National Aeronautics and Space Administration

# Draft Environmental Assessment for Hangar 3 Building Demolition at Moffett Federal Airfield

June 2022

Draft Environmental Assessment for Hangar 3 Building Demolition

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| **Location:** | Ames Research Center, Moffett Federal Airfield in California |
| **Lead Agency:** | National Aeronautics and Space Administration (NASA) Ames Research Center (ARC) |
| **Proposed Action:** | Planetary Ventures LLC (PV) (ground lessee to NASA) is proposing Hangar 3 building demolition |
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| **Date:** | June 2022 |

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# ES-1 EXECUTIVE SUMMARY

This Environmental Assessment (EA) has been prepared for the National Aeronautics and Space Administration (NASA) to evaluate potential effects that arise as a result of the work proposed by Planetary Ventures, LLC (PV or Lessee) to address existing hazardous structural conditions at Hangar 3. Hangar 3 is located adjacent to the Moffett Federal Airfield (MFA), which is part of NASA's Ames Research Center (ARC). NASA entered into an Adaptive Reuse Lease (Lease) with PV in October 2014 for PV's use and occupancy of MFA. The MFA Lease includes Hangar 3 as well as other facilities. The Lessee has proposed demolition of Hangar 3 to remedy its unsafe condition and eliminate the unacceptable structural hazard it poses. The preparation of this EA is consistent with regulations issued by the Council on Environmental Quality (CEQ), 14 Code of Federal Regulations (CFR) Part 1216.3, Procedures for Implementing the National Environmental Policy Act (NEPA), and NASA Procedural Requirements (NPR) 8580.1A, Implementing the National Environmental Policy Act and Executive Order 12114. Preparation of this EA commenced prior to September 14, 2020. This EA has been prepared in accordance with the CEQ regulations implementing the provisions of NEPA as were codified in 1978.

# ES-2 PURPOSE AND NEED

Based on the terms of the Lease, it was anticipated that Hangar 3 would be rehabilitated for use as a research and development facility. However, since the effective date of the Lease, ongoing efforts to rehabilitate Hangar 3 have proven to be ineffective. While PV has undertaken significant additional efforts to repair the damaged trusses since commencing the Lease, it was not possible to keep up with the damage progression continuously advancing throughout the structure. While a temporary internal shoring and hydraulic jacking system is in place, the building is currently unsafe for occupancy and vulnerable to further damage and collapse, especially from seismic or high wind load events.

The purpose of the Project is to remedy this unsafe condition and eliminate an unacceptable structural hazard. The need for the Project is a long-term solution that eliminates the potential for continued degradation or collapse of Hangar 3 under normal or adverse conditions, thereby protecting life and property.

# ES-3 ALTERNATIVES CONSIDERED

## ES-3.1.1. ALTERNATIVES ANALYZED

### Proposed Action - Building Demolition

This alternative, previously referred to as Structural Hazard Remediation in the supporting studies found in the appendices, would involve the demolition of Hangar 3 and would also include removal and management of contaminated materials, equipment, and environmental media. This would remove an unsafe condition and eliminate an unacceptable structural hazard in a timely manner that would eliminate the potential for continued degradation or collapse of Hangar 3 under normal or adverse conditions, thereby protecting life and property. The Proposed Action would occur in three phases, with pre-demolition activities (Phase 1) lasting approximately 80 to 90 working days and demolition (Phase 2) lasting approximately 125 working days. Waste disposal and recycling (Phase 3) would occur concurrently with Phase 1 and Phase 2. The total duration for all phases would take approximately nine months. In Phase 1, a pre-demolition survey would be conducted to characterize non-hazardous and hazardous wastes in accordance with the framework established by applicable federal, state, and local regulations. Phase 2 activities would include removal of all above ground components, and no work would occur below the slab. A 6-foot-high temporary fence would be installed around the demolition area to control entry to the work area, and all of the work would be conducted within the fenced area. All demolition materials would either be tethered and mechanically lowered to the ground or mechanically cut and dropped to the floor. If materials are dropped to the floor, considerations would be made including limiting fall distances and considering the weight of the material being dropped to minimize impacts to the slab. Waste disposal and recycling would occur in Phase 1 with *in situ* characterization prior to demolition to assist in efforts to segregate non-hazardous from hazardous wastes or from incompatible wastes during demolition. In Phase 2, materials would be characterized after demolition but before being loaded onto trucks or trailers for transport to an approved offsite construction waste facility. Upon completion of the Proposed Action, all above ground Hangar 3 components would be removed and only the concrete slab would remain, consistent with pre-Project conditions. No land use is planned for the site after demolition.

### No Action Alternative

Under the No Action Alternative, Hangar 3 would remain unoccupied, and maintenance of the temporary internal shoring and hydraulic jacking system would continue. Under this alternative, no further attempts to complete structural upgrades of Hangar 3 would be undertaken. Although PV has removed all items stored in the structure due to safety concerns, some ongoing maintenance of the extensive internal shoring and hydraulic jacking system for the structure would be required under this alternative. Under this alternative, the structure could sustain further damage and there would be potential for collapse of portions of the hangar from an earthquake or high wind loading, which could result in a partial or full collapse of Hangar 3. Such a collapse would pose a life-safety risk to nearby personnel and damage to nearby property from flying debris.

### ES-3.1.2. ALTERNATIVES CONSIDERED BUT ELIMINATED FROM FURTHER STUDY

#### Reconstruction of Hangar 3

The possibility of fully stabilizing and rehabilitating Hangar 3 was considered. However, full rehabilitation that does not require destruction of the essential components that make Hangar 3 a valuable historic structure would not be possible since it is not feasible to replace damaged components in sequence. In order to bring the structure into prevailing seismic code regulations for safety, Hangar 3 would effectively have to be deconstructed and then reconstructed into an entirely new structure using new materials. In addition, the cost for reconstruction of the hangar would be more than 50 times higher than the Proposed Action. For these reasons, this alternative was dismissed from further study.

#### Partial Preservation of Hangar 3

A partial preservation of Hangar 3 was considered that would have removed the safety hazard associated with the main hangar structure while restabilizing and preserving independent features of the structure. This alternative is referred to as Alternative 2 – Partial Preservation in the supporting studies found in the appendices. Under this alternative, the two sets of concrete towers and box beam structures (at the northern and southern ends) would be retained, and the entire main hangar structure would be demolished. Appendix A, KPFF Memos, provides memorandums that address the feasibility of retaining portions of Hangar 3. Under this alternative, both sets of hangar doors, machinery, and existing tracks would be removed with the demolition of the main hangar structure. Demolition activities related to this alternative would include the three phases discussed in the Proposed Action. This alternative would also include an additional Phase 4 for activities required for abatement and stabilization of the remaining Hangar 3 elements. These activities would include: 1) box beam rehabilitation, shoring, and strengthening; 2) concrete door tower rehabilitation and strengthening; and 3) foundation strengthening. The total duration for all phases would take approximately 21 months.

The costs associated with the partial preservation of Hangar 3 was determined to be considerably higher than the Proposed Action. This alternative would also effectively reduce Hangar 3 to two smaller structures, which would relate in form to each other, but would, as a result, contrast with the overall visual character of Hangar 2. Therefore, this alternative was dismissed from further study.

# ES-4 SUMMARY OF POTENTIAL EFFECTS

This EA considered the following ten resource areas to provide a context for understanding the potential environmental effects of the Proposed Action and alternatives: air quality; biological resources; cultural resources; greenhouse gases and climate change; hazards, safety, and waste management; noise and vibration; transportation and circulation; utilities; visual resources; and water resources.

The environmental consequences associated with the Proposed Action and No Action Alternative were analyzed. Table ES-1 presents a summary of the resources considered and the potential impacts on those resources.

**Table ES- 1 Summary of Environmental Impacts**

| Resource Area | Potential Impacts from the Proposed Action | Potential Impacts from the No Action Alternative |
|---|---|---|
| Air Quality | Construction exhaust emissions would be generated from construction equipment, demolition activities, on-site workers' commutes and hauling of demolition material. Emissions would be below the Federal *de minimis* and Bay Area Air Quality Management District (BAAQMD) thresholds for all criteria pollutants and would be therefore less than significant.<br>Fugitive dust would be generated from demolition activities. A water truck would apply water to exposed areas or those that could generate dust during demolition activities. The Proposed Action would wet any asbestos containing material (ACM) prior to demolition. As a result, these effects would be less than significant.<br>Construction of the Proposed Action would not result in a health risk from exposure to diesel particulate matter (DPM).<br>Impacts to air quality would be less than significant. | Under the No Action Alternative, there would be no disturbance to the existing environment associated with pre-demolition, demolition, and waste removal and recycling. The condition of Hangar 3 would continue to deteriorate.<br>In the event of a structural failure, air quality impacts would be temporary but would be uncontrolled compared to the Proposed Action. Subsequent clean-up would require haul trucks, and construction equipment, similar to those needed for the Proposed Action, which would emit criteria air pollutants and DPM. Quantification of the emissions is not possible because it is speculative to determine the extent of an unplanned collapse.<br>Clean-up would not result in a health risk from exposure to DPM. |
| Biological Resources | The Proposed Action could result in potential impacts to nesting/overwintering burrowing owls, nesting and roosting common (i.e., non-special-status) species of birds, and roosting common species of bats. The Proposed Action would not result in impacts to wetlands, aquatic habitats, riparian habitats, or other sensitive habitats; threatened or endangered species or their habitats; special-status plants; trees; or wildlife movement corridors.<br>The Proposed Action would implement Mitigation Measures BIO-1A through BIO-3D (14 measures) to | Under the No Action Alternative, there would be no disturbance to the existing environment associated with pre-demolition, demolition, and waste removal and recycling. In the event of a structural failure, potential impacts would be uncontrolled and would result in greater direct and immediate impacts to wildlife in the vicinity of the Project site as mitigation measures identified for the Proposed Action would not be implemented. Therefore, wildlife impacts could be significant as the No Action Alternative could result in the loss of bird eggs or nestlings, the |

| Resource Area | Potential Impacts from the Proposed Action | Potential Impacts from the No Action Alternative |
|---|---|---|
| | minimize potential impacts to burrowing owls, nesting and roosting birds, and roosting bats. Because the Proposed Action would not result in effects that are substantial (i.e., resulting in a measurable decline in regional populations) or that could be permanent in their effect on population or subpopulation survival without active management, the impacts would be less than significant.<br><br>**Mitigation Measures:**<br>● BIO-1A. Burrowing Owl Pre-activity Survey of Project Access Route<br>● BIO-1B. Burrowing Owl Pre-activity Survey of Project Site<br>● BIO-1C. Materials Monitoring and Relocation<br>● BIO-1D. Materials Storage<br>● BIO-2A. Avoidance of Bird Nesting Season<br>● BIO-2B. Pre-Activity Surveys for Nesting Birds<br>● BIO-2C. Non-Disturbance Buffers around Active Bird Nests<br>● BIO-2D. Nesting Bird Deterrence<br>● BIO-2E. Pre-Activity Surveys for Roosting Birds<br>● BIO-2F. Passive Relocation of Roosting Birds<br>● BIO-3A. Exclude Bats Prior to Disturbance<br>● BIO-3B: Conduct Pre-Activity Surveys for Roosting Bats<br>● BIO-3C. Avoid Disturbance of Maternity Roosts<br>● BIO-3D. Eviction of Roosting Bats | death or injury of a roosting burrowing owl (if present in debris or materials near the hangar), and the injury or mortality of bats within a roost site in Hangar 3, therefore, violating the MBTA and/or CFGC or potentially affecting the regional population of burrowing owls. |

| Resource Area | Potential Impacts from the Proposed Action | Potential Impacts from the No Action Alternative |
|---|---|---|
| Cultural Resources | The Proposed Action would result in the demolition of Hangar 3, which is both individually listed as a historic structure in the National Register of Historic Places (NRHP) and as a contributor to the NRHP-listed Naval Air Station (NAS) Sunnyvale Historic District. The demolition of Hangar 3 would also disrupt the visual qualities and historic character within the District as a whole. This would impact the historic setting of the District and the individual contributors, particularly on the eastside of the airfield, which includes Hangar 2, Building 055, the East Aircraft Parking Apron, other contributing airfield infrastructure (runways and taxiways), operations and support buildings, and the munitions magazines and historic handling facilities. Thus, the Proposed Action would have an adverse effect on historic resources, as defined by 36 CFR 800(a)(1), Protection of Historic Properties.<br><br>However, the NAS Sunnyvale Historic District and its remaining various contributors would retain sufficient, albeit diminished, historic integrity following the completion of the Proposed Action and would continue to qualify for listing on the NRHP. Additionally, the adverse effects resulting from the Proposed Action would be addressed and resolved through the execution and implementation of a Memorandum of Agreement (MOA) with the State Historic Preservation Officer (SHPO) and other parties.<br><br>There are no ground disturbing activities located within the identified area of heightened prehistoric-era or historic-era archaeological sensitivity or areas with | Under the No Action Alternative, there would be no disturbance to the existing environment associated with pre-demolition, demolition, and waste removal and recycling. In the event of a structural failure, direct and indirect impacts to Hangar 3, the NAS Sunnyvale Historic District, and the other contributors to the NAS Sunnyvale Historic District in the vicinity could occur from the collapse of Hangar 3. Under the No Action Alternative, there would not be a Section 106 process or resulting MOA to address and resolve adverse effects to historic properties. Therefore, the No Action Alternative could result in a significant impact to cultural resources. |

| Resource Area | Potential Impacts from the Proposed Action | Potential Impacts from the No Action Alternative |
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| | known sites. In the event that ground disturbing activities were required and archaeological materials were discovered, all work would be halted, the NASA Cultural Resources Manager would be notified, and the appropriate steps outlined in the Integrated Cultural Resources Management Plan Standard Operating Procedure 8: Inadvertent Discovery would be implemented.<br><br>As a result, impacts on cultural resources under NEPA would be less than significant. | |
| Greenhouse Gases and Climate Change | Demolition of Hangar 3 would result in the emissions of greenhouse gases (GHG) generated from construction equipment, demolition activities, and on-site workers' commutes. The accumulation of GHGs within the atmosphere leads to global climate change.<br>The GHG emissions generated by the Proposed Action would occur over a short-duration of time and would not exceed the Federal Mandatory Reporting Threshold. Therefore, impacts would result in a less than significant contribution to the significant cumulative impact to global climate change. | Under the No Action Alternative there would be no disturbance to the existing environment associated with pre-demolition, demolition, and waste removal and recycling. In the event of a structural failure, demolition, waste removal, and recycling activities like the Proposed Action would be required. GHG emissions would be generated from construction activities and would be comparable to the Proposed Action. Therefore, the No Action Alternative would have a less than significant contribution to the significant cumulative impact to global climate change. |
| Hazards, Safety, and Waste Management | Demolition of Hangar 3 would result in potential exposure of other MFA users to lead-based paint (LBP), ACM, and polychlorinated biphenyls (PCB) in the vicinity of the Project site. All construction activities would comply with Avoidance and Minimization Measure (AMM)-1: Environmental Issues Management Plan | Under the No Action Alternative, there would be no disturbance to the existing environment associated with pre-demolition, demolition, and waste removal and recycling. In the event of a structural failure, the No Action Alternative could result in the uncontrolled release and exposure |

| Resource Area | Potential Impacts from the Proposed Action | Potential Impacts from the No Action Alternative |
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| | (EIMP), to ensure demolition would not expose personnel to site contaminants or release additional contaminants into the environment.<br>To minimize hazards from falls, scaffolding would be installed as per Occupational Safety and Health Administration (OSHA) standards that include provisions such as, but not limited to fall protection, guardrail height, training, and inspection.<br>Implementation of the Proposed Action would create short-term impacts with regard to hazardous wastes during mobilization, demolition, and demobilization activities. All activities would be in compliance with applicable regulations, AMM-1: EIMP, and the site-specific health and safety plan. Moreover, there is adequate capacity at the landfills for any demolition waste.<br>By implementing appropriate plans and complying with applicable regulations, impacts related to worker safety or the exposure to hazardous materials would be less than significant. | of MFA users to hazardous materials, including those containing asbestos, lead, or PCB. The No Action Alternative would not include hazardous material abatement activities described under the Proposed Action. As such, the No Action Alternative could potentially release hazardous materials into the environment causing greater risk to human health and the environment compared to the Proposed Action, resulting in a potentially significant impact. Clean up following structural collapse would be required to follow all applicable federal, state, and local regulations pertaining to the clean-up, abatement, and transport of hazardous materials. |
| Noise and Vibration | Two types of short-term noise impacts could occur during demolition in the Proposed Action: traffic-related noise from demolition crew, equipment, and materials; and noise generated during demolition from building removal. Noise modeling indicates that impacts of demolition activity to sensitive receptors would be negligible, and the Proposed Action would not result in any operational noise as no use is proposed post-demolition. Modeling also indicates that vibration generated from demolition equipment would not be expected to cause damage to existing nearby buildings. | Under the No Action Alternative, there would be no disturbance to the existing environment associated with pre-demolition, demolition, and waste removal and recycling. In an event of a structural failure, there may be instantaneous loud noise from the structural collapse that may be higher than the acceptable noise levels defined in the General Plans for the City of Mountain View and the City of Sunnyvale. In addition, depending on the level of emergency response required, there could be nighttime and |

| Resource Area | Potential Impacts from the Proposed Action | Potential Impacts from the No Action Alternative |
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| | Demolition noise levels would be expected to be well below impact thresholds. Additionally, the Proposed Action would implement the protection measures noted in AMM-2: Noise and Vibration, to further reduce temporary construction noise and vibration impacts on adjacent sensitive receptors. Therefore, noise and vibration impacts on sensitive receptors would be less than significant. | weekend activity noise generated that is not contemplated under the Project. However, these noise impacts would not be considered significant since they would be temporary and short-term. Noise levels from worker and truck trips would be expected to be similar to the Proposed Action and thus would not be significant. However, sudden collapse could have an adverse impact on surrounding structures; if vibration levels were to exceed 0.25 in/sec PPV then damage to nearby structures could result. |
| Transportation and Circulation | The traffic impact analysis found that the surrounding study intersections would operate at level of service (LOS) D or better during the AM and PM peak hours under background conditions. Addition of the peak hour Proposed Action traffic to the study intersections would have a negligible impact on the intersections and would not result in a significant impact at the study intersections. The effects of the Proposed Action on the transportation system would be temporary since the Proposed Action would not generate new operational trips once construction was complete. No offsite improvements at study intersections would be needed under the Proposed Action. Additionally, the Proposed Action would implement AMM-3: Construction Traffic Control Plan, to ensure construction traffic does not block access for other area users and coordination occurs with other construction activities during the same construction period.<br>Since the Proposed Action would not result in a substantial increase in traffic generation or increase in | Under the No Action Alternative, there would be no disturbance to the existing environment associated with pre-demolition, demolition, and waste removal and recycling. In the event of a structural failure, there would be temporary construction traffic for remediation and clean-up activities that would be expected to result in similar LOS at the study intersections as the Proposed Action. As a result, impacts related to temporary construction traffic would be less than significant. |

| Resource Area | Potential Impacts from the Proposed Action | Potential Impacts from the No Action Alternative |
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| | the use of connecting street systems, the impact would be less than significant. | |
| Utilities | The Proposed Action would not result in any new utility infrastructure. Active utility infrastructure connected to Hangar 3 would be identified and disabled before initiating any site work. Underground utility lines would not be impacted as no subsurface activity would occur. All existing service connections would be capped or otherwise disabled. Above-ground water lines serving Hangar 3 would be drained, terminated, and capped at the connection to the service line where it goes below ground. All underground NASA communication infrastructure and vaults would be protected during demolition of Hangar 3. Therefore, the Proposed Action would not disrupt or accidentally damage existing utility lines and the impact would be less than significant. | Under the No Action Alternative, there would be no disturbance to the existing environment associated with pre-demolition, demolition, and waste removal and recycling. In the event of a structural failure, impacts to utilities could be potentially significant as utility connections to Hangar 3 would not be capped or disconnected systematically and thus structural failure could result in the inadvertent loss of service or damage to critical infrastructure such as water lines connecting to Hangar 3 and NASA telecommunication lines that lie underneath the Hangar 3 concrete slab. Additionally, disruption or damage to utility infrastructure could impact service to other MFA users, including the CAANG facility, resulting in a potentially significant impact. |
| Visual Resources | Permanent changes to the existing visual landscape would result from the demolition of Hangar 3. Hangar 3 is a prominent feature in views toward MFA from nearby locations, reinforced by the presence of Hangar 2. As a pair, these structures are highly recognizable visual and historic features in the local and regional landscape. Therefore, the removal of Hangar 3 would be noticeable by viewers familiar with the area. However, such visual changes would not be substantial, as Hangar 2 would provide a similar but new focal point in public views and would maintain the overall visual character of the Project | Under the No Action Alternative, there would be no disturbance to the existing environment associated with pre-demolition, demolition, and waste removal and recycling. In the event of structural failure, potential damage to Hangar 3 would be uncontrolled and thus could affect other nearby structures, including Hangar 2. However, it would be speculative to determine the extent of an unplanned collapse and the potential damage to other structures. In the absence of Hangar 3, Hangar 2 would be the |

| Resource Area | Potential Impacts from the Proposed Action | Potential Impacts from the No Action Alternative |
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| | area. Additionally, as shown in the close-in views from Key Observation Point (KOP) 1 and KOP 2, the removal of Hangar 3 would allow for greater visibility of the Project area and the surrounding hillsides and mountain range. With the demolition of Hangar 3, the vividness would be reduced with the elimination of a repeating form. Hangar 2 would become the sole dominant feature in public views and would retain the elements that contribute to the overall visual character. As such, impacts on the existing visual character and the scenic quality of public views would be less than significant. | sole dominant feature in public views and would retain the elements that contribute to the overall visual character that is evident in existing views toward this portion of MFA. Thus, visual impacts from the No Action Alternative would be less than significant. |
| Water Resources | Under the Proposed Action, construction activities would include abatement, demolition, and waste disposal. All construction activities would be above-ground, and no site grading or site disturbance would occur. Water generated from dust suppression and watering of ACM prior to demolition would be collected and treated, as necessary. All water discharged from demolition activities would be collected in covered and secured Baker tanks and tested prior to being transported offsite or discharged to the sanitary sewer.<br>To minimize potential impacts associated with runoff and sedimentation, the construction contractor would implement a sitewide Stormwater Pollution Prevention Plan (SWPPP) in accordance with AMM-1: EIMP.<br>Ongoing groundwater monitoring would not be disturbed at MFA. There would be no excavation associated with the Proposed Action; therefore, no groundwater would be expected to be encountered, and dewatering would not be needed. As such, significant impacts to groundwater would not occur. Under this alternative, potential impacts to water resources would be minimized | Under the No Action Alternative, there would be no disturbance to the existing environment associated with pre-demolition, demolition, and waste removal and recycling. In the event of a structural failure, existing lead, asbestos, PCB, and other contaminants from building materials within Hangar 3 could be released into the environment, including surface waters, because no abatement of hazardous materials (lead/asbestos/PCB) would be conducted prior to cleanup. Therefore, the No Action Alternative could degrade downstream water quality through the release of hazardous and other contaminants into surface waters and result in a potentially significant impact to water resources. |

| Resource Area | Potential Impacts from the Proposed Action | Potential Impacts from the No Action Alternative |
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| | through implementation of AMM-1: EIMP and would be less than significant. | |

# Abbreviations

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| $\mu g/m^3$ | micrograms per cubic meter |
| ABAG | Association of Bay Area Governments |
| ACE | Altamont Corridor Express |
| ACM | asbestos containing materials |
| ADT | average daily trips |
| AIRFA | American Indian Religious Freedom Act |
| APE | Area of Potential Effects |
| ARC | Ames Research Center |
| ARPA | Archaeological Resources Protection Act |
| BAAQMD | Bay Area Air Quality Management District |
| BCDC | San Francisco Bay Conservation and Development Commission |
| Bay Trail | San Francisco Bay Trail |
| BAT | Best Available Technology |
| BCT | Best Control Technology |
| BMP | Best Management Practice |
| CAA | Clean Air Act |
| CAANG | California Air National Guard |
| CAAQS | California Ambient Air Quality Standards |
| CalEEMod | California Emissions Estimator Model |
| CARB | California Air Resources Board |

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| CDFG | California Department of Fish and Game |
| CDFW | California Department of Fish and Wildlife |
| CEQ | Council of Environmental Quality |
| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act |
| CESA | California Endangered Species Act |
| CFGC | California Fish and Game Code |
| CFR | Code of Federal Regulations |
| CNDDB | California Natural Diversity Database |
| CNEL | Community Noise Equivalent Level |
| CO | carbon monoxide |
| CWA | Clean Water Act |
| dB | decibel |
| dBA | A-weighted decibels |
| DFSP | Defense Fuel Support Point |
| DPM | Diesel Particulate Matter |
| EA | Environmental Assessment |
| EAIP | Eastside Airfield Improvement Project |
| EIMP | Environmental Issues Management Plan |
| EIS | Environmental Impact Statement |
| Empl | Employees |
| EO | Executive Order |
| $^{o}$F | degrees Fahrenheit |
| FAA | Federal Aviation Administration |

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|---|---|
| FESA | Federal Endangered Species Act |
| FHWA | Federal Highway Administration |
| FTA | Federal Transit Administration |
| G | Global ranking |
| GHG | greenhouse gases |
| GNR | global rank not yet assessed |
| $H_2S$ | hydrogen sulfide |
| HTH | H. T. Harvey and Associates |
| ITE | Institute of Traffic Engineers |
| KOP | Key Observation Point |
| KPFF | KPFF Consulting Engineers |
| LBP | lead-based paint |
| $L_{dn}$ | day-night sound level |
| Lease | Adaptive Reuse Lease |
| Leq | Equivalent Continuous Sound Pressure Level |
| Lmax | maximum level of a noise source |
| LOS | level of service |
| MBTA | Migratory Bird Treaty Act |
| MFA | Moffett Federal Airfield |
| mg/m3 | milligrams per cubic meter |
| MM | Mitigation Measure |
| MOA | Memorandum of Agreement |
| MTCO2e | metric tons carbon dioxide equivalent |

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| MTC | Metropolitan Transportation Commission |
| NAAQS | National Ambient Air Quality Standards |
| NADP | NASA Ames Development Plan |
| NAHC | Native American Heritage Commission |
| NAS | Naval Air Station |
| NASA | National Aeronautics and Space Administration |
| Navy | U.S. Navy |
| NEPA | National Environmental Policy Act |
| NHPA | National Historic Preservation Act |
| NMFS | National Marine Fisheries Service |
| $NO_2$ | nitrogen dioxide |
| $NO_X$ | nitrogen oxide |
| NPDES | National Pollutant Discharge Elimination System |
| NPR | NASA Procedural Requirements |
| NRHP | National Register of Historic Places |
| NRP | NASA Research Park |
| $O_3$ | ozone |
| OSHA | Occupational Safety and Health Administration |
| Pb | lead |
| PCB | polychlorinated biphenyls |
| PCE | passenger car equivalent |
| PM | particulate matter |
| ppm | parts per million |

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|---|---|
| PPV | peak particle velocity |
| Project | Hangar 3 Building Demolition |
| PV or Lessee | Planetary Ventures, LLC |
| RCNM | Roadway Construction Noise Model |
| RCRA | Resource Conservation and Recovery Act |
| ROGs | reactive organic gases |
| RWQCB | Regional Water Quality Control Board |
| S | State ranking |
| SFBAAB | San Francisco Bay Area Air Basin |
| SHPO | State Historic Preservation Officer |
| SIP | State Implementation Plan |
| SNR | unranked - state conservation status not yet assessed |
| $SO_2$ | sulfur dioxide |
| sf | square feet |
| SR | State Route |
| Stantec | Stantec Consulting Services Inc. |
| SWPPP | Stormwater Pollution Prevention Plan |
| TAC | Toxic Air Contaminant |
| TPA | Transit Priority Area |
| UC | University of California |
| U.S. or US | United States |
| US 101 | U.S. Highway 101 |
| USACE | U.S. Army Corps of Engineers |

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|---|---|
| USC | U.S. Code |
| USEPA | U.S. Environmental Protection Agency |
| USFWS | U.S. Fish and Wildlife Service |
| USGS | United State Geologic Survey |
| v/c | volume-to-capacity |
| VOCs | volatile organic compounds |
| VTA | Valley Transportation Authority |

# 1.0 Purpose and Need for Action

## 1.1 Introduction

The National Aeronautics and Space Administration (NASA) is evaluating potential environmental effects that may arise as a result of the work proposed by Planetary Ventures, LLC (PV or Lessee) to address existing hazardous structural conditions at Hangar 3. Hangar 3 is located within the NASA Moffett Federal Airfield (MFA) area at NASA's Ames Research Center (ARC). NASA entered into an Adaptive Reuse Lease (Lease) with PV in October 2014 for PV's use and occupancy of MFA. The MFA Lease includes Hangar 3 as well as other facilities (Figure 1-1). The Lessee proposes demolition of Hangar 3 to remedy its unsafe condition and eliminate the unacceptable structural hazard it poses. This Environmental Assessment (EA) has been prepared to assess the potential environmental impacts resulting from this Project. The preparation of this EA is consistent with regulations issued by the Council on Environmental Quality (CEQ), 14 Code of Federal Regulations (CFR) Part 1216.3, Procedures for Implementing the National Environmental Policy Act (NEPA), and NASA Procedural Requirements (NPR) 8580.1A, Implementing the National Environmental Policy Act. In accordance with CEQ Regulations for Implementing the Procedural Provisions of NEPA (40 CFR Parts 1500-1508, Section 1502.13), this section specifies the purpose and need for the Project. Preparation of this EA commenced prior to September 14, 2020. This EA has been prepared in accordance with the CEQ regulations implementing the provisions of NEPA as were codified in 1978, NASA's NEPA implementing regulations (14 CFR subpart 1216.3), and applicable NASA NEPA implementation policy directives and guidelines.


**Figure 1-1 Project Location**

## 1.2 Background

Hangar 3 is a large historic structure covering approximately 16 acres. It is listed in the National Register of Historic Places (NRHP) as a contributor to the Naval Air Station (NAS) Sunnyvale Historic District and has been determined eligible for individual listing in the NRHP.

Hangar 3 was built in August 1943, immediately after Hangar 2, as part of the Navy's Lighter-Than-Air dirigible aircraft coastal defense program during World War II. While Hangar 2 was completed in 372 days, Hangar 3 was completed in a much shorter duration of 208 days (Page and Turnbull 2006). Photo 1 shows construction of both of the Hangars in 1943. Unlike Hangar 1 and its steel construction, Hangars 2 and 3 were constructed of wood since steel was used by other wartime efforts. Significant character-defining features of Hangars 2 and 3 include the following: distinctively large massing (main volume); parabolic roof with corrugated aluminum siding; massive sliding hangar doors with supporting concrete towers, wood box beams, and adjoining clamshell roof; the flanking brick masonry sheds; wood frame truss construction set on repeating concrete bents; expansive interior concrete decking; and the vast open interior volumes. Following the end of World War II, the hangars were used continuously throughout the Post-War period to support a variety of Naval aircraft missions. Hangar 3 is 171 feet high and encloses approximately 240,000 square feet (sf) of open concrete deck underneath wood trusses, and an estimated 122,000 sf of lateral shed space flanking the central volume at the east and west elevations. Hangar 2 is nearly identical to Hangar 3, both consisting of parabolic arch-shaped wood trusses that clear-span the high bay of the hangars at a distance of approximately 234 feet. The trusses are spaced approximately 20 feet on center and are supported at each end by concrete bents. Within the bent's spaces and running the entire length of the hangars on both sides are a two-story office, lab, shop, and other support facilities.

**Photo 1: Hangars 2 and 3 Under Construction, 1943**
Source: Moffett Field Museum

Subsequent to the original construction, a two-story lean-to structure measuring approximately 60 feet in width and 1,000 feet in length was added to the east side of Hangar 3. This addition was primarily designed for office and shop space. After NASA took over the site from the Navy in 1994, NASA leased a portion of Hangar 3 to private entities for research and development, airship production, storage, and aircraft maintenance. During this period, the California Air National Guard (CAANG) continued to use portions of the hangar for aircraft maintenance, machine shop, and office space. On behalf of NASA, the General Services Administration issued a Request for Proposals on May 28, 2013, to obtain lease proposals from qualified private entities for a 96-year adaptive reuse lease of the 1,000-acre parcel known as MFA in Sunnyvale, California. Subsequent to the Request for Proposals process, NASA selected PV as the Lessee and executed the lease on October 30, 2014. Since taking over the property in 2014, PV has invested significant capital into MFA to complete a variety of projects required to improve the condition of the property, including Hangar 3.

Hangar 3 was originally constructed in 1943 as a wood-framed glulam chord and timber arched truss structure and has experienced structural degradation over the years. Repairs began as early as 1946, with batten strengthening (where battens were added to chords to increase stability and prevent buckling) and other strengthening measures. Numerous assessments of the hangar have been undertaken since its construction, noting structural inadequacies and life safety concerns; previous restoration efforts have occurred in 1981-87, 1993, and 1995. Figure 1-2 shows the members surveyed in recent due diligence investigations. Repairs to the glulam chords of the arched truss system[1] occurred in 1981, then 1993, and again in 2015 (Figure 1-3). The distressed condition of Hangar 3 was first observed by PV's structural consultant during the initial visual inspections in July and August 2013, with additional assessments in 2014, 2015, and 2016 (Appendix A.1 through A.3, KPFF Memos).

In August 2015, NASA approved a construction permit for emergency stabilization repairs, due to the severity of the existing damage and the immediate danger of partial, and potentially progressive, structural collapse. That permit commenced a shoring[2] and emergency repairs process that continued through the spring of 2016. Although the original intent of the emergency repair program was to return the arched trusses to their original but deficient state, the program was ultimately abandoned due to the numerous severely damaged arched trusses, as well as the damage progression to undamaged trusses which continued to occur.

Hangar 3 was initially decommissioned, or removed from service, in spring of 2017 in an effort to reduce the threat of further damage or partial collapse and based on the engineering team's observation of new and continued deterioration to a significant portion of the timber arched trusses (Appendix A-4, KPFF Memos). This damage had created an unsafe condition within certain areas of the hangar and east shed. Additional temporary shoring posts were erected several years ago, and the shoring platform was left in place to provide added protection for the building from the potential of future damage and to slow further deterioration. Figure 1-4 shows the location of temporary shoring installed in 2015 and Figure 1-5 shows the damage progression observed in 2017. The decommissioning of Hangar 3 was completed in December 2019. Under existing conditions, the concrete slab floor has some cracks and spalls. These cracks are typical for large concrete pours and do not appear to affect the structural performance of the foundation. The slab floor appears to be intact with no major swells or dips (Page and Turnbull 2006).

[1] A truss system is an arrangement of wooden support beans configured in a triangular shape. Chords are the outer layers of a truss that define the truss shape.

[2] Shoring is the process of temporarily supporting a building or structure with shores (props) when in danger of collapse or during repairs and alterations.

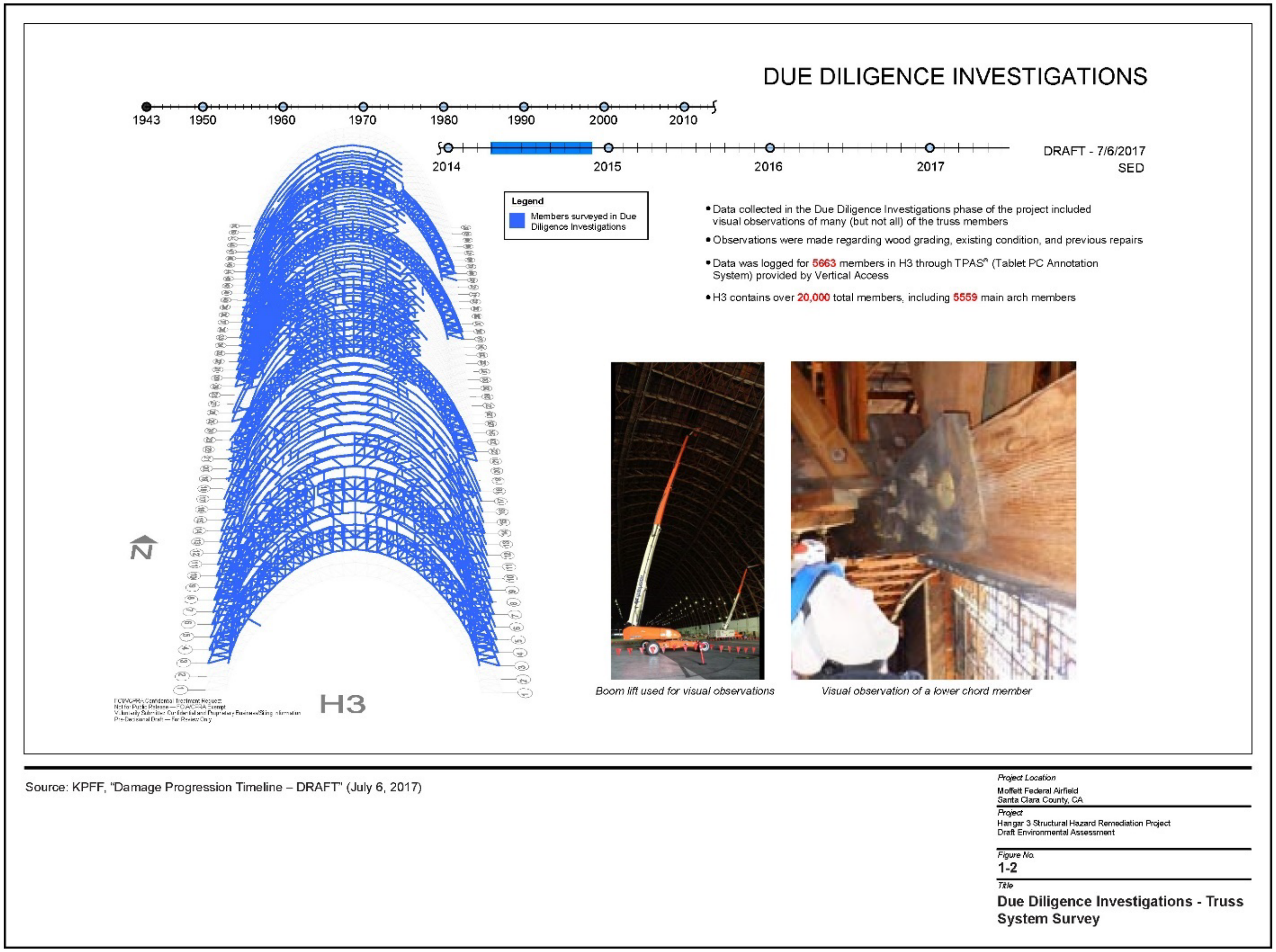
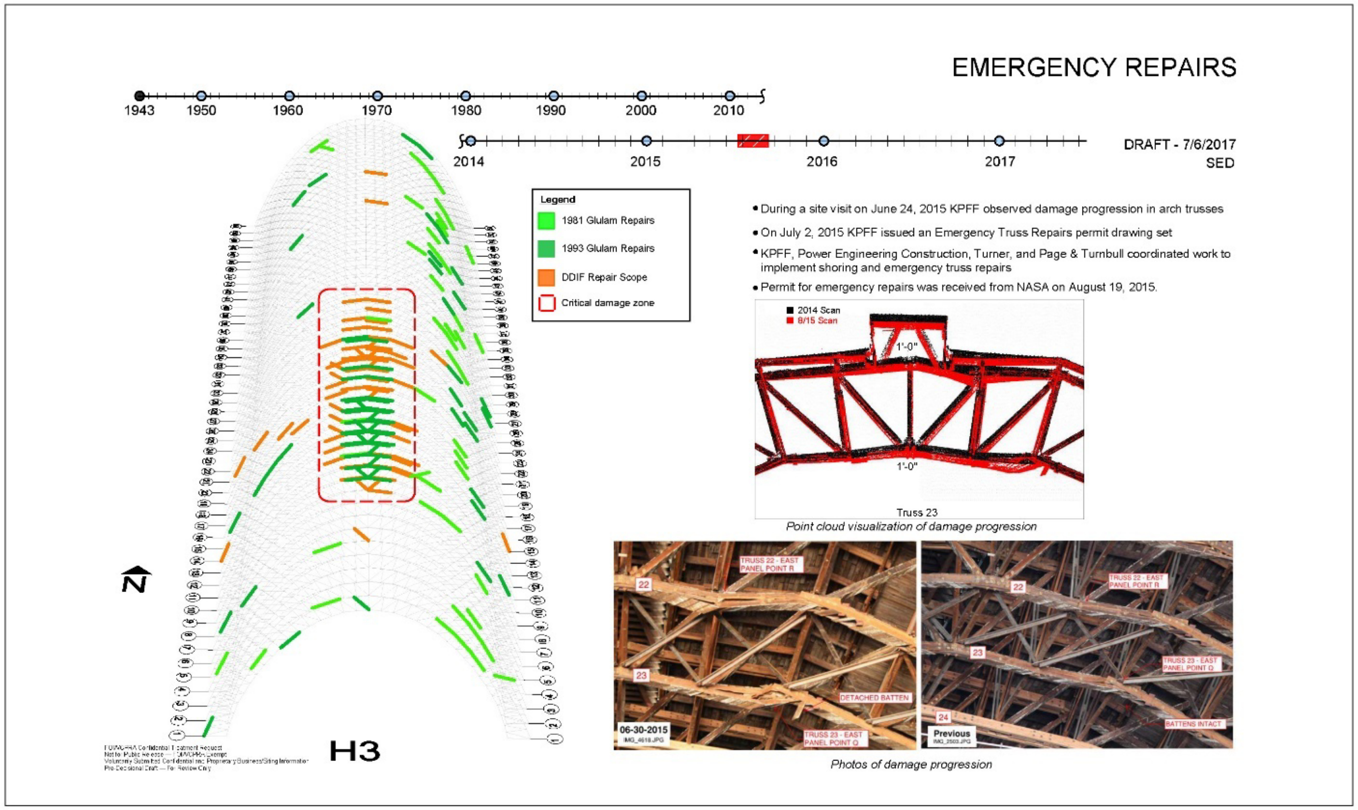



**Figure 1-2 Due Diligence Investigations – Truss System Survey**




Source: KPFF, "Damage Progression Timeline – DRAFT" (July 6, 2017)

*Project Location*
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Santa Clara County, CA

*Project*
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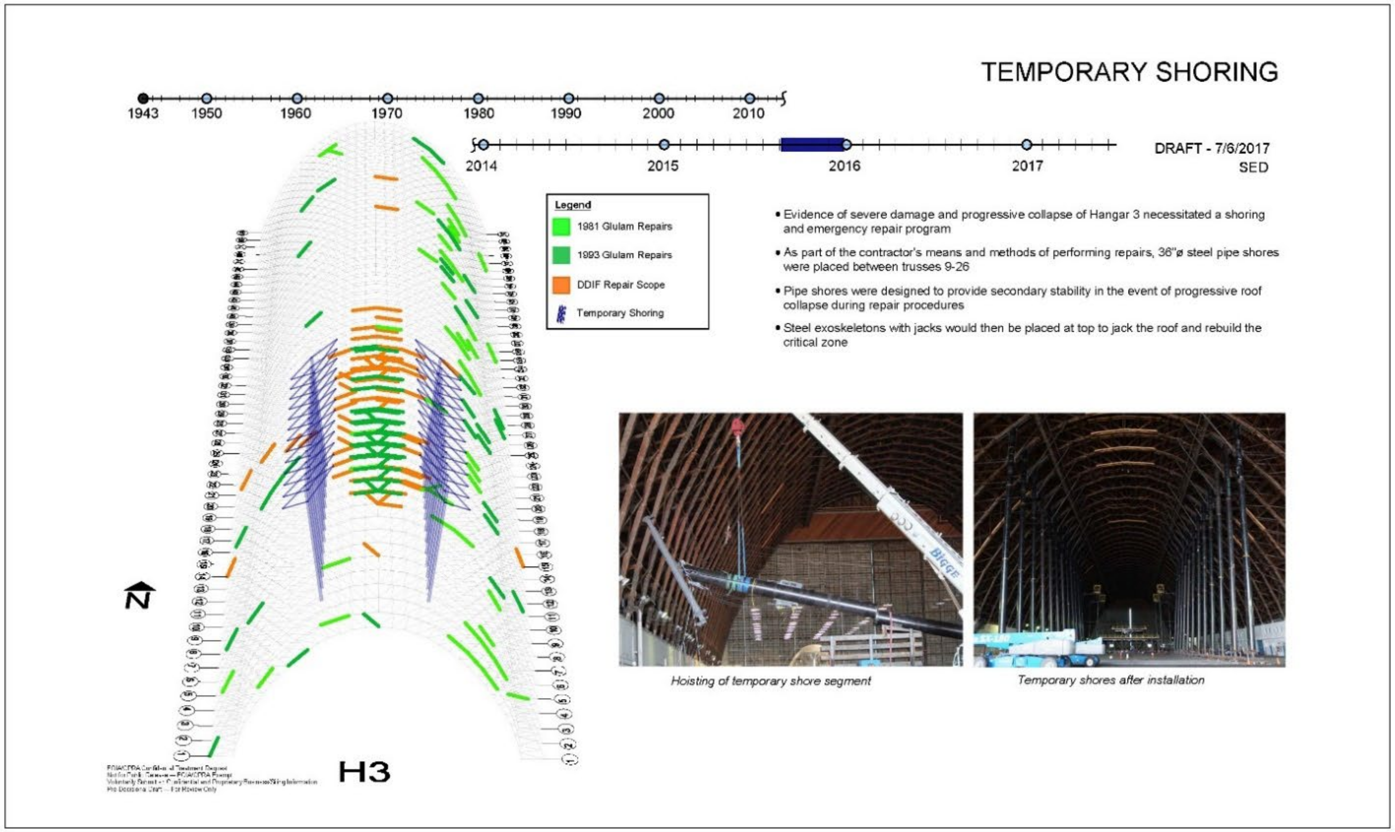
*Figure No.*
**1-3**

*Title*
**Emergency Repairs**

**Figure 1-3 Emergency Repairs**




Source: KPFF, "Damage Progression Timeline – DRAFT" (July 6, 2017)

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**1- 4**

*Title*
**Location of Temporary Shoring**

**Figure 1-4 Location of Temporary Shoring**

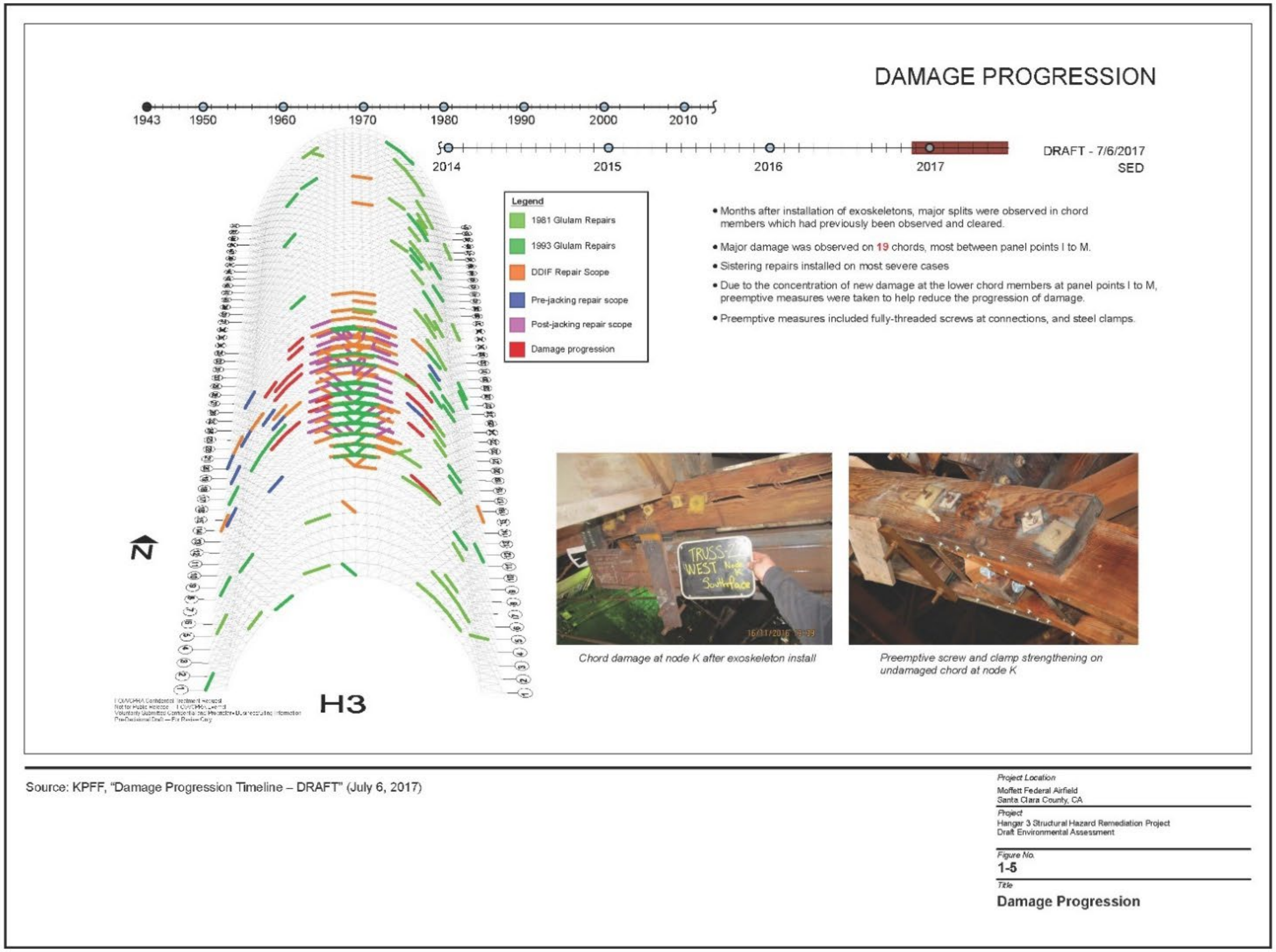



**Figure 1-5 Damage Progression**

Due to the progression of damage to the existing structure, a quarterly monitoring program was initiated in 2017 to evaluate the movements of the structure. Overall, the monitoring has shown that the stabilization efforts have abated further deterioration. While a temporary internal shoring and hydraulic jacking system is in place, the building is currently unsafe for occupancy and vulnerable to further damage and collapse, especially from seismic or high wind load events.

## 1.3 Purpose and Need

NEPA regulations require that a federal agency describe the purpose and need for the Proposed Action. In proposing to lease the MFA premises, NASA identified several criteria that provide the overall context and foundation for the purpose of this Project, including eliminating NASA's escalating operating and maintenance requirements for MFA. Based on the terms of the lease, it was anticipated that Hangar 3 would be rehabilitated for use as a research and development facility. However, since the effective date of the Lease, ongoing efforts to rehabilitate Hangar 3 have proven to be ineffective. While PV has undertaken significant efforts to repair the damaged trusses since commencing the Lease, it was not possible to keep up with the damage progression continuously advancing throughout the structure (Appendix A.4, KPFF Memos). Shoring and bracing has been installed to temporarily reduce the chance of further collapse under normal conditions (Appendix A.4, KPFF Memos). The building is currently unsafe for occupancy and vulnerable to further damage and collapse, especially from seismic or high wind load events. The unstable condition of Hangar 3 does not meet NASA's obligation to manage historic structures in accordance with the National Historic Preservation Act (NHPA), California Building Code 2016 (Chapter 1, Part 2, [A] 116.1 - Unsafe Structures and Equipment), and 2019 California Building Code Section 102.6.2). The purpose of the Project is to remedy this unsafe and non-compliant condition and eliminate an unacceptable structural hazard. The need for the Project is a long-term solution that eliminates the potential for continued degradation or collapse of Hangar 3 under normal or adverse conditions, thereby protecting life and property.

## 1.4 Regulatory Framework

Table 1-1 lists statutes, regulations, Executive Orders (EOs), as well as NPRs, NASA Policy Directives, and NASA Policy Guidance that potentially apply to the scope of this EA. Potentially applicable regulations are cited in resource sections below.

**Table 1-1 Summary of Potentially Applicable Regulatory Requirements**

| **Statutes** |
| --- |
| NEPA of 1969 (42 United States Code [USC] Section 4321-4347) |
| NHPA of 1966 (16 USC Section 470 et seq.) (89 Public Law 966) |
| Clean Air Act (CAA) of 1970 as amended (42 USC Section 7401 et seq.) |
| Clean Water Act (CWA) of 1977 as amended (33 USC Section 1251 et seq.) |
| Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 (42 USC Section 9601 et seq.) |
| Archaeological and Historic Preservation Act (1974) |
| American Indian Religious Freedom Act (1978) |
| Archaeological Resource Protection Act of 1979 (16 USC Section 470aa-mm) |
| Native American Graves Protection and Repatriation Act (1990) |
| Endangered Species Act of 1973 (16 USC Section 1531-1544) |
| Resource Conservation and Recovery Act (42 USC Section 6901 et seq.) |
| **Regulations** |
| CEQ Regulations (40 CFR Parts 1500-1508) |
| 14 CFR Subpart 1216.3 – NASA Regulations for Implementing NEPA |
| 36 CFR Part 800 – Protection of Historic Properties |
| 32 CFR Part 229 – Protection of Archaeological Resources: Uniform Regulations |
| 40 CFR Parts 6, 51, and 93 – Conformity of General Federal Actions to State or Federal Implementation Plans |
| 29 CFR Part 1910 – Occupational Safety and Health Standards |
| 40 CFR Part 261 – Regulation on Identification and Listing of Hazardous Waste |
| 40 CFR Part 279 – Regulation on Standards for the Management of Used Oil |

| |
|---|
| 40 CFR Parts 300-399 – Hazardous Substance Regulations |
| 40 CFR Part 302 – Regulation on Designation, Reportable Quantities, and Notification |
| 40 CFR Part 61 Subpart M – National Emission Standard for Asbestos |
| Secretary of the Interior Standards and Guidelines for Archeology and Historic Preservation (Federal Register Vol. 48, No. 190, 44716-44742) |
| **Executive Orders** |
| EO 11593 – Protection and Enhancement of the Cultural Environment |
| EO 12898 – Environmental Justice |
| **NASA Procedural Requirements, Policy Directives, and Policy Guidance** |
| NPR 8553.1, "NASA Environmental Management System", July 1, 2020 |
| NPR 8580.1A, "Implementing the National Environmental Policy Act and EO 12114", August 1, 2012 |
| NASA ARC "Stormwater Pollution Prevention Plan," June 2021 |
| APR 8500.1 "Ames Environmental Procedural Requirements" October 27, 2020 |

## 1.5 Environmental Review Process

Consistent with NPR 8580.1 Section 2.3.1(a), NASA prepared a Public Involvement Plan to encourage dialogue and sufficiently inform the public and resource agencies during the planning process. In accordance with the CEQ regulations (40 CFR Parts 1500-1508) and NASA Regulations (14 CFR Subpart 1216.3) for implementing NEPA, NASA is soliciting comments on the Draft EA from the public including agencies and interested parties. The Draft EA is being released for a 30-day review and comment period. Per NPR 8580.1A (Section 2.4.2), a Notice of Availability for the Draft Finding of No Significant Impact and accompanying EA has been published in the following newspapers for one day: Mountain View Voice; Palo Alto Weekly; Sunnyvale Sun; and San Jose Mercury News. In addition, the Draft EA is available for review at the City of Mountain View Public Library and the City of Sunnyvale Public Library. NASA has also notified community organizations, elected officials, businesses, federal, state, and local agencies, and other interested parties including the NASA Ames community of the Draft EA's availability for comment.

Following the 30-day comment period on the Draft EA, NASA will review and address all comments as part of the administrative record. Responses to comments will be included as an appendix in the Final EA.

# 2.0 Description of Proposed Action and Alternatives

This section describes details related to the Proposed Action (Building Demolition) and the No Action Alternative evaluated in this EA. Guidance for complying with the NEPA and NPR 8580.1A requires an assessment of potentially effective and reasonably feasible alternatives. Details related to the proposed alternatives, as well as a description of alternatives that were considered but eliminated from further analysis, are provided below.

## 2.1 Introduction

The proposed alternatives, described below, were screened against the following criteria:

- An alternative must eliminate existing life safety and property damage hazards created by the deteriorating condition of Hangar 3 in a timely manner.
- An alternative must be reasonably feasible from a cost, logistical, and engineering perspective.

Alternatives not meeting these criteria were not carried forward for further analysis within this EA (see Section 2.4, Alternatives Considered but Eliminated).

## 2.2 Proposed Action – Building Demolition

This alternative, previously referred to as Structural Hazard Remediation in the supporting studies found in the appendices, would involve the demolition of Hangar 3 (including removal and management of contaminated materials, equipment, and environmental media[3]) to remedy its unsafe condition and eliminate the unacceptable structural hazard it poses. Prior to initiation of any construction activities associated with demolition of Hangar 3, the Lessee or contractor would comply with Title 14, CFR, Part 77, and submit plans to the Federal Aviation Administration (FAA) Form 7460-1, Notice of Proposed Construction or Alteration for review and approval. The total area bounded by the temporary fence line associated with demolition, including equipment staging, is estimated to encompass 784,000 sf (approximately 18 acres) as shown in Figure 2-1. Upon completion of the Proposed Action, all above ground Hangar 3 components would be removed and only the concrete slab would remain, consistent with pre-Project conditions. No land use is planned for the site after demolition. The following activities are anticipated to occur in phases under this alternative.

[3] Soil, water, air, plants, and animals, or any other parts of the environment that can contain contaminants.

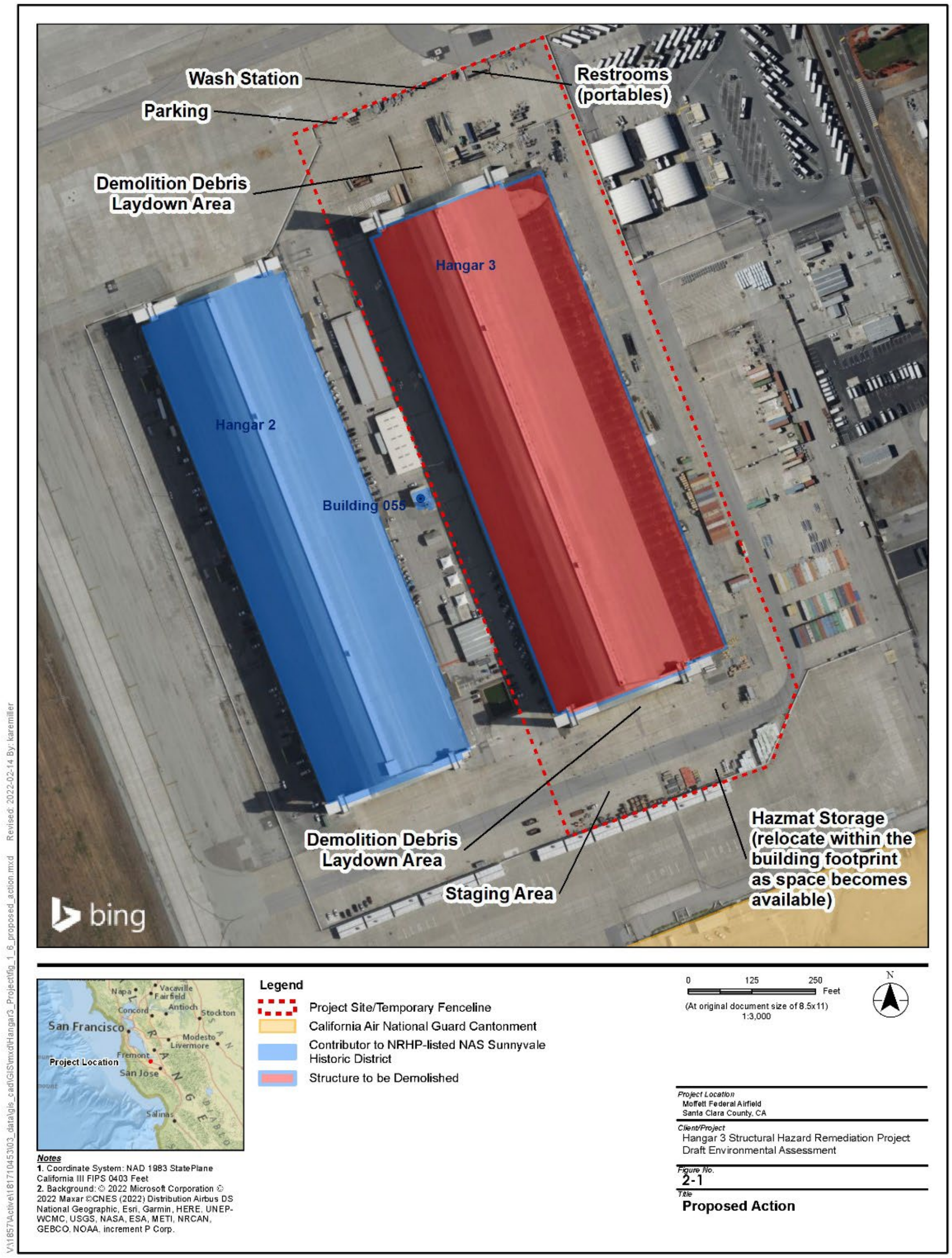



**Figure 2-1 Proposed Action**

### 2.2.1 Phase 1 – Pre-Demolition Activities

Phase 1 would commence with installation of a 6-foot-high temporary fence around the demolition area to control entry within the work area, as shown in Figure 2-1. All of the work would be within the fenced area, including all staging and laydown areas. Prior to demolition, a pre-demolition survey would be conducted to characterize non-hazardous and hazardous materials including lead and asbestos containing material (ACM) in accordance with the framework established by applicable federal, state, and local regulations. All features of Hangar 3 would be inspected for flaking paint, soil staining, or other conditions that could affect the demolition of Hangar 3. The roof would be evaluated for the presence of any fire-proofing material prior to abatement. If material deemed to be hazardous is found, encapsulation (or containment) would be considered prior to abatement by covering the material with an appropriate spray. The contractor would prepare an ACM and lead-based paint (LBP) abatement plan that would adhere to the U.S. Environmental Protection Agency (USEPA) and the Bay Area Air Quality Management District (BAAQMD) requirements. Structural features would be contained, and any LBP and ACM from non-metal components would be removed prior to demolition and transported and disposed of at an appropriate disposal facility. PV would coordinate these activities with NASA.

Pre-demolition activities would require installation of scaffolds for workers, and all scaffolding would be removed as necessary once Phase 1 is complete. A site-specific health and safety plan would be prepared for all phases of the Project and shared with all on-site workers including other staff such as biologists conducting surveys, monitors, etc.

### 2.2.2 Phase 2 – Demolition Activities

Hangar 3 is primarily constructed of lightweight material and is currently supported by a system of large pipe shores, steel exoskeletons, and an internal shoring and hydraulic jacking system that was installed in 2015 (Figure 2-2 and Figure 2-3). Demolition activities would commence from the outside of the building by first removing outside doors, then moving on to the high end of the bay and working from south to north. A bay is approximately 20 to 40 feet between trusses, and bays would be removed one at a time. Materials demolished would either be tethered and mechanically lowered to the floor or would be mechanically cut and dropped onto the floor. Steel trench plates would be placed on the slab to protect underground communication infrastructure and vaults. The trusses would be supported by the existing hydraulic jack system that would remain in place until trusses were removed. Once all the trusses were removed, the concrete bents and brick masonry shed structures, the door towers, box beam, and door tracks would be demolished (Figure 2-2). The bents and the brick walls would be demolished last. A structural engineer would inspect and validate whether the bents are self-supporting and not relying on the removed structure for structural stability. Temporary shoring may be required if bents would become structurally unstable.

Demolition would remove all above ground components. No work is proposed to occur below the slab. The door track system would be chipped with a concrete cruncher and potentially crushed to a size consistent with Class 2 baserock specifications (size range from 0.75 inch to fine dust). All debris would be mechanically tipped toward the inside of Hangar 3 to control the footprint of the demolition. Dust control measures required by the BAAQMD would be implemented during demolition. Water would primarily be used for dust control and wetting ACM, as needed. Water would either be provided by nearby hydrants or water trucks. Water use is expected to be no more than 5,000 gallons per day. All water used for dust control would be collected in covered and secured Baker tanks and tested prior to being transported offsite or discharged to the sanitary sewer. The specific location of Baker tanks would be determined during final design but would be located within the temporary fence line shown on Figure 2-1.

Building 055 is located approximately 50 feet from Hangar 3 and could be temporarily covered with plywood if determined necessary to protect the building from inadvertent flying debris. Hangar 2 is located farther away at approximately 200 feet from Hangar 3 and would not be impacted from demolition activities. In addition, protective screens to prevent flying debris would be installed within the fence line to ensure the safety of nearby structures. The fence would be outside of the airfield operations area so that Project activities would not need to be coordinated with airfield operations. However, the Lessee or contractor would notify FAA of the construction activities. Demolition activities would be temporarily stopped when sustained winds, or gusts, reach or exceed 25 miles per hour to prevent flying debris and possible dust migration.

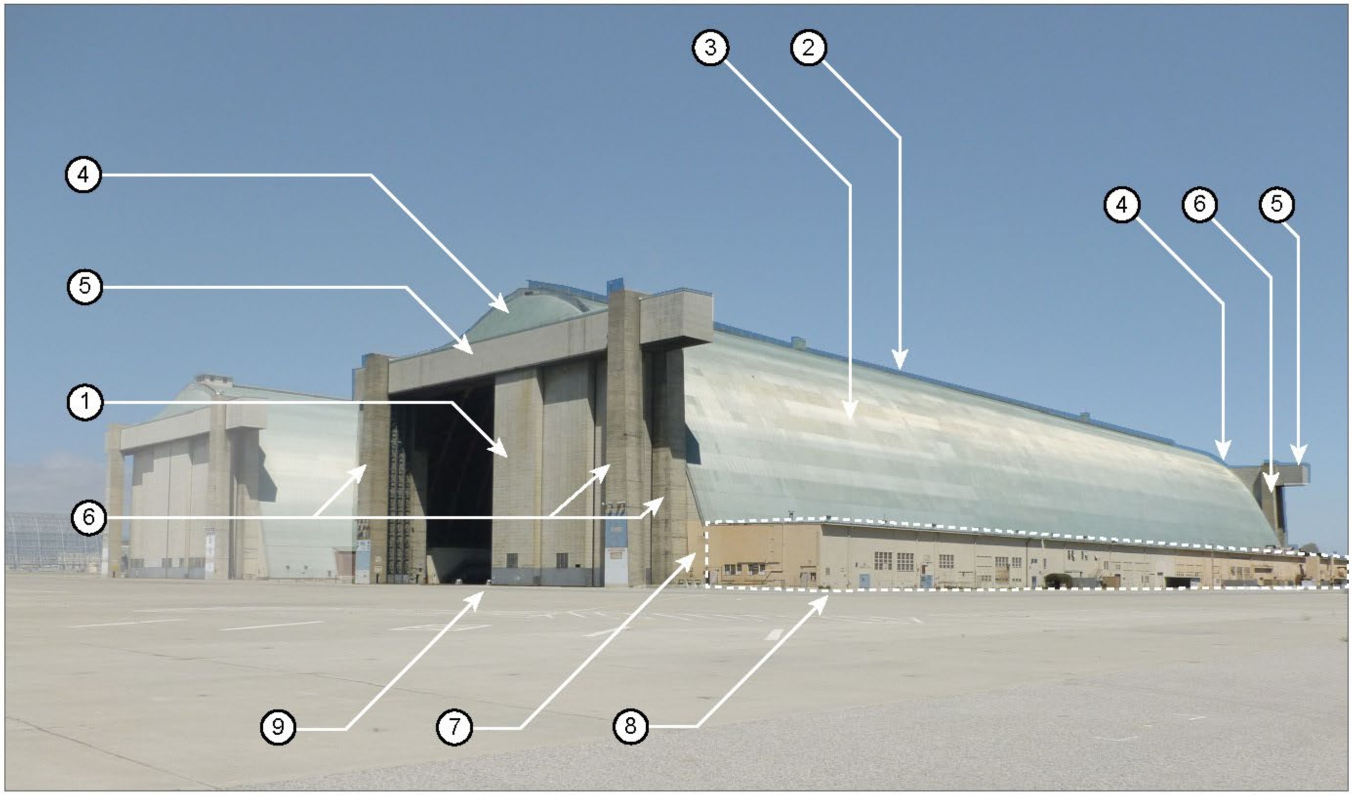
### 2.2.3 Phase 3 – Waste Disposal and Recycling

All waste materials would be characterized in Phase 1 and in Phase 2, and waste disposal and recycling (Phase 3) would occur concurrently throughout the Project[4]. In Phase 1, *in situ* characterization would be completed to characterize materials in place before demolition to assist in efforts to segregate non-hazardous wastes from hazardous or incompatible wastes during demolition. There may be some hazardous waste generated during Phase 1 that would be managed in compliance with applicable regulatory requirements and disposed of at a facility permitted to accept them.

[4] Phase 3 would be concurrent with Phases 1 and 2.

In Phase 2, materials removed would be characterized after demolition but before being loaded onto trucks or trailers for transport to an offsite approved construction waste facility. Waste contents would be confirmed by the demolition contractor or via sampling before transferring offsite, and wastes would be managed in compliance with applicable regulatory requirements. All hazardous materials from demolition would be staged in a hazardous materials storage area within the fenced work area (Figure 2-1).

Throughout Phase 2, the handling and management of waste generated during demolition would follow a hierarchical approach of source reduction, recycling, treatment, and disposal to the extent possible. Non-hazardous materials that were determined to be candidates for recycling would be separated from other materials and would be transported to a licensed recycling facility to reduce the amount of waste being disposed of at landfills. Potentially reusable electronic and electrical devices and components (such as wiring) would be segregated for reconditioning. Depending on the types, sizes, volumes, hazardous contents, or ultimate destinations of materials, containment would be in drums, cubic yard boxes, roll-off bins, lined trucks or trailers, or tanks to prevent the release of materials or hazardous contents. Bins containing hazardous wastes would be kept securely closed, except when wastes would be transferred into or out of them and would be manifested and transported for offsite disposal. Clean up and disposal of all debris would occur in accordance with foreign object debris, health and safety, and environmental requirements.




_Major Elements to be Removed During Demolition_

1. Horizontal Sliding Hangar Doors
2. Monitor Roof
3. Corrugated Aluminum Roof Panels
4. Aluminum Standing Seam Clamshell Roof
5. Wood Box Beam
6. Concrete Towers
7. Cement Asbestos Panels
8. Brick Masonry & Concrete Sheds
9. Metal Rail Door Track System

*Project Location*
Moffett Federal Airfield
Santa Clara County, CA

*Project*
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*Figure No.*
**2-2**

*Title*
**Hangar 3 Features - Exterior**

**Figure 2-2 Hangar 3 Features – Exterior**

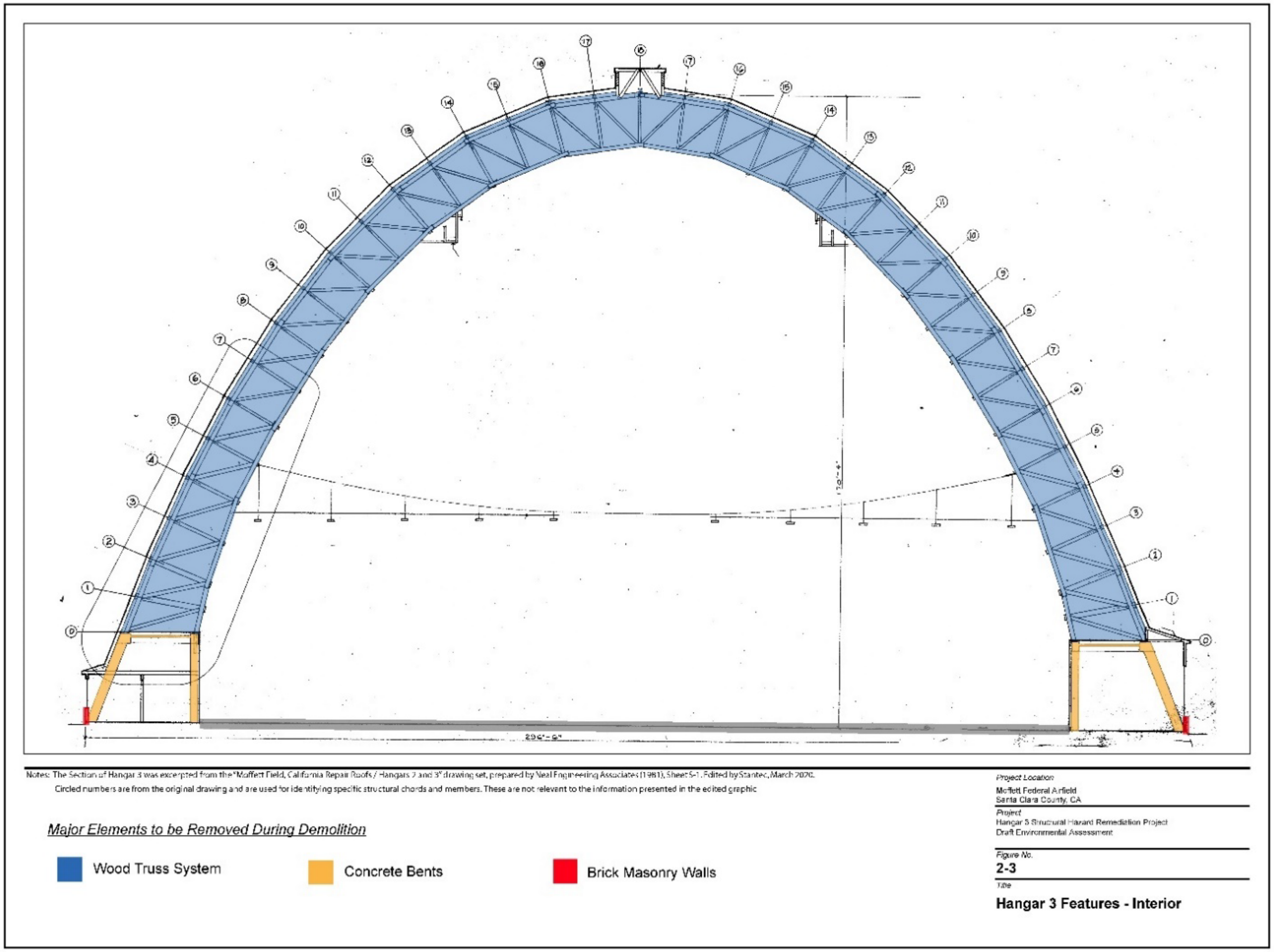



**Figure 2-3 Hangar 3 Features – Interior**

The approximate amount of demolition material to be generated would include 6,000 tons (4,000 cubic yards) of debris, 650 tons (435 cubic yards) of bricks, and 30,500 tons (20,300 cubic yards) of concrete from bents and support structures. Most of this could be transported offsite to a recycling facility, including bricks, and at least 90 percent of the material would be expected to be salvaged. The demolished material would likely be transported to the following facilities (other facilities might be used once demolition begins) and identified for possible export, resale, disposal, or reuse:

- Non-hazardous waste would be transported to either Zanker Recycling or Guadalupe Landfill; and
- Hazardous waste would be transported to either Kettleman Hills Hazardous Waste Facility or US Ecology Nevada, Inc.

### 2.2.4 Utilities

There are existing underground utilities near and around Hangar 3. A low-pressure water line is installed to the north and south of Hangar 3, and along the east and west facades. A sanitary sewer line runs from the CAANG Cantonment along the east side of Hangar 3. A separate sewer line that serves the area east of the airfield is installed along the west side of Hangar 3. Storm drains are also installed to the west and east of Hangar 3. An electrical feeder line and a telecommunication line run underneath the center of Hangar 3 in the east-west direction. Both lines cross the airfield and connect to the NASA Research Park to the west.

Prior to pre-demolition and/or demolition, all existing service connections to Hangar 3 would be capped in accordance with NASA's Underground Utility Abandonment Requirements and Procedures. Above-ground water line connections serving Hangar 3 would be drained, terminated, and capped at the connection to the service line where it goes below ground. No subsurface activity would occur in the area of the Proposed Action. Existing transformers and above-grade electrical facilities serving Hangar 3 would be demolished in accordance with Avoidance and Minimization Measure (AMM)-1: Environmental Issues Management Plan (EIMP) described in Section 2.2.7, Avoidance and Minimization Measures, below. All underground NASA communication infrastructure and vaults would be protected during demolition by placing steel trench plates on the slab. Active utility infrastructure connected to Hangar 3 or in areas anticipated to be disrupted would be identified and capped before initiating any site work. If any utilities could not be protected in place and would need to be rerouted, reroutes would occur within the Proposed Action footprint either on the north or south side and would be determined during final design. There are no known utility lines feeding from Hangar 3 to other users in the MFA Lease Area.

### 2.2.5 Construction Activities and Schedule

Construction activities for the Proposed Action would occur in two distinct, phases: pre-demolition and demolition. Phase 3, waste disposal and recycling, would be concurrent with Phases 1 and 2. The total duration for all phases would take approximately nine months starting in 2022. Pre-demolition would be anticipated to take approximately 80 to 90 working days demolition would take approximately 125 working days. Hazardous waste may be generated during pre-demolition (Phase 1) activities requiring an average of two truck trips per day for a total of four daily truck trips (two inbound, two outbound). The number of truck trips for Phase 2 would vary from 10 to 100 one-way trips per day. Demolition and transport activities would typically occur during daylight hours from 7:00 AM to 3:30 PM on weekdays. Up to 50 workers could be on-site per day during pre-demolition, and 20 workers would be anticipated to be on-site during demolition activities. Approximate locations for equipment staging are shown in Figure 2-1 but would be confirmed on-site during demolition activities. Construction equipment to be used would include demolition excavators, crane, manlift, skid steer, water trucks, and dump/haul trucks. Once construction was completed, all temporary laydown and staging areas would be removed and restored to pre-Project conditions to the extent feasible.

### 2.2.6 Access Routes

Construction-related traffic is expected to follow two routes to the Project site. Construction truck traffic would be expected to travel along Macon Road between the Project site and the 5th Avenue Gate. Construction workers would travel along Macon Road between the Project site and the Ellis Street Gate. Both truck and worker traffic would travel to the gates via State Route (SR) 237 and U.S. Highway 101 (US 101). Both SR 237 and US 101 are located approximately one mile south of Hangar 3 and would be the most logical routes to and from the site for haul-in and haul-out and for construction personnel. A detailed construction traffic route to Hangar 3, with appropriate traffic controls, would be developed as part of Phase 1 efforts, as noted in the AMM-3: Construction Traffic Control Plan (describe in Section 2.2.6, Access Roads below); however, no new access road would be needed.

### 2.2.7 Avoidance and Minimization Measures

The general avoidance and minimization measures (AMMs) described here have been developed to avoid and minimize effects that could result from the Project. As such, these AMMs would be implemented as part of the Proposed Action.

**AMM-1 - Environmental Issues Management Plan (EIMP).** The Lessee has prepared an EIMP, dated 2017, which has been approved by the USEPA and the San Francisco Regional Water Quality Control

Board (RWQCB) that identifies measures specific to the Project site that shall be implemented during all construction activities related to the Proposed Action. The EIMP includes detailed procedures and measures to address known environmental conditions as well as contingency actions to be taken if previously unknown environmental conditions are encountered within the MFA Lease area. Project construction/demolition activities shall comply with the EIMP requirements. Risk management measures described in the EIMP are briefly summarized below:

- Development and implementation of a site-specific health and safety plan that covers health and safety training requirements, personal protective equipment, and other precautions to minimize direct contact with soil, groundwater, and soil vapors.
- Implementation of construction impact mitigation such as dust and odor control measures, decontamination procedures for equipment, stormwater pollution controls (including implementation of best management practices [BMPs] established in NASA ARC's Storm Water Pollution Prevention Plan [SWPPP]), and methods for sampling and analyzing groundwater extracted during construction to determine appropriate storage and disposal practices.
- Proper management of: ACM, debris and structures containing LBP, and/or paint containing polychlorinated biphenyls (PCB), equipment or structures that are removed during Project activities.
- Procedures for the management of the dewatering water generated during construction activities; including, using for dust control within the lease area, sending for treatment, or releasing into the sanitary sewer in accordance with waste discharge permit requirements. If none of these options are available, the Lessee would arrange for disposal at a permitted facility.

**AMM-2 – Noise and Vibration.** The following protection measures shall be implemented during construction:

- Truck traffic associated with demolition work is expected to travel along Macon Road between the Proposed Action site and the 5th Avenue Gate. Demolition workers would travel along Macon Road between the site and the Ellis Street Gate. Neither the truck traffic nor worker traffic would pass through any noise-sensitive neighborhoods before merging onto the freeway.
- All demolition activities would follow the hours restrictions and procedures listed in Chapter 8, Buildings, Article VI, Construction Noise, Section 8.70, Construction noise, of the Mountain View Municipal Code and Paragraph 16.080.030, Hours of Construction – Time and Noise Limitations, in the Sunnyvale Municipal Code.

- Hangar 2 and Building 055 would be protected by carefully lowering materials to the floor of Hangar 3. All demolition materials would either be tethered and mechanically lowered to the ground or mechanically cut and dropped to the floor. If materials are dropped to the floor, consideration would be made including limiting fall distances and the weight of the material being dropped to minimize impacts to the slab. Reducing stress on the slab lowers the vibrational energy that enters the slab and reduces the vibration impact that could propagate through the ground to Hangar 2 and Building 055.
- The trusses would be supported by the existing hydraulic jack system that would remain in place until trusses were removed, thus limiting the opportunity for structural elements to fall to the slab reducing the vibration energy that enters the slab.

**AMM-3 – Construction Traffic Control Plan.** The Lessee shall prepare a detailed construction traffic control plan for NASA’s review and approval prior to any construction activity requiring site access by on-site workers and/or construction trucks. The Plan would include, but would not be limited to, identification of access and haul routes to/from the Project site; appropriate signage and temporary traffic control devices (e.g., lane striping, coning, barricades, etc.) for pedestrians, bicyclists, and motorists; staging areas; construction days and hours; construction worker transportation and parking; and any other disruption to traffic, transit, bicycle, or pedestrian circulation. The approved Construction Traffic Control Plan would be followed for the duration of project activities.

## 2.3 No Action Alternative

For the purpose of this analysis, the No Action Alternative considers a continuation of current activities, and Hangar 3 would not be demolished and remain unoccupied. Maintenance of the temporary internal shoring and hydraulic jacking system would continue under this alternative to try to maintain structural integrity, and no further attempts to complete structural upgrades on Hangar 3 would be undertaken. No use of Hangar 3 would be allowed. Under the No Action Alternative, there is a potential for physical hazards from structural failure.

## 2.4 Alternatives Considered but Eliminated

### 2.4.1 Reconstruction of Hangar 3

The possibility of fully stabilizing and rehabilitating Hangar 3 was also assessed. However, full rehabilitation that does not require destruction of the essential components that make Hangar 3 a valuable historic structure would not be feasible (essential components include: parabolic roof; sliding hangar doors with supporting concrete towers, wood box beams, and adjoining clamshell roof; wood frame truss construction set on repeating concrete bents; expansive interior concrete decking; and the vast open interior volumes). From a construction standpoint, it is not feasible to replace damaged components in sequence (i.e., remove and replace individual components). Full rehabilitation of Hangar 3 would require bringing the structure up to code; however, in order to bring the structure into prevailing seismic code regulations for safety, Hangar 3 would effectively have to be deconstructed and then reconstructed into an entirely new structure using new materials. The cost for reconstruction of the hangar would be more than 50 times higher than the Proposed Action and is not reasonably feasible from a cost perspective; therefore, this alternative does not meet NEPA regulations and CEQ guidance for a reasonable alternative.

### 2.4.2 Partial Preservation of Hangar 3

A partial preservation of Hangar 3 was considered that would have removed the safety hazard associated with the main hangar structure while restabilizing and preserving independent features of the structure. This alternative is referred to as Alternative 2 – Partial Preservation in the supporting studies found in the appendices. Under this alternative, the two sets of concrete towers and box beam structures (at the northern and southern ends) would be retained, and the entire main hangar structure would be demolished. Appendix A, KPFF Memos provides memorandums that address the feasibility of retaining portions of Hangar 3. Under this alternative, both sets of hangar doors, machinery, and existing tracks would be removed with the demolition of the main hangar structure. Demolition activities related to this alternative would include the three phases discussed in the Proposed Action. This alternative would also include an additional Phase 4 for activities required for abatement and stabilization of the remaining Hangar 3 elements. These activities would include: 1) box beam rehabilitation, shoring, and strengthening; 2) concrete door tower rehabilitation and strengthening; and 3) foundation strengthening. The total duration for this alternative would take approximately 21 months.

The costs associated with the partial preservation of Hangar 3 was determined to be considerably higher than the Proposed Action. This alternative would also effectively reduce Hangar 3 to two smaller structures, which would relate in form to each other, but would, as a result, contrast with the overall visual character of Hangar 2. Therefore, this alternative was dismissed from further study.

# 3.0 Affected Environment and Environmental Consequences

NEPA requires that the analysis address areas and components of the environment that may be potentially affected and eliminate issues that are not relevant to the scope of analyses consistent with CEQ regulations in 40 CFR 1500. As directed by NEPA, CEQ regulations on implementing NEPA (40 CFR 1500-1508), NASA's regulations for implementing NEPA (14 CFR 1216), and NASA NEPA management requirements (NPR 8580.1A), the description of the affected environment focuses on those resource areas potentially subject to impacts. Therefore, the level of detail used in describing a resource is in accordance with the anticipated level of environmental impact. An EA has been prepared for NASA to evaluate potential effects that could occur as a result of the work proposed by the Lessee to address existing hazardous structural conditions at Hangar 3. The preparation of an EA was determined to be the appropriate level of analysis as the Proposed Action is not anticipated to result in significant impacts to the environment.

Section 3.1, Environmental Resources Eliminated from Detailed Consideration discusses which resources were eliminated from detailed consideration, and Section 3.2, Environmental Resources Included for Detailed Consideration analyzes those resources considered for detailed analysis. Each environmental resource discussion begins with an explanation of the affected environment and ends with a discussion of potential environmental consequences. The affected environment for each relevant environmental resource is described to provide meaningful points from which the public and agency decision-makers can compare potential future environmental, social, and economic effects. The baseline conditions described in this section constitute conditions under the No Action Alternative. Additionally, the geographic area over where an effect may occur is defined for each resource analyzed. For the purpose of analysis, Project area refers to the general vicinity around the specific Project site.

Potential impacts have been evaluated to determine whether they would constitute a "significant effect" on a particular environmental resource area. The terms "impact" and "effect" are used synonymously in this EA. Impacts occurring only during construction are described as short-term or temporary. In this EA, "construction" refers to the demolition of Hangar 3. Impacts may apply to the full range of natural, aesthetic, historic, cultural, and socioeconomic resources.

The following resources were eliminated from detailed analysis in the EA: floodplains and wetlands; geological resources; land use; and socioeconomics and environmental justice. The following were carried through for detailed analysis: air quality; biological resources; cultural resources; greenhouse gases (GHG) and climate change; hazards, safety and waste management; noise and vibration; transportation and circulation; utilities; visual resources; and water resources. The following supporting technical studies were conducted in preparation of this EA: Air Quality CalEEMod Modeling (Appendix B); Section 106 Report (Appendix C); Noise Technical Memorandum (Appendix D); and Traffic Analysis Memorandum (Appendix E).

## 3.1 Environmental Resources Eliminated from Detailed Consideration

It was determined that the following environmental resources either would not be present or would not be impacted by the Project: floodplains and wetlands (Section 3.1.1); geological resources (Section 3.1.2); land use (Section 3.1.3); and socioeconomics and environmental justice (Section 3.1.4).

### 3.1.1 Floodplains and Wetlands

Historically, flooding at ARC, primarily in the northern portions of the site, originated from the San Francisco Bay and Stevens Creek. Improvements to the bay-side levees and subsequent flood control improvements to Stevens Creek have provided greater protection from flooding in recent years but have not removed the risk entirely. The stormwater drainage and retention systems at ARC lack the capacity to handle high water volumes and have on occasion caused general and localized flooding in certain areas during peak rainfall events (NASA 2015). Per Federal Emergency Management Agency Flood Insurance Rate Map No. 06085C0045H, MFA is located within an area designated as Zone D, indicating areas of undetermined, but possible, flood hazards. Modeling shows roughly the northern third of MFA would be affected during the 100-year flood (NASA 2015). However, the Project would not directly or indirectly impact floodplains since the amount of impervious area, runoff volume, and drainage patterns would stay the same as under existing conditions. The Project site is approximately 1.5 miles from the nearest tsunami inundation area and impacts from a tsunami are not anticipated (California Department of Conservation 2020).

The Project site is limited to the area immediately surrounding Hangar 3, a developed site not located within or near a wetland (NASA 2002) or near any water bodies. The nearest water body to the Project area is associated with Marriage Road Ditch approximately 1,000 feet north of the Project area. Under existing conditions, stormwater from the airfield (including Hangar 3) discharges to the Marriage Road Ditch. Demolition of Hangar 3 would not have a significant impact on the ditch as the stormwater runoff volume and rate from the Project site would remain the same under after demolition. Surface water quality impacts are discussed in Section 3.2.10, Water Resources.

### 3.1.2 Geological Resources

Geological resources include soil types and their engineering properties, and the potential for seismic hazards such as surface fault rupture, strong seismic ground shaking, and liquefaction. Paleontological resources consist of the fossilized remains of ancient plants and animals.

There are no active faults near ARC. Furthermore, ARC is not within any Earthquake Fault Zone as identified by the Alquist-Priolo Earthquake Fault Zoning Act. Consequently, surface rupture is considered unlikely. Nonetheless, because several active faults are in the region (San Andreas, Hayward, and Calaveras) the Project site could experience strong ground shaking from earthquakes (NASA 2015). According to the United States Geologic Survey (USGS), the MFA is in an area identified as having a high risk of liquefaction (USGS 2021). The Project would result in demolition of an above-ground structure that has occupied the site for approximately 77 years and would not include any subsurface work or ground disturbance. Therefore, the Proposed Action would have no impact from soil resources or on paleontological resources. The Project will not result in the construction of any new structures that will be at risk of liquefaction or strong seismic ground shaking. Construction best management practices (BMPs) intended to address potential effects of soil erosion on water quality are discussed in Section 3.2.10, Water Resources and no topographical alterations would occur from the Project. Therefore, there would be no significant construction and/or operation-related impacts to geological resources from the Project.

### 3.1.3 Land Use

The Proposed Action would involve the demolition of Hangar 3. Any land use impacts from construction activities would be localized, temporary, and minimal. Once construction was completed, all temporary laydown and staging areas would be removed and restored to pre-Project conditions to the extent feasible. The Project does not have any operational uses and would not foreclose or impede the future use of the airfield in accordance with the applicable policies of the San Francisco Bay Plan (Bay Plan) as adopted by the San Francisco Bay Conservation and Development Commission (BCDC).

BCDC is a state agency created by the McAteer-Petris Act of 1965 (Cal. Government Code sections 66600 et seq.) to regulate the filling, dredging, and changes in use in the San Francisco Bay. BCDC has permit jurisdiction over shoreline areas subject to tidal action up to the mean high tide line, including all sloughs, tidelands, submerged lands, and marshlands lying between the mean high tide and 5 feet above mean sea level for the nine Bay Area counties with Bay frontage. In addition, BCDC regulates new development within 100 feet of the shoreline to ensure the provision of public access to and along the San Francisco Bay. BCDC is also responsible for ensuring that shoreline property suitable for regional high-priority water-oriented uses, such as ports, water-related industry, water-oriented recreation, airports, and wildlife areas, is reserved for these purposes (BCDC 2021). In addition to its permit authority under state law, BCDC exercises authority under Section 307 of the federal Coastal Zone Management Act (16 U.S.C. section 1456) over federal activities and development projects and non-federal projects that require a federal permit or license or are supported by federal funding. The consistency provisions of Section 307 of the Coastal Zone Management Act provide that any federal activity, including a federal development project, which affects any land or water use or natural resource of BCDC's coastal zone, must be conducted in a manner that is "consistent to the maximum extent practicable" with the enforceable policies of the BCDC's federally-approved coastal management program. Similarly, any nonfederal activity that requires either a federal permit or license or is supported by federal financial assistance that affects BCDC's coastal zone must be conducted in a manner that is fully consistent with the enforceable policies of the BCDC's federally-approved coastal management program, including the McAteer-Petris Act and the Bay Plan (BCDC 2021).

The Project would not involve any construction activities at or near the shoreline of the Bay or within BCDC's 100-foot shoreline band. Further, the Project would not result, either directly or indirectly, in any fill of any portion of the Bay, or of any wetlands, tidal marshes or mudflats, or other aquatic features or resources. The Project would not have an adverse effect on coastal resources within BCDC's jurisdiction, or on the implementation and attainment of the governing objectives and policies of BCDC's Bay Plan.

The Project site is a small portion of the MFA, which is identified as an "Airport" in Plan Map 7 of the Bay Plan. The Bay Plan states MFA is not within BCDC permit jurisdiction, and if and when the airfield is not needed by the Navy, the site should be evaluated for use as a commercial airport (BCDC 2020).

With respect to other potentially applicable Bay Plan policies, the Project's impacts would be outside of the coastal areas subject to BCDC jurisdiction. In addition, the impacts would be minimized through mitigation as detailed in this EA, including mitigation to protect any upland habitat or species present in and around the Project site. The Project would be in accord with any applicable Bay Plan policies on the environment, including policies that pertain to aquatic resources, water quality, tidal marshes and flats, transportation, and other environmental resource categories.

Additionally, with respect to public access, the Project does not include any modifications that would adversely affect access to the Bay. Current public access and recreational opportunities associated with the Bay would be fully maintained.

The Bay Plan states that "airports on the shores of the Bay should be permitted to include within their premises terminals for passengers, cargo, and general aviation; parking and supporting transportation facilities; and ancillary activities such as aircraft maintenance bases that are necessary to the airport operation. Airport-oriented industries (those using air transportation for the movement of goods and personnel or providing services to airport users) may be located within airports designated in the Bay Plan if they cannot feasibly be located elsewhere, but no fill should be permitted to provide space for these industries directly or indirectly" (BCDC 2020). The Project would not change the current airfield operation at MFA and does not involve any fill of coastal or tidal waters, either directly or indirectly.

In sum, the Project would not affect the existing use of MFA or foreclose or impede the site's future use as an airfield in accord with the applicable Bay Plan policies. Further, the Project would not adversely affect coastal resources or interfere with the implementation or attainment of Bay Plan policies.

### 3.1.4 Socioeconomics and Environmental Justice

The Project is not expected to have a measurable effect on the regional economy or surrounding community. Implementation of the Project would not affect employment of PV or NASA employees. Additionally, Hangar 3 is currently unoccupied, and therefore the Project would not result in loss of employment. A temporary need for a moderate number of construction workers would result in a slight increase in the total number of persons working at MFA. Additional support facilities (e.g., housing, transportation) would not be necessary to accommodate the increase in workforce as necessary construction workers are expected to be available locally. Changes to employment and expenditures resulting from the Project would be short-term and beneficial, creating short-term employment opportunities for local contractors. With the exception of employment opportunities, no impacts to socioeconomics would be anticipated for the Project.

EO 12898 directs federal agencies to identify and address disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on low-income populations and minority populations in the U.S. According to USEPA's Environmental Justice Screening and Mapping Tool, the minority population within the Project vicinity falls in the 60 to 70 percentile compared to other communities nationwide (i.e., 30 to 40 percent of other communities in the nation have a higher minority population) and the Project vicinity is bounded to the east by a community with a minority population in the 80 to 90 percentile (Census Tract 5046.02). The Project and immediate vicinity are located in an area where less than 50 percent of the population is low income (EJSCREEN 2022). Information from Metropolitan Transportation Commission Equity Priority Communities, which takes into account more census factors, shows two communities of concern in the vicinity of the Project but more than 1 mile away (Census Tract 5116.08 and 5090.00). The Project is a remediation of an existing building with temporary construction. As described in Section 3.2, Air Quality, nearby communities would not have any increased health risk from project demolition. Moreover, as discussed in Section 3.5, Hazards, Safety, and Waste Management, nearby sensitive populations would not be impacted by hazardous waste or the transport of hazardous materials since the project would be required to comply with all applicable regulations and trucks transporting hazardous materials would not drive through Equity Priority Communities. Once demolition was complete, the Project would not have any long-term operation that may impact nearby communities. Therefore, the Project would not be expected to result in any disproportionate impacts to minorities or low-income populations.

## 3.2 Environmental Resources Included for Detailed Consideration

This section provides detailed analysis for the following resources: air quality, biological resources, cultural resources, GHG and climate change, hazardous materials and waste management, noise and vibration, transportation and circulation, utilities, visual resources, and water resources. Each section defines the resource; summarizes the relevant regulations that affect the analysis; and discusses the affected environment and environmental consequences of the Proposed Action and the No Action Alternative.

### 3.2.1 Air Quality

This section provides a discussion of air pollutants and health risks posed to nearby sensitive receptors from construction and operation of the Proposed Action. This evaluation relies on guidance and thresholds established by the United States Environmental Protection Agency (USEPA) and the Bay Area Air Quality Management District (BAAQMD).

#### Criteria Pollutants

Criteria air pollutants include ozone, carbon monoxide (CO), nitrogen dioxide ($NO_2$), sulfur dioxide ($SO_2$), particulate matter (measured both in units of smaller than 2.5 microns in diameter [$PM_{2.5}$], and in units of particulate matter smaller than 10 microns in diameter [$PM_{10}$]), and lead (Pb).

*Ozone*: The majority of ground-level ozone (more commonly known as “smog”) is formed as a result of complex photochemical reactions in the atmosphere between reactive organic gases (ROGs), nitrogen oxides ($NO_X$), and oxygen. ROGs and $NO_X$ are considered precursors to the formation of ozone, a highly reactive gas that can damage lung tissue and affect respiratory function. While ozone in the lower atmosphere is considered a damaging air pollutant, ozone in the upper atmosphere is beneficial, as it protects the earth from harmful ultraviolet radiation. However, atmospheric processes preclude ground-level ozone from reaching the upper atmosphere (USEPA 2019).

*Carbon Monoxide*: CO is a colorless, odorless, poisonous gas produced by the incomplete combustion of fossil fuels. Elevated levels of CO can result in harmful health effects, especially for the young and elderly, and can also contribute to global climate change (USEPA 2019).

*Nitrogen Dioxide*: $NO_2$ is a brownish, highly reactive gas primarily produced from the burning of fossil fuels. $NO_2$ can also lead to the formation of ozone in the lower atmosphere. $NO_2$ can cause respiratory ailments, especially in the young and elderly, and can lead to degradations in the health of aquatic and terrestrial ecosystems (USEPA 2019).

*Sulfur Dioxide*: $SO_2$ is primarily emitted from the combustion of coal and oil by steel mills, pulp and paper mills, and non-ferrous smelters. High concentrations of $SO_2$ can aggravate existing respiratory and cardiovascular diseases in asthmatics and others who suffer from emphysema or bronchitis. $SO_2$ also contributes to acid rain, which in turn, can lead to the acidification of lakes and streams (USEPA 2019).

*Particulate Matter*: Airborne particulate matter (PM) is a complex mixture of solids and aerosols composed of small droplets of liquid, dry solid fragments, and solid cores with liquid coatings. Particles vary widely in size, shape, and chemical composition, and may contain inorganic ions, metallic compounds, elemental carbon, organic compounds, and compounds from the earth's crust. Particles are defined by their diameter for air quality regulatory purposes. Those with a diameter of 10 microns or less ($PM_{10}$) are inhalable into the lungs and can induce adverse health effects. Fine particulate matter is defined as particles that are 2.5 microns or less in diameter ($PM_{2.5}$). Therefore, $PM_{2.5}$ comprises a portion of $PM_{10}$ (CARB 2021). Emissions from combustion of gasoline, oil, diesel fuel or wood produce much of the $PM_{2.5}$ pollution found in outdoor air, as well as a significant proportion of $PM_{10}$. PM also includes dust from construction sites, landfills and agriculture, wildfires and brush/waste burning, industrial sources, wind-blown dust from open lands, pollen, and fragments of bacteria.

PM may be either directly emitted from sources (primary particles) or formed in the atmosphere through chemical reactions of gases (secondary particles) such as sulfur dioxide ($SO_2$), nitrogen oxides ($NO_X$), and certain organic compounds.

*Lead*: Sources of lead (Pb) include pipes, fuel, and paint, although the use of Pb in these materials has declined dramatically in recent years. Historically, a main source of Pb was automobile emissions. Pb can be inhaled directly or ingested indirectly by consuming Pb-contaminated food, water, or dust. Fetuses and children are most susceptible to Pb poisoning, which can result in heart disease and nervous system damage (USEPA 2019). Through regulations, USEPA has gradually reduced the Pb content of gasoline, essentially eliminating violations of the Pb standard in urban areas except those areas with Pb point sources.

### Diesel Particulate Matter (DPM)

In 1998, the California Air Resources Board (CARB) identified DPM as a toxic air contaminant based on published evidence of a relationship between diesel exhaust exposure and lung cancer and other adverse health effects. This determination is based primarily on evidence from occupational studies that show a link between exposure to DPM and lung cancer induction, as well as death from lung cancer. The exhaust from diesel engines includes hundreds of different gaseous and particulate components, many of which are toxic. Mobile sources, such as trucks and buses, are among the primary sources of diesel emissions, and concentrations of DPM are higher near heavily traveled highways. BAAQMD staff has estimated incremental cancer risk due to measured Toxic Air Contaminants (TAC) in the Bay Area. According to the most recent analysis (BAAQMD 2014), the average regional cancer risk was about 300 per million. That is, for every million residents exposed for 70 years to current levels of TAC, 300 residents would be expected to develop cancer as a result of the exposure. According to the analysis, more than 70 percent of the cancer risk related to air pollution in the Bay Area is due to DPM, and 90 percent of the total risk is due to three compounds: DPM; benzene; and 1,3-butadiene. All three of these compounds are emitted via fuel combustion.

## 3.2.1.1 Regulatory Setting

Under the federal CAA as amended, states are responsible for enforcing the established air quality regulations. CARB enforces air pollution regulations and sets guidelines, as contained in the California State Implementation Plan (SIP), to attain and maintain National Ambient Air Quality Standards (NAAQS) and California Ambient Air Quality Standards (CAAQS). The CAA Amendments of 1990 established new federal nonattainment[5] classifications, new emission control requirements, and new compliance dates for nonattainment areas. The CAA identifies two types of NAAQS. Primary standards provide public health protection, including protecting the health of sensitive populations such as asthmatics, children, and the elderly. Secondary standards provide public welfare protection, including protection against decreased visibility and damage to animals, crops, vegetation, and buildings (USEPA 2021). The CAAQS are equal to or more stringent than the NAAQS and include pollutants for which national standards do not exist. Table 3-1 presents the applicable NAAQS and CAAQS for the Project area.

[5] Any area that does not meet (or that contributes to ambient air quality in a nearby area that does not meet) the national primary or secondary ambient air quality standard for a NAAQS.

**Table 3-1 California and National Ambient Air Quality Standards**

| Pollutant | Averaging Time | California Standard Concentration[1] | National Standard Primary[2] | National Standard Secondary |
|---|---|---|---|---|
| Ozone | 1 Hour | 0.09 ppm (180 μg/m$^3$) | — | Same as Primary Standard |
| | 8 Hour | 0.070 ppm (137 μg/m$^3$) | 0.070ppm (137 μg/m$^3$) | |
| Respirable Particulate Matter | 24 Hour | 50 μg/m$^3$ | 150 μg/m$^3$ | Same as Primary Standard |
| | Annual Arithmetic Mean | 20 μg/m$^3$ | — | |
| Fine Particulate Matter | 24 Hour | — | 35 μg/m$^3$ | Same as Primary Standard |
| | Annual Arithmetic Mean | 12 μg/m$^3$ | 12 μg/m$^3$ | |
| Carbon Monoxide | 1 Hour | 20 ppm (23 mg/m$^3$) | 35 ppm (40 mg/m$^3$) | — |
| | 8 Hour | 9.0 ppm (10 mg/m$^3$) | 9 ppm (10 mg/m$^3$) | — |
| | 8 Hour (Lake Tahoe) | 6 ppm (7 mg/m$^3$) | — | — |
| Nitrogen Dioxide | 1 Hour | 0.18 ppm (339 μg/m$^3$) | 100 ppb (188 μg/m$^3$) | — |
| | Annual Arithmetic Mean | 0.030 ppm (57 μg/m$^3$) | 0.053 ppm (100 μg/m$^3$) | Same as Primary Standard |
| Sulfur Dioxide | 1 Hour | 0.25 ppm (655 μg/m$^3$) | 75 ppb (196 μg/m$^3$) | — |
| | 3 Hour | — | — | 0.5 ppm (1300 μg/m$^3$) |
| | 24 Hour | 0.04 ppm (105 μg/m$^3$) | 0.14 ppm (for certain areas) | — |

| Pollutant | Averaging Time | California Standard Concentration[1] | National Standard Primary[2] | National Standard Secondary |
|---|---|---|---|---|
| | Annual Arithmetic Mean | — | 0.030 ppm (for certain areas) | — |
| Lead | 30-Day Average | 1.5 µg/m³ | — | — |
| | Calendar Quarter | — | 1.5 µg/m³ | Same as Primary Standard |
| | Rolling 3-Month Average | — | 0.15 µg/m³ | |
| Visibility-Reducing Particles | 8 Hour | See Footnote 1 | No National Standards | |
| Sulfates | 24 Hour | 25 µg/m³ | | |
| Hydrogen Sulfide | 1 Hour | 0.03 ppm (42 µg/m³) | | |
| Vinyl Chloride | 24 Hour | 0.01 ppm (26 µg/m³) | | |

Notes
1. CO, $NO_2$, Ozone, PM10, and visibility reducing particles standards are not to be exceeded.
2. Not to be exceeded more than once a year except for annual standards.
-- = no standard established
µg/m3 = micrograms per cubic meter
mg/m3 = milligrams per cubic meter
ppm = parts per million
Source: CARB 2016

The severity of the nonattainment classification drives the associated requirements and compliance dates. The San Francisco Bay Area Air Basin (SFBAAB) is in nonattainment for ozone and particulate matter. The following section provides a summary of the air quality rules and regulations that apply to the Proposed Action.

**General Conformity Rule (40 CFR 51.850-860 and 40 CFR 93.150-160).** Section 176(c) of the 1990 CAA Amendments contains the General Conformity Rule (40 CFR 51.850-860 and 40 CFR 93.150-160). The General Conformity Rule requires any federal agency responsible for an action in a nonattainment or maintenance area[6] to determine that the action conforms to the applicable SIP. This means that federally supported or funded activities will not: (1) cause or contribute to any new air quality standard violation; (2) increase the frequency or severity of any existing standard violation; or (3) delay the timely attainment of any standard, interim emission reduction, or other milestone. The rule allows for approximately 30 exemptions, assuming that they conform to an applicable SIP. Emissions of attainment pollutants are exempt from conformity analyses. Actions would conform to a SIP if their annual direct and indirect emissions remain less than the applicable *de minimis* thresholds. Formal conformity determinations are required for any actions that exceed these thresholds.

**California Clean Air Act.** The California CAA of 1988, as amended in 1992, outlines a program to attain the CAAQS for ozone, $NO_2$, $SO_2$, PM, and CO by the earliest practical date. As shown in Table 3-1, the CAAQS are more stringent than the NAAQS. CARB delegates the authority to regulate stationary source emissions to local air quality management districts. CARB requires these agencies to develop their own strategies for achieving compliance with the NAAQS and CAAQS, but maintains regulatory authority over these strategies, as well as all mobile source emissions throughout the state.

**Bay Area Air Quality Management District (BAAQMD).** BAAQMD is responsible for developing and implementing the clean air plan for attainment and maintenance of the ambient air quality standards in the SFBAAB. BAAQMD has developed the following attainment plans and rules and regulations applicable to the Project:

*2017 Clean Air Plan*

The 2017 Clean Air Plan includes control strategies to reduce ozone precursors (ROG and NOx), particulate matter, TACs, and GHG emissions. The SFBAAB is in nonattainment for state and federal ozone standards due to tightened national ozone standards as well as population and economic growth. The SFBAAB meets state and federal $PM_{2.5}$ standards, however localized levels of PM still impact communities in the Bay Area. The Clean Air Plan included several measures for reducing PM emissions from stationary sources and wood burning.

**Regulation 6, Rule 1: General Requirements.** The purpose of this regulation is to limit the quantity of PM in the atmosphere through the establishment of limitations on emission rates, emission concentrations, visible emissions, and opacity.

[6] Areas that were previously designated as nonattainment areas but have now met the standard (with USEPA approval of a suitable air quality plan) are called "maintenance" areas.

**Regulation 6, Rule 6: Prohibition of Trackout.** This rule reduces the quantity of particulate matter in the atmosphere by prohibiting the trackout of solid materials onto paved public roads outside the boundaries of Large Bulk Material Sites, Large Construction Sites, and Large Disturbed Surface sites including landfills if those areas are more than 1 acre.

**Regulation 11, Rule 2: Asbestos Demolition, Renovation, and Manufacturing.** BAAQMD regulates the emissions of asbestos to the atmosphere during demolition activities and also establishes appropriate water disposal procedures. The rule states that ACM must be adequately wetted prior to demolition to prevent the release of asbestos-containing particles.

### 3.2.1.2 Affected Environment

#### Climate and Meteorology

At an elevation just above sea level and adjacent to the moderating influence of San Francisco Bay and the nearby Pacific Ocean, the climate of MFA is characterized by warm dry summers and cool, moist winters. During the warmer months of the year (normally May through October), the airfield is subject to morning and evening low clouds and fog with primarily sunny conditions occurring during the day. Most of the annual average of 13.5 inches of rainfall occurs between November and April. The annual average high and low temperatures at MFA are 68 degrees Fahrenheit (°F) and 50°F, respectively. Prevailing winds blow from the north-northwest in the region during daytime hours. Nocturnal winds and land breezes during the colder months of the year blow from the south.

#### Regional and Local Air Pollutant Sources

MFA is located in the SFBAAB, which includes the counties of San Francisco, Santa Clara, San Mateo, Marin, Napa, Contra Costa, and Alameda, along with the southeastern portion of Sonoma County and the southwestern portion of Solano County. As discussed above, the local air quality regulatory agency responsible for the basin is BAAQMD.

BAAQMD periodically updates emissions for the entire SFBAAB for the purposes of forecasting future emissions and analyzing emission control measures, and for use in regional air quality modeling. The largest regional sources of air emissions are on-road vehicles. The 2011 BAAQMD emissions inventory determined that on an average daily basis, on-road vehicles emitted 30 percent of volatile organic compounds (VOCs), 56 percent of $NO_X$, and 58 percent of CO emissions within the Bay Area (BAAQMD 2014). Combustion sources produce both primary fine particulate matter and fine particulate precursor pollutants, such as $NO_X$, which react in the atmosphere to produce secondary fine particulates. Coarser particles ($PM_{10}$ and $PM_{2.5}$) mainly occur from soil-disturbing activities, such as construction, mining, agriculture, wildfires, and vehicular road dust.

The SFBAAB is in "marginal"[7] nonattainment of the federal (i.e., NAAQS) 8-hour ozone standards, and "moderate"[8] nonattainment of the federal $PM_{2.5}$ standard (USEPA 2020a). The SFBAAB is in attainment for California (i.e., CAAQS) standards for CO, $NO_2$, $SO_2$, and sulfates and nonattainment for California standards for ozone, $PM_{10}$ and $PM_{2.5}$, and is unclassified for California standards for hydrogen sulfide and visibility reducing particles.

### Baseline Air Quality

USEPA designates all areas of the U.S. as having air quality better than, equal to (attainment)[9], or worse than (nonattainment) the NAAQS. The criteria for nonattainment designation vary by pollutant. An area is in nonattainment for ozone if ozone concentrations exceed the NAAQS more than three discontinuous times in three years, and an area is generally in nonattainment for the other criteria pollutants if concentrations exceed the NAAQS more than once per year. USEPA designates former nonattainment areas that have attained the NAAQS as maintenance areas. As discussed above, the SFBAAB (including Santa Clara County) is in nonattainment of the federal ozone and $PM_{2.5}$ standards. Table 3-2 presents representative air quality data for MFA from monitoring data compiled by CARB for the San Jose – Jackson Street Monitoring Station, the closest monitoring station to the site, between 2018 and 2020.

**Table 3-2 San Jose – Jackson Street Ambient Air Monitoring Data**

| Pollutant | Most Stringent National Standard | Number of Days Standards Were Exceeded and Maximum Concentrations Measured | | |
|---|---|---|---|---|
| | | 2018 | 2019 | 2020 |
| **Ozone** | | | | |
| Maximum 1-hour Concentration (ppm) | >0.09 | 0.078 | **0.095** | **0.106** |
| Days 1-hour Standard Exceeded | | 0 | 1 | **1** |
| Maximum 8-hour Concentration (ppm) | >0.070 | 0.061 | **0.081** | **0.085** |
| Days 8-hour Standard Exceeded | | 0 | **2** | **2** |

[7] Area has a design value of 0.071 up to but not including 0.081 ppm for 8-hour ozone.

[8] Area has a design value of 36 µg/m3 for 24-hour $PM_{2.5}$.

[9] Any area that meets the national primary or secondary ambient air quality standard for the pollutant.

| Pollutant | Most Stringent National Standard | Number of Days Standards Were Exceeded and Maximum Concentrations Measured | | |
|---|---|---|---|---|
| | | **2018** | **2019** | **2020** |
| **Respirable Particulate Matter ($PM_{10}$)** | | | | |
| Maximum 24-hour Concentration (µg/m³) | >50 | **121.8** | **77.1** | **137.1** |
| Days 24-hour Standard Exceeded | | **4** | **4** | **10** |
| **Fine Particulate Matter ($PM_{2.5}$)** | | | | |
| Maximum 24-hour Concentration (µg/m³) | >35 | **133.9** | 34.4 | **120.5** |
| Days 24-hour Standard Exceeded | | **15** | 0 | **12** |
| Annual Average (µg/m³) | >12 | 12.9 | 9.1 | 11.5 |

Notes:

**Bold** values are in excess of the applicable standard.

Number of days exceeded is for all days in a given year, except for $PM_{10}$, which has been monitored every 12 days as of January 2013.

µg/m³ = micrograms per cubic meter

> = greater than

ppm = parts per million

Source: CARB Air Pollution Summary for San Jose- Jackson Street Monitoring Station, 2018-2020

## Sensitive Receptors

Sensitive receptors are children, elderly, asthmatics, and others who are at a heightened risk of negative health outcomes due to exposure to air pollution. Where these sensitive receptors congregate are considered sensitive receptor locations and may include hospitals, schools, and day care centers, and such other locations as CARB may determine (California Health and Safety Code § 42705.5(a)(5)). There are no existing sensitive receptors near (within 1,000 feet)[10] of the Project site. The primary pollutant of concern with regard to exposure of sensitive receptors is DPM generated by construction related vehicles and equipment. The actual risk of adverse air quality effects depends on a person's current health status, the pollutant type and concentration, and the length of exposure to the polluted air. Health risk is a function of the concentration of contaminants in the environment and the duration of exposure to those contaminants. Health effects from TACs are often described in terms of individual cancer risk, which is based on a 30-year lifetime exposure to TACs (OEHHA 2015). Construction activities were modeled based upon an approximately 8-month construction duration, which would be approximately 2 percent of

[10] For assessing community risks and hazards, a 1,000-foot radius is recommended by BAAQMD around the project property boundary.

the total exposure period used for typical health risk calculations. Concentrations of mobile-source DPM emissions are typically reduced by 70 percent at a distance of approximately 500 feet (CARB 2005). The nearest existing sensitive receptors are the multifamily residential buildings at Wescoat Village approximately 5,330 feet to the southwest of MFA. Therefore, construction would take place substantially farther than 500 feet from the nearest sensitive receptors. Due to the temporary nature of construction activities and the dispersive properties of DPM, the nearest residential receptors would not be impacted in regard to air quality. Other exterior active-use areas in the Project vicinity include the Bay Trail and golf course. Those uses are not considered sensitive receptors for air quality purposes because the time spent at those locations is transient. The Project's northern edge is located approximately 3,512 feet from the Bay Trail and about 550 feet from the golf course.

### 3.2.1.3 Approach to Analysis

Temporary construction-related emissions of criteria air pollutants and precursors were calculated using the California Emissions Estimator Model (CalEEMod) Version 2020.4.0 computer program (California Air Pollution Control Officers Association 2017). CalEEMod was used to calculate emissions from demolition and partial preservation of Hangar 3. Modeling was based on Project-specific information (e.g., building type and size, amount of demolition, estimated construction equipment) where available, and default values in CalEEMod that are based on the Project's location, land use type, and type of construction. CalEEMod modeling assumptions are included in Appendix B, Air Quality CalEEMod Modeling Assumptions.

There are no operational impacts to air quality associated with the demolition of Hangar 3 because no land use or activity is proposed following demolition and clean-up under the Proposed Action and, therefore, operational air quality impacts are not discussed further.

#### General Conformity and *De Minimis* Thresholds

The 1990 Amendments to the CAA require that Federal agency activities conform to the SIP with respect to achieving and maintaining attainment of NAAQS and to addressing air quality impacts. If total emissions of individual pollutants resulting from an action exceed *de minimis* threshold values for nonattainment pollutants, then the General Conformity Rule requires that a conformity analysis be performed. A conformity analysis would need to demonstrate that a Proposed Action does not: 1) cause or contribute to any violation of any NAAQS in the area; 2) interfere with provisions in the SIP for maintenance or attainment of any NAAQS; 3) increase the frequency or severity of any existing violation of any NAAQS; or 4) delay timely attainment of any NAAQS, any interim emission reduction goals, or other milestones included in the SIP. If *de minimis* thresholds are not exceeded, no conformity analysis is required.

Table 3-3 details the *de minimis* thresholds for all criteria pollutants. Based on the present attainment status of the SFBAAB (Section 3.2.1.3, Affected Environment), the Proposed Action would conform to the most recent USEPA-approved SIP if annual construction emissions do not exceed the thresholds of 100 tons per year of $NO_X$, VOCs (modeled as ROGs for the purposes of this analysis), CO, $PM_{10}$, and $PM_{2.5}$. Impacts to air quality would be considered significant if the emissions from construction of the Project would result in exceedances of the *de minimis* thresholds.

**Table 3-3 Federal *De Minimis* Thresholds**

| Pollutant | Area Type | Tons per Year |
|---|---|---|
| Ozone ($VOCs$ or $NO_X$) | Serious nonattainment | 50 |
| | Severe nonattainment | 25 |
| | Extreme nonattainment | 10 |
| | **Other areas outside an ozone transport region** | **100** |
| Ozone ($NO_X$) | Marginal and moderate nonattainment inside an ozone transport region | 100 |
| | Maintenance | 100 |
| Ozone (VOCs) | Marginal and moderate nonattainment inside an ozone transport region | 50 |
| | Maintenance within an ozone transport region | 50 |
| | Maintenance outside an ozone transport region | 100 |
| CO, $SO_2$ and $NO_2$ | **All nonattainment and maintenance** | **100** |
| $PM_{10}$ | Serious nonattainment | 70 |
| | **Moderate nonattainment and maintenance** | **100** |

| Pollutant | Area Type | Tons per Year |
|---|---|---|
| $PM_{2.5}$<br>Direct emissions, $SO_2$, $NO_X$ (unless determined not to be a significant precursor), VOCs or ammonia (if determined to be significant precursors) | **Moderate nonattainment and maintenance** | **100** |
| Pb | All nonattainment and maintenance | 25 |

Notes:
CO = carbon monoxide
Pb = lead
$NO_2$ = nitrogen dioxide
$NO_X$ = nitrogen oxide
$PM_{2.5}$ = particulate matter smaller than 2.5 microns in diameter
$PM_{10}$ = particulate matter smaller than 10 microns in diameter
$SO_2$ = sulfur dioxide
VOCs = volatile organic compounds
Bolded thresholds indicate the thresholds applicable to the Proposed Action.
Source: USEPA 2020b

### Bay Area Air Quality Management District Thresholds

The BAAQMD adopted regional air quality thresholds in May 2010 to establish the level at which the BAAQMD believed air pollution emissions would cause adverse air quality impacts to the region. The thresholds represent the levels at which a project's individual emissions of criteria air pollutants ($PM_{10}$ and $PM_{2.5}$) or ozone precursors (VOC and NOx) would result in a cumulatively considerable contribution to the SFBAAB existing air quality conditions. Project emissions were compared against the BAAQMD's construction regional air quality thresholds and are presented in Table 3-4.

**Table 3-4 BAAQMD Regional Air Quality Thresholds**

| Pollutant | Construction Thresholds (average lbs/day) |
|---|---|
| VOC | 54 |
| NOx | 54 |
| $PM_{10}$ (exhaust) | 82 |
| $PM_{2.5}$ (exhaust) | 54 |

| Pollutant | Construction Thresholds (average lbs/day) |
|---|---|

Notes:
NOx = nitrogen oxide
$PM_{2.5}$ = particulate matter smaller than 2.5 microns in diameter
$PM_{10}$ = particulate matter smaller than 10 microns in diameter
VOC = volatile organic compound
lbs/day = pounds per day
Construction particulate matter thresholds only account for exhaust particulate matter emissions. Fugitive dust particulate matter emissions from construction-related activities are required by BAAQMD to be minimized through compliance with Best Management Practices.
Source: BAAQMD 2017

### 3.2.1.4 Environmental Consequences

Proposed Action: Building Demolition

The Proposed Action includes demolition of the existing Hangar 3 at MFA and would occur in three phases with Phase 1: Pre-Demolition Activities lasting approximately 80 to 90 working days and Phase 2: Demolition lasting approximately 125 working days. Phase 3: Waste Disposal and Recycling would occur concurrently with Phases 1 and 2. The total construction duration would take approximately nine months. The construction equipment to be used during each construction phase is detailed in Table 3-5.

**Table 3-5 Construction Equipment for Proposed Action: Building Demolition**

| | Demolition Phase | Demolition Equipment | | On-Road Construction Vehicles |
|---|---|---|---|---|
| Phase 1 and Phase 3 | Pre-Demolition Activities and Waste Disposal and Recycling | • Boom Lifts Tier 4 (2)<br>• Reach Forks (2)<br>• Bobcats (2)<br>• Manlift Tier 4 (1) | • Generators (2)<br>• Demolition Excavators (2)<br>• Swing Stages (2) | • 100 worker trips per day (light-duty vehicle mix)<br>• 360 hauling truck trips total (heavy-duty diesel trucks) |
| Phase 2 and Phase 3 | Demolition and Waste Disposal and Recycling | • Demolition Excavators Tier 4 (5)<br>• Crane Tier 4 (1)<br>• Manlifts Tier 4 (2) | • Demolition Excavators (2)<br>• Skid Steers Tier 4 (2)<br>• Water Truck (1) | • 40 worker trips per day (light-duty vehicle mix)<br>• 4,000 hauling truck trips total (heavy-duty diesel trucks) |

*Criteria Air Pollutants*

As discussed above, the SFBAAB is in nonattainment for federal ozone and $PM_{2.5}$ standards; therefore, these are the potential criteria air pollutants of concern regarding the Proposed Action's environmental effects. To assess potential effects, localized criteria pollutant emissions were modeled and analyzed. Potential localized effects would include exceedances of federal standards for ozone and $PM_{2.5}$.

Air quality modeling was performed using Project-specific details to determine whether the Proposed Action would result in criteria air pollutant emissions in excess of the applicable *de minimis* thresholds and BAAQMD project-level thresholds. Presented in Table 3-6 and Table 3-7, the Proposed Action's construction-related emissions have been estimated using the CalEEMod version 2020.4.0 software. The results of the construction emissions estimates were compared to the federal *de minimis* (Table 3-6) and BAAQMD thresholds (Table 3-7) to determine if the demolition of Hangar 3 would result in exceedances of the thresholds. The following discussion provides Project-specific emissions evaluations for construction in a summary format; all CalEEMod modeling outputs are also included in Appendix B, Air Quality CalEEMod Modeling Assumptions.

**Table 3-6 Estimated Construction Emissions for the Proposed Action**

| Parameter | Air Pollutants (tons) | | | | | |
|---|---|---|---|---|---|---|
| | ROG | $NO_X$ | CO | $SO_X$ | $PM_{10}$ | $PM_{2.5}$ |
| Total Emissions (tons) 2022 | 0.06 | 0.65 | 0.71 | 0.00 | 0.07 | 0.03 |
| Total Emissions (tons) 2023 | 0.20 | 1.84 | 3.30 | 0.01 | 0.33 | 0.10 |
| Maximum annual emissions | 0.205 | 1.84 | 3.30 | 0.01 | 0.33 | 0.10 |
| *Total Construction Emissions* | 0.26 | 2.49 | 4.01 | 0.01 | 0.40 | 0.13 |
| *De Minimis* Thresholds (annual) | 100 | 100 | 100 | 100 | 100 | 100 |
| Exceeds *De Minimis* Thresholds? | No | No | No | No | No | No |

es:

CO = carbon monoxide

$NO_X$ = nitrogen oxides

$PM_{2.5}$ = particulate matter less than 2.5 microns in diameter

$PM_{10}$ = particulate matter less than 10 microns in diameter

ROG = reactive organic gas

$SO_X$ = sulfur oxides

CalEEMod modeling was performed assuming a 2021 construction start date, however, construction would not begin until 2022. Due to stricter on-road and off-road emissions controls with each passing year, the emissions presented above are a conservative estimate and would likely be lower if construction is pushed into a later start date.

Source: Appendix B, Air Quality CalEEMod Modeling Assumptions.

**Table 3-7 Estimated Average Daily Construction Emissions for the Proposed Action**

| Parameter | Air Pollutants (Average lbs/day) | | | | | |
|---|---|---|---|---|---|---|
| | ROG | $NO_X$ | CO | $SO_X$ | $PM_{10}$ | $PM_{2.5}$ |
| Average Daily Construction Emissions | 2.33 | 23.18 | 37.32 | 2.20 | 0.66 | 0.63 |
| BAAQMD Thresholds | 54 | 54 | None | None | 82* | 54* |
| Exceeds BAAQMD Thresholds? | No | No | No | No | No | No |

Notes:

BAAQMD = Bay Area Air Quality Management District

CO = carbon monoxide

lbs/day = pounds per day

$NO_X$ = nitrogen oxides

$PM_{2.5}$ = particulate matter less than 2.5 microns in diameter

$PM_{10}$ = particulate matter less than 10 microns in diameter

ROG = reactive organic gas

$SO_X$ = sulfur oxides

* Exhaust only

Emissions are based on the total tons over the construction period divided by the total number of construction days (215 days).

Source: Appendix B, Air Quality CalEEMod Modeling Assumptions.

During construction of the Proposed Action, various types of equipment and vehicles would temporarily operate on the Project site. Construction exhaust emissions would be generated from construction equipment, on-site workers' commutes, and transportation of demolition material. The aforementioned activities would involve the use of diesel- and gasoline-powered equipment that would generate emissions of criteria pollutants. As shown in Table 3-6 and Table 3-7, Project-associated emissions would be below the *de minimis* and BAAQMD thresholds for all criteria pollutants, respectively.

### *Fugitive Dust*

Project construction activities would also result in the generation of fugitive dust, which includes $PM_{10}$ and $PM_{2.5}$ emissions. Total $PM_{10}$ and $PM_{2.5}$ emissions for the Proposed Action are reported in Table 3-6, which includes fugitive dust and exhaust emissions. Fugitive dust would be generated from demolition activities associated with the removal of building components as well as re-entrained roadway dust from off-road construction equipment and worker, vendor, and haul vehicles. Most of this fugitive dust would remain localized and would be deposited near the Project site. In addition, a water truck would be staged on-site to apply water to building components that could generate dust during demolition activities. BAAQMD regulatory measures and best management practices for addressing fugitive dust would be followed. Potential fugitive dust control activities include adequately wetting fugitive dust sources such as building components, roadways and limiting vehicle speeds.

### *Asbestos Containing Materials*

Asbestos containing materials (ACM) are discussed and addressed in Section 3.2.5, Hazards, Safety, and Waste Management. Compliance with regulatory measures would address potentially significant impacts. Any ACM would be watered prior to demolition to prevent impacts related to air quality during demolition activities.

### *Lead*

There are no existing or proposed Pb point sources within the Project area, however, as discussed in Section 3.2.5, Hazards, Safety, and Waste Management, the Proposed Action would include demolition of a structure that was constructed prior to 1978, and therefore may contain hazardous materials such as lead-based paint (LBP). Per lease requirements, the contractor would prepare an abatement plan for removal of LBP prior to initiating any construction activity. The abatement plan would prevent potential air quality impacts from Pb.

### *Diesel Particulate Matter*

In addition to criteria pollutants, the diesel-powered trucks and demolition equipment would also generate DPM. CARB identified DPM as a TAC in 1998. Exposure to DPM from diesel vehicles and generators can result in health risks to nearby sensitive receptors. Although demolition of Hangar 3 would involve the use of diesel-fueled vehicles, Wescoat Village, the nearest air quality sensitive receptor, is located approximately 5,330 feet southwest from the Project site. As discussed previously, although the golf course is located just over 500 feet from the Project site, it would not be considered a sensitive receptor for air quality purposes. A sensitive receptor is a person in the population who is particularly susceptible to health effects due to exposure to an air contaminant, such as children, the elderly, convalescent centers, hospitals, etc. People visiting the golf course would not be exposed to substantial pollutant concentrations as their time at the golf course is transient and pollutants would be dispersed. Additionally, considering the distance to sensitive receptors, temporary DPM emissions would not pose a health risk because concentrations of mobile-source DPM emissions have been shown to be reduced by approximately 60 percent at a distance of around 300 feet (Zhu et.al. 2002), and CARB notes that DPM from high-volume roadways is typically reduced by at least 70 percent at 500 feet (CARB 2005).

Therefore, the Proposed Action would not result in significant air quality impacts as demolition activities would be temporary and emissions would be below the BAAQMD and federal *de minimis* thresholds. Specifically, construction particulate matter emissions would be less than one ton per year and emissions would disperse as particulate matter travels from the Project site. As a result, the concentration of DPM would be substantially reduced at the distance of the identified sensitive receptors.

#### No Action Alternative

Under the No Action Alternative, there would be no disturbance to the existing environment associated with pre-demolition, demolition, and waste removal and recycling. There would be no immediate air quality impacts. In the event of a structural failure, air quality impacts would likely be temporary. Structural collapse would result in an uncontrolled release of fugitive dust as Hangar 3 components collapse. Subsequent clean-up would require haul trucks and construction equipment, similar to those needed for the Proposed Action, that would emit criteria air pollutants and DPM. Equipment would need to be mobilized immediately to address the hazard and Tier 4 equipment, equipment that would be used under the Proposed Action which meets more stringent emissions standards, may not be available, resulting in more emissions from equipment. Quantification of the emissions from the No Action Alternative would not be possible because it would be speculative to determine the extent of an unplanned collapse. However, there would be a short-term temporary effect that could result in exposure of nearby users to fugitive dust from building collapse and exhaust emissions from cleanup construction vehicles and equipment. Proximity to sensitive receptors for the No Action Alternative would be the same as under the Proposed Action, and DPM generated from clean-up would similarly disperse from the Project site. As a result, the concentration of DPM under the No Action Alternative during any clean-up activities would be substantially reduced at the distance of the identified sensitive receptors and would not result in a localized health risk due to exposure to DPM. However, the potential increase in exhaust emissions associated with potential use of equipment that does not meet Tier 4 emissions standards could result in the generation of temporary emissions that were higher than those from the Proposed Action but would not likely exceed the BAAQMD thresholds of significance. Therefore, potential impacts to air quality from the No Action Alternative could be greater than the Proposed Action.

### 3.2.2 Biological Resources

This analysis focuses on biological resources that are important to the function of the ecosystem, of special importance, or protected under federal or state law or statute, including special-status species and sensitive natural communities, habitats, and vegetation alliances.

“Special-status species” are defined as those species that are protected by state, federal, or local governments as threatened, rare, or endangered. For this environmental review, “special-status plants” are considered plant species that are as follows:

- Listed under the Federal Endangered Species Act (FESA) as threatened, endangered, proposed threatened, proposed endangered, or a candidate species.
- Listed under the California Endangered Species Act (CESA) as threatened, endangered, rare, or a candidate species.
- Listed by the California Native Plant Society as California Rare Plant Rank 1A, 1B, 2, 3, or 4.

For purposes of this analysis, special-status animals are considered animal species that are:

- Listed under FESA as threatened, endangered, proposed threatened, proposed endangered, or a candidate species.
- Listed under CESA as threatened, endangered, or a candidate threatened or endangered species.
- Designated by the California Department of Fish and Wildlife (CDFW) as a California species of special concern.
- Listed in the California Fish and Game Code (CFGC) as fully protected species (fully protected birds are provided in Section 3511, mammals in Section 4700, reptiles and amphibians in Section 5050, and fish in Section 5515).
- Protected under the federal Migratory Bird Treaty Act (MBTA).
- Protected by the Bald and Golden Eagle Protection Act.

Assessment of a project’s effect on migratory birds places an emphasis on “species of concern” as defined by Executive Order 13186, Responsibilities of Federal Agencies to Protect Migratory Birds. Additional assessment of potential impacts on migratory birds that are regionally rare occurs under the special-status species category. The burrowing owl (*Athene cunicularia*) is the most prominent example of a special-status species that occurs at MFA and is considered in NEPA evaluations.

Within California, the state has developed a Natural Heritage Program to classify natural resources, including natural communities and plants and animals of conservation significance. Natural communities are categorized using a hierarchical approach that considers patterns of plant distribution, plant type, landscape and climate characteristics and other environmental factors. "Vegetation alliances" is a categorization of natural community that reflects the number, distribution, and relationship of plants in a regional context. Vegetation alliances are commonly used to assess a project's effects. CDFW determines the level of rarity and imperilment of vegetation types and tracks sensitive communities in its RareFind database (CNDDB 2020). Rankings of natural communities are provided that reflect both global conditions (G) and conditions within California (S). Global and state conditions are ranked 1 (very rare and threatened) to 5 (demonstrably secure). Natural communities ranked S1 through S3 are considered Sensitive Natural Communities. CDFW provides the Vegetation Classification and Mapping Program's currently accepted list of vegetation alliances and associations (CDFG 2010).

Impacts on CDFW sensitive natural communities, vegetation alliances and associations, or any such community identified in local or regional plans, policies, and regulations should be considered and evaluated under NEPA. Furthermore, aquatic, wetland, and riparian habitats are also protected under applicable federal, state, or local regulations and are generally subject to regulation, protection, or consideration by the U.S. Army Corps of Engineers (USACE), Regional Water Quality Control Board (RWQCB), CDFW, and/or the U.S. Fish and Wildlife Service (USFWS).

### 3.2.2.1 Regulatory Setting

Biological resources in the vicinity of the Project site are regulated by several federal, state, and local laws and ordinances, as described below. However, the entire Project site and immediately adjacent areas consist of artificial structures and surfaces, with no listed species, designated habitat or jurisdictional features present that would be subject to federal or state regulatory agency permitting requirements (such as the USACE under Section 404 of the Clean Water Act or Section 10 of the Rivers and Harbors Act; the RWQCB under Section 401 of the Clean Water Act or the Porter-Cologne Water Quality Control Act; the USFWS or the National Marine Fisheries Service (NMFS) under the FESA; the CDFW under the CESA or Section 1602 of the California Fish and Game Code; or NMFS under the Magnuson-Stevens Fishery Conservation and Management Act). Therefore, the Project is not anticipated to affect any of these resources, and no permits related to biological resources would be required.

The following sections focus on regulations that pertain to biological resources that are present on the Project site.

## Federal

### Federal Migratory Bird Treaty Act

The federal Migratory Bird Treaty Act (MBTA), 16 U.S.C. Section 703, prohibits killing, possessing, or trading of migratory birds except in accordance with regulations prescribed by the Secretary of the Interior. The MBTA protects whole birds, parts of birds, and bird eggs and nests, and it prohibits the possession of all nests of protected bird species whether they are active or inactive. An active nest is defined as having eggs or young, as described by the USFWS in its June 14, 2018, memorandum "Destruction and Relocation of Migratory Bird Nest Contents". Nest starts (nests that are under construction and do not yet contain eggs) and inactive nests are not protected from destruction.

In recent years, there have been changes to how the MBTA is implemented and enforced with respect to incidental take of protected birds. However, on October 4, 2021, the USFWS published a final rule revoking a January 7, 2021, regulation that limited the scope of the MBTA. The final rule took effect on December 3, 2021. With this final and formal revocation of the January 7, 2021, rule, the USFWS returns to implementing the MBTA as prohibiting incidental take and applying enforcement discretion, consistent with judicial precedent.

## California

### California Fish and Game Code

Specific sections of the California Fish and Game Code (CFGC) describe regulations pertaining to protection of certain wildlife species. For example, Code Section 2000 prohibits take of any bird, mammal, fish, reptile, or amphibian except as provided by other sections of the code.

The CFGC Sections 3503, 3513, and 3800 (and other sections and subsections) protect native birds, including their nests and eggs, from all forms of take. Disturbance that causes nest abandonment and/or loss of reproductive effort is considered "take" by the CDFW. Raptors (i.e., eagles, hawks, and owls) and their nests are specifically protected in California under Code Section 3503.5. Section 3503.5 states that it is "unlawful to take, possess, or destroy any birds in the order Falconiformes or Strigiformes (birds of prey) or to take, possess, or destroy the nest or eggs of any such bird except as otherwise provided by this code or any regulation adopted pursuant thereto."

Bats and other non-game mammals are protected by CFGC Section 4150, which states that all non-game mammals or parts thereof may not be taken or possessed except as provided otherwise in the code or in accordance with regulations adopted by the commission. Activities resulting in mortality of non-game mammals (e.g., destruction of an occupied nonbreeding bat roost, resulting in the death of bats), or disturbance that causes the loss of a maternity colony of bats (resulting in the death of young), may be considered “take” by the CDFW.

### 3.2.2.2 Affected Environment

The entire Project site is located on developed land consisting of Hangar 3, other smaller buildings and structures located between Hangars 2 and 3, as well as concrete, asphalt, other impervious materials. The entire Project site is devoid of vegetation.

#### Wildlife

Wildlife species found in the vicinity of the Project site are those that are tolerant of periodic human disturbances, including introduced species such as the European starling (*Sturnus vulgaris*), rock pigeon (*Columba livia*), house mouse (*Mus musculus*), Norway rat (*Rattus norvegicus*), and black rat (*Rattus rattus*). A number of common native species also use this habitat, including the western fence lizard (*Sceloporus occidentalis*), gopher snake (*Pituophis catenifer*), striped skunk (*Mephitis mephitis*), raccoon (*Procyon lotor*), gray fox (*Urocyon cinereoargenteus*), and a variety of birds, such as the common raven (*Corvus corax*), house finch (*Haemorhous mexicanus*), black phoebe (*Sayornis nigricans*), barn swallow (*Hirundo rustica*), cliff swallow (*Petrochelidon pyrrhonota*), mourning dove (*Zenaida macroura*), and white-throated swift (*Aeronautes saxatalis*), all of which nest inside and outside of Hangar 3 and on other structures on the site. In addition, American kestrels (*Falco sparverius*) and barn owls (*Tyto alba*) nest and roost in the rafters and box beams of Hangar 3, and red-tailed hawks (*Buteo jamaicensis*) and prairie falcons (*Falco mexicanus*) use Hangar 3 as both day and night-time roosts, as well as hunting perches. Numerous suitable roosting locations for bat species, including the Mexican free-tailed bat (*Tadarida brasiliensis*) and Yuma myotis (*Myotis yumanensis*), are present in Hangar 3, and both species have been observed roosting in the hangar.

#### Special-Status Plants

California Native Plant Species (2020) and the California Natural Diversity Database (CNDDB) (2020) identify 58 special-status plant species as potentially occurring in at least one of the nine U.S. Geological Survey quadrangles containing or surrounding the Project site, and Figure 3-1 depicts CNDDB records of special-status plant species in the general vicinity of the Project site. However, all 58 potentially occurring special-status plant species were determined to be absent from the Project site for at least one of the following reasons: (1) lack of suitable habitat types; (2) absence of specific microhabitat or edaphic requirements, such as serpentine soils; (3) the elevation range of the species is outside of the range on the Project site; and/or (4) the species is considered extirpated.

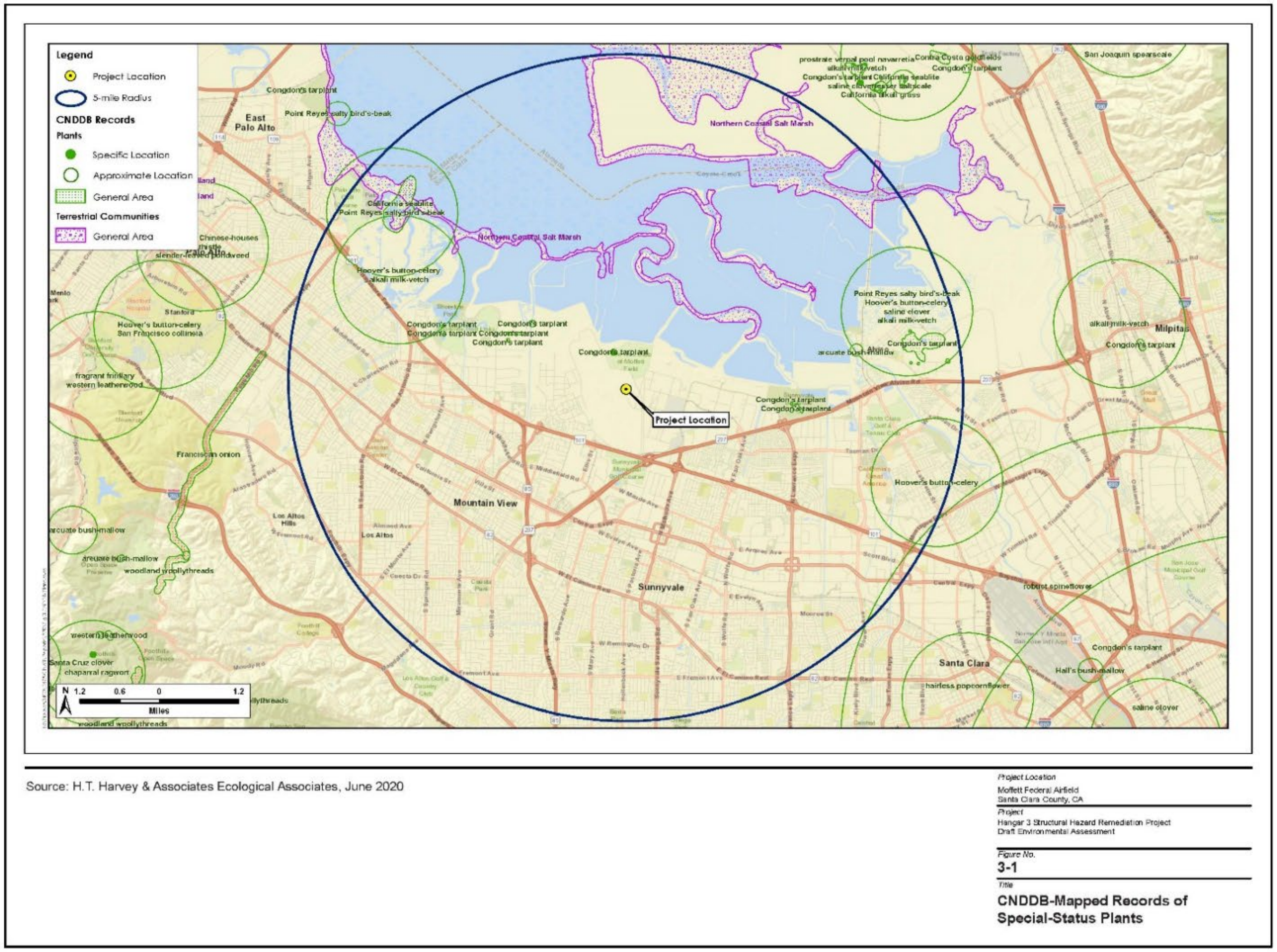
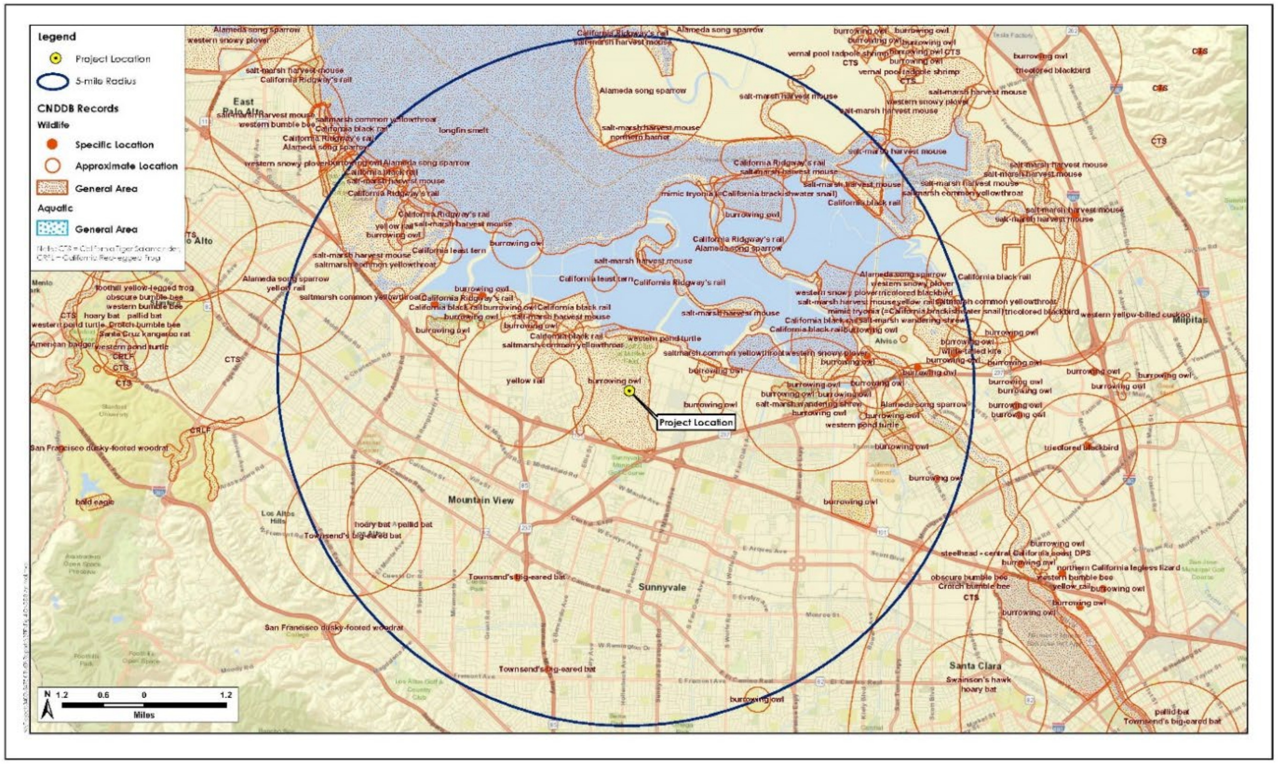



**Figure 3-1 CNDDB-Mapped Records of Special-Status Plants**

### Special-Status Animals

Several special-status animal species are known to occur in the general vicinity of the Project site (CNDDB 2020) (Figure 3-2). However, most of these species were determined to be absent from the Project site because it lacks suitable habitat, is outside the known range of the species, and/or is isolated from the nearest known extant populations by development or otherwise unsuitable habitat. Animal species considered for occurrence but rejected, as well as the reasons for their rejection, include the following (among others):

- The Project site lacks suitable marsh or Bay shoreline habitat for species associated with the South Bay, which includes the federally and/or state-listed California Ridgway's rail (*Rallus obsoletus obsoletus*), California black rail (*Laterallus jamaicensis coturniculus*), California least tern (*Sternula antillarum browni*), western snowy plover (*Charadrius nivosus nivosus*), and salt marsh harvest mouse (*Reithrodontomys raviventris*), as well as the San Francisco common yellowthroat (*Geothlypis trichas sinuosa*) and Alameda song sparrow (*Melospiza melodia pusillula*), both California species of special concern. The nearest tidal marsh habitat is located approximately 1.6 miles to the northwest of Hangar 3 along Stevens Creek, and the nearest nontidal marsh/salt panne habitat is located nearly one mile northwest of the hangar. Therefore, these species are not expected to occur on the Project site or close enough to the site to be affected by Project activities.
- Freshwater marsh habitat, which is located approximately 1,000 feet north of Hangar 3 in the southern end of the Marriage Road ditch, provides suitable nesting and year-round foraging habitat for the San Francisco common yellowthroat. Suitable brackish marsh habitat for the Alameda song sparrow is present even further from Hangar 3, with the closest area of brackish marsh approximately 3,200 feet to the north. Therefore, neither species would occur on the Project site or close enough to the site to be affected by Project activities.
- The American peregrine falcon (*Falco peregrinus anatum*), a state fully-protected species, has been known to nest in the MFA vicinity, though not on the Project site itself. As recently as 2018, the species nested on an 80-foot by 120-foot wind tunnel structure in ARC, located approximately 1.15 miles northwest of the Project site, across the airfield from the Project site (NASA 2015; H.T. Harvey and Associates 2021). Peregrine falcons were previously thought to have nested at the top of Hangar 1, located approximately 0.67 miles west of (and across the




Source: H.T. Harvey & Associates Ecological Associates, June 2020

*Project Location*
Moffett Federal Airfield
Santa Clara County, CA
*Project*
Hangar 3 Structural Hazard Remediation Project
Draft Environmental Assessment
*Figure No.*
**3-2**
*Title*
**CNDDB-Mapped Records of Special-Status Animals**

**Figure 3-2 CNDDB-Mapped Records of Special-Status Animals**

airfield from) the Project site, more than five years ago, though there is no evidence that they have attempted nesting there recently (NASA 2015; H.T. Harvey and Associates 2021). MFA provides suitable foraging habitat for the peregrine falcon, and the species has been observed during the breeding and non-breeding season, transiting through the Project area, hunting for prey on the airfield in the salt-panne habitats and salt marsh ponds located north of the airfield, and occasionally perched on both Hangars 2 and 3. However, peregrine falcons have never been suspected of nesting on Hangars 2 and 3. Also, given the on-going preservation and maintenance disturbance on both hangars, it is highly unlikely that peregrine falcons would attempt to nest on Hangars 2 and 3. The species may infrequently move across the Project site, forage nearby on MFA on occasion, and perch briefly on Hangars 2 and 3, but peregrine falcons would not be expected to reside or nest on the Project site, or otherwise make substantial use of the Project site. Project activities would at most cause very minor, short-term disturbance of the species. However, any short-term disturbance to a perching peregrine falcon (which would simply fly away from or avoid perching close to any perceived disturbance) from Project activities would not be substantial enough to be considered a significant impact.

- The white-tailed kite (*Elanus leucurus*), a state fully protected species, and the loggerhead shrike (*Lanius ludovicianus*), a California species of special concern, are known to breed in the Project vicinity using tall trees and shrubs for nesting and open grasslands, marshes, and ruderal habitats for foraging. Both species are known to occasionally forage in the nearby sod and grass areas of MFA and the golf course during the winter and may pass through the Project site during local migration events. However, no suitable nesting or foraging habitat for either species is present on or directly adjacent to the Project site. Therefore, the white-tailed kite and loggerhead shrike are not expected to occur on the Project site and would not be affected by Project activities.
- Historically, the pallid bat (*Antrozous pallidus*) and Townsend's big-eared bat (*Corynorhinus townsendii*), which are both California species of special concern, were likely present in a number of locations throughout the Project vicinity, but both of their populations have declined in recent decades. Both species have been extirpated as breeders from urban areas close to the Bay, as is the case in the Project vicinity (Pierson and Rainey 1998a and 1998b, CNDDB 2020). Although suitable roosting habitat is present within the box beams of Hangar 3 on the Project site, neither species was detected during visual and acoustic preconstruction surveys as part of the implementation of the MFA Hangars 2 and 3 Due Diligence Wildlife Protection Plan (H. T. Harvey & Associates 2015). During follow-up inspections of bat deterrence devices of box beams in both

Hangars 2 and 3 in 2017 and 2018, these species were not observed. Thus, these two species are not expected to occur in Hangar 3, and they would not be affected by Project activities.

- A population of western pond turtles (*Actinemys marmorata*), a California species of special concern, is known to occur in aquatic habitats (i.e., ponds and drainage canals) north of the Project site. The Marriage Road ditch, located approximately 1,000 feet north of the Project site, is the nearest aquatic habitat. Several years ago, an H. T. Harvey & Associates ecologist discovered a very small hatchling pond turtle just north of Hangar 3 on the open, concrete tarmac. It is unknown whether this individual turtle was a hatchling that had recently emerged from an off-site nest and was in search of aquatic habitat or had dispersed from the Marriage Road ditch. Nonetheless, this finding is anomalous. The Project site does not contain any suitable aquatic or upland habitat, nor nesting habitat, for western pond turtles, and this species would not be expected to regularly disperse across hundreds of feet of open, concrete areas into the Project site with any regularity. Thus, western pond turtles are not expected to occur on the Project site during Project activities, and they would not be affected by Project activities.

One California species of special concern, the burrowing owl, has the potential to occur on the Project site. This species is discussed in detail below.

**Burrowing Owl (*Athene cunicularia*). Federal Listing Status: None; State Listing Status: Species of Special Concern.** The burrowing owl is a small, terrestrial owl of open country. It prefers annual and perennial grasslands, typically with sparse or nonexistent tree or shrub canopies. In California, burrowing owls are found in close association with California ground squirrels (*Otospermophilus beecheyi*); owls use the abandoned burrows of ground squirrels for shelter and nesting. The nesting season, as recognized by CDFW, runs from February 1 through August 31. After nesting is completed, adult owls may remain in their nesting burrows or in nearby burrows, or they may migrate (Gorman et al. 2003). Adult owls disperse across the landscape from 0.1 to 35 miles from their nesting burrows (Rosier et al. 2006). Burrowing owl populations have declined substantially in the San Francisco Bay area in recent years, with declines estimated at four to six percent annually (DeSante et al. 2007; Rosenberg et al. 2007).

The ruderal grassland habitats with numerous ground squirrel burrows on the nearby airfield and in other surrounding areas provide suitable breeding and foraging habitats for burrowing owls. MFA supports one of the last remaining burrowing owl population centers in the South Bay, with numerous records of both nesting and wintering owls in areas surrounding the Project site, documented most recently by H. T. Harvey & Associates pre-activity and winter owl surveys (H. T. Harvey & Associates 2019, 2020a, 2020b), and NASA biologist breeding-season surveys (Chromczak 2018, 2019). Based on a review of data provided by NASA indicating the locations of burrowing owl nests dating back to 1999, the most recent and closest burrowing owl nesting in the Project area occurred in 2013, when a pair of owls nested approximately 775 feet east of Hangar 3 in the old fuel farm depot field, east of Macon Road (Chromczak 2013). Elsewhere, the most recent nests occurred in a gravel lot approximately 630 feet north of Hangar 3 (which has since been paved for bus operations, with PV providing habitat mitigation) and over 1,000 feet north of Hangar 3, north of Macon Road, both in 2012 (Chromczak 2012). However, no suitable nesting or foraging habitat for owls is located on the Project site or within 250 feet of the site. The nearest suitable nesting or foraging habitat for owls is located approximately 460 feet southeast of Hangar 3 in the sod area of the current fuel farm[11].

Nonetheless, staged construction materials (e.g., scaffolding, lumber, etc.) may provide temporary refugia for individual owls moving between areas of suitable habitat. For example, a single wintering owl was observed in January 2018, roosting amongst construction materials found on the east side of Hangar 3. Although no burrows existed in the area, this individual owl persisted in the Project area for approximately one month before moving on. Burrowing owls are not expected to nest or forage on the Project site, nor to roost or overwinter on the Project site, given the lack of suitable habitat; however, the possibility of an individual owl occurring on the Project site as an infrequent wintering, dispersing, or migratory burrowing owl cannot be discounted.

### Sensitive Natural Communities, Habitats, and Vegetation Alliances

**Sensitive Natural Communities.** A query of sensitive habitats in RareFind (CNDDB 2020) identified five sensitive habitats as occurring within the nine U.S. Geological Survey quadrangles containing or surrounding the Project area: north central coast California roach/stickleback/steelhead stream (Rank GNR/SNR[12]); north central coast steelhead/sculpin stream (Rank GNR/SNR[13]); serpentine bunchgrass (Rank G2/S2.2), valley oak woodland (G3/S2.1), and northern coastal salt marsh (Rank G3/S3.2). However, none of these sensitive natural communities occurs adjacent to or on the Project site.

**Sensitive Vegetation Alliances.** No sensitive vegetation alliances occur adjacent to or on the Project site.

**Sensitive Habitats (Waters of the U.S./State).** No aquatic habitats considered waters of the U.S. or waters of the state occur on or adjacent to the Project site. The nearest aquatic habitat is the Marriage Road ditch, which is located approximately 1,000 feet north of Hangar 3.

[11] Fuel farm refers to the fuel facility which includes fuel storage, pumps, and associated infrastructure.

[12] GNR = Global Rank Not Yet Assessed; SNR = Unranked - State Conservation Status Not Yet Assessed

[13] Ibid.

### Non-Native and Invasive Plant Species

The project site is occupied completely by development consisting entirely of buildings/structures, concrete, asphalt, and other impervious materials. The project area is entirely devoid of vegetation. Thus, no non-native or invasive plant species occur in the project area.

## 3.2.2.3 Approach to Analysis

Determination of the potential environmental consequences to biological resources is based on the following: 1) the importance (i.e., legal, commercial, recreation, ecological, or scientific) of the resource; 2) the proportion of the resource that would be affected relative to its occurrence in the region; 3) the sensitivity of the resource to proposed activities; and 4) the duration of ecological ramifications.

Effects on biological resources would be considered adverse if species or habitats of concern were adversely affected over relatively large areas, or if disturbances cause reductions in population size or distribution. Potential physical effects, such as habitat loss, noise, and effects on water resources, were evaluated to determine the type and magnitude of these effects to biological resources resulting from the proposed alternatives.

Impacts to biological resources would be considered significant if the Project resulted in (a) adverse effects on special-status species or populations of other native species that were substantial (i.e., resulting in a measurable decline in regional populations) and that could be permanent in their effect on population or subpopulation survival without active management, (b) loss (in terms of extent) or degradation (in terms of habitat quality) of sensitive or regulated habitats such as aquatic, wetland, or riparian habitats, or (c) violate federal or state regulations related to biological resources.

## 3.2.2.4 Environmental Consequences

### Proposed Action - Building Demolition

The proposed demolition of Hangar 3 may affect burrowing owls, nesting and roosting common (i.e., non-special status) species of birds and roosting common species of bats. The Project would not result in impacts to wetlands, aquatic habitats, riparian habitats, or other sensitive habitats; threatened or endangered species or their habitats; special-status plants; trees; or wildlife movement corridors.

What follows is a description of the potential impacts of the Proposed Action on biological resources, as well as measures that are recommended to mitigate these impacts.

### *Impacts on Burrowing Owls*

Project activities would not result in the loss of burrowing owl nesting and foraging habitat or habitat that is routinely used for overwintering. The Project area is surrounded by pavement, and no suitable nesting or foraging habitat, or natural overwintering habitat (such as burrows in grassland or ruderal habitat) is present within 250 feet of the Project site (250 feet is the typical buffer distance that should be maintained free from new disturbance around active burrowing owl nests [Trulio 2001]). In addition, no burrowing owls have nested anywhere near the Hangar 3 Project area in recent years. CDFW's 2012 Staff Report on Burrowing Owl Mitigation defines occupied burrowing owl habitat as follows: "Occupancy of burrowing owl habitat is confirmed at a site when at least one burrowing owl, or its sign at or near a burrow entrance, is observed within the last three years." The report also states in its habitat assessment reporting guidelines that burrowing owls identified on or adjacent to a site within the last 3 years should be considered when scoping a project and its effects on burrowing owls. This approach (i.e., using occupancy within the last 3 years) is consistent with that used by the Santa Clara Valley Habitat Conservation Plan/Natural Community Conservation Plan (ICF 2012). Therefore, given the lack of suitable habitat on and within 250 feet of the Project site, and data reporting that owls have not nested on or within 250 feet of the Project site in the past three years, neither pre-demolition nor demolition activities at Hangar 3 would impact any burrowing owl nesting, overwintering, or foraging habitat, and would not disturb nesting owls to the point of causing nest abandonment.

Natural habitat (e.g., grassland and ruderal habitat with ground squirrel burrows) where burrowing owls might nest or overwinter is present in areas along the access routes where vehicles would pass as they travel to and from Hangar 3. Although no burrowing owls are known to be present in (or have recently nested in) areas within 250 feet of access routes, it is possible that burrowing owls could nest or overwinter in habitat adjacent to access routes. Vehicular activity associated with the Proposed Action would not represent a novel source of disturbance, as any owls using habitat within 250 feet of the access routes would already be habituated to the noise and movement of buses, construction equipment, and other vehicles. As an example, H. T. Harvey & Associates biologists monitored a single owl at an occupied burrow, located approximately 130 feet north of pavement improvement activities along Macon Road, over the course of seven days in January and February 2020. The biologists took sound level measurements using a decibel (dB) level meter during the monitoring and recorded a maximum of 58 dB from general traffic – which was heavy and concentrated to one lane at the time – and recorded a maximum of 79 dB during all road work, which included not only the continuing general traffic but multiple dump truck deliveries of asphalt, water truck passes, and asphalt paving equipment. The owl remained at its burrow and showed no behavioral signs of disturbance during all road work that was being performed nearby. Further, after the work had been completed, H. T. Harvey & Associates continued to observe this owl in the same burrow location over the next three weeks. In addition, burrowing owls at MFA have consistently selected burrows right along the edges of runways, despite the extremely loud noises associated with aircraft.

Burrowing owls at MFA are not expected to be substantially affected by noise (H.T. Harvey and Associates 2021). However, due to the low and declining population levels of burrowing owls in the region, any impacts from the Project that may result in the injury or mortality of an individual owl would be considered a significant impact owing to potential effects on regional populations of this species. Therefore, a significant impact could occur if an owl were to abandon a nest due to construction traffic along the access routes. Implementation of Mitigation Measure BIO-1A would ensure that the temporary increase in traffic along the access routes associated with pre-demolition or demolition activities would not result in a substantial impact on or disturbance of any burrowing owls that may be present along this route by identifying the locations of any owls nesting or overwintering along the access routes and identifying any necessary measures to reduce the potential for construction vehicles to disturb those owls.

Although no known nesting or overwintering sites are present within 250 feet of the Project site, small numbers of burrowing owls could occasionally use staged equipment and construction materials (e.g., scaffolding, lumber, etc.) as temporary refugia while wintering, dispersing across the Project site between suitable habitat areas at the airfield, or migrating. If an owl is present within piles of such materials, physical disturbance of those materials could result in injury or death of an owl. Ground disturbance, noise, and vibrations caused by Project activities could potentially disturb an individual owl and cause it to move away from work areas, possibly exposing it to increased competition with other birds in the areas to which it disperses, and a greater likelihood of predation caused by unfamiliarity with the new area. As described above, the loss of a single owl from Project Activities would be considered a significant impact. Implementation of Mitigation Measures BIO-1B, BIO-1C, and BIO-1D would avoid injury or mortality of burrowing owls from activities at the Project site.

- **Mitigation Measure BIO-1A. Pre-activity Survey of Project Access Route.** Prior to the commencement of Project-related vehicular activity along the access routes to Hangar 3, a qualified biologist will conduct a pre-activity survey for burrowing owls. The survey area will consist of all suitable owl habitat (e.g., grassland and ruderal habitat with ground squirrel burrows) located within 250 feet and 160 feet of the Project's access route during the breeding season (February 1 through August 31) and non-breeding season (September 1 through January 31), respectively. The survey will consist of at least two site visits, with the first conducted within 14 days prior to the commencement of Project-related vehicular activities along the access routes and the second conducted within 48 hours of the start of Project-related vehicular activities. If no burrowing owls are located during these surveys, no additional action would be warranted.

However, if burrowing owls are located in areas adjacent to or within the specified distances of the access routes as described above, PV will coordinate with NASA on the appropriate avoidance and minimization measures, such as staggering the passage of construction vehicles, implementing a slower speed limit along the access routes, or use of screening or construction monitoring by a qualified biologist, to prevent disturbance to owls from Project-related vehicular activity along the access routes.

- **Mitigation Measure BIO-1B. Pre-activity Survey of Project Site.** Prior to any initial Project-related activity involving the physical manipulation (e.g., relocation, addition to, or removal of) of piles of equipment, debris, or materials that could be used as a perch site by burrowing owls on the Project site, a qualified biologist will conduct a pre-activity survey for burrowing owls. The survey will consist of at least two site visits, with the first conducted within 14 days prior to the start of Project activities and the second conducted within 48 hours of the start of Project activities. Additional surveys will be necessary any time construction activities cease, or equipment and materials remain undisturbed, for more than 7 days after initial Project-related activity has begun. If no burrowing owls are located during these surveys, no additional action would be warranted. However, if burrowing owls are located on or immediately adjacent to impact areas, Mitigation Measure BIO-1C will be implemented.
- **Mitigation Measure BIO-1C. Materials Monitoring and Relocation.** If Project-related activities will directly impact a pile of materials that is occupied by a perching owl, the qualified biologist will coordinate with NASA environmental staff on the best approach to relocate or redistribute the materials to discourage its use as a perch site. This may include monitoring the owl to determine whether it is paired and/or actually nesting (which would be highly unlikely in a pile of materials), monitoring the owl to ensure that it has left the area on its own before materials are accessed and/or moved or redistributed, and/or having a biologist walk toward the owl to cause it to flush from the area where it is perching (being careful to ensure that no avian predators are present nearby at the time). After the owl has moved on its own or flushed, the materials where the bird had taken refuge will be moved and stored in a way that does not create a protected area which the owl may return to and perch. If necessary, the biologist will remain on-site until the materials have been relocated, or rendered unsuitable for use by the owl, to ensure that the bird does not re-occupy the perch site while materials relocation is occurring.
- **Mitigation Measure BIO-1D. Materials Storage.** When materials are delivered to the Project site, material stockpiles should be stored and distributed in such a way as to prevent the creation of an attractive nuisance that may provide artificial nesting or perching habitat for burrowing owls. Equipment or materials with an upright, vertical profile should be stored on their side (if safe to do

so), or tarped to create a slick, unnatural surface. Equipment or materials that are hollow, such as pipe, or otherwise recessed that might provide cover and refugia should be tarped or the openings plugged or covered with plywood (to hinder access) or broken down and redistributed to eliminate any protective cover. Material stockpiles should be located near active work sites where they are regularly exposed to vehicle and foot traffic and be located distant from any adjacent natural habitat (e.g., not along the project margins) to prevent attracting burrowing owls from adjacent properties.

With implementation of Mitigation Measures BIO-1A, BIO-1B, BIO-1C, and BIO-1D the Proposed Action would not have a significant impact on burrowing owls.

### *Impacts on Nesting and Roosting Birds*

Several species of common native birds protected by the MBTA and CFGC are known to nest within Hangar 3 and on associated structures. As described in Section 3.2.2.2, Affected Environment, these species include the barn owl, which nests in the box beams; the white-throated swift, which nests in small, concealed crevices throughout the box beams and the roof of the hangar; the common raven, which is known to nest high on the sidewall truss beams and in the box beams; and the American kestrel, which has nested in a cavity formed by the truss beams and box beam. A number of other species, such as barn swallows, cliff swallows, black phoebes, and house finches, may attach nests to or build nests on top of supports on the exterior or interior of the hangar. Birds may also nest on adjacent structures, potentially close enough to Project activities to be disturbed by pre-demolition or demolition activities. Project-related disturbance during the avian nesting season (February 1 to August 31 for most species in Santa Clara County) could result in the incidental loss of eggs or nestlings either directly through the destruction or disturbance of active nests or indirectly by causing the abandonment of nests.

As described in Section 2.0, Description of Proposed Action and Alternatives, pre-demolition activities would include a survey to identify hazardous non-structural elements comprised of ACM and LBP that would then be removed and use of scaffolding. Demolition activities would be carried out in a phased process, beginning from the outside of the building by first removing outside doors, then moving on to the high end of the bay working from south to north, removing trusses as the demolition advances. The multiple components, varied timing and execution of pre-demolition activities, and the phased approach to demolition would be expected to create enough disturbance to discourage birds from nesting in Hangar 3, helping to avoid impacts. However, as stated above, Project activities could result in the incidental loss of eggs or nestlings either directly through the destruction or disturbance of active nests or indirectly by causing the abandonment of nests, which could violate the MBTA and CFGC thus resulting in a significant impact. Therefore, Mitigation Measures BIO-2A to BIO-2D would be implemented to avoid impacts to nesting birds prior to pre-demolition activities and during each phase of demolition. With implementation of these mitigation measures, the Proposed Action would not have a significant impact on nesting birds resulting in violation of the MBTA and CFGC. In the past, pre-activity surveys conducted for nesting birds, ahead of prior renovation efforts (not part of this Project) in Hangars 2 and 3, proved to be successful in protecting active nests from disturbance, because buffer/no-construction activity zones were delineated, and construction personnel were informed that construction work must avoid those areas while nests were active. Therefore, Mitigation Measures BIO-2A to BIO-2D would be implemented to avoid impacts to nesting birds and as a result the Proposed Action would not have a significant impact on nesting birds.

- **Mitigation Measure BIO-2A. Avoidance of the Nesting Season.** To the extent feasible, pre-demolition and demolition activities should be scheduled to begin during the period between September 1 through January 31, outside the nesting season. If Project activities begin before nesting starts, active nests will not be destroyed or disturbed by pre-demolition or demolition activities, and the pre-demolition and demolition activities themselves would discourage birds from establishing nests in areas where they could be physically impacted or indirectly disturbed once the nesting season begins.
- **Mitigation Measure BIO-2B. Pre-Activity Surveys for Nesting Birds.** If it is not feasible to schedule the commencement of Project activities between September 1 and January 31, then pre-activity surveys for nesting birds will be conducted by a qualified biologist to ensure that no nests will be disturbed during Project-related activities. These surveys will be conducted no more than seven days prior to the initiation of pre-demolition, demolition, or other Project-related activities. During breeding-season surveys for nesting birds, the biologist will inspect all potential nesting locations inside and outside of Hangar 3, as well as all other areas within 300 feet (for raptors) and 100 feet (for non-raptors) of the Project site, where access allows.
- **Mitigation Measure BIO-2C. Non-Disturbance Buffers around Active Nests.** If an active nest (i.e., a nest with viable eggs or live young) is found sufficiently close to the Project area and would be disturbed by Project activities, or if an active nest is present on substrate (such as the hangar structure) that would be subject to substantial vibrations or removal as part of pre-demolition or demolition activities (no matter how far from the nest), a qualified biologist will determine the extent of a construction-free buffer zone to be established around the nest (typically 300 feet for raptors and 100 feet for other species), to ensure that no nests of species protected by the MBTA and CFGC will be disturbed during Project-related activities. However, these buffers may be reduced if the biologist determines that a smaller buffer will adequately prevent excessive disturbance of the nest (e.g., due to intervening structures that block the birds'

view of demolition activities, the level of activity occurring when the nest was established, or other factors). Alternatively, the buffers may be expanded if the biologist determines that a larger buffer is needed, such as if an active nest appears to be disturbed by an increased level of Project activities beyond the initially established construction-free buffer zone distance. If an active nest is on substrate that will be subject to substantial vibrations during Project activities, then the activities potentially causing such vibrations will be postponed (regardless of distance from the nest) while the nest is active. The buffer established around an active nest will remain in place until the nest is no longer active, as determined by the biologist.

- **Mitigation Measure BIO-2D. Nesting Bird Deterrence.** To minimize the potential for active nests to constrain Project activities, PV may elect to deter birds from nesting in, on, or near Hangar 3 prior to the start of Project activities. Deterrence measures would be developed and implemented or supervised by a qualified biologist, and a structural engineer would verify that any manipulation to building structures for nest deterrence would not pose a greater safety hazard than currently exists. Such deterrence measures may include physical removal of nest-starts (nests that are under construction but do not yet contain eggs); installation of physical deterrence devices, such as slippery sloped panels that prevent swallows and phoebes from attaching mud nests to vertical surface, materials to block nooks and crevices that may be used for nesting, and screening or netting to prevent birds from accessing nesting areas; or modification of the nesting area to make it unattractive to birds (such as exposing areas within the box beams where barn owls may attempt to nest). For birds capable of nesting throughout the year (i.e., barn owls), additional deterrence measures may be appropriate, such as the installation of a nest cam (e.g., nestbox camera, birdhouse camera) to determine when a clutch has successfully fledged, or to confirm a period of inactivity between nesting attempts, so that nesting bird deterrents such as those described above can be safely implemented and the nest or underlying box beams can be modified or removed. If any netting is used to deter nesting, it will be regularly inspected and maintained to ensure that birds are not entangled within it or trapped behind it.

In addition to nesting, several species of birds roost within the hangar. For example, larger birds, such as the barn owl or red-tailed hawk, may enter the hangar and roost in the box beams or the eaves of the hangar, and white-throated swifts roost in crevices in the box beams or the hangar's roof. Although birds that roost near hangar exits would be able to escape from the hangar once removal of materials begins during pre-demolition or demolition, it is possible that some birds, such as barn owls within box beams or roosting high near the ceiling in the hangar's interior, may have difficulty escaping the hangar during demolition activities. Though causing the abandonment of a nonbreeding roost site would not represent a significant impact on these species given these species' local and regional abundance and the availability of alternative roost sites, pre-demolition activities that include the removal of non-metal components that are comprised of ACM or LBP or the demolition of structures that contain roosting birds could potentially cause injury or mortality. All native migratory birds are protected under the MBTA and CFGC. Therefore, injury or mortality of birds protected under these regulations would result in a significant impact due to the violation of the MBTA or CFGC. Such impacts could occur year-round. Therefore, Mitigation Measures BIO-2E and BIO-2F would be implemented to avoid impacts to roosting birds. With implementation of these mitigation measures, the Proposed Action would not have a significant impact on roosting birds resulting in violation of the MBTA and CFGC.

- **Mitigation Measure BIO-2E. Pre-Activity Surveys for Roosting Birds.** Regardless of the time of year in which pre-demolition or demolition activities begin, pre-activity surveys for roosting birds will be conducted by a qualified biologist to ensure that no roosting birds will be injured or killed during Project-related activities in Hangar 3. These surveys will be conducted no more than seven days prior to the initiation of pre-demolition or demolition activities to identify active roost sites and allow time for additional remedial actions to be taken, and again immediately before the start of pre-demolition or demolition to clear the work area before work begins. During surveys for roosting birds, the biologist will look for the presence of birds roosting in areas where they could potentially be injured or killed during pre-demolition or demolition activities.
- **Mitigation Measure BIO-2F. Passive Relocation of Roosting Birds.** If birds are found roosting in the interior of Hangar 3 in areas where they may be subject to injury or mortality during pre-demolition or demolition activities, a qualified biologist will identify actions that can be taken to “passively relocate” the birds by encouraging them to leave the hangar. Examples of such actions include removing or physically modifying the structures used for roosting, opening areas of the walls or ceiling close to the roost site to make those sites more exposed and thus less attractive, or the use of auditory deterrents (e.g., recorded vocalizations of falcons or other raptors) or visual deterrents (lasers [not targeting the birds themselves], bright lights, streamers, or other means) to encourage birds to leave areas where they may be subject to injury or mortality. The precise methods used to encourage birds to leave the hangar will be determined by the biologist based on the species in question and the circumstances of the roost. A structural engineer would verify that any manipulation to building structures for passive relocation would not pose a greater safety hazard than currently exists.

### *Impacts on Roosting Bats*

Although no special-status bats are known or expected to roost in Hangar 3, common bat species such as the Mexican free-tailed bat and Yuma myotis are known to roost in the cement towers and box beams of Hangar 3. The proposed demolition of Hangar 3 could result in the direct physical disturbance of any roosting bats that may be present, as well as the loss of roosting sites. In addition, demolition of structures during the bat maternity season (approximately March 15 to August 31) could result in the injury or mortality of young and lactating females within a roost site. Impacts on a large day roost (i.e., 100 or more bats) of common species of bats would be considered a significant impact due to the potential effect on regional populations of the species. However, only a small number of bats (i.e., 10 to 15 bats), were detected during visual and acoustic preconstruction surveys as part of the implementation of the MFA Hangars 2 and 3 Due Diligence Wildlife Protection Plan (H. T. Harvey & Associates 2015). These surveys were conducted at the end of the maternity season (late August and early September), and larger numbers of bats, as well as substantially greater amounts of recent sign (i.e., fresh guano and urine staining), would have been present in the hangars if a large maternity roost were present. The amount of guano and staining present in the box beams, in the hangar interiors, and beneath the box beams was consistent with the small numbers of bats observed during the surveys and using the hangars year-round. Therefore, it was concluded that small numbers of bats use the hangars, and evidence does not support historical use of the hangars by large numbers of bats – although Hangars 2 and 3 have been available for use for many years, they have remained little used by local bat colonies (H. T. Harvey & Associates 2015). Further, bats are not known or expected to use adjacent structures, including nearby Building 055 or other locations that are close enough to be disturbed by Project activities.

Proposed pre-demolition activities may have a minor indirect impact on roosting bats, via disturbance of roost areas where hazardous, non-structural elements are removed. However, Project activities (both pre-demolition and demolition activities) would not be expected to have a significant impact on common species of roosting bats due to the small number of bats that could be impacted. However, activities resulting in the destruction of an occupied nonbreeding bat roost and thus potentially in the death of bats may be considered “take” by the CDFW under the CFGC. Therefore, the death of roosting bats could result in a significant impact due to a violation of the CFGC. Mitigation Measures BIO-3A through BIO-3D would be implemented to avoid injury or mortality of common species of roosting bats. With implementation of these mitigation measures, the Proposed Action would not have a significant impact on roosting bats resulting in violation the CFGC

- **Mitigation Measure BIO-3A. Exclude Bats Prior to Disturbance.** To encourage bats to leave Hangar 3 prior to the initiation of pre-demolition activities, a qualified bat biologist will identify appropriate locations for, and will supervise the installation of, ultrasonic deterrence devices (which were used successfully during restoration activities in Hangars 2 and 3 to encourage bats to leave roosts in the hangars and avoid returning [H. T. Harvey & Associates 2016]). These devices will be employed prior to the start of the bat maternity season (as determined by the qualified bat biologist, but approximately March 15 to August 31) and will be maintained in regular use and checked periodically by the bat biologist to ensure proper function until demolition commences. These devices will remain in use as far into the demolition process as feasible to discourage bats from re-occupying former roosts.

- **Mitigation Measure BIO-3B. Conduct Pre-Activity Surveys for Roosting Bats.** To ensure that the ultrasonic deterrence devices have been successful in deterring bats from occupying Hangar 3 prior to demolition, a pre-activity survey for roosting bats shall be conducted within seven days prior to commencement of pre-demolition and demolition activity. The survey shall be conducted by a qualified bat biologist. If no active roosts are found, then no further action is warranted. If a roost is present, a qualified bat biologist shall determine the species and number of individuals present.
- **Mitigation Measure BIO-3C. Avoid Disturbance of Maternity Roosts.** If an active maternity roost is present within any section of Hangar 3 where materials may be removed during pre-demolition or in areas that are to be demolished, despite the use of ultrasonic bat deterrence devices, disturbance shall not take place during the maternity season (as determined by the qualified bat biologist, but approximately March 15 to August 31), and an appropriate disturbance-free buffer zone (also determined by the qualified bat biologist and based upon the level of Project activity disturbance) shall be observed during this period to avoid disturbing the roosting bats. If a roost is present on infrastructure (such as the hangar structure) that would be subject to substantial vibrations or removal as part of Project activities, the buffer distance will take into consideration not only distance between Project activities and the roost site, but also whether certain activities could cause substantial vibrations at the roost location, no matter how far from the roost those activities occur.
- **Mitigation Measure BIO-3D. Eviction of Roosting Bats.** If an active non-maternity roost is present in Hangar 3, despite the use of ultrasonic bat deterrence devices, the bats will be evicted outside of the maternity season (March 15 to August 31). The bat biologist, along with a structural engineer (who would verify that any manipulation to building structures for bat eviction would not pose a greater safety hazard than currently exists), will determine the appropriate means of evicting the bats depending on the circumstances of the roost. Examples of potential eviction actions include opening the roost area to increased air flow to change the thermal conditions in the roost, establishing increased lighting in the roost area, installing one-way devices to allow bats to exit but not re-enter the roost, or otherwise physically modifying the roost area at night when bats are not present. One-way doors or other deterrence devices should be left in place for

a minimum of two weeks with a minimum of five fair-weather nights with no rainfall and temperatures no colder than 50°F.

#### No Action Alternative

Under the No Action Alternative, there would be no disturbance to the existing environment associated with pre-demolition, demolition, and waste removal and recycling. In the event of a structural failure, potential impacts would be uncontrolled and would result in greater direct and immediate impacts to wildlife in the vicinity of the Project site as mitigation measures identified for the Proposed Action would not be implemented. Therefore, wildlife impacts could be significant as the No Action Alternative could result in the loss of bird eggs or nestlings, the death or injury of a burrowing owl (if present in debris or materials near the hangar), and the injury or mortality of bats within a roost site in Hangar 3, thus violating the MBTA and/or CFGC or potentially affecting the regional population of burrowing owls.

## 3.2.3 Cultural Resources

Cultural resources are historic properties as defined by the NHPA, cultural items as defined by the Native American Graves Protection and Repatriation Act, archaeological resources as defined by the Archaeological Resources Protection Act (ARPA), sacred sites as defined by EO 13007 to which access is afforded under the American Indian Religious Freedom Act (AIRFA), and collections and associated records as defined by 36 CFR 79. For the purposes of this EA, cultural resources are divided into three major categories: archaeological resources (prehistoric and historic), architectural resources, and traditional cultural resources.

### 3.2.3.1 Regulatory Setting

#### NEPA

NEPA provides a broad framework to ensure that agencies take into consideration significant cultural and historic resources when completing projects (40 CFR 1508.8). Under NEPA, cultural and historic resources are part of the "human environment" and cultural aspects of the environment can include the natural environment, the built environment, and human social institutions. Analysis of cultural and historic resources under NEPA addresses archaeological sites, architectural resources, and traditional cultural resources.

Only significant cultural resources, known or unknown, warrant consideration with regard to potential impacts resulting from a proposed action. To be considered significant, cultural or historic resources must meet one or more significance criteria as defined in 36 CFR 60.4 for inclusion in the NRHP, similar to the qualifications for being considered a historic property under the NHPA, or be identified as a significant resource through consultation.

### NHPA

The NHPA provides a regulatory framework to ensure that significant cultural resources are recognized and protected during federal projects and programs through the Section 106 (36 CFR 800) consultation process. For compliance with the NHPA, cultural resource significance is evaluated in terms of eligibility for listing in the National Register of Historic Places (NRHP). Properties listed, or determined eligible for listing, in the NRHP are considered historic properties. Section 106 of the NHPA requires federal agencies to consider the potential effects of undertakings on historic properties. This requires identifying an Area of Potential Effects (APE), which is a geographic area where a federal undertaking may affect historic properties. Potential effects to any historic properties identified within the APE are then considered. If the federal agency determines that an undertaking would result in an adverse effect, then the federal agency must consult with the State Historic Preservation Officer (SHPO) and other relevant parties to resolve the adverse effect through avoidance, minimization, or mitigation.

Per 36 CFR 800.5(a)(1) of the NHPA, the Criteria of Adverse Effects are used to evaluate “when an undertaking may alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the NRHP in a manner that would diminish the integrity of the property’s location, design, setting, materials, workmanship, feeling, or association.” Under 36 CFR 800.5(a)(2), examples of adverse effects include the following:

i) Physical destruction of or damage to all or part of the property.

ii) Alteration of a property including restoration, rehabilitation, repair, maintenance, stabilization, hazardous material remediation, and provision of handicapped accesses that is not consistent with the Secretary of the Interior’s standards for the treatment of historic properties (36 CFR Part 68) and applicable guidelines.

iii) Removal of the property from its historic location.

iv) Change of the character of the property’s use or of physical features within the property’s setting that contribute to its historic significance.

v) Introduction of visual atmospheric, or audible elements that diminish the integrity of the property’s historic features.

vi) Neglect of a property which causes deterioration except where such neglect and deterioration are recognized qualities of a property of religious and cultural significance to an Indian tribe or Native Hawaiian organization.

vii) Transfer, lease, or sale of a property out of Federal ownership or control without adequate legally enforceable restrictions or conditions to ensure long-term preservation of the property’s significance.

In the event an undertaking results in adverse effects to historic properties, the lead federal agency, through consultation with SHPO and other interested parties, resolves the adverse effects through the preparation of a Memorandum of Agreement (MOA), which stipulates a series of mitigating actions that must take place in order to resolve the adverse effects identified. Through the execution of an MOA, adverse effects are then resolved in accordance with the NHPA.

While Section 106 consultation under the NHPA identifies potential adverse effects to historic properties, these adverse effects do not always equate to significant impacts under NEPA, as outlined under 36 CFR 800.8(a)(1), which states, “[a] finding of adverse effect on a historic property does not necessarily require an Environmental Impact Statement (EIS) under NEPA.” An EIS is only required when a significant impact cannot be mitigated. Consultation and review under the NHPA and NEPA are two different types of Federal environmental procedure and the integration of NEPA in the Section 106 process is encouraged but not required, and agencies are authorized to coordinate and integrate aspects of both into their reporting (Council on Environmental Quality, Executive Office of the President, and Advisory Council on Historic Preservation 2013). If mitigation is implemented under the Section 106 process, then significant impacts under NEPA could be reduced to less than significant and the lead federal agency could complete a mitigated Finding of No Significant Impact (FONSI).

### 3.2.3.2 Affected Environment

The Project area is located entirely within the expanded boundaries of the NAS Sunnyvale Historic District. The APE identified as part of the Section 106 consultation process is primarily defined by the boundaries of the historic district, although the eastern boundary extends into the eastern adjacent parcels in neighboring Sunnyvale, California, before extending north through the Lockheed Martin Missile and Space Division campus toward the San Francisco Bay.

## Identified Cultural Resources

### *Archaeological Resources*

In 2017, AECOM prepared the *NASA Ames Research Center Archaeological Resources Study* on behalf of NASA. This study identifies potential archaeological resources throughout MFA and is intended to support the NASA ARC Integrated Cultural Resources Management Plan (AECOM 2014), which provides guidance for the treatment of cultural resources, both archaeological and architectural, on the NASA ARC property. The AECOM study includes a thorough collection of previous archaeological and geotechnical studies, previously recorded resources, historical maps, Sacred Land File searches from the Native American Heritage Commission (NAHC), and other sources, to outline and identify the potential for archaeological resources throughout the site. Based upon these records, an archaeological sensitivity map was created that illustrates areas where archaeological properties are more likely to be extant. The identified areas of sensitivity are organized into four categories:

- Heightened Historic-era Archaeological Sensitivity
- Heightened Prehistoric-era Archaeological Sensitivity
- Heightened Geoarchaeological Sensitivity
- Low Archaeological Sensitivity

The Project area overlaps with areas of heightened historic-era and prehistoric-era archaeological sensitivity, but there are no known archaeological sites within the APE. Although not expected, subsurface cultural resources may be present at or near the Project site, particularly in relation to the overlapping heightened prehistoric-era and historic-era archaeological sensitivity zones.

### *Architectural Resources*

Numerous studies have documented and evaluated the historical significance of the architectural resources at MFA. In 1994, the NAS Sunnyvale Historic District was identified and listed on the NRHP. This discontinuous historic district is made up of the original 1930s portion of MFA, also known as Shenandoah Plaza, which centered around Hangar 1 and the western portion of the MFA property, as well as the eastern side of the airfield surrounding Hangars 2 and 3. In 2013, additional survey work identified the NRHP-eligible expanded boundaries for the NAS Sunnyvale Historic District, which encompasses the entirety of the airfield at MFA, primarily the runway network and buildings directly associated with significant missions and operations during World War II through 1961 (AECOM 2013).

Hangars 2 and 3 are large, wood framed dirigible hangars located on the eastside of the airfield. Constructed between 1942 and 1943, Hangars 2 and 3 are nearly identical hangars based upon a standardized plan that was utilized for similar hangars located at a handful of other airfields that were in operation during World War II. Hangar 2, located directly east adjacent to the airfield, was constructed first, whereas Hangar 3 was constructed second, immediately adjacent to Hangar 2. Both were designed to facilitate the lighter than air coastal defense program at MFA during World War II, and both were used to house fixed wing aircraft that operated out of MFA over the following decades (Stantec 2021).

In 1988, both hangars were determined to be individually eligible for listing on the NRHP for significance associated with events during World War II, and for their overall engineering and design. In 1994, Hangars 2 and 3 were each listed on the NRHP as contributors to the NAS Sunnyvale Historic District as excellent examples of military engineering and design during World War II. In 2013, Hangars 2 and 3 were also identified as contributors to the NRHP-eligible expanded NAS Sunnyvale Historic District, which also includes the airfield features at MFA that were significant to the various missions that took place between 1933-1961 (Stantec 2021).

### *Traditional Cultural Resources*

In 2021, NASA ARC requested an updated Sacred Land files search from the NAHC for MFA, and the results were negative. There are no federally recognized tribes as defined by the U.S. Department of the Interior's Bureau of Indian Affairs and listed in 81 Federal Register 5019. A list of non-federally recognized Native American tribes and/or representatives who may have interest in NASA ARC and future undertakings and Section 106 consultation was provided. NASA ARC has consulted with these representatives on other undertakings at MFA that have had the potential to affect cultural resources at known sites and in areas with high sensitivity for prehistoric archaeological resources. However, these representatives have not provided any additional information regarding known sacred lands or previously undocumented archaeological resources.

### *Native American Consultation*

For this Project, because none of the tribes in the area are federally recognized and the Sacred Lands File search (dated July 28, 2021) did not identify any known Sacred Land Files cultural resources in the area, tribal consultation was not undertaken. No cultural resources significant to tribes were identified within the APE.

### 3.2.3.3 Approach to Analysis

To communicate Section 106 information and meet the requirements under the NHPA, a cultural resources technical study identified potential historic properties within the APE and assessed potential adverse effects on historic properties. Pursuant to Section 106 of the NHPA, NASA made a determination of eligibility on historic properties in the APE and a finding of adverse effect. The SHPO concurred with NASA's findings on August 21, 2020. The Advisory Council on Historic Preservation elected to participate in Section 106 consultation. Additional consulting parties for the development of an MOA to resolve adverse effects to historic properties include the City of Mountain View and the Moffett Field Historical Society. For the purposes of review under NEPA, the adverse effects on historic properties identified through Section 106 consultation are addressed as potentially significant impacts on cultural resources. The Section 106 technical study and correspondence related to the Section 106 process can be found in Appendix C, Section 106 Report of this document, with complete findings, analyses, and letters produced for the Section 106 process.

For the purpose of this analysis, impacts to cultural and historic resources would be considered significant if the Project results in an adverse effect on a historic property that cannot be mitigated. There are no identified Traditional Cultural Resources in the Project area; therefore, no impacts are anticipated on this resource type.

### 3.2.3.4 Environmental Consequences

#### Proposed Action - Building Demolition

*Impacts to Archaeological Resources*

As part of the Proposed Action, there are no ground disturbing activities located within the identified areas of heightened prehistoric-era and historic-era archaeological sensitivity or areas with known sites. In the event ground disturbing activities are required as part of the Proposed Action and archaeological materials were discovered, all work would be halted, the NASA Cultural Resources Manager would be notified, and per the requirements of the lease agreement between NASA and PV, the appropriate steps outlined in the Integrated Cultural Resources Management Plan Standard Operation Procedure 8: Inadvertent Discovery would be implemented (AECOM 2014). Therefore, with the implementation of these measures, the Proposed Action would not result in a significant impact to archaeological resources.

### *Impacts to Architectural Resources*

As concurred upon by the SHPO through the Section 106 consultation process in a letter provided to NASA on August 21, 2020 (SHPO 2020), the Proposed Action would adversely affect Hangar 3 and the NAS Sunnyvale Historic District, primarily through the complete physical loss of Hangar 3, which is both a an individually eligible historic structure and a significant contributor to the NRHP-listed district. The removal of the structure would also disrupt the visual qualities and historic character within the NAS Sunnyvale Historic District as a whole, resulting in indirect adverse impacts. This would impact the historic setting of the individual contributors, particularly on the eastside of the airfield, which includes Hangar 2, Building 055, the East Aircraft Parking Apron, other contributing airfield infrastructure (runways and taxiways), operations and support buildings, and the munitions magazines and historic handling facilities.

While the Proposed Action would result in adverse effects to the NAS Sunnyvale Historic District, the NAS Sunnyvale Historic District and its remaining various contributors would retain sufficient, albeit diminished, historic integrity following the completion of the Proposed Action and would continue to qualify for listing on the NRHP. Additionally, the Proposed Action would include execution of a MOA with stipulations to resolve adverse effects under Section 106 of the NHPA. The MOA is being developed as part of the ongoing Section 106 process and may include stipulations for the archival documentation of Hangar 3, such as a Historic American Engineering Record (HAER), or other methods of recording its history for posterity. With implementation of the MOA, adverse effects would be resolved under Section 106 and the impact on architectural resources would be less than significant.

Additional information regarding the Section 106 process for the Project is located on the NASA ARC website (https://historicproperties.arc.nasa.gov/section106.html) and can be found in Appendix C, Section 106 Report.

## No Action Alternative

Under the No Action Alternative, there would be no disturbance to the existing environment associated with pre-demolition, demolition, and waste removal and recycling. In the event of a structural failure, direct and indirect impacts to Hangar 3, the NAS Sunnyvale Historic District, and the other contributors to the NAS Sunnyvale Historic District in the vicinity including the adjacent Hangar 2 (individually eligible and a contributor to the historic district) and Building 055 could occur from the collapse of Hangar 3. Potential impacts to NAS Sunnyvale Historic District contributing buildings in the vicinity include damage to the exterior of the structures from the uncontrolled collapse of Hangar 3, as well as the potential for long-term structural damage to the contributors from the force of collapse of Hangar 3, which could also cause damage across the Historic District from the sheer size of Hangar 3. Under the No Action Alternative, there would not be a Section 106 process or resulting MOA to address and resolve adverse effects to historic properties. Therefore, the No Action Alternative could result in a significant impact to cultural resources.

### 3.2.4 Greenhouse Gases and Climate Change

This section provides background information about greenhouse gas (GHG) emissions and climate change. GHG emissions have the potential to adversely affect the environment because such emissions contribute cumulatively to global climate change. It is unlikely that a single project will contribute significantly to climate change, but cumulative emissions from many projects could affect global GHG concentrations and the climate system. Therefore, impacts are analyzed within the context of the Proposed Action's potential contribution to the cumulatively significant impact of climate change.

Natural processes and human actions have been identified as affecting the climate. The Intergovernmental Panel on Climate Change (IPCC) has concluded that variations in natural phenomena such as solar radiation and volcanoes produced most of the warming from pre-industrial times to 1950 and had a small cooling effect afterward (IPCC 2021).

However, increasing GHG concentrations resulting from human activity since the 19$^{th}$ century, such as fossil fuel combustion, deforestation, and other activities, are believed to be a major factor in climate change (IPCC 2021). GHGs in the atmosphere naturally trap heat by impeding the exit of solar radiation that has hit the earth and is reflected back into space—a phenomenon sometimes referred to as the "greenhouse effect." Some GHGs occur naturally and are necessary for keeping the Earth's surface inhabitable. However, increases in the concentrations of these gases in the atmosphere during the last 100 years, largely as a result of human activity, have trapped solar radiation and decreased the amount that is reflected back into space, intensifying the natural greenhouse effect, and resulting in the increase of global average temperature.

Carbon dioxide ($CO_2$), methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride are the principal GHGs. When concentrations of these gases exceed historical concentrations in the atmosphere, the greenhouse effect is intensified. $CO_2$, methane, and nitrous oxide occur naturally and are also generated through human activity. With regard to human activity emissions sources, emissions of $CO_2$ are largely by-products of fossil fuel combustion; methane results from off-gassing, natural gas leaks from pipelines and industrial processes, and incomplete combustion associated with agricultural practices, landfills, energy providers, and other industrial facilities; nitrous oxide emissions are also largely attributable to agricultural practices and soil management. $CO_2$ sinks include vegetation and the ocean, which absorb $CO_2$ through sequestration and dissolution, and are two of the largest reservoirs of $CO_2$ sequestration. Other human-generated GHGs include fluorinated gases such as hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride, which have much higher heat-absorption potential than $CO_2$ and are byproducts of certain industrial processes.

$CO_2$ is the primary anthropogenic (human-caused) GHG and has been established as the reference gas to demonstrate the relative effect of different GHGs of equal mass. The effect that each of the GHGs has on global warming is the product of the mass of their emissions and their global warming potential (GWP). GWP indicates how much a gas is predicted to contribute to global warming relative to how much warming would be predicted to be caused by the same mass of $CO_2$. For example, methane and nitrous oxide are substantially more potent GHGs than $CO_2$, with GWPs of 25 and 298 times that of $CO_2$ respectively, which has a GWP of 1, as the reference gas.

In emissions inventories, GHG emissions are typically reported as metric tons (MT) of $CO_2$ equivalent ($CO_2e$). $CO_2e$ is calculated as the product of the mass emitted of a given GHG and its specific GWP.

### 3.2.4.1 Regulatory Setting

There are numerous regulations regarding GHGs and climate change that have been enacted at the federal and state level. The following includes the key federal, state, and regional GHG regulations applicable to the Project.

#### Federal

**Greenhouse Gas Endangerment**. On April 2, 2007, in Massachusetts v. USEPA, 549 US 497, the Supreme Court found that GHGs are air pollutants covered by the CAA. The Court held that the USEPA must determine whether emissions of GHGs from new motor vehicles cause or contribute to air pollution, which may reasonably be anticipated to endanger public health or welfare, or whether the science is too uncertain to make a reasoned decision. In making these decisions, the USEPA is required to follow the language of Section 202(a) of the CAA.

On April 17, 2009, the USEPA Administrator signed proposed “endangerment” and “cause or contribute” findings for GHGs under Section 202(a) of the CAA. The USEPA held a 60-day public comment period, considered public comments, and issued final findings. The USEPA found that six GHGs taken in combination endanger both the public health and the public welfare of current and future generations. The USEPA also found that the combined emissions of these GHGs from new motor vehicles and new motor vehicle engines contribute to the greenhouse effect as air pollution that endangers public health and welfare under CAA Section 202(a).

**Mandatory Reporting of Greenhouse Gases.** The Consolidated Appropriations Act of 2008, passed in December 2007, requires the establishment of mandatory GHG reporting requirements. On September 22, 2009, USEPA issued the Final Mandatory Reporting of Greenhouse Gases Rule, which became effective January 1, 2010. The rule requires reporting of GHG emissions from large sources and suppliers in the U.S. and is intended to collect accurate and timely emissions data to inform future policy decisions. Under the rule, suppliers of fossil fuels or industrial GHGs, manufacturers of vehicles and engines, and facilities that emit 25,000 metric tons or more per year of GHG emissions are required to submit annual reports to the USEPA

**Executive Order 13990.** On January 20, 2021, President Biden issued Executive Order (EO) 13990, “Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis.” Section 7(e) of this EO directs CEQ to rescind the 2019 Draft GHG Guidance and review, revise, and update its 2016 GHG Guidance. The withdrawal of the 2019 guidance did not change any law, regulation, or other legally binding requirement. In the interim, before CEQ updates the 2016 guidance, agencies should consider all available tools and resources in assessing GHG emissions and climate change effects of their proposed actions, including, as appropriate and relevant, the 2016 GHG Guidance.

### California

California has adopted statewide legislation addressing various aspects of climate change and GHG emissions mitigation. Much of this legislation establishes a broad framework for the state’s long-term GHG reduction and climate change adaptation program. The governor has also issued several EOs related to the state’s evolving climate change policy. Of particular importance are the following:

**Executive Order S-3-05.** In 2005, in recognition of California’s vulnerability to the effects of climate change, Governor Arnold Schwarzenegger issued EO S-3-05, which set forth a series of target dates by which statewide emissions of GHGs would be progressively reduced, as follows:

- By 2010, reduce GHG emissions to 2000 levels.
- By 2020, reduce GHG emissions to 1990 levels.
- By 2050, reduce GHG emissions to 80 percent below 1990 levels.

**Executive Order B-30-15.** Governor Brown signed EO B-30-15 on April 29, 2015, which:

- Established a new interim statewide reduction target to reduce GHG emissions to 40 percent below 1990 levels by 2030;

- Ordered all state agencies with jurisdiction over sources of GHG emissions to implement measures to achieve reductions of GHG emissions to meet the 2030 and 2050 reduction targets; and
- Directed CARB to update the Climate Change Scoping Plan (Scoping Plan) to express the 2030 target in terms of million metric tons of $CO_2$ equivalent.

**Assembly Bill (AB) 32 and Senate Bill (SB) 32.** In September 2006, Governor Schwarzenegger signed the California Global Warming Solutions Act of 2006 (AB 32). AB 32 established regulatory, reporting, and market mechanisms to achieve quantifiable reductions in GHG emissions and established a cap on statewide GHG emissions. AB 32 required that statewide GHG emissions be reduced to 1990 levels by 2020. This reduction was to be accomplished by enforcing a statewide cap on GHG emissions that would be phased in starting in 2012. To effectively implement the cap, AB 32 directed CARB to develop and implement regulations to reduce statewide GHG emissions from stationary sources. AB 32 specified that regulations adopted in response to AB 1493 should be used to address GHG emissions from vehicles. However, AB 32 also included language stating that if the AB 1493 regulations could not be implemented, then CARB should develop new regulations to control vehicle GHG emissions under the authorization of AB 32.

In 2016, SB 32 and its companion bill AB 197 amended Health and Safety Code Division 25.5, establishing a new climate pollution reduction target of 40 percent below 1990 levels by 2030, and included provisions to ensure that the benefits of state climate policies reach disadvantaged communities.

**Climate Change Scoping Plan.** A specific requirement of AB 32 was to prepare a Climate Change Scoping Plan for achieving the maximum technologically feasible and cost-effective GHG emission reduction by 2020. CARB developed and approved the initial scoping plan in 2008, outlining the regulations, market-based approaches, voluntary measures, policies, and other emission reduction programs that would be needed to meet the 2020 statewide GHG emission limit and initiate the transformations needed to achieve the state's long-range climate objectives.

CARB approved the 2017 Climate Change Scoping Plan Update (2017 Scoping Plan Update) in December 2017. The 2017 Scoping Plan Update outlines the proposed framework of action for achieving the 2030 GHG target of 40 percent reduction in GHG emissions relative to 1990 levels. Through a combination of data synthesis and modeling, CARB determined that the target statewide 2030 emissions limit is 260 million metric tons of carbon dioxide equivalents ($MMTCO_2e$), and that further commitments would need to be made to achieve an additional reduction of 50 $MMTCO_2e$ beyond current policies and programs.

In the 2017 Scoping Plan Update, CARB recommends statewide targets of no more than 6 metric tons of $CO_2e$ ($MTCO_2e$) per capita by 2030 and no more than 2 $MTCO_2e$ per capita by 2050. CARB acknowledges that because the statewide per-capita targets are based on the statewide GHG emissions inventory that includes all emissions sectors in the state, it is appropriate for local jurisdictions to derive evidence-based local per-capita goals based on local emissions sectors and growth projections.

### 3.2.4.2 Affected Environment

*U.S. Emissions*

In 2018, U.S. GHG emissions totaled 6,677 $MMTCO_2e$, or 5,903 $MMTCO_2e$ after accounting for sequestration from the land sector (USEPA 2020b). Emissions increased from 2017 to 2018 by 3.1 percent (after accounting for sequestration from the land sector). This increase was largely driven by an increase in emissions from fossil fuel combustion, which was a result of multiple factors, including more electricity use due to greater heating and cooling needs resulting from a colder winter and hotter summer in 2018 in comparison to 2017. GHG emissions in 2018 (after accounting for sequestration from the land sector) were 10.2 percent below 2005 levels.

According to the 2018 inventory, $CO_2$ emissions make up over 81 percent of the total GHG emissions with methane at 10 percent, and nitrous oxide and fluorinated gases at 7 and 3 percent, respectively.

*California Greenhouse Gases Emissions Inventory*

The CARB compiles GHG inventories for the state. The annual statewide GHG emission inventory is an important tool in tracking progress towards meeting statewide GHG goals. This document summarizes the trends in emissions and indicators in the California GHG Emission Inventory (the GHG Inventory). The 2020 edition of the inventory includes GHG emissions released during 2000-2018 calendar years. In 2018, emissions from GHG emitting activities statewide were 425 $MMTCO_2e$, 0.8 MMTCO2e higher than 2017 levels and 6 $MMTCO_2e$ below the 2020 GHG Limit of 431 $MMTCO_2e$.

*Consequences of Climate Change in California*

In California, climate change may result in consequences such as the following (from Moser et al. 2009):

- A reduction in the quality and supply of water from the Sierra snowpack.
- Increased risk of large wildfires.
- Reductions in the quality and quantity of certain agricultural products.

- Exacerbation of air quality problems.
- A rise in sea levels resulting in the displacement of coastal businesses and residences.
- An increase in temperature and extreme weather events.
- A decrease in the health and productivity of California's forests.

### 3.2.4.3 Approach to Analysis

GHG emissions were calculated using the same methodology and assumptions as the air quality analysis (see Appendix B, Air Quality CalEEMod Modeling Assumptions). The CalEEMod Version 2020.4.0 computer program (California Air Pollution Control Officers Association 2021) was used to generate the emissions estimate for construction GHG emissions from off-road vehicles (e.g., excavators, boom lifts, etc.) and on-road mobile vehicles (e.g., on-site worker vehicles, haul trucks). CalEEMod was updated in June 2021 after completion of construction estimates. Off-road emission factors have not been updated in the latest version of CalEEMod (Version 2020.4.0), but the on-road emission factors were updated to reflect the CARB EMFAC2017 updates (the previous CalEEMod version used CARB EMFAC2014 data). Other updates to the model reflect changes to building energy use, trip generation, and air-district specific updates for architectural coatings, trip lengths, and trip type allocations (BAAQMD not included). Given that most emissions generated by the Project are from off-road construction equipment, the previous modeling was retained. Impacts from GHG emissions would be considered significant if Project GHG emissions exceed the federal thresholds for Mandatory Reporting or exceed regional thresholds of significance established by BAAQMD.

*Thresholds*

There are no federal numeric thresholds that delineate when a proposed action may have an adverse impact. The CEQ Draft Guidance indicates where possible GHG emissions should be quantified and reported. As noted by CEQ, "climate change is a particularly complex challenge given its global nature and inherent interrelationships among its sources, causation, mechanisms of action and impacts…" (CEQ 2016).

While the federal government has not adopted any numeric thresholds to determine what constitutes a substantial amount of GHG emissions, the Final Mandatory Reporting of Greenhouse Gases Rule uses a metric of 25,000 $MTCO_2e$ for establishing the level a source becomes substantial enough that it should be reported and is used to define a significant impact for purposes of this EA.

Similarly, BAAQMD does not provide a threshold recommendation for construction related GHG emissions. In April 2022, the BAAQMD Board of Directors adopted the BAAQMD guidance, *CEQA Thresholds for Evaluating the Significance of Climate Impacts from Land Use Projects and Plans*. The BAAQMD concurrently developed an updated *Thresholds of Significance Justification Report*. This guidance and associated justification report are not regulatory but present the BAAQMD's recommended thresholds of significance for use in determining whether a proposed project would have a significant impact on climate change and provides the substantial evidence that lead agencies may need to support their use of these thresholds. The *Thresholds of Significance Justification Report* includes acknowledgement by BAAMQD that the updated threshold recommendations do not include a proposed construction-related threshold. BAAQMD's updated recommended thresholds of significance address long-term operational GHG emissions sources associated with proposed projects. Because construction emissions typically occur over a relatively short duration, they generally represent a small portion of a typical project's lifetime generation of GHG emissions. Oftentimes, an accepted practice is to amortize construction emissions over the anticipated lifetime of a Project, so that GHG reduction measures would address construction GHG emissions as part of the operational GHG reduction strategies. However, there is no anticipated increase in operational activities due to the Proposed Action, as such there is no increase in operational GHG emissions. In addition, the updated BAAQMD thresholds focus on best management practices and design features that can be incorporated into project operations, and do not provide quantitative GHG emissions rates or bright-line annual emissions limits to which construction-related emissions could be compared.

Nonetheless, a project's incremental generation of GHG emissions contributes to global GHG concentrations and related impacts to the global climate system. Therefore, construction related GHG emissions were calculated and disclosed, consistent with CEQ guidance. The project's overall contribution to global GHG concentrations was evaluated semi-quantitatively, considering both the projects quantified emissions in comparison to the federal GHG Mandatory Reporting Threshold, as a point of reference, and any emissions benefits the Proposed Action may have.

### 3.2.4.4 Environmental Consequences

#### Proposed Action – Building Demolition

The Proposed Action construction emissions are provided in Table 3-8. As shown below, the total construction emissions from the Proposed Action would be 1,124 $MTCO_2e$. These emissions would be generated over an approximately 9-month construction duration; at the completion of construction, the generation of emissions associated with the Proposed Action would cease. The emissions generated by the Proposed Action would occur over a short duration of time and would not exceed the Federal

Mandatory Reporting Threshold. In addition, while not quantified, the ongoing emissions generated by equipment and vehicle use to support intermittent repairs and maintenance activities to address the existing structure's damage and temporarily reduce the chance of further collapse would be eliminated with implementation of the Proposed Action. Therefore, impacts would result in a less than significant contribution to the significant cumulative impact to global climate change.

**Table 3-8 Estimated Construction GHG Emissions for the Proposed Action**

| Parameter | Metric Tons CO2e |
|---|---|
| Total Emissions 2022 | 216 |
| Total Emissions 2023 | 908 |
| Total Project Emissions[1] | 1,124 |
| Federal Mandatory Reporting Threshold | 25,000 |
| Does the Proposed Action exceed threshold? | No |

Note:

BAAQMD = Bay Area Air Quality Management District

CO2e = carbon dioxide equivalent

[1] CalEEMod modeling was performed assuming a 2021 construction start date, however construction would not begin until 2022. Due to stricter on-road and off-road emissions controls with each passing year, the emissions presented above are a conservative estimate and would likely be lower if construction is pushed into a later start date.

Source: Appendix B, Air Quality CalEEMod Modeling Assumptions.

#### No Action Alternative

Under the No Action Alternative there would be no disturbance to the existing environment associated with pre-demolition, demolition, and waste removal and recycling. In the event of a structural failure, demolition, waste removal, and recycling activities like the Proposed Action would be required. GHG emissions would be generated from construction activities and would be comparable to the Proposed Action. Therefore, the No Action Alternative would have a less than significant contribution to the significant cumulative impact to global climate change.

### 3.2.5 Hazards, Safety, and Waste Management

This section provides a discussion of storage and handling, waste management, and health and safety hazards related to human health (construction crews and operational employees) and the environment .

This evaluation includes risks of material exposures, operational safety hazards, solid waste disposal and structural hazards.

The terms “hazardous materials” and “hazardous waste” refer to substances defined as hazardous by CERCLA and the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act (RCRA). In general, hazardous materials include substances that because of their quantity, concentration, or physical, chemical, or infectious characteristics, may pose risk to public health or the environment when released into the environment. Issues associated with hazardous material and waste typically center around waste streams, underground storage tanks, aboveground storage tanks, and the storage, transport, use, and disposal of fuels, lubricants, and other industrial substances. When such materials are improperly stored, handled, or disposed of, they can threaten the health and well-being of wildlife species, habitats, and soil and water systems, as well as humans.

### 3.2.5.1 Regulatory Setting

The management of hazardous materials and hazardous waste is governed by specific environmental statutes. The following includes the key federal and state regulations applicable to the Project.

**Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 (42 USC 9601–9675) as amended by the Superfund Amendments and Reauthorization Act of 1986.** CERCLA/Superfund Amendments and Reauthorization Act regulate the cleanup of hazardous substance releases in soil and groundwater.

**Department of Transportation Hazardous Materials Transportation Act (49 USC 5101).** The Department of Transportation, in conjunction with the USEPA, is responsible for enforcement and implementation of federal laws and regulations pertaining to safe storage and transportation of hazardous materials.

**Emergency Planning and Community Right-to-Know Act of 1986 (42 USC 11001–11050).** The Emergency Planning and Community Right-to-Know Act requires emergency planning for areas where hazardous materials are manufactured, handled, or stored and provides citizens and local governments with information regarding potential hazards to their community.

**Federal Facility Compliance Act of 1992 (Public Law 102-426).** This act provides for a waiver of sovereign immunity on the part of federal agencies with respect to state and local requirements relating to RCRA solid and hazardous waste laws and regulations. This makes federal agencies subject to the state and local requirements and enables states to impose civil fines on federal agencies.

**Occupational Safety and Health Administration (OSHA) Act of 1970.** Occupational safety standards exist in federal and state laws to minimize worker safety risks from both physical and chemical hazards in the workplace. OSHA is responsible for developing and enforcing workplace safety standards and assuring worker safety in the handling and use of hazardous materials. At the federal level, the Hazard Communication Standard requires that workers be informed of the hazards associated with the materials they handle.

**Pollution Prevention Act of 1990 (42 USC 13101–13109).** This act encourages minimization of pollutants and waste through changes in production processes.

**Resource Conservation and Recovery Act (RCRA) (42 USC 6901–6992).** RCRA, including the 1986 Federal Hazardous and Solid Waste Amendments, is the primary law governing generation, transportation, treatment, storage, and disposal of hazardous waste. RCRA also set forth a framework for the management of non-hazardous solid wastes. The 1984 Federal Hazardous and Solid Waste Amendments focused on waste minimization and phasing out land disposal of hazardous waste as well as corrective action for releases. The 1986 amendments to RCRA enabled EPA to address environmental problems that could result from underground tanks storing petroleum and other hazardous substances.

**USEPA Regulation on Identification and Listing of Hazardous Waste (40 CFR Part 261).** This regulation identifies solid wastes subject to regulation as hazardous and addresses notification requirements under RCRA.

**USEPA Regulation on Standards for the Management of Used Oil (40 CFR Part 279).** This regulation delineates requirements for storage, processing, transport, and disposal of oil that has been contaminated by physical or chemical impurities during use.

**USEPA Regulation on Designation, Reportable Quantities, and Notification (40 CFR Part 302).** This regulation identifies reportable quantities of substances listed in CERCLA and sets forth notification requirements for releases of those substances. It also identifies reportable quantities for hazardous substances designated in the CWA.

**Title 14, California Code of Regulations, Division 7.** CalRecycle regulations pertaining to nonhazardous waste management in California include minimum standards for solid waste handling and disposal; regulatory requirements for composting operations; standards for handling and disposal of asbestos containing waste; resource conservation programs; enforcement of solid waste standards and administration of solid waste facility permits; permitting of waste tire facilities and waste tire hauler registration; special waste standards; used oil recycling program; electronic waste recovery and recycling;

planning guidelines and procedures for preparing, revising, and amending countywide Integrated Waste Management Plans; and solid waste cleanup program.

**Hazardous Waste Control Law of 1972.** The Hazardous Waste Control Act created the state hazardous waste management program, which is similar to but more stringent than the federal RCRA program. The Act is implemented by regulations contained in Title 26 of the California Code of Regulations (CCR), which describes the following required aspects for the proper management of hazardous waste: identification and classification; generation and transportation; design and permitting of recycling, treatment, storage, and disposal facilities; treatment standards; operation of facilities and staff training; and closure of facilities and liability requirements. These regulations list more than 800 materials that may be hazardous and establish criteria for identifying, packaging, and disposing of such waste.

**Bay Area Air Quality Management District (BAAQMD) Regulation 11, Rule 2: Asbestos Demolition, Renovation, and Manufacturing.** BAAQMD regulates the emissions of asbestos into the atmosphere during demolition activities and also establishes appropriate water disposal procedures. The rule states that ACM must be adequately wetted prior to demolition to prevent the release of asbestos-containing particles and requires the visual inspection, sampling, and laboratory analysis prior to demolition for all suspected ACM.

**California Labor Code Section 6716 to 6717.** The Labor Code Section 6716 to 6717 provides for the establishment of standards that protect the health and safety of employees who engage in lead-related construction work, including construction, demolition, renovation, and repair.

### 3.2.5.2 Affected Environment

Hangar 3 was built in 1943 and has been unoccupied since 2017. Considering the age of the structure, there is a potential for the presence of ACM and LBP. LBP was common in buildings built before 1978. Many of the surveyed buildings at ARC have been found to contain LBP. Previous surveys of Hangar 3 have indicated presence of asbestos in the cement panels and LBP in peeling paint (Page & Turnbull 2006). Similarly, PCB have been found in many buildings constructed before 1978 when use of these chemicals in construction materials was common and could potentially be present in Hangar 3 and existing transformers serving Hangar 3. In addition, the wood in Hangar 3 may be treated with fire proofing material that could be hazardous. Asbestos containing materials (ACM) were banned due to their potential to increase the risk of lung disease and cancers. Lead and lead-based paint have been banned due to their toxicity and potential for harming developing tissues and organs. PCB are also carcinogenic and are known to accumulate in the environment. All of these materials are considered hazardous and the proper assessment for and removal of them during demolition and ground disturbance is governed by existing regulations.

ARC is home to several research development projects that potentially use hazardous materials. However, there is no current use of these materials immediately adjacent to Hangar 3. The 2002 NASA Ames Development Plan Final Programmatic Environmental Impact Statement noted that the unpaved and paved areas north of Hangar 3 were potentially used for dumping solvents, paints, and industrial wastewater by past Navy operations, before this area was paved in 1979. The 2014 sub-slab soil vapor sampling indicated presence of VOCs underneath Hangar 3. The Navy is performing ongoing remedial activities in the Project area to address groundwater contamination from past activities and a final workplan was submitted to the RWQCB in February 2020 (NAVFAC 2020a). More recent soil and groundwater sampling was conducted in April 2020 to assess whether shallow groundwater contamination might be associated with, and/or the likely potential source of, the sub-slab vapor contamination previously detected beneath Hangars 2 and 3 (NAVFAC 2020b). The results indicated exceedances in contaminants and sub-slab vapor contamination. The data generated from the annual monitoring provide evidence of generally decreasing concentration of contaminants over time, and a general decrease in the extent of groundwater plumes, which are likely attributable to ongoing natural attenuation (NAVFAC 2020a).

### 3.2.5.3 Approach to Analysis

The level of potential impacts associated with hazardous substances is based on their toxicity, reactivity, ignitability, and corrosivity. Impacts associated with hazardous materials and wastes would be considered significant if the storage, use, transportation, or disposal of hazardous substances and solid waste activities would substantially increase human health risk, environmental exposure, or physical safety or would exceed landfill capacity. The Project would not result in any operational impacts since no use has been proposed post-demolition, and contaminated materials within the Hangar 3 building would be removed and only the concrete slab would remain under the Proposed Action. Therefore, operational impacts from hazardous materials or wastes are not discussed further.

### 3.2.5.4 Environmental Consequences

The Proposed Action would address impacts from structural failure of Hangar 3 and, therefore, impacts to physical safety from collapse of Hangar 3 would not occur.

## Proposed Action – Building Demolition

Demolition of Hangar 3 could potentially expose on-site workers and other MFA users in the vicinity of the Project site to contaminants or hazardous materials. Demolition could also generate hazardous waste as discussed below.

### *Hazardous Materials and Worker Safety*

The Proposed Action would include demolition of a structure that was constructed prior to 1978, and therefore may contain hazardous materials such as LBP, asbestos, and PCB, to which on-site workers and other MFA users could be exposed during pre-demolition and demolition activities. As required by BAAQMD Regulation 11 Rule 2, visual inspection, sampling, and laboratory analysis would be conducted prior to demolition for all suspected ACM. Additionally, a visual inspection for flaking paint, soil staining, or other conditions that could result in exposure to hazardous materials such as lead and PCB would be implemented. If lead/asbestos/PCB were found to be present, USEPA, BAAQMD, and OSHA requirements would be implemented. Prior to initiating pre-demolition and demolition activities, the contractor would prepare an abatement plan for removal of asbestos, PCB, and/or LBP. The Lessee would coordinate all pre-demolition and demolition activities with NASA.

The roof of Hangar 3 would be evaluated for the presence of any fire-proofing material prior to abatement. If material deemed to be hazardous was found, as identified in USEPA Regulation on Identification and Listing of Hazardous Waste (40 CFR Part 261), encapsulation (or containment) would be considered prior to abatement by covering the material with an appropriate spray.

Scaffolding would be required for the workers during pre-demolition (Phase 1) and could result in hazards such as a slip, trip, or fall. The scaffolding would be installed per OSHA's standards that include provisions such as, but not limited to fall protection, guardrail height, training, and inspection. All scaffolding would be removed once abatement was complete in Phase 1.

Demolition in Phase 2 would occur by mechanical equipment and potential hazards during this phase could include mishandling of equipment or falling debris. All demolition would occur in compliance with OSHA standards for Safety and Health Regulations for construction. In addition, a site-specific health and safety plan would be prepared in accordance with AMM-1: EIMP and shared with all on-site workers to minimize potential safety concerns associated with both phases. The Proposed Action would be limited to removal of above-ground components, and exposure to subsurface soil contamination would not be anticipated. However, the health and safety plan would include safety measures and protocols for all construction activities related to the Proposed Action to ensure that demolition would not inadvertently expose personnel to site contaminants or release additional contaminants into the environment.

Therefore, the Proposed Action would not result in significant impacts from exposure to hazardous materials or worker safety by implementing appropriate plans and complying with applicable regulations.

### *Waste Management*

All waste materials would be characterized during both Phases 1 and 2 as noted in Section 2.2, Proposed Action – Building Demolition. Once characterized, the handling and management of waste generated during demolition would follow a hierarchical approach of source reduction, recycling, treatment, and disposal to the extent possible as part of Phase 3. Non-hazardous wastes would be segregated from hazardous wastes or from incompatible wastes before being loaded onto trucks or trailers for transport to an offsite approved disposal facility. Waste contents would be confirmed by the demolition contractor or via sampling before being transferring offsite, and wastes would be managed in compliance with applicable regulatory requirements. All hazardous materials would be staged in a Hazardous Materials Storage Area within the fenced work area shown in Figure 2-1, and clearly labeled or marked.

Non-hazardous materials that were determined to be candidates for recycling would be stored securely and transported to a licensed recycling facility. Depending on the types, sizes, volumes, hazardous contents, or ultimate destinations of materials, containment would be in drums, cubic yard boxes, roll-off bins, lined trucks or trailers, or tanks to prevent the release of materials or hazardous contents. Bins containing hazardous wastes would be kept securely closed when not in use and would be transported offsite for disposal. Transportation of all materials would occur in compliance with applicable regulations that include but are not limited to packaging, labeling, and markings. The approximate amount of demolition material to be generated is 6,000 tons (4,000 cubic yards) of debris, 650 tons (435 cubic yards) of bricks, and 30,500 tons (20,300 cubic yards) of concrete from bents and support structures. As noted in Section 2.2.3, Phase 3 – Waste Disposal and Recycling, most of this could be transported offsite to a recycling facility, including bricks, and at least 90 percent of the material would be expected to be salvaged. Therefore, it is reasonable to assume the amount of material requiring disposal would be much less than 24,375 cubic yards (the sum total of debris, brick and concrete to be generated). The demolished material would likely be transported to one or more of these facilities: Zanker Recycling or Guadalupe Landfill, Kettleman Hills Hazardous Waste Facility, and/or US Ecology Nevada, Inc. As of 2012, the Zanker Landfill has a remaining capacity of 640,000 cubic yards (CalRecylce 2019). The Kettleman Hills facility has a remaining capacity of approximately 4.9 million cubic yards (WM, Inc. 2020). The US Ecology facility had approximately 45.5 million cubic yards of remaining permitted capacity as of December 2018 (US Ecology, Inc. 2019). Therefore, all of these facilities have adequate capacity to accept demolition waste from the Proposed Action. Implementation of the Proposed Action would create short-term impacts with regard to generation of hazardous wastes during pre-demolition and demolition activities. However, no significant impacts would occur as there is adequate capacity at the landfills and storage and transportation of hazardous materials would comply with applicable regulations.

#### No Action Alternative

Under the No Action Alternative, there would be no disturbance to the existing environment associated with pre-demolition, demolition, and waste removal and recycling. In the event of a structural failure, the No Action Alternative could result in the uncontrolled release and exposure of MFA users to hazardous materials, including those containing asbestos, lead, or PCB. The No Action Alternative would not include hazardous material abatement activities described under the Proposed Action. As such, the No Action Alternative could potentially release hazardous materials into the environment causing greater risk to human health and the environment compared to the Proposed Action, resulting in a potentially significant impact. Clean up following structural collapse would be required to follow all applicable federal, state, and local regulations pertaining to the clean-up, abatement, and transport of hazardous materials.

## 3.2.6 Noise and Vibration

This section summarizes the discussion of noise and vibration generated from the Project and the potential impacts on the neighboring sensitive receptors.

Noise is generally defined as unwanted sound that annoys or disturbs people and potentially causes an adverse psychological or physiological effect on human health. Because noise is an environmental pollutant that can interfere with human activities, evaluation of noise is necessary when considering the environmental impacts of a proposed project. Further definitions and how noise is measured can be found in the noise technical memorandum in Appendix D, Noise Technical Memorandum.

### 3.2.6.1 Regulatory Setting

The Noise Control Act of 1972 (Public Law (PL) 92-574) directs federal agencies to comply with applicable federal, state, interstate, and local noise control regulations. The Project site borders the cities of Mountain View and Sunnyvale; therefore, the policies and regulations of these cities are relevant to the Project. The following includes the noise regulations applicable to the Project.

**Federal Aviation Administration (FAA), 14 CFR Part 150 “Airport Noise Compatibility Planning.”** This is the primary Federal regulation guiding and controlling planning for aviation noise compatibility on and around airports. This part prescribes the procedures, standards, and methodology governing the development, submission, and review of airport noise exposure maps and airport noise compatibility programs, including the process for evaluating and approving or disapproving those programs.

**Mountain View 2030 General Plan.** Chapter 7, Noise, of the Mountain View 2030 General Plan (City of Mountain View 2012a) offers policies for addressing exposure to current and project-related noise sources in Mountain View. Table 7.1, Outdoor Noise Environment Guidelines, in the Mountain View 2030 General Plan identifies land use compatibility noise standards for land uses affected by transportation and non-transportation noise sources (see Appendix D, Noise Technical Memorandum).

**Mountain View Municipal Code.** Chapter 8, Buildings, Article VI. Construction Noise, Section 8.70 Construction noise, of the Mountain View Municipal Code generally restricts construction activity to between 7:00 a.m. and 6:00 p.m., Monday through Friday and provides a procedure for modified construction hours at the discretion of the chief building official.

**Sunnyvale General Plan.** Chapter 6, Safety and Noise, of the Sunnyvale General Plan (adopted July 2011) offers policies for addressing exposure to current and project noise sources in Sunnyvale. Figure 6-5, State of California Noise Guidelines for Land Use Planning Summary of Land Use Compatibility for Community Noise Environment, identifies noise standards for specific land uses affected by noise.

Figure 6-6 in the Sunnyvale General Plan determines the severity of noise impacts using the day-night noise level ($L_{dn}$) category of an existing development, the exterior noise exposure category listed in Figure 6-5, and the noise increase estimated from a particular new development. For example, if an existing property currently experiences ambient noise levels that are “conditionally acceptable”, a significant impact would occur if a new project caused the ambient noise levels to increase more than 3 dB.

**Sunnyvale Municipal Code.** Paragraph 16.080.030 “Hours of Construction – Time and Noise Limitations” in the Sunnyvale Municipal Code restricts the acceptable hours of construction to generally between 7:00 a.m. and 6:00 p.m. Monday through Friday and between 8:00 a.m. and 5:00 p.m. on Saturday. Certain exceptions from the noise restrictions may be granted by the chief building official.

### 3.2.6.2 Affected Environment

*Sensitive Receptors*

Some land uses are more tolerant of noise than others. For example, schools, hospitals, churches, and residences are more sensitive to noise intrusion than commercial or industrial activities. Ambient noise levels can also affect the perceived desirability or livability of a development.

Hangar 3 is located at MFA near the cities of Mountain View and Sunnyvale, California. The nearest existing noise-sensitive receptors are the multifamily residential buildings at Wescoat Village approximately 5,330 feet to the southwest. Exterior active-use areas, such as the Bay Trail and the golf course could also be considered noise-sensitive receptors since walkers, joggers, cyclists, and golfers use these spaces for recreation. The Project's northern edge is located approximately 3,512 feet from the Bay Trail and about 550 feet from the golf course.

The nearest vibration-sensitive structure to Hangar 3 is Building 055, which is located about 57 feet from Hangar 3. Hangar 2 is approximately 180 feet from Hangar 3.

### *Ambient Noise Levels*

The existing noise environment in a project area is characterized by the area's general level of development due to the high correlation between the level of development and ambient noise levels. The area surrounding the Project site contains several major noise sources, including highways and busy roadways, such as US 101, SR 85, SR 237, Central Expressway, and West El Camino Real. Other sources of noise, including rail lines, such as freight rail and Caltrain, as well as aircraft traffic from MFA, also contribute to the background noise environment.

Noise contours in the Cities of Mountain View and Sunnyvale General Plans were referenced to consider the ambient noise levels at the neighboring properties around the Project site. Figure 7.3, Noise Contours, 2030, in the City of Mountain View 2030 General Plan indicates that the nearest noise-sensitive receptor, Wescoat Village, is located within the 60-70 A-weighted decibels (dBA) Community Noise Equivalent Level (CNEL)/$L_{dn}$ contour area because of the community's proximity to US 101.

The 2010 Noise Conditions in Sunnyvale, presented in Figure 6-4, 2010 Noise Conditions Map, in the Sunnyvale General Plan shows the noise levels experienced by the commercial properties along Enterprise Way south of 5$^{th}$ Avenue range between below 60 dBA $L_{dn}$ to greater than 75 dBA $L_{dn}$ with the loudest ambient noise levels experienced closest to the intersection of SR 237 and US 101.

Figure 5, 2022 Aircraft Noise Contours, in the November 2012 *Comprehensive Land Use Plan Santa Clara County Moffett Federal Airfield* document, was also referenced to determine previously determined noise conditions at the Project site (SCC ALUC 2012). The figure shows the western edge of the Project site falls between the 70-75 CNEL noise contour. Noise levels from the airfield decrease to the east, away from the runway. The golf course is located outside the 65 dBA CNEL noise contour.

Given the range and age of data in the existing planning documents, noise levels at Wescoat Village were projected using measured ambient noise levels from the May 16, 2019, *East Whisman Precise Plan Noise and Vibration Assessment* document prepared by Illingworth & Rodkin, Inc. The ambient noise levels from this study were used to estimate the conditions experienced at Wescoat Village referenced because of the more recent timing of the measurements and the similarity between the distance to US 101 measurements were made and distance to US 101 of Wescoat Village.

Long-term and short-term ambient noise measurement locations taken for the East Whisman Precise Plan noise monitoring survey are shown in Figure 1 in the above-cited document. While noise measurements for that Project were taken on the south side of US 101, and varying terrain, screening, and vehicle fleet mix volumes could impact overall noise levels, for the purposes of this analysis, it was considered reasonable to estimate noise north of US 101 at Wescoat Village from these measurements. To be conservative, a line source hemispherical radiation pattern for traffic[14] on US 101 was used and only losses from distance (i.e., not from other sources such as varying terrain or screening) from the roadway were considered. When doing so, it appears that measurements made south of US 101 were comparable to those at the same distance to the north of the US 101.

The noise monitoring survey for the East Whisman Precise Plan was conducted between Tuesday, November 15, and Thursday, November 17, 2016. Measurement Location ST-2 at the corner of National Avenue and Fairchild Drive was approximately 142 feet from the edge of US 101. Measurement Location ST-9 at the parking area west of 516 Clyde Avenue was about 1,481 feet from the edge of US 101. The ambient noise levels measured at these locations were 73 dBA $L_{dn}$ at ST-2 and 52 dBA $L_{dn}$ at ST-9.

Wescoat Village occupies an area that is as close as 80 feet and as far as 1,074 feet away from US 101. Accounting for distance attenuation from a line source, expected noise levels at Wescoat Village could be as high as 74 dBA $L_{dn}$ at the edge of the property closest to US 101 and about 54 dBA $L_{dn}$ at the edge of the property farthest away from US 101. This estimate presents a slightly wider range of noise levels than shown in the City of Mountain View 2030 General Plan contours. Since this estimation is based on actual noise measurements conducted later than the measurements for the General Plans, the ambient noise levels at Wescoat Village were assumed to range between 54 dBA $L_{dn}$ and 74 dBA $L_{dn}$.

### 3.2.6.3 Approach to Analysis

*Construction Traffic*

Impacts from future demolition-related traffic, both vehicular and heavy truck, were estimated using predicted traffic counts for the Project prepared by Stantec and included in Appendix D, Noise Technical Memorandum. Noise levels generated by heavy construction truck traffic along 5th Avenue was estimated using the SoundPLAN acoustic modeling software. The impact of noise generated from demolition worker and truck traffic on the surrounding neighborhood was determined using the guidelines listed in

[14] Please see the "Noise Fundamentals and Terminology" section of Appendix C, Section 106 Report. For a point source such as a stationary compressor or demolition equipment, sound attenuates based on geometry at a rate of 6 dB per doubling of distance. For a line source such as free-flowing traffic on a freeway, sound attenuates at a rate of 3 dB per doubling of distance.

the USEPA Region 10 Environmental Impact Statement Guidelines, April 1973. These guidelines have been used as an industry standard to determine the potential impact of noise increases on communities.

Traffic noise primarily depends on traffic volumes, speed (tire noise increases with speed) and the proportion of truck traffic (trucks generate engine, exhaust, and wind noise in addition to tire noise). For example, it takes 25 percent more traffic volume with the same vehicle mix to produce an increase of only 1 dBA in the ambient noise level. A doubling of traffic volume with the same vehicle mix results in a 3 dBA increase in noise levels. Increases in the proportion of truck traffic may result in the same ambient noise level increase even if the total traffic volume is less than the examples described above.

Most people would tolerate a small increase in background noise (up to about 5 dBA) without complaint, especially if the increase is gradual over a period of years (such as from gradually increasing traffic volumes). Increases greater than 5 dBA may cause complaints and interference with sleep. Increases above 10 dBA (heard as a doubling of judged loudness) are likely to cause complaints and should be considered a serious increase. See Appendix D, Noise Technical Memorandum, for a detailed description of the USEPA Region 10 Environmental Impact Statement Guidelines.

### *Demolition Noise and Vibration*

The Federal Highway Administration (FHWA) Roadway Construction Noise Model (RCNM) was used to estimate noise generated from construction and demolition activities. The RCNM is FHWA's national standard for predicting noise generated from demolition activities. The RCNM analysis includes the calculation of noise levels (maximum level of a noise source [$L_{max}$] and equivalent continuous sound pressure level [$L_{eq}$]) at incremental distances for a variety of construction and demolition equipment. Demolition noise levels were calculated for each phase of construction based on a specific equipment list for each phase.

The Cities of Mountain View and Sunnyvale do not have explicit noise limits for construction/demolition work to determine impacts. Therefore, noise limits from the 2018 Federal Transit Administration (FTA) Transit Noise and Vibration Impact Assessment Manual were used to determine impacts from demolition activity. The noise limits are presented in Table 3-9. Since demolition activities would occur during daytime hours only and the closest noise sensitive receptors are residential or recreational uses, the Residential Daytime $L_{eq}$ (8 hour) level from Table 3-9 was used as a threshold. Noise impacts associated with the Project would be considered significant if levels exceed 80 dBA $L_{eq}$ at the closest sensitive receptors.

**Table 3-9 Construction Noise Criteria**

| Land Use | $L_{eq}$ Equipment (8 hour), dBA | | $L_{eq}$ Equipment (30 day), dBA 30-day average |
|---|---|---|---|
| | Day | Night | |
| Residential | 80 | 70 | 75 |
| Commercial | 85 | 85 | 80[1] |
| Industrial | 90 | 90 | 85[1] |

Note:
[1] Use a 24-hour $L_{eq}$ (24hr) instead of $L_{dn}$ equipment (30-day)
Source: FTA 2018

Vibration from demolition equipment is analyzed at the surrounding buildings and compared to the applicable California Department of Transportation (Caltrans) building damage criteria to determine whether demolition activities would generate vibration at levels that could result in building damage. Vibration impacts would be significant if any vibrations from continuous/frequent sources would exceed 0.25 in/sec peak particle velocity (PPV) for “historic and some old” buildings. The “historic and some old buildings” category was considered the most appropriate category considering the structure and condition of Building 055. Please refer to Table 4 in Appendix D, Noise Technical Memorandum, for the guideline vibration damage potential criteria for other building conditions.

The Proposed Action would not result in any operational noise as no use is proposed post-demolition. Therefore, operational noise is not discussed further.

### 3.2.6.4 Environmental Consequences

#### Proposed Action – Building Demolition

##### *Short-Term Noise Impacts*

*Construction Traffic*

Demolition worker traffic would incrementally increase noise levels on access roads leading to the Project site on a temporary and intermittent basis. Medium and heavy truck traffic would travel along Macon Road between the Project site and the 5th Avenue Gate, which is closer to the Project site than the Ellis Street Gate and is designed to accommodate larger vehicles. Demolition workers would travel along Macon Road between the Project site and the Ellis Street Gate. By utilizing these routes, neither the construction worker vehicles nor the construction trucks would be traveling by any noise sensitive receptors or through any noise sensitive neighborhoods on the way to the project site.

As noted in the Air Quality analysis, the pre-demolition phase of this project would involve the highest number of workers on-site per day with a maximum of 50 construction workers per day traveling to and from the site. As stated above, on-site workers would travel along Macon Road between the Project site and the Ellis Street Gate. Assuming a worst-case of all workers driving individual vehicles and entering or exiting the site at the same time, this would add 50 vehicles to the peak hour traffic volumes approaching the Ellis Street Gate. According to the traffic analysis memorandum provided by Stantec (Appendix E, Traffic Analysis Memorandum), the 2022 peak hour background traffic volumes at the intersection of Ellis Street and Manilla Avenue are 1,427 vehicles in the AM and 1,147 vehicles in the PM. Adding 50 construction worker vehicles to the background traffic along Macon Road and Ellis Street represents a maximum 4.4% percent increase in traffic volumes, which equates to a 0.17 dBA increase in noise. This small change in ambient noise due to construction worker traffic would result in a less than significant impact.

As stated above, medium and heavy truck traffic would travel along Macon Road between the Project site and the 5th Avenue Gate, which is designed to accommodate larger vehicles. According to the traffic analysis memorandum provided by Stantec (Appendix E, Traffic Analysis Memorandum), the 2022 AM peak hour traffic traveling on 5$^{th}$ Avenue near N Mathilda Avenue is 46 vehicles in the westbound direction and 323 vehicles in the eastbound direction. Figure C, “Proposed Action Phase 2 AM Peak Hour Trips – Truck Trips” in Appendix E, Traffic Analysis Memorandum, shows the project would add 12 heavy trucks in the westbound direction and 13 heavy trucks in the eastbound direction to the background vehicular traffic on 5$^{th}$ Avenue.

To determine the impact of the construction trucks on overall traffic noise levels, the SoundPLAN acoustic modeling software was used as an analysis tool. The SoundPLAN software models both Ldn and Leq traffic noise levels based on a peak hour traffic volume and considers vehicle type (vehicle, heavy truck, medium truck, bus, motorcycle), vehicle speed, and traffic control devices, such as stop signs and traffic lights. Using the 2022 AM peak hour traffic volumes and expected peak hour heavy truck volumes on 5$^{th}$ Avenue listed above, traffic-related noise levels from construction truck traffic on 5$^{th}$ Avenue were modeled to increase 2.3 dB(A). This change in ambient noise due to construction truck traffic is below 3 dB(A) and therefore, would result in a less than significant impact.

*Demolition Activity*

In addition to noise from construction traffic, noise would result from the demolition of Hangar 3.

The demolition of Hangar 3 would be conducted in three phases, each with its own mix of equipment and resulting noise characteristics and potential effects:

- Phase 1 – Pre-Demolition Activities
- Phase 2 – Demolition
- Phase 3 – Waste Disposal and Recycling

Phase 3 would occur concurrently with both Phase 1 and Phase 2. The main types of noise-producing equipment for each demolition phase are shown in Table 3-10.

**Table 3-10 Proposed Action Phases Equipment**

| Phase | Demolition Equipment | |
|---|---|---|
| Phases 1 and 3 - Pre-Demolition Activities and Waste Disposal and Recycling | • Boom Lifts (2)<br>• Reach Forks (2)<br>• Bobcats (2)<br>• Manlift (1) | • Generators (2)<br>• Demolition Excavators (2)<br>• Swing Stages (2)<br>• Haul Trucks (2)* |
| Phases 2 and 3 - Demolition and Waste Disposal and Recycling | • Demolition Excavators (7)<br>• Crane (1)<br>• Manlifts (2) | • Skid Steers (2)<br>• Water Truck (1)<br>• Haul Trucks (12)* |

Note:
* The number of haul trucks per phase represents the worst-case peak hour volume as taken from the traffic analysis memorandum (Appendix E, Traffic Analysis Memorandum).

Table 3-11 lists types of Project-related equipment and the maximum and average equipment operational noise level presented in the RCNM at various distances from the operating equipment. The 5,330-foot distance represents the approximate distance between the Project and the closest residential receptors at Wescoat Village; the 3,512-foot distance is the closest distance between the edge of the Project area and the Bay Trail, and the 550-foot distance represents the closest distance between the Project and the golf course. The usage factor in Table 3-11 is as defined by the RCNM program.

**Table 3-11 Calculated Noise Level from Each Piece of Demolition Equipment**

| Demolition Equipment Source | Distance to Nearest Noise-Sensitive Receptor | Sound Level at Noise Sensitive Receptors | | |
|---|---|---|---|---|
| | | Usage Factor | $L_{max}$, dBA | $L_{eq}$, dBA |
| Man Lift (Boom Lift) | 5,330 feet | 20% | 34.1 | 27.2 |
| | 3,512 feet | | 37.8 | 30.8 |

| Demolition Equipment Source | Distance to Nearest Noise-Sensitive Receptor | Sound Level at Noise Sensitive Receptors | | |
|---|---|---|---|---|
| | | Usage Factor | $L_{max}$, dBA | $L_{eq}$, dBA |
| | 550 feet | | 53.9 | 46.9 |
| Reach Fork[1] | 5,330 feet | 40% | 38.6 | 34.6 |
| | 3,512 feet | | 42.2 | 38.2 |
| | 550 feet | | 58.3 | 54.3 |
| Bobcat[2] | 5,330 feet | 40% | 43.4 | 39.5 |
| | 3,512 feet | | 47.1 | 43.1 |
| | 550 feet | | 63.2 | 59.2 |
| Generator | 5,330 feet | 50% | 40.1 | 37.1 |
| | 3,512 feet | | 43.7 | 40.7 |
| | 550 feet | | 59.8 | 56.8 |
| Excavator | 5,330 feet | 40% | 40.2 | 36.2 |
| | 3,512 feet | | 43.8 | 39.8 |
| | 550 feet | | 59.9 | 55.9 |
| Swing Stage[3] | 5,330 feet | 20% | 34.1 | 27.2 |
| | 3,512 feet | | 37.8 | 30.8 |
| | 550 feet | | 53.9 | 46.9 |
| Crane | 5,330 feet | 16% | 40.0 | 32.0 |
| | 3,512 feet | | 43.6 | 35.7 |
| | 550 feet | | 59.7 | 51.8 |
| Skid Steer[4] | 5,330 feet | 40% | 38.6 | 34.6 |
| | 3,512 feet | | 42.2 | 38.2 |
| | 550 feet | | 58.3 | 54.3 |
| Water Truck[5] | 5,330 feet | 40% | 33.7 | 29.7 |

| Demolition Equipment Source | Distance to Nearest Noise-Sensitive Receptor | Sound Level at Noise Sensitive Receptors | | |
|---|---|---|---|---|
| | | Usage Factor | $L_{max}$, dBA | $L_{eq}$, dBA |
| | 3,512 feet | | 37.3 | 33.3 |
| | 550 feet | | 53.4 | 49.4 |
| Haul Truck[6] | 5,330 feet | 40% | 35.9 | 31.9 |
| | 3,512 feet | | 39.5 | 35.5 |
| | 550 feet | | 55.6 | 51.6 |

Notes:

1. The RCNM program does not have sound levels for a reach fork. Therefore, the noise levels from a front-end loader were used in the analysis to simulate the reach fork.
2. The RCNM program does not have sound levels for a small Bobcat. Therefore, the noise levels from a tractor were used in the analysis to simulate the small Bobcat.
3. The RCNM program does not have sound levels for a swing stage. Therefore, the noise levels from a man lift were used in the analysis to simulate the swing stage.
4. The RCNM program does not have sound levels for a skid steer. Therefore, the noise levels from a front-end loader were used in the analysis to simulate the skid steer.
5. The RCNM program does not have sound levels for a water truck. Therefore, the noise levels from a flatbed truck were used in the analysis to simulate the water truck.
6. The RCNM program does not have sound levels for a haul truck. Therefore, the noise levels from a dump truck were used in the analysis to simulate the haul truck.

Source: Appendix D, Noise Technical Memorandum, FHWA 2008

A worst-case condition for demolition activity is presented assuming that all noise-generating equipment would be operating at the same time and at the nearest distance from the closest noise-sensitive receptor. Based on this assumption, Table 3-12 shows the $L_{eq}$ and $L_{max}$ noise levels from each phase of demolition were estimated using the RCNM program.

**Table 3-12 Calculated Noise Level from Each Demolition Stage**

| Demolition Phase | Distance to Closest Noise-Sensitive Receptor | Calculated $L_{eq}$, dBA | Calculated $L_{max}$, dBA |
|---|---|---|---|
| Phases 1 and 3: Pre-Demolition Activities and Waste Disposal and Recycling | 5,330 feet (WV) | 46.8 | 50.8 |
| | 3,512 feet (BT) | 50.4 | 54.5 |
| | 550 feet (GC) | 66.5 | 70.6 |
| Phases 2 and 3: Demolition and Waste Disposal and Recycling | 5,330 feet (WV) | 47.6 | 51.8 |
| | 3,512 feet (BT) | 51.2 | 55.4 |
| | 550 feet (GC) | 67.3 | 71.5 |

Notes:
WV = Wescoat Village, BT = Bay Trail, GC = Golf Course

As shown in the table, demolition noise levels at all closest noise-sensitive receptors would be well below the Residential Daytime level of 80 dBA $L_{eq}$ (8 hour) impact threshold as defined in Table 3-12. Therefore, the impact of demolition activity noise to the sensitive receptors would not be significant.

### *Short-Term Vibration Impacts*

Table 7-4 “Vibration Source Levels for Construction Equipment” in the FTA Transit Noise and Vibration Impact Assessment Manual identifies average vibration source levels, in PPV at 25 feet, for the construction and demolition equipment that generates the greatest levels of vibration. Comparing the equipment list in FTA Table 7-4 to the Project’s equipment list in Table 3-10, the equipment most likely to generate perceptible vibrational energy for the Proposed Action would be large and small bulldozers and loaded trucks.

During demolition, equipment such as small bulldozers (Bobcats) and loaded trucks could be used as close as 57 feet from the nearest vibration-sensitive receptor (Building 055). The 57-foot distance represents the separation between the edge of the Hangar 3 Project fence line to Building 055.

The assessment method in the FTA Transit Noise and Vibration Impact Assessment Manual assesses potential annoyance and damage effects from construction (demolition) vibration for each piece of equipment individually. Multiple pieces of equipment operating simultaneously could increase vibration levels but predicting any increase would be difficult. Following the FTA methodology, the vibration levels from the demolition equipment would range from 0.0009 to 0.0259 PPV (in inches/second) at 57 feet, as shown in Table 3-13. This vibration level would not be expected to cause damage to the existing nearby buildings onsite.

**Table 3-13 Vibration Source Levels for Construction/Demolition Equipment**

| Type of Equipment | Peak Particle Velocity (PPV) at 57 Feet (inches/second) | Threshold at which Building Damage Could Occur (PPV) (inches/second) | Exceed Threshold? |
|---|---|---|---|
| Large Bulldozer | 0.0259 | 0.25 | No |
| Loaded Trucks | 0.0221 | 0.25 | No |
| Small Bulldozer | 0.0009 | 0.25 | No |

Source: Calculation Result FTA 2018, Building Damage Threshold, California Department of Transportation 2004

In addition to the equipment, the activity of demolition, such as felling and dropping pieces of structure, could also cause perceptible vibrational energy. For the Proposed Action, materials would either be tethered and mechanically lowered to the ground or mechanically cut and dropped to the floor if this could be accomplished without damaging the Hangar 3 slab. If materials are dropped to the floor, considerations need to be made including limiting fall distances and the weight of the material being dropped to minimize impacts to the slab. The trusses would be supported by the existing hydraulic jack system that would remain in place until trusses were removed, thus limiting the opportunity for the structure to fall to the slab. Reducing stress on the slab lowers the vibrational energy that enters the slab and reduces the vibration impact that could propagate through the ground to Hangar 2 and Building 055.

Therefore, demolition activities would cause minor short-term localized impacts from vibration to the surrounding buildings but would not result in a significant impact. In addition, the Proposed Action would implement the protection measures noted in AMM-2: Noise and Vibration to further reduce temporary construction noise and vibration impacts on adjacent sensitive receptors.

### No Action Alternative

Under the No Action Alternative, there would be no disturbance to the existing environment associated with pre-demolition, demolition, and waste removal and recycling. In an event of a structural failure, there may be instantaneous loud noise from the structural collapse that may be higher than the acceptable noise levels defined in the General Plans for the City of Mountain View and the City of Sunnyvale. In addition, depending on the level of emergency response required, there could be nighttime and weekend activity noise generated that is not contemplated under the Project. However, these noise impacts would not be considered significant since they would be temporary and short-term. Noise levels from worker and truck trips would be expected to be similar to the Proposed Action and thus would not be significant.

However, sudden collapse could have an adverse impact on surrounding structures; if vibration levels were to exceed 0.25 in/sec PPV then damage to nearby structures could result.

### 3.2.7 Transportation and Circulation

This analysis focuses on Project activities and potential transportation impacts on the surrounding street system, pedestrian access, and parking. Traffic conditions such as trip generation and trip distribution are summarized from the traffic analysis memorandum included as Appendix E, Traffic Analysis Memorandum.

#### 3.2.7.1 Regulatory Setting

The Project site is located on federal property, but demolition traffic would use roadways under local and state jurisdiction. The federal government does not employ its own specific standards for intersection operation or other modes that would be used to identify significant environmental impacts. To determine the environmental impacts of its actions, NASA uses the criteria of the local, county, and state jurisdictions. Therefore, the following describes the applicable regulations from those jurisdictions.

**Mountain View General Plan.** The Mobility Element of the Mountain View General Plan includes goals and policies to address circulation, safety, multi-modal transportation, walkability, and accessibility. Until adoption of the mobility plans described in Action MOB 1.1.1 of the General Plan Environmental Impact Report, the Citywide vehicle level of service (LOS) standards from the 1992 General Plan would be used, which include a target peak-hour LOS policy of LOS D for all intersections and roadway segments (City of Mountain View 2012b).

**Sunnyvale General Plan.** The Land Use and Transportation Element of the City of Sunnyvale General Plan includes a series of land use and transportation goals, policies, and actions to provide a framework for how various land uses, developments, and transportation facilities would function together. The City of Sunnyvale uses a LOS D standard for local street intersections and LOS E standard for “regionally significant roadways” (a designation that includes Congestion Management Program facilities) (City of Sunnyvale 2016).

**Caltrans.** Caltrans has authority over the state highway system, including freeways, interchanges, and arterial state routes. Caltrans approves the planning, design, and construction of improvements for all state-controlled facilities, including US 101 and SR 237 located near MFA. Caltrans strives to maintain a LOS of C on all its facilities, but LOS D is acceptable on facilities in urban areas.

### 3.2.7.2 Affected Environment

There are two major highways that provide access to MFA and are described below:

**US 101** is located to the south of the airfield and is a major north-south route through the entire length of California. US 101 is an eight-lane freeway that provides regional access to the Project area and has three mixed-flow lanes and one high occupancy vehicle lane in each direction.

**SR 237** runs east-west and intersects with US 101 near the southeast corner of MFA. SR 237 forms the southern border of the Moffett Park area. SR 237 is a four- to six-lane freeway that provides access between SR 82 (El Camino Real) to the west and Interstate 880 to the east.

The main access to the Hangar 3 site for on-site workers would be from the Ellis Street Gate and for construction trucks would be from the 5th Avenue Gate located southeast of Hangar 3.

Ellis Street is a four-lane arterial running between the Ellis Street Gate at ARC and Middlefield Road in Mountain View. Between Middlefield Road and the interchange with US 101, Ellis Street includes marked bicycle lanes in each direction.

5th Avenue is a two-lane roadway linking Macon Road within MFA to Bordeaux Drive east of Mathilda Avenue in Sunnyvale. A security gate is located at the west end of the street at the edge of NASA property. This street also crosses the Valley Transportation Authority (VTA) light rail line at Mathilda Avenue.

**Transit and Active Transportation**

Public transportation is available within the study area. Valley Transportation Authority (VTA) provides light rail service (Orange Line) in the area with three nearby stations:

- Bayshore/NASA (Manila Drive at Ellis Street, northeast corner)
- Moffett Park (Moffett Park Drive between Enterprise Way and Innovation Way, north side)
- Lockheed Martin (North Mathilda Avenue at 5th Avenue, southwest corner)

VTA provides local bus routes, rapid bus lines, and shuttle services in the general area. Bus Route 51 serves ARC directly, entering via the Moffett Boulevard Gate and stopping along North Akron Road and South Akron Road at Shenandoah Plaza. Rapid Bus Route 523 and Local Bus Route 56 serve the Lockheed Martin Transit Center at Mathilda Avenue and 5th Avenue. VTA also operates a shuttle service (ACE Red line) to connect passengers with Altamont Corridor Express (ACE) commuter rail trains at Great America Station; these shuttles terminate at the Lockheed Martin Transit Center. The City of Mountain View also provides MVgo shuttle services in the general area; however, none of the shuttle routes serve MFA directly.

Bike lanes are striped on 5th Avenue and on Enterprise Way. Within MFA, sharrows are striped on Macon Road in the vicinity of the golf course; approaching the 5th Avenue Gate and continuing south towards Ellis Street Gate, a shared multi-use path is provided along the east side of Macon Road.

Sidewalks are provided on most surrounding streets but may only be present on one side of the street (e.g., west side of Ellis Street, north side of Manila Avenue, east side of Enterprise Way, and south side of 5th Avenue). Within MFA, the quality of pedestrian facilities varies, and sidewalks may not be provided in all locations. However, traffic volumes are generally low on internal streets. Along Macon Road, pedestrian access is accommodated through paved shoulder areas, transitioning to a shared multi-use path closer to the 5th Avenue Gate.

### 3.2.7.3 Approach to Analysis

Potential impacts to transportation are assessed with respect to the potential for disruption or improvement of circulation patterns and traffic operations (as described by LOS). The Project would result in a significant transportation impact if it resulted in a substantial increase in traffic generation or a substantial increase in the use of connecting street systems. Transportation effects may arise from changes in traffic circulation or operations, such as through changes in traffic volumes or physical changes to roadways or traffic control devices.

There is no use proposed at the Project site post-demolition; therefore, no new traffic would occur, and no long-term parking would be required. Thus, no analysis of operational impacts is provided for traffic, transit, bicycle, and pedestrian access; emergency access; or parking. An analysis of construction traffic is provided below.

#### Existing Offsite Conditions

Due to current conditions in California associated with closures and modified work conditions from the COVID-19 pandemic, new traffic counts taken at this time would not be representative of typical conditions. Therefore, intersection turning movement volumes collected in 2018 and 2019 during the typical weekday morning and evening commute periods (7:00 – 9:00 AM, 4:00 – 6:00 PM) were obtained from several sources noted below. Traffic volumes during the peak one hour within the morning and evening count periods were used for the analysis and are referred to as the AM peak hour and PM peak hour.

Figure 3-3 shows the study intersections. NASA provided turning movement counts collected in May 2018 at the following study intersections:

- Ellis Street and Manila Drive
- Ellis Street and US 101 northbound
- Ellis Street and US 101 southbound
- Enterprise Way and Manila Drive/Moffett Park Drive
- Mathilda Avenue and Moffett Park Drive
- Mathilda Avenue and SR 237 westbound
- Mathilda Avenue and SR 237 eastbound

PV provided turning movement counts collected in November 2018 at the following study intersections:

- Enterprise Way and 11th Avenue
- US 101 Northbound and Moffett Park Drive
- Innovation Way and Moffett Park Drive

Counts at the following study intersections were collected in January 2019 by Quality Counts:

- Enterprise Way and 5th Avenue
- Innovation Way and 11th Avenue
- Mathilda Avenue and 5th Avenue

Peak hour factors for each intersection were determined from the intersection count data for use in the intersection delay analysis. Subsequent to the counts being collected in 2018 and 2019, the 5th Avenue Gate was re-opened to commuter bus traffic after being temporarily closed. A conservative assumption of approximately 30 percent of the existing commuter bus traffic using the Ellis Street Gate was rerouted to the 5th Avenue Gate for the purpose of this analysis. These bus trips were added to the counts to approximate existing conditions. Table 3-15 provides the condition of each intersection under existing conditions. All intersections operate at or better than LOS C under the AM and PM peak hour except for the Mathilda Avenue and Moffett Park Drive intersection. Under the AM peak hour this intersection operates at LOS D.

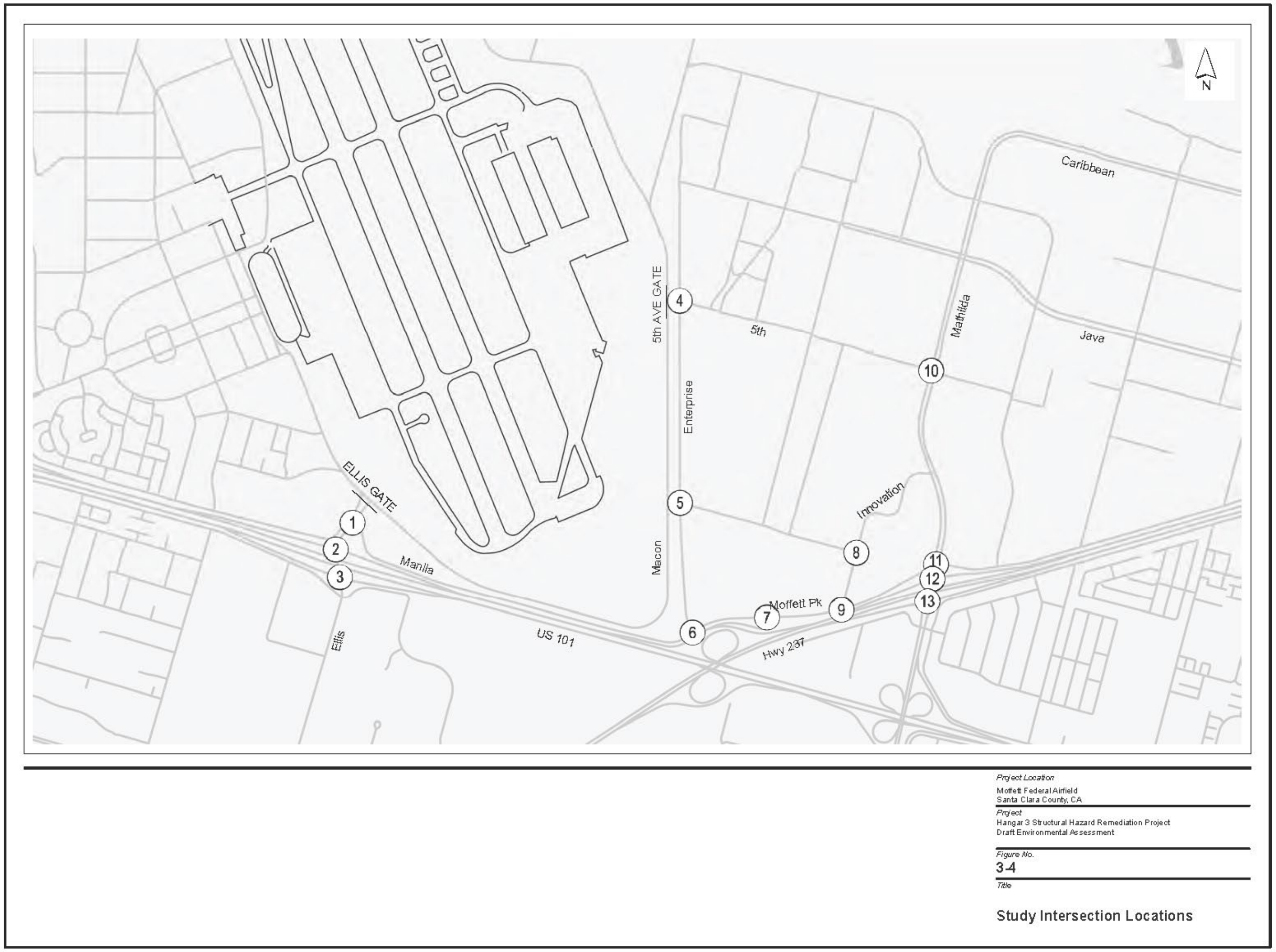



**Figure 3-3 Study Intersection Locations**

### Existing On-Site Conditions

Truck traffic is expected to travel along Macon Road between the Project site and the 5th Avenue Gate. On-site workers would travel along Macon Road between the site and the Ellis Street Gate. Macon Road carries approximately 170 vehicles during the AM peak hour, 250 vehicles during the PM peak hour, and 4,130 vehicles daily based on December 2018 counts. Based on these traffic levels, Macon Road currently operates at LOS A.

### Intersection Analysis Assumptions

The study intersections are located in the cities of Mountain View and Sunnyvale. Traffix software was used to analyze performance of the study intersections. Consistent with the cities of Mountain View and Sunnyvale, LOS D was defined as the threshold for adverse effects.

Existing traffic controls at the study intersections were assumed to remain unchanged under the future analysis conditions, with the exception of the improvements that are currently under construction as part of the SR 237/Mathilda Avenue Interchange improvement project by the VTA.

The criteria for evaluation of the study intersections and on-site roadways are as follows:

1. A significant impact occurs when the background LOS is degraded from LOS D or better to LOS E or F, or
2. If background LOS is E or F, a significant impact occurs when the Project increases delay by 4.0 seconds or more AND increases the volume-to-capacity (v/c) ratio by 0.01 or more, or
3. If background LOS is E or F, a significant impact occurs when the Project decreases delay and increases the v/c ratio by 0.01 or more.

## 3.2.7.4 Environmental Consequences

### Proposed Action – Building Demolition

Hangar 3 would be demolished in phases and the construction traffic for each phase is discussed below.

#### *Phase 1*

Phase 1 is anticipated to take 80 to 90 working days, and the typical workday hours are expected to be from 7:00 AM to 3:30 PM. Once the heavy equipment used in the abatement work is delivered to the Project site, this equipment would be expected to remain on-site for the duration of Phase 1 work. Off-haul truck trips are estimated to average two per workday for a total of four daily truck trips (two inbound, two outbound) during Phase 1.

The off-haul truck trips are assumed to be spread out at an average rate as they are loaded throughout the workday. It is estimated that one truck would enter, and one truck would exit the site during the 1-hour AM peak hour, and one truck would enter (under a worst-case condition) and one truck would exit the site during the 1-hour PM peak hour, after construction activities conclude for the workday. As noted in Section 2.0, Description of Proposed Action and Alternatives, typical construction hours are expected to be until 3:30 PM. However, standard peak hours are used for a conservative analysis.

Trucks take more space and have slower acceleration than passenger cars; therefore, a passenger car equivalent (PCE) factor is applied to the Proposed Action truck trips. The exact types of off-haul trucks are not known at this time. An average PCE of 2.0 is applied to the truck trips for the purpose of roadway capacity analysis.

During the Phase 1 pre-demolition work, 50 workers are estimated to be on-site each day. Nearly all on-site workers would arrive at and leave the Project site before the typical roadway AM and PM peak hours, respectively. A conservative estimate of 10 percent of workers arriving during the AM peak hour and 10 percent leaving during the PM peak hour was assumed. Also, when conservatively assuming each worker arrives in a separate personal vehicle, workers would generate 100 trips daily, of which 5 trips would occur during the AM peak hour and 5 trips would occur during the PM peak hour.

*Phase 2*

Demolition is estimated to take 125 working days. A total of approximately 2,000 trucks removing materials or equipment (2,000 trips in, 2,000 trips out) are estimated for the duration of the demolition work, with a maximum estimate of 100 trucks per workday (100 trips in, 100 trips out).

Off-haul truck trips would be expected to occur at an average rate of 12–13 trucks per hour, as they are loaded throughout the 8-hour workday. The maximum expected daily number of trucks (100 trucks per workday) is assumed for this analysis as a worst-case assumption; therefore, during the 1-hour AM peak hour it is estimated that 13 trucks would enter and 12 trucks would exit the site, and during the 1-hour PM peak hour it is estimated that 12 trucks would enter, and 13 trucks would exit the site. The remaining trucks would enter and exit the site during the off-peak hours. A PCE of 2.0 is applied to the truck trips for the purpose of roadway capacity analysis.

During Phase 2 demolition, 20 workers are estimated to be on-site each workday. Trips generated by these workers are estimated assuming 10 percent arrive during the AM peak hour and 10 percent depart during the PM peak hour as discussed above for Phase 1. Phase 2 workers would generate 40 trips daily, of which 2 trips would occur during the AM peak hour and 2 trips would occur during the PM peak hour.

### *Phase 3*

Phase 3 consists of waste disposal and recycling, which would be conducted concurrent with Phases 1 and 2. Therefore, trip estimates for Phase 3 are included in the Phase 1 and 2 trip estimates described above.

### *Trip Generation*

Table 3-14 summarizes the total trip generation for Phase 1 and Phase 2 of the Proposed Action. As shown in the table, Phase 2 generates more PCE trips than Phase 1; therefore, the Phase 2 trip estimates were used for the intersection analysis to provide the most conservative analysis conditions. The Proposed Action would generate 440 daily PCE trips, of which 52 PCE trips would be generated during the AM peak hour and 52 PCE trips would be generated during the PM peak hour.

**Table 3-14 Trip Generation Summary (Trips/Day) for the Proposed Action**

| Phase | Amount | AM Peak Hour | | | PM Peak Hour | | | ADT |
|---|---|---|---|---|---|---|---|---|
| | | In | Out | Total | In | Out | Total | |
| **Proposed Action** | | | | | | | | |
| **Phase 1 – Pre-Demolition** | | | | | | | | |
| Trucks | 2 Trucks | 1 | 1 | 2 | 1 | 1 | 2 | 4 |
| *Truck PCE (2.0)* | | *2* | *2* | *4* | *2* | *2* | *4* | *8* |
| Workers | 50 Empl | 5 | 0 | 5 | 0 | 5 | 5 | 100 |
| Total Phase 1 PCE Trips | | 7 | 2 | 9 | 2 | 7 | 9 | 108 |
| **Phase 2 – Demolition** | | | | | | | | |
| Trucks | 100 Trucks | 13 | 12 | 25 | 12 | 13 | 25 | 200 |
| *Truck PCE (2.0)* | | *26* | *24* | *50* | *24* | *26* | *50* | *400* |

| Phase | Amount | AM Peak Hour | | | PM Peak Hour | | | ADT |
|---|---|---|---|---|---|---|---|---|
| | | In | Out | Total | In | Out | Total | |
| Workers | 20 Empl | 2 | 0 | 2 | 0 | 2 | 2 | 40 |
| Total Phase 2 PCE Trips | | 28 | 24 | 52 | 24 | 28 | 52 | 440 |

Note:
ADT = Average daily trips
Empl = Employees
PCE = passenger car equivalent

### *Off-site Intersection Analysis*

Based on the proposed schedule, the peak trip generation would take place during Phase 2 of the Proposed Action, which is assumed to occur in 2022; therefore, the background scenario against which the Proposed Action traffic is analyzed is 2022. Baseline volumes were determined by applying a two percent per year growth factor to the traffic counts to produce a conservatively high future traffic forecast. A two percent per year ambient growth factor is consistent with the City of Sunnyvale annual regional growth factors for arterials and collectors. Furthermore, the existing commuter bus traffic that was assumed to be diverted to the 5th Avenue Gate (30 percent of commuter bus traffic) under existing conditions was included to produce 2022 baseline volumes.

Construction of other projects within the MFA property would overlap with the Proposed Action and thus traffic volumes associated with those projects were added to the 2022 baseline volumes to produce a conservative worst-case analysis. Trips related to the Hangar 1 Rehabilitation and Recladding project were estimated to be 37 trips during the AM peak hour and 37 trips during the PM peak hour in 2022. The amount of Eastside Airfield Improvement Project (EAIP) construction traffic occurring in 2022 was estimated to be 12 trips during the AM peak hour and 12 trips during the PM peak hour. These trips were distributed to the study intersections and added to the 2022 background volumes against which the Proposed Action was evaluated.

The 5th Avenue Gate would continue to be open to PV commuter bus traffic but would not be anticipated to be used by personal vehicles. During the Project, truck traffic would be anticipated to use the 5th Avenue Gate to access SR 237 via 5th Avenue and Mathilda Avenue. On-site workers would access Hangar 3 via the Ellis Street Gate. Peak-hour truck PCE trips and worker trips were assigned to the study intersections and added to the background volumes (as part of 2022 Plus Proposed Action in Table 3-15).

Table 3-15 summarizes 2022 background peak hour delay and LOS at the study intersections. As shown in the table, the surrounding study intersections would operate at LOS D or better during the AM and PM peak hours under 2022 background conditions that include Hangar 1 and EAIP construction traffic. Addition of the peak-hour construction traffic from Phase 2 of the Proposed Action would have negligible impact on the study intersections, which would continue to operate at LOS D or better. Since the LOS at the study intersections would not be degraded to an unacceptable level, the Proposed Action would not result in a significant impact due to construction traffic. In addition, the effects of the Proposed Action on the transportation system would be temporary since the Proposed Action would not generate new operational trips once demolition was complete. No off-site improvements at study intersections would be needed under the Proposed Action.

**Table 3-15 Delay and LOS Summary for the Proposed Action**

| Intersection | Control Type | Existing | | | | 2022 Background | | | | 2022 Plus Proposed Action | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | AM Peak Hour | | PM Peak Hour | | AM Peak Hour | | PM Peak Hour | | AM Peak Hour | | PM Peak Hour | |
| | | LOS | Delay (sec) | LOS | Delay (sec) | LOS | Delay (sec) | LOS | Delay (sec) | LOS | Delay (sec) | LOS | Delay (sec) |
| 1. Ellis & Manila | Stop Sign | B | 10.3 | C | 18.6 | B | 11.1 | D | 25.3 | C | 11.1 | D | 25.3 |
| 2. Ellis & US 101 NB | Signal | C | 24.9 | C | 24.1 | C | 24.8 | C | 23.9 | C | 24.8 | C | 23.9 |
| 3. Ellis & US 101 SB | Signal | C | 34.2 | C | 31.7 | D | 35.7 | C | 25.8 | D | 35.7 | C | 25.8 |
| 4. Enterprise & 5th | Stop Sign | A | 8.6 | A | 8.7 | A | 8.7 | A | 8.8 | A | 9.1 | A | 9.3 |
| 5. Enterprise & 11th | Signal | B | 11.4 | B | 11.7 | B | 11.6 | B | 11.8 | B | 11.6 | B | 11.8 |
| 6. Enterprise & Manila | Signal | C | 29.4 | B | 13.3 | C | 33.3 | B | 14.0 | C | 33.3 | B | 14.0 |
| 7. US 101 NB & Moffett Park | Stop Sign | A | 5.3 | B | 13.7 | A | 5.4 | B | 15.3 | A | 5.4 | B | 15.3 |
| 8. Innovation & 11th | Stop Sign | B | 13.2 | C | 20.3 | B | 14.4 | D | 25.1 | B | 14.4 | D | 25.1 |
| 9. Innovation & Moffett Park | Signal | B | 11.3 | B | 15.4 | B | 11.7 | B | 15.7 | B | 11.7 | B | 15.7 |
| 10. Mathilda & 5th | Signal | B | 16.1 | B | 19.1 | B | 16.3 | B | 19.3 | B | 16.4 | B | 19.6 |
| 11. Mathilda & Moffett Park | Signal | D | 42.6 | C | 28.0 | C | 32.7 | D | 43.4 | C | 32.9 | D | 43.9 |

| Intersection | Control Type | Existing | | | | 2022 Background | | | | 2022 Plus Proposed Action | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | AM Peak Hour | | PM Peak Hour | | AM Peak Hour | | PM Peak Hour | | AM Peak Hour | | PM Peak Hour | |
| | | LOS | Delay (sec) | LOS | Delay (sec) | LOS | Delay (sec) | LOS | Delay (sec) | LOS | Delay (sec) | LOS | Delay (sec) |
| 12. Mathilda & SR 237 WB | Signal | B | 11.4 | B | 13.6 | A | 0.3 | A | 0.4 | A | 0.3 | A | 0.4 |
| 13. Mathilda & SR 237 EB | Signal | B | 14.5 | B | 11.1 | B | 17.7 | B | 11.8 | B | 17.7 | B | 12.0 |

Note:
NB = Northbound
SB = Southbound
EB = Eastbound
WB = Westbound

LOS ranges:

| | Signal Control | Stop Sign Control |
|---|---|---|
| A | 0.0 – 10.0 sec | 0.0 – 10.0 sec |
| B | 10.1 – 20.0 sec | 10.1 – 15.0 sec |
| C | 20.1 – 35.0 sec | 15.1 – 25.0 sec |
| D | 35.1 – 55.0 sec | 25.1 – 35.0 sec |
| E | 55.1 – 80.0 sec | 35.1 – 50.0 sec |
| F | Delay > 80.0 sec | Delay > 50.0 sec |

### *On-site Traffic Analysis*

On Macon Road, north of 5th Avenue, Phase 2 of the Proposed Action would add approximately 52 AM peak hour PCE trips, 52 PM peak hour PCE trips, and 440 daily PCE trips. On Macon Road, south of the 5th Avenue Gate, Phase 2 of the Proposed Action would add 2 AM peak hour trips, 2 PM peak hour trips, and 40 daily trips. Macon Road, north and south of 5th Avenue, would continue to operate at LOS A with the addition of the construction traffic from the Proposed Action. The total ADT on Macon Road north of 5th Avenue would be approximately 4,600 vehicles, which is within the range of LOS A. Similarly, the AM peak hour volume on Macon Road north of 5th Avenue would be approximately 220 vehicles during the AM peak hour and 300 vehicles during the PM peak hour, which is within the range of LOS A. Since the LOS for Macon Road would not be degraded to an unacceptable level, the Proposed Action would not result in a significant impact to this roadway due to construction traffic. In addition, a construction traffic control plan would be prepared as noted in AMM-3: Construction Traffic Control Plan to ensure construction traffic does not block access to nearby users and coordination occurs with other construction activities during the same time period. Since the Proposed Action would not result in a substantial increase in traffic generation or a substantial increase in the use of connecting street systems, the impact on transportation and circulation would be less than significant.

### *Parking, Emergency Access, Transit, and Pedestrian and Bicycle Circulation*

Removal of Hangar 3 would not affect bicycle or pedestrian facilities or emergency access during construction. The construction area for Hangar 3 would be fenced and secured and would not block nearby roadways, parking for non-Lessee employees, or any sidewalks or bicycle routes. Access to nearby buildings—as well as general bicycle, pedestrian, and emergency access—would continue to be provided in accordance with AMM-3: Construction Traffic Control Plan. Parking for construction workers would be needed for the duration of the Project and would be provided within the Project area as shown on Figure 1-1. While the majority of on-site workers are anticipated to drive personal vehicles or carpool to the site, workers traveling by transit, by bike, or on foot would continue to have access via the 5th Avenue Gate, the Ellis Street Gate, the Moffett Boulevard Gate, and on-site roadways. Project construction would not involve physical changes to these facilities or otherwise disrupt emergency access or transit, bicycle, or pedestrian circulation. Therefore, the Proposed Action would have no adverse effect on transit, bicycle or pedestrian circulation, emergency access, or parking in the Project area during construction.

#### No Action Alternative

Under the No Action Alternative, there would be no disturbance to the existing environment associated with pre-demolition, demolition, and waste removal and recycling. In the event of a structural failure, there would be temporary construction traffic for remediation and clean-up activities that would be expected to result in similar LOS at the study intersections as the Proposed Action. As a result, impacts related to temporary construction traffic would be less than significant.

## 3.2.8 Utilities

This section provides a discussion of activities related to demolition of Hangar 3 and its potential to impact any existing utilities. Impacts related to stormwater are discussed in Section 3.2.10, Water Resources.

### 3.2.8.1 Regulatory Setting

There are no federal or state regulations concerning utilities that are applicable to the Project.

### 3.2.8.2 Affected Environment

#### Water

NASA currently operates much of the existing backbone system through the MFA Lease area, including the high-pressure P500 line that runs up to Hangars 2 and 3 from the east. Low pressure is also supplied from the P500 line and is regulated by two pressure regulation stations located east of Macon Road at the CAANG Cantonment area. The water system on the east side of runways is isolated from the remainder of the NASA system. The Lessee is responsible for operations and upkeep of the water system within the lease boundary.

#### Sewer

The main sewer trunk line in the MFA Lease area extends across the airfield from the southeastern portion of the Ames Campus area to the northeastern portion of the MFA Lease area near the Northern Channel. This line is a 10-inch vitrified clay pipe running from the CAANG facility along the east side of Hangar 3 and increases to 15 inches at the northeast corner of Hangar 3. Smaller pipelines connect to this trunk line, including pipes serving Hangar 3.

### Electrical and Telecommunication

The MFA Lease area is served by electrical power from the Moffett substation located east of Hangar 3. There are existing electrical lines under both Hangars 2 and 3. These include Feeder 47 and services to CAANG facilities to the north from Switchgear D in Hangar 2. Hangar 2 contains a 2.4-kilovolt transformer serving the CAANG facility. There are existing telecommunication lines underneath both Hangars 2 and 3 that run in the east-west direction. No overhead electrical lines exist within or adjacent to the Project fence line.

## 3.2.8.3 Approach to Analysis

Potential impacts to utilities are assessed with respect to the potential for disruption of any utility. Impacts may arise from construction activity and introduction of construction-related traffic and utility use. Impacts would be significant if existing utilities (water, sewer, electrical, and telecommunication) were either disrupted, or irreparably damaged from Project activities. For this analysis, potential utility impacts associated with implementation of the Project are limited to construction impacts. The Project would not result in operational uses and therefore, no new utility demand would be generated and thus operational utility impacts are not discussed further.

## 3.2.8.4 Environmental Consequences

### Proposed Action – Building Demolition

The Proposed Action would not result in changes to the existing utility infrastructure serving other uses in the MFA Lease area as the Proposed Action does not propose the removal or capping of any utilities that affect other areas or buildings. However, in order to prevent accidental damage or disruption to existing utility lines, the following measures would be implemented as part of the Proposed Action:

- Prior to pre-demolition and demolition activities, all active utility infrastructure connected to Hangar 3 would be identified and disabled to prevent inadvertent loss of service or damage to critical infrastructure such as water lines connecting to Hangar 3, and NASA telecommunication lines that lie underneath the Hangar 3 concrete slab.
- All underground communication infrastructure and vaults would be protected during demolition of Hangar 3 by placing steel trench plates on the concrete slab directly above where the utility lines occur underground.
- All existing service connections to Hangar 3 would be capped or otherwise disabled prior to pre-demolition.

- Above-ground water lines serving Hangar 3 would be drained, terminated, and capped at the connection to the service line where it goes below ground in accordance with NASA's Underground Utility Abandonment Requirements and Procedures.

By taking these steps, the Proposed Action would avoid the potential to disrupt or accidentally damage existing utility lines, and thus impacts to utilities from the Proposed Action would be less than significant.

#### No Action Alternative

Under the No Action Alternative, there would be no disturbance to the existing environment associated with pre-demolition, demolition, and waste removal and recycling. In the event of a structural failure, impacts to utilities could be potentially significant as utility connections to Hangar 3 would not be capped or disconnected systematically and thus structural failure could result in the inadvertent loss of service or damage to critical infrastructure such as water lines connecting to Hangar 3 and NASA telecommunication lines that lie underneath the Hangar 3 concrete slab. Additionally, disruption or damage to utility infrastructure could impact service to other MFA users, including the CAANG facility, resulting in a potentially significant impact.

## 3.2.9 Visual Resources

This section describes the potential effects on visual resources from the Project. Visual resources are elements of a natural or built environment with aesthetic value based on visual quality and character. They may be formally identified by local, state, or federal governments or recognized by other institutions and organizations. Visual resources may also be components of a natural or built environment that contribute to a memorable or distinct landscape.

### 3.2.9.1 Regulatory Setting

The Proposed Action is located on federal land held by NASA and is not subject to local discretionary regulations related to visual resources. However, the following state program and plans pertaining to visual resources that is appropriate to consider when assessing potential effects on Visual Resources.

**California State Scenic Highway Program.** The California State Scenic Highway Program, a provision of the Streets and Highways Code, was established by the legislature in 1963 to preserve and enhance the natural beauty of California. The State Scenic Highway Program includes highways that are either eligible for designation as scenic highways or have been designated as such. The nearest officially designated state scenic highway is SR 9, located about 13 miles south of the Project site (Caltrans 2020).

**City of Mountain View 2030 General Plan.** The City of Mountain View 2030 General Plan does not contain specific goals and policies related to scenic resources; its references to MFA are related to supporting "the preservation of historic buildings and hangars at Moffett Field and NASA Ames" (Policy LUD 11.4: Moffett Field; City of Mountain View 2012a), not to any aesthetic or scenic value associated to these facilities.

**City of Sunnyvale 2011 General Plan.** The City of Sunnyvale 2011 General Plan does not contain specific goals and policies related to scenic resources. Chapter 4, Community Character, of the General Plan pertains to the City of Sunnyvale's visual image and contains goals and policies to ensure that new public and private development is well designed and compatible with surrounding properties and districts. Figure 4-1, City Form Map, in the General Plan identifies MFA as a visual landmark (City of Sunnyvale 2011).

### 3.2.9.2 Affected Environment

The Project area consists of the 1,000-acre MFA Lease area located within the NASA ARC in Santa Clara County, California (Figure 1-1). MFA is the primary land use within the Project area, which is adjacent to the San Francisco Bay to the north, commercial office development to the east, NASA ARC to the west, and US 101 to the south. The San Francisco Bay Trail (Bay Trail), a 500-mile walking and cycling trail that extends along the San Francisco Bay, also borders the northern boundary of MFA.

The Project area is mostly developed, with paved aircraft runways that are part of MFA, several office and administration buildings, buildings owned by the CAANG, and the golf course. There are also three hangars located within the MFA lease area, referred to as Hangar 1, Hangar 2, and Hangar 3 (Figure 1-1). Hangars 2 and 3 are parabolic in shape and appear nearly identical. In views toward the Project area, these hangars are vivid, memorable features and a recognizable source of visual interest in the landscape. Their height and form are identifiable within the broader landscape and contribute to the overall visual character of MFA.

The Project area sits within a larger baylands region that is relatively flat, with elevations ranging from 8 feet to 35 feet above mean sea level. Viewers in the Project area include motorists travelling on the surrounding roadways, recreationists, and workers associated with the nearby office developments. Access to MFA is restricted; however, the public can use Macon Road within NASA's property to access the golf course. Therefore, close-in views are limited to those from publicly accessible locations north of the Project area, such as the Bay Trail and the golf course. Hangar 3 is also visible from more distant locations, including a segment of US 101 and some locations within or along the edge of the surrounding commercial office areas. Distant views of Hangar 3 from these locations are intermittent, as viewers are typically passing through the area while using the nearby roadways or recreation facilities. In addition, from locations within the Project area that are further removed from MFA, buildings and vegetation partially or completely obscure views toward Hangar 3. These same features also limit views beyond MFA, including views of and from the surrounding hillsides, including the Santa Cruz Mountains to the south and west.

MFA is bordered to the west, south, and east by areas completely developed at a moderate level of density. Therefore, existing buildings, infrastructure, and vegetation obstruct views toward MFA from nearby flatlands. In elevated views, including residential neighborhoods and more distant foothill parkland areas that are located as close as 10 miles to the west, intervening vegetation, buildings, and other structures generally obscure MFA. Where visible in limited, intermittent views, MFA appears as part of a broader landscape containing a variety of land uses, forms, and patterns of development.

No officially designated or eligible State Scenic Highways is within or in the vicinity of the Project area. SR 9, located approximately 13 miles south of the Project area, is the only officially designated State Scenic Highway in Santa Clara County (Caltrans 2020). There are no locally designated scenic roads within or in the vicinity of the Project area (Santa Clara County 2008).

### 3.2.9.3 Approach to Analysis

A comparison of the existing conditions and the change to the landscape resulting from implementation of the Project was done based on photographs of existing conditions and visual simulations showing the Proposed Action. Aerial imagery was reviewed to identify where the Project could be visible from visually sensitive areas to select viewpoints for site photography. This included a desktop review of potential line-of-sight views of MFA from distant hillsides using Google Street View. There are few direct, sustained views toward MFA from the broader surrounding area, including local hillsides. Additionally, the Project is within a developed area where buildings, vegetation, or topography either obstruct or limit the duration of relatively narrow views. Therefore, the effects assessed are focused on actual or approximated views within 2 miles of Hangar 3 that are publicly accessible. The furthest segment of the Bay Trail from which unobstructed views toward Hangar 3 are available is just under 2 miles away, to the northwest. San Francisco Bay is beyond the Bay Trail to the northwest and north. In all other directions, MFA is bounded by either the wooded golf course or urbanized areas. Views of Hangar 3 from anywhere beyond MFA are therefore generally obstructed or intermittent and partial. In views toward MFA from beyond 2 miles from within and/or toward these developed areas, Hangar 3 would be identifiable, but it would appear at least partially absorbed into the broader built environment.

Site photographs were taken on September 25, 2019, to document current visual conditions and views toward the Project area. A representative subset of photographed viewpoints was selected for use as Key Observation Points (KOPs), which collectively serve as the basis for this assessment. Assessments of existing visual conditions were made based on professional judgment that considered sensitive viewer groups and viewing areas in the lands surrounding the Project area. Sensitive viewer groups and viewing areas include those who occupy or would occupy the Project site or adjacent lands with views of the Project, such as motorists travelling on the surrounding roadways, recreationists using the golf course at MFA or the Bay Trail, and workers associated with the nearby office developments. The locations of the four KOPs in relation to the Project area are presented on Figure 3-4.

The view from each KOP was photographed using a 35-millimeter, 53-megapixel, full-frame, single-lens reflex camera equipped with a 50-millimeter fixed focal length lens. This configuration is the industry-accepted standard for approximating the field of vision in a static view of the human eye. The camera positioning was determined with a sub-meter, differentially corrected global positioning system. The camera was positioned at eye-level for each photograph.

The site photos were used to generate a rendering showing existing conditions with Hangar 3 demolished and removed. The visual simulations provide clear before-and-after images of the location, scale, and visual appearance of the features affected by and associated with the Proposed Action as seen from KOP 1 through KOP 4. The visual simulations showing the Project are included as Figures 3-6 to 3-9 and described in the following paragraphs.

Impacts to visual resources would be considered significant if the Project resulted in substantially adverse effects to existing visual character and scenic quality as visible from publicly accessible areas with potentially high viewer sensitivity.


**Figure 3-4 Project Area and Key Observation Points**

### KOP 1 – View from the Golf Course at Moffett Federal Airfield

Figure 3-5 provides a close-in view to the south from the golf course at MFA, located approximately 0.5 mile from Hangar 3. This viewpoint was selected because it represents views from a publicly accessible vantage point by golf course operators and users. It is also the closest publicly accessible area with views oriented toward MFA.

### KOP 2 – View from San Francisco Bay Trail

Figure 3-6 provides a mostly unobstructed view of Hangar 3 to the south-southwest from a segment of the Bay Trail, located approximately 0.75 mile away. This viewpoint was selected as it represents views from a publicly accessible vantage point by Bay Trail users travelling west near the point where they would first have mostly unobstructed views toward the Project area.

### KOP 3 – Approximate View from US 101

Figure 3-7 approximates north-northwest views from southbound US 101, located approximately 0.8 mile from Hangar 3. Views of Hangar 3 from US 101 are constrained; the nearest lanes are the northbound ones, from which Hangar 3 is visible in perpendicular or rear-facing views beyond additional frontage roadways and the Caltrain corridor, which includes overhead infrastructure and is bound by fencing. The view from the southbound lanes is oriented more toward the Project area, but the northbound US 101 traffic further obstructs views and makes views of Hangar 3 intermittent. The view from KOP 3 is from the southwest side of the Project area, which is not a publicly accessible location. However, it was selected because it has the same view orientation as the nearby southbound segment of US 101 and thus serves as a conservative approximation of views from the highway.

### KOP 4 – View from San Francisco Bay Trail

Figure 3-8 provides a publicly accessible view to the south-southeast while travelling east on a segment of the Bay Trail, located approximately 1.4 miles from Hangar 3. This viewpoint was selected because it represents the vantage point of trail users who have just turned away from a trail segment that provides an open view of the San Francisco Bay and would now be facing the shoreline and lands beyond, with views oriented toward MFA.


**Figure 3-5 Key Observation Point 1 – View from the Golf Course at Moffett Federal Airfield with the Proposed Action**

a) View to the south-southwest while travelling west on a segment of the San Francisco Bay Trail. Hangar 3 is located to the left and Hangar 2 is located to the right, about 0.75 miles away.

b) View showing the Proposed Action with the demolition of Hangar 3.

Project Location
Moffett Federal Airfield
Santa Clara County, CA

Project
Hangar 3 Structural Hazard Remediation Project
Draft Environmental Assessment

Figure No.
3-7

Title
Key Observation Point 2 - View from San Francisco Bay Trail with the Proposed Action

**Figure 3-6 Key Observation Point 2 – View from the San Francisco Bay Trail with the Proposed Action**


**Figure 3-7 Key Observation Point 3 – Approximate View from US 101 with the Proposed Action**

a) View to the south-southeast while travelling east on a segment of the San Francisco Bay Trail. Hangar 3 is located to the left and Hangar 2 is located to the right, about 1.4 miles away.

b) View showing the Proposed Action with the demolition of Hangar 3.

Project Location
Moffett Federal Airfield
Santa Clara County CA

Project
Hangar 3 Structural Hazard Remediation Project
Draft Environmental Assessment

Figure No.
3-9

Title
Key Observation Point 4 - View from San Francisco Bay Trail with the Proposed Action

**Figure 3-8 Key Observation Point 4 – View from San Francisco Bay Trail with the Proposed Action**

### 3.2.9.4 Environmental Consequences

#### Proposed Action – Building Demolition

Under the Proposed Action, temporary and permanent changes to the existing visual landscape would result from pre-demolition and demolition activities. During pre-demolition and demolition activities, the presence of construction equipment, demolition debris, and vehicles would alter the existing visual character of the Project site. However, once pre-demolition and demolition activities were completed, the temporary materials and equipment would be removed.

All above-ground infrastructure would be removed with the demolition of Hangar 3, and only the concrete slab would remain. The demolition of Hangar 3 would result in permanent changes to the existing visual landscape. As shown in the views from KOP 1 through KOP 4, Hangar 3 is a prominent feature in views toward MFA from nearby locations. Its visual prominence is reinforced by the presence of Hangar 2, which is identical in form and scale to Hangar 3. As a pair, these structures are highly recognizable visual and historic features in the local and regional landscape; therefore, the removal of Hangar 3 would be noticeable by viewers familiar with the area. However, such visual changes would not be substantial, as Hangar 2 would become the focal point in public views and would maintain the overall visual character of the Project area. Additionally, as shown in the close-in views from KOP 1 and KOP 2, the removal of Hangar 3 would allow for greater visibility of the Project area and the surrounding hillsides, as well as of the more distant Santa Cruz Mountain ridgeline.

A similar visual effect would also occur in more distant views. As shown in the views from KOP 3 and KOP 4, Hangar 2 and Hangar 3 appear as prominent, symmetrical structures in MFA, but are partially obscured by existing development and vegetation. With the demolition of Hangar 3, the vividness would be reduced with the elimination of a repeating form. However, Hangar 2 would become the sole dominant feature in public views and would retain the elements that contribute to the overall visual character that is evident in existing views toward this portion of MFA. In the view from KOP 3, there would be increased visibility of the Diablo Range peaks to the east. As such, the Proposed Action would have a less than significant impact on the existing visual character and scenic quality of public views.

Pre-demolition and demolition activities would typically occur during daylight hours from 7:00 AM to 3:30 PM, and no nighttime work would occur. Activities during the Project's pre-demolition and demolition phases would contribute additional light to the site primarily due to the reflection from equipment surfaces and the use of headlights and work lights if activities occur outside of daylight hours. Once demolition of Hangar 3 was completed, all temporary lighting, equipment, and materials would be removed from the

Project site. Therefore, the Proposed Action would not create a new source of substantial light or glare, and the impact would be less than significant.

#### No Action Alternative

Under the No Action Alternative, there would be no disturbance to the existing environment associated with pre-demolition, demolition, and waste removal and recycling. In the event of structural failure, potential damage to Hangar 3 would be uncontrolled and could affect other nearby structures, including Hangar 2. However, it would be speculative to determine the extent of an unplanned collapse and the potential damage to other structures. In the absence of Hangar 3, Hangar 2 would be the sole dominant feature in public views and would retain the elements that contribute to the overall visual character that is evident in existing views toward this portion of MFA. Therefore, visual impacts from the No Action Alternative would be less than significant.

## 3.2.10 Water Resources

The analysis of water resources in this EA focuses on surface water quality, stormwater runoff, and groundwater. Surface water includes all lakes, ponds, rivers, and streams. Groundwater is water that is below the ground surface. Water quality describes the chemical and physical composition of water as affected by natural conditions and human activities.

### 3.2.10.1 Regulatory Setting

The following includes the key federal and state regulations applicable to the Project.

**Clean Water Act (CWA).** The CWA is the primary federal law that protects the quality of the nation's surface waters, including lakes, rivers, and coastal wetlands. CWA sections 303 (Water Quality Standards and Implementation Plans) and 402 (National Pollutant Discharge Elimination System [NPDES]) are implemented and enforced by the individual states. In California, the nine RWQCBs enforce the provisions under guidance from the State Water Resources Control Board.

**NPDES Permit Program.** The NPDES Permit Program is administered by the State Water Resources Control Board and RWQCBs under the authority of the USEPA to control water pollution by regulating point sources that discharge pollutants into Waters of the U.S. If discharges from industrial, municipal, and other facilities go directly to surface waters, then dischargers must apply for permits that regulate and authorize the discharge.

**Industrial General Permit.** NASA's existing facility Industrial General Permit regulates stormwater discharges and authorized non-stormwater discharges from onsite facilities, construction, and municipal sources at ARC as part of the NPDES Permit Program under the CWA. Provisions of this permit would apply to the demolition activity carried out under the Proposed Action.

The permit requires control of pollutant discharges using Best Available Technology (BAT) and Best Control Technology (BCT) to prevent and reduce pollutants and any more stringent controls necessary to meet water quality standards. Dischargers are required to reduce or prevent the discharge of pollutants in stormwater and other water discharges by developing Best Management Practices (BMPs) that comply with the BAT/BCT.

**Stormwater Pollution Prevention Plan**. The NASA ARC SWPPP has been developed and implemented to comply with the requirements of Title 40, Code of Federal Regulations, Parts 122, 123, and 124 and the requirements of the Industrial General Permit. The SWPPP has two major objectives:

1. Identify and evaluate sources of pollutants associated with industrial activities that may affect the quality of a facility's stormwater discharges and authorized non-stormwater discharges;
2. Identify, describe, and implement site-specific BMPs to reduce or prevent pollutants associated with industrial activities in stormwater discharges and authorized non-stormwater discharges. BMPs shall be selected to achieve BAT/BCT and compliance with water quality standards.

Compliance with the SWPPP during the Proposed Action would be required by the NASA ARC Industrial General Permit.

**San Francisco Bay Basin Water Quality Control Plan (Basin Plan).** The Basin Plan is the San Francisco Bay RWQCB's master water quality control planning document. The Basin Plan designates beneficial uses and water quality objectives for waters of the State, including surface waters and groundwater, and also includes programs of implementation to achieve water quality objectives. The current Basin Plan reflects all amendments as of November 5, 2019 (RWQCB 2019).

### 3.2.10.2 Affected Environment

Precipitation that falls at NASA ARC drains to two distinct watersheds (i.e., drainage areas). These watersheds split NASA ARC into, the western drainage system encompassing 680 acres, and the eastern drainage system encompassing 1,010 acres. The Project site is entirely within the eastern drainage system. All stormwater in this system flows north and discharges to the Marriage Road ditch and the North Patrol Road Channel. This water is discharged downstream to the easternmost Lockheed Pond through a culvert and is then pumped into the Moffett Channel, where it is ultimately discharged into Guadalupe Slough and then the San Francisco Bay.

Surface water quality at ARC is typical of urban or developed streams where various types of point- and nonpoint-source pollutants affect water quality. Surface water drainage at ARC has been substantially modified for stormwater management, and water quality concerns focus on maintaining compliance with the California NPDES General Permits CAS000001 and CAS000002. Monitoring the quality of stormwater at NASA ARC is also important to track movement of contaminants and contaminated groundwater (NASA 2015). NASA monitors four times per year at the North Patrol Road channel pumpstation prior to leaving NASA's site.

Since the early 1980s, numerous investigations have been conducted at and around ARC to evaluate soil and groundwater contamination in the area. Activities at the MEW Superfund site (which originates in Mountain View), the Navy, and ARC, have all contributed to an area of groundwater contamination consisting of plumes of dissolved VOCs collectively referred to as the regional plume that exists in the groundwater beneath ARC (NASA 2015), including Hangars 2 and 3. MFA is currently covered under a NPDES General Permit (No. CAG912003) to regulate discharge or reuse of extracted and treated groundwater resulting from the cleanup of groundwater polluted by VOCs (NASA 2009).

### 3.2.10.3 Approach to Analysis

Impacts associated with surface water quality, stormwater runoff and groundwater that could result from construction activities associated with the Project were evaluated based on expected construction practice, the materials to be used, and the locations and duration of the activities. The effects of the Project were compared to environmental baseline conditions (i.e., existing conditions) to determine the duration and magnitude of impacts.

Significant impacts to water resources would result if the Project: (1) discharged construction pollutants or contaminated groundwater into downstream areas such that degradation of water quality would occur; (2) resulted in increased runoff such that stormwater drainage capacity would be exceeded or result in flooding; or (3) interfered with sustainable groundwater management by substantially reducing groundwater recharge or substantially decreasing groundwater supplies.

There are no operational uses proposed as part of the Project; therefore, operational impacts to water resources are not discussed further. Also, given the Project would not change the amount of impervious surface or alter the existing storm drain system. Once Hangar 3 was demolished, stormwater from the site would continue to discharge into the existing storm drains and flow north into the Marriage Road ditch and the North Patrol Road Channel. Therefore, the Proposed Action would not result in increased runoff and thus the analysis below focuses on surface water quality and groundwater and does not discuss stormwater runoff.

### 3.2.10.4 Environmental Consequences

#### Proposed Action – Building Demolition

Under the Proposed Action, construction activities would include abatement, demolition, and waste disposal. All construction activities would be above-ground, and no site grading or ground disturbance would occur. However, demolition activities could result in discharge of pollutants such as asbestos and lead into surface water. Construction equipment used on-site may release small quantities of petroleum products including diesel, gasoline, and grease that could be combined with the wastewater generated during construction.

The Proposed Action would require the management of wastewater generated from dust suppression, potential watering of ACM, and other temporary localized increases in runoff to nearby surface waters as noted in AMM-1: EIMP. All water discharged during demolition would be collected in covered and secured Baker tanks and then tested to determine whether it should be transported offsite to a hazardous waste facility or otherwise discharged to the sanitary sewer in accordance with AMM-1: EIMP. The location of the Baker tanks would be determined during final design but would be located within the temporary fence line.

In the event of a storm or heavy rain event, debris and contaminated materials from the Project site could potentially run off into surface waters and degrade water quality. The Proposed Project would comply with the existing Industrial General Permit and NASA's ARC SWPPP. The SWPPP includes a series of BMPs that are designed to control surface runoff and prevent contamination of surface waters (NASA 2021). For example, all construction activities at ARC would be required to adhere to erosion control and site stabilization stormwater BMPs, which include preventing runoff from flowing across disturbed areas by diverting the flow to vegetated areas and providing drainage ways for increase runoff (NASA 2009b). The Lessee's contractor would be responsible for implementation of the SWPPP.

Collection of all wastewater, implementation of AMM-1: EIMP, and compliance with the existing Industrial General Permit and NASA's ARC SWPPP would control surface water runoff and prevent the discharge of construction pollutants into downstream surface waters such that degradation of water quality would not occur. Therefore, the Proposed Action would have a less than significant impact on surface water quality.

The existing sewer facilities at Project discharge to the City of Sunnyvale's sewer system. While some of the wastewater collected may be suitable for discharge to the City of Sunnyvale's Wastewater Treatment Plant, an Incidental Discharge Permit would be required prior to discharge. This permit would enable the City of Sunnyvale to determine whether discharge was acceptable. If the permit is granted, then the existing sewer facilities would be expected to accommodate the amount of wastewater generated from construction of the Project. If the permit is not granted, wastewater would be hauled offsite for disposal at a suitable facility.

There are Navy groundwater monitoring wells located within the Project area; however, none of the wells are located within Hangar 3 and would not be directly affected by construction activities. Any existing wells in the vicinity of the Project site would be protected in accordance with AMM-1: EIMP. The Proposed Action would not be expected to encounter groundwater or require dewatering as excavation would not occur. In addition, the project would not change the amount of impervious area and thus not change groundwater recharge. Therefore, the Proposed Action would not interfere with sustainable groundwater management and would have a less than significant impact on groundwater resources. Therefore, when considering all potential effects to water, the Proposed Action would not have a significant impact on water resources.

### No Action Alternative

Under the No Action Alternative, there would be no disturbance to the existing environment associated with pre-demolition, demolition, and waste removal and recycling. In the event of a structural failure, existing lead, asbestos, PCB, and other contaminants from building materials within Hangar 3 could be released into the environment, including surface waters, because no abatement of hazardous materials (lead/asbestos/PCB) would be conducted prior to cleanup. Therefore, the No Action Alternative could degrade downstream water quality through the release of hazardous and other contaminants into surface waters and result in a potentially significant impact to water resources.

## 3.3 Cumulative Impacts

Federal regulations implementing NEPA require federal agencies to include an analysis of potential cumulative effects of a project. This includes connected, cumulative, and similar actions (40 CFR Section 1508.25). Additionally, the CEQ further explained in *Considering Cumulative Effects Under the NEPA* (CEQ 1997) that, "each resource, ecosystem and human community must be analyzed in terms of its ability to accommodate additional effects, based on its own time and space parameters." A cumulative effects analysis generally encompasses geographic boundaries beyond the immediate area of the Proposed Action, and includes past, present, and reasonably foreseeable future actions to capture these additional effects. The list of projects included in this cumulative analysis was developed by reviewing the NASA Ames Development Plan (NADP), Moffett Park Specific Plan, East Whisman Precise Plan, the City of Mountain View Planning Division's website (2021), and City of Sunnyvale's Projects in Sunnyvale website (2021). Projects were included in the cumulative analysis if they were in MFA, ARC, or in the immediate vicinity of the Project and would occur in the same timeframe as the Proposed Action.

### 3.3.1 Cumulative Impact Setting

The geographic area analyzed for cumulative impacts is dependent on the resource being analyzed. The geographic area associated with the proposed Project's environmental impacts defines the boundaries of the area used for compiling the list of past, present, and reasonably foreseeable future projects considered in the cumulative impact analysis. This analysis considers the specific geographic area that is directly related to the individual topic addressed within that section.

For example, the analysis of air quality is based on a regional level because air quality impacts are regional in nature, whereas analysis of impacts to visual resources only considers related projects in the vicinity of the Project site because of the localized nature of the impact.

The geographic area that could be affected by implementation of the Project in combination with other projects varies depending on the type of environmental resource being considered. Table 3-16 provides the geographic area in the cumulative analysis for each resource area.

**Table 3-16 Geographic Scope of Cumulative Impact Analysis**

| Resource | Geographic Area of Cumulative Analysis |
|---|---|
| Air Quality | SFAAB |
| Biological Resources | ARC |
| Cultural Resources | NAS Sunnyvale Historic District and portions of the City of Sunnyvale to the east, including the Lockheed Missile & Space Division Campus |
| Greenhouse Gases and Climate Change | Global |
| Hazards, Safety, and Waste Management | ARC |
| Noise and Vibration | ARC |

| Resource | Geographic Area of Cumulative Analysis |
|---|---|
| Transportation and Circulation | Intersections in the cities of Mountain View and Sunnyvale and streets within ARC identified in Appendix E, Traffic Analysis Memorandum. |
| Utilities | ARC |
| Visual Resources | ARC |
| Water Resources | MFA Watershed |

The temporal scope for cumulative effects analysis differs between the two alternatives. Under the Proposed Action, demolition would occur over approximately nine months and no operational activities would occur once demolition was completed. This limited duration, without an operational component, minimizes the potential for the Proposed Action to have an additive effect when combined with other reasonably foreseeable future actions. Under the No Action Alternative, Hangar 3 would continue to deteriorate and would result in additional impacts as described in Section 3.2, Environmental Resources Included for Detailed Consideration. Under the No Action Alternative, it is not known how long the existing structure would remain standing given the potential for collapse.

### 3.3.2 Projects Considered for Cumulative Impact Analysis

Past actions at MFA include repairs to Hangars 2 and 3, 5th Avenue Gate Improvements, Bus Maintenance Facility, CAANG's 129th Rescue Wing Project, and US 101 Northbound Off-Ramp at Moffett Boulevard Improvements. In the past, numerous small-scale construction, operations, and maintenance projects have occurred at MFA. These past projects were conducted in accordance with applicable regulations, resulted in negligible environmental impacts, and are assumed to contribute (in part) to the existing conditions described in Section 3.2, Environmental Resources Included for Detailed Consideration.

Present actions include projects that are currently being implemented or for which a decision to proceed has already been made and would soon be implemented at ARC. These include the Bay View Project, Hangar 1 Rehabilitation and Recladding, Airside Fuel Farm, NASA Housing Project, and the U.S. Geological Survey (USGS) Lab on Parcel 15.

Reasonably foreseeable future actions within MFA and other portions of ARC include the EAIP and future developments as contemplated in the NADP for portions of ARC that are directly west of MFA, including development by the University of California (UC). The future actions on MFA and other portions of ARC involve federal agency agreements or funding and would require NEPA documentation.

The planning programs in the City of Sunnyvale's Moffett Park Specific Plan and City of Mountain View's East Whisman Precise Plan describe future development over a 10-year+ horizon[15]. Over the period between now and 2030, development would be expected to occur, or has already occurred as part of these plans. However, the location and schedule of such developments are uncertain and thus the potential for effects from the general developments contained in these plans to cumulate with those of the Project, which has a very short near-term timeline, is extremely speculative. Therefore, developments under these two plans were not included as reasonably foreseeable future projects.

Rather, the current project list on the City of Mountain View and City of Sunnyvale's websites were reviewed for pending projects surrounding the 5th Avenue Gate and Ellis Street Gate where Project activities (travel by construction worker vehicles and construction trucks) would occur outside of ARC. Current projects within the City of Mountain View are located south of US 101. Two hotel development projects in Sunnyvale are proposed along North Mathilda Avenue, along the route construction trucks would take from the 5th Avenue Gate to SR 237 and US 101; however, these hotels are currently under construction and are expected to be completed by the time of Project implementation. These foreseeable projects in Mountain View and Sunnyvale could overlap with the Project, but their effects would be localized and to the extent that they generate traffic that could combine with that of the Project along SR 237 and US 101, the traffic analysis for the Project (see Section 3.2.7, Transportation and Circulation) incorporates a two percent per year growth factor to traffic due to future development. Therefore, current City of Mountain View and City of Sunnyvale projects are not discussed specifically within this cumulative analysis.

Table 3-17 summarizes past, present, and reasonably foreseeable future actions included in the cumulative effects analysis, and the location of each of these projects is depicted on Figure 3-9.

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[15] The timelines for the East Whisman Plan range from 2019 to beyond 2030. There is no known timeline for development under the Moffett Park Specific Plan as it is currently being updated by the City of Sunnyvale.

**Table 3-17 Cumulative Actions**

| Past Actions | Present Actions | Reasonably Foreseeable Future Actions |
|---|---|---|
| • Repairs to Hangars 2 and 3<br>• 5th Avenue Gate Improvements<br>• Bus Maintenance Facility<br>• CAANG 129th Rescue Wing Project<br>• Natural Gas Separation Project<br>• DLA Tank Removal Project<br>• US 101 Northbound Off-Ramp at Moffett Boulevard Improvements | • Hangar 1 Rehabilitation and Recladding<br>• Bay View Project<br>• Airside Fuel Farm<br>• NASA Housing Project<br>• U.S. Geologic Survey (USGS) Lab on NRP Parcel 15 | • EAIP<br>• University of California (UC) development |

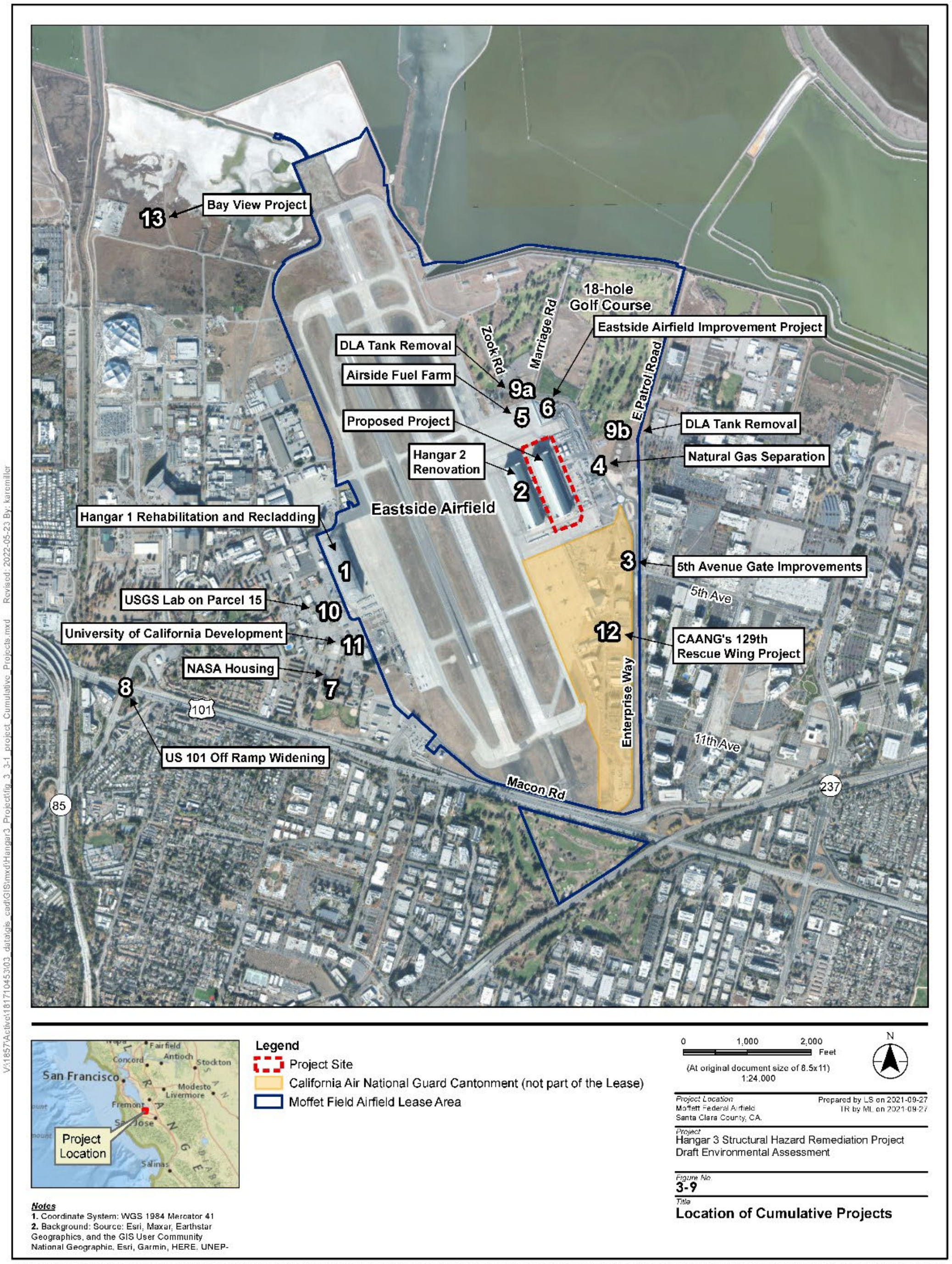


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**Figure 3-9 Location of Cumulative Projects**

#### 3.3.2.1 Past Actions

Hangars 2 and 3 were constructed between 1942 and 1943. Repairs occurred periodically throughout the service life of the hangars, from early repairs in their service life to emergency repairs on Hangar 3 from the 1980s until recently.

The 5th Avenue Gate Improvements project was undertaken to help alleviate traffic congestion at the Ellis Street interchange by providing an alternative point of entry to the Eastside Airfield area for MFA site users through the 5th Avenue Gate, and by providing a larger vehicular queueing area for inspections within the MFA Lease area. This project was completed in 2020.

The Lessee also operates an existing bus maintenance facility at MFA located east of Hangar 3 that is limited to maintenance work on its commuter bus fleet during the daytime layover. Otherwise, the buses use other decentralized facilities in the South Bay. The current bus maintenance facility is roughly 10 acres and has been in operation since 2016. The current bus maintenance facility serves approximately 225 buses and includes four electric bus chargers. The existing maintenance service infrastructure is limited to temporary tents that are used to clean the buses and perform light maintenance activities, such as changing tires and topping off fluids.

CAANG's 129$^{th}$ Rescue Wing Project included a consolidation of their facilities. As part of this project, the 129$^{th}$ Rescue Wing corrected some of their functional space shortfalls by vacating certain facilities and constructing new facilities thereby allowing the 129$^{th}$ Rescue Wing to carry out their mission more effectively. This project was completed in February 2021.

The Natural Gas Separation Project was approved by NASA and replaced the natural gas line at Buildings 934 and 545 with standalone 1,000-gallon propane tank gas systems to separate PV's natural gas utility system from the system serving NASA and the CAANG facility. The existing appliances were retained and retrofitted to operate with propane fuel. Construction began in October 2020 and has been completed.

The Defense Logistics Agency (DLA) Tank Removal Project included removal of five underground storage tanks (USTs) and associated pipelines, truck fill stands, high-speed aircraft fueling hydrants, and related infrastructure from the inactive former Defense Fuel Support Point (DFSP) at Moffett Field. This project was completed in 2021.

The US 101 Northbound Off-Ramp Project at Moffett Boulevard included the widening of the northbound off-ramp to construct a right-turn pocket near the signalized intersection. Construction included land stripping at the Moffett Boulevard and US 101 northbound intersection as well as adjustments to sidewalks, traffic signals, and curbs-and-gutters. Construction was completed in December 2021.

### 3.3.2.2 Present Actions

The Hangar 1 Rehabilitation and Recladding Project is currently starting implementation. The rehabilitation and recladding (replacement of original metal panels and glazing) for Hangar 1 would include full scale abatement of the steel superstructure, structural upgrades, metal reskin of hangar, and installation of interior improvements. Although specific users of the hangar are not yet known, the hangar will be designed for a F-1 standard under the California Building Code. The anticipated construction schedule is early 2022 to mid-2025.

The Bay View Project consists of 1.1 million sf of office and 240 short-term employee accommodation units. Construction began in 2017 and will be completed in 2022.

The Airside Fuel Farm Project includes replacing the existing fuel farm facility with a new facility. Fuel farm refers to the fuel facility that includes fuel storage, pumps, and associated infrastructure. The new facility would be designed to accommodate existing and future aviation fuel needs, and the existing and future PV bus maintenance facility. Construction should begin in 2022 and is expected to be completed in 2023.

The NASA Housing Project outlined in the NADP is currently in the planning stage. The project would include up to 2.75 million sf of development consisting of up to 2,068 housing units, 250,000 sf of ancillary uses, and 100,000 sf of retail space on approximately 46 acres with a target to complete in the next 17 years. The project site is located at the Ellis Street Gate between Wescoat Village and MFA. The housing project may include installing a recycled water pipeline along Macon Road from Ellis Street Gate until Macon Road turns north. This off-site improvement would occur at the beginning of the project, which may be midway through 2023.

The USGS Lab on NRP Parcel 15 includes the construction of a new 48,000 sf two-story laboratory building west of Hangar 1. This lab provides a facility suitable for USGS research needs and supports the relocation of the USGS research programs from their current Menlo Park Campus to NASA ARC. The development includes labs, clean rooms, high-bay labs, office, and chemical storage. Demolition of two additions to Building 006, all storage sheds and associated structures within the NRP parcel 15, select underground utilities, and portions of utility vaults would be required. Construction would take approximately 24 months to complete and is expected to be complete in 2024.

#### 3.3.2.3 Reasonably Foreseeable Future Actions

The EAIP is currently in the planning stage. The project would develop approximately 50 acres on the Eastside Airfield portion of MFA and include development of a private aircraft hangar north of Hangar 3 and connected to Building 686, as well as modifications to the existing bus maintenance facility (BMF) adjacent to the Hangar 3 to accommodate more commuter buses. In an effort to electrify the lessee's commuter bus fleet, 26,000 solar panels would be installed over the bus parking stall areas atop a free-standing solar canopy structure. In addition, the Moffett substation east of the BMF would be replaced and a battery energy storage system would be installed. The anticipated construction schedule is from 2022 through 2025.

The University of California (UC) and NASA have signed a lease for possible development of up to 1.4 million sf of commercial, educational, residential, and ancillary lodging and retail space on 36 acres, directly west of MFA in the southeastern portion of ARC (OPR 2020). NASA and UC are in the planning stage, which is expected to continue through the end of 2024. Should the project move forward, construction would be anticipated to begin in approximately 2025.

### 3.3.3 Cumulative Impact Analysis

Cumulative impacts result from the incremental effect of an action when added to the cumulative effect of other past, present, and reasonably foreseeable future actions. Impacts from individual projects that are less than significant may be or become collectively significant. For each resource evaluated in Section 3.2, Environmental Resources Included for Detailed Consideration, this analysis discusses the cumulative effect of the past, present, and future actions identified in Section 3.3.2, Project Considered for Cumulative Impact Analysis, as well as any incremental effect of the Proposed Action.

#### 3.3.3.1 Resource Topics with No Cumulative Effects

The preceding analyses in Section 3.2, Environmental Resources included for Detailed Consideration, identified a number of resource topics for which there would be no impacts as a result of either alternative. This determination was made because the resource was not present; the Project would have no change to existing conditions; or potential impacts would be avoided or minimized by existing regulations and/or measures included as part of the Project including AMMs 1 (EIMP), 2 (Noise and Vibration), and 3 (Construction Traffic Control Plan). Because cumulative impacts are defined as the combined effect of past, present, and reasonably foreseeable future projects, including the alternative under consideration, if a project alternative (i.e., either Proposed Action or No Action) would have no effect on these resources, then, by definition, there would be no cumulative effect. In other words, the

Project alternatives would not have an incremental impact on these resources, and cumulative effects would be the same with or without the Project alternatives. Table 3-18 below summarizes the resource topics with no cumulative effects and the primary reason(s) for this conclusion based on the analyses in Section 3.2, Environmental Resources Eliminated from Detailed Consideration.

**Table 3-18 Resource Topics with No Cumulative Effect**

| Resource Topics with No Cumulative Effect | Rationale |
|---|---|
| Floodplains and Wetlands | See Section 3.1.1: no change from existing conditions |
| Geological Resources | See Section 3.1.2: no change from existing conditions |
| Land Use | See Section 3.1.3: no change from existing conditions |
| Socioeconomics and Environmental Justice | See Section 3.1.4: no change from existing conditions |
| Sensitive Natural Communities/Habitats | See Section 3.2.2: resources not present |
| Tribal Cultural Resources and Archaeological Resources[1] | See Section 3.2.3: resources not present, subsurface work not anticipated, but if discovered, Project includes avoidance and minimization measures (Integrated Cultural Resource Management Plan Standard 8 for inadvertent discovery). |
| Hazards and Safety[2] | See Section 3.2.5: existing regulations and avoidance and minimization measures (AMM-1: EIMP). Cumulative effects to waste management are described below. |
| Transportation and Circulation: Parking, Emergency Access, Transit, and Pedestrian and Bicycle Circulation[3] | See Section 3.2.7: Project includes avoidance and minimization measures (AMM-3: Construction Traffic Control Plan) |

| Resource Topics with No Cumulative Effect | Rationale |
|---|---|
| Utilities[4] | See Section 3.2.8: Project includes measures to protect utilities, no changes to utilities that affect other buildings, no change in utility demand |
| Water Resources | See Section 3.2.10: Project includes avoidance and minimization measures (AMM-1: EIMP) |

Notes:

[1] There are potential cumulative effects to architectural resources as a result of the Project; therefore, cumulative effects to architectural resources are described below.

[2] There are potential effects to waste management as a result of the Project; therefore, cumulative effects to waste management are described below.

[3] There are potential effects to traffic as a result of the Project; therefore, cumulative effects to traffic are described below.

[4] There are potential effects to utilities as a result of the No Action Alternative; therefore, cumulative effects to utilities as a result of this alternative are described below.

#### 3.3.3.2 Air Quality

The geographic area of cumulative analysis for air quality emissions is the SFBAAB, which is within the jurisdiction of the BAAQMD (Table 3-16). The CARB geographically divided the state into 15 air basins for the purposes of managing air quality on a regional basis. Air basins were identified based on similarity of meteorological and geographic conditions. Therefore, the SFBAAB is the appropriate geographic analysis area for cumulative air quality impacts. The applicable air district responsible for regional air quality planning, monitoring, and maintaining or reaching attainment of criteria air pollutants within the SFBAAB is the BAAQMD. The existing air quality conditions within the SFBAAB are discussed in Section 3.2.1, Air Quality.

##### Cumulative Effects without the Proposed Action

By its very nature, regional air pollution is largely a cumulative impact. Past, present, and future development projects contribute to the region‘s adverse air quality impacts on a cumulative basis. A project’s emissions may be individually limited, and no single project is typically sufficient in size to independently affect the region’s attainment of state or federal ambient air quality standards. Rather, a project’s individual emissions contribute to the existing and future ambient air quality and may be cumulatively considerable when taken in combination with past, present, and future development projects.

Air pollutant emissions from the construction of past actions, including repairs to Hangars 2 and 3, 5th Avenue Gate Improvements, Bus Maintenance Facility, the CAANG 129th Rescue Wing project, US 101 Northbound Off-Ramp at Moffett Boulevard Improvements, and the DLA tank removal project, as well as actions throughout the SFBAAB, have already occurred and were temporary in nature, in that such emissions were no longer generated after the completion of construction. These past actions have also resulted in a long-term change in operational activities, which generate ongoing air pollutant emissions from area-, energy-, and mobile-sources. Present and reasonably foreseeable future actions would have construction and long-term operational air quality emissions. The SFBAAB is in "marginal"[16] nonattainment of the federal 8-hour ozone standards, and "moderate"[17] nonattainment of the federal $PM_{2.5}$ standard (USEPA 2020a). The SFBAAB is in attainment for California standards for CO, $NO_2$, $SO_2$, and sulfates and nonattainment for California standards for ozone, $PM_{10}$ and $PM_{2.5}$, and unclassified for California standards for hydrogen sulfide and visibility reducing particles. Past actions' criteria air pollutant emissions contribute to the regional air quality and attainment status of the SFBAAB. The region's designation as nonattainment for the aforementioned criteria air pollutants is a result of past and present development in the SFBAAB; this regional impact is cumulative rather than attributable to any one source and is a cumulatively significant impact.

Present and reasonably foreseeable future actions also result in the generation of air pollutant emissions from temporary construction and long-term operational activities. Projects within the SFBAAB would adhere to the BAAQMD 2017 Clean Air Plan, as applicable, and comply with the BAAQMD rules and regulations, including dust control measures during construction. The BAAQMD 2017 Clean Air Plan provides a regional strategy for the BAAQMD to continue to maintain as well as progress toward attaining state and federal ambient air quality standards within the SFBAAB, pursuant to the federal Clean Air Act and California Clean Air Act. Federal projects would also be required to comply with the Clean Air Act General Conformity Rule, which is intended to avoid the potential for federal actions to adversely affect local air quality attainment standards. Despite compliance with regulatory requirements, present and future projects would result in emissions within the SFBAAB that contribute to the current nonattainment status of the region. This is a significant cumulative impact.

### Cumulative Effects with the Proposed Action

The Proposed Action would only generate air emissions from temporary demolition-related activity and traffic. Proposed Action construction emissions of criteria air pollutants would not exceed the applicable

[16] Area has a design value of 0.071 up to but not including 0.081 ppm for 8-hour ozone.

[17] Area has a design value of 36 µg/m3 for 24-hour $PM_{2.5}$.

Federal *de minimis* or BAAQMD thresholds. BAAQMD thresholds are more conservative than *de minimis* thresholds and provide a regional context for which to evaluate this Project.

In establishing its recommended significance thresholds, BAAQMD explained as follows in its CEQA Air Quality Guidelines (2017):

> Past, present, and future development projects contribute to the region's adverse air quality impacts on a cumulative basis. By its very nature, air pollution is largely a cumulative impact. No single project is sufficient in size to, by itself, result in nonattainment of ambient air quality standards. Instead, a project's individual emissions contribute to existing cumulatively significant adverse air quality impacts. If a project's contribution to the cumulative impact is considerable, then the project's impact on air quality would be considered significant.
>
> In developing thresholds of significance for air pollutants, BAAQMD considered the emission levels for which a project's individual emissions would be cumulatively considerable. If a project exceeds the identified significance thresholds, its emissions would be cumulatively considerable, resulting in significant adverse air quality impacts to the region's existing air quality conditions. Therefore, additional analysis to assess cumulative impacts is unnecessary.

As detailed in Section 3.2.1, Air Quality, the Proposed Action would comply with applicable rules and regulations for the purposes of reducing air pollutant emissions during construction. The limited emissions from the Proposed Action are substantially below the BAAQMD construction thresholds. As BAAQMD explains, "[i]n developing thresholds of significance for air pollutants, BAAQMD considered the emission levels for which a project's individual emissions would be cumulatively considerable." If a project exceeds the identified significance thresholds, its emissions would be cumulatively considerable, resulting in significant adverse air quality impacts to the region's existing air quality conditions. Therefore, because the construction emissions are below the thresholds, construction of the Proposed Action would not result in a cumulatively considerable contribution to the significant impact of regional air quality, even though there are present and reasonably foreseeable future projects that would contribute air emissions in the same timeframe as the Proposed Action. Further, after completion of the short construction period, there would be no operational activities, and thus no operational air emissions associated with the Proposed Action.

In addition, localized exhaust emissions can result in exposure of sensitive receptors to substantial concentrations of DPM, which can result in health effects. However, dispersion of air emissions during the short construction period would be localized as the emissions would dissipate substantially with distance from the source; for example, concentrations of mobile-source DPM emissions have been shown to be reduced by approximately 60 percent at a distance of around 300 feet [Zhu et.al. 2002], and CARB notes that DPM from high-volume roadways is typically reduced by at least 70 percent at 500 feet (CARB 2005). As detailed in Section 3.2.1, Air Quality, regarding the individual air quality impacts associated with the Proposed Action, no sensitive receptors are located near (within 1,000 feet)[18] the Proposed Action site. Therefore, the DPM emissions generated from construction of the Proposed Action would be insignificant at the sensitive receptors and the Proposed Action would not result in a compounding effect to health risk in combination with other cumulative projects. Moreover, standard fugitive dust suppression protocols would be followed.

Therefore, the temporary air emissions associated with the Proposed Action (no operational impacts), when combined with other past, present, and reasonably foreseeable future actions, would not be cumulatively significant.

#### Cumulative Effects with the No Action Alternative

Under the No Action Alternative, the existing conditions would remain the same and there would be no immediate impact to air quality. Therefore, the No Action Alternative would not contribute to cumulative impacts. However, as detailed in Section 3.2.1, Air Quality, structural collapse would result in an uncontrolled release of fugitive dust and subsequent clean-up would require haul trucks and construction equipment, similar to those needed for the Proposed Action, that would emit criteria air pollutants and DPM, but Tier 4 equipment (which meets more stringent emissions standards and substantially reduces DPM and NOx emissions from construction equipment) may not be available to support these cleanup activities, thereby resulting in an increase in emissions compared to the Proposed Action. It was concluded for the analysis of the No Action Alternative (Section 3.2.1.4, Environmental Consequences) that potential impacts to air quality from the No Action Alternative could be greater than the Proposed Action but would likely not exceed BAAQMD significance thresholds. Therefore, air quality impacts as a result of the No Action Alternative, when combined with past, present, and reasonably foreseeable future actions, would not be cumulatively significant.

### 3.3.3.3 Biological Resources

The geographic area of cumulative analysis for biological resources is ARC (Table 3-16) because direct and indirect effects to biological resources are not anticipated to extend beyond the limits of ARC under either of the alternatives considered. There would be no cumulative impacts to wetlands, sensitive natural

[18] For assessing community risks and hazards, a 1,000-foot radius is recommended by BAAQMD around the project property boundary.

communities, or critical biological habitats because these resources are not present in the Project area (Table 3-18). Therefore, this section only addresses cumulative effects to bat and bird species.

### Cumulative Effects without the Proposed Action

Impacts to biological resources from past actions have already occurred and resulted in the permanent conversion of natural land to a developed landcover. Present and reasonably foreseeable future actions could have noise-related impacts from increased noise levels associated with construction activities in conjunction with vibrational impacts from heavy equipment, and either a temporary or permanent loss of vegetated habitat and/or artificial, anthropogenic infrastructure that could support roosting habitat for bats and nesting/ roosting habitat for birds.

Prior to the European settlement of the San Francisco Bay Area, landcover at ARC was dominated by tidal marsh bayland, which was converted post-European settlement to grassland and agricultural habitats. When considered together, past actions, spanning from the initial construction of ARC to the present, have affected biological resources, including significant loss of natural habitat resulting in the current conditions at ARC. However, cumulative effects of past actions on birds and bats post-construction have likely been minimal, with the exception of burrowing owls as described below. Roosting habitat for bats and nesting habitat for birds (excluding burrowing owls) may historically have been present in the area. The natural habitats, including mature trees and snags (for birds and bats) and tidal marsh (for birds) were either removed or experienced a temporary loss with the development of ARC. With the expansion of ARC, the conversion of tidal marsh bayland-to-grassland habitat may have attracted burrowing owls from the surrounding areas, which would not have inhabited the tidal marsh habitat previously. Altogether, the availability of bat roosting and bird nesting habitat may have been partially restored, albeit artificially, since development of airfield-related infrastructure at ARC, and provides burrowing owls in particular with additional nesting and foraging habitat. With the exception of the burrowing owl, the composition of bird species that presently nest, roost, or forage at ARC have adapted to disturbed or developed habitat and have likely increased with the changes to landcover from natural to developed habitat over time (Steve Rottenborn, HT Harvey & Associates, personal communication). However, these urban-adapted species only replaced the original, more variable composition of tidal marsh bird species that would have historically occupied the native bayland habitat previously. The present populations of bird (excluding the burrowing owl) and bat species potentially impacted by the cumulative projects (Table 3-17) are more adapted to urban environments and are generally common and abundant; their population numbers are not expected to decline following the completion of cumulative projects.

Unlike other urban-adapted bird species expected in the region, burrowing owls have experienced a significant population decline, especially the San Francisco Bay Area population whose number of nesting pairs decreased by approximately 28 percent between 1991 and 2007 (DeSante et al. 2007, Wilkerson and Siegel 2010). ARC represents one of only five known breeding locations in the San Francisco Bay Area. Although ARC population numbers remained relatively stable between 2000 and 2010, between 2014 and 2016 there was a marked decline of more than 50 percent of the population at ARC and at an additional two of the four other breeding locations in the San Francisco Bay Area (NASA 2022). The present population of burrowing owls potentially impacted by the cumulative projects are sensitive to disturbance and are under pressure from loss of habitat by development. Because the cumulative projects would result in more disturbance, loss of marginal habitat, and increase the presence of humans near breeding areas, the population of burrowing owls at ARC could be adversely affected by the completion of cumulative projects.

The cumulative effects on biological resources from present and reasonably foreseeable future actions include effects on wildlife and vegetation. Such effects could include the introduction of non-native, invasive, or urban-adapted predatory species (e.g. weeds, domestic cats, Norway rats); additional loss and removal of habitat associated with grading, new development, and clearing of vegetation; disruption to wildlife habitat from increased human presence or noise; and direct impacts as a result of the removal of occupied habitat (i.e., viable nests or roosts in vegetation or ground nests impacted by construction or maintenance equipment) for new developments.

The demolition of existing structures and the construction of future structures associated with present and future projects could result in the removal and introduction of artificial, anthropogenic infrastructure that act as incidental bat roosting and bird nesting habitat. However, the demolition and construction of these structures would be considered inconsequential for species populations overall because of the highly disturbed, sterile nature of a built environment where the natural prey base (e.g., insects, seeds) and habitat complexity (e.g., vegetative cover from predators, perching habitat, water sources) are greatly reduced, if not absent. Bat and bird species that would be displaced by present and future projects (e.g., USGS Lab, NASA Housing, UC development) at NASA ARC already have ample artificial, anthropomorphic infrastructure in the built environment to accommodate relocation within ARC and the surrounding area. Where cumulative projects would be located in areas that are less developed, such as EAIP and Bay View, NADP and project specific mitigation measures would mitigate these projects' effects on protected resources such as bat and bird species, including burrowing owls. Therefore, the cumulative impacts on bat and bird species of past, present, and reasonably foreseeable future projects would be less than significant.

### Cumulative Effects with the Proposed Action

The Proposed Action has the potential to increase the cumulative effect on biological resources described above through the additional demolition of artificial, anthropogenic infrastructure that acts as incidental bat roosting and bird roosting and nesting habitat. However, the incremental biological impacts of the Proposed Action would be limited in time and space to the structure and location of Hangar 3; specifically, the localized removal of artificial, anthropogenic infrastructure that provides roosting and nesting habitat, and the permanent displacement of roosting/nesting individuals outside of the sensitive breeding seasons. While H3 is a large structure, it is relatively small given the extensive presence of development at the Project site. With the inclusion of 14 mitigation measures addressing burrowing owls, other nesting and roosting birds, and bats (BIO-1A through BIO-3D), the Proposed Action would not be cumulatively significant.

There would be no long-term cumulative impacts because there would be no operational activities associated with the Proposed Action after demolition activities were completed. Therefore, cumulative impacts to biological resources associated with the Proposed Action, when combined with past, present, and reasonably foreseeable future actions, would not be significant.

### Cumulative Effects with the No Action Alternative

Under the No Action Alternative, existing conditions would remain the same and there would be no immediate impact to wildlife. The recommended mitigation measures (BIO-1A through BIO-3D) to avoid the direct injury or mortality of bats and birds would not be necessary for the No Action Alternative. However, in the event of a structural failure, potential impacts would be uncontrolled and unmitigated, resulting in greater direct and immediate impacts to wildlife in the vicinity of the Project site as mitigation measures identified for the Proposed Action would not be implemented. Therefore, wildlife impacts could be significant as the No Action Alternative could result in the loss of bird eggs or nestlings, the death or injury of a burrowing owl (if present in debris or materials near the hangar), and the injury or mortality of bats within a roost site in Hangar 3, thus violating the MBTA and/or CFGC or potentially affecting the regional population of burrowing owls. Therefore, impacts to biological resources associated with the No Action Alternative, when combined with past, present, and reasonably foreseeable future actions, could be cumulatively significant.

## 3.3.3.4 Cultural Resources

The geographic area of cumulative analysis for cultural resources is the APE for the Project (Appendix C, Section 106 Report), which includes the NAS Sunnyvale Historic District and portions of the City of

Sunnyvale to the east, including the Lockheed Missile & Space Division Campus (Table 3-16). There would be no cumulative impacts to tribal cultural resources as these resources are not present within the APE (Table 3-18). In addition, because there would be no subsurface work for either the Proposed Action or No Action Alternative, effects to archaeological resources would not be anticipated. If subsurface work were to occur under either alternative, compliance with NASA's Integrated Cultural Resource Management Plan protocol for inadvertent discovery would be required. Therefore, this section only addresses cumulative effects to architectural resources for both alternatives.

### Cumulative Effects without the Proposed Action

Past actions, spanning from the initial construction of the MFA to the present, may have had adverse effects on cultural resources resulting in the current conditions in the APE. Recent past actions (see Table 3-17), including repairs to Hangar 2 and Hangar 3, as well as other building improvements, developments, and maintenance activities may have incrementally affected the historic integrity of historic properties in the APE, including the NAS Sunnyvale Historic District and its contributors, of which Hangars 1, 2, and 3 are individually eligible historic properties. In terms of potential effects from present and reasonably foreseeable future projects, three cumulative projects, the Bay View Project, NASA Housing Project, and UC Development, would not directly affect the Historic District or any other historic properties, and indirect effects to historic properties within the APEs of those projects, particularly due to visual intrusions, would not be adverse. Four reasonably foreseeable future projects would occur within the Historic District, including the Hangar 1 Rehabilitation and Recladding Project, the Airside Fuel Farm Project, the USGS Lab on NRP Parcel 15, and the EAIP and thus could have compounding effects to cultural resources. The Hangar 1 Rehabilitation and Recladding Project would improve Hangar 1, an individually eligible historic property in the APE and a contributor to the Historic District, in conformance with the Secretary of the Interior's Standards for Rehabilitation and would not adversely affect the Historic District. The Airside Fuel Farm Project would install new aboveground fuel storage tanks and other fueling facilities adjacent to the East Aircraft Parking Apron, a contributing feature of the Historic District, but would not alter the feature or adversely affect the Historic District. The USGS Lab on NRP Parcel 15 would entail the infill construction of a modern building in proximity to Shenandoah Plaza and adjacent to several contributors to the Historic District; however, the design of the new building was determined to conform with the Secretary of the Interior's Standards for Rehabilitation and would not adversely affect the Historic District.

The EAIP would alter an area within the Historic District that partially overlaps the APE and includes eligible contributors Building 69, the East Aircraft Parking Apron, Hangar 2, Hangar 3, Buildings 55, 70-74, and 143-147, and the Naval Storage Depot. The EAIP would demolish Building 69, alter the East

Aircraft Parking Apron, and alter the setting of the surrounding contributors, resulting in a loss of integrity and adversely affecting the Historic District. To resolve these adverse effects, an MOA would be developed through the NHPA Section 106 consultation process.

Although the EAIP would diminish its historic integrity through loss and alteration of a small portion of contributors, overall, the combined effects of these projects on the Historic District would not diminish its historic integrity. Despite the EAIP's adverse effects, the Historic District would not be substantially altered and would continue to qualify for listing on the NRHP, because the majority of remaining contributors would be unaffected and would retain sufficient historic integrity to convey its significance. Therefore, the cumulative impact to cultural resources from past, present, and reasonably foreseeable future projects without the Project would be less than significant.

### Cumulative Effects with the Proposed Action

The Proposed Action would have adverse effects on Hangar 3, the NAS Sunnyvale Historic District, and other contributors to the Historic District, as described above in Section 3.2.3.4, Environmental Consequences. The demolition of Hangar 3 would eliminate the individually eligible historic property; no future actions would further affect this individual resource. The Proposed Action would also result in indirect effects from the loss of Hangar 3 on the setting of surrounding contributors on the east side of the airfield near Hangar 3, which would diminish the historic integrity of the Historic District.

The Proposed Action in combination with the EAIP (the only cumulative project to adversely affect the Historic District) would further diminish the Historic District's historic integrity due to the additional loss of a contributor and the indirect effects of that loss on the setting of surrounding contributors. Despite these additional effects, the Historic District would continue to qualify for listing in the NRHP, because the majority of remaining contributors would be unaffected and would retain sufficient historic integrity to convey their significance. Each cumulative project that results in an adverse effect must involve consultation with the SHPO and other entities and the development and execution of an MOA as part of the NRHP Section 106 consultation process. This process would address the adverse effects on the Historic District or other historic properties before the projects could be approved. As a result, although the EAIP and the Proposed Action would diminish the Historic District's integrity, the MOAs would provide the requisite measures to resolve the adverse effects on historic properties. Therefore, the cumulative impact to cultural resources from past, present, and reasonably foreseeable future projects when combined with the Proposed Action would be less than significant.

### Cumulative Effects with the No Action Alternative

Under the No Action Alternative, there would be no disturbance to the existing environment associated with demolition of Hangar 3. The existing conditions would remain the same and no contribution to cumulative impacts to cultural resources would occur. However, in the event of a structural failure, significant impacts to the NAS Sunnyvale Historic District and its contributors in the vicinity could occur due to the collapse of Hangar 3. No protections afforded by the Section 106 process or an executed MOA would address and resolve potential adverse effects on Hangar 3 or the Historic District. Therefore, the No Action Alternative when combined with past, present, and reasonably foreseeable future actions could result in significant cumulative impacts to cultural resources.

## 3.3.3.5 Greenhouse Gases and Climate Change

Unlike criteria air pollutants and toxic air contaminants that tend to have localized or regional impacts, GHG emissions tend to disperse more broadly and are more of a global concern because of their relatively longer atmospheric lifetimes compared to air pollutant emissions. The total amount and types of GHG emissions, regardless of their location, have the most significant effect on climate change globally. Therefore, GHG emissions are cumulative in nature and the geographic area of cumulative analysis for GHG and climate change is global (Table 3-16).

### Cumulative Effects without the Proposed Action

In its CEQA Air Quality Guidelines (2017), BAAQMD explains:

> Similar to regulated air pollutants, GHG emissions and global climate change also represent cumulative impacts. GHG emissions contribute, on a cumulative basis, to the significant adverse environmental impacts of global climate change. Climate change impacts may include an increase in extreme heat days, higher concentrations of air pollutants, sea level rise, impacts to water supply and water quality, public health impacts, impacts to ecosystems, impacts to agriculture, and other environmental impacts. No single project could generate enough GHG emissions to noticeably change the global average temperature. The combination of GHG emissions from past, present, and future projects contribute substantially to the phenomenon of global climate change and its associated environmental impacts.

The construction of past actions, including repairs to Hangars 2 and 3, 5th Avenue Gate Improvements, Bus Maintenance Facility, the CAANG 129$^{th}$ Rescue Wing project, and US 101 Northbound Off-Ramp at Moffett Boulevard Improvements, have already occurred but the GHG emissions generated from such actions persist in the atmosphere. Ongoing operational activities associated with past actions, such as energy and water consumption, waste generation, and vehicle trips, result in the ongoing generation of GHG emissions. Present and reasonably foreseeable future actions would result in the generation of GHG emissions from temporary construction and long-term operational activities, a portion of which could be generated concurrently with those resulting from implementation of the Proposed Action. As described by the BAAQMD, no single project would generate a level of emissions that would individually change the global climate; instead, GHG emissions are inherently cumulative as the combination of GHG emissions from past, present, and future projects have contributed to and will contribute to the significant impact of global climate change.

### Cumulative Effects with the Proposed Action

As discussed in Section 3.2.4, Greenhouse Gases and Climate Change, the Proposed Action's GHG emissions were quantified and determined to be less than the federal Mandatory Reporting Threshold. In addition, the Proposed Action's GHG emissions were determined to occur over a short construction duration and the Proposed Action would also provide a benefit of eliminating mobile source GHG emissions from ongoing vehicle and equipment use for repairs and maintenance to the existing structure. Therefore, while the geographic area of consideration for this cumulative impact analysis is global in scale, and although the combination of past, present, and reasonably foreseeable future actions globally result in the cumulatively significant impact of climate change, the Proposed Action's contribution to cumulative GHG emissions and climate change impacts would result in a less than significant contribution to the significant cumulative impact to global climate change.

### Cumulative Effects with the No Action Alternative

Under the No Action Alternative, the existing conditions would remain the same and there would be no immediate impact to GHG emissions and climate change. However, some mobile source GHG emissions would be created by ongoing repair and maintenance. Further, in the event of a structural failure, GHG emissions would be generated from vehicles and equipment used in clean-up activities. However, clean-up activities would be temporary, and there would be no long-term operational activities and, therefore, no long-term generation of GHG emissions would be expected to occur once clean-up was completed. In the event of a structural failure, vehicle and equipment use would not be substantially different in scale than that anticipated under the Proposed Action. Therefore, although the combination of past, present, and reasonably foreseeable future actions globally result in the cumulatively significant impact of climate change, the No Action Alternative's contribution to cumulative GHG emissions and climate change impacts would be less than cumulatively considerable.

#### 3.3.3.6 Hazards, Safety, and Waste Management

The geographic area of cumulative analysis for hazards, safety, and waste management is ARC (Table 3-16) because direct and indirect effects to these resources are not anticipated to extend beyond the limits of ARC under either of the alternatives considered. There would be no cumulative impacts related to hazards and safety (Table 3-18) because of existing regulations governing hazards and worker safety and AMM-1: EIMP, which would also apply to the cumulative projects (a specific EIMP or use of the ARC-wide EIMP is required for all NASA lessees). Therefore, the discussion below addresses cumulative effects for waste management only.

##### Cumulative Effects without the Proposed Action

Past projects have contributed to the available capacity at the nearby hazardous waste and sanitary waste landfills. Although population and employment increases in the region have increased the volume of wastes, state regulations requiring greater recycling, composting, and other actions to divert wastes from landfills have extended the capacity of these facilities, in combination with approvals from the landfill operators to expand their operations. These facilities include Zanker Recycling or Guadalupe Landfill, Kettleman Hills Hazardous Waste Facility, and/or US Ecology Nevada, Inc. As of 2012, the Zanker Landfill has a remaining capacity of 640,000 cubic yards for municipal solid waste (CalRecycle 2019). The Kettleman Hills facility has a remaining capacity of approximately 4.9 million cubic yards for hazardous materials (WM, Inc. 2020). The US Ecology facility had approximately 45.5 million cubic yards of remaining permitted capacity as of December 2018 for both municipal and hazardous wastes (US Ecology, Inc. 2019).

Present and reasonably foreseeable future actions would increase the demand on these facilities. Many of the present and reasonably foreseeable future actions include demolition of existing buildings and would include the disposal of construction debris and materials. Federal requirements for waste management are contained in the Resource Conservation and Recovery Act (Subtitles C and D), but generally rely on local and state ordinances and regulations to implement measures to divert or recycle wastes. California, as part of its efforts to address climate change, requires businesses, multifamily complexes, state universities, and government entities that generate more than 4 cubic yards of waste to recycle. More specifically, under the California Green Building Standards Code, Title 24, Part 11, construction projects must recycle and/or salvage for reuse a minimum of 65 percent of the nonhazardous construction and demolition waste in accordance with Section 5.408.1.1, 5.408.1.2, or 5.408.1.3; or meet a local construction and demolition waste management ordinance, which ever is more stringent. Additionally, per Section 5.410.1 of the California Green Building Standards Code, Title 24, Part 11, once operational, each project would be required to provide readily accessible areas that serve the entire building and are identified for the depositing, storage, and collection of non-hazardous materials for recycling or meet a lawfully enacted local recycling ordinance, if more restrictive. Due to regulations for construction and debris diversion, recycling, and the remaining capacity of over 50 million cubic yards in the three landfills that would serve the cumulative projects, it is anticipated that the construction and operational wastes from these cumulative projects could be accommodated and the cumulative impact to waste management would not be significant.

### Cumulative Effects with the Proposed Action

The Proposed Action would adhere to all applicable regulations and the associated standard protocols and procedures for the management and disposal of waste from demolition activities. As described in Section 3.2.5, Hazards, Safety, and Waste Management, the Proposed Action would generate approximately 24,375 cubic yards of waste and thus would contribute incrementally to the cumulative impact from development at ARC. However, 65 percent of the non-hazardous waste from the Proposed Action would be recycled in accordance with the California Green Building Standards Code, Title 24, Part 11. Even if all of the waste associated with the Proposed Action were to be disposed of at the landfills stated above, the incremental demand on these facilities would not be cumulatively considerable. The cumulative effect with other present and reasonably foreseeable future projects would not exceed the landfill capacities and therefore the cumulative effect with the Proposed Action would be less than significant.

### Cumulative Effects with the No Action Alternative

Under the No Action Alternative, existing conditions would remain the same, and no impacts related to waste would occur. Under these conditions, the No Action Alternative would not contribute to cumulative waste impacts at ARC. However, in the event of a structural failure, the No Action Alternative would result in a waste volume similar to the Proposed Action as described in Section 3.2.5, Hazards, Safety, and Waste Management, and therefore, cumulative effects on waste management and disposal at sanitary landfills would be similar to that described above for the Proposed Action. If there was a structural failure, the No Action Alternative could result in the uncontrolled release and exposure of hazardous materials, including those containing asbestos, lead, and PCB. The No Action Alternative would not include hazard abatement activities described under the Proposed Action. As such, if there was a structural failure, the No Action Alternative could potentially release hazardous materials causing greater risk to human health and the environment compared to the Proposed Action and could be cumulatively significant.

### 3.3.3.7 Noise and Vibration

The geographic area of cumulative analysis for noise and vibration is ARC (Table 3-16) because direct and indirect effects to these resources are not anticipated to extend beyond the limits of ARC under any of the alternatives considered.

#### Cumulative Effects without the Proposed Action

Noise impacts from past actions, including repairs to Hangars 2 and 3, 5th Avenue Gate Improvements, Bus Maintenance Facility, US 101 Northbound Off-Ramp at Moffett Boulevard Improvements, and the CAANG 129$^{th}$ Rescue Wing project, have already occurred and are a component of the ambient background conditions at ARC. Present and reasonably foreseeable future actions would contribute to these background conditions, but the overall contribution to ambient noise levels would be largely localized because noise impacts attenuate with distance. Thus, cumulative projects with similar construction schedules (e.g., Hangar 1 Rehabilitation and Recladding, USGS Lab, and NASA Housing in the NRP area and the Airside Fuel Farm and the EAIP on the east side of the airfield) could temporarily increase ambient conditions in these areas of ARC, but the impacts would be temporary and limited to nearby sensitive receptors. The most prominent change would be due to the operational vehicular traffic noise generated by the cumulative projects. However, these changes are not likely to be noticeable since even a doubling of traffic volumes would only increase noise levels by 3 dB, which is barely perceptible and unlikely to trigger complaints by occupants of noise-sensitive land uses along the roadways as described in Section 3.2.6, Noise and Vibration. Therefore, the cumulative construction noise impacts without the Project would be noticeable in portions of ARC, but because of their localized and temporary nature would not be cumulatively significant. The long-term cumulative operational noise effects would be from traffic noise, which would not increase ambient conditions substantially. Therefore, cumulative noise impacts without the Proposed Action would be less than significant.

The cumulative projects would not be located close enough to each other to result in physical damage due to vibration. Therefore, cumulative vibration impacts without the Proposed Action would be less than significant.

#### Cumulative Effects with the Proposed Action

The incremental noise effects from the Proposed Action would only occur during the limited timeframe for the removal of Hangar 3 (approximately 9 months). Of the cumulative projects that are near the Proposed Action, only the Airside Fuel Farm and possibly the initial phases of the EAIP have similar construction schedules as the Proposed Action. As shown in Table 3-12, worst-case Leq noise levels associated with the demolition of Hangar 3 were calculated at 67.3 dB(A) at the golf course, 51.2 dB(A) at the Bay Trail, and 47.6 dB(A) at Wescoat Village. Combined noise levels from the construction of the Airside Fuel Farm and the EAIP could reach levels of 78.6 dB(A) Leq at the golf course, 54.1 dB(A) at the Bay Trail, and 48.9 dB(A) at Wescoat Village. Using the principles of decibel addition, Leq noise levels at the golf course, Bay Trail, and Wescoat Village could be increased to 78.9 dB(A), 55.9 dB(A), and 51.3 dB(A), respectively. Even with three active construction projects occurring simultaneously, and using a worst-case scenario, noise levels at all closest noise-sensitive receptors would be expected to be below the Residential Daytime level of 80 dB(A) Leq (8 hour) impact threshold as defined in Table 3-12.

The NASA Housing Project would be located approximately 4,710 feet southwest of Hangar 3. While distant from the Proposed Action in terms of noise impacts (because of the attenuation of noise with distance from the source), this EA examines the potential for cumulative effects of the housing project with that of the Proposed Action. Worst-case noise levels generated from the Project's demolition (Pre-Demolition Activities Phase 1) were calculated at 48.6 dBA Leq at the future NASA Housing Project. Construction noise levels generated on the NASA Housing Project site could be as loud as 95 dBA Leq, depending on the construction equipment used and the distance from the equipment. Using standard logarithmic addition, the noise generated from the demolition activities at Hangar 3 would not increase the noise generated from the construction of the NASA Housing Project. Therefore, demolition noise from the Hangar 3 Building Demolition Project in combination with construction noise from the future NASA Housing Project would not result in a significant cumulative impact to the surrounding community, particularly residents of Wescoat Village.

Thus, the cumulative effect with the Proposed Action would be temporary and limited to the eastern portion of the MFA where users of the Bay Trail and the golf course, who are transient and would not be affected for the duration of construction, are the only sensitive receptors. The incremental traffic noise from construction traffic would not be noticeable compared to ambient conditions, and worst-case noise effects from demolition activities would not be significant. Furthermore, the Proposed Action also would adhere to noise and vibration protection measures as specified in AMM-2. There would be no long-term noise effects from the Proposed Action, which does not include any operational activities after construction and demolition activities are completed.

Therefore, given the limited and temporary nature of the noise impacts as a result of demolition activities (i.e., no operational effects), the cumulative effect of the Proposed Action with other present and reasonably foreseeable future projects would be less than significant.

The cumulative projects would not be located close enough to Hangar 3 or each other to result in physical damage due to vibration. Therefore, cumulative vibration impacts with the Proposed Action would be less than significant.

#### Cumulative Effects with the No Action Alternative

Under the No Action Alternative, existing conditions would remain the same, and no impacts related to temporary construction noise would occur. Under these conditions, the No Action Alternative would not contribute to cumulative noise or vibration impacts at ARC. In the event of a structural failure, there may be instantaneous loud noise from the structural collapse that would be temporary and short-term and may be higher than the acceptable noise levels defined in the General Plans for the City of Mountain View and the City of Sunnyvale. In addition, depending on the level of emergency response required, there could be nighttime and weekend activity noise generated that is not contemplated under the Project. However, these noise impacts would not be considered significant since they would be temporary and short-term. Noise levels from worker and truck trips would be expected to be similar to the Proposed Action and thus would not be significant. However, sudden collapse could have an adverse impact on surrounding structures if vibration levels were to exceed 0.25 in/sec PPV then damage to nearby structures and utilities could result. Despite these project alternative-specific impacts, it is not possible to anticipate when this event might occur and whether there could be cumulative impacts with other projects in Hangar 3’s immediate vicinity. Because the impacts would be sudden and a one-time temporary event, it is not expected that this scenario, in combination with past, present, and reasonably foreseeable future actions, would result in a significant cumulative noise or vibration impact.

### 3.3.3.8 Transportation and Circulation

The geographic area of cumulative analysis for transportation and circulation includes intersections in the cities of Mountain View and Sunnyvale and streets within ARC as identified in Appendix E, Traffic Analysis Memorandum (Table 3-16). This analysis area was chosen based on the location of these intersections and streets, which provide access to the MFA (see Appendix E, Traffic Analysis Memorandum). There would be no cumulative impacts on transit, bicycle and pedestrian circulation, emergency access, or parking because these resources would not be affected by the Project (Table 3-18) and because circulation and access would continue to be provided in accordance with AMM-3: Construction Traffic Control Plan. Therefore, the discussion below addresses cumulative effects to traffic only.

## Cumulative Effects without the Proposed Action

Past actions including repairs to Hangars 2 and 3, 5th Avenue Gate Improvements, Bus Maintenance Facility, US 101 Northbound Off-Ramp at Moffett Boulevard Improvements, and the CAANG 129th Rescue Wing project would have affected transportation facilities temporarily by increasing construction traffic during repairs. There were also changes in the vehicle mix and local circulation because of increased bus traffic within the project area and better access and circulation at the 5th Avenue Gate that also alleviated traffic congestion at the Ellis Street interchange. As shown in Section 3.2.7, Transportation and Utilities, and Table 3-15, existing conditions and future background conditions in 2022 (including a two-percent-per-year increase in traffic volumes to account for background growth) for ARC and nearby streets and intersections show acceptable levels of service.

Present and future actions would result in an increase in traffic on streets and at intersections, both within ARC and offsite, due to construction and operation of those projects. Given the scale and intensity of the cumulative projects, it is reasonable to assume that the cumulative operational impacts could be significant without the Project. The Bay View, NASA Housing, and UC projects collectively account for 5.5 million sf of present and foreseeable development over approximately 125 acres on the western portion of ARC and would be expected to increase trips and travel on local ARC streets, at the Ellis Street Gate, and on the nearby highways and local streets providing access to ARC. Over the short-term (through 2023), cumulative traffic impacts from projects at ARC would be construction related, involving truck movements for delivery of construction materials and equipment and hauling of construction debris, as well as arrival and departure of construction personnel. These cumulative trips would result in congestion on local streets, intersections, and highways providing access to ARC. Although temporary, it is expected that the cumulative impacts from present and foreseeable projects could be significant.

## Cumulative Effects with the Proposed Action

Because there is no operational use of the Hangar 3 site, cumulative effects to traffic from the Proposed Action would be limited to the construction period. As noted in Section 3.2.7, Transportation and Circulation, peak trip generation for the Proposed Action would occur during Phase 2, which is anticipated to occur in 2022. Baseline traffic volumes for 2022 incorporate a growth factor (two percent per year), commuter bus use of the 5th Avenue Gate (30 percent of commuter bus traffic), as well as construction traffic from present and future projects that are anticipated to overlap with construction of the Project. These projects include Hangar 1 Rehabilitation and Recladding and EAIP. With the additional peak-hour traffic predicted from the Proposed Action, off-site study intersections would operate at LOS D or better during the AM and PM peak hours under 2022 background conditions.

With respect to onsite construction traffic, the Proposed Action would adhere to AMM-3: Construction Traffic Control Plan to ensure construction traffic does not block access to nearby users and coordination occurs with other construction activities during the same time period. Similar avoidance and minimization measures would also apply to other cumulative projects that would use the 5th Avenue Gate (EAIP, Airside Fuel Farm) and would enable NASA to monitor, coordinate, and control the construction traffic so the cumulative construction traffic impact at the 5th Avenue Gate would be less than significant. Although such similar measures would apply to the cumulative projects at ARC to the west of MFA, the number and scale of those projects are much greater. The use of the Ellis Street Gate by construction workers coming and going to Hangar 3 as a result of the Project would be greatest during Phase 2 but would contribute only 2 trips during the AM and PM peak hours. Therefore, the impact to onsite circulation and the Ellis Street Gate as a result of the Proposed Action would not be cumulatively significant.

Construction and/or operation of the project and other cumulative projects would generally increase traffic along onsite roadways. Because the onsite roadway network operates well below capacity and is used only by site-related traffic (through access is not permitted), impacts to onsite circulation would not be cumulatively significant. Construction activities associated with some of the cumulative projects—such as potential recycled water pipeline construction along Macon Road for the NASA Housing project—may require temporary partial closures of certain onsite roadways from time to time. However, impacts associated with partial closures would typically be limited in scope and duration and would dissipate upon re-opening of the roadway. Application of AMM-3 to project-related construction activities and of similar measures to other cumulative projects would address temporary impacts to on-site circulation and ensure that the cumulative impacts to roadways remain less than significant.

### Cumulative Effects with the No Action Alternative

Under the No Action Alternative, there would be no incremental traffic effects on the existing environment as would occur under the Proposed Action. Therefore, under the No Action Alternative, there would be no cumulative traffic impacts. However, in the event of a Hangar 3 structural failure, there would be temporary construction traffic for remediation and clean-up activities that would compound with the effects of other traffic on the streets and highways. Under this scenario, the No Action Alternative would result in similar contributions to traffic and congestion as the Proposed Action, because debris removal efforts under the No Action Alternative would be expected to be similar to demolition efforts under the Proposed Action.

If a structural failure under the No Action Alternative were to occur in 2022, the cumulative effect with other present and reasonably foreseeable future projects would not result in significant traffic impacts to off-site intersections and on-site streets. However, if a structural failure were to occur in a year when there was additional traffic due to the construction and/or operation of other present or future projects, traffic impacts could be different; predicting specific traffic levels and thus traffic impacts would be too speculative at this time.

### 3.3.3.9 Utilities

The geographic area of cumulative analysis for utilities is ARC (Table 3-16) because direct and indirect effects to utilities are not anticipated to extend beyond the limits of ARC under either of the alternatives considered. There would be no cumulative impacts to utilities under the Proposed Action (Table 3-18) because the Project would not result in the removal of any utilities that affect other areas or buildings, no additional demand would result from the Project, and the Project would include measures to protect utilities during construction. However, there would be impacts to utilities under the No Action Alternative. Thus, the discussion below addresses cumulative effects to utilities as a result of the No Action Alternative only.

#### Cumulative Effects without the Proposed Action

Past actions have resulted in the existing use, capacity, and distribution of utilities at ARC. These past actions have resulted in the installation of new utility lines, upgrades to or replacement of aging utility infrastructure, capping or otherwise decommissioning utility infrastructure, and increases in utility demand. Present actions in the vicinity of the project area and reasonably foreseeable future actions would result in similar impacts to utilities due to additional development and demolition of unused facilities. The scale, intensity, and size of the present and foreseeable projects would be expected to increase demand and expansion of the utility infrastructure at ARC. In close proximity to Hangar 3, the EAIP would result in new utility lines (water, reclaimed water, stormwater and sewer) adjacent to Hangar 3, as well as new electrical and telecommunication lines immediately north of Hangar 3. It is anticipated that for all projects at ARC, coordination with federal agencies and local utilities would occur and BMPs would be implemented to prevent potential interruptions in service.

#### Cumulative Effects with the No Action Alternative

Under the No Action Alternative, there would be no disturbance to the existing environment associated with Project activities including pre-demolition, demolition, and waste removal and recycling. In the event of a structural failure, impacts to utilities could be potentially significant as utility connections to Hangar 3 would not be capped or disconnected systematically and could result in the inadvertent loss of service or damage to critical infrastructure such as water lines connecting to Hangar 3 and NASA telecommunication lines that lie underneath the Hangar 3 concrete slab. Additionally, disruption or damage to utility infrastructure could impact service to other MFA users, including the CAANG facility and the future EAIP (during construction or operation) as this project would use existing utility infrastructure surrounding Hangar 3 and would include new infrastructure around the Hangar 3 site. Other current and future projects may also rely on utility infrastructure that could be affected by a structural collapse of Hangar 3. Therefore, the cumulative effect of the No Action Alternative with other present and reasonably foreseeable future projects could be potentially significant.

### 3.3.3.10 Visual Resources

The geographic area of cumulative analysis for visual resources is ARC (Table 3-16) because direct and indirect effects to visual resources are not anticipated to extend beyond the limits of ARC under either of the alternatives considered.

#### Cumulative Effects without the Proposed Action

Past actions including repairs to Hangars 2 and 3, 5th Avenue Gate Improvements, Bus Maintenance Facility, the CAANG 129$^{th}$ Rescue Wing Project, and US 101 Northbound Off-Ramp at Moffett Boulevard Improvements did not result in significant changes to the existing visual landscape as these projects involved minor improvements to existing facilities within MFA. The overall existing visual context of ARC is defined by several visually prominent features that dominate both distant and close-up views: the three historic hangars (approximately 170 to 200 feet tall) built between the 1930s and the start of World War II, the 80x120 wind tunnel building (approximately 80 feet tall) built in the late 1980s, and the level, wide open paved expanses of the airfields, and undeveloped land to the northwest and the golf course that opened in 1959 to the northeast of Hangars 2 and 3. This visual setting has remained relatively stable for the past 30 years with mostly minor, localized modifications as individual buildings were upgraded or replaced.

Present actions (i.e., Hangar 1 Rehabilitation and Recladding, Bay View Project, Airside Fuel Farm, NASA Housing Project, USGS Lab) and reasonably foreseeable future actions would involve development that cumulatively would alter the existing visual character of ARC by increasing the scale, mix, and intensity of development, primarily in the western portion of ARC. The addition of 1.1 million sf of development associated with Bay View in the northwest portion of ARC, 2.7 million sf, primarily in nearly 2,100 dwelling units, as part of the NASA Housing Project along US 101 in the NRP area, and the new UC development, also in the NRP area, would intensify the development pattern, extending it further to the north (Bay View) and within the NRP area.

These changes to the visual character of ARC, however, would not be particularly visible nor substantially alter views and the changes to the views of ARC resulting from past, present, and reasonably foreseeable future development would not be considered adverse. Views of ARC from higher elevations to the southwest, south, and southeast are distant (more than 2 miles) with few wide, panoramic views of ARC. At this distance, the infill development projects would be barely distinguishable from the broader landscape, although taller buildings that may be developed as part of the NASA Housing Project and the UC development may be identifiable. In general, the present and foreseeable development would blend in with the existing buildings and structures, and at the higher elevations would not obstruct views of the San Francisco Bay or the ridgelines and hillsides of the Diablo Range on the east side of the bay. At lower elevations, distant and close-up views would be obstructed by intervening buildings, highways, and vegetation. There would be occasional intermittent views of portions of ARC but no direct, sustained views that encompass the entire ARC with the cumulative projects.

Views from the nearby freeways are largely limited – occasional distant views of MFA are available from SR 237. These views are largely intermittent and obstructed by the mid-rise, high-tech buildings between SR 237 and ARC. Only at the overcrossing of US 101 are there direct views of ARC, but at this location, ARC is not in the direct viewshed of the motorists. Rather, travelers would need to look towards the north to see get a wider view of ARC. From this location and from US 101 below, which has a more direct northward view towards ARC, the views would not encompass all of the present and foreseeable development. At these locations, which are slightly elevated above the airfield, the development pattern is low-rise, with a strong horizontal element defined by the generally low-rise buildings and trees at ARC, punctuated by Hangar 1, the 80x120 wind tunnel building, and potentially mid-rise development from the NASA Housing Project and the UC development. The latter two projects, in combination with the Hangar 1 Rehabilitation and Recladding Project, would be partially visible and alter the visual landscape for US 101 travelers. The low-rise structures around the existing ballfields would be replaced with multi-story buildings. As travelers come closer to the cumulative project sites, the visual change would be less evident because of intervening vegetation along the north side of US 101 that screens most close-up views.

Because of their height and scale, Hangars 1, 2 and 3, along with the surrounding open area defined by the airfields and the golf course, would continue to be the defining features of the visual setting. The addition of EAIP improvements would increase the amount of development, but would not introduce a substantial alteration, since these improvements would not alter the coherence, vividness, or primary views from US 101 or the Bay Trail. For example, the proposed EAIP would include the demolition and removal of structures, construction of a private hangar, modifications to an existing bus maintenance facility, and construction of a battery energy storage system within MFA. Development associated with the proposed EAIP would not substantially alter the existing visual character or scenic quality of public views toward ARC. The western portion of ARC is already highly developed and the projects in the NRP area would not be visually prominent from the Bay Trail KOPs; therefore, it is unlikely that other present or reasonably foreseeable future actions would substantially alter the existing visual character or scenic quality of public views toward ARC. These projects would appear as part of the larger ARC landscape. Therefore, cumulative impacts on visual resources would be less than significant.

### Cumulative Effects with the Proposed Action

The incremental visual impacts of the Proposed Action would be a noticeable permanent change to the visual setting. The recognizable and memorable distant, mid-range, and close up views of the pair of historic wood hangars would be altered with the removal of Hangar 3 under the Proposed Action. As described above, there are limited vantage points from which cumulative changes at ARC would be noticeable, none of which are mid-range or close up. From the closer vantage points (i.e., KOP 1 through 4), Hangar 2 would become the focal point. The visual setting would be defined by Hangar 2 with the wide-open expanses of the airfields and wooded golf course. There would be only limited glimpses of the other cumulative projects. Thus, the cumulative impacts from mid-range and close-up viewpoints would generally be the same as those described for the Proposed Action – less than significant.

From more distant vantage points in the higher elevations, the cumulative effect without Hangar 3 would be predominantly the same as the cumulative effect with Hangar 3 – that is, a more urban, intensely developed ARC west of the airfields and aircraft-related uses, openness, and Hangars 1 and 2 next to the airfield. Because the overall visual landscape across ARC would generally be the same, views of the Bay would be retained, views across the Bay to the Diablo Range would still be available, and there would be relatively few available sustained views of the entire ARC. The cumulative visual impacts with the Proposed Action for distant views also would be less than significant.

### Cumulative Effects with the No Action Alternative

Under the No Action Alternative, there would be no change to Hangar 3 and the cumulative visual impact would be identical to that described for the visual landscape and views under cumulative effects without the Proposed Action. In the event of structural failure, potential damage to Hangar 3 would be uncontrolled and could affect other nearby structures, including Hangar 2. However, it would be speculative to determine the extent of an unplanned collapse and the potential damage to other structures. In the absence of Hangar 3, Hangar 2 would be the sole dominant feature in public views and would retain the elements that contribute to the overall visual character that is evident in existing views toward this portion of MFA. Therefore, the cumulative impacts with the No Action Alternative would be the same as those described above for the Proposed Action and would be less than significant.

# 4.0 List of Preparers

The EA was prepared for the proposed building demolition of Hangar 3 by the individuals and organizations listed in Table 4-1.

**Table 4-1 List of Preparers**

| Name | Title | Area of Contribution |
|---|---|---|
| **NASA** | | |
| Andres Estrada | Center NEPA Manager | Reviewer |
| Brian Lawry | Chief Building Official | Reviewer |
| Jonathan Ikan | Cultural Resource Manager | Reviewer |
| **AECOM** | | |
| Anne Ferguson | NEPA Specialist | Reviewer |
| Rod Jeung | NEPA Specialist | Reviewer |
| Jillian Betro | NEPA Specialist | Reviewer |
| Anthony Mangonon | Traffic Engineer | Reviewer |
| Trina Meiser | Cultural Resource Specialist | Reviewer |
| Mandi McElroy | Biologist | Reviewer |
| Matthew Bettelheim | Biologist | Reviewer |
| Suzanne McFerran | Air Quality Specialist | Reviewer |
| Jim Cowan | Noise Specialist | Reviewer |
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Notes:
QA/QC = quality assurance/quality control

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# Appendix A (A.1 through A.4)
# KPFF Memos

# A.1 - Due Diligence
# Phase 1 Report

kpff Consulting Engineers

# Building 46 (Hangar 2) and Building 47 (Hangar 3)

# Due Diligence Phase 1 Report

August 9, 2013

## *Building history*

Hangars 2 and 3 are the world's largest freestanding wood-frame structures constructed by the U.S. Navy in 1942 to aid the WWII efforts and the "lighter-than-air" (LTA) program. These hangars are integrated with a total of 17 other identical hangars that were constructed across the U.S. to house dirigibles such as the USS Macon and the USS Akron. To conserve metal resources for the war efforts, the 17 hangars were primarily constructed of wood and concrete, as shown in Figure 1. Hangars 2 and 3 are officially addressed as Buildings 46 and 47, respectively, on the NASA Ames Research Center historic properties.

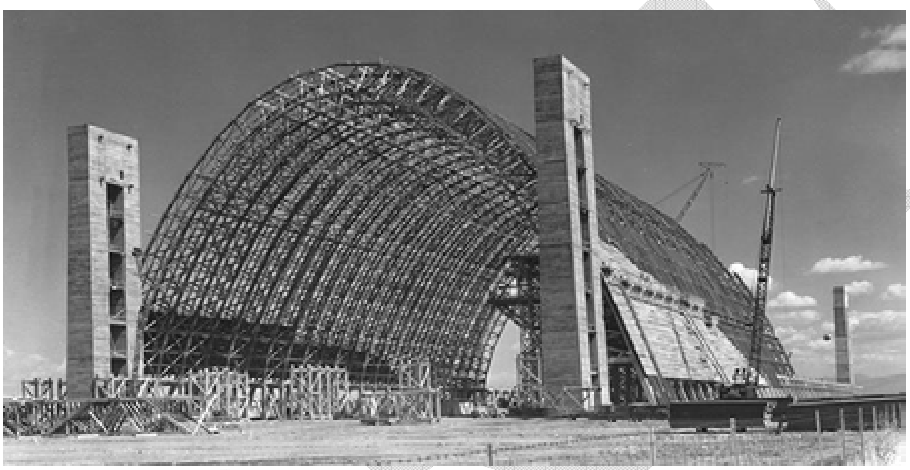

**Figure 1. 1942 Hangar 2 Construction.**

The primary structural aspects of Hangars 2 and 3 involve 51 timber arches that are spaced 20 feet on center and rise above the slab on grade approximately 170 feet to the arch outer chord. The timber arches are orientated in the transverse direction and connected at the base to a two-story transverse concrete bent. The concrete bents are located on concrete pile caps and timber piles with an allowable load capacity of 12 tons each. The outer and inner footings of the bent consist of 9 and 12 piles, respectively, where 3 piles in each group were battered to resist an outward dead and wind thrust loads. The arches and the concrete bents are supported in the longitudinal direction by timber cross braces. However, at various locations throughout the hangars, the cross braces have been retrofitted with either steel braces or steel cables. Two inch diagonal tongue and groove timber sheathing encloses the hangars on the outer chords of the arches, as well as the exterior roof assembly of an asphaltic material and corrugated aluminum. The latter was a replacement in 1956 for the original tarpaper rolled roofing.

The doors at the north and south ends of each hangar consist of six aluminum and wood frame sliding panels. These doors are guided by rails on slab as well as through a transverse box beam spanning between two concrete towers. The box beam is a double-height wood truss sheathed with wood diagonal tongue and groove patterns. The box beam is approximately 20 ft square and cantilevers 20 ft beyond



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each tower, as shown in Figure 2. The tower and box beam assembly are attached to the timber hangar through anchor bolts embedded into the concrete towers. The supporting structure for the hangar doors is a free standing structure and separated from the timber hangar by a gap separating the two structures. Similar to the concrete bents, the towers are supported on concrete pile caps and timber piles with an allowable load of 30 tons each. A total of 816 piles were used for all towers of a single hangar. The main footprint of both hangars is approximately 296’6”x1000’. A two-story annex building measuring 62’x1000’ was added to the east side of Hangar 3 in 1945 for additional office and shop space.

**Figure 2. 2013 Hangar 2 (nearest hangar) and Hangar 3.**

Numerous problems arose during the design and construction phases of the hangars. The primary challenge at the time was the lack of knowledge in detailing, fabricating, treating, and handling the mass amount of timber required. Research and testing were not allocated by the project because it was considered part of the Accelerated Public Works Program of the Navy in aid of the war efforts.

## *Documents reviewed*


1. Ambrose Group, Inc. (2012).
2. Page & Turnbull, Inc. (2006), “Re-use Guidelines,” NASA Ames Research Center, [Hangars 2 & 3].
3. Supplements to Page & Turnbull, Inc. (2006)
   a. Degenkolb (2006) [Chapter 5]
   b. Flynn et al. (2002), “An Initial Evaluation of Douglas Fir Wood Components in Hangars 2 and 3 at the NASA/Ames Research Center,” UC Forest Products Laboratory.
   c. Dolci and Team (2000), “Encompassing Synopsis of the Condition and Feasible Utility of Blimp Hangars 2 & 3.”
   d. BAMSI, Inc. (1994), “Hangar 3 Exerpts of Moffett Field Hangar Life Safety Evaluation,” Moffett Field Development Project, Plant Engineering Office.
   e. Rutherford & Chekene (R&C) (1992) [Analysis for only Hangar 3]
   f. R&C (1984-‘85) [Analysis for only Hangar 2]
4. Neal, Donald W. (1986), “Restoration of Navy LTA (Lighter than air) Hangars”, Conf. Proceed. in Evaluation and Upgrading of Wood Structures: Case Studies, ASCE, pp. 1-12.
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## *Summary of previous reports*

Numerous assessments of the wood conditions have been documented over the years. The most recent documentation was in 2012 by Ambrose Group, Inc. for only Hangar 2. A thorough non-invasive and non-destructive visual inspection was completed for the interior structural members of the hangar, as well as for the interior of the box beams and overhead catwalks. The inspection noted visual signs of warping and splitting of the main trusses, with the largest crack measured 3.5" wide by 10' in length. In addition, there were multiple cases of missing and compromised fasteners, splitting of tieback and brace members, deflection of the exterior horizontal joints, signs of water staining, and timber shedding throughout the hangar. Similarly, the condition of the box beams showed signs of water intrusion and timber shedding. Splitting was also observed on the cross bracing within the south box beam. The catwalks and ladders used to ascend to the upper catwalk appeared to be in fair and slightly less fair condition, respectively. However, both contained age cracks and showed signs of vertical and lateral deflections when walking on, according to the report.

Page & Turnbull's 2006 Re-Use Guidelines for Hangars 2 and 3 included a detailed description of the historical context, the structural and non-structural systems and their conditions, as well as the re-use methodology. Page & Turnbull advised that the hangars do not comply with the ASCE 31-03 Life Safety performance level. If an earthquake were to occur, major structural damage could result. Therefore, a Full Building Tier 2 analysis was recommended. In addition, the report stated that the members were overstressed due to wind loading. The report recommended that further analysis should follow the guidelines of the California Historical Building Code (CHBC) for seismic and ASCE 7 for wind. The CHBC states that the seismic forces to be used for evaluation and possible strengthening need not exceed 0.75 times the seismic forces prescribed by the 1995 edition of the California Building Code (CBC). The seismic forces would be computed based on $R_w$ forces tabulated in the CBC for similar lateral force resisting systems. Based on past history with this type of construction, there is potential of complete collapse during a major earthquake, excessive wind, or small fire within the vicinity.

Page & Turnbull and the NASA Ames project managers suggested three new uses for Hangar 2 and 3. The possibly scenarios were:

Scheme 1: Missile Defense Command Center (Low Occupancy, High-Level Security)
Scheme 2: Federal Emergency and Management Agency Storage Facility (Low Occupancy, Low-Level Security)
Scheme 3: Public Use Sports Arena and Club (High Occupancy, Low-Level Security)

For each scheme, Page & Turnbull listed recommended improvements based on the level of occupancy and security. The improvements addressed issues of structural inspection/repair, fire protection, emergency systems, MEP, accessibility, egress, doors, windows, new raised topping slab, and new architectural finishes. However, it is recommended that NASA Ames compile a complete analysis for the re-use impacts regarding code issues, structural and system upgrades, accessibility requirements, hazardous materials abatement, envelope repairs, and the alterations of the historic fabric. In addition, because Hangar 2 and 3 are considered historic buildings, all work to the hangar should comply with The Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for Preserving, Rehabilitating, Restoring, and Reconstructing Historic Buildings.

As a section within the re-use guidelines, Page & Turnbull (2006) reference Degenkolb (2006) in Chapter 5 regarding the historical context of the structural systems and a chronological documentation of the structural retrofits and analyses conducted. The report makes note of the hangars having an original design loading, which is similar to the data presented in Amirikian (1943), of the following:

Earthquake = 10% x W
Wind = 10 psf windward + 19 psf suction at the base + 24 psf suction at top of arch
Hoist = 5 kips at panel points near catwalks
Live = Not considered

The considered load combinations were D, D+W, D+EQ, and D+Hoist+0.5W

Also, the allowable material specifications for the original timber design was:
Arch trusses = 1400 psi bending, 1100 psi compression
Other members = 1200 psi bending, 1000 psi compression

In addition, Degenkolb (2006) performed a limited ASCE 31-03 analysis, assuming Site Class D soils, to confirm the general conclusions from previous analyses. The results of this study were identical to those provided by R&C (1984-’85), who conducted a full dynamic analysis of Hangar 2. The corresponding R&C analyses assumed stick models depicting the response of the structure as well as considered foundation stiffness by springs. For a single arch frame in the transverse direction, the truss was modeled as a beam to reduce the number of members analyzed. A similar concept was conducted for the bottom chord bracing in the longitudinal direction. The concrete tower and door structures were analyzed by hand calculations.

The results from R&C analyses are summarized by the following:

- The concrete bents were severely overstressed in bending and inadequately reinforced for ductile behavior.
- All connections of the longitudinal bracing trusses were overstressed.
- The horizontal members of the longitudinal trusses were determined inadequate.
- The concrete door towers were overstressed in bending at the top and base.

The retrofit schemes presented by R&C (1984-’85) involve the addition of concrete wall infill to every third existing concrete bent, construction of a new concrete diaphragm at the top of the concrete bents, strengthening of all overstressed longitudinal bracing connections and horizontal members with steel tubes, and construction of two new concrete struts to brace each tower.

However, to preserve the historical structural context of the hangars, Degenkolb provided an alternative retrofit scheme of strengthening the concrete bents and towers along with the installation of a new pile foundation. In addition, Degenkolb addressed the inadequate spacing of the seismic joint separating the timber hangar from the tower and box beam assembly, as well as documenting that no calculations have been performed on the expandable hangar doors. R&C estimated the overall structural and non-structural repair for only Hangar 2 was [redacted] and [redacted], respectively. However, it was assumed that similar retrofit costs and analysis results were applicable for Hangar 3.

In 1992, R&C performed an analysis of only Hangar 3 as defined by FEMA 178 (NEHRP Handbook for Seismic Evaluation of Existing Buildings, 1992). The results concluded that the structure did not satisfy the criteria for minimum NEHRP Life Safety performance. Concern was raised on a soft story in the concrete frames because of inadequate reinforcing, inadequate connections of the diagonal bracing, and a complete lack of connection from the diaphragm to the concrete foundation. In addition, it was observed that two adjacent arches contained 1” cracks on the bottom and top chords around the location of the apex. The recommendations emphasized the damaged arches were life safety hazards and must be repaired. The retrofit schemes for Hangar 3 followed the same guideline as the 1984 retrofits, but with the addition of strengthening to the two-story building annex.

Degenkolb (2006) performed an analysis considering the effects of wind and gravity. The results showed overstressed wood braces throughout the hangars under wind loading. However, Degenkolb highlighted that their analysis was limited and recommended that prior to hangar re-use, a comprehensive wind analysis must be performed using ASCE 7 wind design criteria. In addition, Degenkolb advised that Hangars 2 and 3 are susceptible to severe seismic shaking but are not located within the near-field effects of any fault systems. A site specific geotechnical analysis was not performed. However, both hangars are vulnerable to soil liquefaction as classified by the Association of Bay Area Governments.

Degenkolb also noted that Hangar 2 contains structural select Douglas-fir wood with Minalith fire retardant treatment (FRT). The latter was observed by teeth pressed incisions into the wood, as well as fibers littered on the surface of the wood and throughout the floors. On the contrary, Hangar 3 does not have the same FRT and the wood is an alternate species of Douglas-fir. This was validated in the UC Forest Products Laboratory report by Flynn et al. (2002). Further analyses of the wood in Hangar 3 indicate a darker appearance when compared to Hangar 2, as well as a lack of teeth pressed incisions. However, crystals were noted on the surface of the wood indicating a salt based FRT formulation used in Hangar 3. It was also noted that if either of the wood is burned, the low toxicity Chromium III existing within the wood converts to Chromium IV and thus is more toxic (Flynn et al., 2002).

**Table 1. Retrofit cost projection for hangar code compliance (Dolci and Team, 2000)**

| Function | Hangar 2 | Hangar 3 | Total |
|---|---|---|---|
| Maintenance/Repair M.E.&P. | [redacted] | [redacted] | [redacted] |
| Structural/Seismic Upgrades | [redacted] | [redacted] | [redacted] |
| Fire Protection | [redacted] | [redacted] | [redacted] |
| Roof Repair | [redacted] | [redacted] | [redacted] |
| Hazard Remediation | [redacted] | [redacted] | [redacted] |
| Code Compliance (M&E), OSHA (occupational Safety), ADA | [redacted] | [redacted] | [redacted] |
| Total | [redacted] | [redacted] | [redacted] |
| Demolition | [redacted] | [redacted] | [redacted] |

Dolci and Team (2000) provided retrofit cost projections for the hangars (see Table 1). In addition, they noted that Hangar 3 was in better condition than Hangar 2. KPFF Consulting Engineers do not support this statement based on the recent site visit observations. Dolci and Team also studied an alternative use for 747 aircraft and stated that the existing 10” concrete slab floor of the hangars cannot support a fully loaded 747 aircraft. It was recommended that the floor be removed and replaced with a 14.5” reinforced concrete slab if this use was being considered.

Neal (1986) discusses the 1981 assessment and retrofits for Hangars 2 and 3. Between the two hangars, there were a total of 1,513 minor repairs, 18 damaged frame members, and 36 locations of buckling at the arch frames. No structural analysis was conducted by the Navy, but rather the retrofit efforts were confined to restoring the distressed members to their original condition. The retrofit solution for buckled members involved additional glulam bypass members. Neal indicates there was no secondary buckling following the repair of a buckled chord segment.

## *Summary of recent site visit*

KPFF conducted a site visit for Hangars 2 and 3 on July 31 and August 1, 2013, accompanied by Ronald Anthony, wood scientist of Anthony & Associates. It was observed that Hangar 3 appears to be in worse condition than Hangar 2. A large number of timber arches were strengthened by additional timber bypass members, clamps, stitch bolts, and steel cables, as shown in Figure 3. These restoration efforts were primarily completed by Power-Anderson, Inc. in 1981-‘87, as mentioned in Neal (1986) and Page & Turnbull (2006), and thereafter in 1995 by Philo & Sons, Inc.

**(a) (b) (c)**

**Figure 3. Retrofit techniques observed throughout Hangars 2 and 3 (a) Strengthening of arch chords by addition of glulam bypass members (b) Clamps and stitch bolts to close small cracks (c) Replacement of wood sag braces with steel cables and bolts.**

However, to the best of our knowledge, there is no documentation within past 10 years of a full assessment to the condition of Hangar 3. Our recent site visit observed additional cracks in the wood and distortions of the main arch chords near the apex of multiple arches. This is shown in Figure 4 for the specified arch lines and nodal positions. For reference, the arch lines range from 1 to 51, where line 1 depicts the southernmost arch and line 51 represents the northernmost arch. The nodal positions describe the vertical locations of the horizontal joints. Node 0 and node 36 are respectively defined at the base of the arch on the east and west sides (top of the concrete bent). The arch apex is depicted as node 18.

As seen in Figure 4, a significant amount of cracking and out-of-plane distortion is observed on the bottom and top chords of the timber arches. The most prominent cracks are located in the bottom chord of arch 21 at node 16 and in the top chord of arch 22 at node 16. Both cracks widths are approximately 8” and contribute to the appearance of torsionally warped members. The latter could be a direct result of the out-of-plane relative distortion, as seen between nodes 16 and 17 within the bottom chord of arch 22.

This general observation is emphasized in Figure 5 with the relative lateral displacement between the apex of the arch and a theoretical reference line connecting adjacent arch nodes. Similar results are also displayed in Figure 6 for the top chord of arch 18.

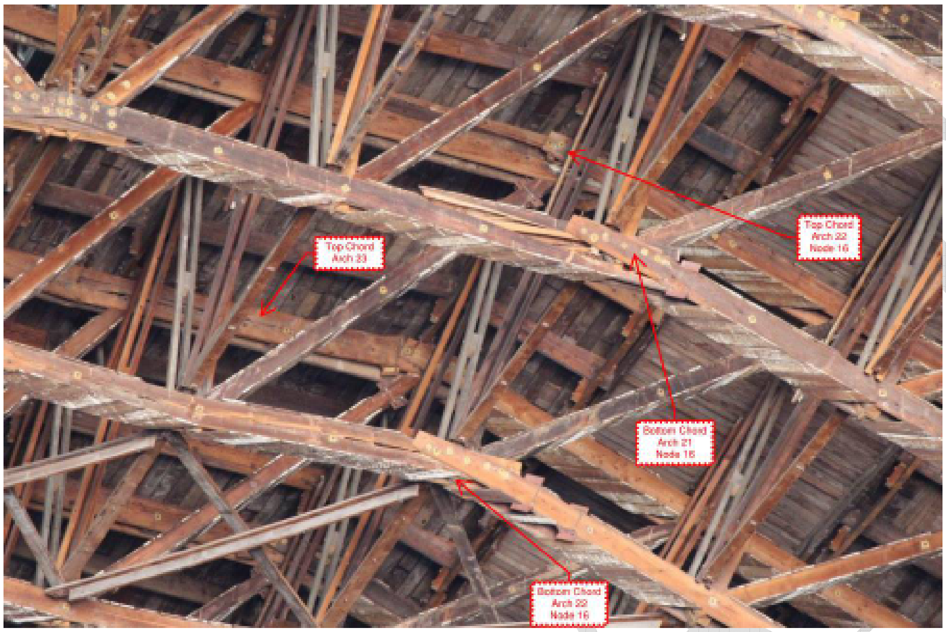


**Figure 4. Observed cracks and distortion of the timber arch bottom and top chords in Hangar 3.**

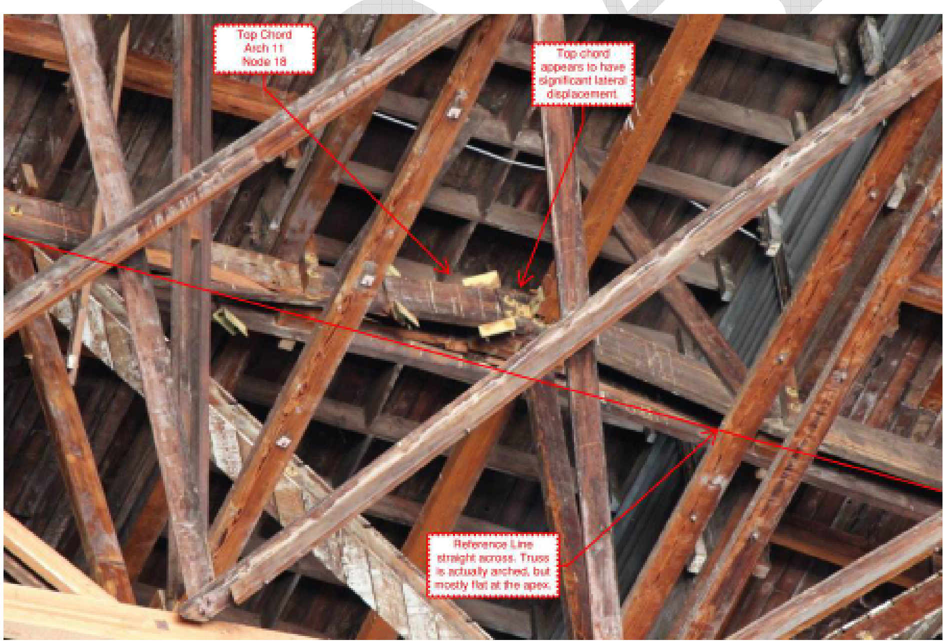


**Figure 5. Relative lateral displacement between arch apex and reference line for Hangar 3 single arch.**

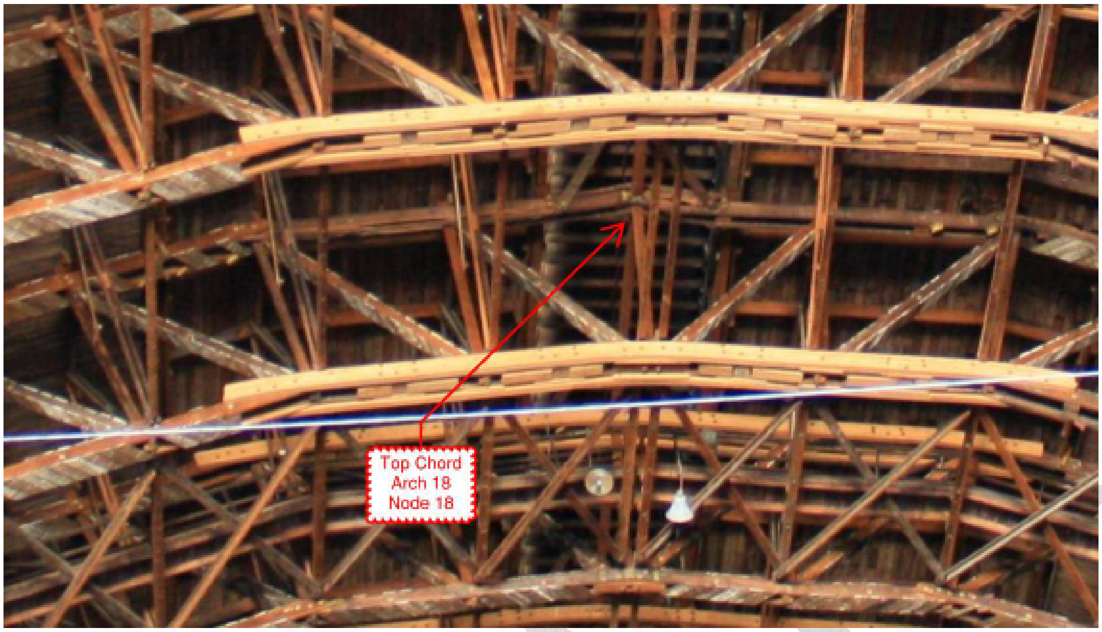

**Figure 6. Observed cracks and lateral displacement of arch top chord in Hangar 3.**

In addition, it was observed that the apex of numerous arches contain a consistent trend of node 18 displacing relative to the adjacent nodes supporting the monitor (exterior protrusion of the hangar at the apex outer chord). This is displayed in Figure 5 for arch 11, Figure 6 for arch 18, and Figure 7 for arches 21 and 22. The latter contains blue sketch-up arrows displaying the relative lateral displacement of the nodes, where node 18 appears to display south. It is unknown whether or not if all of the observed cracks and distortions propagated from the 1995 retrofits or if their origin emanated within the past couple of months.


**Figure 7. General trend of relative lateral displacement at the arch apex top chord in Hangar 3.**

Hangar 2 did not have the extent of distress as seen in Hangar 3. There was only one location where the main arches where strengthened by glulam bypass members. This location was on arch line 14 and between nodes 28 and 30. The only visual signs of distress were observed through end splits of cross braces, as shown in Figure 8. This distress was common at locations where the fasteners were too close to the end grains.

**Figure 8. Example location of end split in cross brace member within Hangar 2.**

It was also observed while walking through the office spaces that various concrete bents in Hangar 2 are braced in the weak axis with steel HSS horizontal and cross braces. This was documented by Page &

Turnbull (2006). However, wide flange steel shapes were also observed for additional reinforcement of the concrete bents in the strong axis, as shown in Figure 9.

(a) (b)

**Figure 9. Hangar 2 office space retrofits (a) Longitudinal HSS and Lateral I-Shape bracing (b) Lateral I-Shape and HSS bracing.**

While on the recent site visit, it was also observed that the doors on the southwest corner of Hangar 3 were open while all other doors between both hangars were closed. Therefore, future observations must verify if the doors are operable. In addition, the existing corrugated aluminum sheathing was detached at various locations along the roof of Hangars 2 and 3, as shown by example in Figure 10.

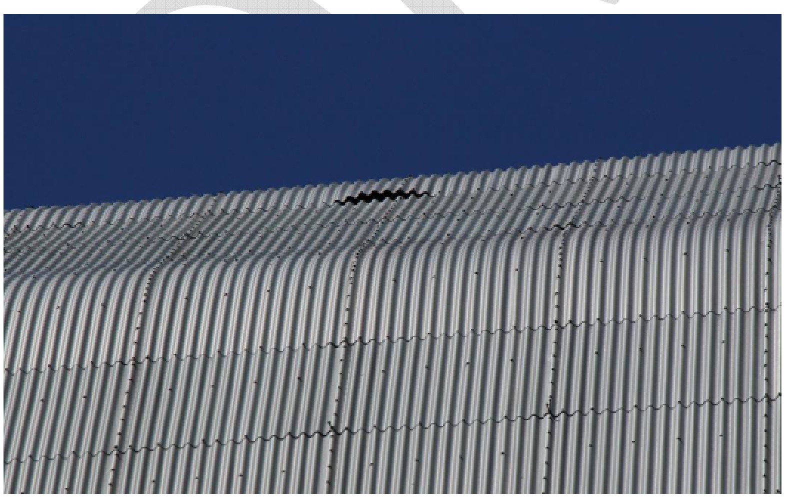

**Figure 10. Example location of detached corrugated aluminum sheathing on roof exterior of Hangar 2.**

Anthony & Associates provided the following preliminary recommendations through email:

1. "For analysis purposes, the wood species appears to be Douglas-fir in both hangars.
2. For analysis purposes, the grade of the members appears to be Select Structural, Structural Joists & Planks.
3. There appears to be little distress to the timbers in Hangar 2. Some end splits are present when the fasteners are close to the end grain. Seasoning checks are common, but not problematic.
4. Access was quite limited, but there were no signs of visible deterioration due to wood decay fungi. It is likely that there are isolated areas of decay where roof leaks have occurred.
5. As we observed together, there are failures, particularly in the bottom chords of the trusses near the peak of the roof in Hangar 3, that should be further investigated.
6. The effect of the fire-retardant treatment (Minalith in Hangar 2, unknown in Hangar 3) is uncertain. I need to look into this further, but that is likely beyond the scope of this work."

## *Summary of recommendations*

Based on our review of the existing documents and our site visits, KPFF makes the following recommendations:

1. KPFF concurs with the general retrofit recommendations provided by Rutherford & Chekene, Degenkolb, and Page & Turnbull. Associated pricing can be used as a ROM estimate scaled to today's dollars. However because of the limitations and assumptions previously presented, KPFF recommends a complete seismic and wind analysis of both hangars using current codes.
2. KPFF recommends immediate correction for the alignment and bracing of the previously mentioned arches for in and out-of-plane movement. Methods of adding glulam bypass members as well as clamps and stitch bolts to the connections provide good potential for restoring the arches back to their original strength. However, it is recommended to monitor adjacent connections and members during restoration as load redistribution could be a potential hazard.
3. KPFF recommends full documentation of all member split end locations. The retrofit techniques will involve clamps, stitch bolts, and some form of epoxy injection.
4. KPFF recommends a survey of the condition of the existing roofing, followed by proposed methods of repair or replacement.
5. KPFF recommends that the project team researches whether the hangar doors are currently operable, and for the team to assess the usable life and anticipated maintenance required for the continued operation of the hangar doors.
6. KPFF recommends a thorough investigation with full accessibility to all interior/exterior structural members and connections for condition assessment and retrofit documentation.
7. KPFF requests a complete set of structural drawings for Hangars 2 and 3, and including all documentation for the Hangar 3 building annex.
8. KPFF recommends a site specific geotechnical assessment for the risk of bay mud consolidation and/or liquefaction effects.

# A.2 - Hangar 3
# Emergency Truss Repairs

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# Hangar 3 Emergency Truss Repairs Narrative

May 26, 2016

This narrative provides a summary of the current situation and background relevant to the ongoing emergency truss repairs at Moffett Federal Airfield, Hangar 3. We understand that this summary will assist in explaining the context of the Hangar 3 damage and emergency repair work to the wider group of stakeholders involved in this project, including the State Historic Preservation Officer as part of the NHPA Section 106 Consultation.

## 1 Conditions observed necessitating the need for emergency repair

### 1.1 Dates of initial and follow up observations

The distressed condition of Hangar 3 was a pre-existing condition that was first observed by the team during the pre-lease RFP Due Diligence phase. Site visits for visual observation were conducted during July and August 2013. Access for visual observations was limited to the hangar deck and some shed areas. KPFF issued a Due Diligence Condition Assessment report on August 23, 2013 documenting the existing member distress observed at the top and bottom chords of the Hangar 3 roof trusses. It is unknown how long the damage existed prior to this time.

The design team progressed with further Due Diligence Investigation activities after the February 10, 2014 selection of Planetary Ventures as the preferred lessee for MFA. Design Development findings were compiled and submitted to the State Historic Preservation Office as support information when a Section 106 consultation package was submitted in May 2015.

In April 2014, DPR Construction began 3D laser scanning operations for Hangars 2 and 3. Site access issues during ongoing lease negotiations delayed the final scan results unto a later date.

Around August 2014, detailed wood condition assessment operations began by Anthony & Associates in coordination with the design team. A combination of visual observation, in-place visual grading, material sampling and testing, and photography was conducted using aerial boom lifts during several weeks of field operations. Preliminary data from the wood condition assessment was delivered to the design team on December 1, 2014. On December 19, 2014, KPFF issued the first draft scope narrative for a Hangar 3 structural monitoring program. This program was recommended based on the severity of prior damage observed and the uncertain timeframe to perform repairs prior to Planetary Ventures' occupancy of MFA.

On February 9, 2015, KPFF was notified of a small piece of wood which fell from the trusses to the ground within Hangar 3. We understand that OSHA was notified in response to this hazard. NASA requested information on the damaged zones of trusses, and KPFF provided a summary of due diligence data collected for Trusses 17–21 on February 13, 2015.

On April 1, 2015, Planetary Ventures took over MFA from NASA. At the PV-NASA meeting on April 8, 2015 to "re kick-off the project", the Hangar 3 damage was discussed and NASA suggested that conditions reviewed to date did not warrant an expedited review process for emergency repairs.

On June 24, 2015, KPFF performed a routine site visit to observe field conditions of the shed framing in Hangar 2. During that site visit, KPFF also observed Hangar 3 trusses from the deck slab and upon observation, suspected damage progression in the Hangar 3 arched trusses. On June 30, 2015, KPFF performed a follow-up site visit to Hangar 3 with aerial boom lift access and observed severe damage progression and increased excessive truss deflections. Turner Construction provided photographs of the ridge line indicating substantial increased deflection at the roof monitor. KPFF issued findings in engineer's field report EFR-03 along with recommendations for a zone of immediate emergency shoring due to damage progression. Selected photos from EFR-03 are provided below in Figure 1, Figure 2, and Figure 3. A reference truss elevation with panel points labeled is provided in Figure 4.

On July 2, 2015, KPFF issued the Hangar 3 Emergency Truss Repairs set for permit approval. DPR Construction performed another 3D laser scan survey of the trusses at the beginning of August. The permit was received for the emergency repairs, Permit No. 15PV2.300.000, in late August. Construction also began in late August. Coordination between KPFF, Power Engineering Construction, Turner, and the design team for the implementation of shoring and emergency repairs is ongoing as of today.

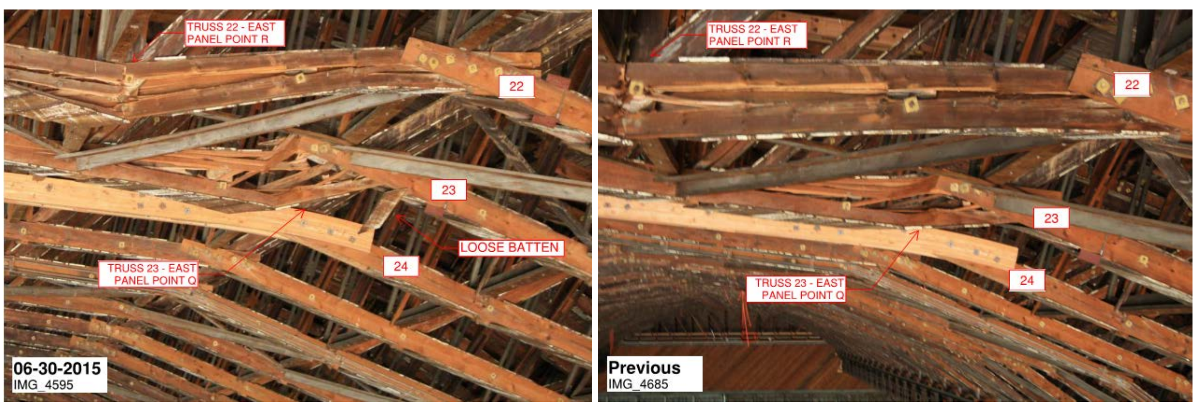



*Figure 1. Truss damage progression at Trusses 22 and 23 East near Panel Points R and O.*

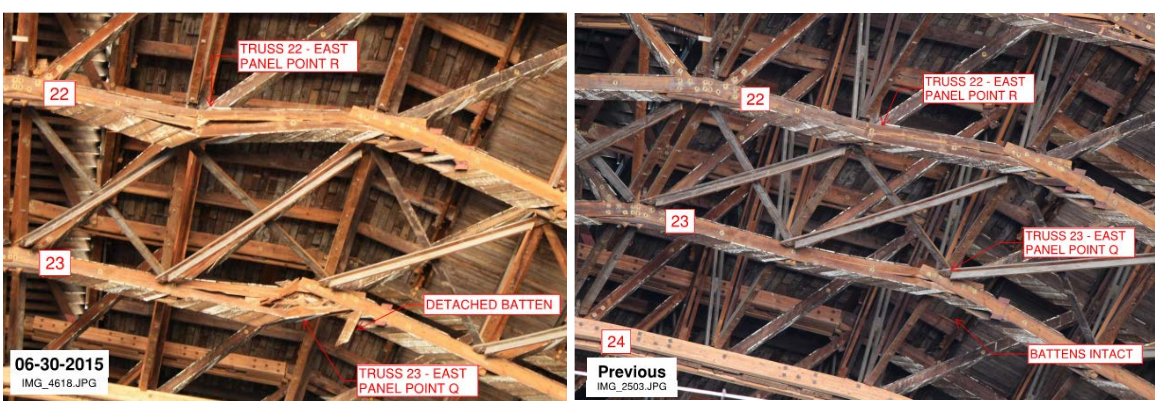



*Figure 2. Truss damage progress at Trusses 22 and 23 East near Panel Points R and Q.*

*Figure 3. Damage observable at ridge line from building exterior.*

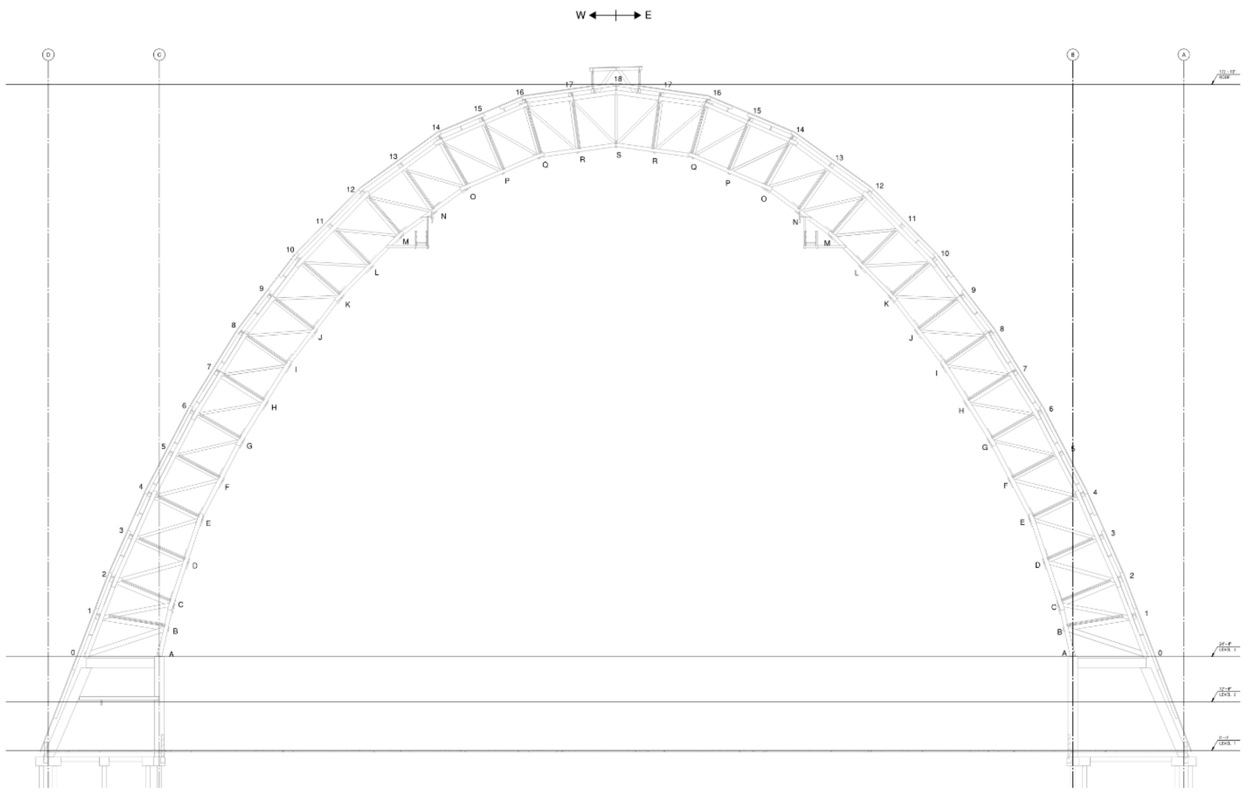


*Figure 4. Typical truss elevation with labeled panel points.*

### 1.2 Opinion regarding threat of collapse / partial collapse

Based on the progressing downward movement of the trusses observed in Hangar 3, there is a threat of partial collapse of the upper portions of the roof which may lead to progressive collapse of other portions of the truss. For this reason, temporary shoring has been installed within the most severely damaged zones to prevent any progressive collapse from occurring within the Hangar. The temporary shoring does not provide shoring to the upper most portion of the truss, since that zone needs to remain clear for accessibility by the movable access tower for the installation of truss repairs.

The following photos (Figure 5, Figure 6) demonstrate the severity of existing damage and the immediate danger of partial structure collapse.

*Figure 5. Broken top chord near roof monitor at top of truss*

*Figure 6. Broken bottom chord near top of truss.*

### 1.3 Data – summary of deflection and other measurements

Quantitative measurements of the truss deflections were taken from successive point cloud surveying of the hangar interior. The damage progression is shown in an example processed image from the 3D point cloud scans taken in 2014 and 2015 (Figure 7). In that figure, the black portion represents the actual position of Truss 22 between Panel Points Q-West and Q-East in 2014, while the red portion shows the position in August 2015. The measurements on the image show the increase in downward deflection between the surveys. A summary of deflections at Panel Point S indicate zones of damage concentration (Figure 8).

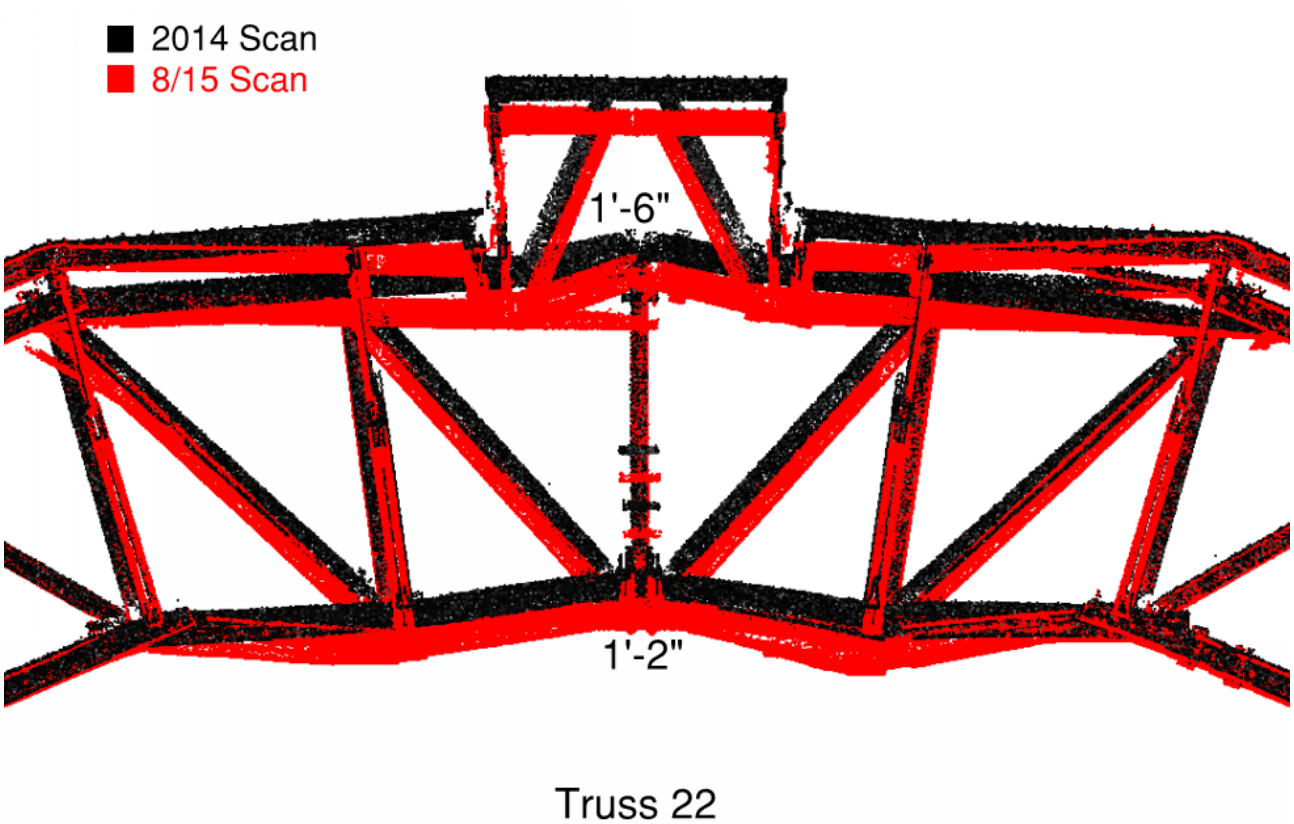



*Figure 7. Approximately 18" of additional deflection observed between 2014 and 2015 point cloud surveying scan at top of truss.*

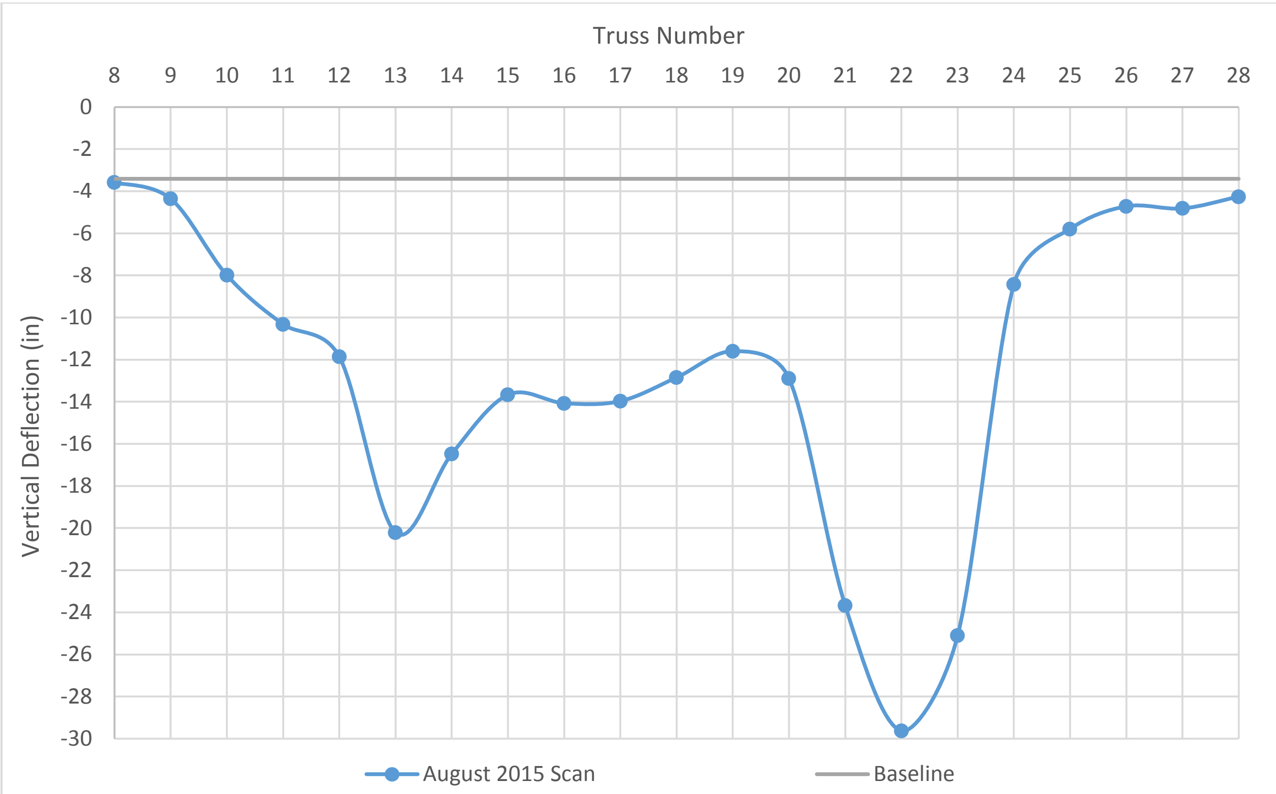



*Figure 8. Deflections relative to baseline at Panel Point S.*

## 2 Options for Emergency Repair considered

The selected scheme involving steel "exoskeleton" frames for jacking and temporary support of roof framing is described further in Section 3 of this narrative. The project team also explored several other options which were evaluated based on several factors including safety of workers during installation, construction sequence and schedule, engineering feasibility, cost, and effects to historic fabric.

For reference, the following is a list of alternatives considered:

- Jacking and shoring from traditional scaffolding: this scheme involved the installation of traditional scaffolding that would be capable of resisting additional loads due to jacking and shoring.
- Jacking and shoring from access tower: shoring and jacking from an access tower that extended to most of the severely damage zone.
- Wave Method: incrementally jacking from a smaller access tower starting at one end of the emergency repair zone and moving down (and possibly back) along the hangar deck.
- Exterior shoring: this scheme involved the installation of an exterior cable suspension system attached to the hangar roof. The cables would be supported by towers on the outside of the hangar and anchored to the ground. This type of temporary shoring system was used at the Tustin Hangars in Southern California.

In addition to selecting a method of installation, the project team also selected a target criteria for roof deflections. The number of exoskeletons and the number of jacks required depends on the amount of deflection to be reversed during the Emergency Repair process. However, full restoration back to the previous undamaged roof geometry may prove to be physically infeasible due to the complexity, risk, and timing involved in these operations due to existing field conditions. KPFF established the target deflection criteria shown in Table 1 and Figure 9 based on "Good", "Better", and "Best" scenarios.

Figure 9 was generated to illustrate the roof deflections (in blue) relative to a baseline that represents the average roof deflection at the trusses in the hangar that do not exhibit severe damage. The figure was used to compare the different deflection criteria options.

The project team selected the "Best-A" target criteria. Given the necessity of field adjustments due to the uncertain and changing existing conditions of the trusses and attachments, the project team may need to relax the acceptance criteria at specific locations. The end result could be a lower final outcome at some locations despite planning for "Best". Choosing the "Best" target reduces the risk of ending up with final deflections below even the "Good" scenario. Achieving this highest objective endeavors to restore the trusses closer to their original design geometry. This reduces the risk of residual stresses and deflections in the truss members and resulting complications for the future seismic retrofit design of the hangar wood structure. Choosing a lesser criteria would have also introduced the risk of significant added cost for the future rehabilitation of Hangar 3. Targeting a lesser deflection target could lock in a less desirable pre-deflected shape, which may complicate installation of strengthening members or prompt another phase of jacking and shoring at a later time.

*Table 1. Deflection criteria options considered.*

| | Good | Better | Best-A | Best-B |
|---|---|---|---|---|
| Truss and Roof Framing Maximum Deflection Relative to Average "Undamaged" Truss Elevation | ± 8" | ± 4" | ± 1" | ± 1" |
| Truss and Roof Framing Deflection Relative to Adjacent Trusses | ± 4" | ± 3" | ± 2" | ± 2" |
| Roof Monitor Deflection between Adjacent Trusses | ± 4" | ± 3" | ± 2" | ± 2" |
| Exoskeleton Locations | Trusses 11.5–23.5 | Trusses 9.5–24.5 | Trusses 9.5–25.5 | Trusses 8.5–26.5 |
| Number of Exoskeletons | 13 | 16 | 17 | 19 |
| Number of Exoskeleton Jacks | 104 | 128 | 136 | 152 |
| Number of Bays Where Jacking from the Shoring Tower is Required | 0 | 0 | 3 | 1 |

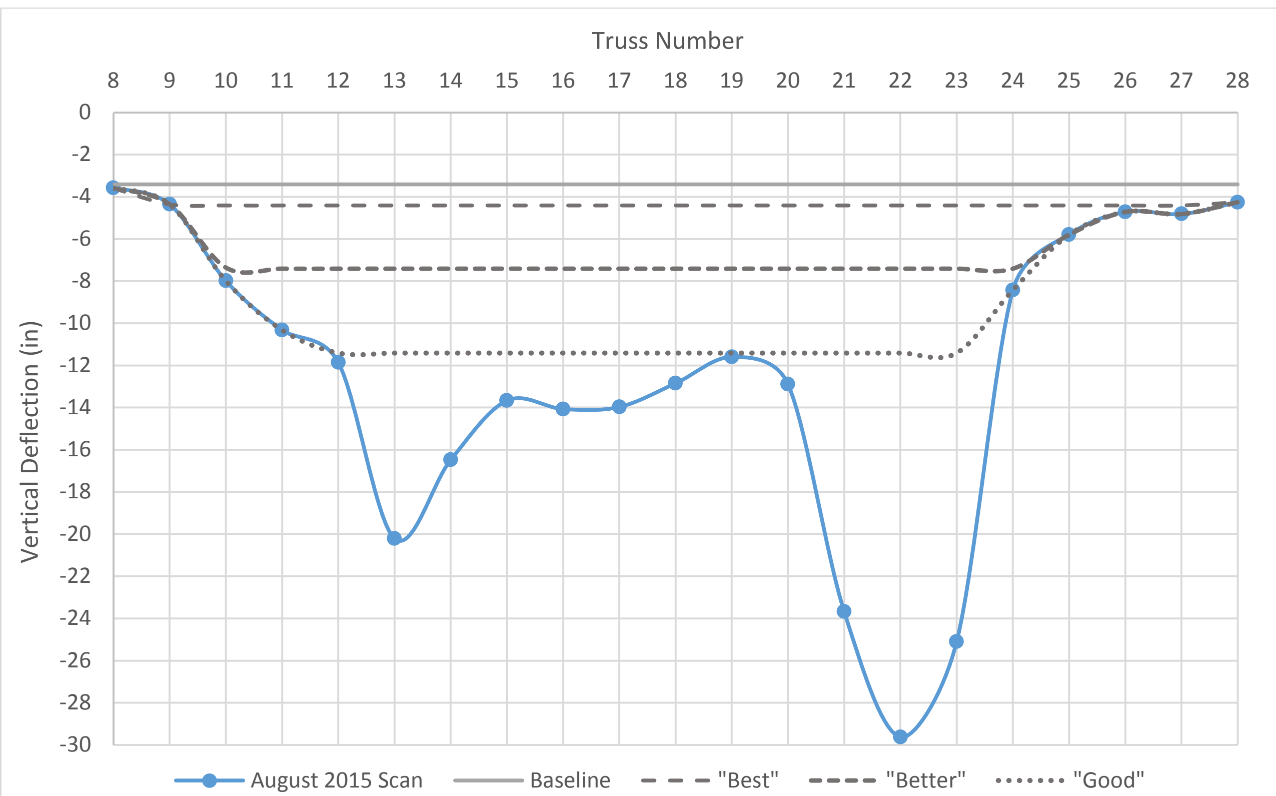



*Figure 9. Hangar 3 Panel Point 18 Deflection with Deflection Criteria Options*

Two options were studied by the design and construction team for the "Best" criteria. The difference between the two options is the sequence of construction and amount of Exoskeletons and jacks required. The first scenario (Best-A) utilizes both the access shoring tower and the Exoskeletons for jacking. Sequentially, the jacking at the trusses with the Exoskeletons are performed first, and then the shoring tower is moved to the ends of the severe damage zone to access the final 3 trusses (see Figure 10). In this scenario, an additional four Exoskeletons are required relative to the "Good" criteria.

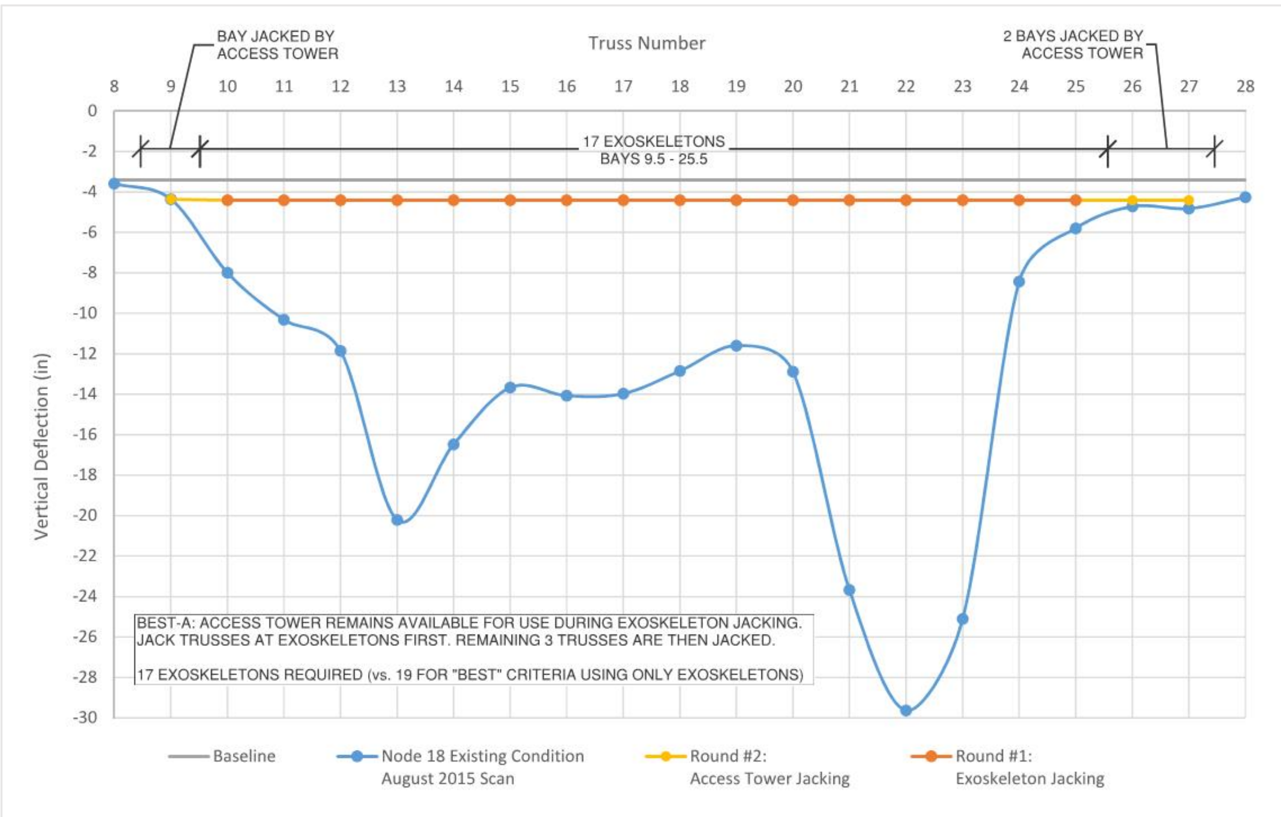



*Figure 10. "Best-A" Target Deflection Criteria*

The second scenario (Best-B) includes using only Exoskeletons for jacking trusses of significant deflection. In this scenario, two more Exoskeletons are required in addition to those required for the "Best-A" criteria, one between trusses 8 and 9, and one between trusses 25 and 26. Truss 27, which exhibits minor deflections, may need to be jacked from the access shoring tower to achieve the deflection criteria.

## 3 Emergency Repair Strategy for Selected Option

Step 1: Install temporary shoring braces to prevent full collapse of hangar (Figure 11 and Figure 12). The upper portion of the hangar remains unsupported and local damage progression and partial collapse of the upper zone is still possible.

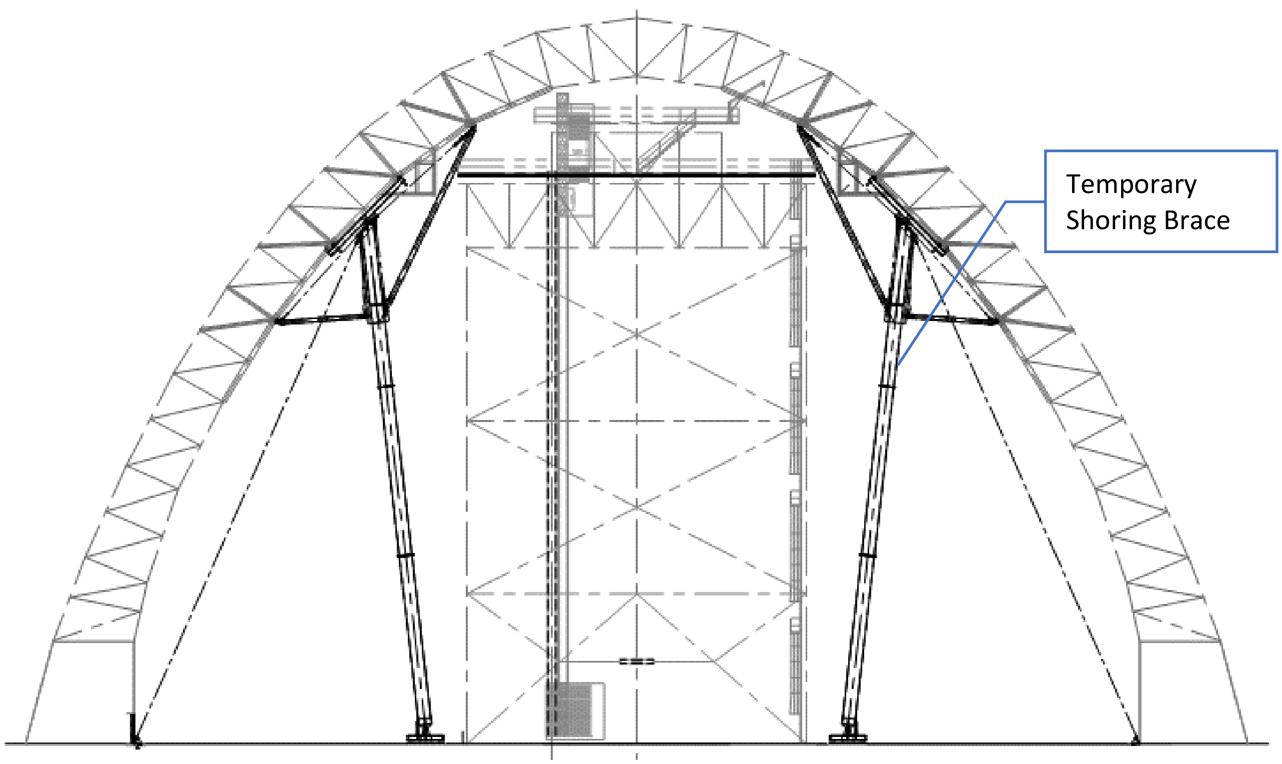



*Figure 11. Temporary Shoring + Shoring Tower*

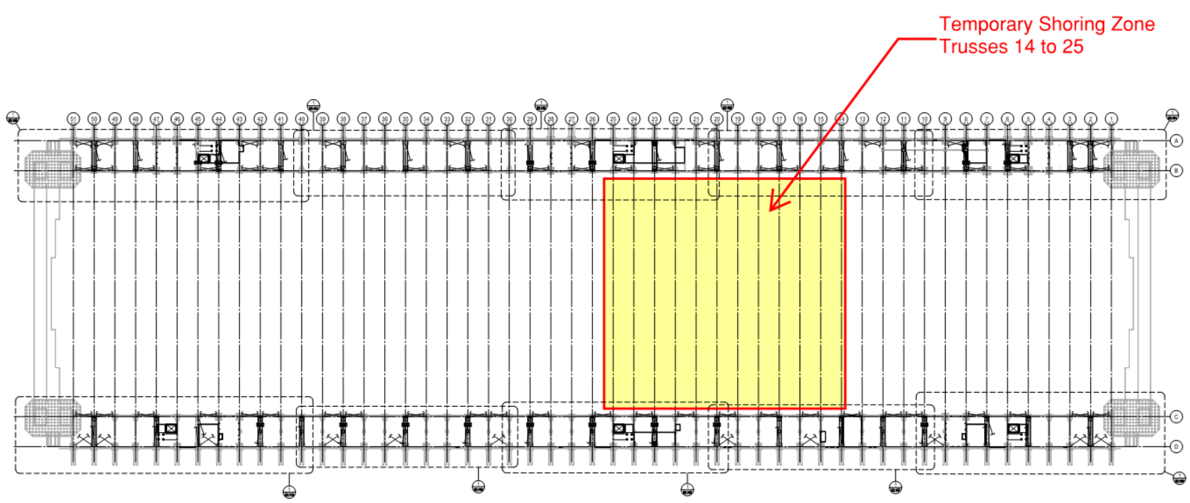



*Figure 12. Zone of temporary shoring.*

Step 2: Fabricate shoring tower and move shoring tower into the hangar to begin temporary support of the upper zone, and installation of support "Exoskeletons". A computer rendering by Power Engineering Construction of these pieces is shown in Figure 13.

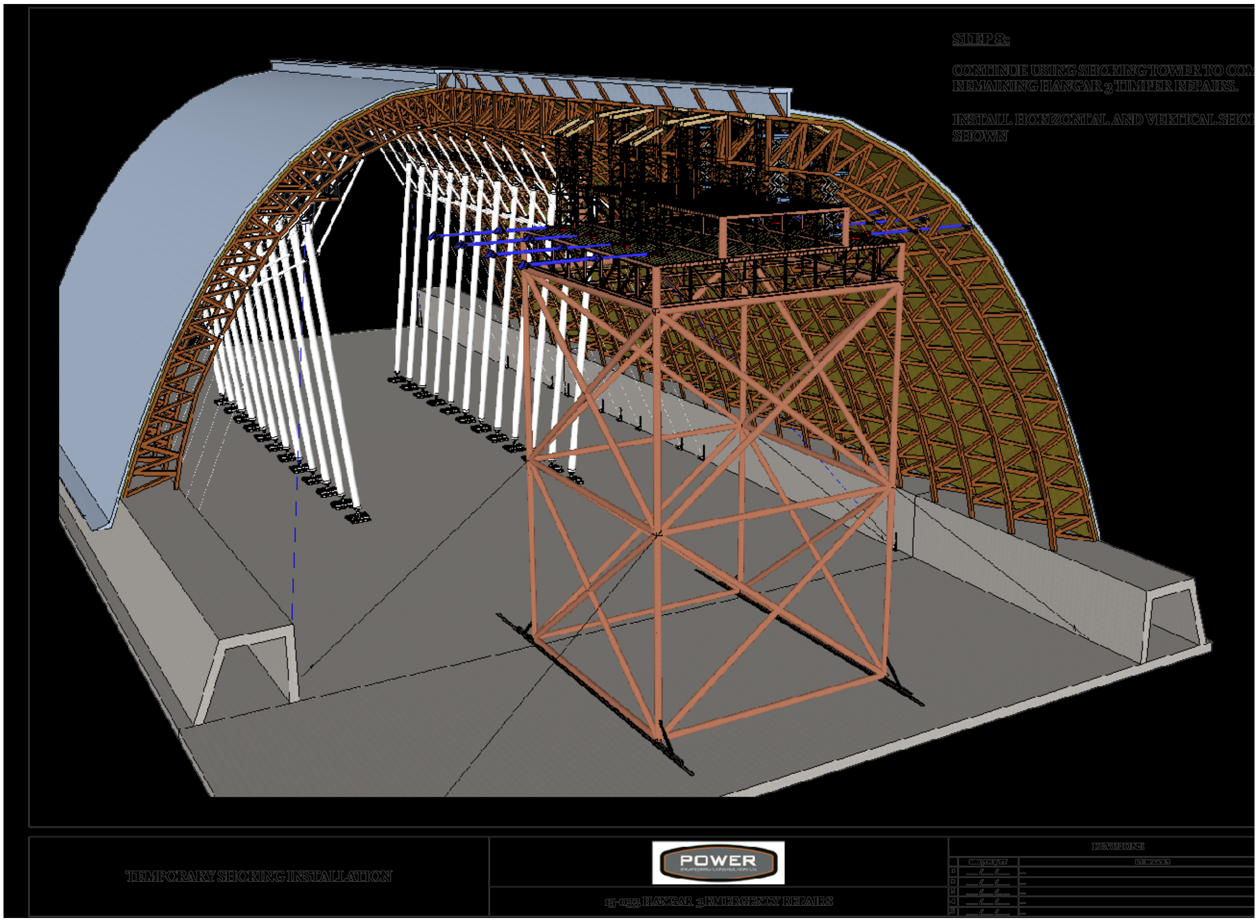



*Figure 13. Isometric of Temporary Shoring & Shoring Tower*

Step 3: Install steel truss support frames called "Exoskeletons" (Figure 14) in between existing wood trusses that have exhibited significant damage and deflection. The Exoskeletons are shop welded in segments which are field bolted together. The Exoskeletons are to be installed in the space between the existing trusses and will be attached to the existing trusses with bolts and steel plates (Figure 15).

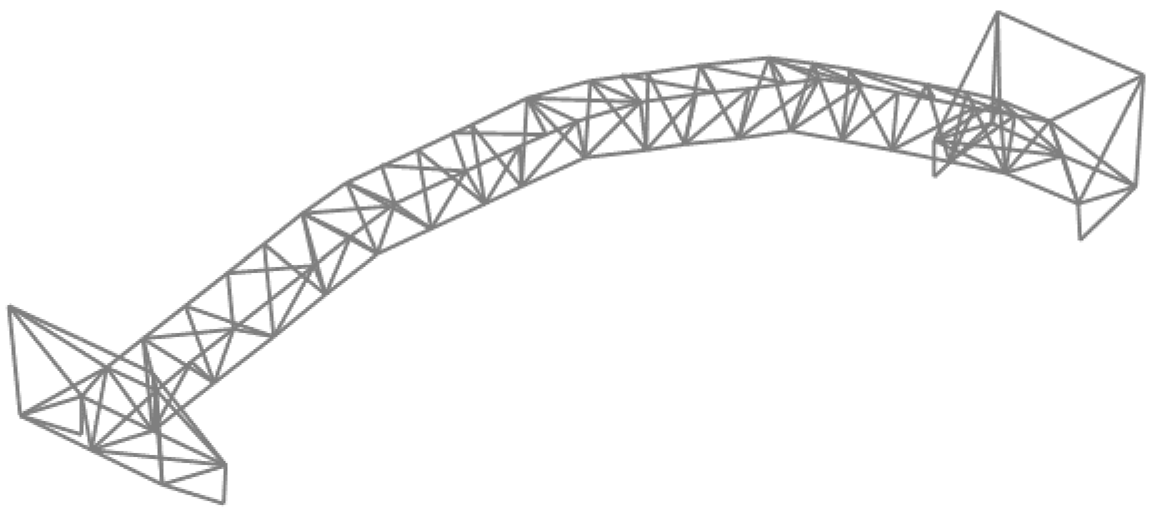


*Figure 14. 3D Isometric of Steel Exoskeleton*

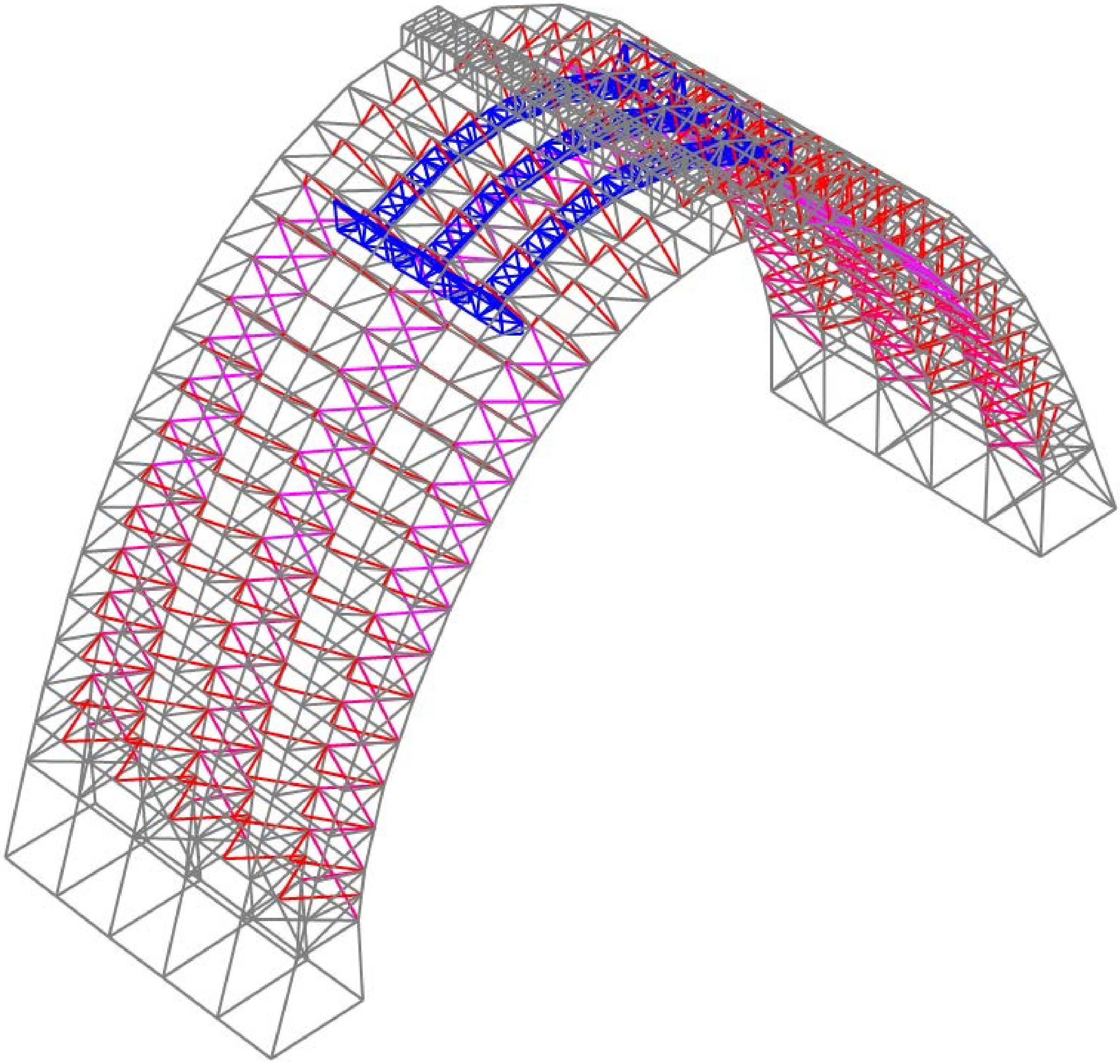


*Figure 15. 3D Isometric of Exoskeletons Installed between Existing Wood Trusses*

Step 4: Jack existing gravity framing from Exoskeletons to take gravity load off of the existing trusses and restore roof profile as close as possible to its undamaged state.

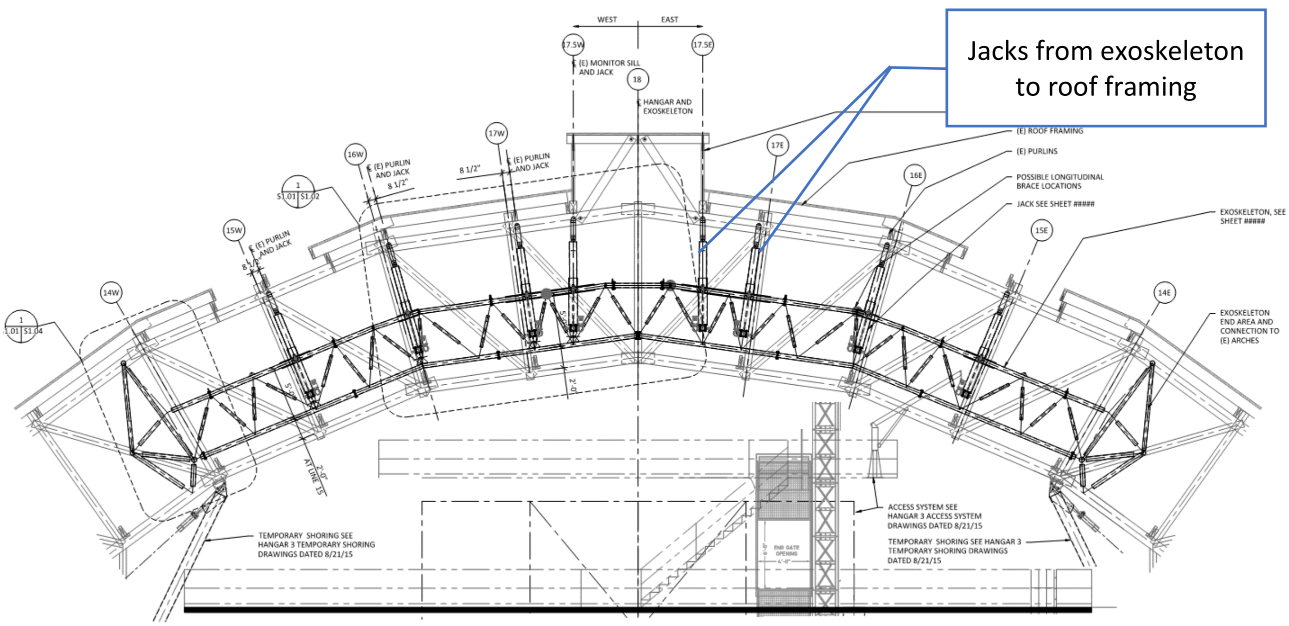



*Figure 16. Exoskeleton Elevation (Preliminary Drawings)*

Step 5: Perform emergency repairs to existing trusses and restore trusses as close as possible to original undamaged position from shoring tower.

Step 6: Remove jacks and Exoskeletons from the hangar. Remove connection steel plates except those portions that were used also to repair damaged existing timbers.

Step 7: Remove temporary shoring. Holes in existing concrete will be patched with a high-strength, non-shrink, non-metallic grout to match the color and texture of surrounding concrete as much as possible.

### 3.1 Portions that are permanent vs portions that are temporary

Temporary items include attachments and temporary wood repairs installed as part of the means and methods of construction. These items will be removed when practical in the construction sequence. Examples include the large temporary shoring tubes, tie rod bracing, jacks, access tower, and the steel Exoskeletons.

Permanent minor connection strengthening consists of stitch bolts at wood arch truss connection ends, and clamps at splits along the lengths of members (Figure 17). These have been installed in areas which require strengthening as part of the jacking sequence and emergency truss repair installation.

*Figure 17. Example of new minor connection strengthening stitch bolts adjacent to existing angle clamp.*

Permanent major connection strengthening consists of galvanized and painted cut HSS steel tubes, steel plates, and bolts (Figure 18). These items are currently being fabricated and coated and are pending installation. This type of repair will be installed in locations of severe damage within truss panel point connections, where the connection is damaged, but the timber is in fair condition outside the connection zone.

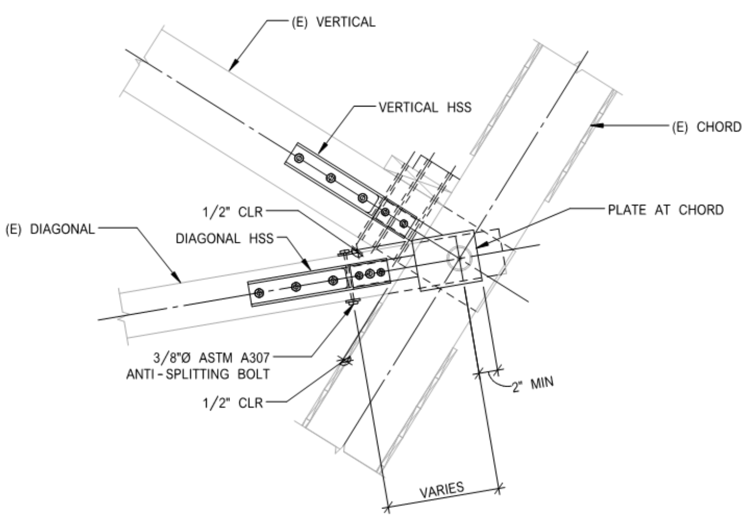



*Figure 18. Permanent major connection strengthening.*

### 3.2 Stamping of new wood members

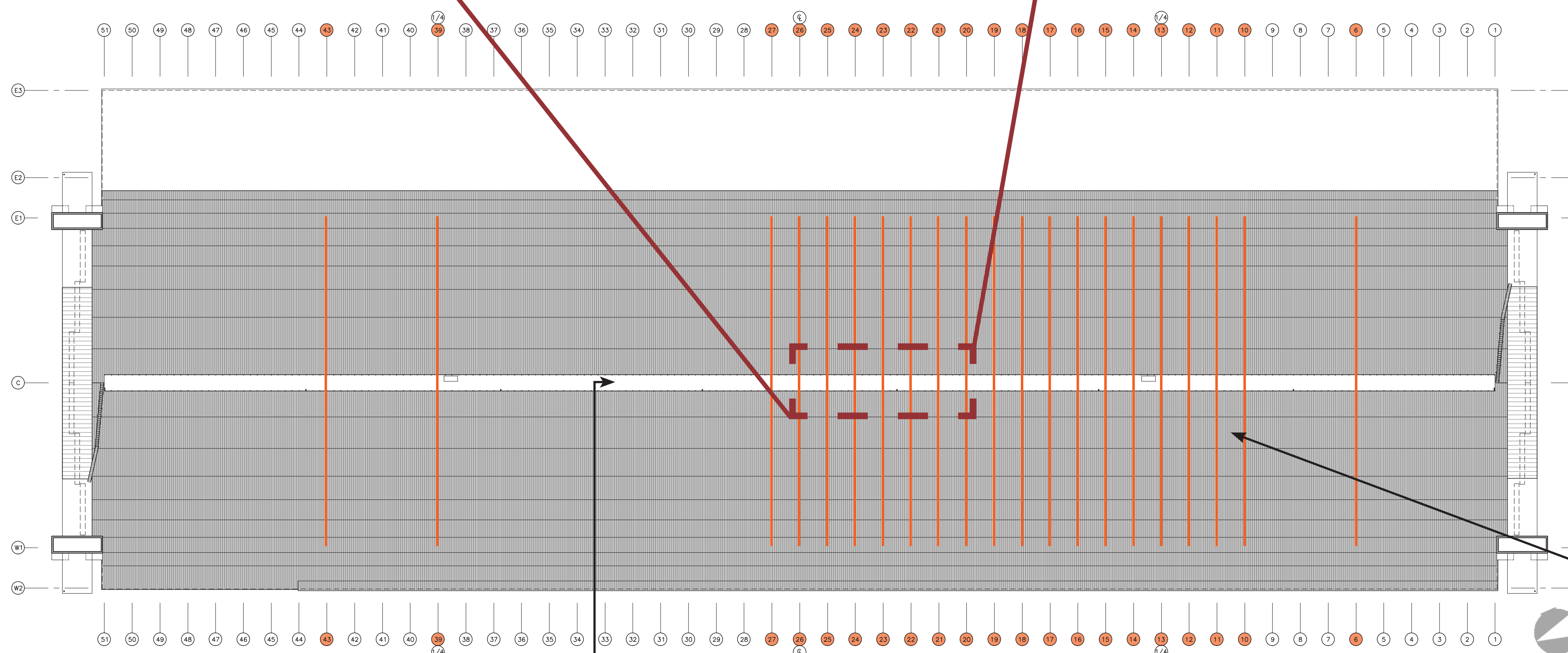
New wood members installed in the emergency repairs project will be labeled in order to distinguish them from existing materials within the hangar. These members are stamped with a custom fabricated branding iron pyrography stamp with the text "2015/2016" using 3/4-inch tall lettering with the Arial typeface.

### 3.3 Why selected option is best for preservation

The selected emergency repair strategy is best for preservation because we are achieving the best restoration of the hangar ridge line deflection with the intent of replacing damaged truss members in-kind with timber similar to the original truss configuration. The project team decided to pursue the "Best" deflection criteria which targets restoration of the truss and roof framing nearest to the average "undamaged" truss elevation. In the event that "Best" is unachievable due to field conditions, a lesser criteria can still be achieved which is acceptable from a structural and architectural standpoint.


PREVIOUS (west facade)
03-20-2014


CURRENT (east facade)
03-08-2016




06-30-2015


10-01-2015

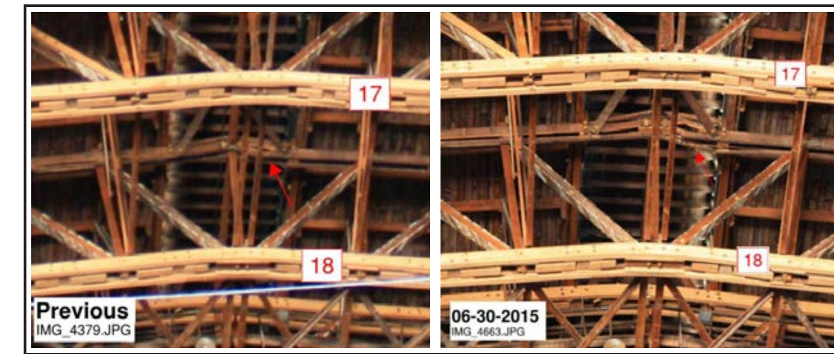
KEY
— Location of trusses for emergency repairs

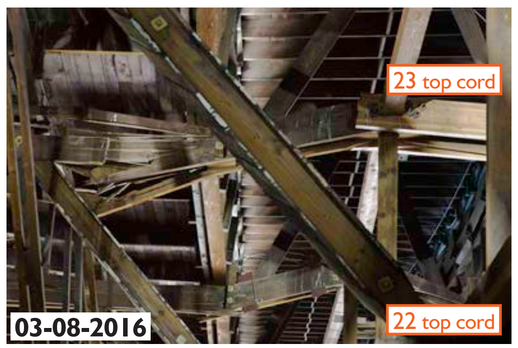
## EXTERIOR CONDITIONS

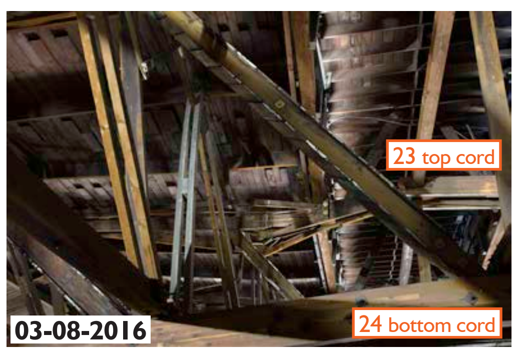
Roof plan from Hangar 3 Existing Roof Plan by Page & Turnbull on 03-30-2015, with photographs by Erin Ouborg, Steven Aiello, and Mark Citret on behalf of Page & Turnbull, as well as photographs from Engineer's Field Report by KPFF on 06-30-2015

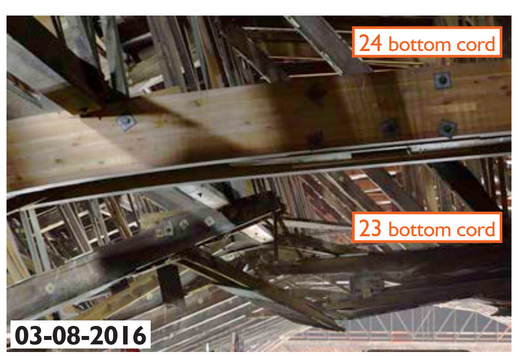


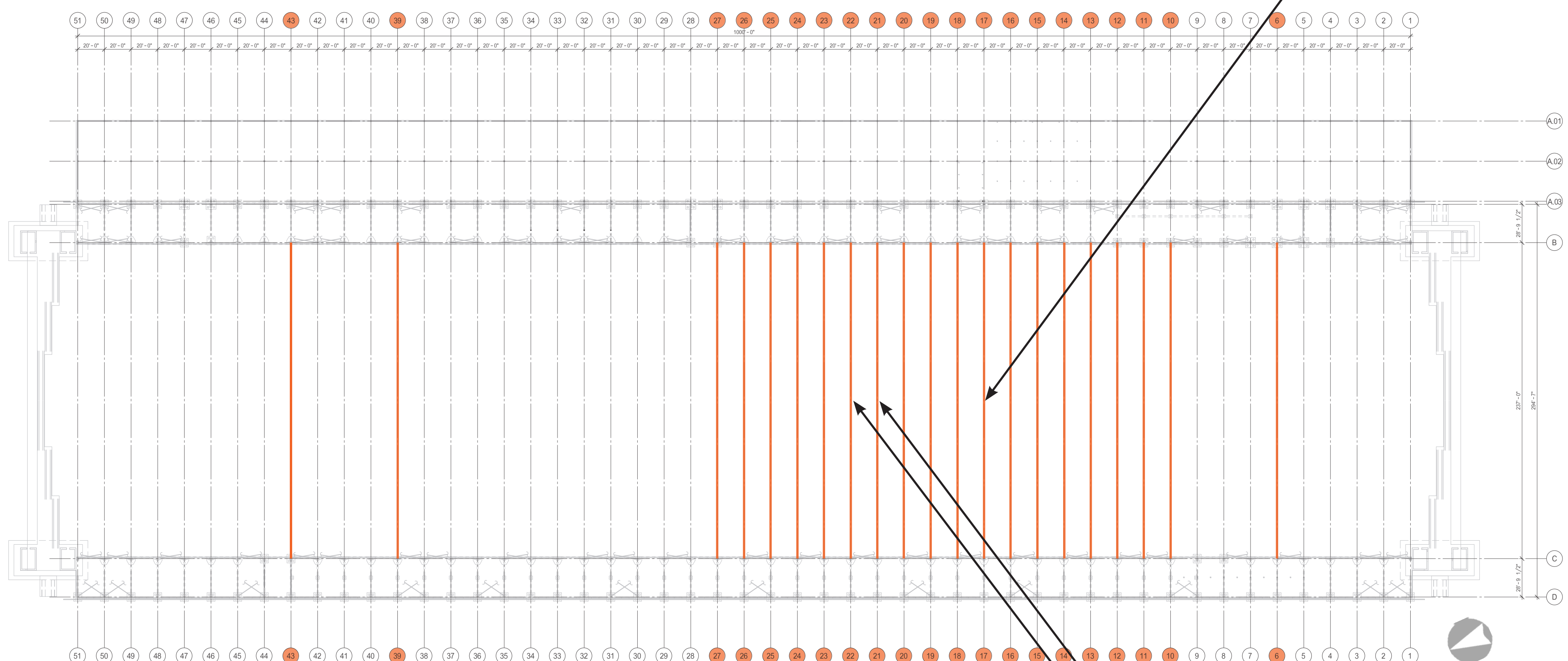








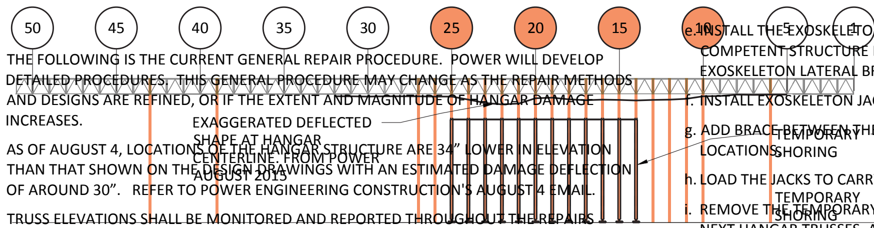
KEY
— Location of trusses for emergency repairs

## INTERIOR CONDITIONS

Foundation Plan from Moffett Federal Airfield - Hangar 3 Emergency Truss Repairs Set, Permit Revision 1 by KPFF on 03-17-2016, with photographs by Erin Ouborg and Mark Citret on behalf of Page & Turnbull, as well as photographs from Engineer's Field Report by KPFF on 06-30-2015

b. POSITION THE ACCESS SYSTEM UNDER THE LEAST DAMAGED TRUSSES AT ONE END OF WHERE THE EXOSKELETONS WILL BE INSTALLED.
d. INSTALL LATERAL BRACING BETWEEN HANGAR TRUSSES ABOVE ACCESS SYSTEM.
c. INSTALL TEMPORARY POST SHORING BETWEEN THE ACCESS SYSTEM DECKS AND THE ROOF PURLINS.

1. INSTALL TEMPORARY SHORING




THE FOLLOWING IS THE CURRENT GENERAL REPAIR PROCEDURE. POWER WILL DEVELOP DETAILED PROCEDURES. THIS GENERAL PROCEDURE MAY CHANGE AS THE REPAIR METHODS AND DESIGNS ARE REFINED, OR IF THE EXTENT AND MAGNITUDE OF HANGAR DAMAGE INCREASES.

AS OF AUGUST 4, LOCATIONS OF THE HANGAR STRUCTURE ARE 34" LOWER IN ELEVATION THAN THAT SHOWN ON THE DESIGN DRAWINGS WITH AN ESTIMATED DAMAGE DEFLECTION OF AROUND 30". REFER TO POWER ENGINEERING CONSTRUCTION'S AUGUST 4 EMAIL.

TRUSS ELEVATIONS SHALL BE MONITORED AND REPORTED THROUGHOUT THE REPAIRS BASED ON THE REPAIR GEOMETRY CRITERIA. SEE KPFF REPAIR DRAWINGS.

REPAIR APPROACH:

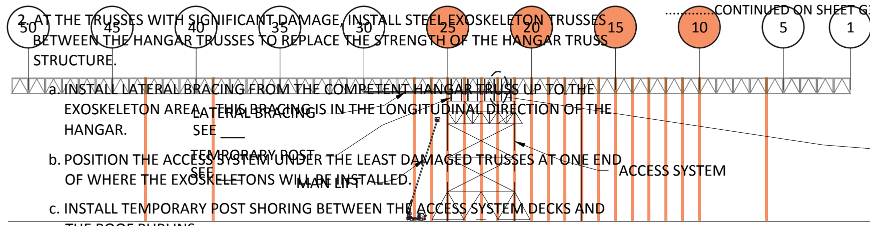
1. INSTALL TEMPORARY SHORING SYSTEMS BETWEEN THE SLAB AND HANGAR STRUCTURE TO SHORE THE LOWER TWO THIRDS OF THE HANGAR STRUCTURE. REFER TO THE DRAWINGS: HANGAR 3 TEMPORARY SHORING, LIFTECH, JULY 28, 2015, REVISED AUGUST 22, 2015.
2. AT THE TRUSSES WITH SIGNIFICANT DAMAGE, INSTALL STEEL EXOSKELETON TRUSSES BETWEEN THE HANGAR TRUSSES TO REPLACE THE STRENGTH OF THE HANGAR TRUSS STRUCTURE.
   a. INSTALL LATERAL BRACING FROM THE COMPETENT HANGAR TRUSS UP TO THE EXOSKELETON AREA. LATERAL BRACING IS IN THE LONGITUDINAL DIRECTION OF THE HANGAR.
   b. POSITION THE ACCESS SYSTEM UNDER THE LEAST DAMAGED TRUSSES AT ONE END OF WHERE THE EXOSKELETONS WILL BE INSTALLED.
   c. INSTALL TEMPORARY POST SHORING BETWEEN THE ACCESS SYSTEM DECKS AND THE ROOF PURLINS.
   d. INSTALL LATERAL BRACING BETWEEN HANGAR TRUSSES ABOVE ACCESS SYSTEM.
   e. INSTALL THE EXOSKELETON, CONNECTING THE ENDS OF THE EXOSKELETON TO COMPETENT STRUCTURE LOWER ON THE EXISTING HANGAR TRUSS. INSTALL ANY EXOSKELETON LATERAL BRACING.
   f. INSTALL EXOSKELETON JACKS TO BE USED TO JACK AGAINST THE PURLINS.
   g. ADD BRACE BETWEEN THE RAFTER AND PURLIN NEAR THE HEADER BEAM BEARING LOCATIONS.
   h. LOAD THE JACKS TO CARRY THE ROOF SYSTEM LOADING. DO NOT LIFT.
   i. REMOVE THE TEMPORARY POST SHORING, MOVE THE ACCESS SYSTEM UNDER THE NEXT HANGAR TRUSSES, AND REPEAT STEP 2 UNTIL ALL EXOSKELETONS ARE INSTALLED AND LOADED.
3. INSTALL LATERAL BRACING AT HANGAR TRUSS LOCATIONS THAT ARE BEYOND THE EXOSKELETON LOCATIONS BUT WILL ALSO BE RAISED.
4. REMOVE DAMAGED PORTIONS OF THE HANGAR TRUSS AND DISCONNECT THE HANGAR TRUSSES FROM THE ROOF. START AT THE HANGAR TRUSSES WITH THE LEAST DAMAGE.

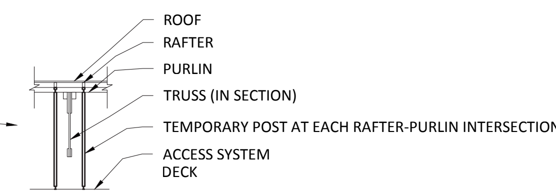
........CONTINUED ON SHEET S3.02


09-24-2015


11-10-2015

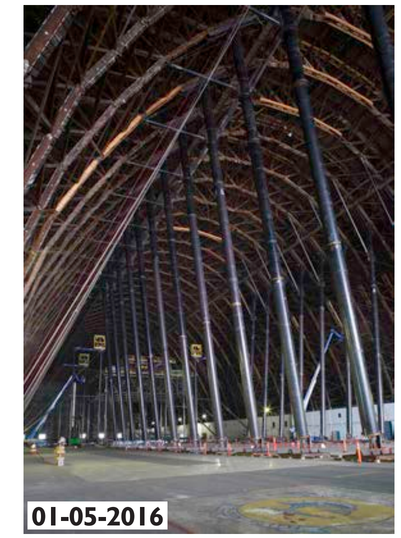
2a AND 2d. INSTALL LATERAL BRACING AND 2c. TEMPORARY POST SHORING.





01-05-2016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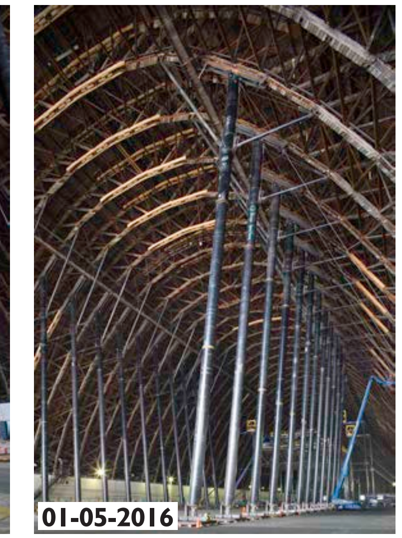
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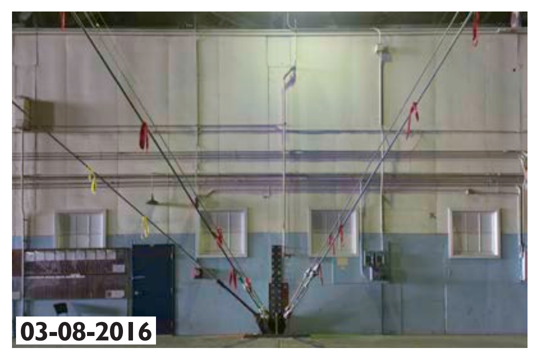
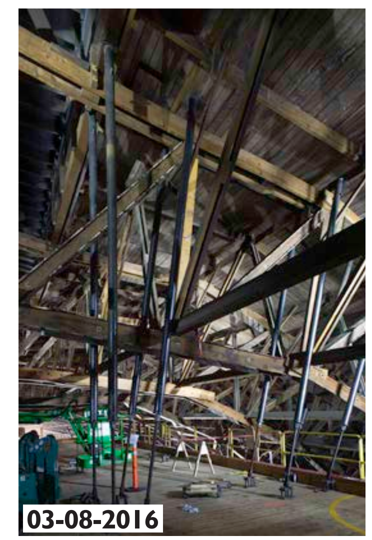
01-05-2016


02-02-2016

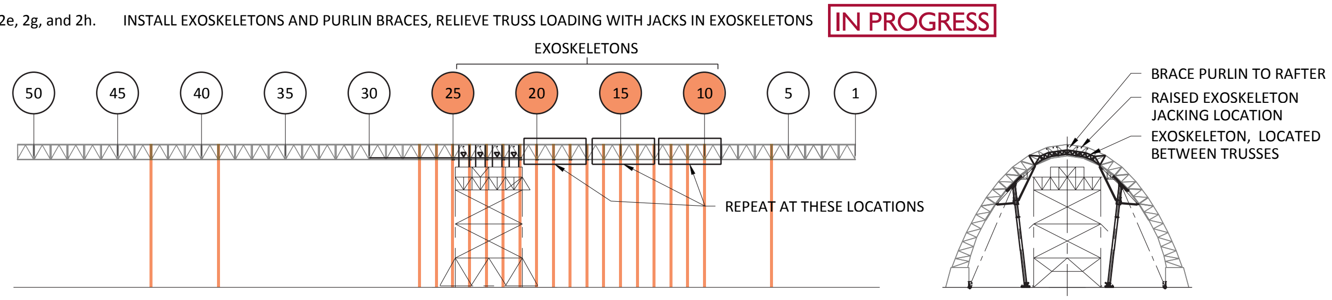

02-02-2016


03-08-2016

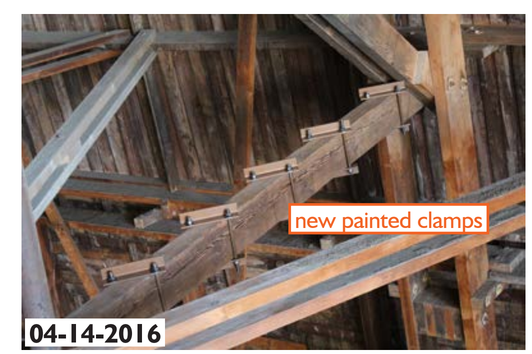

03-08-2016

03-22-2016

2e, 2g, and 2h. INSTALL EXOSKELETONS AND PURLIN BRACES, RELIEVE TRUSS LOADING WITH JACKS IN EXOSKELETONS **IN PROGRESS**




04-07-2016



04-14-2016


04-14-2016

KEY
— Location of trusses for emergency repairs

# REPAIR PROCEDURES

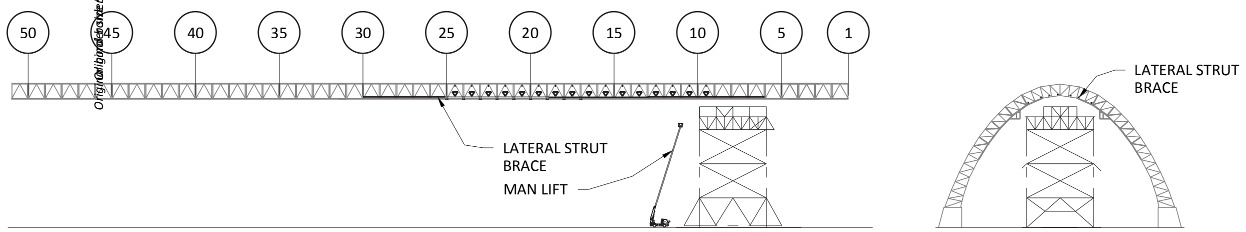
Elevations from Hangar 3 Shoring and Access System drawings by Power and Liftech on 10-06-2015, with photographs by Erin Ouborg and Mark Citret on behalf of Page & Turnbull



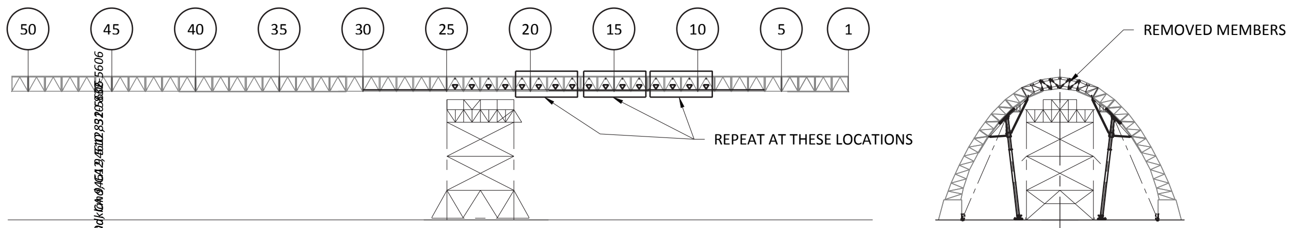



344 - 20th STREET SUITE 360, Oakland, CA 94612, 510 832-5606

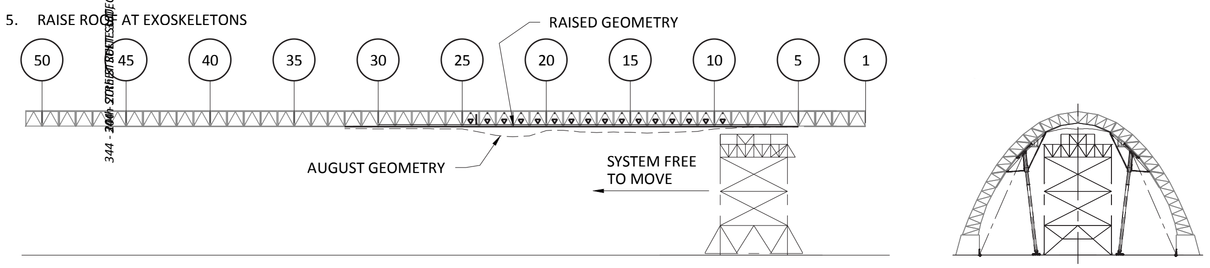
3. INSTALL LATERAL BRACING BEYOND EXOSKELETON LOCATIONS



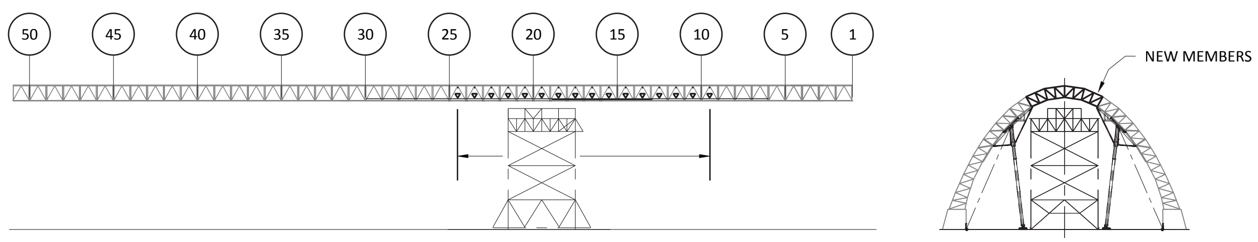

4. REMOVE HANGAR TRUSS DAMAGE AT EXOSKELETONS, AND DISCONNECT HANGAR TRUSSES FROM THE ROOF.



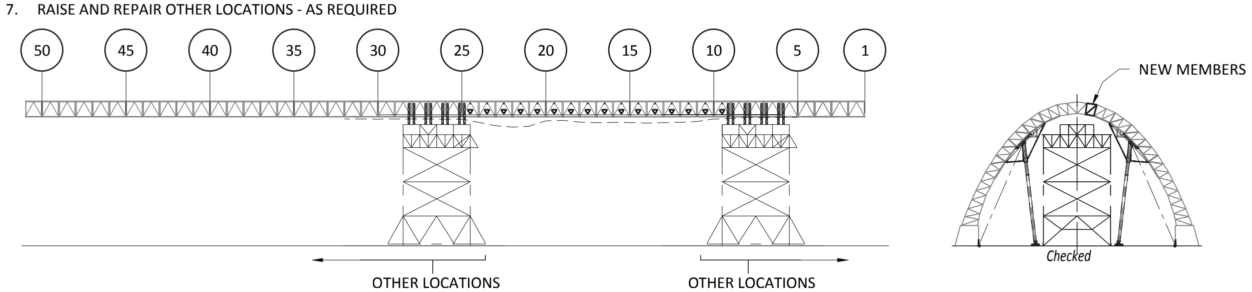

5. RAISE ROOF AT EXOSKELETONS




6. REPAIR OR REBUILD HANGAR TRUSSES AT RAISED LOCATIONS

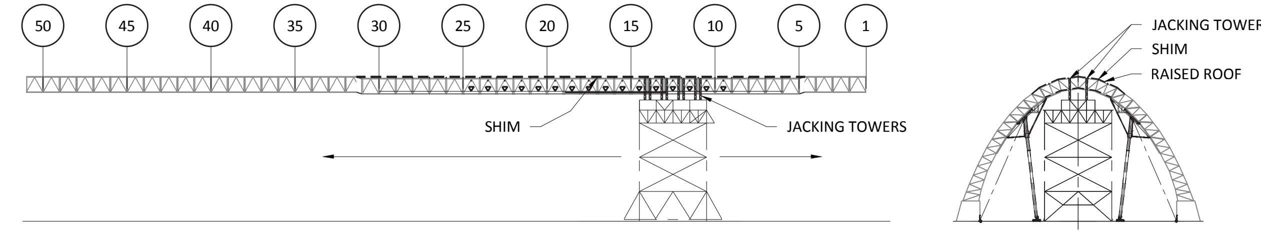



7. RAISE AND REPAIR OTHER LOCATIONS - AS REQUIRED

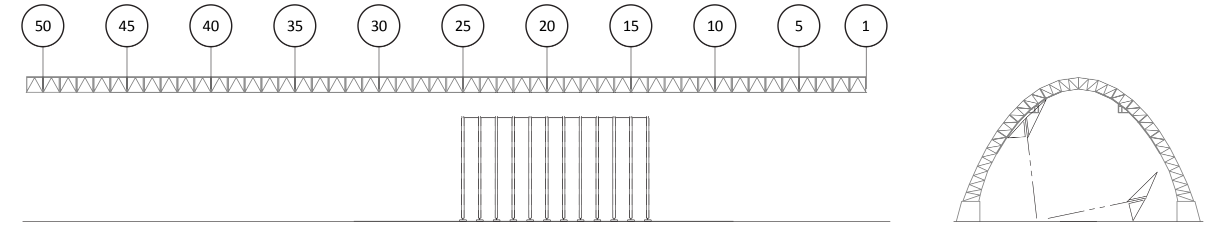


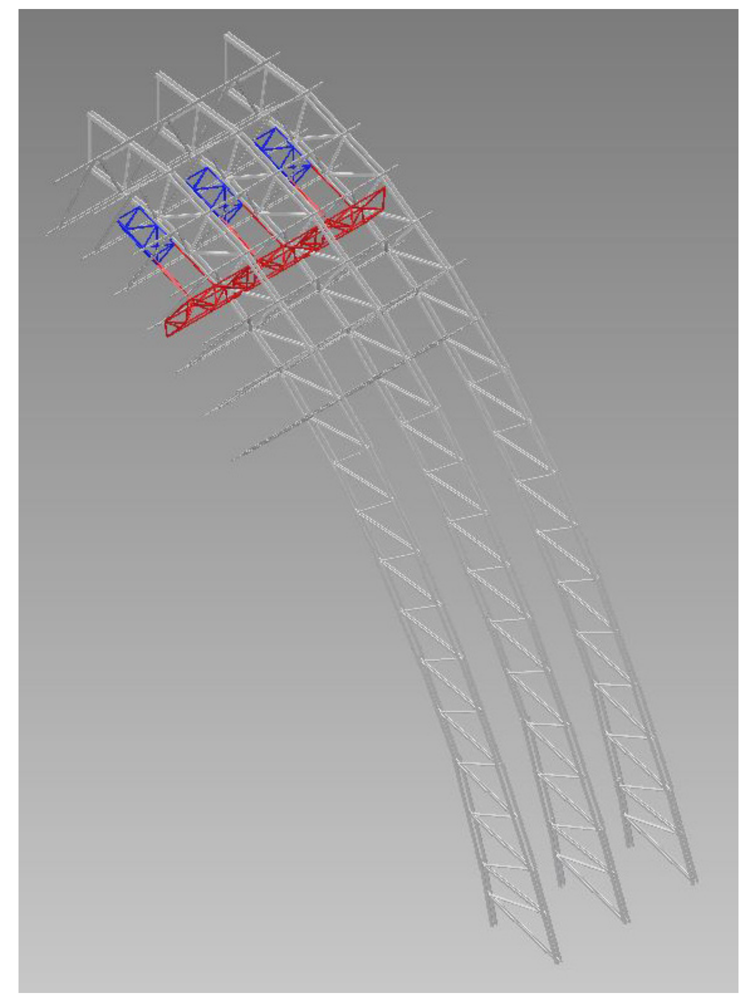

Checked

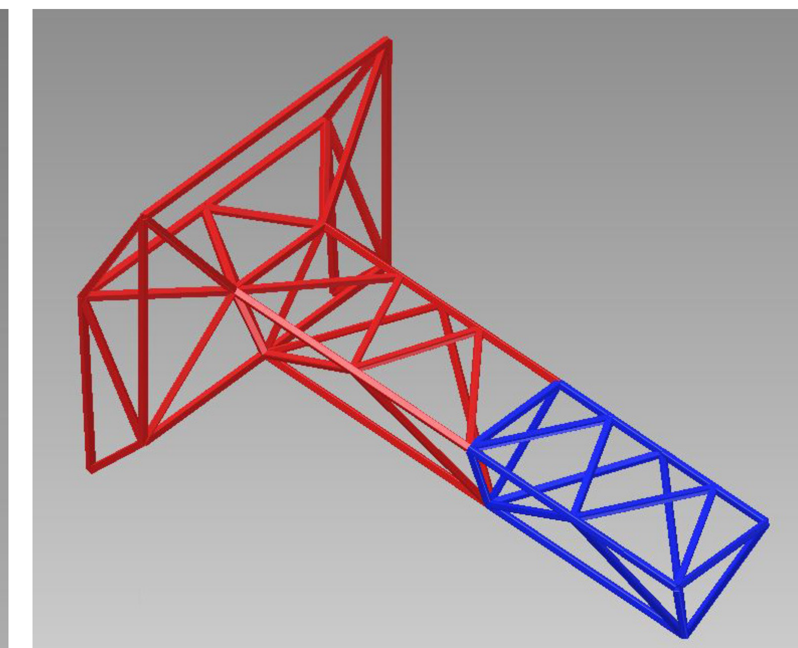
8. ADDITIONAL ROOF ELEVATION ADJUSTMENT BY SHIMMING - AS REQUIRED




9. REMOVE LATERAL BRACING AND TEMPORARY SHORING





3D Model of Exoskeleton (colors are for visual aid only)

Checked

Checked

Checked

## REPAIR PROCEDURES (REMAINING STEPS)

Elevations from Hangar 3 Shoring and Access System drawings by Power and Liftech on 10-06-2015, with 3D Model of Exoskeleton by Liftech on 10-06-2015

# A.3 - Due Diligence Investigations

# CONSTRUCTION

1943 1950 1960 1970 1980 1990 2000 2010

2014 2015 2016 2017

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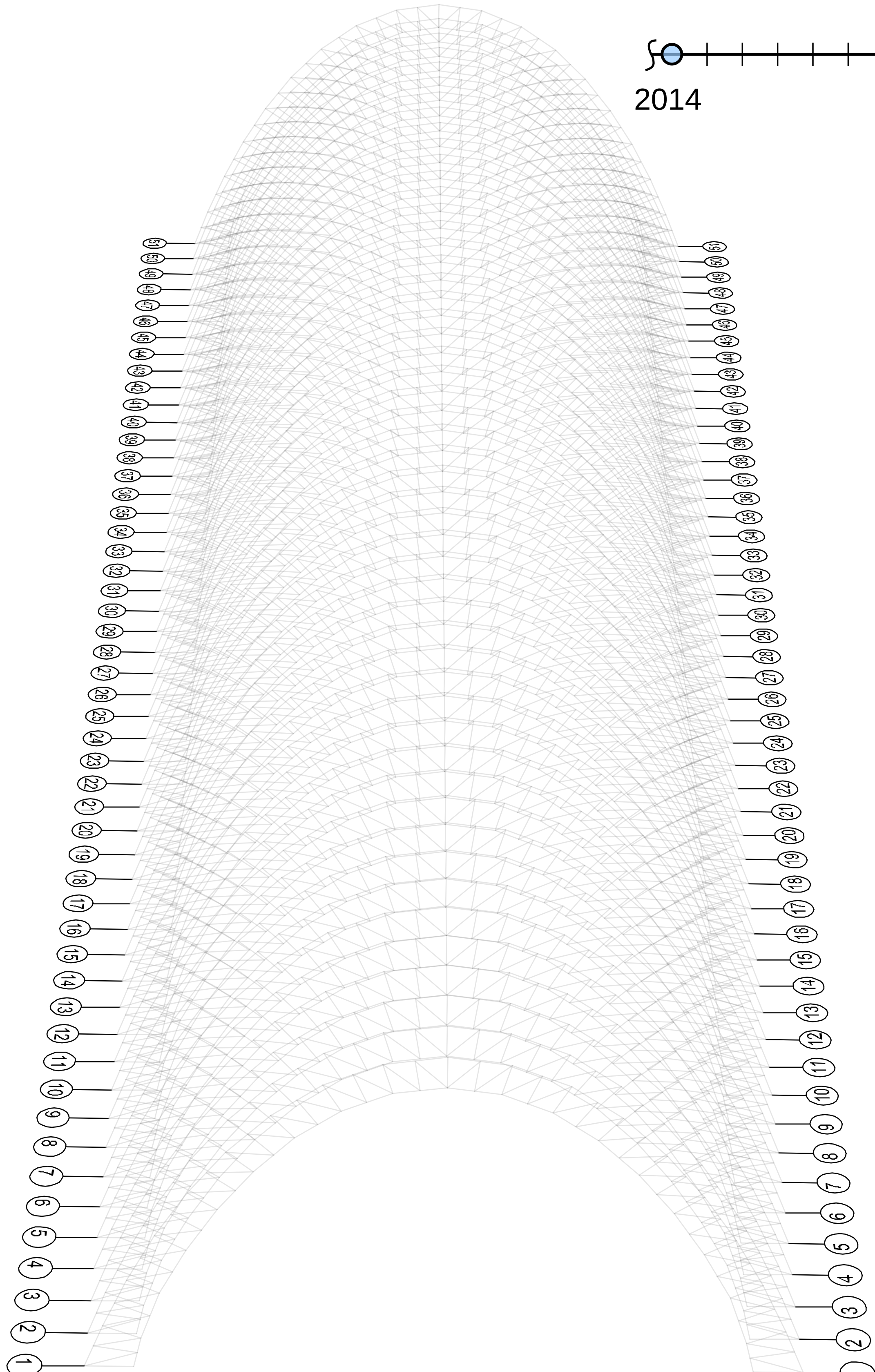
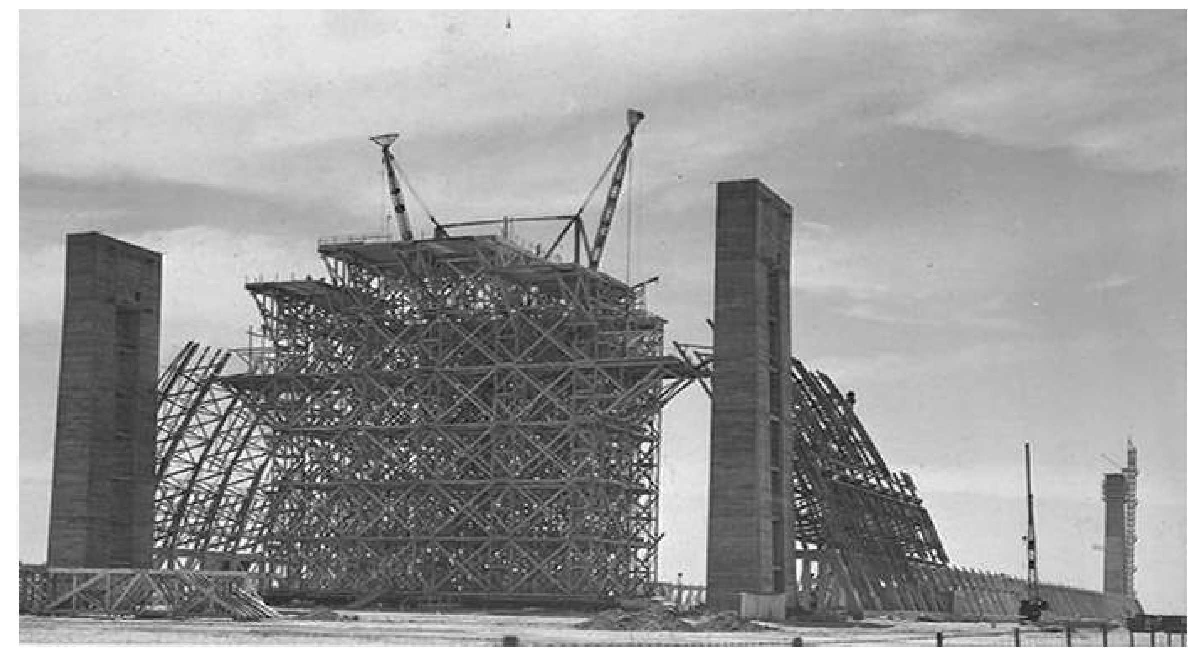
SED

- Built in 1943 to house the Navy LTA (Lighter than Air) program, which used blimps to provide a network for coastal submarine patrol
- Built with wood to save steel for the war effort
- Intended to be semi-permanent wartime structures



N

H3



*Hangar 3 under construction*
*-US Navy Historic Photos*

*Pre-assembled truss panels awaiting erection*
*-US Navy Historic Photos*

*Hangars 2&3 under construction*
*-US Navy Historic Photos*

# EAST SHED ANNEX

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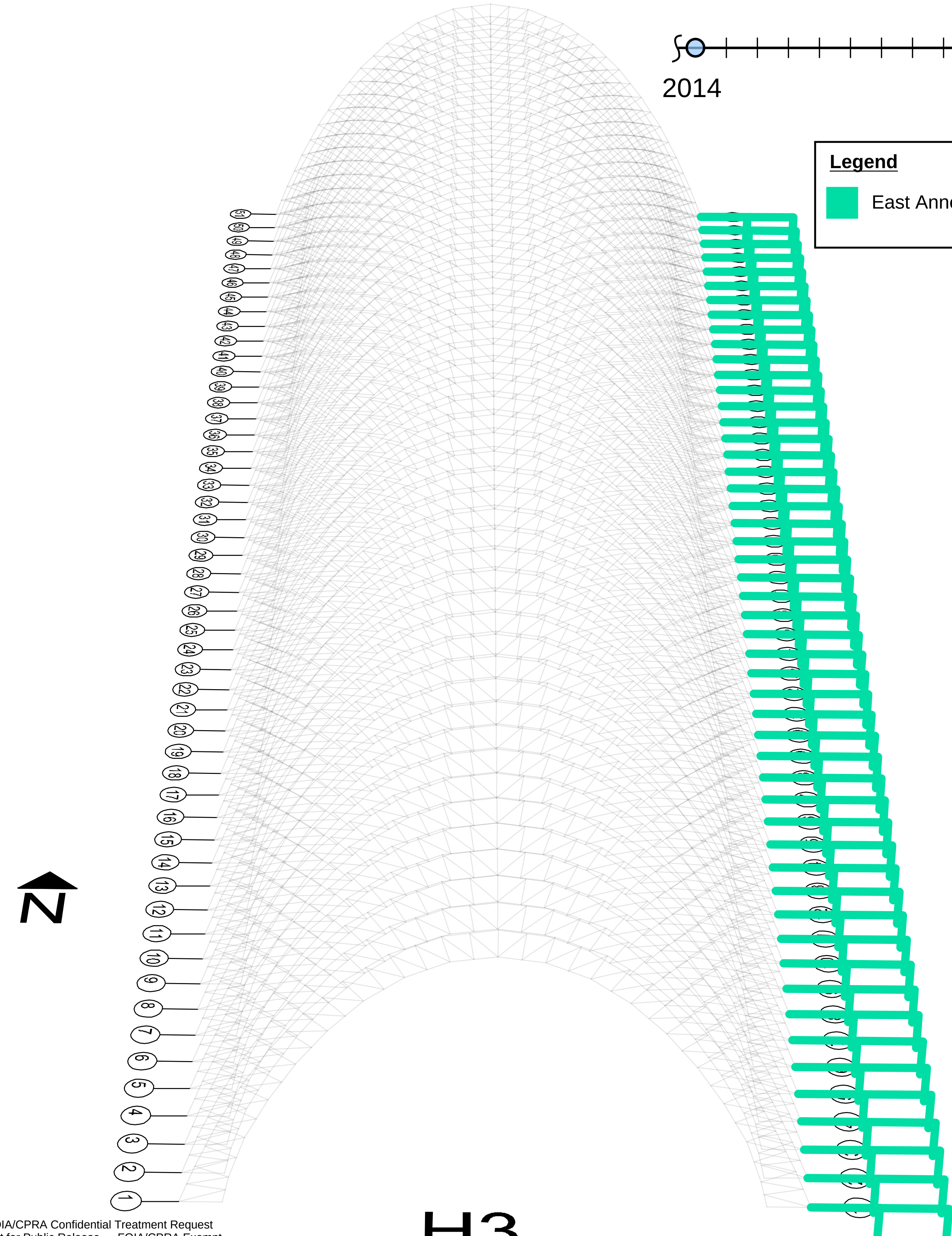
SED

1945

1943 | 1950 | 1960 | 1970 | 1980 | 1990 | 2000 | 2010

2014 | 2015 | 2016 | 2017



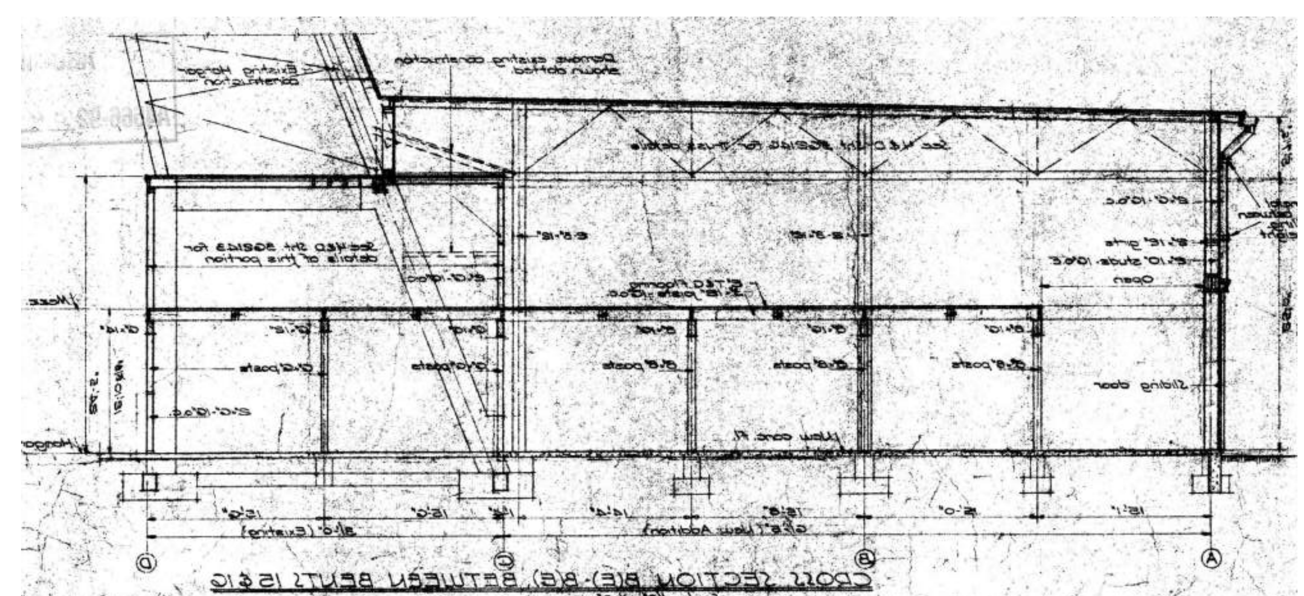

H3

**Legend**

East Annex Shed

- After WW2, the east shed was expanded to support Heavier than Air (H.T.A.) operations

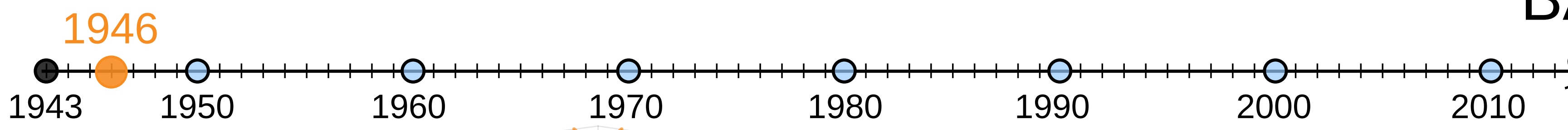
*Interior view of Hangar 3 East Shed Annex*

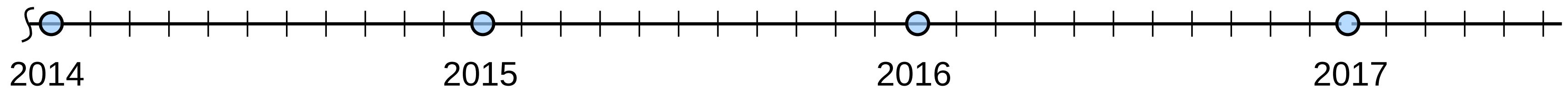


*Elevation view of Hangar 3 East Shed Annex*

# BATTEN STRENGTHENING

kpff San Francisco

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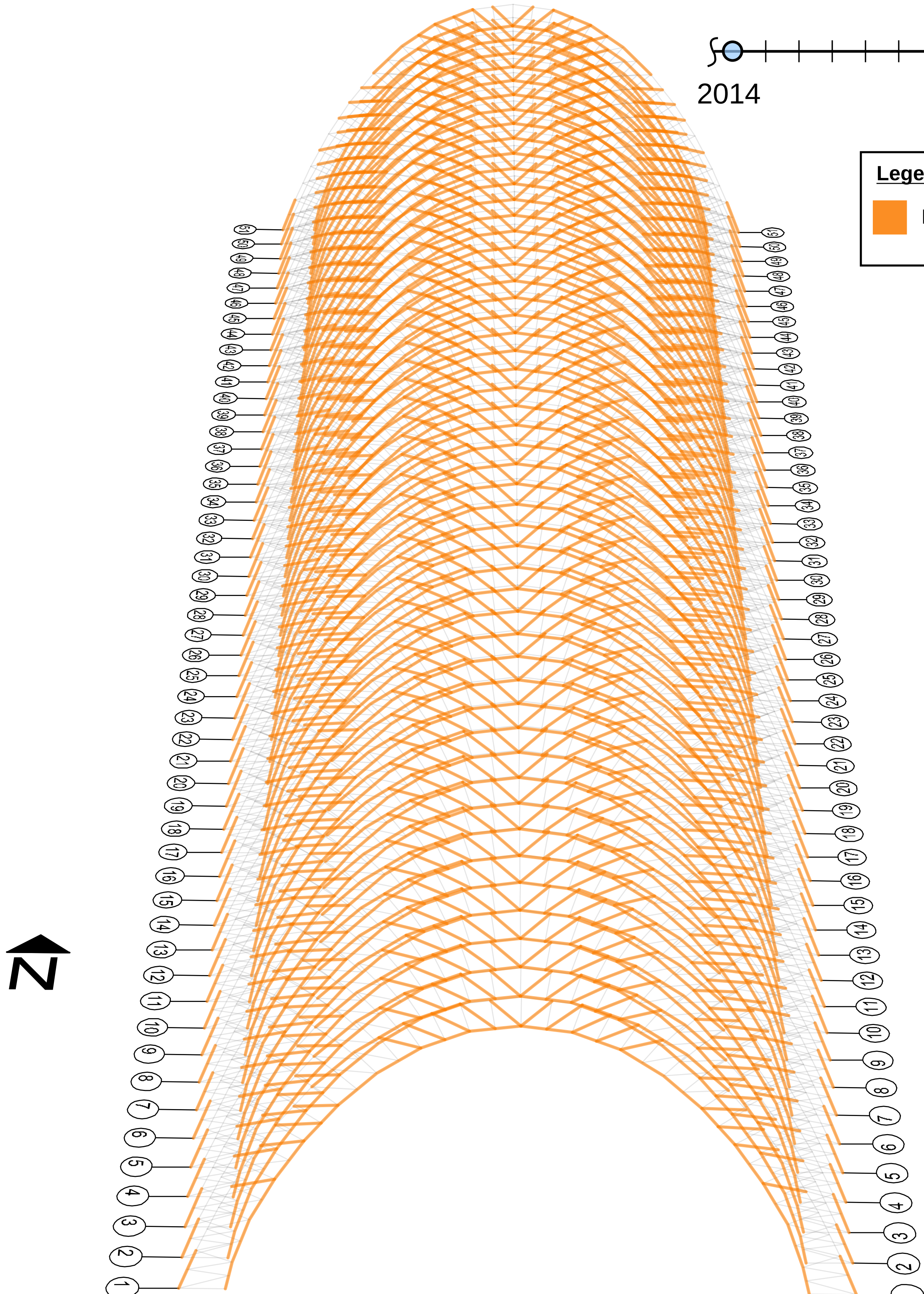
SED



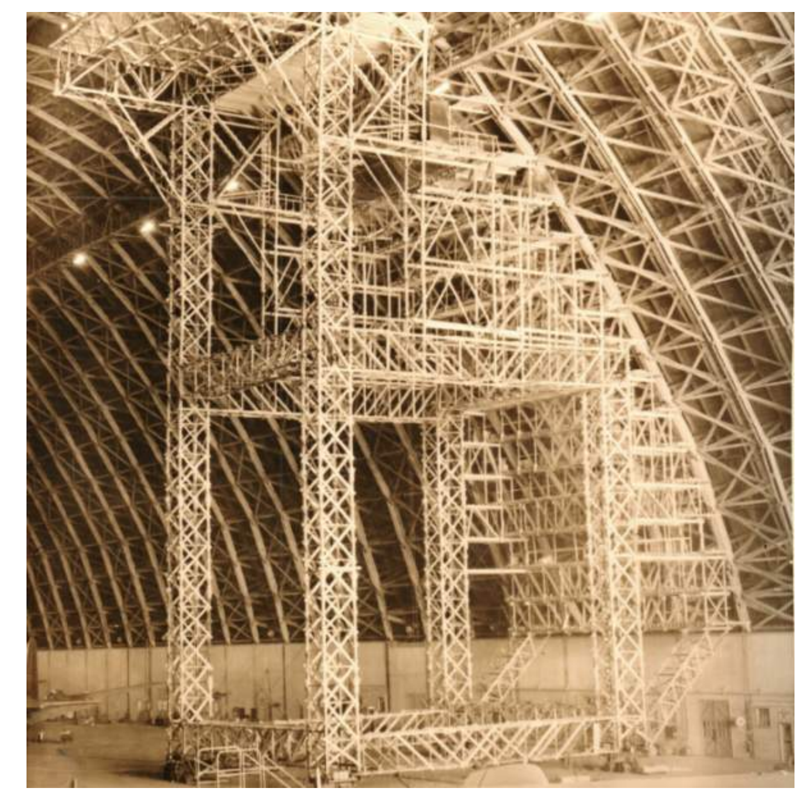

H3

**Legend**

Batten Strengthening

- Battens were added to bottom chords, and some top chords and diagonals to increase stability and help prevent buckling
- Upgrade was intended to increase the longevity of the temporary structure
- Battens added to **2244** members per hangar
- Batten wood was treated with a mixture of borax, white lead, and linseed oil paint.
- "These battens, with a few additional bolts and blocking at the chord splices, are the principle measures taken in strengthening and making permanent these wood buildings." "*Strengthening of LTA Hangars, Naval Air Station, Moffett Field, California*", J.S. Marsh, 1946

*Typical chord member with battens*



*Rolling scaffold used to install battens*
*- Seabees Historic Photos*

# KNEE BRACES

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SED

1946

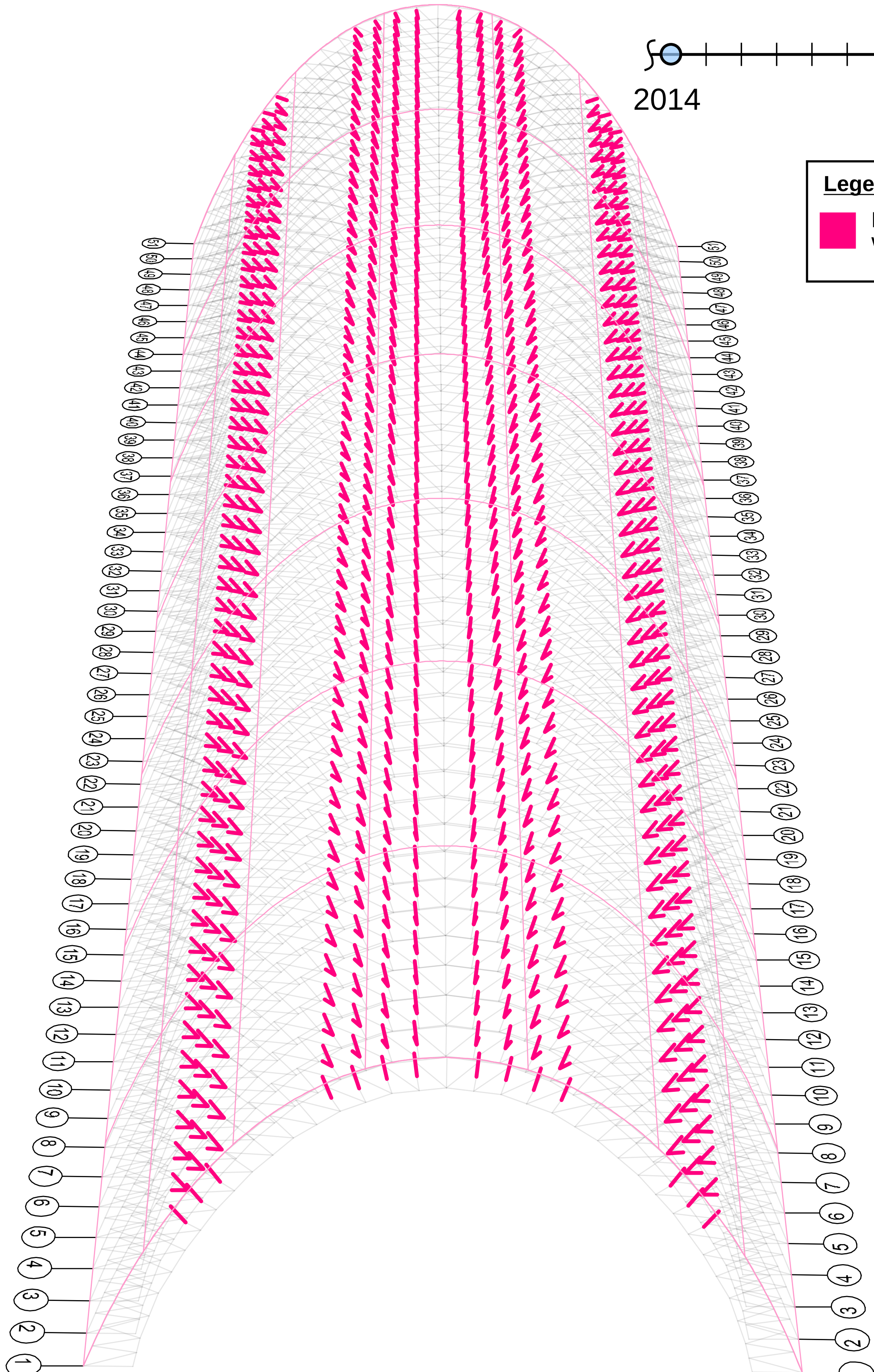
1943 1950 1960 1970 1980 1990 2000 2010

2014 2015 2016 2017

**Legend**

Knee Braces at Vertical Web Members

- Knee-braces were added to reduce the unbraced length of certain vertical web members
- These braces were part of the 1946 strengthening measures described by J.S. Marsh.
- Knee braces added to **700** vertical web members



N

H3

*Typical vertical web member with added knee-braces*

# RE-ROOFING

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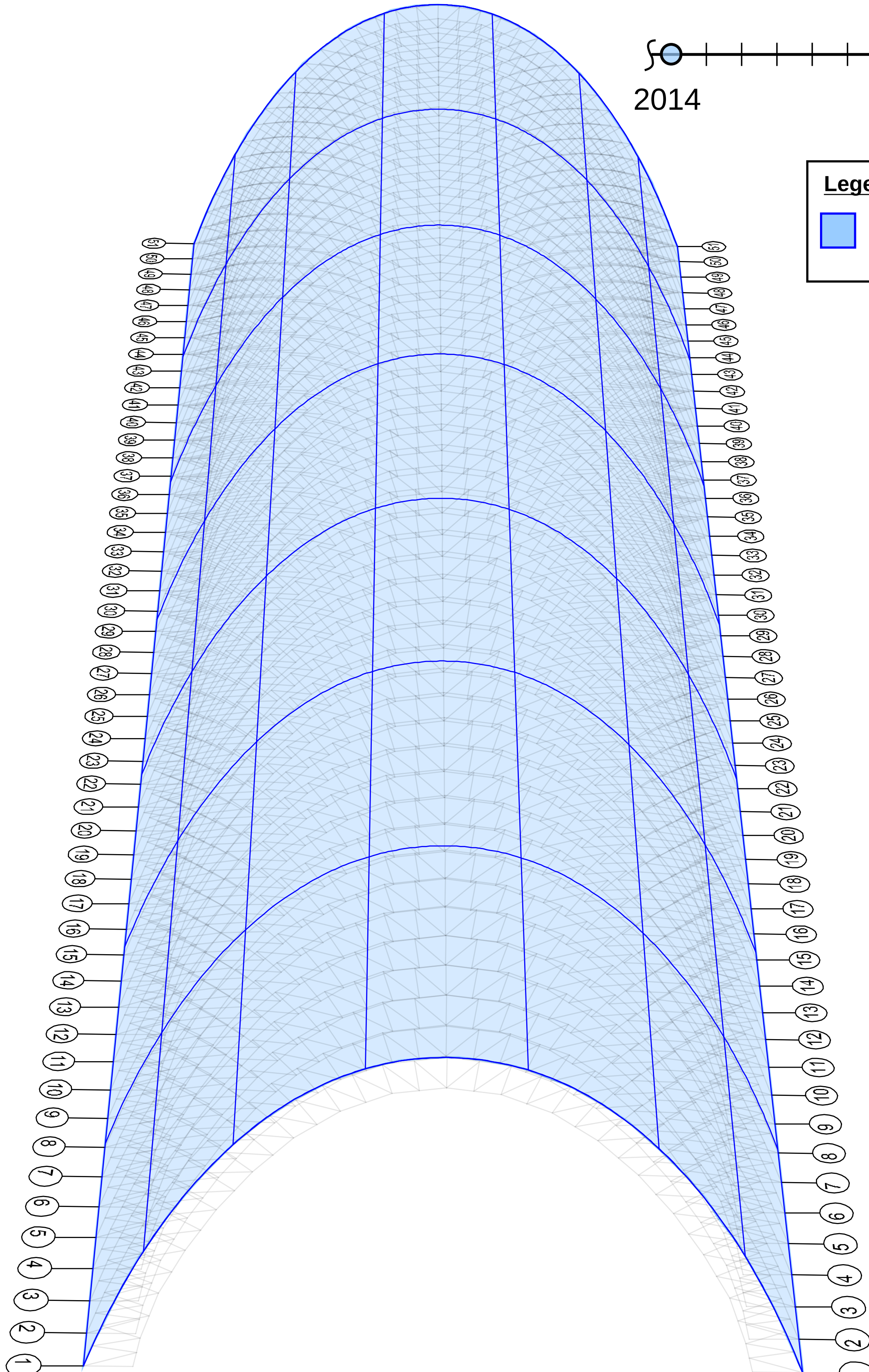
SED

1943 · 1950 · **1956** · 1960 · 1970 · 1980 · 1990 · 2000 · 2010

2014 · 2015 · 2016 · 2017



N

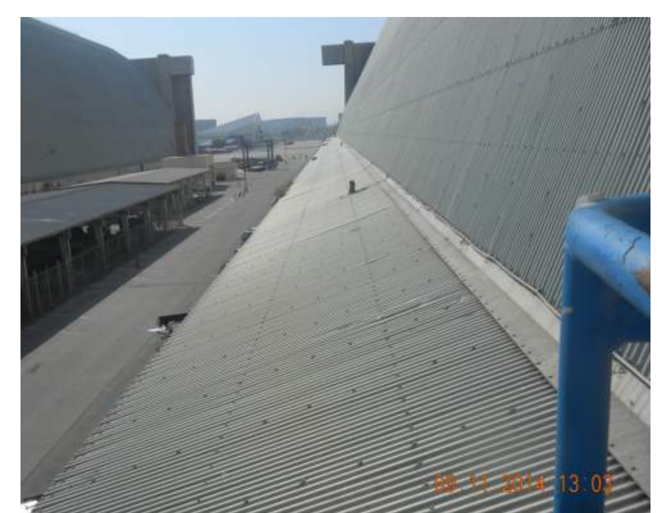
H3

**Legend**
New Roofing

- Original roofing system was roll-roofing over panelized wood sheathing
- Roof was upgraded to corrugated aluminum panels over roofing felt in 1956
- Approximately **466,000** ft² of roofing per hangar

*Original roofing system*
*-Seabees Historic Photos*

*Asphalt shingles documented in 1954*
*-Seabees Historic Photos*



*Current aluminum roofing*

# MAINTENANCE REPAIRS

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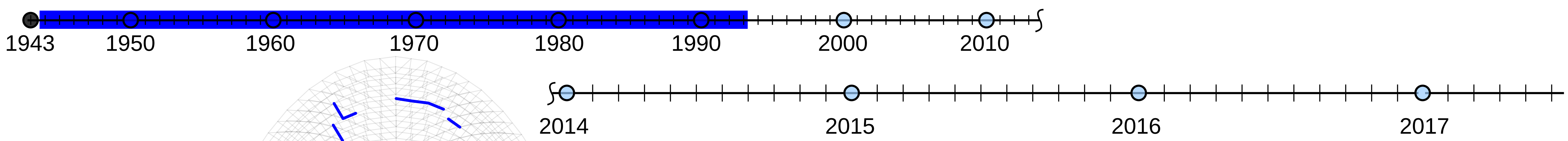
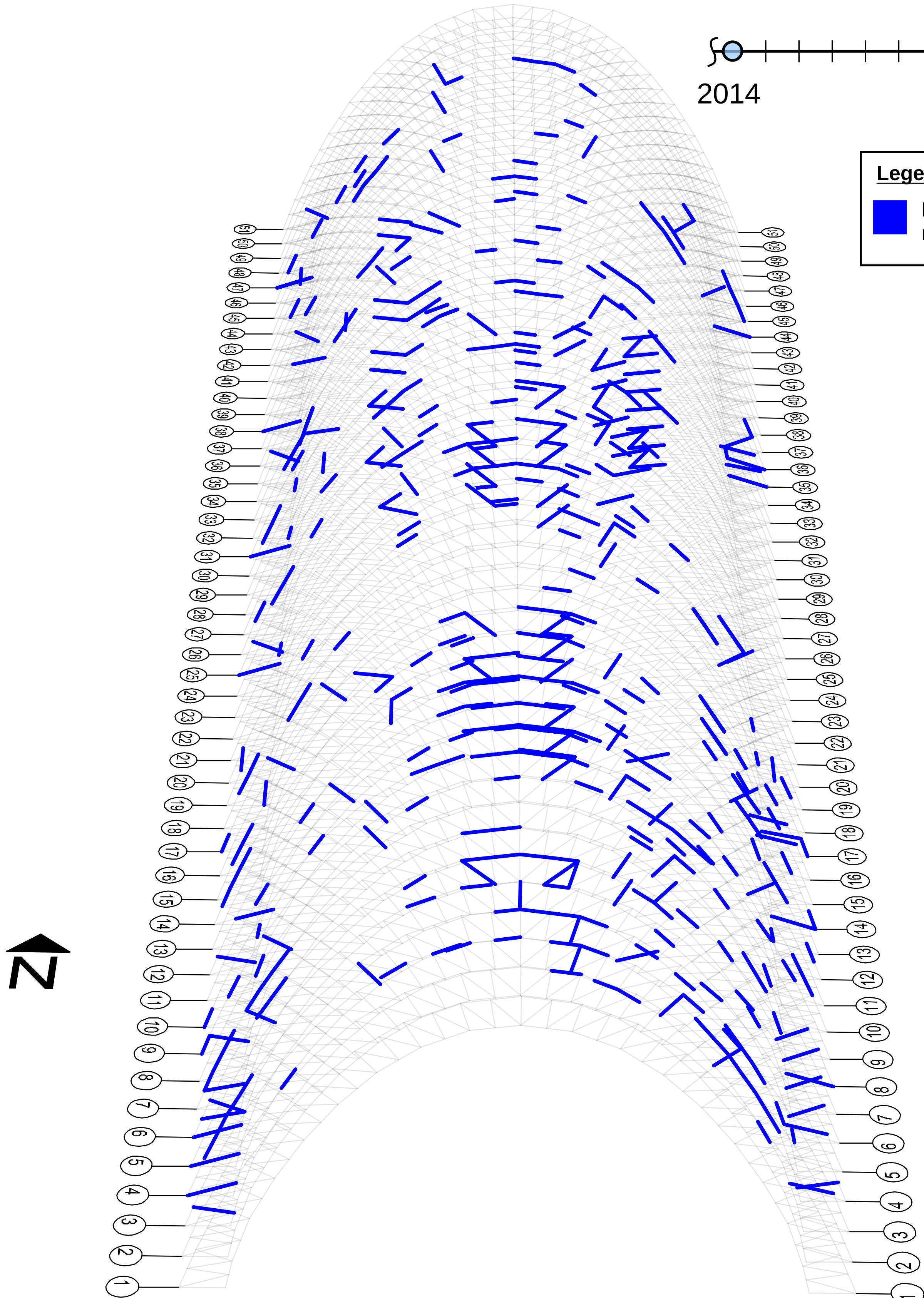
SED



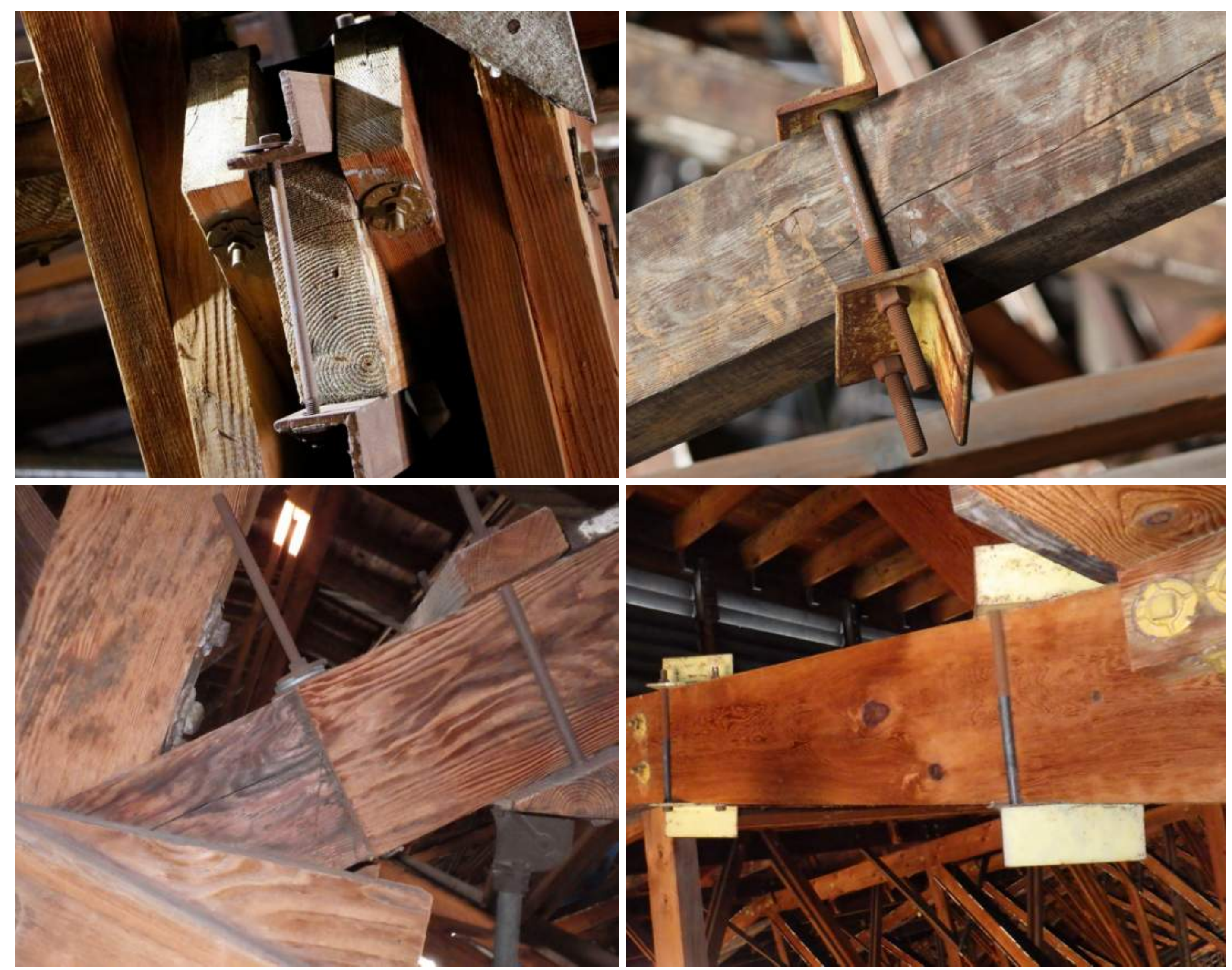



**Legend**

Documented existing minor repairs

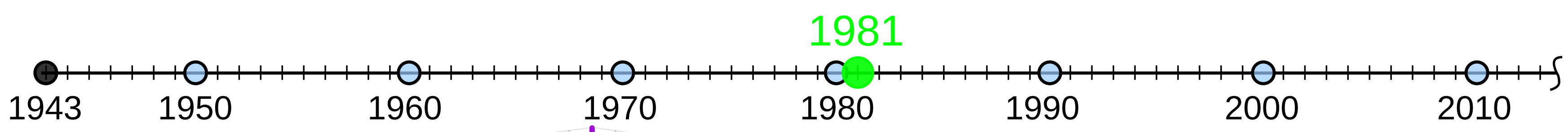
H3

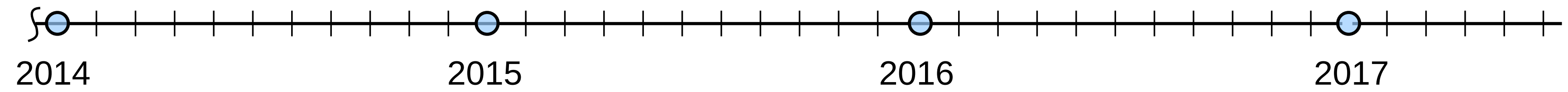
- Standard repairs for Navy maintenance included steel clamps and stitch bolts to fix minor splits "*Maintenance Procedure for Timber Trussed Structures*" Department of Navy Bureau of Yards and Docks, 1944
- Repairs occurred periodically throughout the service life of the hangars
- Navy records indicate that Timber Structures performed an inspection of the hangars in 1954
- The extent of these repairs is not fully documented
- Minor repairs have been documented at **541** members in H3 (many still undocumented)



*Minor repairs made during Hangar 3 service life*

# 1981 REPAIRS




kpff San Francisco

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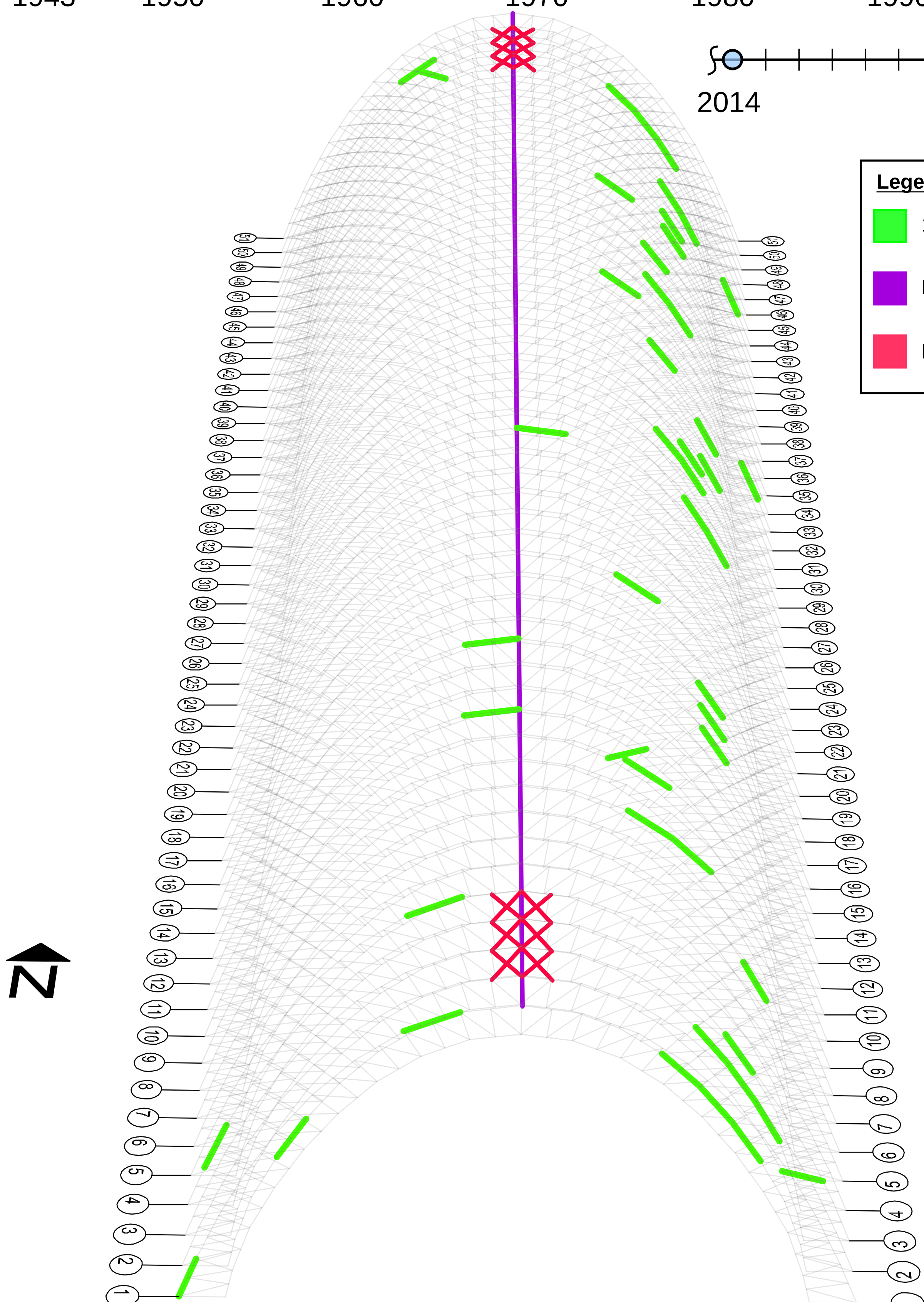
SED

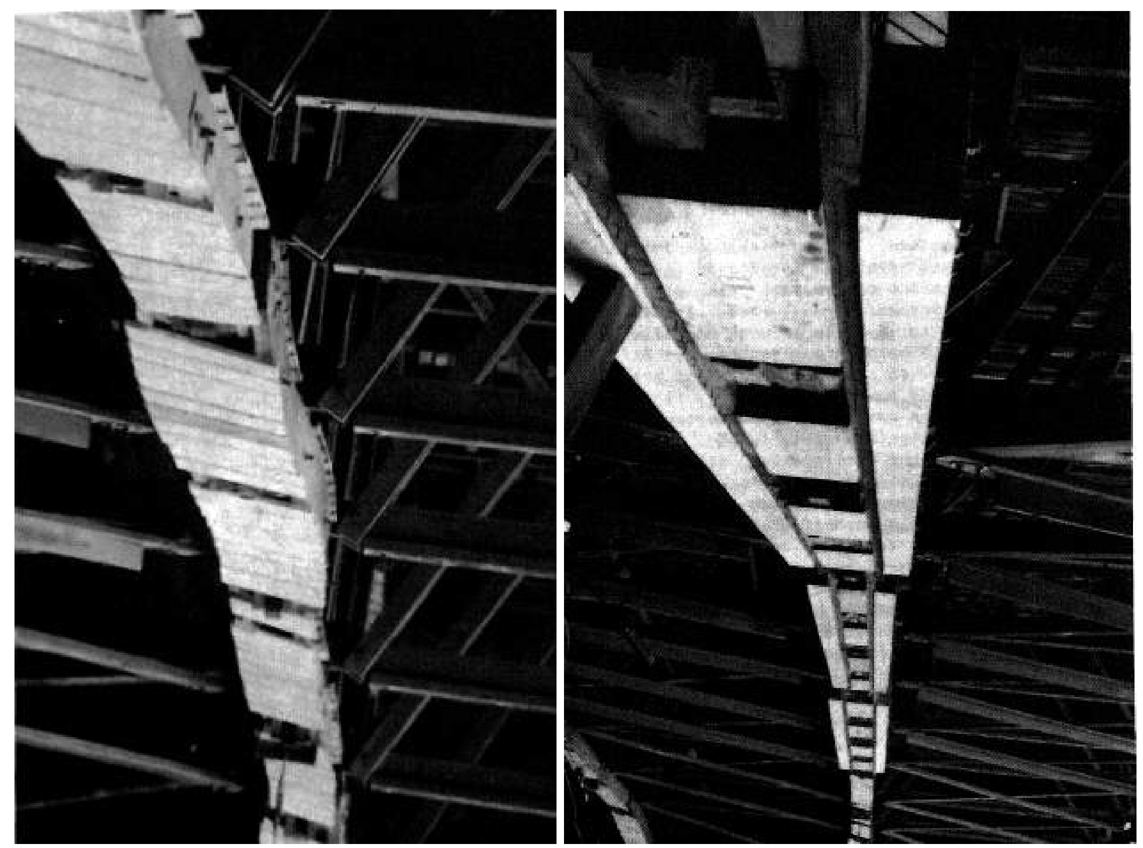


H3

**Legend**

- 1981 Glulam Repairs
- Node 18 Struts
- Rod Cross-Braces

- Major glulam repairs were made in 1981 to correct buckling observed in truss chords
- Glulam strongback members were installed to re-align chords, but load path remained in the original members
- Major repairs made to **49** members
- Struts added at each arch at node 18 to brace top of truss, with rod cross-bracing added at the north and south ends of the hangar
- Minor repairs were also made with clamps and stitch bolts. Many 1x6 purlin ties were replaced with steel rod ties

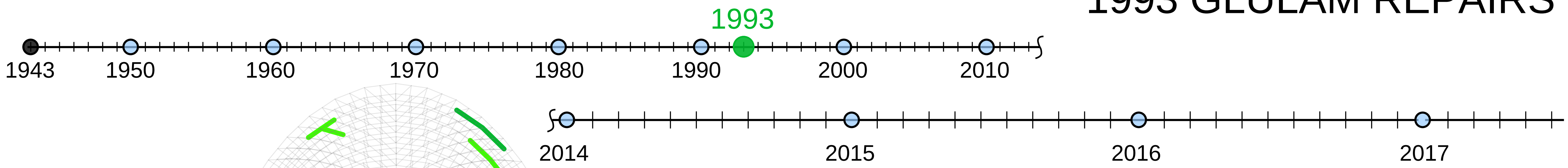


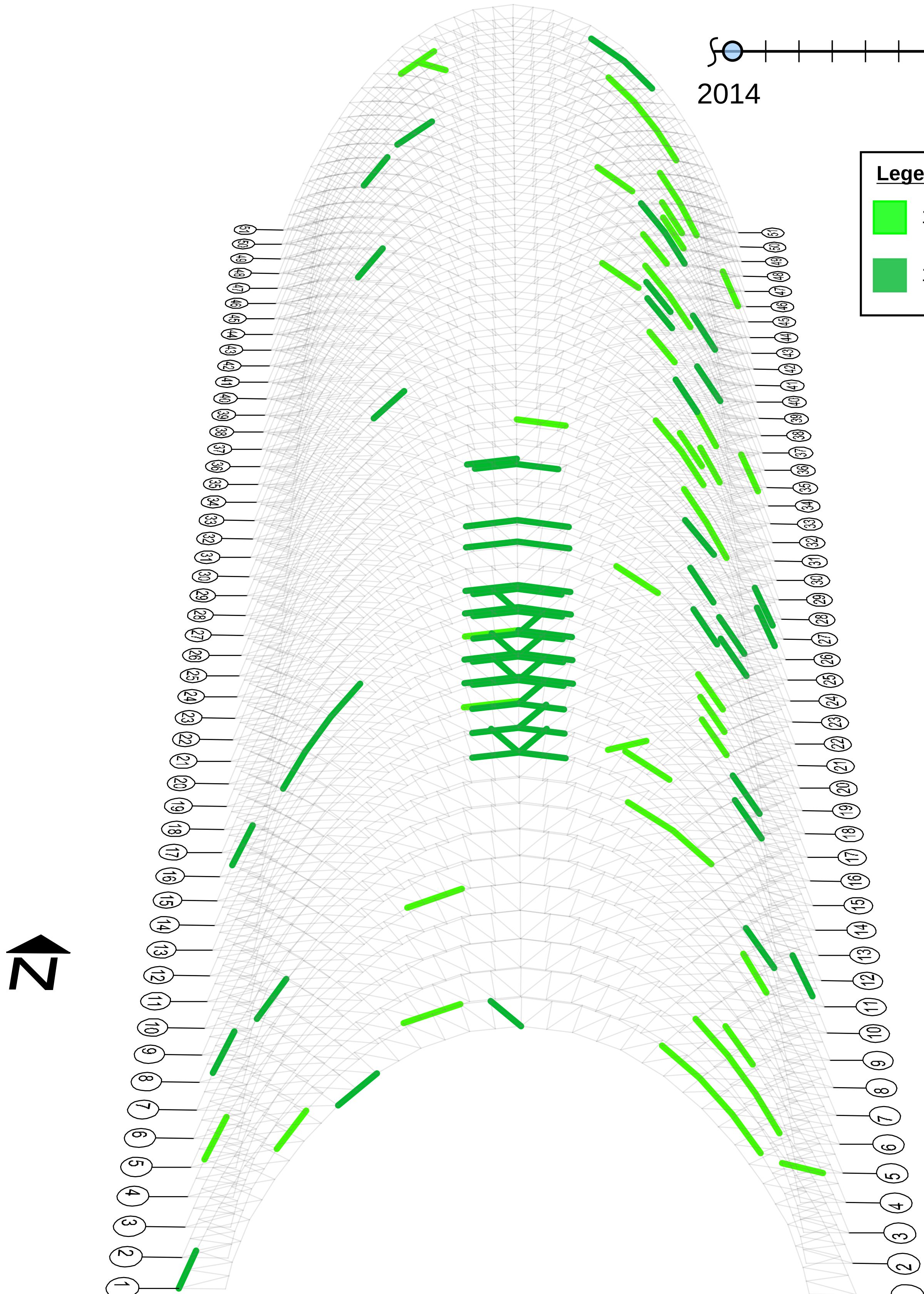
*Buckled chords (left) and glulam strongback repairs (right)*
*-"Restoration of Navy LTA (Lighter than air) Hangars", Donal Neal, 1986*

*Node 18 struts*

# 1993 GLULAM REPAIRS

DRAFT - 7/6/2017
SED




H3

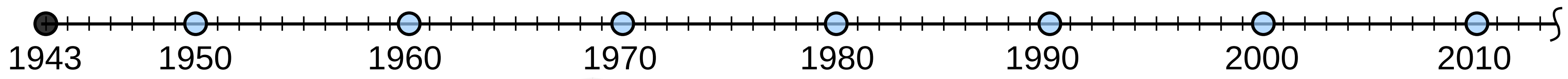
**Legend**

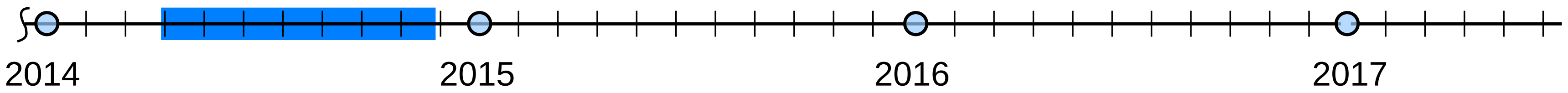
- 1981 Glulam Repairs
- 1993 Glulam Repairs

- Continued deterioration of Hangar 3 necessitated further glulam repairs in 1993
- Repairs consisted of glulam strongbacks for buckling, and multi-chord glulam sistered members
- Many of these repairs were made in the critical zone where the most severe deflections and damage were later found
- Major repairs made to **75** members
- Sistering repairs also made to roof support purlins and minor clamp repairs were again performed on arch trusses

*1993 glulam sister repairs to chord members in critical zone*

# DUE DILIGENCE INVESTIGATIONS



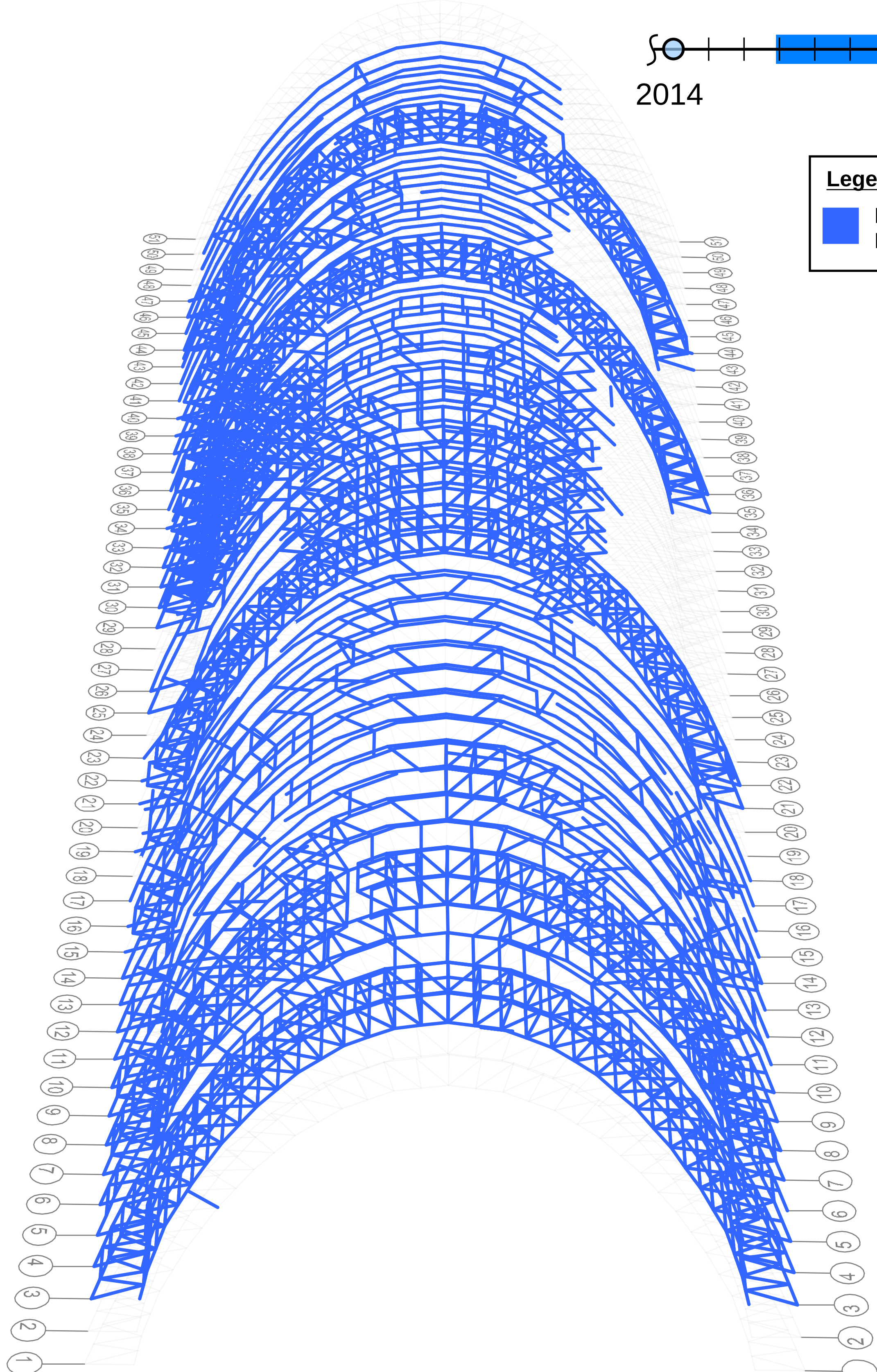




DRAFT - 7/6/2017
SED

**Legend**

Members surveyed in Due Diligence Investigations

- Data collected in the Due Diligence Investigations phase of the project included visual observations of many (but not all) of the truss members
- Observations were made regarding wood grading, existing condition, and previous repairs
- Data was logged for **5663** members in H3 through TPAS® (Tablet PC Annotation System) provided by Vertical Access
- H3 contains over **20,000** total members, including **5559** main arch members
- Results summarized in Page & Turnbull Due Diligence Investigations Findings Report (DDIF)



N

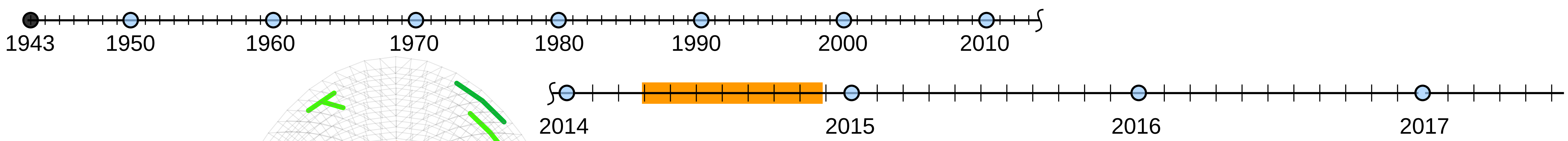
H3

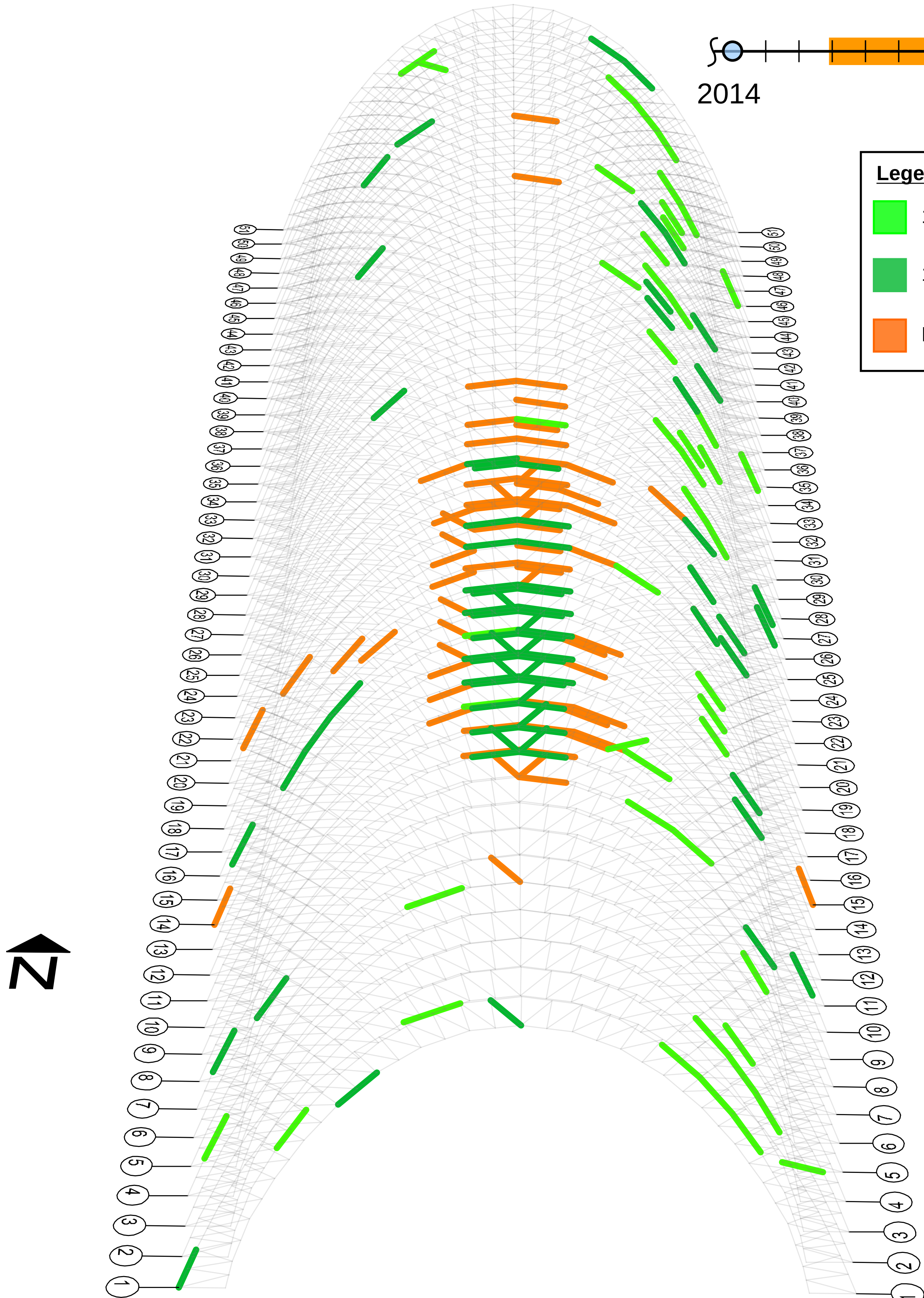
*Boom lift used for visual observations*

*Visual observation of a lower chord member*

# DDIF REPAIR SCOPE

DRAFT - 7/6/2017
SED



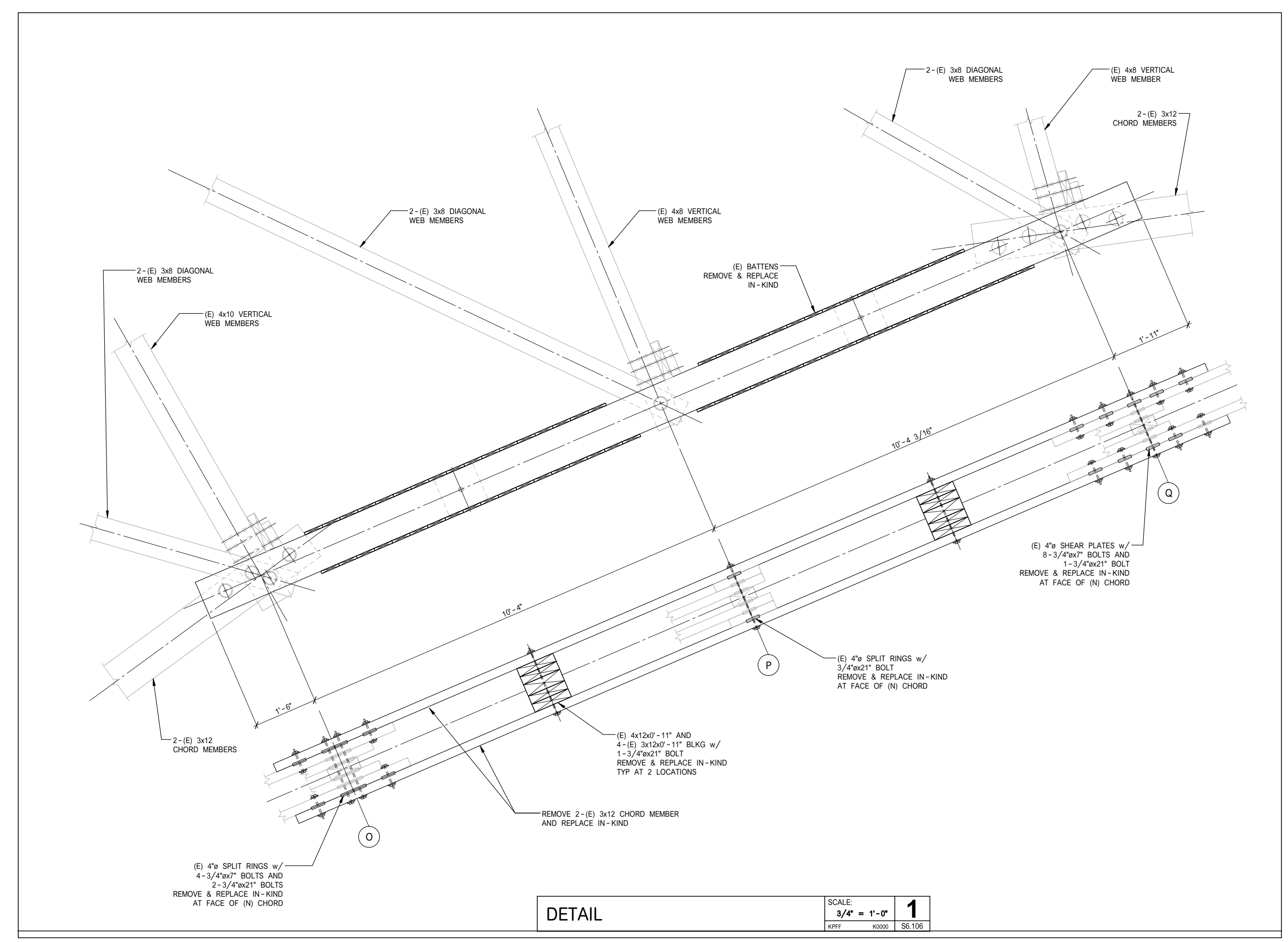




H3

**Legend**

- 1981 Glulam Repairs
- 1993 Glulam Repairs
- DDIF Repair Scope

- TPAS® data was reviewed and damaged members were identified for repair
- 68 members were found to be damaged and in need of major repairs




*Example detail for removal and replacement of damaged chords found in TPAS®*

# EMERGENCY REPAIRS

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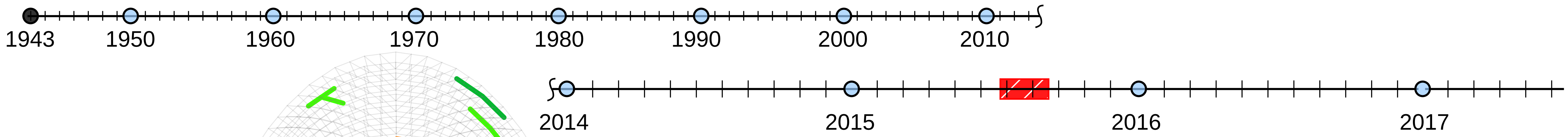
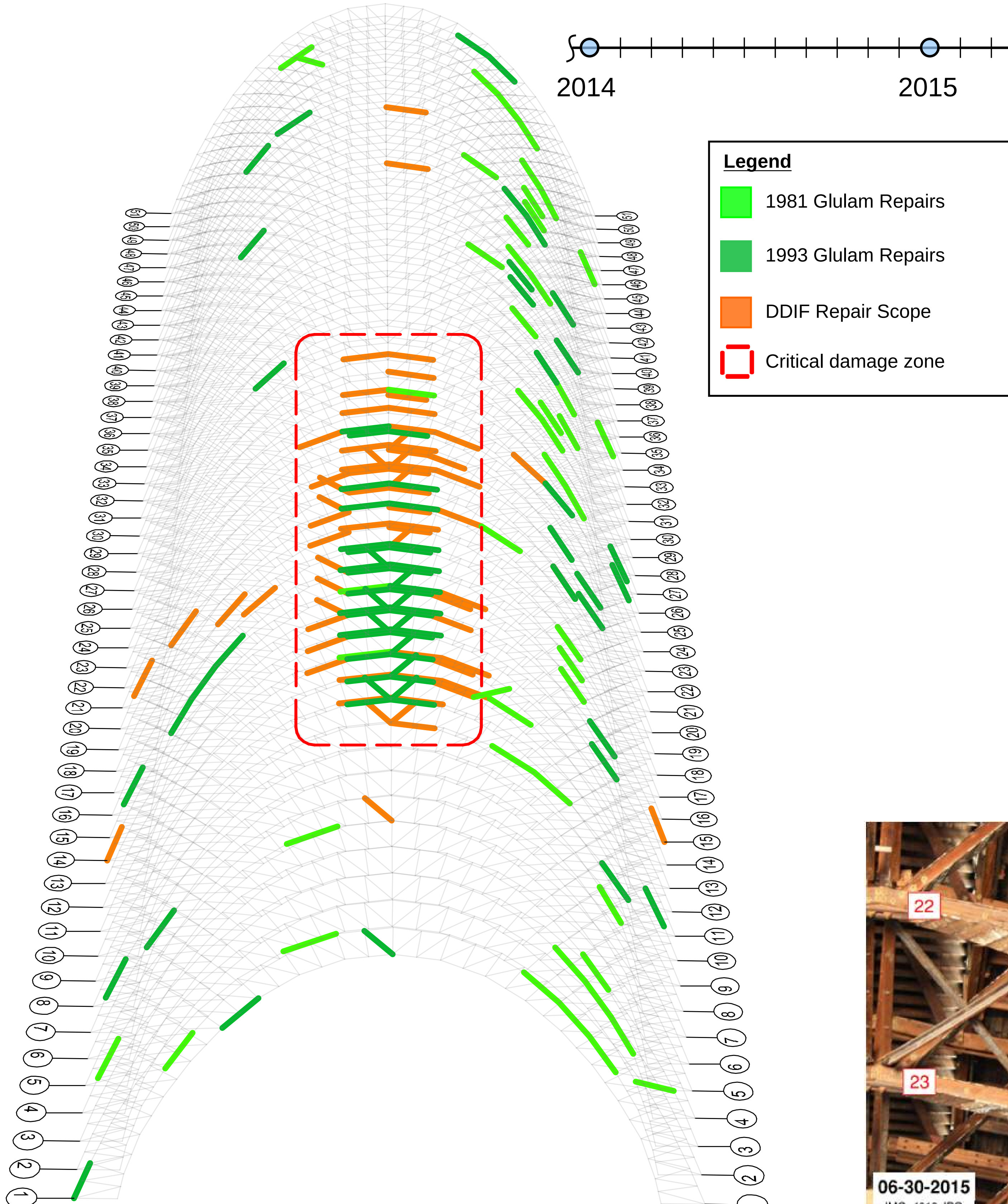
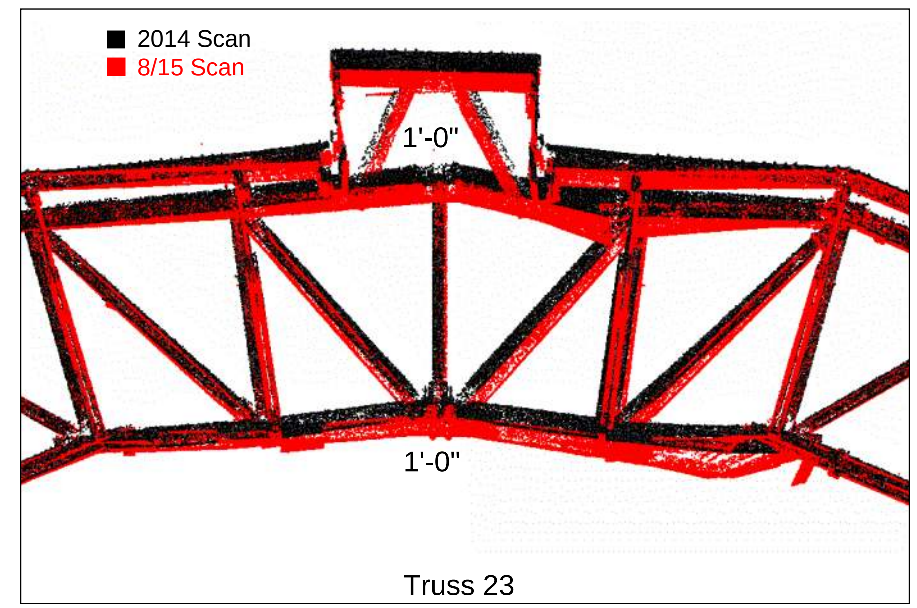
SED

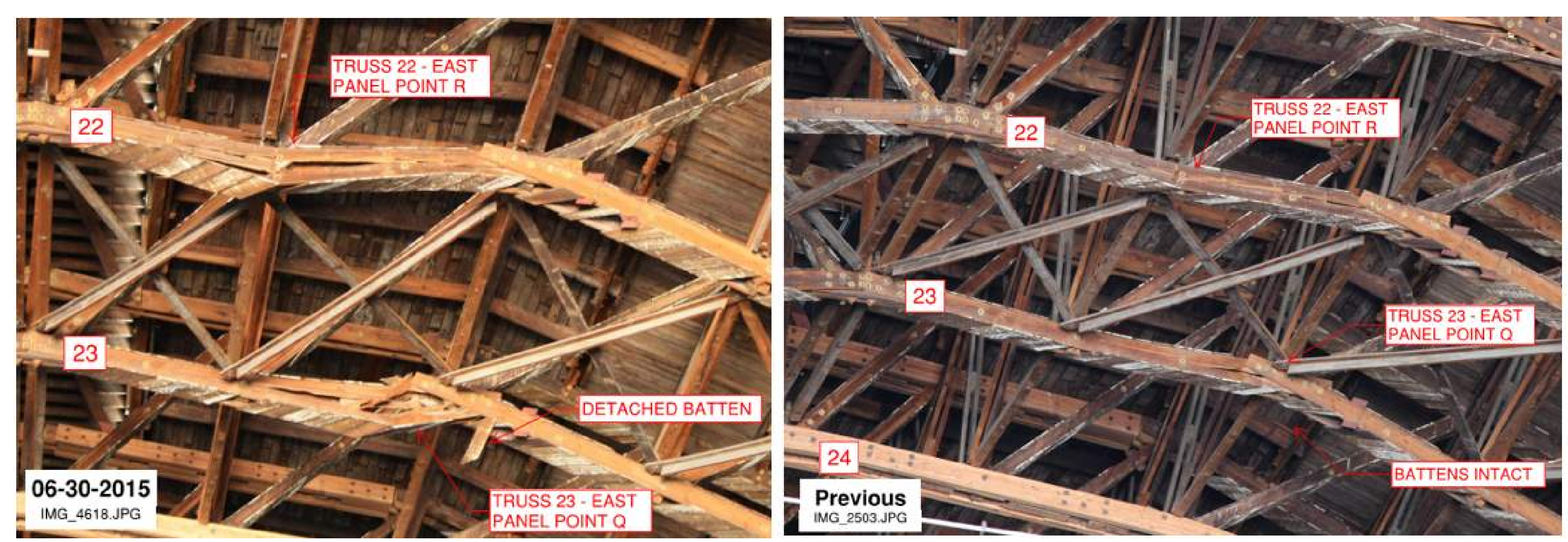



- During a site visit on June 24, 2015 KPFF observed damage progression in arch trusses
- On July 2, 2015 KPFF issued an Emergency Truss Repairs permit drawing set
- KPFF, Power Engineering Construction, Turner, and Page & Turnbull coordinated work to implement shoring and emergency truss repairs
- Permit for emergency repairs was received from NASA on August 19, 2015.

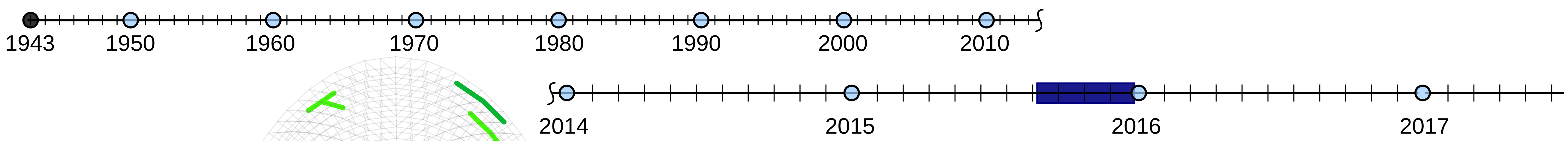



*Point cloud visualization of damage progression*

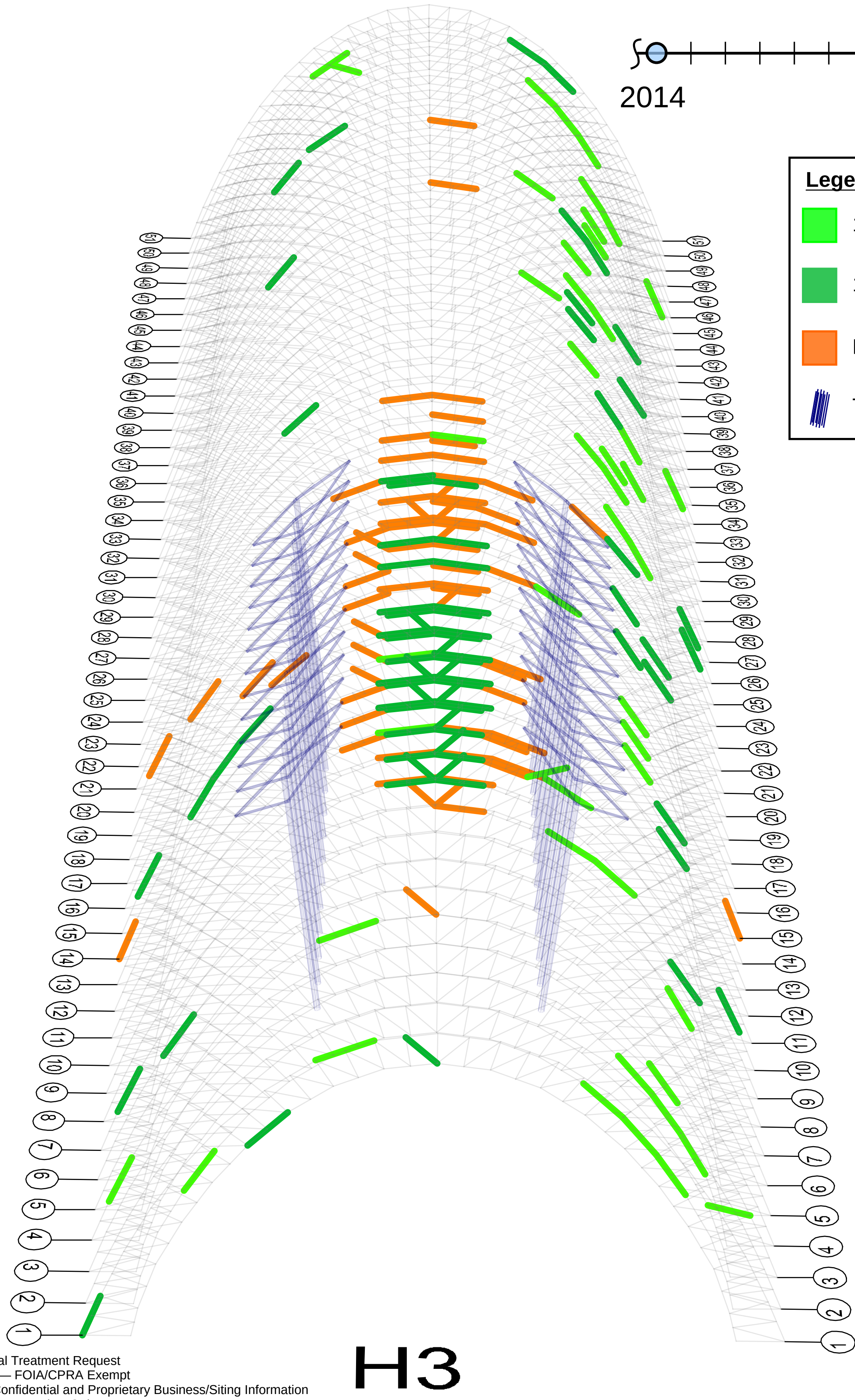



*Photos of damage progression*

# TEMPORARY SHORING




DRAFT - 7/6/2017
SED




**Legend**

- 1981 Glulam Repairs
- 1993 Glulam Repairs
- DDIF Repair Scope
- Temporary Shoring

- Evidence of severe damage and progressive collapse of Hangar 3 necessitated a shoring and emergency repair program
- As part of the contractor's means and methods of performing repairs, 36"ø steel pipe shores were placed between trusses 9-26
- Pipe shores were designed to provide secondary stability in the event of progressive roof collapse during repair procedures
- Steel exoskeletons with jacks would then be placed at top to jack the roof and rebuild the critical zone


*Hoisting of temporary shore segment*


*Temporary shores after installation*

# OBSERVATIONS BELOW EXOSKELETON

1943 1950 1960 1970 1980 1990 2000 2010

2014 2015 2016 2017

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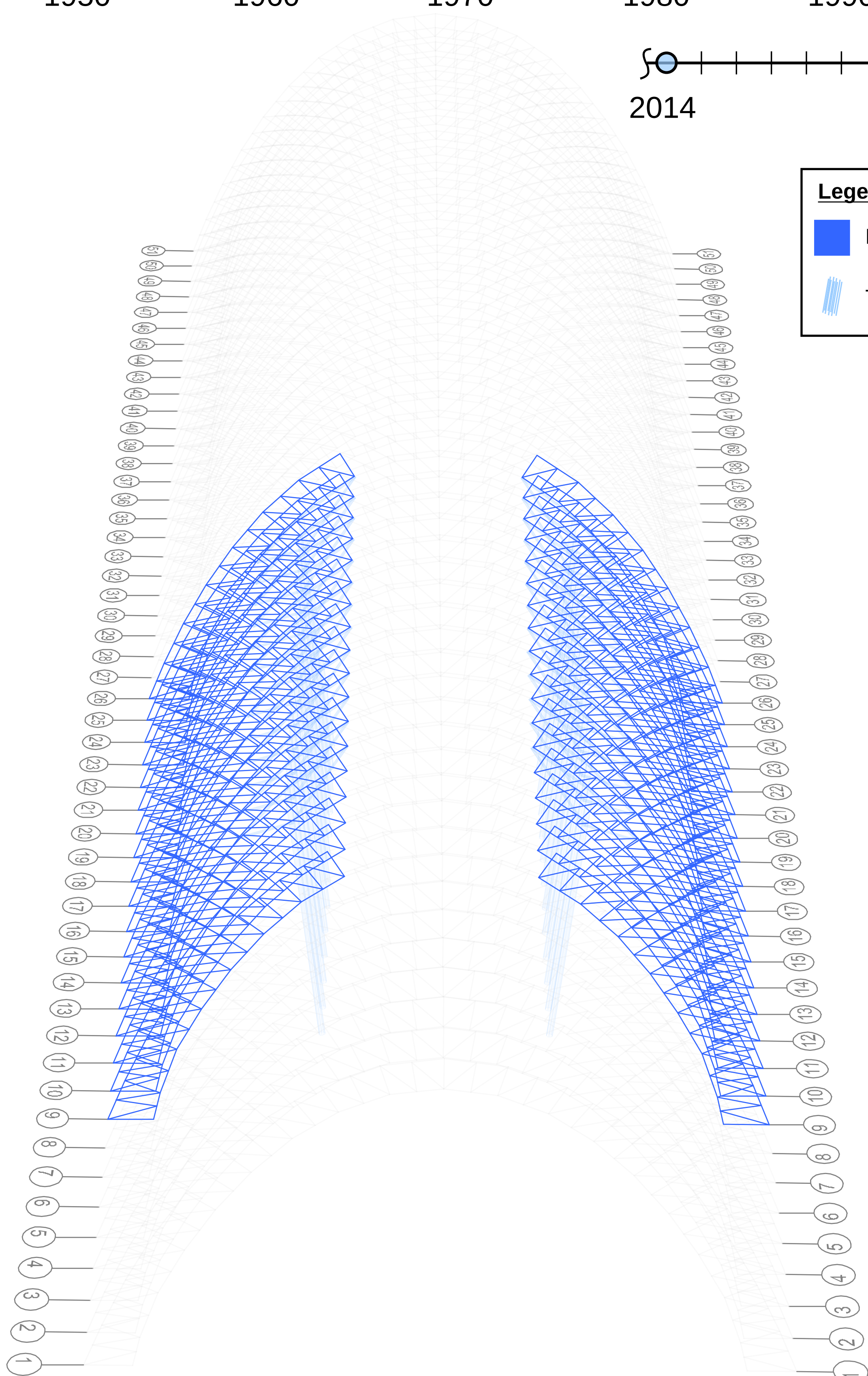
SED

**Legend**

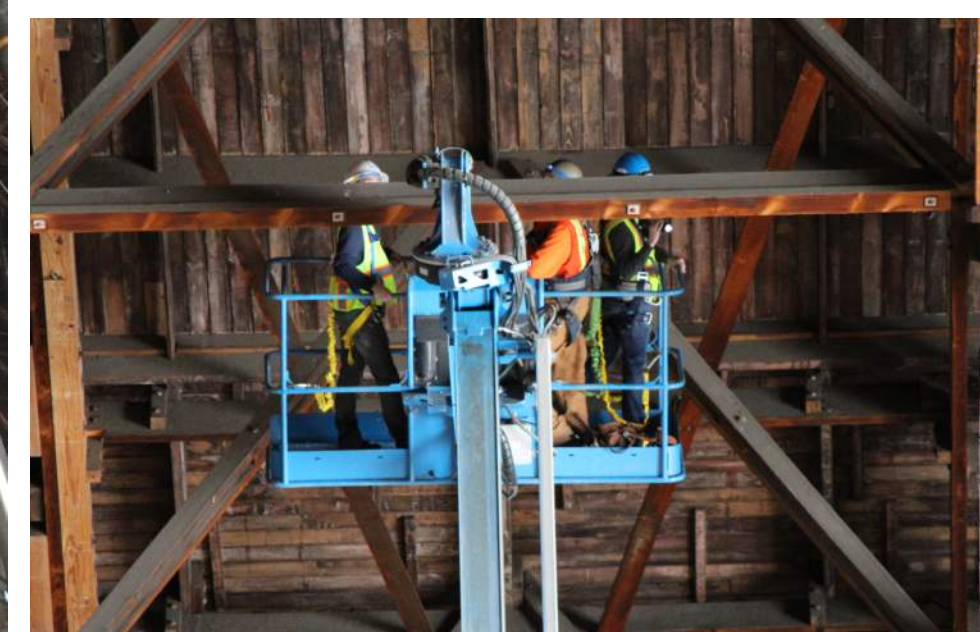
- Members surveyed below exoskeletons
- Temporary shoring

- Before the exoskeletons could be placed, the condition of the trusses below had to be verified to ensure they could take the additional weight
- Any damage of main arch members needed to be repaired prior to exoskeleton installation
- KPFF conducted a survey of main arch members between Trusses 9-26 below panel point O and 14
- **1548** main arch chords and webs were surveyed for damage



H3

*Boom lift used for visual observations*



*KPFF condition assessment crew*

# PRE-JACKING REPAIR SCOPE

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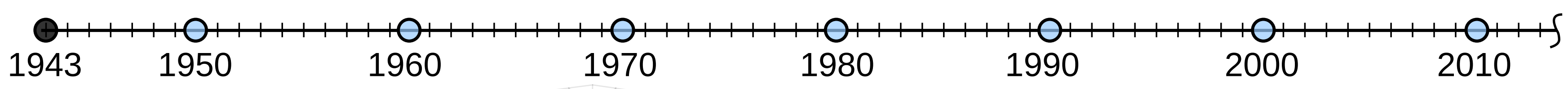
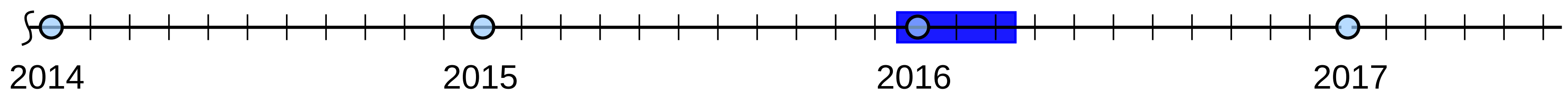
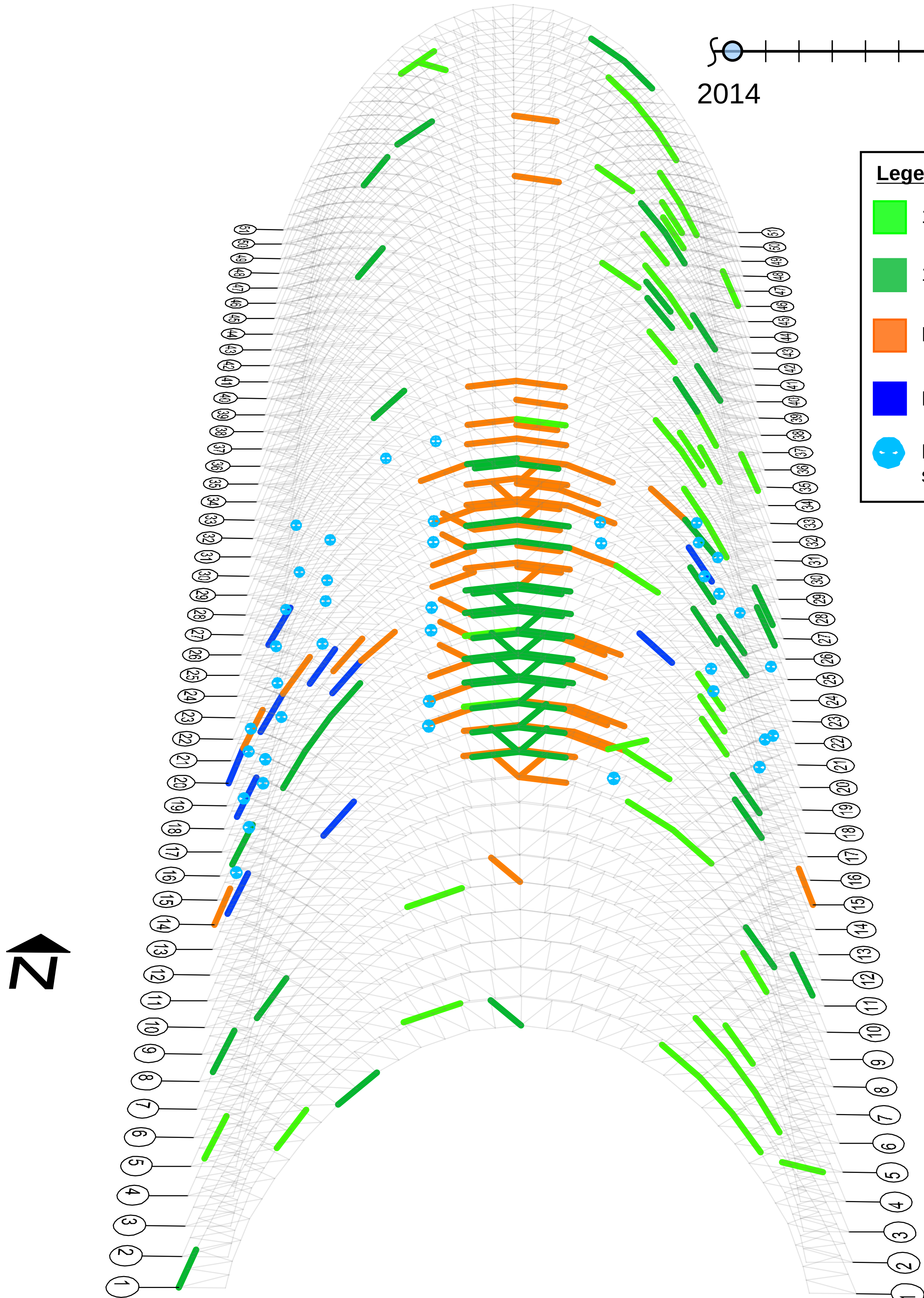
SED




**Legend**

- 1981 Glulam Repairs
- 1993 Glulam Repairs
- DDIF Repair Scope
- Pre-jacking sister repair
- Pre-jacking connection strengthening bracket

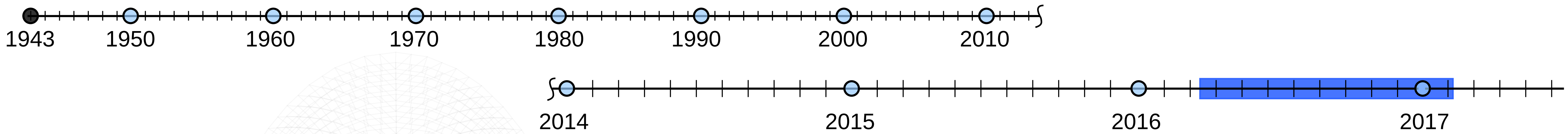
- The KPFF survey discovered chord damage which was either not observed or not present during the due diligence investigations
- The survey uncovered extensive deficiencies within the web member connections, including many plug pullout failures
- **10** additional arch members received glulam sistering repairs
- **39** chord connections received connection strengthening brackets

*Chord sister repair installed prior to exoskeletons*

*Typical connection strengthening bracket*

# ACCESS TOWER OBSERVATIONS

kpff San Francisco

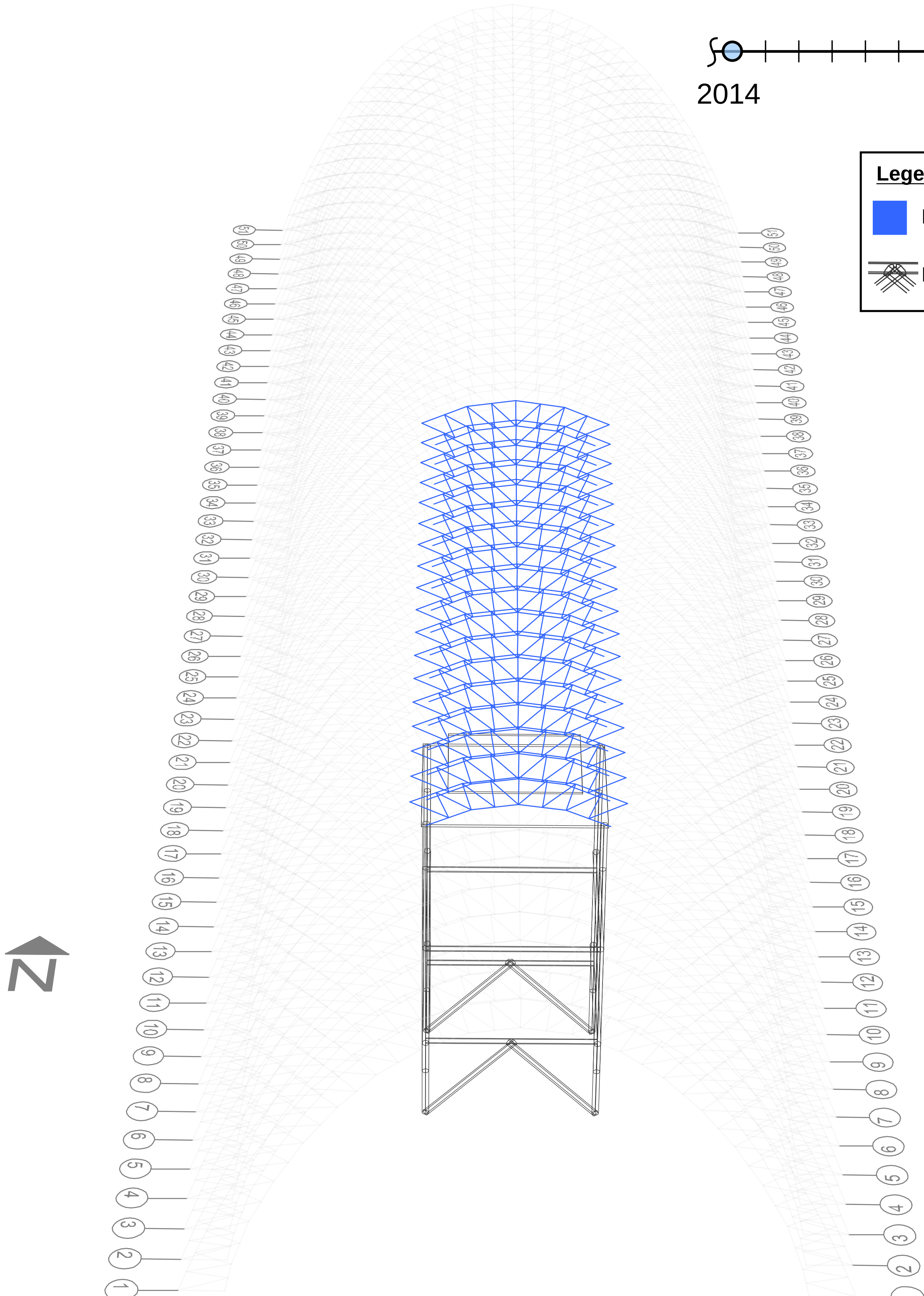



DRAFT - 7/6/2017
SED

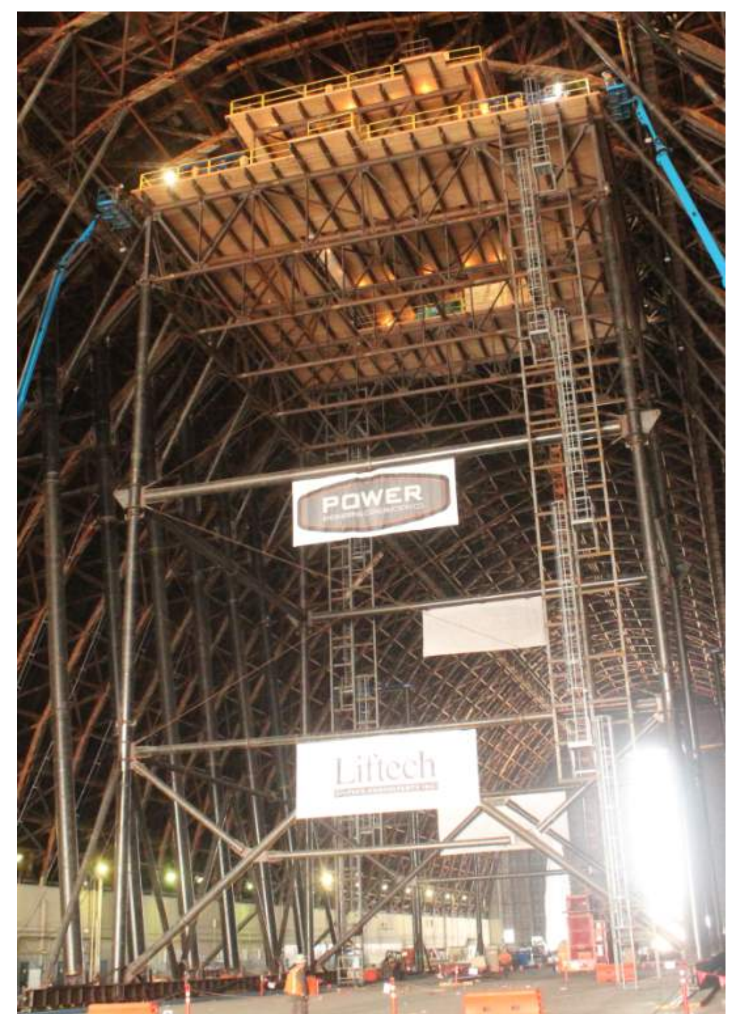
**Legend**

- Members surveyed from tower
- Movable access tower

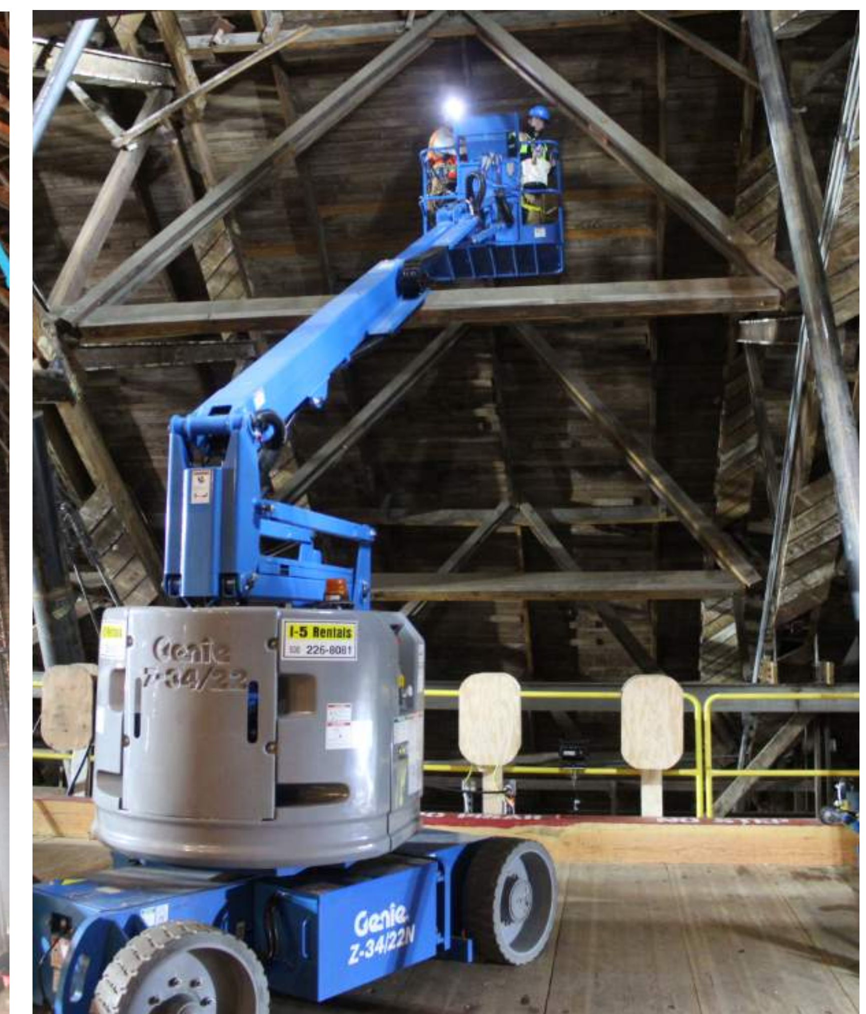
- The movable access tower provided clearance for KPFF to make additional observations in the zones above the temporary shores
- Chord and web members were observed after each tower move before the exoskeletons were installed
- Additional damage observed in this zone was planned to be repaired after roof jacking




H3



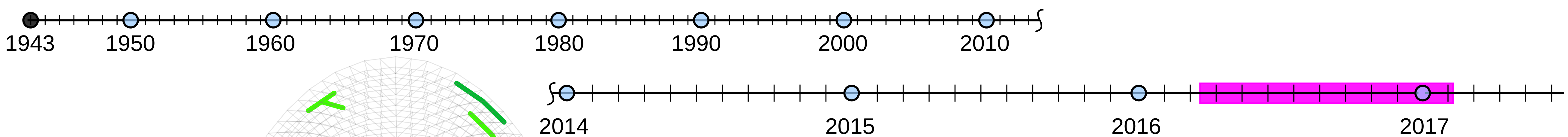

*Movable access tower*



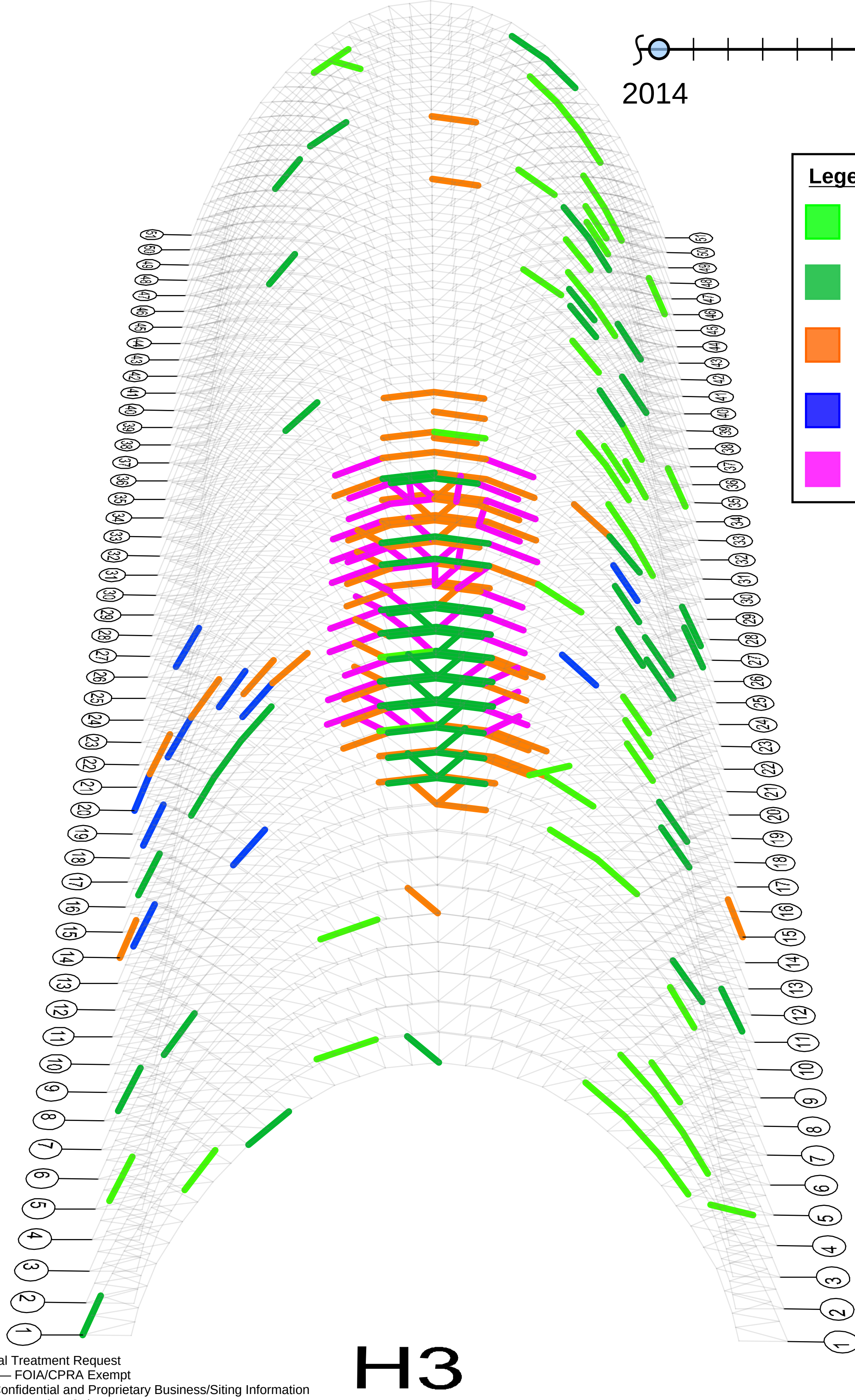

*Truss observations from a boom lift on top of access tower*

# POST-JACKING REPAIR SCOPE

kpff San Francisco



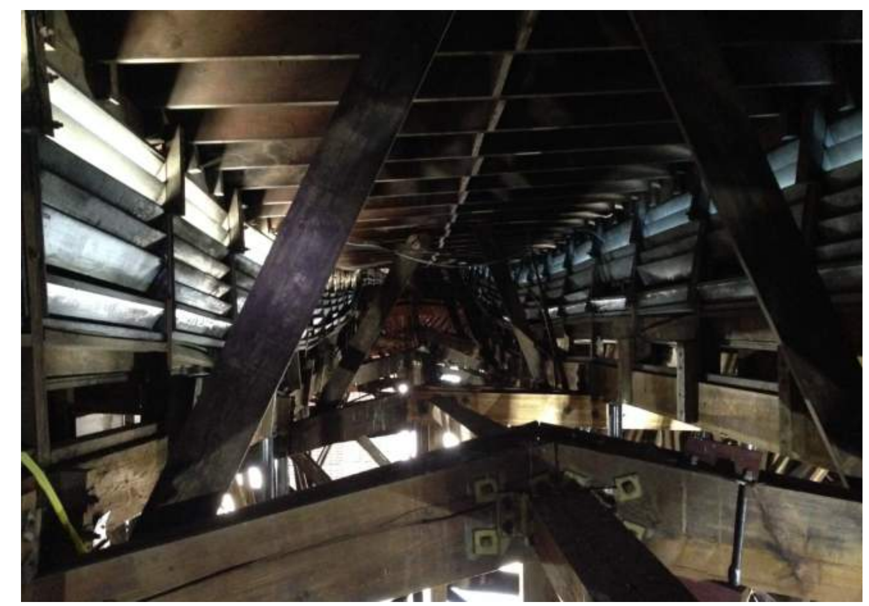

DRAFT - 7/6/2017
SED



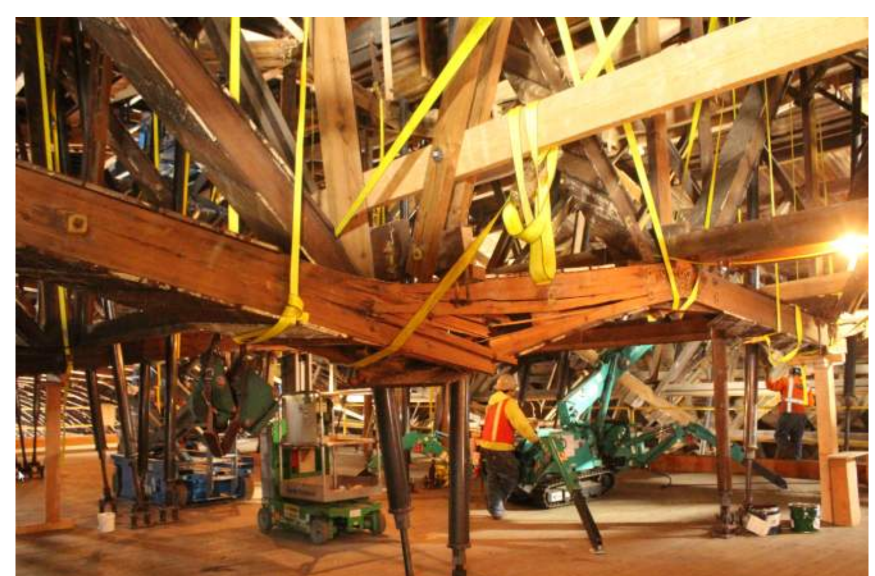

**Legend**

- 1981 Glulam Repairs
- 1993 Glulam Repairs
- DDIF Repair Scope
- Pre-jacking repair scope
- Post-jacking repair scope

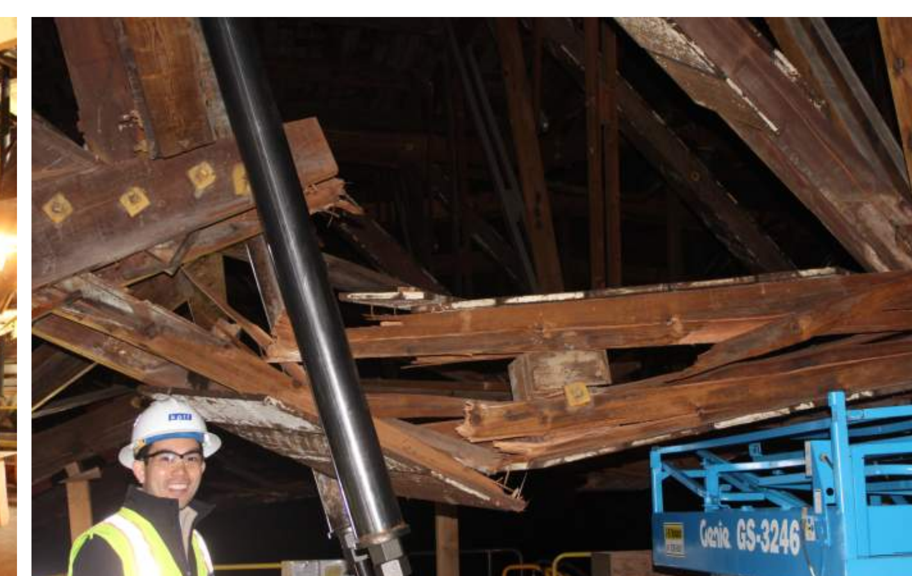
- 50 additional members were identified as severely damaged and scheduled to be removed and replaced after roof jacking
- Before jacking and repairs were made, decision was made to defer further construction activities



*Roof monitor deflection in critical zone*



*Temporary strapping on chord marked for removal and replacement*

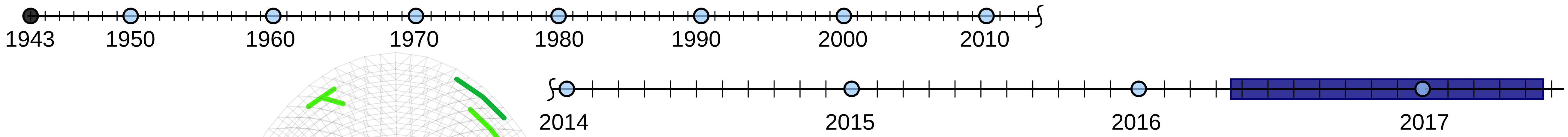


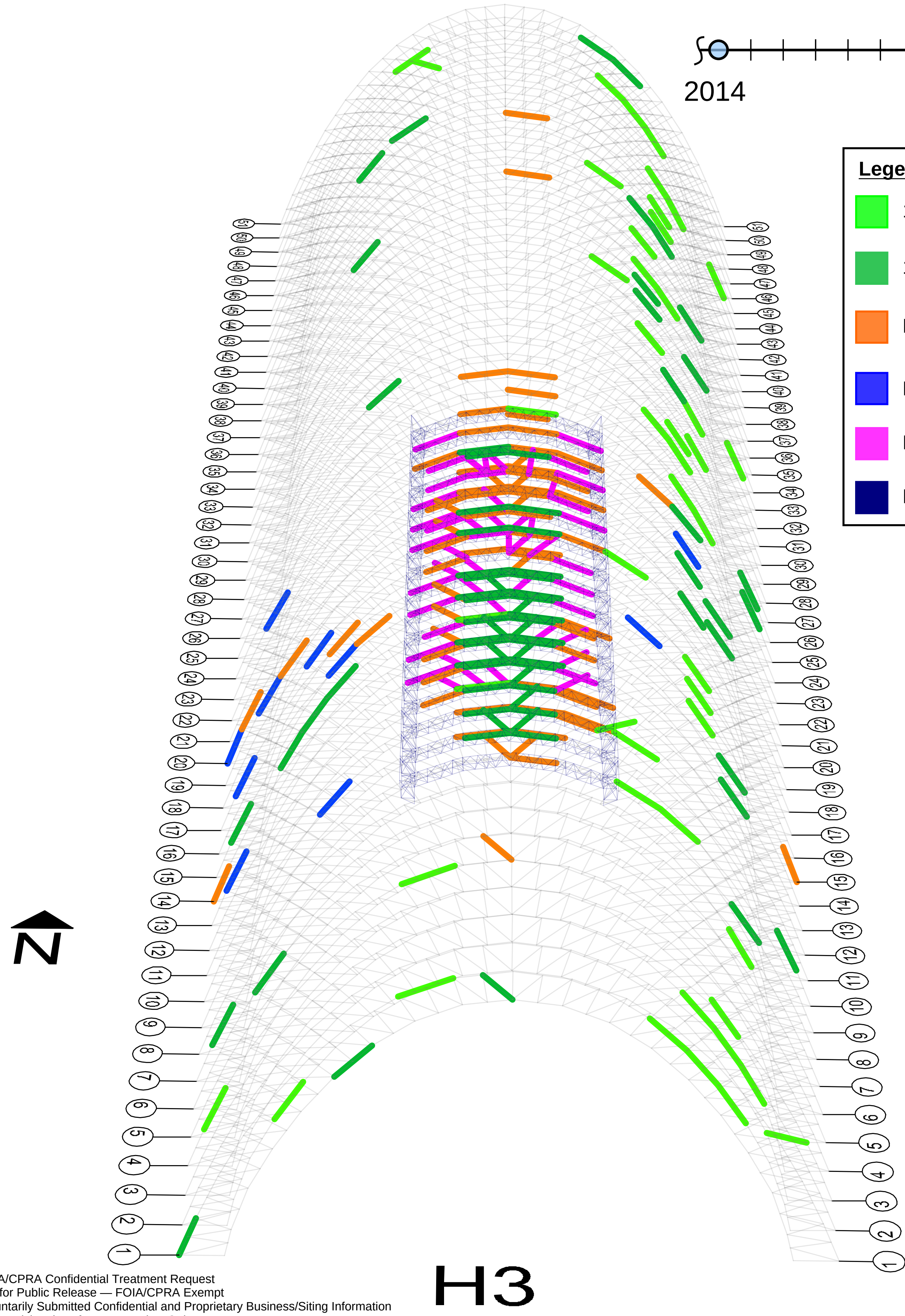

*Damaged chord member viewed from access tower*

# EXOSKELETONS

kpff San Francisco

DRAFT - 7/6/2017
SED




**Legend**

- 1981 Glulam Repairs
- 1993 Glulam Repairs
- DDIF Repair Scope
- Pre-jacking repair scope
- Post-jacking repair scope
- Exoskeletons

- Steel exoskeletons were installed at Trusses 9-26 after observations were made.

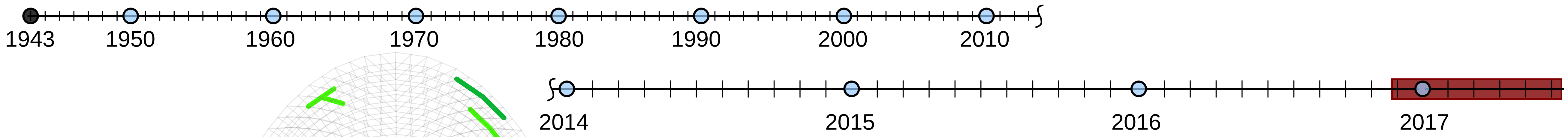
*Hoisting exoskeleton segment into place*

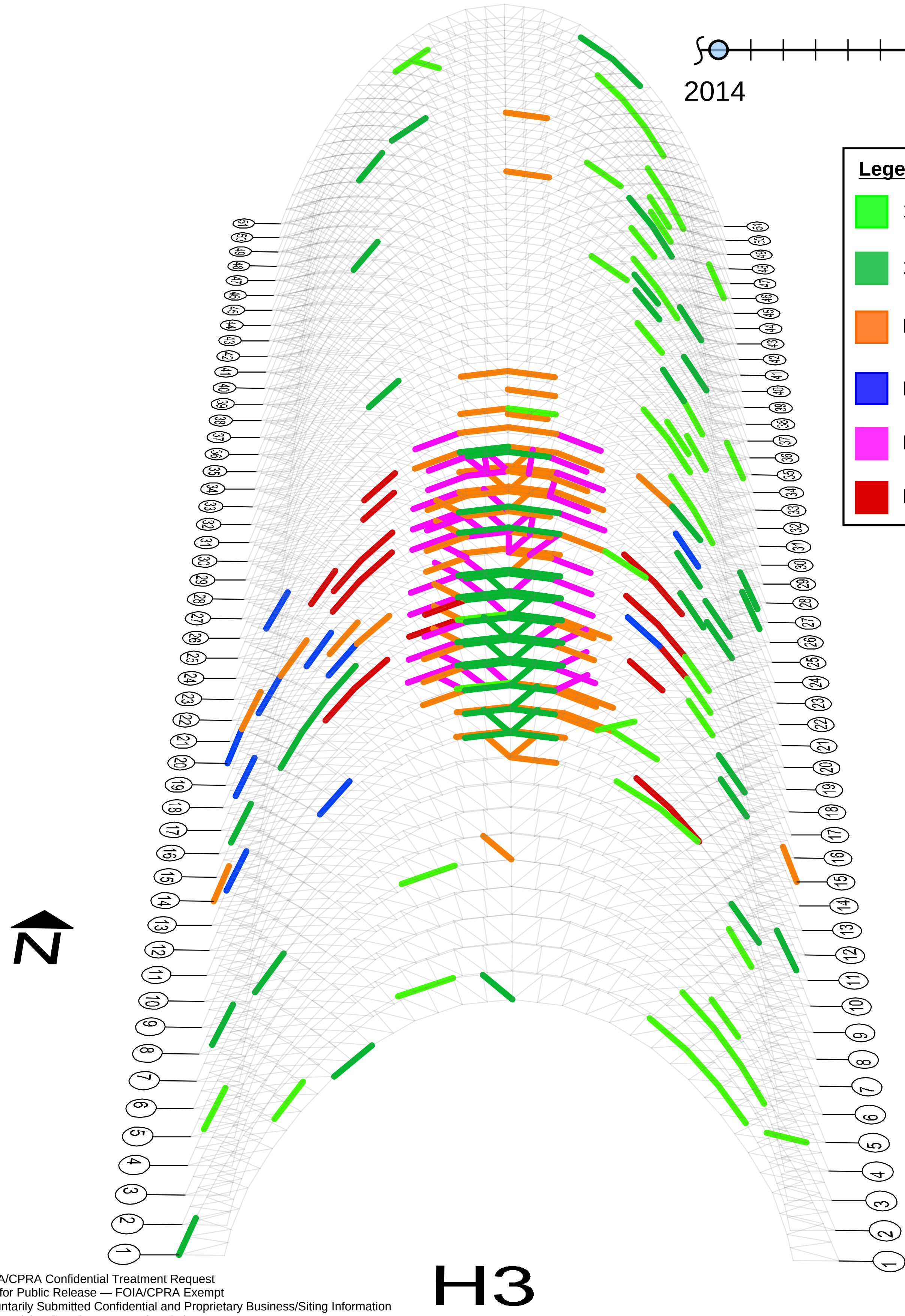
*Installed exoskeletons*

# DAMAGE PROGRESSION



DRAFT - 7/6/2017
SED




**Legend**

- 1981 Glulam Repairs
- 1993 Glulam Repairs
- DDIF Repair Scope
- Pre-jacking repair scope
- Post-jacking repair scope
- Damage progression

- Months after installation of exoskeletons, major splits were observed in chord members which had previously been observed and cleared.
- Major damage was observed on 19 chords, most between panel points I to M.
- Sistering repairs installed on most severe cases
- Due to the concentration of new damage at the lower chord members at panel points I to M, preemptive measures were taken to help reduce the progression of damage.
- Preemptive measures included fully-threaded screws at connections, and steel clamps.


*Chord damage at node K after exoskeleton install*

*Preemptive screw and clamp strengthening on undamaged chord at node K*

# A.4 - Structural Site Observations

August 21, 2019

Sallie Lim
Director
Legal Department / Google Inc.
1600 Amphitheater Pkwy
Mountain View, CA 94043 **VIA Email: sallie@google.com**

Gary S. McKitterick, Esq.
Partner
Allen Matkins Leck Gamble Mallory & Natsis, LLP
1900 Main Street, 5th Floor
Irvine, CA 92614-7321 **VIA Email: gmckitterick@allenmatkins.com**

Subject: Moffett Federal Airfield Hangar 3 – Mountain View, California
Structural Site Observation

Dear Ms. Lim and Mr. McKitterick:

As part of the quarterly Hangar 3 structural assessment, I've recently conducted a site visit on behalf of Planetary Ventures to visually observe the general condition of the existing hangar structure and the temporary shoring devices that were left in place when the work was terminated. After walking the entire Hangar 3 structure, I have prepared the following comments, observations and conclusions:

Overall Comments:

1. The original intent of the emergency truss repair program was to return the damaged and broken arched trusses to their original deficient state.
2. The emergency truss repair program was ultimately abandoned due to the numerous severely damaged arched trusses as well as the damage progression to undamaged trusses which continued to occur during the installation of the required repairs.
3. Once abandoned, additional shores were installed, shoring support elements were left in place and the shoring platform was positioned in a manner to provide asset protection. These steps were meant to be a temporary or short term solution to assist with the protection of the damage elements.
4. The structure remains unsafe and is very vulnerable to further damage or partial collapse while left in its current unrepaired state.

kpff

Observations:

5. Upon arrival at the site, the hangar was locked up and not accessible as previously recommended.
6. We did not observe any wood material or other debris which had fallen from the existing framing to the hangar deck below.
7. It was not apparent that further damaged had appeared since our last site visit and the monitoring program has been discontinued.

Conclusions:

8. Overall, the hangar structure has existed well past its original design life. Varying levels of damage exist to other parts of the timber framing, beyond that of the work outlined in the Emergency Truss Repair work. Subsequently, the level of repair required to return the hangar to its original deficient state is excessive and cost prohibitive.
9. The shoring and platform shoring, which were left in place as a means of providing short term asset protection were only intended to be short term. Previous discussions had placed the time limit describing "short term" at roughly 2-3 years maximum.
10. Further, in its current unrepaired state, the structure is far more vulnerable to sustaining further damage and even experiencing partial collapse of areas from earthquake and/or high wind loading.
11. Finally, it is my professional opinion, that the structure left in its current unrepaired and unsafe condition is likely uninsurable.

Based on my discussion above, it remains my professional opinion that the hangar is unsafe, should not be occupied and could become a potential site hazard from seismic and/or high wind forces. In addition, the work required to return the hangar to a limited Occupiable use level, is extensive and undefinable and further, the necessary work required would be cost-prohibitive and is therefore not salvageable.

This concludes my structural site visit observation report and status update on the existing hangar 3 structure. Please feel free to contact me if you have further questions or comments.

Very truly yours,

Blake W. Dilsworth

Blake W. Dilsworth, S.E.
Principal

BWD/MFA Hangar 3 00 20100821 L1

# Appendix B – Air Quality CalEEMod Modeling Assumptions

## Construction Equipment Lists

## Table 1: Proposed Action

| Phase | PV Equipment List | | | CalEEMod List | | | |
|---|---|---|---|---|---|---|---|
| | Equipment Type | Quantity | HP | Equipment Type | Quantity | HP | Tier |
| 1 – Pre-demolition Activities | 135’ Boom Lifts | 2 | Not specified | Aerial Lift | 2 | 75 | 4 |
| | 54’ Reach Forks (Gradell) | 2 | Not specified | Forklift | 2 | 130 | Statewide Average |
| | 68” Bobcats | 2 | Not specified | Skid Steer Loaders | 2 | 65 | Statewide Average |
| | 56KW Power Generators | 2 | 75 | Generator | 2 | 75 | Statewide Average |
| | FE50 Demolition Excavator | 2 | 313 | Excavator | 2 | 313 | Statewide Average |
| | 60’ Swing Stages | 2 | Not specified | Other Construction Equipment | 2 | 30 | Statewide Average |
| | 185’ Manlift | 1 | 99 | Aerial Lift | 1 | 99 | 4 |
| 2 and 3- Demolition and Waste Disposal Recycling | FE 180 Demolition Excavator | 1 | 760 | Excavator | 1 | 760 | 4 |
| | FE210 Demolition Excavator | 1 | 532 | Excavator | 1 | 532 | Statewide Average |
| | FE200 Demolition Excavator | 1 | 532 | Excavator | 1 | 532 | Statewide Average |
| | FE115 Demolition Excavator | 1 | 532 | Excavator | 1 | 532 | 4 |
| | FE50 Demolition Excavator | 3 | 313 | Excavator | 3 | 313 | 4 |
| | Linkbelt TR8090 Crane 90 ton | 1 | 270 | Crane | 1 | 270 | 4 |
| | 185’ Manlift | 2 | 99 | Aerial Lift | 2 | 99 | 4 |
| | Cat 246D Skid Steer | 2 | 74 | Skid Steer Loaders | 2 | 74 | 4 |
| | Ford F650 Water Truck | 1 | 440 | Off-highway Truck | 1 | 440 | Statewide Average |

**Table 2: Alternative 2 – Partial Preservation**

| Phase | PV Equipment List | | | CalEEMod List | | | |
|---|---|---|---|---|---|---|---|
| | Equipment Type | Quantity | HP | Equipment Type | Quantity | HP | Tier |
| 1 – Pre-demolition Activities | 135' Boom Lifts | 2 | Not specified | Aerial Lift | 2 | 75 | 4 |
| | 54' Reach Forks (Gradell) | 2 | Not specified | Forklift | 2 | 130 | Statewide Average |
| | 68" Bobcats | 2 | Not specified | Skid Steer Loaders | 2 | 65 | Statewide Average |
| | 56KW Power Generators | 2 | 75 | Generator | 2 | 75 | Statewide Average |
| | FE50 Demolition Excavator | 2 | 313 | Excavator | 2 | 313 | Statewide Average |
| | 60' Swing Stages | 2 | Not specified | Other Construction Equipment | 2 | 30 | Statewide Average |
| | 185' Manlift | 1 | 99 | Aerial Lift | 1 | 99 | 4 |
| 2 and 3- Demolition and Waste Disposal Recycling | FE 180 Demolition Excavator | 1 | 760 | Excavator | 1 | 760 | 4 |
| | FE210 Demolition Excavator | 1 | 532 | Excavator | 1 | 532 | Statewide Average |
| | FE200 Demolition Excavator | 1 | 532 | Excavator | 1 | 532 | Statewide Average |
| | FE115 Demolition Excavator | 1 | 532 | Excavator | 1 | 532 | 4 |
| | FE50 Demolition Excavator | 3 | 313 | Excavator | 3 | 313 | 4 |
| | Linkbelt TR8090 Crane 90 ton | 1 | 270 | Crane | 1* | 270 | 4 |
| | 185' Manlift | 2 | 99 | Aerial Lift | 2 | 99 | 4 |
| | Cat 246D Skid Steer | 2 | 74 | Skid Steer Loaders | 2 | 74 | 4 |
| | Ford F650 Water Truck | 1 | 440 | Off-highway Truck | 1 | 440 | Statewide Average |
| 4 – Structural Upgrades and Renovations | 135' Boom Lift | 2 | Not specified | Aerial Lift | 2 | 75 | Statewide Average |
| | 54' Reach Forks (Gradell) | 1 | Not specified | Forklift | 1 | 130 | Statewide Average |
| | 56KW Power Generator | 1 | 75 | Generator | 1 | 75 | Statewide Average |
| | 185' Manlift | 2 | 99 | Aerial Lift | 2 | 99 | 4 |
| | Bore/Drill Rig | 1 | 221 | Bore/Drill Rig | 1 | 221 | Statewide Average |
| | Linkbel TR8090 Crane 90 ton | 1 | 270 | Crane | 1* | 270 | 4 |

*indicates equipment that is expected to operate 6 hours/day.

**EMFAC Off-Model Adjustment Factors for Gasoline Light Duty Vehicle to Account for the SAFE Vehicle Rule Applied**

# Hangar 3 Facility

## Bay Area AQMD Air District, Annual

## 1.0 Project Characteristics

### 1.1 Land Usage

| Land Uses | Size | Metric | Lot Acreage | Floor Surface Area | Population |
|---|---|---|---|---|---|
| General Heavy Industry | 784.00 | 1000sqft | 18.00 | 784,000.00 | 0 |

### 1.2 Other Project Characteristics

| | | | | | |
|---|---|---|---|---|---|
| **Urbanization** | Urban | **Wind Speed (m/s)** | 2.2 | **Precipitation Freq (Days)** | 64 |
| **Climate Zone** | 4 | | | **Operational Year** | 2023 |
| **Utility Company** | Pacific Gas and Electric Company | | | | |
| **CO2 Intensity (lb/MWhr)** | 203.98 | **CH4 Intensity (lb/MWhr)** | 0.033 | **N2O Intensity (lb/MWhr)** | 0.004 |

### 1.3 User Entered Comments & Non-Default Data

Project Characteristics -

Land Use -

Construction Phase - Based on construction schedule as described in the Project Description.

Off-road Equipment - Construction equipment provided by PV.

Off-road Equipment - Construction equipment information received from PV.

Trips and VMT - Trips and milage based on information received from PV. Hauling distance for hazard materials (pre-demolition) is an average distance between the proposed disposal sites.

Demolition -

Grading -

Vehicle Trips - No operational trips.

Vehicle Emission Factors -

Vehicle Emission Factors -

**EMFAC Off-Model Adjustment Factors for Gasoline Light Duty Vehicle to Account for the SAFE Vehicle Rule Applied**

Vehicle Emission Factors -

Area Coating - No operational impacts.

Energy Use - No operational impacts.

Water And Wastewater - No operational impacts.

Solid Waste - No operational impacts.

Construction Off-road Equipment Mitigation - 5,000 gallons of water will be used to water the site per day. Tiered equipment based on description from PV (see construction equipment list [Table 1]).

| Table Name | Column Name | Default Value | New Value |
|---|---|---|---|
| tblAreaCoating | Area_Nonresidential_Exterior | 392000 | 0 |
| tblAreaCoating | Area_Nonresidential_Interior | 1176000 | 0 |
| tblConstEquipMitigation | NumberOfEquipmentMitigated | 0.00 | 5.00 |
| tblConstEquipMitigation | NumberOfEquipmentMitigated | 0.00 | 1.00 |
| tblConstEquipMitigation | NumberOfEquipmentMitigated | 0.00 | 5.00 |
| tblConstEquipMitigation | NumberOfEquipmentMitigated | 0.00 | 2.00 |
| tblConstEquipMitigation | Tier | No Change | Tier 4 Final |
| tblConstEquipMitigation | Tier | No Change | Tier 4 Final |
| tblConstEquipMitigation | Tier | No Change | Tier 4 Final |
| tblConstEquipMitigation | Tier | No Change | Tier 4 Final |
| tblConstructionPhase | NumDays | 20.00 | 125.00 |
| tblConstructionPhase | NumDays | 10.00 | 90.00 |
| tblEnergyUse | LightingElect | 3.08 | 0.00 |
| tblEnergyUse | NT24E | 3.70 | 0.00 |
| tblEnergyUse | NT24NG | 6.67 | 0.00 |
| tblEnergyUse | T24E | 1.32 | 0.00 |
| tblEnergyUse | T24NG | 19.51 | 0.00 |
| tblOffRoadEquipment | HorsePower | 158.00 | 760.00 |
| tblOffRoadEquipment | HorsePower | 158.00 | 313.00 |
| tblOffRoadEquipment | HorsePower | 158.00 | 532.00 |
| tblOffRoadEquipment | HorsePower | 63.00 | 75.00 |

**EMFAC Off-Model Adjustment Factors for Gasoline Light Duty Vehicle to Account for the SAFE Vehicle Rule Applied**

| | | | |
|---|---|---|---|
| tblOffRoadEquipment | HorsePower | 63.00 | 99.00 |
| tblOffRoadEquipment | HorsePower | 63.00 | 99.00 |
| tblOffRoadEquipment | HorsePower | 231.00 | 270.00 |
| tblOffRoadEquipment | HorsePower | 158.00 | 313.00 |
| tblOffRoadEquipment | HorsePower | 89.00 | 130.00 |
| tblOffRoadEquipment | HorsePower | 84.00 | 75.00 |
| tblOffRoadEquipment | HorsePower | 124.00 | 440.00 |
| tblOffRoadEquipment | HorsePower | 172.00 | 30.00 |
| tblOffRoadEquipment | HorsePower | 65.00 | 74.00 |
| tblOffRoadEquipment | OffRoadEquipmentUnitAmount | 3.00 | 1.00 |
| tblSolidWaste | SolidWasteGenerationRate | 972.16 | 0.00 |
| tblTripsAndVMT | HaulingTripLength | 20.00 | 350.00 |
| tblTripsAndVMT | HaulingTripNumber | 0.00 | 360.00 |
| tblTripsAndVMT | HaulingTripNumber | 3,673.00 | 4,000.00 |
| tblTripsAndVMT | WorkerTripNumber | 33.00 | 100.00 |
| tblTripsAndVMT | WorkerTripNumber | 33.00 | 40.00 |
| tblVehicleTrips | ST_TR | 6.42 | 0.00 |
| tblVehicleTrips | SU_TR | 5.09 | 0.00 |
| tblVehicleTrips | WD_TR | 3.93 | 0.00 |
| tblWater | ElectricityIntensityFactorForWastewaterTreatment | 1,911.00 | 0.00 |
| tblWater | ElectricityIntensityFactorToDistribute | 1,272.00 | 0.00 |
| tblWater | ElectricityIntensityFactorToSupply | 2,117.00 | 0.00 |
| tblWater | ElectricityIntensityFactorToTreat | 111.00 | 0.00 |
| tblWater | IndoorWaterUseRate | 181,300,000.00 | 0.00 |

## 2.0 Emissions Summary

## 2.1 Overall Construction

**Unmitigated Construction**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Year | tons/yr | | | | | | | | | | MT/yr | | | | | |
| 2021 | 0.0673 | 0.7511 | 0.6371 | 2.2700e-003 | 0.0444 | 0.0251 | 0.0695 | 0.0120 | 0.0238 | 0.0359 | 0.0000 | 210.0964 | 210.0964 | 0.0293 | 0.0159 | 215.5654 |
| 2022 | 0.2649 | 2.7647 | 2.5356 | 9.8800e-003 | 0.4954 | 0.0860 | 0.5814 | 0.0868 | 0.0798 | 0.1666 | 0.0000 | 892.4675 | 892.4675 | 0.2096 | 0.0358 | 908.3683 |
| **Maximum** | **0.2649** | **2.7647** | **2.5356** | **9.8800e-003** | **0.4954** | **0.0860** | **0.5814** | **0.0868** | **0.0798** | **0.1666** | **0.0000** | **892.4675** | **892.4675** | **0.2096** | **0.0358** | **908.3683** |

**Mitigated Construction**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Year | tons/yr | | | | | | | | | | MT/yr | | | | | |
| 2021 | 0.0609 | 0.6536 | 0.7149 | 2.2700e-003 | 0.0444 | 0.0216 | 0.0660 | 0.0120 | 0.0207 | 0.0327 | 0.0000 | 210.0963 | 210.0963 | 0.0293 | 0.0159 | 215.5652 |
| 2022 | 0.1901 | 1.8383 | 3.2969 | 9.8800e-003 | 0.2768 | 0.0498 | 0.3266 | 0.0537 | 0.0470 | 0.1007 | 0.0000 | 892.4667 | 892.4667 | 0.2096 | 0.0358 | 908.3675 |
| **Maximum** | **0.1901** | **1.8383** | **3.2969** | **9.8800e-003** | **0.2768** | **0.0498** | **0.3266** | **0.0537** | **0.0470** | **0.1007** | **0.0000** | **892.4667** | **892.4667** | **0.2096** | **0.0358** | **908.3675** |

**EMFAC Off-Model Adjustment Factors for Gasoline Light Duty Vehicle to Account for the SAFE Vehicle Rule Applied**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio-CO2 | Total CO2 | CH4 | N20 | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Percent Reduction** | **24.43** | **29.12** | **-26.45** | **0.00** | **40.50** | **35.72** | **39.68** | **33.50** | **34.65** | **34.09** | **0.00** | **0.00** | **0.00** | **0.00** | **0.00** | **0.00** |

| Quarter | Start Date | End Date | Maximum Unmitigated ROG + NOX (tons/quarter) | Maximum Mitigated ROG + NOX (tons/quarter) |
|---|---|---|---|---|
| **1** | **1-1-2022** | **3-31-2022** | 1.3839 | 1.1244 |
| **2** | **4-1-2022** | **6-30-2022** | 2.2148 | 1.6180 |
| **3** | **7-1-2022** | **9-30-2022** | 1.3873 | 1.0135 |
| | | **Highest** | 2.2148 | 1.6180 |

## 2.2 Overall Operational

**Unmitigated Operational**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | tons/yr | | | | | | | | | | MT/yr | | | | | |
| Area | 3.0626 | 7.0000e-005 | 7.2000e-003 | 0.0000 | | 3.0000e-005 | 3.0000e-005 | | 3.0000e-005 | 3.0000e-005 | 0.0000 | 0.0140 | 0.0140 | 4.0000e-005 | 0.0000 | 0.0149 |
| Energy | 0.0000 | 0.0000 | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Mobile | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Waste | | | | | | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Water | | | | | | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| **Total** | **3.0626** | **7.0000e-005** | **7.2000e-003** | **0.0000** | **0.0000** | **3.0000e-005** | **3.0000e-005** | **0.0000** | **3.0000e-005** | **3.0000e-005** | **0.0000** | **0.0140** | **0.0140** | **4.0000e-005** | **0.0000** | **0.0149** |

## 2.2 Overall Operational

**Mitigated Operational**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | tons/yr | | | | | | | | | | MT/yr | | | | | |
| Area | 3.0626 | 7.0000e-005 | 7.2000e-003 | 0.0000 | | 3.0000e-005 | 3.0000e-005 | | 3.0000e-005 | 3.0000e-005 | 0.0000 | 0.0140 | 0.0140 | 4.0000e-005 | 0.0000 | 0.0149 |
| Energy | 0.0000 | 0.0000 | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Mobile | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Waste | | | | | | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Water | | | | | | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| **Total** | **3.0626** | **7.0000e-005** | **7.2000e-003** | **0.0000** | **0.0000** | **3.0000e-005** | **3.0000e-005** | **0.0000** | **3.0000e-005** | **3.0000e-005** | **0.0000** | **0.0140** | **0.0140** | **4.0000e-005** | **0.0000** | **0.0149** |

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio-CO2 | Total CO2 | CH4 | N20 | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Percent Reduction** | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

## 3.0 Construction Detail

**Construction Phase**

| Phase Number | Phase Name | Phase Type | Start Date | End Date | Num Days Week | Num Days | Phase Description |
|---|---|---|---|---|---|---|---|
| 1 | Pre-Demolition | Site Preparation | 11/1/2021 | 3/4/2022 | 5 | 90 | |
| 2 | Demolition | Demolition | 3/5/2022 | 8/26/2022 | 5 | 125 | |

**EMFAC Off-Model Adjustment Factors for Gasoline Light Duty Vehicle to Account for the SAFE Vehicle Rule Applied**

**Acres of Grading (Site Preparation Phase): 0**

**Acres of Grading (Grading Phase): 0**

**Acres of Paving: 0**

**Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 0; Non-Residential Outdoor: 0; Striped Parking Area: 0 (Architectural Coating – sqft)**

## OffRoad Equipment

| Phase Name | Offroad Equipment Type | Amount | Usage Hours | Horse Power | Load Factor |
|---|---|---|---|---|---|
| Pre-Demolition | Aerial Lifts | 2 | 8.00 | 75 | 0.31 |
| Pre-Demolition | Aerial Lifts | 1 | 8.00 | 99 | 0.31 |
| Pre-Demolition | Excavators | 2 | 8.00 | 313 | 0.38 |
| Pre-Demolition | Forklifts | 2 | 8.00 | 130 | 0.20 |
| Pre-Demolition | Generator Sets | 2 | 8.00 | 75 | 0.74 |
| Pre-Demolition | Other Construction Equipment | 2 | 8.00 | 30 | 0.42 |
| Pre-Demolition | Skid Steer Loaders | 2 | 8.00 | 65 | 0.37 |
| Demolition | Aerial Lifts | 2 | 8.00 | 99 | 0.31 |
| Demolition | Cranes | 1 | 8.00 | 270 | 0.29 |
| Demolition | Excavators | 1 | 8.00 | 760 | 0.38 |
| Demolition | Excavators | 3 | 8.00 | 313 | 0.38 |
| Demolition | Excavators | 3 | 8.00 | 532 | 0.38 |
| Demolition | Off-Highway Tractors | 1 | 8.00 | 440 | 0.44 |
| Demolition | Skid Steer Loaders | 2 | 8.00 | 74 | 0.37 |

## Trips and VMT

| Phase Name | Offroad Equipment Count | Worker Trip Number | Vendor Trip Number | Hauling Trip Number | Worker Trip Length | Vendor Trip Length | Hauling Trip Length | Worker Vehicle Class | Vendor Vehicle Class | Hauling Vehicle Class |
|---|---|---|---|---|---|---|---|---|---|---|
| Pre-Demolition | 13 | 100.00 | 0.00 | 360.00 | 10.80 | 7.30 | 350.00 | LD_Mix | HDT_Mix | HHDT |
| Demolition | 13 | 40.00 | 0.00 | 4,000.00 | 10.80 | 7.30 | 20.00 | LD_Mix | HDT_Mix | HHDT |

## 3.1 Mitigation Measures Construction

Use Cleaner Engines for Construction Equipment

Water Exposed Area

## 3.2 Pre-Demolition - 2021

**Unmitigated Construction On-Site**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | tons/yr | | | | | | | | | | MT/yr | | | | | |
| Fugitive Dust | | | | | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Off-Road | 0.0510 | 0.4608 | 0.5303 | 1.1200e-003 | | 0.0209 | 0.0209 | | 0.0197 | 0.0197 | 0.0000 | 97.8435 | 97.8435 | 0.0255 | 0.0000 | 98.4800 |
| **Total** | **0.0510** | **0.4608** | **0.5303** | **1.1200e-003** | **0.0000** | **0.0209** | **0.0209** | **0.0000** | **0.0197** | **0.0197** | **0.0000** | **97.8435** | **97.8435** | **0.0255** | **0.0000** | **98.4800** |

## 3.2 Pre-Demolition - 2021

**Unmitigated Construction Off-Site**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | tons/yr | | | | | | | | | | MT/yr | | | | | |
| Hauling | 9.5600e-003 | 0.2853 | 0.0483 | 9.9000e-004 | 0.0266 | 4.1600e-003 | 0.0308 | 7.3100e-003 | 3.9800e-003 | 0.0113 | 0.0000 | 97.5697 | 97.5697 | 3.3000e-003 | 0.0155 | 102.2565 |
| Vendor | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Worker | 6.6600e-003 | 5.0600e-003 | 0.0584 | 1.6000e-004 | 0.0178 | 1.0000e-004 | 0.0179 | 4.7300e-003 | 9.0000e-005 | 4.8200e-003 | 0.0000 | 14.6832 | 14.6832 | 4.9000e-004 | 4.5000e-004 | 14.8288 |
| **Total** | **0.0162** | **0.2904** | **0.1067** | **1.1500e-003** | **0.0444** | **4.2600e-003** | **0.0486** | **0.0120** | **4.0700e-003** | **0.0161** | **0.0000** | **112.2529** | **112.2529** | **3.7900e-003** | **0.0159** | **117.0853** |

**Mitigated Construction On-Site**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | tons/yr | | | | | | | | | | MT/yr | | | | | |
| Fugitive Dust | | | | | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Off-Road | 0.0447 | 0.3633 | 0.6082 | 1.1200e-003 | | 0.0174 | 0.0174 | | 0.0166 | 0.0166 | 0.0000 | 97.8434 | 97.8434 | 0.0255 | 0.0000 | 98.4799 |
| **Total** | **0.0447** | **0.3633** | **0.6082** | **1.1200e-003** | **0.0000** | **0.0174** | **0.0174** | **0.0000** | **0.0166** | **0.0166** | **0.0000** | **97.8434** | **97.8434** | **0.0255** | **0.0000** | **98.4799** |

## 3.2 Pre-Demolition - 2021

**Mitigated Construction Off-Site**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | tons/yr | | | | | | | | | | MT/yr | | | | | |
| Hauling | 9.5600e-003 | 0.2853 | 0.0483 | 9.9000e-004 | 0.0266 | 4.1600e-003 | 0.0308 | 7.3100e-003 | 3.9800e-003 | 0.0113 | 0.0000 | 97.5697 | 97.5697 | 3.3000e-003 | 0.0155 | 102.2565 |
| Vendor | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Worker | 6.6600e-003 | 5.0600e-003 | 0.0584 | 1.6000e-004 | 0.0178 | 1.0000e-004 | 0.0179 | 4.7300e-003 | 9.0000e-005 | 4.8200e-003 | 0.0000 | 14.6832 | 14.6832 | 4.9000e-004 | 4.5000e-004 | 14.8288 |
| **Total** | **0.0162** | **0.2904** | **0.1067** | **1.1500e-003** | **0.0444** | **4.2600e-003** | **0.0486** | **0.0120** | **4.0700e-003** | **0.0161** | **0.0000** | **112.2529** | **112.2529** | **3.7900e-003** | **0.0159** | **117.0853** |

## 3.2 Pre-Demolition - 2022

**Unmitigated Construction On-Site**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | tons/yr | | | | | | | | | | MT/yr | | | | | |
| Fugitive Dust | | | | | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Off-Road | 0.0465 | 0.4060 | 0.5252 | 1.1200e-003 | | 0.0179 | 0.0179 | | 0.0169 | 0.0169 | 0.0000 | 97.8722 | 97.8722 | 0.0254 | 0.0000 | 98.5069 |
| **Total** | **0.0465** | **0.4060** | **0.5252** | **1.1200e-003** | **0.0000** | **0.0179** | **0.0179** | **0.0000** | **0.0169** | **0.0169** | **0.0000** | **97.8722** | **97.8722** | **0.0254** | **0.0000** | **98.5069** |

## 3.2 Pre-Demolition - 2022

**Unmitigated Construction Off-Site**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | tons/yr | | | | | | | | | | MT/yr | | | | | |
| Hauling | 5.9100e-003 | 0.2439 | 0.0381 | 9.6000e-004 | 0.0266 | 2.4100e-003 | 0.0290 | 7.3100e-003 | 2.3100e-003 | 9.6200e-003 | 0.0000 | 95.0025 | 95.0025 | 3.1600e-003 | 0.0151 | 99.5663 |
| Vendor | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Worker | 6.1800e-003 | 4.4500e-003 | 0.0538 | 1.5000e-004 | 0.0178 | 1.0000e-004 | 0.0179 | 4.7300e-003 | 9.0000e-005 | 4.8200e-003 | 0.0000 | 14.2991 | 14.2991 | 4.4000e-004 | 4.1000e-004 | 14.4331 |
| **Total** | **0.0121** | **0.2484** | **0.0919** | **1.1100e-003** | **0.0444** | **2.5100e-003** | **0.0469** | **0.0120** | **2.4000e-003** | **0.0144** | **0.0000** | **109.3016** | **109.3016** | **3.6000e-003** | **0.0155** | **113.9994** |

**Mitigated Construction On-Site**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | tons/yr | | | | | | | | | | MT/yr | | | | | |
| Fugitive Dust | | | | | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Off-Road | 0.0412 | 0.3289 | 0.6045 | 1.1200e-003 | | 0.0151 | 0.0151 | | 0.0144 | 0.0144 | 0.0000 | 97.8721 | 97.8721 | 0.0254 | 0.0000 | 98.5068 |
| **Total** | **0.0412** | **0.3289** | **0.6045** | **1.1200e-003** | **0.0000** | **0.0151** | **0.0151** | **0.0000** | **0.0144** | **0.0144** | **0.0000** | **97.8721** | **97.8721** | **0.0254** | **0.0000** | **98.5068** |

## 3.2 Pre-Demolition - 2022

**Mitigated Construction Off-Site**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | tons/yr | | | | | | | | | | MT/yr | | | | | |
| Hauling | 5.9100e-003 | 0.2439 | 0.0381 | 9.6000e-004 | 0.0266 | 2.4100e-003 | 0.0290 | 7.3100e-003 | 2.3100e-003 | 9.6200e-003 | 0.0000 | 95.0025 | 95.0025 | 3.1600e-003 | 0.0151 | 99.5663 |
| Vendor | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Worker | 6.1800e-003 | 4.4500e-003 | 0.0538 | 1.5000e-004 | 0.0178 | 1.0000e-004 | 0.0179 | 4.7300e-003 | 9.0000e-005 | 4.8200e-003 | 0.0000 | 14.2991 | 14.2991 | 4.4000e-004 | 4.1000e-004 | 14.4331 |
| **Total** | **0.0121** | **0.2484** | **0.0919** | **1.1100e-003** | **0.0444** | **2.5100e-003** | **0.0469** | **0.0120** | **2.4000e-003** | **0.0144** | **0.0000** | **109.3016** | **109.3016** | **3.6000e-003** | **0.0155** | **113.9994** |

## 3.3 Demolition - 2022

**Unmitigated Construction On-Site**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | tons/yr | | | | | | | | | | MT/yr | | | | | |
| Fugitive Dust | | | | | 0.3975 | 0.0000 | 0.3975 | 0.0602 | 0.0000 | 0.0602 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Off-Road | 0.1901 | 1.7610 | 1.7854 | 6.2000e-003 | | 0.0624 | 0.0624 | | 0.0574 | 0.0574 | 0.0000 | 544.0371 | 544.0371 | 0.1760 | 0.0000 | 548.4360 |
| **Total** | **0.1901** | **1.7610** | **1.7854** | **6.2000e-003** | **0.3975** | **0.0624** | **0.4599** | **0.0602** | **0.0574** | **0.1176** | **0.0000** | **544.0371** | **544.0371** | **0.1760** | **0.0000** | **548.4360** |

## 3.3 Demolition - 2022

**Unmitigated Construction Off-Site**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | tons/yr | | | | | | | | | | MT/yr | | | | | |
| Hauling | 9.3300e-003 | 0.3443 | 0.0732 | 1.2700e-003 | 0.0338 | 3.0900e-003 | 0.0369 | 9.3000e-003 | 2.9600e-003 | 0.0123 | 0.0000 | 125.3686 | 125.3686 | 4.1300e-003 | 0.0199 | 131.3892 |
| Vendor | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Worker | 6.8700e-003 | 4.9500e-003 | 0.0598 | 1.7000e-004 | 0.0198 | 1.1000e-004 | 0.0199 | 5.2600e-003 | 1.0000e-004 | 5.3500e-003 | 0.0000 | 15.8879 | 15.8879 | 4.9000e-004 | 4.6000e-004 | 16.0368 |
| **Total** | **0.0162** | **0.3493** | **0.1330** | **1.4400e-003** | **0.0536** | **3.2000e-003** | **0.0568** | **0.0146** | **3.0600e-003** | **0.0176** | **0.0000** | **141.2565** | **141.2565** | **4.6200e-003** | **0.0203** | **147.4260** |

**Mitigated Construction On-Site**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | tons/yr | | | | | | | | | | MT/yr | | | | | |
| Fugitive Dust | | | | | 0.1789 | 0.0000 | 0.1789 | 0.0271 | 0.0000 | 0.0271 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Off-Road | 0.1206 | 0.9117 | 2.4674 | 6.2000e-003 | | 0.0290 | 0.0290 | | 0.0272 | 0.0272 | 0.0000 | 544.0365 | 544.0365 | 0.1760 | 0.0000 | 548.4353 |
| **Total** | **0.1206** | **0.9117** | **2.4674** | **6.2000e-003** | **0.1789** | **0.0290** | **0.2079** | **0.0271** | **0.0272** | **0.0542** | **0.0000** | **544.0365** | **544.0365** | **0.1760** | **0.0000** | **548.4353** |

### 3.3 Demolition - 2022

**Mitigated Construction Off-Site**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | tons/yr | | | | | | | | | | MT/yr | | | | | |
| Hauling | 9.3300e-003 | 0.3443 | 0.0732 | 1.2700e-003 | 0.0338 | 3.0900e-003 | 0.0369 | 9.3000e-003 | 2.9600e-003 | 0.0123 | 0.0000 | 125.3686 | 125.3686 | 4.1300e-003 | 0.0199 | 131.3892 |
| Vendor | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Worker | 6.8700e-003 | 4.9500e-003 | 0.0598 | 1.7000e-004 | 0.0198 | 1.1000e-004 | 0.0199 | 5.2600e-003 | 1.0000e-004 | 5.3500e-003 | 0.0000 | 15.8879 | 15.8879 | 4.9000e-004 | 4.6000e-004 | 16.0368 |
| **Total** | **0.0162** | **0.3493** | **0.1330** | **1.4400e-003** | **0.0536** | **3.2000e-003** | **0.0568** | **0.0146** | **3.0600e-003** | **0.0176** | **0.0000** | **141.2565** | **141.2565** | **4.6200e-003** | **0.0203** | **147.4260** |

## 4.0 Operational Detail - Mobile

### 4.1 Mitigation Measures Mobile

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | tons/yr | | | | | | | | | | MT/yr | | | | | |
| Mitigated | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Unmitigated | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |

### 4.2 Trip Summary Information

| | Average Daily Trip Rate | | | Unmitigated | Mitigated |
|---|---|---|---|---|---|
| Land Use | Weekday | Saturday | Sunday | Annual VMT | Annual VMT |
| General Heavy Industry | 0.00 | 0.00 | 0.00 | | |
| Total | 0.00 | 0.00 | 0.00 | | |

### 4.3 Trip Type Information

| | Miles | | | Trip % | | | Trip Purpose % | | |
|---|---|---|---|---|---|---|---|---|---|
| Land Use | H-W or C-W | H-S or C-C | H-O or C-NW | H-W or C-W | H-S or C-C | H-O or C-NW | Primary | Diverted | Pass-by |
| General Heavy Industry | 9.50 | 7.30 | 7.30 | 59.00 | 28.00 | 13.00 | 92 | 5 | 3 |

### 4.4 Fleet Mix

| Land Use | LDA | LDT1 | LDT2 | MDV | LHD1 | LHD2 | MHD | HHD | OBUS | UBUS | MCY | SBUS | MH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| General Heavy Industry | 0.552821 | 0.058334 | 0.189005 | 0.121481 | 0.023262 | 0.005577 | 0.010166 | 0.007476 | 0.001000 | 0.000579 | 0.026545 | 0.000826 | 0.002928 |

## 5.0 Energy Detail

Historical Energy Use: N

### 5.1 Mitigation Measures Energy

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | tons/yr | | | | | | | | | | MT/yr | | | | | |
| Electricity Mitigated | | | | | | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Electricity Unmitigated | | | | | | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| NaturalGas Mitigated | 0.0000 | 0.0000 | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| NaturalGas Unmitigated | 0.0000 | 0.0000 | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |

## 5.2 Energy by Land Use - NaturalGas

**Unmitigated**

| | NaturalGas Use | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Land Use | kBTU/yr | tons/yr | | | | | | | | | | MT/yr | | | | | |
| General Heavy Industry | 0 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| **Total** | | **0.0000** | **0.0000** | **0.0000** | **0.0000** | | **0.0000** | **0.0000** | | **0.0000** | **0.0000** | **0.0000** | **0.0000** | **0.0000** | **0.0000** | **0.0000** | **0.0000** |

**Mitigated**

| | NaturalGas Use | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Land Use | kBTU/yr | tons/yr | | | | | | | | | | MT/yr | | | | | |
| General Heavy Industry | 0 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| **Total** | | **0.0000** | **0.0000** | **0.0000** | **0.0000** | | **0.0000** | **0.0000** | | **0.0000** | **0.0000** | **0.0000** | **0.0000** | **0.0000** | **0.0000** | **0.0000** | **0.0000** |

## 5.3 Energy by Land Use - Electricity

**Unmitigated**

| | Electricity Use | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|
| Land Use | kWh/yr | MT/yr | | | |
| General Heavy Industry | 0 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| **Total** | | **0.0000** | **0.0000** | **0.0000** | **0.0000** |

**Mitigated**

| | Electricity Use | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|
| Land Use | kWh/yr | MT/yr | | | |
| General Heavy Industry | 0 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| **Total** | | **0.0000** | **0.0000** | **0.0000** | **0.0000** |

# 6.0 Area Detail

## 6.1 Mitigation Measures Area

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | tons/yr | | | | | | | | | | MT/yr | | | | | |
| Mitigated | 3.0626 | 7.0000e-005 | 7.2000e-003 | 0.0000 | | 3.0000e-005 | 3.0000e-005 | | 3.0000e-005 | 3.0000e-005 | 0.0000 | 0.0140 | 0.0140 | 4.0000e-005 | 0.0000 | 0.0149 |
| Unmitigated | 3.0626 | 7.0000e-005 | 7.2000e-003 | 0.0000 | | 3.0000e-005 | 3.0000e-005 | | 3.0000e-005 | 3.0000e-005 | 0.0000 | 0.0140 | 0.0140 | 4.0000e-005 | 0.0000 | 0.0149 |

## 6.2 Area by SubCategory

**Unmitigated**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SubCategory | tons/yr | | | | | | | | | | MT/yr | | | | | |
| Architectural Coating | 0.0000 | | | | | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Consumer Products | 3.0619 | | | | | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Landscaping | 6.7000e-004 | 7.0000e-005 | 7.2000e-003 | 0.0000 | | 3.0000e-005 | 3.0000e-005 | | 3.0000e-005 | 3.0000e-005 | 0.0000 | 0.0140 | 0.0140 | 4.0000e-005 | 0.0000 | 0.0149 |
| **Total** | **3.0626** | **7.0000e-005** | **7.2000e-003** | **0.0000** | | **3.0000e-005** | **3.0000e-005** | | **3.0000e-005** | **3.0000e-005** | **0.0000** | **0.0140** | **0.0140** | **4.0000e-005** | **0.0000** | **0.0149** |

## 6.2 Area by SubCategory

**Mitigated**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SubCategory | tons/yr | | | | | | | | | | MT/yr | | | | | |
| Architectural Coating | 0.0000 | | | | | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Consumer Products | 3.0619 | | | | | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Landscaping | 6.7000e-004 | 7.0000e-005 | 7.2000e-003 | 0.0000 | | 3.0000e-005 | 3.0000e-005 | | 3.0000e-005 | 3.0000e-005 | 0.0000 | 0.0140 | 0.0140 | 4.0000e-005 | 0.0000 | 0.0149 |
| **Total** | **3.0626** | **7.0000e-005** | **7.2000e-003** | **0.0000** | | **3.0000e-005** | **3.0000e-005** | | **3.0000e-005** | **3.0000e-005** | **0.0000** | **0.0140** | **0.0140** | **4.0000e-005** | **0.0000** | **0.0149** |

# 7.0 Water Detail

## 7.1 Mitigation Measures Water

| | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|
| Category | MT/yr | | | |
| Mitigated | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Unmitigated | 0.0000 | 0.0000 | 0.0000 | 0.0000 |

## 7.2 Water by Land Use

**Unmitigated**

| | Indoor/Outdoor Use | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|
| Land Use | Mgal | MT/yr | | | |
| General Heavy Industry | 0 / 0 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| **Total** | | **0.0000** | **0.0000** | **0.0000** | **0.0000** |

### 7.2 Water by Land Use

**Mitigated**

| | Indoor/Outdoor Use | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|
| Land Use | Mgal | MT/yr | | | |
| General Heavy Industry | 0 / 0 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| **Total** | | **0.0000** | **0.0000** | **0.0000** | **0.0000** |

## 8.0 Waste Detail

### 8.1 Mitigation Measures Waste

**Category/Year**

| | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|
| | MT/yr | | | |
| Mitigated | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Unmitigated | 0.0000 | 0.0000 | 0.0000 | 0.0000 |

## 8.2 Waste by Land Use

**Unmitigated**

| | Waste Disposed | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|
| Land Use | tons | MT/yr | | | |
| General Heavy Industry | 0 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| **Total** | | **0.0000** | **0.0000** | **0.0000** | **0.0000** |

**Mitigated**

| | Waste Disposed | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|
| Land Use | tons | MT/yr | | | |
| General Heavy Industry | 0 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| **Total** | | **0.0000** | **0.0000** | **0.0000** | **0.0000** |

## 9.0 Operational Offroad

| Equipment Type | Number | Hours/Day | Days/Year | Horse Power | Load Factor | Fuel Type |
|---|---|---|---|---|---|---|

## 10.0 Stationary Equipment

**Fire Pumps and Emergency Generators**

| Equipment Type | Number | Hours/Day | Hours/Year | Horse Power | Load Factor | Fuel Type |
|---|---|---|---|---|---|---|

**Boilers**

| Equipment Type | Number | Heat Input/Day | Heat Input/Year | Boiler Rating | Fuel Type |
|---|---|---|---|---|---|

**User Defined Equipment**

| Equipment Type | Number |
|---|---|

## 11.0 Vegetation

# Hangar 3 Facility, Alternative 2

**Bay Area AQMD Air District, Annual**

## 1.0 Project Characteristics

### 1.1 Land Usage

| Land Uses | Size | Metric | Lot Acreage | Floor Surface Area | Population |
|---|---|---|---|---|---|
| General Heavy Industry | 784.00 | 1000sqft | 18.00 | 784,000.00 | 0 |

### 1.2 Other Project Characteristics

| | | | | | |
|---|---|---|---|---|---|
| **Urbanization** | Urban | **Wind Speed (m/s)** | 2.2 | **Precipitation Freq (Days)** | 64 |
| **Climate Zone** | 4 | | | **Operational Year** | 2023 |
| **Utility Company** | Pacific Gas and Electric Company | | | | |
| **CO2 Intensity (lb/MWhr)** | 203.98 | **CH4 Intensity (lb/MWhr)** | 0.033 | **N2O Intensity (lb/MWhr)** | 0.004 |

### 1.3 User Entered Comments & Non-Default Data

Project Characteristics -

Land Use -

Construction Phase - Based on construction schedule as described in the Project Description.

Off-road Equipment - Construction equipment provided by PV.

Off-road Equipment - Construction equipment information received from PV.

Trips and VMT - Trips and milage based on information received from PV. Hauling distance for hazard materials (pre-demolition) is an average distance between the proposed disposal sites.

Demolition -

Grading -

Vehicle Trips - No operational trips.

Vehicle Emission Factors -

Vehicle Emission Factors -

Vehicle Emission Factors -

Area Coating - No operational impacts.

Energy Use - No operational impacts.

Water And Wastewater - No operational impacts.

Solid Waste - No operational impacts.

Construction Off-road Equipment Mitigation - 5,000 gallons of water will be used to water the site per day. Tiered equipment based on description from PV (see construction equipment list [Table 1]).

Off-road Equipment - PV provided construction equipment list.

| Table Name | Column Name | Default Value | New Value |
|---|---|---|---|
| tblAreaCoating | Area_Nonresidential_Exterior | 392000 | 0 |
| tblAreaCoating | Area_Nonresidential_Interior | 1176000 | 0 |
| tblConstEquipMitigation | NumberOfEquipmentMitigated | 0.00 | 5.00 |
| tblConstEquipMitigation | NumberOfEquipmentMitigated | 0.00 | 1.00 |
| tblConstEquipMitigation | NumberOfEquipmentMitigated | 0.00 | 5.00 |
| tblConstEquipMitigation | NumberOfEquipmentMitigated | 0.00 | 2.00 |
| tblConstEquipMitigation | Tier | No Change | Tier 4 Final |
| tblConstEquipMitigation | Tier | No Change | Tier 4 Final |
| tblConstEquipMitigation | Tier | No Change | Tier 4 Final |
| tblConstEquipMitigation | Tier | No Change | Tier 4 Final |
| tblConstructionPhase | NumDays | 10.00 | 90.00 |
| tblConstructionPhase | NumDays | 20.00 | 125.00 |
| tblConstructionPhase | NumDays | 300.00 | 260.00 |
| tblConstructionPhase | PhaseEndDate | 12/10/2021 | 3/4/2022 |
| tblConstructionPhase | PhaseStartDate | 11/27/2021 | 11/1/2021 |
| tblEnergyUse | LightingElect | 3.08 | 0.00 |
| tblEnergyUse | NT24E | 3.70 | 0.00 |
| tblEnergyUse | NT24NG | 6.67 | 0.00 |
| tblEnergyUse | T24E | 1.32 | 0.00 |
| tblEnergyUse | T24NG | 19.51 | 0.00 |

**EMFAC Off-Model Adjustment Factors for Gasoline Light Duty Vehicle to Account for the SAFE Vehicle Rule Applied**

| | | | |
|---|---|---|---|
| tblOffRoadEquipment | HorsePower | 158.00 | 760.00 |
| tblOffRoadEquipment | HorsePower | 158.00 | 313.00 |
| tblOffRoadEquipment | HorsePower | 158.00 | 532.00 |
| tblOffRoadEquipment | HorsePower | 63.00 | 75.00 |
| tblOffRoadEquipment | HorsePower | 63.00 | 99.00 |
| tblOffRoadEquipment | HorsePower | 63.00 | 99.00 |
| tblOffRoadEquipment | HorsePower | 231.00 | 270.00 |
| tblOffRoadEquipment | HorsePower | 158.00 | 313.00 |
| tblOffRoadEquipment | HorsePower | 89.00 | 130.00 |
| tblOffRoadEquipment | HorsePower | 84.00 | 75.00 |
| tblOffRoadEquipment | HorsePower | 124.00 | 440.00 |
| tblOffRoadEquipment | HorsePower | 172.00 | 30.00 |
| tblOffRoadEquipment | HorsePower | 65.00 | 74.00 |
| tblOffRoadEquipment | HorsePower | 231.00 | 270.00 |
| tblOffRoadEquipment | HorsePower | 89.00 | 130.00 |
| tblOffRoadEquipment | HorsePower | 84.00 | 75.00 |
| tblOffRoadEquipment | HorsePower | 63.00 | 75.00 |
| tblOffRoadEquipment | HorsePower | 63.00 | 99.00 |
| tblOffRoadEquipment | OffRoadEquipmentType | Tractors/Loaders/Backhoes | Aerial Lifts |
| tblOffRoadEquipment | OffRoadEquipmentType | Welders | Aerial Lifts |
| tblOffRoadEquipment | OffRoadEquipmentType | | Bore/Drill Rigs |
| tblOffRoadEquipment | OffRoadEquipmentUnitAmount | 3.00 | 1.00 |
| tblOffRoadEquipment | OffRoadEquipmentUnitAmount | 0.00 | 2.00 |
| tblOffRoadEquipment | OffRoadEquipmentUnitAmount | 0.00 | 1.00 |
| tblOffRoadEquipment | OffRoadEquipmentUnitAmount | 0.00 | 1.00 |
| tblOffRoadEquipment | OffRoadEquipmentUnitAmount | 0.00 | 2.00 |
| tblOffRoadEquipment | OffRoadEquipmentUnitAmount | 1.00 | 0.00 |
| tblOffRoadEquipment | OffRoadEquipmentUnitAmount | 3.00 | 1.00 |
| tblOffRoadEquipment | OffRoadEquipmentUnitAmount | 2.00 | 0.00 |

**EMFAC Off-Model Adjustment Factors for Gasoline Light Duty Vehicle to Account for the SAFE Vehicle Rule Applied**

| | | | |
|---|---|---|---|
| tblOffRoadEquipment | OffRoadEquipmentUnitAmount | 3.00 | 0.00 |
| tblOffRoadEquipment | OffRoadEquipmentUnitAmount | 0.00 | 2.00 |
| tblOffRoadEquipment | OffRoadEquipmentUnitAmount | 4.00 | 0.00 |
| tblOffRoadEquipment | OffRoadEquipmentUnitAmount | 0.00 | 2.00 |
| tblOffRoadEquipment | OffRoadEquipmentUnitAmount | 0.00 | 1.00 |
| tblOffRoadEquipment | PhaseName | | Demolition |
| tblOffRoadEquipment | PhaseName | | Demolition |
| tblOffRoadEquipment | PhaseName | | Demolition |
| tblOffRoadEquipment | PhaseName | | Demolition |
| tblOffRoadEquipment | PhaseName | | Structural Upgrades |
| tblOffRoadEquipment | PhaseName | | Structural Upgrades |
| tblOffRoadEquipment | PhaseName | | Structural Upgrades |
| tblOffRoadEquipment | UsageHours | 7.00 | 6.00 |
| tblSolidWaste | SolidWasteGenerationRate | 972.16 | 0.00 |
| tblTripsAndVMT | HaulingTripLength | 20.00 | 350.00 |
| tblTripsAndVMT | HaulingTripNumber | 0.00 | 360.00 |
| tblTripsAndVMT | HaulingTripNumber | 0.00 | 15,600.00 |
| tblTripsAndVMT | VendorTripNumber | 128.00 | 0.00 |
| tblTripsAndVMT | WorkerTripNumber | 33.00 | 100.00 |
| tblTripsAndVMT | WorkerTripNumber | 33.00 | 40.00 |
| tblTripsAndVMT | WorkerTripNumber | 329.00 | 60.00 |
| tblVehicleTrips | ST_TR | 6.42 | 0.00 |
| tblVehicleTrips | SU_TR | 5.09 | 0.00 |
| tblVehicleTrips | WD_TR | 3.93 | 0.00 |
| tblWater | ElectricityIntensityFactorForWastewaterTreatment | 1,911.00 | 0.00 |
| tblWater | ElectricityIntensityFactorToDistribute | 1,272.00 | 0.00 |
| tblWater | ElectricityIntensityFactorToSupply | 2,117.00 | 0.00 |
| tblWater | ElectricityIntensityFactorToTreat | 111.00 | 0.00 |
| tblWater | IndoorWaterUseRate | 181,300,000.00 | 0.00 |

## 2.0 Emissions Summary

## 2.1 Overall Construction

**Unmitigated Construction**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Year | tons/yr | | | | | | | | | | MT/yr | | | | | |
| 2021 | 0.0673 | 0.7511 | 0.6371 | 2.2700e-003 | 0.0444 | 0.0251 | 0.0695 | 0.0120 | 0.0238 | 0.0359 | 0.0000 | 210.0964 | 210.0964 | 0.0293 | 0.0159 | 215.5654 |
| 2022 | 0.3252 | 3.5658 | 3.2996 | 0.0126 | 0.3924 | 0.1063 | 0.4987 | 0.0774 | 0.0991 | 0.1765 | 0.0000 | 1,139.9460 | 1,139.9460 | 0.2452 | 0.0543 | 1,162.2696 |
| 2023 | 0.1117 | 1.6337 | 1.5407 | 6.1300e-003 | 0.1265 | 0.0387 | 0.1653 | 0.0345 | 0.0366 | 0.0711 | 0.0000 | 573.1123 | 573.1123 | 0.0756 | 0.0491 | 589.6344 |
| **Maximum** | **0.3252** | **3.5658** | **3.2996** | **0.0126** | **0.3924** | **0.1063** | **0.4987** | **0.0774** | **0.0991** | **0.1765** | **0.0000** | **1,139.9460** | **1,139.9460** | **0.2452** | **0.0543** | **1,162.2696** |

**Mitigated Construction**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Year | tons/yr | | | | | | | | | | MT/yr | | | | | |
| 2021 | 0.0616 | 0.6741 | 0.7077 | 2.2700e-003 | 0.0444 | 0.0220 | 0.0664 | 0.0120 | 0.0210 | 0.0330 | 0.0000 | 210.0963 | 210.0963 | 0.0293 | 0.0159 | 215.5652 |
| 2022 | 0.2565 | 2.7162 | 4.0628 | 0.0126 | 0.2591 | 0.0734 | 0.3326 | 0.0573 | 0.0694 | 0.1266 | 0.0000 | 1,139.9451 | 1,139.9451 | 0.2452 | 0.0543 | 1,162.2687 |
| 2023 | 0.1004 | 1.4201 | 1.5962 | 6.1300e-003 | 0.1265 | 0.0329 | 0.1595 | 0.0345 | 0.0314 | 0.0658 | 0.0000 | 573.1121 | 573.1121 | 0.0756 | 0.0491 | 589.6341 |
| **Maximum** | **0.2565** | **2.7162** | **4.0628** | **0.0126** | **0.2591** | **0.0734** | **0.3326** | **0.0573** | **0.0694** | **0.1266** | **0.0000** | **1,139.9451** | **1,139.9451** | **0.2452** | **0.0543** | **1,162.2687** |

**EMFAC Off-Model Adjustment Factors for Gasoline Light Duty Vehicle to Account for the SAFE Vehicle Rule Applied**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio-CO2 | Total CO2 | CH4 | N20 | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Percent Reduction | 17.01 | 19.16 | -16.23 | 0.00 | 23.66 | 24.58 | 23.88 | 16.28 | 23.71 | 20.46 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| Quarter | Start Date | End Date | Maximum Unmitigated ROG + NOX (tons/quarter) | Maximum Mitigated ROG + NOX (tons/quarter) |
|---|---|---|---|---|
| 1 | 11-1-2021 | 1-31-2022 | 1.1510 | 1.0399 |
| 2 | 2-1-2022 | 4-30-2022 | 1.6885 | 1.3641 |
| 3 | 5-1-2022 | 7-31-2022 | 2.1244 | 1.6524 |
| 4 | 8-1-2022 | 10-31-2022 | 1.1664 | 0.9636 |
| 5 | 11-1-2022 | 1-31-2023 | 0.7591 | 0.6656 |
| 6 | 2-1-2023 | 4-30-2023 | 0.6532 | 0.5691 |
| 7 | 5-1-2023 | 7-31-2023 | 0.6650 | 0.5780 |
| 8 | 8-1-2023 | 9-30-2023 | 0.1807 | 0.1571 |
| | | Highest | 2.1244 | 1.6524 |

## 2.2 Overall Operational

**Unmitigated Operational**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | tons/yr | | | | | | | | | | MT/yr | | | | | |
| Area | 3.0626 | 7.0000e-005 | 7.2000e-003 | 0.0000 | | 3.0000e-005 | 3.0000e-005 | | 3.0000e-005 | 3.0000e-005 | 0.0000 | 0.0140 | 0.0140 | 4.0000e-005 | 0.0000 | 0.0149 |
| Energy | 0.0000 | 0.0000 | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Mobile | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Waste | | | | | | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Water | | | | | | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| **Total** | **3.0626** | **7.0000e-005** | **7.2000e-003** | **0.0000** | **0.0000** | **3.0000e-005** | **3.0000e-005** | **0.0000** | **3.0000e-005** | **3.0000e-005** | **0.0000** | **0.0140** | **0.0140** | **4.0000e-005** | **0.0000** | **0.0149** |

## 2.2 Overall Operational

**Mitigated Operational**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | tons/yr | | | | | | | | | | MT/yr | | | | | |
| Area | 3.0626 | 7.0000e-005 | 7.2000e-003 | 0.0000 | | 3.0000e-005 | 3.0000e-005 | | 3.0000e-005 | 3.0000e-005 | 0.0000 | 0.0140 | 0.0140 | 4.0000e-005 | 0.0000 | 0.0149 |
| Energy | 0.0000 | 0.0000 | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Mobile | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Waste | | | | | | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Water | | | | | | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| **Total** | **3.0626** | **7.0000e-005** | **7.2000e-003** | **0.0000** | **0.0000** | **3.0000e-005** | **3.0000e-005** | **0.0000** | **3.0000e-005** | **3.0000e-005** | **0.0000** | **0.0140** | **0.0140** | **4.0000e-005** | **0.0000** | **0.0149** |

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio-CO2 | Total CO2 | CH4 | N20 | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Percent Reduction** | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

## 3.0 Construction Detail

**Construction Phase**

| Phase Number | Phase Name | Phase Type | Start Date | End Date | Num Days Week | Num Days | Phase Description |
|---|---|---|---|---|---|---|---|
| 1 | Pre-Demolition | Site Preparation | 11/1/2021 | 3/4/2022 | 5 | 90 | |
| 2 | Demolition | Demolition | 3/5/2022 | 8/26/2022 | 5 | 125 | |
| 3 | Structural Upgrades | Building Construction | 8/27/2022 | 8/25/2023 | 5 | 260 | |

**Acres of Grading (Site Preparation Phase): 0**

**Acres of Grading (Grading Phase): 0**

**Acres of Paving: 0**

**Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 0; Non-Residential Outdoor: 0; Striped Parking Area: 0 (Architectural Coating – sqft)**

**OffRoad Equipment**

| Phase Name | Offroad Equipment Type | Amount | Usage Hours | Horse Power | Load Factor |
|---|---|---|---|---|---|
| Pre-Demolition | Aerial Lifts | 2 | 8.00 | 75 | 0.31 |
| Pre-Demolition | Aerial Lifts | 1 | 8.00 | 99 | 0.31 |
| Pre-Demolition | Excavators | 2 | 8.00 | 313 | 0.38 |
| Pre-Demolition | Forklifts | 2 | 8.00 | 130 | 0.20 |
| Pre-Demolition | Generator Sets | 2 | 8.00 | 75 | 0.74 |
| Pre-Demolition | Other Construction Equipment | 2 | 8.00 | 30 | 0.42 |
| Pre-Demolition | Skid Steer Loaders | 2 | 8.00 | 65 | 0.37 |
| Demolition | Aerial Lifts | 2 | 8.00 | 99 | 0.31 |
| Demolition | Cranes | 1 | 6.00 | 270 | 0.29 |
| Demolition | Excavators | 1 | 8.00 | 760 | 0.38 |
| Demolition | Excavators | 3 | 8.00 | 313 | 0.38 |
| Demolition | Excavators | 3 | 8.00 | 532 | 0.38 |
| Demolition | Off-Highway Tractors | 1 | 8.00 | 440 | 0.44 |
| Demolition | Skid Steer Loaders | 2 | 8.00 | 74 | 0.37 |
| Demolition | Concrete/Industrial Saws | 0 | 8.00 | 81 | 0.73 |
| Structural Upgrades | Cranes | 1 | 6.00 | 270 | 0.29 |
| Structural Upgrades | Forklifts | 1 | 8.00 | 130 | 0.20 |
| Structural Upgrades | Generator Sets | 1 | 8.00 | 75 | 0.74 |
| Demolition | Rubber Tired Dozers | 0 | 8.00 | 247 | 0.40 |
| Pre-Demolition | Rubber Tired Dozers | 0 | 8.00 | 247 | 0.40 |

| | | | | | |
|---|---|---|---|---|---|
| Structural Upgrades | Aerial Lifts | 2 | 8.00 | 75 | 0.31 |
| Pre-Demolition | Tractors/Loaders/Backhoes | 0 | 8.00 | 97 | 0.37 |
| Structural Upgrades | Aerial Lifts | 2 | 8.00 | 99 | 0.31 |
| Structural Upgrades | Bore/Drill Rigs | 1 | 8.00 | 221 | 0.50 |

**Trips and VMT**

| Phase Name | Offroad Equipment Count | Worker Trip Number | Vendor Trip Number | Hauling Trip Number | Worker Trip Length | Vendor Trip Length | Hauling Trip Length | Worker Vehicle Class | Vendor Vehicle Class | Hauling Vehicle Class |
|---|---|---|---|---|---|---|---|---|---|---|
| Pre-Demolition | 13 | 100.00 | 0.00 | 360.00 | 10.80 | 7.30 | 350.00 | LD_Mix | HDT_Mix | HHDT |
| Demolition | 13 | 40.00 | 0.00 | 2,240.00 | 10.80 | 7.30 | 20.00 | LD_Mix | HDT_Mix | HHDT |
| Structural Upgrades | 8 | 60.00 | 0.00 | 15,600.00 | 10.80 | 7.30 | 20.00 | LD_Mix | HDT_Mix | HHDT |

## 3.1 Mitigation Measures Construction

Use Cleaner Engines for Construction Equipment

Water Exposed Area

## 3.2 Pre-Demolition - 2021

**Unmitigated Construction On-Site**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | tons/yr | | | | | | | | | | MT/yr | | | | | |
| Fugitive Dust | | | | | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Off-Road | 0.0510 | 0.4608 | 0.5303 | 1.1200e-003 | | 0.0209 | 0.0209 | | 0.0197 | 0.0197 | 0.0000 | 97.8435 | 97.8435 | 0.0255 | 0.0000 | 98.4800 |
| **Total** | **0.0510** | **0.4608** | **0.5303** | **1.1200e-003** | **0.0000** | **0.0209** | **0.0209** | **0.0000** | **0.0197** | **0.0197** | **0.0000** | **97.8435** | **97.8435** | **0.0255** | **0.0000** | **98.4800** |

## 3.2 Pre-Demolition - 2021

**Unmitigated Construction Off-Site**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | tons/yr | | | | | | | | | | MT/yr | | | | | |
| Hauling | 9.5600e-003 | 0.2853 | 0.0483 | 9.9000e-004 | 0.0266 | 4.1600e-003 | 0.0308 | 7.3100e-003 | 3.9800e-003 | 0.0113 | 0.0000 | 97.5697 | 97.5697 | 3.3000e-003 | 0.0155 | 102.2565 |
| Vendor | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Worker | 6.6600e-003 | 5.0600e-003 | 0.0584 | 1.6000e-004 | 0.0178 | 1.0000e-004 | 0.0179 | 4.7300e-003 | 9.0000e-005 | 4.8200e-003 | 0.0000 | 14.6832 | 14.6832 | 4.9000e-004 | 4.5000e-004 | 14.8288 |
| **Total** | **0.0162** | **0.2904** | **0.1067** | **1.1500e-003** | **0.0444** | **4.2600e-003** | **0.0486** | **0.0120** | **4.0700e-003** | **0.0161** | **0.0000** | **112.2529** | **112.2529** | **3.7900e-003** | **0.0159** | **117.0853** |

**Mitigated Construction On-Site**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | tons/yr | | | | | | | | | | MT/yr | | | | | |
| Fugitive Dust | | | | | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Off-Road | 0.0454 | 0.3837 | 0.6009 | 1.1200e-003 | | 0.0177 | 0.0177 | | 0.0169 | 0.0169 | 0.0000 | 97.8434 | 97.8434 | 0.0255 | 0.0000 | 98.4799 |
| **Total** | **0.0454** | **0.3837** | **0.6009** | **1.1200e-003** | **0.0000** | **0.0177** | **0.0177** | **0.0000** | **0.0169** | **0.0169** | **0.0000** | **97.8434** | **97.8434** | **0.0255** | **0.0000** | **98.4799** |

## 3.2 Pre-Demolition - 2021

**Mitigated Construction Off-Site**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | tons/yr | | | | | | | | | | MT/yr | | | | | |
| Hauling | 9.5600e-003 | 0.2853 | 0.0483 | 9.9000e-004 | 0.0266 | 4.1600e-003 | 0.0308 | 7.3100e-003 | 3.9800e-003 | 0.0113 | 0.0000 | 97.5697 | 97.5697 | 3.3000e-003 | 0.0155 | 102.2565 |
| Vendor | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Worker | 6.6600e-003 | 5.0600e-003 | 0.0584 | 1.6000e-004 | 0.0178 | 1.0000e-004 | 0.0179 | 4.7300e-003 | 9.0000e-005 | 4.8200e-003 | 0.0000 | 14.6832 | 14.6832 | 4.9000e-004 | 4.5000e-004 | 14.8288 |
| **Total** | **0.0162** | **0.2904** | **0.1067** | **1.1500e-003** | **0.0444** | **4.2600e-003** | **0.0486** | **0.0120** | **4.0700e-003** | **0.0161** | **0.0000** | **112.2529** | **112.2529** | **3.7900e-003** | **0.0159** | **117.0853** |

## 3.2 Pre-Demolition - 2022

**Unmitigated Construction On-Site**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | tons/yr | | | | | | | | | | MT/yr | | | | | |
| Fugitive Dust | | | | | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Off-Road | 0.0465 | 0.4060 | 0.5252 | 1.1200e-003 | | 0.0179 | 0.0179 | | 0.0169 | 0.0169 | 0.0000 | 97.8722 | 97.8722 | 0.0254 | 0.0000 | 98.5069 |
| **Total** | **0.0465** | **0.4060** | **0.5252** | **1.1200e-003** | **0.0000** | **0.0179** | **0.0179** | **0.0000** | **0.0169** | **0.0169** | **0.0000** | **97.8722** | **97.8722** | **0.0254** | **0.0000** | **98.5069** |

## 3.2 Pre-Demolition - 2022

**Unmitigated Construction Off-Site**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | tons/yr | | | | | | | | | | MT/yr | | | | | |
| Hauling | 5.9100e-003 | 0.2439 | 0.0381 | 9.6000e-004 | 0.0266 | 2.4100e-003 | 0.0290 | 7.3100e-003 | 2.3100e-003 | 9.6200e-003 | 0.0000 | 95.0025 | 95.0025 | 3.1600e-003 | 0.0151 | 99.5663 |
| Vendor | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Worker | 6.1800e-003 | 4.4500e-003 | 0.0538 | 1.5000e-004 | 0.0178 | 1.0000e-004 | 0.0179 | 4.7300e-003 | 9.0000e-005 | 4.8200e-003 | 0.0000 | 14.2991 | 14.2991 | 4.4000e-004 | 4.1000e-004 | 14.4331 |
| **Total** | **0.0121** | **0.2484** | **0.0919** | **1.1100e-003** | **0.0444** | **2.5100e-003** | **0.0469** | **0.0120** | **2.4000e-003** | **0.0144** | **0.0000** | **109.3016** | **109.3016** | **3.6000e-003** | **0.0155** | **113.9994** |

**Mitigated Construction On-Site**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | tons/yr | | | | | | | | | | MT/yr | | | | | |
| Fugitive Dust | | | | | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Off-Road | 0.0418 | 0.3478 | 0.5973 | 1.1200e-003 | | 0.0154 | 0.0154 | | 0.0147 | 0.0147 | 0.0000 | 97.8721 | 97.8721 | 0.0254 | 0.0000 | 98.5068 |
| **Total** | **0.0418** | **0.3478** | **0.5973** | **1.1200e-003** | **0.0000** | **0.0154** | **0.0154** | **0.0000** | **0.0147** | **0.0147** | **0.0000** | **97.8721** | **97.8721** | **0.0254** | **0.0000** | **98.5068** |

## 3.2 Pre-Demolition - 2022

**Mitigated Construction Off-Site**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | tons/yr | | | | | | | | | | MT/yr | | | | | |
| Hauling | 5.9100e-003 | 0.2439 | 0.0381 | 9.6000e-004 | 0.0266 | 2.4100e-003 | 0.0290 | 7.3100e-003 | 2.3100e-003 | 9.6200e-003 | 0.0000 | 95.0025 | 95.0025 | 3.1600e-003 | 0.0151 | 99.5663 |
| Vendor | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Worker | 6.1800e-003 | 4.4500e-003 | 0.0538 | 1.5000e-004 | 0.0178 | 1.0000e-004 | 0.0179 | 4.7300e-003 | 9.0000e-005 | 4.8200e-003 | 0.0000 | 14.2991 | 14.2991 | 4.4000e-004 | 4.1000e-004 | 14.4331 |
| **Total** | **0.0121** | **0.2484** | **0.0919** | **1.1100e-003** | **0.0444** | **2.5100e-003** | **0.0469** | **0.0120** | **2.4000e-003** | **0.0144** | **0.0000** | **109.3016** | **109.3016** | **3.6000e-003** | **0.0155** | **113.9994** |

## 3.3 Demolition - 2022

**Unmitigated Construction On-Site**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | tons/yr | | | | | | | | | | MT/yr | | | | | |
| Fugitive Dust | | | | | 0.2423 | 0.0000 | 0.2423 | 0.0367 | 0.0000 | 0.0367 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Off-Road | 0.1844 | 1.6986 | 1.7377 | 6.0900e-003 | | 0.0599 | 0.0599 | | 0.0551 | 0.0551 | 0.0000 | 534.7942 | 534.7942 | 0.1730 | 0.0000 | 539.1183 |
| **Total** | **0.1844** | **1.6986** | **1.7377** | **6.0900e-003** | **0.2423** | **0.0599** | **0.3022** | **0.0367** | **0.0551** | **0.0918** | **0.0000** | **534.7942** | **534.7942** | **0.1730** | **0.0000** | **539.1183** |

## 3.3 Demolition - 2022

### Unmitigated Construction Off-Site

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | tons/yr | | | | | | | | | | MT/yr | | | | | |
| Hauling | 5.2200e-003 | 0.1928 | 0.0410 | 7.1000e-004 | 0.0189 | 1.7300e-003 | 0.0207 | 5.2100e-003 | 1.6500e-003 | 6.8600e-003 | 0.0000 | 70.2064 | 70.2064 | 2.3100e-003 | 0.0111 | 73.5780 |
| Vendor | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Worker | 6.8700e-003 | 4.9500e-003 | 0.0598 | 1.7000e-004 | 0.0198 | 1.1000e-004 | 0.0199 | 5.2600e-003 | 1.0000e-004 | 5.3500e-003 | 0.0000 | 15.8879 | 15.8879 | 4.9000e-004 | 4.6000e-004 | 16.0368 |
| **Total** | **0.0121** | **0.1978** | **0.1008** | **8.8000e-004** | **0.0387** | **1.8400e-003** | **0.0405** | **0.0105** | **1.7500e-003** | **0.0122** | **0.0000** | **86.0943** | **86.0943** | **2.8000e-003** | **0.0116** | **89.6147** |

### Mitigated Construction On-Site

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | tons/yr | | | | | | | | | | MT/yr | | | | | |
| Fugitive Dust | | | | | 0.1091 | 0.0000 | 0.1091 | 0.0165 | 0.0000 | 0.0165 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Off-Road | 0.1272 | 1.0330 | 2.4044 | 6.0900e-003 | | 0.0330 | 0.0330 | | 0.0308 | 0.0308 | 0.0000 | 534.7936 | 534.7936 | 0.1730 | 0.0000 | 539.1177 |
| **Total** | **0.1272** | **1.0330** | **2.4044** | **6.0900e-003** | **0.1091** | **0.0330** | **0.1421** | **0.0165** | **0.0308** | **0.0473** | **0.0000** | **534.7936** | **534.7936** | **0.1730** | **0.0000** | **539.1177** |

## 3.3 Demolition - 2022

**Mitigated Construction Off-Site**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | tons/yr | | | | | | | | | | MT/yr | | | | | |
| Hauling | 5.2200e-003 | 0.1928 | 0.0410 | 7.1000e-004 | 0.0189 | 1.7300e-003 | 0.0207 | 5.2100e-003 | 1.6500e-003 | 6.8600e-003 | 0.0000 | 70.2064 | 70.2064 | 2.3100e-003 | 0.0111 | 73.5780 |
| Vendor | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Worker | 6.8700e-003 | 4.9500e-003 | 0.0598 | 1.7000e-004 | 0.0198 | 1.1000e-004 | 0.0199 | 5.2600e-003 | 1.0000e-004 | 5.3500e-003 | 0.0000 | 15.8879 | 15.8879 | 4.9000e-004 | 4.6000e-004 | 16.0368 |
| **Total** | **0.0121** | **0.1978** | **0.1008** | **8.8000e-004** | **0.0387** | **1.8400e-003** | **0.0405** | **0.0105** | **1.7500e-003** | **0.0122** | **0.0000** | **86.0943** | **86.0943** | **2.8000e-003** | **0.0116** | **89.6147** |

## 3.4 Structural Upgrades - 2022

**Unmitigated Construction On-Site**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | tons/yr | | | | | | | | | | MT/yr | | | | | |
| Off-Road | 0.0501 | 0.5450 | 0.6806 | 1.4300e-003 | | 0.0200 | 0.0200 | | 0.0188 | 0.0188 | 0.0000 | 125.4772 | 125.4772 | 0.0343 | 0.0000 | 126.3351 |
| **Total** | **0.0501** | **0.5450** | **0.6806** | **1.4300e-003** | | **0.0200** | **0.0200** | | **0.0188** | **0.0188** | **0.0000** | **125.4772** | **125.4772** | **0.0343** | **0.0000** | **126.3351** |

## 3.4 Structural Upgrades - 2022

**Unmitigated Construction Off-Site**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | tons/yr | | | | | | | | | | MT/yr | | | | | |
| Hauling | 0.0126 | 0.4648 | 0.0989 | 1.7100e-003 | 0.0457 | 4.1700e-003 | 0.0498 | 0.0126 | 3.9900e-003 | 0.0166 | 0.0000 | 169.2476 | 169.2476 | 5.5800e-003 | 0.0268 | 177.3755 |
| Vendor | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Worker | 7.4200e-003 | 5.3400e-003 | 0.0646 | 1.9000e-004 | 0.0213 | 1.2000e-004 | 0.0215 | 5.6800e-003 | 1.1000e-004 | 5.7800e-003 | 0.0000 | 17.1589 | 17.1589 | 5.3000e-004 | 5.0000e-004 | 17.3197 |
| **Total** | **0.0200** | **0.4702** | **0.1634** | **1.9000e-003** | **0.0670** | **4.2900e-003** | **0.0713** | **0.0182** | **4.1000e-003** | **0.0223** | **0.0000** | **186.4065** | **186.4065** | **6.1100e-003** | **0.0273** | **194.6952** |

**Mitigated Construction On-Site**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | tons/yr | | | | | | | | | | MT/yr | | | | | |
| Off-Road | 0.0433 | 0.4192 | 0.7050 | 1.4300e-003 | | 0.0164 | 0.0164 | | 0.0156 | 0.0156 | 0.0000 | 125.4770 | 125.4770 | 0.0343 | 0.0000 | 126.3349 |
| **Total** | **0.0433** | **0.4192** | **0.7050** | **1.4300e-003** | | **0.0164** | **0.0164** | | **0.0156** | **0.0156** | **0.0000** | **125.4770** | **125.4770** | **0.0343** | **0.0000** | **126.3349** |

## 3.4 Structural Upgrades - 2022

**Mitigated Construction Off-Site**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | tons/yr | | | | | | | | | | MT/yr | | | | | |
| Hauling | 0.0126 | 0.4648 | 0.0989 | 1.7100e-003 | 0.0457 | 4.1700e-003 | 0.0498 | 0.0126 | 3.9900e-003 | 0.0166 | 0.0000 | 169.2476 | 169.2476 | 5.5800e-003 | 0.0268 | 177.3755 |
| Vendor | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Worker | 7.4200e-003 | 5.3400e-003 | 0.0646 | 1.9000e-004 | 0.0213 | 1.2000e-004 | 0.0215 | 5.6800e-003 | 1.1000e-004 | 5.7800e-003 | 0.0000 | 17.1589 | 17.1589 | 5.3000e-004 | 5.0000e-004 | 17.3197 |
| **Total** | **0.0200** | **0.4702** | **0.1634** | **1.9000e-003** | **0.0670** | **4.2900e-003** | **0.0713** | **0.0182** | **4.1000e-003** | **0.0223** | **0.0000** | **186.4065** | **186.4065** | **6.1100e-003** | **0.0273** | **194.6952** |

## 3.4 Structural Upgrades - 2023

**Unmitigated Construction On-Site**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | tons/yr | | | | | | | | | | MT/yr | | | | | |
| Off-Road | 0.0881 | 0.9332 | 1.2649 | 2.7100e-003 | | 0.0329 | 0.0329 | | 0.0311 | 0.0311 | 0.0000 | 237.1636 | 237.1636 | 0.0647 | 0.0000 | 238.7815 |
| **Total** | **0.0881** | **0.9332** | **1.2649** | **2.7100e-003** | | **0.0329** | **0.0329** | | **0.0311** | **0.0311** | **0.0000** | **237.1636** | **237.1636** | **0.0647** | **0.0000** | **238.7815** |

## 3.4 Structural Upgrades - 2023

**Unmitigated Construction Off-Site**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | tons/yr | | | | | | | | | | MT/yr | | | | | |
| Hauling | 0.0106 | 0.6916 | 0.1627 | 3.0800e-003 | 0.0863 | 5.5900e-003 | 0.0918 | 0.0237 | 5.3500e-003 | 0.0291 | 0.0000 | 304.3645 | 304.3645 | 0.0100 | 0.0482 | 318.9877 |
| Vendor | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Worker | 0.0131 | 8.9300e-003 | 0.1131 | 3.4000e-004 | 0.0403 | 2.1000e-004 | 0.0405 | 0.0107 | 1.9000e-004 | 0.0109 | 0.0000 | 31.5843 | 31.5843 | 9.1000e-004 | 8.7000e-004 | 31.8652 |
| **Total** | **0.0237** | **0.7005** | **0.2758** | **3.4200e-003** | **0.1266** | **5.8000e-003** | **0.1324** | **0.0344** | **5.5400e-003** | **0.0400** | **0.0000** | **335.9488** | **335.9488** | **0.0109** | **0.0491** | **350.8529** |

**Mitigated Construction On-Site**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | tons/yr | | | | | | | | | | MT/yr | | | | | |
| Off-Road | 0.0767 | 0.7195 | 1.3204 | 2.7100e-003 | | 0.0271 | 0.0271 | | 0.0258 | 0.0258 | 0.0000 | 237.1633 | 237.1633 | 0.0647 | 0.0000 | 238.7812 |
| **Total** | **0.0767** | **0.7195** | **1.3204** | **2.7100e-003** | | **0.0271** | **0.0271** | | **0.0258** | **0.0258** | **0.0000** | **237.1633** | **237.1633** | **0.0647** | **0.0000** | **238.7812** |

## 3.4 Structural Upgrades - 2023

**Mitigated Construction Off-Site**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | tons/yr | | | | | | | | | | MT/yr | | | | | |
| Hauling | 0.0106 | 0.6916 | 0.1627 | 3.0800e-003 | 0.0863 | 5.5900e-003 | 0.0918 | 0.0237 | 5.3500e-003 | 0.0291 | 0.0000 | 304.3645 | 304.3645 | 0.0100 | 0.0482 | 318.9877 |
| Vendor | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Worker | 0.0131 | 8.9300e-003 | 0.1131 | 3.4000e-004 | 0.0403 | 2.1000e-004 | 0.0405 | 0.0107 | 1.9000e-004 | 0.0109 | 0.0000 | 31.5843 | 31.5843 | 9.1000e-004 | 8.7000e-004 | 31.8652 |
| **Total** | **0.0237** | **0.7005** | **0.2758** | **3.4200e-003** | **0.1266** | **5.8000e-003** | **0.1324** | **0.0344** | **5.5400e-003** | **0.0400** | **0.0000** | **335.9488** | **335.9488** | **0.0109** | **0.0491** | **350.8529** |

## 4.0 Operational Detail - Mobile

### 4.1 Mitigation Measures Mobile

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | tons/yr | | | | | | | | | | MT/yr | | | | | |
| Mitigated | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Unmitigated | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |

### 4.2 Trip Summary Information

| | Average Daily Trip Rate | | | Unmitigated | Mitigated |
|---|---|---|---|---|---|
| Land Use | Weekday | Saturday | Sunday | Annual VMT | Annual VMT |
| General Heavy Industry | 0.00 | 0.00 | 0.00 | | |
| Total | 0.00 | 0.00 | 0.00 | | |

### 4.3 Trip Type Information

| | Miles | | | Trip % | | | Trip Purpose % | | |
|---|---|---|---|---|---|---|---|---|---|
| Land Use | H-W or C-W | H-S or C-C | H-O or C-NW | H-W or C-W | H-S or C-C | H-O or C-NW | Primary | Diverted | Pass-by |
| General Heavy Industry | 9.50 | 7.30 | 7.30 | 59.00 | 28.00 | 13.00 | 92 | 5 | 3 |

### 4.4 Fleet Mix

| Land Use | LDA | LDT1 | LDT2 | MDV | LHD1 | LHD2 | MHD | HHD | OBUS | UBUS | MCY | SBUS | MH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| General Heavy Industry | 0.552821 | 0.058334 | 0.189005 | 0.121481 | 0.023262 | 0.005577 | 0.010166 | 0.007476 | 0.001000 | 0.000579 | 0.026545 | 0.000826 | 0.002928 |

## 5.0 Energy Detail

Historical Energy Use: N

### 5.1 Mitigation Measures Energy

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | tons/yr | | | | | | | | | | MT/yr | | | | | |
| Electricity Mitigated | | | | | | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Electricity Unmitigated | | | | | | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| NaturalGas Mitigated | 0.0000 | 0.0000 | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| NaturalGas Unmitigated | 0.0000 | 0.0000 | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |

## 5.2 Energy by Land Use - NaturalGas

**Unmitigated**

| | NaturalGas Use | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Land Use | kBTU/yr | tons/yr | | | | | | | | | | MT/yr | | | | | |
| General Heavy Industry | 0 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| **Total** | | **0.0000** | **0.0000** | **0.0000** | **0.0000** | | **0.0000** | **0.0000** | | **0.0000** | **0.0000** | **0.0000** | **0.0000** | **0.0000** | **0.0000** | **0.0000** | **0.0000** |

**Mitigated**

| | NaturalGas Use | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Land Use | kBTU/yr | tons/yr | | | | | | | | | | MT/yr | | | | | |
| General Heavy Industry | 0 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| **Total** | | **0.0000** | **0.0000** | **0.0000** | **0.0000** | | **0.0000** | **0.0000** | | **0.0000** | **0.0000** | **0.0000** | **0.0000** | **0.0000** | **0.0000** | **0.0000** | **0.0000** |

## 5.3 Energy by Land Use - Electricity

**Unmitigated**

| | Electricity Use | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|
| Land Use | kWh/yr | MT/yr | | | |
| General Heavy Industry | 0 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| **Total** | | **0.0000** | **0.0000** | **0.0000** | **0.0000** |

**Mitigated**

| | Electricity Use | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|
| Land Use | kWh/yr | MT/yr | | | |
| General Heavy Industry | 0 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| **Total** | | **0.0000** | **0.0000** | **0.0000** | **0.0000** |

# 6.0 Area Detail

## 6.1 Mitigation Measures Area

**EMFAC Off-Model Adjustment Factors for Gasoline Light Duty Vehicle to Account for the SAFE Vehicle Rule Applied**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | tons/yr | | | | | | | | | | MT/yr | | | | | |
| Mitigated | 3.0626 | 7.0000e-005 | 7.2000e-003 | 0.0000 | | 3.0000e-005 | 3.0000e-005 | | 3.0000e-005 | 3.0000e-005 | 0.0000 | 0.0140 | 0.0140 | 4.0000e-005 | 0.0000 | 0.0149 |
| Unmitigated | 3.0626 | 7.0000e-005 | 7.2000e-003 | 0.0000 | | 3.0000e-005 | 3.0000e-005 | | 3.0000e-005 | 3.0000e-005 | 0.0000 | 0.0140 | 0.0140 | 4.0000e-005 | 0.0000 | 0.0149 |

## 6.2 Area by SubCategory

**Unmitigated**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SubCategory | tons/yr | | | | | | | | | | MT/yr | | | | | |
| Architectural Coating | 0.0000 | | | | | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Consumer Products | 3.0619 | | | | | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Landscaping | 6.7000e-004 | 7.0000e-005 | 7.2000e-003 | 0.0000 | | 3.0000e-005 | 3.0000e-005 | | 3.0000e-005 | 3.0000e-005 | 0.0000 | 0.0140 | 0.0140 | 4.0000e-005 | 0.0000 | 0.0149 |
| **Total** | **3.0626** | **7.0000e-005** | **7.2000e-003** | **0.0000** | | **3.0000e-005** | **3.0000e-005** | | **3.0000e-005** | **3.0000e-005** | **0.0000** | **0.0140** | **0.0140** | **4.0000e-005** | **0.0000** | **0.0149** |

## 6.2 Area by SubCategory

**Mitigated**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SubCategory | tons/yr | | | | | | | | | | MT/yr | | | | | |
| Architectural Coating | 0.0000 | | | | | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Consumer Products | 3.0619 | | | | | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Landscaping | 6.7000e-004 | 7.0000e-005 | 7.2000e-003 | 0.0000 | | 3.0000e-005 | 3.0000e-005 | | 3.0000e-005 | 3.0000e-005 | 0.0000 | 0.0140 | 0.0140 | 4.0000e-005 | 0.0000 | 0.0149 |
| **Total** | **3.0626** | **7.0000e-005** | **7.2000e-003** | **0.0000** | | **3.0000e-005** | **3.0000e-005** | | **3.0000e-005** | **3.0000e-005** | **0.0000** | **0.0140** | **0.0140** | **4.0000e-005** | **0.0000** | **0.0149** |

## 7.0 Water Detail

### 7.1 Mitigation Measures Water

| | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|
| Category | MT/yr | | | |
| Mitigated | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Unmitigated | 0.0000 | 0.0000 | 0.0000 | 0.0000 |

## 7.2 Water by Land Use

**Unmitigated**

| | Indoor/Outdoor Use | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|
| Land Use | Mgal | MT/yr | | | |
| General Heavy Industry | 0 / 0 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| **Total** | | **0.0000** | **0.0000** | **0.0000** | **0.0000** |

## 7.2 Water by Land Use

**Mitigated**

| | Indoor/Outdoor Use | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|
| Land Use | Mgal | MT/yr | | | |
| General Heavy Industry | 0 / 0 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| **Total** | | **0.0000** | **0.0000** | **0.0000** | **0.0000** |

# 8.0 Waste Detail

## 8.1 Mitigation Measures Waste

**Category/Year**

| | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|
| | MT/yr | | | |
| Mitigated | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Unmitigated | 0.0000 | 0.0000 | 0.0000 | 0.0000 |

## 8.2 Waste by Land Use

**Unmitigated**

| | Waste Disposed | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|
| Land Use | tons | MT/yr | | | |
| General Heavy Industry | 0 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| **Total** | | **0.0000** | **0.0000** | **0.0000** | **0.0000** |

**Mitigated**

| | Waste Disposed | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|
| Land Use | tons | MT/yr | | | |
| General Heavy Industry | 0 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| **Total** | | **0.0000** | **0.0000** | **0.0000** | **0.0000** |

## 9.0 Operational Offroad

| Equipment Type | Number | Hours/Day | Days/Year | Horse Power | Load Factor | Fuel Type |
|---|---|---|---|---|---|---|

## 10.0 Stationary Equipment

### Fire Pumps and Emergency Generators

| Equipment Type | Number | Hours/Day | Hours/Year | Horse Power | Load Factor | Fuel Type |
|---|---|---|---|---|---|---|

### Boilers

| Equipment Type | Number | Heat Input/Day | Heat Input/Year | Boiler Rating | Fuel Type |
|---|---|---|---|---|---|

### User Defined Equipment

| Equipment Type | Number |
|---|---|

## 11.0 Vegetation

# Appendix C – Section 106 Report

# MFA Hangar 3 Hazard Remediation Section 106 Technical Report

SHPO# NASA_2019_1216_001

Moffett Federal Airfield,
Santa Clara County, California

Prepared for:
NASA Ames Research Center
Historic Preservation Office

Prepared by:

Stantec Consulting Services, Inc.

May 11, 2020

## Sign-off Sheet

This document entitled MFA Hangar 3 Hazard Remediation Section 106 Technical Report was prepared by Stantec Consulting Services Inc. ("Stantec") for the account of Planetary Ventures (the "Client"). Any reliance on this document by any third party is strictly prohibited. The material in it reflects Stantec's professional judgment in light of the scope, schedule and other limitations stated in the document and in the contract between Stantec and the Client. The opinions in the document are based on conditions and information existing at the time the document was published and do not take into account any subsequent changes. In preparing the document, Stantec did not verify information supplied to it by others. Any use which a third party makes of this document is the responsibility of such third party. Such third party agrees that Stantec shall not be responsible for costs or damages of any kind, if any, suffered by it or any other third party as a result of decisions made or actions taken based on this document.

Prepared by ______________________________

(signature)

**Daniel Herrick, MHC**

Reviewed by ______________________________

(signature)

**Garret Root, MA**

Approved by ______________________________

(signature)

**Alisa Reynolds, MA, RPA**

## Table of Contents

## List of Appendices

## Abbreviations

| | |
|---|---|
| ACHP | Advisory Council on Historic Preservation |
| ADI | Area of Direct Impacts |
| APE | Area of Potential Effects |
| APN | Assessor Parcel Number |
| ARC | Ames Research Center |
| ARS | Archaeological Resources Study |
| CAANG | California Air National Guard |
| CFR | Code of Federal Regulations |
| CRM | Cultural Resource Manager |
| DPR | California Department of Parks & Recreation |
| FAA | Federal Aviation Administration |
| HPSR | Historic Property Survey Report |
| ICRMP | Integrated Cultural Resources Management Plan |
| LTA | Lighter-than-air |
| LMSD | Lockheed Missile & Space Division |
| MFA | Moffett Federal Airfield |

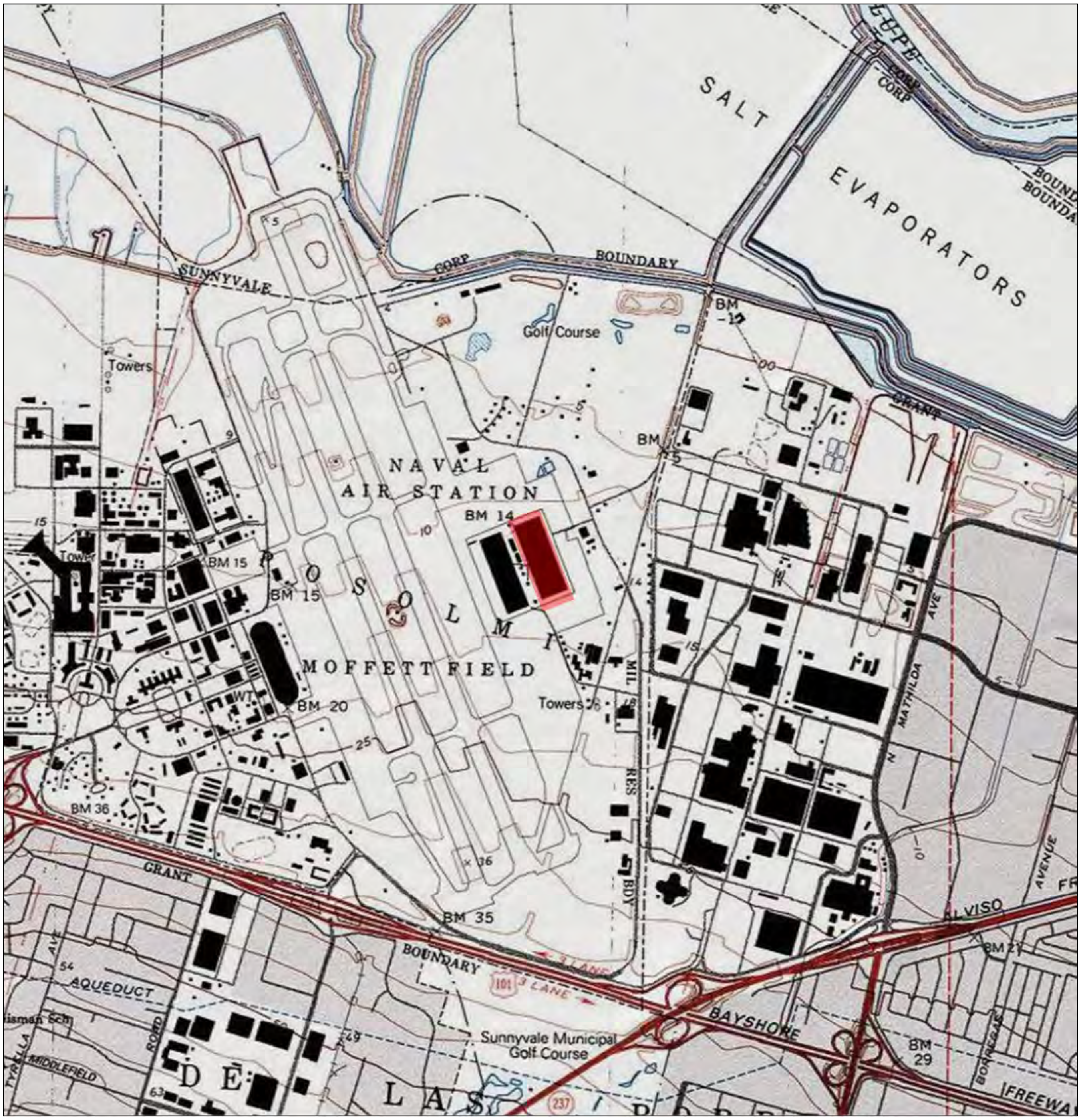
| | |
|---|---|
| NAS | Naval Air Station |
| NASA | National Aeronautics and Space Administration |
| NASA ARC | NASA Ames Research Center |
| NATS | Naval Air Transport Services |
| NAHC | Native American Heritage Commission |
| NHPA | National Historic Preservation Act of 1966 |
| NRHP | National Register of Historic Places |
| NWIC | Northwest Information Center |
| PV | Planetary Ventures, LLC |
| SOI Qualifications | Secretary of the Interior's Professional Qualifications Standards |
| SHPO | California State Historic Preservation Officer |

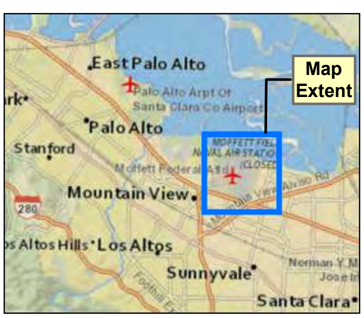
# 1.0 Introduction

Stantec Consulting Services, Inc. (Stantec) has prepared this technical report on behalf of Planetary Ventures, LLC (PV), which has entered into an Adaptive Reuse Lease with the National Aeronautics and Space Administration (NASA) for the Ames Research Center (ARC) Eastside/ Airfield area at Moffett Federal Airfield (MFA). As the lead federal agency, NASA is responsible for compliance with Section 106 of the National Historic Preservation Act of 1966 (NHPA), which requires federal agencies to assess effects of undertakings on historic properties. Included in the leasehold is Hangar 3, a large, wood-frame, former dirigible hangar constructed during World War II (**Figure 1**). Hangar 3 is currently unoccupied and supported by a system of large pipe shores, steel exoskeletons, and hydraulic jacks installed during a repair program initiated in 2015 to stabilize the structure and provide asset protection. However, the conducted repair work was unable to alleviate damage and structural deterioration, and the installed shoring system is only intended to provide short-term stabilization (approximately two to three years). Due to its advanced deterioration, PV is proposing to methodically demolish Hangar 3. All work associated with the proposed Hangar 3 Hazard Remediation project will be referred to as the “Undertaking.”

This technical report addresses the requirements of Section 106 of the NHPA, per 36 CFR Section 800, to assess the potential of adverse effects on historic properties. It includes a description of the Undertaking, a description of the Area of Potential Effects (APE), the identification of all historic properties within the APE, and an assessment of adverse effects based upon the Criteria of Adverse Effects (36 CFR Section 800.5).

This technical report was prepared by architectural historian Daniel Herrick, MHC, and archaeologist Gilbert Browning, MA RPA, with review by senior architectural historian Garret Root, MA. Mr. Herrick and Root meet the Secretary of the Interior’s Professional Qualification Standards for architectural history and history, and Mr. Browning meets the qualifications for archaeology.




Project Location

0 1,000 2,000
Feet
(At original document size of 8.5x11)
1:430,000

N

Stantec

*Project Location*

Moffett Field, Santa Clara County

*Client/Project*

**MFA Hangar 3 Hazard Remediation**
**Section 106 Technical Report**

*Figure No.*

1

*Title*

Project Location Map

***Notes***

**1.** Coordinate System: NAD 1983 StatePlane California III FIPS 0403 Feet
**2.** Data Sources: Stantec 2019.
**3.** Background: Copyright:© 2013 National Geographic Society, i-cubed
National Geographic, Esri, Garmin, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp.

# 2.0 Background

In 1931, the US Navy selected the current site of MFA to construct Naval Air Station (NAS) Sunnyvale as a dedicated west coast center for the Navy's dirigible rigid airship program.[1] The airfield campus featured a series of Spanish Colonial Revival style military buildings centered around the monumental Hangar 1. The large steel-frame structure was composed in the Streamline Moderne style and designed to house the USS *Macon*, which operated at the base until it crashed into the Pacific Ocean in 1935. Following the loss of the USS *Macon*, the Navy transferred the airfield to the US Army Air Corps, which operated the property as an observation and training facility in the years leading up to World War II. The Army transitioned the use from dirigible to fixed wing aircraft. Upon US entrance to World War II in 1941, the Navy reassumed control of the airfield renaming it Moffett Field after the Rear-Admiral William Moffett. The renamed airfield became the center for the new Lighter-than-air (LTA) coastal defense program.

In 1942, construction began on two new dirigible hangars, Hangars 2 and 3. The nearly identical structures utilized a standardized design used at a number of bases including NAS Santa Ana, California and NAS Tillamook, Oregon. Both hangars are large timber framed structures that are over 1,100' long, 375' wide, and 170' tall. They are defined by a large parabolic roof clad with exterior corrugated aluminum panels that enclose the main hangar volume, which is supported by 51 regularly spaced Douglas Fir wood arched trusses. The trusses are set on concrete bents located along the east and west elevations, which contain the two-story peripheral shed structures that housed office and operations spaces in the hangar. At the north and south elevations are the large multi-panel sliding doors, which roll on a metal track system and are supported by a large wood box beam on concrete towers. A clamshell aluminum standing seam roof with wood sheathing connects the main hangar structure to the box beam at both the north and south elevations. Unlike Hangar 1 and its steel construction, Hangars 2 and 3 were constructed of wood as steel was used by other wartime efforts. Construction of Hangar 2 began first, followed quickly by Hangar 3 (**Figure 2**). While Hangar 2 was constructed on an impressive schedule of 372 days, Hangar 3 was constructed in just 208 days. Because of this expedited construction for Hangar 3, it is not as well constructed as Hangar 2.[2]

[1] The following section was derived from AECOM, *Historic Property Survey Report for the Airfield at NASA Ames Research Center, Moffett Field, California*, prepared for NASA Ames Research Center (November 2013). Any additional sources will be cited accordingly.
[2] Page & Turnbull, "Hangar 3 Re-use Guidelines" (2006), 30.

**Figure 2: Ca.1943 aerial photograph showing Hangar 2 (left) and Hangar 3 (right) under construction. Source: Moffett Field Historical Society.**

By the end of World War II in 1945, the LTA program was rendered obsolete, and MFA's mission returned to use of fixed wing aircraft. In 1947, the Naval Air Transport Service (NATS) utilized Hangar 3 for housing and maintenance of aircraft (**Figure 3**). With the outbreak of the Korean War, MFA supported several jet aircraft squadrons, which continued to operate at the airfield until 1961.


**Figure 3: 1947 Aerial Photograph of MFA, looking southeast with Hangars 2 and 3 in the background. Source: Moffett Field Historical Society.**

In 1963, MFA became the command center, administration, and training facility for Pacific anti-submarine operations resulting in stationing of several squadrons of Orion P-3 Anti-submarine aircraft. Hangar 2 and 3 housed the Orion P-3 aircraft and supported this mission until 1994, when MFA was decommissioned by the Navy and transferred to NASA ARC, which had been operating nearby and sharing the airfield since the 1940s. The California Air National Guard (CAANG) partially occupied Hangar 3 through the 1990s, although the building remained largely vacant and under-utilized.

In 1988, both Hangar 2 and Hangar 3 were determined individually eligible for listing on the National Register of Historic Places (NRHP) for significance associated with events during World War II, and for their overall engineering and design. In 1994, both hangars were listed on the NRHP as a contributor the NAS Sunnyvale Historic District as excellent examples of military engineering and design during World War II.

## 2.1 Repairs & Existing Conditions

Exploration of potential reuse for Hangar 3 began in 2006, resulting in preparation of documents related to existing conditions, reuse opportunities, and rehabilitation. At the time, an assessment of the structural system determined that Hangar 3 did not meet life-safety performance requirements and noted that major structural damage may occur in the event of a seismic event. It was recommended that full seismic testing should be conducted to further assess the structural deficiencies of the building. However, according to an in-depth structural analysis report, prepared by KPFF Consulting Engineers in August 2013, it does not appear that any additional study was conducted over those years (see **Appendix A.1** the 2013 Due Diligence Report).[3] The 2013 KPFF report noted that Hangar 3 exhibited very poor truss system conditions, especially in comparison to Hangar 2. This included observable cracks in the wood members, as well as distortion and displacement throughout the main chords; recommendations to document, investigate, and repair 68 members of the truss system were made in support of rehabilitating of Hangar 3.[4]

In May 2015, NASA initiated Section 106 Consultation for the Hangars 2 and 3 Core and Shell Rehabilitation Project, which proposed a finding of no adverse effect to the structure. In a letter dated August 27, 2015, the California State Historic Preservation Officer (SHPO) concurred with the finding that the proposed work, including structural repairs, would not result in an adverse effect to either structure (SHPO #: NASA_2015_0605_001). However, since submittal of the Section 106 materials and subsequent concurrence on the finding of no adverse effect, the quickly degrading structural conditions at Hangar 3 have greatly changed the scope of work proposed for the structure.

By June 2015, worsening structural conditions were observed by structural engineers, including truss deflection, increased cracking, and a partial collapse of select trusses underneath the monitor roof. An immediate structural analysis was conducted by PV's structural engineer, KPFF, and a series of stabilization repairs were started in August 2015, followed by additional emergency repairs that begun in February 2016.[5] In May 2016, KPFF prepared an additional conditions assessment and emergency repair document in response to the degrading structure (see **Appendix A.2** for the 2016 Emergency Truss repair Narrative).[6] Additional structural investigations discovered new damage was spreading throughout the chords and was not previously observed or

[3] KPFF, "Building 46 (Hangar 2) and Building 47 (Hangar 3) Due Diligence Phase 1 report," August 9, 2013.
[4] KPFF, "Damage Progression Timeline - DRAFT " July 6, 2017.
[5] Repair timeline confirmed during a telephone call between PV and the repairs contractor on March 31, 2020.
[6] KPFF, "Hangar 3 Emergency Truss Repairs Narrative," May 26, 2016.

reported during due-diligence exercises.[7] Furthermore, the document outlines an opinion regarding the structural condition, which states that "based on the progressing downward movement of the trusses observed in Hangar 3, there is a threat of partial collapse of the upper portions of the roof which may lead to progressive collapse of other portions of the truss."[8] In response, an emergency truss repair program was developed to stabilize the degrading condition of the structure, and outlined in the document.

**Photograph 1: East elevation of Hangar 3, looking southwest. Note the dip in the roofline at center, indicating the partial roof failure.**

The Emergency repair measures performed, starting in February 2016, include the following:

- Installation of temporary steel pipe shoring system within the interior volume of Hangar 3. Two sets of 36" pipe shores were installed from trusses 9 to 26, totaling 24 shores. These were anchored into the existing Hangar 3 concrete decking and

[7] Repair timeline confirmed during a telephone call between PV and the repairs contractor on March 31, 2020.
[8] KPFF, "Hangar 3 Emergency Truss Repairs Narrative," May 26, 2016.

attached to truss members.

- Installation of 17 steel exoskeletons (in between each truss from 9.5 to 25.5). The roof is currently supported by the steel exoskeletons, which are connected to the damaged trusses and jacking system.

- Portions of the trusses were repaired, both in the areas of the exoskeleton and in less severely damaged areas. Some timber members that were deteriorated beyond repair were unable to be completely removed due to accessibility and safety concerns, and were ultimately repaired in place.

- Repairs in place included: upper and lower timber chord members, vertical and diagonal web members, battens, and attachment hardware, including but not limited to shear plates, split rings, and bolts. New battens were added over the damaged areas, particularly in the main area of damage spanning between trusses 9 to 26.

- Some  original Douglas Fir members were replaced in kind, while some new Douglas Fir members were bolted to the existing to support further degradation of the damaged members. Other members were temporarily affixed with glulam (composite glue-laminated wood) instead of to Douglas Fir.

- The box beam structure south end, which was deflecting, was re-leveled and the south hangar doors were made manually operational. Areas of wood roof sheathing at the south end of the hangar above the box beam were modified as necessary following the relevelling process.[9]

Following the execution of these repairs, structural engineers continued to observe the conditions of the hangar. To allow this observation work to continue, a large, movable observation access tower and deck was installed at the area between trusses 9 to 26, where the critical area of damage was observed and where the pipe shoring system had been installed (**Photograph 2**). Further observation revealed that following the emergency repairs, damage continued to progress through the structural system to previously undamaged areas (see **Appendix A.3** for the 2017 Damage Progression Timeline). Through early 2017, major damage and cracking was observed at chords, and 50 additional truss members were exhibiting severe damage.[10] Subsequent assessment of the of the structure by PV's structural engineer KPFF determined that varying levels of damage to the structural system exist beyond the truss repairs, and that the broader structural system has existed well beyond its service life.[11]

[9] Repairs confirmed during a telephone call between PV and the repairs contractor on March 31, 2020.
[10] KPFF, "Damage Progression Timeline - DRAFT " July 6, 2017.
[11] KPFF, "Moffett Federal Airfield Hangar 3 – Mountain View, California, Structural Site Observation," August 21, 2019.

In May 2017, the structure was deemed unsafe and unoccupiable, and NASA and CAANG were notified and asked to vacate Hangar 3. Currently, the structure is only accessible by select construction personnel. The extensive level of repairs required to stabilize Hangar 3 would involve a vast and cost prohibitive repair program K based upon the progression damage throughout the structure, would not guarantee structural stability if executed. The structural engineers also noted that in its current unrepaired state, Hangar 3 is far more vulnerable to sustaining further damage and partial collapse from seismic or high wind load events. According to an August 2019 site observation memorandum provided by KPFF, the hangar in its current state, is unoccupiable and uninsurable, and the level of work required to bring the structure to a limited occupiable use is "*extensive and undefinable, and further, the necessary work would be cost-prohibitive and is therefore not salvageable*." (see **Appendix A.4** for the August 2019 memorandum)[12]

[12] Ibid.

**Photograph 2: Interior volume Hangar 3 showing the hydraulic jack system which runs the length of the main structure and the repair scaffolding deck at center.**

# 3.0 Description of the Undertaking

The Undertaking will involve the systematic, controlled demolition of Hangar 3. Prior to demolition activities, the site and structure will be inspected for hazardous materials. Any materials containing asbestos or other hazardous compounds will be removed and disposed of in an appropriate manner. Additionally, active utility infrastructure connected to Hangar 3 will be identified and disconnected. Existing transformers and above grade electrical would be disconnected and demolished in no other loads are fed downstream. All underground NASA communication infrastructure and vaults would be protected during demolition. All existing service connections would be capped. Above ground water lines serving Hangar 3 would be drained, terminated, and capped at the connection to the service line. Disconnecting utilities will occur at-grade and will not involve below grade activities.

Per Federal Aviation Administration (FAA) requirements, pre-demolition activities may also include installation of temporary airspace obstruction lights, used to alert aircraft of obstacles and to avoid penetrations to airspace, until new obstruction lights are installed on Hangar 2. These lights will likely be installed along the monitor roof of Hangar 2 and attached along the existing guard rail. The obstruction lights will utilize existing electrical feeds, which extend to Building 55. The temporary obstruction lights would also require replacing the existing electrical panel in Building 55 (located approximately 50' from the west elevation of Hangar 3). The new panel would be installed within the main interior volume and will reuse existing conduits. Also, at Building 55, the exterior envelope may be temporarily covered by plywood to protect the building from damage that could result from demolition activities. If required, the plywood protection be installed around the perimeter of the building, extending up along the east, north, and south elevations. Protection would likely be installed away from the building envelope and anchored into the surrounding concrete surface. If plywood is to be connected to the building, connection points would be minimized in size and limited to specific locations to reduce the disturbance to the envelope. Any connection points would be repaired to match the existing conditions following the removal of the plywood protection.

Demolition of Hangar 3 will involve systematic removal of materials, starting with the massive hangar doors located at the north and south facades, which will be carefully dismantled and lowered into the immediate vicinity of the subject elevation. After, demolition will extend from south-to-north, removing the truss systems and primarily lowering materials within the interior volume and existing footprint of the structure. If, however, this approach is not feasible because of the structural condition of Hangar 3, supportive scaffolding will be used to safely provide the necessary controls. Once all of the trusses are removed, the concrete bents and brick masonry shed structures will be demolished, as well as the existing door towers, box beam, and door tracks. All above-ground elements of the structure will be removed, except for the concrete slab of Hangar 3; there is no below-grade work associated with the Undertaking. All removed materials, if unsalvageable, will be transported offsite to appropriate disposal facilities.

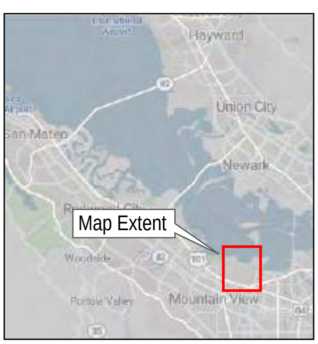
To secure the demolition site and protect adjacent structures, temporary fencing will be installed, creating a perimeter that will extend around the hangar. This staging area will largely coincide with the existing fencing installed around the Hangar. The temporary fencing will be an 8' high chain link fence set into concrete jersey barriers, which will be placed onto the surrounding paved surfaces to form the perimeter around the entire staging area; no physical anchoring to the existing surfaces will occur. Following demolition, all temporary fencing will be removed and any damage to the paved surfaces will be repaired in kind, restoring them to their existing condition.

# 4.0 Area of Potential Effects

The APE is located within the expanded NAS Sunnyvale Historic District on the east side of the airfield (**Figure 4**). For the current Undertaking, the APE boundaries coincide with the Eastside/Airfield area of MFA, in which Hangar 3 is located, and extends into portions of the neighboring City of Sunnyvale to the east. The location and size of the APE accounts for both potential direct and indirect effects to any historic properties, particularly those within the boundaries of the expanded NAS Sunnyvale Historic District.

The APE includes the Project footprint, which is primarily defined by the footprint of Hangar 3 and the demolition staging areas, which extend around the Hangar and largely align with the existing fence line. These areas account for where direct physical effects associated with the Undertaking may occur. This area, defined as the Area of Direct Impacts (ADI), will extend outwards approximately 30’ from the east and west elevations of the hangar. At the north and south elevations, the ADI boundary will extend approximately 200’ and 170’, respectively. The ADI also includes the adjacent Building 55 and select locations along the roof monitor of Hangar 2, where upgrades associated with the temporary aviation obstruction lights will be installed. The majority of work will be located at and above grade with no ground-disturbing activities; vertical boundaries of the APE are limited to the grade of the existing concrete slab of Hangar 3.

The APE also accounts for indirect effects, such as visual and atmospheric alterations to the historic setting and sense of place for historic properties. The APE boundaries largely coincide with the Eastside/Airfield area of MFA, where Hangar 3 is most visible. New and intensive mid-to-high rise commercial development around MFA block visual corridors and limited indirect effects on the eastern and southern boundaries, whereas Hangar 2 and Hangar 1 obstruct views of Hangar 3 to the west. The north boundary of the APE follows the NASA ARC property boundary along San Francisco Bay, respectively. The east boundary extends to include the east adjacent commercial buildings and the Lockheed Martin facilities located in Sunnyvale, California.




Notes
1. Dept. of the Interior, USGS Topographic Map, Mountain View, CA (2018).

Area of Direct Impacts (ADI)

Area of Potential Effects (APE)

Expanded NAS Sunnyvale Historic District

0 500 1,000 2,000 feet

Stantec

Project Location
T06.0S, R02.0W, Sec11-14
USGS 7.5min Quad:
Mountain View

Client/Project
**MFA Hangar 3 Hazard Remediation**
Section 106 Technical Report

Figure No.
4

Title
Undertaking Area of Potential Effects (APE)

# 5.0 Identification of Historic Properties

Per 36 CFR Section 800.16(1)(1), “historic properties” may include any district, site, building, structure, or object that is listed, or eligible for listing, in the NRHP.

## 5.1 Archaeological

In February 2017, AECOM prepared the *NASA Ames Research Center Archaeological Resources Study* (ARS), which identified potential archaeological resources throughout the NASA Ames Research Center property, including MFA. The ARS is intended to support the NASA Ames Research Center’s Integrated Cultural Resources Management Plan (ICRMP), which provides guidance for the treatment of cultural resources, both archaeological and built environment, on the NASA Ames property. The ARS, the contents and methodology of which was agreed upon by the SHPO in June 2017 (SHPO # NASA_2015_0928_001), includes a thorough collection of previous archaeological and geotechnical studies, previously recorded resources, historical maps and photographs, Sacred Land Files searches from the Native American Heritage Commission (NAHC), and other forms of documentation, to outline and identify the potential for archaeological resources throughout the site. Based upon these records, an archaeological sensitivity map was created that illustrates particular areas where archaeological properties are more likely to be extant. The identified areas of sensitivity are organized into four categories:

- Heightened Historic-era Archaeological Sensitivity
- Heightened Prehistoric-era Archaeological Sensitivity
- Heightened Geoarchaeological Sensitivity
- Low Archaeological Sensitivity

According to the ARS, the Undertaking is partially located within areas identified as having both Heightened Historic-era and Prehistoric-era Archaeological Sensitivity, meaning there is the potential for below ground resources to be extant, although there are no known archaeological sites in the ADI. In its existing condition, the entirety of the ADI is paved with no observable exposed soil, rendering a pedestrian archaeological survey ineffective (**Figure 5**).

Although the ADI is partially located in areas of heightened archaeological sensitivity for both Historic-era and Prehistoric-era resources, there are no ground-disturbing activities proposed. Therefore, there is no potential to effect below-ground historic properties in the APE.

## Confidential Attachment Removed:

Figure 5 – Areas of Archaeological Sensitivity

# 5.2 Built Environment

## 5.2.1 Moffett Federal Airfield

Numerous studies have documented and evaluated historical significance of the built environment at MFA. The following outlines historic surveys and studies relevant to the Undertaking and the associated historic properties identified within the APE.

### 5.2.1.1 NRHP-Listed NAS Sunnyvale Historic District

In 1994, the NAS Sunnyvale Historic District was identified and listed on the NRHP (**Appendix B.1**). The discontiguous historic district comprised the original 1930s portion of MFA, also known as Shenandoah Plaza, which centered around Hangar 1 and the western portion of the MFA property, as well as the eastern side of the airfield surrounding Hangars 2 and 3. The discontiguous historic district was determined significant under Criteria A and C for its associations with the development of US Naval aviation prior to World War II, and for its unifying architecture exhibited by the collection of Spanish Colonial Revival style and for the significant engineering exhibited by Hangar 1, as well as Hangars 2 and 3. The historic district is listed with a period of significance spanning 1930 to 1943, which coincides with the construction of the Shenandoah Plaza portion of MFA, as well as Hangars 2 and 3.

The APE is centered around Hangar 3 and includes the eastern portion of the district, as well as the eastern most properties of the Shenandoah Plaza portion of the district.

### 5.2.1.2 Historic Property Survey Report for the NASA Ames Research Center, Moffett Field, California (AECOM, 2013)

In 2013, AECOM prepared the *Historic Property Survey Report for the Airfield at NASA Ames Research Center, Moffett Field, California* (HPSR), which identified the NRHP-eligible expanded NAS Sunnyvale Historic District that encompassed the entirety of MFA, primarily the runway network and buildings directly associated with the operation of the airfield and the significant missions (**Appendix B.2**). The historic district was identified as significant under Criteria A (events) and C (architecture) with a period of significance spanning from 1930-1961. While the revised boundaries of the expanded historic district were concurred upon by SHPO on June 6, 2013, the contributing status of specific properties to the district has not received formal concurrence. However, SHPO, California Office of Historic Preservation staff, and NASA have agreed upon recognizing the identified historic district and the contributors outlined in the 2013 AECOM HPSR as historic properties for the purposes of Section 106 consultation.[13]

The current Undertaking's location is within the boundaries of the expanded NAS Sunnyvale Historic District. There are several contributing properties located within the identified APE.

### 5.2.2 Stantec Desktop Survey of East Adjacent Parcels Sunnyvale, California (2019)

In December 2019, Stantec architectural historians and archaeologists performed a desktop survey of the area located directly east of MFA in Sunnyvale, California, that is included in the indirect APE. This involved visiting the Northwest Information Center (NWIC) to find previous historic evaluations and reports specific to the area. While records for surrounding areas were found for a variety of previous studies, none were specific to the built environment properties located within this specific portion of the APE. Additional research was conducted, which involved examining and reviewing various public records, including Santa Clara County records, City of Sunnyvale planning documents, and Environmental Impact Reports that were prepared for projects in this specific area.

The following table (**Table 1**) and map (**Figure 6**) outlines the existing built environment properties located within the east adjacent parcels in Sunnyvale, California. The table includes the address, assessor parcel number (APN), common name of the property, year built, and any relevant information related to historic status or potential NRHP evaluations.

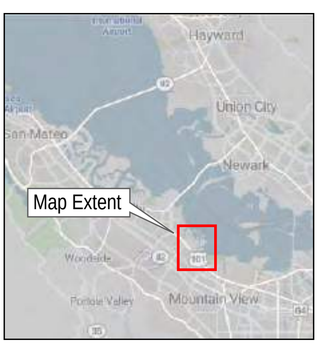
**Table 1: Built Environment Properties within the East portion of the APE in Sunnyvale, California.**

| Bldg .# | Address | APN | Name | Year Built | Evaluation Status |
|---|---|---|---|---|---|
| A | 1080 Enterprise Way, Sunnyvale, CA | 110-57-002 | Moffett Towers Club | 2008 | Under 50 years, not NRHP eligible |
| D | 1110 Enterprise Way, Sunnyvale, CA | 110-57-007 | Moffett Towers I-D | 2008 | Under 50 years, not NRHP eligible |

[13] SHPO letter to Keith Venter, Historic Preservation Officer at NASA ARC, "Section 111 Outlease for Hangar One and Moffett Federal Airfield, NASA Ames Research Center, Moffett Field CA" SHPO Reference: NASA_2013_0417_001 (June 6, 2013).

| | | | | | |
|---|---|---|---|---|---|
| E | 1120 Enterprise Way, Sunnyvale, CA | 110-57-004 | Moffett Towers I-E | 2008 | Under 50 years, not NRHP eligible |
| F | 1140 Enterprise Way, Sunnyvale, CA | 110-57-005 | Moffett Towers I-F | 2008 | Under 50 years, not NRHP eligible |
| G | 1180 Enterprise Way, Sunnyvale, CA | 110-57-006 | Moffett Towers I-G | 2008 | Under 50 years, not NRHP eligible |
| P3 | 1180 Enterprise Way, Sunnyvale, CA | 110-57-000-B1 | Moffett Towers I, Parking Garage #3 | 2008 | Under 50 years, not NRHP eligible |
| P4 | 1180 Enterprise Way, Sunnyvale, CA | 110-57-000-B1 | Moffett Towers I, Parking Garage #4 | 2012 | Under 50 years, not NRHP eligible |
| - | 1111 Lockheed Martin Way, Sunnyvale, CA | 110-01-026 | Lockheed Missiles & Space Campus | 1965 | Over 50 years, not previously evaluated |


0 500 1,000 2,000 feet




Notes
1. Dept. of the Interior, USGS Topographic Map, Mountain View, CA (2018).

Undertaking Area - Area of Direct Impacts (ADI)

Area of Potential Effects (APE)

Stantec 2019 Built Environment Desktop Survey Area

NAS Sunnyvale Historic District Boundaries (NRHP Listed)

Expanded NAS Sunnyvale Historic District Boundaries (NRHP Eligible)

Lockheed Martin Missile & Space Division Campus

Stantec

Project Location
T06.0S, R02.0W, Sec11-14
USGS 7.5min Quad:
Mountain View

Client/Project
**MFA Hangar 3 Hazard Remediation**
**Section 106 Technical Report**

Figure No.
6

Title
2019 Built Environment
Desktop Survey Properties

Of these properties, the majority are recently constructed commercial office buildings and supporting parking garages. These buildings are not 50 years old and do not meet the age threshold requirement for NRHP eligibility and were not investigated. However, the northwest portion of the Lockheed Martin Missiles & Space campus is also located in the APE. While the full survey and evaluation of these high profile and sensitive technical facilities was not within the scope of this effort, the following section outlines the approach taken with these properties for the purposes of the Hangar 3 Hazard Remediation Section 106 consultation effort.

#### 5.2.2.1 Lockheed Martin Missiles & Space Campus, Sunnyvale

The Lockheed Corporation was originally founded in San Francisco, California, by brothers Allan and Malcom Loughead in 1912, as the Loughead Aircraft Manufacturing Company. The company eventually folded, but was reinvented as the Lockheed Aircraft Company in 1926. Two years later, Lockheed relocated to Burbank, California, and became an important aircraft development and manufacturing company responsible for major developments in aviation from the 1920s through World War II. At the end of the War, Lockheed was a predominant defense contractor and was responsible for developing some of the most advanced aviation and aerospace programs for the US during the Cold War.

In 1956, the Lockheed company purchased over 400 acres in Sunnyvale, California. The location, considered ideal for its proximity to Stanford University and the facilities at NASA ARC, was developed for the Lockheed Missiles & Space Division (LMSD). Founded in 1955, the LMSD was contracted by the federal government to develop the US Navy’s ballistic missile program, as well the US Air Force’s advanced military satellite systems and advanced warning systems. Of the programs developed at LMSD campus, the most famous and well known include the Polaris missile program, as well as the recently declassified CORONA program, which was the first satellite surveillance program developed during the Cold War.[14] To facilitate the advanced research and development and manufacturing activities at Sunnyvale, Lockheed constructed a vast campus of facilities in the area directly east of MFA. The northwest corner of this campus is located within the APE. This portion of the campus features several large facility buildings, as well as a variety of support structures and recreational facilities. The initial buildings appear to have been constructed in 1965 and were subsequently expanded over the following years, reaching its current configuration by the 1980s.

Due to the highly sensitive nature of the facility and the ongoing programs, a full survey and evaluation of the property for potential NRHP eligibility was not conducted. However, given the advanced nature and high-profile research and development that has occurred at the property, this study assumes that the property would likely be

[14] The History Factory, *Innovation with Purpose: Lockheed Martin’s First 100 Years* (Washington DC: Lockheed Martin Company, 2013), 121-123.

eligible for listing in the NRHP per the Advisory Council on Historic Preservation's (ACHP) guidance on applying NRHP criteria on scientific facilities, specifically as a property "associated with events that have made a significant contribution to, and are identified with, or that outstandingly represent the broad national patterns of United States history and from which an understanding and appreciation of those patterns may be gained."[15] Additionally, while the campus in its current configuration is not yet 50 years of age, the nature of the programs administered at the facilities by LMSD have the potential to be of exceptional significance and could qualify under Criteria Consideration G: Properties that have achieved significance within 50 years. As such, the LMSD campus is being treated as a historic property for the purposes of this Section 106 Consultation only. Future evaluation of the property should be conducted to fully assess the historical significance and integrity of the campus.

### 5.2.3 Historic Properties in the APE

The following table (**Table 1**) and map (**Figure 7**), outlines the built environment historic properties located within the APE by number and name, as well as the year they were constructed, their historic status and history of previous evaluations. Only Hangar 3 is located within the ADI.

**Table 2: Historic Properties Within the Undertaking APE**

| Bldg. # | Bldg. Name (Current/ Historic) | Year Built | Historic Status |
|---|---|---|---|
| 01 | Hangar 1 | 1931-33 | • Individually eligible to NRHP<br>• NRHP-listed Contributor to NAS Sunnyvale Historic District |
| 32 | North Floodlight Tower | 1934 | • NRHP-listed Contributor to NAS Sunnyvale Historic District |
| 33 | South Floodlight Tower | 1934 | • NRHP-listed Contributor to NAS Sunnyvale Historic District |
| 46 | Hangar 2 | 1942 | • Individually eligible to NRHP<br>• NRHP-listed Contributor to NAS Sunnyvale Historic District |
| 47 | Hangar 3 | 1943 | • Individually eligible to NRHP<br>• NRHP-listed Contributor to NAS Sunnyvale Historic District |

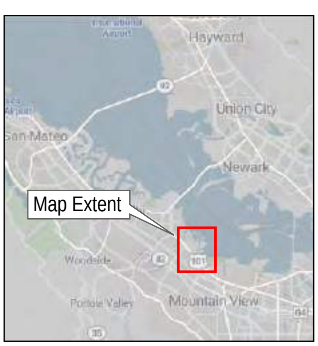
[15] Advisory Council on Historic Preservation, *Balancing Historic Preservation Needs with the Operation of Highly Technical or Scientific Facilities* (Washington DC: Advisory Council on Historic Preservation, 1991), 30.

| | | | |
|---|---|---|---|
| 55 | Heat Plant | 1943 | • NRHP-listed Contributor to NAS Sunnyvale Historic District |
| 69 | Inert Ammunition Storage | 1943 | • Identified as a contributor to the potentially eligible expanded NAS Sunnyvale Historic District<br>• Evaluated as ineligible in Section 106 consultation for the Defense Support Fuel Point Closure project; however, SHPO did not concur with these findings and continued to be treated as a historic property.[16] |
| 70 | Fuse & Detonator Magazine | 1943 | • Identified as a contributor to the potentially eligible expanded NAS Sunnyvale Historic District |
| 71, 72, 73, 74 | High Explosive Magazines | 1943 | • Identified as contributors to the potentially eligible expanded NAS Sunnyvale Historic District |
| 105 | Airfield Lighting Vault | 1947 | • Identified as a contributor to the potentially eligible expanded NAS Sunnyvale Historic District |
| 106 | Aircraft Compass Calibration Pad | 1947 | • Identified as a contributor to the potentially eligible expanded NAS Sunnyvale Historic District |
| 143, 147 | High Explosive Magazines | 1951 | • Identified as contributors to the potentially eligible expanded NAS Sunnyvale Historic District |
| 158 | Flight Operations Building & Tower | 1954 | • Identified as a contributor to the potentially eligible expanded NAS Sunnyvale Historic District |
| 329 | Ultra-High Frequency/ Very High Frequency Receiver Building | 1958 | • Identified as a contributor to the potentially eligible expanded NAS Sunnyvale Historic District |
| 442 | Ordnance Handling Pad | 1956 | • Identified as a contributor to the potentially eligible expanded NAS Sunnyvale Historic District |

[16] AECOM, *Historic Property Survey Report for the Ames Research Center Defense Fuel Support Point Closure Project, Moffett Field, California* (April 2016).

| | | | |
|---|---|---|---|
| 454 | Ultra-High Frequency/ Very High Frequency Transmission Building | 1960 | • Identified as a contributor to the potentially eligible expanded NAS Sunnyvale Historic District |
| MF1000 | Runway 32L/ 14R | 1938 | • Identified as a contributor to the potentially eligible expanded NAS Sunnyvale Historic District |
| MF1001 | Instrument Runway 14L/ 32R | 1945 | • Identified as a contributor to the potentially eligible expanded NAS Sunnyvale Historic District |
| MF1002 | Aircraft Parking Aprons | 1945 | • Identified as contributors to the potentially eligible expanded NAS Sunnyvale Historic District |
| MF1016 | Parallel & Connecting Taxiways | Ca.1946 | • Identified as contributors to the potentially eligible expanded NAS Sunnyvale Historic District. |
| - | Lockheed Missile & Space Campus | Ca.1965 | • Not formally evaluated, but presumed NRHP-eligible for the purposes of this Section 106 Consultation |


0 500 1,000 2,000
feet




Notes

1. Dept. of the Interior, USGS Topographic Map, Mountain View, CA (2018).

- Undertaking Area - Area of Direct Impacts (ADI)
- Area of Potential Effects (APE)
- NAS Sunnyvale Historic District Boundaries (NRHP Listed)
- NAS Sunnyvale Historic District Contributing Property (NRHP Listed)
- Expanded NAS Sunnyvale Historic District Boundaries (NRHP Eligible)
- Expanded NAS Sunnyvale Historic District Contributing Property (NRHP Eligible)
- Lockheed Missle & Space Campus (Presumed NRHP Eligible for the purposes of this Section 106 Consultation)

Stantec

Project Location
T06.0S, R02.0W, Sec11-14
USGS 7.5min Quad:
Mountain View

Client/Project
**MFA Hangar 3 Hazard Remediation**
**Section 106 Technical Report**

Figure No.
7

Title
Built Environment Historic Properties

### 5.2.3.1 Affected Historic Properties

The following section outlines the identified historic properties within the APE that have the potential to be affected by the Undertaking (**Figure 7**). Of the identified built environment properties, only Hangar 3, Building 55 and small portions of the east Aircraft Parking Apron (East MF1002) and Hangar 2 are located within the ADI (**Figure 8**).

*NAS Sunnyvale Historic District*

As outlined in Section 5.2.1.1, the original NAS Sunnyvale Historic District was listed on the NRHP in 1994, and determined significant under Criteria A and C for its associations with the development of US Naval aviation prior to World War II, and for its cohesive collection of Spanish Colonial Revival style buildings and the engineering associated with the hangars. In 2013, the expanded NAS Sunnyvale Historic District was identified and determined eligible for listing on the NRHP with an expanded period of significance of 1930-1961, which included the 1950s jet operations of the early Cold War. The expanded district included large swaths of the MFA property that were left out of the original NRHP-listed district, primarily the central airfield and the eastside portion of the airfield, which includes the munitions handling network of magazines and associated safety buffer zone at the northeast corner of the property.

Contributing elements of the NAS Sunnyvale Historic District located within the APE includes all of the contributing airfield features – two runways (MF 1000, MF1001), aircraft parking aprons (MF 1002) on the east and west sides of the airfield, various taxiways (MF 1016), and other features (Buildings 106 and 442) – which are primarily defined by their expansive, flat paved surfaces with axial siting and open setting. Also included are the supportive airfield operations buildings (Buildings 105, 329, 454), which are typically simple, prefabricated buildings that house the communication and electrical equipment for the airfield instrumentation, save for the Flight Operations Building & Tower (Building 158), which is a larger two-story building with Mid-Century architectural detailing and prominent control tower. Of the original Shenandoah portion of the westside of the airfield, only Hangar 1 and the two small supporting floodlight towers (Buildings 32 and 33) are located within the APE. On the eastside of the airfield, the entirety of the Hangar 2/3 Precinct is included within the APE, as are the surrounding areas associated with the munitions handling network, which includes the concrete magazines (Buildings 70-74, 146, 147) set within the center of the Golf Course, as well as the simple, inert ammunition storage building (Building 69), located north of Hangars 2 and 3.

Of the various identified character-defining features, the following are those that are most relevant within the context of the APE and the Undertaking (see **Appendix B.2** for complete list of character-defining features):[17]

- Flat topography with broad open views across the aviation areas.
- Expansive, linear system of airfield runway features, including the two parallel runways, associated taxiway network, and the compass calibration pad.
- Long views along the airfield towards San Francisco Bay and the salt ponds
- Collection of historic aviation facilities along the perimeter of the airfield. This includes both contributing and non-contributing elements, as the general massing and appearance solidify the spatial organization and character of the airfield.
- Visual dominance of Hangar 1 from throughout the airfield.
- Views to Hangar 2 and 3, which frame the eastside of the airfield and spatially balance Hangar 1 to the west. The three hangars are of primary significance and are their massing and appearance support the historic character and integrity of the airfield.
- Ammunition storage and handling features at the northeast corner of the airfield, which include the regularly spaced bunker-like magazines and simple storage facilities, all set within the open space of the safety buffer zone.
- Structures associated with aviation lighting, including the two distinct Hangar 1 floodlight towers and simple, utilitarian operations shelters.
- Collective design of buildings and structures and the aesthetics of “futuristic grandeur.”
- Ongoing aviation use.

*Hangar 1*

Hangar 1 is a large, steel framed dirigible hangar located on the westside of the airfield at MFA. Constructed between 1932 and 1933, Hangar 1 was designed to house the USS *Macon,* which was a large dirigible aircraft that operated at MFA until it crashed into the Pacific Ocean in 1935. Over the following decades, it continued to house aircraft and support the various missions that occurred at the airfield. The Streamline Moderne inspired structure continues to be the most prominent and iconic historic structures at MFA (**Photograph 3**).

[17] AECOM, “Historic Property Survey Report,” 5.4-5.5.

**Photograph 3: North and east elevations of Hangar 1, looking south.**

The structure has been determined individually eligible for listing on the NRHP for significance associated with Naval history and for its unique engineering and architectural design. In 1994, Hangar 1, as well as the adjacent Moderne style Floodlight Towers (Buildings 32 and 33), was listed on the NRHP as a contributor to the NAS Sunnyvale Historic District.

The most significant character-defining features of the structure include its size and massing, Streamline Moderne style, the "clam shell" doors, the steel exoskeleton structural system, the visual prominence within MFA, and its relationship to the entirety of the sight, particularly to the adjacent Buildings 32 and 33, as well as Hangars 2 and 3, located on the opposite side of the airfield.[18] When it was first identified, the original cladding was considered a character-defining feature, but was removed in the late 2000s; however, efforts to rehabilitate the structure are underway.

[18] Page & Turnbull, Inc. "Hangar One, Moffett Field, California – Re-Use Guidelines," prepared for NASA/ Ames Research Center (August 24, 2001), 3-4.

*Hangars 2 & 3 – Buildings 46 & 47*

Hangars 2 and 3 are large, wood framed dirigible hangars located on the eastside of the Airfield. Constructed between 1942 and 1943, Hangars 2 and 3 are nearly identical hangars based upon a standardized plan that was utilized for similar hangars located at a handful of other airfields that were in operation during World War II (**Photograph 4**). Hangar 2, located directly east adjacent to the airfield, was constructed first, whereas Hangar 3 was constructed second. Both were designed to facilitate the LTA coastal defense program at MFA during World War II, and both was used to house fixed wing aircraft that operated out of MFA over the following decades.

In 1988, both hangars were determined individually eligible for listing on the NRHP for significance associated with events during World War II, and for their overall engineering and design. In 1994, Hangars 2 and 3 were each listed on the NRHP as contributors to the NAS Sunnyvale Historic District as excellent examples of military engineering and design during World War II. In 2013, Hangars 2 and 3 was also identified as contributors to the NRHP-eligible expanded NAS Sunnyvale Historic District, which also includes the airfield features at MFA that were significant to the various missions that took place between 1933-1961.

The most significant character-defining features of both hangars include the distinctively large massing; parabolic roof with corrugated aluminum siding; massive sliding hangar doors with supporting concrete towers, wood box beams, and adjoining clamshell roof; the flanking brick masonry sheds; wood frame truss construction set on repeating concrete bents; expansive interior concrete decking; and the vast open interior volumes. Additionally, the two structures are unique for the parallel siting and nearly identical composition, which creates the paired hangars appearance.

**Photograph 4: South and east elevation of Hangar 3 with Hangar 2 in the background.**

*Building 55 – Heat Plant*

Building 55, located between Hangar 2 and 3 on the eastside of the airfield, was constructed in 1943 as the boiler room and shared heat plant for the two structures. The simple single-story, double-height building was listed on the NRHP in 1994 as a contributor to the original NAS Sunnyvale Historic District. Character-defining features of Building 55 include the square layout and box-like massing, the elongated brick masonry chimney, and its utilitarian style with unadorned stucco wall planes and limited divided-light fenestrations. As a building directly associated with Hangars 2 and 3, the spatial relationship between Building 55 and the two structures, both in terms of its placement between the hangars, and its notably small visual presence in comparison to the monumental paired structures (**Photograph 5**).

**Photograph 5: South and west elevation of Building 55 with Hangar 3 in the background, facing northwest.**[19]

*MF 1002 – Aircraft Parking Apron*

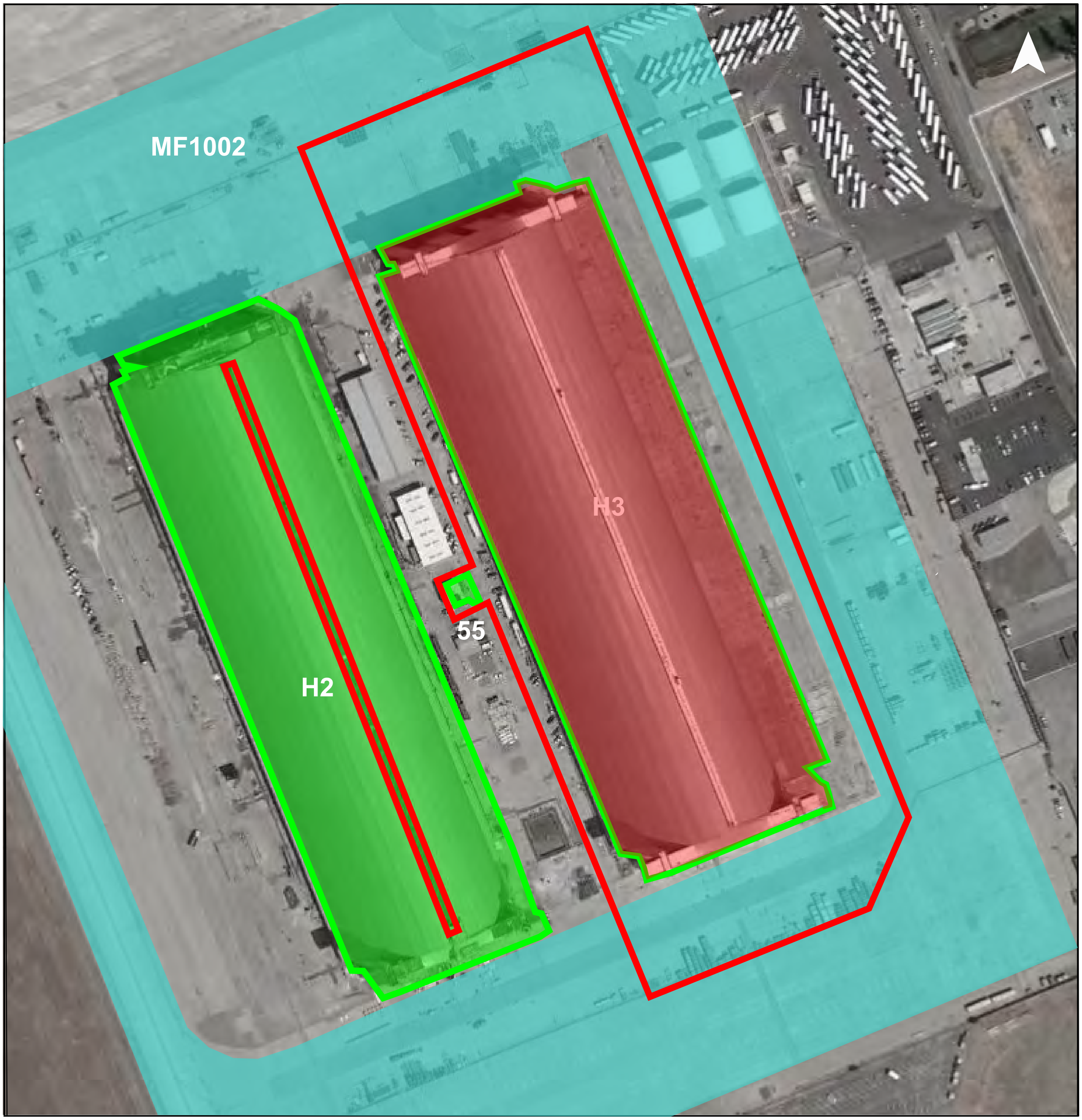
The East MF1002 aircraft parking apron is an expansive, paved surface located on the eastside of the airfield extending along the East Parallel Taxiway from the CAANG property northwards and surrounding Hangars 2 and 3. Originally constructed in 1942 as a location for aircraft parking, the Navy expanded East MF1002 to accommodate increased aircraft operations at MFA with the southern apron expanded in the mid-1950s and the northern portion expanded ca.1980.

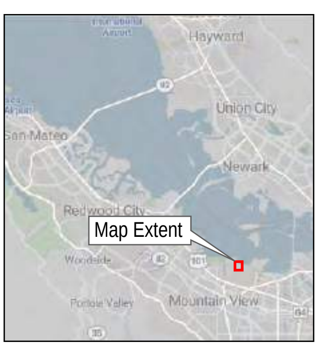
The predominant character-defining feature of East MF1002 is the flat, paved surface organized in a repeating, squared grid pattern. At the center of many repeating squares are embedded aircraft tie downs (**Photograph 6**). While the entirety of the Parking Apron features this repeating pattern, character-defining spaces are those that were constructed within the 1933-1961 period of significance of the expanded NAS

[19] Photograph courtesy of PV, 2014.

Sunnyvale Historic District. This includes the areas directly surrounding the hangars and to the south along the current CAANG cantonment area.

**Photograph 6: North portion of East MF1002 exhibiting typical conditions; note Hangar 3 north façade at right.**




Notes
1. Dept. of the Interior, USGS Topographic Map, Mountain View, CA (2018).

- Undertaking Area - Area of Direct Impacts (ADI)
- Area of Demolition
- NAS Sunnyvale Historic District Contributing Property (NRHP Listed)
- Expanded NAS Sunnyvale Historic District Contributing Property (NRHP Eligible)

0 100 200 400 feet

Stantec

Project Location
T06.0S, R02.0W, Sec11-14
USGS 7.5min Quad:
Mountain View

Client/Project
**MFA Hangar 3 Hazard Remediation**
**Section 106 Technical Report**

Figure No.
8

Title
Undertaking Area/
Area of Direct Impacts (ADI)

# 6.0 Assessment of Effects

Per 36 CFR 800.5(a)(1) of the NHPA, the Criteria of Adverse Effects are applied to assess potential effects of the Undertaking on historic properties located within the associated APE:

> (1) Criteria of adverse effect. An Adverse effect is found when an undertaking may alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the NRHP in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association. Consideration shall be given to all qualifying characteristics of a historic property including those that may have been identified subsequent to the original evaluation of the property's eligibility for the NRHP. Adverse effects may include reasonably foreseeable effects caused by the undertaking that may occur later in time, be farther removed in distance, or be cumulative.

The following analysis takes into consideration potential direct and indirect effects in relation to the integrity of historic properties located in the APE.

## 6.1 Archaeological Properties

In terms of archaeological historic properties, there will be no direct effects. Although the Project footprint is located in identified areas of heightened archaeological sensitivity, there are no ground disturbing activities associated with the Undertaking. The demolition scope includes removing the Hangar 3 structure to the existing concrete pad only with no below grade work.

Therefore, the Undertaking will not result in adverse effects on any as yet discovered below-ground resources.

## 6.2 Built Environment Properties

### 6.2.1 Hangar 3

The Undertaking will have direct effects on Hangar 3, primarily through the demolition and removal of all above-ground elements associated with the structure. Hangar 3 is a significant historic property at MFA, and its removal will result in the complete loss of all of its character-defining features, aspects of historical integrity, and sever its ability to convey its significance, ultimately disqualifying it from listing on the NRHP.

Therefore, the Undertaking will result in an adverse effect on Hangar 3.

### 6.2.2 Hangar 2

The Undertaking will not have direct adverse effects on Hangar 2. A small portion of Hangar 2 is located within the ADI, including select areas along the monitor roof where temporary obstruction lighting may be installed per FAA requirements. This will likely involve attachment to the existing guard rail system. The areas where anchors are connected to the guard rails will be small and will not diminish the overall integrity of the feature, nor of Hangar 2. Upon removal of the temporary lighting, the connection points will be repaired to match the existing materials. The lights will utilize existing electrical networks and will not require any additional interventions that would result in an adverse effect. Additionally, the installation of temporary obstruction lighting will not result in in an indirect adverse effect. These temporary elements will be aesthetically utilitarian and standard in design to all aviation facilities, and will not diminish character-defining features of Hangar 2, nor create a visual change that would diminish the overall setting, feeling, design, or association of Hangar 2.

The Undertaking, specifically the demolition of Hangar 3, will result in indirect adverse effects on Hangar 2. One of the primary character-defining features of Hangar 2 is the distinctive parallel spatial organization with Hangar 3 along the eastside of the airfield, which creates the iconic paired appearance. The removal would substantially disrupt this spatial organization and remove a significant element of the Hangar 2/3 Precinct, and ultimately result in diminished integrity of design for Hangar 2. Also, while the Undertaking would not result in any direct and physical alterations to the structure, the loss of the neighboring Hangar 3 would change significant visual and spatial character-defining elements of Hangar 2 associated with its historical significance. This will result in a diminished integrity of setting, feeling, and association.

Overall, Hangar 2 will retain sufficient integrity to continue qualifying for listing on the NRHP, both as an individual structure and as a contributor to the NAS Sunnyvale Historic District. Hangar 2 will not be physically altered in way that will affect its ability to convey its individual significance, and the remainder of the district will remain in its existing condition, and contribute to the integrity of setting, feeling, and association for Hangar 2. However, the visual loss of Hangar 3 will greatly alter the spatial organization of Hangar 2 and will diminish several aspects of historic integrity, particularly design, setting, feeling, and association.

Therefore, the Undertaking will result in an adverse effect on Hangar 2.

### 6.2.3 Building 55

At Building 55, direct work involves the installation of the temporary plywood protection and the potential replacement of the electrical panel in support of the proposed aircraft obstruction lights. The plywood protection would be installed around the building to provide a barrier from potential loose debris resulting from the demolition activities at the neighboring Hangar 3. While the exact nature of the plywood installation is unknown, any and all attachments to the building itself will be limited to preserve the existing materials, and all connection points will be repaired to match the existing conditions following the removal of the plywood. A new electrical panel will replace the existing one within Building 55, and will not have a direct effect on the exterior of the building or its character-defining features. Additionally, the new panel will likely reuse the existing electrical conduits and system, and will not involve the addition of new openings or alterations to the building envelope. Therefore, the direct alterations to Building 55 will not result in adverse effect.

The Undertaking will have indirect adverse effects Building 55. Building 55 was specifically designed as a shared heating plant for both Hangars 2 and 3. The removal of Hangar 3 will diminish the integrity of design by removing one of these key structures, while also drastically changing the character-defining visual and spatial relationship of the building between the two monumental hangars. This loss of Hangar 3 will change these character-defining spatial and visual features of Building 55 that will result in diminished integrity of setting, feeling, and associations as a shared heating plant from the World War II-era. Therefore, the diminished integrity of Building 55 caused by the Undertaking will result in adverse effect.

Despite adverse effects caused by the Undertaking, Building 55 will retain its physical aspects of integrity and its associations with Hangar 2 and the other contributors of the NAS Sunnyvale Historic District; it will still qualify for listing on the NRHP. However, the demolition of Hangar 3 will result in diminished integrity of design, setting, feeling, and association.

Therefore, the Undertaking will result in an adverse effect on Building 55.

### 6.2.4 East MF 1002

At East MF 1002, the Undertaking will not have direct adverse effects on the historic property. Select areas will be utilized for staging purposes and demarcated with a temporary chain-link fencing system set on jersey barrier supports, which will not be physically anchored to the paved surface of East MF 1002, and will not directly alter the historic property. Demolition activities at Hangar 3 involve depositing debris and removed materials towards the center of the structure, and will not result in materials falling onto the paved surfaces of East MF 1002. In the event that repairs to the character-defining gridded, paved surface of East MF 1002 are required, all repairs will be in-kind and will match the existing conditions of the feature Therefore, the direct alterations of the Undertaking at East MF1002 will not result in an adverse effect.

Similar to Hangar 2, East MF1002 was specifically designed, oriented, and operated around Hangar 3. While the Undertaking would have no effect on the overall character-defining features, the visual loss of Hangar 3 would disrupt the spatial organization of the apron, which was specifically constructed and oriented around Hangars 2 and 3. Although MF 1002 will remain in its existing physical condition and will continue to contribute to the NRHP-eligible district, the visual alteration caused by the removal of Hangar 3 would result in a visual and spatial disruption that will leave the property disconnected from the airfield. This will result in diminished integrity of setting, design, feeling, and association of East MF 1002.

Therefore, the Undertaking will result in an adverse effect on MF 1002.

### 6.2.5 Hangar 1

Constructed in 1933 as the original dirigible hangar at MFA, Hangar 1 is of primary significance within the original and expanded NAS Sunnyvale Historic Districts. The structure is not located within the ADI, and no scope associated with the Undertaking will result in direct alterations to Hangar 1, leaving the structure in its existing condition.

Unlike Hangars 2 and 3, Hangar 1 was designed and constructed independently a decade prior and does not have the same direct associations with Hangar 3 in the same way as Hangar 2. As such, the removal of Hangar 3 will not diminish the integrity of design for Hangar 1, which will be retained in its existing condition. Additionally, Hangar 1 is located on the westside of the airfield and is visually separated from Hangar 3 by both the airfield and Hangar 2, which borders the airfield and blocks many of the view corridors to the Hangar 3 (**Figure 7**). While this visual separation of Hangar 1 and Hangar 3 reduces the overall indirect effect of the Undertaking on Hangar 1, the arrangement of all three hangars is a significant aspect of the historic setting and spatial organization of each individual hangar, as well as the larger NAS Sunnyvale Historic District. The removal of Hangar 3 will result in diminished integrity of setting, feeling, and association of Hangar 1, and, therefore, will result in an adverse effect.

Despite the diminished integrity of setting, feeling, and association resulting from the removal of Hangar 3, Hangar 1 and its immediate surroundings will not be physically altered. Hangar 1 will continue to convey its significance as a the most significant structure at MFA, and as a primary contributor to the NAS Sunnyvale Historic District. Additionally, the area surrounding Hangar 1 will be retained in its existing condition, and contribute to the integrity of setting, feeling, and association of the structure. As such, Hangar 1 will continue to qualify for the NRHP, despite the adverse effects resulting from the Undertaking.

### 6.2.6 NAS Sunnyvale Historic District

As described in previous sections, Hangar 3 is a primary contributor to the NAS Sunnyvale Historic District. Constructed in 1943, Hangar 3 was a key structure from World War II through the Cold War. As such, Hangar 3 was central within the property and has direct associations with how the remainder of the airfield was ultimately designed, constructed, and used. Specifically, within the NAS Sunnyvale Historic District, Hangar 3 is noted as a central character-defining feature for its visual prominence within the district. Also, its massing and overall aesthetics are considered a significant and unifying component within the landscape that lends to the broader historic character and integrity of the district.

While the majority of the NAS Sunnyvale Historic District and its contributors will remain in its existing condition following the completion of the Undertaking, the demolition of Hangar 3 will result in the visual loss of a primary contributing and character-defining element. This will greatly alter the spatial relationships within the district, as well disrupting the visual and aesthetic qualities throughout the airfield. Therefore, the demolition of Hangar 3 will both directly and indirectly affect the NAS Sunnyvale Historic District in a way that diminishes its overall historical integrity, particularly the integrity of design, materials, workmanship, setting, feeling and association.

Furthermore, the loss of Hangar 3 will result in the visual alterations within the setting of several of the contributing structures within the APE and not discussed individually above. This includes the following:

- Eastside ammunition magazines and storage facilities (Buildings 66-74, 143, 147),
- Airfield features, including runways and taxiways (MF 1000, MF 1001, MF 1016, Buildings 106 & 142),
- Airfield operations and support buildings (Buildings 105, 158, 329, & 454).

These features are set outside the Hangar 2/3 Precinct and are not within the ADI. While they will not be directly affected by the Undertaking, the visual loss of Hangar 3 will result in diminished integrity of setting, feeling, and association, resulting in adverse effects.

### 6.2.7 Lockheed Martin Missile & Space Campus

The Lockheed Martin Missile & Space Campus is located northwest of Hangar 3, beyond the property boundaries at MFA. The collection of buildings is located in a secure area and supports the advanced research and development, testing, and manufacturing activities that occur at the property. While a formal significance evaluation was not conducted of the property, the nature of the property and the work at the campus suggests that it is likely historic, and is being treated as such for the purposes of this Section 106 consultation effort.

As a highly advanced technical facility, the property is inherently inward looking and has no significant associations or relationship specifically with Hangar 3. The proximity of the campus in relation to the airfield is noteworthy as many Lockheed projects underwent testing using the airfield as a staging ground, but Hangar 3 is unrelated to the Lockheed mission. Therefore, the spatial organization between the campus and the airfield will be retained following the demolition of Hangar 3 and the integrity of setting, feeling, or association will not be diminished. Therefore, the Undertaking will not result in an adverse effect on the Lockheed Martin Missile & Space Campus.

## 6.3 Summary

As described above, the Undertaking will have adverse effects on historic properties. The demolition of Hangar 3 will result in the complete physical loss of a historic property, constituting an adverse effect to the structure, as well as the broader NAS Sunnyvale Historic District to which it is a NRHP-listed contributor. Although small portions of East MF1002 are located within the ADI, this area is used primarily as a staging site and will be repaired in kind following the completion of all work. Small portions of Building 55 and Hangar 2 are also located in the ADI, although the proposed physical work occurring at these locations will not result in adverse effects to either property. Additionally, all work is occurring above ground, so no ground disturbing activities will have the potential to disrupt any unknown archaeological resources.

In terms of indirect effects, Hangar 3 is part of a large collection of historic properties at MFA, especially in relation to the neighboring Hangar 2 and Building 55, East MF 1002, Hangar 1 on the west side of the airfield, and the expanded NAS Sunnyvale Historic District. The demolition of Hangar 3 will result in diminished integrity of setting, design, feeling, and association with the adjacent Hangar 2, Building 55, and East MF1002, all of which are directly associated with Hangar 3 through their placement and historic use. Also, as one of the primary contributing buildings within the NAS Sunnyvale Historic District, the removal of Hangar 3 will alter the visual qualities and spatial organization of the district. The visual and spatial disruption will result in diminished integrity for the NAS Sunnyvale Historic District and its contributing properties. Therefore, the Undertaking will result in adverse effects to several historic properties, including Hangar 2, Building 55, East MF1002, Hangar 1, and the broader NAS Sunnyvale Historic District.[20]

While the Undertaking will result in adverse effects throughout the site, the only affected property that will not retain significant historic integrity to qualify for listing on the NRHP

[20] Note: while the Undertaking will result in adverse effects throughout the site, the only property that will not retain significant historic integrity to qualify for listing on the NRHP is Hangar 3.

is Hangar 3. All other historic properties will retain sufficient, albeit diminished, integrity to qualify for listing despite adverse effects resulting from the Undertaking.

# 7.0 Resolution of Adverse Effects

In order to resolve adverse effects under Section 106, it is the lead federal agency's responsibility to consult with SHPO and other interested parties in finding solutions to avoid, minimize, or mitigate adverse effects to historic properties.

The previous emergency repair and stabilization efforts at Hangar 3 were conducted with the goal of avoiding and minimizing further structural damage to the historic property. However, these efforts were unsuccessful, and demolition of the structure is required to remove the hazardous conditions associated with the current structural state. As such, Section 106 consultation among NASA ARC, the SHPO, and consulting parties is necessary to determine appropriate mitigation measures and establish an agreement to resolve adverse effects of the Undertaking.

The following section lists potential interested parties for Section 106 consultation for the Undertaking, as well as preliminary mitigation measures developed to resolve the adverse effects that may be incorporated into a future Memorandum of Agreement (MOA).

## 7.1 Interested Parties

In a letter dated December 13, 2019, NASA ARC initiated Section 106 consultation with the SHPO and provided a list of potential consulting parties for review and comment. The potential interested parties include a collection of local government departments in the surrounding communities of Sunnyvale and Mountain View, California, as well as several non-profit organizations with missions dedicated to promoting history and historic preservation at MFA, Silicon Valley, and the broader San Francisco Bay Area. In a response letter dated January 23, 2020, the SHPO provided no other suggestions related to potential consulting parties.

Letters were mailed to several of the potential consulting parties to assess interest on March 19, 2019 (**Appendix C.1**). These letters included a brief background on Hangar 3 and the existing conditions, a description of the Undertaking, and location map. The letter requests that all parties interested in consulting on the Undertaking contact the NASA ARC Cultural Resources Manager (CRM). All responses sent to the CRM are asked to include the name of the organization, the name and contact information of the primary contact, and a formal statement of election to participate in the Section 106 consultation process. The list of parties that were sent letters includes the following:

- The Moffett Field Historical Society
- The City of Sunnyvale, California
- The City of Mountain View, California
- Sunnyvale Historical Society
- Mountain View Historical Association
- History San Jose
- Silicon Valley Historical Association
- California Preservation Foundation
- National Trust for Historic Preservation

As of the date of publication of this technical report, the City of Mountain View and the Moffett Field Historical Society have elected to participate as consulting parties in the Section 106 consultation process for this Undertaking (**Appendix C.1.1**).

It is recognized that residents of the State of California are currently under a Shelter-in-Place order from the Office of the Governor in response to the outbreak of the Covid-19 Virus, and that many of the interested parties may not have access to formal mail deliveries. Therefore, email correspondence to the remaining potential interested parties was submitted on April 29, 2020 to fully confirm interest in participating in Section 106 consultation for this Undertaking (**Appendix C.2**). All responses and a list of confirmed interested parties will be provided to SHPO during the preparation of a draft MOA.

## 7.2 Preliminary Mitigation Measures

The following section has been developed with the intent of providing a preliminary list of appropriate mitigation measures to inform ongoing Section 106 consultation.

### 7.2.1 Development of Mitigation Measures

In developing mitigation measures to resolve adverse effects, there are several factors that should be considered. According to the ACHP, creative and effective mitigation measures for resolving adverse effects under Section 106 should address the following considerations:

1. *Consider the significance of the affected property.* Mitigation should be generally related to the significance of the property that is being adversely affected. Things to consider include areas of significance, integrity, qualifying characteristics, and boundaries. Compare the importance of one historic property relative to other properties of its type. Those properties that have a greater level of significance generally warrant greater levels of mitigation.

2. *Consider the public benefit.* The National Historic Preservation Act recognizes that preservation is a public interest so ideally mitigation will provide a public benefit to the community in which the resource is located. Educational materials benefit the public by increasing knowledge of and appreciation for the past. Local consulting parties are usually aware of the preservation needs of their community and therefore are useful, indeed critical,

resource for mitigation ideas that can best benefit the public.

3. *Consider the needs of all parties.* The primary focus of consultation should be on meeting the needs of those consulting parties who ascribe importance or value to a property. This is especially true of traditional cultural properties and properties that are significant to local communities.

4. *Consider mitigation that enhances knowledge and protection of historic properties.* When a building has been adequately documented, consider alternative mitigations that enhance the knowledge of and/or protection of similar property types. Rather than (or in addition to) documenting a building that is to be removed, consider the historic contexts or survey updates. This could also involve the development of educational programs or the preservation of archaeological sites outside of a project area.

5. *Consider cost.* The cost of mitigation should be proportionate to the property's significance and integrity and the scale of the effects of the project. Also keep in mind that the use of public monies must be justifiable. Finally, there must also be a clear connection between the resource affected and the mitigation plan and it must be demonstrable that the mitigation is in the public interest.

All of these factors have been considered in developing mitigation measures for resolving adverse effects for the Undertaking. Direct effects include the loss of Hangar 3 itself. Indirect effects will largely be through the visual disruption of spatial organizations and overall setting through the loss of Hangar 3 in relation to Hangar 2, Building 55, and other contributing properties on the eastside of the airfield, as well as in relation to the broader NAS Sunnyvale Historic District.

### 7.2.2 Proposed Mitigation Measures

Using the ACHP considerations outlined above, the following proposed mitigation measures have been developed as suggestions for the resolution of adverse effects to be determined through Section 106 consultation. It should be noted, not all of these suggestions may be required as part of the Section 106 consultation process. Our experience allows us to anticipate that documentation under a National Park Service program, exploring salvage opportunities, and creating an interpretive component will be a baseline for mitigation, the exact implementation of any of these components will be determined through Section 106 consultation which may allow for alternative or additional interesting approaches and engaging outcomes for the public.

#### 7.2.2.1 Documentation

*A) Traditional Documentation - HAER*

For the demolition, it is proposed that Hangar 3 and the surrounding area be documented per the standards and guidelines of a National Park Service, Historic American Engineering Record (HAER) program. Each program has a different level that dictates the level of effort required. Given the significance of Hangar 3 as both an individual structure and as a contributor to the broader NAS Sunnyvale Historic District, Level I documentation, which requires full format high quality archival photographs of the Hangar and its setting, a detailed written report, and a set of measured drawings, is appropriate. All of the materials should be formatted for submittal to the Library of Congress; additional copies of the materials should be prepared and submitted to appropriate local repositories, such as the Moffett Field Historical Society, the Sunnyvale Public Library, and the Mountain View Public Library, and other relevant archives in the South Bay region.

The following outlines proposed strategies and conditions for the documentation, which Stantec recommends be included within the prepared stipulations of an eventual MOA:

- Materials should be prepared by an architectural historian and/or historic architect who meets the Secretary of the Interior’s Professional Qualifications Standards (SOI Qualifications) for architectural history, history, or historic architecture.
- Photographs and field measurements for the measured site plans must be completed prior to the demolition of Hangar 3.

*B) Non-Traditional Documentation*

Stantec further recommends Hangar 3 be documented using three-dimensional (3D) scanning technology to capture both the exterior and interior (where possible), as well as various vantage points of the overall setting of the Hangar 2/3 Precinct. Digital 3D documentation is a powerful tool in creating immersive virtual reality modelling that can be implemented in future interpretive programs.

#### 7.2.2.2 Salvage Opportunities

A potential mitigation measure is the preparation of a Salvage Report for materials within Hangar 3. The report should be prepared by an architectural historian and/or historic architect who meets the SOI Qualifications for their respective fields. The report should focus on the feasibility for removing significant materials or character-defining features of the Hangar and salvaging those for future reuse. However, it is noted that the demolition of this structure is a complicated undertaking and that many of the materials within Hangar 3 are hazardous. These challenges should be analyzed within the salvage report.

Potential reuse for salvageable materials may include the following:

- Development and construction of landscape elements at Moffett Field and NASA Ames Research Center, such as site furnishings, wayfinding materials, and art installations.
- Reuse of selected materials on Hangar 2 for maintenance purposes.
- Use for future interpretive elements at a variety of museums and civic institutions throughout the region.
- Donation for reuse as part of public arts programs. In the event that materials are salvageable and safe for reuse, materials could be used by artists in public art projects to create unique installations within civic settings of surrounding municipalities, including at educational institutions and local aviation settings, such as the San Jose and San Francisco International Airports.

#### 7.2.2.3 Historic Interpretive Materials

*A) Physical Interpretive Materials*

As a mitigation measure, Stantec recommends that historic interpretive materials be incorporated into future plans for the site, specifically for the open spaces and at publicly accessible areas, such as the Bay View Trail, or at the Moffett Field Museum operated by the Moffett Field Historical Society. Although the exact level and medium of interpretation is yet to be determined, the following initial design criteria are proposed as part of future stipulations:

- Interpretive materials should be publicly accessible and placed either on-site or at appropriate perimeter locations that are deemed safe, accessible, and appropriate.
- Interpretive materials may take a variety of forms and mediums within the landscape, including signage, art installations, and site furnishings.
- In all instances, physical elements should consider and reflect upon character-defining features of the NAS Sunnyvale Historic District, such as architectural vocabulary and materials.
- Interpretive materials will be consistent with any design guidelines or master plans that pertain to NASA Ames Research Center.

*B) Coordination with institutions*

Consulting parties should coordinate with a variety of local institutions in the development of interpretive materials. Specifically, the Moffett Field Historical Society may have an interest in the potential salvage of existing artefacts within the Hangar that may be of noteworthy importance to the former occupants and operations at the property. Most notably, there are several murals and amateur pieces of artwork related to the former squadron located throughout the building. If salvage is feasible, these may be of interest to the Moffett Field Historical Society for inclusion in their on-site museum, or other educational institutions throughout the region.

# 8.0 Conclusion

The Undertaking, which involves the demolition of Hangar 3, will result in the complete loss of the subject structure’s historic integrity and will disqualify it from its current listing on the NRHP. Additionally, as a primary contributor to the NAS Sunnyvale Historic District, the demolition of Hangar 3 will result in diminished integrity for the district and the identified NRHP-listed and NRHP-eligible contributors within the APE, particularly for the immediately surrounding and operationally linked properties of Hangar 2, Building 55, and East MF1002, as well as Hangar 1. Therefore, it is apparent that the Undertaking will result in adverse effects on historic properties.

In support of ongoing consultation efforts, a list of preliminary mitigation measures has been developed for review. These are intended to provide a foundation for future Section 106 consultation.

# 9.0 References

Advisory Council on Historic Preservation. *Balancing Historic Preservation Needs with the Operation of Highly Technical or Scientific Facilities.* Washington DC: Advisory Council on Historic Preservation, 1991.

AECOM. *Historic Property Survey Report for the Airfield at NASA Ames Research Center, Moffett Field, California*. Prepared for NASA Ames Research Center (November 2013).

AECOM, Historic Property Survey Report for the Ames Research Center Defense Fuel Support Point Closure Project, Moffett Field, California (April 2016).

AECOM. *Integrated Cultural Resources Management Plan, NASA Ames Research Center*. Prepared for NASA Ames Research Center (November 2014).

AECOM. *NASA Ames Research Center, Archaeological Resources Study.* Prepared for NASA Ames Research Center (February 2017).

The History Factory. *Innovation with Purpose: Lockheed Martin’s First 100 Years* Washington DC: Lockheed Martin Company, 2013.

KPFF. “Building 46 (Hagar 2) and Building 47 (Hangar 3) Due Diligence Phase 1 Report.” August 9, 2013.

KPFF. "Damage Progression Timeline & Repairs Timeline – DRAFT." July 6, 2017.

KPFF. "Hangar 3 Emergency Truss Repairs Narrative," May 26, 2016.

KPFF. "Moffett Federal Airfield Hangar 3 – Mountain View, California, Structural Site Observation." August 21, 2019.

National Park Service. "National Register of Historic Places Registration Form – United States Naval Air Station Sunnyvale, California – Historic District," Reference #94000045. Prepared by Ronnie Bamburg, Urban Programmers (1994).

National Park Service. *National Register Bulletin: How to apply the National Register Criteria for Evaluation* (rev.2002). Accessed August 20, 2019. http://nps.gov/nr/publications/bulletins/nrb15/Index.htm

SHPO Letter to Jonathan Ikan at NASA ARC. "Hangar 3 Demolition Project, Moffett Federal Airfield, NASA Ames Research Center, Santa Clara County – NASA_2019_1216_001." January 23, 2020.

SHPO Letter to Keith Venter, Historic Preservation Officer at NASA ARC, "Section 111 Outlease for Hangar One and Moffett Federal Airfield, NASA Ames Research Center, Moffett Field CA - NASA_2013_0417_001." June 6, 2013).

# Appendix A KPFF Structural Engineering Documents for Hangar 3

## A.1 KPFF, "Building 46 (Hangar 2) & Building 47 (Hangar 3) Due Diligence Phase 1 Report" (August 9, 2013)

kpff Consulting Engineers

# Building 46 (Hangar 2) and Building 47 (Hangar 3)

# Due Diligence Phase 1 Report

August 9, 2013

## *Building history*

Hangars 2 and 3 are the world's largest freestanding wood-frame structures constructed by the U.S. Navy in 1942 to aid the WWII efforts and the "lighter-than-air" (LTA) program. These hangars are integrated with a total of 17 other identical hangars that were constructed across the U.S. to house dirigibles such as the USS Macon and the USS Akron. To conserve metal resources for the war efforts, the 17 hangars were primarily constructed of wood and concrete, as shown in Figure 1. Hangars 2 and 3 are officially addressed as Buildings 46 and 47, respectively, on the NASA Ames Research Center historic properties.

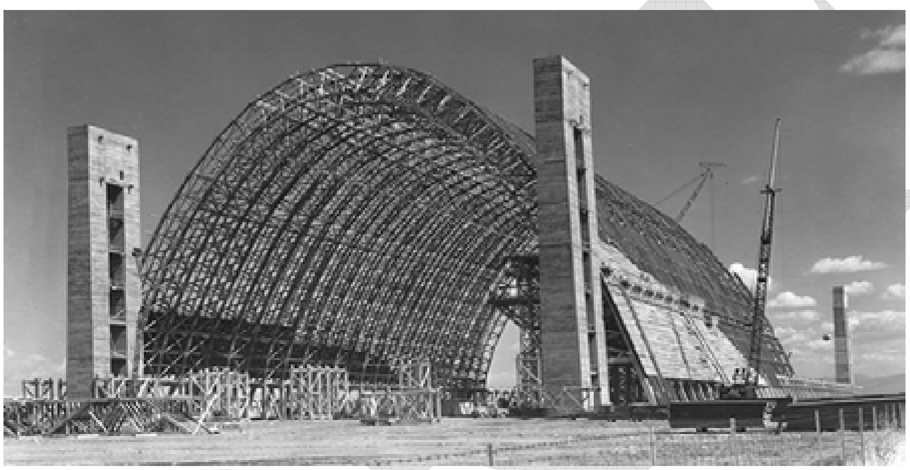


**Figure 1. 1942 Hangar 2 Construction.**

The primary structural aspects of Hangars 2 and 3 involve 51 timber arches that are spaced 20 feet on center and rise above the slab on grade approximately 170 feet to the arch outer chord. The timber arches are orientated in the transverse direction and connected at the base to a two-story transverse concrete bent. The concrete bents are located on concrete pile caps and timber piles with an allowable load capacity of 12 tons each. The outer and inner footings of the bent consist of 9 and 12 piles, respectively, where 3 piles in each group were battered to resist an outward dead and wind thrust loads. The arches and the concrete bents are supported in the longitudinal direction by timber cross braces. However, at various locations throughout the hangars, the cross braces have been retrofitted with either steel braces or steel cables. Two inch diagonal tongue and groove timber sheathing encloses the hangars on the outer chords of the arches, as well as the exterior roof assembly of an asphaltic material and corrugated aluminum. The latter was a replacement in 1956 for the original tarpaper rolled roofing.

The doors at the north and south ends of each hangar consist of six aluminum and wood frame sliding panels. These doors are guided by rails on slab as well as through a transverse box beam spanning between two concrete towers. The box beam is a double-height wood truss sheathed with wood diagonal tongue and groove patterns. The box beam is approximately 20 ft square and cantilevers 20 ft beyond each tower, as shown in Figure 2. The tower and box beam assembly are attached to the timber hangar through anchor bolts embedded into the concrete towers. The supporting structure for the hangar doors is a free standing structure and separated from the timber hangar by a gap separating the two structures. Similar to the concrete bents, the towers are supported on concrete pile caps and timber piles with an allowable load of 30 tons each. A total of 816 piles were used for all towers of a single hangar. The main footprint of both hangars is approximately 296’6”x1000’. A two-story annex building measuring 62’x1000’ was added to the east side of Hangar 3 in 1945 for additional office and shop space.

**Figure 2. 2013 Hangar 2 (nearest hangar) and Hangar 3.**

Numerous problems arose during the design and construction phases of the hangars. The primary challenge at the time was the lack of knowledge in detailing, fabricating, treating, and handling the mass amount of timber required. Research and testing were not allocated by the project because it was considered part of the Accelerated Public Works Program of the Navy in aid of the war efforts.

## *Documents reviewed*

1. Ambrose Group, Inc. (2012).
2. Page & Turnbull, Inc. (2006), “Re-use Guidelines,” NASA Ames Research Center, [Hangars 2 & 3].
3. Supplements to Page & Turnbull, Inc. (2006)
    a. Degenkolb (2006) [Chapter 5]
    b. Flynn et al. (2002), “An Initial Evaluation of Douglas Fir Wood Components in Hangars 2 and 3 at the NASA/Ames Research Center,” UC Forest Products Laboratory.
    c. Dolci and Team (2000), “Encompassing Synopsis of the Condition and Feasible Utility of Blimp Hangars 2 & 3.”
    d. BAMSI, Inc. (1994), “Hangar 3 Exerpts of Moffett Field Hangar Life Safety Evaluation,” Moffett Field Development Project, Plant Engineering Office.
    e. Rutherford & Chekene (R&C) (1992) [Analysis for only Hangar 3]
    f. R&C (1984-‘85) [Analysis for only Hangar 2]
4. Neal, Donald W. (1986), “Restoration of Navy LTA (Lighter than air) Hangars”, Conf. Proceed. in Evaluation and Upgrading of Wood Structures: Case Studies, ASCE, pp. 1-12.
5. Amirikian, A. (1943), “Navy Develops All-Timber Blimp Hangar,” ASCE Civil Engineering, Vol. 13, No. 10 and 11.

## *Summary of previous reports*

Numerous assessments of the wood conditions have been documented over the years. The most recent documentation was in 2012 by Ambrose Group, Inc. for only Hangar 2. A thorough non-invasive and non-destructive visual inspection was completed for the interior structural members of the hangar, as well as for the interior of the box beams and overhead catwalks. The inspection noted visual signs of warping and splitting of the main trusses, with the largest crack measured 3.5" wide by 10' in length. In addition, there were multiple cases of missing and compromised fasteners, splitting of tieback and brace members, deflection of the exterior horizontal joints, signs of water staining, and timber shedding throughout the hangar. Similarly, the condition of the box beams showed signs of water intrusion and timber shedding. Splitting was also observed on the cross bracing within the south box beam. The catwalks and ladders used to ascend to the upper catwalk appeared to be in fair and slightly less fair condition, respectively. However, both contained age cracks and showed signs of vertical and lateral deflections when walking on, according to the report.

Page & Turnbull's 2006 Re-Use Guidelines for Hangars 2 and 3 included a detailed description of the historical context, the structural and non-structural systems and their conditions, as well as the re-use methodology. Page & Turnbull advised that the hangars do not comply with the ASCE 31-03 Life Safety performance level. If an earthquake were to occur, major structural damage could result. Therefore, a Full Building Tier 2 analysis was recommended. In addition, the report stated that the members were overstressed due to wind loading. The report recommended that further analysis should follow the guidelines of the California Historical Building Code (CHBC) for seismic and ASCE 7 for wind. The CHBC states that the seismic forces to be used for evaluation and possible strengthening need not exceed 0.75 times the seismic forces prescribed by the 1995 edition of the California Building Code (CBC). The seismic forces would be computed based on $R_w$ forces tabulated in the CBC for similar lateral force resisting systems. Based on past history with this type of construction, there is potential of complete collapse during a major earthquake, excessive wind, or small fire within the vicinity.

Page & Turnbull and the NASA Ames project managers suggested three new uses for Hangar 2 and 3. The possibly scenarios were:

Scheme 1: Missile Defense Command Center (Low Occupancy, High-Level Security)
Scheme 2: Federal Emergency and Management Agency Storage Facility (Low Occupancy, Low-Level Security)
Scheme 3: Public Use Sports Arena and Club (High Occupancy, Low-Level Security)

For each scheme, Page & Turnbull listed recommended improvements based on the level of occupancy and security. The improvements addressed issues of structural inspection/repair, fire protection, emergency systems, MEP, accessibility, egress, doors, windows, new raised topping slab, and new architectural finishes. However, it is recommended that NASA Ames compile a complete analysis for the re-use impacts regarding code issues, structural and system upgrades, accessibility requirements, hazardous materials abatement, envelope repairs, and the alterations of the historic fabric. In addition, because Hangar 2 and 3 are considered historic buildings, all work to the hangar should comply with The Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for Preserving, Rehabilitating, Restoring, and Reconstructing Historic Buildings.

As a section within the re-use guidelines, Page & Turnbull (2006) reference Degenkolb (2006) in Chapter 5 regarding the historical context of the structural systems and a chronological documentation of the structural retrofits and analyses conducted. The report makes note of the hangars having an original design loading, which is similar to the data presented in Amirikian (1943), of the following:

Earthquake = 10% x W
Wind = 10 psf windward + 19 psf suction at the base + 24 psf suction at top of arch
Hoist = 5 kips at panel points near catwalks
Live = Not considered

The considered load combinations were D, D+W, D+EQ, and D+Hoist+0.5W

Also, the allowable material specifications for the original timber design was:
Arch trusses = 1400 psi bending, 1100 psi compression
Other members = 1200 psi bending, 1000 psi compression

In addition, Degenkolb (2006) performed a limited ASCE 31-03 analysis, assuming Site Class D soils, to confirm the general conclusions from previous analyses. The results of this study were identical to those provided by R&C (1984-'85), who conducted a full dynamic analysis of Hangar 2. The corresponding R&C analyses assumed stick models depicting the response of the structure as well as considered foundation stiffness by springs. For a single arch frame in the transverse direction, the truss was modeled as a beam to reduce the number of members analyzed. A similar concept was conducted for the bottom chord bracing in the longitudinal direction. The concrete tower and door structures were analyzed by hand calculations.

The results from R&C analyses are summarized by the following:

- The concrete bents were severely overstressed in bending and inadequately reinforced for ductile behavior.
- All connections of the longitudinal bracing trusses were overstressed.
- The horizontal members of the longitudinal trusses were determined inadequate.
- The concrete door towers were overstressed in bending at the top and base.

The retrofit schemes presented by R&C (1984-'85) involve the addition of concrete wall infill to every third existing concrete bent, construction of a new concrete diaphragm at the top of the concrete bents, strengthening of all overstressed longitudinal bracing connections and horizontal members with steel tubes, and construction of two new concrete struts to brace each tower.

However, to preserve the historical structural context of the hangars, Degenkolb provided an alternative retrofit scheme of strengthening the concrete bents and towers along with the installation of a new pile foundation. In addition, Degenkolb addressed the inadequate spacing of the seismic joint separating the timber hangar from the tower and box beam assembly, as well as documenting that no calculations have been performed on the expandable hangar doors. R&C estimated the overall structural and non-structural repair for only Hangar 2 was [redacted] and [redacted], respectively. However, it was assumed that similar retrofit costs and analysis results were applicable for Hangar 3.

In 1992, R&C performed an analysis of only Hangar 3 as defined by FEMA 178 (NEHRP Handbook for Seismic Evaluation of Existing Buildings, 1992). The results concluded that the structure did not satisfy the criteria for minimum NEHRP Life Safety performance. Concern was raised on a soft story in the concrete frames because of inadequate reinforcing, inadequate connections of the diagonal bracing, and a complete lack of connection from the diaphragm to the concrete foundation. In addition, it was observed that two adjacent arches contained 1" cracks on the bottom and top chords around the location of the apex. The recommendations emphasized the damaged arches were life safety hazards and must be repaired. The retrofit schemes for Hangar 3 followed the same guideline as the 1984 retrofits, but with the addition of strengthening to the two-story building annex.

Degenkolb (2006) performed an analysis considering the effects of wind and gravity. The results showed overstressed wood braces throughout the hangars under wind loading. However, Degenkolb highlighted that their analysis was limited and recommended that prior to hangar re-use, a comprehensive wind analysis must be performed using ASCE 7 wind design criteria. In addition, Degenkolb advised that Hangars 2 and 3 are susceptible to severe seismic shaking but are not located within the near-field effects of any fault systems. A site specific geotechnical analysis was not performed. However, both hangars are vulnerable to soil liquefaction as classified by the Association of Bay Area Governments.

Degenkolb also noted that Hangar 2 contains structural select Douglas-fir wood with Minalith fire retardant treatment (FRT). The latter was observed by teeth pressed incisions into the wood, as well as fibers littered on the surface of the wood and throughout the floors. On the contrary, Hangar 3 does not have the same FRT and the wood is an alternate species of Douglas-fir. This was validated in the UC Forest Products Laboratory report by Flynn et al. (2002). Further analyses of the wood in Hangar 3 indicate a darker appearance when compared to Hangar 2, as well as a lack of teeth pressed incisions. However, crystals were noted on the surface of the wood indicating a salt based FRT formulation used in Hangar 3. It was also noted that if either of the wood is burned, the low toxicity Chromium III existing within the wood converts to Chromium IV and thus is more toxic (Flynn et al., 2002).

**Table 1. Retrofit cost projection for hangar code compliance (Dolci and Team, 2000)**

| Function | Hangar 2 | Hangar 3 | Total |
|---|---|---|---|
| Maintenance/Repair M.E.&P. | [redacted] | | |
| Structural/Seismic Upgrades | [redacted] | | |
| Fire Protection | | | |
| Roof Repair | | | |
| Hazard Remediation | [redacted] | | |
| Code Compliance (M&E), OSHA (occupational Safety), ADA | [redacted] | | |
| Total | [redacted] | | |
| Demolition | [redacted] | | |

Dolci and Team (2000) provided retrofit cost projections for the hangars (see Table 1). In addition, they noted that Hangar 3 was in better condition than Hangar 2. KPFF Consulting Engineers do not support this statement based on the recent site visit observations. Dolci and Team also studied an alternative use for 747 aircraft and stated that the existing 10" concrete slab floor of the hangars cannot support a fully loaded 747 aircraft. It was recommended that the floor be removed and replaced with a 14.5" reinforced concrete slab if this use was being considered.

Neal (1986) discusses the 1981 assessment and retrofits for Hangars 2 and 3. Between the two hangars, there were a total of 1,513 minor repairs, 18 damaged frame members, and 36 locations of buckling at the arch frames. No structural analysis was conducted by the Navy, but rather the retrofit efforts were confined to restoring the distressed members to their original condition. The retrofit solution for buckled members involved additional glulam bypass members. Neal indicates there was no secondary buckling following the repair of a buckled chord segment.

## *Summary of recent site visit*

KPFF conducted a site visit for Hangars 2 and 3 on July 31 and August 1, 2013, accompanied by Ronald Anthony, wood scientist of Anthony & Associates. It was observed that Hangar 3 appears to be in worse condition than Hangar 2. A large number of timber arches were strengthened by additional timber bypass members, clamps, stitch bolts, and steel cables, as shown in Figure 3. These restoration efforts were primarily completed by Power-Anderson, Inc. in 1981-‘87, as mentioned in Neal (1986) and Page & Turnbull (2006), and thereafter in 1995 by Philo & Sons, Inc.

(a) (b) (c)

**Figure 3. Retrofit techniques observed throughout Hangars 2 and 3 (a) Strengthening of arch chords by addition of glulam bypass members (b) Clamps and stitch bolts to close small cracks (c) Replacement of wood sag braces with steel cables and bolts.**

However, to the best of our knowledge, there is no documentation within past 10 years of a full assessment to the condition of Hangar 3. Our recent site visit observed additional cracks in the wood and distortions of the main arch chords near the apex of multiple arches. This is shown in Figure 4 for the specified arch lines and nodal positions. For reference, the arch lines range from 1 to 51, where line 1 depicts the southernmost arch and line 51 represents the northernmost arch. The nodal positions describe the vertical locations of the horizontal joints. Node 0 and node 36 are respectively defined at the base of the arch on the east and west sides (top of the concrete bent). The arch apex is depicted as node 18.

As seen in Figure 4, a significant amount of cracking and out-of-plane distortion is observed on the bottom and top chords of the timber arches. The most prominent cracks are located in the bottom chord of arch 21 at node 16 and in the top chord of arch 22 at node 16. Both cracks widths are approximately 8” and contribute to the appearance of torsionally warped members. The latter could be a direct result of the out-of-plane relative distortion, as seen between nodes 16 and 17 within the bottom chord of arch 22.

This general observation is emphasized in Figure 5 with the relative lateral displacement between the apex of the arch and a theoretical reference line connecting adjacent arch nodes. Similar results are also displayed in Figure 6 for the top chord of arch 18.

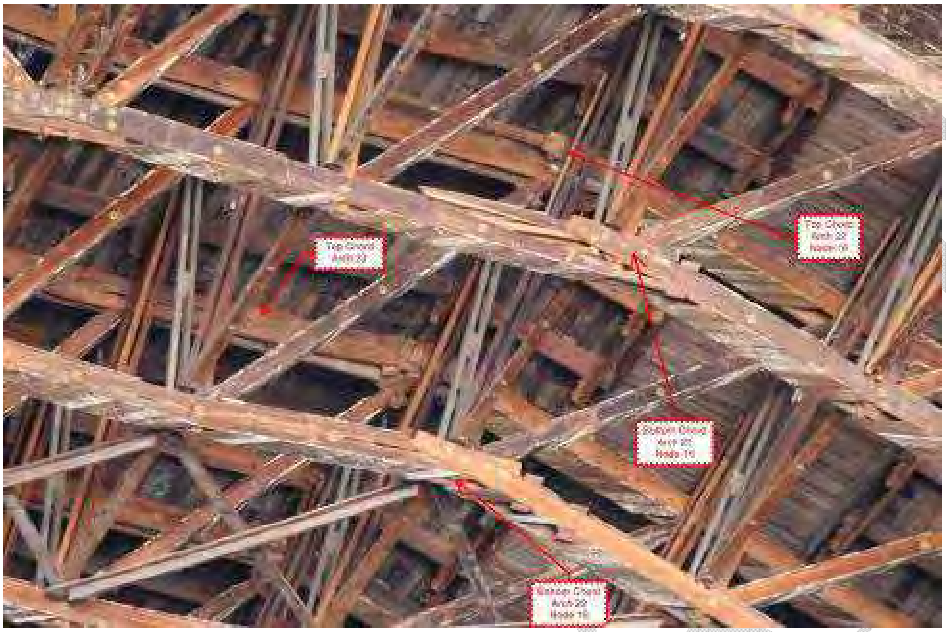



**Figure 4. Observed cracks and distortion of the timber arch bottom and top chords in Hangar 3.**


**Figure 5. Relative lateral displacement between arch apex and reference line for Hangar 3 single arch.**

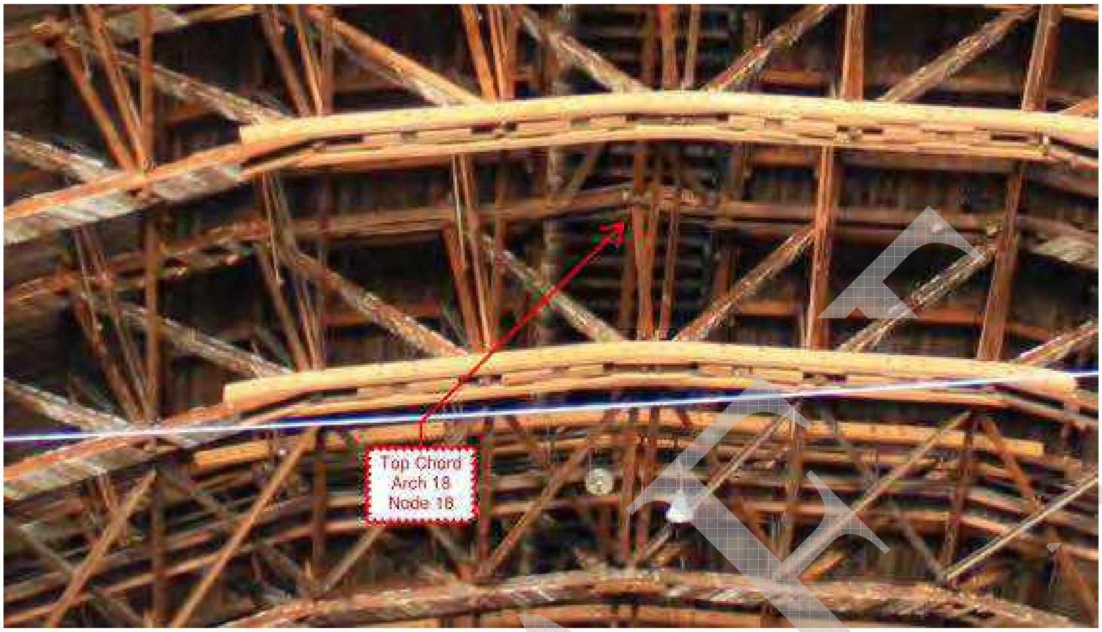


**Figure 6. Observed cracks and lateral displacement of arch top chord in Hangar 3.**

In addition, it was observed that the apex of numerous arches contain a consistent trend of node 18 displacing relative to the adjacent nodes supporting the monitor (exterior protrusion of the hangar at the apex outer chord). This is displayed in Figure 5 for arch 11, Figure 6 for arch 18, and Figure 7 for arches 21 and 22. The latter contains blue sketch-up arrows displaying the relative lateral displacement of the nodes, where node 18 appears to display south. It is unknown whether or not if all of the observed cracks and distortions propagated from the 1995 retrofits or if their origin emanated within the past couple of months.

**Figure 7. General trend of relative lateral displacement at the arch apex top chord in Hangar 3.**

Hangar 2 did not have the extent of distress as seen in Hangar 3. There was only one location where the main arches where strengthened by glulam bypass members. This location was on arch line 14 and between nodes 28 and 30. The only visual signs of distress were observed through end splits of cross braces, as shown in Figure 8. This distress was common at locations where the fasteners were too close to the end grains.


**Figure 8. Example location of end split in cross brace member within Hangar 2.**

It was also observed while walking through the office spaces that various concrete bents in Hangar 2 are braced in the weak axis with steel HSS horizontal and cross braces. This was documented by Page &

Turnbull (2006). However, wide flange steel shapes were also observed for additional reinforcement of the concrete bents in the strong axis, as shown in Figure 9.

(a) (b)

**Figure 9. Hangar 2 office space retrofits (a) Longitudinal HSS and Lateral I-Shape bracing (b) Lateral I-Shape and HSS bracing.**

While on the recent site visit, it was also observed that the doors on the southwest corner of Hangar 3 were open while all other doors between both hangars were closed. Therefore, future observations must verify if the doors are operable. In addition, the existing corrugated aluminum sheathing was detached at various locations along the roof of Hangars 2 and 3, as shown by example in Figure 10.

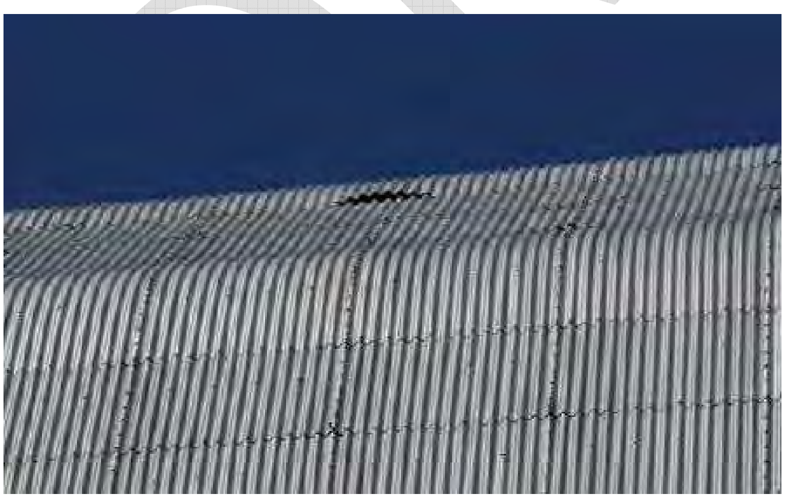


**Figure 10. Example location of detached corrugated aluminum sheathing on roof exterior of Hangar 2.**

Anthony & Associates provided the following preliminary recommendations through email:

1. “For analysis purposes, the wood species appears to be Douglas-fir in both hangars.
2. For analysis purposes, the grade of the members appears to be Select Structural, Structural Joists & Planks.
3. There appears to be little distress to the timbers in Hangar 2. Some end splits are present when the fasteners are close to the end grain. Seasoning checks are common, but not problematic.
4. Access was quite limited, but there were no signs of visible deterioration due to wood decay fungi. It is likely that there are isolated areas of decay where roof leaks have occurred.
5. As we observed together, there are failures, particularly in the bottom chords of the trusses near the peak of the roof in Hangar 3, that should be further investigated.
6. The effect of the fire-retardant treatment (Minalith in Hangar 2, unknown in Hangar 3) is uncertain. I need to look into this further, but that is likely beyond the scope of this work.”

## Summary of recommendations

Based on our review of the existing documents and our site visits, KPFF makes the following recommendations:

1. KPFF concurs with the general retrofit recommendations provided by Rutherford & Chekene, Degenkolb, and Page & Turnbull. Associated pricing can be used as a ROM estimate scaled to today’s dollars. However because of the limitations and assumptions previously presented, KPFF recommends a complete seismic and wind analysis of both hangars using current codes.
2. KPFF recommends immediate correction for the alignment and bracing of the previously mentioned arches for in and out-of-plane movement. Methods of adding glulam bypass members as well as clamps and stitch bolts to the connections provide good potential for restoring the arches back to their original strength. However, it is recommended to monitor adjacent connections and members during restoration as load redistribution could be a potential hazard.
3. KPFF recommends full documentation of all member split end locations. The retrofit techniques will involve clamps, stitch bolts, and some form of epoxy injection.
4. KPFF recommends a survey of the condition of the existing roofing, followed by proposed methods of repair or replacement.
5. KPFF recommends that the project team researches whether the hangar doors are currently operable, and for the team to assess the usable life and anticipated maintenance required for the continued operation of the hangar doors.
6. KPFF recommends a thorough investigation with full accessibility to all interior/exterior structural members and connections for condition assessment and retrofit documentation.
7. KPFF requests a complete set of structural drawings for Hangars 2 and 3, and including all documentation for the Hangar 3 building annex.
8. KPFF recommends a site specific geotechnical assessment for the risk of bay mud consolidation and/or liquefaction effects.

# A.2 KPFF, "Hangar 3 Emergency Truss Repairs Narrative" (May 26, 2016)

## Hangar 3 Emergency Truss Repairs Narrative

May 26, 2016

This narrative provides a summary of the current situation and background relevant to the ongoing emergency truss repairs at Moffett Federal Airfield, Hangar 3. We understand that this summary will assist in explaining the context of the Hangar 3 damage and emergency repair work to the wider group of stakeholders involved in this project, including the State Historic Preservation Officer as part of the NHPA Section 106 Consultation.

### 1 Conditions observed necessitating the need for emergency repair

#### 1.1 Dates of initial and follow up observations

The distressed condition of Hangar 3 was a pre-existing condition that was first observed by the team during the pre-lease RFP Due Diligence phase. Site visits for visual observation were conducted during July and August 2013. Access for visual observations was limited to the hangar deck and some shed areas. KPFF issued a Due Diligence Condition Assessment report on August 23, 2013 documenting the existing member distress observed at the top and bottom chords of the Hangar 3 roof trusses. It is unknown how long the damage existed prior to this time.

The design team progressed with further Due Diligence Investigation activities after the February 10, 2014 selection of Planetary Ventures as the preferred lessee for MFA. Design Development findings were compiled and submitted to the State Historic Preservation Office as support information when a Section 106 consultation package was submitted in May 2015.

In April 2014, DPR Construction began 3D laser scanning operations for Hangars 2 and 3. Site access issues during ongoing lease negotiations delayed the final scan results unto a later date.

Around August 2014, detailed wood condition assessment operations began by Anthony & Associates in coordination with the design team. A combination of visual observation, in-place visual grading, material sampling and testing, and photography was conducted using aerial boom lifts during several weeks of field operations. Preliminary data from the wood condition assessment was delivered to the design team on December 1, 2014. On December 19, 2014, KPFF issued the first draft scope narrative for a Hangar 3 structural monitoring program. This program was recommended based on the severity of prior damage observed and the uncertain timeframe to perform repairs prior to Planetary Ventures' occupancy of MFA.

On February 9, 2015, KPFF was notified of a small piece of wood which fell from the trusses to the ground within Hangar 3. We understand that OSHA was notified in response to this hazard. NASA requested information on the damaged zones of trusses, and KPFF provided a summary of due diligence data collected for Trusses 17–21 on February 13, 2015.

On April 1, 2015, Planetary Ventures took over MFA from NASA. At the PV-NASA meeting on April 8, 2015 to "re kick-off the project", the Hangar 3 damage was discussed and NASA suggested that conditions reviewed to date did not warrant an expedited review process for emergency repairs.

On June 24, 2015, KPFF performed a routine site visit to observe field conditions of the shed framing in Hangar 2. During that site visit, KPFF also observed Hangar 3 trusses from the deck slab and upon observation, suspected damage progression in the Hangar 3 arched trusses. On June 30, 2015, KPFF performed a follow-up site visit to Hangar 3 with aerial boom lift access and observed severe damage progression and increased excessive truss deflections. Turner Construction provided photographs of the ridge line indicating substantial increased deflection at the roof monitor. KPFF issued findings in engineer's field report EFR-03 along with recommendations for a zone of immediate emergency shoring due to damage progression. Selected photos from EFR-03 are provided below in Figure 1, Figure 2, and Figure 3. A reference truss elevation with panel points labeled is provided in Figure 4.

On July 2, 2015, KPFF issued the Hangar 3 Emergency Truss Repairs set for permit approval. DPR Construction performed another 3D laser scan survey of the trusses at the beginning of August. The permit was received for the emergency repairs, Permit No. 15PV2.300.000, in late August. Construction also began in late August. Coordination between KPFF, Power Engineering Construction, Turner, and the design team for the implementation of shoring and emergency repairs is ongoing as of today.

*Figure 1. Truss damage progression at Trusses 22 and 23 East near Panel Points R and O.*

*Figure 2. Truss damage progress at Trusses 22 and 23 East near Panel Points R and Q.*

*Figure 3. Damage observable at ridge line from building exterior.*

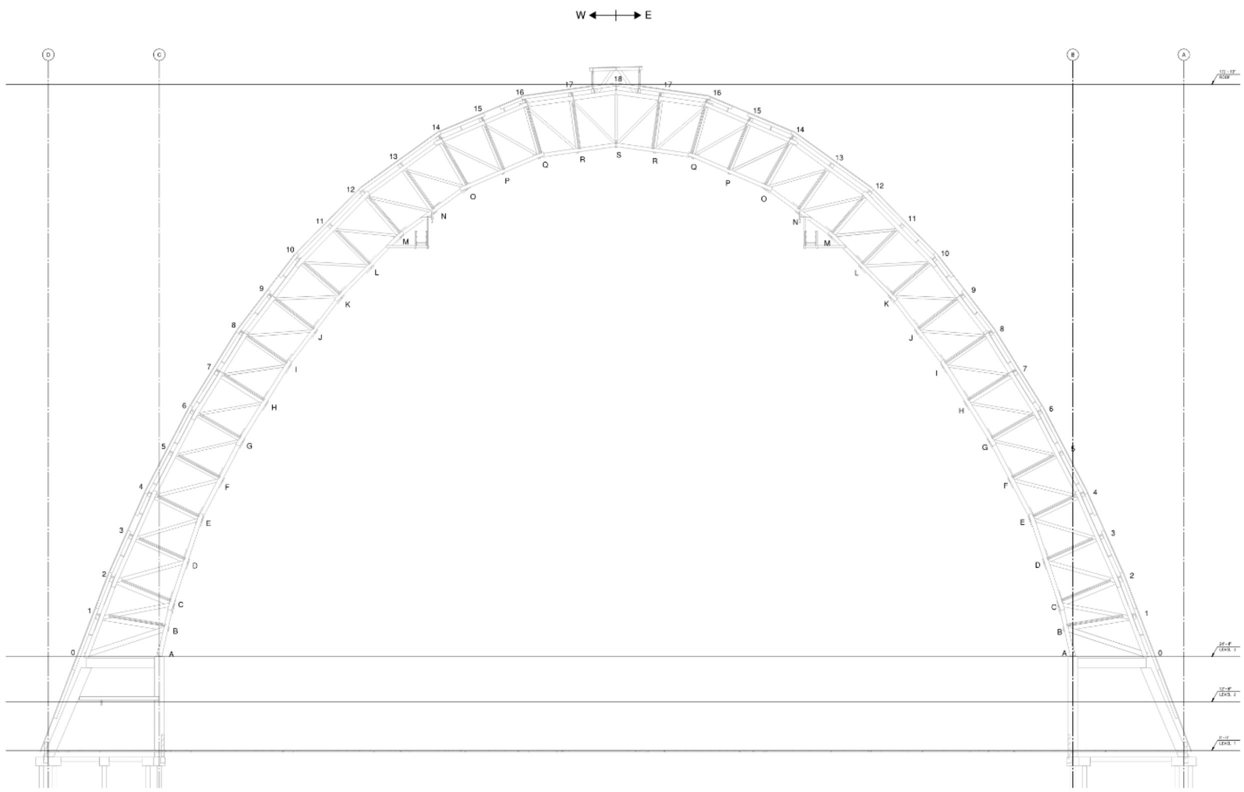


*Figure 4. Typical truss elevation with labeled panel points.*

### 1.2 Opinion regarding threat of collapse / partial collapse

Based on the progressing downward movement of the trusses observed in Hangar 3, there is a threat of partial collapse of the upper portions of the roof which may lead to progressive collapse of other portions of the truss. For this reason, temporary shoring has been installed within the most severely damaged zones to prevent any progressive collapse from occurring within the Hangar. The temporary shoring does not provide shoring to the upper most portion of the truss, since that zone needs to remain clear for accessibility by the movable access tower for the installation of truss repairs.

The following photos (Figure 5, Figure 6) demonstrate the severity of existing damage and the immediate danger of partial structure collapse.


*Figure 5. Broken top chord near roof monitor at top of truss*


*Figure 6. Broken bottom chord near top of truss.*

### 1.3 Data – summary of deflection and other measurements

Quantitative measurements of the truss deflections were taken from successive point cloud surveying of the hangar interior. The damage progression is shown in an example processed image from the 3D point cloud scans taken in 2014 and 2015 (Figure 7). In that figure, the black portion represents the actual position of Truss 22 between Panel Points Q-West and Q-East in 2014, while the red portion shows the position in August 2015. The measurements on the image show the increase in downward deflection between the surveys. A summary of deflections at Panel Point S indicate zones of damage concentration (Figure 8).

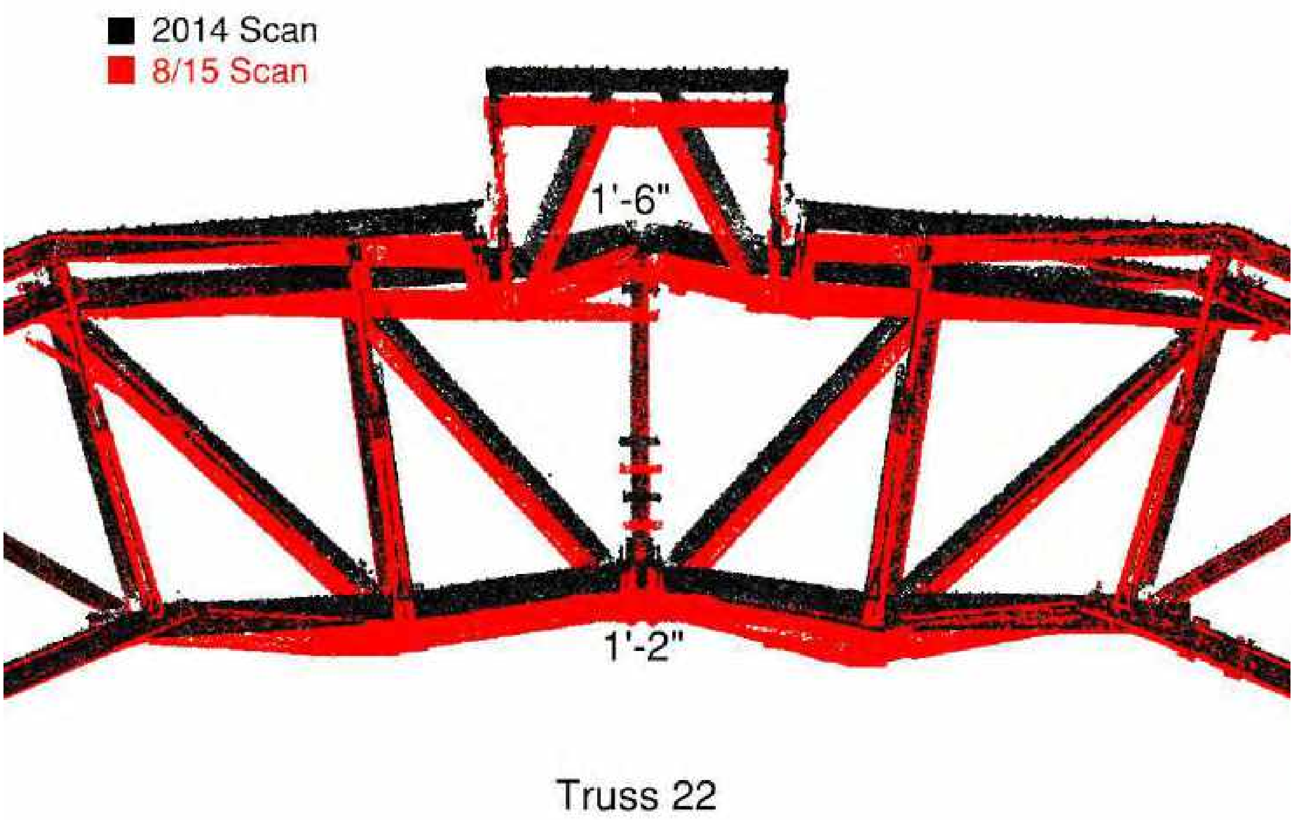



*Figure 7. Approximately 18" of additional deflection observed between 2014 and 2015 point cloud surveying scan at top of truss.*

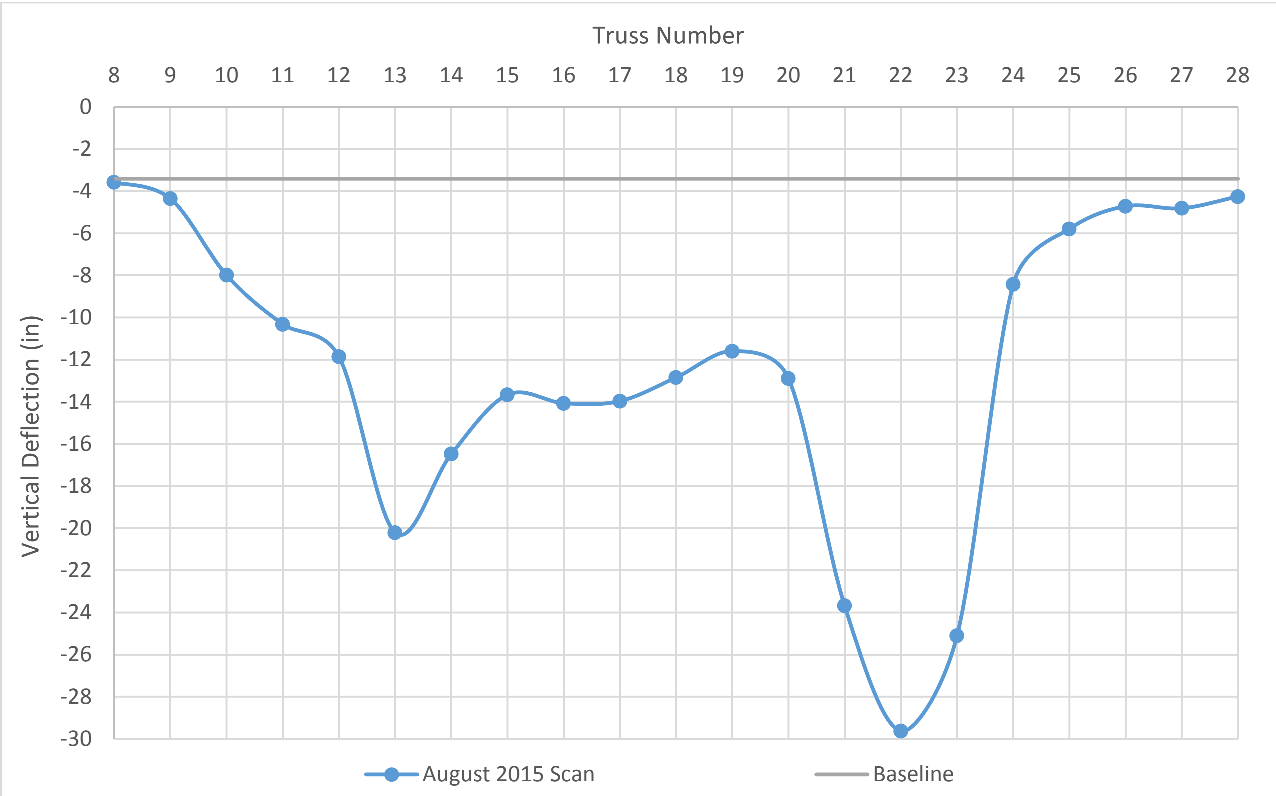



*Figure 8. Deflections relative to baseline at Panel Point S.*

## 2 Options for Emergency Repair considered

The selected scheme involving steel "exoskeleton" frames for jacking and temporary support of roof framing is described further in Section 3 of this narrative. The project team also explored several other options which were evaluated based on several factors including safety of workers during installation, construction sequence and schedule, engineering feasibility, cost, and effects to historic fabric.

For reference, the following is a list of alternatives considered:

- Jacking and shoring from traditional scaffolding: this scheme involved the installation of traditional scaffolding that would be capable of resisting additional loads due to jacking and shoring.
- Jacking and shoring from access tower: shoring and jacking from an access tower that extended to most of the severely damage zone.
- Wave Method: incrementally jacking from a smaller access tower starting at one end of the emergency repair zone and moving down (and possibly back) along the hangar deck.
- Exterior shoring: this scheme involved the installation of an exterior cable suspension system attached to the hangar roof. The cables would be supported by towers on the outside of the hangar and anchored to the ground. This type of temporary shoring system was used at the Tustin Hangars in Southern California.

In addition to selecting a method of installation, the project team also selected a target criteria for roof deflections. The number of exoskeletons and the number of jacks required depends on the amount of deflection to be reversed during the Emergency Repair process. However, full restoration back to the previous undamaged roof geometry may prove to be physically infeasible due to the complexity, risk, and timing involved in these operations due to existing field conditions. KPFF established the target deflection criteria shown in Table 1 and Figure 9 based on "Good", "Better", and "Best" scenarios.

Figure 9 was generated to illustrate the roof deflections (in blue) relative to a baseline that represents the average roof deflection at the trusses in the hangar that do not exhibit severe damage. The figure was used to compare the different deflection criteria options.

The project team selected the "Best-A" target criteria. Given the necessity of field adjustments due to the uncertain and changing existing conditions of the trusses and attachments, the project team may need to relax the acceptance criteria at specific locations. The end result could be a lower final outcome at some locations despite planning for "Best". Choosing the "Best" target reduces the risk of ending up with final deflections below even the "Good" scenario. Achieving this highest objective endeavors to restore the trusses closer to their original design geometry. This reduces the risk of residual stresses and deflections in the truss members and resulting complications for the future seismic retrofit design of the hangar wood structure. Choosing a lesser criteria would have also introduced the risk of significant added cost for the future rehabilitation of Hangar 3. Targeting a lesser deflection target could lock in a less desirable pre-deflected shape, which may complicate installation of strengthening members or prompt another phase of jacking and shoring at a later time.

*Table 1. Deflection criteria options considered.*

| | Good | Better | Best-A | Best-B |
|---|---|---|---|---|
| Truss and Roof Framing Maximum Deflection Relative to Average "Undamaged" Truss Elevation | ± 8" | ± 4" | ± 1" | ± 1" |
| Truss and Roof Framing Deflection Relative to Adjacent Trusses | ± 4" | ± 3" | ± 2" | ± 2" |
| Roof Monitor Deflection between Adjacent Trusses | ± 4" | ± 3" | ± 2" | ± 2" |
| Exoskeleton Locations | Trusses 11.5–23.5 | Trusses 9.5–24.5 | Trusses 9.5–25.5 | Trusses 8.5–26.5 |
| Number of Exoskeletons | 13 | 16 | 17 | 19 |
| Number of Exoskeleton Jacks | 104 | 128 | 136 | 152 |
| Number of Bays Where Jacking from the Shoring Tower is Required | 0 | 0 | 3 | 1 |

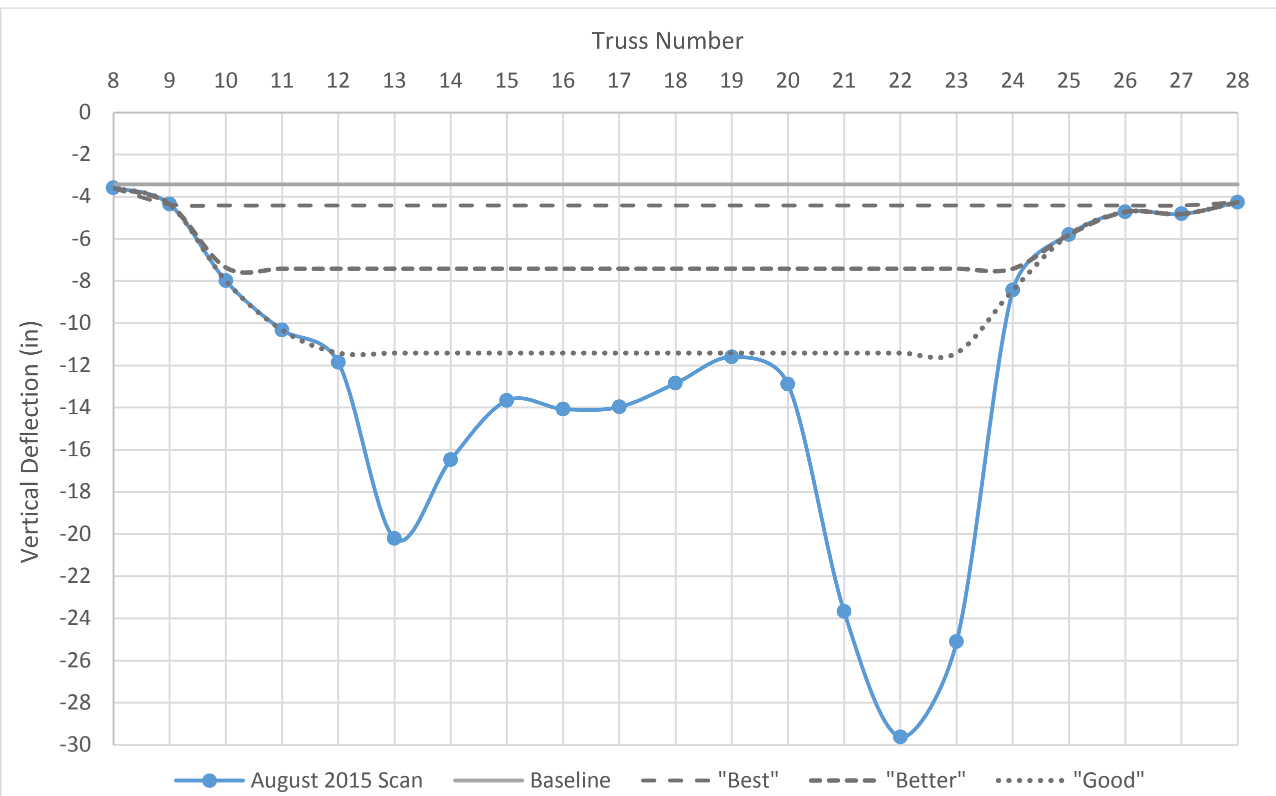



*Figure 9. Hangar 3 Panel Point 18 Deflection with Deflection Criteria Options*

Two options were studied by the design and construction team for the “Best” criteria. The difference between the two options is the sequence of construction and amount of Exoskeletons and jacks required. The first scenario (Best-A) utilizes both the access shoring tower and the Exoskeletons for jacking. Sequentially, the jacking at the trusses with the Exoskeletons are performed first, and then the shoring tower is moved to the ends of the severe damage zone to access the final 3 trusses (see Figure 10). In this scenario, an additional four Exoskeletons are required relative to the “Good” criteria.

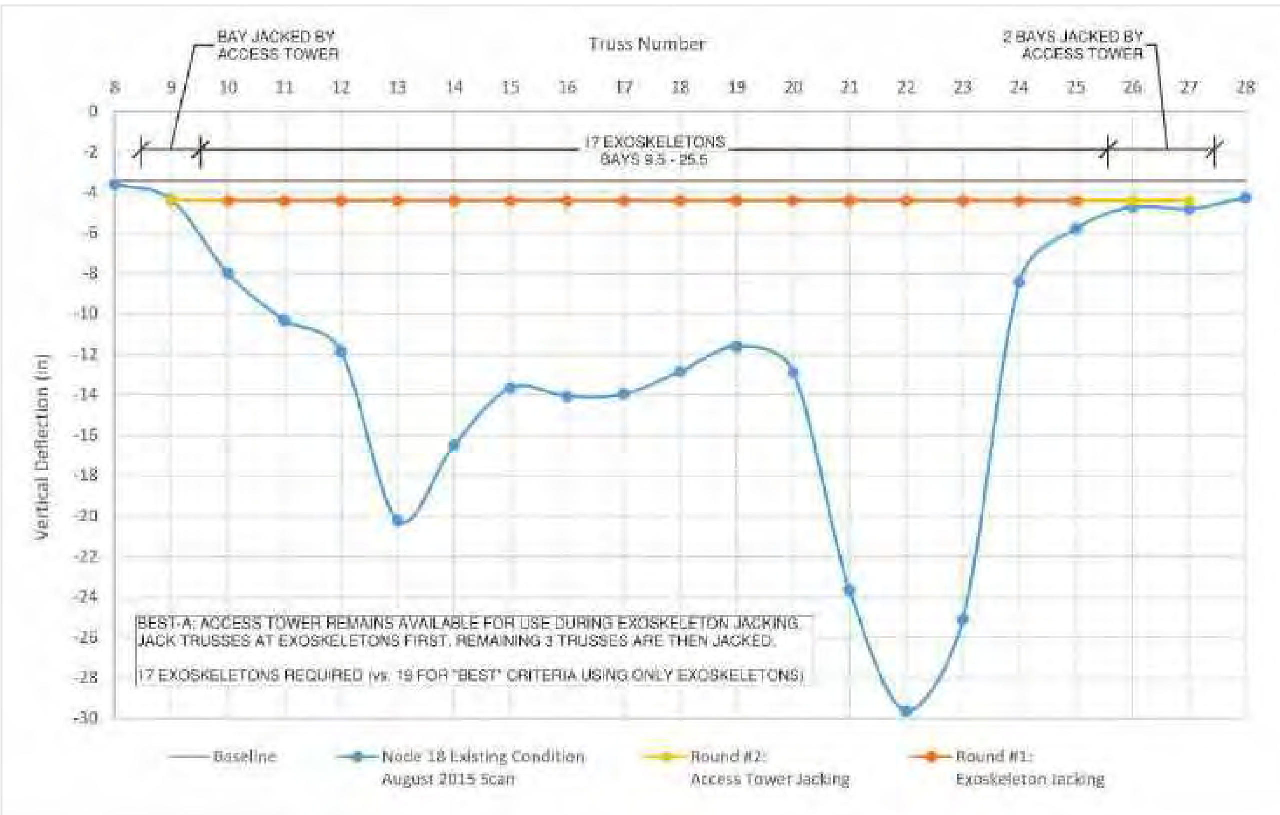



*Figure 10. “Best-A” Target Deflection Criteria*

The second scenario (Best-B) includes using only Exoskeletons for jacking trusses of significant deflection. In this scenario, two more Exoskeletons are required in addition to those required for the “Best-A” criteria, one between trusses 8 and 9, and one between trusses 25 and 26. Truss 27, which exhibits minor deflections, may need to be jacked from the access shoring tower to achieve the deflection criteria.

## 3 Emergency Repair Strategy for Selected Option

Step 1: Install temporary shoring braces to prevent full collapse of hangar (Figure 11 and Figure 12). The upper portion of the hangar remains unsupported and local damage progression and partial collapse of the upper zone is still possible.

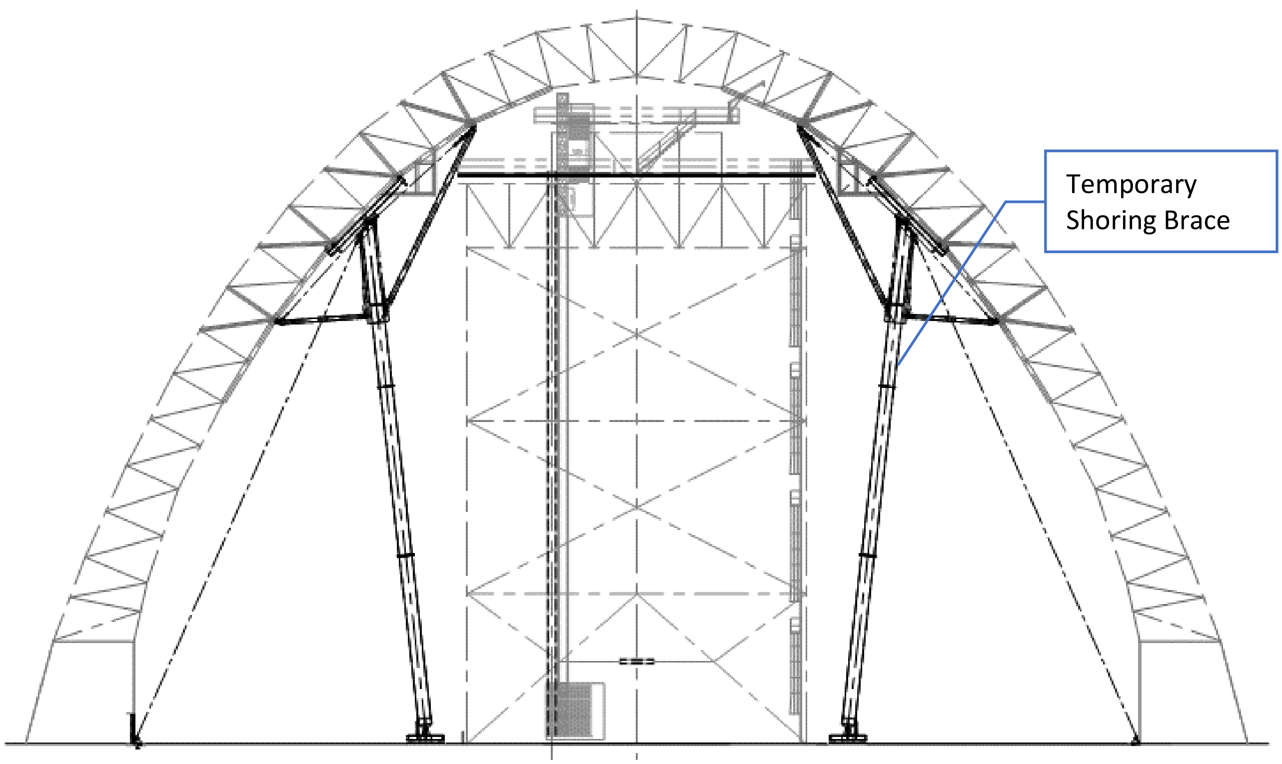



*Figure 11. Temporary Shoring + Shoring Tower*


*Figure 12. Zone of temporary shoring.*

Step 2: Fabricate shoring tower and move shoring tower into the hangar to begin temporary support of the upper zone, and installation of support "Exoskeletons". A computer rendering by Power Engineering Construction of these pieces is shown in Figure 13.

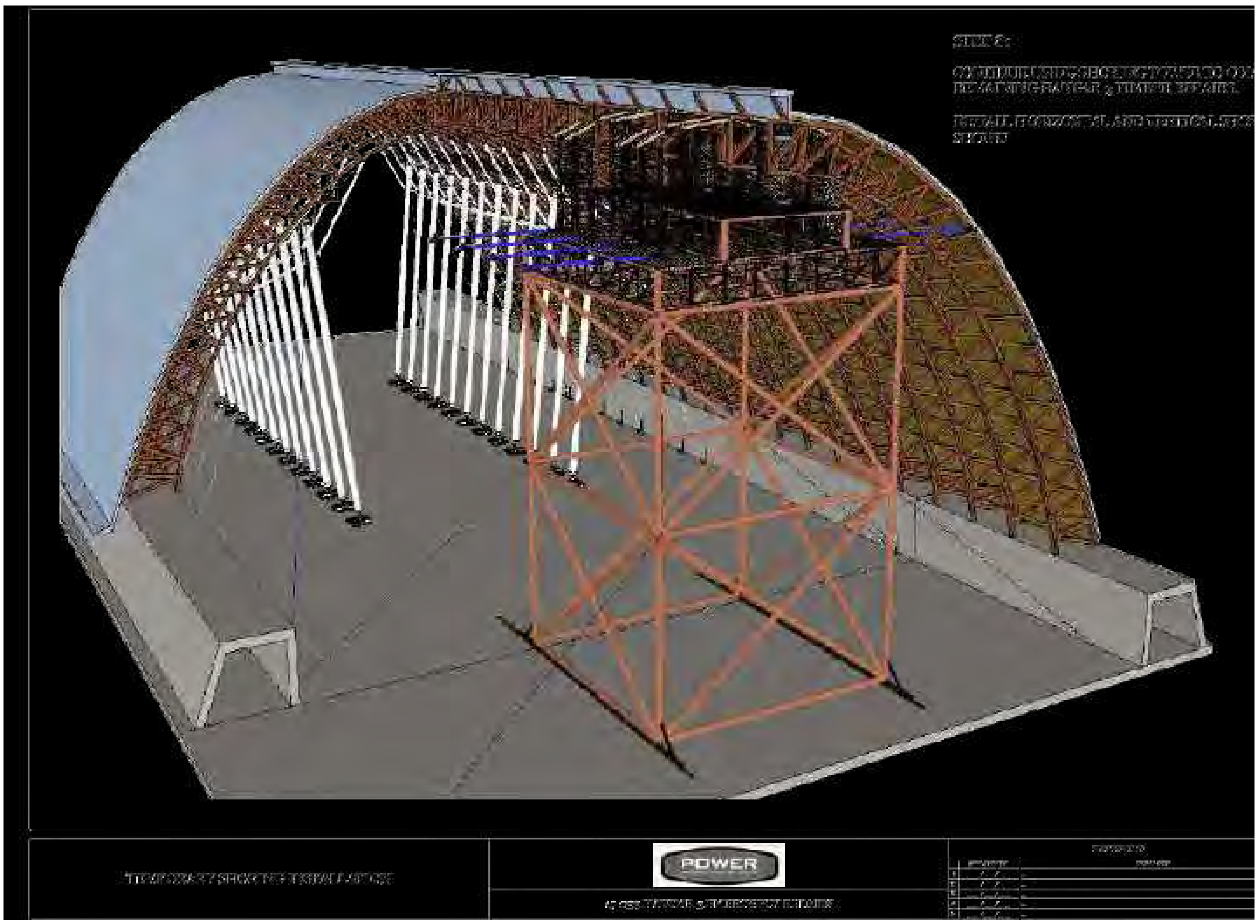



*Figure 13. Isometric of Temporary Shoring & Shoring Tower*

Step 3: Install steel truss support frames called "Exoskeletons" (Figure 14) in between existing wood trusses that have exhibited significant damage and deflection. The Exoskeletons are shop welded in segments which are field bolted together. The Exoskeletons are to be installed in the space between the existing trusses and will be attached to the existing trusses with bolts and steel plates (Figure 15).

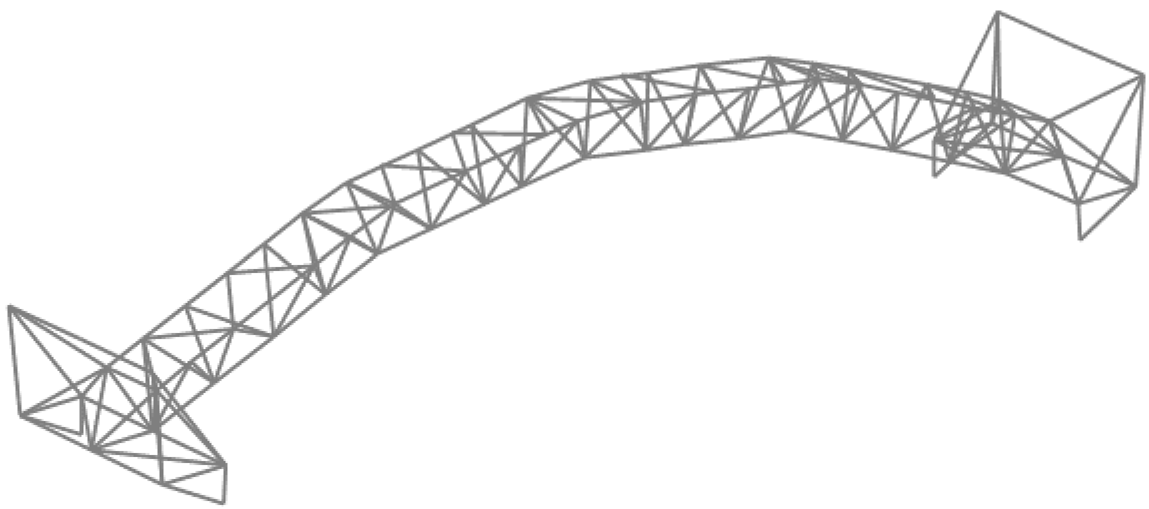


*Figure 14. 3D Isometric of Steel Exoskeleton*

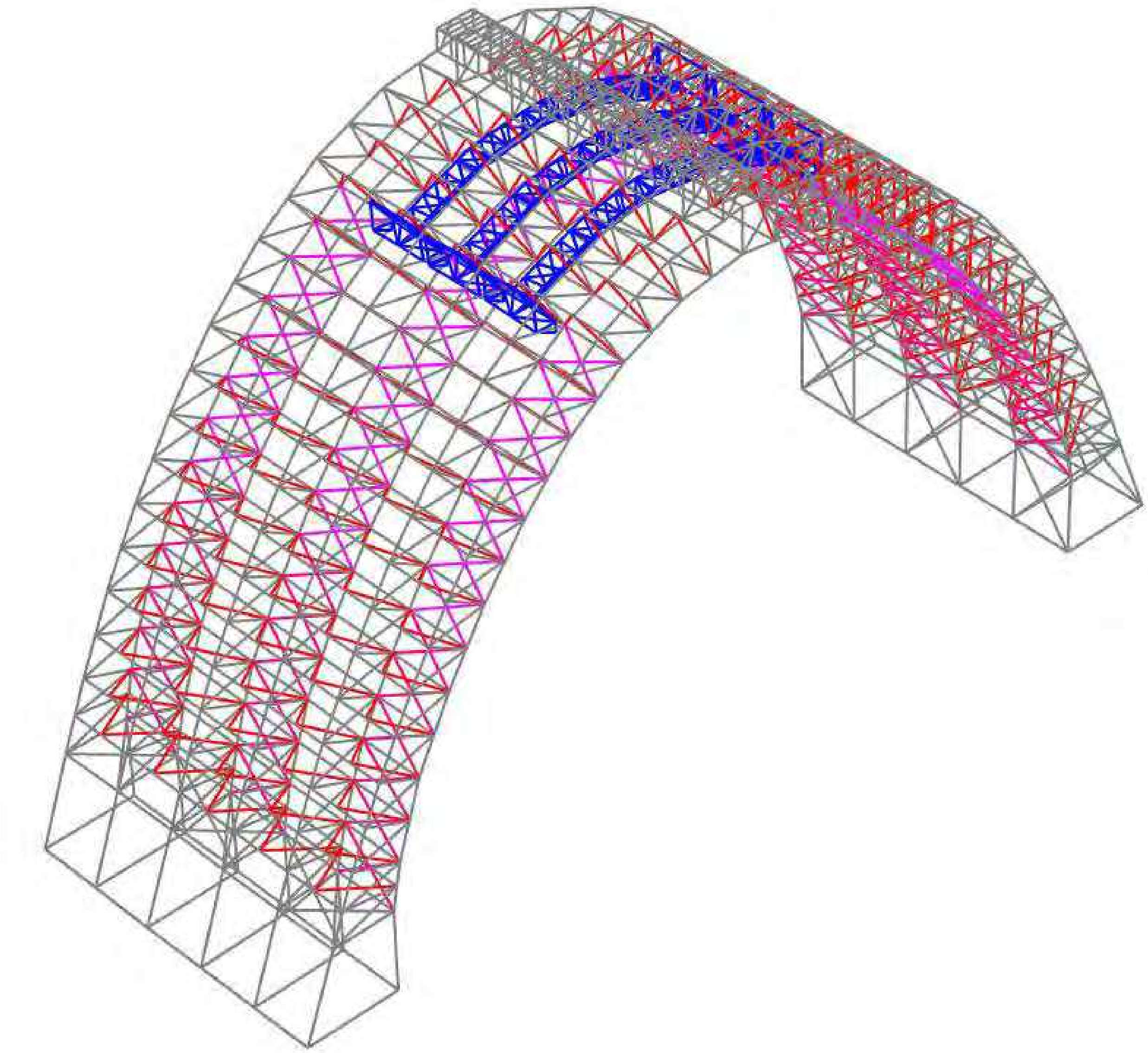


*Figure 15. 3D Isometric of Exoskeletons Installed between Existing Wood Trusses*

Step 4: Jack existing gravity framing from Exoskeletons to take gravity load off of the existing trusses and restore roof profile as close as possible to its undamaged state.

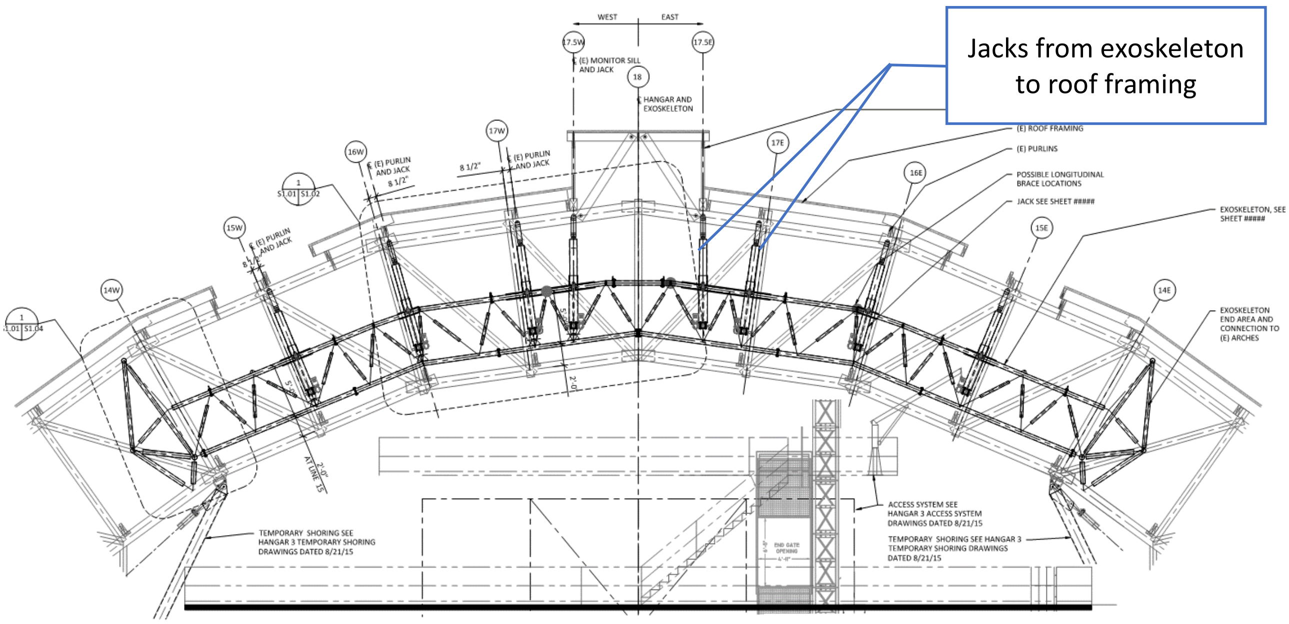



*Figure 16. Exoskeleton Elevation (Preliminary Drawings)*

Step 5: Perform emergency repairs to existing trusses and restore trusses as close as possible to original undamaged position from shoring tower.

Step 6: Remove jacks and Exoskeletons from the hangar. Remove connection steel plates except those portions that were used also to repair damaged existing timbers.

Step 7: Remove temporary shoring. Holes in existing concrete will be patched with a high-strength, non-shrink, non-metallic grout to match the color and texture of surrounding concrete as much as possible.

### 3.1 Portions that are permanent vs portions that are temporary

Temporary items include attachments and temporary wood repairs installed as part of the means and methods of construction. These items will be removed when practical in the construction sequence. Examples include the large temporary shoring tubes, tie rod bracing, jacks, access tower, and the steel Exoskeletons.

Permanent minor connection strengthening consists of stitch bolts at wood arch truss connection ends, and clamps at splits along the lengths of members (Figure 17). These have been installed in areas which require strengthening as part of the jacking sequence and emergency truss repair installation.

*Figure 17. Example of new minor connection strengthening stitch bolts adjacent to existing angle clamp.*

Permanent major connection strengthening consists of galvanized and painted cut HSS steel tubes, steel plates, and bolts (Figure 18). These items are currently being fabricated and coated and are pending installation. This type of repair will be installed in locations of severe damage within truss panel point connections, where the connection is damaged, but the timber is in fair condition outside the connection zone.

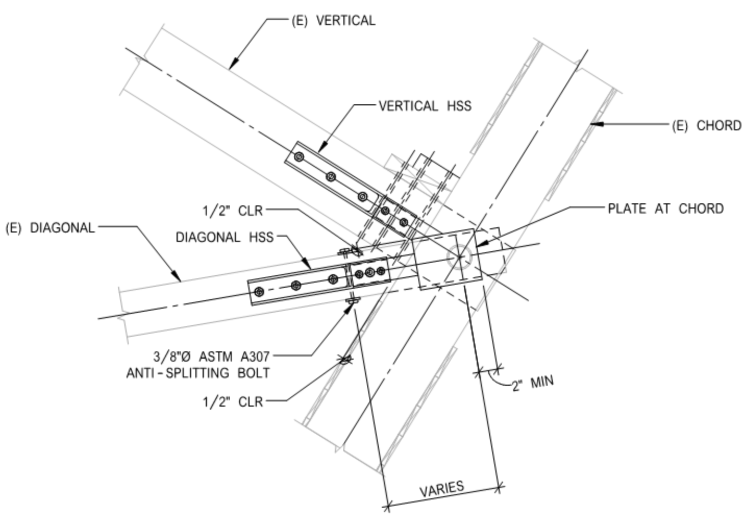



*Figure 18. Permanent major connection strengthening.*

### 3.2 Stamping of new wood members

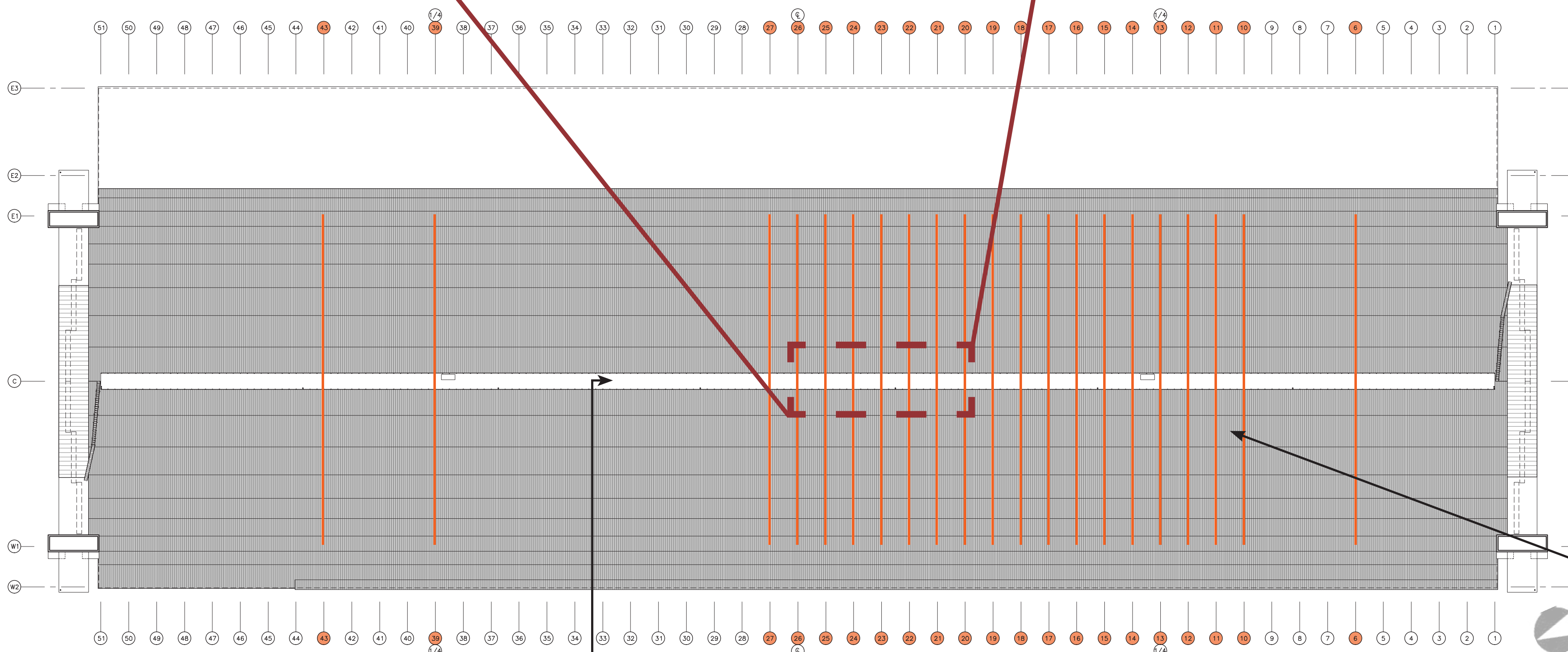
New wood members installed in the emergency repairs project will be labeled in order to distinguish them from existing materials within the hangar. These members are stamped with a custom fabricated branding iron pyrography stamp with the text “2015/2016” using 3/4-inch tall lettering with the Arial typeface.

### 3.3 Why selected option is best for preservation

The selected emergency repair strategy is best for preservation because we are achieving the best restoration of the hangar ridge line deflection with the intent of replacing damaged truss members in-kind with timber similar to the original truss configuration. The project team decided to pursue the “Best” deflection criteria which targets restoration of the truss and roof framing nearest to the average “undamaged” truss elevation. In the event that “Best” is unachievable due to field conditions, a lesser criteria can still be achieved which is acceptable from a structural and architectural standpoint.


PREVIOUS (west facade)
03-20-2014


CURRENT (east facade)
03-08-2016




06-30-2015

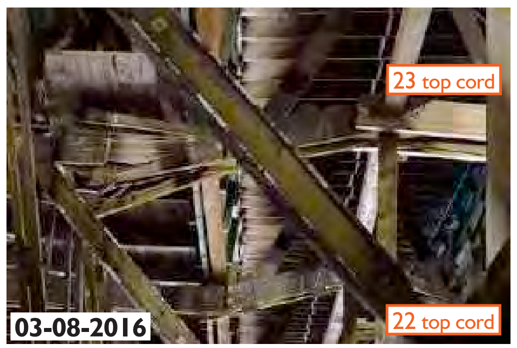

10-01-2015

KEY
— Location of trusses for emergency repairs

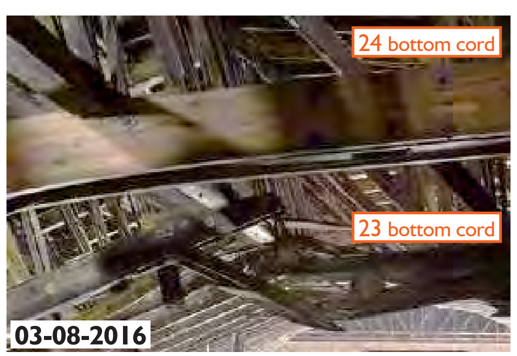
## EXTERIOR CONDITIONS

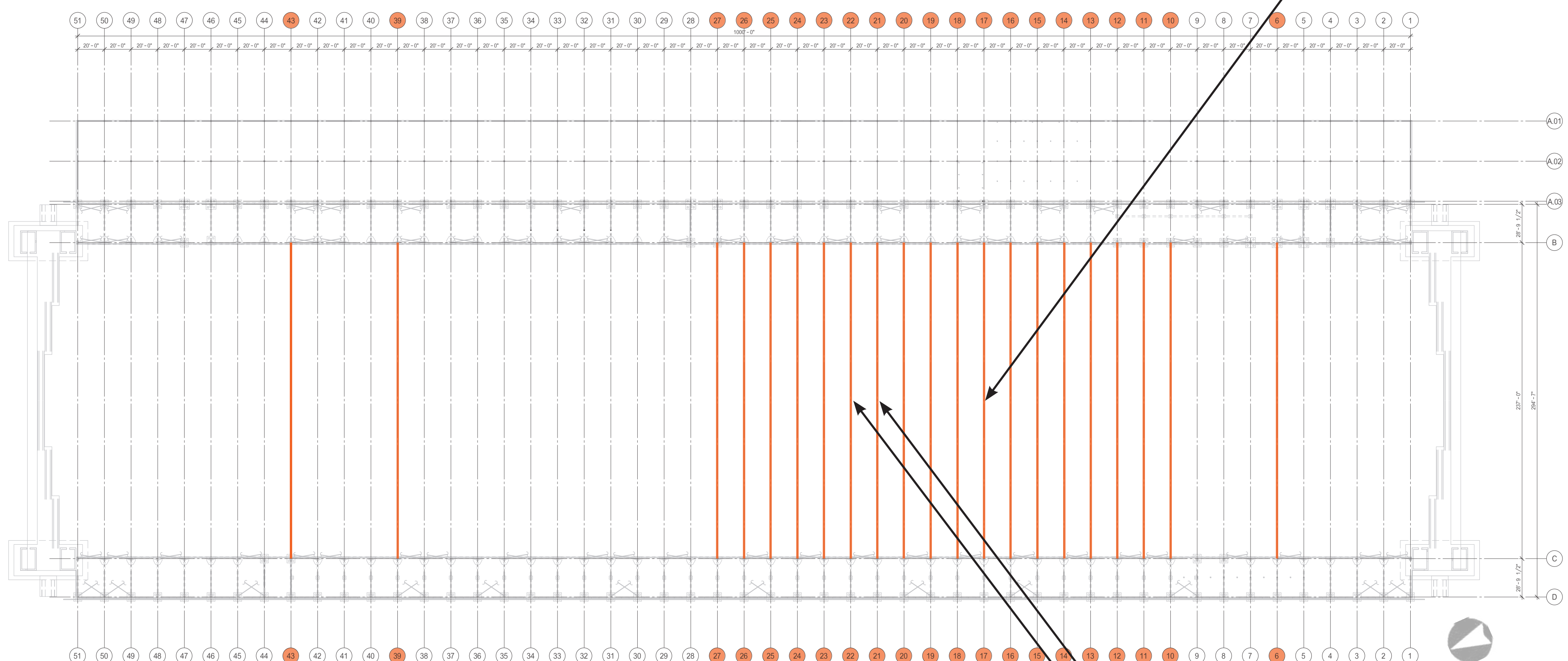
Roof plan from Hangar 3 Existing Roof Plan by Page & Turnbull on 03-30-2015, with photographs by Erin Ouborg, Steven Aiello, and Mark Citret on behalf of Page & Turnbull, as well as photographs from Engineer's Field Report by KPFF on 06-30-2015

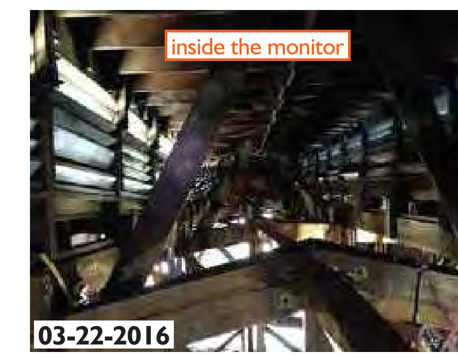










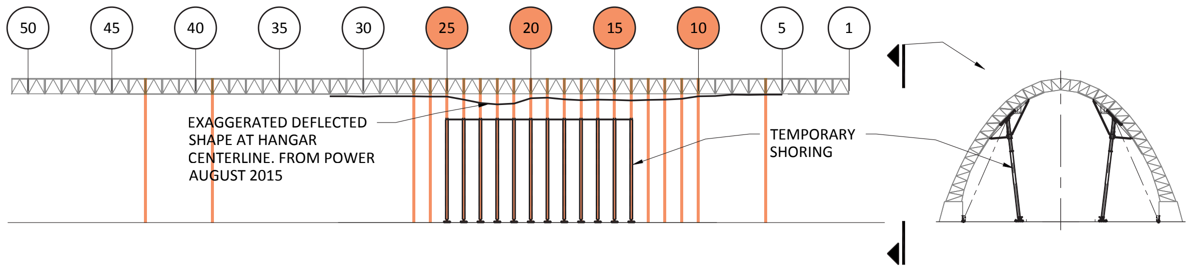

KEY

— Location of trusses for emergency repairs

## INTERIOR CONDITIONS

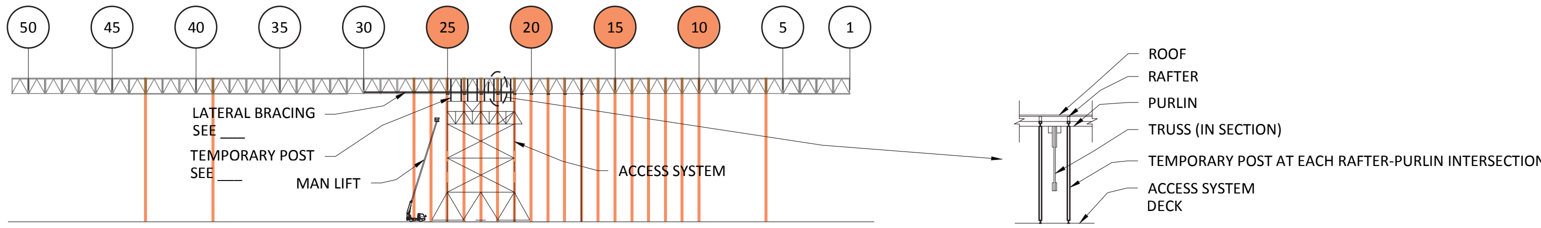
Foundation Plan from Moffett Federal Airfield - Hangar 3 Emergency Truss Repairs Set, Permit Revision 1 by KPFF on 03-17-2016, with photographs by Erin Ouborg and Mark Citret on behalf of Page & Turnbull, as well as photographs from Engineer's Field Report by KPFF on 06-30-2015

1. INSTALL TEMPORARY SHORING

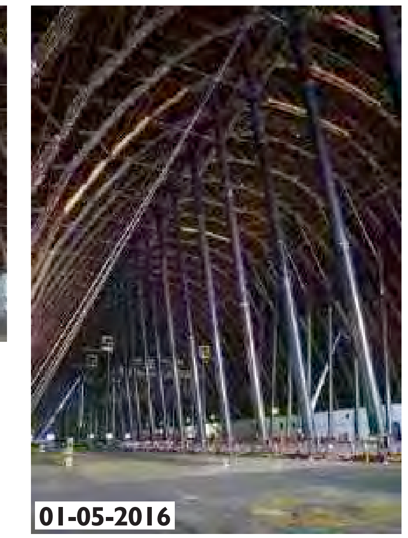


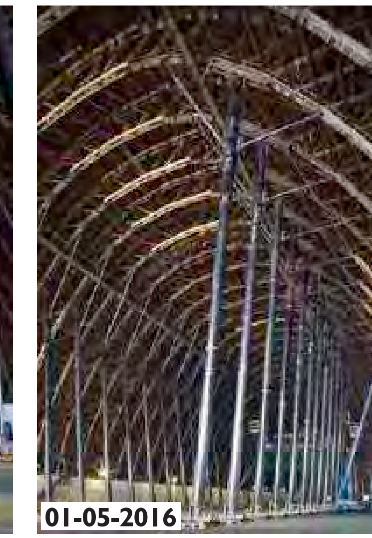



2a AND 2d. INSTALL LATERAL BRACING AND 2c. TEMPORARY POST SHORING.



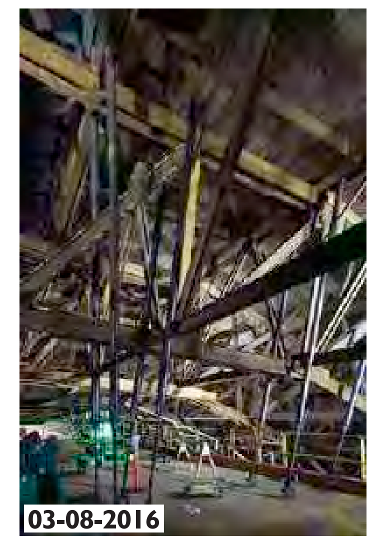




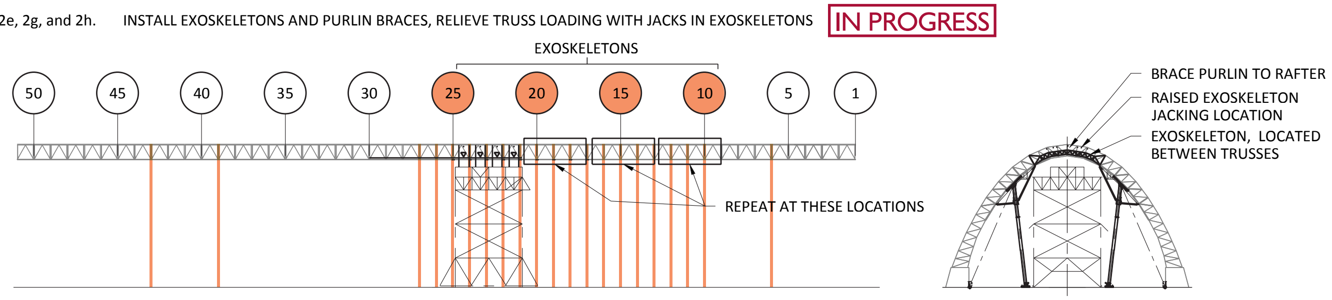






2e, 2g, and 2h. INSTALL EXOSKELETONS AND PURLIN BRACES, RELIEVE TRUSS LOADING WITH JACKS IN EXOSKELETONS IN PROGRESS





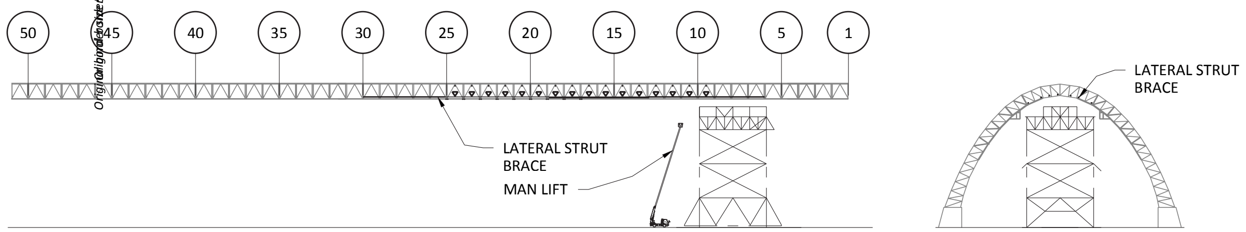


KEY
— Location of trusses for emergency repairs

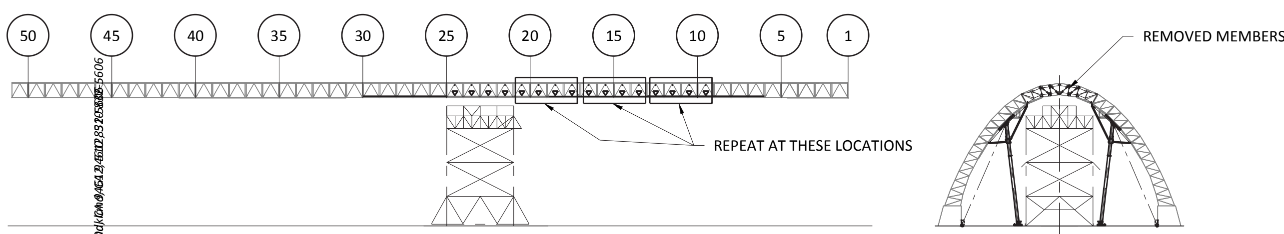
## REPAIR PROCEDURES

Elevations from Hangar 3 Shoring and Access System drawings by Power and Liftech on 10-06-2015, with photographs by Erin Ouborg and Mark Citret on behalf of Page & Turnbull

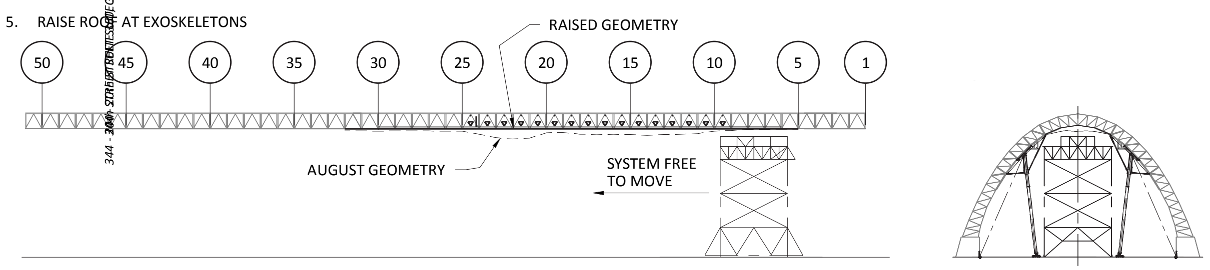
3. INSTALL LATERAL BRACING BEYOND EXOSKELETON LOCATIONS



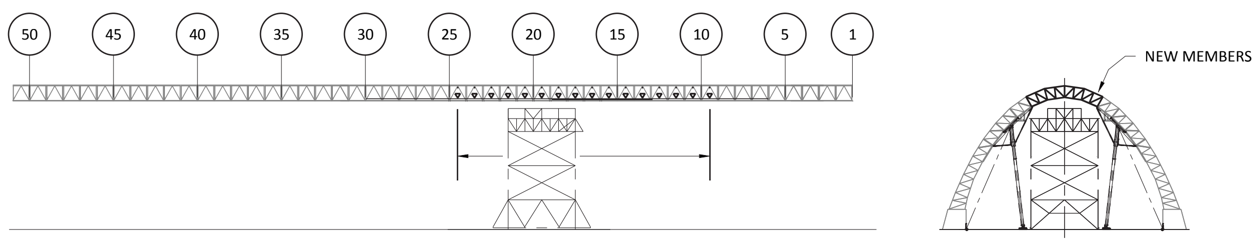

4. REMOVE HANGAR TRUSS DAMAGE AT EXOSKELETONS, AND DISCONNECT HANGAR TRUSSES FROM THE ROOF.



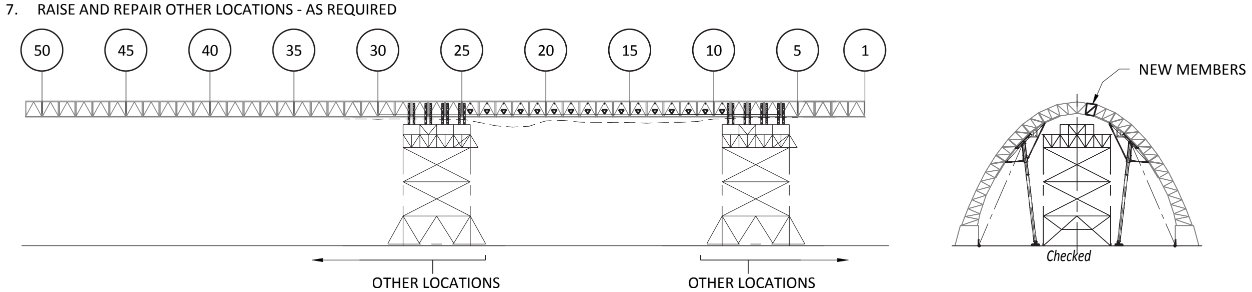

5. RAISE ROOF AT EXOSKELETONS




6. REPAIR OR REBUILD HANGAR TRUSSES AT RAISED LOCATIONS

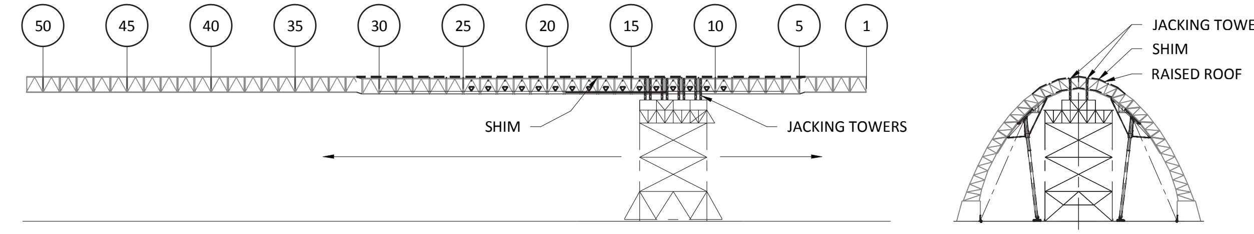



7. RAISE AND REPAIR OTHER LOCATIONS - AS REQUIRED

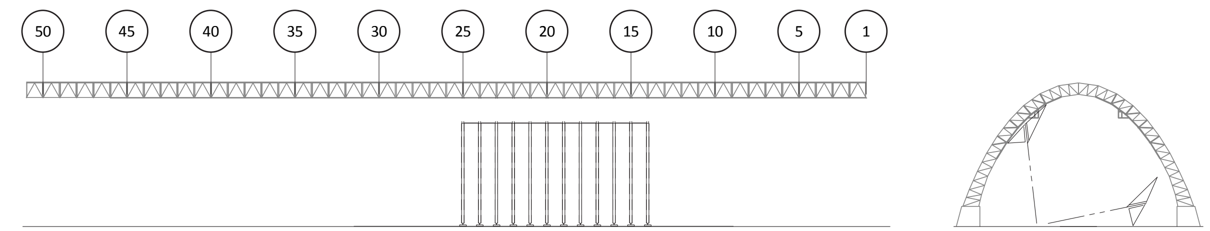


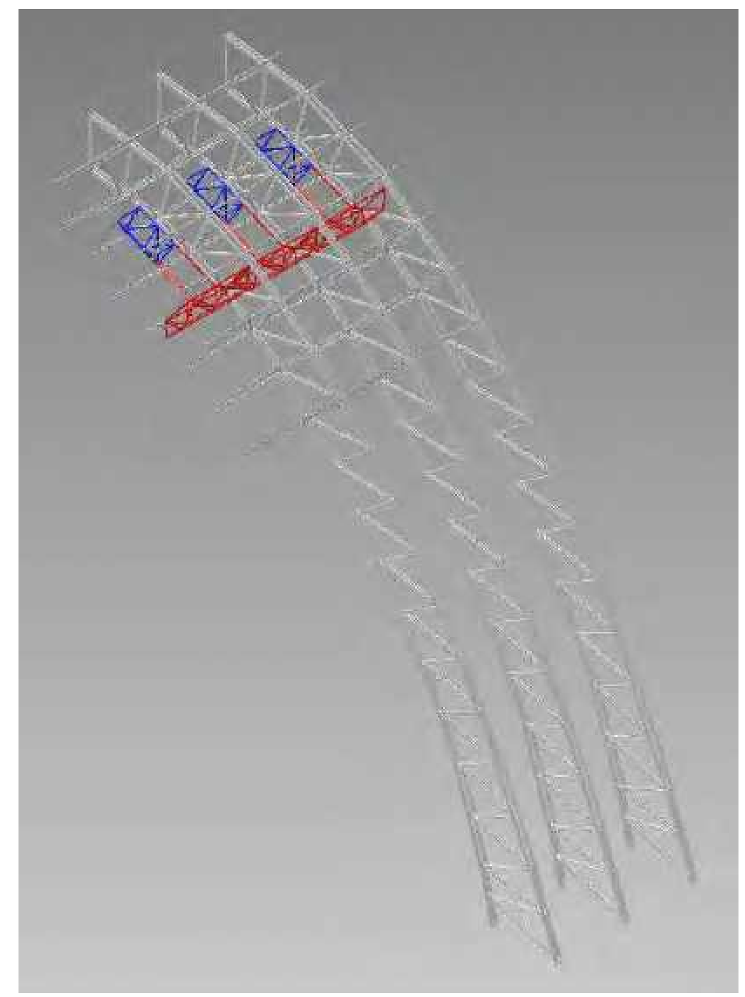

Checked

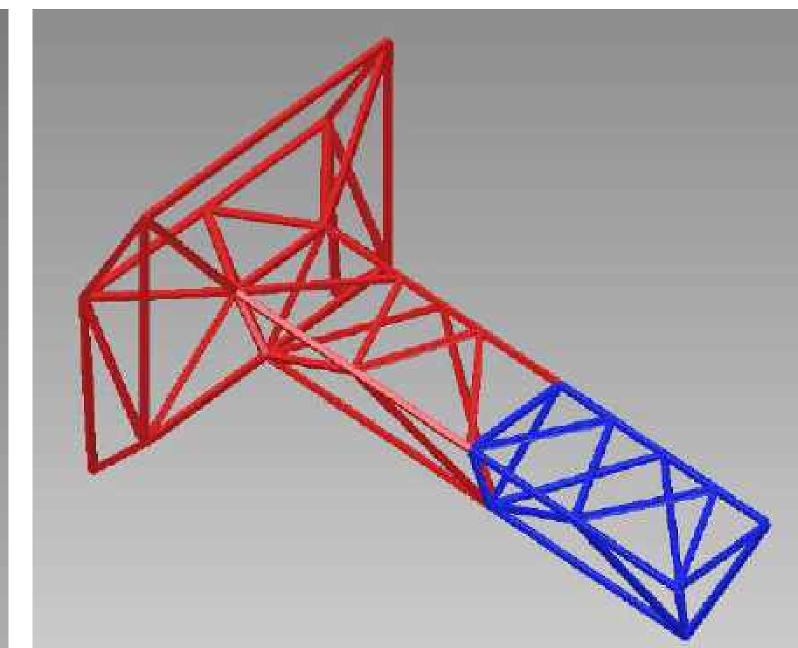
8. ADDITIONAL ROOF ELEVATION ADJUSTMENT BY SHIMMING - AS REQUIRED




9. REMOVE LATERAL BRACING AND TEMPORARY SHORING





3D Model of Exoskeleton (colors are for visual aid only)

Checked

Checked

Checked

## REPAIR PROCEDURES (REMAINING STEPS)

Elevations from Hangar 3 Shoring and Access System drawings by Power and Liftech on 10-06-2015, with 3D Model of Exoskeleton by Liftech on 10-06-2015

# A.3 KPFF, “Hangar 3 Damage Progression & Repairs Timeline” (July 6, 2017)

# CONSTRUCTION

1943 1950 1960 1970 1980 1990 2000 2010

2014 2015 2016 2017

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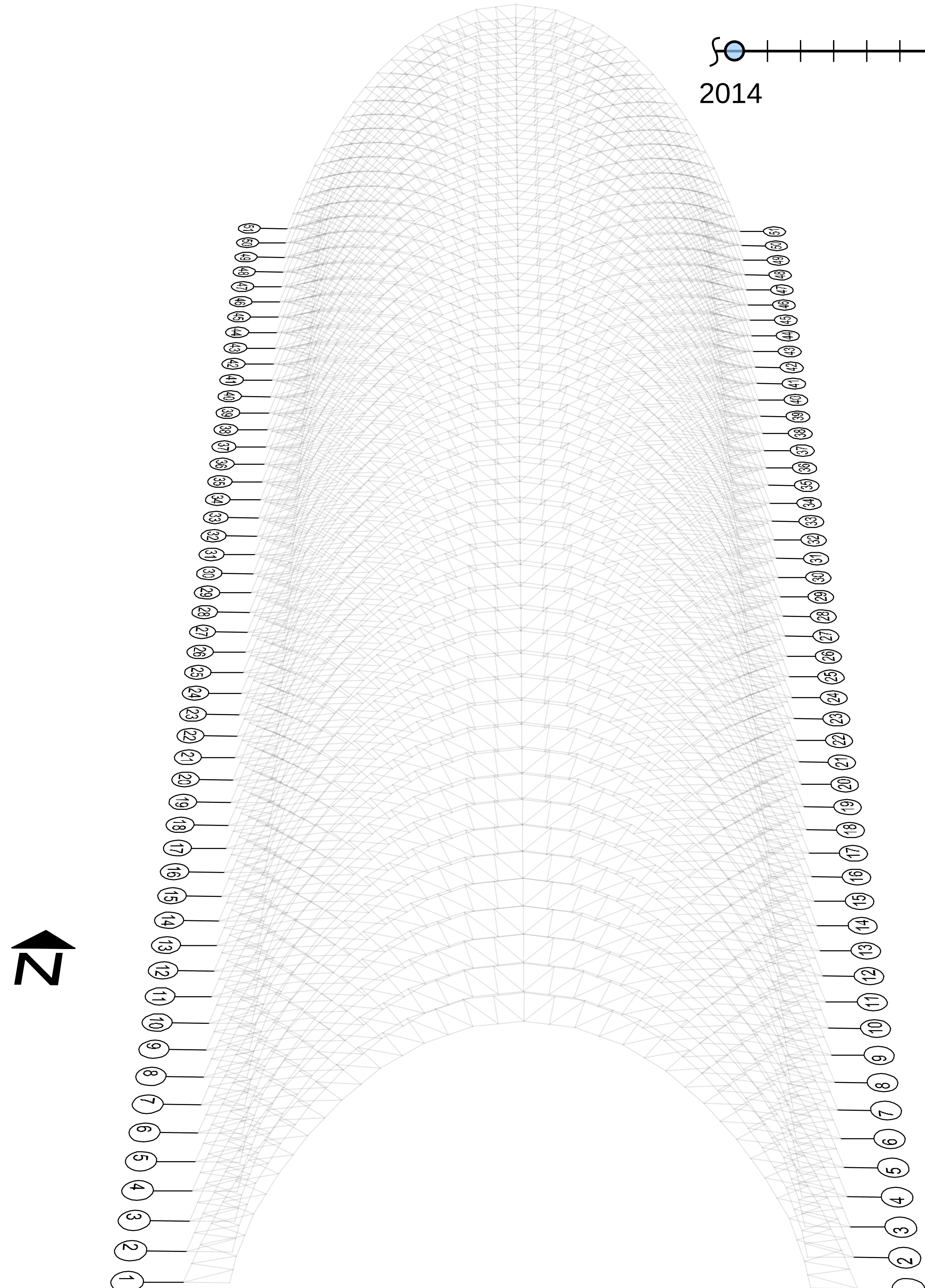
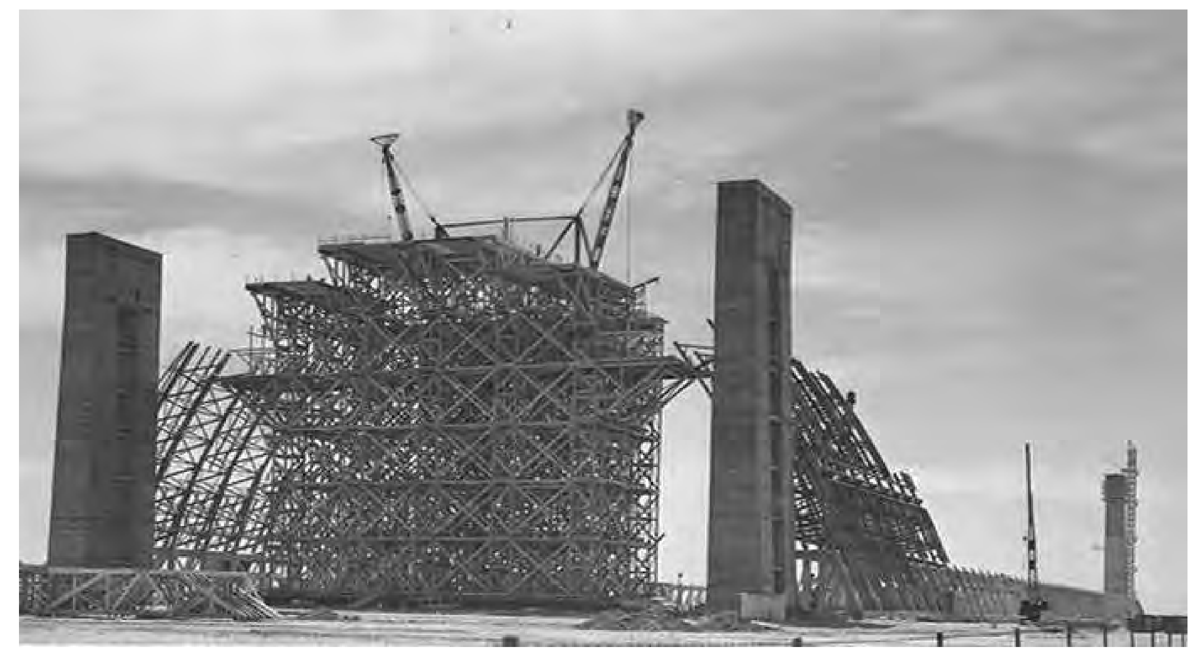
- Built in 1943 to house the Navy LTA (Lighter than Air) program, which used blimps to provide a network for coastal submarine patrol
- Built with wood to save steel for the war effort
- Intended to be semi-permanent wartime structures



H3

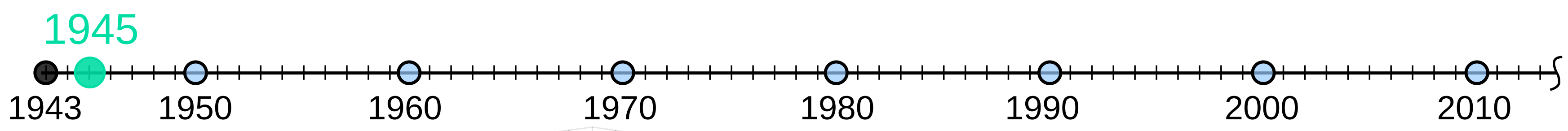


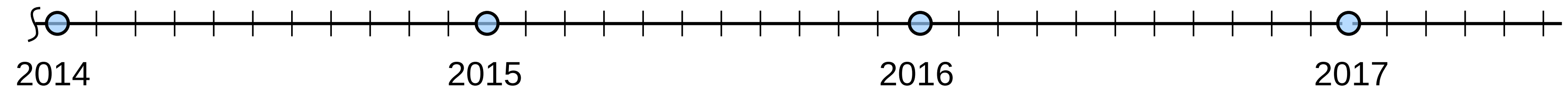
*Hangar 3 under construction*
*-US Navy Historic Photos*

*Pre-assembled truss panels awaiting erection*
*-US Navy Historic Photos*

*Hangars 2&3 under construction*
*-US Navy Historic Photos*

# EAST SHED ANNEX

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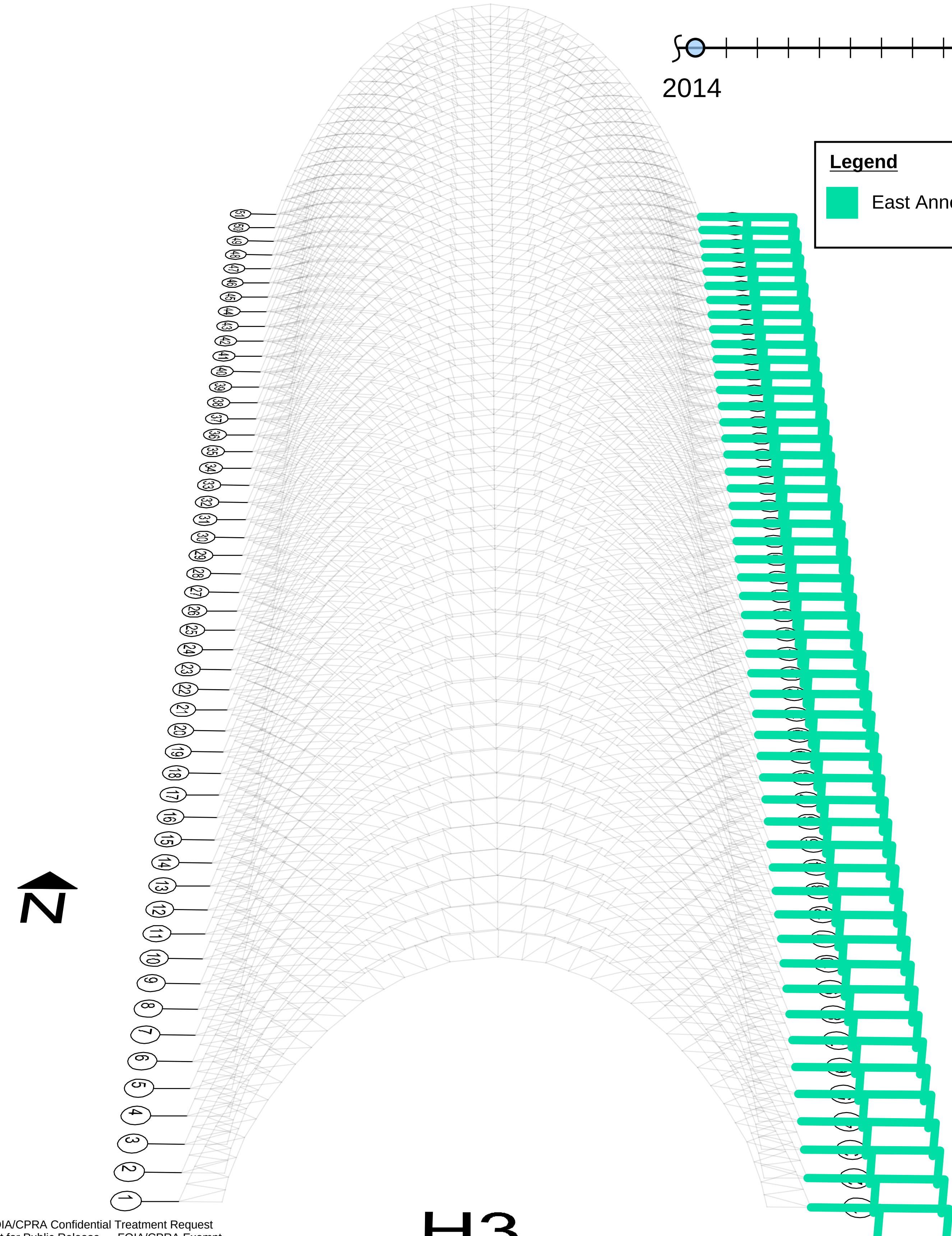


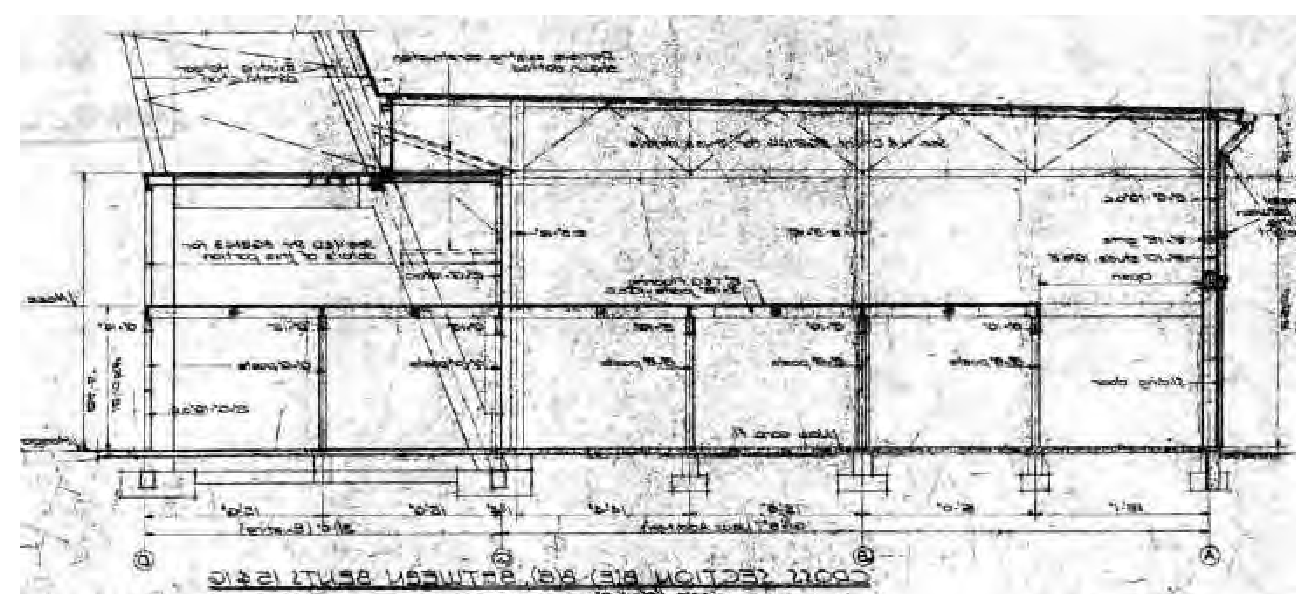
**Legend**

East Annex Shed

H3

- After WW2, the east shed was expanded to support Heavier than Air (H.T.A.) operations

*Interior view of Hangar 3 East Shed Annex*



*Elevation view of Hangar 3 East Shed Annex*

# BATTEN STRENGTHENING

1946

1943 1950 1960 1970 1980 1990 2000 2010

2014 2015 2016 2017

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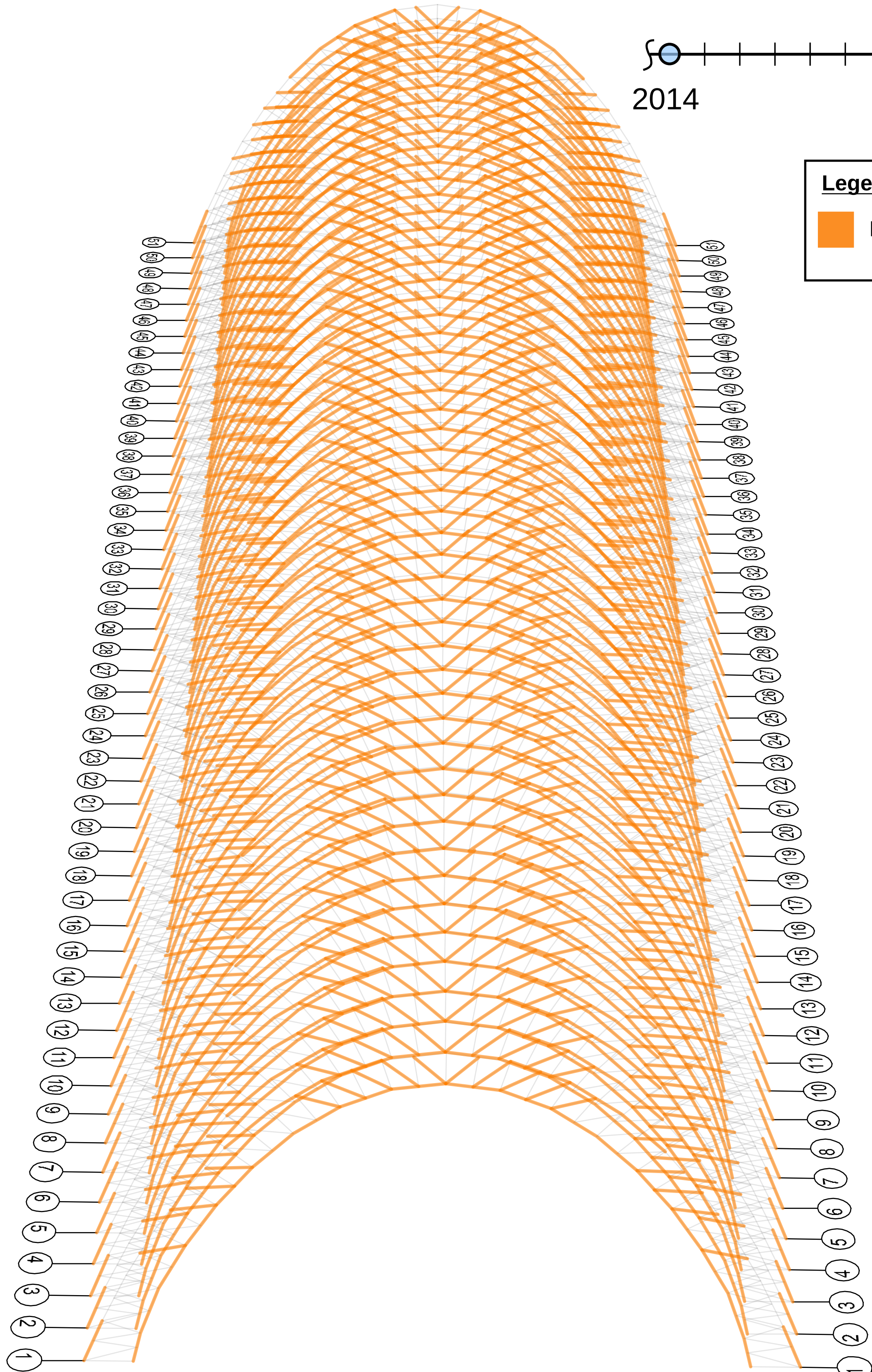

H3

**Legend**

Batten Strengthening

- Battens were added to bottom chords, and some top chords and diagonals to increase stability and help prevent buckling
- Upgrade was intended to increase the longevity of the temporary structure
- Battens added to **2244** members per hangar
- Batten wood was treated with a mixture of borax, white lead, and linseed oil paint.
- "These battens, with a few additional bolts and blocking at the chord splices, are the principle measures taken in strengthening and making permanent these wood buildings." "*Strengthening of LTA Hangars, Naval Air Station, Moffett Field, California*", J.S. Marsh, 1946

*Typical chord member with battens*

*Rolling scaffold used to install battens - Seabees Historic Photos*

# KNEE BRACES

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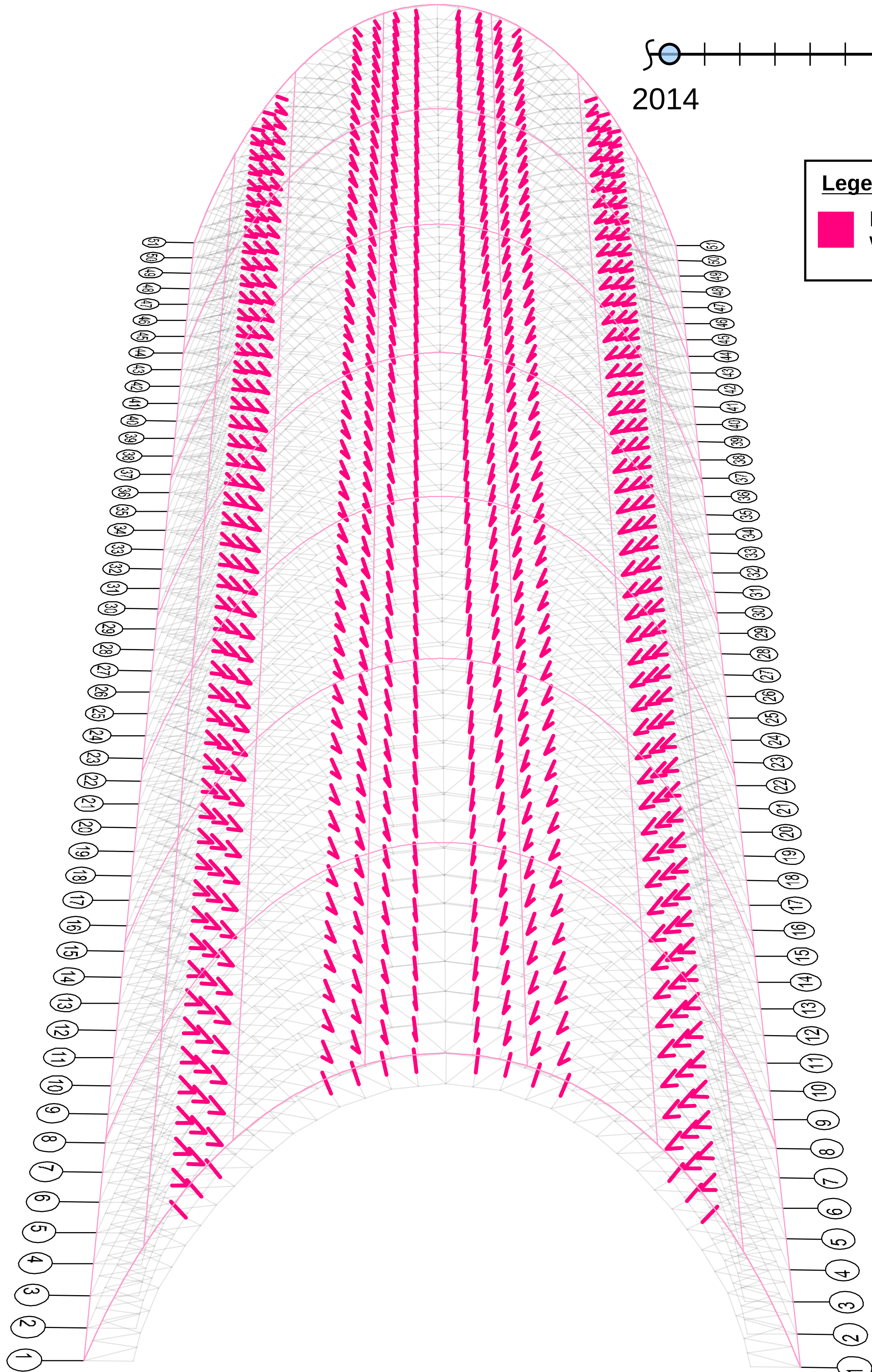
1946

1943 1950 1960 1970 1980 1990 2000 2010

2014 2015 2016 2017




**Legend**

Knee Braces at Vertical Web Members

- Knee-braces were added to reduce the unbraced length of certain vertical web members
- These braces were part of the 1946 strengthening measures described by J.S. Marsh.
- Knee braces added to **700** vertical web members

*Typical vertical web member with added knee-braces*

# RE-ROOFING

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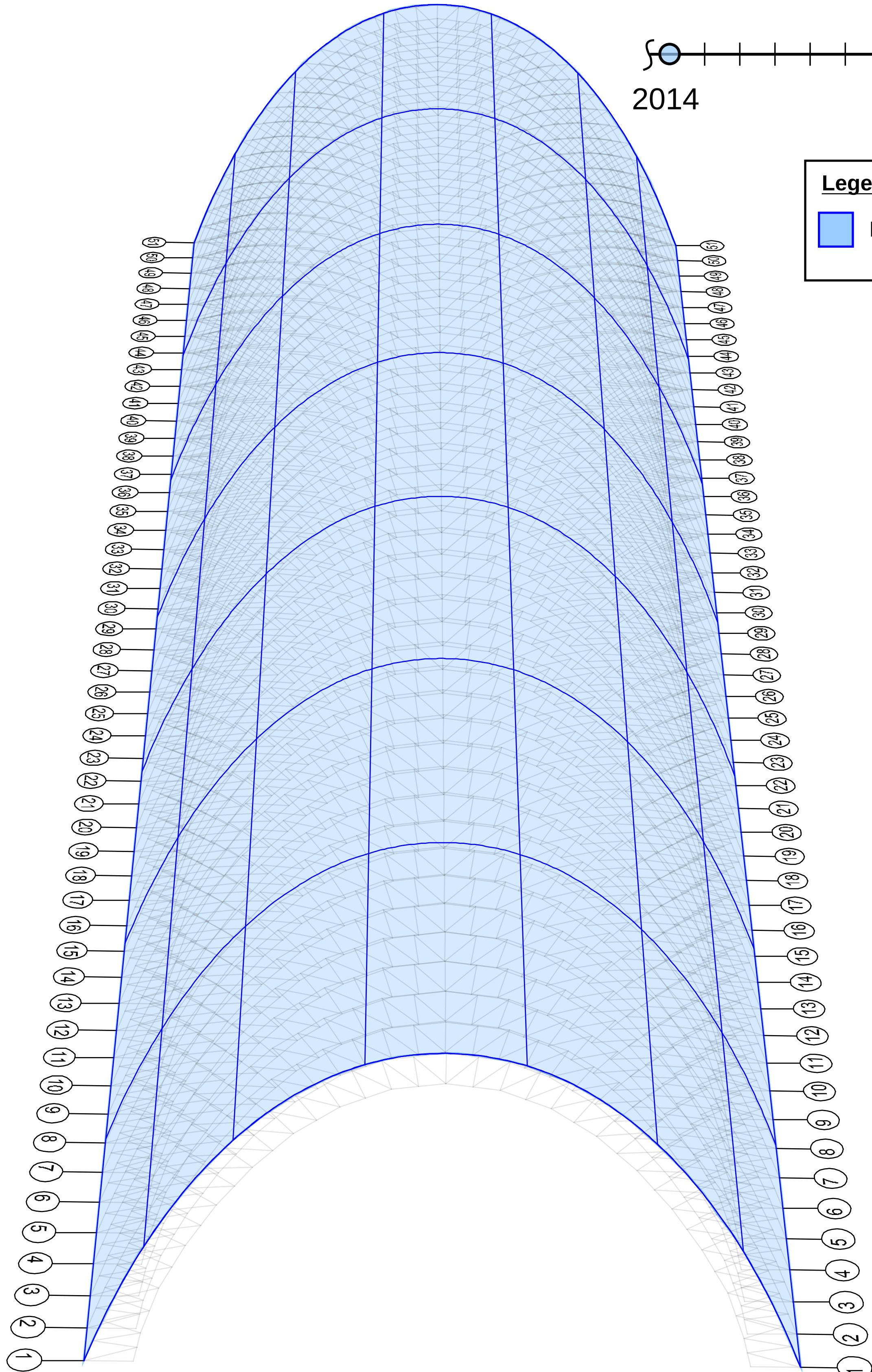
1943 — 1950 — **1956** — 1960 — 1970 — 1980 — 1990 — 2000 — 2010

2014 — 2015 — 2016 — 2017



N

H3

**Legend**

New Roofing

- Original roofing system was roll-roofing over panelized wood sheathing
- Roof was upgraded to corrugated aluminum panels over roofing felt in 1956
- Approximately **466,000** ft$^2$ of roofing per hangar

*Original roofing system*
*-Seabees Historic Photos*

*Asphalt shingles documented in 1954*
*-Seabees Historic Photos*

*Current aluminum roofing*

# MAINTENANCE REPAIRS

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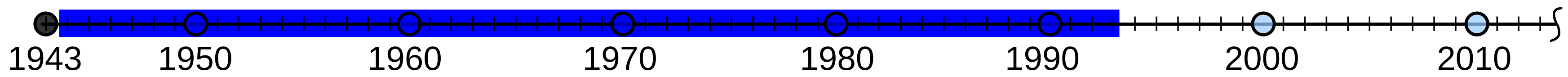
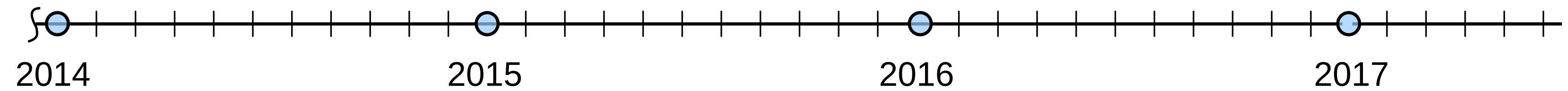
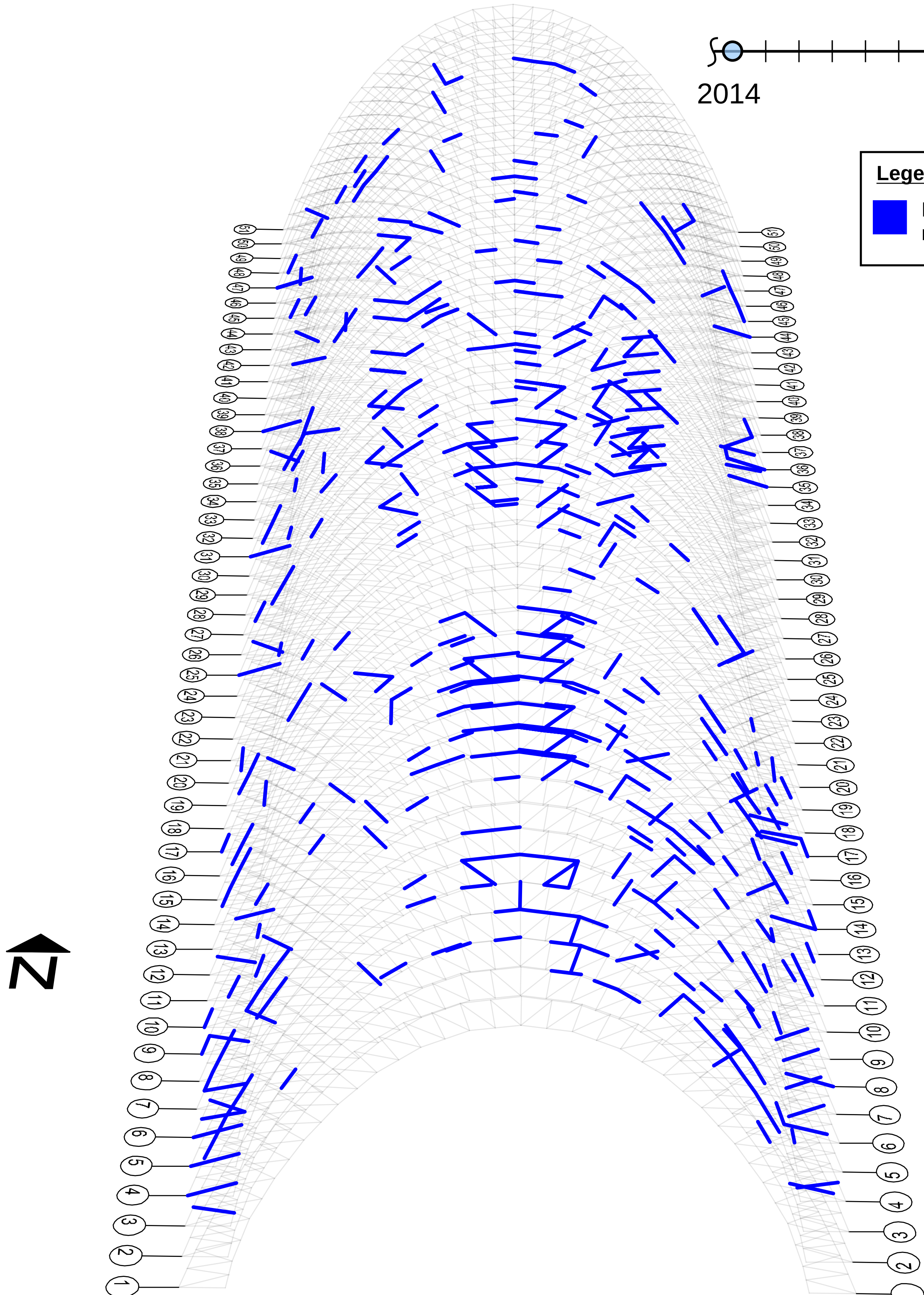


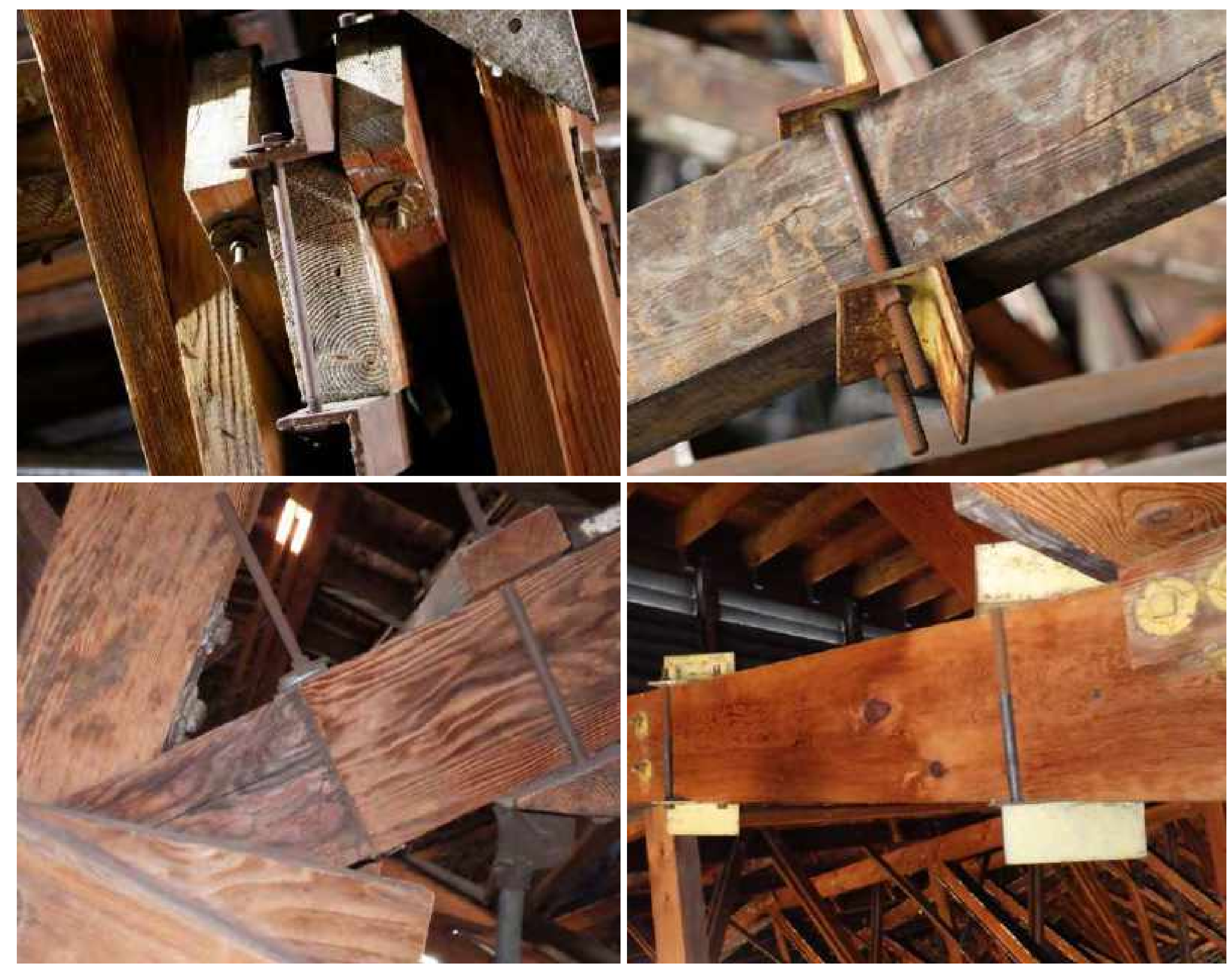




H3

**Legend**

Documented existing minor repairs

- Standard repairs for Navy maintenance included steel clamps and stitch bolts to fix minor splits "*Maintenance Procedure for Timber Trussed Structures*" Department of Navy Bureau of Yards and Docks, 1944
- Repairs occurred periodically throughout the service life of the hangars
- Navy records indicate that Timber Structures performed an inspection of the hangars in 1954
- The extent of these repairs is not fully documented
- Minor repairs have been documented at **541** members in H3 (many still undocumented)



*Minor repairs made during Hangar 3 service life*

# 1981 REPAIRS

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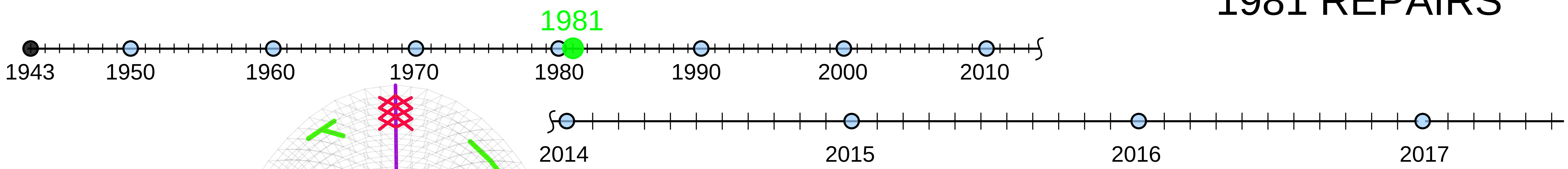


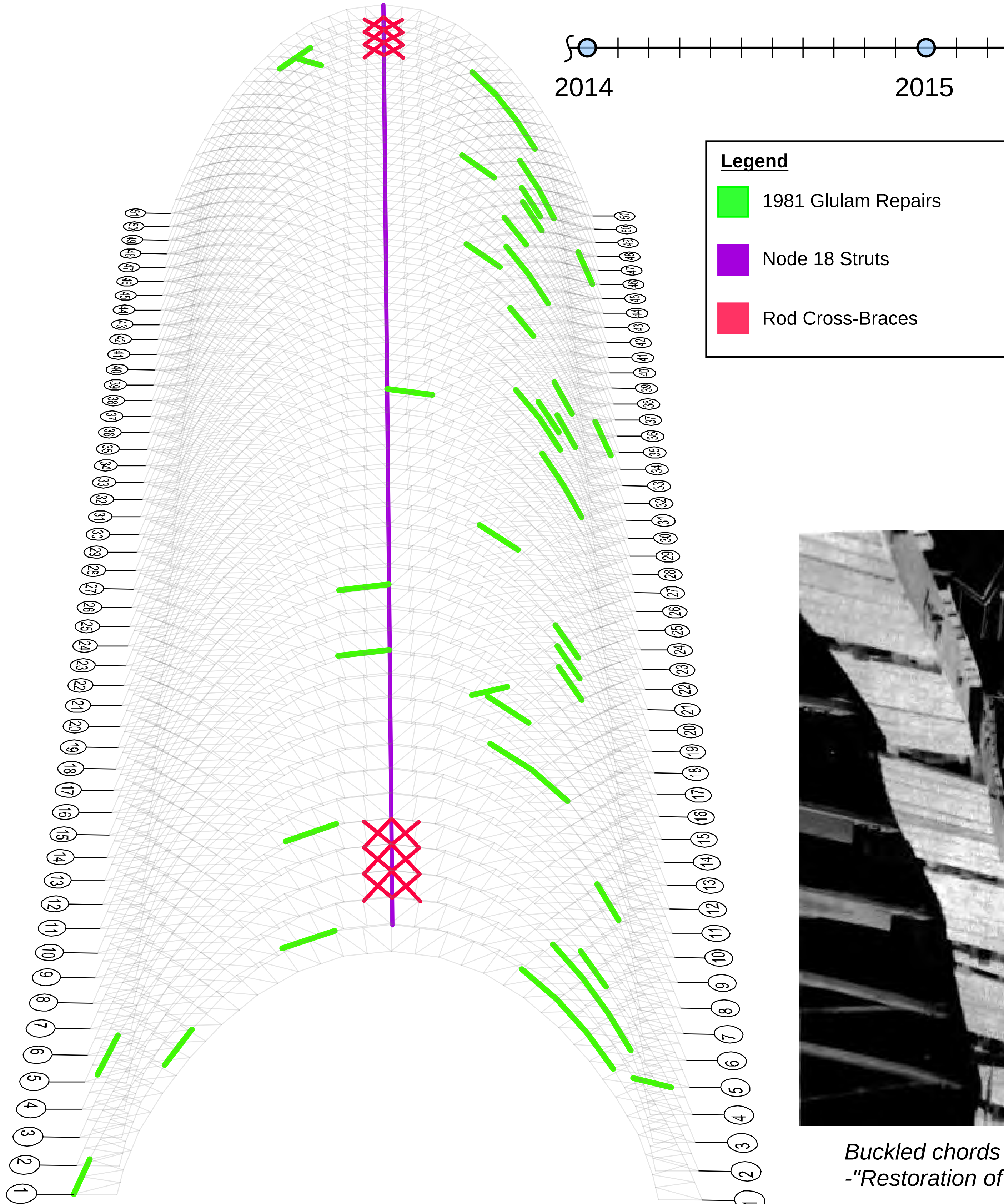


H3

- Major glulam repairs were made in 1981 to correct buckling observed in truss chords
- Glulam strongback members were installed to re-align chords, but load path remained in the original members
- Major repairs made to **49** members
- Struts added at each arch at node 18 to brace top of truss, with rod cross-bracing added at the north and south ends of the hangar
- Minor repairs were also made with clamps and stitch bolts. Many 1x6 purlin ties were replaced with steel rod ties

*Buckled chords (left) and glulam strongback repairs (right)*
*-"Restoration of Navy LTA (Lighter than air) Hangars", Donal Neal, 1986*

*Node 18 struts*

# 1993 GLULAM REPAIRS

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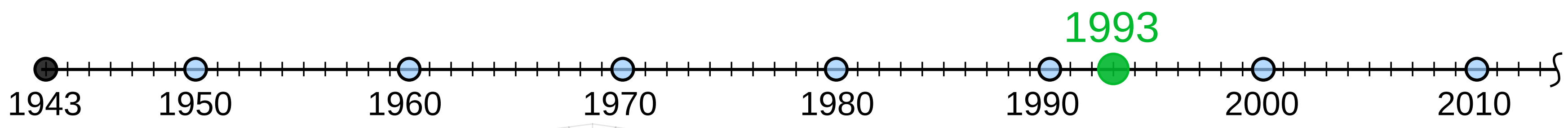


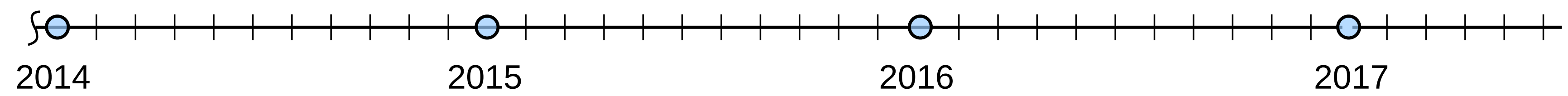


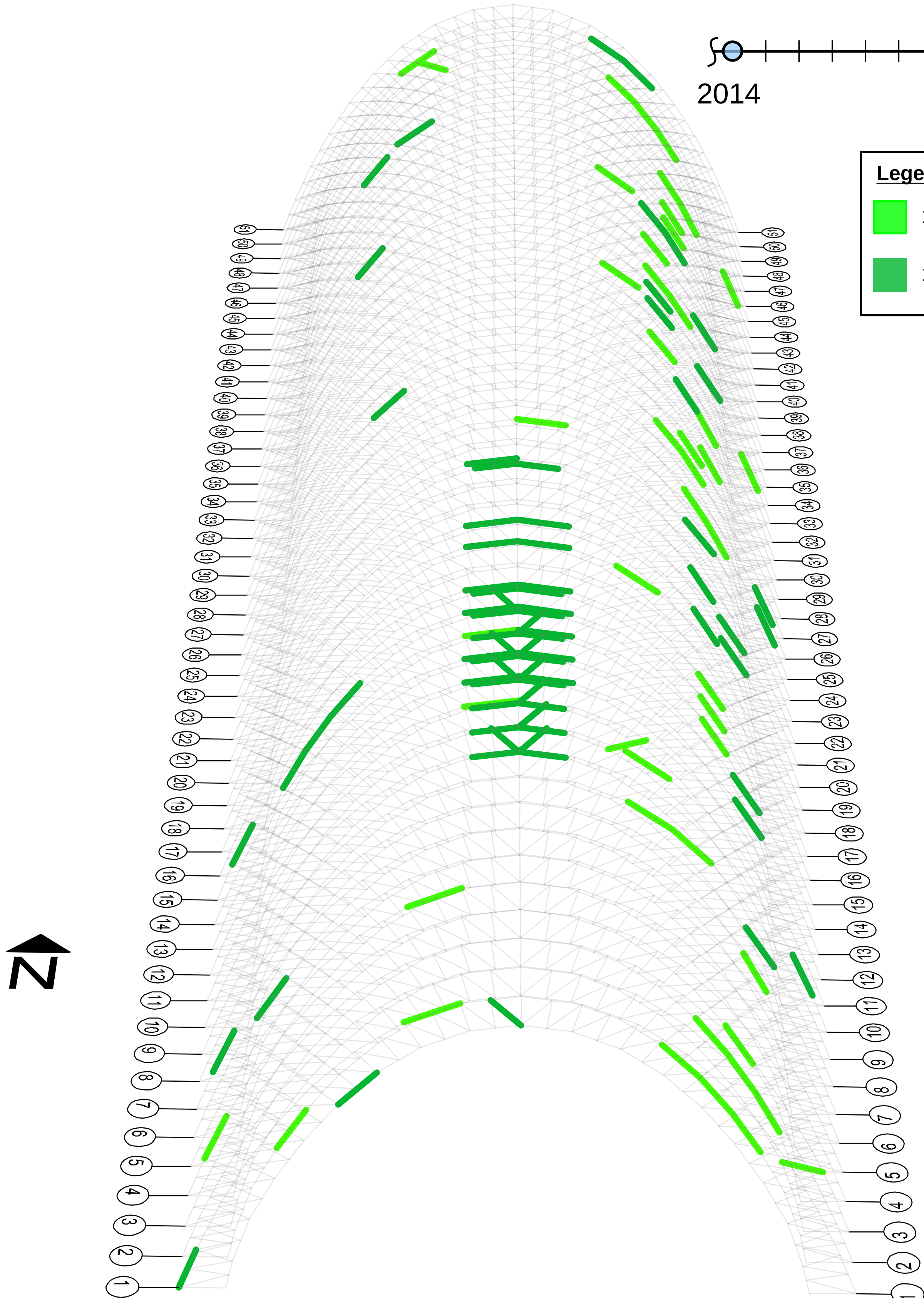


H3

**Legend**

- 1981 Glulam Repairs
- 1993 Glulam Repairs

- Continued deterioration of Hangar 3 necessitated further glulam repairs in 1993
- Repairs consisted of glulam strongbacks for buckling, and multi-chord glulam sistered members
- Many of these repairs were made in the critical zone where the most severe deflections and damage were later found
- Major repairs made to **75** members
- Sistering repairs also made to roof support purlins and minor clamp repairs were again performed on arch trusses

*1993 glulam sister repairs to chord members in critical zone*

# DUE DILIGENCE INVESTIGATIONS

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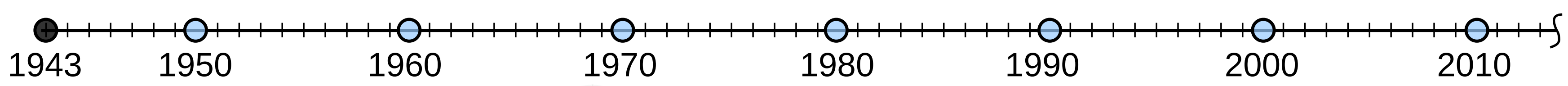


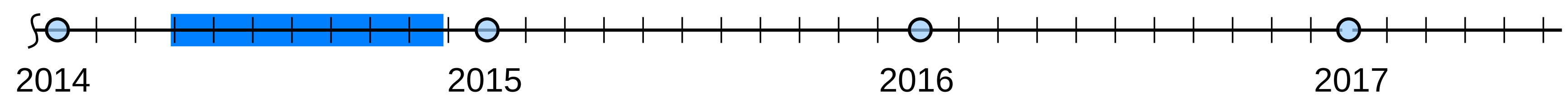


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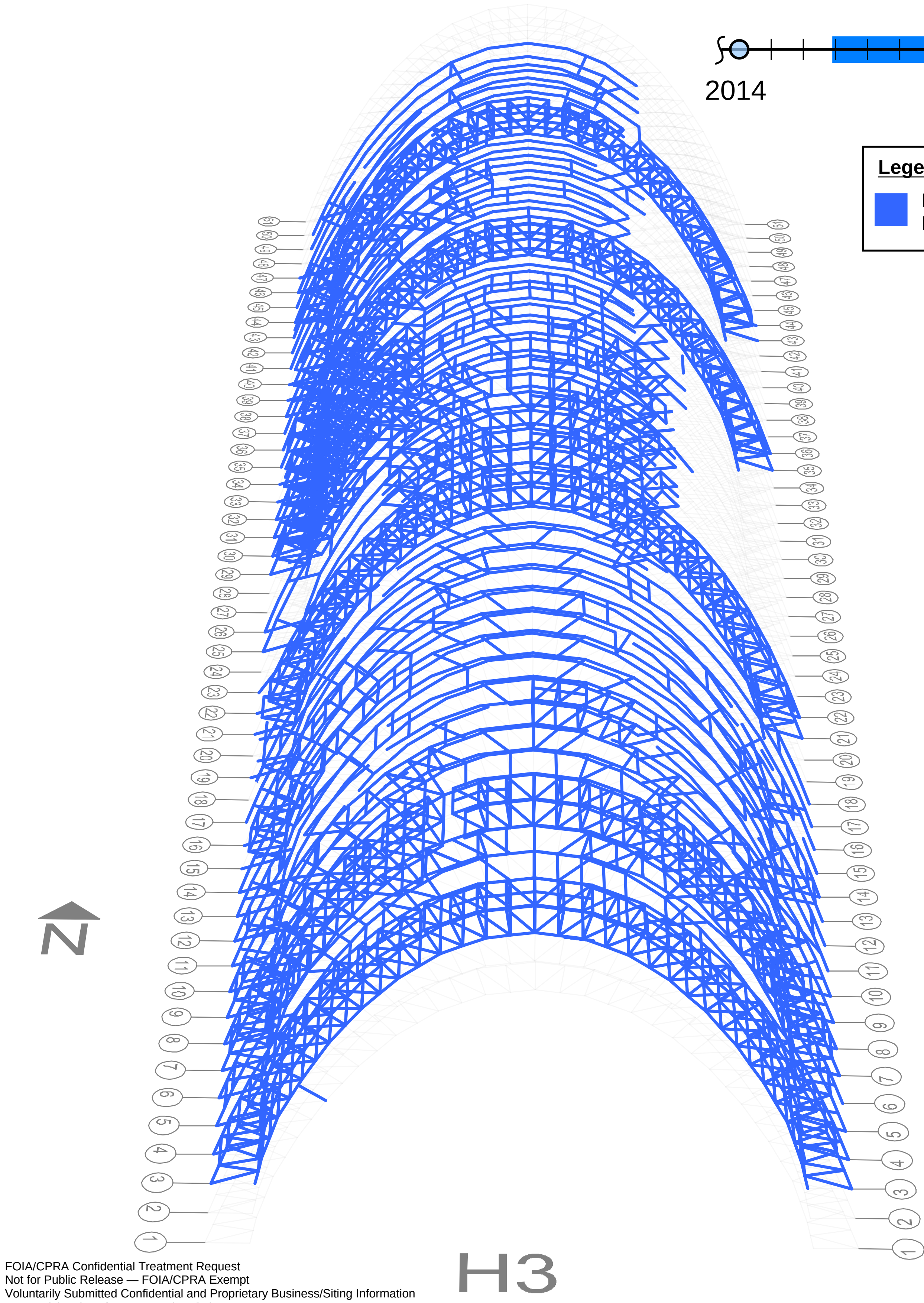
SED

**Legend**

Members surveyed in Due Diligence Investigations




- Data collected in the Due Diligence Investigations phase of the project included visual observations of many (but not all) of the truss members
- Observations were made regarding wood grading, existing condition, and previous repairs
- Data was logged for **5663** members in H3 through TPAS® (Tablet PC Annotation System) provided by Vertical Access
- H3 contains over **20,000** total members, including **5559** main arch members
- Results summarized in Page & Turnbull Due Diligence Investigations Findings Report (DDIF)

*Boom lift used for visual observations*

*Visual observation of a lower chord member*

# DDIF REPAIR SCOPE

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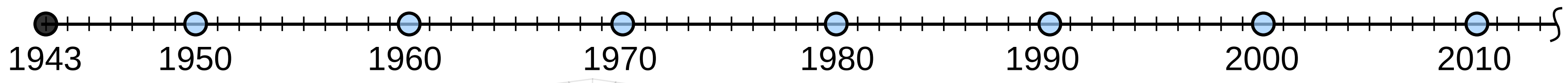
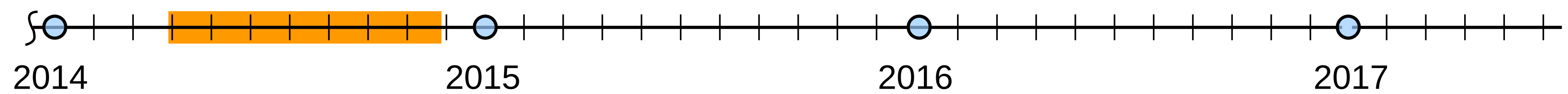
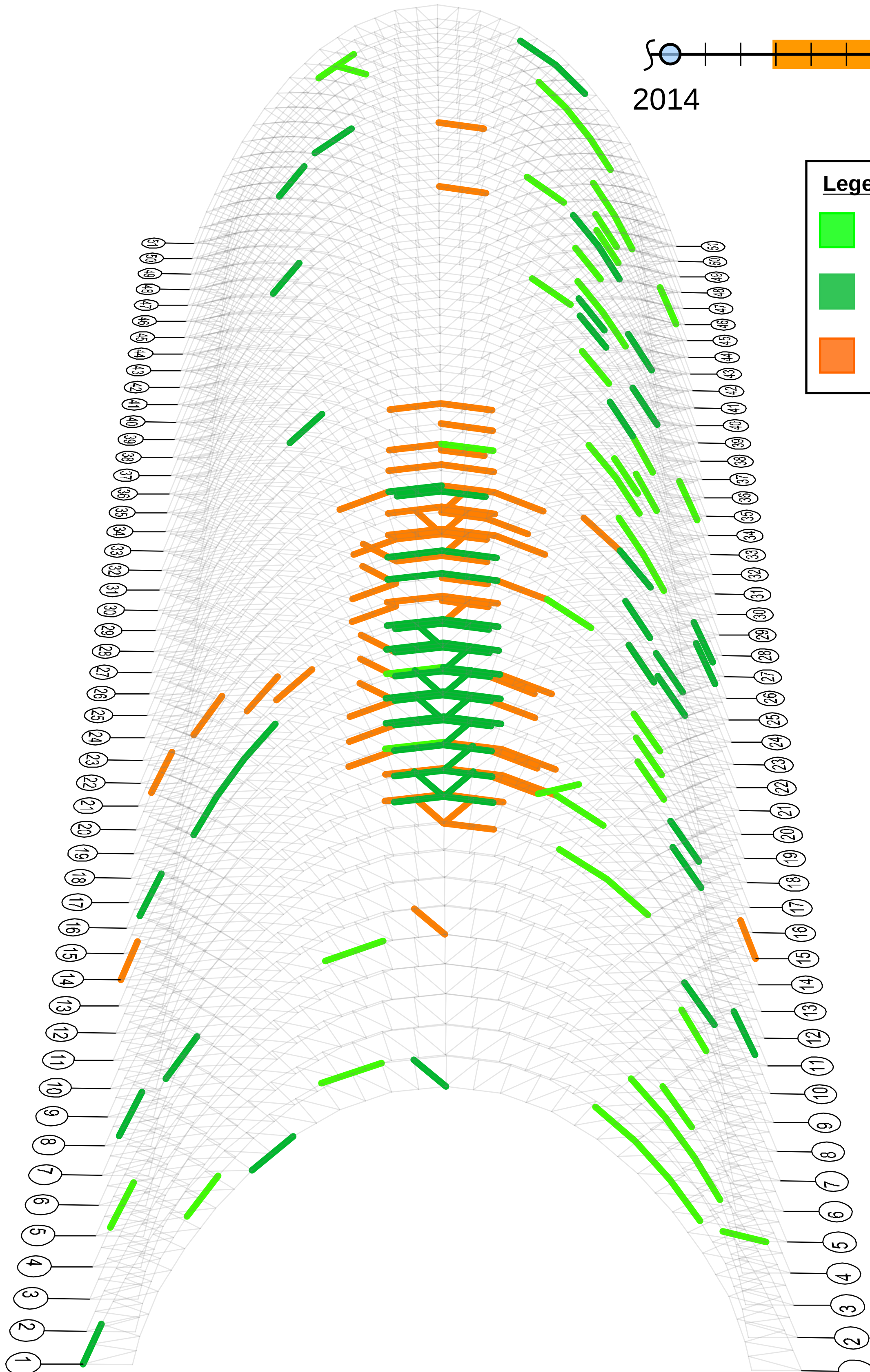


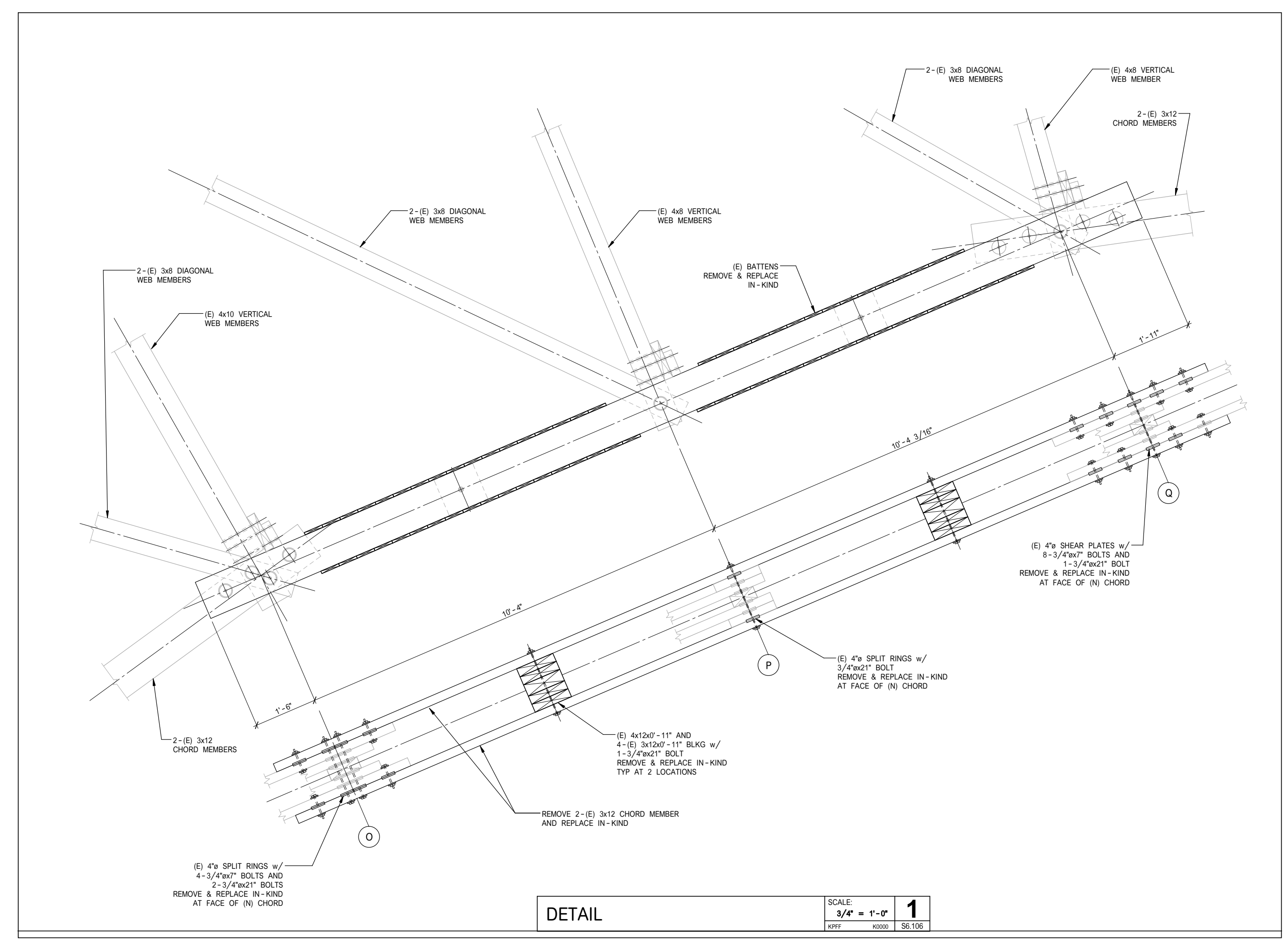




**Legend**
- 1981 Glulam Repairs
- 1993 Glulam Repairs
- DDIF Repair Scope

- TPAS® data was reviewed and damaged members were identified for repair
- **68** members were found to be damaged and in need of major repairs

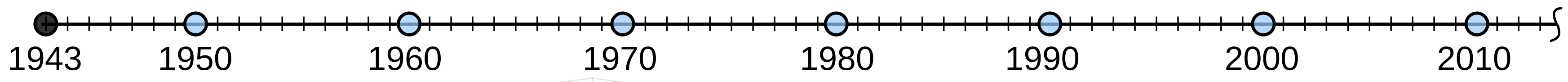


H3




*Example detail for removal and replacement of damaged chords found in TPAS®*

# EMERGENCY REPAIRS

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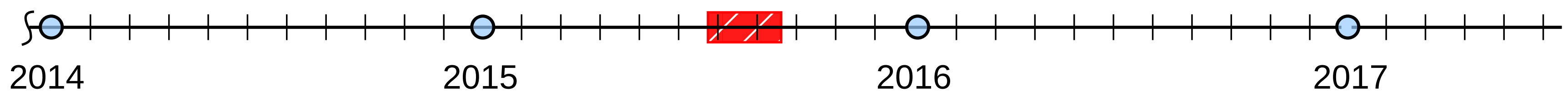


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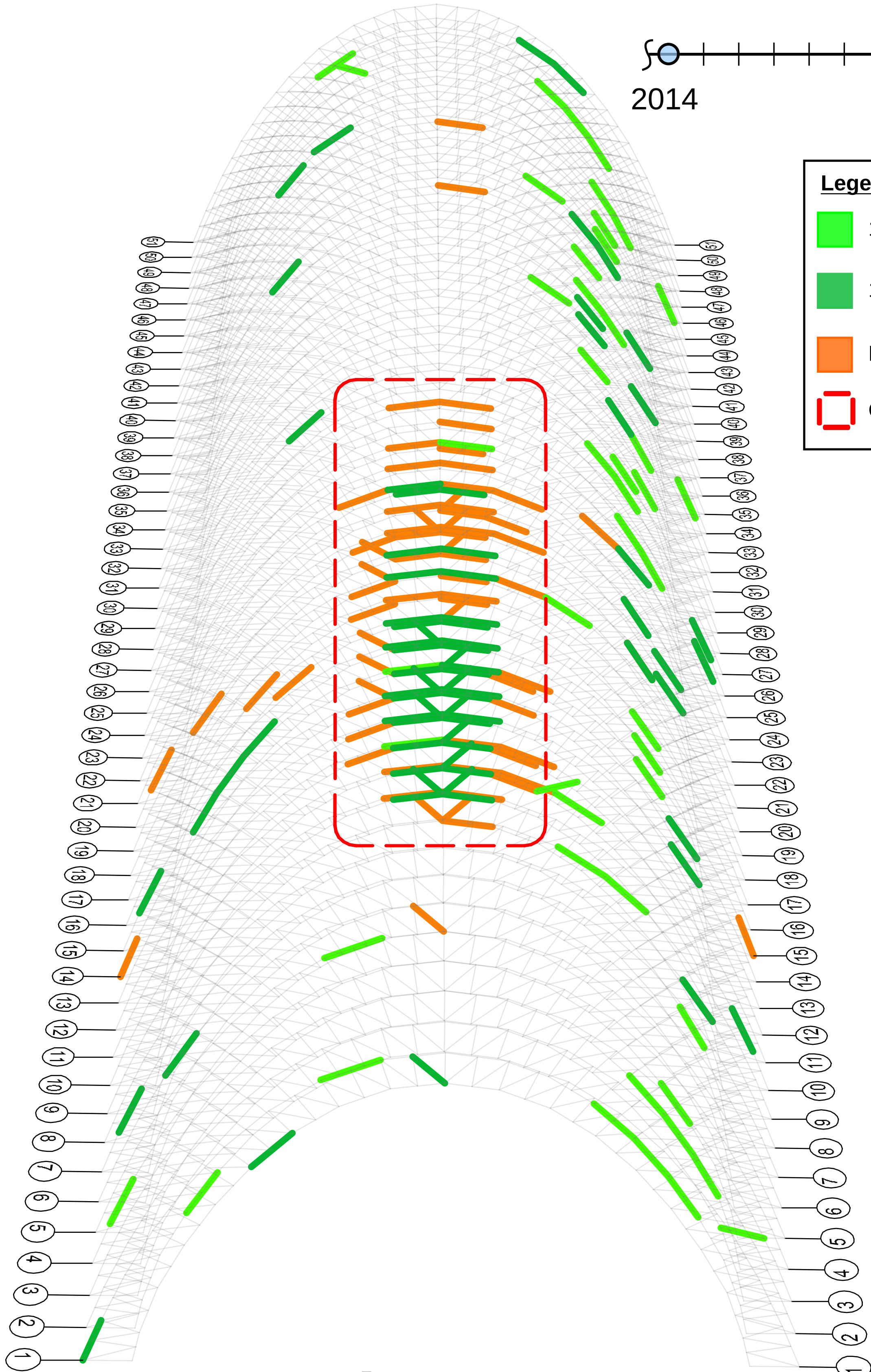
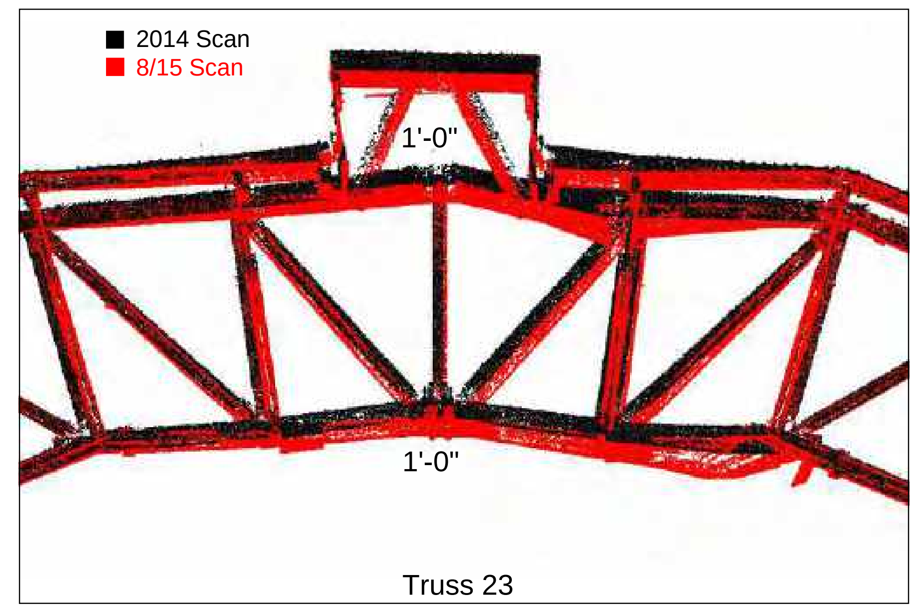


H3

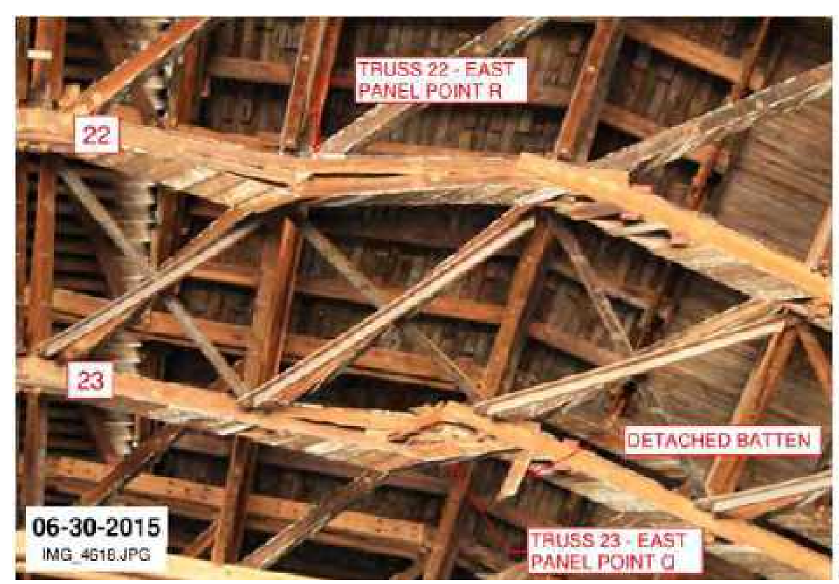
**Legend**

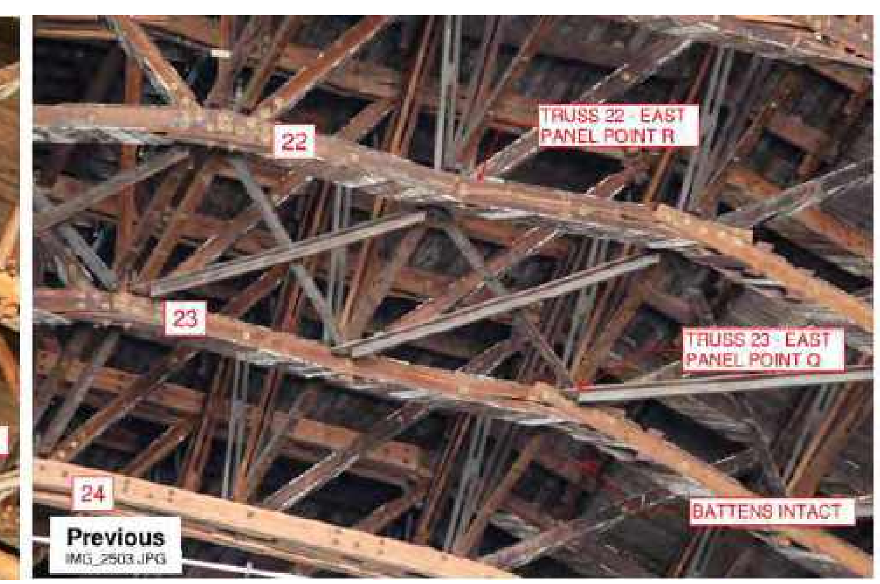
- 1981 Glulam Repairs
- 1993 Glulam Repairs
- DDIF Repair Scope
- Critical damage zone

- During a site visit on June 24, 2015 KPFF observed damage progression in arch trusses
- On July 2, 2015 KPFF issued an Emergency Truss Repairs permit drawing set
- KPFF, Power Engineering Construction, Turner, and Page & Turnbull coordinated work to implement shoring and emergency truss repairs
- Permit for emergency repairs was received from NASA on August 19, 2015.




*Point cloud visualization of damage progression*




*Photos of damage progression*

# TEMPORARY SHORING

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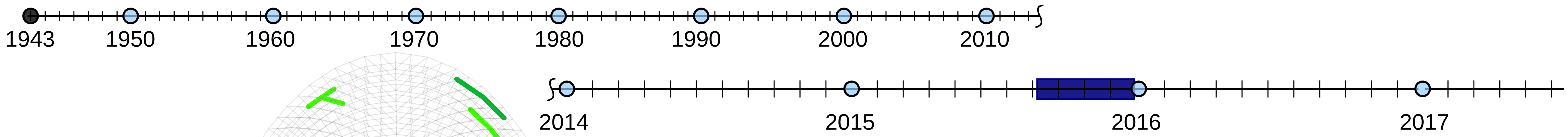
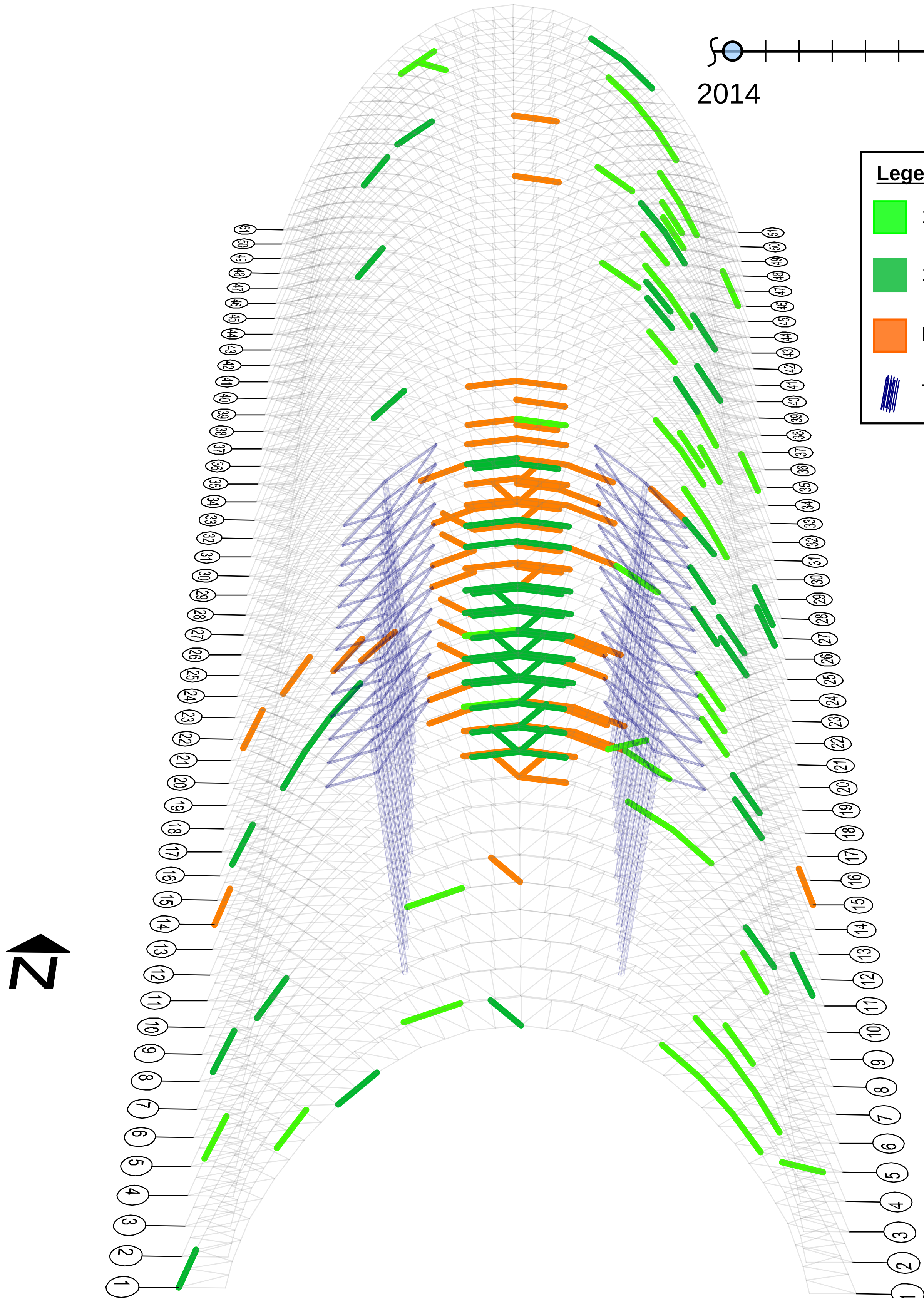


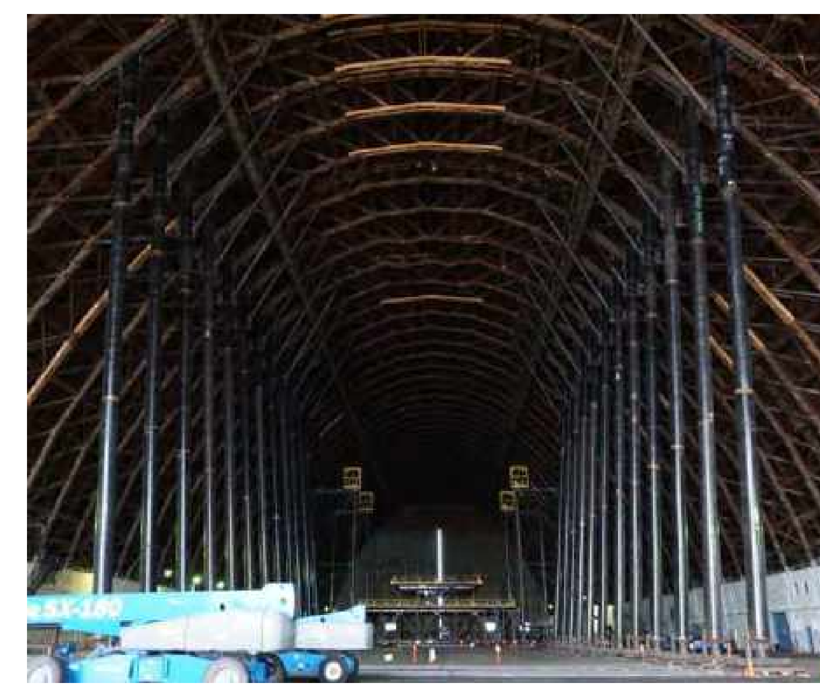
H3

**Legend**

- 1981 Glulam Repairs
- 1993 Glulam Repairs
- DDIF Repair Scope
- Temporary Shoring

- Evidence of severe damage and progressive collapse of Hangar 3 necessitated a shoring and emergency repair program
- As part of the contractor's means and methods of performing repairs, 36"ø steel pipe shores were placed between trusses 9-26
- Pipe shores were designed to provide secondary stability in the event of progressive roof collapse during repair procedures
- Steel exoskeletons with jacks would then be placed at top to jack the roof and rebuild the critical zone

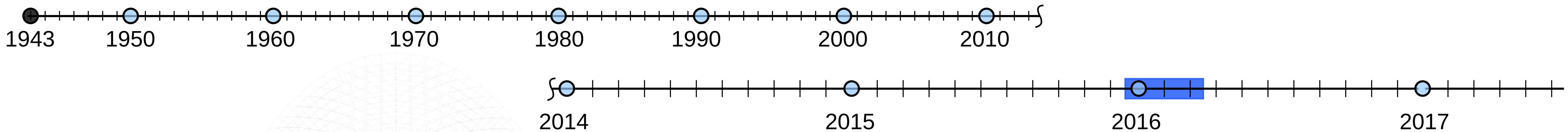
*Hoisting of temporary shore segment*



*Temporary shores after installation*

# OBSERVATIONS BELOW EXOSKELETON

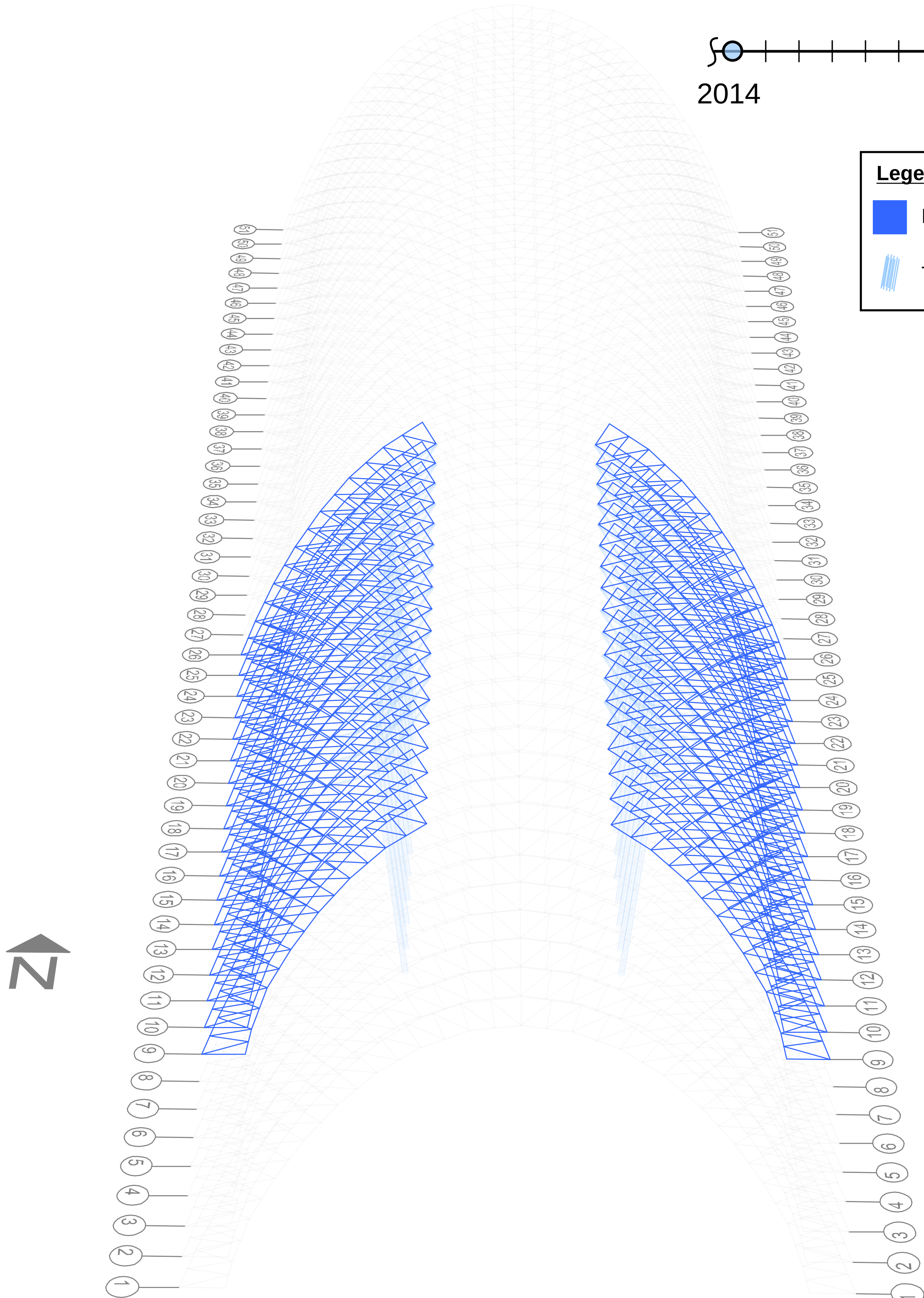





**Legend**

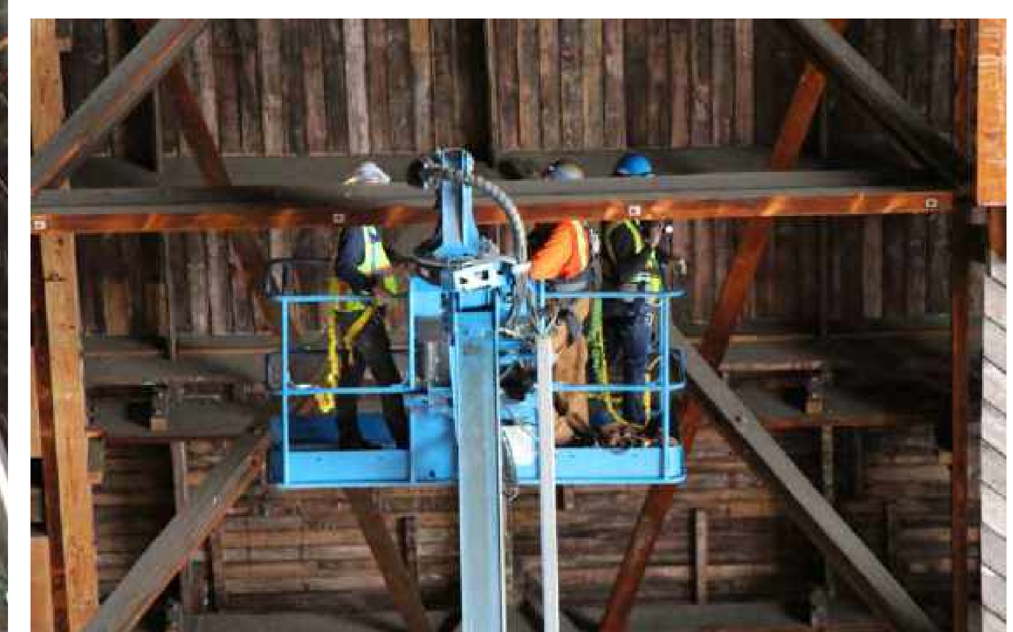
- Members surveyed below exoskeletons
- Temporary shoring

- Before the exoskeletons could be placed, the condition of the trusses below had to be verified to ensure they could take the additional weight
- Any damage of main arch members needed to be repaired prior to exoskeleton installation
- KPFF conducted a survey of main arch members between Trusses 9-26 below panel point O and 14
- **1548** main arch chords and webs were surveyed for damage




H3

*Boom lift used for visual observations*



*KPFF condition assessment crew*

# PRE-JACKING REPAIR SCOPE

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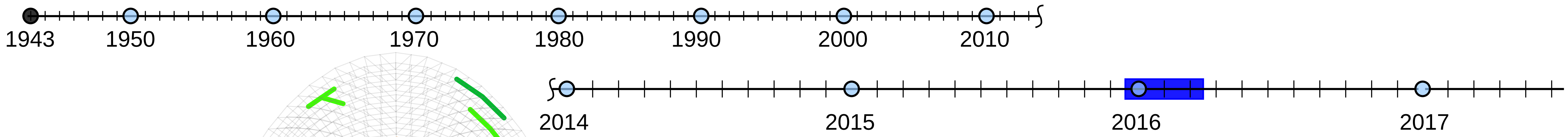
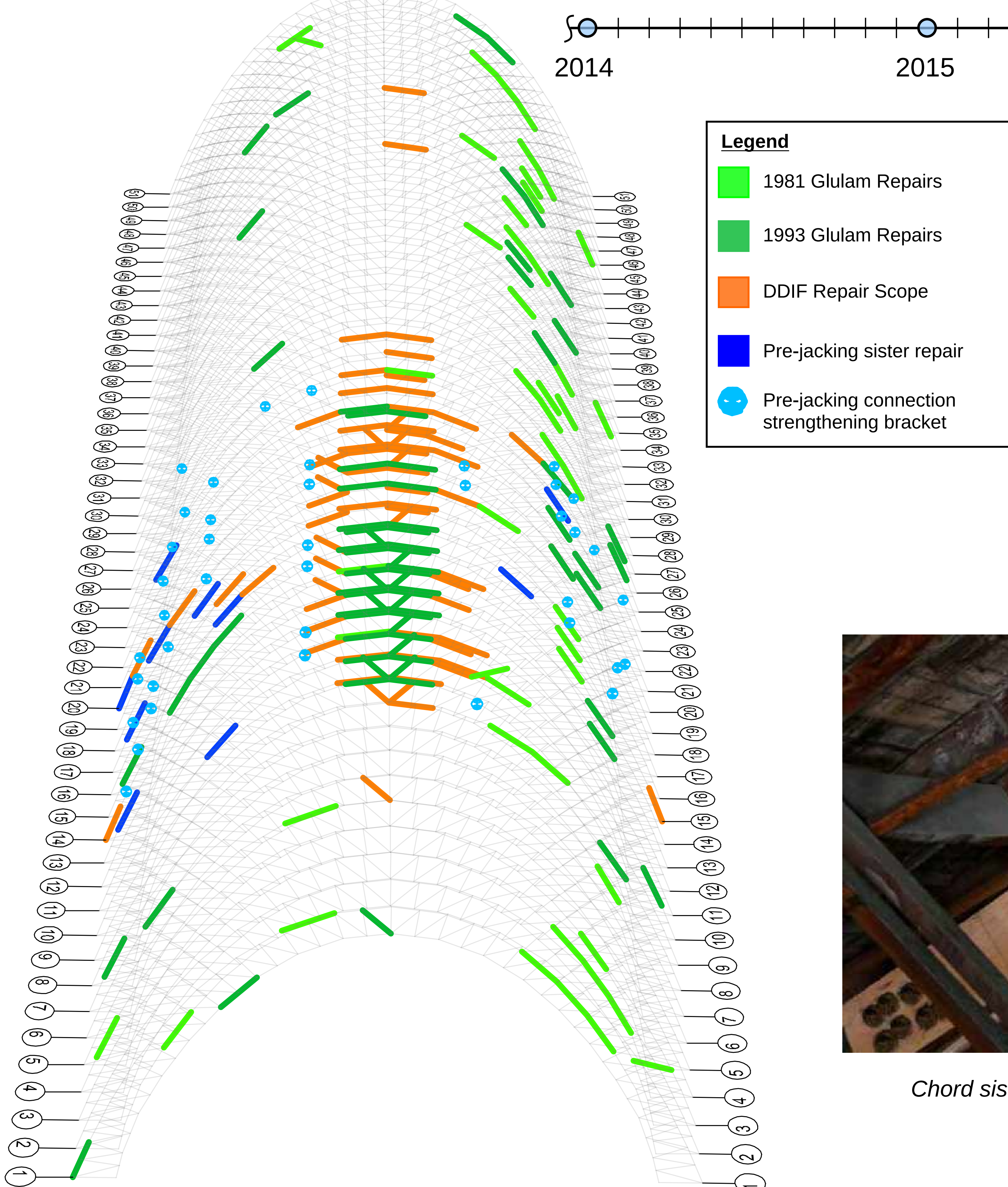


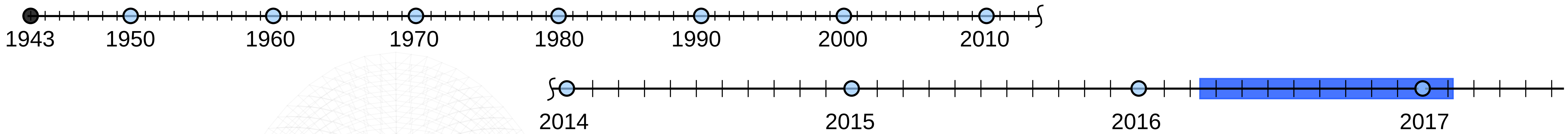




- The KPFF survey discovered chord damage which was either not observed or not present during the due diligence investigations
- The survey uncovered extensive deficiencies within the web member connections, including many plug pullout failures
- **10** additional arch members received glulam sistering repairs
- **39** chord connections received connection strengthening brackets

*Chord sister repair installed prior to exoskeletons*

*Typical connection strengthening bracket*

# ACCESS TOWER OBSERVATIONS

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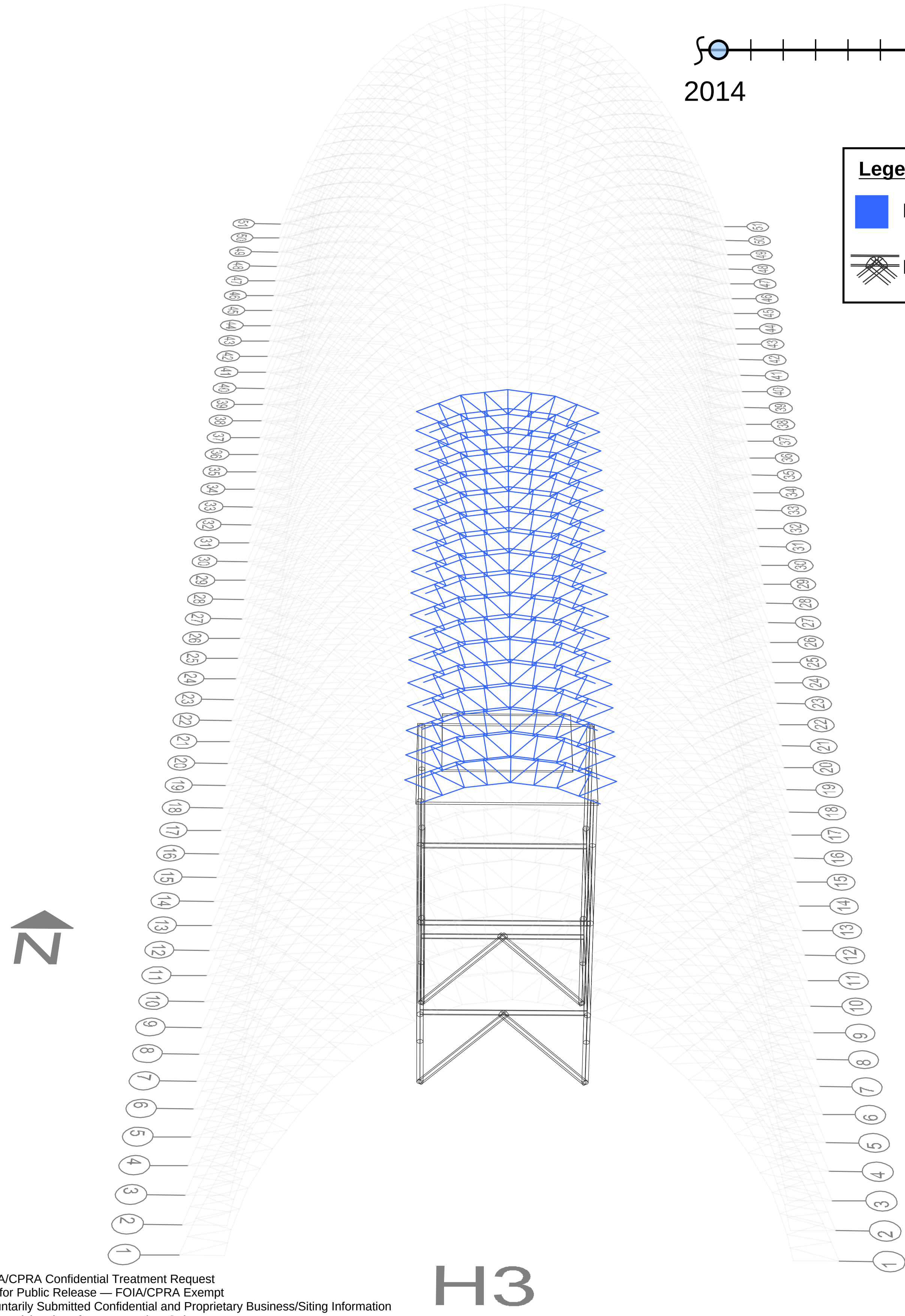
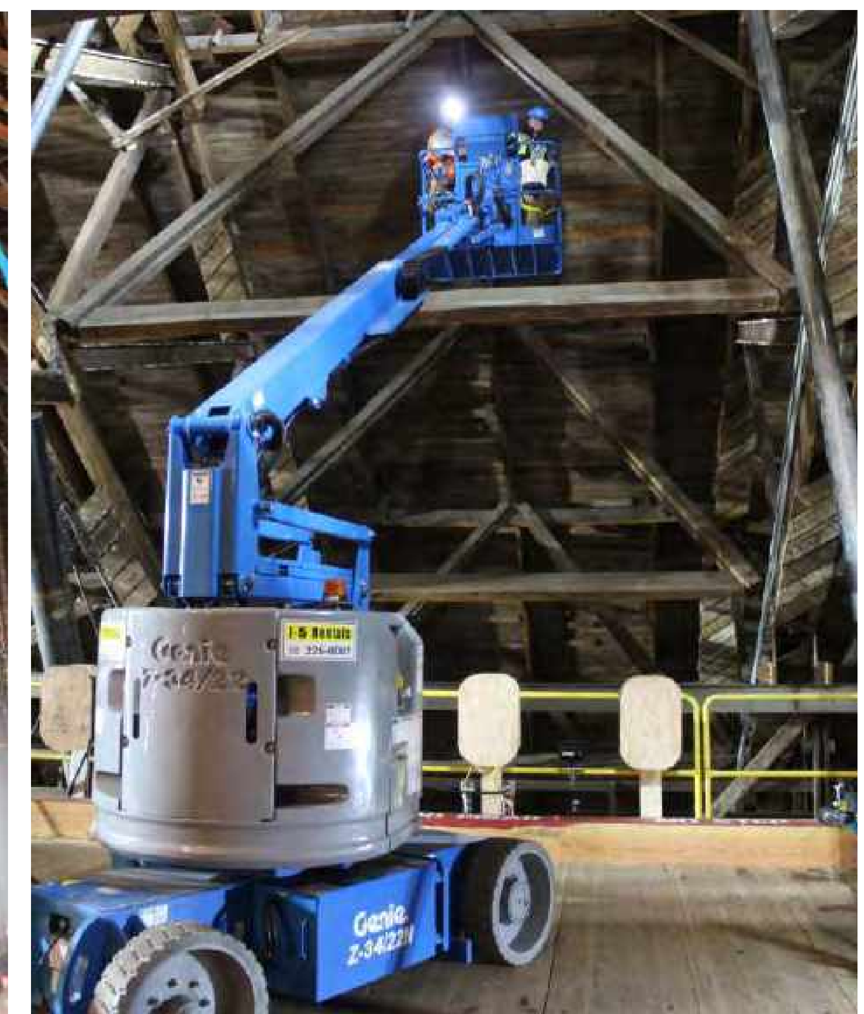



**Legend**

- Members surveyed from tower
- Movable access tower

- The movable access tower provided clearance for KPFF to make additional observations in the zones above the temporary shores
- Chord and web members were observed after each tower move before the exoskeletons were installed
- Additional damage observed in this zone was planned to be repaired after roof jacking


*Movable access tower*




*Truss observations from a boom lift on top of access tower*

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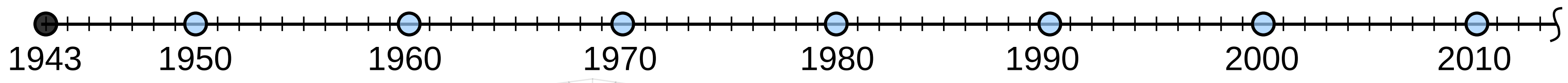
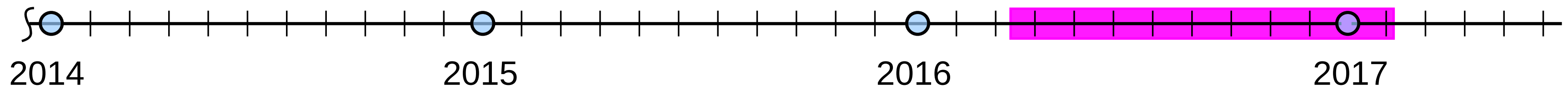
Not for Public Release — FOIA/CPRA Exempt
Voluntarily Submitted Confidential and Proprietary Business/Siting Information
Pre-Decisional Draft — For Review Only

# POST-JACKING REPAIR SCOPE

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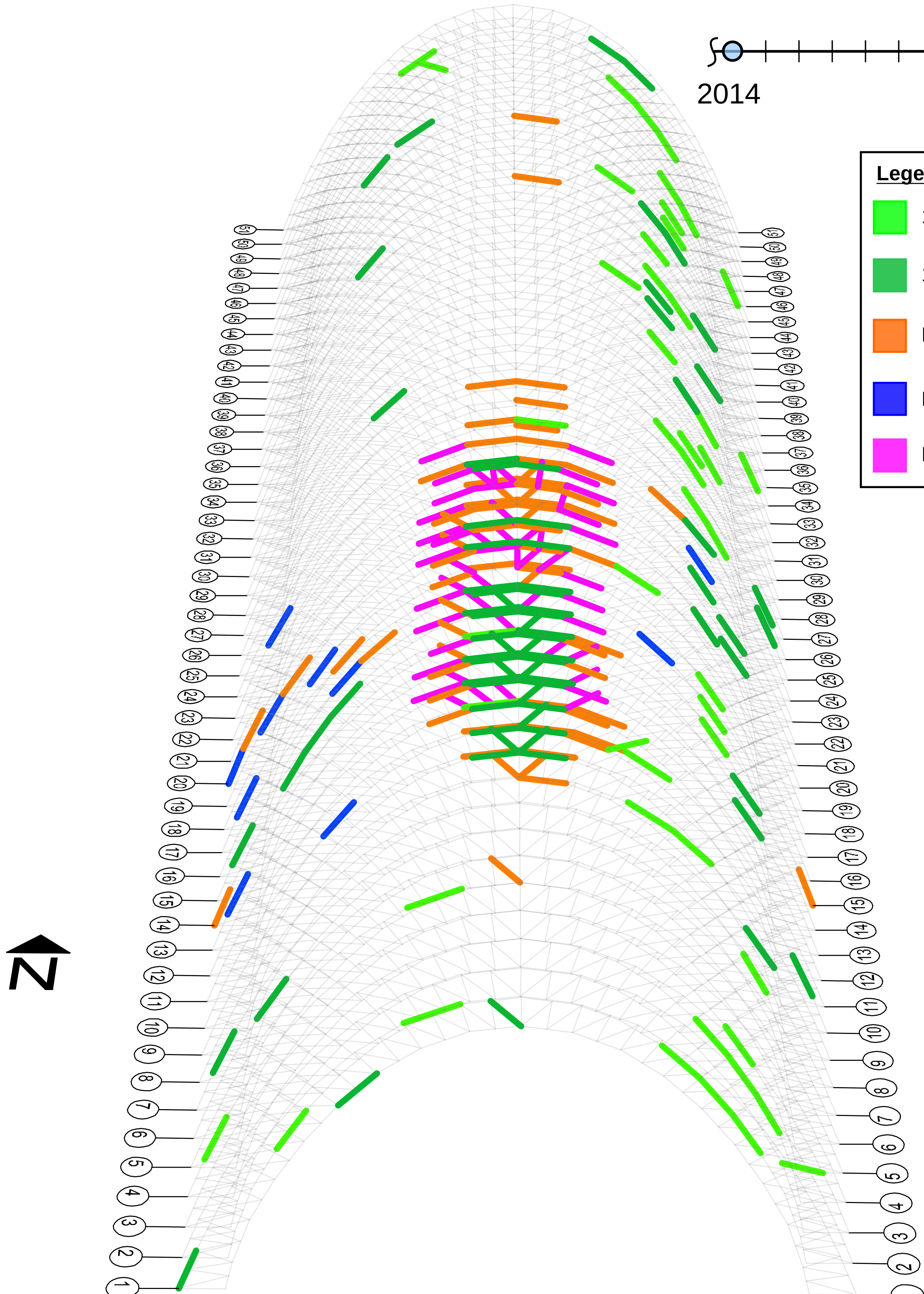
SED

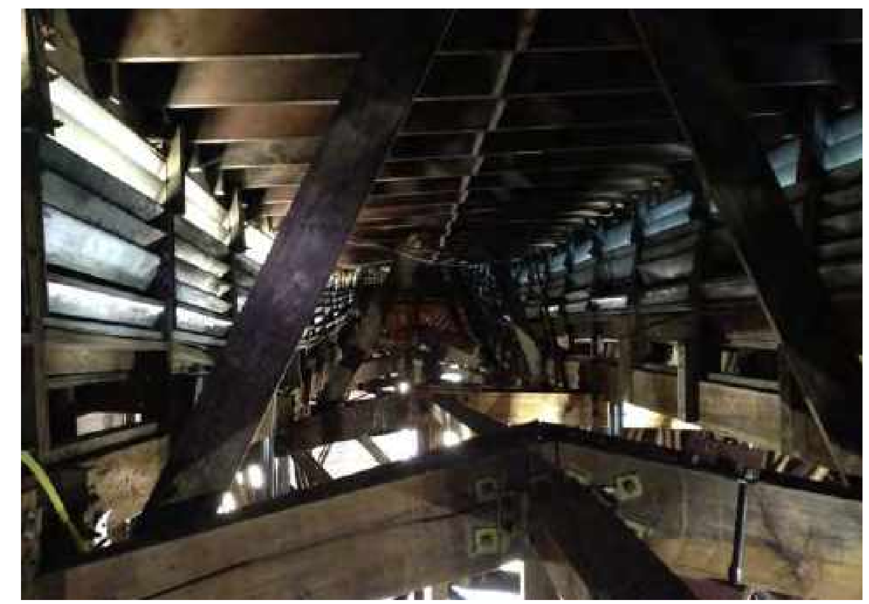



H3

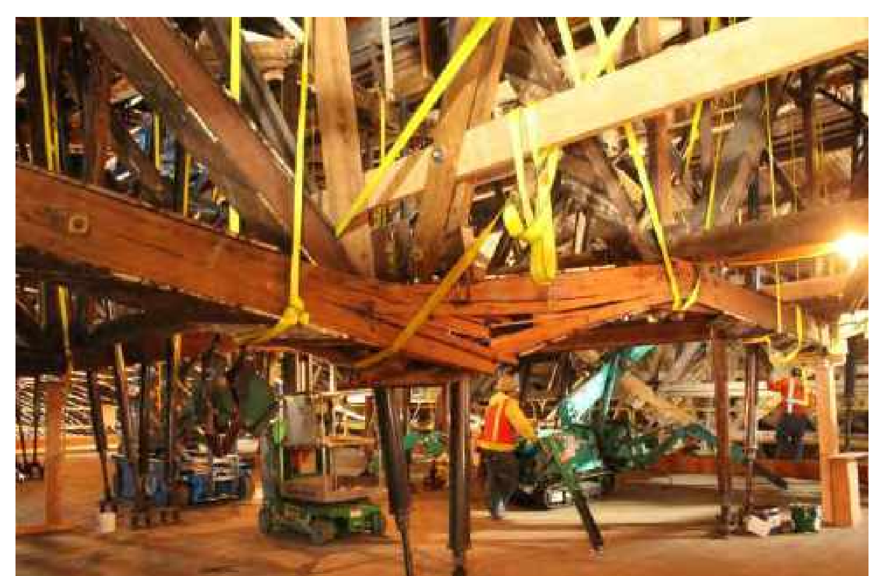
**Legend**

- 1981 Glulam Repairs
- 1993 Glulam Repairs
- DDIF Repair Scope
- Pre-jacking repair scope
- Post-jacking repair scope

- **50** additional members were identified as severely damaged and scheduled to be removed and replaced after roof jacking
- Before jacking and repairs were made, decision was made to defer further construction activities



*Roof monitor deflection in critical zone*



*Temporary strapping on chord marked for removal and replacement*

*Damaged chord member viewed from access tower*

# EXOSKELETONS

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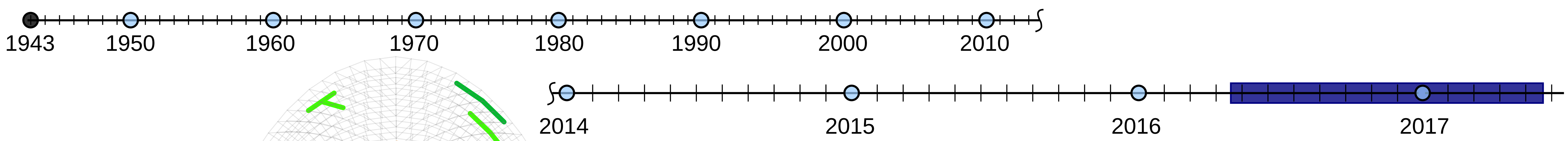
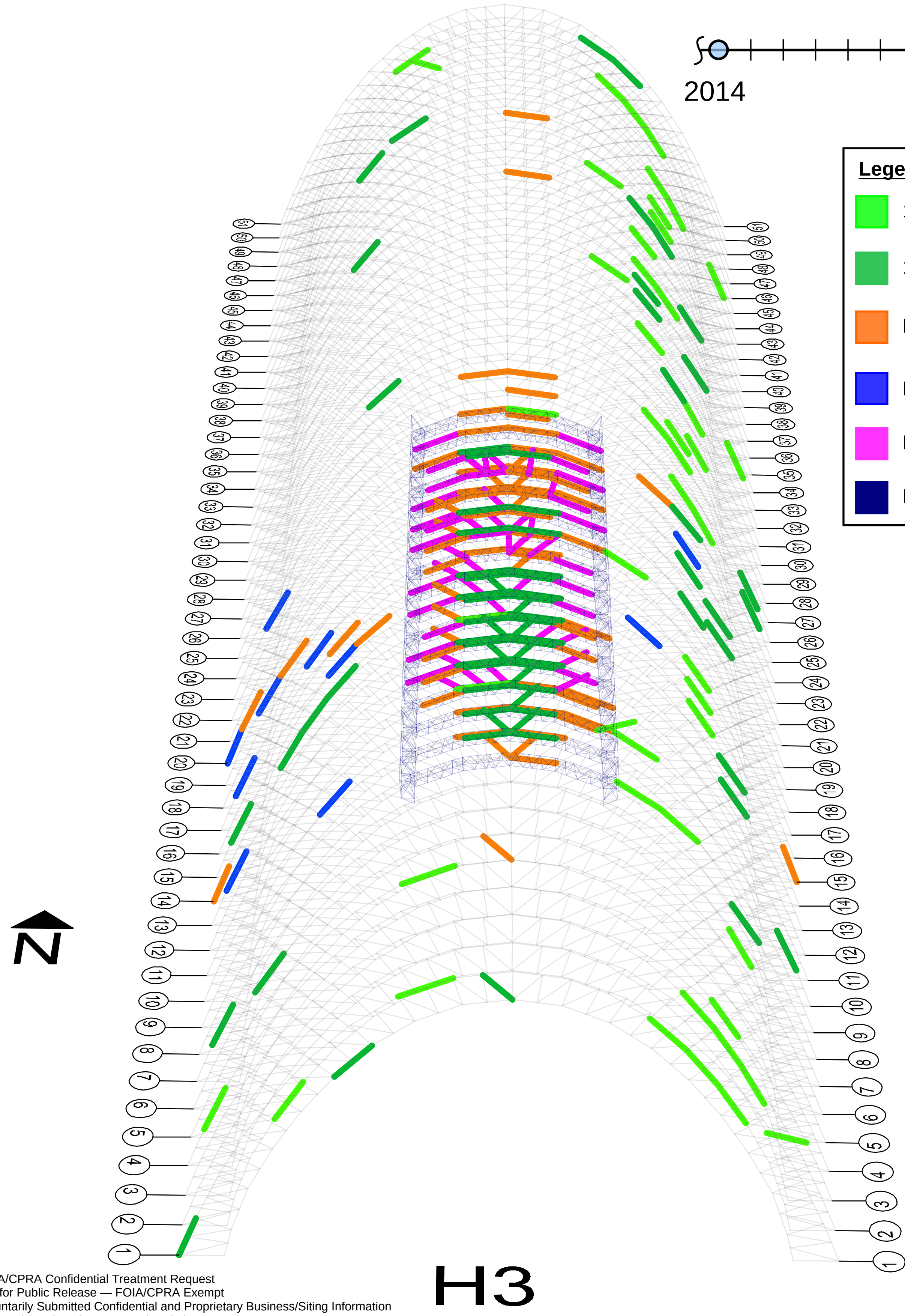



**Legend**

- 1981 Glulam Repairs
- 1993 Glulam Repairs
- DDIF Repair Scope
- Pre-jacking repair scope
- Post-jacking repair scope
- Exoskeletons

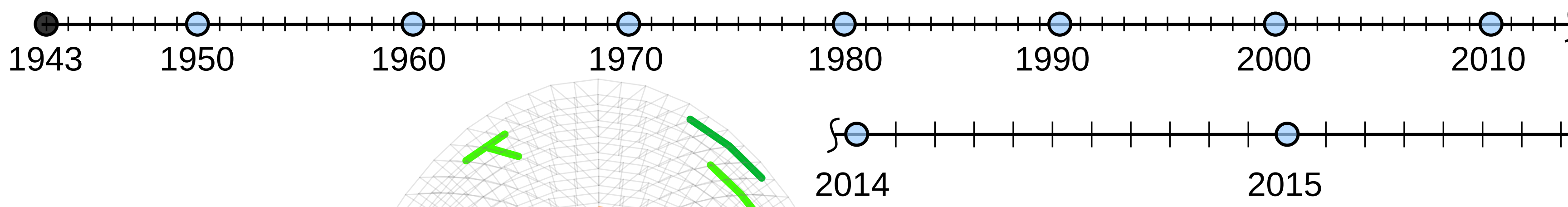
- Steel exoskeletons were installed at Trusses 9-26 after observations were made.

*Hoisting exoskeleton segment into place*

*Installed exoskeletons*

# DAMAGE PROGRESSION

kpff San Francisco

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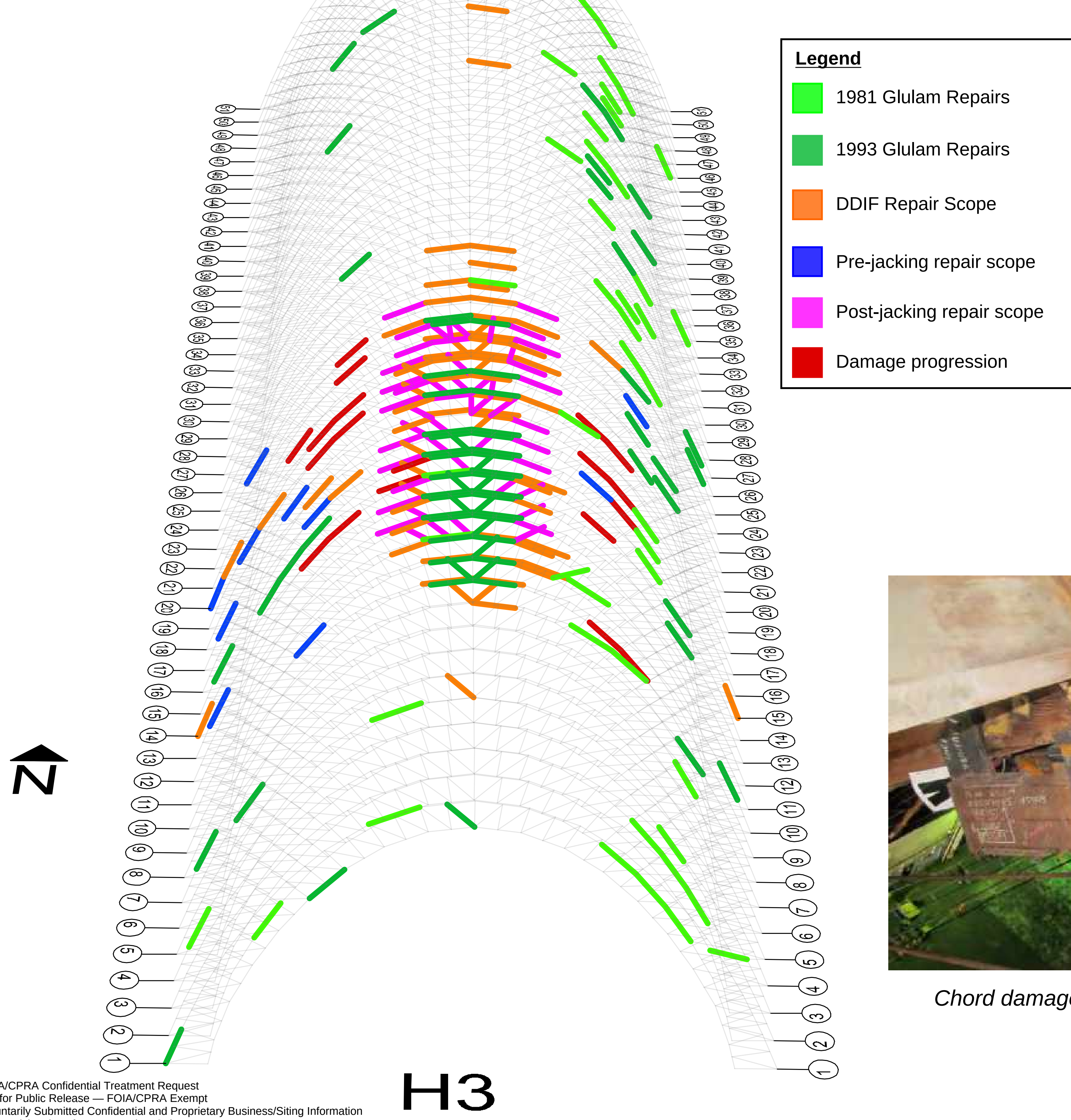



- Months after installation of exoskeletons, major splits were observed in chord members which had previously been observed and cleared.
- Major damage was observed on **19** chords, most between panel points I to M.
- Sistering repairs installed on most severe cases
- Due to the concentration of new damage at the lower chord members at panel points I to M, preemptive measures were taken to help reduce the progression of damage.
- Preemptive measures included fully-threaded screws at connections, and steel clamps.


*Chord damage at node K after exoskeleton install*

*Preemptive screw and clamp strengthening on undamaged chord at node K*

# A.4 KPFF, "Moffett Federal Airfield Hangar 3 – Mountain View, California, Structural Site Observations" (August 21, 2019)

45 Fremont Street, 28th Floor San Francisco, CA 94105 415.989.1004 kpff.com

August 21, 2019

Sallie Lim
Director
Legal Department / Google Inc.
1600 Amphitheater Pkwy
Mountain View, CA 94043 **VIA Email: sallie@google.com**

Gary S. McKitterick, Esq.
Partner
Allen Matkins Leck Gamble Mallory & Natsis, LLP
1900 Main Street, 5th Floor
Irvine, CA 92614-7321 **VIA Email: gmckitterick@allenmatkins.com**

Subject: Moffett Federal Airfield Hangar 3 – Mountain View, California
Structural Site Observation

Dear Ms. Lim and Mr. McKitterick:

As part of the quarterly Hangar 3 structural assessment, I've recently conducted a site visit on behalf of Planetary Ventures to visually observe the general condition of the existing hangar structure and the temporary shoring devices that were left in place when the work was terminated. After walking the entire Hangar 3 structure, I have prepared the following comments, observations and conclusions:

Overall Comments:

1. The original intent of the emergency truss repair program was to return the damaged and broken arched trusses to their original deficient state.
2. The emergency truss repair program was ultimately abandoned due to the numerous severely damaged arched trusses as well as the damage progression to undamaged trusses which continued to occur during the installation of the required repairs.
3. Once abandoned, additional shores were installed, shoring support elements were left in place and the shoring platform was positioned in a manner to provide asset protection. These steps were meant to be a temporary or short term solution to assist with the protection of the damage elements.
4. The structure remains unsafe and is very vulnerable to further damage or partial collapse while left in its current unrepaired state.

Observations:

5. Upon arrival at the site, the hangar was locked up and not accessible as previously recommended.
6. We did not observe any wood material or other debris which had fallen from the existing framing to the hangar deck below.
7. It was not apparent that further damaged had appeared since our last site visit and the monitoring program has been discontinued.

Conclusions:

8. Overall, the hangar structure has existed well past its original design life. Varying levels of damage exist to other parts of the timber framing, beyond that of the work outlined in the Emergency Truss Repair work. Subsequently, the level of repair required to return the hangar to its original deficient state is excessive and cost prohibitive.
9. The shoring and platform shoring, which were left in place as a means of providing short term asset protection were only intended to be short term. Previous discussions had placed the time limit describing "short term" at roughly 2-3 years maximum.
10. Further, in its current unrepaired state, the structure is far more vulnerable to sustaining further damage and even experiencing partial collapse of areas from earthquake and/or high wind loading.
11. Finally, it is my professional opinion, that the structure left in its current unrepaired and unsafe condition is likely uninsurable.

Based on my discussion above, it remains my professional opinion that the hangar is unsafe, should not be occupied and could become a potential site hazard from seismic and/or high wind forces. In addition, the work required to return the hangar to a limited Occupiable use level, is extensive and undefinable and further, the necessary work required would be cost-prohibitive and is therefore not salvageable.

This concludes my structural site visit observation report and status update on the existing hangar 3 structure. Please feel free to contact me if you have further questions or comments.

Very truly yours,

Blake W. Dilsworth, S.E.
Principal

BWD/MFA Hangar 3 00 20100821 L1

# Appendix B Historic Property Information

## B.1 NAS Sunnyvale Historic District National Register of Historic Places Nomination (1994)

**United States Department of the Interior**
National Park Service

# National Register of Historic Places Registration Form

This form is for use in nominating or requesting determinations of eligibility for individual properties or districts. See instructions in *Guidelines for Completing National Register Forms* (National Register Bulletin 16). Complete each item by marking "x" in the appropriate box or by entering the requested information. If an item does not apply to the property being documented, enter "N/A" for "not applicable." For functions, styles, materials, and areas of significance, enter only the categories and subcategories listed in the instructions. For additional space use continuation sheets (Form 10-900a). Type all entries.

## 1. Name of Property

historic name: United States Naval Air Station Sunnyvale, California- Historic District
other names/site number: U. S. Naval Air Station Moffett Field - Central Historic District

## 2. Location

street & number: Central District — [ ] not for publication
city, town: Naval Air Station Moffett Field — [ ] vicinity
state: California code: CA county: Santa Clara code: CA 085 zip code: 94035

## 3. Classification

**Ownership of Property**
- [ ] private
- [ ] public-local
- [ ] public-State
- [X] public-Federal

**Category of Property**
- [ ] building(s)
- [X] district
- [ ] site
- [ ] structure
- [ ] object

**Number of Resources within Property**

| Contributing | Noncontributing | |
|---|---|---|
| 40 | 54 | buildings |
| | | sites |
| 1 | | structures |
| 2 | | objects |
| 43 | 54 | Total |

Name of related multiple property listing:

Number of contributing resources previously listed in the National Register 1

## 4. State/Federal Agency Certification

As the designated authority under the National Historic Preservation Act of 1966, as amended, I hereby certify that this [ ] nomination [ ] request for determination of eligibility meets the documentation standards for registering properties in the National Register of Historic Places and meets the procedural and professional requirements set forth in 36 CFR Part 60. In my opinion, the property [ ] meets [ ] does not meet the National Register criteria. [ ] See continuation sheet.

Signature of certifying official — Date

State or Federal agency and bureau

In my opinion, the property [ ] meets [ ] does not meet the National Register criteria. [ ] See continuation sheet.

Signature of commenting or other official — Date

State or Federal agency and bureau

## 5. National Park Service Certification

I, hereby, certify that this property is:

- [ ] entered in the National Register.
  - [ ] See continuation sheet
- [ ] determined eligible for the National Register. [ ] See continuation sheet.
- [ ] determined not eligible for the National Register.
- [ ] removed from the National Register.
- [ ] other, (explain:)

Signature of the Keeper — Date of Action

## 6. Function or Use

| Historic Functions (enter categories from instructions) | Current Functions (enter categories from instructions) |
|---|---|
| Defense Naval Facility | Defense Naval Facility |
| Air Facility | Air Facility |

## 7. Description

| Architectural Classification (enter categories from instructions) | Materials (enter categories from instructions) |
|---|---|
| | foundation concrete |
| Late 19th and 20th Century Revivals | walls stucco |
| Mission/Spanish Colonial Revival | |
| Other: Dirigible Hangar | roof clay tile |
| WW II Blimp Hangar (2) | other terra cotta panels |

Describe present and historic physical appearance.

### SITE DEFINITION

The site consists of a large number of buildings that were constructed over an approximately 60 year time frame from the early 1930's until today. The buildings are clustered in a formal campus-like layout that is defined by a western-facing gated entrance and a very well tended landscape which includes mature specimen trees, shrubs, and manicured lawns.

The site can be easily divided into its stylistic components that also define the different eras of construction over the base's lifetime.

The oldest and most historically significant buildings, from an architectural and engineering standpoint that form a coherent core, include the formal cluster of buildings dating from 1933 that lead up to, and include, the imposing Hangar #1 (the original dirigible hangar) and WWII Blimp Hangars. This area of the base is bounded by Bushnell Road on the north, the automobile parking spaces behind Sayre Avenue on the east, Westcoat Road on the south; and the entry, Clark Road, on the west. The central area is laid out in an axial plan in a northeasterly direction with the original buildings symmetrically placed along a grand central greensward. In addition to this very defined central space where the earliest major base buildings are located, there is an equally significant adjunct of 9 officers' residences clustered around Berry Drive just to the south of the main gated entrance in another formally laid out plan with grass medians, a grass island at the end of the southern cul-de-sac, and a characteristically suburban curved residential street. In keeping with the symmetry that was so strong to the original plan, another unbuilt residential complex was originally planned for the northern side of the entrance drive.

These earliest buildings, which were designed by the Navy Department Bureau of Yards and Docks, exemplify California's most popular contemporary architectural style of the 1920's and early '30's. They are constructed in a late Spanish Colonial Revival architectural style (a style that was equally as popular in government construction in the eastern sections of the United States during the 1920's and into the early 1940's), as well as aspects that presage the modern designs of the Internationalist styles which would predominate in American architecture for the next thirty-five years (from approximately 1940 to 1975) .

[X] See continuation sheet

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

NATIONAL REGISTER OF HISTORIC PLACES
EVALUATION/RETURN SHEET

REQUESTED ACTION: NOMINATION

PROPERTY NAME: US Naval Air Station Sunnyvale, California, Historic District

MULTIPLE NAME:

STATE & COUNTY: CALIFORNIA, Santa Clara

DATE RECEIVED: 1/11/94 DATE OF PENDING LIST: 1/26/94
DATE OF 16TH DAY: 2/11/94 DATE OF 45TH DAY: 2/27/94
DATE OF WEEKLY LIST:

REFERENCE NUMBER: 94000045

NOMINATOR: FEDERAL NAVY

REASONS FOR REVIEW:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| APPEAL: | N | DATA PROBLEM: | N | LANDSCAPE: | N | LESS THAN 50 YEARS: | N |
| OTHER: | Y | PDIL: | N | PERIOD: | N | PROGRAM UNAPPROVED: | N |
| REQUEST: | N | SAMPLE: | N | SLR DRAFT: | Y | NATIONAL: | Y |

COMMENT WAIVER: N

✓ ACCEPT ___RETURN ___REJECT 2/24/94 DATE

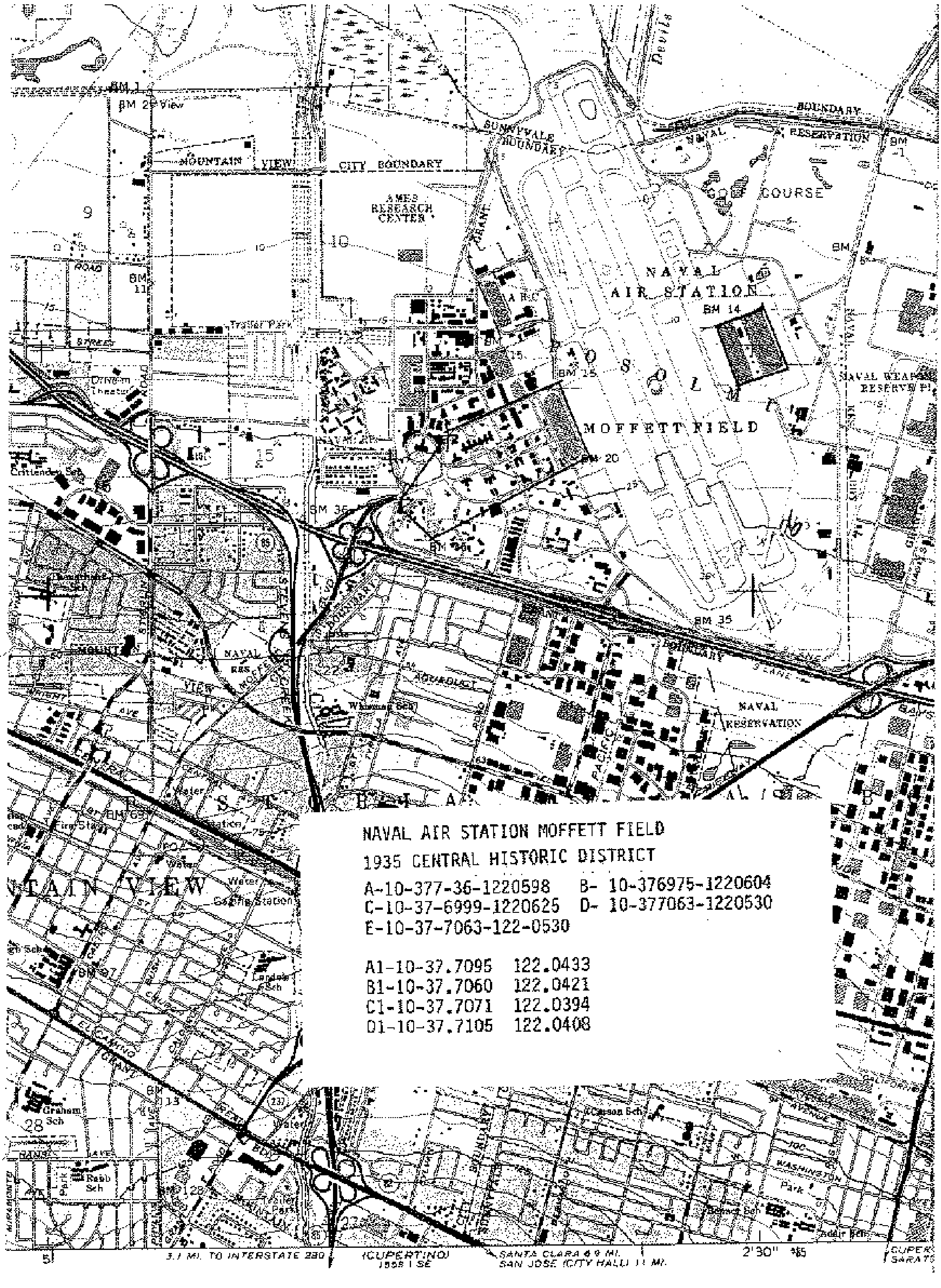
ABSTRACT/SUMMARY COMMENTS:

The U.S. Naval Air Station Sunnyvale, California Historic District is eligible under NR criteria A and C in the areas of Military History, Architecture, and Engineering. The discontiguous district represents a rather unique and significant episode in the development of U.S. naval aviation prior to World War II. The Sunnyvale base was one of two Naval Air Stations built to port lighter-than-air dirigibles during the 1930s. Dirigible Hangar #1, the later blimp hangars # and #3, and their accompanying support buildings all represent excellent examples of early twentieth-century military planning, engineering, and construction.

The three enormous airship hangars represent significant engineering accomplishments and they are among a limited number of extant historic airship facilities in the United States. The core o the historic Naval Air Station--centered on a landscaped "common" and dominated by the looming airship hangars--remains largely intact and includes fine regional examples of Spanish Colonial Revival design.

RECOM./CRITERIA Accept A+C
REVIEWER Paul R. [illegible]
DISCIPLINE [illegible]
DATE 2/24/94

DOCUMENTATION see attached comments Y/N see attached SLR (Y)/N

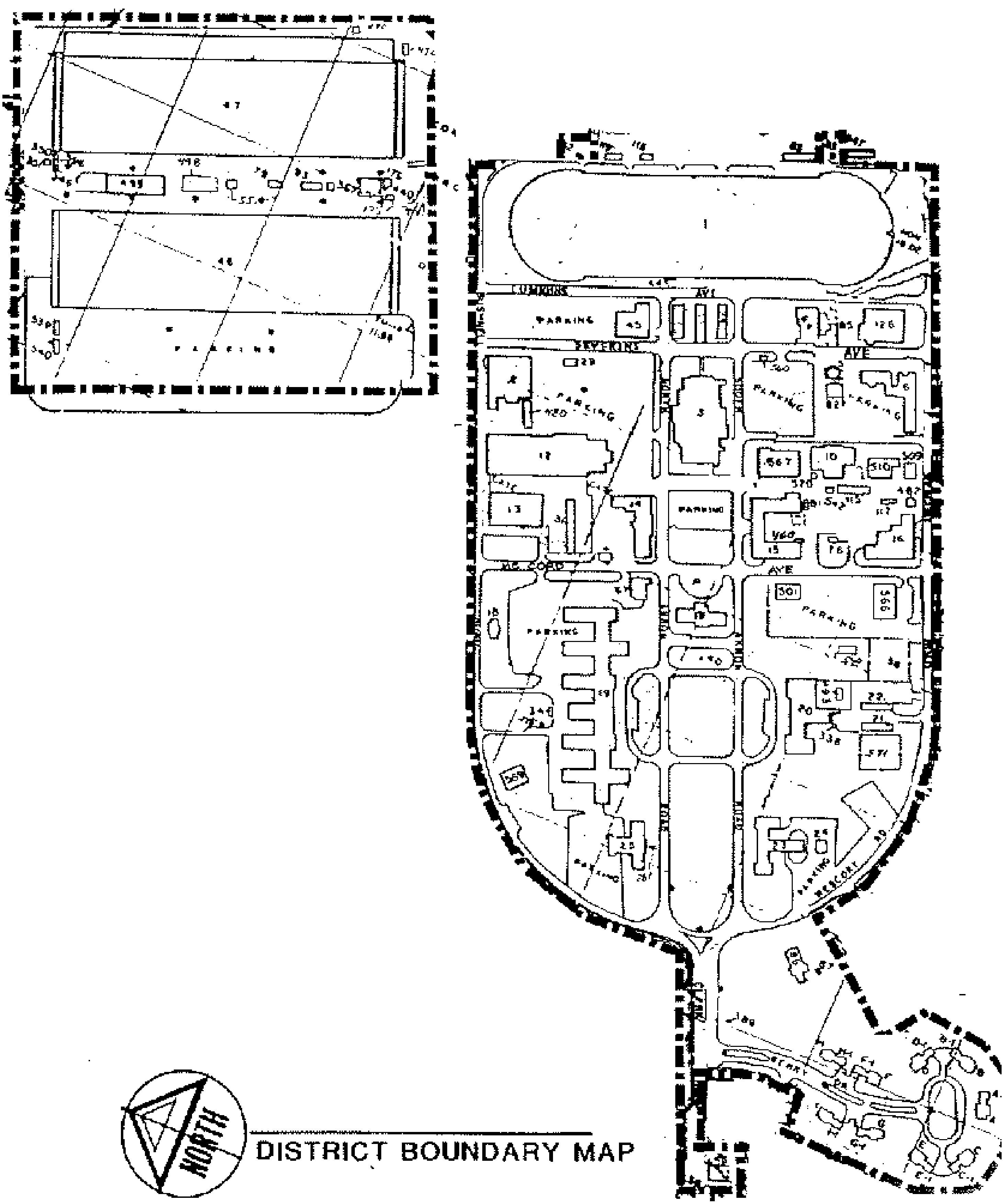



NAVAL AIR STATION MOFFETT FIELD

1935 CENTRAL HISTORIC DISTRICT

A-10-377-36-1220598 B- 10-376975-1220604
C-10-37-6999-1220625 D- 10-377063-1220530
E-10-37-7063-122-0530

A1-10-37.7095 122.0433
B1-10-37.7060 122.0421
C1-10-37.7071 122.0394
D1-10-37.7105 122.0408




DISTRICT BOUNDARY MAP

## HISTORIC DISTRICT BUILDING LIST

| Building | Contributing/ Non-Contributing | Building | Contributing/ Non-Contributing |
|---|---|---|---|
| 1 | C | 79 | NC |
| 2 | C | 81 | NC |
| 3 | NC | 85 | NC |
| 5 | C | 86 | NC |
| 6 | C | 87 | NC |
| 12 | NC | 93 | NC |
| 13 | NC | 115 | NC |
| 14 | NC | 117 | NC |
| 15 | C | 123 | NC |
| 16 | C | 133 | NC |
| 17 | C | 175 | NC |
| 18 | C | 333 | NC |
| 19 | C | 338 | NC |
| 20 | C | 346 | NC |
| 21 | C | 350 | NC |
| 22 | C | 351 | NC |
| 23 | C | 367,389 | NC |
| 24 | C | 396 | NC |
| 25 | C | 440,460 | NC |
| 26 | C | 470 | NC |
| 29 | NC | 472 | NC |
| 31 | NC | 478,482 | NC |
| 32 | C | 493 | NC |
| 33 | C | 498 | NC |
| 34 | NC | 499 | NC |
| 36 | NC | 501 | NC |
| 37 | C | 509 | NC |
| 38 | NC | 510 | NC |
| 40 | NC | 527 | NC |
| 44 | NC | 542 | NC |
| 45 | NC | 553 | NC |
| 46 | C | 566 | NC |
| 47 | C | 567 | NC |
| 55 | C | 569 | NC |
| 64 | NC | 570 | NC |
| 67 | NC | 753 | NC |
| 76 | NC | 941 | NC |
| | | 942,943 | NC |

This hybrid style forms a unifying element that not only holds the myriad of architectural uses together, but gives the entire complex a very satisfying central theme. The style is highly ornamented in the most significant buildings (such as the Administration and Bachelor Officers' Quarters) and stripped of ornament, but no less supportive of the whole in the smaller out buildings and garages. Interestingly, the building that is the raison d'etre of the entire Naval Air Station, Hangar #1, eschews any historicism in its design, but rather reflects the highest Streamline Moderne forms of modern technology at its finest.

Another slightly newer cluster of buildings is also defined by their distinctive architectural style which reflects the most popular designs of their time. These buildings are those structures which were built in the 1940's and early '50's and that are designed in a very plain International style of architecture defined by the simple stripped geometrical forms of the structures. These interesting examples are located at a few scattered sites within the original plat noted above (i.e. the Post Office, #67, for example), as well as being set in a long row along Dailey Road between the original campus plan and the Bayshore Freeway (#152). Other noteworthy buildings include the Control Tower (#158) at the far eastern edge of the site and the original Chapel Building (#86), which is a reinterpreted hybrid style that exhibits aspects of both a stripped Spanish Colonial Revival design and ornament hinting at more of a Mission Revival style. Additionally, two slightly smaller, but no less impressive hangars (Hangar #2 and #3), were constructed across the runways to the east of Hangar #1. These buildings were designed for the smaller blimps that replaced the huge rigid framed dirigibles of the 1930's for which Hangar #1 was designed. They also were designed in a much more prosaic and conventional architectural style than the metal sheathed futuristic Hangar #1.

A building that provides visual compatibility with the 1930's Spanish Colonial Revival buildings is the Chapel. This is due both to its physical location within the historic district, as well as to its architectural design, which is much more compatible with the older buildings on the base rather than the later International styled buildings. Early photos of the building illustrate a structure whose basic form of rather simply pitched cruciform plan appears to be very standard designed archetype military base chapel of the 1940's. But to this basic form, the designers add very site specific detailing which, though not technically a re-creation of the Spanish Colonial Revivals around it, very handsomely picks up hints of the building characteristics of the older structures. These details include, most importantly, the cupola which mimics the tower on the Administration Building, and the projecting curvilinear portico with its stone-like entry frame which takes directly from the Spanish Colonial Revival interpretations surrounding. The end result is an almost textbook example of a successfully designed new structure sensitive to an established architectural campus. Because the chapel was constructed well after the 1933 period it is not a contributing building to the historic district.

Because the International style buildings are less than 50 years old and are not individually exceptional, they will not qualify for listing in the National Register at this time and will not be discussed in any detail. This group consists of buildings 148-156, 158 and building 67.

In addition to these two major stylistic groupings, there are a number of other buildings on the site that have been constructed over the past approximately 50 years that fill up the site, but do not represent very fine examples of architectural design. These buildings are characterized by their utilitarian function, such as the number of Quonset huts (#111, #118 and #119) found throughout the site, as well as the plethora of small wooden and stucco buildings with little discernible styling that comprise much of the barracks, enlisted housing, shopping and warehousing spaces (#E-52, #E-13, #E-29, #347, #223, #245, and #244).

Thus from a specific design standpoint, the site can be divided into the following five main components that comprise its strongest identifying features:

A. Original Spanish Colonial Revival Design
B. Significant Engineering Features (Hangars #1,#2,&#3)
C. Miscellaneous Supportive Design Features
D. Post 1935 buildings designed in the Spanish Colonial Revival Style
E. International Style Buildings from the 40's

Out of these five categories, the proposed historic district from the 1930's will include all those features identified with item "A, B & C" immediately above.

## A. ARCHITECTURAL DESCRIPTION OF THE SPANISH COLONIAL REVIVAL-DESIGNED ORIGINAL BASE BUILDINGS.

The original plan of Moffett Field was constructed in an architectural style that had as its antecedent the exuberant and capricious ornamentation applied by the 17th Century architect, Jose Churriguere, and eloquently revived by Bertram Goodhue in the design for the 1915 San Diego Panama Pacific Exposition. The Navy first attempted the style at Chollas Heights Radio Transmission Station in 1916 and followed with Goodhues' Marine Corps Recruit Depot, c. 1920, Naval Air Station North Island, c.1921, and his sketches for the Naval Training Center in San Diego, a year or so later. This form of Spanish Colonial Revival design reached its zenith at the end of the 1920's and was gradually losing favor to the modern designs of the mid-to-late 1930's. By the 1940's only some very late examples, usually transitional in styling that reflected the rise of both modern schools of architecture (Moderne and Deco styles, as well as the later International or Bauhaus-influenced styles) were being built.

The complex of original buildings that comprise the heart of the Naval Air Station Moffett Field are examples of late Spanish Colonial Revival design reflecting a much more severe example of this style with strong influences of the more modern style precepts, as well as hints of Eastern Colonial designs. The resulting hybrid significantly alters the original architecture of this style.

# National Register of Historic Places Continuation Sheet



These buildings are characterized as essentially two-storied white or off-white stucco structures that are capped by very low-pitched Spanish tile roofs, which are punctuated by projecting chimneys, air ducts and, in the case of the true centerpiece building, the Administrative Building (#17), a richly ornamented, roof pavilion where corner columns support a decorated dome. The buildings are all rectangular in plan with either central projecting spaces or corner wings. Wall surfaces are very plain with the major break up of space occurring either in the location of rectangular-shaped windows, slightly projecting stringcourses between the floors, round arched entryways or arcaded ornamentation styled to look like granite around the major entry doors and surrounding significant window spaces.

It is the variation of the above major design elements that define the original base architecture. The two most handsome entrances are the round arched arcades that distinguish both the aforementioned Administration Building and the equally impressive Bachelor Officers' Quarters (#20). Repeated ornamentation include the flattened urn motif, various cartouches, and quarter-foil windows found along the exterior surfaces of all the major structures. The juxtaposition between the flat surfaces of the exteriors contrasting with the florid ornament around the major doors and windows provide the perfect tension that distinguishes the Spanish Colonial Revival style. A notable somewhat stripped example of this style is the impressive original Aircraft Tower (#18).

Some of the minor out-buildings, although stripped of much ornamentation, exhibit sensitive design features such as the low stepped parapets of buildings #22 and #2, the repeated multilight apertures of #10, and the simple, yet distinctive massing of the original portions of #6, which acts to reinforce the common design theme throughout the historic core. All of these original outbuildings significantly reinforce the common design theme of the historic campus.

The second cluster of original buildings, which forms an equally impressive uniform design statement, is found in the earliest residential units of the detached officers housing. In this extremely pleasant space, made so by its luxuriant landscaping and large unbroken lawns, a very simple house plan is repeated with only slight variations. The structures are designed in a very stripped and somewhat severe Spanish Colonial Revival style with two-storied, rectangular plan residences joined to a garage, either a one or two storied garage, by an arcade. The roof lines are low pitched gables that are sheathed in red Spanish tiles and punctuated by end fireplaces. Apertures are symmetrically placed on the structures with the dominant design characteristically reserved for the front entry. Windows are generally rectangular in shape, double hung and 3 over 2 in design. As with the major buildings on the working base section, here two stringcourses and various door surrounds provide the major contrast to the very simple stucco walls. Additionally, a similarly designed structure forms a prominent security building at the front gateway.

B. DESCRIPTION OF THE ORIGINAL ENGINEERING FEATURES (HANGARS #1, #2, AND #3)

Completely separate in design, but of such striking style and size as to warrant separate discussion are the three buildings that form the raison d'etre of the entire complex. The three hangars are of such proportions that for this reason alone they warrant the title "landmark". Aesthetically, the original hangar, which was constructed to hold USS MACON, a dirigible, is of such a unique design that it stands apart even from its later sister buildings. Hangar #1 is a metal sheathed behemoth whose rounded shape is both the epitome of the aerodynamically influenced Streamline Moderne style as well as a stylistic cousin to the huge airship that originally berthed inside the mammoth hangar.

Above all other buildings found on the Moffett Field site, Hangar #1 is without question the most significant building both architecturally and historically. It is one of the major buildings of Northern California, and has been recognized as an Engineering Landmark by the American Society of Civil Engineers.

Hangars #2 and #3 are significant more for their size than their unique styling or design. They represent more prosaic attempts at constructing very large military hangars. Similarly designed structures are found on Marine Corps Air Station, Tustin, California and at Coos Bay, Oregon. The more common design does not, however, detract from the sheer magnitude of the two huge buildings side by side. Along with Hangar #1, these two buildings help define the south San Francisco Bay Area from all distant directions.

C. DESCRIPTION OF THE OTHER SUPPORTIVE DESIGN ELEMENTS (I.E. LANDSCAPING, GATEWAYS, ARTWORK AND ITEMS OF INTEREST IN THE LANDSCAPE, STREET LIGHTING, AND SIGNAGE)

The third and final group of elements add immeasurably to the quality of design cohesion that characterizes the Naval Air Station Moffett Field site. These elements support the physical layout of the site plan as well as the quality of the original historical architecture. They also help define the campus-like quality of the base as well as unify the disparate building styles and types.

Most prominent of these supportive elements is the landscaping. The ubiquitous mature trees, the huge green spaces, and the careful placement of plants and shrubs which add immeasurably to the mise-en-scene. The luxuriant and well tended landscape is the first feature which one experiences after passing through the entry gate. Early photos of the site show a very desolate natural landscape which was essentially bay lowlands. Blueprint plans from April 29, 1933 illustrate the importance that a unifying and coordinating landscaping plan for the air station had in forming the basis for today's superlative luxuriant landscape. There could be no doubt that the existing grounds could not have been produced without a well conceived original plan.

Of almost equal importance in differentiating the site from its surroundings is the entry wall and gate itself (#36). Although very restrained in design, the gate forms a physical entrance into the unique area from the very bland surrounds. It should be noted that the wall, gateway, and gatehouse all derive from the original base architectural design plan.

Street furniture, interesting items on the landscape, and street lighting also add to the unique quality of the site. The furniture includes a detached community message board, a sundial and an historic anchor, both in front of building #25, as well as within the central greensward. The street lighting still retains its original bases, but the lamps themselves, from a later '50's design, are somewhat inconsistent with the Spanish Colonial Revival buildings of the historic core. Replacement with a more original form should be encouraged.

Signage too helps add to the unifying elements of the site. It is, most prominently in the historic core, understated in blue with gold lettering which is very supportive of original high design standards. Such attention to detail should also be encouraged to continue. For it is in the sum of all of these disparate features that the whole of a unique and memorable built environment results .

## INDIVIDUAL SITE DESCRIPTIONS:

The following descriptions define the special design characteristics that distinguish the architecturally significant buildings from the 1933 plan (with two notable exceptions being a description of the 1943 designed Hangars #2 and #3).

**HANGAR # 1: BUILDING #1**

The site consists of a very large (1140'x308'x194') single-story, dirigible hangar that is constructed with three hinged steel truss arches and "X" cross bracing that is sheathed in large metal plates and set on a huge rectangular-oriented, elliptical shaped, floor plan and designed in a slightly flattened parabolic form. The structure further exhibits four rows of very large rectangularshaped and horizontally-oriented window bands along its two dominating eastern and western facing flanks. These apertures appear flush with the immense metallic skin of the building and greatly add to the very futuristic aerodynamic effect of the design.

Of particular engineering note are the hangar doors that run the full height of both the north and south-facing elevations. These doors are retractable and form a halfdome shape when closed.

The building exhibits a very clean, Streamline Moderne design which perfectly mimics the form of the airships themselves. Located perpendicular to the axis of the station plan this dominate structure provides the focus of the 1933 station plan.

The mammoth structure designed to hold fully inflated giant dirigible airships from the 1930's military fleet (such as USS MACON) was actually constructed in 1932 preceding the buildings of the surrounding base which date from 1933. The structure is important due to its unique use (dirigible hangar), beautifully executed Streamline Moderne architectural design, ingenious engineering construction; and for its very size that still dominates a greatly urbanized Santa Clara County in the 1990's. From all aspects of national landmark status criteria, this building qualifies on its own. When added within the context of the surrounding supporting campus plan, the entire ensemble forms a very unique sense of place within the built environment and continues to exhibit national prominence.

HANGAR #2 AND #3: BUILDINGS #46 AND #47

The site consists of twin hangars that were designed for the, blimp fleet during WWII. They are of treated California redwood frame construction, configured on a rectangular plan in a more flattened parabolic form than Hangar #1; and characterized by their immense, moderately pitched porticoes at each of the north and south-facing hangar doors. These dominating entries are supported by very large concrete piers at each of the four corners. The twin buildings are set on a site plan that is directly oriented with the earlier Hangar #1, which is due west. The scale of the structure is exemplified by their dimensions, which at 1,075'x297'x171' (180,518 sq. ft.) make them slightly smaller than their predecessor, but still very impressive on the landscape. The use of wood construction instead of a steel truss system was in response to the war effort. Like most west coast military facilities constructed after 1941, metal was used very sparingly to conserve the resource for use in constructing ships and armament.

The design of these two buildings is in a much more conservative architectural style than the futuristic form of Hangar #1. These later hangars are almost domestic in their gabled porticoes. They definitely lack the daring and ingenuity of the other hangar's form and they are much less a unique design to the area. In fact, four other structures of like design were built on the west coast during World War II, to house the blimps used to patrol the Pacific coastal waters of the United States. Two in Coos Bay, Oregon which are no longer owned by the Federal Government and two on what is now Marine Corps Air Station, Tustin in Southern California. All four of these structures have been nominated to the National Register.

Although not of equal architectural or design merit as Hangar #1, these two like-structures are significant from both an historic perspective (as excellent extant examples of WWII blimp hangars) as well as an architectural/engineering perspective (they are after all buildings of incredible size and stature upon the landscape). The twin structures further add to the important design whole of the best of the original 1933 plan and the just slightly less impressive structures from the 1940's which help in-fill much of the site. They were completed in 1943. The combined visual power of Hangars #1, #2, and #3 form a physical presence upon the urbanscape which still dominates the low horizontal design of the Santa Clara Valley.

**ADMINISTRATION BUILDING: BUILDING # 17**

The site consists of a two-story structure that is constructed on a shallow cruciform rectangular floor plan which is built of wood and sheathed in stucco with red Spanish tile roofing and terra cotta ornamentation, especially notable in the window and door surrounds. The building is the most prominently sited structure within the 1933 campus plan. It is set in the very heart of the open grassy median as a definite center point to the original plan. Its architectural design represents a late example of Spanish Colonial Revival style with some modifications that give it a kinship with Eastern military bases of the same vintage (that were designed in dry formal interpretations of Colonial Revival).

The building is 148'x41 'x37' and contains 16,954 sq. ft. The structure is characterized by the features which define all of the original buildings: the very low pitched, slightly hipped and tiled roofline. Exterior walls are flat and devoid of ornament, save a stringcourse running the entire perimeter of the building and separating the two stories. The eave line is very shallow. Windows are simple, rectangular in plan, vertical in orientation, multi-paned and double hung. Overscaled terra cotta ornamentation define the major front and back entrances, as well as the centered second story window. The main or west-facing entrance projects out from the main structure and exhibits a triple round-arched, recessed entrance.

Ornamental urns, pilasters and floral design (characteristic of Churrigueresque Spanish architecture of the 1 7th Century) add a much needed ornamental counterpoint to the very simple and severe basic design.

A further feature which distinguishes this structure among all of the others in the original campus plan is the small centered Bell Tower. This small belvedere is capped by a diminutive, red-colored dome and distinguished by very flat arches at each of its four faces. This architectural style is much more characteristic of the colonial designs of the Eastern United States and is a major factor in classifying the overall base design as a modified Spanish Colonial Revival style.

With the nearby Bachelor Officers Quarters and the Married Officers' Residencies, the Administration Building, (which is also historically referred to as the Admirals Quarters) is the most architecturally important building from the original 1933 construction (excluding Hangar #1). This building sets the design criteria that is followed throughout the original campus plan. It acts both as a handsome example of hybrid revivalist architecture which is prominently set at the most important axial juncture of the site and as one of the most lavishly ornamented of Moffett Field's original structures. As such, the Administration Building is a key to the historic fabric of the site.

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BACHELOR OFFICERS QUARTERS: BUILDING #20

The site consists of a large, two-storied structure that was constructed on an irregular rectangular shaped site plan which is actually symmetrical in form. The building exhibits a more ornamented interpretation of a hybrid Spanish Colonial Revival architectural design. It is characterized by the same basic features that distinguish all of the original buildings. The roofline is lowpitched and sheathed in red Spanish tile, the eave is fairly shallow, wall surfaces are unadorned white stucco; and window shapes are paired rectangular forms which are double hung, 3 over 2 in form. Major entrances are distinguished by terra cotta facing that emulates granite. Three large round arches provide the building with a very elegant entryway. Flat unadorned pilasters separate these arches. They are further adorned with flat urn detailing. The characteristic stringcourse separates the two floors. A rear wing projects toward the south.

The structure is sited symmetrically across from the equally prominent, but slightly less architecturally impressive, Bachelor Enlisted Quarters (#19) which has been greatly enlarged with a rather bland International Style addition at both ends. The structure is further enhanced by a well conceived and equally well maintained landscape plan.

Along with the cluster of major buildings that are set along the formal axis of North and South Akron Roads, the BOQ helps define the high quality design character that distinguishes the historic core of Moffett Field. The structure is an extremely fine example of historicist architecture of the 1930's and remains a key element in the cohesion of the base's physical form.

GYMNASIUM: BUILDING #2

The site consists of a very large, single-story, plaster-sheathed, steel framed building that is constructed on a slightly irregular rectangular floor plan with a flat roof that is distinguished by slightly projecting stepped parapets that hint at the utilitarian designs of the original campus plan of 1933. the roof is wood sheathing on steel beams. This structure exhibits a ubiquitous projecting stringcourse encircling the building, as well as the very plain beige plaster walls. The major design feature on this essentially utilitarian structure is in the window placement. Here, the structure is characterized by very tall, horizontally-banded, multi-paned apertures which act to break up the surface of the exterior walls either as centered indentations on large expansions of plaster or as repeated forms which act almost like columns along the major side elevations.

This structure avoids, as do all of the original functional outbuildings, the Spanish Colonial Revival design of the major living areas of the base. Interestingly, it provides a handsome architectural bridge between the very futuristic Streamline Moderne design of Hangar #1 and the more historicist styles of the original campus plan.

# National Register of Historic Places Continuation Sheet



The site is significant both historically and architecturally. It was originally constructed to be a balloon hangar which justifies its extremely large interior single story space (19,691 sq. ft., 130'x88'x63'). Additionally, the building sets the reserved design criteria for the outbuildings on the base which handsomely support their more ornamental Spanish Colonial Revival contemporaries. Features which characterize these original outbuildings include flat roofs, shallow parapets which are slightly stepped; and severely unadorned exterior walls. Windows are rectangular in form and provide the dominant design ornamentation.

Although these buildings do not provide the obvious ornamentation, stylistic historicism or landscaped surroundings of the more apparently significant original Spanish Colonial Revival structures, they exemplify an extremely sophisticated design criteria of their own which greatly adds to the overall cohesion of the existing campus. In their own right, the Gymnasium, along with similarly designed original 1933 outbuildings such as the Garage (buildings #21 and #22), are major factors from the original 1933 design which make NAS Moffett Field so architecturally distinguished .

**BUILDING #23, INSTRUCTION BUILDING**

Fronting on Akron Road, the former dispensary is one of the buildings that defines the original architectural design and is symmetrically placed, opposite building #25, to balance the entrance to the base's formal plan. The two story, above grade, building is basically a "T" form executed with the typical elements of the Spanish Colonial Revival architecture, low pitched tile roof, stucco sheathing and terra-cotta ornamentation. The front facade has a central entrance recessed behind three arched openings that form an arcade. Terra-cotta surrounds decorate the three windows above the entry and the doors at the east and west ends. The building, originally the base dispensary, was enlarged by the U.S.Army's Air Corps in 1936, when extensions were added to the rear and the east end. The building is 105 feet by 96 feet and 10,995 square feet of floor space.

Of the original buildings, #23 and #25 are significant because of their representation of the Spanish Colonial Revival design and for their locations at the entrance of the working station. Opposite each other, across the central lawn mall, these buildings provide symmetry to the original plan.

**BUILDING #25 THEATER**

The theater, two stories over a basement, is a typical example of the significant supporting buildings that define the original architecture. The "T" form is executed with a low pitched tile roof, stucco sheathing and terra-cotta ornamentation. The typical protected entry is behind an arcade that, in this case, is projected forward. The fenestration, again typical of the dominant style, is symmetrical for all floors except those voids above the entrance. Here the pattern changes to a band of windows divided into three elements that balance the three arches of the arcade. The building is 150 feet by 110 feet in an irregular plan that accommodates 7,745 square feet of floor space.

**BUILDINGS #21, #22 AND #24 - GARAGES**

This group of detached garages are supportive elements in the historic district. Each is one story and is constructed using typical materials and simple forms of the ancillary buildings. Buildings #21 and #22 retain the original use and design, including corner parapets. The buildings, located behind Building #20, are almost identical, 98 feet by 24 feet with garage door openings facing each other. Building #24, located behind Building #23, was the ambulance garage. It is smaller 45 feet by 30 feet. The large garage door openings have been infilled and the interior space modified for administrative offices.

The garages are significant supportive buildings that compliment the architecture of the larger buildings. Building #24 retains the original mass and form but, the alterations have changed its appearance as a garage.

**BUILDING #10 - HEAT PLANT**

One of the original buildings, the heat plant is a large industrial building of block massing in an irregular "T" form that is two stories in height. A single story element fits into the south west corner. Typical of power plant design, the dominate feature is the fenestration. This building has window banks that extend to the second story. A coursing separates the massing with smaller rectangular windows above the band. In keeping with the dominant architecture, this utilitarian building is decorated with a simple surrounds at the entrances. Flat arches top the tall window banks. The glazing is rectangular pane divided mullions. Most of the first floor windows have transoms that are operable. While the upper rows are all operable. A second coursing divides the lower portion of walls at about four feet, the basement line. Building #10, is sheathed in stucco with a flat roof. This building is a handsome version of a utilitarian industrial design.

The heat plant is one of the original buildings. It is significant as an example of the dominate architectural design stripped to the essence, entrance surrounds and arched windows, for industrial use.

# National Register of Historic Places Continuation Sheet



**STRUCTURE #5 - Water Tower:**

Supported by a tall steel frame, the water tank is topped with a conical roof. The traditional red and white checkered paint defines this classic industrial design. One of the original structures, the water tower is a functional and visually distinctive feature.

**BUILDINGS A THROUGH I AND ANCILLARY GARAGES A-1 THROUGH I-1**

REPRESENTATIVE SINGLE FAMILY RESIDENCES (COMMANDING, SENIOR AND JUNIOR MARRIED OFFICERS QUARTERS):

The original 1933 detached residential structures are all designed in a like architectural style of which any single building represents an archetype for the whole. The example used here is site #A1, which is referred to in the 1933 landscape plan as the "Commanding Officers' Quarters".

The site consists of a very simple, two-storied, rectangular-planned single family residence that is constructed of wood frame with a low gabled red Spanish tiled roof over a very plain stuccoed exterior (which is punctuated by a formal placement of both windows and doors). A simple chimney adorns the western facade. An attached single-storied, round-arched breezeway connects the residence with a large, two-storied, rectangular-planned garage set slightly behind the main structure.

Stylistically, the residence reflects all of the specific design criteria which unifies all of the original 1933 Spanish Colonial Revival architecture on the base. Windows are almost flush with the plain exterior walls. They are also essentially rectangular in shape, double hung, multi-paned and symmetrically placed along the facades. A colored, projecting stringcourse separates the two stories. The front entry is the most prominent exterior feature with a slightly recessed almost flat arched entry with projecting surrounds. An ornamental sidelight window is balanced by a large wrought iron projecting lamp on both sides of the main entrance.

Landscaping is characteristically both formal and very well maintained. The very large mature trees add immeasurably in setting apart the residential quarter as an oasis amid the functioning base. The open greenswards that distinguish the street directly tie in with the more formal axial plan of the rest of the base. The curved street pattern illustrates the influence of contemporary suburban design on such residential planning even on a military base.

The original 1933 detached residences form a key architectural component in the significant whole that distinguishes the site plan of the naval air station. Along with the verdant landscaping and extra wide spacing, this enclave of buildings helps define all that is special about the site from a design perspective.

# National Register of Historic Places Continuation Sheet



## CONTROL TOWER: (AEROLOGICAL BUILDING FLIGHT CONTROL TOWER) BUILDING #18

The site consists of a moderately-sized (3590 sq. ft.), two-storied building with a centered third story, hexagonal-shaped Control Tower. The structure is designed on a slightly varied rectangular floor plan with a very minimal attempt at exterior ornamentation. It is another of the utilitarian structures from the original plan that exhibits hints of the Spanish Colonial Revival design of the major buildings (in the centered round arch, the overscaled twin wrought iron Spanish styled lamps on both sides of the entry and the ubiquitous terra cotta surrounds ornamenting the front door). Otherwise, this structure is very simple in its design. Its walls are unadorned plaster. Windows are slightly recessed, rectangular in plan, multi-paned, double hung and symmetrically placed along the exterior facade.

The hexagonal tower is, along with the projecting metal tower above, the most distinguishing feature of the structure. It is characterized by its band of vertically oriented windows on each of the eight faces, as well as the iron railing which caps the flat-roofed tower from above.

The building's significance is due both to its history as the original Control Tower for the air station, as well as to its architectural design which once again exemplifies the sophisticated aspects of the original 1933 plan. The structure provides a transition between the more historically refined Spanish Colonial Revival architecture and the simple, yet equally impressive, more modern styles of the utilitarian outbuildings. It is the cohesion provided by the interaction between these two styles that provide the stylistic excellence of the historic core plan.

## TWIN SMALL TOWERS (FLOOR WATCHTOWERS): BUILDINGS #32 AND #33

These two twin sites (#32 and #33) consist of very small, two-storied towers that are distinguished by their very unusual design. They are towers that are distinguished by their very unusual design. They are very small structures (578 sq. ft., 14'x14'x25') that appear to be composed of a standard two-story rectangular tower with flat roof joined to a slightly smaller two-storied rounded tower with like flat roof that is capped with metal railing. The buildings are very simple in form. There are really no specific architectural embellishments. They exhibit all of the standard features of the utilitarian structures on the base without any ornament. Recessed, double-hung, multi-paned windows provide the major characteristic design feature which ties them into the surrounding historic core buildings. A prominent projecting stringcourse characteristically separates the two floors.

The significance of these two small utilitarian buildings is primarily in their unique function and form. They are very site specific and add a distinctive counterpoint to all of the rectangular shaped structures on the base. They are architectural curiosities that add immeasurably to the historic and architectural importance of the site.

**INTERIOR SPACES:**

Naval Air Station Moffett Field has been in continuous use since it was constructed. During the years the interiors of the buildings were altered to accommodate changes in uses and space requirements. The alterations have redesigned the original interior space plans, removed the original surfaces and changed the spacial feeling of the interiors. Due to the alterations, the interiors do not retain architectural integrity or historic significance.

**NON-CONTRIBUTING BUILDINGS**

Within the boundary of the historic district the number of non-contributing buildings exceeds the number of significant buildings and structures. This unusual ratio does not diminish the significance or integrity of the district. Most of the non-contributing buildings were constructed after the period of significance and are primarily small utilitarian constructions. The Chapel and heating plant, buildings 86 & 87 were constructed after the period of significance yet are designed in the idiom of the district. Thus, Naval Air Station Moffett Field, despite the imbalance in numbers of contributing and non-contributing buildings, maintains exceptional integrity of the 1933 station plan and architectural design.

The International style buildings were predominately constructed after 1944 and are not 50 years old. Therefore, they are not eligible for listing at this time. The Post Office, building #67, constructed in 1943, one of the finest examples of this style, is not significant as an individual building and should be included with the later International style buildings.

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National Park Service

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SIGNIFICANT AND CONTRIBUTING BUILDINGS

| BLDG. # | CURRENT USE | ORIGINAL USE |
|---|---|---|
| 1 | Hangar #1 | Hangar #1 |
| 2 | Gymnasium | Balloon Hangar |
| 5 | Water Tank | Water Tank |
| 10 | Heat Plant Building | Storehouse |
| 15 | PW Shop | Fire Station/Laundry/Garage |
| 16 | PW Shop | Locomotive Crane Shed |
| 17 | CPWP Administration | Administrative Building |
| 18 | NAV RES Administration | Aereological Center |
| 19 | BEQ | BEQ/Brig |
| 20 | BOQ | BOQ/Mess Hall & Galley |
| 21 | BOQ Detached Garage | BOQ Detached Garage |
| 22 | BOQ Detached Garage | BOQ Detached Garage |
| 23 | Instruction Building | Dispensary E |
| 24 | Administrative Office Building | Ambulance Garage |
| 25 | Base Theater/Recreation Service/Thrift Shop | Bowling Alley/Recreation Building |
| 26 | Gate House/Iron Fence | Gate House/Iron Fence |
| 32 | Storage | Tank House |
| 33 | Storage | Water Tower |
| 37 | Scale House | Scale House |
| A, A1 | Officers Housing and Garages | Housing and Garages |
| B, B1 | | |
| C, C1 | | |
| D, D1 | | |
| E, E1 | | |
| F, F1 | | |
| G, G1 | | |
| H, H1 | | |
| I, I1 | | |
| 46 | Hangar #2 | Hangar #2 |
| 47 | Hangar #3 | Hangar #3 |
| 55 | Heat Plant for Hangars #2 and 3 | Heat Plant for Hangars #2 and #3 |

SIGNIFICANT OBJECTS

| | | |
|---|---|---|
| 40 | Flagstaff/Commons | Flagstaff and Commons |
| | Memorial Anchor | Anchor |

Several factors contributed to the commissioning of the U.S. Naval Air Station Sunnyvale on April 8, 1933. Of foremost importance was the vision for the future of aircraft and influence of Admiral William A. Moffett. Appointed by President Harding on July 25, 1924, to be the first as Chief of the Naval Bureau of Aeronautics, Admiral Moffett had already established himself the proponent for increased Naval aircraft as an integral component of the Navy's ability to control the seas off the coasts of the United States. In the 12 years that Admiral Moffett lead the bureau, the U.S. Navy was catapulted into the lasting interlocking strategy of Naval presence in the air as well as the sea. But he also spoke of the future in commercial aviation. In the 1920's, he appears fascinated with the lighter than air technology of the dirigibles. The success of the zeppelins in WWI contributed to the development of the larger dirigibles. This was however, marred by the disasters resulting from the flammability of the hydrogen used to fill the chambers. Each country involved in the hydrogen filled dirigibles experienced tragedy. A memorial plaque in Shenandoah Plaza at Moffett Field commemorates USS SHENANDOAH that was lost with a crew of 14 on September 3, 1925. The largest of the dirigibles, HINDENBERG, burst into flames over Lakehurst, New Jersey in 1937, culminating a series of tragic losses involving the dirigibles and hydrogen. Helium, produced only in Texas and Kansas, had been known to be a reasonable replacement for hydrogen, but was prevented from export by the 1925 Helium Export Act. Moffett began a lobbying campaign to have the U.S. Navy use helium filled dirigibles to patrol the coasts. In Moffett's plan, these giant rigid frame airships would provide the long range observation for the surface Navy below. He believed the dirigibles could be fashioned to carry small planes and might even be equipped with bombs. The idea was not far-fetched. The technology of the 1920's allowed dirigibles which could stay aloft for 14 days and fly 10,000 miles. The lobbying proved successful with the 1926 congressional authorization for two Naval dirigibles capable of carrying aircraft and a new aircraft base for the west coast. The dirigibles were to be built by the Goodyear-Zeppelin Corporation in Akron, Ohio. The first to be completed was based at Lakehurst, New Jersey. The selection of the site and construction of a base to service the second would be undertaken on the west coast.

The west coast site appeared to be slated for Camp Kerney near San Diego when the northern California politicians realized the opportunities to be created and forced the federal planners to accept applications from the entire west coast. Applications were received from 997 locations. San Francisco mayor, James Rolph, saw the benefit to the Bay Area even though his city did not have a site suitable for the base. The appeal was for 2,000 acres with unobstructed approaches, clean water, rail access and good flying weather was heard by Mrs. Laura Whipple, a recently established real estate broker from the East Bay. Familiar with the Sunnyvale area, she selected the Rancho Unigo, a former Indian Reservation, that seemed to meet all the criteria. Appointing herself "Chairman of the Landholders Commission", she obtained an option for 1,750 acres at the price of nearly $500,000. She wired San Jose congressman, Joseph Free,that a perfect site for the dirigible base had been located and optioned. The proposal from San Diego offered free land; in order for the Sunnyvale site to be selected the same offer would have to be made. Under

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the leadership of presidents of the Chambers of Commerce from Mt. View and San Jose, a campaign to raise the funds and solidify the offer went forward. The newspapers, including the San Jose Mercury Herald, were enthusiastically in support of the proposal and offered publicity and public relations material to support the proposal. After three years of study and debate, it was time for a decision. On December 28, 1930, the vote registered by the House Naval Affairs Committee for H.R. 6810, introduced by Congressman Free, selected Sunnyvale by 18 to 1 and Camp Kerney as the auxiliary base. As a member of the West Coast Naval Airship Base Board, Moffett had favored Sunnyvale while the Secretary of the Navy, Charles F. Adams, preferred Camp Kerney.

Once selected, the issue remained to raise the money to purchase the land. Under the leadership of A. M. Mortensen, President of the San Jose Chamber of Commerce, the funds were raised and on August 2, 1931, the Chamber's check for $476,165.90 completed the purchase of 1000 acres of the Rancho Unigo. Also on August 2, 1931, the land was transferred to the U.S. Navy for $1.00. This completed a long and arduous partnership between the cities of the Bay Area to gain the prestige, jobs and economic interests that would follow the base.

The budget for constructing the base was $5,000,000. The U.S. Navy of Yards and Docks would be responsible for the design and coordinate the construction. Lt. Commander Earl Marshall was given the responsibility. Ernest Wolf, an experienced engineer from the Goodrich Zeppelin Corporation, was to be the Associate Engineer. Hangar #1, as it would be called, was the most important building and received the first attention. The design had been refined in Akron by Dr. Hugo Ekener, to form a rounded building that followed the form of the dirigible. Enormous curved doors on each end would slide over the building, rolling on 40 wheels over standard gauge railroad track, and propelled by 150 hp electric motors, thus minimizing the turbulence and problems encountered with past designs. In fact, it was the window patterns that dictated the north-south orientation and siting of Hangar #1; the rest of the base followed. Of the $2,250,000 budgeted for the hangar, $1,116,044 was awarded to the Wallace Bridge and Structural Steel Company of Seattle to fabricate the steel for the structure and doors. Seims-Helmers, Inc. of San Francisco bid $398,937 for the roofing, windows and siding on the airdock that would measure 1, 133 feet long, 308 feet wide and 198 feet high. The floor area is just over eight acres. A structural space frame, the design and construction of this hangar remain a feat unparalleled in the engineering of enclosed space.

Railroad tracks ran through the hangar, culminating at the mooring tower. The tower secured the dirigible to the ground by mooring lines. This tower has been removed. The other large structure that was necessary for the dirigible was the helium tank that was located in front of the hangar.

The plan for the base and the design of the buildings was also undertaken by the Naval Bureau of Yards and Docks.

The style for the buildings, Spanish Colonial Revival, is reflective of the popularity of the revival movement and the desire of the local politicians to have the base designed in the "California Style" of white stucco walled buildings with red tile roofs. The plan and building design was very formal, an axial orientation with the bemouth hangar to the east and the base extending west. Following the Spanish influence, a large plaza is the central element with the most ornately decorated building, the Administration Building, at the head of the plaza behind the flag pole and in front of the hangar. On the south side of the plaza were located the dispensary and Bachelor Officers' Quarters. To the north were the recreation building and the barracks. To the southwest on the cul-de-sac were located the nine officers' houses and garages. Extending to the east, and south, behind this formal plaza arrangement were the utilitarian buildings, fire station, garage, laundry boiler plant, locomotive and crane shed, shops, helium storage and water tower. To the north were the commissary, store house, gas station, balloon shed and storage buildings. Directly behind the Administration Building was the cafe (later the Officers' Club), and of course, the Hangar. The base was designed in anticipation of the importance of the automobile. Broad roads, large parking areas and garages were incorporated in the plan.

Landscaping was carefully planned to mature in harmony with the buildings and circulation elements. The area considered the Naval Air Station Sunnyvale Historic District maintain the integrity of the original design and represent one of the finest formal plans for a government facility in California. It was a forward-thinking plan with expansion to occur outside the formal plaza, thus the quality of design has been maintained. The original base is a one-of-a-kind facility in the Santa Clara Valley with great importance in the architectural heritage, facility planning and economic growth of the region.

The primary significance of the historic district is the association with the "lighter than air" dirigible program. The dirigibles, to be the eyes in the sky for the Navy, were in operation for a relatively short time. USS MACON, one of the two dirigibles constructed for the Navy, was christened by Mrs. William Adger Moffett (wife of Admiral Moffett) on March 11, 1933. An article about the landing in Sunnyvale was reported in the October 15, 1933 edition of the San Francisco Chronicle that read, "30,000 Thrilled as the MACON Moors at Home Station." The sister dirigible, AKRON, had been lost on April 13, 1933, making the MACON the last dirigible. For 16 months, USS MACON was a common sight over the Santa Clara Valley as it performed in a number of military maneuvers with the Pacific Fleet. Admiral Moffett had been well aware that the slow moving dirigibles could be of great benefit when assigned as an observatory for the fleet, but were vulnerable if used in maneuvers with the fleet. Shortly after arriving at Sunnyvale, USS MACON was deployed on tactical maneuvers with the Pacific Fleet. Equipped with an internal hangar and steel frame hoist termed a "trapeze", USS MACON carried four small fighter planes. The Sparrowhawks (F9C) were bi-plane fighters developed specifically to be carried in the dirigible by Curtis. Each weighed only 2,500 pounds with a pilot. As an airborne carrier, the dirigible was a hulking target that "failed to demonstrate military usefulness," according to the Commander in Chief of the United States Fleet, Admiral David Sellers. While returning from maneuvers with the fleet on February 12, 1935, USS MACON experienced a structural failure and crashed into the Pacific. Of the 83 crew, only 2 were lost. It was the headline in the San Francisco Chronicle the next day that told the story, "Dirigible Doomed as Defense Factor, Officials Say." The era of dirigibles was over, the only remaining element of the Moffett five year plan was Hangar #1 and the base at Sunnyvale.

During this period, the U.S. Army Air Corps operated a limited number of blimps in conjunction with observation exercises. In September, 1935, seven months after USS MACON went down, the Army assumed control of the base and Hangar #1. The facility was used by the Army for pursuit and observation activities until 1940 when it was converted to the West Coast Air Corps Training Facility. During this period, the dispensary was enlarged and barracks were added.

Shortly after the outbreak of WWII, the base was returned to the U.S. Navy. In April, 1942, the base was recommissioned Naval Air Station Moffett Field.

The return to Naval Command was to provide expanded facilities for small blimps and balloons used for coastal observation. Hangars #2 and #3 were constructed for blimps in 1942. They are included in the historic district because of the use as a lighter than air facility, and for their architectural/engineering importance.

One of the most recognizable landmarks in the San Francisco Bay Area, Hangar #1 and the original base are significant in the history of Naval Aviation, defense and in the development of the Santa Clara Valley. From the original base and because of the facility location and landing field, NASA Ames Research Center is located to the north adjacent to the original plaza boundary and at the north boundary of the historic district. It is far easier to measure the importance of the dirigible in Naval Aviation and defense history than it is to measure the enormous impact upon the growth of the defense and space industry in Northern California because of the original location of this base with the 1000+ acres.

The Naval Air Station Sunnyvale Historic District is recommended for listing in the National Register of Historic Places at the National Level of significance under Criteria A, as the only base designed specifically for the Navy to home port USS MACON, the only dirigible in the fleet, a significant contribution to the broad pattern of our history; and under Criteria C, a facility plan and architectural design that embody the distinctive characteristics of a type, period, or method of construction or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction.

The landscape plan (Y&D drawing No. 115840) was approved on April 29, 1933. This plan shows the base in its entirety.

United States Department of the Interior
National Park Service

# National Register of Historic Places Continuation Sheet



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|---|---|---|---|
| ZONE 10 | E | 37.7063 | 122.0530 |
| | A1 | 37.7095 | 122.0433 |
| | B1 | 37.7060 | 122.0421 |
| | C1 | 37.7071 | 122.0394 |
| | D1 | 37.7105 | 122.0408 |

State of California – The Resources Agency
DEPARTMENT OF PARKS AND RECREATION
OFFICE OF HISTORIC PRESERVATION

# HISTORIC RESOURCES INVENTORY

Ser. No. ______
National Register status ______
Local designation ______

## IDENTIFICATION AND LOCATION

1. Historic name ______
*2. Common or current name Non-contributing buildings(1940-1944) within the NAS Moffett Field Historic District.
*3. Number & street Buildings: #64, #67, #86, #87 Cross-corridor ______
City ______ Vicinity only ______ Zip ______ County ______
4. UTM zone ______ A ______ B ______ C ______ D ______
5. Quad map No. ______ Parcel No. ______ Other ______

## DESCRIPTION

6. Property category ______ If district, number of documented resources ______
*7. Briefly describe the present physical appearance of the property, including condition, boundaries, related features, surroundings, and (if appropriate) architectural style.

These buildings represent a later group, located throughout the station and with these four examples in the area of the NAS Moffett Field Historic District, that is defined by distinctive architectural styles that reflect the most popular designs of the time.

Building #86 - Chapel and #87 Chapel Heat Pump, are executed in a slightly Mission Revival design that is an extension of the Spanish Colonial Revival architecture of the Historic District. Located between the Officers Housing Area and the central buildings of the 1933 base, the buildings are architecturally compatible with the 1933 Historic District.

Buildings #64 and #67 are examples of the International Style with the Post Office #67 a particularly fine example.

*Attach photo envelope here
Put address and photo date on rear of photo

8. Planning agency ______
9. Owner & address ______
10. Type of ownership ______
11. Present use ______
12. Zoning ______
13. Threats ______

Send a copy of this form to: State Office of Historic Preservation, P.O. Box 942896, Sacramento, CA 94296-0001

* Complete these items for historic preservation compliance projects under Section 106 (36 CFR 800). All items must be completed for historical resources survey information.

DPR 523 (Rev. 8/90)

## 8. Statement of Significance

Certifying official has considered the significance of this property in relation to other properties:
[X] nationally [ ] statewide [ ] locally

Applicable National Register Criteria [X] A [ ] B [X] C [ ] D

Criteria Considerations (Exceptions) [ ] A [ ] B [ ] C [ ] D [ ] E [ ] F [ ] G

| Areas of Significance (enter categories from instructions) | Period of Significance | Significant Dates |
|---|---|---|
| Military | 1930-1935 | |
| Engineering | 1942-1946 | |

Cultural Affiliation

Significant Person
Moffett, William Adger; Admiral

Architect/Builder
U.S. Navy Bureau of Yards and Docks

State significance of property, and justify criteria, criteria considerations, and areas and periods of significance noted above.

In the nation's quest to provide security for the lengthy expanse of it's coastlines the opportunity for air reconnaissance was realized by the futuristic Admiral William A. Moffett. Through his efforts, two Naval Air Stations were commissioned in the early 1930's to port the two U.S. Naval Airships (dirigibles) he believed capable of this challenge. The Naval Air Station Sunnyvale was the Pacific Coast location selected, designed and developed to port USS MACON (ZRS 5). The immense structure, Hangar #1, designed to house USS MACON, with its larger counterpart in Akron, Ohio, remain the two largest structures in the United States without internal support. At the onset of WWII, the base was expanded with Hangars #2 and #3 which were designed to accommodate the smaller blimps and balloons used for reconnaissance, until the range of heavier than air aircraft (airplanes) was sufficient to patrol the coast. The significance of the U.S. Naval Air Station Sunnyvale Historic District is attributed to the association with the expanding defense capabilities of the U.S. Navy, the engineering technology found in lighter than air ships, the design of the hangar and system for porting the dirigible and in the plan and architectural style of the station designed to support this defense technology. The significance of Hangar #1, was recognized when it was designated a Naval Historical Monument. It has been designated a Califronia Historic Civil Engineering Landmark, by the San Francisco section, American Society of Civil Engineers, and has been determined eligible for listing in the National Register of Historic Places by the U.S. Navy in consultation with the California State Historic Preservation Officer. The entire historic district is supported for listing in the National Register of Historic Places at the national level of significance under Criterion A for the association with coastal defense and naval technology that has made a significant contribution to the broad patterns of our history; and Criterion C reflecting the distinctive type, period, method of construction and high artistic values that are represented in the 1933 station plan and buildings. In 1942, the station was recommissioned, U. S. Naval Air Station, Moffett Field, in recognition of the significant contribution to naval history by Admiral Moffett, contributions that have gained him the unofficial title, "Father of Naval Aviation."

[X] See continuation sheet

## 9. Major Bibliographical References

Gragg, Dan The Guide to Military Installations, Harisburg, PA; Stackpole Books, 1983
Payne, Stephen M., Santa Clara County: Harvest of Change, Santa Clara, CA; Windsor Publicati 1987

Unpublished:

Histoirc Civil Engineering Landmarks of San Francisco and Northern California, 125th Annual Conference, American Society of Civil Engineers, San Francisco Section, Sponsor, 1977.

Ifft, Jerry. The Era of Dirigibles at Moffett Field, 1987; California Room, Martin Luther King, Jr. Memorial Library, San Jose, CA

Interviews:

Benjamin Mandweiler, NAS, Moffett Field, Public Works Department
Lt. Col. Robert N. Maupin, USAF. Ret.

☐ See continuation sheet

Previous documentation on file (NPS):
- ☐ preliminary determination of individual listing (36 CFR 67) has been requested
- ☐ previously listed in the National Register
- ☐ previously determined eligible by the National Register
- ☐ designated a National Historic Landmark
- ☐ recorded by Historic American Buildings Survey # ____
- ☐ recorded by Historic American Engineering Record # ____

Primary location of additional data:
- ☐ State historic preservation office
- ☐ Other State agency
- [X] Federal agency
- ☐ Local government
- ☐ University
- ☐ Other

Specify repository: ____

## 10. Geographical Data

Acreage of property 124 Acres (approximately)

UTM References

| | Zone | Easting | Northing |
|---|---|---|---|
| A | 1 0 | 3 7 7 0 3 6 | 1 2 2 0 5 9 8 |
| B | 1 0 | 3 7 6 9 7 5 | 1 2 2 0 6 0 4 |
| C | 1 0 | 3 7 6 9 9 9 | 1 2 2 0 6 2 5 |
| D | 1 0 | 3 7 7 0 6 3 | 1 2 2 0 5 3 0 |

[X] See continuation sheet

Verbal Boundary Description

The Naval Air Station Sunnyvale includes all of the 1933 original base plan with the addition of the 22.5 acre detached area containing hangars #2 and #3. The boundary line begins at the Main Gate, including the entrance gate and fence, proceeds along Clark Road to Berry Road where the boundary turns south to encircle the quarters A through H, north behind quarter F to Westcoat Road, east to Sayre Ave., north to Bushnell Road and west to Clark Road. A detached area is included in the historic district to incorporate hangars #2 and #3 with a 25 foot band of land around the pair.

Boundary Justification

The boundary includes the limits of development in the 1933 base plan for the Naval Air Station Sunnyvale, as prepared by the Navy Department, Bureau of Yards and Docks, and the area incorporating hangars #2 and #3 that are associated with lighter than air military aircraft.

☐ See continuation sheet

## 11. Form Prepared By

name/title Bonnie Bamburg
organization Urban Programmers — date November 9, 1991
street & number 1174 Lincoln Avenue — telephone 408-971-1421
city or town San Jose — state California — zip code 95125

# B.2 AECOM, Historic Property Survey Report (2013)

Historic Property Survey Report for the Airfield at

# NASA Ames Research Center, Moffett Field, California

Prepared for:

NASA Ames Research Center

Prepared by:

AECOM
300 California Street, Suite 400
San Francisco, CA 94104

AECOM

November 26, 2013

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**Figures**



**Appendices**

# ACRONYMS AND OTHER ABBREVIATIONS

| | |
|---|---|
| ACHP | Advisory Council on Historic Preservation |
| ARC | Ames Research Center |
| B.P. | Before Present |
| CANG | California Air National Guard |
| FASRON | Fleet Aircraft Service Squadron |
| HPSR | historic property survey report |
| HRPP | historic resources protection plan |
| ICRMP | integrated cultural resources management plan |
| LTA | lighter-than-air |
| NACA | National Advisory Committee for Aeronautics |
| NAS | Naval Air Station |
| NASA | National Aeronautics and Space Administration |
| NAS Sunnyvale Historic District | Naval Air Station Sunnyvale Historic District |
| Navy | U.S. Department of the Navy |
| NHPA | National Historic Preservation Act |
| NRHP | National Register of Historic Places |
| RFP | request for proposals |
| SHPO | State Historic Preservation Officer |
| U.S. 101 | U.S. Highway 101 |

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# 1.0 INTRODUCTION

## 1.1 PURPOSE AND SCOPE OF REPORT

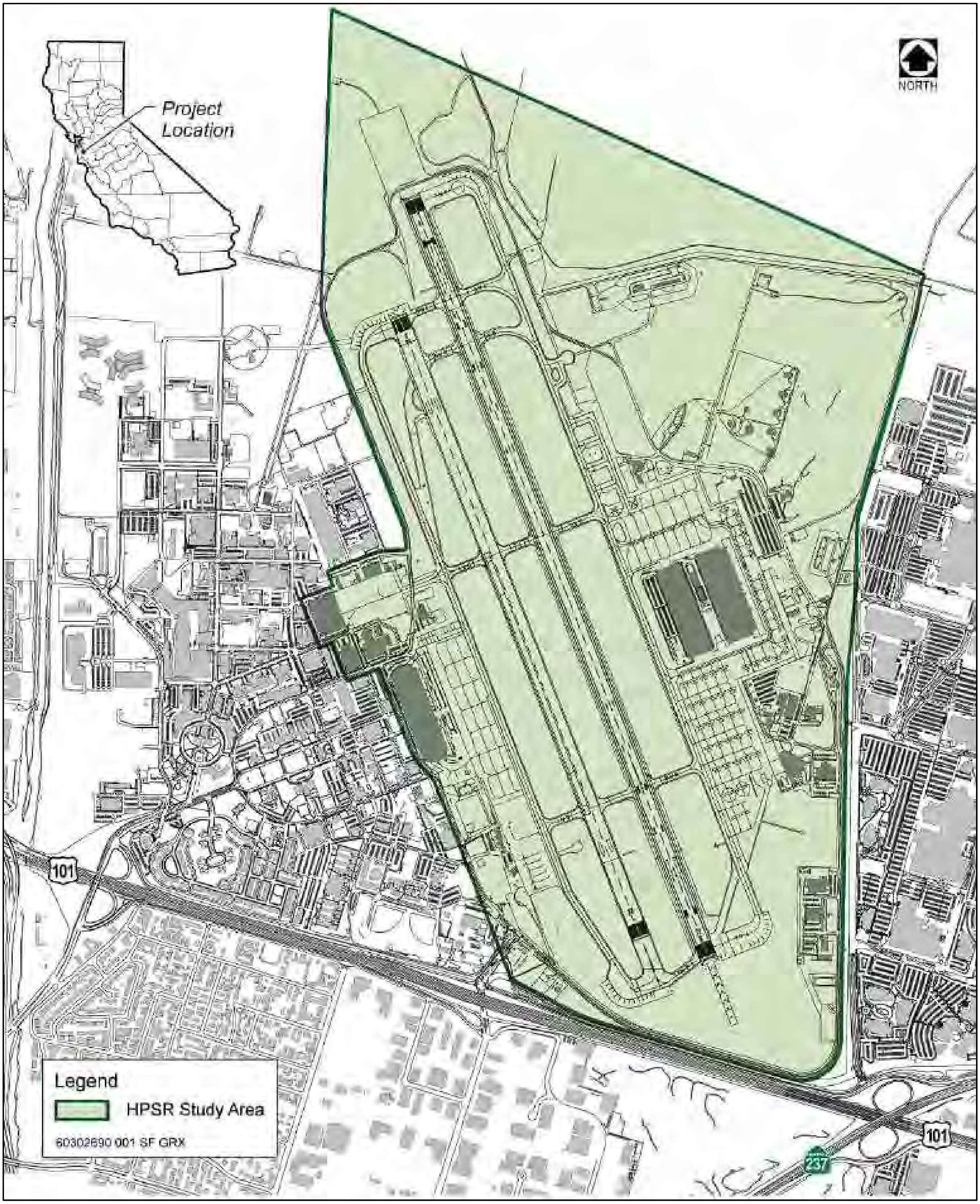
This historic property survey report (HPSR) was undertaken by AECOM on behalf of the National Aeronautics and Space Administration (NASA) Ames Research Center (ARC). The HPSR supports NASA's compliance with Section 110 of the National Historic Preservation Act (NHPA) and with other laws and regulations. This report has been prepared as part of ongoing consultation between NASA and the California State Historic Preservation Office (SHPO) regarding the National Register of Historic Places (NRHP) eligibility of the Airfield area of the NASA ARC as a contributing feature of the Naval Air Station Sunnyvale Historic District (NAS Sunnyvale Historic District). In addition, the HPSR will provide NASA and its potential tenant(s) or lessees with more specifics about which physical features of the Airfield are to be treated in accordance with historic preservation standards. The HPSR will be used to support the completion of consultation on NRHP eligibility with the SHPO, and will also to provide baseline information to potential lessees regarding the Airfield.

## 1.2 STUDY AREA DESCRIPTION

Located in Santa Clara County, California, on the south side of lower San Francisco Bay, the NASA ARC lies between the cities of Sunnyvale and Mountain View. Portions of the site now called NASA ARC have been known in the past as Naval Air Station (NAS) Sunnyvale and NAS Moffett Field (or Moffett Field). In this report, the facility is referred to by its appropriate historical name in the description of each historical period, and otherwise is generally referred to as NASA ARC.

Within NASA ARC there are several functional areas: the NASA Ames Campus in the northwest quadrant; the former U.S. Department of the Navy (Navy) housing and support area in the southwest quadrant; the NAS Sunnyvale, California National Register Historic District (NAS Sunnyvale Historic District) in the central area west of and including Hangar 1, as well as Hangars 2 and 3; and the Airfield area, including the munitions magazines and safety buffer zone, which compose the entire eastern half of the facility. The Airfield includes two parallel runways and associated Hangars 1, 2, and 3 and the safety buffer zone northeast of the runways.

The approximately 1,160-acre HPSR study area is bounded on the north by San Francisco Bay wetlands and salt ponds, on the west by the NAS Sunnyvale Historic District and the NASA ARC, at the south by U.S. Highway 101 (U.S. 101), and on the east by a heavily developed industrial park (see Figure 1, "HPSR Study Area").




Source: Data compiled by AECOM in 2013

**Figure 1. HPSR Study Area**

# 2.0 METHODOLOGY

The HPSR provides an overview of and justification for the eligibility of the Airfield for inclusion in the NRHP as an extension of the NAS Sunnyvale Historic District. The following sections describe the methods used to conduct further research on the context and site history of the Airfield, the sources and methods used to compile an inventory of the Airfield's historic-period components, identification of character-defining and contributing features, and the criteria applied during the evaluation of whether the Airfield is eligible for listing in the NRHP.

## 2.1 RESEARCH METHODS

The physical history of the Airfield was developed based on archival research completed at the NASA ARC Aviation Management Office and the Moffett Field Historical Society Museum. Archival materials collected from these repositories included historic drawings and photographs from the previous reports and studies, and Navy historical publications.

Section 4.0, "Inventory," was developed based on materials provided by NASA, consisting of a master inventory of all buildings and structures in the HPSR study area, site plans, and various reports and studies completed for the NASA ARC. The project team conducted an overview survey of the Airfield on June 13, 2013, for project scoping, and a reconnaissance survey on June 24, 2013. Project team members photographed buildings and structures in the study area that were constructed in 1963 or earlier (the 50-year cutoff). Because the scope of the HPSR is focused on providing a discussion of the character-defining features of the Airfield at SHPO's request, this report does not include comprehensive photo documentation or California Department of Parks and Recreation survey forms. For selected photographs, see Appendix A, "Selected Historic Photographs," and Appendix B, "Selected Existing Conditions Photographs."

## 2.2 EVALUATION CRITERIA AND GUIDELINES

Section 5.1, "Statement of Significance," defines the historic significance of the Airfield, including a period of significance, based on NRHP criteria. Properties listed in the NRHP must be significant to American history, architecture, archaeology, engineering, or culture, and must exhibit integrity of location, design, setting, materials, workmanship, feeling, and association. To be eligible for listing, a property must meet one or more of the following criteria:

A. Be associated with events that have made a significant contribution to the broad patterns of our history

B. Be associated with the lives of persons significant in our past

C. Embody distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction

D. Have yielded, or may be likely to yield, information important in prehistory or history.

In addition to considering significance as defined in the NAS Sunnyvale Historic District's NRHP nomination form and subsequent studies, several National Register bulletins were consulted during the evaluation of significance and the integrity assessment for the Airfield. National Register Bulletin 15, "How to Apply the

National Register Criteria for Evaluation" (NPS 1997), provided overall direction. Bulletin 15 outlines the evaluation criteria and discusses how to evaluate properties within applicable historic contexts, define the significance of historic properties, and evaluate their integrity. National Register Bulletin 18, "How to Evaluate and Nominate Designed Historic Landscapes" (NPS n.d.), and Bulletin 43, "Guidelines for Evaluating and Documenting Historic Aviation Properties" (NPS 1998a), also provided important guidance relevant to the HPSR study area.

### 2.2.1 Guidelines for Integrity Assessment

In Section 5.2 of this HPSR, the integrity of the Airfield is assessed based on a comparison of existing and historic conditions. The National Park Service defines integrity as the authenticity of a landscape's historic identity, evinced by the survival of physical characteristics that existed during its period of significance. Historical integrity is evaluated to determine whether the characteristics and features that defined the landscape during the historic period are present. The seven qualities of historic integrity defined by the National Register Program are *location, setting, feeling, association, design, workmanship,* and *materials*. Of the seven qualities, the most essential for historic landscapes are setting, feeling, association, and design.

### 2.2.2 Guidelines for Identification of Character-Defining and Contributing Features

A primary goal of the survey is to identify the historic character of the Airfield's landscape. *Historic character* is the quality of a historic landscape that imparts its historic associations, and is created by the assembly of *character defining features* that communicate the visual aspects, features, materials, and spaces associated with the property's history. The Airfield has a distinctive character supported by the character-defining features that tell its story. Character-defining features are identified in Section 5.3.

Some features of the Airfield's landscape may be identified as *contributing features* for NRHP listing purposes. These are discussed as they relate to historic landscape character in Section 5.3. This study provides a preliminary identification of contributing features, including those with known dates of origin within the historic period of significance, and known to retain integrity. Some smaller resources such as lighting, and those with an indirect relationship to significance such as roads and sidewalks, were not evaluated in this study. Also, please note that some types of landscape characteristics such as views and vegetation, despite helping to define historic character, are not technically eligible for the NRHP because of the NRHP's narrower focus on buildings, structures, objects, and sites. These types of resources are addressed as "character defining" when relevant.

The difference between a *contributing feature* and a *character-defining feature* requires some explanation. According to the National Park Service *Guide to Cultural Landscape Reports*, a contributing feature is "a biotic or abiotic feature associated with a landscape characteristic that contributes to the significance of the cultural landscape" (NPS 1998b). Individual buildings, roads, vegetation (specimens, groups, or communities), or small-scale features are contributing features. Noncontributing features either are non-historic (postdating the period of significance) or have lost their integrity (because of condition issues or other factors). Within the set of contributing landscape features, character-defining features represent the following (NPS 1998b):

> …[the most] prominent or distinctive aspect(s), quality(ies), or characteristic(s) of a historic property that contributes significantly to its physical character. Structures, objects, vegetation, spatial relationships, views…may be such features…. The term "character-defining feature" was conceived to guide the

appropriate treatment and management of historic structures (and later of cultural landscapes), so that features conveying historic character would be retained by treatment activities.

In addition, a recommended eligible boundary is identified for the Airfield site based on its significance and integrity.

## 2.3 PREVIOUS STUDIES

### 2.3.1 U.S. Naval Air Station Sunnyvale Historic District

The NAS Sunnyvale Historic District was listed in the NRHP in 1994. The district's periods of significance are 1930-1935 and 1942-1946, and it is listed under Criteria A and C in the areas of Architecture and Engineering/Military. Under Criterion A, the NRHP nomination describes the district as representing a "unique and significant episode in the development of U.S. naval aviation prior to World War II…one of two Naval Air Stations built to support lighter-than-air dirigibles during the 1930s" (Urban Programmers 1994). Under Criterion C, the district is considered a good regional example of military design in the Spanish Colonial Revival style. It encompasses the 1933 original installation area to the west of the Airfield, as well as the 22.5-acre discontiguous area containing Hangars 2 and 3, which are associated with lighter-than-air military aircraft in World War II. The NRHP nomination calls Hangars 1, 2, and 3 "excellent examples of early twentieth-century military planning, engineering and construction" (Urban Programmers 1994). Other contributing elements contained in the district include the original Spanish Revival buildings, as well as later buildings in the same style and International style buildings of the 1940s. In total, according to the NRHP nomination form, 40 buildings, one structure, and two objects contribute to the district, and 54 noncontributing buildings are present within its boundary.

Hangar 1 is noted on the NRHP nomination form as "a metal sheathed behemoth whose rounded shape is both the epitome of the aerodynamically influenced Streamline Moderne style as well as a stylistic cousin to the huge airship that originally berthed inside the mammoth hangar" (Urban Programmers 1994).

Although the 1994 nomination form does not clearly specify significance under Criterion A, a later study (NASA 2013a) identified its significance for association with important events in U.S. history. The NASA Web site for Hangar 1 notes that the NAS Sunnyvale Historic District has been determined eligible under "Criterion A for its association with coastal defense and naval technology that has made a significant contribution to the broad pattern of our history" (NASA 2012).

### 2.3.2 Other Established Significance Themes

A variety of additional designations and evaluations provide other aspects and types of significance recognition for the resources at the Airfield. For example, according to the NASA Web site for Hangar 1, "The historic significance of Hangar 1 was also recognized when it was designated a Naval Historical Monument. It has been designated a California Historic Civil Engineering Landmark by the San Francisco section, American Society of Civil Engineers" (NASA 2012).

In 2013, the NASA ARC submitted a statement of the Airfield's historical significance to the SHPO and the federal Advisory Council on Historic Preservation (ACHP). The Airfield and its component features were determined to be eligible for the NRHP under Criterion A, and to contribute to the adjacent NAS Sunnyvale Historic District. The nomination has not been formally updated to include these areas.

Numerous other resources at NASA ARC have been identified as eligible, although they are also not listed in the NRHP. A 1998 study of Cold War resources at the Airfield provides eligibility determinations. Please see the table in the Appendix C, “Preliminary Inventory of Contributing Airfield Historic Resources,” for more information about the status of individual resources.

# 3.0 SITE PHYSICAL HISTORY

## 3.1 DEVELOPMENTAL HISTORY

### 3.1.1 Pre-airfield Period (to 1930)

The earliest well-documented entry and spread of native peoples throughout California occurred at the beginning of the Paleo-Indian Period (12,000–8000 years Before Present [B.P.]), and social units are thought to have been small and highly mobile. Known sites have been identified in the contexts of ancient pluvial lakeshores and coastlines, as evidenced by such characteristic hunting implements as fluted projectile points and flaked stone crescent forms. Prehistoric adaptations over the ensuing centuries have been identified in the archaeological record by numerous researchers working in the Bay Area since the early 1900s, as summarized by Fredrickson (1974) and Moratto ([1984] 2004).

Few archaeological sites have been found in the Bay Area that date to the Paleo-Indian Period or the subsequent Lower Archaic (8000–5000 B.P.) time period, probably because of high sedimentation rates and sea level rise. However, archaeologists have recovered a great deal of information from sites occupied during the Middle Archaic Period (5000–2500 B.P.). By this time, broad regional subsistence patterns gave way to more intensive procurement practices. Economies were more diversified, possibly including the introduction of acorn-processing technology, and populations were growing and occupying more diverse settings. Permanent villages that were occupied throughout the year were established, primarily along major waterways. The onset of status distinctions and other indicators of growing sociopolitical complexity mark the Upper Archaic Period (2500–1300 B.P.). Exchange systems became more complex and formalized, and evidence of regular sustained trade between groups was more prevalent.

Several technological and social changes characterize the Emergent Period (1300–200 B.P.). Territorial boundaries between groups became well established, and it became increasingly common for distinctions in an individual's social status to be linked to acquired wealth. In the latter portion of this period (500–200 B.P.), exchange relations became highly regularized and sophisticated. The clamshell disk bead became a monetary unit, and specialists arose to govern various aspects of production and material exchange.

The Middle Archaic, Upper Archaic, and Emergent Periods can be broken down further, according to additional cultural manifestations that are well represented in archaeological assemblages in the Bay Area:

- *Windmiller Pattern* (5000–1500 B.P.) peoples placed an increased emphasis on acorn use and on a continuation of hunting and fishing activities. Ground and polished charmstones, twined basketry, baked clay artifacts, and worked shell and bone were hallmarks of Windmiller culture. Widely ranging trade patterns brought goods in from the Coast Ranges and trans-Sierran sources, as well as from closer trading partners.
- *Berkeley Pattern* (2200–1300 B.P.) peoples exhibited an increase in the use of acorns as a food source, compared to what was seen previously in the archaeological record. Distinctive stone and shell artifacts differentiated this period from earlier or later cultural expressions. Burials were most often placed in a tightly flexed position and frequently included red ochre.
- The *Augustine Pattern* (1300–200 B.P.) reflected increasing populations, resulting from more intensive food procurement strategies, as well as from a marked change in burial practices and increased trade activities.

> Intensive fishing, hunting and gathering, complex exchange systems, and a wider variety in mortuary patterns are all hallmarks of this period.

Ethnographic and archaeological research indicate that the NASA ARC falls within the traditional boundaries of the Ohlone, whose territory stretched from San Francisco Bay at the north to the southern tip of Monterey Bay, extending 60 miles inland (NASA 2002b). The primary social organization of this group was centered around the patrilineal family unit, with a focus on patrilocality, and sovereign tribelets were often defined by territorial holdings (Bennyhoff 1977). The NASA ARC is located on Ramaytush and Tamyen (Tamien) lands of the Ohlone sphere of influence and has been specifically associated with the Posol-mi tribelet (a place name likely associated with the Rancho Posolmi, below) (NASA 2009; Kroeber 1925). The total number of individuals residing in this area has been estimated to be as high as 1,200 at the time of European contact; however, the combined effects of missionization and European-borne diseases had a heavy toll on these communities, nearly decimating the population and traditional practices (NASA 2009).

In 1772, the Spanish, led by Juan Bautista de Anza, began exploring the inner coastal region of California. Later, Spanish settlers established a permanent presence by constructing missions and presidios. When Mexico became independent from Spain in 1822, the Spanish missions were secularized and their lands were redistributed to private individuals by way of land grants. Large parcels were developed into cattle ranches, maintained by Mexican grantees.

In 1844, the Rancho Posolmi, on which NASA ARC lands are contained, was granted to Lopez Iñigo (also Indigo or Ynigo), a Native American documented as living in the vicinity of present-day Mountain View and farming what would become NASA ARC lands as early as 1834 (NASA 2009; Garaventa et al. 1991). The grant was later patented in 1881, at which time the grant was known to have been divided into three parts: 448.02 acres to Iñigo's descendants, 847.98 acres to Robert Walkinshaw, and 400 acres to Thomas Campbell. Research indicates that the known remains of buildings associated with these ranchos are located outside of the NASA ARC land holdings. Iñigo is thought to have lived on-site until his death in 1864, and a marker entitled the "Inigo Grave Site" *[sic]* was erected by the Mountain View Pioneer and Historical Association on the perimeter road near the northeast corner of what was then known as NAS Moffett Field (Garaventa et al. 1991). Although the marker is no longer standing, Iñigo's interment is believed to be located within the boundaries of resource CA-SCI-12/H (see Section 4.2.5, "Archaeological Sites").

### 3.1.2 U.S. Navy Dirigible Operations (1931–1935)

The agricultural land that would become NAS Sunnyvale was purchased with funds raised by local citizens and civic leaders who were enthusiastic about the prospect of a naval airfield coming to the area. The civic group sold the land to the Navy for $1, and NAS Sunnyvale was officially established on August 2, 1931.

Construction began on NAS Sunnyvale in October 1931 (see Appendix D, "Period Plans"). Hangar 1, the massive steel-frame structure built to house the dirigible USS *Macon*, the flagship for NAS Sunnyvale, was completed in April 1933. North and south of Hangar 1, two mooring circles were built to control and secure the *Macon*. The nose of the dirigible would attach to a telescoping mooring mast and the tail fin would attach to a stem beam (or bolster beam); the stem beam and mooring mast were attached to a track that allowed the *Macon* to be rotated and moved in and out of Hangar 1. West of Hangar 1, the Navy built a campus of buildings to support dirigible operations on the airfield. The Spanish Colonial–style buildings built in the area now known as the NAS

Sunnyvale Historic District were based on designs by the Naval Bureau of Yards and Docks. East of Hangar 1, closer to San Francisco Bay, the former agricultural land was cleared and leveled, and an airfield with a single narrow runway was built. This small runway was originally used by F9C *Sparrowhawks*, small biplane fighters that accompanied (and could be carried by) the USS *Macon*. Within a short time, the original runway was expanded and two more small runways were added. NAS Sunnyvale was formally commissioned on April 12, 1933.

The USS *Macon* arrived at NAS Sunnyvale in October 1933 and was stationed there until February 1935, when the dirigible was damaged during a mission off the coast of Point Sur, California, and crashed in the Pacific Ocean. Soon after the crash, the Navy terminated its dirigible program and the airfield at NAS Sunnyvale was transferred to the U.S. Army Air Corps.

### 3.1.3 U.S. Army Air Corps (1935–1942)

In September 1935, the Navy transferred the airfield to the U.S. Army Air Corps for use in pursuit and observation operations. When the Airfield was occupied by the Army Air Corps, the Airfield's focus moved from lighter-than-air (LTA) operations to heavier-than-air aircraft used in pursuit and training operations. The Army Air Corps used bigger aircraft that required longer and wider runways, including the P-36 *Hawk* and BT-13 *Valiant*. In 1938, the Army Air Corps removed the older runway system and built a 2,140-foot-long runway (Runway 14R-32L) using 3-inch-thick asphalt concrete. Historic photographs taken during this period show a wide runway bordered on the west side by an apron or taxiway marked by diagonal lines. Parking areas surrounding Hangar 1 were unpaved earth (Veronico 2006).

In 1940, anticipating the outbreak of World War II, the Army Air Corps converted the airfield to become its West Coast training headquarters. In 1941, to accommodate larger aircraft used to train pilots and their support crew, Runway 14R-32L was extended again.

### 3.1.4 Navy Lighter-than-Air Operations and World War II (1942–1947)

After the bombing of Pearl Harbor in December 1941, the Navy reassumed control of the airfield, which was renamed the U.S. NAS Moffett Field, or simply Moffett Field. LTA operations were needed by the military once again, and Moffett Field became devoted exclusively to LTA aviation, primarily for reconnaissance and surveillance of the Pacific coast. Moffett Field was the headquarters for Fleet Airship Wing Three, composed of three LTA bases on the West Coast: Tillamook, Oregon; Santa Ana, California; and Sunnyvale, California. The first blimps arrived at Moffett Field as part of the West Coast's first LTA squadron, ZP-32, which launched its first patrol flight over the Pacific coast in February 1942 (Veronico 2006). Moffett Field was also used to train new airship pilots, using free balloons and blimps.

With the increase in LTA activity at Moffett Field, Hangar 1 was once again filled to capacity with K- and L-class nonrigid airships. In 1942, construction started on the first of two new enormous wood-frame hangars on the east side of the runways, which by this time had been expanded and reconfigured by the Army Air Corps (see Appendix D). Hangars 2 and 3 were completed in 1943 and used by the Navy Station Assembly and Repair Department to assemble, erect, store, and maintain blimps and balloons (Gleason 1958). LTA operations continued at Moffett Field until August 1947 when the program was deemed obsolete and terminated, making Moffett Field an exclusively heavier-than-air base (Gleason 1958).

Also during this period, the Navy started to focus more attention on expanding the base, including adding facilities for ammunition storage and heavier-than-air aircraft. In April 1942, the Navy purchased 225 acres east of the airfield, presumably to construct an ammunition storage area (Gleason 1958). In 1943, the Navy built a large munitions storage and loading area off the northeast corner of the airfield. The Navy chose this area because most munitions arrived at the Airfield by boat along the ferry channel, and because that was the most lightly occupied part of the airfield (NASA 2013a). The munitions area included five magazines (now known as 070 to 074), a small bunker, an inert ammunition storage building, and nine fortified combat ammunition loading circles. The four magazines were concrete bunkers with cylindrical roofs set into a concrete front wall; lying 8 feet across from the door of these magazines was a matching berm with headwall that served as a blast deflector in case of accidental explosion. Concrete ramps were built to facilitate the transport of munitions from these magazines to the aircraft being readied for their missions. A safety buffer zone was outlined within the explosion arc of these magazines.

Beginning in 1943, the Navy started the first in a series of major changes to the airfield and surrounding areas after the Naval Bureau of Yards and Docks allotted $1.12 million for new construction at Moffett Field (Gleason 1958). By this time, the Navy was flying larger and powerful aircraft such as the PV-1 *Ventura* and Army B-26 *Marauders*, which required more modifications to the runway (Veronico 2006). In May 1944, Runway 14R-32L was extended to its present length with 11-inch Portland cement concrete, anticipating greater use by fixed-wing aircraft in the postwar period (NASA 2013a).

### 3.1.5 Navy Transport Operations (1945–1950)

After World War II, Moffett Field became home to Squadron 4 of the Naval Air Transport Service, with support operations dedicated to aircraft maintenance and overhaul. It was during this period that most of the current-day airfield was built. Beginning in 1945, the Navy spent millions of dollars for improvements and new construction at Moffett Field (Gleason 1958) (see Appendix D). The airfield was expanded and extended to accommodate the Navy's largest transport aircraft, including a huge four-engine transport plane called the R5D *Skymaster* (Gleason 1958). In 1946, Runway 32R-14L was built of 8-inch-thick reinforced concrete to an original length of 7,425 feet. The west and east parallel taxiways were built, along with many of the parking aprons. In 1947, high-intensity approach, taxiway, and runway lights were added to the airfield (Gleason 1958) (see Appendix D). In the late 1940s, two more air transport squadrons (Squadrons 3 and 5) were commissioned at the base, making Moffett Field the largest Naval Air Transport Service base on the West Coast. Squadron 5—the first squadron in the Navy to have nuclear-weapon capabilities—flew the large patrol bombers P2V *Neptune* and AJ *Savage* (Gleason 1958).

Moffett Field's Naval Air Transport Service overhaul and repair operations were closed down in October 1949 (Gleason 1958).

### 3.1.6 Korean War and Navy Jets (1950–1961)

The Korean War started in June 1950 and Moffett Field became the home base for aircraft carrier squadrons and their fighter jets. Jets were first introduced by the U.S. military during World War II, but did not appear at Moffett Field until 1950 with the arrival of the F3D *Skynight*, the Navy's first operational jet night fighter. Navy carrier squadrons stationed at Moffett Field used the airfield for training purposes, including simulated carrier landings. (Runways were equipped with emergency arresting gear similar to the equipment used to stop planes on aircraft carriers.) Moffett Field was also used to train pilots on new jet aircraft before they were first introduced into operational squadrons. Almost every new supersonic jet fighter aircraft in the Navy or U.S. Air Force inventories in the early 1950s was flight-tested at Moffett Field (NASA 2013a). To support the new jets stationed at Moffett Field, two new squadrons were commissioned in March 1951 to provide maintenance services: Fleet Aircraft Service Squadron (FASRON) 10 was one of the first all-jet Fleet Aircraft Service squadrons in the Navy. One of its main roles was to repair damaged aircraft serving in the Pacific Fleet. The FASRON groups used Hangars 2 and 3 for maintenance operations.

In June 1951, to accommodate jet operations at Moffett Field, the Navy embarked on the largest post–World War II expansion program at the airfield (see Appendix D). Because jet aircraft flew much faster and at higher altitudes than propeller-powered aircraft, the airfield at Moffett Field needed to be modified.

Both runways were extended and resurfaced at least once; Runway 32R-14L was extended to 9,200 feet (Navy 1954). Taxiways were expanded, parking and apron areas were added, and new supply, transportation, garage, and barracks buildings were constructed (Gleason 1958). The Flight Operations Building (158) was completed in February 1954 (Gleason 1958). In October 1956, a cutting-edge, high-speed refueling system (MF1003) was added to the apron area north of Hangar 2. This system allowed eight aircraft to be refueled simultaneously at the rate of 5 minutes per plane.

The northeast area of the airfield near the coastline and magazines also saw changes during this period. Three new high-explosive magazines were built along Marriage Road (143, 147, and 528), and an ordnance handling pad (442) was added to the northeast side of the airfield. In 1953, an extensive fuel transport and storage system was completed. The barge canal, dock, wharf, and pipeline system enabled the Navy to bring in large amounts of fuel by barge directly from the refinery, rather than by truck or railroad; fuel was piped from the barge to underground storage tanks in the fuel farm east of Hangar 3, saving time and money. In 1960, a golf course was built within the safety buffer zone surrounding the magazines as an acceptable low-occupancy use (NASA 2013a).

Jet operations at Moffett Field were so extensive that the base was designated a master jet base in 1953 (the first of nine such Navy bases), and operational units on-site reached an all-time high in 1955. However, by the early 1960s, the Navy's operational priorities had changed, and the focus shifted from fighter jets to anti-submarine warfare. Jet operations at Moffett Field ended in 1961.

### 3.1.7 Navy Antisubmarine Warfare Operations (1962–1994)

In November 1962 Moffett Field was selected as the West Coast's training center for the Navy's anti-submarine warfare in the Pacific Ocean. The training was centered on the new propeller-driven anti-submarine aircraft, the Lockheed P3 *Orion*. The Pacific Fleet's first *Orion* arrived at Moffett Field in late January 1963, and for the next three decades the P3s would be a common sight over Moffett Field (Navy 1963). Pilots and technical crews were trained on the *Orion* in an area of the airfield nicknamed "Orion University," two World War II buildings in the California Air National Guard (CANG) outlease area reconfigured for this use (654, 655, and 669) (see Appendix D).

The P3 *Orion* had an internal bomb bay that could house torpedoes, nuclear weapons, and various other mines, missiles, and bombs. To store the weapons used for the *Orion* missions, specifically Mark 46 torpedoes, cluster bombs, and Bullpup or Harpoon missiles, the Navy added a new magazine facility to the safety buffer zone in 1965 (561 and 484-492). In 1973 Moffett Field became the headquarters of the Commander Patrol Wings, U.S.

Pacific Fleet, responsible for patrolling 93 million square miles of ocean from Alaska to Hawaii (see Appendix D).

In 1991, the Base Realignment and Closure Commission recommended the closure of Moffett Field as a naval air station. On July 1, 1994, Moffett Field was closed to military operations, renamed Moffett Federal Airfield, and transferred to NASA (with the exception of the military housing units, which were transferred to the U.S. Air Force).

### 3.1.8 Moffett Federal Airfield (1994–Present)

The munitions storage area is currently used to support operations of the CANG 129th Rescue Wing, and to store explosives used by NASA ARC researchers working on the research gun ranges, both the horizontal ballistic ranges and the vertical impact gun range. It also encompasses the Moffett Golf Course, a full 18-hole regulation course that is open to federal and military personnel and retirees and is currently managed by the Ames Exchange. The golf course site is a critical portion of the 28% of green space required in the NASA ARC's programmatic environmental impact statement and record of decision (2002) for the *NASA Ames Development Plan*. There are plans to rebuild some magazines to prevent the explosive safety arc area from impinging on the San Francisco Bay Trail, in line with local, state, and federal efforts to open the Bay Trail to the public (see Appendix D).

### 3.1.9 National Advisory Committee for Aeronautics and NASA (1939–Present)

In December 1939, the National Advisory Committee for Aeronautics (NACA) began construction of the Ames Aeronautical Laboratory off the northwest corner of the airfield. One of the first buildings constructed at Ames Aeronautical Laboratory was a hangar for research aircraft, now called the Flight Research Facility N210, marking the beginning of NACA's (and later NASA's) association with the airfield. In October 1940 NACA's first research aircraft—a North American O-47 observation plane—arrived at the airfield. By 1941, some of NACA's now-famous wind tunnels were complete and in operation, testing airflow of high-speed fighter aircraft during World War II.

In the mid-1940s, NACA added a second aircraft hangar (N211) to supplement N210 and extended the ramps and taxiways connecting the airfield to the NACA area. Around this time NACA was constructing more wind tunnels and had started a vigorous flight test program on the airfield. One such program, focusing on deicing technologies, won the Collier Trophy in 1946 and validated technology important to the air war in the Pacific during World War II.

The airfield improvements during the Navy Transport period (1945–1950), especially the addition of a longer runway (32R-14L), allowed a significant expansion in NACA's flight test program. Soon after the end of World War II, the NACA flight test program focused on problems with high-speed aircraft. Before Chuck Yeager broke the sound barrier in the Bell X-1 in 1947, NACA test pilot George Cooper (a fighter pilot with the Army Air Force in World War II) broke the sound barrier in dives of aircraft over Moffett Field. The supersonic research carried out by NACA at Moffett Field in the 1940s resulted in the some of the most significant advancements in aeronautical engineering up to that time (Anderson n.d.).

NACA was renamed NASA in 1958. In the 1960s, the NASA ARC continued its research program, the airfield was the site of extensive research into short takeoff and landing technologies and vertical takeoff and landing aircraft. In 1965, the Army located its Aeromechanics Laboratory at Moffett Field, and the airfield became the primary site for research on helicopters during the latter years of the Vietnam War. In the mid-1970s, NASA made a major commitment to advancing the technology of tilt-rotor aircraft, and the XV-15—the forerunner of the V-22 *Osprey,* which is now in service with the U.S. Marine Corps along with the U.S. Air Force inventory throughout their theaters of operation—was test-flown at Moffett Field.

The NASA ARC hosted a fleet of airborne science aircraft at Moffett Field that made major discoveries in the discipline of infrared astronomy, and on which the earliest instruments for high-altitude observation of Earth were validated. The airfield became the staging area for some of the most significant earth sciences missions of the 1970s and 1980s.

In 1998 the aircraft that NASA ARC used for earth science and infrared astronomy were transferred to the Dryden Flight Research Center. NASA's flight test helicopters remained at Moffett Field, and the airfield found other uses.

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# 4.0 INVENTORY

## 4.1 OVERVIEW OF EXISTING CONDITIONS

The Airfield is part of the NASA ARC at Moffett Field, located on the south shore of San Francisco Bay, 35 miles south of San Francisco. The NASA ARC is situated between the Santa Cruz Mountains to the west and the foothills of the Diablo Range to the east. Immediately north of the NASA ARC is an extensive series of wetlands and historic salt ponds. Vehicular access to the NASA ARC is from U.S. 101, a major south-north artery running from California to the state of Washington. Approximately 1,780 acres compose the NASA ARC; the Airfield, with all its component features, occupies 971 of these acres.

The Airfield encompasses features directly associated with the facility's historic core area, which served aircraft, transport, research, maintenance, and training missions, and which has evolved to continue to serve these uses throughout its history. The Airfield's historic features have enabled its ongoing use by dirigibles, balloons, airplanes, rotorcraft, and jets over the decades. These features include circulation elements used by aircraft, such as runways, taxiways, parking mats, compass calibration pads, ramps, repair aprons, and hardstands; buildings used to house aircraft, such as hangars; and buildings and structures involved in aviation operations, such as fuel transport and storage systems, repair shops, control towers, and aids to navigation (such as airport lighting).

Many of the surrounding areas are closely related to—if not directly a part of—the Airfield. Related features include research and training facilities that rely on their adjacency to aviation areas, as well as those that indirectly support aviation functions, such as administrative facilities; open spaces that provide safety buffers between the flight zone and munitions storage; and hazardous elements of a military airfield such as fueling areas, munitions storage and loading, and areas used by test vehicles.

## 4.2 AIRFIELD FEATURES

The spatial organization, circulation, historic buildings and structures, views, archaeological sites, and land uses at the Airfield are described below, including a description of existing conditions and brief overview of their evolution over time.

### 4.2.1 Spatial Organization

Spatial organization is the arrangement of elements that define and create spaces in the landscape. This is an essential aspect of a functional landscape such as the Airfield, because much about the Airfield's appearance today is driven by the patterns needed to support the spatial requirements of historic functions. The landscape has been dedicated to aviation uses since the inception of NAS Sunnyvale in the early 1930s, and the Airfield continues to be arranged to support this use today. When first constructed, the installation was centered on Hangar 1 and the associated dirigible-mooring circles to the north and south. Less than a decade later, the focus had moved to the east after the U.S. Army Air Corps constructed the first iteration of the Airfield's modern runway system. The spatial organization that exists in 2013 was largely established in the mid-1940s after construction of Hangars 2 and 3, the safety buffer zone, the magazines in the far northeast corner of the property, and the area south of Hangars 2 and 3 that now encompasses the CANG site.

Spatially, the Airfield is composed of the following features: the broad, open runways and associated taxiways, compass calibration pad, aircraft parking aprons at hangars, and refueling pads; the monolithic Hangars 1, 2, and 3 that frame the runways on two sides; the open landscape of the safety buffer zone surrounding the group of earthen-bermed ammunition magazines and associated structures to the northeast, including a golf course with a few buildings; the CANG area, including a hangar and open paved aircraft parking apron; and the NASA/NACA hangars with a similar aircraft parking apron.

The Airfield's landscape is defined along most of its edges by the groups of buildings in adjacent areas, including the three large hangars and the CANG and NACA/NASA buildings. Many of these date to the historic period; their massing and location help define the extent of the aviation areas as they have existed over decades.

### 4.2.2 Circulation

Circulation on the Airfield is defined primarily by the aviation features such as runways and taxiways. There are also vehicular roads and associated pedestrian sidewalks.

The runway system has two main taxiways at the east and west edges and six shorter taxiways crossing the concrete runways perpendicularly. There are five major parking aprons (or ramps): directly east of Hangar 1, north of Hangars 2 and 3, north of Hangar 1 at the NACA/NASA site, at the former high-speed fueling pits on the northeast side of the runways, and in the CANG area.

The vehicular roadways are an important feature of the Shenandoah Plaza area in the current NAS Sunnyvale Historic District, forming a symmetrical, Beaux-Arts circulation pattern that drives the layout of the buildings in the area. However, the roads in the Airfield area are secondary to aviation circulation in the landscape, and have been so throughout the installation's history.

The NASA ARC and the Airfield are accessed by two primary entrances, one on Moffett Boulevard and one on Ellis Street—both major exits off U.S. 101. The Airfield is encircled by a single contiguous loop road that, starting west of Hangar 1, is called Cummins Road. As the road encircles the Airfield to the south it becomes Macon Road, wrapping around the south end of the runways and Hangars 2 and 3, then heading north to the northernmost magazine in the safety buffer zone. Secondary roads in the Airfield area consist of the East Patrol Road, which follows the easternmost boundary of NASA property; Marriage Road, which bisects the southern magazine area and the golf course; the North Perimeter Road, which wraps around to the north of the runways and back south toward Hangar 1; and Zook Road, which runs along the westernmost border of the Airfield until it connects with Cummings Road to the west of Hangar 1. These roads are generally two lanes and paved with asphalt; some have associated sidewalks and concrete curbs. The paving and configuration of many of the roads in the Airfield area have changed over time as runways were extended and other aviation use–driven functions evolved. There are smaller roads as well, such as the one leading from the safety buffer zone to the ordnance handling pad; access roads within the CANG area; vehicular parking areas; and a road leading between Hangars 2 and 3.

### 4.2.3 Buildings and Structures

An inventory of contributing buildings and structures that lie within both the current NAS Sunnyvale Historic District and the Airfield's proposed extension is provided in Appendix C. This inventory lists the name and facility number for each feature and indicates the current use of that feature. The inventory also indicates whether each feature is believed to contribute to the Airfield's significance, and thus supports the Airfield's qualification for listing in the NRHP.

The most visible buildings and structures at the Airfield continue to be the ones that have been present since the historic period of significance. Buildings and structures at the edges of the open aviation areas provide a visual break and a spatially defined edge to the open runway, taxiway, and apron areas. Most of the views at the Airfield are dominated by the massive steel-frame structure of Hangar 1, which also serves as the anchor to the west side of the runway system. The vast Hangars 2 and 3, with their wood-frame structures and aluminum panels, are equally imposing, anchoring the east side of the runways. More than a hundred other buildings and structures, both historic and nonhistoric, stand within the Airfield area. Of these, a few in addition to the large hangars stand out as unique. For example, the north and south floodlight towers (Buildings 32 and 33, constructed in 1934) served as original aviation-operation buildings in the 1930s. Another building in the study area that merits mentioning is Airfield Flight Operations Building 158, located south of Hangar 1 and used for all communication and navigation related to airfield activity. Constructed in 1954, the Airfield Flight Operations Building is a two-story concrete building with a three-story observation tower. Other unique structures at the Airfield include the bunker-like "igloo"-style ammunition magazines constructed in 1943, and a fuel-distribution system constructed in the 1950s, which includes a berthing wharf and pier, pipes, bridges, storage tanks, and high-speed fueling pits.

The portion of the Airfield with the most buildings constructed after 1963 is the CANG area, located in the southeast corner of the Airfield. Although the CANG area contains some buildings constructed before 1963, most of the buildings were constructed in the 1970s and 1980s. Aside from Hangars 1–3, the CANG buildings are the largest buildings within the Airfield. The CANG area contains various administrative and aviation-operations buildings, an expansive modern hangar building constructed in 2003, maintenance and storage buildings, and a building dedicated to CANG civil engineering. Post-1963 buildings located within the safety buffer zone surrounding the original 1940s magazines include a large magazine to the north with seven magazines constructed in 1965, a missile magazine added in 1976, and miscellaneous associated facilities. Another magazine was added adjacent to the original 1940s magazines in 1970. Other areas within the Airfield that contain post-1963 buildings include the alley between Hangars 2 and 3 and the areas north and northeast of the hangars; the fuel farm area east of Hangars 2 and 3; the golf course; and a small handful of buildings west of the runways.

Many of the fueling features appear to no longer be operational and their individual conditions and historic integrity have not yet been determined. All other existing buildings, structures, and features at the Airfield are related to operations and communications, training and operations (CANG), storage, utilities, security, and entertainment (golf course).

### 4.2.4 Views

Views of Hangar 1 are considered paramount at the Airfield, and are available from many locations. Hangar 1 can also be seen from U.S. 101, and it is widely recognized as an iconic Bay Area landmark. Notable views of Hangar 1 include those from the main gate entrance at Moffett Boulevard to the NASA ARC; from the runways; and from Hangars 2 and 3. Another notable view at the Airfield is the expansive, open view from the south end of the runways looking north toward San Francisco Bay. The panoramic view of the entire Airfield from the control tower at the Flight Operations Building is also important.

### 4.2.5 Archaeological Sites

Archaeological sites that have been found at the NASA ARC provide a context for understanding what other as-yet-undiscovered sites may be encountered (for example, during construction or other ground-disturbing activities). A total of 10 archaeological sites are reported to be located within the boundaries of the former Moffett Field and the NASA ARC: CA-SCI-12/H, CA-SCI-14 through CA-SCI-17, CA-SCI-19 through CA-SCI-21/H, CA-SCI-24, and CA-SCI-18/H (Garaventa et al. 1991; NASA 2002b). Most of these resources were recorded in 1912, but the Basin Research investigation (Garaventa et al. 1991) states that few have been reidentified, although multiple field investigations have been conducted. One possible exception is Resource CA-SCI-20H, composed of a diffuse scatter of shell fragments, but a specific aboriginal use or cultural association could not be determined.

Historic maps suggest that archaeological deposits related to a landing and connecting road, stage stop, and dwellings dating to the 1850s to the 1890s may be present near the Airfield. The 1991 Basin Research study failed to identify these and concluded that none of the sites within Moffett Field appeared eligible for inclusion in the NRHP (Garaventa et al. 1991; NASA 2002b). With the exception of Resources CA-SCI-12/H, CA-SCI-21, and CA-SCI-24, these sites were reported to be near the airfield, and have likely been long since destroyed. Basin Research further stated that, given the level of disturbance caused by the installation of modern infrastructure (electrical and telephone distribution systems, water and sewer systems, and gas lines), little potential exists for encountering intact archaeological resources.

### 4.2.6 Land Uses

During the decades since its inception in 1930, the Airfield has been used for a variety of aviation purposes, serving LTA craft (dirigibles, balloons, and blimps), airplanes, jets, and rotorcraft. In recent years, NASA has continued to use the Airfield without major modifications. Existing military tenants continue to be based at existing facilities, and to use the Airfield for aviation training; local police and county sheriff's departments base their patrol helicopters there as well. In addition, the Airfield is used by private entities to transport satellites to launch facilities, and transport patients and organs to local hospitals. The Airfield is often used by transient military aircraft, by NASA aircraft conducting flight research, and aircraft from the 89th Military Airlift Wing. Also, Aero Flight Dynamics Directorate helicopters occupy the NASA ramp at N248 and use the Airfield. None of the current land uses have required the addition of intrusive new construction that would diminish the character and setting of the Airfield and its historic contextual relationships to adjacent historic properties.

# 5.0 EVALUATION

## 5.1 STATEMENT OF SIGNIFICANCE

The Airfield is nationally significant under Criterion A as the central core facility of aviation-related research programs, as well as significant transport, training, and other aviation uses at the property. The Airfield's landscape is composed of a collection of buildings and structures that contribute to the adjacent NAS Sunnyvale Historic District under Criterion A. The Airfield's inclusion in the existing historic district expands the district's currently defined significance to include World War II and ongoing use of the Airfield for Cold War–era NACA, NASA, and military missions.

### 5.1.1 Period of Significance

The NAS Sunnyvale Historic District was listed in the NRHP under Criteria A and C in the areas of Architecture and Engineering/Military with a period of significance of 1930-1935 and 1942-1946; the Airfield and all building and structures located within that area were excluded from the district boundary.

The Airfield and its contributing features appear to be eligible for listing in the NRHP under Criterion A as an extension of the NAS Sunnyvale Historic District. Furthermore, it is recommended that the period of significance under Criterion A for the NAS Sunnyvale Historic District should be revised to 1930-1961. This revised period of significance reflects the significant modifications to the Airfield that occurred between 1935 and 1942—a period initially excluded from the NRHP nomination—and adds 1946-1961, which corresponds to the Airfield's continuous association with significant Navy and NASA missions during World War II and subsequent early NACA/NASA missions during the Cold War. The revised period of significance (1930 to 1961) would primarily apply to those features within the district that functionally relate to the operations of the Airfield.

As discussed previously in Section 3.1, "Developmental History," the current form of the runways began to take shape as the Airfield was modified to accommodate heavier-than-air craft for the U.S. Army Air Corps beginning in the mid-1930s. This modification included removing the older LTA runways and introducing Runway 14R-32L in 1938. With the introduction of the major runway that would shape the configuration of the Airfield as it is still seen today, the period of significance justifiably includes the years between 1935 and 1942, which were omitted from the original NAS Sunnyvale Historic District NRHP listing. The Airfield continued to take on its current configuration with major building campaigns in 1945 (for the Navy transport missions) and 1951 (for the Navy jets' missions). Changes to the configuration of the aviation areas over time reflect changing technologies and needs. These changes retained the Airfield's place at the cutting edge of scientific and aviation research and permitted its continuing use. Therefore, the changes throughout the period of significance are part of the site's character and reflect its central function.

### 5.1.2 Relevant Theme Studies and Contexts

Resources associated with the Airfield are mentioned in a National Park Service National Historic Landmarks theme study, *American Aviation Heritage*, which identified Moffett Field as significant. It was recommended for further study as an important representative of military aviation, specifically LTA craft, for the World War II period (1939–1945) (NPS 2004):

> During World War II, the field at Sunnyvale, commonly known as Moffett Field, served as the navy's west coast lighter-than-air operations center and as the headquarters for the Commander, Fleet Airships Pacific. It also served as the primary training site for blimp pilots in the United States, all free balloon (untethered) training, and as an assembly center for Goodyear blimps from approximately 1942 to 1944. Now known as the NASA Ames Research Center, NASA administers the field's historic resources including three dirigible hangars: Hangar #1, the original hangar built in 1932 for the storage of the airship Macon and training World War II airship pilots, and the World War II era Hangars #2 and #3.

Context studies help to place the Airfield within the bigger picture of significant events and movements in American history. A major study of this type is the *NASA-wide Survey and Evaluation of Historic Facilities in the Context of the U.S. Space Shuttle Program: Roll-up Report*. In addition, the ACHP provided a "Program Comment for World War II and Cold War Eras (1939–1974) Ammunition Storage Facilities" that provides references to context and guidance on historic ammunition facilities, which may apply to the magazines located on the northeastern portion of the Airfield (ACHP n.d.).

### 5.1.3 Additional Considerations for Significance

Ongoing operations at the Airfield since 1961 continue to carry the mission of the facility forward. This continuing use, however, is not considered to confer eligibility, because of the 50-year cutoff for NRHP eligibility. The property has not been identified as exceptionally significant for events after 1961, so Criterion Consideration G (for significant sites less than 50 years old) is not applicable. However, the passage of time may render later events at the Airfield significant as researchers gain historical perspective on the value of these events to the bigger picture of American history. It is therefore recommended that the significance be periodically reevaluated to determine whether the end date should be moved forward.

## 5.2 INTEGRITY ASSESSMENT

The Airfield's landscape is defined to a great degree by its continuous evolution to serve the needs of aviation research for nearly a century. The layout of aviation areas has been modified over time to accommodate new types of aircraft and allow the facility to continue to carry out its historic mission of cutting-edge aviation research. As the ACHP notes (ACHP 1991):

> Many of the facilities and much of the equipment associated with scientific or engineering advancements remain in active use today, but need to be continuously upgraded and modified to stay at the cutting edge of technology…. a balance must be struck between the needs of active scientific and technological facilities and the need to preserve the physical evidence of America's scientific heritage.

The U.S. Army Corps of Engineers, in *Guidelines for Documenting and Evaluating Historic Military Landscapes: An Integrated Landscape Approach* (Loechl et al. n.d.), identifies the ongoing use of historic facilities as an important aspect of retaining their integrity. If consistent use continues to sustain these functional landscapes, some changes to the physical fabric to support the ongoing historic core mission (and similar or related uses) are expected and may not detract from the historic integrity of the property. Also noted in this study are the differences between "core" mission facilities, which are essential to the historic purpose of the landscape, and support facilities, which are secondary. When considering issues of significance and integrity, core facilities are considered more crucial to sustaining this type of historic landscape's historic identity (Loechl et al. n.d.).

As a result, sites such as the Airfield (significant historic military, scientific and technological resources) have a greater degree of flexibility than some other kinds of historic properties to allow judicious, thoughtful changes to support ongoing uses. The upgrading of obsolete aviation features to continue the mission of the Airfield does not have the same negative impacts to integrity that would occur should unrelated new construction destroy historic aviation features. Because the changes have accrued in a way that retains the relationships among the Airfield's character-defining features and supports its ongoing aviation missions, the property retains overall integrity. Historic integrity would not be diminished by interior changes to buildings and structures within the District that contribute to Criterion A (that is, buildings and structures lacking NR design significance), if they are not individually listed. The primary function of these resources as character-defining features is their exterior massing and character in the larger landscape of the Airfield. Likewise, typical changes to non-contributing buildings and structures that would be necessary to support ongoing uses are unlikely to have an impact on the integrity of the overall district, although this should be guided by future preservation planning projects and guidance (such as found in an Integrated Cultural Resources Management Plan [ICRMP]).

The Airfield retains its integrity of location because it remains in its original geographic location. Its setting has been slightly diminished by new development in the vicinity since the 1960s. Still, the visual relationships—most importantly to Hangar 1, but also to the bay and salt ponds to the east and north, and to Shenandoah Plaza and other features of the NAS Sunnyvale Historic District to the west—remain similar to their historic appearance before 1961, and continue to define the site's setting as they have since the 1930s. Therefore, integrity of setting is retained.

The Airfield's integrity of feeling is retained because the ongoing aviation use of the property and the associated features and activities evoke a sense of its continuing historic use, even though the military airship period is long past. In recent years, commercial airship use has provided continuity of historic activities, which also supports integrity of feeling.

The Airfield retains integrity of association because Hangar 1 and other character-defining features are present to represent the many different significant aviation activities that occurred there throughout the historic period.

Integrity of design is retained, and remains most evident in Hangars 1, 2, and 3 as well as other buildings and structures. The integrity of design related to Hangar 1 has been somewhat diminished because of the loss of the exterior cladding of the structure; it resembles its historic appearance less closely with the siding missing. However, this is a reversible condition, because the siding may be replaced. Although some larger landscape features such as the aviation paved areas have changed substantially since the 1930s, they have changed only slightly since the end of the period of significance in 1961. Specific safety-related historic design associated with these kinds of facilities is evident in the layout and features of the munitions storage area, such as the bermed "igloo" storage bunkers and the use of a buffer zone of standard width to ensure that safety objectives for facility design were met.

Integrity of workmanship and materials have both been diminished because of the loss or replacement of materials such as aviation area paving and the siding of Hangar 1; however, these aspects are less important to the integrity of large landscapes such as this (as noted in National Register Bulletin 40 [NPS 1999]).

## 5.3 IDENTIFICATION OF HISTORIC CHARACTER AND CHARACTER-DEFINING FEATURES

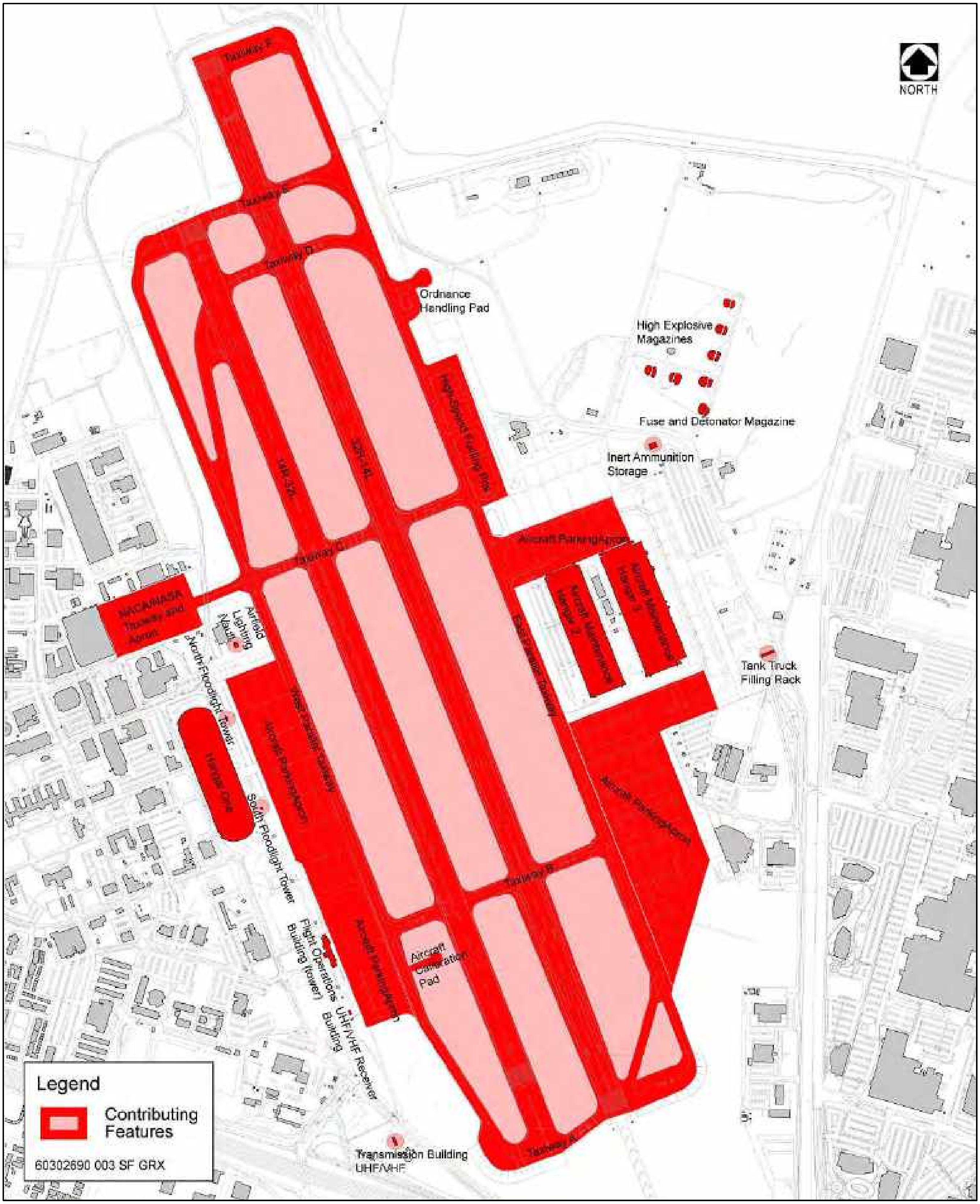
The Airfield encompasses the features directly associated with the Airfield's core aviation mission, which has evolved throughout its history. These features include facilities that served the station's dirigibles, balloons, airplanes, and rotorcraft from the Airfield's construction in 1930 through World War II and the early NACA/NASA years. Many of the features in surrounding areas, though not part of the Airfield, are closely related to it. These include research and training facilities that rely on their adjacency to aviation features, as well as resources such as administrative facilities that indirectly support aviation functions. In addition, views to Hangar 1 from all areas are widely recognized as significant, because Hangar 1 is an iconic landmark in the broader landscape including the NASA ARC and beyond.

The large-scale, monolithic, high Modern appearance of Hangar 1 and the utilitarian, hard-edged character of the Airfield create a distinctive contrast with the finer-textured Shenandoah Plaza area with its Spanish Colonial–Revival architecture, symmetrical road system, and formal plantings. The visual character of the Airfield area throughout the Airfield's history has been open and expansive, hard-surfaced, and functional. The runways were historically large, flat, open, linear features designed to be highly visible from the air, oriented for optimal takeoff and landing based on prevailing winds and surrounding topography. The size and configuration of aviation features were modified over time, driven by the requirements of different types of aircraft that were in use. In the 1930s, Hangar 1 was the central feature of the dirigible-focused aviation area, with tracks extending from its end doors to mooring circles on the north and south. As the Airfield's mission left LTA craft behind and shifted to focus on airplanes and rotorcraft, the small runway system became more important and the tracks and mooring circles were removed. The runway system expanded to a large rectangular field in the 1940s and then gained more well-defined circulation, with longer runways and adjacent taxiways, as it was extended to accommodate additional aircraft types through the 1950s. Throughout these alterations, the Airfield's relationship to and views of Hangar 1 have remained its dominant character-defining feature.

Some contributing buildings and structures are noted below as they relate to the Airfield's historic landscape character. A preliminary inventory of contributing features is provided in Appendix C. This table lists the buildings and structures located within the Airfield area that are known to date to the period of significance, retain integrity, and relate to the significance of the Airfield and/or the existing NAS Sunnyvale Historic District. Some secondary features, such as roads and sidewalks, lighting, belowground features, pipes associated with former fueling systems, and antennae were not evaluated at this time because of the limited availability of information about their integrity and relationship to significance.

Character-defining features of the Airfield are as follows (Figure 2, "Airfield Contributing Features"):

- Flat topography.
- Broad, open views across aviation areas.
- Long views to the salt ponds and San Francisco Bay.
- The expansive, linear system of aviation circulation, dominated by the two parallel concrete-paved runways and their associated taxiways. Associated contributing structures include Runway 14R-32L, Instrument Runway 32R-14L, west and east parallel taxiways, and the aircraft compass calibration pad.




Source: Data compiled by AECOM in 2013

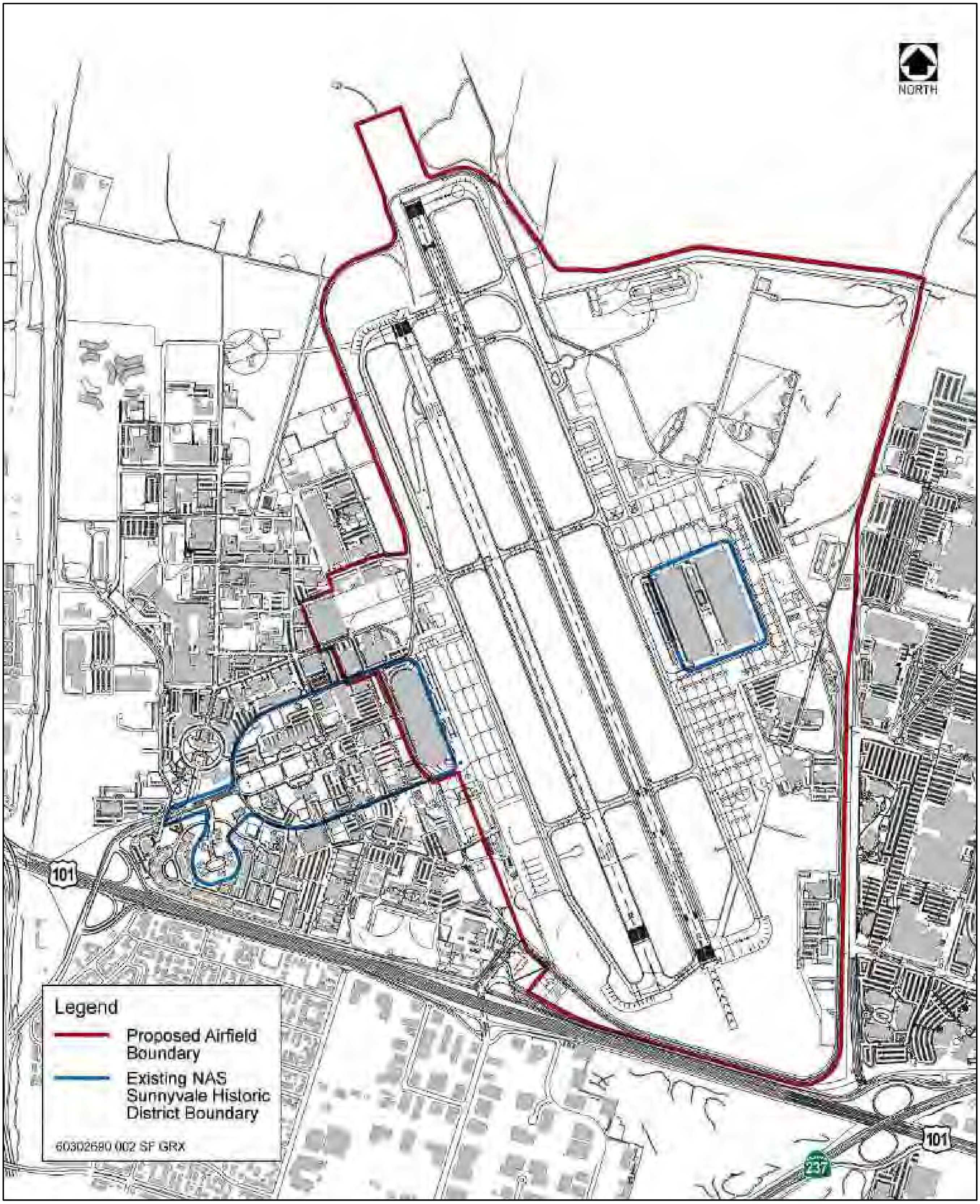
**Figure 2. Preliminary Map of Contributing Airfield Features**

- The historic hangars and other aviation facilities that define the edges of the aviation areas. These include Hangars 1, 2, and 3; the NASA/NACA hangar; and the CANG area hangar. Even if some of these buildings and structures do not retain individual integrity (because of factors such as interior renovations or changes to exterior materials), their presence supports the historic spatial character and texture of the Airfield landscape.
- Visual dominance of Hangar 1 from all areas.
- Views to aircraft maintenance Hangars 2 and 3, framing the east side of the runway areas and visually balancing Hangar 1 on the west side. The three hangars are all contributing features of the NAS Sunnyvale Historic District, but their massing and exterior appearance support the historic character and integrity of the Airfield and the landscape's spatial arrangement.
- The concrete aircraft parking aprons, with their grid-like texture, adjacent to the hangars.
- Historic aircraft fueling features that relate to early-1950s use of the Airfield, including the high-speed fueling pits and tank truck filling rack. These appear to no longer be in use.
- The features at the northeastern edge of the Airfield that are associated with historic ammunition storage and handling, including the row of four heavily fortified, earthen-walled ordnance magazines; the inert ammunition storage building; the two high-explosive magazines; the ordnance handling pad; the fuse and detonator magazine; and the associated open space of the safety buffer zone that has historically been part of the design specifications for such magazines.
- The distinctive structures and buildings associated with historic aviation lighting, such as the architecturally unusual north and south floodlight towers adjacent to Hangar 1 and the airfield lighting vault.
- The collective design of buildings and structures lending a "futuristic grandeur" to the appearance of the Airfield and NAS Sunnyvale Historic District together (Gleason 1958).
- Ongoing aviation use.

## 5.4 BOUNDARY JUSTIFICATION

This study recommends that the Airfield and its contributing features are eligible for listing as an extension of the NAS Sunnyvale Historic District, which is already listed in the NRHP. Thus, the discussion of the boundary necessarily suggests the need to expand the boundary of the NAS Sunnyvale Historic District to encompass the Airfield (see Figure 3, "Proposed Revised Boundary, NAS Sunnyvale Historic District").

The Airfield encompasses historic features directly associated with the facility's core aircraft, transport, research, maintenance, and training mission, which has evolved throughout its history. These features include those used to support operations involving dirigibles, balloons, airplanes, rotorcraft, and jets. The facilities directly associated with this use include circulation features used by aircraft, such as runways, taxiways, parking and repair aprons, and compass calibration pads; buildings used to house aircraft, such as hangars; and buildings and structures directly involved in aviation operations, such as fuel transport and storage systems, repair shops, control towers, and aids to navigation (such as airport lighting). The eligible Airfield also includes research and training facilities that rely on their adjacency to aviation features, as well as resources such as administrative facilities that indirectly support aviation functions; open spaces that provide safety buffers between the flight zone and munitions; and some hazardous elements of a military airfield such as fueling areas, munitions storage and loading facilities, and areas used by test vehicles.




Source: Data compiled by AECOM in 2013

**Figure 3. Proposed Revised Boundary, NAS Sunnyvale Historic District**

The corresponding boundary line follows the current outer fenceline along the northern, eastern, and southern boundaries of the NASA ARC, inclusive of the vehicular roadway that is used to access the eastern Airfield areas from the operational center of the NASA ARC on the west. The boundary is a bit more complex on the west side, where the Airfield abuts the research center. North of Hangar 1, the boundary corresponds to the current fenceline, which incorporates the small apron in front of historic Hangars 210 and 211 and the flight-related buildings that face this apron. At Hangar 1 the boundary would defer to the existing NAS Sunnyvale Historic District boundary line as it follows the NAS Sunnyvale Historic District to the west and south, and back in to encompass Hangar 1 on the south. Heading in a southerly direction from the southeast corner of Hangar 1, the revised boundary runs parallel to the runways to the point where it meets Cody Road (including the flight operations building), and then meets with the current outer fenceline around the southeast end of the NASA ARC, inclusive of the vehicular roadway and communications structures south of the security guard station.

# 6.0 TREATMENT

## 6.1 MANAGEMENT CONTEXT

NASA developed a historic resources protection plan (HRPP) in 2002. The HRPP consists of a 10-year programmatic agreement between NASA ARC, the SHPO, and the Advisory Council on Historic Preservation. The agreement, which became effective November 15, defines the historic preservation management plan for the NASA Research Park, including the NAS Sunnyvale Historic District at Moffett Field (NASA 2002a). The HRPP expired in 2012. NASA ARC is preparing an integrated cultural resources management plan (ICRMP) in accordance with current NASA standards, to serve as the management tool for historic properties for the next decade. The results of this study will be incorporated into the ICRMP.

The ICRMP will also identify other treatment and planning tools that may be necessary for ongoing stewardship of the NAS Sunnyvale Historic District (including the Airfield). Currently 98 acres in the southeast portion of the Airfield are encumbered by a permit to the U.S. Air Force with respect to the CANG Cantonment Area. NASA ARC is considering options for leasing out other portions of the Airfield area. NASA and the U.S. General Services Administration have partnered to issue a request for proposals (RFP) to obtain lease proposals from qualified entities to rehabilitate and adaptively reuse historic Hangar 1 and to operate, manage, and maintain Moffett Federal Airfield (NASA 2013a). The RFP includes a requirement for the lessee to rehabilitate and adaptively reuse Hangar 1 and manage and maintain the Airfield in compliance with the *Secretary of the Interior's Standards for the Treatment of Historic Properties and Guidelines for the Treatment of Cultural Landscapes*. The following treatment guidelines are intended to provide NASA and potential lessees with a framework for considering appropriate future uses and treatment approaches for the Airfield's contributing features, in light of its eligible status for inclusion as an extension of the NAS Sunnyvale Historic District.

## 6.2 TREATMENT APPROACH

The U.S. Department of the Interior currently recognizes four appropriate treatment alternatives for historic properties: preservation, rehabilitation, restoration, and reconstruction. These are defined and discussed in the *Secretary of the Interior's Standards for the Treatment of Historic Properties and Guidelines for the Treatment of Cultural Landscapes* (NPS 1995). Originally, these approaches were developed for historic properties in the NRHP, and were focused on issues specific to buildings and structures. The Secretary of the Interior's guidelines addressing historic landscapes were subsequently developed and appended to these standards. *Guidelines for the Treatment of Cultural Landscapes* were appended to the Secretary of the Interior's standards in 1992, when the standards were revised so that they could be applied not just to buildings and structures, but also to sites, objects, districts, and landscapes.

National Park Service *Director's Order-28: Cultural Resource Management Guideline* (1998), adapted from historic-property treatment guidance, also provides specific guidance for treatment of landscapes. Director's Order 28 provides the following definitions of the four treatment alternatives for cultural landscapes:

- *Preservation* maintains the existing integrity and character of a historic property by arresting or retarding deterioration caused by natural forces and normal use. It includes both maintenance and stabilization. Maintenance is a systematic activity mitigating wear and deterioration of a historic property by protecting its conditions. In light of the dynamic qualities of a landscape, maintenance is essential for the long-term preservation of individual features and integrity of the entire landscape. Stabilization involves reestablishing the stability of unsafe, damaged, or deteriorated resources while maintaining their existing character.

- *Rehabilitation* improves the utility or function of a historic property, through repair or alteration, to make possible an efficient, compatible use while preserving those portions or features that are important in defining its significance.
- *Restoration* accurately depicts the form, features, and character of a cultural landscape as it appeared at a specific period or as intended by its original constructed design. It may involve the reconstruction of missing historic features and cultural value in themselves.
- *Reconstruction* entails depicting the form, features, and details of a nonsurviving cultural landscape, or any part thereof, as it appeared at a specific period or as intended by its original constructed design. Reconstructing an entire landscape is always a last-resort measure for addressing a management objective and should be undertaken only after consultation.

The recommended landscape treatment approach for the Airfield is rehabilitation. Rehabilitation is the appropriate treatment approach wherever an activity requires physical changes to the landscape, such as large-scale repairs, replacement of historic features, and alterations and additions for a new or continued use (new roads, buildings, or parking, for example).

## 6.3 TREATMENT GUIDELINES

Guidelines for treatment describe how to accomplish needed changes in the landscape without compromising its historic character. The guidelines outlined below are intended to complement the treatment concepts, and to establish a general approach to historic airfield preservation and continuing use. Guidelines are organized by categories: spatial organization, archaeological resources, views and viewsheds, circulation, historic buildings and structures, small-scale features, land use, topographic modifications, additional studies, and new construction. These sections give general recommended actions to meet the goals of resource preservation.

Rehabilitation standards acknowledge the need to alter or add to a cultural landscape to meet continuing or new uses while retaining the landscape’s historic character (NPS 1995):

> In Rehabilitation, the historic landscape’s character-defining features are protected and maintained. The Secretary of Interior’s Standards for Rehabilitation permit the replacement of deteriorated, damaged, or missing features using either traditional or substitute materials. Of the four treatments, only Rehabilitation includes an opportunity to make possible an efficient contemporary use through alterations and additions.

The following general preservation actions are associated with rehabilitation (NPS 1995):

- **Identify, Retain, and Preserve Historic Materials and Features**: Any treatment of historic landscapes begins with identification of the features and materials that are important to the landscape’s historic character and must be retained.
- **Protect and Maintain Historic Features and Materials**: Protection generally involves the least degree of intervention and is preparatory to other work; it may be accomplished through permanent or temporary measures. For example, protection includes restricting access to fragile earthworks or cabling a tree to protect

against breakage. Maintenance includes daily, seasonal, and cyclical tasks and the techniques, methods, and materials used to implement them.

- **Repair Historic Features and Materials:** When existing conditions of character-defining materials and portions of features warrant more extensive work, repairing is recommended. Rehabilitation guidance for the repair of historic features and materials begins with the least degree of intervention possible. Repairing also includes the limited replacement in kind of extensively deteriorated materials or parts of features. Using material that matches the historic in design, color, and texture is always the preferred option; however, substitute material is acceptable if the material conveys the same visual appearance as the historic period.
- **Replace Deteriorated Historic Materials and Features:** Following repair in the hierarchy, rehabilitation guidance is provided for replacing an entire character-defining feature with new material because the level of deterioration or damage precludes repair. The preferred option is always replacement of the entire feature in kind. Because this approach may not always be technically, economically, or environmentally feasible, the use of compatible substitute materials can be considered. Whatever level of replacement takes place, the historic features and materials should serve as a guide to the work. Although the rehabilitation guidelines recommend replacing an entire feature that is extensively deteriorated or damaged, they never recommend removing the feature and replacing it with new material if repair is possible.
- **Design for the Replacement of Missing Historic Features:** When an entire feature is missing, the landscape's historic character is diminished. Accepting the loss is one possibility; however, where an important feature is missing, its replacement is always recommended in the rehabilitation guidelines as the first or preferred course of action. Thus, if adequate historical, pictorial, and physical documentation exists so that the feature may be reproduced accurately, and if it is desirable to reestablish the feature as part of the landscape's historical appearance, then planning, designing, and installing a new feature based on such information is appropriate. A second course of action for the replacement feature is to create a new design that is compatible with the remaining character-defining features of the historic landscape. The new design should always take into account the spatial organization and land patterns, features, and materials of the cultural landscape itself; most importantly, the new design should be clearly differentiated so that a false historical appearance is not created.
- **Alterations/Additions for New Use:** When alterations to a historic landscape are needed to assure its continued use, it is most important that such alterations do not radically change, obscure, or destroy character-defining spatial organization and land patterns or features and materials. Such work may also include selectively removing features that detract from the overall historic character. Installing additions to a historic landscape may seem to be essential for a new use; however, the rehabilitation guidelines emphasize that such new additions should be considered only after it is determined that those needs cannot be met by altering secondary (i.e., non-character-defining) spatial organization and land patterns or features. If alternative solutions have been thoroughly evaluated and a new addition is still judged to be the only viable alternative, the addition should be planned, designed, and installed to be clearly differentiated from the character-defining features so that these features are not radically changed, obscured, damaged, or destroyed.

### 6.3.1 Spatial Organization

Spatial organization is the arrangement of elements that define and create spaces in the landscape. This is an essential part of a functional landscape such as the Airfield. Consider retaining the open qualities of the runways and taxiways, framed by the large Hangars 1, 2, and 3. Avoid adding new, vertical features within the open, broad expanse of paving. Consider adding any new buildings and structures as infill within other areas. Retain the open areas around the munitions magazines that compose the safety arcs for explosives.

### 6.3.2 Archaeological Resources

Most of the archaeological resources identified at NASA ARC date to the prehistoric and early historic periods; therefore, they predate the Airfield. Should intact archaeological sites be encountered, much could be learned about the indigenous occupation and subsequent settling of the Sacramento–San Joaquin Delta vicinity. The overall stewardship goal for archaeological sites is protection from disturbance and monitoring of any undertakings that may affect archaeological resources. Any projects involving ground disturbance will adhere to NASA's unexpected-discovery plan, in accordance with Title 36, Section 800.11 of the Code of Federal Regulations. Similarly, projects will comply with the Native American Graves and Repatriation Act and its implementing regulations.

### 6.3.3 Views and Viewsheds

Views are a critical aspect of the Airfield's character. The overall stewardship goal is to retain the views that have consistently been part of the Airfield's appearance over time. In particular, the open views along and across the runway area, featuring the visually prominent Hangars 1, 2, and 3, and the views of the surrounding setting such as San Francisco Bay and the salt ponds should be preserved. For example, if new, vertical features are being considered for addition to the landscape, avoid placing them along the runway alignments or near the facades of the hangars.

### 6.3.4 Circulation

Circulation includes roads as well as aviation features such as runways and taxiways. Retain the existing historic patterns of circulation, such as road alignments and widths, and runway and taxiway alignments. Retain and maintain historic paving materials. Consider repairing or replacing damaged and worn historic materials in-kind to preserve the appearance of features such as the concrete runways and historic curbing.

### 6.3.5 Historic Buildings and Structures

The focus of landscape treatment is on building exteriors and forms as they affect the landscape, not building interiors or detailed structural and engineering recommendations. In general, alterations to contributing buildings and structures that significantly change the massing and exterior appearance may have an impact on the integrity of the District. Retain and maintain the historic Hangars 1, 2, and 3. Maintain the exterior appearance of Hangars 2 and 3, and consider replacing the missing exterior cladding of Hangar 1 with materials that replicate its appearance in the historic period (1930–1961). Coordinate other exterior alterations to contributing buildings with guidance documents such as the ICRMP to ensure compliance with appropriate standards.

### 6.3.6 Small-Scale Features

Small-scale landscape features include both historic features (such as stone and concrete markers) and nonhistoric ones (such as signs and memorials). Many of these features have changed over time; they largely serve the Airfield's functional needs, and historic small-scale features were removed as they became obsolete. Identify historic small-scale features and, if practicable, preserve in-place; if they must be removed, consider moving them to another location if they could serve a memorial or interpretive purpose. If not, document thoroughly before removing.

### 6.3.7 Land Uses

As noted above, continuing aviation uses fundamentally support the ongoing significance of the Airfield. Insofar as possible, continue to use the Airfield and its associated features for aviation functions. Other uses and activities within buildings and structures that do not require exterior alterations to historic resources may also be appropriate. Avoid introducing incompatible land uses and associated construction within the Airfield area. Refer to guidance provided in historic preservation management documents such as the ICRMP.

### 6.3.8 Topographic Modifications

Topographic modifications include areas that have been graded. The Airfield is distinguished by its flat topography. Maintain the level character of the area, and avoid adding significant areas of cut and fill as part of construction activities within the Airfield site.

### 6.3.9 Recommended Studies

Consider undertaking historic structure reports for historic buildings and structures to detail their conditions. Provide technical guidance on material conservation and structural treatment for repair, stabilization, and other future actions. Additional studies may be identified in the ICRMP, which is in progress.

### 6.3.10 New Construction

New additions and adjacent or related new construction should be undertaken in such a manner that, should the additions or construction elements be removed in the future, the essential form and integrity of the historic property and its environment would be unimpaired.

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# APPENDIX A

Selected Historic Photographs

Early aerial photograph of NAS Sunnyvale showing Shenandoah Plaza at center left, Hangar 1 with the mooring circles for the *USS Macon*, and the original runway configuration for the *Sparrowhawk* planes at center right, c. 1933 *(Source: Moffett Field Historical Society)*

Aerial photograph of NAS Sunnyvale with Hangar 1 at upper right and larger runway system at center and left, c. 1934-1938 (*Source: Moffett Field Historical Society)*

Aerial photograph of NAS Sunnyvale, c. 1938 *(Source: NASA Ames History Office)*

Aerial photograph of NAS Moffett Field with new runway configuration and safety buffer zone under construction, July 25, 1943 (*Source: NASA Ames History Office*)

Aerial photograph of NAS Moffett Field showing recently completed Hangars 2 and 3 at center right and future CANG area at lower left, 1944 (*Source: Moffett Field Historical Society*)

Aerial photograph of NAS showing the completed magazines and safety buffer zone, c. 1945 *(Source: NASA Ames History Office)*

Aerial photograph of NAS Moffett Field during Naval Air Transport Service period, 1947. Note taxiway and apron in front of NACA hangars to the left of Hangar 1. *(Source: Moffett Field Historical Society)*

Aerial photograph of NAS Moffett Field after new ramps and taxiways were installed and the runways were extended, 1953 (*Source: Moffett Field Historical Society)*

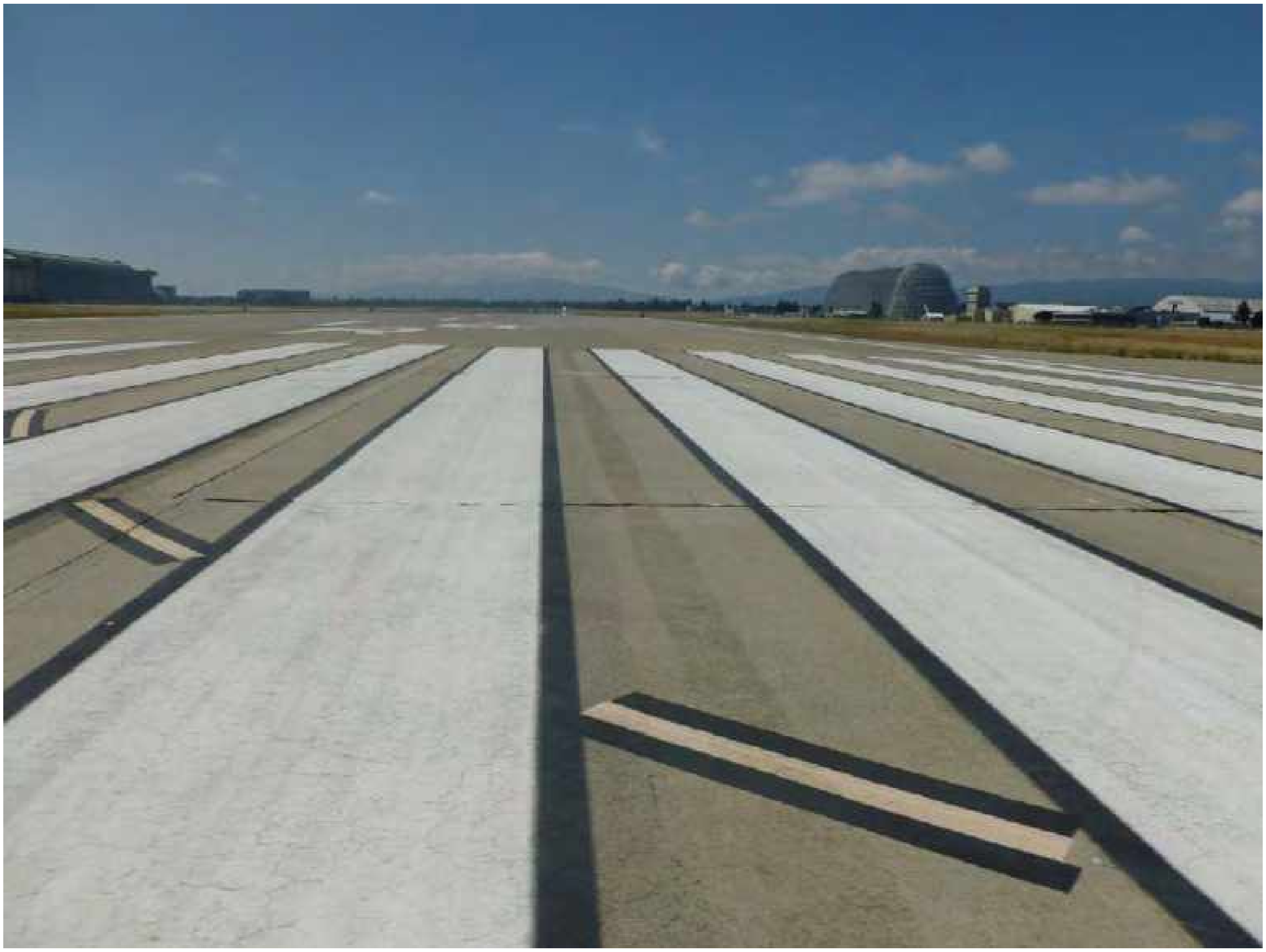
Aerial photograph of NAS Moffett Field after more modifications to the airfield and extensions to the runways, 1967. Note the addition of the golf course at lower right. *(Source: Moffett Field Historical Society)*

# APPENDIX B

Selected Existing Conditions Photographs

Panoramas of the Airfield. Looking north and northeast toward Hangars 1, 2, and 3 (top); looking east toward CANG and south toward the end of the runways (bottom) *(Source: AECOM 2013)*

View from north end of runways looking south toward Hangars 1, 2, and 3 (*Source: AECOM 2013)*



Detail view of Runway 14R-32L looking south (*Source: AECOM 2013*)

View of east parallel taxiway looking south toward Hangars 2 and 3 (*Source: AECOM 2013*)

View of magazines 70-74 and surrounding safety buffer zone, looking east *(Source: AECOM 2013)*

View of Hangar 1 looking northwest (*Source: AECOM 2013)*

View of Hangars 2 and 3 looking northwest *(Source: AECOM 2013)*

# APPENDIX C

Preliminary Inventory of Contributing Airfield Features

This list represents a preliminary identification of contributing features. Other features located within the Airfield may date to the period of significance but are not included in this inventory because their construction dates, integrity, or condition could not be determined, or because they could not be accessed during the field survey. Further evaluation to determine if these features are contributors may be required in future studies.

**Table C-1. Preliminary Inventory of Contributing Airfield Features**

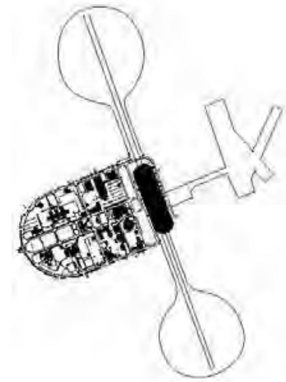
| Feature Number | Feature Name | Estimated Construction Date | Historic Use | Contributor to the Existing NAS Sunnyvale NR District? | Proposed New Contributor to NAS Sunnyvale NR District? |
|---|---|---|---|---|---|
| 001 | Hangar One | 06/01/1933 | Aircraft Maintenance Hangar | YES | NO |
| 032 | North Floodlight Tower | 01/01/1934 | Aviation Operations Building | YES | NO |
| 033 | South Floodlight Tower | 01/01/1934 | Aviation Operations Building | YES | NO |
| 046 | Aircraft Maintenance Hangar 2 | 1943 | Aircraft Maintenance Hangar | YES | NO |
| 047 | Aircraft Maintenance Hangar 3 | 1943 | Aircraft Maintenance Hangar | YES | NO |
| 069 | Inert Ammunition Storage | 06/01/1943 | Inert Storehouse - Bulk | NO | YES |
| 070 | Fuse & Detonator Magazine | 03/01/1943 | Fuse and Detonator Magazine - Ready Issue | NO | YES |
| 071 | High Explosive Magazine | 08/01/1943 | Explosive Storage (Miscellaneous) | NO | YES |
| 072 | High Explosive Magazine | 08/01/1943 | Explosive Storage (Miscellaneous) | NO | YES |
| 073 | High Explosive Magazine | 08/01/1943 | Explosive Storage (Miscellaneous) | NO | YES |
| 074 | High Explosive Magazine | 08/01/1943 | Explosive Storage (Miscellaneous) | NO | YES |
| 105 | Airfield Lighting Vault | 12/01/1947 | Substation. Historically this transformer provided light for the airfield | NO | YES |
| 106 | Aircraft Compass Calibration Pad (Compass Rose) | 12/01/1947 | Compass Calibration Pad, Surfaced | NO | YES |
| 141 | Tank Truck Filling Rack | 12/01/1952 | Aircraft Truck Fueling Facility | NO | YES |
| 143 | High Explosive Magazine | 05/01/1951 | Explosive Storage (Miscellaneous) | NO | YES |
| 147 | High Explosive Magazine | 05/01/1951 | Explosive Storage (Miscellaneous) | NO | YES |
| 158 | Flight Operations Building (Tower) | 1954 (Feb) | Flight operations | NO | YES |
| 329 | Ultra High Frequency/Very High Frequency (UHF/VHF) Receiver Building | 1958 | Facilitate air traffic control communications | NO | YES |
| 442 | Ordnance Handling Pad | 04/01/1956 (Likely 1951 or 1952) | Taxiway (Concrete) | NO | YES |

**Table C-1. Preliminary Inventory of Contributing Airfield Features**

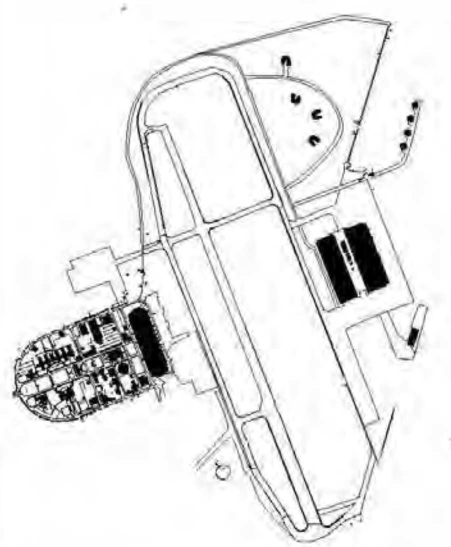
| Feature Number | Feature Name | Estimated Construction Date | Historic Use | Contributor to the Existing NAS Sunnyvale NR District? | Proposed New Contributor to NAS Sunnyvale NR District? |
|---|---|---|---|---|---|
| 454 | Transmission Building Uhf/Vhf | 12/31/1960 | Communications Building. Facilitates air traffic control communications. | NO | YES |
| MF1000 | Runway 32l/14r | Originally Constructed in 1938 (Later Extended) | Runway (Concrete) | NO | YES |
| MF1001 | Instrument Runway 32r/14l | 12/31/1945 (Later Extended) | Runway (Concrete) | NO | YES |
| MF1002 | Aircraft Parking Apron | 05/01/1945 | Aircraft Parking, Access or Maintenance Apron (Concrete) | NO | YES |
| MF1003 | Hi-Speed Aircraft Fueling Pits | 12/01/1955 | Aircraft Direct Fueling Station | NO | YES |
| MF1016 | West Parallel Aircraft Taxiway | c. 1946 | Taxiway (Concrete) | NO | YES |
| MF1016 | East Parallel Aircraft Taxiway | c. 1946 | Taxiway (Concrete) | NO | YES |
| MF1016 | Connecting Taxiways | c. 1946 | Taxiway (Concrete) | NO | YES |

# APPENDIX D

Period Plans



1934



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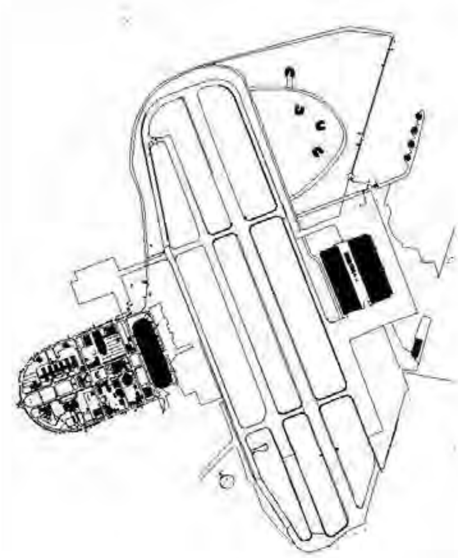

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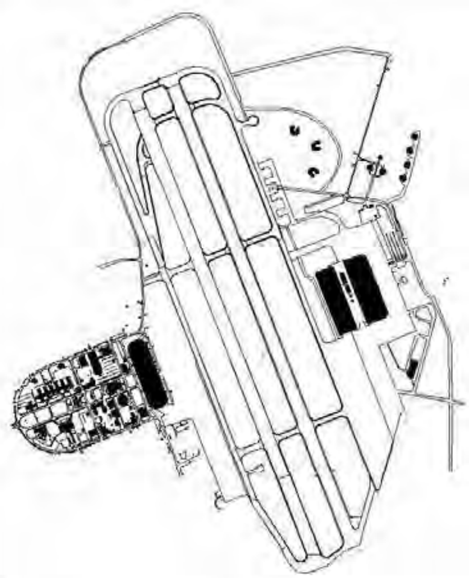

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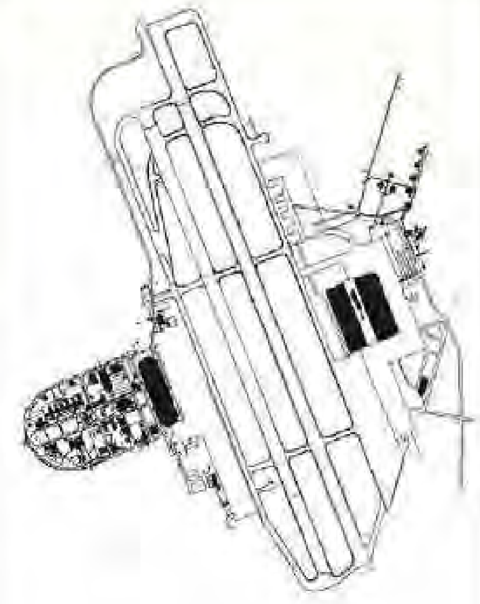

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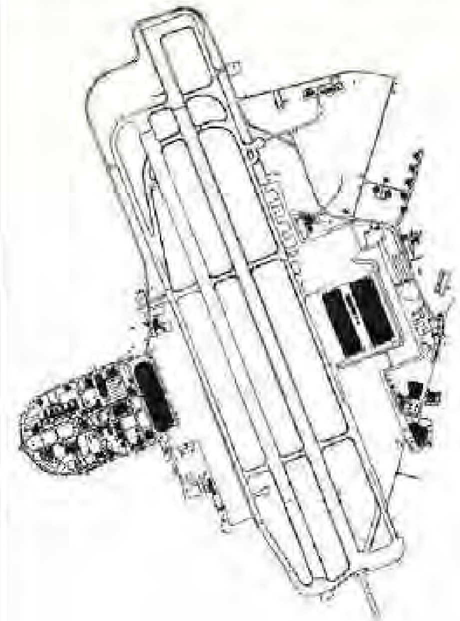

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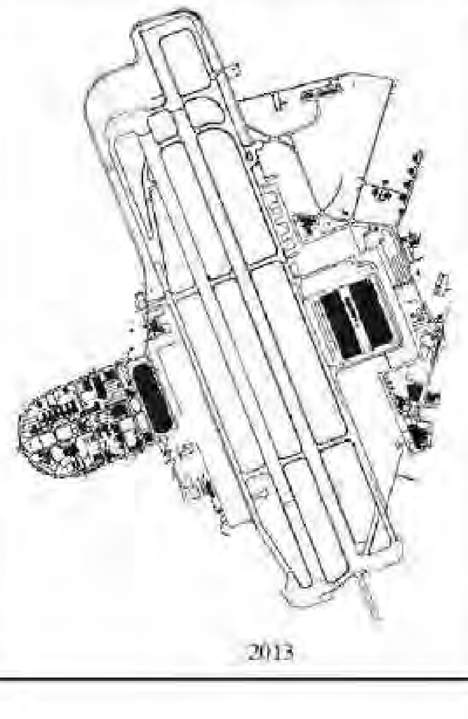


2013

# Appendix C Interested Party Consultation

## C.1 Initial Invitation Letters to Potential Interested Parties (March 19, 2020)

- The Moffett Field Historical Society
- The City of Sunnyvale, California
- The City of Mountain View, California
- Sunnyvale Historical Society
- Mountain View Historical Association
- History San Jose
- Silicon Valley Historical Association
- California Preservation Foundation
- National Trust for Historic Preservation

National Aeronautics and Space Administration

**Ames Research Center**
Moffett Field, California 94035

March 19, 2020

Herb Parsons
President
Moffett Field Historical Society
P.O.Box 16
Moffett Field, CA 94035-0016

Subject: Section 106 Consultation for the Proposed Hangar 3 Demolition Project at NASA Ames Research Center, Moffett Field, Santa Clara County, CA (NASA_2019_1216_001)

Dear Mr. Parsons,

In support of its responsibilities under Section 106 of the National Historic Preservation Act of 1966 (NHPA), the National Aeronautics and Space Administration Ames Research Center (NASA ARC) has initiated Section 106 consultation with the California State Historic Preservation Officer (SHPO) regarding the proposed Hangar 3 Demolition Project (Project or Undertaking) located at Moffett Field, Santa Clara County, California (see attached Figure 1 for project location map). Built in 1943, Hangar 3 is listed in the National Register of Historic Places (NRHP) as a contributor to the U.S. Naval Air Station (NAS) Sunnyvale Historic District and is a historic property for the purposes of Section 106 consultation.

In 2014, Planetary Ventures, LLC (PV) entered into a lease agreement with NASA ARC for the MFA premises, including use of Hangar 3 for research and development, such as testing and light assembly uses related to space, aviation, rover/robotics, and other emerging technologies. Initially, potential reuse scenarios for Hangar 3 were explored in 2006, resulting in preparation of documents related to existing conditions, reuse opportunities, and rehabilitation. In 2015, PV submitted plans under Section 106 consultation for the Remediation and Rehabilitation of Hangars 2 and 3, Core and Shell Project. This project intended to rehabilitate elements of Hangars 2 and 3, including the abatement and remediation of hazardous materials, repairs and upgrades to the structural systems, repairs to the exterior envelopes, and a variety of systems upgrades. Initial Section 106 consultation produced a finding of No Adverse Effect to historic properties, and rehabilitation efforts at Hangar 2 are proceeding. However, in 2016, the roof of Hangar 3 partially collapsed, resulting in additional structural analysis. Emergency repairs to the truss system were made, but damage continued to spread throughout the structural system, despite the efforts to contain and stabilize the structure. The extensive damage and advanced deteriorated state of the structure has required stabilization of multiple truss members with a temporary shoring assembly.

Per the recommendations resulting from recent monitoring by structural engineers, Hangar 3 is vulnerable to further damage and partial collapse, particularly in the event of seismic or high wind load events. The potential for collapse of Hangar 3 presents a significant life safety and surrounding property damage risk. Based upon the opinions of the structural engineers, the repairs required to return Hangar 3 to occupancy would be extensive, undefinable, and cost-prohibitive. Currently, Hangar 3 is closed to occupancy and is being stabilized through an extensive internal shoring and hydraulic jacking system, although engineering analysis has demonstrated that this solution is short-term and not sustainable. Therefore, NASA ARC is

processing a request by PV to demolish Hangar 3, which would qualify as a federal undertaking under Section 106 of the NHPA and would result in an adverse effect.

NASA ARC is contacting you to assess your organization's interest in participating as a consulting party as defined in 36 CFR Section 800.2(c) in the Section 106 of the NHPA review process for the Hangar 3 Demolition Project. If you would like to participate, you may elect to do so by sending written notification by email with the subject heading "Hangar 3 Section 106 Consultation Interested Party" to me at Jonathan.d.ikan@nasa.gov within the next 30 days. Please include the following information:

1. Name
2. Title
3. Organization/Affiliation
4. Address
5. Email address
6. Phone number
7. Statement of election to participate as a consulting party

Please contact me if you have any questions pertaining to this process. I appreciate your attention and look forward to hearing from you regarding this Undertaking.

Sincerely,

Jonathan Ikan
Cultural Resource Manager, Facilities Engineering Branch
NASA Ames Research Center, Mail Stop 213-8
Moffett Field, CA 94035
(605) 604-6859
Jonathan.d.ikan@nasa.gov

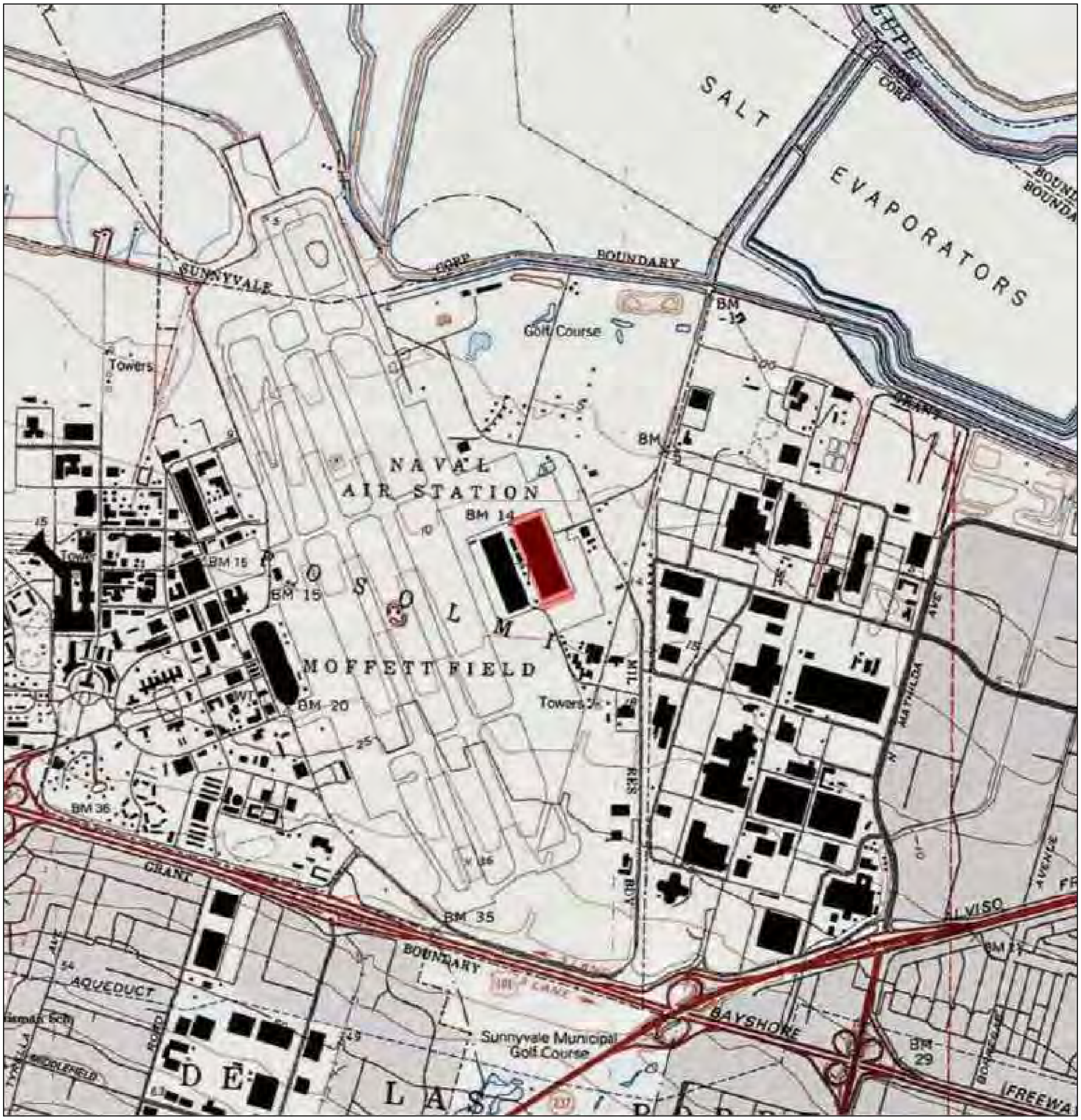
Cc:

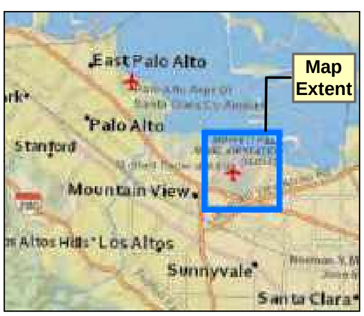
Ms. Rebecca Klein, NASA FPO
Environmental Management Division
NASA Headquarters
300 E Street, SW
Washington, DC 20546-0001

Lease Administration Team
Planetary Ventures
1600 Amphitheater Pkwy
Mountain View, CA 94043

Legal Department/Legal Matters
Planetary Ventures
1600 Amphitheater Pkwy
Mountain View, CA 94043

Attachments:
Figure 1. Regional Project Location Map




Project Location

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(At original document size of 8.5x11)
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Stantec

*Project Location*
Moffett Field, Santa Clara County

Prepared by DL on 2020-03-03
TR by JC on 2020-03-03
IR Review by DH on 2020-03-03

*Client/Project*
181710453

Planetary Ventures, LLC
MFA Hangar 3 Demolition Project

*Figure No.*
1

*Title*
**Project Location Map**

***Notes***
**1.** Coordinate System: NAD 1983 StatePlane California III FIPS 0403 Feet
**2.** Data Sources: Stantec 2019.
**3.** Background: Copyright:© 2013 National Geographic Society, i-cubed
National Geographic, Esri, Garmin, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp.

\\Us0312-ppfss01\workgroup\1857\active\181710453\01_Cultural\02_S106\H3\S106\Figures\consult letters\GIS Figures\MXD\Figure1_ProjectLocationMap.mxd Revised: 2020-03-03 By: dalaw

National Aeronautics and Space Administration

**Ames Research Center**
Moffett Field, California 94035

March 19, 2020

Trudi Ryan
Community Development Director
City of Sunnyvale
456 W. Olive Avenue
Sunnyvale, CA 94086

Subject: Section 106 Consultation for the Proposed Hangar 3 Demolition Project at NASA Ames Research Center, Moffett Field, Santa Clara County, CA (NASA_2019_1216_001)

Dear Ms. Ryan,

In support of its responsibilities under Section 106 of the National Historic Preservation Act of 1966 (NHPA), the National Aeronautics and Space Administration Ames Research Center (NASA ARC) has initiated Section 106 consultation with the California State Historic Preservation Officer (SHPO) regarding the proposed Hangar 3 Demolition Project (Project or Undertaking) located at Moffett Field, Santa Clara County, California (see attached Figure 1 for project location map). Built in 1943, Hangar 3 is listed in the National Register of Historic Places (NRHP) as a contributor to the U.S. Naval Air Station (NAS) Sunnyvale Historic District and is a historic property for the purposes of Section 106 consultation.

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1. Name
2. Title
3. Organization/Affiliation
4. Address
5. Email address
6. Phone number
7. Statement of election to participate as a consulting party

Please contact me if you have any questions pertaining to this process. I appreciate your attention and look forward to hearing from you regarding this Undertaking.

Sincerely,

Jonathan Ikan
Cultural Resource Manager, Facilities Engineering Branch
NASA Ames Research Center, Mail Stop 213-8
Moffett Field, CA 94035
(605) 604-6859
Jonathan.d.ikan@nasa.gov

Cc:

Ms. Rebecca Klein, NASA FPO
Environmental Management Division
NASA Headquarters
300 E Street, SW
Washington, DC  20546-0001

Lease Administration Team
Planetary Ventures
1600 Amphitheater Pkwy
Mountain View, CA 94043

Legal Department/Legal Matters
Planetary Ventures
1600 Amphitheater Pkwy
Mountain View, CA 94043

Attachments:
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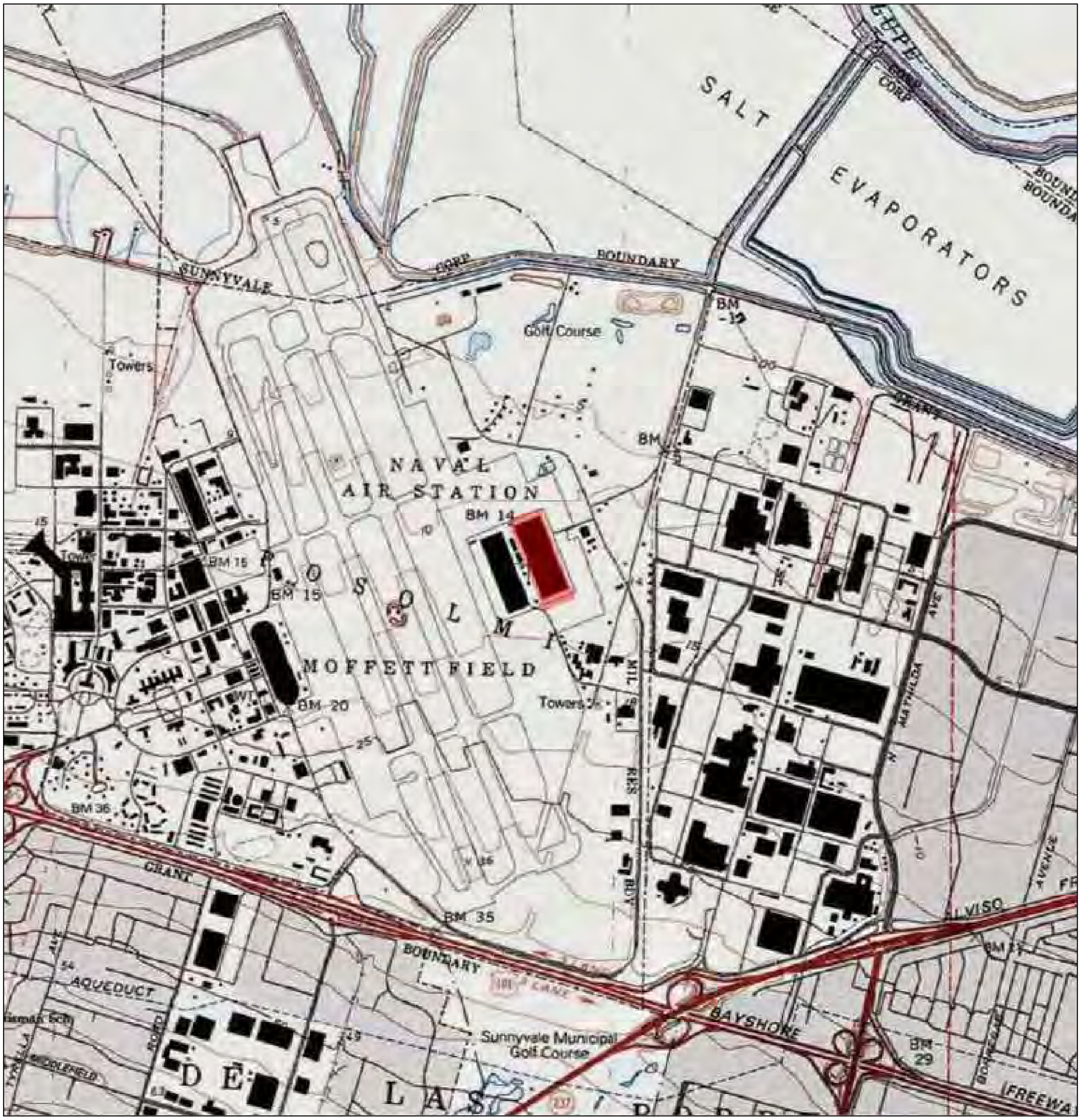


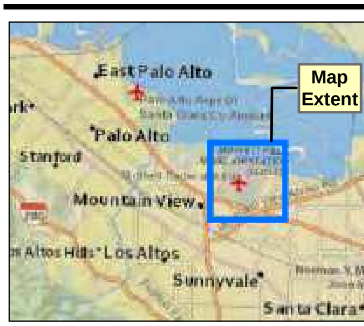


Project Location

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Stantec

*Project Location*
Moffett Field, Santa Clara County

Prepared by DL on 2020-03-03
TR by JC on 2020-03-03
IR Review by DH on 2020-03-03

*Client/Project*
181710453

Planetary Ventures, LLC
MFA Hangar 3 Demolition Project

*Figure No.*
1

*Title*
**Project Location Map**

***Notes***
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National Geographic, Esri, Garmin, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp.

National Aeronautics and Space Administration

**Ames Research Center**
Moffett Field, California 94035

March 19, 2020

Aarti Shrivastava
Assistant City Manager/Community
Development Director City of Mountain View
500 Castro Street, 1st Floor
Mountain View, CA 94035-0016

Subject: Section 106 Consultation for the Proposed Hangar 3 Demolition Project at NASA Ames Research Center, Moffett Field, Santa Clara County, CA (NASA_2019_1216_001)

Dear Ms. Shrivastava,

In support of its responsibilities under Section 106 of the National Historic Preservation Act of 1966 (NHPA), the National Aeronautics and Space Administration Ames Research Center (NASA ARC) has initiated Section 106 consultation with the California State Historic Preservation Officer (SHPO) regarding the proposed Hangar 3 Demolition Project (Project or Undertaking) located at Moffett Field, Santa Clara County, California (see attached Figure 1 for project location map). Built in 1943, Hangar 3 is listed in the National Register of Historic Places (NRHP) as a contributor to the U.S. Naval Air Station (NAS) Sunnyvale Historic District and is a historic property for the purposes of Section 106 consultation.

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1. Name
2. Title
3. Organization/Affiliation
4. Address
5. Email address
6. Phone number
7. Statement of election to participate as a consulting party

Please contact me if you have any questions pertaining to this process. I appreciate your attention and look forward to hearing from you regarding this Undertaking.

Sincerely,

Jonathan Ikan
Cultural Resource Manager, Facilities Engineering Branch
NASA Ames Research Center, Mail Stop 213-8
Moffett Field, CA 94035
(605) 604-6859
Jonathan.d.ikan@nasa.gov

Cc:

Ms. Rebecca Klein, NASA FPO
Environmental Management Division
NASA Headquarters
300 E Street, SW
Washington, DC  20546-0001

Lease Administration Team
Planetary Ventures
1600 Amphitheater Pkwy
Mountain View, CA 94043

Legal Department/Legal Matters
Planetary Ventures
1600 Amphitheater Pkwy
Mountain View, CA 94043

Attachments:
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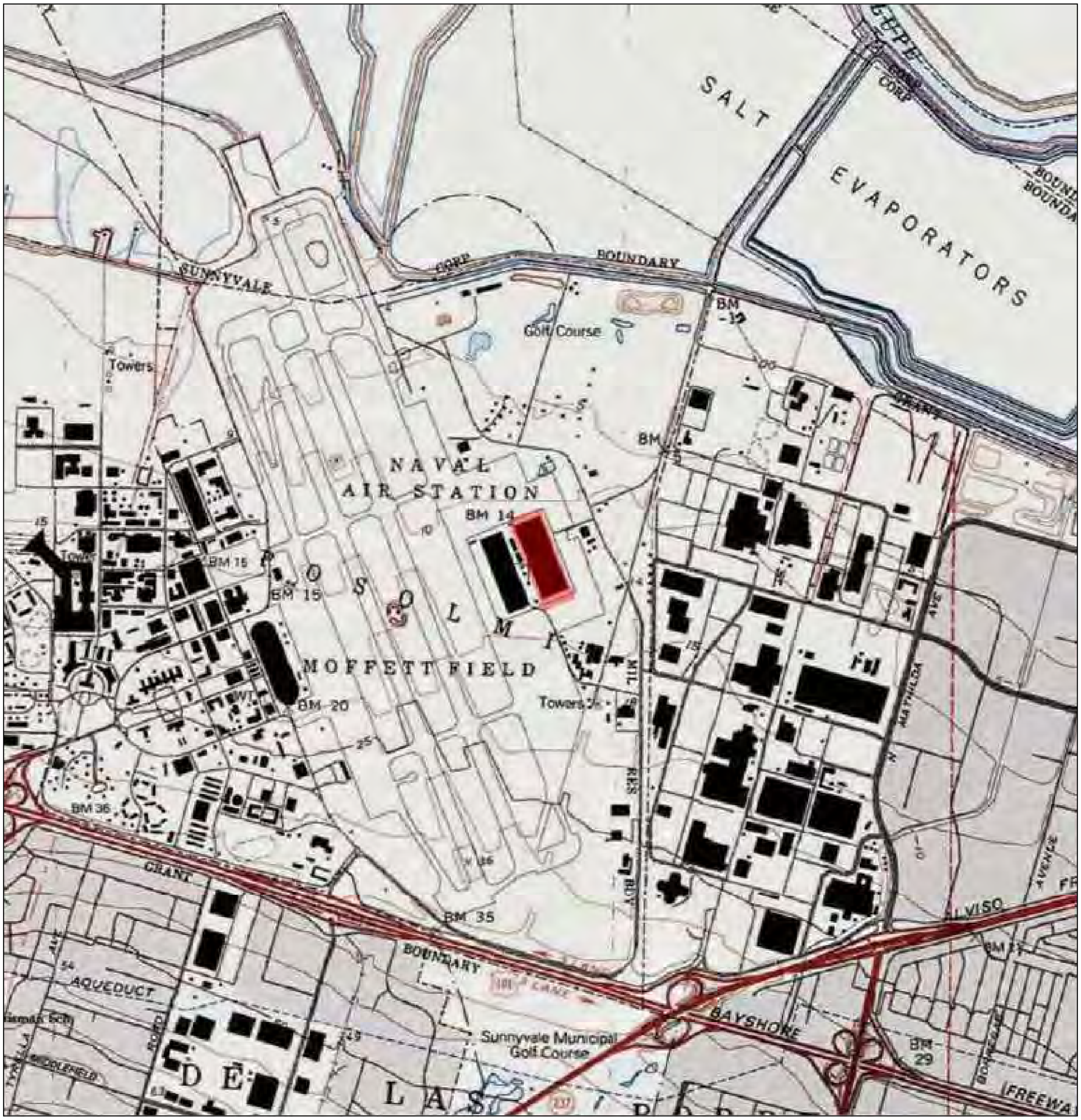


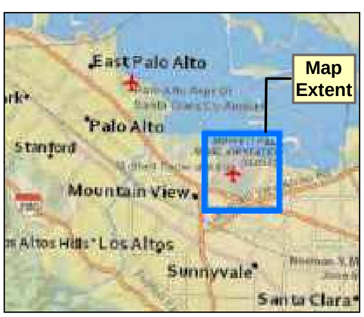


Project Location

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Stantec

*Project Location*
Moffett Field, Santa Clara County

Prepared by DL on 2020-03-03
TR by JC on 2020-03-03
IR Review by DH on 2020-03-03

*Client/Project*
181710453
Planetary Ventures, LLC
MFA Hangar 3 Demolition Project

*Figure No.*
1

*Title*
**Project Location Map**

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National Aeronautics and Space Administration

**Ames Research Center**
Moffett Field, California 94035

March 19, 2020

Laura Babcock
Director
Sunnyvale Historical Society
P.O. Box 2187
Sunnyvale, CA 94087-0187

Subject: Section 106 Consultation for the Proposed Hangar 3 Demolition Project at NASA Ames Research Center, Moffett Field, Santa Clara County, CA (NASA_2019_1216_001)

Dear Ms. Babcock,

In support of its responsibilities under Section 106 of the National Historic Preservation Act of 1966 (NHPA), the National Aeronautics and Space Administration Ames Research Center (NASA ARC) has initiated Section 106 consultation with the California State Historic Preservation Officer (SHPO) regarding the proposed Hangar 3 Demolition Project (Project or Undertaking) located at Moffett Field, Santa Clara County, California (see attached Figure 1 for project location map). Built in 1943, Hangar 3 is listed in the National Register of Historic Places (NRHP) as a contributor to the U.S. Naval Air Station (NAS) Sunnyvale Historic District and is a historic property for the purposes of Section 106 consultation.

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1. Name
2. Title
3. Organization/Affiliation
4. Address
5. Email address
6. Phone number
7. Statement of election to participate as a consulting party

Please contact me if you have any questions pertaining to this process. I appreciate your attention and look forward to hearing from you regarding this Undertaking.

Sincerely,

Jonathan Ikan
Cultural Resource Manager, Facilities Engineering Branch
NASA Ames Research Center, Mail Stop 213-8
Moffett Field, CA 94035
(605) 604-6859
Jonathan.d.ikan@nasa.gov

Cc:

Ms. Rebecca Klein, NASA FPO
Environmental Management Division
NASA Headquarters
300 E Street, SW
Washington, DC 20546-0001

Lease Administration Team
Planetary Ventures
1600 Amphitheater Pkwy
Mountain View, CA 94043

Legal Department/Legal Matters
Planetary Ventures
1600 Amphitheater Pkwy
Mountain View, CA 94043

Attachments:
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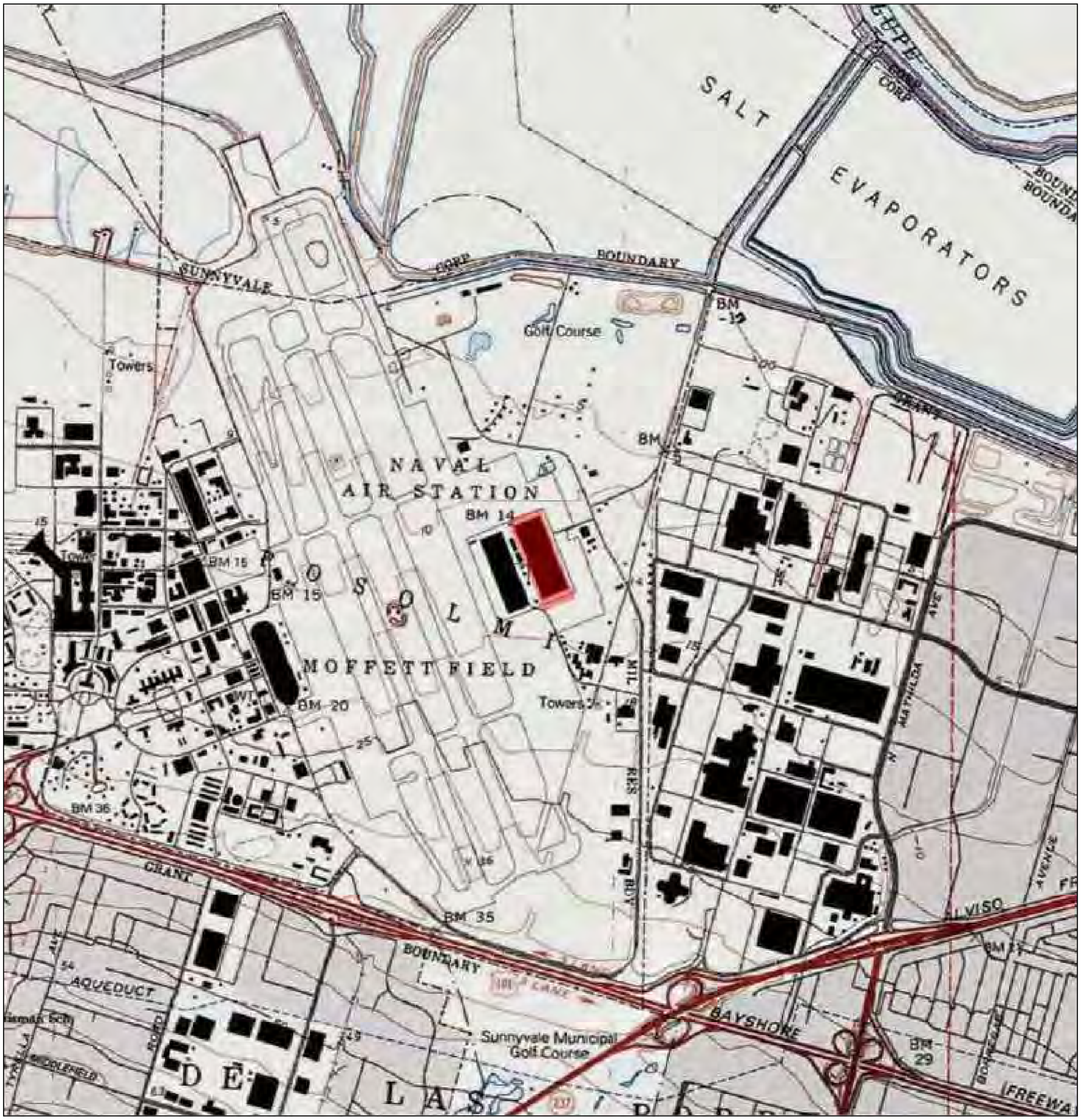


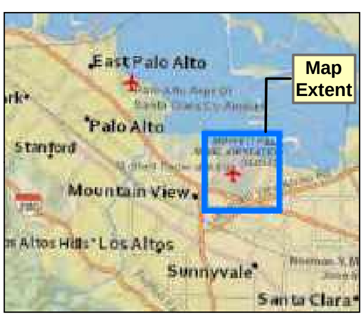


Project Location

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Stantec

*Project Location*
Moffett Field, Santa Clara County

Prepared by DL on 2020-03-03
TR by JC on 2020-03-03
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*Client/Project*
181710453

Planetary Ventures, LLC
MFA Hangar 3 Demolition Project

*Figure No.*
1

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National Aeronautics and Space Administration

**Ames Research Center**
Moffett Field, California 94035

March 19, 2020

Nick Perry
President
Mountain View Historical Association
P.O. Box 252
Mountain View, CA 94042

Subject: Section 106 Consultation for the Proposed Hangar 3 Demolition Project at NASA Ames Research Center, Moffett Field, Santa Clara County, CA (NASA_2019_1216_001)

Dear Mr. Perry,

In support of its responsibilities under Section 106 of the National Historic Preservation Act of 1966 (NHPA), the National Aeronautics and Space Administration Ames Research Center (NASA ARC) has initiated Section 106 consultation with the California State Historic Preservation Officer (SHPO) regarding the proposed Hangar 3 Demolition Project (Project or Undertaking) located at Moffett Field, Santa Clara County, California (see attached Figure 1 for project location map). Built in 1943, Hangar 3 is listed in the National Register of Historic Places (NRHP) as a contributor to the U.S. Naval Air Station (NAS) Sunnyvale Historic District and is a historic property for the purposes of Section 106 consultation.

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6. Phone number
7. Statement of election to participate as a consulting party

Please contact me if you have any questions pertaining to this process. I appreciate your attention and look forward to hearing from you regarding this Undertaking.

Sincerely,

Jonathan Ikan
Cultural Resource Manager, Facilities Engineering Branch
NASA Ames Research Center, Mail Stop 213-8
Moffett Field, CA 94035
(605) 604-6859
Jonathan.d.ikan@nasa.gov

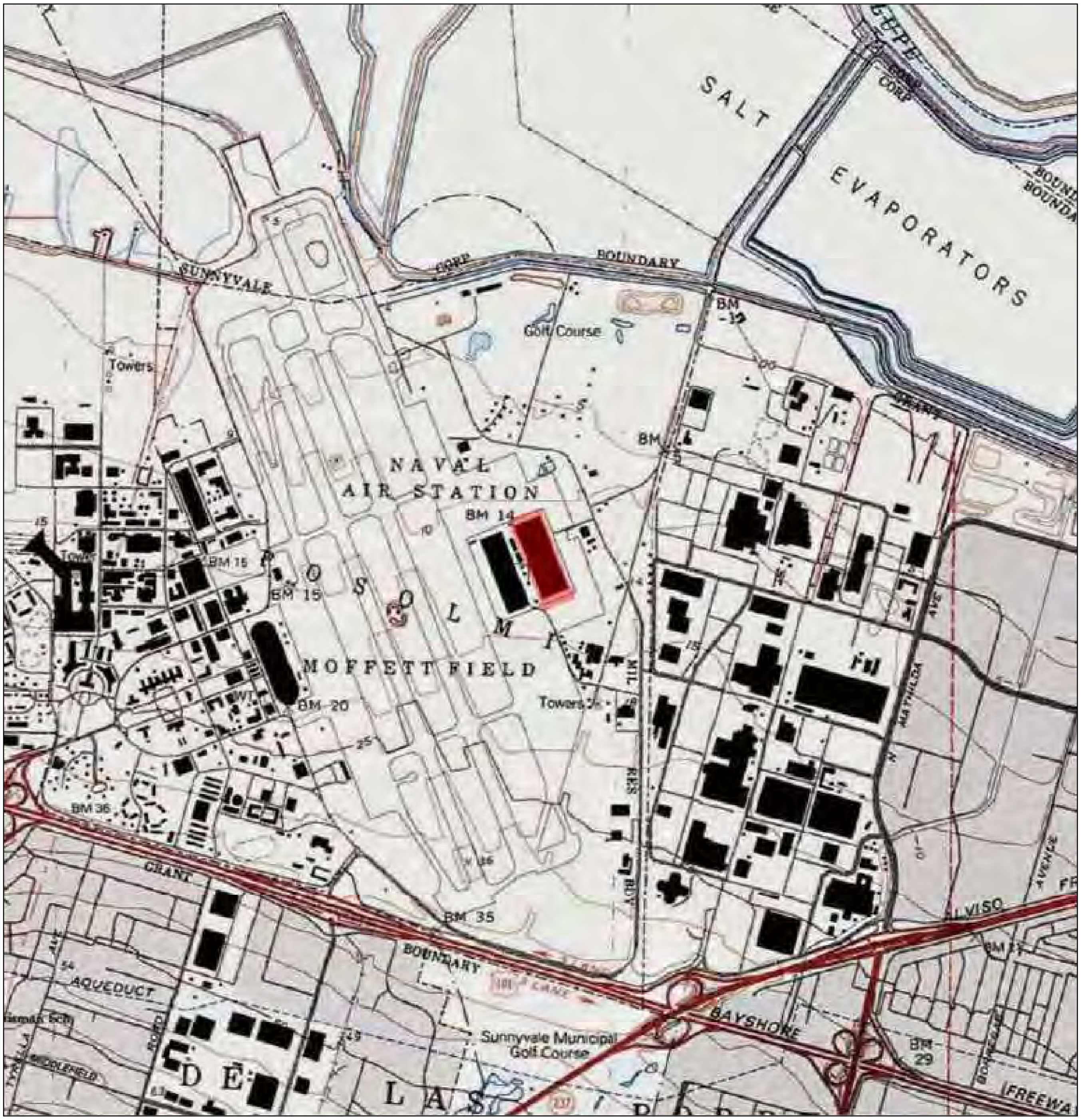
Cc:

Ms. Rebecca Klein, NASA FPO
Environmental Management Division
NASA Headquarters
300 E Street, SW
Washington, DC  20546-0001

Lease Administration Team
Planetary Ventures
1600 Amphitheater Pkwy
Mountain View, CA 94043

Legal Department/Legal Matters
Planetary Ventures
1600 Amphitheater Pkwy
Mountain View, CA 94043

Attachments:
Figure 1. Regional Project Location Map





Project Location

0 1,000 2,000 Feet
(At original document size of 8.5x11)
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N

Stantec

*Project Location*
Moffett Field, Santa Clara County

Prepared by DL on 2020-03-03
TR by JC on 2020-03-03
IR Review by DH on 2020-03-03

*Client/Project*
181710453
Planetary Ventures, LLC
MFA Hangar 3 Demolition Project

*Figure No.*
1

*Title*
**Project Location Map**

***Notes***
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\\Us0312-ppfss01\workgroup\1857\active\181710453\01_Cultural\02_S106\H3\S106\Figures\consult letters\GIS Figures\MXD\Figure1_ProjectLocationMap.mxd Revised: 2020-03-03 By: dalaw

National Aeronautics and Space Administration

**Ames Research Center**
Moffett Field, California 94035

March 19, 2020

William P. Schroh, Jr.
President & CEO
History San Jose
1650 Senter Road
San Jose, CA 95112

Subject: Section 106 Consultation for the Proposed Hangar 3 Demolition Project at NASA Ames Research Center, Moffett Field, Santa Clara County, CA (NASA_2019_1216_001)

Dear Mr. Schroh,

In support of its responsibilities under Section 106 of the National Historic Preservation Act of 1966 (NHPA), the National Aeronautics and Space Administration Ames Research Center (NASA ARC) has initiated Section 106 consultation with the California State Historic Preservation Officer (SHPO) regarding the proposed Hangar 3 Demolition Project (Project or Undertaking) located at Moffett Field, Santa Clara County, California (see attached Figure 1 for project location map). Built in 1943, Hangar 3 is listed in the National Register of Historic Places (NRHP) as a contributor to the U.S. Naval Air Station (NAS) Sunnyvale Historic District and is a historic property for the purposes of Section 106 consultation.

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Per the recommendations resulting from recent monitoring by structural engineers, Hangar 3 is vulnerable to further damage and partial collapse, particularly in the event of seismic or high wind load events. The potential for collapse of Hangar 3 presents a significant life safety and surrounding property damage risk. Based upon the opinions of the structural engineers, the repairs required to return Hangar 3 to occupancy would be extensive, undefinable, and cost-prohibitive. Currently, Hangar 3 is closed to occupancy and is being stabilized through an extensive internal shoring and hydraulic jacking system, although engineering analysis has demonstrated that this solution is short-term and not sustainable. Therefore, NASA ARC is

processing a request by PV to demolish Hangar 3, which would qualify as a federal undertaking under Section 106 of the NHPA and would result in an adverse effect.

NASA ARC is contacting you to assess your organization's interest in participating as a consulting party as defined in 36 CFR Section 800.2(c) in the Section 106 of the NHPA review process for the Hangar 3 Demolition Project. If you would like to participate, you may elect to do so by sending written notification by email with the subject heading "Hangar 3 Section 106 Consultation Interested Party" to me at Jonathan.d.ikan@nasa.gov within the next 30 days. Please include the following information:

1. Name
2. Title
3. Organization/Affiliation
4. Address
5. Email address
6. Phone number
7. Statement of election to participate as a consulting party

Please contact me if you have any questions pertaining to this process. I appreciate your attention and look forward to hearing from you regarding this Undertaking.

Sincerely,

Jonathan Ikan
Cultural Resource Manager, Facilities Engineering Branch
NASA Ames Research Center, Mail Stop 213-8
Moffett Field, CA 94035
(605) 604-6859
Jonathan.d.ikan@nasa.gov

Cc:

Ms. Rebecca Klein, NASA FPO
Environmental Management Division
NASA Headquarters
300 E Street, SW
Washington, DC 20546-0001

Lease Administration Team
Planetary Ventures
1600 Amphitheater Pkwy
Mountain View, CA 94043

Legal Department/Legal Matters
Planetary Ventures
1600 Amphitheater Pkwy
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Attachments:
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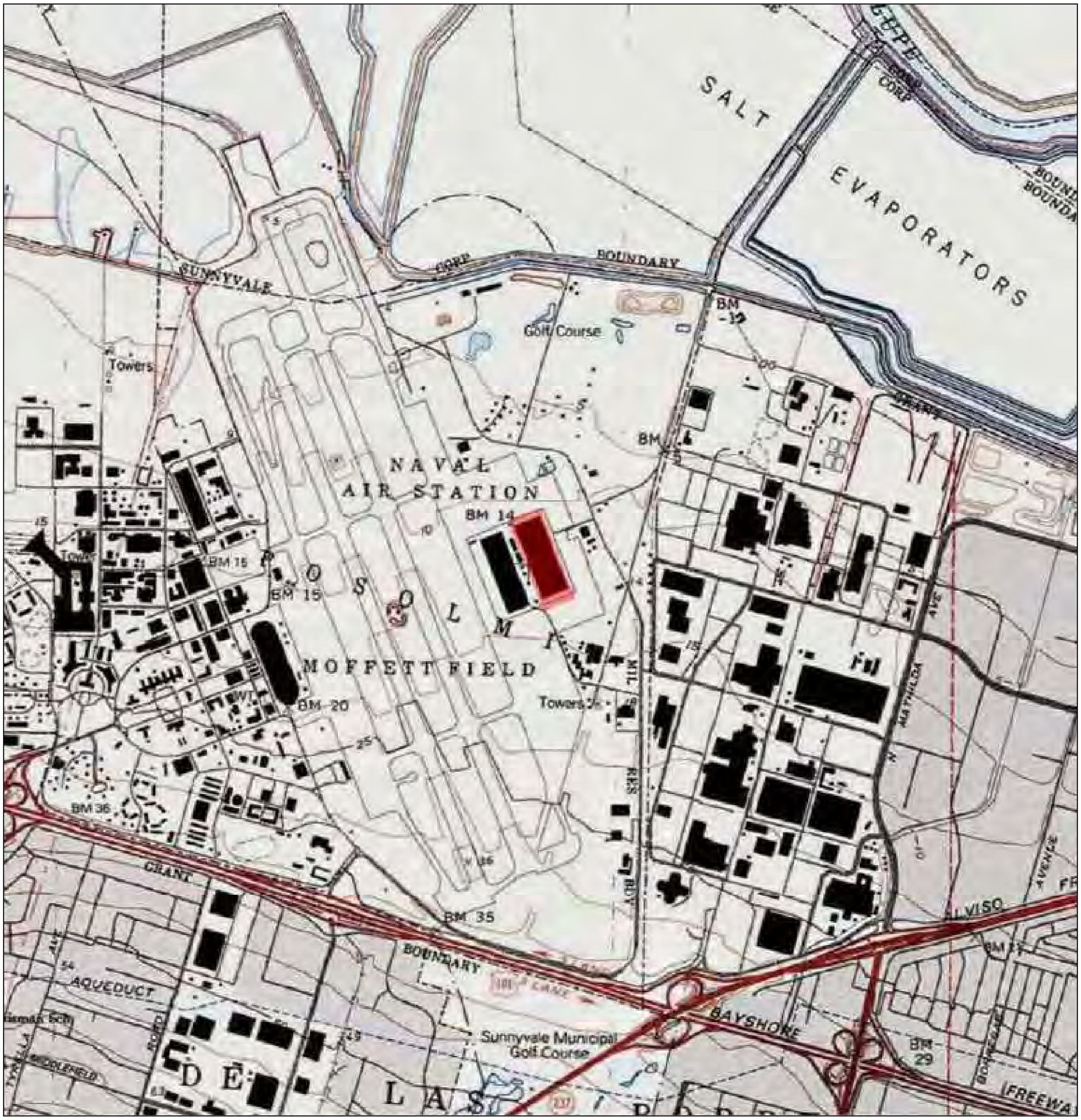



Project Location

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Stantec

*Project Location*
Moffett Field, Santa Clara County

Prepared by DL on 2020-03-03
TR by JC on 2020-03-03
IR Review by DH on 2020-03-03

*Client/Project*
181710453
Planetary Ventures, LLC
MFA Hangar 3 Demolition Project

*Figure No.*
1

*Title*
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\\Us0312-ppfss01\workgroup\1857\active\181710453\01_Cultural\02_S106\H3\S106\Figures\consult letters\GIS Figures\MXD\Figure1_ProjectLocationMap.mxd Revised: 2020-03-03 By: dalaw

National Aeronautics and Space Administration

**Ames Research Center**
Moffett Field, California 94035

March 19, 2020

John McLaughlin
Silicon Valley Historical Society
1134 Crane Street, Suite 216
Menlo Park, CA 94025

Subject: Section 106 Consultation for the Proposed Hangar 3 Demolition Project at NASA Ames Research Center, Moffett Field, Santa Clara County, CA (NASA_2019_1216_001)

Dear Mr. McLaughlin,

In support of its responsibilities under Section 106 of the National Historic Preservation Act of 1966 (NHPA), the National Aeronautics and Space Administration Ames Research Center (NASA ARC) has initiated Section 106 consultation with the California State Historic Preservation Officer (SHPO) regarding the proposed Hangar 3 Demolition Project (Project or Undertaking) located at Moffett Field, Santa Clara County, California (see attached Figure 1 for project location map). Built in 1943, Hangar 3 is listed in the National Register of Historic Places (NRHP) as a contributor to the U.S. Naval Air Station (NAS) Sunnyvale Historic District and is a historic property for the purposes of Section 106 consultation.

In 2014, Planetary Ventures, LLC (PV) entered into a lease agreement with NASA ARC for the MFA premises, including use of Hangar 3 for research and development, such as testing and light assembly uses related to space, aviation, rover/robotics, and other emerging technologies. Initially, potential reuse scenarios for Hangar 3 were explored in 2006, resulting in preparation of documents related to existing conditions, reuse opportunities, and rehabilitation. In 2015, PV submitted plans under Section 106 consultation for the Remediation and Rehabilitation of Hangars 2 and 3, Core and Shell Project. This project intended to rehabilitate elements of Hangars 2 and 3, including the abatement and remediation of hazardous materials, repairs and upgrades to the structural systems, repairs to the exterior envelopes, and a variety of systems upgrades. Initial Section 106 consultation produced a finding of No Adverse Effect to historic properties, and rehabilitation efforts at Hangar 2 are proceeding. However, in 2016, the roof of Hangar 3 partially collapsed, resulting in additional structural analysis. Emergency repairs to the truss system were made, but damage continued to spread throughout the structural system, despite the efforts to contain and stabilize the structure. The extensive damage and advanced deteriorated state of the structure has required stabilization of multiple truss members with a temporary shoring assembly.

Per the recommendations resulting from recent monitoring by structural engineers, Hangar 3 is vulnerable to further damage and partial collapse, particularly in the event of seismic or high wind load events. The potential for collapse of Hangar 3 presents a significant life safety and surrounding property damage risk. Based upon the opinions of the structural engineers, the repairs required to return Hangar 3 to occupancy would be extensive, undefinable, and cost-prohibitive. Currently, Hangar 3 is closed to occupancy and is being stabilized through an extensive internal shoring and hydraulic jacking system, although engineering analysis has demonstrated that this solution is short-term and not sustainable. Therefore, NASA ARC is

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NASA ARC is contacting you to assess your organization's interest in participating as a consulting party as defined in 36 CFR Section 800.2(c) in the Section 106 of the NHPA review process for the Hangar 3 Demolition Project. If you would like to participate, you may elect to do so by sending written notification by email with the subject heading "Hangar 3 Section 106 Consultation Interested Party" to me at Jonathan.d.ikan@nasa.gov within the next 30 days. Please include the following information:

1. Name
2. Title
3. Organization/Affiliation
4. Address
5. Email address
6. Phone number
7. Statement of election to participate as a consulting party

Please contact me if you have any questions pertaining to this process. I appreciate your attention and look forward to hearing from you regarding this Undertaking.

Sincerely,

Jonathan Ikan
Cultural Resource Manager, Facilities Engineering Branch
NASA Ames Research Center, Mail Stop 213-8
Moffett Field, CA 94035
(605) 604-6859
Jonathan.d.ikan@nasa.gov

Cc:

Ms. Rebecca Klein, NASA FPO
Environmental Management Division
NASA Headquarters
300 E Street, SW
Washington, DC 20546-0001

Lease Administration Team
Planetary Ventures
1600 Amphitheater Pkwy
Mountain View, CA 94043

Legal Department/Legal Matters
Planetary Ventures
1600 Amphitheater Pkwy
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Attachments:
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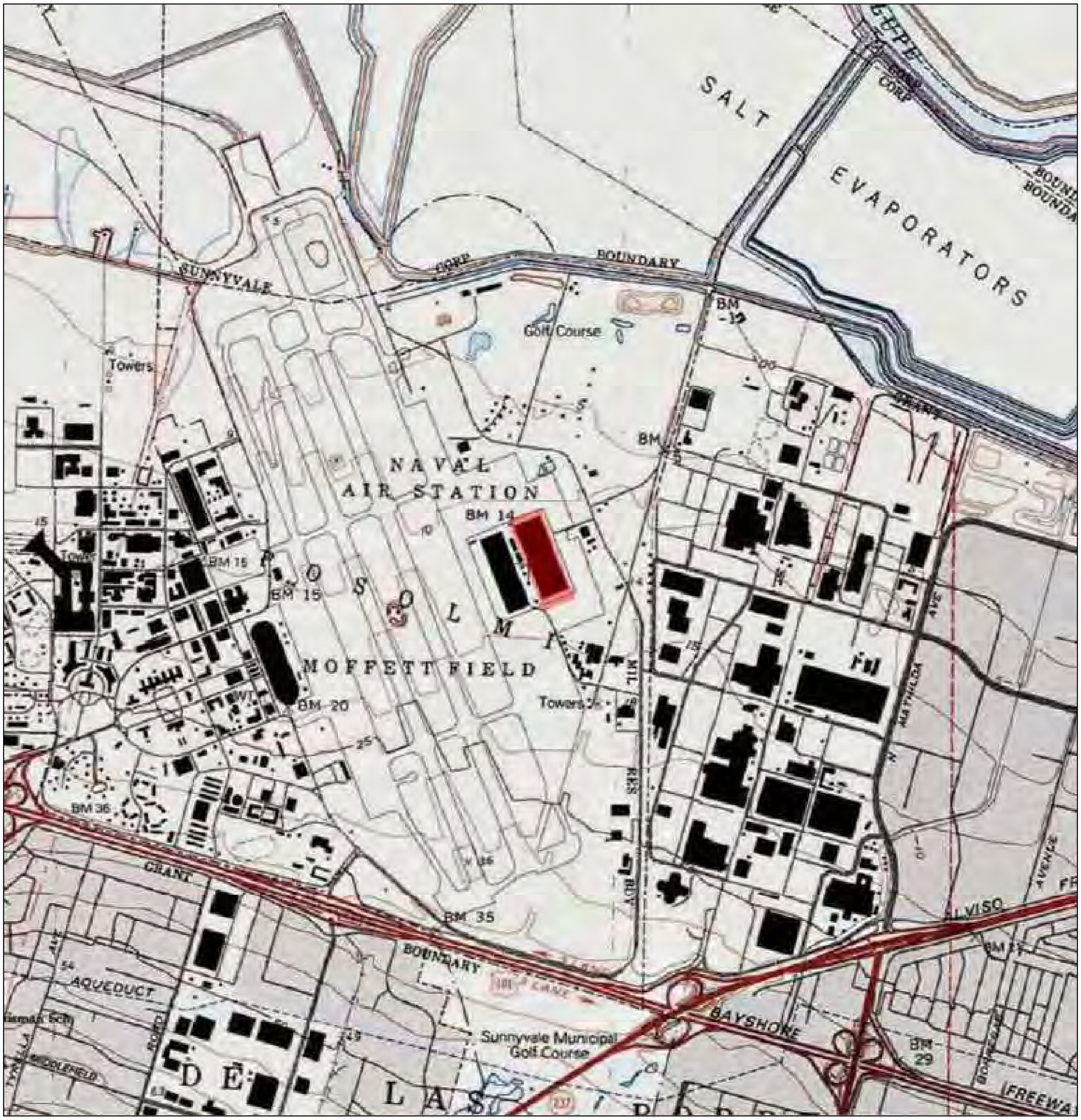


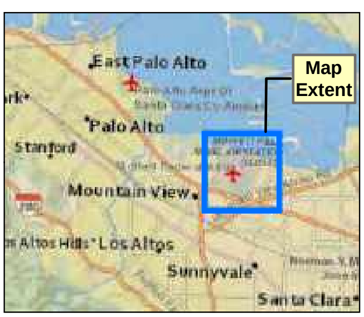


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TR by JC on 2020-03-03
IR Review by DH on 2020-03-03

*Client/Project*
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Planetary Ventures, LLC
MFA Hangar 3 Demolition Project

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National Aeronautics and Space Administration

**Ames Research Center**
Moffett Field, California 94035

March 19, 2020

Cindy Heitzman
Executive Director
California Preservation Foundation
101 The Embarcadero, Suite 120
San Francisco, CA 94105-1215

Subject: Section 106 Consultation for the Proposed Hangar 3 Demolition Project at NASA Ames Research Center, Moffett Field, Santa Clara County, CA (NASA_2019_1216_001)

Dear Ms. Heitzman,

In support of its responsibilities under Section 106 of the National Historic Preservation Act of 1966 (NHPA), the National Aeronautics and Space Administration Ames Research Center (NASA ARC) has initiated Section 106 consultation with the California State Historic Preservation Officer (SHPO) regarding the proposed Hangar 3 Demolition Project (Project or Undertaking) located at Moffett Field, Santa Clara County, California (see attached Figure 1 for project location map). Built in 1943, Hangar 3 is listed in the National Register of Historic Places (NRHP) as a contributor to the U.S. Naval Air Station (NAS) Sunnyvale Historic District and is a historic property for the purposes of Section 106 consultation.

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1. Name
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3. Organization/Affiliation
4. Address
5. Email address
6. Phone number
7. Statement of election to participate as a consulting party

Please contact me if you have any questions pertaining to this process. I appreciate your attention and look forward to hearing from you regarding this Undertaking.

Sincerely,

Jonathan Ikan
Cultural Resource Manager, Facilities Engineering Branch
NASA Ames Research Center, Mail Stop 213-8
Moffett Field, CA 94035
(605) 604-6859
Jonathan.d.ikan@nasa.gov

Cc:

Ms. Rebecca Klein, NASA FPO
Environmental Management Division
NASA Headquarters
300 E Street, SW
Washington, DC  20546-0001

Lease Administration Team
Planetary Ventures
1600 Amphitheater Pkwy
Mountain View, CA 94043

Legal Department/Legal Matters
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Attachments:
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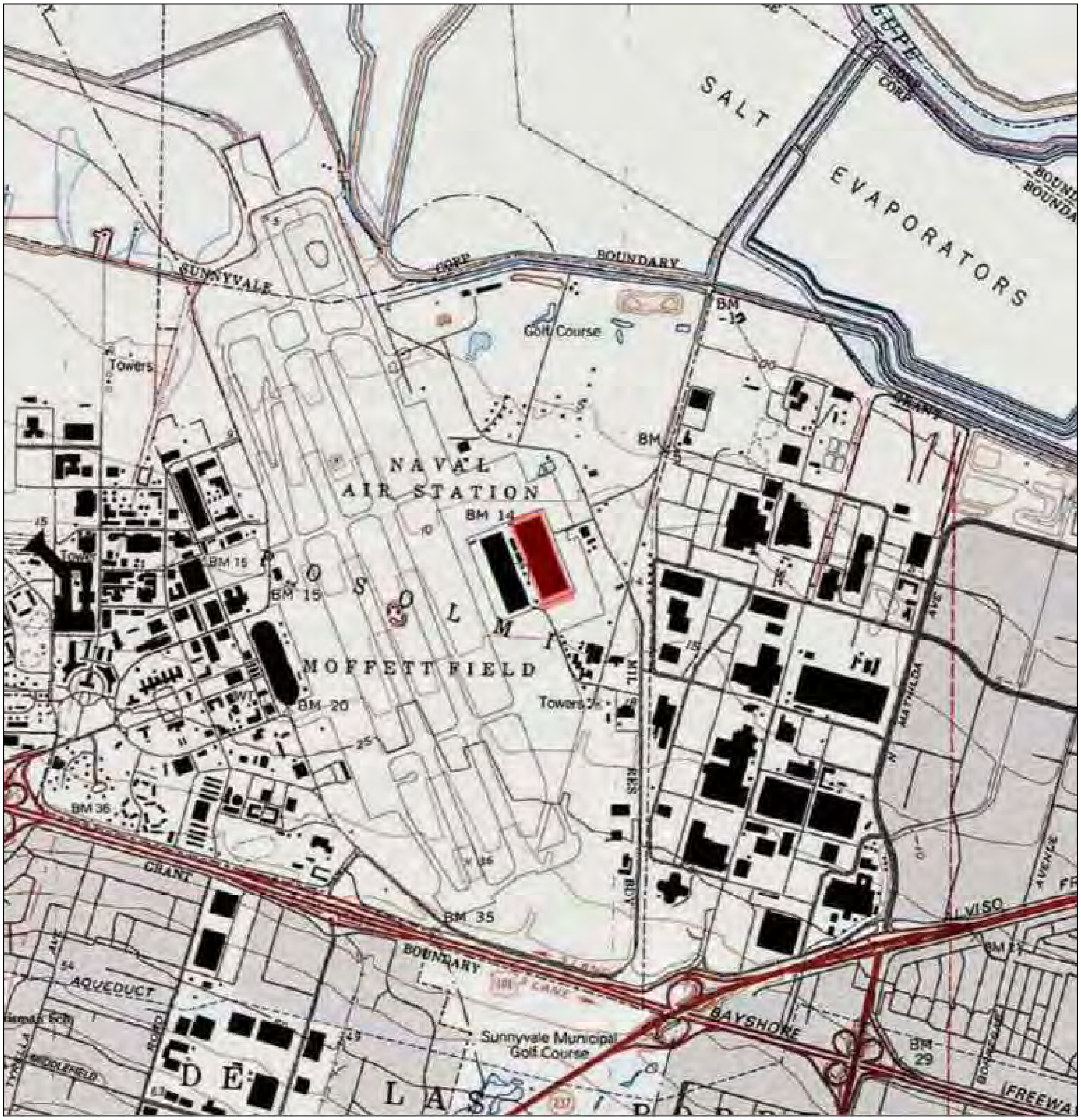



Project Location

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Stantec

*Project Location*
Moffett Field, Santa Clara County

Prepared by DL on 2020-03-03
TR by JC on 2020-03-03
IR Review by DH on 2020-03-03

*Client/Project*
181710453

Planetary Ventures, LLC
MFA Hangar 3 Demolition Project

*Figure No.*
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*Title*
**Project Location Map**

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National Aeronautics and Space Administration

**Ames Research Center**
Moffett Field, California 94035

March 19, 2020

Christina Morris
Field Director
National Trust for Historic Preservation, Los Angeles Office
700 Flower Street, Suite 1100
Los Angeles, CA 90017

Subject: Section 106 Consultation for the Proposed Hangar 3 Demolition Project at NASA Ames Research Center, Moffett Field, Santa Clara County, CA (NASA_2019_1216_001)

Dear Ms. Morris,

In support of its responsibilities under Section 106 of the National Historic Preservation Act of 1966 (NHPA), the National Aeronautics and Space Administration Ames Research Center (NASA ARC) has initiated Section 106 consultation with the California State Historic Preservation Officer (SHPO) regarding the proposed Hangar 3 Demolition Project (Project or Undertaking) located at Moffett Field, Santa Clara County, California (see attached Figure 1 for project location map). Built in 1943, Hangar 3 is listed in the National Register of Historic Places (NRHP) as a contributor to the U.S. Naval Air Station (NAS) Sunnyvale Historic District and is a historic property for the purposes of Section 106 consultation.

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1. Name
2. Title
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4. Address
5. Email address
6. Phone number
7. Statement of election to participate as a consulting party

Please contact me if you have any questions pertaining to this process. I appreciate your attention and look forward to hearing from you regarding this Undertaking.

Sincerely,

Jonathan Ikan
Cultural Resource Manager, Facilities Engineering Branch
NASA Ames Research Center, Mail Stop 213-8
Moffett Field, CA 94035
(605) 604-6859
Jonathan.d.ikan@nasa.gov

Cc:

Ms. Rebecca Klein, NASA FPO
Environmental Management Division
NASA Headquarters
300 E Street, SW
Washington, DC  20546-0001

Lease Administration Team
Planetary Ventures
1600 Amphitheater Pkwy
Mountain View, CA 94043

Legal Department/Legal Matters
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Attachments:
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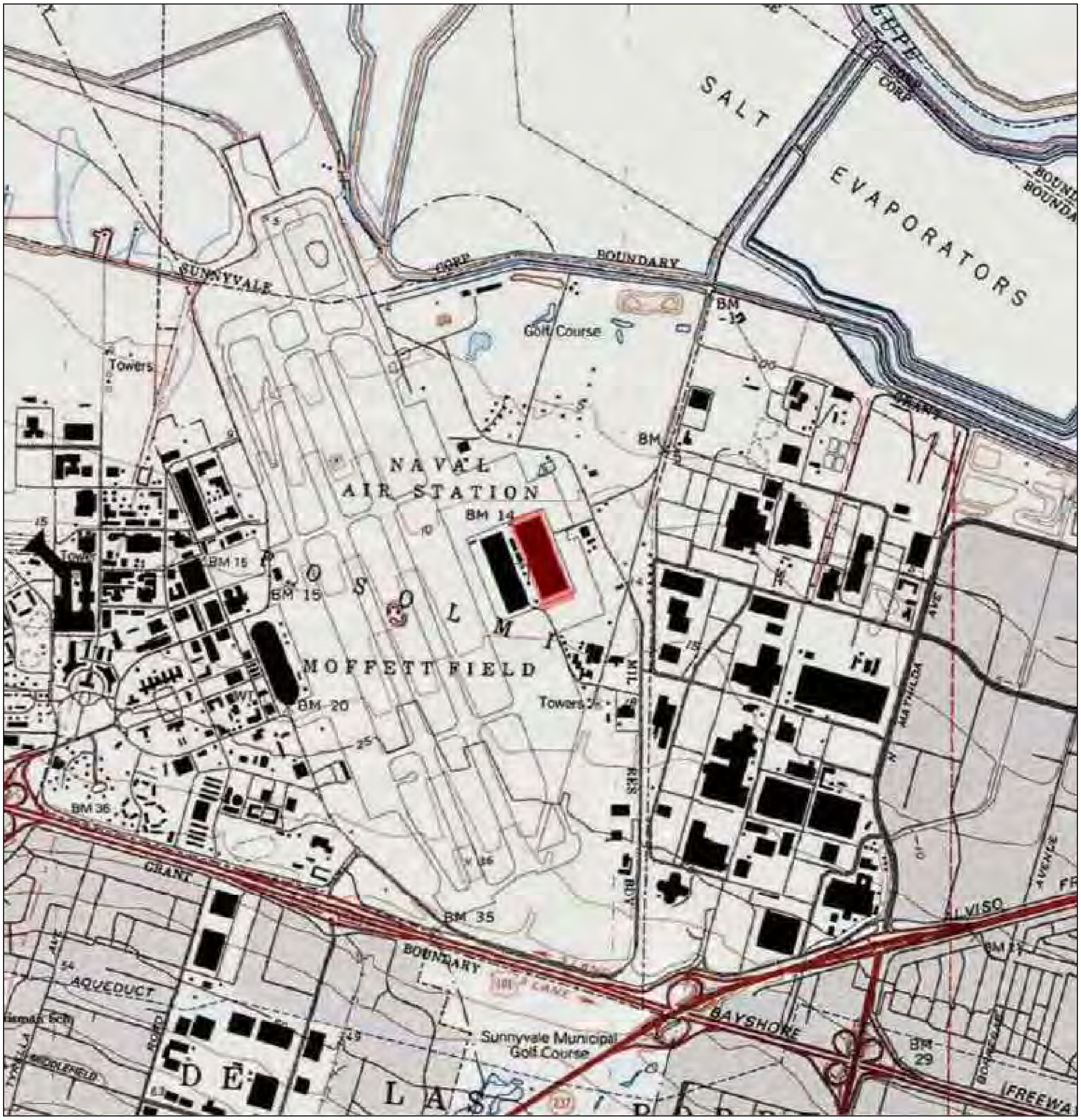



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181710453
Planetary Ventures, LLC
MFA Hangar 3 Demolition Project

*Figure No.*
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*Title*
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## C.1.1 Responses from Potential Interested Parties Invitation Letters (Spring 2020)

- The Moffett Field Historical Society
- The City of Mountain View, California

## Herrick, Daniel

**From:** Ikan, Jonathan D. (ARC-JCE) <jonathan.d.ikan@nasa.gov>
**Sent:** Monday, April 13, 2020 3:00 PM
**To:** Herb Parsons
**Cc:** Moffett Museum; Meiser, Trina; Herrick, Daniel; Nihal Oztek
**Subject:** Re: [EXTERNAL] Hangar 3 Section 106 Consultation Interested Party

Hi Herb,

Firstly, apologies for the delayed response. Secondly, thank you confirming that MFHS is interested in participating in our H3 Demo Project. Thank you providing your information below. Have a great day.

Thanks,
Jonathan

---

**From:** Herb Parsons <herbndi@sbcglobal.net>
**Date:** Friday, March 27, 2020 at 11:02 AM
**To:** "Ikan, Jonathan D. (ARC-JCE)" <jonathan.d.ikan@nasa.gov>
**Cc:** Moffett Museum <moffettmuseum@sbcglobal.net>
**Subject:** [EXTERNAL] Hangar 3 Section 106 Consultation Interested Party

Mr. Ikan,

This email is in response to your letter of March 19, 2020.

Yes, the Moffett Field Historical Society (MFHS) is most interested in participating in the Hangar 3 Demolition Project as a consultant.

Please list me as:

Herb Parsons
President
Moffett Field Historical Society
PO Box 16 /B-126 Moffett Field, CA 94035
herbndi@sbcglobal.net / moffettmuseum@sbcglobal.net
(408) 464-6295 (c) / 650 964-4024 (o)

Sincerely,

Herb

## Herrick, Daniel

**Subject:** FW: [EXTERNAL] Hangar 3 Section 106 Consultation Interested Party

From: **Ikan, Jonathan D. (ARC-JCE)** <jonathan.d.ikan@nasa.gov>
Date: Fri, Apr 3, 2020 at 9:45 AM
Subject: Re: [EXTERNAL] Hangar 3 Section 106 Consultation Interested Party
To: Gilmore, Christina <Christina.Gilmore@mountainview.gov>, Matichak, Lisa <Lisa.Matichak@mountainview.gov>, McCarthy, Kimbra <Kimbra.McCarthy@mountainview.gov>, Shrivastava, Aarti <Aarti.Shrivastava@mountainview.gov>
Cc: Nihal Oztek <noztek@google.com>, Anthony LaMarca <alamarca@google.com>, Meiser, Trina <trina.meiser@aecom.com>

Good morning Christina,

Thank you for confirming participation for the City of Mountain View as a consulting party and for providing Councilmember Lisa Matichak's contact information. And thank you, I'll reach out to you if there are any questions.

Best,

Jonathan

---

**From:** "Gilmore, Christina" <Christina.Gilmore@mountainview.gov>
**Date:** Thursday, April 2, 2020 at 7:53 PM
**To:** "Ikan, Jonathan D. (ARC-JCE)" <jonathan.d.ikan@nasa.gov>, "Matichak, Lisa" <Lisa.Matichak@mountainview.gov>, "McCarthy, Kimbra" <Kimbra.McCarthy@mountainview.gov>, "Shrivastava, Aarti" <Aarti.Shrivastava@mountainview.gov>
**Cc:** "Gilmore, Christina" <Christina.Gilmore@mountainview.gov>
**Subject:** [EXTERNAL] Hangar 3 Section 106 Consultation Interested Party

Dear Mr. Ikan,

The City of Mountain View thanks you for the opportunity to participate in the Section 106 of the NHPA review process for the Hangar 3 Demolition Project as a consulting party. Councilmember Lisa Matichak will be representing the City of Mountain View. Please see the following information below as requested:

1. **Name:** Lisa Matichak

2. **Title:** Councilmember
3. **Organization/Affiliation**: City of Mountain View
4. **Address**: 500 Castro Street, Mountain View, CA
5. **Email address**: Lisa.Matichak@mountainview.gov
6. **Phone number**: 650-903-6304
7. **Statement of election to participate**: Moffett Field and many of the structures on the Field hold historical significance. But given the stated condition of Hanger 3, it is prudent to consider demolition of the hanger in light of the expressed safety concerns. I am interested in being part of the team to learn more about the condition of the hanger and to address the proposed demolition.

If you have any questions, please do not hesitate to contact me.

Thank you,


Christina Gilmore

Assistant to the City Manager, City of Mountain View

E-Mail: christina.gilmore@mountainview.gov

Phone: (650) 903-6215

eFax: (650) 963-3099

www.mountainview.gov

# C.2 Follow-up Emails to Interested Parties (April 29, 2020)

- The City of Sunnyvale, California
- Sunnyvale Historical Society
- Mountain View Historical Association
- History San Jose
- Silicon Valley Historical Association
- California Preservation Foundation
- National Trust for Historic Preservation

## Herrick, Daniel

| | |
|---|---|
| **From:** | Herrick, Daniel |
| **Sent:** | Wednesday, April 29, 2020 4:55 PM |
| **To:** | tryan@sunnyvale.ca.gov |
| **Cc:** | Ikan, Jonathan D. (ARC-JCE); Meiser, Trina |
| **Subject:** | Invitation to participate in Section 106 Consultations at NASA Ames Research Center, Moffett Field - Hangar 1 and Hangar 3 Projects |
| **Attachments:** | 2020-03-19_NASA Moffett Field_Hangar 3_S106 Invitation Letter_City of Sunnyvale.pdf; 2020-02-18_NASA Moffett Field_Hangar 1_S106 Invitation Letter_City of Sunnyvale.pdf |

Dear Ms. Ryan,

I am writing on behalf of Jonathan Ikan, Cultural Resource Manager at NASA Ames Research Center in support of two ongoing projects occurring at Moffett Field in Santa Clara County, California. Currently, Planetary Ventures, LLC (PV) has entered into a long-term lease at Moffett Field and is proposing two separate projects that are both undergoing Section 106 Consultation with the California State Historic Preservation Officer (SHPO), for compliance with the National Historic Preservation Act of 1966 (NHPA).

In support of Section 106 consultation, you and your organization are being contacted to assess your interest in participating as a potential consulting party under one or both of the proposed projects. The proposed projects include:

1) **Hangar 1 Rehabilitation Section 106 Consultation**: Constructed in 1933, Hangar 1 is a large, steel framed dirigible aircraft hangar that is listed on the National Register of Historic Places as a contributor to the NAS Sunnyvale Historic District for its associations with naval aviation history and its engineering/design. Remediation efforts were conducted in 2002, which included the removal of the original cladding system, which included asbestos, PCBs, and lead-based paint. However, further remediation is required at the steel structure. Following completion of the remediation activities, rehabilitation work will include recladding the 1933 structure with a new metal skin, glazing, and roof system, all of which are being designed with period appropriate aesthetics.

2) **Hangar 3 Demolition Section 106 Consultation**: Hangar 3 is one of two wood framed dirigible hangars that was constructed at Moffett Field between 1942 and 1943, and is listed on the National Register of Historic Places as a contributor to the NAS Sunnyvale Historic District for its associations with naval aviation history and its engineering/design. Originally slated for rehabilitation in 2015, Hangar 3 has since exhibited advancing structural deterioration, including partial roof collapse and progressive damage to the truss system. Despite extensive efforts to repair and alleviate the issues, structural engineers have assessed that the condition of the hangar has continued to deteriorate. Although it is temporarily stabilized, Hangar 3 continues to pose a potential life safety and surrounding property damage risk, including the neighboring Hangar 2, which is also historic and currently undergoing rehabilitation. As such, strategic and controlled demolition of Hangar 3 is proposed to remove the hazardous conditions.

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If you have any further questions or concerns, please feel free to respond to our team, or reach out directly to Jonathan Ikan (email: jonathan.d.ikan@nasa.gov, phone #: (650) 604-6859).

We thank you for time and look forward to hearing from you.

Best,

**Dan Herrick**
Architectural Historian, Preservation Planner

Direct: 916 669-5963
Mobile: 916 291-9976
Daniel.Herrick@stantec.com

Stantec

## Herrick, Daniel

**From:** Herrick, Daniel
**Sent:** Wednesday, April 29, 2020 5:02 PM
**To:** lbabcock@heritageparkmuseum.org; info@heritageparkmuseum.org
**Cc:** Ikan, Jonathan D. (ARC-JCE); Meiser, Trina
**Subject:** Invitation to participate in Section 106 Consultations at NASA Ames Research Center, Moffett Field - Hangar 1 and Hangar 3 Projects
**Attachments:** 2020-02-18_NASA Moffett Field_Hangar 1_S106 Invitation Letter_Sunnyvale Historical Society.pdf; 2020-03-19_NASA Moffett Field_Hangar 3_S106 Invitation Letter_Sunnyvale Historical Society.pdf

Dear Ms. Babcock,

I am writing on behalf of Jonathan Ikan, Cultural Resource Manager at NASA Ames Research Center in support of two ongoing projects occurring at Moffett Field in Santa Clara County, California. Currently, Planetary Ventures, LLC (PV) has entered into a long-term lease at Moffett Field and is proposing two separate projects that are both undergoing Section 106 Consultation with the California State Historic Preservation Officer (SHPO), for compliance with the National Historic Preservation Act of 1966 (NHPA).

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We thank you for time and look forward to hearing from you.

Best,

**Dan Herrick**
Architectural Historian, Preservation Planner

Direct: 916 669-5963
Mobile: 916 291-9976
Daniel.Herrick@stantec.com

Stantec

## Herrick, Daniel

**From:** Herrick, Daniel
**Sent:** Wednesday, April 29, 2020 5:02 PM
**To:** lbabcock@heritageparkmuseum.org; info@heritageparkmuseum.org
**Cc:** Ikan, Jonathan D. (ARC-JCE); Meiser, Trina
**Subject:** Invitation to participate in Section 106 Consultations at NASA Ames Research Center, Moffett Field - Hangar 1 and Hangar 3 Projects
**Attachments:** 2020-02-18_NASA Moffett Field_Hangar 1_S106 Invitation Letter_Sunnyvale Historical Society.pdf; 2020-03-19_NASA Moffett Field_Hangar 3_S106 Invitation Letter_Sunnyvale Historical Society.pdf

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Best,


**Dan Herrick**
Architectural Historian, Preservation Planner

Direct: 916 669-5963
Mobile: 916 291-9976
Daniel.Herrick@stantec.com

Stantec

## Herrick, Daniel

| | |
|---|---|
| **From:** | Herrick, Daniel |
| **Sent:** | Wednesday, April 29, 2020 4:54 PM |
| **To:** | bschroh@historysanjose.org |
| **Cc:** | Ikan, Jonathan D. (ARC-JCE); Meiser, Trina |
| **Subject:** | Invitation to participate in Section 106 Consultations at NASA Ames Research Center, Moffett Field - Hangar 1 and Hangar 3 Projects |
| **Attachments:** | 2020-02-18_NASA Moffett Field_Hangar 1_S106 Invitation Letter_History San Jose.pdf; 2020-03-19_NASA Moffett Field_Hangar 3_S106 Invitation Letter_History San Jose.pdf |

Dear Mr. Schroh,

I am writing on behalf of Jonathan Ikan, Cultural Resource Manager at NASA Ames Research Center in support of two ongoing projects occurring at Moffett Field in Santa Clara County, California. Currently, Planetary Ventures, LLC (PV) has entered into a long-term lease at Moffett Field and is proposing two separate projects that are both undergoing Section 106 Consultation with the California State Historic Preservation Officer (SHPO), for compliance with the National Historic Preservation Act of 1966 (NHPA).

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We thank you for time and look forward to hearing from you.

Best,

**Dan Herrick**
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Direct: 916 669-5963
Mobile: 916 291-9976
Daniel.Herrick@stantec.com

Stantec

## Herrick, Daniel

**From:** Herrick, Daniel
**Sent:** Wednesday, April 29, 2020 4:56 PM
**To:** Contact@SiliconValleyHistorical.org; john@historytech.org
**Cc:** Ikan, Jonathan D. (ARC-JCE); Meiser, Trina
**Subject:** Invitation to participate in Section 106 Consultations at NASA Ames Research Center, Moffett Field - Hangar 1 and Hangar 3 Projects
**Attachments:** 2020-03-19_NASA Moffett Field_Hangar 3_S106 Invitation Letter_Silicon Valley Historical Society.pdf; 2020-02-18_NASA Moffett Field_Hangar 1_S106 Invitation Letter_Silicon Valley Historical Society.pdf

Dear Mr. McLaughlin,

I am writing on behalf of Jonathan Ikan, Cultural Resource Manager at NASA Ames Research Center in support of two ongoing projects occurring at Moffett Field in Santa Clara County, California. Currently, Planetary Ventures, LLC (PV) has entered into a long-term lease at Moffett Field and is proposing two separate projects that are both undergoing Section 106 Consultation with the California State Historic Preservation Officer (SHPO), for compliance with the National Historic Preservation Act of 1966 (NHPA).

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Daniel.Herrick@stantec.com

Stantec

## Herrick, Daniel

**From:** Herrick, Daniel
**Sent:** Wednesday, April 29, 2020 4:52 PM
**To:** cheitzman@californiapreservation.org
**Cc:** Ikan, Jonathan D. (ARC-JCE); Meiser, Trina
**Subject:** Invitation to participate in Section 106 Consultations at NASA Ames Research Center, Moffett Field - Hangar 1 and Hangar 3 Projects
**Attachments:** 2020-02-18_NASA Moffett Field_Hangar 1_S106 Invitation Letter_CPF.pdf; 2020-03-19 _NASA Moffett Field_Hangar 3_S106 Invitation Letter_CPF.pdf

Dear Ms. Heitzman,

I am writing on behalf of Jonathan Ikan, Cultural Resource Manager at NASA Ames Research Center in support of two ongoing projects occurring at Moffett Field in Santa Clara County, California. Currently, Planetary Ventures, LLC (PV) has entered into a long-term lease at Moffett Field and is proposing two separate projects that are both undergoing Section 106 Consultation with the California State Historic Preservation Officer (SHPO), for compliance with the National Historic Preservation Act of 1966 (NHPA).

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Direct: 916 669-5963
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Stantec

## Herrick, Daniel

| | |
|---|---|
| **From:** | Herrick, Daniel |
| **Sent:** | Wednesday, April 29, 2020 4:53 PM |
| **To:** | cmorris@savingplaces.org |
| **Cc:** | Ikan, Jonathan D. (ARC-JCE); Meiser, Trina |
| **Subject:** | Invitation to participate in Section 106 Consultations at NASA Ames Research Center, Moffett Field - Hangar 1 and Hangar 3 Projects |
| **Attachments:** | 2020-02-18_NASA Moffett Field_Hangar 1_S106 Invitation Letter_National Trust.pdf; 2020-03-19_NASA Moffett Field_Hangar 3_S106 Invitation Letter_National Trust.pdf |

Dear Ms. Morris,

I am writing on behalf of Jonathan Ikan, Cultural Resource Manager at NASA Ames Research Center in support of two ongoing projects occurring at Moffett Field in Santa Clara County, California. Currently, Planetary Ventures, LLC (PV) has entered into a long-term lease at Moffett Field and is proposing two separate projects that are both undergoing Section 106 Consultation with the California State Historic Preservation Officer (SHPO), for compliance with the National Historic Preservation Act of 1966 (NHPA).

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Best,

**Dan Herrick**
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Direct: 916 669-5963
Mobile: 916 291-9976
Daniel.Herrick@stantec.com

Stantec

# Appendix D – Noise Technical Memorandum

| | | | |
|---|---|---|---|
| To: | Nihal Oztek<br>Planetary Ventures, LLC | From: | Stantec Consulting Services Inc.<br>1340 Treat Boulevard, Suite 300<br>Walnut Creek, CA |
| File: | 181710453 | Date: | May 26, 2022 |

**Reference: Noise Technical Memorandum for Hangar 3 Building Demolition Project**

## INTRODUCTION

### Noise Technical Memo Purpose

The purpose of this Noise Technical Memorandum (Memo) is to support the Hangar 3 Building Demolition Project (Proposed Action, Project) National Environmental Policy Act (NEPA) Environmental Assessment (EA). This Memo has been prepared to analyze the potential noise and vibration generated from the Proposed Action and Partial Preservation Alternative to the neighboring sensitive receptors.

### Project Location

The National Aeronautics and Space Administration (NASA) is evaluating impacts from the proposed demolition of Hangar 3 at the NASA Moffett Federal Airfield (MFA) located in the portion of the Ames Research Center (ARC) that NASA has leased to Planetary Ventures, LLC (PV or Lessee). The 1,000-acre MFA Lease area is located at the NASA ARC, in Santa Clara County, California. The ARC is located 35 miles south of San Francisco and 10 miles north of San Jose on approximately 2,000 acres of land in the heart of Silicon Valley. The MFA Lease area includes aircraft runways (Moffett Airfield), Hangar 1, Hangar 2, Hangar 3, assorted structures, and an 18-hole golf course. The project site includes Hangar 3 and is located on federal land held by NASA and leased to PV. The Project site is directly adjacent to both the City of Mountain View and the City of Sunnyvale.

### Proposed Action – Building Demolition

The Proposed Action would involve the demolition of Hangar 3 to remedy the unsafe condition of Hangar 3 and eliminate an unacceptable structural hazard. The Proposed Action would consist of pre-demolition activities, including inspections and identification of materials, abatement, demolition activities, and waste disposal and recycling

## REGULATORY SETTING

### Federal Guidelines

In the past, USEPA coordinated all federal noise control activities through its Office of Noise Abatement and Control. However, in 1981, Congress concluded that noise issues were best handled at the state or local level. As a result, the USEPA phased out the office's funding in 1982 as part of a shift in federal noise control policy to transfer the primary responsibility of regulating noise to state and local governments. However, the Noise Control Act of 1972 and the Quiet Communities Act of 1978 were not rescinded by Congress and remain in effect today although essentially unfunded. Additionally, Title IV – Noise Pollution of the CAA provides guidance to state and local entities for establishing appropriate noise control standards.

For highway projects with Federal Highway Administration (FHWA) involvement, 23 Code of Federal Regulations 722 governs the analysis and abatement of traffic noise impacts. Since this project does not involve a highway with FHWA involvement, no Federal Guidelines apply to the Hangar 3 Building Demolition Project.

## State Guidelines

The State of California has adopted noise standards in areas of regulation not preempted by the federal government. State standards regulate noise levels of motor vehicles, sound transmission through buildings, occupational noise control, and noise insulation. Title 24 of the California Code of Regulations, also known as the California Buildings Standards Code, establishes building standards applicable to all occupancies throughout the state. Section 1207 of the California Building Code provides acoustical regulations for both exterior-to-interior sound insulation as well as sound and impact isolation between adjacent spaces of various occupied units. Title 24 regulations generally state that interior noise levels generated by exterior noise sources shall not exceed 45 A-weighted decibels (dBA) day-night sound level (Ldn)/Community Noise Equivalent Level (CNEL), with windows closed, in any habitable room for general residential uses. The Green Buildings Standards Code establishes maximum one-hour Leq exterior noise levels for commercial buildings. Since this project does not involve the construction of any new buildings, no state guidelines apply to the Hangar 3 Building Demolition Project.

## Local Guidelines

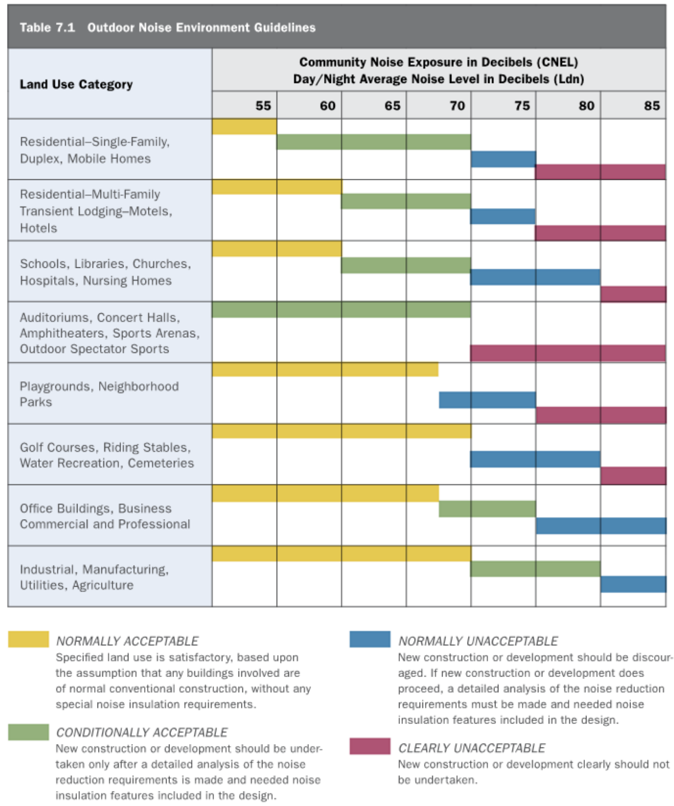
Noise sources associated with construction and demolition activities are generally subject to local control through noise ordinances and general plan policies. Local general plans identify general principles intended to guide and influence development plans.

### Mountain View 2030 General Plan

Chapter 7 “Noise” within the Mountain View 2030 General Plan[1] (adopted July 2012) offers policies for addressing exposure to current and projects noise sources in Mountain View. Table 7.1 “Outdoor Noise

[1] https://www.mountainview.gov/civicax/filebank/blobdload.aspx?blobid=10702

Environment Guidelines" in the Mountain View 2030 General Plan is provided below and identifies land use compatibility noise standards for land uses affected by transportation and non-transportation noise sources.



*Source: State of California General Plan Guidelines, 2003.*

The Mountain View General Plan Action Items List, 2018[2] also identifies the following regarding construction noise:

- NOI 1.6.3 "Truck Traffic". Encourage a limitation on commercial, industrial, and construction truck traffic through residential areas by measures such as requiring truck traffic routes and traffic plans be identified for new construction and new commercial and industrial areas.

**Mountain View Municipal Code**

Chapter 8 "Buildings", Article VI "Construction Noise", Section 8.70 "Construction noise" of the Mountain View Municipal Code[3] states the following:

a. *Hours of construction. No construction activity shall commence prior to 7:00 a.m. nor continue later than 6:00 p.m., Monday through Friday, nor shall any work be permitted on Saturday or Sunday or holidays unless prior written approval is granted by the chief building official. The term "construction activity" shall include any physical activity on the construction site or in the staging area, including the delivery of materials. In approving modified hours, the chief building official may specifically designate and/or limit the activities permitted during the modified hours.*

b. *Modification. At any time before commencement of or during construction activity, the chief building official may modify the permitted hours of construction upon twenty-four (24) hours written notice to the contractor, applicant, developer, or owner. The chief building official can reduce the hours of construction activity below the 7:00 a.m. to 6:00 p.m. time frame or increase the allowable hours.*

c. *Sign required. If the hours of construction activity are modified, then the general contractor, applicant, developer, or owner shall erect a sign at a prominent location on the construction site to advise subcontractors and material suppliers of the working hours. The contractor, owner or applicant shall immediately produce upon request any written order or permit from the chief building official pursuant to this section upon the request of any member of the public, the police or city staff.*

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[2] https://www.mountainview.gov/civicax/filebank/blobdload.aspx?BlobID=26547
[3] https://library.municode.com/ca/mountain_view/codes/code_of_ordinances?nodeId=PTIITHCO_CH8BU_ARTVICONO

d. *Violation. Violation of the allowed hours of construction activity, the chief building official's order, required signage or this section shall be a violation of this code.*

**City of Sunnyvale Moffett Park Specific Plan**

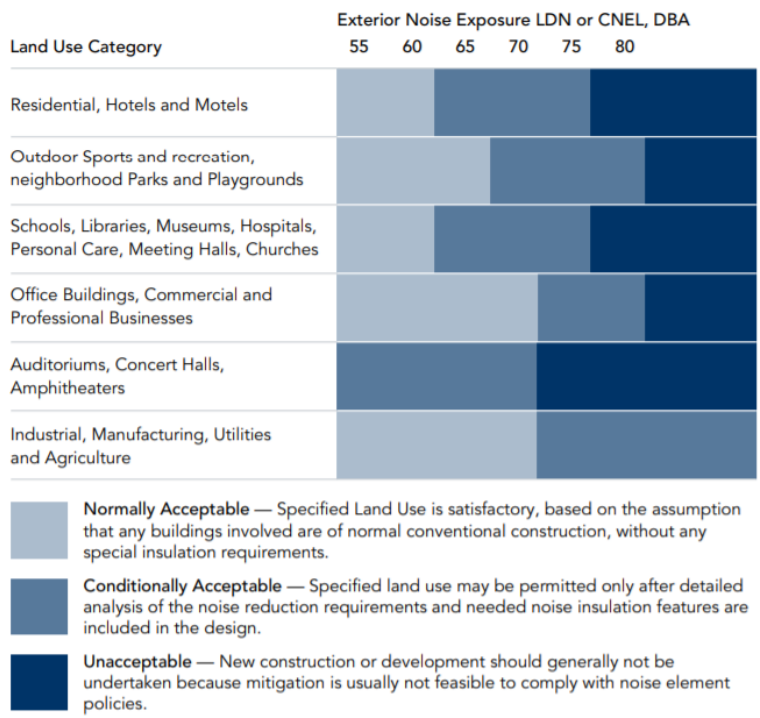
The City of Sunnyvale Moffett Park Specific Plan, Updated 2013[4], identifies planning framework for the land area bordered by Moffett Federal Airfield, the closed Sunnyvale Landfill and the Sunnyvale Materials Recovery and Transfer Station, State Highway 237, and Baylands Park in Sunnyvale, California. This document contains no guidelines or requirements relating to noise.

**Sunnyvale General Plan**

Chapter 6 "Noise" within the Sunnyvale General Plan[5] (adopted July 2011) offers policies for addressing exposure to current and project noise sources in Sunnyvale. Figure 6-5 "State of California Noise Guidelines for Land Use Planning Summary of Land Use Compatibility for Community Noise Environment" is provided below and identifies noise standards for specific land uses affected by noise.

Figure 6-6 in the Sunnyvale General Plan (shown below) defines a "significant" noise impact based on the Ldn category of an existing development, the exterior noise exposure category listed in Figure 6-5, and the noise increase estimated from a particular new development. For example, if an existing property currently experiences ambient noise levels that are "conditionally acceptable", a significant impact would occur if a new property caused the ambient noise levels to increase more than 3 dB.

Figure 6-5: State of California Noise Guidelines for Land Use Planning
Summary of Land Use Compatibility for Community Noise Environment




*Source: Illingworth and Rodkin, Inc. / Acoustics – Air Quality, 1997*

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4 https://sunnyvale.ca.gov/civicax/filebank/blobdload.aspx?blobid=22831
5 https://sunnyvale.ca.gov/civicax/filebank/blobdload.aspx?blobid=23733

Figure 6-6: Significant Noise Impacts from New Development on Existing Land Use

| Ldn Category of Existing Development Per Figure 6-4 | Noise Increase Considered "Significant" over Existing Noise Levels |
|---|---|
| Normally Acceptable | An increase of more than 3 dBA and the total Ldn exceeds the "normally acceptable" category |
| Normally Acceptable | An increase of more than 5 dBA |
| Conditionally Acceptable | An increase of more than 3 dBA |
| Unacceptable | An increase of more than 3 dBA |

The City of Sunnyvale General Plan also states the following regarding traffic noise from major roadways:

> *"Major roadways cause most of the transportation noise in Sunnyvale. Sunnyvale has an interstate, three highways, two expressways and numerous arterial and collector streets within or near its borders. Virtually all existing homes next to freeways and expressways are protected by sound walls or depressed grades. Traffic noise is generally not an issue for commercial, office, and industrial uses."*

**Sunnyvale Municipal Code**

Paragraph 16.080.030 "Hours of Construction – Time and Noise Limitations" in the Sunnyvale Municipal Code[6] states the following:

> *Construction activity shall be permitted between the hours of 7a.m. and 6 p.m. daily Monday through Friday. Saturday hours of operation shall be between 8 a.m. and 5 p.m. There shall be no construction activity on Sunday or federal holidays when city offices are closed.*
>
> *No loud environmentally disruptive noises, such as air compressors without mufflers, continuously running motors or generators, loud playing musical instruments, radios, etc., will be allowed where such noises may be a nuisance to adjacent residential neighborhoods.*
>
> *Exceptions:*
>
> *b) As determined by the chief building official:*
>
> *1) No loud environmentally disruptive noises, such as air compressors without mufflers, continuously running motors or generators, loud playing musical instruments, radios, etc., will be allowed where such noises may be a nuisance to adjacent properties.*
>
> *2) Where emergency conditions exist, construction activity may be permitted at any hour or day of the week. Such emergencies shall be completed as rapidly as possible to prevent any disruption to other properties.*

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[6] https://qcode.us/codes/sunnyvale/

3) *Where additional construction activity will not be a nuisance to surrounding properties, based on location and type of construction, a waiver may be granted to allow hours of construction other than as stated in this section.*

## AFFECTED ENVIRONMENT

### Noise Fundamentals and Terminology

Noise is generally defined as unwanted sound that annoys or disturbs people and potentially causes an adverse psychological or physiological effect on human health. Because noise is an environmental pollutant that can interfere with human activities, evaluation of noise is necessary when considering the environmental impacts of a proposed project.

Sound is mechanical energy (vibration) transmitted by pressure waves over a medium such as air or water. Sound is characterized by various parameters that include the rate of oscillation of sound waves (frequency), the speed of propagation, and the pressure level or energy content (amplitude). In particular, the sound pressure level is the most common descriptor used to characterize the loudness of an ambient (existing) sound level. Although the decibel (dB) scale, a logarithmic scale, is used to quantify sound intensity, it does not accurately describe how sound intensity is perceived by human hearing. The perceived loudness of sound is dependent upon many factors, including sound pressure level and frequency content. The human ear is not equally sensitive to all frequencies in the entire spectrum, so noise measurements are weighted more heavily for frequencies to which humans are sensitive in a process called A-weighting, written as dBA and referred to as A-weighted decibels. There is a strong correlation between A-weighted sound levels (expressed as dBA) and community response to noise. For this reason, the A-weighted sound level has become the standard tool of environmental noise assessment. Table 1 defines sound measurements and other terminology used in this Memo, and Table 2 summarizes typical A-weighted sound levels for different noise sources.

With respect to how humans perceive and react to changes in noise levels, a 1 dBA increase is imperceptible, a 3 dBA increase is barely perceptible, a 5 dBA increase is clearly noticeable, and a 10 dBA increase is subjectively perceived as approximately twice as loud (Egan 2007). These subjective reactions to changes in noise levels were developed on the basis of test subjects' reactions to changes in the levels of steady-state pure tones or broadband noise and to changes in levels of a given noise source. These statistical indicators are thought to be most applicable to noise levels in the range of 50 to 70 dBA, as this is the usual range of voice and interior noise levels. A number of agencies and municipalities have developed or adopted noise level standards consistent with these and other similar studies to help prevent annoyance and to protect against the degradation of the existing noise environment.

Different types of measurements are used to characterize the time-varying nature of sound. These measurements include the equivalent sound level (Leq), the minimum and maximum sound levels (Lmin and Lmax), percentile-exceeded sound levels (such as $L_{10}$ and $L_{20}$), the day-night sound level (Ldn), and the community noise equivalent level (CNEL). Ldn and CNEL values differ by less than 1 dB. As a matter of practice, Ldn and CNEL values are considered to be equivalent and are treated as such in this assessment.

For a point source such as a stationary compressor or demolition equipment, sound attenuates based on geometry at a rate of 6 dB per doubling of distance. For a line source such as free-flowing traffic on a freeway, sound attenuates at a rate of 3 dB per doubling of distance[7]. Atmospheric conditions, including wind, temperature gradients, and humidity, can change how sound propagates over distance and can affect the level of sound received at a given location. The degree to which the ground surface absorbs acoustical energy also affects sound propagation. Sound that travels over an acoustically absorptive surface, such as

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[7] Federal Highway Administration Analysis and Abatement Guidance document 2011, https://www.fhwa.dot.gov/environment/noise/regulations_and_guidance/analysis_and_abatement_guidance/

grass, attenuates at a greater rate than sound that travels over a hard surface, such as pavement. The increased attenuation is typically in the range of 1 to 2 dB per doubling of distance. Barriers, such as buildings and topography that block the line of sight between a source and receiver, also increase the attenuation of sound over distance.

**Table 1: Definition of Sound Measurement**

| Sound Measurements | Definition |
|---|---|
| Decibel (dB) | A unitless measure of sound on a logarithmic scale, which indicates the squared ratio of sound pressure amplitude to a reference sound pressure amplitude. The reference pressure is 20 micro-pascals. |
| A-Weighted Decibel (dBA) | An overall frequency-weighted sound level in decibels that approximates the frequency response of the human ear. |
| C-Weighted Decibel (dBC) | The sound pressure level in decibels as measured using the C- weighting filter network. The C-weighting is very close to an unweighted or flat response. C-weighting is only used in special cases when low-frequency noise is of particular importance. A comparison of measured A- and C-weighted level gives an indication of low frequency content. |
| Maximum Sound Level (Lmax) | The maximum sound level measured during the measurement period. |
| Minimum Sound Level (Lmin) | The minimum sound level measured during the measurement period. |
| Equivalent Sound Level (Leq) | The equivalent steady-state sound level that in a stated period of time would contain the same acoustical energy. |
| Percentile-Exceeded Sound Level ($L_{xx}$) | The sound level exceeded xx percent of a specific time period. $L_{10}$ is the sound level exceeded 10 percent of the time. $L_{90}$ is the sound level exceeded 90 percent of the time. $L_{90}$ is often considered to be representative of the background noise level in a given area. |
| Day-Night Level (Ldn) | The energy average of the A-weighted sound levels occurring during a 24-hour period, with 10 dB added to the A-weighted sound levels occurring during the period from 10:00 PM to 7:00 AM. |
| Community Noise Equivalent Level (CNEL) | The energy average of the A-weighted sound levels occurring during a 24-hour period with 5 dB added to the A-weighted sound levels occurring during the period from 7:00 PM to 10:00 PM and 10 dB added to the A-weighted sound levels occurring during the period from 10:00 PM to 7:00 AM. |
| Peak Particle Velocity (Peak Velocity or PPV) | A measurement of ground vibration defined as the maximum speed (measured in inches per second) at which a particle in the ground is moving relative to its inactive state. PPV is usually expressed in inches/second. |
| Frequency: Hertz (Hz) | The number of complete pressure fluctuations per second above and below atmospheric pressure. |

Source: Federal Highway Administration Construction Noise Handbook, 2006
(https://www.fhwa.dot.gov/environment/noise/construction_noise/handbook/handbook02.cfm)

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**Table 2: Typical A-Weighted Sound Levels**

| Common Outdoor Activities | Noise Level (dBA) | Common Indoor Activities |
|---|---|---|
| | -110- | Rock band |
| Jet flyover at 1,000 Feet | | |
| | -100- | |
| Gas lawnmower at 3 Feet | | |
| | -90- | |
| Diesel truck at 50 Feet at 50 MPH | | Food blender at 3 Feet |
| Noisy urban area, daytime | -80- | Garbage Disposal at 3 Feet |
| Gas lawnmower, 100 Feet | | |
| Commercial area | -70- | Vacuum Cleaner at 10 Feet |
| Heavy traffic at 300 Feet | | Normal Speech at 3 Feet |
| | -60- | |
| Quiet urban daytime | | Large business office |
| | -50- | Dishwasher in next room |
| Quiet urban nighttime | | |
| Quiet suburban nighttime | -40- | Theater, large conference room (Background) |
| Quiet rural nighttime | -30- | Library |
| | -20- | Bedroom at night, concert hall (Background) |
| | -10- | Broadcast/recording studio |
| | -0- | |

Source: Caltrans, Technical Noise Supplement Traffic Noise Analysis Protocol, September 2013 (https://dot.ca.gov/-/media/dot-media/programs/environmental-analysis/documents/env/tens-sep2013-a11y.pdf)

### Decibel Addition

Because decibels are logarithmic units, sound pressure levels cannot be added or subtracted through ordinary arithmetic. On the dB scale, a doubling of sound energy corresponds to a 3 dB increase. In other words, when two identical sources are each producing sound of the same loudness, their combined sound level at a given distance would be 3 dB higher than one source under the same conditions. For example, if one source produces a sound pressure level of 70 dBA, two identical sources would combine to produce 73 dBA. The cumulative sound level of any number of sources can be determined using decibel addition.

### Vibration Standards

Vibration is like noise such that noise involves a source, a transmission path, and a receiver. While related to noise, vibration differs in that noise is generally considered to be pressure waves transmitted through air, whereas vibration usually consists of the excitation of a structure or surface. As seismic waves travel outward from a vibration source, they excite the particles of rock and soil through which they pass and cause them to oscillate. The actual distance that these particles move is usually only a few ten-thousandths to a few thousandths of an inch. The rate or velocity (in inches per second) at which these particles move is the commonly accepted descriptor of the vibration amplitude, referred to as the peak particle velocity (PPV).

Vibration can be measured in terms of acceleration, velocity, or displacement. A common practice is to monitor vibration measures in terms of PPV. Standards pertaining to perception as well as damage to structures have been developed by the California Department of Transportation for vibration levels defined in terms of peak particle velocities (Tables 3 and 4, respectively).

A person's perception to vibration depends on their individual sensitivity to vibration, as well as the amplitude and frequency of the source and the response of the system that is vibrating. Human and structural response to different vibration levels is influenced by a number of factors, including ground type, distance between source and receptor, duration, and the number of perceived vibration events. Table 3 notes that the general threshold at which human annoyance could occur is 0.1 PPV. Table 4 indicates the threshold for damage to structures ranges from 0.2 to 0.5 PPV, depending on the condition of the structure.

**Table 3: Guideline Vibration Annoyance Potential Criteria**

| Human Response | Maximum PPV (in/sec) | |
|---|---|---|
| | Transient Sources | Continuous/Frequent Sources |
| Barely perceptible | 0.04 | 0.01 |
| Distinctly perceptible | 0.25 | 0.04 |
| Strongly perceptible | 0.9 | 0.1 |
| Severe | 2.0 | 0.4 |

Notes: Transient sources create a single isolated vibration event, such as blasting or drop balls. Continuous/frequent intermittent sources include impact pile drivers, pogo-stick compactors, crack-and-seal equipment, vibratory pile drivers, and vibratory compaction equipment.
In/sec = inches per second
Source: California Department of Transportation 2004

**Table 4: Guideline Vibration Damage Potential Criteria**

| Structure and Condition | Maximum PPV (in/sec) | |
|---|---|---|
| | Transient Sources | Continuous/Frequent Sources |
| Extremely fragile historic buildings, ruins, ancient monuments | 0.12 | 0.08 |
| Fragile buildings | 0.2 | 0.1 |
| Historic and some old buildings | 0.5 | 0.25 |
| Older residential structure | 0.5 | 0.3 |
| New residential structures | 1.0 | 0.5 |
| Modern industrial/commercial buildings | 2.0 | 0.5 |

Note:
in/sec = inches per second
Source: California Department of Transportation 2004.

Operation of heavy construction and demolition equipment creates seismic waves that radiate along the surface of the Earth and downward into the Earth. These surface waves can be felt as ground vibration. Vibration from operation of this equipment can result in effects ranging from annoyance of people to damage of structures. Varying geology and distance will result in different vibration levels containing different frequencies and displacements. In all cases, vibration amplitudes will decrease with increasing distance.

Perceptible groundborne vibration is generally limited to areas within a few hundred feet of construction/demolition activities.

Table 5 summarizes typical vibration source levels generated by various construction/demolition equipment as defined by the FTA Transit Noise and Vibration Impact Assessment Manual. The Manual does not identify specific equipment related to micropile drilling as a major vibration source and states “drilled piles causes lower vibration levels where the geological conditions permit their use”. Therefore, no reference PPV levels are included in the manual for micropile drilling equipment.

**Table 5: Vibration Source Levels for Construction/Demolition Equipment**

| Equipment | PPV at 25 Feet |
|---|---|
| Large bulldozer | 0.089 |
| Loaded trucks | 0.076 |
| Small bulldozer | 0.003 |
| Pile Driver (Sonic, Typical) | 0.17 |
| Pile Driver (Sonic, Upper Range) | 0.734 |

Source: Federal Transit Administration Transit Noise and Vibration Impact Assessment Manual, September 2018

Vibration amplitude attenuates over distance and is a complex function of how energy is imparted into the ground and the soil conditions through which the vibration is traveling. The following equation can be used to estimate the vibration level at a given distance for typical soil conditions (Federal Transit Administration 2018). PPVref is the reference PPV from Table 5:

PPV = PPVref x (25/Distance)^1.5

## Identification of Sensitive Receptors and Existing Ambient Noise Levels

### Sensitive Receptors

Some land uses are more tolerant of noise than others. For example, schools, hospitals, churches, and residences are more sensitive to noise intrusion than are commercial or industrial activities. Ambient noise levels can also affect the perceived desirability or livability of a development.

Hangar 3 is located at Moffett Field near the cities of Mountain View and Sunnyvale, California. The nearest existing noise-sensitive receptors are the multifamily residential buildings at Wescoat Village at Moffett Field approximately 5,330 feet to the southwest. Exterior active-use areas, such as the Bay Trail and The Golf Club at Moffett Field could also be considered noise-sensitive receptors since walkers, joggers, cyclists, and golfers will be utilizing these spaces for recreation and relaxation. The Project edge is located approximately 3,512’ from the Bay Trail and about 550’ from the golf course.

The nearest vibration-sensitive structure to the Hangar 3 is Building 055, which is located about 57’ from Hangar 3. Hangar 2 is approximately 180 feet from Hangar 3. In addition to Building 055 and Hangar 2, there are existing utilities, which run very close to the area marked for micropile drilling activity.

**Ambient Noise Levels**

The existing noise environment in a project area is characterized by the area's general level of development due to the high correlation between the level of development and ambient noise levels. Areas that are not urbanized are relatively quiet, while areas that are more urbanized are noisier as a result of roadway traffic, industrial activities, and other human activities.

The area around the project site in the cities of Mountain View and Sunnyvale contains several major noise sources, including highways and busy roadways, such as U.S. Highway 101 (US 101), State Route (SR) 85, SR 237, Central Expressway, and West El Camino Real. Other sources of noise, including rail lines, such as freight rail, Caltrain, and aircraft traffic from Moffett Field, also impact the community.

Noise contours in the Cities of Mountain View and Sunnyvale General Plans were referenced to consider the ambient noise levels at the neighboring properties around the Project site. Figure 7.3, Noise Contours, 2030, in the City of Mountain View 2030 General Plan indicates that the nearest noise-sensitive receptor, Wescoat Village, is located within the 60-70 A-weighted decibels (dBA) Community Noise Equivalent Level (CNEL)/Ldn contour area because of the community's proximity to US 101.

The 2010 Noise Conditions in Sunnyvale, presented in Figure 6-4, 2010 Noise Conditions Map, in the Sunnyvale General Plan shows the noise levels experienced by the commercial properties along Enterprise Way south of 5th Avenue range between below 60 dBA Ldn to greater than 75 dBA Ldn with the loudest ambient noise levels experienced closest to the intersection of SR 237 and US 101.

Figure 5, 2022 Aircraft Noise Contours, in the November 2012 Comprehensive Land Use Plan Santa Clara County Moffett Federal Airfield document, was also referenced to determine previously determined noise conditions at the Project site (SCC ALUC 2012). The figure shows the western edge of the Project site falls between the 70-75 CNEL noise contour. Noise levels from the airfield decrease to the east, away from the runway. The golf course is located outside the 65 dBA CNEL noise contour.

Given the range and age of data in the existing planning documents, noise levels at Wescoat Village were projected using measured ambient noise levels from the May 16, 2019, East Whisman Precise Plan Noise and Vibration Assessment document prepared by Illingworth & Rodkin, Inc. The ambient noise levels from this study were used to estimate the conditions experienced at Wescoat Village referenced because of the more recent timing of the measurements and the similarity between the distance to US 101 measurements were made and distance to US 101 of Wescoat Village.

Long-term and short-term ambient noise measurement locations taken for the East Whisman Precise Plan noise monitoring survey are shown in Figure 1 in the above-cited document. While noise measurements for that Project were taken on the south side of US 101, and varying terrain, screening, and vehicle fleet mix volumes could impact overall noise levels, for the purposes of this analysis, it was considered reasonable to estimate noise north of US 101 at Wescoat Village from these measurements. To be conservative, a line source hemispherical radiation pattern for traffic on US 101 was used and only losses from distance (i.e., not from other sources such as varying terrain or screening) from the roadway were considered. When doing so, it appears that measurements made south of US 101 were comparable to those at the same distance to the north of the US 101.

The noise monitoring survey for the East Whisman Precise Plan was conducted between Tuesday, November 15, and Thursday, November 17, 2016. Measurement Location ST-2 at the corner of National Avenue and Fairchild Drive was approximately 142 feet from the edge of US 101. Measurement Location ST-9 at the parking area west of 516 Clyde Avenue was about 1,481 feet from the edge of US 101. The ambient noise levels measured at these locations were 73 dBA Ldn at ST-2 and 52 dBA Ldn at ST-9.

Wescoat Village occupies an area that is as close as 80 feet and as far as 1,074 feet away from US 101. Accounting for distance attenuation from a line source, expected noise levels at Wescoat Village could be as high as 74 dBA Ldn at the edge of the property closest to US 101 and about 54 dBA Ldn at the edge of the property farthest away from US 101. This estimate presents a slightly wider range of noise levels than shown in the City of Mountain View 2030 General Plan contours. Since this estimation is based on actual noise measurements conducted later than the measurements for the General Plans, the ambient noise levels at Wescoat Village were assumed to range between 54 dBA Ldn and 74 dBA Ldn.

## APPROACH TO ANALYSIS

In accordance with NEPA requirements, the noise analysis contained in this Memo evaluates the Proposed Action's noise and vibration sources to determine the impact of the Proposed Action on the existing ambient noise environment. The following approach was used for the analysis:

### Construction Traffic

Impacts from future demolition-related traffic, both vehicular and heavy truck, were estimated using predicted traffic counts for the Project provided by Stantec Consulting Services Inc. (Stantec). Noise levels generated by heavy construction truck traffic along 5$^{th}$ Avenue was estimated using the SoundPLAN acoustic modeling software. The impact of noise generated from demolition worker traffic on the surrounding neighborhood was determined using the guidelines listed in the Environmental Protection Agency Region 10 Environmental Impact Statement Guidelines, April 1973. These guidelines have been used as industry standard to determine the potential impact of noise increases on communities.

Traffic noise primarily depends on traffic volumes, speed (tire noise increases with speed) and the proportion of truck traffic (trucks generate engine, exhaust, and wind noise in addition to tire noise). For example, it takes 25 percent more traffic volume with the same vehicle mix to produce an increase of only 1 dBA in the ambient noise level. A doubling of traffic volume with the same vehicle mix results in a 3 dBA increase in noise levels. Increases in the proportion of truck traffic may result in the same ambient noise level increase even if the total traffic volume is less than the examples described above.

Most people will tolerate a small increase in background noise (up to about 5 dBA) without complaint, especially if the increase is gradual over a period of years (such as from gradually increasing traffic volumes). Increases greater than 5 dBA may cause complaints and interference with sleep. Increases above 10 dBA (heard as a doubling of judged loudness) are likely to cause complaints and should be considered a serious increase. Table 6 defines each of the traditional impact descriptions, their quantitative range, and the qualitative human response to changes in noise levels.

**Table 6: EPA Impact Guidelines**

| Increase over Existing or Baseline Sound Levels | Impact Per EPA Region Guidelines | Qualitative Human Perception of Difference in Sound Levels |
|---|---|---|
| 0 dB to 5 dB | Minimum Impact | Imperceivable or Slight Difference |
| 6 dB to 10 dB | Significant Impact | Significant Noticeable Difference – Complaints Possible |
| Over 10 dB | Serious Impact | Loudness Changes by a Factor of Two or Greater. Clearly Audible Difference – Complaints Likely |

Source: Environmental Protection Agency Region 10 Environmental Impact Statement Guidelines, April 1973

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### Demolition Noise and Vibration

The FHWA Roadway Construction Noise Model (RCNM) was used to estimate noise generated from construction/demolition activities. The RCNM is used as FHWA's national standard for predicting noise generated from construction and demolition activities. The RCNM analysis includes the calculation of noise levels (Lmax and Leq) at incremental distances for a variety of construction and demolition equipment. The spreadsheet inputs include acoustical use factors, Lmax values, and Leq values at various distances depending on the ambient noise measurement location. Demolition noise levels were calculated for each phase of construction based on a specific equipment list for each phase. The Cities of Mountain View and Sunnyvale do not have explicit noise limits for construction/demolition work to determine impacts. Therefore, the noise limits listed Table 7-3 "Detailed Analysis Construction Noise Criteria" in the 2018 FTA Transit Noise and Vibration Impact Assessment Manual was used to determine impacts from demolition activity. The noise limits listed in Table 7-3 are as follows:

**Table 7-3 Detailed Analysis Construction Noise Criteria**

| Land Use | $L_{eq.equip(8hr)}$, dBA Day | Night | $L_{dn.equip(30day)}$, dBA 30-day Average |
|---|---|---|---|
| Residential | 80 | 70 | 75 |
| Commercial | 85 | 85 | 80* |
| Industrial | 90 | 90 | 85* |

*Use a 24-hour $L_{eq(24hr)}$ instead of $L_{dn.equip(30day)}$.

Since demolition activities would occur during daytime hours only and the closest noise sensitive receptors are residential or recreational uses, the Residential Daytime Leq (8 hour) level from the table above was used as a threshold. Noise impacts associated with the Project would be considered significant if levels exceed 80 dB(A) Leq at the closest sensitive receptors.

Vibration from demolition equipment is analyzed at the surrounding buildings and compared to the applicable California Department of Transportation (Caltrans) building damage criteria to determine whether demolition activities would generate vibration at levels that could result in building damage. Vibration impacts would be significant if any vibrations from continuous/frequent sources would exceed 0.25 in/sec peak particle velocity (PPV) for "historic and some old" buildings. The "historic and some old buildings" category was considered the most appropriate category to reflect the structure and condition of Building 055.

## ENVIRONMENTAL CONSEQUENCES

### Demolition

#### Temporary Demolition Noise Impacts

Construction Traffic

Demolition worker traffic would incrementally increase noise levels on access roads leading to the Project site on a temporary and intermittent basis. Medium and heavy truck traffic would travel along Macon Road between the Project site and the 5th Avenue Gate, which is closer to the Project site than the Ellis Street Gate and is designed to accommodate larger vehicles. Demolition workers would travel along Macon Road between the Project site and the Ellis Street Gate. By utilizing these routes, neither the construction worker vehicles nor the construction trucks would be traveling by any noise sensitive receptors or through any noise sensitive neighborhoods on the way to the project site.

As noted in the Air Quality analysis, the pre-demolition phase of this project would involve the highest number of workers on site per day with a maximum of 50 construction workers per day traveling to and from the site.

As stated above, on-site workers would travel along Macon Road between the Project site and the Ellis Street Gate. Assuming a worst-case of all workers driving individual vehicles and entering or existing the site at the same time, this would add 50 vehicles to the peak hour traffic volumes approaching the Ellis Street Gate. According to the traffic analysis memorandum provided by Stantec (Appendix E, Traffic Analysis Memorandum, in the Draft Environmental Assessment [EA] prepared for this project), the 2022 peak hour background traffic volumes at the intersection of Ellis Street and Manilla Avenue are 1,427 vehicles in the AM and 1,147 vehicles in the PM. Adding 50 construction worker vehicles to the background traffic along Macon Road and Ellis Street represents a maximum 4.4% percent increase in traffic volumes, which equates to a 0.17 dBA increase in noise. This small change in ambient noise due to construction worker traffic would result in a less than significant impact.

As stated above, medium and heavy truck traffic would travel along Macon Road between the Project site and the 5th Avenue Gate, which is designed to accommodate larger vehicles. According to the traffic analysis memorandum provided by Stantec (Appendix E, Traffic Analysis Memorandum, in the Draft EA prepared for this project), the 2022 AM peak hour traffic traveling on 5$^{th}$ Avenue near N Mathilda Avenue is 46 vehicles in the westbound direction and 323 vehicles in the eastbound direction. Figure C, “Proposed Action Phase 2 AM Peak Hour Trips – Truck Trips” in the Traffic Analysis Memorandum (see Appendix E of the Draft EA), shows the project will add 12 heavy construction trucks in the westbound direction and 13 heavy construction trucks in the eastbound direction to the background vehicular traffic on 5$^{th}$ Avenue.

To determine the impact of the construction trucks on overall traffic noise levels, the SoundPLAN acoustic modeling software was used as an analysis tool. The SoundPLAN software models both Ldn and Leq traffic noise levels based on a peak hour traffic volume and considers vehicle type (vehicle, heavy truck, medium truck, bus, motorcycle), vehicle speed, and traffic control devices, such as stop signs and traffic lights. Using the 2022 AM peak hour traffic volumes and expected peak hour heavy truck volumes on 5$^{th}$ Avenue listed above, traffic-related noise levels including construction truck traffic on 5$^{th}$ Avenue were modeled to increase 2.3 dB(A). This change in ambient noise due to construction truck traffic is below 3 dB(A) and therefore, would result in a less than significant impact.

Demolition Activity

In addition to noise from construction worker vehicular traffic, noise would result from the demolition of Hangar 3. Each demolition stage would have its own mix of equipment, and consequently, its own noise characteristics. These various operations would change the character of the noise generated at the Project site and, therefore, the noise level as demolition progresses.

The demolition of the Hangar 3 Building Demolition Project would be conducted in three phases, each with its own mix of equipment and resulting noise characteristics and potential effects. Therefore, construction noise levels for the following three phases were analyzed for this Project:

- Phase 1 – Pre-Demolition Activities
- Phase 2 – Demolition
- Phase 3 – Waste Disposal and Recycling

Phase 3 would occur concurrently with both Phase 1 and Phase 2. The main types of noise-producing equipment for each demolition phase are shown in Table 8.

**Table 8: Demolition Phases Equipment**

| Demolition Phase | Demolition Equipment |
|---|---|
| Phase 1 and Phase 3 - Pre-Demolition Activities and Waste Disposal and Recycling | • Boom Lifts (2)<br>• Reach Forks (2)<br>• Bobcats (2)<br>• Generators (2)<br>• Demolition Excavators (2) |

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| Demolition Phase | Demolition Equipment |
|---|---|
| | • Manlift (1)<br>• Swing Stages (2)<br>• Haul Trucks (2)* |
| Phases 2 and 3 - Demolition and Waste Disposal and Recycling | • Demolition Excavators (7)<br>• Crane (1)<br>• Manlifts (2)<br>• Skid Steers (2)<br>• Water Truck (1)<br>• Haul Trucks (12)* |
| * The number of haul trucks per phase represents the worst-case peak hour volume as taken from the Stantec traffic study. | |

Table 9 lists types of Project-related equipment and the maximum and average operational noise level as presented in the RCNM at 5,330 feet from the operating equipment. The 5,330-foot distance represents the approximate distance between the Project and the closest multifamily residential receptors at Wescoat Village at Moffett Field, the 3,512-foot distance is the closest distance between the edge of the project area and the Bay Trail, and the 550-foot distance represents the closest distance between the Project and the golf course. The usage factor in Table 9 is as defined by the RCNM program.

**Table 9: Calculated Noise Level from Each Piece of Demolition Equipment**

| Demolition Equipment Source | Distance to Nearest Noise-Sensitive Receptor | Sound Level at Residence | | |
|---|---|---|---|---|
| | | Usage Factor | Lmax, dBA | Leq, dBA |
| Man Lift (Boom Lift) | 5,330 feet | 20% | 34.1 | 27.2 |
| | 3,512 feet | | 37.8 | 30.8 |
| | 550 feet | | 53.9 | 46.9 |
| Reach Fork[1] | 5,330 feet | 40% | 38.6 | 34.6 |
| | 3,512 feet | | 42.2 | 38.2 |
| | 550 feet | | 58.3 | 54.3 |
| Bobcat[2] | 5,330 feet | 40% | 43.4 | 39.5 |
| | 3,512 feet | | 47.1 | 43.1 |
| | 550 feet | | 63.2 | 59.2 |
| Generator | 5,330 feet | 50% | 40.1 | 37.1 |
| | 3,512 feet | | 43.7 | 40.7 |
| | 550 feet | | 59.8 | 56.8 |
| Excavator | 5,330 feet | 40% | 40.2 | 36.2 |
| | 3,512 feet | | 43.8 | 39.8 |
| | 550 feet | | 59.9 | 55.9 |
| Swing Stage[3] | 5,330 feet | 20% | 34.1 | 27.2 |
| | 3,512 feet | | 37.8 | 30.8 |
| | 550 feet | | 53.9 | 46.9 |
| Crane | 5,330 feet | 16% | 40.0 | 32.0 |
| | 3,512 feet | | 43.6 | 35.7 |

| Demolition Equipment Source | Distance to Nearest Noise-Sensitive Receptor | Sound Level at Residence | | |
|---|---|---|---|---|
| | | Usage Factor | Lmax, dBA | Leq, dBA |
| | 550 feet | | 59.7 | 51.8 |
| Skid Steer[4] | 5,330 feet | 40% | 38.6 | 34.6 |
| | 3,512 feet | | 42.2 | 38.2 |
| | 550 feet | | 58.3 | 54.3 |
| Water Truck[5] | 5,330 feet | 40% | 33.7 | 29.7 |
| | 3,512 feet | | 37.3 | 33.3 |
| | 550 feet | | 53.4 | 49.4 |
| Auger Drill Rig | 5,330 feet | 20% | 43.8 | 36.8 |
| | 3,512 feet | | 42.2 | 35.2 |
| | 550 feet | | 58.3 | 51.3 |
| Haul Truck[6] | 5,330 feet | 40% | 35.9 | 31.9 |
| | 3,512 feet | | 39.5 | 35.5 |
| | 550 feet | | 55.6 | 51.6 |

Notes:
1. The RCNM program does not have sound levels for a reach fork. Therefore, the noise levels from a front-end loader were used in the analysis to simulate the reach fork.
2. The RCNM program does not have sound levels for a small Bobcat. Therefore, the noise levels from a tractor were used in the analysis to simulate the small Bobcat.
3. The RCNM program does not have sound levels for a swing stage. Therefore, the noise levels from a man lift were used in the analysis to simulate the swing stage.
4. The RCNM program does not have sound levels for a skid steer. Therefore, the noise levels from a front-end loader were used in the analysis to simulate the skid steer.
5. The RCNM program does not have sound levels for a water truck. Therefore, the noise levels from a flatbed truck were used in the analysis to simulate the water truck.
6. The RCNM program does not have sound levels for a haul truck. Therefore, the noise levels from a dump truck were used in the analysis to simulate the haul truck.
Source: Stantec 2020, Federal Highway Administration RCNM 2008

A worst-case condition for demolition activity is presented assuming all noise-generating equipment would be operating at the same time and at the same distance from the closest noise-sensitive receptor. Based on this assumption, the RCNM program calculated the following combined Leq and Lmax noise levels from each phase of demolition as shown in Table 10:

**Table 10: Calculated Noise Level from Each Demolition Stage**

| Demolition Phase | Distance to Closest Noise Sensitive Receptor | Calculated Leq, dBA | Calculated Lmax, dBA |
|---|---|---|---|
| Pre-Demolition Activities and Waste Disposal and Recycling | 5,330 feet (WV) | 46.8 | 50.8 |
| | 3,512 feet (BT) | 50.4 | 54.5 |
| | 550 feet (GC) | 66.5 | 70.6 |
| Demolition and Waste Disposal and Recycling | 5,330 feet (WV) | 47.6 | 51.8 |
| | 3,512 feet (BT) | 51.2 | 55.4 |
| | 550 feet (GC) | 67.3 | 71.5 |
| Notes: WV = Wescoat Village; BT = Bay Trail; GC = Golf Course | | | |

Demolition noise levels at all closest noise-sensitive receptors are expected to be well below the Residential Daytime level of 80 dB(A) Leq (8 hour) impact threshold as defined in Table 7-3 “Detailed Analysis Construction Noise Criteria” in the 2018 FTA Transit Noise and Vibration Impact Assessment Manual. Therefore, the impact of demolition activity noise to the sensitive receptors would be less than significant.

Cumulative Demolition Noise Impacts

The incremental noise effects from the Proposed Action would only occur during the limited timeframe for the removal of Hangar 3 (approximately 9 months). Of the cumulative projects that are near the Proposed Action, only the Airside Fuel Farm and possibly the initial phases of the EAIP have similar construction schedules as the Proposed Action. As shown in Table 10, worst-case Leq noise levels associated with the demolition of Hangar 3 were calculated at 67.3 dB(A) at the golf course, 51.2 dB(A) at the Bay Trail, and 47.6 dB(A) at Wescoat Village at MFA. Combined noise levels from the construction of the Airside Fuel Farm and the EAIP could reach levels of 78.6 dB(A) Leq at the golf course, 54.1 dB(A) at the Bay Trail, and 48.9 dB(A) at the Wescoat Village at MFA site. Using the principles of decibel addition, Leq noise levels at the golf course, Bay Trail, and Wescoat Village at MFA could be increased to 78.9 dB(A), 55.9 dB(A), and 51.8 dB(A), respectively. Even with three active construction project sites occurring simultaneously, and using a worst-case scenario, noise levels at all closest noise-sensitive receptors are expected to be below the Residential Daytime level of 80 dB(A) Leq (8 hour) impact threshold as defined in Table 7-3 “Detailed Analysis Construction Noise Criteria” in the 2018 FTA Transit Noise and Vibration Impact Assessment Manual.

The NASA Housing Project would be located approximately 4,710 feet southwest of Hangar 3. While distant from the Proposed Action in terms of noise impacts (because of the attenuation of noise with distance from the source), this EA examines the potential for cumulative effects of this project with that of the Proposed Action. Worst-case noise levels generated from the Project’s demolition (Pre-Demolition Activities Phase) were calculated at 48.6 dBA Leq at the future NASA Housing Project. Construction noise levels generated on the NASA Housing Project site could be as loud as 95 dBA Leq, depending on the construction equipment used and the distance from the equipment. Using standard logarithmic addition, the noise generated from the demolition activities at Hangar 3 would not increase the noise generated from the construction of the NASA Housing Project site. Therefore, demolition noise from the Hangar 3 Building Demolition Project in combination with construction noise from the future NASA Housing Project would not result in a significant cumulative impact to the surrounding community, particularly residents of Wescoat Village.

Thus, the cumulative effect with the Proposed Action would be temporary and limited to the eastern portion of the MFA where users of the Bay Trail and the golf course, who are transient and would not be affected for the duration of construction, are the only sensitive receptors. The incremental traffic noise from construction traffic would not be noticeable compared to ambient conditions, and worst-case noise effects from demolition activities would not be significant. Furthermore, the Proposed Action also would adhere to noise and vibration protection measures. Further, there would be no long-term noise effects from the Proposed Action, which does not include any operational activities after construction and demolition activities are completed.

Therefore, given the limited and temporary nature of the noise impacts as a result of demolition activities (i.e., no operational effects), the Proposed Action would not be cumulatively significant when combined with past, present, and reasonably foreseeable future actions.

**Short-Term Demolition Vibration Impacts**

Table 7-4 "Vibration Source Levels for Construction Equipment" in the FTA Transit Noise and Vibration Impact Assessment Manual lists average vibration source levels, in PPV at 25 feet, for the construction and demolition equipment which generates the greatest levels of vibration. The equipment listed in the FTA table includes impact and sonic pile drivers, clam shovel drops, hydromills, vibratory rollers, hoe rams, large bulldozers, caisson drilling, loaded trucks, jackhammers, and small bulldozers. Comparing the equipment list in FTA Table 7-4 to the Project's equipment list in Table 11, the equipment most likely to generate vibrational energy for the Proposed Action would be large and small bulldozers and loaded trucks.

During demolition, equipment such as small bulldozers (Bobcats) and loaded trucks could be used as close as 57 feet from the nearest vibration-sensitive receptor (Building 055). The 57-foot distance represents the separation between the edge of the fence line to Building 055.

The assessment method as described in the FTA Transit Noise and Vibration Impact Assessment Manual states to "assess potential annoyance and damage effects from construction (demolition) vibration for each piece of equipment individually." Multiple pieces of equipment operating simultaneously could increase vibration levels but predicting any increase could be difficult. Therefore, using the assessment method as described in the FTA Transit Noise and Vibration Impact Assessment Manual, demolition equipment that would be used during the project is expected to generate vibration levels up to 0.0259 PPV at 57 feet, as shown in Table 11. This vibration level would not be expected to cause damage to the existing nearby buildings onsite. All demolition activities would also follow the hours restrictions and procedures listed in Chapter 8 "Buildings", Article VI "Construction Noise", Section 8.70 "Construction noise" of the Mountain View Municipal Code.

As a note, since there are no occupied buildings within close proximity of Hangar 3, the perceptible groundborne vibration criteria listed in Table 3 were not used for this project.

**Table 11: Vibration Source Levels for Construction/Demolition Equipment**

| Type of Equipment | Peak Particle Velocity (PPV) at 57 Feet | Threshold at which Building Damage Could Occur (PPV) | Potential for Proposed Action to Exceed Threshold |
|---|---|---|---|
| Large Bulldozer | 0.0259 | 0.25 | None |
| Loaded Trucks | 0.0221 | 0.25 | None |
| Small Bulldozer | 0.0009 | 0.25 | None |

Source: Federal Transit Administration Transit Noise and Vibration Impact Assessment Manual, September 2018

In addition to the equipment, the activity of demolition, such as felling and dropping pieces of structure, could also cause vibrational energy. For the Hangar 3 Building Demolition Project, materials would either be tethered and mechanically lowered to the ground or mechanically cut and dropped to the floor if this can be accomplished without damaging the Hangar 3 slab. If materials are dropped to the floor, considerations need to be made including limiting fall distances and considering the weight of the material being dropped to minimize impacts to the slab. The trusses would be supported by the existing hydraulic jack system that would remain in place until trusses were removed, thus limiting the opportunity for the structure to fall to the slab. Reducing stress on the slab lowers the vibrational energy which enters the slab and reduces the vibration impact which could propagate through the ground to Hangar 2 and Building 055.

## SUMMARY OF NOISE/VIBRATION REDUCTION MEASURES

The following summary of measures will be followed to help reduce noise and vibration to adjacent sensitive receptors:

- Truck traffic associated with demolition work will either travel along Macon Road between the Project site and the 5th Avenue gate or along Macon Road between the Project site and the Ellis Street gate. These planned routes would travel around the edge of Moffett Field within the City of Sunnyvale and not pass through any noise-sensitive neighborhoods before merging onto the freeway.

- All demolition activities would follow the hours restrictions and procedures listed in Chapter 8 “Buildings”, Article VI “Construction Noise”, Section 8.70 “Construction noise” of the Mountain View Municipal Code and Paragraph 16.080.030 “Hours of Construction – Time and Noise Limitations” in the Sunnyvale Municipal Code.

- Hangar 2 and Building 055 would be protected by carefully lowering materials to the floor. All demolition materials would either be tethered and mechanically lowered to the ground or mechanically cut and dropped to the floor. If materials are dropped to the floor, considerations would be made including limiting fall distances and considering the weight of the material being dropped to minimize impacts to the slab. Reducing stress on the slab lowers the vibrational energy that enters the slab and reduces the vibration impact that could propagate through the ground to Hangar 2 and Building 055.

- The trusses would be supported by the existing hydraulic jack system that would remain in place until trusses are removed.

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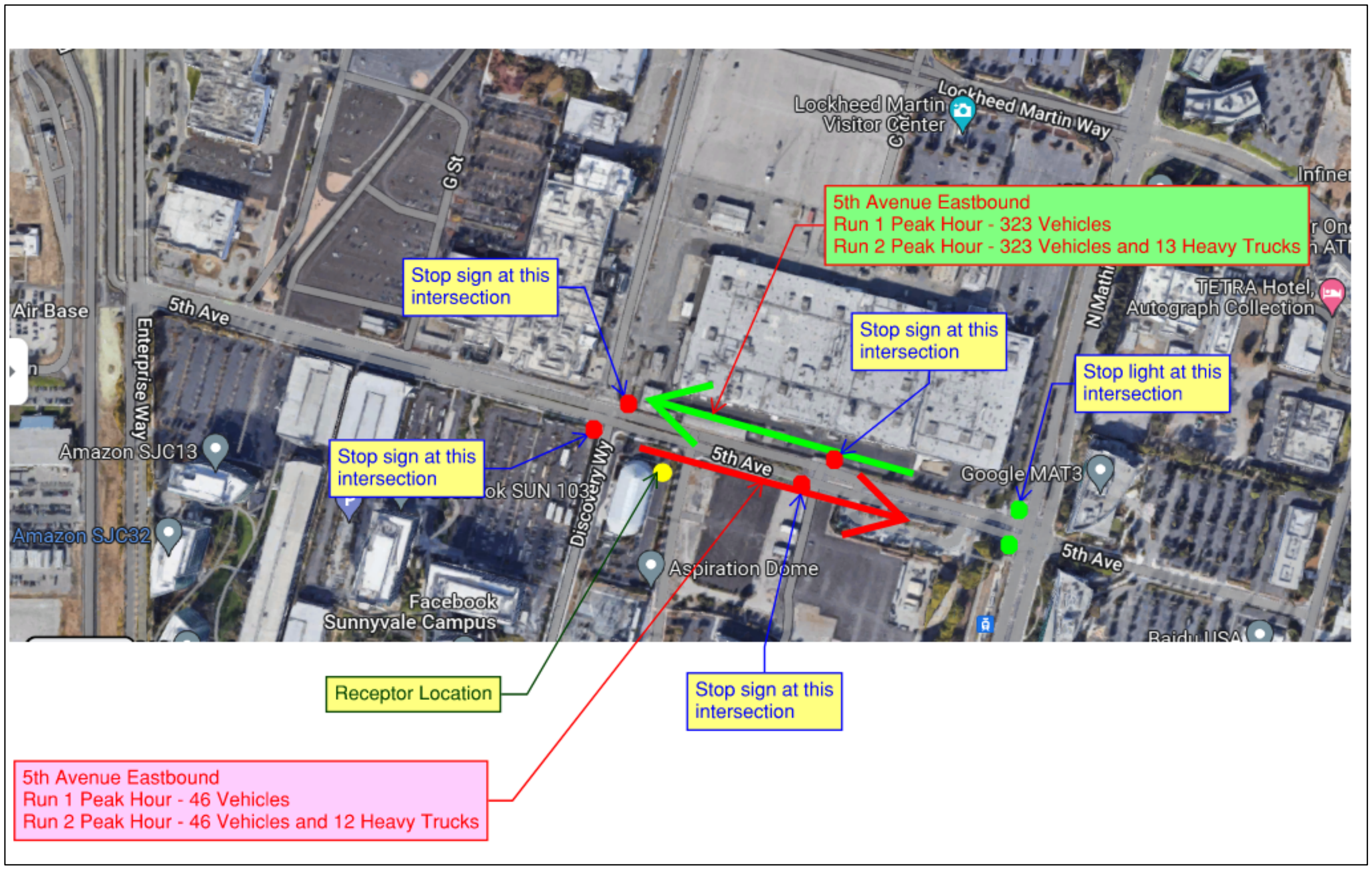
**Hangar 3 Project**
**RUN 1: SoundPLAN Traffic Model Results Along 5th Avenue with Peak Hour Vehicles - NO Construction Trucks**
**26-May-22**

| Receiver | Ldn/dB(A) | Leq,d/dB(A) | Leq,n/dB(A) |
|---|---|---|---|
| Receiver about 125' from Centerline of 5th Avenue | 62.4 | 56 | 56 |

| Time slice | 63Hz dB(A) | 125Hz dB(A) | 250Hz dB(A) | 500Hz dB(A) | 1kHz dB(A) | 2kHz dB(A) | 4kHz dB(A) | 8kHz dB(A) |
|---|---|---|---|---|---|---|---|---|
| Ldn | 48.8 | 53.6 | 53.8 | 55.4 | 57 | 54.5 | 47 | 40.1 |
| Leq,d | 42.3 | 47.2 | 47.4 | 49 | 50.5 | 48.1 | 40.6 | 33.7 |
| Leq,n | 42.3 | 47.2 | 47.4 | 49 | 50.5 | 48.1 | 40.6 | 33.7 |

| Road | ADT Veh/24h | Gradient % |
|---|---|---|
| 5th Ave Eastbound | 1104 | 0 |
| 5th Ave Westbound | 7752 | 0 |

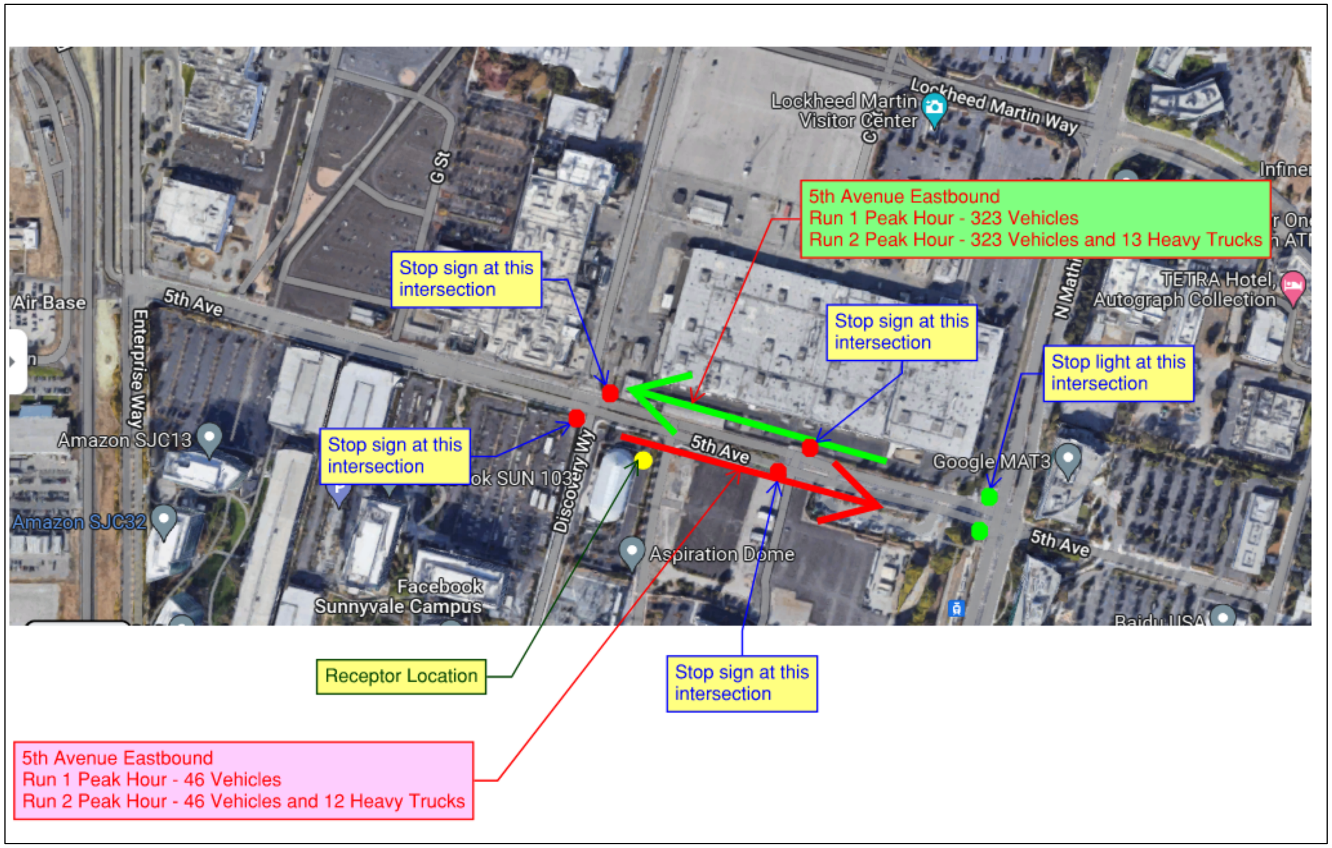


**Hangar 3 Project**
**RUN 2: SoundPLAN Traffic Model Results Along 5th Avenue with 25 Added Heavy Trucks**
**26-May-22**

| Receiver | Ldn/dB(A) | Leq,d/dB(A) | Leq,n/dB(A) |
|---|---|---|---|
| Receiver about 125' from Centerline of 5th Avenue | 64.7 | 58.3 | 58.3 |

| Time slice | 63Hz dB(A) | 125Hz dB(A) | 250Hz dB(A) | 500Hz dB(A) | 1kHz dB(A) | 2kHz dB(A) | 4kHz dB(A) | 8kHz dB(A) |
|---|---|---|---|---|---|---|---|---|
| Ldn | 49.7 | 55.8 | 56.6 | 57.7 | 59 | 57.2 | 50.7 | 43.9 |
| Leq,d | 43.3 | 49.4 | 50.2 | 51.3 | 52.6 | 50.8 | 44.3 | 37.5 |
| Leq,n | 43.3 | 49.4 | 50.2 | 51.3 | 52.6 | 50.8 | 44.3 | 37.5 |

| Road | ADT Veh/24h | Gradient % |
|---|---|---|
| 5th Ave Eastbound | 1392 | 0 |
| 5th Ave Westbound | 8064 | 0 |



# Appendix E – Traffic Analysis Memorandum

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# Memo

| | | | |
|---|---|---|---|
| To: | Planetary Ventures<br>1600 Amphitheater Parkway<br>Mountain View, CA 94043 | From: | Daryl Zerfass / Cathy Lawrence<br>Stantec Consulting Services Inc.<br>38 Technology Drive<br>Irvine, CA 92618 |
| File: | 181710453 | Date: | February 10, 2022 |

**Reference: Traffic Analysis – Hangar 3 Structural Hazard Remediation Project**

Hangar 3 is located within the Moffett Federal Airfield (MFA) area at NASA's Ames Research Center (ARC). NASA entered into an Adaptive Reuse Lease ("MFA Lease") with Planetary Ventures, LLC (PV) in 2014 for PV's use of MFA. PV proposes the structural hazard remediation of Hangar 3 to remedy the unsafe condition of Hangar 3 and eliminate an unacceptable structural hazard.

The scope of the Hangar 3 Structural Hazard Remediation Project (Proposed Action – Building Demolition) analyzed in this report is limited to activities related to demolition of Hangar 3 and Partial Preservation Alternative, and its potential transportation impact on the surrounding street system. Alternative modes of transportation are evaluated.

## Project Description and Trip Generation Assumptions

### Proposed Action – Building Demolition – Structural Hazard Remediation

The Proposed Action – Building Demolition would involve the demolition of Hangar 3 to remove a major safety liability (including removal and management of contaminated materials, equipment, and environmental media) in a timely way and would provide an environment without hazards to life or property from partial or full building collapse. The Proposed Action – Building Demolition would consist of pre-demolition activities, including inspections and identification of materials, abatement, demolition activities, and waste disposal and recycling.

The structural hazard remediation of Hangar 3 would occur in phases.

### Phase 1 – Pre-Demolition

Phase 1 consists of pre-demolition activities. Phase 1 is anticipated to take 80 to 90 working days, and the typical workday hours are expected to be from 7 AM to 3:30 PM. Once the heavy equipment used in the abatement work is delivered to the site, it is expected to remain on-site for the duration of Phase 1 work. Off-haul truck trips are estimated to average two per workday for a total of four daily truck trips (two inbound, two outbound) during Phase 1.

The off-haul truck trips are assumed to be spread out at an average rate as they are loaded throughout the workday. It is estimated that one truck would enter, and one truck would exit the site during the AM peak hour, and one truck would enter, and, under worst-case conditions, one truck would exit the site during the PM peak hour after construction activities conclude for the workday.

Trucks take more space and have slower acceleration than passenger cars; therefore, a passenger car equivalent (PCE) factor is applied to the Proposed Action – Building Demolition truck trips. The exact types of off-haul trucks are not known at this time. An average PCE of 2.0 is applied to the truck trips for the purpose of roadway capacity analysis.

**Reference: Traffic Analysis – Hangar 3 Structural Hazard Remediation Project**

During the Phase 1 pre-demolition work, 50 workers are estimated to be onsite each workday. The construction workday is expected to be from 7:00 AM to 3:30 PM, and nearly all construction workers would arrive at and leave the construction site before the typical roadway AM and PM peak hours, respectively. A conservative estimate of 10 percent of workers arriving during the AM peak hour and 10 percent leaving during the PM peak hour was assumed. Also, when conservatively assuming each worker arrives in a separate personal vehicle, workers would generate 100 trips daily, of which 5 would occur during the AM peak hour and 5 would occur during the PM peak hour.

The construction workers are expected to use the Ellis Street Gate and to park at the Proposed Action – Building Demolition site. Truck traffic is assumed to use the 5th Avenue Gate.

### Phase 2 – Demolition

Phase 2 consists of the demolition activities. Demolition is estimated to take 125 working days. A total of approximately 2,000 trucks removing materials or equipment (2,000 trips in, 2,000 trips out) are estimated for the duration of the demolition work, with a maximum estimate of 100 trucks per workday (100 trips in, 100 trips out).

Off-haul truck trips are expected to occur at an average rate as they are loaded throughout the eight-hour workday. The maximum expected daily number of trucks (100 trucks per workday) is assumed for this analysis as a worst-case assumption; therefore, during the AM peak hour it is estimated that 13 trucks would enter and 12 trucks would exit the site, and during the PM peak hour it is estimated that 12 trucks would enter and 13 trucks would exit the site. The remaining trucks would enter and exit the site during the off-peak hours.

The exact types of off-haul trucks are not known at this time. An average PCE of 2.0 is applied to the truck trips for the purpose of roadway capacity analysis.

During Phase 2 demolition, 20 workers are estimated to be onsite each workday. Trips generated by these workers are estimated as discussed above. Phase 2 workers would generate 40 trips daily, of which 2 would occur during the AM peak hour and 2 would occur during the PM peak hour.

The construction workers are expected to use the Ellis Street Gate and to park at the Proposed Action – Building Demolition site. Truck traffic is assumed to use the 5th Avenue Gate.

### Phase 3 – Waste Disposal and Recycling

Phase 3 consists of waste disposal and recycling. This would occur during demolition; therefore, trip estimates for Phase 3 are included in Phases 1 and 2 trip estimates described above.

### Partial Preservation Alternative

The Partial Preservation Alternative consists of the removal of the main volume, or central part, of Hangar 3 while both sets of concrete towers and box beam structures would be retained. A new stabilizing structure would be designed and constructed to support them. The Partial Preservation Alternative would add the renovation and reinforcement of the north and south façades as Phase 4 to the Project schedule. Phases 1 through 3 would remain the same as the Proposed Action – Building Demolition.

**Reference: Traffic Analysis – Hangar 3 Structural Hazard Remediation Project**

## Phase 4 – Renovation and Reinforcement

Phase 4 consists of the renovation and reinforcement of the north and south facades of Hangar 3. The construction is estimated to take 260 working days after completion of Phases 2 and 3, and the typical workday hours are expected to be 7 AM to 3:30 PM. During the typical workday, off-haul trucks are estimated to number 30 per workday (30 trips in, 30 trips out) on average. The truck trips are assumed to be spread out proportionately at an average rate as they are loaded throughout the eight-hour workday. It is estimated that 4 trucks would enter, and 4 trucks would exit the site during the one-hour peak of the AM peak period, and 4 trucks would enter, and 4 trucks would exit the site during the one-hour peak of the PM peak period.

The exact types of off-haul trucks are not known at this time. An average PCE of 2.0 is applied to the truck trips for the purpose of roadway capacity analysis.

During Phase 4 renovation and reinforcement, 30 workers are estimated to be onsite each workday. Trips generated by these workers are estimated as discussed above. Phase 4 workers would generate 60 trips daily, of which 3 would occur during the AM peak hour and 3 would occur during the PM peak hour.

The construction workers are expected to use the Ellis Street Gate and to park at the Proposed Action – Building Demolition site. Truck traffic is assumed to use the 5th Avenue Gate.

### Trip Generation – Peak Proposed Action – Building Demolition Phase

**Table 1** (attached) summarizes the total trip generation for Phase 1 and Phase 2 of the Proposed Action – Building Demolition and Phase 1, Phase 2, and Phase 4 of the Partial Preservation Alternative. Phase 3 (waste disposal and recycling) would occur as part of the Phase 1 and Phase 2 demolition activity. The trip estimates for Phase 3 are included in the Phase 1 and Phase 2 trips. As shown in the table, Phase 2 of the Proposed Action – Building Demolition generates more PCE trips than Phase 1; therefore, the Phase 2 traffic estimate was used for the intersection analysis to provide the most conservative analysis conditions for the Proposed Action – Building Demolition. The Proposed Action – Building Demolition would generate 440 daily PCE trips, of which 52 PCE trips would be generated during the AM peak hour and 52 PCE trips would be generated during the PM peak hour.

The Partial Preservation Alternative would generate the same number of trips during Phases 1, 2, and 3 as the Proposed Action – Building Demolition, and the trips generated during Phase 4, which would occur after completion of Phases 2 and 3, would be fewer than those generated during Phase 2. Therefore, the results of the analysis of Phase 2 of the Proposed Action – Building Demolition would be the same for the Partial Preservation Alternative.

## Existing Offsite Conditions

Intersection turning movement volumes collected in 2018 and 2019 during the typical weekday morning and evening commute periods (7 – 9 AM, 4 – 6 PM) were obtained from several sources. Traffic volumes during the peak one hour within the morning and evening count periods were used for the analysis and are referred to as the AM peak hour and PM peak hour. Due to the current travel restrictions in place due to the COVID-19 pandemic, new traffic counts taken at this time would not be representative of typical conditions. It is assumed that the existing traffic counts represent a conservative baseline given that some of the pre-COVID-19 traffic may not fully return to the road network in a post-COVID-19 environment due to the increase in telecommuting that has occurred, especially in this region where high-tech office users are predominant.

NASA-provided traffic counts were collected in May 2018 at the following study intersections:

Ellis Street & Manila Drive
Ellis Street & US 101 Northbound
Ellis Street & US 101 Southbound
Enterprise Way & Manila Drive/Moffett Park Drive
Mathilda Avenue & Moffett Park Drive
Mathilda Avenue & State Route (SR) 237 Westbound
Mathilda Avenue & SR 237 Eastbound

Google-provided intersection volumes were counted in November 2018 at the following study intersections:

Enterprise Way & 11th Avenue
US 101 Northbound & Moffett Park Drive
Innovation Way & Moffett Park Drive

Counts at the following study intersections were collected in January 2019 by Quality Counts:

Enterprise Way & 5th Avenue
Innovation Way & 11th Avenue
Mathilda Avenue & 5th Avenue

The locations of the study intersections are illustrated in **Figure 1** (attached). Peak hour factors for each intersection were determined from the intersection count data for use in the intersection delay analysis. Subsequent to the counts being collected in 2018 and 2019, the 5th Avenue Gate was re-opened to commuter bus traffic after being temporarily closed. A conservative assumption of approximately 30 percent of the existing commuter bus traffic using the Ellis Street Gate was rerouted to the new 5th Avenue Gate for the purpose of this study. These bus trips were added to the counts to approximate existing conditions.

## Intersection Analysis Assumptions

The study intersections are located in the cities of Mountain View and Sunnyvale, and the analysis methodology and adverse effects criteria are consistent with the cities of Mountain View and Sunnyvale criteria. Traffix software was utilized in the analysis of the study intersections consistent with the analysis methodology used by Santa Clara County and the Cities of Mountain View and Sunnyvale. Level of service (LOS) D is defined by the cities as the acceptable LOS.

The existing traffic controls at the study intersections were assumed to remain unchanged from existing conditions under the future analysis conditions, with the exception of the improvements that are currently under construction as part of the State Route 237/Mathilda Avenue Interchange improvement project by the Valley Transportation Authority (VTA).

The criteria for evaluation of the study intersections are as follows:

1. An impact occurs when the background LOS is degraded from LOS D or better to LOS E or F, OR
2. If background LOS is E or F, an impact occurs when the Project increases delay by 4.0 seconds or more AND increases V/C by 0.01 or more, OR
3. If background LOS is E or F, an impact occurs when the Project decreases delay AND increases V/C by 0.01 or more.

These criteria are consistent with the criteria used by the cities of Mountain View and Sunnyvale to determine desirable operational conditions for city intersections.

## Intersection Analysis

Given the proposed schedule, the background scenario against which the peak phase (Phase 2) of the Proposed Action – Building Demolition traffic is analyzed is year 2022. Baseline volumes were determined by applying a two percent per year growth factor to the traffic counts. The two percent ambient growth factor accounts for approved and pending projects in the area, including the portions of Moffett Park Specific Plan and East Whisman Precise Plan Project that may be developed by 2022. The historical ambient growth rate for this area has averaged less than two percent per year based on a comparison of existing peak hour volumes along the Mathilda Avenue corridor over a 16-year period (2002 to 2018). A summary of the derivation of the two percent growth factor is attached. Therefore, application of a two percent per year growth factor would produce a conservatively high future traffic forecast and is consistent with the City of Sunnyvale annual regional growth factors for arterials and collectors. Furthermore, the existing commuter bus traffic that has been rerouted to the 5th Avenue Gate under existing conditions is included to produce 2022 baseline volumes.

### 2022 Cumulative Construction Traffic

Construction of other projects within the MFA property are expected to occur during Phase 2 of the Proposed Action – Building Demolition and, based on information that was available at the time of this analysis, traffic associated with those projects was added to the 2022 baseline volumes to produce a conservative worst-case analysis. Various phases of construction of Hangar 1 and Eastside Airfield Improvements Project (EAIP) on the MFA property were anticipated to overlap with Phase 2 of the Proposed Action – Building Demolition. The construction schedules of these projects that coincide with the Proposed Action – Building Demolition were estimated.

Peak hour construction traffic for the cumulative projects was estimated based on the assumptions outlined above for the Proposed Action – Building Demolition.

- The abatement, structural rehab, and exterior cladding phases of Hangar 1 were anticipated to occur in 2022 during the peak construction phase the Proposed Action – Building Demolition. The Hangar 1 construction trips were estimated to be 37 during the AM peak hour and 37 during the PM peak hour. These trips would use the Ellis Street Gate for access.

- At the time of this analysis, site utilities and foundations work for the private hangar and parking lot improvements and paving for the bus maintenance facility of the EAIP were expected to occur in 2022, along with certain modifications to the golf course. Since that time, the golf course modification portion has been removed from the EAIP project description; however, the trips associated with these construction workers and trucks are included in the background traffic estimates, which results in a worst-case, more conservative background setting. The amount of EAIP construction traffic occurring in 2022 was estimated to be 12 trips during the AM peak hour and 12 trips during the PM peak hour. Worker trips are expected to use the Ellis Street Gate for access, and truck trips are assumed to use the 5th Avenue Gate.

These cumulative project trips were distributed to the study intersections and added to the existing intersection volumes to produce 2022 background volumes against which the Proposed Action – Building Demolition is evaluated.

**Reference: Traffic Analysis – Hangar 3 Structural Hazard Remediation Project**

The NASA Housing project and the remaining NRP components, including the university, are in the planning stages, and construction is not anticipated to occur until after completion of the Proposed Action – Building Demolition. Therefore, traffic from construction of the NASA Housing project and NRP components were not included in the background construction traffic estimates and will not add traffic to the background conditions at the study intersections. Furthermore, the Bay View project and construction of the US Geological Survey (USGS) Lab on Parcel 15 could overlap with Phase 2 of the Proposed Action - Building Demolition; however, based on the location of these projects, their traffic is expected to utilize the Moffett Boulevard Gate and would not affect the study intersections. Construction traffic from the Airside Fuel Farm Project, which consists of replacing the existing fuel farm facility with a new facility, was not included in the cumulative background traffic since information on the project's construction activities was not available at the time of this analysis.

Study Area Evaluation

As discussed above, the 5th Avenue Gate would continue to be open to PV commuter bus traffic but is anticipated to not be used by personal vehicles. It is also anticipated that construction truck traffic would also be temporarily allowed at the 5th Avenue Gate. During the Hangar 3 demolition, truck traffic is anticipated to use the 5th Avenue Gate to access SR 237 via 5th Avenue and Mathilda Avenue. Construction workers would access MFA via the Ellis Street Gate. Peak hour truck PCE trips and worker trips were assigned to the study intersections and added to the background volumes. **Figures 2 and 3** show the trips from the Proposed Action – Building Demolition at the study intersections during the AM and PM peak hour, respectively. Similarly, AM and PM peak hour trips from the MFA construction projects discussed above are illustrated in **Figures 4 and 5**, respectively.

The Existing AM and PM peak hour intersection volumes are illustrated in the attached **Figures 6 and 7**, respectively. The AM and PM peak hour intersection volumes under 2022 Background conditions are illustrated in **Figures 8 and 9**, respectively. The AM and PM peak hour intersection volumes under 2022 plus Project conditions are illustrated in **Figures 10 and 11**, respectively.

**Table 2** (attached) summarizes existing and 2022 background peak hour delay and LOS at the study intersections. The surrounding study intersections would operate at LOS D or better during the AM and PM peak hours under background conditions that include Hangar 1 and EAIP construction traffic. Addition of the peak hour Hangar 3 Structural Hazard Remediation Project traffic to the study intersections would have no significant impact on the intersections, as shown in Table 2.

**Alternative Modes of Transportation**

Public transportation is available within the study area. VTA provides light rail (Orange Line) in the area with stations located at the northeast corner of Ellis Street and Manila Drive and the southwest corner of Mathilda Avenue and 5th Avenue.

VTA provides local bus routes, rapid bus lines, and express bus lines in the general area. Bus Route 51 provides access to the Moffett Boulevard Gate. Rapid Bus Route 523 and Express Route 121/122 stop at Mathilda Avenue and 5th Avenue. The City of Mountain View provides shuttle services in the general area; however, none of the shuttle routes serve MFA. Public bus routes do not circulate within MFA.

Bike lanes are striped on 5th Avenue and on Enterprise Way. Within MFA, sharrows are striped on Macon Road in the vicinity of the golf course; however, there are no bicycle facilities on Macon Road south of the Proposed Action – Building Demolition site.

**Reference: Traffic Analysis – Hangar 3 Structural Hazard Remediation Project**

Sidewalks are located on Ellis Street south of the Ellis Street Gate, on the south side of 5th Avenue east of Enterprise Way, and on the east side of Enterprise Way south of 5th Avenue. Pedestrian facilities are not provided along Macon Road within MFA.

The lack of alternative transportation modes within MFA to the construction site would result in a nominal number of construction workers using public transit, bicycle travel, or pedestrian facilities since public bus/shuttle, bicycle, or pedestrian connections between the light rail stations or bus stops and the Proposed Action – Building Demolition site would not be available. Therefore, the majority of construction workers are anticipated to drive personal vehicles or carpool to the site. The Proposed Action – Building Demolition would have no adverse effect on the transit, bicycle, or pedestrian networks in the study area either during or after demolition.

### On-Site Transportation Evaluation

Truck traffic is expected to travel along Macon Road between the Proposed Action – Building Demolition site and 5th Avenue Gate. Construction workers would travel along Macon Road between the site and Ellis Street Gate. Macon Road is currently carrying approximately 170 vehicles during the AM peak hour traffic, 250 vehicles during the PM peak hour, and 4,130 vehicles daily based on December 2018 counts. Macon Road is currently operating at LOS A.

North of 5th Avenue, Phase 2 of the Proposed Action – Building Demolition would add approximately 52 AM peak hour PCE trips, 52 PM peak hour PCE trips, and 440 daily PCE trips to the traffic along Macon Road. South of 5th Avenue, Phase 2 of the Proposed Action – Building Demolition would add 2 AM peak hour trips, 2 PM peak hour trips, and 40 daily trips to Macon Road. Macon Road north and south of 5th Avenue would continue to operate at LOS A with the addition of the Proposed Action – Building Demolition traffic.

### Emergency Access

Access for emergency vehicles would be maintained at all times during the Proposed Action – Building Demolition in accordance with the avoidance and minimization measures (AMM-3: Construction Traffic Control Plan).

## Conclusions

The existing LOS at the study intersections is LOS D or better. Construction of Hangar 1 and EAIP is expected to occur during the same time frame as Phase 2 of demolition of Hangar 3; therefore, traffic from Hangar 1 and EAIP construction was added to 2022 intersection peak hour volumes to produce cumulative background conditions used for the analysis of Hangar 3 demolition traffic. The traffic anticipated from Phase 2 of the Proposed Action – Building Demolition is 52 PCE trips during the AM peak hour and 52 PCE trips during the PM peak hour. This level of additional peak hour traffic would not result in a significant impact at the study intersections, resulting in acceptable LOS D or better. The effects of the Proposed Action – Building Demolition on the transportation system are temporary since the Proposed Action – Building Demolition would not generate new operational trips once construction is complete. No off-site improvements are required for the proposed demolition at the study intersections.

**Reference: Traffic Analysis – Hangar 3 Structural Hazard Remediation Project**

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Attachment: Tables 1 – 2
Figures 1 - 11
Background Traffic Growth Estimate
Traffix Delay Results

**Reference:** **Traffic Analysis – Hangar 3 Structural Hazard Remediation Project**

### Table 1 Hangar 3 Structural Hazard Remediation Project Trip Generation Summary

| Phase | Amount | AM Peak Hour | | | PM Peak Hour | | | ADT |
|---|---|---|---|---|---|---|---|---|
| | | In | Out | Total | In | Out | Total | |
| **Proposed Action – Buidling Demolition** | | | | | | | | |
| **Phase 1 – Pre-Demolition** | | | | | | | | |
| Trucks | 2 Trucks | 1 | 1 | 2 | 1 | 1 | 2 | 4 |
| *Truck PCE (2.0)* | | *2* | *2* | *4* | *2* | *2* | *4* | *8* |
| Workers | 50 Empl | 5 | 0 | 5 | 0 | 5 | 5 | 100 |
| Total Phase 1 PCE Trips | | 7 | 2 | 9 | 2 | 7 | 9 | 108 |
| | | | | | | | | |
| **Phase 2 – Demolition** | | | | | | | | |
| Trucks | 100 Trucks | 13 | 12 | 25 | 12 | 13 | 25 | 200[1] |
| *Truck PCE (2.0)* | | *26* | *24* | *50* | *24* | *26* | *50* | *400* |
| Workers | 20 Empl | 2 | 0 | 2 | 0 | 2 | 2 | 40 |
| Total Phase 2 PCE Trips | | 28 | 24 | 52 | 24 | 28 | 52 | 440 |
| | | | | | | | | |
| **Partial Preservation Alternative** | | | | | | | | |
| **Phase 1 – Pre-Demolition** | | | | | | | | |
| Trucks | 2 Trucks | 1 | 1 | 2 | 1 | 1 | 2 | 4 |
| *Truck PCE (2.0)* | | *2* | *2* | *4* | *2* | *2* | *4* | *8* |
| Workers | 50 Empl | 5 | 0 | 5 | 0 | 5 | 5 | 100 |
| Total Phase 1 PCE Trips | | 7 | 2 | 9 | 2 | 7 | 9 | 108 |
| | | | | | | | | |
| **Phase 2 – Demolition** | | | | | | | | |
| Trucks | 100 Trucks | 13 | 12 | 25 | 12 | 13 | 25 | 200 |
| *Truck PCE (2.0)* | | *26* | *24* | *50* | *24* | *26* | *50* | *400* |
| Workers | 20 Empl | 2 | 0 | 2 | 0 | 2 | 2 | 40 |
| Total Phase 2 PCE Trips | | 28 | 24 | 52 | 24 | 28 | 52 | 440 |
| | | | | | | | | |
| **Phase 4 – Renovation and Reinforcement** | | | | | | | | |
| Trucks | 30 Trucks | 4 | 4 | 8 | 4 | 4 | 8 | 60 |
| *Truck PCE (2.0)* | | *8* | *8* | *16* | *8* | *8* | *16* | *120* |
| Workers | 30 Empl | 3 | 0 | 3 | 0 | 3 | 3 | 60 |
| Total Phase 4 PCE Trips | | 11 | 8 | 19 | 8 | 11 | 19 | 80 |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

Notes:
[1] The estimate of Phase 2 daily truck trips is conservatively high to determine the worst-case trip generation for the Proposed Action – Building Demolition. The average number of truck trips per workday would be lower, with the total number of truck trips not to exceed 4,000 truck trips for the duration of Phase 2.

ADT = Average daily trips
PCE = Passenger car equivalents
Empl = Employees

**Reference:** **Traffic Analysis – Hangar 3 Structural Hazard Remediation Project**

### Table 2 Hangar 3 Structural Hazard Remediation Project Delay and LOS Summary

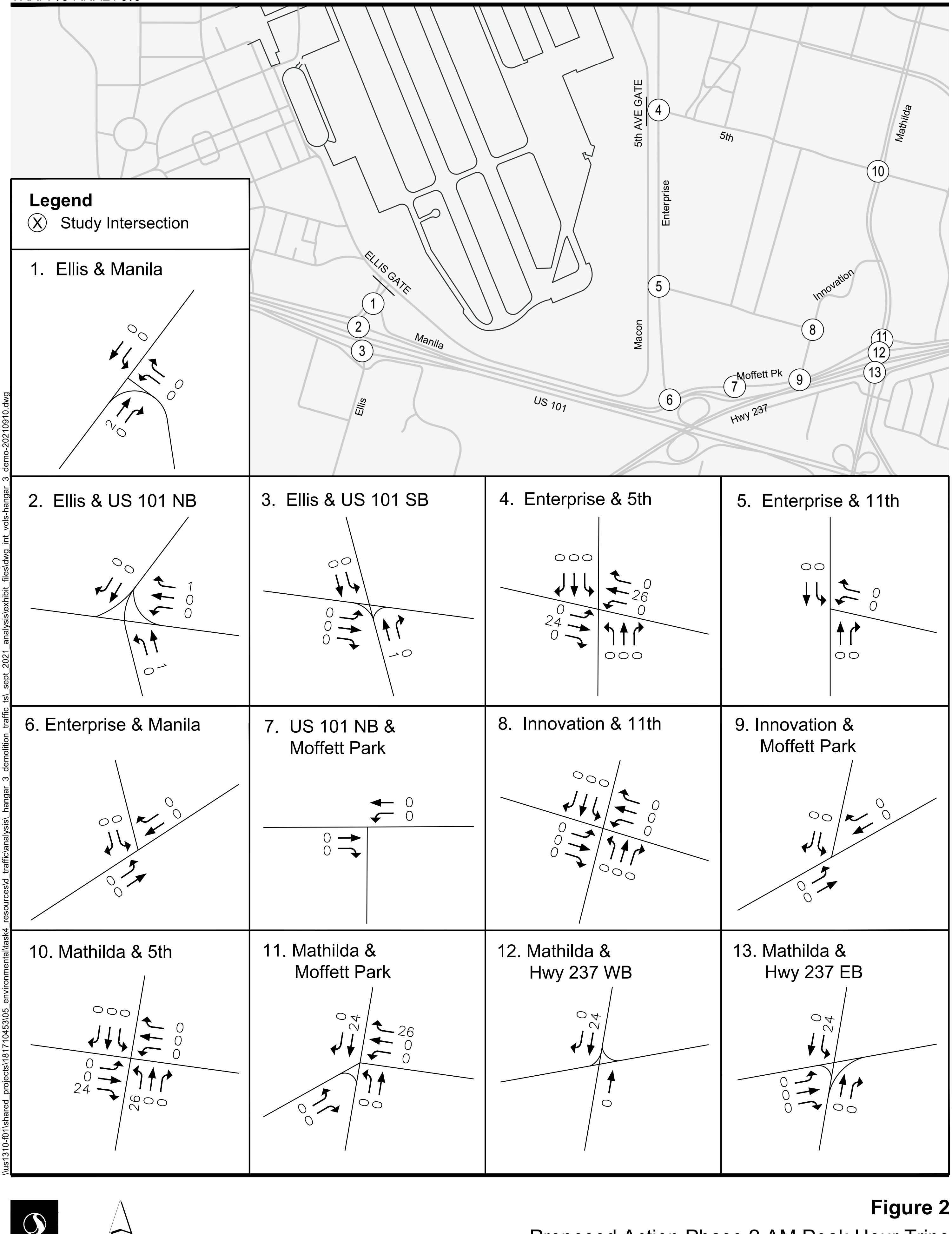
| Intersection | Control Type | Existing | | | | 2022 Background | | | | 2022 Plus Proposed Action | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | AM Peak Hour | | PM Peak Hour | | AM Peak Hour | | PM Peak Hour | | AM Peak Hour | | PM Peak Hour | |
| | | LOS | Delay (sec) | LOS | Delay (sec) | LOS | Delay (sec) | LOS | Delay (sec) | LOS | Delay (sec) | LOS | Delay (sec) |
| 1. Ellis & Manila | Stop Sign | B | 10.3 | C | 18.6 | B | 11.1 | D | 25.3 | C | 11.1 | D | 25.3 |
| 2. Ellis & US 101 NB | Signal | C | 24.9 | C | 24.1 | C | 24.8 | C | 23.9 | C | 24.8 | C | 23.9 |
| 3. Ellis & US 101 SB | Signal | C | 34.2 | C | 31.7 | D | 35.7 | C | 25.8 | D | 35.7 | C | 25.8 |
| 4. Enterprise & 5th | Stop Sign | A | 8.6 | A | 8.7 | A | 8.7 | A | 8.8 | A | 9.1 | A | 9.3 |
| 5. Enterprise & 11th | Signal | B | 11.4 | B | 11.7 | B | 11.6 | B | 11.8 | B | 11.6 | B | 11.8 |
| 6. Enterprise & Manila | Signal | C | 29.4 | B | 13.3 | C | 33.3 | B | 14.0 | C | 33.3 | B | 14.0 |
| 7. US 101 NB & Moffett Park | Stop Sign | A | 5.3 | B | 13.7 | A | 5.4 | B | 15.3 | A | 5.4 | B | 15.3 |
| 8. Innovation & 11th | Stop Sign | B | 13.2 | C | 20.3 | B | 14.4 | D | 25.1 | B | 14.4 | D | 25.1 |
| 9. Innovation & Moffett Park | Signal | B | 11.3 | B | 15.4 | B | 11.7 | B | 15.7 | B | 11.7 | B | 15.7 |
| 10. Mathilda & 5th | Signal | B | 16.1 | B | 19.1 | B | 16.3 | B | 19.3 | B | 16.4 | B | 19.6 |
| 11. Mathilda & Moffett Park | Signal | D | 42.6 | C | 28.0 | C | 32.7 | D | 43.4 | C | 32.9 | D | 43.9 |
| 12. Mathilda & SR 237 WB | Signal | B | 11.4 | B | 13.6 | A | 0.3 | A | 0.4 | A | 0.3 | A | 0.4 |
| 13. Mathilda & SR 237 EB | Signal | B | 14.5 | B | 11.1 | B | 17.7 | B | 11.8 | B | 17.7 | B | 12.0 |

LOS = Level of service
NB = Northbound
SB = Southbound
EB = Eastbound
WB = Westbound

| LOS ranges: | | Signal Control | Stop Sign Control |
|---|---|---|---|
| | A | 0.0 – 10.0 sec | 0.0 – 10.0 sec |
| | B | 10.1 – 20.0 sec | 10.1 – 15.0 sec |
| | C | 20.1 – 35.0 sec | 15.1 – 25.0 sec |
| | D | 35.1 – 55.0 sec | 25.1 – 35.0 sec |
| | E | 55.1 – 80.0 sec | 35.1 – 50.0 sec |
| | F | Delay > 80.0 sec | Delay > 50.0 sec |

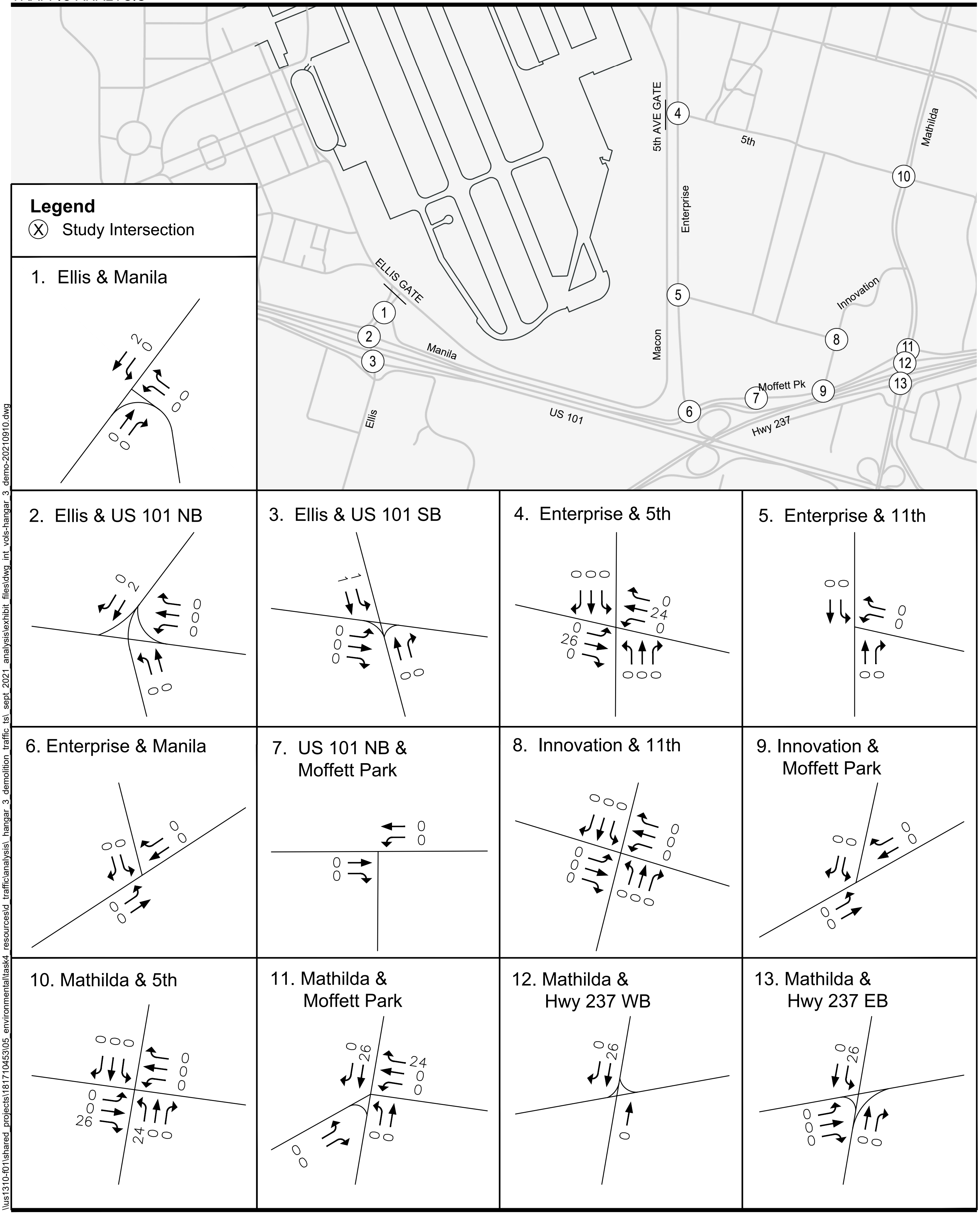

**Figure 1**
Study Intersection Locations

# Peak Hour Intersection Turning Movement Volumes




\\us1310-f01\shared_projects\181710453\05_environmental\task4_resources\d_traffic\analysis_hangar_3_demolition_traffic_ts_sept_2021_analysis\exhibit_files\dwg_int_vols-hangar_3_demo-20210910.dwg

**Figure 2**
Proposed Action Phase 2 AM Peak Hour Trips

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N

**Figure 3**

Proposed Action Phase 2 PM Peak Hour Trips

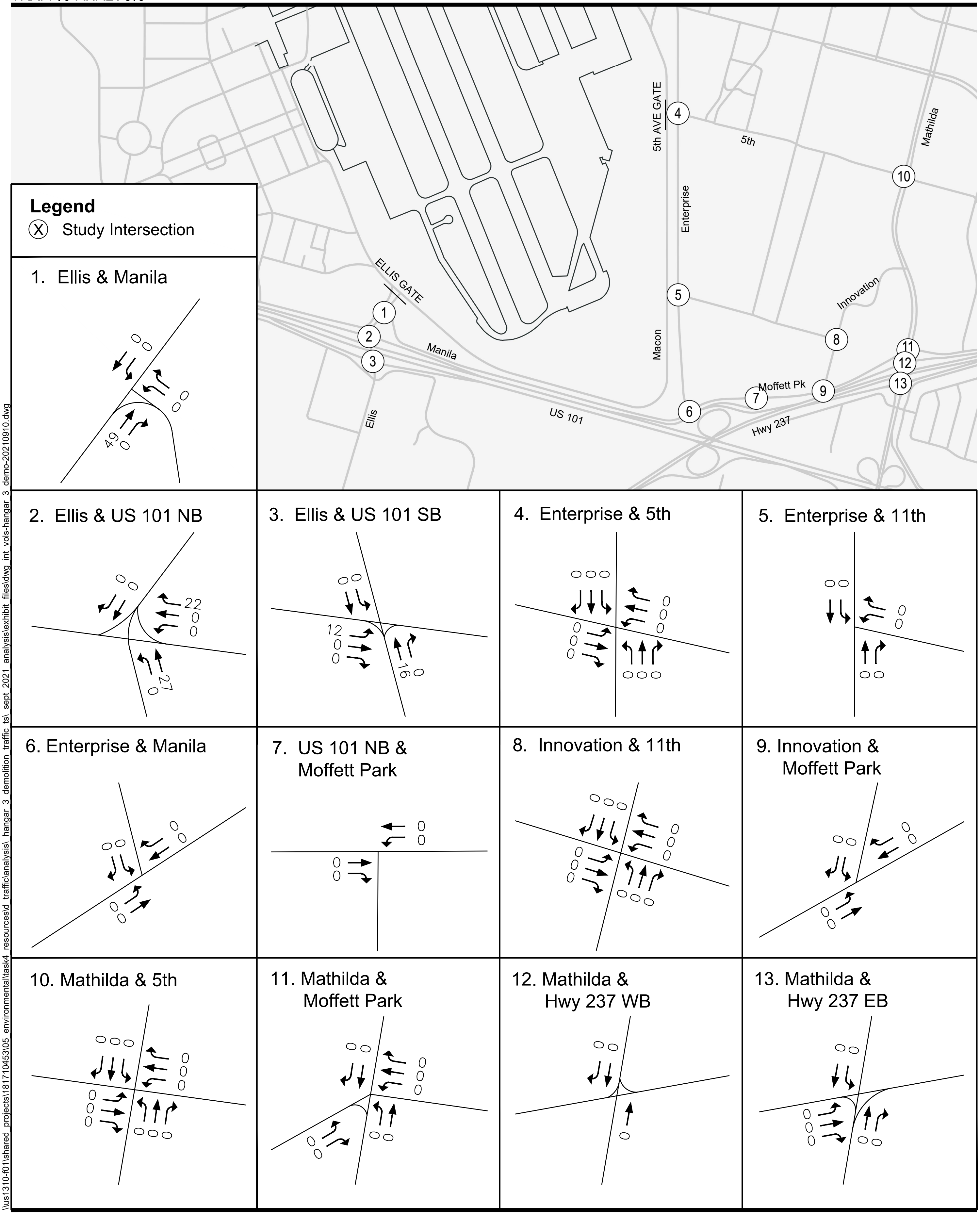


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**Figure 4**
MFA Construction Projects AM Peak Hour Trips

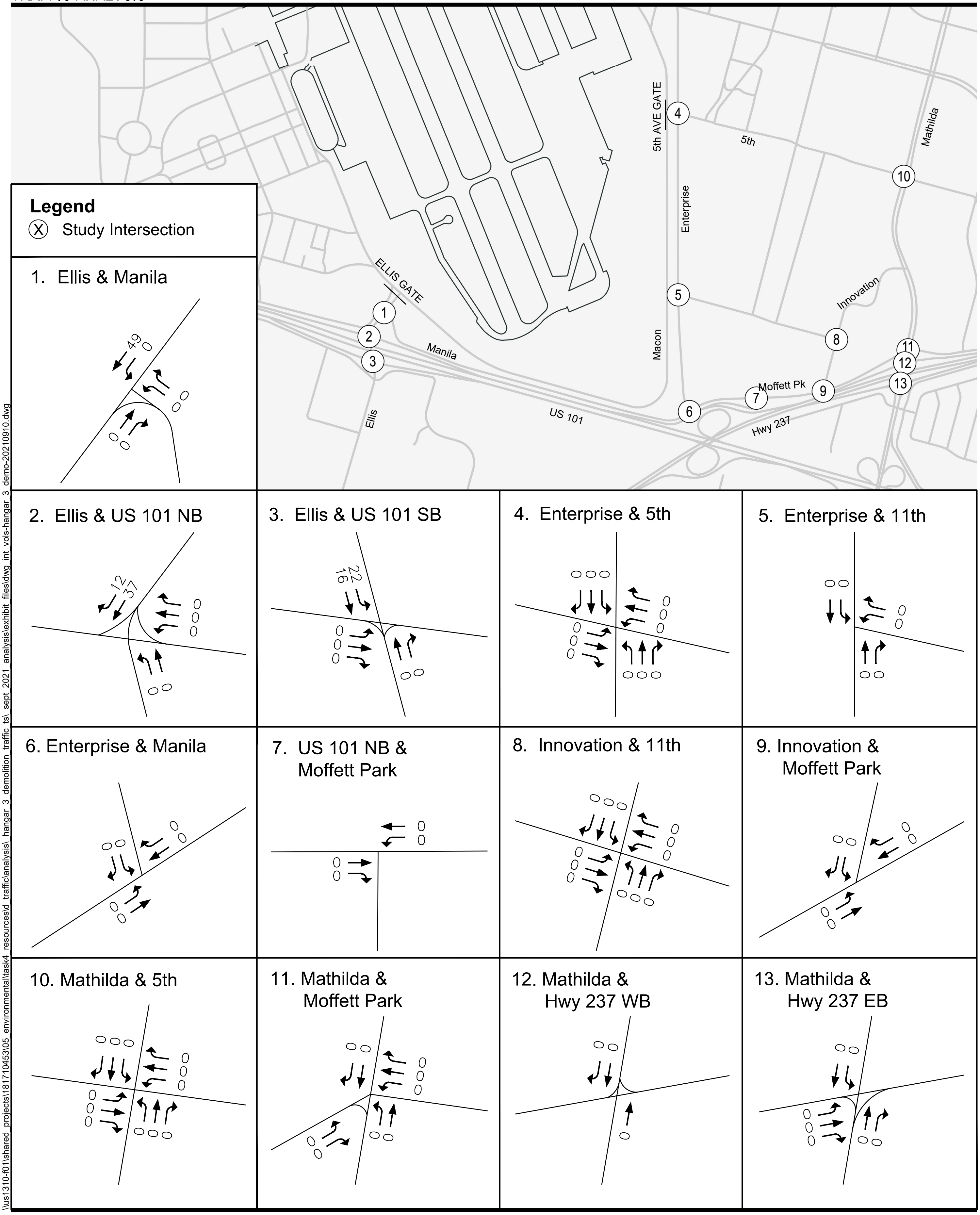


**Figure 5**

MFA Construction Projects PM Peak Hour Trips

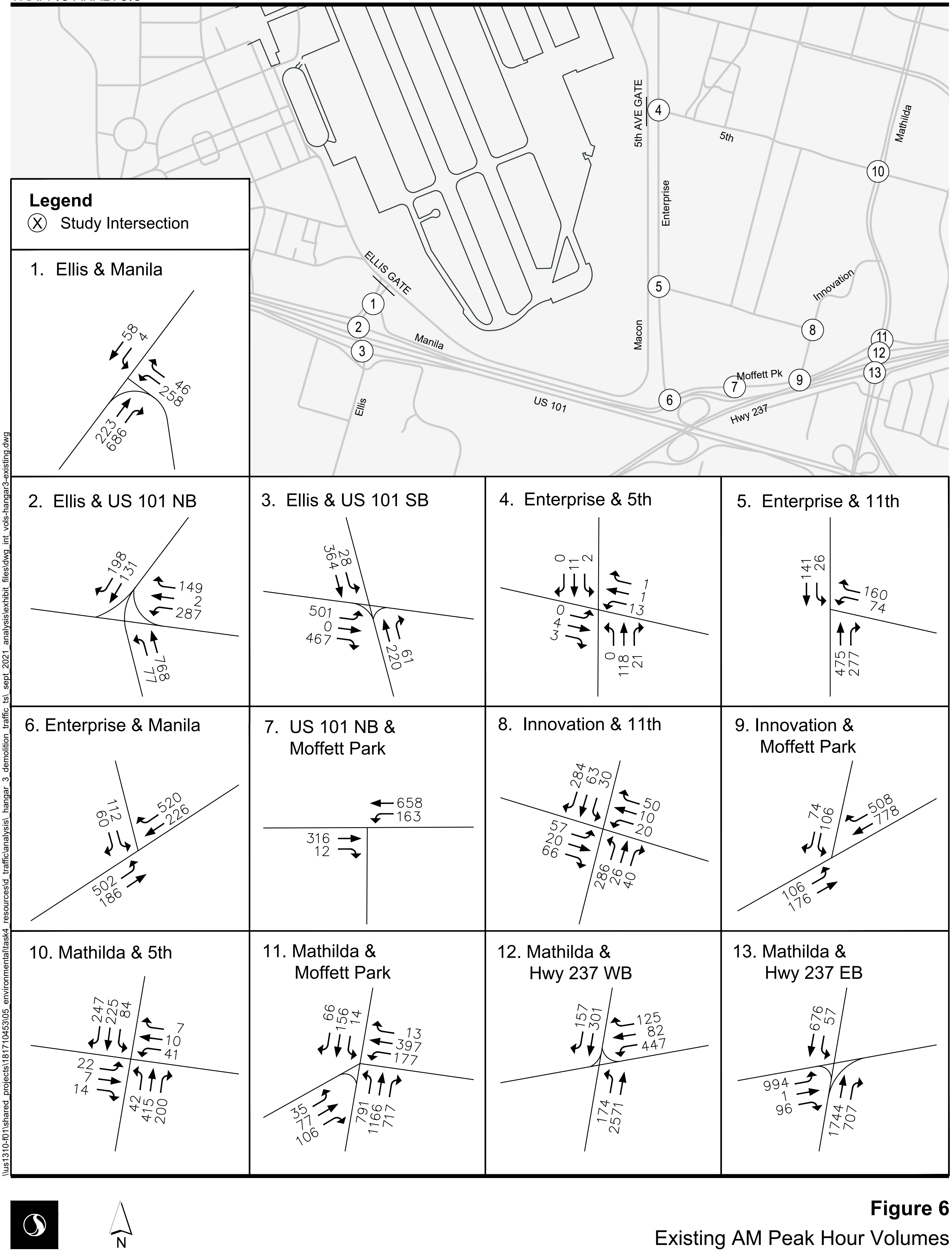


**Figure 6**
Existing AM Peak Hour Volumes

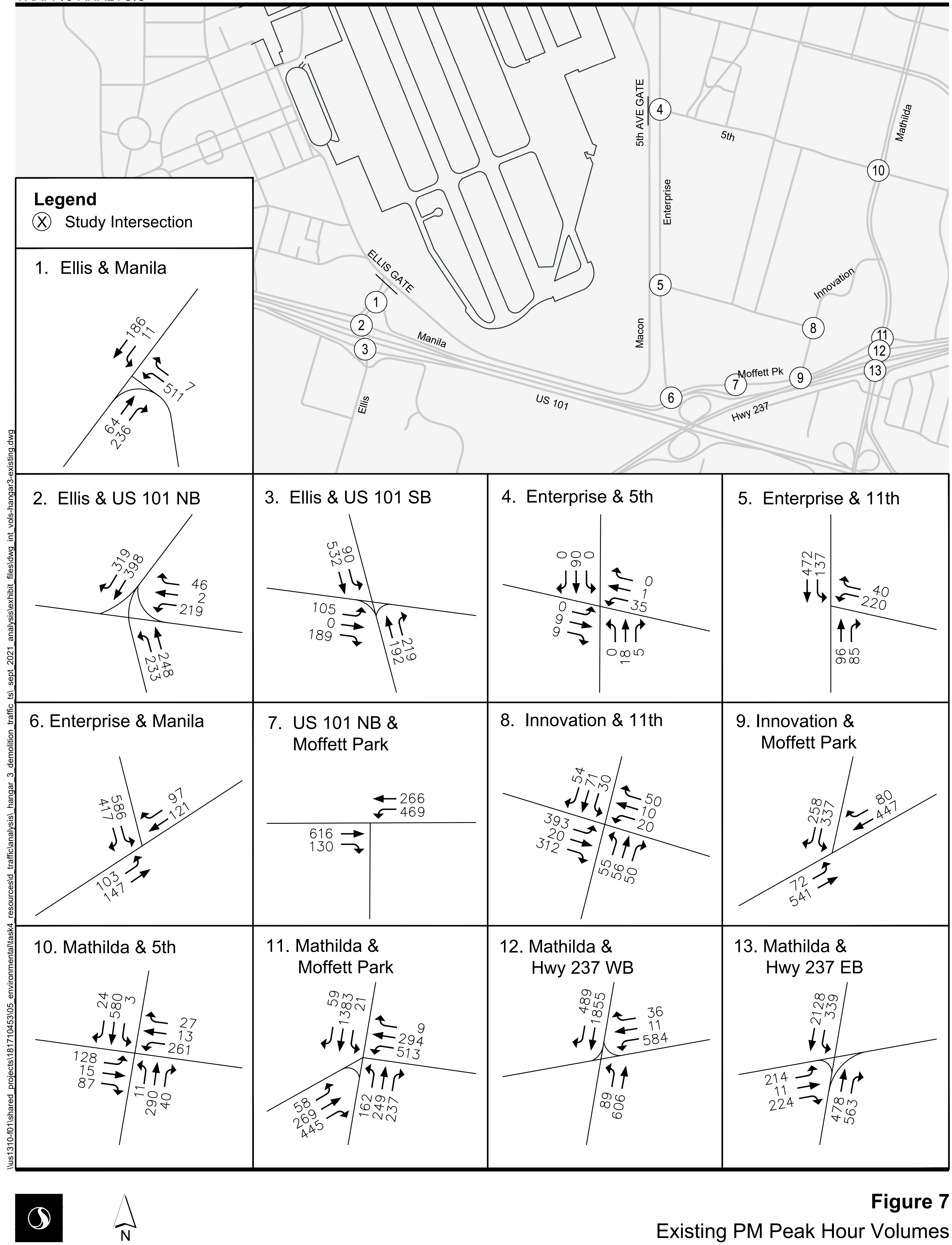


**Figure 7**
Existing PM Peak Hour Volumes

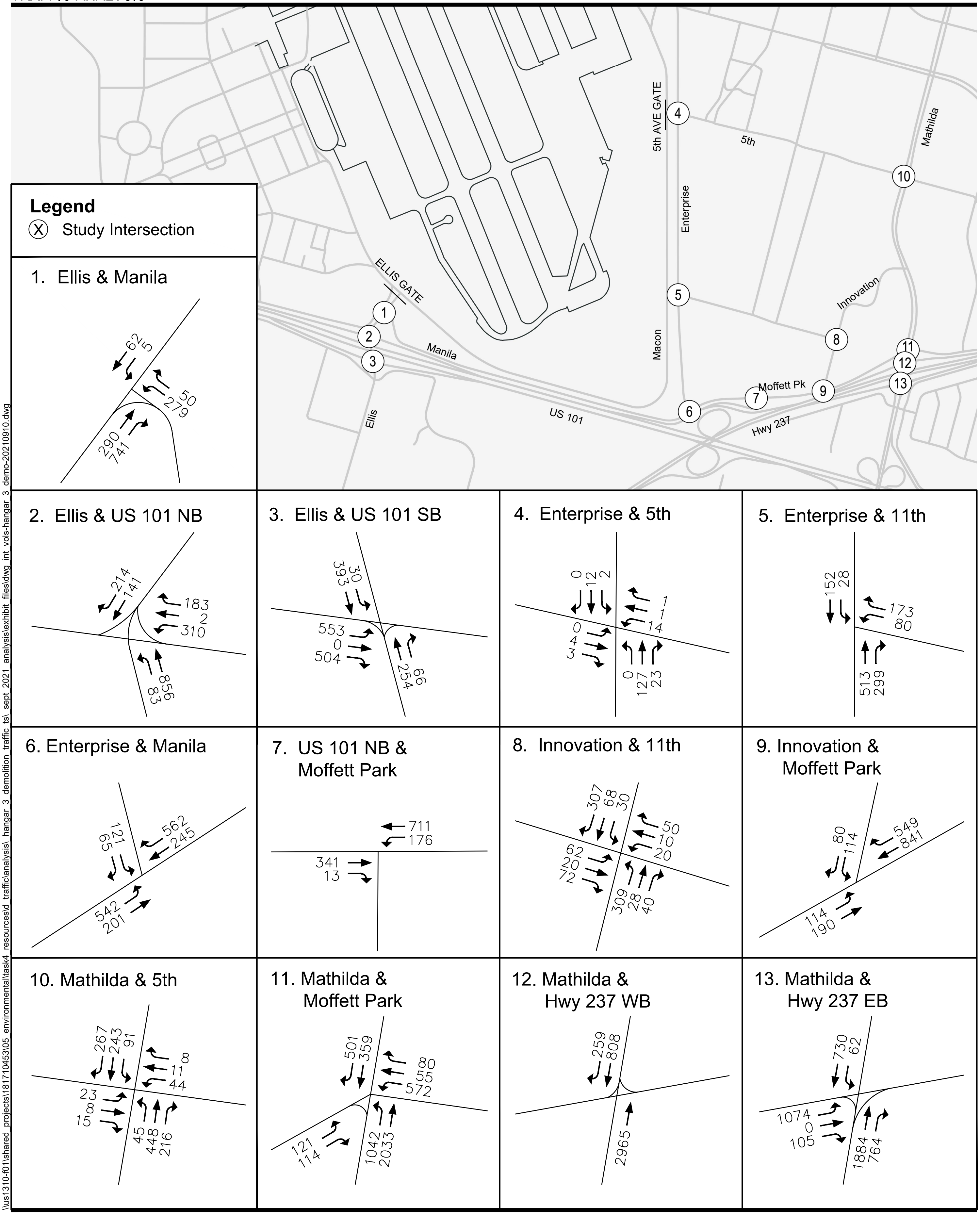


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**Figure 8**
2022 Background AM Peak Hour Volumes

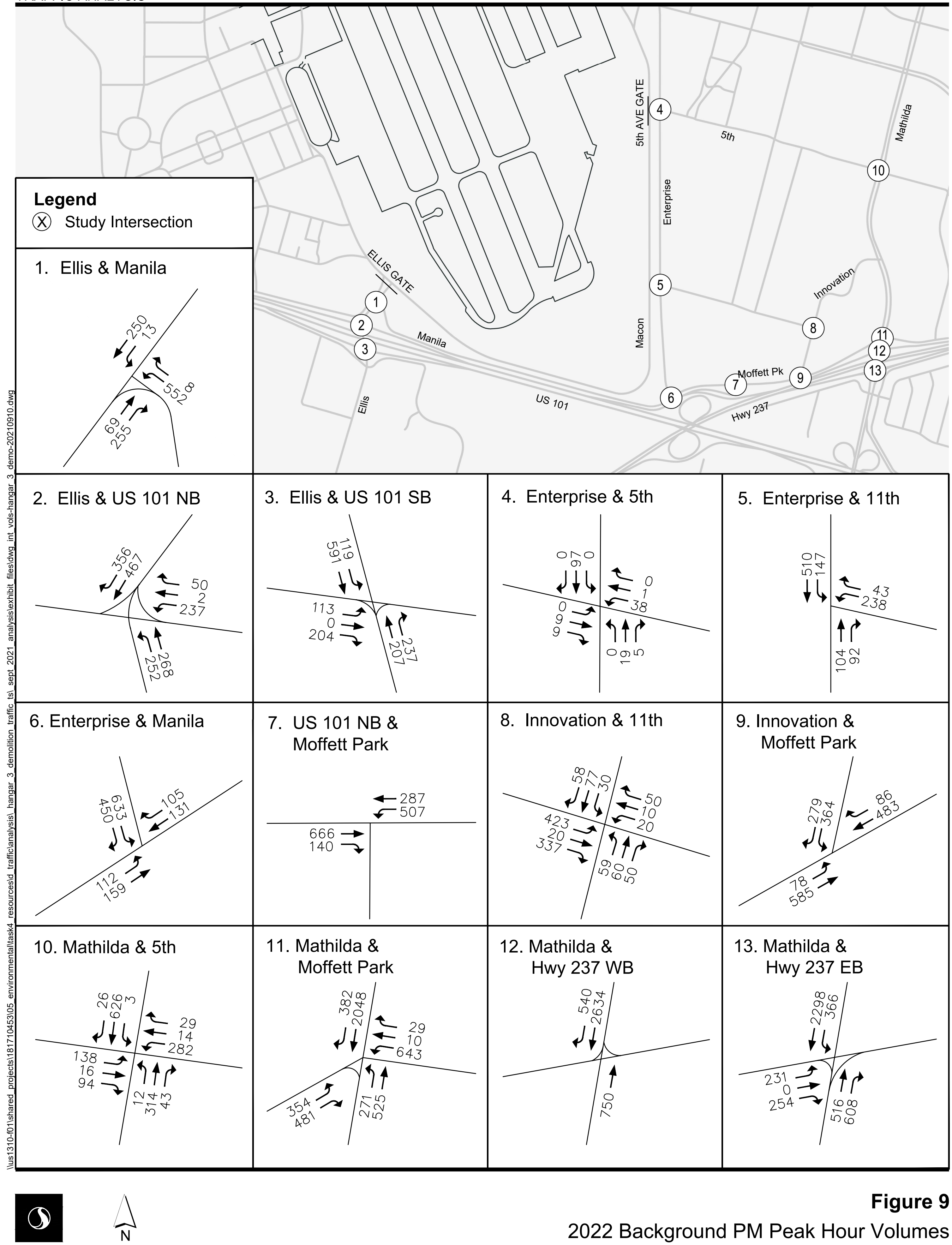
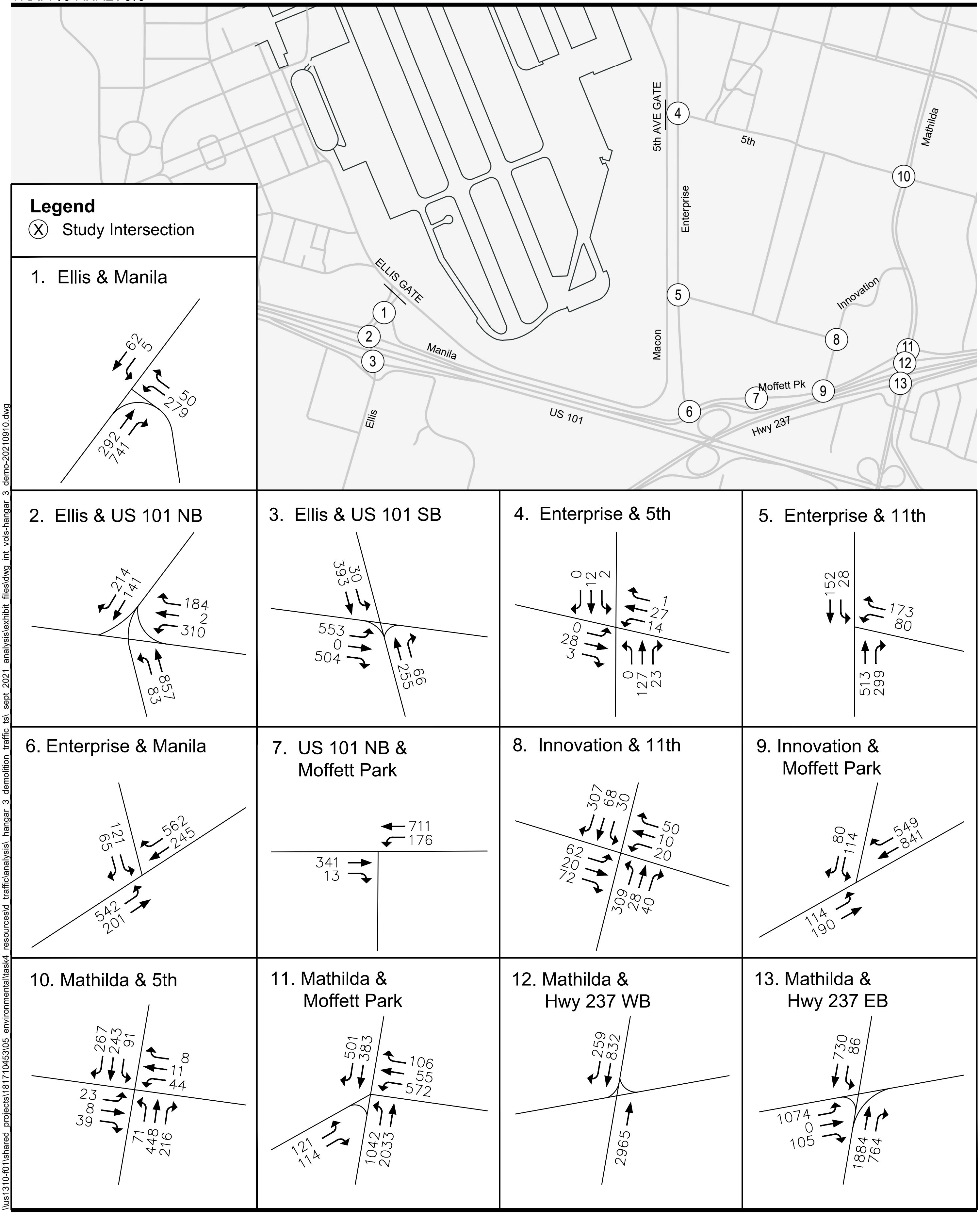



**Figure 9**

2022 Background PM Peak Hour Volumes

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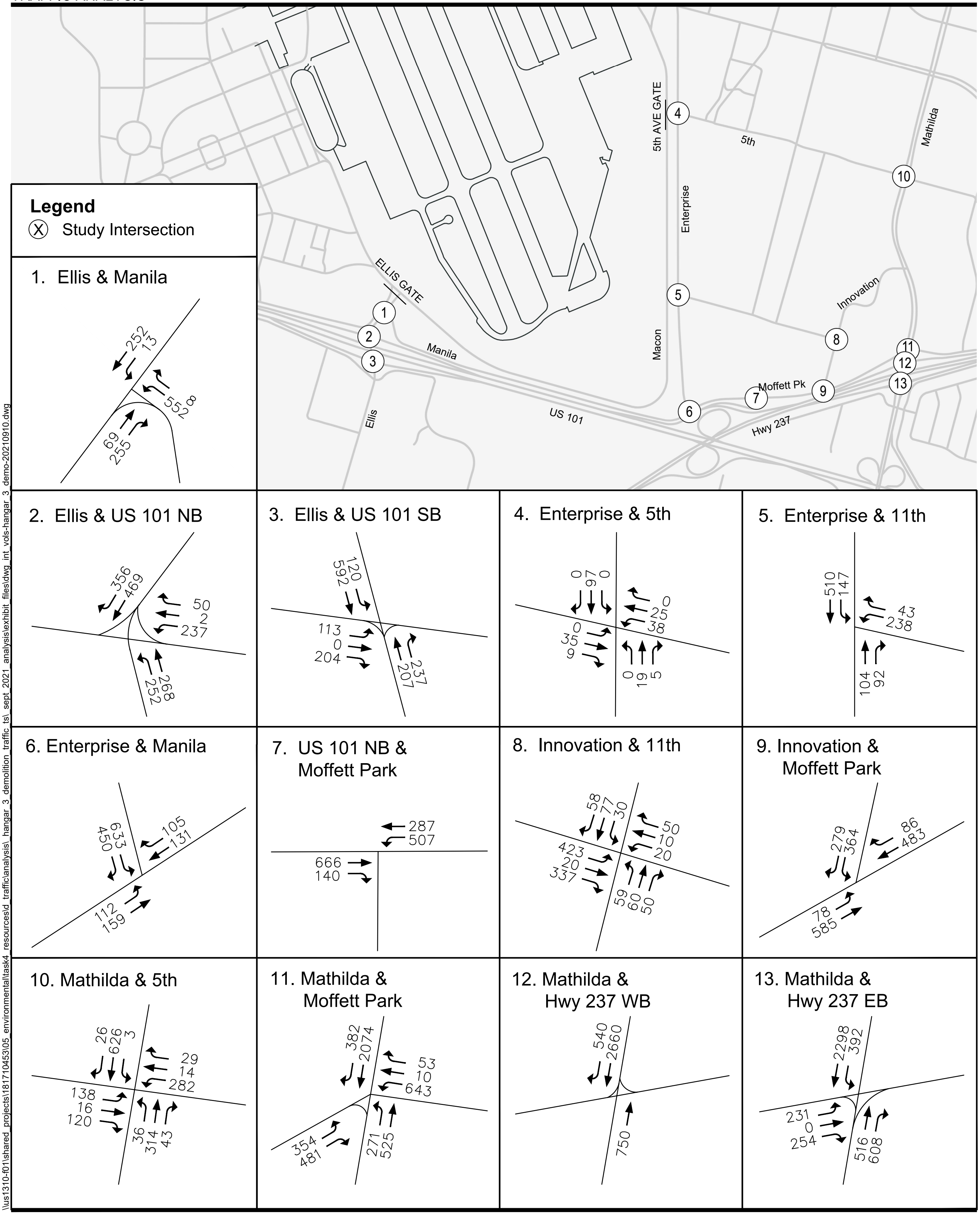
N

**Figure 10**

2022 + Proposed Action Phase 2 AM Peak Hour Volumes




\\us1310-f01\shared_projects\181710453\05_environmental\task4_resources\d_traffic\analysis_hangar_3_demolition_traffic_ts_sept_2021_analysis\exhibit_files\dwg_int_vols-hangar_3_demo-20210910.dwg

N

**Figure 11**

2022 + Proposed Action Phase 2 PM Peak Hour Volumes

# Background Traffic Growth Estimate

# 16-Year Volume Growth - Moffett Park SP 2002 Counts to EAIP 2018 Counts

| Intersection | EAIP Intersection Number | Moffett Park Intersection Number | Volume | | | | | | | | | | | | Total Volume | 16 Year Growth | Annual Rate |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Southbound Left | Southbound Through | Southbound Right | Westbound Left | Westbound Through | Westbound Right | Northbound Left | Northbound Through | Northbound Right | Eastbound Left | Eastbound Through | Eastbound Right | | | |
| **AM Peak Hour** | | | | | | | | | | | | | | | | | |
| Mathilda & 5th Ave | 10 | 25 | | | | | | | | | | | | | | | |
| 2002 | | | 12 | 82 | 25 | 16 | 9 | 3 | 142 | 535 | 112 | 33 | 13 | 38 | 1020 | | |
| 2018 | | | 84 | 229 | 246 | 41 | 10 | 7 | 41 | 415 | 200 | 18 | 7 | 14 | 1312 | 28.63% | 1.79% |
| Mathilda & Moffett Park | 11 | 32 | | | | | | | | | | | | | | | |
| 2002 | | | 5 | 187 | 24 | 138 | 21 | 9 | 503 | 1167 | 934 | 25 | 57 | 47 | 3117 | | |
| 2018 | | | 14 | 156 | 70 | 177 | 397 | 13 | 792 | 1166 | 717 | 35 | 77 | 106 | 3720 | 19.35% | 1.21% |
| Mathilda & Hwy 237 WB | 12 | 35 | | | | | | | | | | | | | | | |
| 2002 | | | 0 | 305 | 67 | 411 | 4 | 203 | 143 | 2401 | 0 | 0 | 0 | 0 | 3534 | | |
| 2018 | | | 0 | 301 | 157 | 447 | 82 | 125 | 174 | 2572 | 0 | 0 | 0 | 0 | 3858 | 9.17% | 0.57% |
| Mathilda & Hwy 237 EB | 13 | 34 | | | | | | | | | | | | | | | |
| 2002 | | | 61 | 655 | 0 | 0 | 0 | 0 | 0 | 1844 | 1154 | 700 | 2 | 91 | 4507 | | |
| 2018 | | | 57 | 676 | 0 | 0 | 0 | 0 | 0 | 1745 | 707 | 994 | 1 | 96 | 4276 | -5.13% | -0.32% |
| | | | | | | | | | | | | | | | | | |
| **PM Peak Hour** | | | | | | | | | | | | | | | | | |
| Mathilda & 5th Ave | 10 | 25 | | | | | | | | | | | | | | | |
| 2002 | | | 2 | 501 | 18 | 107 | 8 | 5 | 41 | 134 | 22 | 26 | 6 | 167 | 1037 | | |
| 2018 | | | 3 | 580 | 23 | 261 | 13 | 27 | 11 | 297 | 40 | 119 | 15 | 87 | 1476 | 42.33% | 2.65% |
| Mathilda & Moffett Park | 11 | 32 | | | | | | | | | | | | | | | |
| 2002 | | | 13 | 830 | 101 | 653 | 172 | 13 | 101 | 189 | 226 | 12 | 17 | 311 | 2638 | | |
| 2018 | | | 21 | 1383 | 59 | 513 | 294 | 9 | 162 | 249 | 237 | 65 | 269 | 445 | 3706 | 40.49% | 2.53% |
| Mathilda & Hwy 237 WB | 12 | 35 | | | | | | | | | | | | | | | |
| 2002 | | | 0 | 1510 | 284 | 858 | 54 | 82 | 191 | 434 | 0 | 0 | 0 | 0 | 3413 | | |
| 2018 | | | 0 | 1855 | 489 | 584 | 11 | 36 | 89 | 606 | 0 | 0 | 0 | 0 | 3670 | 7.53% | 0.47% |
| Mathilda & Hwy 237 EB | 13 | 34 | | | | | | | | | | | | | | | |
| 2002 | | | 192 | 2176 | 0 | 0 | 0 | 0 | 0 | 444 | 530 | 181 | 2 | 143 | 3668 | | |
| 2018 | | | 339 | 2128 | 0 | 0 | 0 | 0 | 0 | 478 | 563 | 214 | 11 | 224 | 3957 | 7.88% | 0.49% |
| | | | | | | | | | | | | | | | | | |
| **Average Mathilda Avenue Corridor Growth** | | | | | | | | | | | | | | | | | **1.17%** |

# Traffix Delay Results

# Existing Conditions

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Planetary Ventures
MFA Hangar 3 Project

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Scenario Report

| | |
|---|---|
| Scenario: | Existing AM Peak |
| Command: | Default Command |
| Volume: | Existing AM Peak |
| Geometry: | Existing |
| Impact Fee: | Default Impact Fee |
| Trip Generation: | Default Trip Generation |
| Trip Distribution: | Default Trip Distribution |
| Paths: | Default Path |
| Routes: | Default Route |
| Configuration: | Default Configuration |

Planetary Ventures
MFA Hangar 3 Project

Impact Analysis Report
Level Of Service

| Intersection | Base LOS | Base Del/ Veh | Base V/C | Future LOS | Future Del/ Veh | Future V/C | Change in |
|---|---|---|---|---|---|---|---|
| # 1 Ellis & Manila | B | 10.3 | 0.439 | B | 10.3 | 0.439 | + 0.000 V/C |
| # 2 Ellis & US 101 NB | C | 24.9 | 0.573 | C | 24.9 | 0.573 | + 0.000 D/V |
| # 3 Ellis & US 101 SB | C- | 34.2 | 0.466 | C- | 34.2 | 0.466 | + 0.000 D/V |
| # 4 Enterprise & 5th | A | 8.6 | 0.204 | A | 8.6 | 0.204 | + 0.000 V/C |
| # 5 Enterprise & 11th | B+ | 11.4 | 0.400 | B+ | 11.4 | 0.400 | + 0.000 D/V |
| # 6 Enterprise & Manila/Moffett Pa | C | 29.4 | 0.755 | C | 29.4 | 0.755 | + 0.000 D/V |
| # 7 US 101 NB & Moffett Park | A | 5.3 | 0.420 | A | 5.3 | 0.420 | + 0.000 D/V |
| # 8 Innovation & 11th | B | 13.2 | 0.587 | B | 13.2 | 0.587 | + 0.000 V/C |
| # 9 Innovation & Moffett Park | B+ | 11.3 | 0.524 | B+ | 11.3 | 0.524 | + 0.000 D/V |
| # 10 Mathilda & 5th | B | 16.1 | 0.244 | B | 16.1 | 0.244 | + 0.000 D/V |
| # 11 Mathilda & Moffett Park | D | 42.6 | 0.845 | D | 42.6 | 0.845 | + 0.000 D/V |
| # 12 Mathilda & Hwy 237 WB | B+ | 11.4 | 0.610 | B+ | 11.4 | 0.610 | + 0.000 D/V |
| # 13 Mathilda & Hwy 237 EB | B | 14.5 | 0.522 | B | 14.5 | 0.522 | + 0.000 D/V |

```
--------------------------------------------------------------------------------
                             Planetary Ventures
                            MFA Hangar 3 Project
--------------------------------------------------------------------------------
                     Level Of Service Computation Report
            2000 HCM 4-Way Stop Method (Future Volume Alternative)
********************************************************************************
Intersection #1 Ellis & Manila
********************************************************************************
Cycle (sec):          100                Critical Vol./Cap.(X):         0.439
Loss Time (sec):       12                Average Delay (sec/veh):        10.3
Optimal Cycle:          0                Level Of Service:                  B
********************************************************************************
Street Name:                 Ellis                             Manila
Approach:      North Bound      South Bound      East Bound       West Bound
Movement:     L  -  T  -  R   L  -  T  -  R   L  -  T  -  R   L  -  T  -  R
-------------|---------------||---------------||---------------||---------------|
Control:        Stop Sign        Stop Sign        Stop Sign        Stop Sign
Rights:           Ignore          Include          Include          Include
Min. Green:     7   10    10    7   10    10    7   10    10    7   10    10
Lanes:        0  0  2  0  1   0  1  1  0  0   0  0  0  0  0   0  0  1! 0  0
-------------|---------------||---------------||---------------||---------------|
Volume Module:AM Peak Hour
Base Vol:       0  223   686    4   58     0    0    0     0  258    0    46
Growth Adj:  1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
Initial Bse:    0  223   686    4   58     0    0    0     0  258    0    46
Added Vol:      0    0     0    0    0     0    0    0     0    0    0     0
New Trips:      0    0     0    0    0     0    0    0     0    0    0     0
Initial Fut:    0  223   686    4   58     0    0    0     0  258    0    46
User Adj:    1.00 1.00  0.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
PHF Adj:     0.95 0.95  0.00 0.95 0.95  0.95 0.95 0.95  0.95 0.95 0.95  0.95
PHF Volume:     0  235     0    4   61     0    0    0     0  272    0    48
Reduct Vol:     0    0     0    0    0     0    0    0     0    0    0     0
Reduced Vol:    0  235     0    4   61     0    0    0     0  272    0    48
PCE Adj:     1.00 1.00  0.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
MLF Adj:     1.00 1.00  0.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
FinalVolume:    0  235     0    4   61     0    0    0     0  272    0    48
-------------|---------------||---------------||---------------||---------------|
Saturation Flow Module:
Adjustment:  1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
Lanes:       0.00 2.00  1.00 0.13 1.87  0.00 0.00 0.00  0.00 0.85 0.00  0.15
Final Sat.:     0 1270   725   77 1126     0    0    0     0  619    0   110
-------------|---------------||---------------||---------------||---------------|
Capacity Analysis Module:
Vol/Sat:     xxxx 0.18  0.00 0.05 0.05  xxxx xxxx xxxx  xxxx 0.44 xxxx  0.44
Crit Moves:       ****       ****                             ****
Delay/Veh:    0.0  9.3   0.0  8.7  8.7   0.0  0.0  0.0   0.0 11.3  0.0  11.3
Delay Adj:   1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
AdjDel/Veh:   0.0  9.3   0.0  8.7  8.7   0.0  0.0  0.0   0.0 11.3  0.0  11.3
LOS by Move:    *    A     *    A    A     *    *    *     *    B    *     B
ApproachDel:         9.3             8.7           xxxxxx            11.3
Delay Adj:          1.00            1.00            xxxxx            1.00
ApprAdjDel:          9.3             8.7           xxxxxx            11.3
LOS by Appr:          A               A                *               B
AllWayAvgQ:   0.0  0.2   0.0  0.1  0.1   0.0  0.0  0.0   0.0  0.7  0.7   0.7
********************************************************************************
Note: Queue reported is the number of cars per lane.
```

Planetary Ventures
MFA Hangar 3 Project

Level Of Service Computation Report
2000 HCM Operations Method (Future Volume Alternative)

Intersection #2 Ellis & US 101 NB

| | | | |
|---|---|---|---|
| Cycle (sec): | 60 | Critical Vol./Cap.(X): | 0.573 |
| Loss Time (sec): | 9 | Average Delay (sec/veh): | 24.9 |
| Optimal Cycle: | 39 | Level Of Service: | C |

| Street Name: | Ellis | | | | | | US 101 NB | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach: | North Bound | | | South Bound | | | East Bound | | | West Bound | | |
| Movement: | L | T | R | L | T | R | L | T | R | L | T | R |
| Control: | Split Phase | | | Split Phase | | | Protected | | | Protected | | |
| Rights: | Include | | | Include | | | Include | | | Include | | |
| Min. Green: | 7 | 10 | 10 | 7 | 10 | 10 | 7 | 10 | 10 | 7 | 10 | 10 |
| Y+R: | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lanes: | 0 1 1 0 0 | | | 0 0 1 1 0 | | | 0 0 0 0 0 | | | 0 1 0 0 2 | | |
| **Volume Module:AM Peak Hour** | | | | | | | | | | | | |
| Base Vol: | 77 | 768 | 0 | 0 | 131 | 198 | 0 | 0 | 0 | 287 | 2 | 149 |
| Growth Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Initial Bse: | 77 | 768 | 0 | 0 | 131 | 198 | 0 | 0 | 0 | 287 | 2 | 149 |
| Added Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| New Trips: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Initial Fut: | 77 | 768 | 0 | 0 | 131 | 198 | 0 | 0 | 0 | 287 | 2 | 149 |
| User Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| PHF Adj: | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| PHF Volume: | 82 | 817 | 0 | 0 | 139 | 211 | 0 | 0 | 0 | 305 | 2 | 159 |
| Reduct Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced Vol: | 82 | 817 | 0 | 0 | 139 | 211 | 0 | 0 | 0 | 305 | 2 | 159 |
| PCE Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| MLF Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| FinalVolume: | 82 | 817 | 0 | 0 | 139 | 211 | 0 | 0 | 0 | 305 | 2 | 159 |
| **Saturation Flow Module:** | | | | | | | | | | | | |
| Sat/Lane: | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Adjustment: | 0.95 | 0.98 | 0.92 | 0.92 | 1.00 | 0.92 | 0.92 | 1.00 | 0.92 | 0.95 | 0.95 | 0.83 |
| Lanes: | 0.19 | 1.81 | 0.00 | 0.00 | 1.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.99 | 0.01 | 2.00 |
| Final Sat.: | 337 | 3363 | 0 | 0 | 1900 | 1750 | 0 | 0 | 0 | 1788 | 12 | 3150 |
| **Capacity Analysis Module:** | | | | | | | | | | | | |
| Vol/Sat: | 0.24 | 0.24 | 0.00 | 0.00 | 0.07 | 0.12 | 0.00 | 0.00 | 0.00 | 0.17 | 0.17 | 0.05 |
| Crit Moves: | | **** | | | **** | | | | | **** | | |
| Green Time: | 22.5 | 22.5 | 0.0 | 0.0 | 12.6 | 12.6 | 0.0 | 0.0 | 0.0 | 15.9 | 15.9 | 15.9 |
| Volume/Cap: | 0.65 | 0.65 | 0.00 | 0.00 | 0.35 | 0.57 | 0.00 | 0.00 | 0.00 | 0.65 | 0.65 | 0.19 |
| Delay/Veh: | 28.2 | 28.2 | 0.0 | 0.0 | 20.4 | 22.6 | 0.0 | 0.0 | 0.0 | 22.7 | 22.7 | 17.2 |
| User DelAdj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| AdjDel/Veh: | 28.2 | 28.2 | 0.0 | 0.0 | 20.4 | 22.6 | 0.0 | 0.0 | 0.0 | 22.7 | 22.7 | 17.2 |
| LOS by Move: | C | C | A | A | C+ | C+ | A | A | A | C+ | C+ | B |
| HCM2kAvgQ: | 8 | 8 | 0 | 0 | 3 | 5 | 0 | 0 | 0 | 6 | 6 | 1 |

Note: Queue reported is the number of cars per lane.

Planetary Ventures
MFA Hangar 3 Project

Level Of Service Computation Report
2000 HCM Operations Method (Future Volume Alternative)

Intersection #3 Ellis & US 101 SB

| | | | |
|---|---|---|---|
| Cycle (sec): | 60 | Critical Vol./Cap.(X): | 0.466 |
| Loss Time (sec): | 9 | Average Delay (sec/veh): | 34.2 |
| Optimal Cycle: | 36 | Level Of Service: | C- |

Street Name: Ellis / US 101 SB

| Approach: | North Bound | South Bound | East Bound | West Bound |
|---|---|---|---|---|
| Movement: | L - T - R | L - T - R | L - T - R | L - T - R |
| Control: | Protected | Protected | Protected | Protected |
| Rights: | Ignore | Include | Include | Include |
| Lanes: | 0 0 2 0 1 | 1 0 1 0 0 | 1 0 0 0 1 | 0 0 0 0 0 |

| Movement: | NB L | NB T | NB R | SB L | SB T | SB R | EB L | EB T | EB R | WB L | WB T | WB R |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Min. Green: | 7 | 10 | 10 | 7 | 10 | 10 | 7 | 10 | 10 | 7 | 10 | 10 |
| Y+R: | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| **Volume Module:AM Peak Hour** | | | | | | | | | | | | |
| Base Vol: | 0 | 220 | 61 | 28 | 364 | 0 | 501 | 0 | 467 | 0 | 0 | 0 |
| Growth Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Initial Bse: | 0 | 220 | 61 | 28 | 364 | 0 | 501 | 0 | 467 | 0 | 0 | 0 |
| Added Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| New Trips: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Initial Fut: | 0 | 220 | 61 | 28 | 364 | 0 | 501 | 0 | 467 | 0 | 0 | 0 |
| User Adj: | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| PHF Adj: | 0.91 | 0.91 | 0.00 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 |
| PHF Volume: | 0 | 242 | 0 | 31 | 400 | 0 | 551 | 0 | 513 | 0 | 0 | 0 |
| Reduct Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced Vol: | 0 | 242 | 0 | 31 | 400 | 0 | 551 | 0 | 513 | 0 | 0 | 0 |
| PCE Adj: | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| MLF Adj: | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| FinalVolume: | 0 | 242 | 0 | 31 | 400 | 0 | 551 | 0 | 513 | 0 | 0 | 0 |
| **Saturation Flow Module:** | | | | | | | | | | | | |
| Sat/Lane: | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Adjustment: | 0.92 | 1.00 | 0.92 | 0.92 | 1.00 | 0.92 | 0.92 | 1.00 | 0.92 | 0.92 | 1.00 | 0.92 |
| Lanes: | 0.00 | 2.00 | 1.00 | 1.00 | 1.00 | 0.00 | 1.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Final Sat.: | 0 | 3800 | 1750 | 1750 | 1900 | 0 | 1750 | 0 | 1750 | 0 | 0 | 0 |
| **Capacity Analysis Module:** | | | | | | | | | | | | |
| Vol/Sat: | 0.00 | 0.06 | 0.00 | 0.02 | 0.21 | 0.00 | 0.31 | 0.00 | 0.29 | 0.00 | 0.00 | 0.00 |
| Crit Moves: | | **** | | **** | | | **** | | | | | |
| Green Time: | 0.0 | 10.0 | 0.0 | 7.0 | 17.0 | 0.0 | 34.0 | 0.0 | 34.0 | 0.0 | 0.0 | 0.0 |
| Volume/Cap: | 0.00 | 0.38 | 0.00 | 0.15 | 0.74 | 0.00 | 0.56 | 0.00 | 0.52 | 0.00 | 0.00 | 0.00 |
| Delay/Veh: | 0.0 | 22.6 | 0.0 | 24.2 | 25.1 | 0.0 | 45.2 | 0.0 | 35.7 | 0.0 | 0.0 | 0.0 |
| User DelAdj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| AdjDel/Veh: | 0.0 | 22.6 | 0.0 | 24.2 | 25.1 | 0.0 | 45.2 | 0.0 | 35.7 | 0.0 | 0.0 | 0.0 |
| LOS by Move: | A | C+ | A | C | C | A | D | A | D+ | A | A | A |
| HCM2kAvgQ: | 0 | 2 | 0 | 1 | 9 | 0 | 8 | 0 | 7 | 0 | 0 | 0 |

Note: Queue reported is the number of cars per lane.

```
--------------------------------------------------------------------------------
                             Planetary Ventures
                            MFA Hangar 3 Project
--------------------------------------------------------------------------------
                      Level Of Service Computation Report
            2000 HCM 4-Way Stop Method (Future Volume Alternative)
********************************************************************************
Intersection #4 Enterprise & 5th
********************************************************************************
Cycle (sec):          100                 Critical Vol./Cap.(X):        0.204
Loss Time (sec):        0                 Average Delay (sec/veh):        8.6
Optimal Cycle:          0                 Level Of Service:                 A
********************************************************************************
Street Name:              Enterprise                                5th
Approach:       North Bound      South Bound      East Bound       West Bound
Movement:     L  -  T  -  R    L  -  T  -  R    L  -  T  -  R    L  -  T  -  R
------------|----------------||----------------||----------------||----------------|
Control:       Stop Sign        Stop Sign        Stop Sign        Stop Sign
Rights:          Include          Ignore           Ignore           Include
Min. Green:    0     0     0    0     0     0    0     0     0    0     0     0
Lanes:        1  0  0  1  0    0  1  0  0  0    0  0  0  1  0    0  1  0  0  1
------------|----------------||----------------||----------------||----------------|
Volume Module:AM Peak Hour
Base Vol:      0   118    21    2    11     0    0     4     3   13     1     1
Growth Adj:  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
Initial Bse:   0   118    21    2    11     0    0     4     3   13     1     1
Added Vol:     0     0     0    0     0     0    0     0     0    0     0     0
New Trips:     0     0     0    0     0     0    0     0     0    0     0     0
Initial Fut:   0   118    21    2    11     0    0     4     3   13     1     1
User Adj:    1.00 1.00  1.00  1.00 1.00  0.00  1.00 1.00  0.00  1.00 1.00  1.00
PHF Adj:     0.88 0.88  0.88  0.88 0.88  0.00  0.88 0.88  0.00  0.88 0.88  0.88
PHF Volume:    0   134    24    2    13     0    0     5     0   15     1     1
Reduct Vol:    0     0     0    0     0     0    0     0     0    0     0     0
Reduced Vol:   0   134    24    2    13     0    0     5     0   15     1     1
PCE Adj:     1.00 1.00  1.00  1.00 1.00  0.00  1.00 1.00  0.00  1.00 1.00  1.00
MLF Adj:     1.00 1.00  1.00  1.00 1.00  0.00  1.00 1.00  0.00  1.00 1.00  1.00
FinalVolume:   0   134    24    2    13     0    0     5     0   15     1     1
------------|----------------||----------------||----------------||----------------|
Saturation Flow Module:
Adjustment:  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
Lanes:       1.00 0.85  0.15  0.15 0.85  0.00  0.00 1.00  0.00  0.93 0.07  1.00
Final Sat.:   685  658   117   115  634     0     0  529     0   496   38   645
------------|----------------||----------------||----------------||----------------|
Capacity Analysis Module:
Vol/Sat:     0.00 0.20  0.20  0.02 0.02  xxxx  xxxx 0.01  xxxx  0.03 0.03  0.00
Crit Moves:       ****             ****              ****              ****
Delay/Veh:    0.0  8.5   8.5   7.9  7.9   0.0   0.0  9.7   0.0   9.5  9.5   8.1
Delay Adj:   1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
AdjDel/Veh:   0.0  8.5   8.5   7.9  7.9   0.0   0.0  9.7   0.0   9.5  9.5   8.1
LOS by Move:    *    A     A     A    A     *     *    A     *     A    A     A
ApproachDel:        8.5              7.9              9.7              9.4
Delay Adj:         1.00             1.00             1.00             1.00
ApprAdjDel:         8.5              7.9              9.7              9.4
LOS by Appr:          A                A                A                A
AllWayAvgQ:   0.0  0.3   0.3   0.0  0.0   0.0   0.0  0.0   0.0   0.0  0.0   0.0
********************************************************************************
Note: Queue reported is the number of cars per lane.
```

```
--------------------------------------------------------------------------------
                             Planetary Ventures
                            MFA Hangar 3 Project
--------------------------------------------------------------------------------
                     Level Of Service Computation Report
            2000 HCM Operations Method (Future Volume Alternative)
********************************************************************************
Intersection #5 Enterprise & 11th
********************************************************************************
Cycle (sec):         60              Critical Vol./Cap.(X):         0.400
Loss Time (sec):      9              Average Delay (sec/veh):        11.4
Optimal Cycle:       36              Level Of Service:                 B+
********************************************************************************
Street Name:               Enterprise                            11th
Approach:      North Bound      South Bound       East Bound       West Bound
Movement:     L  -  T  -  R   L  -  T  -  R   L  -  T  -  R   L  -  T  -  R
------------|---------------||---------------||---------------||---------------|
Control:        Protected        Protected         Protected        Protected
Rights:          Include          Include           Include          Include
Min. Green:     0   10    10     7   10     0     0    0     0     7    0    10
Y+R:          4.0  4.0   4.0   4.0  4.0   4.0   4.0  4.0   4.0   4.0  4.0   4.0
Lanes:        0  0  1  1  0   1  0  2  0  0   0  0  0  0  0   2  0  0  0  1
------------|---------------||---------------||---------------||---------------|
Volume Module:AM Peak Hour
Base Vol:       0  475   277    26  141     0     0    0     0    74    0   160
Growth Adj:  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
Initial Bse:    0  475   277    26  141     0     0    0     0    74    0   160
Added Vol:      0    0     0     0    0     0     0    0     0     0    0     0
New Trips:      0    0     0     0    0     0     0    0     0     0    0     0
Initial Fut:    0  475   277    26  141     0     0    0     0    74    0   160
User Adj:    1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
PHF Adj:     0.91 0.91  0.91  0.91 0.91  0.91  0.91 0.91  0.91  0.91 0.91  0.91
PHF Volume:     0  522   304    29  155     0     0    0     0    81    0   176
Reduct Vol:     0    0     0     0    0     0     0    0     0     0    0     0
Reduced Vol:    0  522   304    29  155     0     0    0     0    81    0   176
PCE Adj:     1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
MLF Adj:     1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
FinalVolume:    0  522   304    29  155     0     0    0     0    81    0   176
------------|---------------||---------------||---------------||---------------|
Saturation Flow Module:
Sat/Lane:    1900 1900  1900  1900 1900  1900  1900 1900  1900  1900 1900  1900
Adjustment:  0.92 0.99  0.95  0.92 1.00  0.92  0.92 1.00  0.92  0.83 1.00  0.92
Lanes:       0.00 1.24  0.76  1.00 2.00  0.00  0.00 0.00  0.00  2.00 0.00  1.00
Final Sat.:     0 2336  1362  1750 3800     0     0    0     0  3150    0  1750
------------|---------------||---------------||---------------||---------------|
Capacity Analysis Module:
Vol/Sat:     0.00 0.22  0.22  0.02 0.04  0.00  0.00 0.00  0.00  0.03 0.00  0.10
Crit Moves:       ****        ****                                            ****
Green Time:   0.0 30.4  30.4   7.0 37.4   0.0   0.0  0.0   0.0  13.6  0.0  13.6
Volume/Cap:  0.00 0.44  0.44  0.14 0.07  0.00  0.00 0.00  0.00  0.11 0.00  0.44
Delay/Veh:    0.0  9.6   9.6  24.1  4.5   0.0   0.0  0.0   0.0  18.4  0.0  20.7
User DelAdj: 1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
AdjDel/Veh:   0.0  9.6   9.6  24.1  4.5   0.0   0.0  0.0   0.0  18.4  0.0  20.7
LOS by Move:    A    A     A     C    A     A     A    A     A    B-    A    C+
HCM2kAvgQ:      0    5     5     1    1     0     0    0     0     1    0     4
********************************************************************************
Note: Queue reported is the number of cars per lane.

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Planetary Ventures
MFA Hangar 3 Project

Level Of Service Computation Report
2000 HCM Operations Method (Future Volume Alternative)

Intersection #6 Enterprise & Manila/Moffett Park

| | | | |
|---|---|---|---|
| Cycle (sec): | 100 | Critical Vol./Cap.(X): | 0.755 |
| Loss Time (sec): | 9 | Average Delay (sec/veh): | 29.4 |
| Optimal Cycle: | 59 | Level Of Service: | C |

| Street Name: | Enterprise | | | | | | Manila/Moffett Park | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach: | North Bound | | | South Bound | | | East Bound | | | West Bound | | |
| Movement: | L | T | R | L | T | R | L | T | R | L | T | R |
| Control: | Protected | | | Protected | | | Protected | | | Protected | | |
| Rights: | Include | | | Include | | | Include | | | Include | | |
| Min. Green: | 0 | 0 | 0 | 7 | 0 | 10 | 7 | 10 | 0 | 0 | 10 | 10 |
| Y+R: | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lanes: | 0 0 0 0 0 | | | 1 0 0 0 1 | | | 1 0 1 0 0 | | | 0 0 1 0 1 | | |
| **Volume Module:AM Peak Hour** | | | | | | | | | | | | |
| Base Vol: | 0 | 0 | 0 | 112 | 0 | 60 | 502 | 186 | 0 | 0 | 226 | 520 |
| Growth Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Initial Bse: | 0 | 0 | 0 | 112 | 0 | 60 | 502 | 186 | 0 | 0 | 226 | 520 |
| Added Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| New Trips: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Initial Fut: | 0 | 0 | 0 | 112 | 0 | 60 | 502 | 186 | 0 | 0 | 226 | 520 |
| User Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| PHF Adj: | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 |
| PHF Volume: | 0 | 0 | 0 | 124 | 0 | 67 | 558 | 207 | 0 | 0 | 251 | 578 |
| Reduct Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced Vol: | 0 | 0 | 0 | 124 | 0 | 67 | 558 | 207 | 0 | 0 | 251 | 578 |
| PCE Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| MLF Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| FinalVolume: | 0 | 0 | 0 | 124 | 0 | 67 | 558 | 207 | 0 | 0 | 251 | 578 |
| **Saturation Flow Module:** | | | | | | | | | | | | |
| Sat/Lane: | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Adjustment: | 0.92 | 1.00 | 0.92 | 0.92 | 1.00 | 0.92 | 0.92 | 1.00 | 0.92 | 0.92 | 1.00 | 0.92 |
| Lanes: | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 1.00 | 1.00 | 1.00 | 0.00 | 0.00 | 1.00 | 1.00 |
| Final Sat.: | 0 | 0 | 0 | 1750 | 0 | 1750 | 1750 | 1900 | 0 | 0 | 1900 | 1750 |
| **Capacity Analysis Module:** | | | | | | | | | | | | |
| Vol/Sat: | 0.00 | 0.00 | 0.00 | 0.07 | 0.00 | 0.04 | 0.32 | 0.11 | 0.00 | 0.00 | 0.13 | 0.33 |
| Crit Moves: | | | | | | **** | **** | | | | | **** |
| Green Time: | 0.0 | 0.0 | 0.0 | 10.0 | 0.0 | 10.0 | 39.8 | 81.0 | 0.0 | 0.0 | 41.2 | 41.2 |
| Volume/Cap: | 0.00 | 0.00 | 0.00 | 0.71 | 0.00 | 0.38 | 0.80 | 0.13 | 0.00 | 0.00 | 0.32 | 0.80 |
| Delay/Veh: | 0.0 | 0.0 | 0.0 | 56.4 | 0.0 | 43.5 | 33.2 | 2.1 | 0.0 | 0.0 | 20.1 | 32.2 |
| User DelAdj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| AdjDel/Veh: | 0.0 | 0.0 | 0.0 | 56.4 | 0.0 | 43.5 | 33.2 | 2.1 | 0.0 | 0.0 | 20.1 | 32.2 |
| LOS by Move: | A | A | A | E+ | A | D | C- | A | A | A | C+ | C- |
| HCM2kAvgQ: | 0 | 0 | 0 | 6 | 0 | 2 | 18 | 1 | 0 | 0 | 5 | 19 |

Note: Queue reported is the number of cars per lane.

Planetary Ventures
MFA Hangar 3 Project

Level Of Service Computation Report
2000 HCM Operations Method (Future Volume Alternative)

Intersection #7 US 101 NB & Moffett Park

| | | | |
|---|---|---|---|
| Cycle (sec): | 60 | Critical Vol./Cap.(X): | 0.420 |
| Loss Time (sec): | 9 | Average Delay (sec/veh): | 5.3 |
| Optimal Cycle: | 29 | Level Of Service: | A |

| Street Name: | US 101 NB | | | | | | Moffett Park | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach: | North Bound | | | South Bound | | | East Bound | | | West Bound | | |
| Movement: | L | T | R | L | T | R | L | T | R | L | T | R |
| Control: | Protected | | | Protected | | | Protected | | | Protected | | |
| Rights: | Include | | | Include | | | Include | | | Include | | |
| Min. Green: | 7 | 10 | 10 | 7 | 10 | 10 | 7 | 10 | 10 | 7 | 10 | 10 |
| Y+R: | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lanes: | 0 0 | 0 | 0 0 | 0 0 | 0 | 0 0 | 0 0 | 1 | 0 1 | 1 0 | 1 | 0 0 |
| **Volume Module:AM Peak Hour** | | | | | | | | | | | | |
| Base Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 316 | 12 | 163 | 658 | 0 |
| Growth Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Initial Bse: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 316 | 12 | 163 | 658 | 0 |
| Added Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| New Trips: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Initial Fut: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 316 | 12 | 163 | 658 | 0 |
| User Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| PHF Adj: | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 |
| PHF Volume: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 326 | 12 | 168 | 678 | 0 |
| Reduct Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 326 | 12 | 168 | 678 | 0 |
| PCE Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| MLF Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| FinalVolume: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 326 | 12 | 168 | 678 | 0 |
| **Saturation Flow Module:** | | | | | | | | | | | | |
| Sat/Lane: | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Adjustment: | 0.92 | 1.00 | 0.92 | 0.92 | 1.00 | 0.92 | 0.92 | 1.00 | 0.92 | 0.92 | 1.00 | 0.92 |
| Lanes: | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.00 |
| Final Sat.: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1900 | 1750 | 1750 | 1900 | 0 |
| **Capacity Analysis Module:** | | | | | | | | | | | | |
| Vol/Sat: | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.17 | 0.01 | 0.10 | 0.36 | 0.00 |
| Crit Moves: | | | | | | | **** | | | | **** | |
| Green Time: | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 30.3 | 30.3 | 20.7 | 51.0 | 0.0 |
| Volume/Cap: | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.34 | 0.01 | 0.28 | 0.42 | 0.00 |
| Delay/Veh: | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 9.1 | 7.4 | 14.5 | 1.2 | 0.0 |
| User DelAdj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| AdjDel/Veh: | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 9.1 | 7.4 | 14.5 | 1.2 | 0.0 |
| LOS by Move: | A | A | A | A | A | A | A | A | A | B | A | A |
| HCM2kAvgQ: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 3 | 3 | 0 |

Note: Queue reported is the number of cars per lane.

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--------------------------------------------------------------------------------
                             Planetary Ventures
                            MFA Hangar 3 Project
--------------------------------------------------------------------------------
                      Level Of Service Computation Report
              2000 HCM 4-Way Stop Method (Future Volume Alternative)
********************************************************************************
Intersection #8 Innovation & 11th
********************************************************************************
Cycle (sec):          100               Critical Vol./Cap.(X):         0.587
Loss Time (sec):        0               Average Delay (sec/veh):        13.2
Optimal Cycle:          0               Level Of Service:                  B
********************************************************************************
Street Name:                Innovation                          11th
Approach:      North Bound      South Bound      East Bound       West Bound
Movement:     L  -  T  -  R   L  -  T  -  R   L  -  T  -  R   L  -  T  -  R
------------|---------------||---------------||---------------||---------------|
Control:        Stop Sign        Stop Sign        Stop Sign        Stop Sign
Rights:           Include          Include          Include          Include
Min. Green:     0     0     0     0     0     0     0     0     0     0     0     0
Lanes:        1  1  0  1  0   1  0  1  1  0   1  0  0  1  1   0  0  1! 0  0
------------|---------------||---------------||---------------||---------------|
Volume Module:AM Peak Hour
Base Vol:     286    26    40    30    63   284    57    20    66    20    10    50
Growth Adj:  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
Initial Bse:  286    26    40    30    63   284    57    20    66    20    10    50
Added Vol:      0     0     0     0     0     0     0     0     0     0     0     0
New Trips:      0     0     0     0     0     0     0     0     0     0     0     0
Initial Fut:  286    26    40    30    63   284    57    20    66    20    10    50
User Adj:    1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
PHF Adj:     0.82 0.82  0.82  0.82 0.82  0.82  0.82 0.82  0.82  0.82 0.82  0.82
PHF Volume:   349    32    49    37    77   346    70    24    80    24    12    61
Reduct Vol:     0     0     0     0     0     0     0     0     0     0     0     0
Reduced Vol:  349    32    49    37    77   346    70    24    80    24    12    61
PCE Adj:     1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
MLF Adj:     1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
FinalVolume:  349    32    49    37    77   346    70    24    80    24    12    61
------------|---------------||---------------||---------------||---------------|
Saturation Flow Module:
Adjustment:  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
Lanes:       2.00 0.39  0.61  1.00 1.00  1.00  1.00 0.47  1.53  0.25 0.12  0.63
Final Sat.:   981  219   338   488  524   590   425  221   748   124   62   310
------------|---------------||---------------||---------------||---------------|
Capacity Analysis Module:
Vol/Sat:     0.36 0.14  0.14  0.08 0.15  0.59  0.16 0.11  0.11  0.20 0.20  0.20
Crit Moves:  ****                          ****  ****                   ****
Delay/Veh:   13.5  9.9   9.9  10.4 10.4  16.3  12.1 10.6  10.4  11.2 11.2  11.2
Delay Adj:   1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
AdjDel/Veh:  13.5  9.9   9.9  10.4 10.4  16.3  12.1 10.6  10.4  11.2 11.2  11.2
LOS by Move:    B    A     A     B    B     C     B    B     B     B    B     B
ApproachDel:      12.8              14.8              11.1              11.2
Delay Adj:        1.00              1.00              1.00              1.00
ApprAdjDel:       12.8              14.8              11.1              11.2
LOS by Appr:        B                 B                 B                 B
AllWayAvgQ:   0.5  0.2   0.2   0.1  0.2   1.2   0.2  0.1   0.1   0.2  0.2   0.2
********************************************************************************
Note: Queue reported is the number of cars per lane.
```

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--------------------------------------------------------------------------------
                              Planetary Ventures
                             MFA Hangar 3 Project
--------------------------------------------------------------------------------
                      Level Of Service Computation Report
            2000 HCM Operations Method (Future Volume Alternative)
********************************************************************************
Intersection #9 Innovation & Moffett Park
********************************************************************************
Cycle (sec):          60              Critical Vol./Cap.(X):         0.524
Loss Time (sec):       9              Average Delay (sec/veh):        11.3
Optimal Cycle:        39              Level Of Service:                 B+
********************************************************************************
Street Name:                Innovation                      Moffett Park
Approach:      North Bound      South Bound       East Bound       West Bound
Movement:     L  -  T  -  R   L  -  T  -  R   L  -  T  -  R   L  -  T  -  R
------------|---------------||---------------||---------------||---------------|
Control:       Protected        Protected        Protected        Protected
Rights:          Include          Include          Include          Include
Min. Green:    0    0     0    7    0    10   10   10     0    0   10    10
Y+R:          4.0  4.0   4.0  4.0  4.0   4.0  4.0  4.0   4.0  4.0  4.0   4.0
Lanes:        0  0  0  0  0   1  0  1! 0  0   1  0  2  0  0   0  0  2  0  1
------------|---------------||---------------||---------------||---------------|
Volume Module:AM Peak Hour
Base Vol:      0    0     0  106    0    74  106  176     0    0  778   508
Growth Adj:  1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
Initial Bse:   0    0     0  106    0    74  106  176     0    0  778   508
Added Vol:     0    0     0    0    0     0    0    0     0    0    0     0
New Trips:     0    0     0    0    0     0    0    0     0    0    0     0
Initial Fut:   0    0     0  106    0    74  106  176     0    0  778   508
User Adj:    1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
PHF Adj:     0.95 0.95  0.95 0.95 0.95  0.95 0.95 0.95  0.95 0.95 0.95  0.95
PHF Volume:    0    0     0  112    0    78  112  185     0    0  819   535
Reduct Vol:    0    0     0    0    0     0    0    0     0    0    0     0
Reduced Vol:   0    0     0  112    0    78  112  185     0    0  819   535
PCE Adj:     1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
MLF Adj:     1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
FinalVolume:   0    0     0  112    0    78  112  185     0    0  819   535
------------|---------------||---------------||---------------||---------------|
Saturation Flow Module:
Sat/Lane:    1900 1900  1900 1900 1900  1900 1900 1900  1900 1900 1900  1900
Adjustment:  0.92 1.00  0.92 0.92 1.00  0.92 0.92 1.00  0.92 0.92 1.00  0.92
Lanes:       0.00 0.00  0.00 1.42 0.00  0.58 1.00 2.00  0.00 0.00 2.00  1.00
Final Sat.:    0    0     0 2480    0  1020 1750 3800     0    0 3800  1750
------------|---------------||---------------||---------------||---------------|
Capacity Analysis Module:
Vol/Sat:     0.00 0.00  0.00 0.04 0.00  0.08 0.06 0.05  0.00 0.00 0.22  0.31
Crit Moves:                             **** ****                         ****
Green Time:   0.0  0.0   0.0 10.0  0.0  10.0 10.0 41.0   0.0  0.0 31.0  31.0
Volume/Cap:  0.00 0.00  0.00 0.27 0.00  0.46 0.38 0.07  0.00 0.00 0.42  0.59
Delay/Veh:    0.0  0.0   0.0 22.0  0.0  23.4 23.1  3.2   0.0  0.0  9.1  11.1
User DelAdj: 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
AdjDel/Veh:   0.0  0.0   0.0 22.0  0.0  23.4 23.1  3.2   0.0  0.0  9.1  11.1
LOS by Move:    A    A     A   C+    A     C    C    A     A    A    A    B+
HCM2kAvgQ:      0    0     0    2    0     3    2    1     0    0    5     8
********************************************************************************
Note: Queue reported is the number of cars per lane.
```

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--------------------------------------------------------------------------------
                            Planetary Ventures
                           MFA Hangar 3 Project
--------------------------------------------------------------------------------

                    Level Of Service Computation Report
           2000 HCM Operations Method (Future Volume Alternative)
********************************************************************************
Intersection #10 Mathilda & 5th
********************************************************************************
Cycle (sec):          60                Critical Vol./Cap.(X):        0.244
Loss Time (sec):      12                Average Delay (sec/veh):       16.1
Optimal Cycle:        46                Level Of Service:                 B
********************************************************************************
Street Name:              Mathilda                            5th
Approach:      North Bound      South Bound       East Bound       West Bound
Movement:     L  -  T  -  R   L  -  T  -  R   L  -  T  -  R   L  -  T  -  R
------------|---------------||---------------||---------------||---------------|
Control:        Protected        Protected        Protected        Protected
Rights:           Include          Ignore           Include          Include
Min. Green:     7   10    10    7   10    10    7   10    10    7   10    10
Y+R:          4.0  4.0   4.0  4.0  4.0   4.0  4.0  4.0   4.0  4.0  4.0   4.0
Lanes:        2  0  2  1  0   1  0  3  0  9   2  0  1  0  1   2  0  0  1  0
------------|---------------||---------------||---------------||---------------|
Volume Module:AM Peak Hour
Base Vol:      42  415   200   84  225   247   22    7    14   41   10     7
Growth Adj:  1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
Initial Bse:   42  415   200   84  225   247   22    7    14   41   10     7
Added Vol:      0    0     0    0    0     0    0    0     0    0    0     0
New Trips:      0    0     0    0    0     0    0    0     0    0    0     0
Initial Fut:   42  415   200   84  225   247   22    7    14   41   10     7
User Adj:    1.00 1.00  1.00 1.00 1.00  0.00 1.00 1.00  1.00 1.00 1.00  1.00
PHF Adj:     0.89 0.89  0.89 0.89 0.89  0.00 0.89 0.89  0.89 0.89 0.89  0.89
PHF Volume:    47  466   225   94  253     0   25    8    16   46   11     8
Reduct Vol:     0    0     0    0    0     0    0    0     0    0    0     0
Reduced Vol:   47  466   225   94  253     0   25    8    16   46   11     8
PCE Adj:     1.00 1.00  1.00 1.00 1.00  0.00 1.00 1.00  1.00 1.00 1.00  1.00
MLF Adj:     1.00 1.00  1.00 1.00 1.00  0.00 1.00 1.00  1.00 1.00 1.00  1.00
FinalVolume:   47  466   225   94  253     0   25    8    16   46   11     8
------------|---------------||---------------||---------------||---------------|
Saturation Flow Module:
Sat/Lane:    1900 1900  1900 1900 1900  1900 1900 1900  1900 1900 1900  1900
Adjustment:  0.83 1.00  0.95 0.92 1.00  0.80 0.83 1.00  0.92 0.83 0.95  0.95
Lanes:       2.00 2.00  1.00 1.00 3.00  9.00 2.00 1.00  1.00 2.00 0.59  0.41
Final Sat.:  3150 3798  1800 1750 5700 13653 3150 1900  1750 3150 1059   741
------------|---------------||---------------||---------------||---------------|
Capacity Analysis Module:
Vol/Sat:     0.01 0.12  0.12 0.05 0.04  0.00 0.01 0.00  0.01 0.01 0.01  0.01
Crit Moves:       ****       ****             ****                  ****
Green Time:  12.8 21.5  21.5  9.5 18.2   0.0  7.0 10.0  10.0  7.0 10.0  10.0
Volume/Cap:  0.07 0.34  0.35 0.34 0.15  0.00 0.07 0.02  0.05 0.13 0.06  0.06
Delay/Veh:   18.9 14.2  14.2 23.2 15.2   0.0 23.7 21.0  21.1 23.9 21.1  21.1
User DelAdj: 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
AdjDel/Veh:  18.9 14.2  14.2 23.2 15.2   0.0 23.7 21.0  21.1 23.9 21.1  21.1
LOS by Move:   B-    B     B    C    B     A    C   C+    C+    C   C+    C+
HCM2kAvgQ:      0    3     3    2    1     0    0    0     0    1    0     0
********************************************************************************
Note: Queue reported is the number of cars per lane.
```

Planetary Ventures
MFA Hangar 3 Project

Level Of Service Computation Report
2000 HCM Operations Method (Future Volume Alternative)

Intersection #11 Mathilda & Moffett Park

| | | | |
|---|---|---|---|
| Cycle (sec): | 70 | Critical Vol./Cap.(X): | 0.845 |
| Loss Time (sec): | 12 | Average Delay (sec/veh): | 42.6 |
| Optimal Cycle: | 76 | Level Of Service: | D |

| Street Name: | Mathilda | | | | | | Moffett Park | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach: | North Bound | | | South Bound | | | East Bound | | | West Bound | | |
| Movement: | L | T | R | L | T | R | L | T | R | L | T | R |
| Control: | Protected | | | Protected | | | Protected | | | Protected | | |
| Rights: | Include | | | Include | | | Ignore | | | Include | | |
| Min. Green: | 7 | 10 | 10 | 7 | 10 | 10 | 7 | 10 | 10 | 7 | 10 | 10 |
| Y+R: | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lanes: | 2 0 2 1 0 | | | 1 0 3 1 0 | | | 1 0 1 0 1 | | | 2 0 0 1 0 | | |
| **Volume Module:AM Peak Hour** | | | | | | | | | | | | |
| Base Vol: | 791 | 1166 | 717 | 14 | 156 | 66 | 35 | 77 | 106 | 177 | 397 | 13 |
| Growth Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Initial Bse: | 791 | 1166 | 717 | 14 | 156 | 66 | 35 | 77 | 106 | 177 | 397 | 13 |
| Added Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| New Trips: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Initial Fut: | 791 | 1166 | 717 | 14 | 156 | 66 | 35 | 77 | 106 | 177 | 397 | 13 |
| User Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 1.00 |
| PHF Adj: | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.00 | 0.95 | 0.95 | 0.95 |
| PHF Volume: | 833 | 1227 | 755 | 15 | 164 | 69 | 37 | 81 | 0 | 186 | 418 | 14 |
| Reduct Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced Vol: | 833 | 1227 | 755 | 15 | 164 | 69 | 37 | 81 | 0 | 186 | 418 | 14 |
| PCE Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 1.00 |
| MLF Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 1.00 |
| FinalVolume: | 833 | 1227 | 755 | 15 | 164 | 69 | 37 | 81 | 0 | 186 | 418 | 14 |
| **Saturation Flow Module:** | | | | | | | | | | | | |
| Sat/Lane: | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Adjustment: | 0.83 | 1.00 | 0.92 | 0.92 | 1.00 | 0.92 | 0.92 | 1.00 | 0.92 | 0.83 | 0.95 | 0.95 |
| Lanes: | 2.00 | 2.00 | 1.00 | 1.00 | 3.00 | 1.00 | 1.00 | 1.00 | 1.00 | 2.00 | 0.97 | 0.03 |
| Final Sat.: | 3150 | 3800 | 1750 | 1750 | 5700 | 1750 | 1750 | 1900 | 1750 | 3150 | 1743 | 57 |
| **Capacity Analysis Module:** | | | | | | | | | | | | |
| Vol/Sat: | 0.26 | 0.32 | 0.43 | 0.01 | 0.03 | 0.04 | 0.02 | 0.04 | 0.00 | 0.06 | 0.24 | 0.24 |
| Crit Moves: | | | **** | **** | | | **** | | | | **** | |
| Green Time: | 22.9 | 28.3 | 28.3 | 7.0 | 12.4 | 12.4 | 7.0 | 13.4 | 0.0 | 9.4 | 15.7 | 15.7 |
| Volume/Cap: | 0.81 | 0.80 | 1.07 | 0.08 | 0.16 | 0.22 | 0.21 | 0.22 | 0.00 | 0.44 | 1.07 | 1.07 |
| Delay/Veh: | 36.8 | 24.6 | 62.5 | 28.8 | 24.5 | 24.8 | 29.6 | 24.2 | 0.0 | 28.7 | 91.0 | 91.0 |
| User DelAdj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| AdjDel/Veh: | 36.8 | 24.6 | 62.5 | 28.8 | 24.5 | 24.8 | 29.6 | 24.2 | 0.0 | 28.7 | 91.0 | 91.0 |
| LOS by Move: | D+ | C | E | C | C | C | C | C | A | C | F | F |
| HCM2kAvgQ: | 12 | 14 | 30 | 0 | 1 | 2 | 1 | 2 | 0 | 3 | 18 | 18 |

Note: Queue reported is the number of cars per lane.

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------------------------------------------------------------------------------
                             Planetary Ventures
                            MFA Hangar 3 Project
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                      Level Of Service Computation Report
            2000 HCM Operations Method (Future Volume Alternative)
******************************************************************************
Intersection #12 Mathilda & Hwy 237 WB
******************************************************************************
Cycle (sec):          60                Critical Vol./Cap.(X):        0.610
Loss Time (sec):       9                Average Delay (sec/veh):       11.4
Optimal Cycle:        39                Level Of Service:                B+
******************************************************************************
Street Name:                Mathilda                         Hwy 237 WB
Approach:       North Bound       South Bound       East Bound        West Bound
Movement:     L  -  T  -  R    L  -  T  -  R    L  -  T  -  R    L  -  T  -  R
------------|----------------||----------------||----------------||----------------|
Control:        Protected         Protected         Protected         Protected
Rights:           Include           Include           Include           Include
Min. Green:     7   10     0     0   10    10     0    0     0     7   10    10
Y+R:          4.0  4.0   4.0   4.0  4.0   4.0   4.0  4.0   4.0   4.0  4.0   4.0
Lanes:        1  0  4  0  0    0  0  3  1  0    0  0  0  0  0    1  1  0  0  1
------------|----------------||----------------||----------------||----------------|
Volume Module:AM Peak Hour
Base Vol:     174 2571     0     0  301   157     0    0     0   447   82   125
Growth Adj:  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
Initial Bse:  174 2571     0     0  301   157     0    0     0   447   82   125
Added Vol:      0    0     0     0    0     0     0    0     0     0    0     0
New Trips:      0    0     0     0    0     0     0    0     0     0    0     0
Initial Fut:  174 2571     0     0  301   157     0    0     0   447   82   125
User Adj:    1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
PHF Adj:     0.94 0.94  0.94  0.94 0.94  0.94  0.94 0.94  0.94  0.94 0.94  0.94
PHF Volume:   185 2735     0     0  320   167     0    0     0   476   87   133
Reduct Vol:     0    0     0     0    0     0     0    0     0     0    0     0
Reduced Vol:  185 2735     0     0  320   167     0    0     0   476   87   133
PCE Adj:     1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
MLF Adj:     1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
FinalVolume:  185 2735     0     0  320   167     0    0     0   476   87   133
------------|----------------||----------------||----------------||----------------|
Saturation Flow Module:
Sat/Lane:    1900 1900  1900  1900 1900  1900  1900 1900  1900  1900 1900  1900
Adjustment:  0.92 1.00  0.92  0.92 1.00  0.92  0.92 1.00  0.92  0.93 0.95  0.92
Lanes:       1.00 4.00  0.00  0.00 3.00  1.00  0.00 0.00  0.00  1.69 0.31  1.00
Final Sat.:  1750 7600     0     0 5700  1750     0    0     0  3000  550  1750
------------|----------------||----------------||----------------||----------------|
Capacity Analysis Module:
Vol/Sat:     0.11 0.36  0.00  0.00 0.06  0.10  0.00 0.00  0.00  0.16 0.16  0.08
Crit Moves:       ****        ****                                     ****
Green Time:  14.6 35.4   0.0   0.0 20.8  20.8   0.0  0.0   0.0  15.6 15.6  15.6
Volume/Cap:  0.44 0.61  0.00  0.00 0.16  0.27  0.00 0.00  0.00  0.61 0.61  0.29
Delay/Veh:   19.9  8.1   0.0   0.0 13.6  14.2   0.0  0.0   0.0  20.7 20.7  18.1
User DelAdj: 1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
AdjDel/Veh:  19.9  8.1   0.0   0.0 13.6  14.2   0.0  0.0   0.0  20.7 20.7  18.1
LOS by Move:   B-    A     A     A    B     B     A    A     A    C+   C+    B-
HCM2kAvgQ:      4    9     0     0    1     3     0    0     0     6    6     2
******************************************************************************
Note: Queue reported is the number of cars per lane.
```

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--------------------------------------------------------------------------------
                          Planetary Ventures
                         MFA Hangar 3 Project
--------------------------------------------------------------------------------
                    Level Of Service Computation Report
            2000 HCM Operations Method (Future Volume Alternative)
********************************************************************************
Intersection #13 Mathilda & Hwy 237 EB
********************************************************************************
Cycle (sec):          60                Critical Vol./Cap.(X):         0.522
Loss Time (sec):       9                Average Delay (sec/veh):        14.5
Optimal Cycle:        36                Level Of Service:                  B
********************************************************************************
Street Name:                Mathilda                           Hwy 237 EB
Approach:       North Bound      South Bound      East Bound       West Bound
Movement:     L  -  T  -  R   L  -  T  -  R   L  -  T  -  R   L  -  T  -  R
------------|---------------||---------------||---------------||---------------|
Control:        Protected        Protected        Protected        Protected
Rights:           Ignore          Include          Include          Include
Min. Green:     0   10    10    7   10     0    7   10    10    0    0     0
Y+R:          4.0  4.0   4.0  4.0  4.0   4.0  4.0  4.0   4.0  4.0  4.0   4.0
Lanes:        0  0  5  0  1   1  0  3  0  0   2  1  0  0  1   0  0  0  0  0
------------|---------------||---------------||---------------||---------------|
Volume Module:AM Peak Hour
Base Vol:       0 1744   707   57  676     0  994    1    96    0    0     0
Growth Adj:  1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
Initial Bse:    0 1744   707   57  676     0  994    1    96    0    0     0
Added Vol:      0    0     0    0    0     0    0    0     0    0    0     0
New Trips:      0    0     0    0    0     0    0    0     0    0    0     0
Initial Fut:    0 1744   707   57  676     0  994    1    96    0    0     0
User Adj:    1.00 1.00  0.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
PHF Adj:     0.94 0.94  0.00 0.94 0.94  0.94 0.94 0.94  0.94 0.94 0.94  0.94
PHF Volume:     0 1855     0   61  719     0 1057    1   102    0    0     0
Reduct Vol:     0    0     0    0    0     0    0    0     0    0    0     0
Reduced Vol:    0 1855     0   61  719     0 1057    1   102    0    0     0
PCE Adj:     1.00 1.00  0.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
MLF Adj:     1.00 1.00  0.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
FinalVolume:    0 1855     0   61  719     0 1057    1   102    0    0     0
------------|---------------||---------------||---------------||---------------|
Saturation Flow Module:
Sat/Lane:    1900 1900  1900 1900 1900  1900 1900 1900  1900 1900 1900  1900
Adjustment:  0.92 1.00  0.92 0.92 1.00  0.92 0.87 0.95  0.92 0.92 1.00  0.92
Lanes:       0.00 5.00  1.00 1.00 3.00  0.00 2.99 0.01  1.00 0.00 0.00  0.00
Final Sat.:     0 9500  1750 1750 5700     0 4945    5  1750    0    0     0
------------|---------------||---------------||---------------||---------------|
Capacity Analysis Module:
Vol/Sat:     0.00 0.20  0.00 0.03 0.13  0.00 0.21 0.21  0.06 0.00 0.00  0.00
Crit Moves:       ****       ****             ****
Green Time:   0.0 21.0   0.0  7.0 28.0   0.0 23.0 23.0  23.0  0.0  0.0   0.0
Volume/Cap:  0.00 0.56  0.00 0.30 0.27  0.00 0.56 0.56  0.15 0.00 0.00  0.00
Delay/Veh:    0.0 16.0   0.0 25.1  9.8   0.0 14.9 14.9  12.2  0.0  0.0   0.0
User DelAdj: 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
AdjDel/Veh:   0.0 16.0   0.0 25.1  9.8   0.0 14.9 14.9  12.2  0.0  0.0   0.0
LOS by Move:    A    B     A    C    A     A    B    B     B    A    A     A
HCM2kAvgQ:      0    6     0    1    3     0    7    7     1    0    0     0
********************************************************************************
Note: Queue reported is the number of cars per lane.
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Planetary Ventures
MFA Hangar 3 Project

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Scenario Report

| | |
|---|---|
| Scenario: | Existing PM Peak |
| Command: | Default Command |
| Volume: | Existing PM Peak |
| Geometry: | Existing |
| Impact Fee: | Default Impact Fee |
| Trip Generation: | Default Trip Generation |
| Trip Distribution: | Default Trip Distribution |
| Paths: | Default Path |
| Routes: | Default Route |
| Configuration: | Default Configuration |

Planetary Ventures
MFA Hangar 3 Project

Impact Analysis Report
Level Of Service

| Intersection | Base LOS | Base Del/ Veh | Base V/ C | Future LOS | Future Del/ Veh | Future V/ C | Change in |
|---|---|---|---|---|---|---|---|
| # 1 Ellis & Manila | C | 18.6 | 0.784 | C | 18.6 | 0.784 | + 0.000 V/C |
| # 2 Ellis & US 101 NB | C | 24.1 | 0.565 | C | 24.1 | 0.565 | + 0.000 D/V |
| # 3 Ellis & US 101 SB | C | 31.7 | 0.491 | C | 31.7 | 0.491 | + 0.000 D/V |
| # 4 Enterprise & 5th | A | 8.7 | 0.145 | A | 8.7 | 0.145 | + 0.000 V/C |
| # 5 Enterprise & 11th | B+ | 11.7 | 0.196 | B+ | 11.7 | 0.196 | + 0.000 D/V |
| # 6 Enterprise & Manila/Moffett Pa | B | 13.3 | 0.572 | B | 13.3 | 0.572 | + 0.000 D/V |
| # 7 US 101 NB & Moffett Park | B | 13.7 | 0.718 | B | 13.7 | 0.718 | + 0.000 D/V |
| # 8 Innovation & 11th | C | 20.3 | 0.856 | C | 20.3 | 0.856 | + 0.000 V/C |
| # 9 Innovation & Moffett Park | B | 15.4 | 0.498 | B | 15.4 | 0.498 | + 0.000 D/V |
| # 10 Mathilda & 5th | B- | 19.1 | 0.346 | B- | 19.1 | 0.346 | + 0.000 D/V |
| # 11 Mathilda & Moffett Park | C | 28.0 | 0.704 | C | 28.0 | 0.704 | + 0.000 D/V |
| # 12 Mathilda & Hwy 237 WB | B | 13.6 | 0.665 | B | 13.6 | 0.665 | + 0.000 D/V |
| # 13 Mathilda & Hwy 237 EB | B+ | 11.1 | 0.596 | B+ | 11.1 | 0.596 | + 0.000 D/V |

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--------------------------------------------------------------------------------
                             Planetary Ventures
                            MFA Hangar 3 Project
--------------------------------------------------------------------------------
                      Level Of Service Computation Report
           2000 HCM 4-Way Stop Method (Future Volume Alternative)
********************************************************************************
Intersection #1 Ellis & Manila
********************************************************************************
Cycle (sec):         100                Critical Vol./Cap.(X):        0.784
Loss Time (sec):      12                Average Delay (sec/veh):       18.6
Optimal Cycle:         0                Level Of Service:                 C
********************************************************************************
Street Name:                Ellis                              Manila
Approach:      North Bound      South Bound      East Bound       West Bound
Movement:     L  -  T  -  R   L  -  T  -  R   L  -  T  -  R   L  -  T  -  R
------------|---------------||---------------||---------------||---------------|
Control:        Stop Sign        Stop Sign        Stop Sign        Stop Sign
Rights:           Ignore          Include          Include          Include
Min. Green:     7   10    10    7   10    10    7   10    10    7   10    10
Lanes:        0  0  2  0  1   0  1  1  0  0   0  0  0  0  0   0  0  1! 0  0
------------|---------------||---------------||---------------||---------------|
Volume Module:PM Peak Hour
Base Vol:       0   64   236    11  186     0     0    0     0   511    0     7
Growth Adj:  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
Initial Bse:    0   64   236    11  186     0     0    0     0   511    0     7
Added Vol:      0    0     0     0    0     0     0    0     0     0    0     0
New Trips:      0    0     0     0    0     0     0    0     0     0    0     0
Initial Fut:    0   64   236    11  186     0     0    0     0   511    0     7
User Adj:    1.00 1.00  0.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
PHF Adj:     0.92 0.92  0.00  0.92 0.92  0.92  0.92 0.92  0.92  0.92 0.92  0.92
PHF Volume:     0   70     0    12  202     0     0    0     0   555    0     8
Reduct Vol:     0    0     0     0    0     0     0    0     0     0    0     0
Reduced Vol:    0   70     0    12  202     0     0    0     0   555    0     8
PCE Adj:     1.00 1.00  0.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
MLF Adj:     1.00 1.00  0.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
FinalVolume:    0   70     0    12  202     0     0    0     0   555    0     8
------------|---------------||---------------||---------------||---------------|
Saturation Flow Module:
Adjustment:  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
Lanes:       0.00 2.00  1.00  0.11 1.89  0.00  0.00 0.00  0.00  0.99 0.00  0.01
Final Sat.:     0 1046   582    61 1040     0     0    0     0   709    0    10
------------|---------------||---------------||---------------||---------------|
Capacity Analysis Module:
Vol/Sat:     xxxx 0.07  0.00  0.20 0.19  xxxx  xxxx xxxx  xxxx  0.78 xxxx  0.78
Crit Moves:       ****        ****                                ****
Delay/Veh:    0.0  9.5   0.0  10.3 10.2   0.0   0.0  0.0   0.0  22.9  0.0  22.9
Delay Adj:   1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
AdjDel/Veh:   0.0  9.5   0.0  10.3 10.2   0.0   0.0  0.0   0.0  22.9  0.0  22.9
LOS by Move:    *    A     *     B    B     *     *    *     *     C    *     C
ApproachDel:         9.5             10.2            xxxxxx            22.9
Delay Adj:          1.00             1.00             xxxxx            1.00
ApprAdjDel:          9.5             10.2            xxxxxx            22.9
LOS by Appr:           A                B                 *               C
AllWayAvgQ:   0.0  0.1   0.0   0.2  0.2   0.0   0.0  0.0   0.0   3.0  3.0   3.0
********************************************************************************
Note: Queue reported is the number of cars per lane.

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                              Planetary Ventures
                             MFA Hangar 3 Project
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                     Level Of Service Computation Report
           2000 HCM Operations Method (Future Volume Alternative)
*******************************************************************************
Intersection #2 Ellis & US 101 NB
*******************************************************************************
Cycle (sec):           60                Critical Vol./Cap.(X):         0.565
Loss Time (sec):        9                Average Delay (sec/veh):        24.1
Optimal Cycle:         39                Level Of Service:                  C
*******************************************************************************
Street Name:                 Ellis                            US 101 NB
Approach:       North Bound      South Bound      East Bound       West Bound
Movement:      L  -  T  -  R   L  -  T  -  R   L  -  T  -  R   L  -  T  -  R
------------|---------------||---------------||---------------||---------------|
Control:       Split Phase      Split Phase       Protected        Protected
Rights:           Include          Include          Include          Include
Min. Green:     7   10    10    7   10    10    7   10    10    7   10    10
Y+R:           4.0  4.0   4.0  4.0  4.0   4.0  4.0  4.0   4.0  4.0  4.0   4.0
Lanes:         0  1  1  0  0   0  0  1  1  0   0  0  0  0  0   0  1  0  0  2
------------|---------------||---------------||---------------||---------------|
Volume Module:PM Peak Hour
Base Vol:      233  248     0     0  398   319     0    0     0   219    2    46
Growth Adj:   1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
Initial Bse:   233  248     0     0  398   319     0    0     0   219    2    46
Added Vol:       0    0     0     0    0     0     0    0     0     0    0     0
New Trips:       0    0     0     0    0     0     0    0     0     0    0     0
Initial Fut:   233  248     0     0  398   319     0    0     0   219    2    46
User Adj:     1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
PHF Adj:      0.93 0.93  0.93  0.93 0.93  0.93  0.93 0.93  0.93  0.93 0.93  0.93
PHF Volume:    251  267     0     0  428   343     0    0     0   235    2    49
Reduct Vol:      0    0     0     0    0     0     0    0     0     0    0     0
Reduced Vol:   251  267     0     0  428   343     0    0     0   235    2    49
PCE Adj:      1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
MLF Adj:      1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
FinalVolume:   251  267     0     0  428   343     0    0     0   235    2    49
------------|---------------||---------------||---------------||---------------|
Saturation Flow Module:
Sat/Lane:     1900 1900  1900  1900 1900  1900  1900 1900  1900  1900 1900  1900
Adjustment:   0.95 1.00  0.92  0.92 0.99  0.95  0.92 1.00  0.92  0.95 0.95  0.83
Lanes:        1.00 1.00  0.00  0.00 1.09  0.91  0.00 0.00  0.00  0.99 0.01  2.00
Final Sat.:   1791 1906     0     0 2053  1645     0    0     0  1784   16  3150
------------|---------------||---------------||---------------||---------------|
Capacity Analysis Module:
Vol/Sat:      0.14 0.14  0.00  0.00 0.21  0.21  0.00 0.00  0.00  0.13 0.13  0.02
Crit Moves:        ****              ****                              ****
Green Time:   14.9 14.9   0.0   0.0 22.1  22.1   0.0  0.0   0.0  14.0 14.0  14.0
Volume/Cap:   0.57 0.57  0.00  0.00 0.57  0.57  0.00 0.00  0.00  0.57 0.57  0.07
Delay/Veh:    38.3 38.3   0.0   0.0 15.7  15.7   0.0  0.0   0.0  22.1 22.1  17.9
User DelAdj:  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
AdjDel/Veh:   38.3 38.3   0.0   0.0 15.7  15.7   0.0  0.0   0.0  22.1 22.1  17.9
LOS by Move:    D+   D+     A     A    B     B     A    A     A    C+   C+     B
HCM2kAvgQ:       5    5     0     0    7     7     0    0     0     5    5     0
*******************************************************************************
Note: Queue reported is the number of cars per lane.
```

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-------------------------------------------------------------------------------
                           Planetary Ventures
                          MFA Hangar 3 Project
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                   Level Of Service Computation Report
            2000 HCM Operations Method (Future Volume Alternative)
*******************************************************************************
Intersection #3 Ellis & US 101 SB
*******************************************************************************
Cycle (sec):           60                Critical Vol./Cap.(X):         0.491
Loss Time (sec):        9                Average Delay (sec/veh):        31.7
Optimal Cycle:         36                Level Of Service:                  C
*******************************************************************************
Street Name:                 Ellis                          US 101 SB
Approach:      North Bound      South Bound      East Bound       West Bound
Movement:     L  -  T  -  R   L  -  T  -  R   L  -  T  -  R   L  -  T  -  R
------------|---------------||---------------||---------------||---------------|
Control:        Protected        Protected        Protected        Protected
Rights:           Ignore           Include          Include          Include
Min. Green:     7   10    10     7   10    10     7   10    10     7   10    10
Y+R:          4.0  4.0   4.0   4.0  4.0   4.0   4.0  4.0   4.0   4.0  4.0   4.0
Lanes:        0  0  2  0  1   1  0  1  0  0   1  0  0  0  1   0  0  0  0  0
------------|---------------||---------------||---------------||---------------|
Volume Module:PM Peak Hour
Base Vol:       0  192   219    90  532     0   105    0   189     0    0     0
Growth Adj:  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
Initial Bse:    0  192   219    90  532     0   105    0   189     0    0     0
Added Vol:      0    0     0     0    0     0     0    0     0     0    0     0
New Trips:      0    0     0     0    0     0     0    0     0     0    0     0
Initial Fut:    0  192   219    90  532     0   105    0   189     0    0     0
User Adj:    1.00 1.00  0.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
PHF Adj:     0.93 0.93  0.00  0.93 0.93  0.93  0.93 0.93  0.93  0.93 0.93  0.93
PHF Volume:     0  206     0    97  572     0   113    0   203     0    0     0
Reduct Vol:     0    0     0     0    0     0     0    0     0     0    0     0
Reduced Vol:    0  206     0    97  572     0   113    0   203     0    0     0
PCE Adj:     1.00 1.00  0.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
MLF Adj:     1.00 1.00  0.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
FinalVolume:    0  206     0    97  572     0   113    0   203     0    0     0
------------|---------------||---------------||---------------||---------------|
Saturation Flow Module:
Sat/Lane:    1900 1900  1900  1900 1900  1900  1900 1900  1900  1900 1900  1900
Adjustment:  0.92 1.00  0.92  0.92 1.00  0.92  0.92 1.00  0.92  0.92 1.00  0.92
Lanes:       0.00 2.00  1.00  1.00 1.00  0.00  1.00 0.00  1.00  0.00 0.00  0.00
Final Sat.:     0 3800  1750  1750 1900     0  1750    0  1750     0    0     0
------------|---------------||---------------||---------------||---------------|
Capacity Analysis Module:
Vol/Sat:     0.00 0.05  0.00  0.06 0.30  0.00  0.06 0.00  0.12  0.00 0.00  0.00
Crit Moves:  ****                   ****                    ****
Green Time:   0.0 21.6   0.0  15.2 36.8   0.0  14.2  0.0  14.2   0.0  0.0   0.0
Volume/Cap:  0.00 0.15  0.00  0.22 0.49  0.00  0.27 0.00  0.49  0.00 0.00  0.00
Delay/Veh:    0.0 13.0   0.0  18.0  6.7   0.0 106.0  0.0  85.9   0.0  0.0   0.0
User DelAdj: 1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
AdjDel/Veh:   0.0 13.0   0.0  18.0  6.7   0.0 106.0  0.0  85.9   0.0  0.0   0.0
LOS by Move:    A    B     A     B    A     A     F    A     F     A    A     A
HCM2kAvgQ:      0    1     0     2    6     0     2    0     4     0    0     0
*******************************************************************************
Note: Queue reported is the number of cars per lane.
```

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--------------------------------------------------------------------------------
                              Planetary Ventures
                             MFA Hangar 3 Project
--------------------------------------------------------------------------------
                      Level Of Service Computation Report
            2000 HCM 4-Way Stop Method (Future Volume Alternative)
********************************************************************************
Intersection #4 Enterprise & 5th
********************************************************************************
Cycle (sec):          100                Critical Vol./Cap.(X):         0.145
Loss Time (sec):        0                Average Delay (sec/veh):         8.7
Optimal Cycle:          0                Level Of Service:                  A
********************************************************************************
Street Name:              Enterprise                            5th
Approach:      North Bound      South Bound      East Bound       West Bound
Movement:     L  -  T  -  R   L  -  T  -  R   L  -  T  -  R   L  -  T  -  R
------------|----------------||----------------||----------------||----------------|
Control:        Stop Sign        Stop Sign        Stop Sign        Stop Sign
Rights:          Include           Ignore           Ignore          Include
Min. Green:     0     0     0     0     0     0     0     0     0     0     0     0
Lanes:        1  0  0  1  0   0  0  1  0  0   0  0  0  1  0   0  1  0  0  1
------------|----------------||----------------||----------------||----------------|
Volume Module:PM Peak Hour
Base Vol:       0    18     5     0    90     0     0     9     9    35     1     0
Growth Adj:  1.00  1.00  1.00  1.00  1.00  1.00  1.00  1.00  1.00  1.00  1.00  1.00
Initial Bse:    0    18     5     0    90     0     0     9     9    35     1     0
Added Vol:      0     0     0     0     0     0     0     0     0     0     0     0
New Trips:      0     0     0     0     0     0     0     0     0     0     0     0
Initial Fut:    0    18     5     0    90     0     0     9     9    35     1     0
User Adj:    1.00  1.00  1.00  1.00  1.00  0.00  1.00  1.00  0.00  1.00  1.00  1.00
PHF Adj:     0.82  0.82  0.82  0.82  0.82  0.00  0.82  0.82  0.00  0.82  0.82  0.82
PHF Volume:     0    22     6     0   110     0     0    11     0    43     1     0
Reduct Vol:     0     0     0     0     0     0     0     0     0     0     0     0
Reduced Vol:    0    22     6     0   110     0     0    11     0    43     1     0
PCE Adj:     1.00  1.00  1.00  1.00  1.00  0.00  1.00  1.00  0.00  1.00  1.00  1.00
MLF Adj:     1.00  1.00  1.00  1.00  1.00  0.00  1.00  1.00  0.00  1.00  1.00  1.00
FinalVolume:    0    22     6     0   110     0     0    11     0    43     1     0
------------|----------------||----------------||----------------||----------------|
Saturation Flow Module:
Adjustment:  1.00  1.00  1.00  1.00  1.00  1.00  1.00  1.00  1.00  1.00  1.00  1.00
Lanes:       1.00  0.78  0.22  0.00  1.00  0.00  0.00  1.00  0.00  0.97  0.03  1.00
Final Sat.:   657   584   162     0   756     0     0   534     0   526    15   657
------------|----------------||----------------||----------------||----------------|
Capacity Analysis Module:
Vol/Sat:     0.00  0.04  0.04  xxxx  0.15  xxxx  xxxx  0.02  xxxx  0.08  0.08  0.00
Crit Moves:               ****        ****              ****        ****
Delay/Veh:    0.0   7.6   7.6   0.0   8.5   0.0   0.0   9.7   0.0   9.8   9.8   0.0
Delay Adj:   1.00  1.00  1.00  1.00  1.00  1.00  1.00  1.00  1.00  1.00  1.00  1.00
AdjDel/Veh:   0.0   7.6   7.6   0.0   8.5   0.0   0.0   9.7   0.0   9.8   9.8   0.0
LOS by Move:    *     A     A     *     A     *     *     A     *     A     A     *
ApproachDel:        7.6               8.5               9.7               9.8
Delay Adj:         1.00              1.00              1.00              1.00
ApprAdjDel:         7.6               8.5               9.7               9.8
LOS by Appr:          A                 A                 A                 A
AllWayAvgQ:   0.0   0.0   0.0   0.2   0.2   0.2   0.0   0.0   0.0   0.1   0.1   0.0
********************************************************************************
Note: Queue reported is the number of cars per lane.
```

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Planetary Ventures
MFA Hangar 3 Project

Level Of Service Computation Report
2000 HCM Operations Method (Future Volume Alternative)

Intersection #5 Enterprise & 11th

| | | | |
|---|---|---|---|
| Cycle (sec): | 60 | Critical Vol./Cap.(X): | 0.196 |
| Loss Time (sec): | 9 | Average Delay (sec/veh): | 11.7 |
| Optimal Cycle: | 36 | Level Of Service: | B+ |

| Street Name: | Enterprise | | | | | | 11th | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach: | North Bound | | | South Bound | | | East Bound | | | West Bound | | |
| Movement: | L | T | R | L | T | R | L | T | R | L | T | R |
| Control: | Protected | | | Protected | | | Protected | | | Protected | | |
| Rights: | Include | | | Include | | | Include | | | Include | | |
| Min. Green: | 0 | 10 | 10 | 7 | 10 | 0 | 0 | 0 | 0 | 7 | 0 | 10 |
| Y+R: | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lanes: | 0 0 | 1 | 1 0 | 1 0 | 2 | 0 0 | 0 0 | 0 | 0 0 | 2 0 | 0 | 0 1 |
| **Volume Module:PM Peak Hour** | | | | | | | | | | | | |
| Base Vol: | 0 | 96 | 85 | 137 | 472 | 0 | 0 | 0 | 0 | 220 | 0 | 40 |
| Growth Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Initial Bse: | 0 | 96 | 85 | 137 | 472 | 0 | 0 | 0 | 0 | 220 | 0 | 40 |
| Added Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| New Trips: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Initial Fut: | 0 | 96 | 85 | 137 | 472 | 0 | 0 | 0 | 0 | 220 | 0 | 40 |
| User Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| PHF Adj: | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 |
| PHF Volume: | 0 | 107 | 94 | 152 | 524 | 0 | 0 | 0 | 0 | 244 | 0 | 44 |
| Reduct Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced Vol: | 0 | 107 | 94 | 152 | 524 | 0 | 0 | 0 | 0 | 244 | 0 | 44 |
| PCE Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| MLF Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| FinalVolume: | 0 | 107 | 94 | 152 | 524 | 0 | 0 | 0 | 0 | 244 | 0 | 44 |
| **Saturation Flow Module:** | | | | | | | | | | | | |
| Sat/Lane: | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Adjustment: | 0.92 | 1.00 | 0.95 | 0.92 | 1.00 | 0.92 | 0.92 | 1.00 | 0.92 | 0.83 | 1.00 | 0.92 |
| Lanes: | 0.00 | 1.04 | 0.96 | 1.00 | 2.00 | 0.00 | 0.00 | 0.00 | 0.00 | 2.00 | 0.00 | 1.00 |
| Final Sat.: | 0 | 1961 | 1736 | 1750 | 3800 | 0 | 0 | 0 | 0 | 3150 | 0 | 1750 |
| **Capacity Analysis Module:** | | | | | | | | | | | | |
| Vol/Sat: | 0.00 | 0.05 | 0.05 | 0.09 | 0.14 | 0.00 | 0.00 | 0.00 | 0.00 | 0.08 | 0.00 | 0.03 |
| Crit Moves: | | **** | | **** | | | | | | | | **** |
| Green Time: | 0.0 | 15.8 | 15.8 | 25.2 | 41.0 | 0.0 | 0.0 | 0.0 | 0.0 | 10.0 | 0.0 | 10.0 |
| Volume/Cap: | 0.00 | 0.21 | 0.21 | 0.21 | 0.20 | 0.00 | 0.00 | 0.00 | 0.00 | 0.47 | 0.00 | 0.15 |
| Delay/Veh: | 0.0 | 17.3 | 17.3 | 11.2 | 3.5 | 0.0 | 0.0 | 0.0 | 0.0 | 23.2 | 0.0 | 21.6 |
| User DelAdj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| AdjDel/Veh: | 0.0 | 17.3 | 17.3 | 11.2 | 3.5 | 0.0 | 0.0 | 0.0 | 0.0 | 23.2 | 0.0 | 21.6 |
| LOS by Move: | A | B | B | B+ | A | A | A | A | A | C | A | C+ |
| HCM2kAvgQ: | 0 | 2 | 2 | 2 | 2 | 0 | 0 | 0 | 0 | 3 | 0 | 1 |

Note: Queue reported is the number of cars per lane.

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--------------------------------------------------------------------------------
                              Planetary Ventures
                             MFA Hangar 3 Project
--------------------------------------------------------------------------------
                       Level Of Service Computation Report
             2000 HCM Operations Method (Future Volume Alternative)
********************************************************************************
Intersection #6 Enterprise & Manila/Moffett Park
********************************************************************************
Cycle (sec):          60                Critical Vol./Cap.(X):         0.572
Loss Time (sec):       9                Average Delay (sec/veh):        13.3
Optimal Cycle:        36                Level Of Service:                  B
********************************************************************************
Street Name:                Enterprise                    Manila/Moffett Park
Approach:      North Bound      South Bound      East Bound       West Bound
Movement:     L  -  T  -  R   L  -  T  -  R   L  -  T  -  R   L  -  T  -  R
------------|----------------||----------------||----------------||----------------|
Control:        Protected        Protected        Protected        Protected
Rights:           Include          Include          Include          Include
Min. Green:     0    0     0    7    0    10    7   10     0    0   10    10
Y+R:          4.0  4.0   4.0  4.0  4.0   4.0  4.0  4.0   4.0  4.0  4.0   4.0
Lanes:        0  0  0  0  0   1  0  0  0  1   1  0  1  0  0   0  0  1  0  1
------------|----------------||----------------||----------------||----------------|
Volume Module:PM Peak Hour
Base Vol:       0    0     0  586    0   417  103  147     0    0  121    97
Growth Adj:  1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
Initial Bse:    0    0     0  586    0   417  103  147     0    0  121    97
Added Vol:      0    0     0    0    0     0    0    0     0    0    0     0
New Trips:      0    0     0    0    0     0    0    0     0    0    0     0
Initial Fut:    0    0     0  586    0   417  103  147     0    0  121    97
User Adj:    1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
PHF Adj:     0.94 0.94  0.94 0.94 0.94  0.94 0.94 0.94  0.94 0.94 0.94  0.94
PHF Volume:     0    0     0  623    0   444  110  156     0    0  129   103
Reduct Vol:     0    0     0    0    0     0    0    0     0    0    0     0
Reduced Vol:    0    0     0  623    0   444  110  156     0    0  129   103
PCE Adj:     1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
MLF Adj:     1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
FinalVolume:    0    0     0  623    0   444  110  156     0    0  129   103
------------|----------------||----------------||----------------||----------------|
Saturation Flow Module:
Sat/Lane:    1900 1900  1900 1900 1900  1900 1900 1900  1900 1900 1900  1900
Adjustment:  0.92 1.00  0.92 0.92 1.00  0.92 0.92 1.00  0.92 0.92 1.00  0.92
Lanes:       0.00 0.00  0.00 1.00 0.00  1.00 1.00 1.00  0.00 0.00 1.00  1.00
Final Sat.:     0    0     0 1750    0  1750 1750 1900     0    0 1900  1750
------------|----------------||----------------||----------------||----------------|
Capacity Analysis Module:
Vol/Sat:     0.00 0.00  0.00 0.36 0.00  0.25 0.06 0.08  0.00 0.00 0.07  0.06
Crit Moves:                  ****             ****                  ****
Green Time:   0.0  0.0   0.0 34.0  0.0  34.0  7.0 17.0   0.0  0.0 10.0  10.0
Volume/Cap:  0.00 0.00  0.00 0.63 0.00  0.45 0.54 0.29  0.00 0.00 0.41  0.35
Delay/Veh:    0.0  0.0   0.0 10.0  0.0   7.9 27.8 17.1   0.0  0.0 23.2  22.9
User DelAdj: 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
AdjDel/Veh:   0.0  0.0   0.0 10.0  0.0   7.9 27.8 17.1   0.0  0.0 23.2  22.9
LOS by Move:    A    A     A   B+    A     A    C    B     A    A    C    C+
HCM2kAvgQ:      0    0     0    9    0     5    3    2     0    0    3     2
********************************************************************************
Note: Queue reported is the number of cars per lane.
```

Planetary Ventures
MFA Hangar 3 Project

Level Of Service Computation Report
2000 HCM Operations Method (Future Volume Alternative)

Intersection #7 US 101 NB & Moffett Park

| | | | |
|---|---|---|---|
| Cycle (sec): | 60 | Critical Vol./Cap.(X): | 0.718 |
| Loss Time (sec): | 9 | Average Delay (sec/veh): | 13.7 |
| Optimal Cycle: | 48 | Level Of Service: | B |

| Street Name: | US 101 NB | | | | | | Moffett Park | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach: | North Bound | | | South Bound | | | East Bound | | | West Bound | | |
| Movement: | L | T | R | L | T | R | L | T | R | L | T | R |
| Control: | Protected | | | Protected | | | Protected | | | Protected | | |
| Rights: | Include | | | Include | | | Include | | | Include | | |
| Min. Green: | 7 | 10 | 10 | 7 | 10 | 10 | 7 | 10 | 10 | 7 | 10 | 10 |
| Y+R: | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lanes: | 0 0 | 0 | 0 0 | 0 0 | 0 | 0 0 | 0 0 | 1 | 0 1 | 1 0 | 1 | 0 0 |
| **Volume Module:PM Peak Hour** | | | | | | | | | | | | |
| Base Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 616 | 130 | 469 | 266 | 0 |
| Growth Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Initial Bse: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 616 | 130 | 469 | 266 | 0 |
| Added Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| New Trips: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Initial Fut: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 616 | 130 | 469 | 266 | 0 |
| User Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| PHF Adj: | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 |
| PHF Volume: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 635 | 134 | 484 | 274 | 0 |
| Reduct Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 635 | 134 | 484 | 274 | 0 |
| PCE Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| MLF Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| FinalVolume: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 635 | 134 | 484 | 274 | 0 |
| **Saturation Flow Module:** | | | | | | | | | | | | |
| Sat/Lane: | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Adjustment: | 0.92 | 1.00 | 0.92 | 0.92 | 1.00 | 0.92 | 0.92 | 1.00 | 0.92 | 0.92 | 1.00 | 0.92 |
| Lanes: | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.00 |
| Final Sat.: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1900 | 1750 | 1750 | 1900 | 0 |
| **Capacity Analysis Module:** | | | | | | | | | | | | |
| Vol/Sat: | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.33 | 0.08 | 0.28 | 0.14 | 0.00 |
| Crit Moves: | | | | | | | | **** | | **** | | |
| Green Time: | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 27.9 | 27.9 | 23.1 | 51.0 | 0.0 |
| Volume/Cap: | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.72 | 0.16 | 0.72 | 0.17 | 0.00 |
| Delay/Veh: | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 15.8 | 9.4 | 19.4 | 0.8 | 0.0 |
| User DelAdj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| AdjDel/Veh: | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 15.8 | 9.4 | 19.4 | 0.8 | 0.0 |
| LOS by Move: | A | A | A | A | A | A | A | B | A | B- | A | A |
| HCM2kAvgQ: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 2 | 10 | 1 | 0 |

Note: Queue reported is the number of cars per lane.

```
--------------------------------------------------------------------------------
                              Planetary Ventures
                             MFA Hangar 3 Project
--------------------------------------------------------------------------------
                        Level Of Service Computation Report
                2000 HCM 4-Way Stop Method (Future Volume Alternative)
********************************************************************************
Intersection #8 Innovation & 11th
********************************************************************************
Cycle (sec):          100               Critical Vol./Cap.(X):         0.856
Loss Time (sec):        0               Average Delay (sec/veh):        20.3
Optimal Cycle:          0               Level Of Service:                  C
********************************************************************************
Street Name:                 Innovation                           11th
Approach:       North Bound      South Bound       East Bound       West Bound
Movement:     L  -  T  -  R   L  -  T  -  R   L  -  T  -  R   L  -  T  -  R
------------|---------------||---------------||---------------||---------------|
Control:        Stop Sign        Stop Sign        Stop Sign        Stop Sign
Rights:          Include          Include          Include          Include
Min. Green:     0     0     0     0     0     0     0     0     0     0     0     0
Lanes:        1  1  0  1  0   1  0  1  1  0   1  0  0  1  1   0  0  1! 0  0
------------|---------------||---------------||---------------||---------------|
Volume Module:PM Peak Hour
Base Vol:      55    56    50    30    71    54   393    20   312    20    10    50
Growth Adj:  1.00  1.00  1.00  1.00  1.00  1.00  1.00  1.00  1.00  1.00  1.00  1.00
Initial Bse:   55    56    50    30    71    54   393    20   312    20    10    50
Added Vol:      0     0     0     0     0     0     0     0     0     0     0     0
New Trips:      0     0     0     0     0     0     0     0     0     0     0     0
Initial Fut:   55    56    50    30    71    54   393    20   312    20    10    50
User Adj:    1.00  1.00  1.00  1.00  1.00  1.00  1.00  1.00  1.00  1.00  1.00  1.00
PHF Adj:     0.88  0.88  0.88  0.88  0.88  0.88  0.88  0.88  0.88  0.88  0.88  0.88
PHF Volume:    63    64    57    34    81    61   447    23   355    23    11    57
Reduct Vol:     0     0     0     0     0     0     0     0     0     0     0     0
Reduced Vol:   63    64    57    34    81    61   447    23   355    23    11    57
PCE Adj:     1.00  1.00  1.00  1.00  1.00  1.00  1.00  1.00  1.00  1.00  1.00  1.00
MLF Adj:     1.00  1.00  1.00  1.00  1.00  1.00  1.00  1.00  1.00  1.00  1.00  1.00
FinalVolume:   63    64    57    34    81    61   447    23   355    23    11    57
------------|---------------||---------------||---------------||---------------|
Saturation Flow Module:
Adjustment:  1.00  1.00  1.00  1.00  1.00  1.00  1.00  1.00  1.00  1.00  1.00  1.00
Lanes:       1.02  1.04  0.94  1.00  1.14  0.86  1.00  0.12  1.88  0.25  0.13  0.62
Final Sat.:   434   472   461   422   515   419   521    74  1165   136    68   339
------------|---------------||---------------||---------------||---------------|
Capacity Analysis Module:
Vol/Sat:     0.14  0.13  0.12  0.08  0.16  0.15  0.86  0.31  0.30  0.17  0.17  0.17
Crit Moves:  ****                    ****        ****                    ****
Delay/Veh:   12.0  11.3  10.5  11.4  11.5  10.8  37.5  10.9  10.8  10.5  10.5  10.5
Delay Adj:   1.00  1.00  1.00  1.00  1.00  1.00  1.00  1.00  1.00  1.00  1.00  1.00
AdjDel/Veh:  12.0  11.3  10.5  11.4  11.5  10.8  37.5  10.9  10.8  10.5  10.5  10.5
LOS by Move:    B     B     B     B     B     B     E     B     B     B     B     B
ApproachDel:       11.3              11.2              25.3              10.5
Delay Adj:         1.00              1.00              1.00              1.00
ApprAdjDel:        11.3              11.2              25.3              10.5
LOS by Appr:          B                 B                 D                 B
AllWayAvgQ:   0.1   0.1   0.1   0.1   0.2   0.1   4.0   0.4   0.4   0.2   0.2   0.2
********************************************************************************
Note: Queue reported is the number of cars per lane.
```

Planetary Ventures
MFA Hangar 3 Project

Level Of Service Computation Report
2000 HCM Operations Method (Future Volume Alternative)

Intersection #9 Innovation & Moffett Park

| | | | |
|---|---|---|---|
| Cycle (sec): | 60 | Critical Vol./Cap.(X): | 0.498 |
| Loss Time (sec): | 9 | Average Delay (sec/veh): | 15.4 |
| Optimal Cycle: | 39 | Level Of Service: | B |

| Street Name: | Innovation | | | | | | Moffett Park | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach: | North Bound | | | South Bound | | | East Bound | | | West Bound | | |
| Movement: | L | T | R | L | T | R | L | T | R | L | T | R |
| Control: | Protected | | | Protected | | | Protected | | | Protected | | |
| Rights: | Include | | | Include | | | Include | | | Include | | |
| Min. Green: | 0 | 0 | 0 | 7 | 0 | 10 | 10 | 10 | 0 | 0 | 10 | 10 |
| Y+R: | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lanes: | 0 0 | 0 | 0 0 | 1 0 | 1! | 0 0 | 1 0 | 2 | 0 0 | 0 0 | 2 | 0 1 |
| **Volume Module:PM Peak Hour** | | | | | | | | | | | | |
| Base Vol: | 0 | 0 | 0 | 337 | 0 | 258 | 72 | 541 | 0 | 0 | 447 | 80 |
| Growth Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Initial Bse: | 0 | 0 | 0 | 337 | 0 | 258 | 72 | 541 | 0 | 0 | 447 | 80 |
| Added Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| New Trips: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Initial Fut: | 0 | 0 | 0 | 337 | 0 | 258 | 72 | 541 | 0 | 0 | 447 | 80 |
| User Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| PHF Adj: | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| PHF Volume: | 0 | 0 | 0 | 355 | 0 | 272 | 76 | 569 | 0 | 0 | 471 | 84 |
| Reduct Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced Vol: | 0 | 0 | 0 | 355 | 0 | 272 | 76 | 569 | 0 | 0 | 471 | 84 |
| PCE Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| MLF Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| FinalVolume: | 0 | 0 | 0 | 355 | 0 | 272 | 76 | 569 | 0 | 0 | 471 | 84 |
| **Saturation Flow Module:** | | | | | | | | | | | | |
| Sat/Lane: | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Adjustment: | 0.92 | 1.00 | 0.92 | 0.92 | 1.00 | 0.92 | 0.92 | 1.00 | 0.92 | 0.92 | 1.00 | 0.92 |
| Lanes: | 0.00 | 0.00 | 0.00 | 1.40 | 0.00 | 0.60 | 1.00 | 2.00 | 0.00 | 0.00 | 2.00 | 1.00 |
| Final Sat.: | 0 | 0 | 0 | 2441 | 0 | 1059 | 1750 | 3800 | 0 | 0 | 3800 | 1750 |
| **Capacity Analysis Module:** | | | | | | | | | | | | |
| Vol/Sat: | 0.00 | 0.00 | 0.00 | 0.15 | 0.00 | 0.26 | 0.04 | 0.15 | 0.00 | 0.00 | 0.12 | 0.05 |
| Crit Moves: | | | | | | **** | **** | | | | **** | |
| Green Time: | 0.0 | 0.0 | 0.0 | 27.7 | 0.0 | 27.7 | 10.0 | 23.3 | 0.0 | 0.0 | 13.3 | 13.3 |
| Volume/Cap: | 0.00 | 0.00 | 0.00 | 0.32 | 0.00 | 0.56 | 0.26 | 0.39 | 0.00 | 0.00 | 0.56 | 0.22 |
| Delay/Veh: | 0.0 | 0.0 | 0.0 | 10.3 | 0.0 | 12.4 | 22.3 | 13.3 | 0.0 | 0.0 | 21.5 | 19.3 |
| User DelAdj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| AdjDel/Veh: | 0.0 | 0.0 | 0.0 | 10.3 | 0.0 | 12.4 | 22.3 | 13.3 | 0.0 | 0.0 | 21.5 | 19.3 |
| LOS by Move: | A | A | A | B+ | A | B | C+ | B | A | A | C+ | B- |
| HCM2kAvgQ: | 0 | 0 | 0 | 3 | 0 | 7 | 2 | 4 | 0 | 0 | 5 | 2 |

Note: Queue reported is the number of cars per lane.

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--------------------------------------------------------------------------------
                            Planetary Ventures
                           MFA Hangar 3 Project
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                     Level Of Service Computation Report
               2000 HCM Operations Method (Future Volume Alternative)
********************************************************************************
Intersection #10 Mathilda & 5th
********************************************************************************
Cycle (sec):           60                  Critical Vol./Cap.(X):         0.346
Loss Time (sec):       12                  Average Delay (sec/veh):        19.1
Optimal Cycle:         46                  Level Of Service:                 B-
********************************************************************************
Street Name:                Mathilda                                5th
Approach:       North Bound      South Bound       East Bound        West Bound
Movement:     L  -  T  -  R    L  -  T  -  R    L  -  T  -  R    L  -  T  -  R
------------|----------------||----------------||----------------||----------------|
Control:        Protected         Protected         Protected         Protected
Rights:           Include           Ignore            Include           Include
Min. Green:     7   10    10     7   10    10     7   10    10     7   10    10
Y+R:          4.0  4.0   4.0   4.0  4.0   4.0   4.0  4.0   4.0   4.0  4.0   4.0
Lanes:        2  0  2  1  0    1  0  3  0  9    2  0  1  0  1    2  0  0  1  0
------------|----------------||----------------||----------------||----------------|
Volume Module:PM Peak Hour
Base Vol:      11  290    40     3  580    24   128   15    87   261   13    27
Growth Adj:  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
Initial Bse:   11  290    40     3  580    24   128   15    87   261   13    27
Added Vol:      0    0     0     0    0     0     0    0     0     0    0     0
New Trips:      0    0     0     0    0     0     0    0     0     0    0     0
Initial Fut:   11  290    40     3  580    24   128   15    87   261   13    27
User Adj:    1.00 1.00  1.00  1.00 1.00  0.00  1.00 1.00  1.00  1.00 1.00  1.00
PHF Adj:     0.86 0.86  0.86  0.86 0.86  0.00  0.86 0.86  0.86  0.86 0.86  0.86
PHF Volume:    13  337    47     3  674     0   149   17   101   303   15    31
Reduct Vol:     0    0     0     0    0     0     0    0     0     0    0     0
Reduced Vol:   13  337    47     3  674     0   149   17   101   303   15    31
PCE Adj:     1.00 1.00  1.00  1.00 1.00  0.00  1.00 1.00  1.00  1.00 1.00  1.00
MLF Adj:     1.00 1.00  1.00  1.00 1.00  0.00  1.00 1.00  1.00  1.00 1.00  1.00
FinalVolume:   13  337    47     3  674     0   149   17   101   303   15    31
------------|----------------||----------------||----------------||----------------|
Saturation Flow Module:
Sat/Lane:    1900 1900  1900  1900 1900  1900  1900 1900  1900  1900 1900  1900
Adjustment:  0.83 0.99  0.95  0.92 1.00  0.80  0.83 1.00  0.92  0.83 0.95  0.95
Lanes:       2.00 2.62  0.38  1.00 3.00  9.00  2.00 1.00  1.00  2.00 0.33  0.67
Final Sat.:  3150 4920   679  1750 5700 13653  3150 1900  1750  3150  585  1215
------------|----------------||----------------||----------------||----------------|
Capacity Analysis Module:
Vol/Sat:     0.00 0.07  0.07  0.00 0.12  0.00  0.05 0.01  0.06  0.10 0.03  0.03
Crit Moves:  ****                   ****                     ****  ****
Green Time:   7.0 14.2  14.2   9.9 17.1   0.0   9.8 10.0  10.0  13.9 14.1  14.1
Volume/Cap:  0.03 0.29  0.29  0.01 0.42  0.00  0.29 0.06  0.35  0.42 0.11  0.11
Delay/Veh:   23.5 18.9  18.9  21.0 17.6   0.0  22.3 21.1  22.8  20.0 18.2  18.2
User DelAdj: 1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
AdjDel/Veh:  23.5 18.9  18.9  21.0 17.6   0.0  22.3 21.1  22.8  20.0 18.2  18.2
LOS by Move:    C   B-    B-    C+    B     A    C+   C+    C+    B-   B-    B-
HCM2kAvgQ:      0    2     2     0    4     0     2    0     2     3    1     1
********************************************************************************
Note: Queue reported is the number of cars per lane.
```

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--------------------------------------------------------------------------------
                           Planetary Ventures
                          MFA Hangar 3 Project
--------------------------------------------------------------------------------
                     Level Of Service Computation Report
          2000 HCM Operations Method (Future Volume Alternative)
********************************************************************************
Intersection #11 Mathilda & Moffett Park
********************************************************************************
Cycle (sec):          70                Critical Vol./Cap.(X):         0.704
Loss Time (sec):      12                Average Delay (sec/veh):        28.0
Optimal Cycle:        55                Level Of Service:                  C
********************************************************************************
Street Name:               Mathilda                          Moffett Park
Approach:      North Bound      South Bound      East Bound       West Bound
Movement:     L  -  T  -  R   L  -  T  -  R   L  -  T  -  R   L  -  T  -  R
------------|---------------||---------------||---------------||---------------|
Control:       Protected        Protected        Protected        Protected
Rights:          Include          Include          Ignore           Include
Min. Green:     7   10    10     7   10    10     7   10    10     7   10    10
Y+R:          4.0  4.0   4.0   4.0  4.0   4.0   4.0  4.0   4.0   4.0  4.0   4.0
Lanes:        2  0  2  1  0   1  0  3  1  0   1  0  1  0  1   2  0  0  1  0
------------|---------------||---------------||---------------||---------------|
Volume Module:PM Peak Hour
Base Vol:     162  249   237    21 1383    59    58  269   445   513  294     9
Growth Adj:  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
Initial Bse:  162  249   237    21 1383    59    58  269   445   513  294     9
Added Vol:      0    0     0     0    0     0     0    0     0     0    0     0
New Trips:      0    0     0     0    0     0     0    0     0     0    0     0
Initial Fut:  162  249   237    21 1383    59    58  269   445   513  294     9
User Adj:    1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  0.00  1.00 1.00  1.00
PHF Adj:     0.94 0.94  0.94  0.94 0.94  0.94  0.94 0.94  0.00  0.94 0.94  0.94
PHF Volume:   172  265   252    22 1471    63    62  286     0   546  313    10
Reduct Vol:     0    0     0     0    0     0     0    0     0     0    0     0
Reduced Vol:  172  265   252    22 1471    63    62  286     0   546  313    10
PCE Adj:     1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  0.00  1.00 1.00  1.00
MLF Adj:     1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  0.00  1.00 1.00  1.00
FinalVolume:  172  265   252    22 1471    63    62  286     0   546  313    10
------------|---------------||---------------||---------------||---------------|
Saturation Flow Module:
Sat/Lane:    1900 1900  1900  1900 1900  1900  1900 1900  1900  1900 1900  1900
Adjustment:  0.83 1.00  0.92  0.92 0.99  0.95  0.92 1.00  0.92  0.83 0.95  0.95
Lanes:       2.00 2.00  1.00  1.00 3.83  0.17  1.00 1.00  1.00  2.00 0.97  0.03
Final Sat.:  3150 3800  1750  1750 7193   307  1750 1900  1750  3150 1747    53
------------|---------------||---------------||---------------||---------------|
Capacity Analysis Module:
Vol/Sat:     0.05 0.07  0.14  0.01 0.20  0.20  0.04 0.15  0.00  0.17 0.18  0.18
Crit Moves:  ****                   ****              ****        ****
Green Time:   7.0 15.8  15.8  11.0 19.7  19.7  11.2 14.5   0.0  16.7 20.1  20.1
Volume/Cap:  0.55 0.31  0.64  0.08 0.73  0.73  0.22 0.73  0.00  0.73 0.62  0.62
Delay/Veh:   66.3 29.1  26.3  25.4 24.0  24.0  26.0 32.4   0.0  28.1 24.1  24.1
User DelAdj: 1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
AdjDel/Veh:  66.3 29.1  26.3  25.4 24.0  24.0  26.0 32.4   0.0  28.1 24.1  24.1
LOS by Move:    E    C     C     C    C     C     C   C-     A     C    C     C
HCM2kAvgQ:      3    3     6     0    9     9     1    7     0     8    7     7
********************************************************************************
Note: Queue reported is the number of cars per lane.
```

Planetary Ventures
MFA Hangar 3 Project

Level Of Service Computation Report
2000 HCM Operations Method (Future Volume Alternative)

Intersection #12 Mathilda & Hwy 237 WB

| | | | |
|---|---|---|---|
| Cycle (sec): | 60 | Critical Vol./Cap.(X): | 0.665 |
| Loss Time (sec): | 9 | Average Delay (sec/veh): | 13.6 |
| Optimal Cycle: | 43 | Level Of Service: | B |

| Street Name: | Mathilda | | | | | | Hwy 237 WB | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach: | North Bound | | | South Bound | | | East Bound | | | West Bound | | |
| Movement: | L | T | R | L | T | R | L | T | R | L | T | R |
| Control: | Protected | | | Protected | | | Protected | | | Protected | | |
| Rights: | Include | | | Include | | | Include | | | Include | | |
| Min. Green: | 7 | 10 | 0 | 0 | 10 | 10 | 0 | 0 | 0 | 7 | 10 | 10 |
| Y+R: | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lanes: | 1 0 | 4 | 0 0 | 0 0 | 3 | 1 0 | 0 0 | 0 | 0 0 | 1 1 | 0 | 0 1 |
| Volume Module:PM Peak Hour | | | | | | | | | | | | |
| Base Vol: | 89 | 606 | 0 | 0 | 1855 | 489 | 0 | 0 | 0 | 584 | 11 | 36 |
| Growth Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Initial Bse: | 89 | 606 | 0 | 0 | 1855 | 489 | 0 | 0 | 0 | 584 | 11 | 36 |
| Added Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| New Trips: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Initial Fut: | 89 | 606 | 0 | 0 | 1855 | 489 | 0 | 0 | 0 | 584 | 11 | 36 |
| User Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| PHF Adj: | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| PHF Volume: | 95 | 645 | 0 | 0 | 1973 | 520 | 0 | 0 | 0 | 621 | 12 | 38 |
| Reduct Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced Vol: | 95 | 645 | 0 | 0 | 1973 | 520 | 0 | 0 | 0 | 621 | 12 | 38 |
| PCE Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| MLF Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| FinalVolume: | 95 | 645 | 0 | 0 | 1973 | 520 | 0 | 0 | 0 | 621 | 12 | 38 |
| Saturation Flow Module: | | | | | | | | | | | | |
| Sat/Lane: | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Adjustment: | 0.92 | 1.00 | 0.92 | 0.92 | 1.00 | 0.95 | 0.92 | 1.00 | 0.92 | 0.93 | 0.95 | 0.92 |
| Lanes: | 1.00 | 4.00 | 0.00 | 0.00 | 3.13 | 0.87 | 0.00 | 0.00 | 0.00 | 1.96 | 0.04 | 1.00 |
| Final Sat.: | 1750 | 7600 | 0 | 0 | 5933 | 1564 | 0 | 0 | 0 | 3484 | 66 | 1750 |
| Capacity Analysis Module: | | | | | | | | | | | | |
| Vol/Sat: | 0.05 | 0.08 | 0.00 | 0.00 | 0.33 | 0.33 | 0.00 | 0.00 | 0.00 | 0.18 | 0.18 | 0.02 |
| Crit Moves: | **** | | | | **** | | | | | **** | | |
| Green Time: | 7.0 | 35.6 | 0.0 | 0.0 | 28.6 | 28.6 | 0.0 | 0.0 | 0.0 | 15.4 | 15.4 | 15.4 |
| Volume/Cap: | 0.46 | 0.14 | 0.00 | 0.00 | 0.70 | 0.70 | 0.00 | 0.00 | 0.00 | 0.70 | 0.70 | 0.09 |
| Delay/Veh: | 26.4 | 5.4 | 0.0 | 0.0 | 12.9 | 12.9 | 0.0 | 0.0 | 0.0 | 22.6 | 22.6 | 17.1 |
| User DelAdj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| AdjDel/Veh: | 26.4 | 5.4 | 0.0 | 0.0 | 12.9 | 12.9 | 0.0 | 0.0 | 0.0 | 22.6 | 22.6 | 17.1 |
| LOS by Move: | C | A | A | A | B | B | A | A | A | C+ | C+ | B |
| HCM2kAvgQ: | 2 | 1 | 0 | 0 | 10 | 10 | 0 | 0 | 0 | 7 | 7 | 1 |

Note: Queue reported is the number of cars per lane.

Planetary Ventures
MFA Hangar 3 Project

Level Of Service Computation Report
2000 HCM Operations Method (Future Volume Alternative)

Intersection #13 Mathilda & Hwy 237 EB

| | | | |
|---|---|---|---|
| Cycle (sec): | 60 | Critical Vol./Cap.(X): | 0.596 |
| Loss Time (sec): | 9 | Average Delay (sec/veh): | 11.1 |
| Optimal Cycle: | 38 | Level Of Service: | B+ |

| Street Name: | Mathilda | | | | | | Hwy 237 EB | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach: | North Bound | | | South Bound | | | East Bound | | | West Bound | | |
| Movement: | L | T | R | L | T | R | L | T | R | L | T | R |
| Control: | Protected | | | Protected | | | Protected | | | Protected | | |
| Rights: | Ignore | | | Include | | | Include | | | Include | | |
| Min. Green: | 0 | 10 | 10 | 7 | 10 | 0 | 7 | 10 | 10 | 0 | 0 | 0 |
| Y+R: | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lanes: | 0 0 | 5 | 0 1 | 1 0 | 3 | 0 0 | 2 1 | 0 | 0 1 | 0 0 | 0 | 0 0 |
| **Volume Module:PM Peak Hour** | | | | | | | | | | | | |
| Base Vol: | 0 | 478 | 563 | 339 | 2128 | 0 | 214 | 11 | 224 | 0 | 0 | 0 |
| Growth Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Initial Bse: | 0 | 478 | 563 | 339 | 2128 | 0 | 214 | 11 | 224 | 0 | 0 | 0 |
| Added Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| New Trips: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Initial Fut: | 0 | 478 | 563 | 339 | 2128 | 0 | 214 | 11 | 224 | 0 | 0 | 0 |
| User Adj: | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| PHF Adj: | 0.99 | 0.99 | 0.00 | 0.99 | 0.99 | 0.99 | 0.99 | 0.99 | 0.99 | 0.99 | 0.99 | 0.99 |
| PHF Volume: | 0 | 483 | 0 | 342 | 2149 | 0 | 216 | 11 | 226 | 0 | 0 | 0 |
| Reduct Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced Vol: | 0 | 483 | 0 | 342 | 2149 | 0 | 216 | 11 | 226 | 0 | 0 | 0 |
| PCE Adj: | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| MLF Adj: | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| FinalVolume: | 0 | 483 | 0 | 342 | 2149 | 0 | 216 | 11 | 226 | 0 | 0 | 0 |
| **Saturation Flow Module:** | | | | | | | | | | | | |
| Sat/Lane: | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Adjustment: | 0.92 | 1.00 | 0.92 | 0.92 | 1.00 | 0.92 | 0.86 | 0.95 | 0.92 | 0.92 | 1.00 | 0.92 |
| Lanes: | 0.00 | 5.00 | 1.00 | 1.00 | 3.00 | 0.00 | 2.87 | 0.13 | 1.00 | 0.00 | 0.00 | 0.00 |
| Final Sat.: | 0 | 9500 | 1750 | 1750 | 5700 | 0 | 4706 | 242 | 1750 | 0 | 0 | 0 |
| **Capacity Analysis Module:** | | | | | | | | | | | | |
| Vol/Sat: | 0.00 | 0.05 | 0.00 | 0.20 | 0.38 | 0.00 | 0.05 | 0.05 | 0.13 | 0.00 | 0.00 | 0.00 |
| Crit Moves: | **** | | | | **** | | | | **** | | | |
| Green Time: | 0.0 | 17.5 | 0.0 | 20.5 | 38.0 | 0.0 | 13.0 | 13.0 | 13.0 | 0.0 | 0.0 | 0.0 |
| Volume/Cap: | 0.00 | 0.17 | 0.00 | 0.57 | 0.60 | 0.00 | 0.21 | 0.21 | 0.60 | 0.00 | 0.00 | 0.00 |
| Delay/Veh: | 0.0 | 15.9 | 0.0 | 17.5 | 6.8 | 0.0 | 19.4 | 19.4 | 23.7 | 0.0 | 0.0 | 0.0 |
| User DelAdj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| AdjDel/Veh: | 0.0 | 15.9 | 0.0 | 17.5 | 6.8 | 0.0 | 19.4 | 19.4 | 23.7 | 0.0 | 0.0 | 0.0 |
| LOS by Move: | A | B | A | B | A | A | B- | B- | C | A | A | A |
| HCM2kAvgQ: | 0 | 1 | 0 | 6 | 8 | 0 | 1 | 1 | 5 | 0 | 0 | 0 |

Note: Queue reported is the number of cars per lane.

# 2022 Background Conditions

Planetary Ventures
MFA Hangar 3 Project

Scenario Report

| | |
|---|---|
| Scenario: | 2022 Background - AM Peak |
| Command: | Default Command |
| Volume: | 2022 Background - AM Peak |
| Geometry: | Existing |
| Impact Fee: | Default Impact Fee |
| Trip Generation: | Default Trip Generation |
| Trip Distribution: | Default Trip Distribution |
| Paths: | Default Path |
| Routes: | Default Route |
| Configuration: | Default Configuration |

Planetary Ventures
MFA Hangar 3 Project

Impact Analysis Report
Level Of Service

| Intersection | Base LOS | Base Del/Veh | Base V/C | Future LOS | Future Del/Veh | Future V/C | Change in |
|---|---|---|---|---|---|---|---|
| # 1 Ellis & Manila | B | 11.1 | 0.496 | B | 11.1 | 0.496 | + 0.000 V/C |
| # 2 Ellis & US 101 NB | C | 24.8 | 0.638 | C | 24.8 | 0.638 | + 0.000 D/V |
| # 3 Ellis & US 101 SB | D+ | 35.7 | 0.526 | D+ | 35.7 | 0.526 | + 0.000 D/V |
| # 4 Enterprise & 5th | A | 8.7 | 0.220 | A | 8.7 | 0.220 | + 0.000 V/C |
| # 5 Enterprise & 11th | B+ | 11.6 | 0.432 | B+ | 11.6 | 0.432 | + 0.000 D/V |
| # 6 Enterprise & Manila/Moffett Pa | C- | 33.3 | 0.816 | C- | 33.3 | 0.816 | + 0.000 D/V |
| # 7 US 101 NB & Moffett Park | A | 5.4 | 0.454 | A | 5.4 | 0.454 | + 0.000 D/V |
| # 8 Innovation & 11th | B | 14.4 | 0.649 | B | 14.4 | 0.649 | + 0.000 V/C |
| # 9 Innovation & Moffett Park | B+ | 11.7 | 0.566 | B+ | 11.7 | 0.566 | + 0.000 D/V |
| # 10 Mathilda & 5th | B | 16.3 | 0.270 | B | 16.3 | 0.270 | + 0.000 D/V |
| # 11 Mathilda & Moffett Park | C- | 32.7 | 0.922 | C- | 32.7 | 0.922 | + 0.000 D/V |
| # 12 Mathilda & Hwy 237 WB | A | 0.3 | 0.350 | A | 0.3 | 0.350 | + 0.000 D/V |
| # 13 Mathilda & Hwy 237 EB | B | 17.7 | 0.746 | B | 17.7 | 0.746 | + 0.000 D/V |

```
--------------------------------------------------------------------------------
                          Planetary Ventures
                         MFA Hangar 3 Project
--------------------------------------------------------------------------------
                     Level Of Service Computation Report
           2000 HCM 4-Way Stop Method (Future Volume Alternative)
********************************************************************************
Intersection #1 Ellis & Manila
********************************************************************************
Cycle (sec):         100               Critical Vol./Cap.(X):        0.496
Loss Time (sec):      12               Average Delay (sec/veh):       11.1
Optimal Cycle:         0               Level Of Service:                 B
********************************************************************************
Street Name:                Ellis                               Manila
Approach:      North Bound      South Bound      East Bound       West Bound
Movement:     L  -  T  -  R   L  -  T  -  R   L  -  T  -  R   L  -  T  -  R
------------|----------------||----------------||----------------||----------------|
Control:        Stop Sign        Stop Sign        Stop Sign        Stop Sign
Rights:           Ignore          Include          Include          Include
Min. Green:     7   10    10    7   10    10    7   10    10    7   10    10
Lanes:        0  0  2  0  1   0  1  1  0  0   0  0  0  0  1   0  0  1! 0  0
------------|----------------||----------------||----------------||----------------|
Volume Module:AM Peak Hour
Base Vol:       0  290   741    5   62     0    0    0     0  279    0    50
Growth Adj:  1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
Initial Bse:    0  290   741    5   62     0    0    0     0  279    0    50
Added Vol:      0    0     0    0    0     0    0    0     0    0    0     0
New Trips:      0    0     0    0    0     0    0    0     0    0    0     0
Initial Fut:    0  290   741    5   62     0    0    0     0  279    0    50
User Adj:    1.00 1.00  0.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
PHF Adj:     0.95 0.95  0.00 0.95 0.95  0.95 0.95 0.95  0.95 0.95 0.95  0.95
PHF Volume:     0  305     0    5   65     0    0    0     0  294    0    53
Reduct Vol:     0    0     0    0    0     0    0    0     0    0    0     0
Reduced Vol:    0  305     0    5   65     0    0    0     0  294    0    53
PCE Adj:     1.00 1.00  0.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
MLF Adj:     1.00 1.00  0.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
FinalVolume:    0  305     0    5   65     0    0    0     0  294    0    53
------------|----------------||----------------||----------------||----------------|
Saturation Flow Module:
Adjustment:  1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
Lanes:       0.00 2.00  1.00 0.15 1.85  0.00 0.00 0.00  1.00 0.85 0.00  0.15
Final Sat.:     0 1247   709   86 1069     0    0    0   700  593    0   106
------------|----------------||----------------||----------------||----------------|
Capacity Analysis Module:
Vol/Sat:     xxxx 0.24  0.00 0.06 0.06  xxxx xxxx xxxx  0.00 0.50 xxxx  0.50
Crit Moves:       ****       ****                       ****  ****
Delay/Veh:    0.0 10.0   0.0  9.0  8.9   0.0  0.0  0.0   0.0 12.6  0.0  12.6
Delay Adj:   1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
AdjDel/Veh:   0.0 10.0   0.0  9.0  8.9   0.0  0.0  0.0   0.0 12.6  0.0  12.6
LOS by Move:    *    A     *    A    A     *    *    *     *    B    *     B
ApproachDel:      10.0              8.9            xxxxxx            12.6
Delay Adj:        1.00             1.00             xxxxx            1.00
ApprAdjDel:       10.0              8.9            xxxxxx            12.6
LOS by Appr:         A                A                 *               B
AllWayAvgQ:   0.0  0.3   0.0  0.1  0.1   0.0  0.0  0.0   0.0  0.9  0.9   0.9
********************************************************************************
Note: Queue reported is the number of cars per lane.
```

```
--------------------------------------------------------------------------------
                          Planetary Ventures
                          MFA Hangar 3 Project
--------------------------------------------------------------------------------
                   Level Of Service Computation Report
         2000 HCM Operations Method (Future Volume Alternative)
********************************************************************************
Intersection #2 Ellis & US 101 NB
********************************************************************************
Cycle (sec):         55                 Critical Vol./Cap.(X):         0.638
Loss Time (sec):      9                 Average Delay (sec/veh):        24.8
Optimal Cycle:       40                 Level Of Service:                  C
********************************************************************************
Street Name:                 Ellis                          US 101 NB
Approach:      North Bound      South Bound      East Bound       West Bound
Movement:    L  -  T  -  R   L  -  T  -  R   L  -  T  -  R   L  -  T  -  R
------------|---------------||---------------||---------------||---------------|
Control:      Split Phase      Split Phase       Protected        Protected
Rights:          Include          Include          Include          Include
Min. Green:    7   10    10    7   10    10    7   10    10    7   10    10
Y+R:         4.0  4.0   4.0  4.0  4.0   4.0  4.0  4.0   4.0  4.0  4.0   4.0
Lanes:       0  1  1  0  0   0  0  1  1  0   0  0  0  0  0   0  1  0  0  2
------------|---------------||---------------||---------------||---------------|
Volume Module:AM Peak Hour
Base Vol:     83  856     0    0  141   214    0    0     0  310    2   183
Growth Adj:  1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
Initial Bse:  83  856     0    0  141   214    0    0     0  310    2   183
Added Vol:     0    0     0    0    0     0    0    0     0    0    0     0
New Trips:     0    0     0    0    0     0    0    0     0    0    0     0
Initial Fut:  83  856     0    0  141   214    0    0     0  310    2   183
User Adj:    1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
PHF Adj:     0.94 0.94  0.94 0.94 0.94  0.94 0.94 0.94  0.94 0.94 0.94  0.94
PHF Volume:   88  911     0    0  150   228    0    0     0  330    2   195
Reduct Vol:    0    0     0    0    0     0    0    0     0    0    0     0
Reduced Vol:  88  911     0    0  150   228    0    0     0  330    2   195
PCE Adj:     1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
MLF Adj:     1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
FinalVolume:  88  911     0    0  150   228    0    0     0  330    2   195
------------|---------------||---------------||---------------||---------------|
Saturation Flow Module:
Sat/Lane:    1900 1900  1900 1900 1900  1900 1900 1900  1900 1900 1900  1900
Adjustment:  0.95 0.98  0.92 0.92 1.00  0.92 0.92 1.00  0.92 0.95 0.95  0.83
Lanes:       0.18 1.82  0.00 0.00 1.00  1.00 0.00 0.00  0.00 0.99 0.01  2.00
Final Sat.:   327 3373     0    0 1900  1750    0    0     0 1788   12  3150
------------|---------------||---------------||---------------||---------------|
Capacity Analysis Module:
Vol/Sat:     0.27 0.27  0.00 0.00 0.08  0.13 0.00 0.00  0.00 0.18 0.18  0.06
Crit Moves:  ****                 ****                          ****
Green Time:  20.7 20.7   0.0  0.0 11.2  11.2  0.0  0.0   0.0 14.1 14.1  14.1
Volume/Cap:  0.72 0.72  0.00 0.00 0.39  0.64 0.00 0.00  0.00 0.72 0.72  0.24
Delay/Veh:   28.2 28.2   0.0  0.0 19.2  22.4  0.0  0.0   0.0 24.0 24.0  16.4
User DelAdj: 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
AdjDel/Veh:  28.2 28.2   0.0  0.0 19.2  22.4  0.0  0.0   0.0 24.0 24.0  16.4
LOS by Move:    C    C     A    A   B-    C+    A    A     A    C    C     B
HCM2kAvgQ:      9    9     0    0    3     5    0    0     0    7    7     2
********************************************************************************
Note: Queue reported is the number of cars per lane.
```

```
------------------------------------------------------------------------------
                            Planetary Ventures
                           MFA Hangar 3 Project
------------------------------------------------------------------------------
                    Level Of Service Computation Report
            2000 HCM Operations Method (Future Volume Alternative)
******************************************************************************
Intersection #3 Ellis & US 101 SB
******************************************************************************
Cycle (sec):          55                Critical Vol./Cap.(X):         0.526
Loss Time (sec):       9                Average Delay (sec/veh):        35.7
Optimal Cycle:        36                Level Of Service:                 D+
******************************************************************************
Street Name:                 Ellis                             US 101 SB
Approach:      North Bound      South Bound      East Bound       West Bound
Movement:     L  -  T  -  R   L  -  T  -  R   L  -  T  -  R   L  -  T  -  R
------------|---------------||---------------||---------------||---------------|
Control:        Protected        Protected        Protected        Protected
Rights:           Ignore          Include          Include          Include
Min. Green:     7   10    10    7   10    10    7   10    10    7   10    10
Y+R:          4.0  4.0   4.0  4.0  4.0   4.0  4.0  4.0   4.0  4.0  4.0   4.0
Lanes:        0  0  2  0  1   1  0  1  0  0   1  0  0  0  1   0  0  0  0  0
------------|---------------||---------------||---------------||---------------|
Volume Module:AM Peak Hour
Base Vol:       0  254    66   30  393     0  553    0   504    0    0     0
Growth Adj:  1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
Initial Bse:    0  254    66   30  393     0  553    0   504    0    0     0
Added Vol:      0    0     0    0    0     0    0    0     0    0    0     0
New Trips:      0    0     0    0    0     0    0    0     0    0    0     0
Initial Fut:    0  254    66   30  393     0  553    0   504    0    0     0
User Adj:    1.00 1.00  0.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
PHF Adj:     0.91 0.91  0.00 0.91 0.91  0.91 0.91 0.91  0.91 0.91 0.91  0.91
PHF Volume:     0  279     0   33  432     0  608    0   554    0    0     0
Reduct Vol:     0    0     0    0    0     0    0    0     0    0    0     0
Reduced Vol:    0  279     0   33  432     0  608    0   554    0    0     0
PCE Adj:     1.00 1.00  0.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
MLF Adj:     1.00 1.00  0.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
FinalVolume:    0  279     0   33  432     0  608    0   554    0    0     0
------------|---------------||---------------||---------------||---------------|
Saturation Flow Module:
Sat/Lane:    1900 1900  1900 1900 1900  1900 1900 1900  1900 1900 1900  1900
Adjustment:  0.92 1.00  0.92 0.92 1.00  0.92 0.92 1.00  0.92 0.92 1.00  0.92
Lanes:       0.00 2.00  1.00 1.00 1.00  0.00 1.00 0.00  1.00 0.00 0.00  0.00
Final Sat.:     0 3800  1750 1750 1900     0 1750    0  1750    0    0     0
------------|---------------||---------------||---------------||---------------|
Capacity Analysis Module:
Vol/Sat:     0.00 0.07  0.00 0.02 0.23  0.00 0.35 0.00  0.32 0.00 0.00  0.00
Crit Moves:       ****       ****            ****
Green Time:   0.0 10.0   0.0  7.0 17.0   0.0 29.0  0.0  29.0  0.0  0.0   0.0
Volume/Cap:  0.00 0.40  0.00 0.15 0.74  0.00 0.66 0.00  0.60 0.00 0.00  0.00
Delay/Veh:    0.0 20.3   0.0 21.7 21.8   0.0 50.2  0.0  39.4  0.0  0.0   0.0
User DelAdj: 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
AdjDel/Veh:   0.0 20.3   0.0 21.7 21.8   0.0 50.2  0.0  39.4  0.0  0.0   0.0
LOS by Move:    A   C+     A   C+   C+     A    D    A     D    A    A     A
HCM2kAvgQ:      0    3     0    1    8     0    9    0     8    0    0     0
******************************************************************************
Note: Queue reported is the number of cars per lane.
```

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--------------------------------------------------------------------------------
                              Planetary Ventures
                             MFA Hangar 3 Project
--------------------------------------------------------------------------------
                       Level Of Service Computation Report
            2000 HCM 4-Way Stop Method (Future Volume Alternative)
********************************************************************************
Intersection #4 Enterprise & 5th
********************************************************************************
Cycle (sec):         100              Critical Vol./Cap.(X):        0.220
Loss Time (sec):       0              Average Delay (sec/veh):        8.7
Optimal Cycle:         0              Level Of Service:                 A
********************************************************************************
Street Name:              Enterprise                             5th
Approach:      North Bound      South Bound       East Bound       West Bound
Movement:     L  -  T  -  R   L  -  T  -  R    L  -  T  -  R    L  -  T  -  R
------------|---------------||---------------||---------------||---------------|
Control:       Stop Sign        Stop Sign        Stop Sign        Stop Sign
Rights:          Include          Ignore           Ignore          Include
Min. Green:    0    0     0    0    0     0    0    0     0    0    0     0
Lanes:        1  0  0  1  0   0  1  0  0  0    0  1  0  1  0    0  1  0  0  1
------------|---------------||---------------||---------------||---------------|
Volume Module:AM Peak Hour
Base Vol:      0  127    23    2   12     0    0    4     3   14    1     1
Growth Adj:  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
Initial Bse:   0  127    23    2   12     0    0    4     3   14    1     1
Added Vol:     0    0     0    0    0     0    0    0     0    0    0     0
New Trips:     0    0     0    0    0     0    0    0     0    0    0     0
Initial Fut:   0  127    23    2   12     0    0    4     3   14    1     1
User Adj:    1.00 1.00  1.00  1.00 1.00  0.00  1.00 1.00  0.00  1.00 1.00  1.00
PHF Adj:     0.88 0.88  0.88  0.88 0.88  0.00  0.88 0.88  0.00  0.88 0.88  0.88
PHF Volume:    0  144    26    2   14     0    0    5     0   16    1     1
Reduct Vol:    0    0     0    0    0     0    0    0     0    0    0     0
Reduced Vol:   0  144    26    2   14     0    0    5     0   16    1     1
PCE Adj:     1.00 1.00  1.00  1.00 1.00  0.00  1.00 1.00  0.00  1.00 1.00  1.00
MLF Adj:     1.00 1.00  1.00  1.00 1.00  0.00  1.00 1.00  0.00  1.00 1.00  1.00
FinalVolume:   0  144    26    2   14     0    0    5     0   16    1     1
------------|---------------||---------------||---------------||---------------|
Saturation Flow Module:
Adjustment:  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
Lanes:       1.00 0.85  0.15  0.14 0.86  0.00  0.00 2.00  0.00  0.93 0.07  1.00
Final Sat.:   684  656   119   107  640     0     0 1054     0   495   35   640
------------|---------------||---------------||---------------||---------------|
Capacity Analysis Module:
Vol/Sat:     0.00 0.22  0.22  0.02 0.02  xxxx  xxxx 0.00  xxxx  0.03 0.03  0.00
Crit Moves:       ****             ****              ****             ****
Delay/Veh:    0.0  8.6   8.6   7.9  7.9   0.0   0.0  9.4   0.0   9.5  9.5   8.2
Delay Adj:   1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
AdjDel/Veh:   0.0  8.6   8.6   7.9  7.9   0.0   0.0  9.4   0.0   9.5  9.5   8.2
LOS by Move:    *    A     A     A    A     *     *    A     *     A    A     A
ApproachDel:       8.6              7.9              9.4              9.4
Delay Adj:        1.00             1.00             1.00             1.00
ApprAdjDel:        8.6              7.9              9.4              9.4
LOS by Appr:         A                A                A                A
AllWayAvgQ:   0.0  0.3   0.3   0.0  0.0   0.0   0.0  0.0   0.0   0.0  0.0   0.0
********************************************************************************
Note: Queue reported is the number of cars per lane.
```

```
--------------------------------------------------------------------------------
                              Planetary Ventures
                             MFA Hangar 3 Project
--------------------------------------------------------------------------------
                      Level Of Service Computation Report
            2000 HCM Operations Method (Future Volume Alternative)
********************************************************************************
Intersection #5 Enterprise & 11th
********************************************************************************
Cycle (sec):          60                 Critical Vol./Cap.(X):         0.432
Loss Time (sec):       9                 Average Delay (sec/veh):        11.6
Optimal Cycle:        36                 Level Of Service:                 B+
********************************************************************************
Street Name:               Enterprise                            11th
Approach:      North Bound      South Bound      East Bound       West Bound
Movement:    L  -  T  -  R   L  -  T  -  R   L  -  T  -  R   L  -  T  -  R
------------|---------------||---------------||---------------||---------------|
Control:       Protected        Protected        Protected        Protected
Rights:          Include          Include          Include          Include
Min. Green:    0   10    10    7   10     0    0    0     0    7    0    10
Y+R:         4.0  4.0   4.0  4.0  4.0   4.0  4.0  4.0   4.0  4.0  4.0   4.0
Lanes:       0  0  1  1  0   1  0  2  0  0   0  0  0  0  0   2  0  0  0  1
------------|---------------||---------------||---------------||---------------|
Volume Module:AM Peak Hour
Base Vol:      0  513   299   28  152     0    0    0     0   80    0   173
Growth Adj:  1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
Initial Bse:   0  513   299   28  152     0    0    0     0   80    0   173
Added Vol:     0    0     0    0    0     0    0    0     0    0    0     0
New Trips:     0    0     0    0    0     0    0    0     0    0    0     0
Initial Fut:   0  513   299   28  152     0    0    0     0   80    0   173
User Adj:    1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
PHF Adj:     0.91 0.91  0.91 0.91 0.91  0.91 0.91 0.91  0.91 0.91 0.91  0.91
PHF Volume:    0  564   329   31  167     0    0    0     0   88    0   190
Reduct Vol:    0    0     0    0    0     0    0    0     0    0    0     0
Reduced Vol:   0  564   329   31  167     0    0    0     0   88    0   190
PCE Adj:     1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
MLF Adj:     1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
FinalVolume:   0  564   329   31  167     0    0    0     0   88    0   190
------------|---------------||---------------||---------------||---------------|
Saturation Flow Module:
Sat/Lane:    1900 1900  1900 1900 1900  1900 1900 1900  1900 1900 1900  1900
Adjustment:  0.92 0.99  0.95 0.92 1.00  0.92 0.92 1.00  0.92 0.83 1.00  0.92
Lanes:       0.00 1.24  0.76 1.00 2.00  0.00 0.00 0.00  0.00 2.00 0.00  1.00
Final Sat.:    0 2337  1362 1750 3800     0    0    0     0 3150    0  1750
------------|---------------||---------------||---------------||---------------|
Capacity Analysis Module:
Vol/Sat:     0.00 0.24  0.24 0.02 0.04  0.00 0.00 0.00  0.00 0.03 0.00  0.11
Crit Moves:       ****       ****                                         ****
Green Time:   0.0 30.3  30.3  7.0 37.3   0.0  0.0  0.0   0.0 13.7  0.0  13.7
Volume/Cap:  0.00 0.48  0.48 0.15 0.07  0.00 0.00 0.00  0.00 0.12 0.00  0.48
Delay/Veh:    0.0  9.9   9.9 24.2  4.5   0.0  0.0  0.0   0.0 18.5  0.0  21.0
User DelAdj: 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
AdjDel/Veh:   0.0  9.9   9.9 24.2  4.5   0.0  0.0  0.0   0.0 18.5  0.0  21.0
LOS by Move:    A    A     A    C    A     A    A    A     A   B-    A    C+
HCM2kAvgQ:      0    6     6    1    1     0    0    0     0    1    0     4
********************************************************************************
Note: Queue reported is the number of cars per lane.
```

Planetary Ventures
MFA Hangar 3 Project

Level Of Service Computation Report
2000 HCM Operations Method (Future Volume Alternative)

Intersection #6 Enterprise & Manila/Moffett Park

| | | | |
|---|---|---|---|
| Cycle (sec): | 100 | Critical Vol./Cap.(X): | 0.816 |
| Loss Time (sec): | 9 | Average Delay (sec/veh): | 33.3 |
| Optimal Cycle: | 72 | Level Of Service: | C- |

| Street Name: | Enterprise | | | | | | Manila/Moffett Park | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach: | North Bound | | | South Bound | | | East Bound | | | West Bound | | |
| Movement: | L | T | R | L | T | R | L | T | R | L | T | R |
| Control: | Protected | | | Protected | | | Protected | | | Protected | | |
| Rights: | Include | | | Include | | | Include | | | Include | | |
| Min. Green: | 0 | 0 | 0 | 7 | 0 | 10 | 7 | 10 | 0 | 0 | 10 | 10 |
| Y+R: | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lanes: | 0 0 | 0 | 0 0 | 1 0 | 0 | 0 1 | 1 0 | 1 | 0 0 | 0 0 | 1 | 0 1 |
| Volume Module:AM Peak Hour | | | | | | | | | | | | |
| Base Vol: | 0 | 0 | 0 | 121 | 0 | 65 | 542 | 201 | 0 | 0 | 245 | 562 |
| Growth Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Initial Bse: | 0 | 0 | 0 | 121 | 0 | 65 | 542 | 201 | 0 | 0 | 245 | 562 |
| Added Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| New Trips: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Initial Fut: | 0 | 0 | 0 | 121 | 0 | 65 | 542 | 201 | 0 | 0 | 245 | 562 |
| User Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| PHF Adj: | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 |
| PHF Volume: | 0 | 0 | 0 | 134 | 0 | 72 | 602 | 223 | 0 | 0 | 272 | 624 |
| Reduct Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced Vol: | 0 | 0 | 0 | 134 | 0 | 72 | 602 | 223 | 0 | 0 | 272 | 624 |
| PCE Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| MLF Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| FinalVolume: | 0 | 0 | 0 | 134 | 0 | 72 | 602 | 223 | 0 | 0 | 272 | 624 |
| Saturation Flow Module: | | | | | | | | | | | | |
| Sat/Lane: | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Adjustment: | 0.92 | 1.00 | 0.92 | 0.92 | 1.00 | 0.92 | 0.92 | 1.00 | 0.92 | 0.92 | 1.00 | 0.92 |
| Lanes: | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 1.00 | 1.00 | 1.00 | 0.00 | 0.00 | 1.00 | 1.00 |
| Final Sat.: | 0 | 0 | 0 | 1750 | 0 | 1750 | 1750 | 1900 | 0 | 0 | 1900 | 1750 |
| Capacity Analysis Module: | | | | | | | | | | | | |
| Vol/Sat: | 0.00 | 0.00 | 0.00 | 0.08 | 0.00 | 0.04 | 0.34 | 0.12 | 0.00 | 0.00 | 0.14 | 0.36 |
| Crit Moves: | | | | | | **** | **** | | | | | **** |
| Green Time: | 0.0 | 0.0 | 0.0 | 10.0 | 0.0 | 10.0 | 39.8 | 81.0 | 0.0 | 0.0 | 41.2 | 41.2 |
| Volume/Cap: | 0.00 | 0.00 | 0.00 | 0.77 | 0.00 | 0.41 | 0.87 | 0.15 | 0.00 | 0.00 | 0.35 | 0.87 |
| Delay/Veh: | 0.0 | 0.0 | 0.0 | 62.3 | 0.0 | 43.8 | 38.7 | 2.1 | 0.0 | 0.0 | 20.4 | 37.5 |
| User DelAdj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| AdjDel/Veh: | 0.0 | 0.0 | 0.0 | 62.3 | 0.0 | 43.8 | 38.7 | 2.1 | 0.0 | 0.0 | 20.4 | 37.5 |
| LOS by Move: | A | A | A | E | A | D | D+ | A | A | A | C+ | D+ |
| HCM2kAvgQ: | 0 | 0 | 0 | 6 | 0 | 3 | 21 | 2 | 0 | 0 | 6 | 22 |

Note: Queue reported is the number of cars per lane.

Planetary Ventures
MFA Hangar 3 Project

Level Of Service Computation Report
2000 HCM Operations Method (Future Volume Alternative)

Intersection #7 US 101 NB & Moffett Park

| | | | |
|---|---|---|---|
| Cycle (sec): | 60 | Critical Vol./Cap.(X): | 0.454 |
| Loss Time (sec): | 9 | Average Delay (sec/veh): | 5.4 |
| Optimal Cycle: | 30 | Level Of Service: | A |

| Street Name: | US 101 NB | | | | | | Moffett Park | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach: | North Bound | | | South Bound | | | East Bound | | | West Bound | | |
| Movement: | L | T | R | L | T | R | L | T | R | L | T | R |
| Control: | Protected | | | Protected | | | Protected | | | Protected | | |
| Rights: | Include | | | Include | | | Include | | | Include | | |
| Min. Green: | 7 | 10 | 10 | 7 | 10 | 10 | 7 | 10 | 10 | 7 | 10 | 10 |
| Y+R: | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lanes: | 0 0 | 0 | 0 0 | 0 0 | 0 | 0 0 | 0 0 | 1 | 0 1 | 1 0 | 1 | 0 0 |
| **Volume Module:AM Peak Hour** | | | | | | | | | | | | |
| Base Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 341 | 13 | 176 | 711 | 0 |
| Growth Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Initial Bse: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 341 | 13 | 176 | 711 | 0 |
| Added Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| New Trips: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Initial Fut: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 341 | 13 | 176 | 711 | 0 |
| User Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| PHF Adj: | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 |
| PHF Volume: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 352 | 13 | 181 | 733 | 0 |
| Reduct Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 352 | 13 | 181 | 733 | 0 |
| PCE Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| MLF Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| FinalVolume: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 352 | 13 | 181 | 733 | 0 |
| **Saturation Flow Module:** | | | | | | | | | | | | |
| Sat/Lane: | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Adjustment: | 0.92 | 1.00 | 0.92 | 0.92 | 1.00 | 0.92 | 0.92 | 1.00 | 0.92 | 0.92 | 1.00 | 0.92 |
| Lanes: | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.00 |
| Final Sat.: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1900 | 1750 | 1750 | 1900 | 0 |
| **Capacity Analysis Module:** | | | | | | | | | | | | |
| Vol/Sat: | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.19 | 0.01 | 0.10 | 0.39 | 0.00 |
| Crit Moves: | | | | | | | **** | | | | **** | |
| Green Time: | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 31.3 | 31.3 | 19.7 | 51.0 | 0.0 |
| Volume/Cap: | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.35 | 0.01 | 0.32 | 0.45 | 0.00 |
| Delay/Veh: | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 8.7 | 6.9 | 15.4 | 1.3 | 0.0 |
| User DelAdj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| AdjDel/Veh: | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 8.7 | 6.9 | 15.4 | 1.3 | 0.0 |
| LOS by Move: | A | A | A | A | A | A | A | A | A | B | A | A |
| HCM2kAvgQ: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 3 | 4 | 0 |

Note: Queue reported is the number of cars per lane.

Planetary Ventures
MFA Hangar 3 Project

Level Of Service Computation Report
2000 HCM 4-Way Stop Method (Future Volume Alternative)

Intersection #8 Innovation & 11th

| | | | |
|---|---|---|---|
| Cycle (sec): | 100 | Critical Vol./Cap.(X): | 0.649 |
| Loss Time (sec): | 0 | Average Delay (sec/veh): | 14.4 |
| Optimal Cycle: | 0 | Level Of Service: | B |

| Street Name: | Innovation | | | | | | 11th | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach: | North Bound | | | South Bound | | | East Bound | | | West Bound | | |
| Movement: | L | T | R | L | T | R | L | T | R | L | T | R |
| Control: | Stop Sign | | | Stop Sign | | | Stop Sign | | | Stop Sign | | |
| Rights: | Include | | | Include | | | Include | | | Include | | |
| Min. Green: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lanes: | 1 1 0 1 0 | | | 1 0 1 1 0 | | | 1 0 0 1 1 | | | 0 0 1! 0 0 | | |
| **Volume Module:AM Peak Hour** | | | | | | | | | | | | |
| Base Vol: | 309 | 28 | 40 | 30 | 68 | 307 | 62 | 20 | 72 | 20 | 10 | 50 |
| Growth Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Initial Bse: | 309 | 28 | 40 | 30 | 68 | 307 | 62 | 20 | 72 | 20 | 10 | 50 |
| Added Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| New Trips: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Initial Fut: | 309 | 28 | 40 | 30 | 68 | 307 | 62 | 20 | 72 | 20 | 10 | 50 |
| User Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| PHF Adj: | 0.82 | 0.82 | 0.82 | 0.82 | 0.82 | 0.82 | 0.82 | 0.82 | 0.82 | 0.82 | 0.82 | 0.82 |
| PHF Volume: | 377 | 34 | 49 | 37 | 83 | 374 | 76 | 24 | 88 | 24 | 12 | 61 |
| Reduct Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced Vol: | 377 | 34 | 49 | 37 | 83 | 374 | 76 | 24 | 88 | 24 | 12 | 61 |
| PCE Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| MLF Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| FinalVolume: | 377 | 34 | 49 | 37 | 83 | 374 | 76 | 24 | 88 | 24 | 12 | 61 |
| **Saturation Flow Module:** | | | | | | | | | | | | |
| Adjustment: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Lanes: | 2.00 | 0.41 | 0.59 | 1.00 | 1.00 | 1.00 | 1.00 | 0.43 | 1.57 | 0.25 | 0.12 | 0.63 |
| Final Sat.: | 960 | 224 | 319 | 477 | 513 | 577 | 417 | 202 | 746 | 120 | 60 | 300 |
| **Capacity Analysis Module:** | | | | | | | | | | | | |
| Vol/Sat: | 0.39 | 0.15 | 0.15 | 0.08 | 0.16 | 0.65 | 0.18 | 0.12 | 0.12 | 0.20 | 0.20 | 0.20 |
| Crit Moves: | **** | | | | | **** | **** | | | | **** | |
| Delay/Veh: | 14.4 | 10.2 | 10.2 | 10.6 | 10.8 | 18.8 | 12.5 | 10.9 | 10.6 | 11.5 | 11.5 | 11.5 |
| Delay Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| AdjDel/Veh: | 14.4 | 10.2 | 10.2 | 10.6 | 10.8 | 18.8 | 12.5 | 10.9 | 10.6 | 11.5 | 11.5 | 11.5 |
| LOS by Move: | B | B | B | B | B | C | B | B | B | B | B | B |
| ApproachDel: | | 13.6 | | | 16.8 | | | 11.4 | | | 11.5 | |
| Delay Adj: | | 1.00 | | | 1.00 | | | 1.00 | | | 1.00 | |
| ApprAdjDel: | | 13.6 | | | 16.8 | | | 11.4 | | | 11.5 | |
| LOS by Appr: | | B | | | C | | | B | | | B | |
| AllWayAvgQ: | 0.6 | 0.2 | 0.2 | 0.1 | 0.2 | 1.6 | 0.2 | 0.1 | 0.1 | 0.2 | 0.2 | 0.2 |

Note: Queue reported is the number of cars per lane.

```
-------------------------------------------------------------------------------
                              Planetary Ventures
                             MFA Hangar 3 Project
-------------------------------------------------------------------------------
                       Level Of Service Computation Report
          2000 HCM Operations Method (Future Volume Alternative)
*******************************************************************************
Intersection #9 Innovation & Moffett Park
*******************************************************************************
Cycle (sec):          60                Critical Vol./Cap.(X):         0.566
Loss Time (sec):       9                Average Delay (sec/veh):        11.7
Optimal Cycle:        39                Level Of Service:                 B+
*******************************************************************************
Street Name:               Innovation                        Moffett Park
Approach:      North Bound      South Bound      East Bound       West Bound
Movement:     L  -  T  -  R   L  -  T  -  R   L  -  T  -  R   L  -  T  -  R
------------|---------------||---------------||---------------||---------------|
Control:       Protected        Protected        Protected        Protected
Rights:          Include          Include          Include          Include
Min. Green:    0     0     0    7     0    10   10    10     0    0    10    10
Y+R:          4.0  4.0   4.0  4.0  4.0   4.0  4.0  4.0   4.0  4.0  4.0   4.0
Lanes:        0  0  0  0  0   1  0  1! 0  0   1  0  2  0  0   0  0  2  0  1
------------|---------------||---------------||---------------||---------------|
Volume Module:AM Peak Hour
Base Vol:      0     0     0  114     0    80  114  190     0    0  841   549
Growth Adj:  1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
Initial Bse:   0     0     0  114     0    80  114  190     0    0  841   549
Added Vol:     0     0     0    0     0     0    0    0     0    0    0     0
New Trips:     0     0     0    0     0     0    0    0     0    0    0     0
Initial Fut:   0     0     0  114     0    80  114  190     0    0  841   549
User Adj:    1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
PHF Adj:     0.95 0.95  0.95 0.95 0.95  0.95 0.95 0.95  0.95 0.95 0.95  0.95
PHF Volume:    0     0     0  120     0    84  120  200     0    0  885   578
Reduct Vol:    0     0     0    0     0     0    0    0     0    0    0     0
Reduced Vol:   0     0     0  120     0    84  120  200     0    0  885   578
PCE Adj:     1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
MLF Adj:     1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
FinalVolume:   0     0     0  120     0    84  120  200     0    0  885   578
------------|---------------||---------------||---------------||---------------|
Saturation Flow Module:
Sat/Lane:    1900 1900  1900 1900 1900  1900 1900 1900  1900 1900 1900  1900
Adjustment:  0.92 1.00  0.92 0.92 1.00  0.92 0.92 1.00  0.92 0.92 1.00  0.92
Lanes:       0.00 0.00  0.00 1.42 0.00  0.58 1.00 2.00  0.00 0.00 2.00  1.00
Final Sat.:    0     0     0 2478     0  1022 1750 3800     0    0 3800  1750
------------|---------------||---------------||---------------||---------------|
Capacity Analysis Module:
Vol/Sat:     0.00 0.00  0.00 0.05 0.00  0.08 0.07 0.05  0.00 0.00 0.23  0.33
Crit Moves:                             ****  ****                         ****
Green Time:   0.0  0.0   0.0 10.0  0.0  10.0 10.0 41.0   0.0  0.0 31.0  31.0
Volume/Cap:  0.00 0.00  0.00 0.29 0.00  0.49 0.41 0.08  0.00 0.00 0.45  0.64
Delay/Veh:    0.0  0.0   0.0 22.1  0.0  23.6 23.3  3.2   0.0  0.0  9.3  12.0
User DelAdj: 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
AdjDel/Veh:   0.0  0.0   0.0 22.1  0.0  23.6 23.3  3.2   0.0  0.0  9.3  12.0
LOS by Move:    A    A     A   C+    A     C    C    A     A    A    A     B
HCM2kAvgQ:      0    0     0    2    0     3    3    1     0    0    5     9
*******************************************************************************
Note: Queue reported is the number of cars per lane.
```

Planetary Ventures
MFA Hangar 3 Project

Level Of Service Computation Report
2000 HCM Operations Method (Future Volume Alternative)

Intersection #10 Mathilda & 5th

| | | | |
|---|---|---|---|
| Cycle (sec): | 60 | Critical Vol./Cap.(X): | 0.270 |
| Loss Time (sec): | 12 | Average Delay (sec/veh): | 16.3 |
| Optimal Cycle: | 46 | Level Of Service: | B |

| Street Name: | Mathilda | | | | | | 5th | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach: | North Bound | | | South Bound | | | East Bound | | | West Bound | | |
| Movement: | L | T | R | L | T | R | L | T | R | L | T | R |
| Control: | Protected | | | Protected | | | Protected | | | Protected | | |
| Rights: | Include | | | Ignore | | | Include | | | Include | | |
| Min. Green: | 7 | 10 | 10 | 7 | 10 | 10 | 7 | 10 | 10 | 7 | 10 | 10 |
| Y+R: | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lanes: | 2 0 2 1 0 | | | 1 0 3 0 9 | | | 2 0 1 0 1 | | | 2 0 0 1 0 | | |
| **Volume Module:AM Peak Hour** | | | | | | | | | | | | |
| Base Vol: | 45 | 448 | 216 | 91 | 243 | 267 | 23 | 8 | 15 | 44 | 11 | 8 |
| Growth Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Initial Bse: | 45 | 448 | 216 | 91 | 243 | 267 | 23 | 8 | 15 | 44 | 11 | 8 |
| Added Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| New Trips: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Initial Fut: | 45 | 448 | 216 | 91 | 243 | 267 | 23 | 8 | 15 | 44 | 11 | 8 |
| User Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| PHF Adj: | 0.89 | 0.89 | 0.89 | 0.89 | 0.89 | 0.00 | 0.89 | 0.89 | 0.89 | 0.89 | 0.89 | 0.89 |
| PHF Volume: | 51 | 503 | 243 | 102 | 273 | 0 | 26 | 9 | 17 | 49 | 12 | 9 |
| Reduct Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced Vol: | 51 | 503 | 243 | 102 | 273 | 0 | 26 | 9 | 17 | 49 | 12 | 9 |
| PCE Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| MLF Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| FinalVolume: | 51 | 503 | 243 | 102 | 273 | 0 | 26 | 9 | 17 | 49 | 12 | 9 |
| **Saturation Flow Module:** | | | | | | | | | | | | |
| Sat/Lane: | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Adjustment: | 0.83 | 1.00 | 0.95 | 0.92 | 1.00 | 0.80 | 0.83 | 1.00 | 0.92 | 0.83 | 0.95 | 0.95 |
| Lanes: | 2.00 | 2.00 | 1.00 | 1.00 | 3.00 | 9.00 | 2.00 | 1.00 | 1.00 | 2.00 | 0.58 | 0.42 |
| Final Sat.: | 3150 | 3798 | 1800 | 1750 | 5700 | 13653 | 3150 | 1900 | 1750 | 3150 | 1042 | 758 |
| **Capacity Analysis Module:** | | | | | | | | | | | | |
| Vol/Sat: | 0.02 | 0.13 | 0.13 | 0.06 | 0.05 | 0.00 | 0.01 | 0.00 | 0.01 | 0.02 | 0.01 | 0.01 |
| Crit Moves: | | **** | | **** | | | | | **** | **** | | |
| Green Time: | 12.8 | 21.5 | 21.5 | 9.5 | 18.2 | 0.0 | 7.0 | 10.0 | 10.0 | 7.0 | 10.0 | 10.0 |
| Volume/Cap: | 0.08 | 0.37 | 0.38 | 0.37 | 0.16 | 0.00 | 0.07 | 0.03 | 0.06 | 0.13 | 0.07 | 0.07 |
| Delay/Veh: | 18.9 | 14.3 | 14.4 | 23.4 | 15.3 | 0.0 | 23.7 | 21.0 | 21.1 | 23.9 | 21.2 | 21.2 |
| User DelAdj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| AdjDel/Veh: | 18.9 | 14.3 | 14.4 | 23.4 | 15.3 | 0.0 | 23.7 | 21.0 | 21.1 | 23.9 | 21.2 | 21.2 |
| LOS by Move: | B- | B | B | C | B | A | C | C+ | C+ | C | C+ | C+ |
| HCM2kAvgQ: | 0 | 4 | 4 | 2 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |

Note: Queue reported is the number of cars per lane.

Planetary Ventures
MFA Hangar 3 Project

Level Of Service Computation Report
2000 HCM Operations Method (Future Volume Alternative)

Intersection #11 Mathilda & Moffett Park

| | | | |
|---|---|---|---|
| Cycle (sec): | 90 | Critical Vol./Cap.(X): | 0.922 |
| Loss Time (sec): | 12 | Average Delay (sec/veh): | 32.7 |
| Optimal Cycle: | 114 | Level Of Service: | C- |

| Street Name: | Mathilda | | | | | | Moffett Park | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach: | North Bound | | | South Bound | | | East Bound | | | West Bound | | |
| Movement: | L | T | R | L | T | R | L | T | R | L | T | R |
| Control: | | Protected | | | Protected | | | Protected | | | Protected | |
| Rights: | | Include | | | Include | | | Ignore | | | Include | |
| Min. Green: | 7 | 10 | 0 | 0 | 10 | 10 | 7 | 0 | 10 | 7 | 10 | 10 |
| Y+R: | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lanes: | | 2 0 3 0 0 | | | 0 0 2 1 0 | | | 0 0 1! 0 1 | | | 1 1 0 1 0 | |
| Volume Module:AM Peak Hour | | | | | | | | | | | | |
| Base Vol: | 1042 | 2033 | 0 | 0 | 359 | 501 | 121 | 0 | 114 | 572 | 55 | 80 |
| Growth Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Initial Bse: | 1042 | 2033 | 0 | 0 | 359 | 501 | 121 | 0 | 114 | 572 | 55 | 80 |
| Added Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| New Trips: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Initial Fut: | 1042 | 2033 | 0 | 0 | 359 | 501 | 121 | 0 | 114 | 572 | 55 | 80 |
| User Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 1.00 |
| PHF Adj: | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.00 | 0.95 | 0.95 | 0.95 |
| PHF Volume: | 1097 | 2140 | 0 | 0 | 378 | 527 | 127 | 0 | 0 | 602 | 58 | 84 |
| Reduct Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced Vol: | 1097 | 2140 | 0 | 0 | 378 | 527 | 127 | 0 | 0 | 602 | 58 | 84 |
| PCE Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 1.00 |
| MLF Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 1.00 |
| FinalVolume: | 1097 | 2140 | 0 | 0 | 378 | 527 | 127 | 0 | 0 | 602 | 58 | 84 |
| Saturation Flow Module: | | | | | | | | | | | | |
| Sat/Lane: | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Adjustment: | 0.83 | 1.00 | 0.92 | 0.92 | 1.00 | 0.92 | 0.95 | 0.95 | 0.92 | 0.94 | 0.95 | 0.95 |
| Lanes: | 2.00 | 3.00 | 0.00 | 0.00 | 2.00 | 1.00 | 1.00 | 0.00 | 1.00 | 2.00 | 0.41 | 0.59 |
| Final Sat.: | 3150 | 5700 | 0 | 0 | 3800 | 1750 | 1800 | 0 | 1750 | 3559 | 733 | 1067 |
| Capacity Analysis Module: | | | | | | | | | | | | |
| Vol/Sat: | 0.35 | 0.38 | 0.00 | 0.00 | 0.10 | 0.30 | 0.07 | 0.00 | 0.00 | 0.17 | 0.08 | 0.08 |
| Crit Moves: | **** | | | | | **** | **** | | | | **** | |
| Green Time: | 32.7 | 61.0 | 0.0 | 0.0 | 28.3 | 28.3 | 7.0 | 0.0 | 0.0 | 17.0 | 10.0 | 10.0 |
| Volume/Cap: | 0.96 | 0.55 | 0.00 | 0.00 | 0.32 | 0.96 | 0.91 | 0.00 | 0.00 | 0.90 | 0.71 | 0.71 |
| Delay/Veh: | 54.9 | 10.5 | 0.0 | 0.0 | 23.5 | 50.1 | 91.0 | 0.0 | 0.0 | 47.9 | 40.9 | 40.9 |
| User DelAdj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| AdjDel/Veh: | 54.9 | 10.5 | 0.0 | 0.0 | 23.5 | 50.1 | 91.0 | 0.0 | 0.0 | 47.9 | 40.9 | 40.9 |
| LOS by Move: | D- | B+ | A | A | C | D | F | A | A | D | D | D |
| HCM2kAvgQ: | 24 | 10 | 0 | 0 | 4 | 21 | 7 | 0 | 0 | 12 | 6 | 6 |

Note: Queue reported is the number of cars per lane.

```
--------------------------------------------------------------------------------
                            Planetary Ventures
                           MFA Hangar 3 Project
--------------------------------------------------------------------------------

                     Level Of Service Computation Report
           2000 HCM Operations Method (Future Volume Alternative)
********************************************************************************
Intersection #12 Mathilda & Hwy 237 WB
********************************************************************************
Cycle (sec):         180              Critical Vol./Cap.(X):         0.350
Loss Time (sec):       9              Average Delay (sec/veh):         0.3
Optimal Cycle:        28              Level Of Service:                  A
********************************************************************************
Street Name:                Mathilda                          Hwy 237 WB
Approach:      North Bound      South Bound      East Bound       West Bound
Movement:     L  -  T  -  R   L  -  T  -  R   L  -  T  -  R   L  -  T  -  R
------------|---------------||---------------||---------------||---------------|
Control:        Protected        Protected        Protected        Protected
Rights:          Include          Include          Include          Include
Min. Green:    0   10     0    0   10    10    0    0     0    0    0     0
Y+R:          4.0  4.0   4.0  4.0  4.0   4.0  4.0  4.0   4.0  4.0  4.0   4.0
Lanes:        0  0  5  0  0   0  0  3  1  0   0  0  0  0  0   0  0  0  0  0
------------|---------------||---------------||---------------||---------------|
Volume Module:AM Peak Hour
Base Vol:       0 2965     0    0  808   259    0    0     0    0    0     0
Growth Adj:  1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
Initial Bse:    0 2965     0    0  808   259    0    0     0    0    0     0
Added Vol:      0    0     0    0    0     0    0    0     0    0    0     0
New Trips:      0    0     0    0    0     0    0    0     0    0    0     0
Initial Fut:    0 2965     0    0  808   259    0    0     0    0    0     0
User Adj:    1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
PHF Adj:     0.94 0.94  0.94 0.94 0.94  0.94 0.94 0.94  0.94 0.94 0.94  0.94
PHF Volume:     0 3154     0    0  860   276    0    0     0    0    0     0
Reduct Vol:     0    0     0    0    0     0    0    0     0    0    0     0
Reduced Vol:    0 3154     0    0  860   276    0    0     0    0    0     0
PCE Adj:     1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
MLF Adj:     1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
FinalVolume:    0 3154     0    0  860   276    0    0     0    0    0     0
------------|---------------||---------------||---------------||---------------|
Saturation Flow Module:
Sat/Lane:    1900 1900  1900 1900 1900  1900 1900 1900  1900 1900 1900  1900
Adjustment:  0.92 1.00  0.92 0.92 1.00  0.95 0.92 1.00  0.92 0.92 1.00  0.92
Lanes:       0.00 5.00  0.00 0.00 3.00  1.00 0.00 0.00  0.00 0.00 0.00  0.00
Final Sat.:     0 9500     0    0 5697  1800    0    0     0    0    0     0
------------|---------------||---------------||---------------||---------------|
Capacity Analysis Module:
Vol/Sat:     0.00 0.33  0.00 0.00 0.15  0.15 0.00 0.00  0.00 0.00 0.00  0.00
Crit Moves:       ****       ****
Green Time:   0.0  171   0.0  0.0  171 171.0  0.0  0.0   0.0  0.0  0.0   0.0
Volume/Cap:  0.00 0.35  0.00 0.00 0.16  0.16 0.00 0.00  0.00 0.00 0.00  0.00
Delay/Veh:    0.0  0.4   0.0  0.0  0.3   0.3  0.0  0.0   0.0  0.0  0.0   0.0
User DelAdj: 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
AdjDel/Veh:   0.0  0.4   0.0  0.0  0.3   0.3  0.0  0.0   0.0  0.0  0.0   0.0
LOS by Move:    A    A     A    A    A     A    A    A     A    A    A     A
HCM2kAvgQ:      0    3     0    0    1     1    0    0     0    0    0     0
********************************************************************************
Note: Queue reported is the number of cars per lane.
```

Planetary Ventures
MFA Hangar 3 Project

Level Of Service Computation Report
2000 HCM Operations Method (Future Volume Alternative)

Intersection #13 Mathilda & Hwy 237 EB

| | | | |
|---|---|---|---|
| Cycle (sec): | 50 | Critical Vol./Cap.(X): | 0.746 |
| Loss Time (sec): | 9 | Average Delay (sec/veh): | 17.7 |
| Optimal Cycle: | 48 | Level Of Service: | B |

| Street Name: | Mathilda | | | | | | Hwy 237 EB | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach: | North Bound | | | South Bound | | | East Bound | | | West Bound | | |
| Movement: | L | T | R | L | T | R | L | T | R | L | T | R |
| Control: | | Protected | | | Protected | | | Protected | | | Protected | |
| Rights: | | Ignore | | | Include | | | Include | | | Include | |
| Min. Green: | 0 | 10 | 10 | 7 | 10 | 0 | 7 | 10 | 10 | 0 | 0 | 0 |
| Y+R: | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lanes: | 0 0 5 0 2 | | | 1 0 3 0 0 | | | 2 0 0 0 1 | | | 0 0 0 0 0 | | |
| **Volume Module:AM Peak Hour** | | | | | | | | | | | | |
| Base Vol: | 0 | 1884 | 764 | 62 | 730 | 0 | 1074 | 0 | 105 | 0 | 0 | 0 |
| Growth Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Initial Bse: | 0 | 1884 | 764 | 62 | 730 | 0 | 1074 | 0 | 105 | 0 | 0 | 0 |
| Added Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| New Trips: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Initial Fut: | 0 | 1884 | 764 | 62 | 730 | 0 | 1074 | 0 | 105 | 0 | 0 | 0 |
| User Adj: | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| PHF Adj: | 0.94 | 0.94 | 0.00 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| PHF Volume: | 0 | 2004 | 0 | 66 | 777 | 0 | 1143 | 0 | 112 | 0 | 0 | 0 |
| Reduct Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced Vol: | 0 | 2004 | 0 | 66 | 777 | 0 | 1143 | 0 | 112 | 0 | 0 | 0 |
| PCE Adj: | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| MLF Adj: | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| FinalVolume: | 0 | 2004 | 0 | 66 | 777 | 0 | 1143 | 0 | 112 | 0 | 0 | 0 |
| **Saturation Flow Module:** | | | | | | | | | | | | |
| Sat/Lane: | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Adjustment: | 0.92 | 1.00 | 0.83 | 0.92 | 1.00 | 0.92 | 0.83 | 1.00 | 0.92 | 0.92 | 1.00 | 0.92 |
| Lanes: | 0.00 | 5.00 | 2.00 | 1.00 | 3.00 | 0.00 | 2.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Final Sat.: | 0 | 9500 | 3150 | 1750 | 5700 | 0 | 3150 | 0 | 1750 | 0 | 0 | 0 |
| **Capacity Analysis Module:** | | | | | | | | | | | | |
| Vol/Sat: | 0.00 | 0.21 | 0.00 | 0.04 | 0.14 | 0.00 | 0.36 | 0.00 | 0.06 | 0.00 | 0.00 | 0.00 |
| Crit Moves: | | **** | | **** | | | **** | | | | | |
| Green Time: | 0.0 | 12.5 | 0.0 | 7.0 | 19.5 | 0.0 | 21.5 | 0.0 | 21.5 | 0.0 | 0.0 | 0.0 |
| Volume/Cap: | 0.00 | 0.84 | 0.00 | 0.27 | 0.35 | 0.00 | 0.84 | 0.00 | 0.15 | 0.00 | 0.00 | 0.00 |
| Delay/Veh: | 0.0 | 20.8 | 0.0 | 19.8 | 10.9 | 0.0 | 17.8 | 0.0 | 8.8 | 0.0 | 0.0 | 0.0 |
| User DelAdj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| AdjDel/Veh: | 0.0 | 20.8 | 0.0 | 19.8 | 10.9 | 0.0 | 17.8 | 0.0 | 8.8 | 0.0 | 0.0 | 0.0 |
| LOS by Move: | A | C+ | A | B- | B+ | A | B | A | A | A | A | A |
| HCM2kAvgQ: | 0 | 9 | 0 | 1 | 3 | 0 | 13 | 0 | 1 | 0 | 0 | 0 |

Note: Queue reported is the number of cars per lane.

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Planetary Ventures
MFA Hangar 3 Project

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Scenario Report

| | |
|---|---|
| Scenario: | 2022 Background - PM Peak |
| Command: | Default Command |
| Volume: | 2022 Background - PM Peak |
| Geometry: | Existing |
| Impact Fee: | Default Impact Fee |
| Trip Generation: | Default Trip Generation |
| Trip Distribution: | Default Trip Distribution |
| Paths: | Default Path |
| Routes: | Default Route |
| Configuration: | Default Configuration |

Planetary Ventures
MFA Hangar 3 Project

Impact Analysis Report
Level Of Service

| Intersection | Base LOS | Base Del/Veh | Base V/C | Future LOS | Future Del/Veh | Future V/C | Change in |
|---|---|---|---|---|---|---|---|
| # 1 Ellis & Manila | D | 25.3 | 0.883 | D | 25.3 | 0.883 | + 0.000 V/C |
| # 2 Ellis & US 101 NB | C | 23.9 | 0.638 | C | 23.9 | 0.638 | + 0.000 D/V |
| # 3 Ellis & US 101 SB | C | 25.8 | 0.332 | C | 25.8 | 0.332 | + 0.000 D/V |
| # 4 Enterprise & 5th | A | 8.8 | 0.157 | A | 8.8 | 0.157 | + 0.000 V/C |
| # 5 Enterprise & 11th | B+ | 11.8 | 0.211 | B+ | 11.8 | 0.211 | + 0.000 D/V |
| # 6 Enterprise & Manila/Moffett Pa | B | 14.0 | 0.619 | B | 14.0 | 0.619 | + 0.000 D/V |
| # 7 US 101 NB & Moffett Park | B | 15.3 | 0.777 | B | 15.3 | 0.777 | + 0.000 D/V |
| # 8 Innovation & 11th | D | 25.1 | 0.932 | D | 25.1 | 0.932 | + 0.000 V/C |
| # 9 Innovation & Moffett Park | B | 15.7 | 0.539 | B | 15.7 | 0.539 | + 0.000 D/V |
| # 10 Mathilda & 5th | B- | 19.3 | 0.373 | B- | 19.3 | 0.373 | + 0.000 D/V |
| # 11 Mathilda & Moffett Park | D | 43.4 | 0.859 | D | 43.4 | 0.859 | + 0.000 D/V |
| # 12 Mathilda & Hwy 237 WB | A | 0.4 | 0.474 | A | 0.4 | 0.474 | + 0.000 D/V |
| # 13 Mathilda & Hwy 237 EB | B+ | 11.8 | 0.652 | B+ | 11.8 | 0.652 | + 0.000 D/V |

Planetary Ventures
MFA Hangar 3 Project

Level Of Service Computation Report
2000 HCM 4-Way Stop Method (Future Volume Alternative)

Intersection #1 Ellis & Manila

| | | | |
|---|---|---|---|
| Cycle (sec): | 100 | Critical Vol./Cap.(X): | 0.883 |
| Loss Time (sec): | 12 | Average Delay (sec/veh): | 25.3 |
| Optimal Cycle: | 0 | Level Of Service: | D |

| Street Name: | Ellis | | Manila | |
|---|---|---|---|---|
| Approach: | North Bound | South Bound | East Bound | West Bound |
| Control: | Stop Sign | Stop Sign | Stop Sign | Stop Sign |
| Rights: | Ignore | Include | Include | Include |
| Lanes: | 0 0 2 0 1 | 0 1 1 0 0 | 0 0 0 0 1 | 0 0 1! 0 0 |

| Movement: | L | T | R | L | T | R | L | T | R | L | T | R |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Min. Green: | 7 | 10 | 10 | 7 | 10 | 10 | 7 | 10 | 10 | 7 | 10 | 10 |
| **Volume Module:PM Peak Hour** | | | | | | | | | | | | |
| Base Vol: | 0 | 69 | 255 | 13 | 250 | 0 | 0 | 0 | 0 | 552 | 0 | 8 |
| Growth Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Initial Bse: | 0 | 69 | 255 | 13 | 250 | 0 | 0 | 0 | 0 | 552 | 0 | 8 |
| Added Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| New Trips: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Initial Fut: | 0 | 69 | 255 | 13 | 250 | 0 | 0 | 0 | 0 | 552 | 0 | 8 |
| User Adj: | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| PHF Adj: | 0.92 | 0.92 | 0.00 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| PHF Volume: | 0 | 75 | 0 | 14 | 272 | 0 | 0 | 0 | 0 | 600 | 0 | 9 |
| Reduct Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced Vol: | 0 | 75 | 0 | 14 | 272 | 0 | 0 | 0 | 0 | 600 | 0 | 9 |
| PCE Adj: | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| MLF Adj: | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| FinalVolume: | 0 | 75 | 0 | 14 | 272 | 0 | 0 | 0 | 0 | 600 | 0 | 9 |
| **Saturation Flow Module:** | | | | | | | | | | | | |
| Adjustment: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Lanes: | 0.00 | 2.00 | 1.00 | 0.10 | 1.90 | 0.00 | 0.00 | 0.00 | 1.00 | 0.99 | 0.00 | 0.01 |
| Final Sat.: | 0 | 1027 | 570 | 54 | 1033 | 0 | 0 | 0 | 643 | 679 | 0 | 10 |
| **Capacity Analysis Module:** | | | | | | | | | | | | |
| Vol/Sat: | xxxx | 0.07 | 0.00 | 0.26 | 0.26 | xxxx | xxxx | xxxx | 0.00 | 0.88 | xxxx | 0.88 |
| Crit Moves: | | **** | | **** | | | | | **** | **** | | |
| Delay/Veh: | 0.0 | 9.9 | 0.0 | 11.3 | 11.2 | 0.0 | 0.0 | 0.0 | 0.0 | 33.8 | 0.0 | 33.8 |
| Delay Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| AdjDel/Veh: | 0.0 | 9.9 | 0.0 | 11.3 | 11.2 | 0.0 | 0.0 | 0.0 | 0.0 | 33.8 | 0.0 | 33.8 |
| LOS by Move: | * | A | * | B | B | * | * | * | * | D | * | D |
| ApproachDel: | | 9.9 | | | 11.2 | | | xxxxxx | | | 33.8 | |
| Delay Adj: | | 1.00 | | | 1.00 | | | xxxxx | | | 1.00 | |
| ApprAdjDel: | | 9.9 | | | 11.2 | | | xxxxxx | | | 33.8 | |
| LOS by Appr: | | A | | | B | | | * | | | D | |
| AllWayAvgQ: | 0.0 | 0.1 | 0.0 | 0.3 | 0.3 | 0.0 | 0.0 | 0.0 | 0.0 | 4.9 | 4.9 | 4.9 |

Note: Queue reported is the number of cars per lane.

```
-------------------------------------------------------------------------------
                            Planetary Ventures
                           MFA Hangar 3  Project
-------------------------------------------------------------------------------
                     Level Of Service Computation Report
           2000 HCM Operations Method (Future Volume Alternative)
*******************************************************************************
Intersection #2 Ellis & US 101 NB
*******************************************************************************
Cycle (sec):          55                Critical Vol./Cap.(X):         0.638
Loss Time (sec):       9                Average Delay (sec/veh):        23.9
Optimal Cycle:        40                Level Of Service:                  C
*******************************************************************************
Street Name:                 Ellis                            US 101 NB
Approach:      North Bound      South Bound      East Bound       West Bound
Movement:     L  -  T  -  R   L  -  T  -  R   L  -  T  -  R   L  -  T  -  R
------------|---------------||---------------||---------------||---------------|
Control:       Split Phase      Split Phase       Protected        Protected
Rights:           Include          Include          Include          Include
Min. Green:     7   10    10     7   10    10     7   10    10     7   10    10
Y+R:          4.0  4.0   4.0   4.0  4.0   4.0   4.0  4.0   4.0   4.0  4.0   4.0
Lanes:        0  1  1  0  0   0  0  1  1  0   0  0  0  0  0   0  1  0  0  2
------------|---------------||---------------||---------------||---------------|
Volume Module:PM Peak Hour
Base Vol:     252  268     0     0  467   356     0    0     0   237    2    50
Growth Adj:  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
Initial Bse:  252  268     0     0  467   356     0    0     0   237    2    50
Added Vol:      0    0     0     0    0     0     0    0     0     0    0     0
New Trips:      0    0     0     0    0     0     0    0     0     0    0     0
Initial Fut:  252  268     0     0  467   356     0    0     0   237    2    50
User Adj:    1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
PHF Adj:     0.93 0.93  0.93  0.93 0.93  0.93  0.93 0.93  0.93  0.93 0.93  0.93
PHF Volume:   271  288     0     0  502   383     0    0     0   255    2    54
Reduct Vol:     0    0     0     0    0     0     0    0     0     0    0     0
Reduced Vol:  271  288     0     0  502   383     0    0     0   255    2    54
PCE Adj:     1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
MLF Adj:     1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
FinalVolume:  271  288     0     0  502   383     0    0     0   255    2    54
------------|---------------||---------------||---------------||---------------|
Saturation Flow Module:
Sat/Lane:    1900 1900  1900  1900 1900  1900  1900 1900  1900  1900 1900  1900
Adjustment:  0.95 1.00  0.92  0.92 0.99  0.95  0.92 1.00  0.92  0.95 0.95  0.83
Lanes:       1.00 1.00  0.00  0.00 1.11  0.89  0.00 0.00  0.00  0.99 0.01  2.00
Final Sat.:  1792 1906     0     0 2098  1600     0    0     0  1785   15  3150
------------|---------------||---------------||---------------||---------------|
Capacity Analysis Module:
Vol/Sat:     0.15 0.15  0.00  0.00 0.24  0.24  0.00 0.00  0.00  0.14 0.14  0.02
Crit Moves:       ****             ****                                ****
Green Time:  13.0 13.0   0.0   0.0 20.6  20.6   0.0  0.0   0.0  12.3 12.3  12.3
Volume/Cap:  0.64 0.64  0.00  0.00 0.64  0.64  0.00 0.00  0.00  0.64 0.64  0.08
Delay/Veh:   38.9 38.9   0.0   0.0 15.1  15.1   0.0  0.0   0.0  22.7 22.7  16.9
User DelAdj: 1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
AdjDel/Veh:  38.9 38.9   0.0   0.0 15.1  15.1   0.0  0.0   0.0  22.7 22.7  16.9
LOS by Move:   D+   D+     A     A    B     B     A    A     A    C+   C+     B
HCM2kAvgQ:      6    6     0     0    7     7     0    0     0     5    5     0
*******************************************************************************
Note: Queue reported is the number of cars per lane.
```

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-------------------------------------------------------------------------------
                           Planetary Ventures
                          MFA Hangar 3  Project
-------------------------------------------------------------------------------

                     Level Of Service Computation Report
           2000 HCM Operations Method (Future Volume Alternative)
*******************************************************************************
Intersection #3 Ellis & US 101 SB
*******************************************************************************
Cycle (sec):          40                Critical Vol./Cap.(X):        0.332
Loss Time (sec):       9                Average Delay (sec/veh):       25.8
Optimal Cycle:        36                Level Of Service:                 C
*******************************************************************************
Street Name:                 Ellis                         US 101 SB
Approach:      North Bound      South Bound      East Bound       West Bound
Movement:     L  -  T  -  R   L  -  T  -  R   L  -  T  -  R   L  -  T  -  R
------------|----------------||----------------||----------------||----------------|
Control:        Protected        Protected        Protected        Protected
Rights:           Ignore          Include          Include          Include
Min. Green:     7   10    10     7   10    10     7   10    10     7   10    10
Y+R:          4.0  4.0   4.0   4.0  4.0   4.0   4.0  4.0   4.0   4.0  4.0   4.0
Lanes:        0  0  2  0  1   1  0  1  0  0   1  0  0  0  1   0  0  0  0  0
------------|----------------||----------------||----------------||----------------|
Volume Module:PM Peak Hour
Base Vol:       0  207   237   119  591     0   113    0   204     0    0     0
Growth Adj:  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
Initial Bse:    0  207   237   119  591     0   113    0   204     0    0     0
Added Vol:      0    0     0     0    0     0     0    0     0     0    0     0
New Trips:      0    0     0     0    0     0     0    0     0     0    0     0
Initial Fut:    0  207   237   119  591     0   113    0   204     0    0     0
User Adj:    1.00 1.00  0.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
PHF Adj:     0.93 0.93  0.00  0.93 0.93  0.93  0.93 0.93  0.93  0.93 0.93  0.93
PHF Volume:     0  223     0   128  635     0   122    0   219     0    0     0
Reduct Vol:     0    0     0     0    0     0     0    0     0     0    0     0
Reduced Vol:    0  223     0   128  635     0   122    0   219     0    0     0
PCE Adj:     1.00 1.00  0.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
MLF Adj:     1.00 1.00  0.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
FinalVolume:    0  223     0   128  635     0   122    0   219     0    0     0
------------|----------------||----------------||----------------||----------------|
Saturation Flow Module:
Sat/Lane:    1900 1900  1900  1900 1900  1900  1900 1900  1900  1900 1900  1900
Adjustment:  0.92 1.00  0.92  0.92 1.00  0.92  0.92 1.00  0.92  0.92 1.00  0.92
Lanes:       0.00 2.00  1.00  1.00 1.00  0.00  1.00 0.00  1.00  0.00 0.00  0.00
Final Sat.:     0 3800  1750  1750 1900     0  1750    0  1750     0    0     0
------------|----------------||----------------||----------------||----------------|
Capacity Analysis Module:
Vol/Sat:     0.00 0.06  0.00  0.07 0.33  0.00  0.07 0.00  0.13  0.00 0.00  0.00
Crit Moves:       ****        ****                          ****
Green Time:   0.0 10.0   0.0   7.7 17.7   0.0  13.3  0.0  13.3   0.0  0.0   0.0
Volume/Cap:  0.00 0.23  0.00  0.38 0.75  0.00  0.21 0.00  0.38  0.00 0.00  0.00
Delay/Veh:    0.0 12.1   0.0  14.7 13.2   0.0  71.8  0.0  57.2   0.0  0.0   0.0
User DelAdj: 1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
AdjDel/Veh:   0.0 12.1   0.0  14.7 13.2   0.0  71.8  0.0  57.2   0.0  0.0   0.0
LOS by Move:    A    B     A     B    B     A     E    A    E+     A    A     A
HCM2kAvgQ:      0    1     0     2    9     0     1    0     3     0    0     0
*******************************************************************************
Note: Queue reported is the number of cars per lane.
```

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--------------------------------------------------------------------------------
                           Planetary Ventures
                          MFA Hangar 3  Project
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                    Level Of Service Computation Report
            2000 HCM 4-Way Stop Method (Future Volume Alternative)
********************************************************************************
Intersection #4 Enterprise & 5th
********************************************************************************
Cycle (sec):          100               Critical Vol./Cap.(X):         0.157
Loss Time (sec):        0               Average Delay (sec/veh):         8.8
Optimal Cycle:          0               Level Of Service:                  A
********************************************************************************
Street Name:              Enterprise                              5th
Approach:      North Bound      South Bound       East Bound       West Bound
Movement:     L  -  T  -  R   L  -  T  -  R   L  -  T  -  R   L  -  T  -  R
------------|---------------||---------------||---------------||---------------|
Control:        Stop Sign        Stop Sign        Stop Sign        Stop Sign
Rights:           Include          Ignore           Ignore          Include
Min. Green:     0    0     0    0    0     0    0    0     0    0    0     0
Lanes:        1  0  0  1  0   0  0  1  0  0   0  1  0  1  0   0  1  0  0  1
------------|---------------||---------------||---------------||---------------|
Volume Module:PM Peak Hour
Base Vol:       0   19     5    0   97     0    0    9     9   38    1     0
Growth Adj:  1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
Initial Bse:    0   19     5    0   97     0    0    9     9   38    1     0
Added Vol:      0    0     0    0    0     0    0    0     0    0    0     0
New Trips:      0    0     0    0    0     0    0    0     0    0    0     0
Initial Fut:    0   19     5    0   97     0    0    9     9   38    1     0
User Adj:    1.00 1.00  1.00 1.00 1.00  0.00 1.00 1.00  0.00 1.00 1.00  1.00
PHF Adj:     0.82 0.82  0.82 0.82 0.82  0.00 0.82 0.82  0.00 0.82 0.82  0.82
PHF Volume:     0   23     6    0  118     0    0   11     0   46    1     0
Reduct Vol:     0    0     0    0    0     0    0    0     0    0    0     0
Reduced Vol:    0   23     6    0  118     0    0   11     0   46    1     0
PCE Adj:     1.00 1.00  1.00 1.00 1.00  0.00 1.00 1.00  0.00 1.00 1.00  1.00
MLF Adj:     1.00 1.00  1.00 1.00 1.00  0.00 1.00 1.00  0.00 1.00 1.00  1.00
FinalVolume:    0   23     6    0  118     0    0   11     0   46    1     0
------------|---------------||---------------||---------------||---------------|
Saturation Flow Module:
Adjustment:  1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
Lanes:       1.00 0.79  0.21 0.00 1.00  0.00 0.00 2.00  0.00 0.97 0.03  1.00
Final Sat.:   655  586   154    0  754     0    0 1067     0  524   14   654
------------|---------------||---------------||---------------||---------------|
Capacity Analysis Module:
Vol/Sat:     0.00 0.04  0.04 xxxx 0.16  xxxx xxxx 0.01  xxxx 0.09 0.09  0.00
Crit Moves:       ****             ****             ****             ****
Delay/Veh:    0.0  7.7   7.7  0.0  8.6   0.0  0.0  9.4   0.0  9.9  9.9   0.0
Delay Adj:   1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
AdjDel/Veh:   0.0  7.7   7.7  0.0  8.6   0.0  0.0  9.4   0.0  9.9  9.9   0.0
LOS by Move:    *    A     A    *    A     *    *    A     *    A    A     *
ApproachDel:       7.7              8.6              9.4              9.9
Delay Adj:        1.00             1.00             1.00             1.00
ApprAdjDel:        7.7              8.6              9.4              9.9
LOS by Appr:         A                A                A                A
AllWayAvgQ:   0.0  0.0   0.0  0.2  0.2   0.2  0.0  0.0   0.0  0.1  0.1   0.0
********************************************************************************
Note: Queue reported is the number of cars per lane.

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--------------------------------------------------------------------------------
                              Planetary Ventures
                             MFA Hangar 3  Project
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                       Level Of Service Computation Report
            2000 HCM Operations Method (Future Volume Alternative)
********************************************************************************
Intersection #5 Enterprise & 11th
********************************************************************************
Cycle (sec):          60                Critical Vol./Cap.(X):         0.211
Loss Time (sec):       9                Average Delay (sec/veh):        11.8
Optimal Cycle:        36                Level Of Service:                 B+
********************************************************************************
Street Name:               Enterprise                          11th
Approach:       North Bound      South Bound      East Bound       West Bound
Movement:     L  -  T  -  R   L  -  T  -  R   L  -  T  -  R   L  -  T  -  R
------------|---------------||---------------||---------------||---------------|
Control:        Protected        Protected        Protected        Protected
Rights:           Include          Include          Include          Include
Min. Green:     0   10    10    7   10     0    0    0     0    7    0    10
Y+R:          4.0  4.0   4.0  4.0  4.0   4.0  4.0  4.0   4.0  4.0  4.0   4.0
Lanes:        0  0  1  1  0   1  0  2  0  0   0  0  0  0  0   2  0  0  0  1
------------|---------------||---------------||---------------||---------------|
Volume Module:PM Peak Hour
Base Vol:       0  104    92  147  510     0    0    0     0  238    0    43
Growth Adj:  1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
Initial Bse:    0  104    92  147  510     0    0    0     0  238    0    43
Added Vol:      0    0     0    0    0     0    0    0     0    0    0     0
New Trips:      0    0     0    0    0     0    0    0     0    0    0     0
Initial Fut:    0  104    92  147  510     0    0    0     0  238    0    43
User Adj:    1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
PHF Adj:     0.90 0.90  0.90 0.90 0.90  0.90 0.90 0.90  0.90 0.90 0.90  0.90
PHF Volume:     0  116   102  163  567     0    0    0     0  264    0    48
Reduct Vol:     0    0     0    0    0     0    0    0     0    0    0     0
Reduced Vol:    0  116   102  163  567     0    0    0     0  264    0    48
PCE Adj:     1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
MLF Adj:     1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
FinalVolume:    0  116   102  163  567     0    0    0     0  264    0    48
------------|---------------||---------------||---------------||---------------|
Saturation Flow Module:
Sat/Lane:    1900 1900  1900 1900 1900  1900 1900 1900  1900 1900 1900  1900
Adjustment:  0.92 1.00  0.95 0.92 1.00  0.92 0.92 1.00  0.92 0.83 1.00  0.92
Lanes:       0.00 1.04  0.96 1.00 2.00  0.00 0.00 0.00  0.00 2.00 0.00  1.00
Final Sat.:     0 1962  1736 1750 3800     0    0    0     0 3150    0  1750
------------|---------------||---------------||---------------||---------------|
Capacity Analysis Module:
Vol/Sat:     0.00 0.06  0.06 0.09 0.15  0.00 0.00 0.00  0.00 0.08 0.00  0.03
Crit Moves:       ****       ****                                         ****
Green Time:   0.0 15.9  15.9 25.1 41.0   0.0  0.0  0.0   0.0 10.0  0.0  10.0
Volume/Cap:  0.00 0.22  0.22 0.22 0.22  0.00 0.00 0.00  0.00 0.50 0.00  0.16
Delay/Veh:    0.0 17.4  17.4 11.3  3.6   0.0  0.0  0.0   0.0 23.5  0.0  21.7
User DelAdj: 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
AdjDel/Veh:   0.0 17.4  17.4 11.3  3.6   0.0  0.0  0.0   0.0 23.5  0.0  21.7
LOS by Move:    A    B     B   B+    A     A    A    A     A    C    A    C+
HCM2kAvgQ:      0    2     2    2    2     0    0    0     0    3    0     1
********************************************************************************
Note: Queue reported is the number of cars per lane.
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-------------------------------------------------------------------------------
                          Planetary Ventures
                         MFA Hangar 3  Project
-------------------------------------------------------------------------------
                   Level Of Service Computation Report
            2000 HCM Operations Method (Future Volume Alternative)
*******************************************************************************
Intersection #6 Enterprise & Manila/Moffett Park
*******************************************************************************
Cycle (sec):          60                Critical Vol./Cap.(X):         0.619
Loss Time (sec):       9                Average Delay (sec/veh):        14.0
Optimal Cycle:        39                Level Of Service:                  B
*******************************************************************************
Street Name:              Enterprise                  Manila/Moffett Park
Approach:      North Bound      South Bound      East Bound       West Bound
Movement:    L  -  T  -  R   L  -  T  -  R   L  -  T  -  R   L  -  T  -  R
------------|---------------||---------------||---------------||---------------|
Control:       Protected        Protected        Protected        Protected
Rights:          Include          Include          Include          Include
Min. Green:    0    0     0    7    0    10    7   10     0    0   10    10
Y+R:         4.0  4.0   4.0  4.0  4.0   4.0  4.0  4.0   4.0  4.0  4.0   4.0
Lanes:       0  0  0  0  0   1  0  0  0  1   1  0  1  0  0   0  0  1  0  1
------------|---------------||---------------||---------------||---------------|
Volume Module:PM Peak Hour
Base Vol:      0    0     0  633    0   450  112  159     0    0  131   105
Growth Adj:  1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
Initial Bse:   0    0     0  633    0   450  112  159     0    0  131   105
Added Vol:     0    0     0    0    0     0    0    0     0    0    0     0
New Trips:     0    0     0    0    0     0    0    0     0    0    0     0
Initial Fut:   0    0     0  633    0   450  112  159     0    0  131   105
User Adj:    1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
PHF Adj:     0.94 0.94  0.94 0.94 0.94  0.94 0.94 0.94  0.94 0.94 0.94  0.94
PHF Volume:    0    0     0  673    0   479  119  169     0    0  139   112
Reduct Vol:    0    0     0    0    0     0    0    0     0    0    0     0
Reduced Vol:   0    0     0  673    0   479  119  169     0    0  139   112
PCE Adj:     1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
MLF Adj:     1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
FinalVolume:   0    0     0  673    0   479  119  169     0    0  139   112
------------|---------------||---------------||---------------||---------------|
Saturation Flow Module:
Sat/Lane:    1900 1900  1900 1900 1900  1900 1900 1900  1900 1900 1900  1900
Adjustment:  0.92 1.00  0.92 0.92 1.00  0.92 0.92 1.00  0.92 0.92 1.00  0.92
Lanes:       0.00 0.00  0.00 1.00 0.00  1.00 1.00 1.00  0.00 0.00 1.00  1.00
Final Sat.:    0    0     0 1750    0  1750 1750 1900     0    0 1900  1750
------------|---------------||---------------||---------------||---------------|
Capacity Analysis Module:
Vol/Sat:     0.00 0.00  0.00 0.38 0.00  0.27 0.07 0.09  0.00 0.00 0.07  0.06
Crit Moves:                  ****             ****                  ****
Green Time:   0.0  0.0   0.0 34.0  0.0  34.0  7.0 17.0   0.0  0.0 10.0  10.0
Volume/Cap:  0.00 0.00  0.00 0.68 0.00  0.48 0.58 0.31  0.00 0.00 0.44  0.38
Delay/Veh:    0.0  0.0   0.0 11.1  0.0   8.1 29.4 17.3   0.0  0.0 23.5  23.1
User DelAdj: 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
AdjDel/Veh:   0.0  0.0   0.0 11.1  0.0   8.1 29.4 17.3   0.0  0.0 23.5  23.1
LOS by Move:    A    A     A   B+    A     A    C    B     A    A    C     C
HCM2kAvgQ:      0    0     0   11    0     6    3    3     0    0    3     2
*******************************************************************************
Note: Queue reported is the number of cars per lane.
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                            Planetary Ventures
                           MFA Hangar 3  Project
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                     Level Of Service Computation Report
            2000 HCM Operations Method (Future Volume Alternative)
********************************************************************************
Intersection #7 US 101 NB & Moffett Park
********************************************************************************
Cycle (sec):          60                Critical Vol./Cap.(X):        0.777
Loss Time (sec):       9                Average Delay (sec/veh):       15.3
Optimal Cycle:        55                Level Of Service:                 B
********************************************************************************
Street Name:                 US 101 NB                       Moffett Park
Approach:      North Bound      South Bound      East Bound       West Bound
Movement:     L  -  T  -  R   L  -  T  -  R   L  -  T  -  R   L  -  T  -  R
------------|---------------||---------------||---------------||---------------|
Control:        Protected        Protected        Protected        Protected
Rights:           Include          Include          Include          Include
Min. Green:     7   10    10    7   10    10    7   10    10    7   10    10
Y+R:          4.0  4.0   4.0  4.0  4.0   4.0  4.0  4.0   4.0  4.0  4.0   4.0
Lanes:        0  0  0  0  0   0  0  0  0  0   0  0  1  0  1   1  0  1  0  0
------------|---------------||---------------||---------------||---------------|
Volume Module:PM Peak Hour
Base Vol:       0    0     0    0    0     0    0  666   140  507  287     0
Growth Adj:  1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
Initial Bse:    0    0     0    0    0     0    0  666   140  507  287     0
Added Vol:      0    0     0    0    0     0    0    0     0    0    0     0
New Trips:      0    0     0    0    0     0    0    0     0    0    0     0
Initial Fut:    0    0     0    0    0     0    0  666   140  507  287     0
User Adj:    1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
PHF Adj:     0.97 0.97  0.97 0.97 0.97  0.97 0.97 0.97  0.97 0.97 0.97  0.97
PHF Volume:     0    0     0    0    0     0    0  687   144  523  296     0
Reduct Vol:     0    0     0    0    0     0    0    0     0    0    0     0
Reduced Vol:    0    0     0    0    0     0    0  687   144  523  296     0
PCE Adj:     1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
MLF Adj:     1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
FinalVolume:    0    0     0    0    0     0    0  687   144  523  296     0
------------|---------------||---------------||---------------||---------------|
Saturation Flow Module:
Sat/Lane:    1900 1900  1900 1900 1900  1900 1900 1900  1900 1900 1900  1900
Adjustment:  0.92 1.00  0.92 0.92 1.00  0.92 0.92 1.00  0.92 0.92 1.00  0.92
Lanes:       0.00 0.00  0.00 0.00 0.00  0.00 0.00 1.00  1.00 1.00 1.00  0.00
Final Sat.:     0    0     0    0    0     0    0 1900  1750 1750 1900     0
------------|---------------||---------------||---------------||---------------|
Capacity Analysis Module:
Vol/Sat:     0.00 0.00  0.00 0.00 0.00  0.00 0.00 0.36  0.08 0.30 0.16  0.00
Crit Moves:                                       ****      ****
Green Time:   0.0  0.0   0.0  0.0  0.0   0.0  0.0 27.9  27.9 23.1 51.0   0.0
Volume/Cap:  0.00 0.00  0.00 0.00 0.00  0.00 0.00 0.78  0.18 0.78 0.18  0.00
Delay/Veh:    0.0  0.0   0.0  0.0  0.0   0.0  0.0 17.8   9.5 21.9  0.9   0.0
User DelAdj: 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
AdjDel/Veh:   0.0  0.0   0.0  0.0  0.0   0.0  0.0 17.8   9.5 21.9  0.9   0.0
LOS by Move:    A    A     A    A    A     A    A    B     A   C+    A     A
HCM2kAvgQ:      0    0     0    0    0     0    0   13     2   11    1     0
********************************************************************************
Note: Queue reported is the number of cars per lane.
```

```
--------------------------------------------------------------------------------
                              Planetary Ventures
                             MFA Hangar 3  Project
--------------------------------------------------------------------------------
                       Level Of Service Computation Report
            2000 HCM 4-Way Stop Method (Future Volume Alternative)
********************************************************************************
Intersection #8 Innovation & 11th
********************************************************************************
Cycle (sec):         100               Critical Vol./Cap.(X):         0.932
Loss Time (sec):       0               Average Delay (sec/veh):        25.1
Optimal Cycle:         0               Level Of Service:                  D
********************************************************************************
Street Name:              Innovation                              11th
Approach:      North Bound      South Bound      East Bound      West Bound
Movement:     L  -  T  -  R   L  -  T  -  R   L  -  T  -  R   L  -  T  -  R
------------|---------------||---------------||---------------||---------------|
Control:        Stop Sign        Stop Sign        Stop Sign        Stop Sign
Rights:          Include          Include          Include          Include
Min. Green:    0    0     0    0    0     0    0    0     0    0    0     0
Lanes:        1  1  0  1  0   1  0  1  1  0   1  0  0  1  1   0  0  1!  0  0
------------|---------------||---------------||---------------||---------------|
Volume Module:PM Peak Hour
Base Vol:     59   60    50   30   77    58  423   20   337   20   10    50
Growth Adj:  1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
Initial Bse:  59   60    50   30   77    58  423   20   337   20   10    50
Added Vol:     0    0     0    0    0     0    0    0     0    0    0     0
New Trips:     0    0     0    0    0     0    0    0     0    0    0     0
Initial Fut:  59   60    50   30   77    58  423   20   337   20   10    50
User Adj:    1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
PHF Adj:     0.88 0.88  0.88 0.88 0.88  0.88 0.88 0.88  0.88 0.88 0.88  0.88
PHF Volume:   67   68    57   34   88    66  481   23   383   23   11    57
Reduct Vol:    0    0     0    0    0     0    0    0     0    0    0     0
Reduced Vol:  67   68    57   34   88    66  481   23   383   23   11    57
PCE Adj:     1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
MLF Adj:     1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
FinalVolume:  67   68    57   34   88    66  481   23   383   23   11    57
------------|---------------||---------------||---------------||---------------|
Saturation Flow Module:
Adjustment:  1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
Lanes:       1.04 1.07  0.89 1.00 1.14  0.86 1.00 0.11  1.89 0.25 0.13  0.62
Final Sat.:   441  477   432  418  513   413  516   68  1155  133   67   333
------------|---------------||---------------||---------------||---------------|
Capacity Analysis Module:
Vol/Sat:     0.15 0.14  0.13 0.08 0.17  0.16 0.93 0.33  0.33 0.17 0.17  0.17
Crit Moves:  ****                 ****       ****                   ****
Delay/Veh:   12.3 11.6  10.8 11.6 11.9  11.1 50.1 11.4  11.3 10.7 10.7  10.7
Delay Adj:   1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
AdjDel/Veh:  12.3 11.6  10.8 11.6 11.9  11.1 50.1 11.4  11.3 10.7 10.7  10.7
LOS by Move:    B    B     B    B    B     B    F    B     B    B    B     B
ApproachDel:       11.6             11.6             32.3             10.7
Delay Adj:         1.00             1.00             1.00             1.00
ApprAdjDel:        11.6             11.6             32.3             10.7
LOS by Appr:          B                B                D                B
AllWayAvgQ:   0.2  0.1   0.1  0.1  0.2   0.2  5.8  0.5   0.5  0.2  0.2   0.2
********************************************************************************
Note: Queue reported is the number of cars per lane.
```

Planetary Ventures
MFA Hangar 3 Project

Level Of Service Computation Report
2000 HCM Operations Method (Future Volume Alternative)

Intersection #9 Innovation & Moffett Park

| | | | |
|---|---|---|---|
| Cycle (sec): | 60 | Critical Vol./Cap.(X): | 0.539 |
| Loss Time (sec): | 9 | Average Delay (sec/veh): | 15.7 |
| Optimal Cycle: | 39 | Level Of Service: | B |

| Street Name: | Innovation | | | | | | Moffett Park | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach: | North Bound | | | South Bound | | | East Bound | | | West Bound | | |
| Movement: | L | T | R | L | T | R | L | T | R | L | T | R |
| Control: | Protected | | | Protected | | | Protected | | | Protected | | |
| Rights: | Include | | | Include | | | Include | | | Include | | |
| Min. Green: | 0 | 0 | 0 | 7 | 0 | 10 | 10 | 10 | 0 | 0 | 10 | 10 |
| Y+R: | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lanes: | 0 0 | 0 | 0 0 | 1 0 | 1! | 0 0 | 1 0 | 2 | 0 0 | 0 0 | 2 | 0 1 |
| **Volume Module:PM Peak Hour** | | | | | | | | | | | | |
| Base Vol: | 0 | 0 | 0 | 364 | 0 | 279 | 78 | 585 | 0 | 0 | 483 | 86 |
| Growth Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Initial Bse: | 0 | 0 | 0 | 364 | 0 | 279 | 78 | 585 | 0 | 0 | 483 | 86 |
| Added Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| New Trips: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Initial Fut: | 0 | 0 | 0 | 364 | 0 | 279 | 78 | 585 | 0 | 0 | 483 | 86 |
| User Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| PHF Adj: | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| PHF Volume: | 0 | 0 | 0 | 383 | 0 | 294 | 82 | 616 | 0 | 0 | 508 | 91 |
| Reduct Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced Vol: | 0 | 0 | 0 | 383 | 0 | 294 | 82 | 616 | 0 | 0 | 508 | 91 |
| PCE Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| MLF Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| FinalVolume: | 0 | 0 | 0 | 383 | 0 | 294 | 82 | 616 | 0 | 0 | 508 | 91 |
| **Saturation Flow Module:** | | | | | | | | | | | | |
| Sat/Lane: | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Adjustment: | 0.92 | 1.00 | 0.92 | 0.92 | 1.00 | 0.92 | 0.92 | 1.00 | 0.92 | 0.92 | 1.00 | 0.92 |
| Lanes: | 0.00 | 0.00 | 0.00 | 1.39 | 0.00 | 0.61 | 1.00 | 2.00 | 0.00 | 0.00 | 2.00 | 1.00 |
| Final Sat.: | 0 | 0 | 0 | 2441 | 0 | 1059 | 1750 | 3800 | 0 | 0 | 3800 | 1750 |
| **Capacity Analysis Module:** | | | | | | | | | | | | |
| Vol/Sat: | 0.00 | 0.00 | 0.00 | 0.16 | 0.00 | 0.28 | 0.05 | 0.16 | 0.00 | 0.00 | 0.13 | 0.05 |
| Crit Moves: | | | | | | **** | **** | | | | **** | |
| Green Time: | 0.0 | 0.0 | 0.0 | 27.7 | 0.0 | 27.7 | 10.0 | 23.3 | 0.0 | 0.0 | 13.3 | 13.3 |
| Volume/Cap: | 0.00 | 0.00 | 0.00 | 0.34 | 0.00 | 0.60 | 0.28 | 0.42 | 0.00 | 0.00 | 0.60 | 0.23 |
| Delay/Veh: | 0.0 | 0.0 | 0.0 | 10.4 | 0.0 | 13.0 | 22.4 | 13.6 | 0.0 | 0.0 | 22.2 | 19.4 |
| User DelAdj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| AdjDel/Veh: | 0.0 | 0.0 | 0.0 | 10.4 | 0.0 | 13.0 | 22.4 | 13.6 | 0.0 | 0.0 | 22.2 | 19.4 |
| LOS by Move: | A | A | A | B+ | A | B | C+ | B | A | A | C+ | B- |
| HCM2kAvgQ: | 0 | 0 | 0 | 4 | 0 | 8 | 2 | 4 | 0 | 0 | 5 | 2 |

Note: Queue reported is the number of cars per lane.

Planetary Ventures
MFA Hangar 3  Project

Level Of Service Computation Report
2000 HCM Operations Method (Future Volume Alternative)

Intersection #10 Mathilda & 5th

| | | | |
|---|---|---|---|
| Cycle (sec): | 60 | Critical Vol./Cap.(X): | 0.373 |
| Loss Time (sec): | 12 | Average Delay (sec/veh): | 19.3 |
| Optimal Cycle: | 46 | Level Of Service: | B- |

| Street Name: | Mathilda | | | | | | 5th | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach: | North Bound | | | South Bound | | | East Bound | | | West Bound | | |
| Movement: | L | T | R | L | T | R | L | T | R | L | T | R |
| Control: | Protected | | | Protected | | | Protected | | | Protected | | |
| Rights: | Include | | | Ignore | | | Include | | | Include | | |
| Min. Green: | 7 | 10 | 10 | 7 | 10 | 10 | 7 | 10 | 10 | 7 | 10 | 10 |
| Y+R: | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lanes: | 2 0 2 1 0 | | | 1 0 3 0 9 | | | 2 0 1 0 1 | | | 2 0 0 1 0 | | |
| **Volume Module:PM Peak Hour** | | | | | | | | | | | | |
| Base Vol: | 12 | 314 | 43 | 3 | 626 | 26 | 138 | 16 | 94 | 282 | 14 | 29 |
| Growth Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Initial Bse: | 12 | 314 | 43 | 3 | 626 | 26 | 138 | 16 | 94 | 282 | 14 | 29 |
| Added Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| New Trips: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Initial Fut: | 12 | 314 | 43 | 3 | 626 | 26 | 138 | 16 | 94 | 282 | 14 | 29 |
| User Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| PHF Adj: | 0.86 | 0.86 | 0.86 | 0.86 | 0.86 | 0.00 | 0.86 | 0.86 | 0.86 | 0.86 | 0.86 | 0.86 |
| PHF Volume: | 14 | 365 | 50 | 3 | 728 | 0 | 160 | 19 | 109 | 328 | 16 | 34 |
| Reduct Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced Vol: | 14 | 365 | 50 | 3 | 728 | 0 | 160 | 19 | 109 | 328 | 16 | 34 |
| PCE Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| MLF Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| FinalVolume: | 14 | 365 | 50 | 3 | 728 | 0 | 160 | 19 | 109 | 328 | 16 | 34 |
| **Saturation Flow Module:** | | | | | | | | | | | | |
| Sat/Lane: | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Adjustment: | 0.83 | 0.99 | 0.95 | 0.92 | 1.00 | 0.80 | 0.83 | 1.00 | 0.92 | 0.83 | 0.95 | 0.95 |
| Lanes: | 2.00 | 2.63 | 0.37 | 1.00 | 3.00 | 9.00 | 2.00 | 1.00 | 1.00 | 2.00 | 0.33 | 0.67 |
| Final Sat.: | 3150 | 4925 | 674 | 1750 | 5700 | 13653 | 3150 | 1900 | 1750 | 3150 | 586 | 1214 |
| **Capacity Analysis Module:** | | | | | | | | | | | | |
| Vol/Sat: | 0.00 | 0.07 | 0.07 | 0.00 | 0.13 | 0.00 | 0.05 | 0.01 | 0.06 | 0.10 | 0.03 | 0.03 |
| Crit Moves: | **** | | | | **** | | | | **** | **** | | |
| Green Time: | 7.0 | 14.2 | 14.2 | 9.9 | 17.1 | 0.0 | 9.9 | 10.0 | 10.0 | 13.9 | 14.1 | 14.1 |
| Volume/Cap: | 0.04 | 0.31 | 0.31 | 0.01 | 0.45 | 0.00 | 0.31 | 0.06 | 0.37 | 0.45 | 0.12 | 0.12 |
| Delay/Veh: | 23.6 | 19.0 | 19.0 | 21.0 | 17.8 | 0.0 | 22.4 | 21.1 | 23.0 | 20.2 | 18.2 | 18.2 |
| User DelAdj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| AdjDel/Veh: | 23.6 | 19.0 | 19.0 | 21.0 | 17.8 | 0.0 | 22.4 | 21.1 | 23.0 | 20.2 | 18.2 | 18.2 |
| LOS by Move: | C | B- | B- | C+ | B | A | C+ | C+ | C | C+ | B- | B- |
| HCM2kAvgQ: | 0 | 2 | 2 | 0 | 4 | 0 | 2 | 0 | 2 | 4 | 1 | 1 |

Note: Queue reported is the number of cars per lane.

Planetary Ventures
MFA Hangar 3 Project

Level Of Service Computation Report
2000 HCM Operations Method (Future Volume Alternative)

Intersection #11 Mathilda & Moffett Park

| | | | |
|---|---|---|---|
| Cycle (sec): | 140 | Critical Vol./Cap.(X): | 0.859 |
| Loss Time (sec): | 12 | Average Delay (sec/veh): | 43.4 |
| Optimal Cycle: | 106 | Level Of Service: | D |

| Street Name: | Mathilda | | | | | | Moffett Park | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach: | North Bound | | | South Bound | | | East Bound | | | West Bound | | |
| Movement: | L | T | R | L | T | R | L | T | R | L | T | R |
| Control: | Protected | | | Protected | | | Protected | | | Protected | | |
| Rights: | Include | | | Include | | | Ignore | | | Include | | |
| Min. Green: | 7 | 10 | 0 | 0 | 10 | 10 | 7 | 0 | 10 | 7 | 10 | 10 |
| Y+R: | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lanes: | 2 0 3 0 0 | | | 0 0 2 1 0 | | | 0 0 1! 0 1 | | | 1 1 0 1 0 | | |
| **Volume Module:PM Peak Hour** | | | | | | | | | | | | |
| Base Vol: | 271 | 525 | 0 | 0 | 2048 | 382 | 354 | 0 | 481 | 643 | 10 | 29 |
| Growth Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Initial Bse: | 271 | 525 | 0 | 0 | 2048 | 382 | 354 | 0 | 481 | 643 | 10 | 29 |
| Added Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| New Trips: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Initial Fut: | 271 | 525 | 0 | 0 | 2048 | 382 | 354 | 0 | 481 | 643 | 10 | 29 |
| User Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 1.00 |
| PHF Adj: | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.00 | 0.94 | 0.94 | 0.94 |
| PHF Volume: | 288 | 559 | 0 | 0 | 2179 | 406 | 377 | 0 | 0 | 684 | 11 | 31 |
| Reduct Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced Vol: | 288 | 559 | 0 | 0 | 2179 | 406 | 377 | 0 | 0 | 684 | 11 | 31 |
| PCE Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 1.00 |
| MLF Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 1.00 |
| FinalVolume: | 288 | 559 | 0 | 0 | 2179 | 406 | 377 | 0 | 0 | 684 | 11 | 31 |
| **Saturation Flow Module:** | | | | | | | | | | | | |
| Sat/Lane: | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Adjustment: | 0.83 | 1.00 | 0.92 | 0.92 | 0.99 | 0.95 | 0.95 | 0.95 | 0.92 | 0.94 | 0.95 | 0.95 |
| Lanes: | 2.00 | 3.00 | 0.00 | 0.00 | 2.51 | 0.49 | 1.00 | 0.00 | 1.00 | 2.00 | 0.26 | 0.74 |
| Final Sat.: | 3150 | 5700 | 0 | 0 | 4719 | 880 | 1800 | 0 | 1750 | 3565 | 462 | 1338 |
| **Capacity Analysis Module:** | | | | | | | | | | | | |
| Vol/Sat: | 0.09 | 0.10 | 0.00 | 0.00 | 0.46 | 0.46 | 0.21 | 0.00 | 0.00 | 0.19 | 0.02 | 0.02 |
| Crit Moves: | **** | | | | **** | | **** | | | | **** | |
| Green Time: | 14.2 | 85.6 | 0.0 | 0.0 | 71.5 | 71.5 | 32.4 | 0.0 | 0.0 | 42.4 | 10.0 | 10.0 |
| Volume/Cap: | 0.90 | 0.16 | 0.00 | 0.00 | 0.90 | 0.90 | 0.90 | 0.00 | 0.00 | 0.63 | 0.32 | 0.32 |
| Delay/Veh: | 123.8 | 14.8 | 0.0 | 0.0 | 35.7 | 35.7 | 75.0 | 0.0 | 0.0 | 43.3 | 61.9 | 61.9 |
| User DelAdj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| AdjDel/Veh: | 123.8 | 14.8 | 0.0 | 0.0 | 35.7 | 35.7 | 75.0 | 0.0 | 0.0 | 43.3 | 61.9 | 61.9 |
| LOS by Move: | F | B | A | A | D+ | D+ | E- | A | A | D | E | E |
| HCM2kAvgQ: | 10 | 3 | 0 | 0 | 37 | 37 | 20 | 0 | 0 | 14 | 2 | 2 |

Note: Queue reported is the number of cars per lane.

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--------------------------------------------------------------------------------
                          Planetary Ventures
                         MFA Hangar 3  Project
--------------------------------------------------------------------------------
                    Level Of Service Computation Report
            2000 HCM Operations Method (Future Volume Alternative)
********************************************************************************
Intersection #12 Mathilda & Hwy 237 WB
********************************************************************************
Cycle (sec):         180              Critical Vol./Cap.(X):        0.474
Loss Time (sec):       9              Average Delay (sec/veh):        0.4
Optimal Cycle:        34              Level Of Service:                 A
********************************************************************************
Street Name:               Mathilda                          Hwy 237 WB
Approach:      North Bound      South Bound      East Bound       West Bound
Movement:     L  -  T  -  R   L  -  T  -  R   L  -  T  -  R   L  -  T  -  R
------------|----------------||----------------||----------------||----------------|
Control:        Protected        Protected        Protected        Protected
Rights:           Include          Include          Include          Include
Min. Green:     0   10     0     0   10    10     0    0     0     0    0     0
Y+R:          4.0  4.0   4.0   4.0  4.0   4.0   4.0  4.0   4.0   4.0  4.0   4.0
Lanes:        0  0  5  0  0   0  0  3  1  0   0  0  0  0  0   0  0  0  0  0
------------|----------------||----------------||----------------||----------------|
Volume Module:PM Peak Hour
Base Vol:       0  750     0     0 2634   540     0    0     0     0    0     0
Growth Adj:  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
Initial Bse:    0  750     0     0 2634   540     0    0     0     0    0     0
Added Vol:      0    0     0     0    0     0     0    0     0     0    0     0
New Trips:      0    0     0     0    0     0     0    0     0     0    0     0
Initial Fut:    0  750     0     0 2634   540     0    0     0     0    0     0
User Adj:    1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
PHF Adj:     0.94 0.94  0.94  0.94 0.94  0.94  0.94 0.94  0.94  0.94 0.94  0.94
PHF Volume:     0  798     0     0 2802   574     0    0     0     0    0     0
Reduct Vol:     0    0     0     0    0     0     0    0     0     0    0     0
Reduced Vol:    0  798     0     0 2802   574     0    0     0     0    0     0
PCE Adj:     1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
MLF Adj:     1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
FinalVolume:    0  798     0     0 2802   574     0    0     0     0    0     0
------------|----------------||----------------||----------------||----------------|
Saturation Flow Module:
Sat/Lane:    1900 1900  1900  1900 1900  1900  1900 1900  1900  1900 1900  1900
Adjustment:  0.92 1.00  0.92  0.92 0.99  0.95  0.92 1.00  0.92  0.92 1.00  0.92
Lanes:       0.00 5.00  0.00  0.00 3.29  0.71  0.00 0.00  0.00  0.00 0.00  0.00
Final Sat.:     0 9500     0     0 6222  1276     0    0     0     0    0     0
------------|----------------||----------------||----------------||----------------|
Capacity Analysis Module:
Vol/Sat:     0.00 0.08  0.00  0.00 0.45  0.45  0.00 0.00  0.00  0.00 0.00  0.00
Crit Moves:  ****                    ****
Green Time:   0.0  171   0.0   0.0  171 171.0   0.0  0.0   0.0   0.0  0.0   0.0
Volume/Cap:  0.00 0.09  0.00  0.00 0.47  0.47  0.00 0.00  0.00  0.00 0.00  0.00
Delay/Veh:    0.0  0.2   0.0   0.0  0.5   0.5   0.0  0.0   0.0   0.0  0.0   0.0
User DelAdj: 1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
AdjDel/Veh:   0.0  0.2   0.0   0.0  0.5   0.5   0.0  0.0   0.0   0.0  0.0   0.0
LOS by Move:    A    A     A     A    A     A     A    A     A     A    A     A
HCM2kAvgQ:      0    1     0     0    5     5     0    0     0     0    0     0
********************************************************************************
Note: Queue reported is the number of cars per lane.
```

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--------------------------------------------------------------------------------
                             Planetary Ventures
                            MFA Hangar 3  Project
--------------------------------------------------------------------------------

                     Level Of Service Computation Report
            2000 HCM Operations Method (Future Volume Alternative)
********************************************************************************
Intersection #13 Mathilda & Hwy 237 EB
********************************************************************************
Cycle (sec):          60                Critical Vol./Cap.(X):         0.652
Loss Time (sec):       9                Average Delay (sec/veh):        11.8
Optimal Cycle:        42                Level Of Service:                 B+
********************************************************************************
Street Name:               Mathilda                          Hwy 237 EB
Approach:      North Bound      South Bound      East Bound       West Bound
Movement:     L  -  T  -  R   L  -  T  -  R   L  -  T  -  R   L  -  T  -  R
------------|---------------||---------------||---------------||---------------|
Control:       Protected        Protected        Protected        Protected
Rights:          Ignore          Include          Include          Include
Min. Green:    0   10    10    7   10     0    7    0    10    0    0     0
Y+R:          4.0  4.0   4.0  4.0  4.0   4.0  4.0  4.0   4.0  4.0  4.0   4.0
Lanes:        0  0  5  0  2   1  0  3  0  0   2  0  0  0  1   0  0  0  0  0
------------|---------------||---------------||---------------||---------------|
Volume Module:PM Peak Hour
Base Vol:      0  516   608   366 2298     0   231    0   254     0    0     0
Growth Adj:  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
Initial Bse:   0  516   608   366 2298     0   231    0   254     0    0     0
Added Vol:     0    0     0     0    0     0     0    0     0     0    0     0
New Trips:     0    0     0     0    0     0     0    0     0     0    0     0
Initial Fut:   0  516   608   366 2298     0   231    0   254     0    0     0
User Adj:    1.00 1.00  0.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
PHF Adj:     0.99 0.99  0.00  0.99 0.99  0.99  0.99 0.99  0.99  0.99 0.99  0.99
PHF Volume:    0  521     0   370 2321     0   233    0   257     0    0     0
Reduct Vol:    0    0     0     0    0     0     0    0     0     0    0     0
Reduced Vol:   0  521     0   370 2321     0   233    0   257     0    0     0
PCE Adj:     1.00 1.00  0.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
MLF Adj:     1.00 1.00  0.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
FinalVolume:   0  521     0   370 2321     0   233    0   257     0    0     0
------------|---------------||---------------||---------------||---------------|
Saturation Flow Module:
Sat/Lane:    1900 1900  1900  1900 1900  1900  1900 1900  1900  1900 1900  1900
Adjustment:  0.92 1.00  0.83  0.92 1.00  0.92  0.83 1.00  0.92  0.92 1.00  0.92
Lanes:       0.00 5.00  2.00  1.00 3.00  0.00  2.00 0.00  1.00  0.00 0.00  0.00
Final Sat.:    0 9500  3150  1750 5700     0  3150    0  1750     0    0     0
------------|---------------||---------------||---------------||---------------|
Capacity Analysis Module:
Vol/Sat:     0.00 0.05  0.00  0.21 0.41  0.00  0.07 0.00  0.15  0.00 0.00  0.00
Crit Moves:  ****                   ****                   ****
Green Time:   0.0 16.5   0.0  21.0 37.5   0.0  13.5  0.0  13.5   0.0  0.0   0.0
Volume/Cap:  0.00 0.20  0.00  0.60 0.65  0.00  0.33 0.00  0.65  0.00 0.00  0.00
Delay/Veh:    0.0 16.7   0.0  17.8  7.6   0.0  19.7  0.0  25.0   0.0  0.0   0.0
User DelAdj: 1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
AdjDel/Veh:   0.0 16.7   0.0  17.8  7.6   0.0  19.7  0.0  25.0   0.0  0.0   0.0
LOS by Move:    A    B     A     B    A     A    B-    A     C     A    A     A
HCM2kAvgQ:      0    2     0     7   10     0     2    0     6     0    0     0
********************************************************************************
Note: Queue reported is the number of cars per lane.
```

# 2022 Plus Proposed Action Conditions

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Planetary Ventures
MFA Hangar 3 Project

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Scenario Report

| | |
|---|---|
| Scenario: | 2022 + Hangar 3 Demo Phase 2 - AM Peak |
| Command: | Default Command |
| Volume: | 2022 + Hangar 3 Demo Phase 2 - AM Peak |
| Geometry: | Existing |
| Impact Fee: | Default Impact Fee |
| Trip Generation: | Default Trip Generation |
| Trip Distribution: | Default Trip Distribution |
| Paths: | Default Path |
| Routes: | Default Route |
| Configuration: | Default Configuration |

Planetary Ventures
MFA Hangar 3 Project

Impact Analysis Report
Level Of Service

| Intersection | Base LOS | Base Del/ Veh | Base V/ C | Future LOS | Future Del/ Veh | Future V/ C | Change in |
|---|---|---|---|---|---|---|---|
| # 1 Ellis & Manila | B | 11.1 | 0.496 | B | 11.1 | 0.496 | + 0.000 V/C |
| # 2 Ellis & US 101 NB | C | 24.8 | 0.638 | C | 24.8 | 0.638 | -0.001 D/V |
| # 3 Ellis & US 101 SB | D+ | 35.7 | 0.526 | D+ | 35.7 | 0.526 | -0.008 D/V |
| # 4 Enterprise & 5th | A | 8.7 | 0.220 | A | 9.1 | 0.231 | + 0.011 V/C |
| # 5 Enterprise & 11th | B+ | 11.6 | 0.432 | B+ | 11.6 | 0.432 | + 0.000 D/V |
| # 6 Enterprise & Manila/Moffett Pa | C- | 33.3 | 0.816 | C- | 33.3 | 0.816 | + 0.000 D/V |
| # 7 US 101 NB & Moffett Park | A | 5.4 | 0.454 | A | 5.4 | 0.454 | + 0.000 D/V |
| # 8 Innovation & 11th | B | 14.4 | 0.649 | B | 14.4 | 0.649 | + 0.000 V/C |
| # 9 Innovation & Moffett Park | B+ | 11.7 | 0.566 | B+ | 11.7 | 0.566 | + 0.000 D/V |
| # 10 Mathilda & 5th | B | 16.3 | 0.270 | B | 16.4 | 0.290 | + 0.184 D/V |
| # 11 Mathilda & Moffett Park | C- | 32.7 | 0.922 | C- | 32.9 | 0.940 | + 0.133 D/V |
| # 12 Mathilda & Hwy 237 WB | A | 0.3 | 0.350 | A | 0.3 | 0.350 | -0.000 D/V |
| # 13 Mathilda & Hwy 237 EB | B | 17.7 | 0.746 | B | 17.7 | 0.763 | + 0.028 D/V |

```
-------------------------------------------------------------------------------
                          Planetary Ventures
                         MFA Hangar 3 Project
-------------------------------------------------------------------------------
                    Level Of Service Computation Report
          2000 HCM 4-Way Stop Method (Future Volume Alternative)
*******************************************************************************
Intersection #1 Ellis & Manila
*******************************************************************************
Cycle (sec):         100               Critical Vol./Cap.(X):         0.496
Loss Time (sec):      12               Average Delay (sec/veh):        11.1
Optimal Cycle:         0               Level Of Service:                  B
*******************************************************************************
Street Name:                 Ellis                             Manila
Approach:       North Bound      South Bound       East Bound       West Bound
Movement:     L  -  T  -  R    L  -  T  -  R    L  -  T  -  R    L  -  T  -  R
------------|---------------||---------------||---------------||---------------|
Control:       Stop Sign        Stop Sign        Stop Sign        Stop Sign
Rights:          Ignore          Include          Include          Include
Min. Green:    7   10    10    7   10    10    7   10    10    7   10    10
Lanes:        0  0  2  0  1    0  1  1  0  0    0  0  0  0  1    0  0  1! 0  0
------------|---------------||---------------||---------------||---------------|
Volume Module:AM Peak Hour
Base Vol:      0  290   741    5   62     0    0    0     0  279    0    50
Growth Adj:  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
Initial Bse:   0  290   741    5   62     0    0    0     0  279    0    50
Added Vol:     0    0     0    0    0     0    0    0     0    0    0     0
Project:       0    2     0    0    0     0    0    0     0    0    0     0
Initial Fut:   0  292   741    5   62     0    0    0     0  279    0    50
User Adj:    1.00 1.00  0.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
PHF Adj:     0.95 0.95  0.00  0.95 0.95  0.95  0.95 0.95  0.95  0.95 0.95  0.95
PHF Volume:    0  307     0    5   65     0    0    0     0  294    0    53
Reduct Vol:    0    0     0    0    0     0    0    0     0    0    0     0
Reduced Vol:   0  307     0    5   65     0    0    0     0  294    0    53
PCE Adj:     1.00 1.00  0.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
MLF Adj:     1.00 1.00  0.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
FinalVolume:   0  307     0    5   65     0    0    0     0  294    0    53
------------|---------------||---------------||---------------||---------------|
Saturation Flow Module:
Adjustment:  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
Lanes:       0.00 2.00  1.00  0.15 1.85  0.00  0.00 0.00  1.00  0.85 0.00  0.15
Final Sat.:    0 1247   709   86 1069     0    0    0   699  592    0   106
------------|---------------||---------------||---------------||---------------|
Capacity Analysis Module:
Vol/Sat:     xxxx 0.25  0.00  0.06 0.06  xxxx  xxxx xxxx  0.00  0.50 xxxx  0.50
Crit Moves:       ****        ****                        ****              ****
Delay/Veh:    0.0 10.0   0.0   9.0  8.9   0.0   0.0  0.0   0.0  12.6  0.0  12.6
Delay Adj:   1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
AdjDel/Veh:   0.0 10.0   0.0   9.0  8.9   0.0   0.0  0.0   0.0  12.6  0.0  12.6
LOS by Move:    *    A     *     A    A     *     *    *     *     B    *     B
ApproachDel:      10.0              8.9            xxxxxx             12.6
Delay Adj:        1.00             1.00             xxxxx             1.00
ApprAdjDel:       10.0              8.9            xxxxxx             12.6
LOS by Appr:         A                A                 *                B
AllWayAvgQ:   0.0  0.3   0.0   0.1  0.1   0.0   0.0  0.0   0.0   0.9  0.9   0.9
*******************************************************************************
Note: Queue reported is the number of cars per lane.
```

Planetary Ventures
MFA Hangar 3 Project

Level Of Service Computation Report
2000 HCM Operations Method (Future Volume Alternative)

Intersection #2 Ellis & US 101 NB

| | | | | |
|---|---|---|---|---|
| Cycle (sec): | 55 | | Critical Vol./Cap.(X): | 0.638 |
| Loss Time (sec): | 9 | | Average Delay (sec/veh): | 24.8 |
| Optimal Cycle: | 40 | | Level Of Service: | C |

| Street Name: | Ellis | | | | | | US 101 NB | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach: | North Bound | | | South Bound | | | East Bound | | | West Bound | | |
| Movement: | L | T | R | L | T | R | L | T | R | L | T | R |
| Control: | Split Phase | | | Split Phase | | | Protected | | | Protected | | |
| Rights: | Include | | | Include | | | Include | | | Include | | |
| Min. Green: | 7 | 10 | 10 | 7 | 10 | 10 | 7 | 10 | 10 | 7 | 10 | 10 |
| Y+R: | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lanes: | 0 1 | 1 0 | 0 | 0 0 | 1 1 | 0 | 0 0 | 0 0 | 0 | 0 1 | 0 0 | 2 |
| **Volume Module:AM Peak Hour** | | | | | | | | | | | | |
| Base Vol: | 83 | 856 | 0 | 0 | 141 | 214 | 0 | 0 | 0 | 310 | 2 | 183 |
| Growth Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Initial Bse: | 83 | 856 | 0 | 0 | 141 | 214 | 0 | 0 | 0 | 310 | 2 | 183 |
| Added Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Project: | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| Initial Fut: | 83 | 857 | 0 | 0 | 141 | 214 | 0 | 0 | 0 | 310 | 2 | 184 |
| User Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| PHF Adj: | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| PHF Volume: | 88 | 912 | 0 | 0 | 150 | 228 | 0 | 0 | 0 | 330 | 2 | 196 |
| Reduct Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced Vol: | 88 | 912 | 0 | 0 | 150 | 228 | 0 | 0 | 0 | 330 | 2 | 196 |
| PCE Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| MLF Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| FinalVolume: | 88 | 912 | 0 | 0 | 150 | 228 | 0 | 0 | 0 | 330 | 2 | 196 |
| **Saturation Flow Module:** | | | | | | | | | | | | |
| Sat/Lane: | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Adjustment: | 0.95 | 0.98 | 0.92 | 0.92 | 1.00 | 0.92 | 0.92 | 1.00 | 0.92 | 0.95 | 0.95 | 0.83 |
| Lanes: | 0.18 | 1.82 | 0.00 | 0.00 | 1.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.99 | 0.01 | 2.00 |
| Final Sat.: | 327 | 3373 | 0 | 0 | 1900 | 1750 | 0 | 0 | 0 | 1788 | 12 | 3150 |
| **Capacity Analysis Module:** | | | | | | | | | | | | |
| Vol/Sat: | 0.27 | 0.27 | 0.00 | 0.00 | 0.08 | 0.13 | 0.00 | 0.00 | 0.00 | 0.18 | 0.18 | 0.06 |
| Crit Moves: | | **** | | | **** | | | | | **** | | |
| Green Time: | 20.7 | 20.7 | 0.0 | 0.0 | 11.2 | 11.2 | 0.0 | 0.0 | 0.0 | 14.1 | 14.1 | 14.1 |
| Volume/Cap: | 0.72 | 0.72 | 0.00 | 0.00 | 0.39 | 0.64 | 0.00 | 0.00 | 0.00 | 0.72 | 0.72 | 0.24 |
| Delay/Veh: | 28.2 | 28.2 | 0.0 | 0.0 | 19.2 | 22.4 | 0.0 | 0.0 | 0.0 | 24.1 | 24.1 | 16.4 |
| User DelAdj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| AdjDel/Veh: | 28.2 | 28.2 | 0.0 | 0.0 | 19.2 | 22.4 | 0.0 | 0.0 | 0.0 | 24.1 | 24.1 | 16.4 |
| LOS by Move: | C | C | A | A | B- | C+ | A | A | A | C | C | B |
| HCM2kAvgQ: | 9 | 9 | 0 | 0 | 3 | 5 | 0 | 0 | 0 | 7 | 7 | 2 |

Note: Queue reported is the number of cars per lane.

```
---------------------------------------------------------------------------------
                              Planetary Ventures
                             MFA Hangar 3 Project
---------------------------------------------------------------------------------
                       Level Of Service Computation Report
            2000 HCM Operations Method (Future Volume Alternative)
*********************************************************************************
Intersection #3 Ellis & US 101 SB
*********************************************************************************
Cycle (sec):          55                Critical Vol./Cap.(X):        0.526
Loss Time (sec):       9                Average Delay (sec/veh):       35.7
Optimal Cycle:        36                Level Of Service:                D+
*********************************************************************************
Street Name:                 Ellis                             US 101 SB
Approach:      North Bound      South Bound       East Bound       West Bound
Movement:     L  -  T  -  R   L  -  T  -  R    L  -  T  -  R    L  -  T  -  R
------------|---------------||---------------||---------------||---------------|
Control:        Protected        Protected        Protected        Protected
Rights:           Ignore           Include          Include          Include
Min. Green:     7   10    10    7   10    10    7   10    10    7   10    10
Y+R:          4.0  4.0   4.0  4.0  4.0   4.0  4.0  4.0   4.0  4.0  4.0   4.0
Lanes:        0  0  2  0  1   1  0  1  0  0   1  0  0  0  1   0  0  0  0  0
------------|---------------||---------------||---------------||---------------|
Volume Module:AM Peak Hour
Base Vol:       0  254    66   30  393     0  553    0   504    0    0     0
Growth Adj:  1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
Initial Bse:    0  254    66   30  393     0  553    0   504    0    0     0
Added Vol:      0    0     0    0    0     0    0    0     0    0    0     0
Project:        0    1     0    0    0     0    0    0     0    0    0     0
Initial Fut:    0  255    66   30  393     0  553    0   504    0    0     0
User Adj:    1.00 1.00  0.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
PHF Adj:     0.91 0.91  0.00 0.91 0.91  0.91 0.91 0.91  0.91 0.91 0.91  0.91
PHF Volume:     0  280     0   33  432     0  608    0   554    0    0     0
Reduct Vol:     0    0     0    0    0     0    0    0     0    0    0     0
Reduced Vol:    0  280     0   33  432     0  608    0   554    0    0     0
PCE Adj:     1.00 1.00  0.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
MLF Adj:     1.00 1.00  0.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
FinalVolume:    0  280     0   33  432     0  608    0   554    0    0     0
------------|---------------||---------------||---------------||---------------|
Saturation Flow Module:
Sat/Lane:    1900 1900  1900 1900 1900  1900 1900 1900  1900 1900 1900  1900
Adjustment:  0.92 1.00  0.92 0.92 1.00  0.92 0.92 1.00  0.92 0.92 1.00  0.92
Lanes:       0.00 2.00  1.00 1.00 1.00  0.00 1.00 0.00  1.00 0.00 0.00  0.00
Final Sat.:     0 3800  1750 1750 1900     0 1750    0  1750    0    0     0
------------|---------------||---------------||---------------||---------------|
Capacity Analysis Module:
Vol/Sat:     0.00 0.07  0.00 0.02 0.23  0.00 0.35 0.00  0.32 0.00 0.00  0.00
Crit Moves:       ****       ****             ****
Green Time:   0.0 10.0   0.0  7.0 17.0   0.0 29.0  0.0  29.0  0.0  0.0   0.0
Volume/Cap:  0.00 0.41  0.00 0.15 0.74  0.00 0.66 0.00  0.60 0.00 0.00  0.00
Delay/Veh:    0.0 20.3   0.0 21.7 21.8   0.0 50.2  0.0  39.4  0.0  0.0   0.0
User DelAdj: 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
AdjDel/Veh:   0.0 20.3   0.0 21.7 21.8   0.0 50.2  0.0  39.4  0.0  0.0   0.0
LOS by Move:    A   C+     A   C+   C+     A    D    A     D    A    A     A
HCM2kAvgQ:      0    3     0    1    8     0    9    0     8    0    0     0
*********************************************************************************
Note: Queue reported is the number of cars per lane.
```

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--------------------------------------------------------------------------------
                             Planetary Ventures
                            MFA Hangar 3 Project
--------------------------------------------------------------------------------
                       Level Of Service Computation Report
             2000 HCM 4-Way Stop Method (Future Volume Alternative)
********************************************************************************
Intersection #4 Enterprise & 5th
********************************************************************************
Cycle (sec):         100               Critical Vol./Cap.(X):         0.231
Loss Time (sec):       0               Average Delay (sec/veh):         9.1
Optimal Cycle:         0               Level Of Service:                  A
********************************************************************************
Street Name:              Enterprise                             5th
Approach:      North Bound      South Bound       East Bound       West Bound
Movement:     L  -  T  -  R   L  -  T  -  R   L  -  T  -  R   L  -  T  -  R
------------|---------------||---------------||---------------||---------------|
Control:       Stop Sign        Stop Sign        Stop Sign        Stop Sign
Rights:          Include          Ignore           Ignore           Include
Min. Green:     0    0     0    0    0     0    0    0     0    0    0     0
Lanes:        1  0  0  1  0   0  1  0  0  0   0  1  0  1  0   0  1  0  0  1
------------|---------------||---------------||---------------||---------------|
Volume Module:AM Peak Hour
Base Vol:       0  127    23    2   12     0    0    4     3   14    1     1
Growth Adj:  1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
Initial Bse:    0  127    23    2   12     0    0    4     3   14    1     1
Added Vol:      0    0     0    0    0     0    0    0     0    0    0     0
Project:        0    0     0    0    0     0    0   24     0    0   26     0
Initial Fut:    0  127    23    2   12     0    0   28     3   14   27     1
User Adj:    1.00 1.00  1.00 1.00 1.00  0.00 1.00 1.00  0.00 1.00 1.00  1.00
PHF Adj:     0.88 0.88  0.88 0.88 0.88  0.00 0.88 0.88  0.00 0.88 0.88  0.88
PHF Volume:     0  144    26    2   14     0    0   32     0   16   31     1
Reduct Vol:     0    0     0    0    0     0    0    0     0    0    0     0
Reduced Vol:    0  144    26    2   14     0    0   32     0   16   31     1
PCE Adj:     1.00 1.00  1.00 1.00 1.00  0.00 1.00 1.00  0.00 1.00 1.00  1.00
MLF Adj:     1.00 1.00  1.00 1.00 1.00  0.00 1.00 1.00  0.00 1.00 1.00  1.00
FinalVolume:    0  144    26    2   14     0    0   32     0   16   31     1
------------|---------------||---------------||---------------||---------------|
Saturation Flow Module:
Adjustment:  1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
Lanes:       1.00 0.85  0.15 0.14 0.86  0.00 0.00 2.00  0.00 0.34 0.66  1.00
Final Sat.:   656  625   113  101  608     0    0 1046     0  188  363   634
------------|---------------||---------------||---------------||---------------|
Capacity Analysis Module:
Vol/Sat:     0.00 0.23  0.23 0.02 0.02  xxxx xxxx 0.03  xxxx 0.08 0.08  0.00
Crit Moves:       ****           ****             ****             ****
Delay/Veh:    0.0  8.9   8.9  8.1  8.1   0.0  0.0  9.6   0.0  9.6  9.6   8.2
Delay Adj:   1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
AdjDel/Veh:   0.0  8.9   8.9  8.1  8.1   0.0  0.0  9.6   0.0  9.6  9.6   8.2
LOS by Move:    *    A     A    A    A     *    *    A     *    A    A     A
ApproachDel:       8.9              8.1              9.6              9.6
Delay Adj:        1.00             1.00             1.00             1.00
ApprAdjDel:        8.9              8.1              9.6              9.6
LOS by Appr:         A                A                A                A
AllWayAvgQ:   0.0  0.3   0.3  0.0  0.0   0.0  0.0  0.0   0.0  0.1  0.1   0.0
********************************************************************************
Note: Queue reported is the number of cars per lane.
```

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--------------------------------------------------------------------------------
                              Planetary Ventures
                             MFA Hangar 3 Project
--------------------------------------------------------------------------------

                      Level Of Service Computation Report
            2000 HCM Operations Method (Future Volume Alternative)
********************************************************************************
Intersection #5 Enterprise & 11th
********************************************************************************
Cycle (sec):          60                  Critical Vol./Cap.(X):         0.432
Loss Time (sec):       9                  Average Delay (sec/veh):        11.6
Optimal Cycle:        36                  Level Of Service:                 B+
********************************************************************************
Street Name:                Enterprise                             11th
Approach:      North Bound      South Bound      East Bound       West Bound
Movement:     L  -  T  -  R   L  -  T  -  R   L  -  T  -  R   L  -  T  -  R
------------|---------------||---------------||---------------||---------------|
Control:        Protected        Protected        Protected        Protected
Rights:           Include          Include          Include          Include
Min. Green:     0   10    10    7   10     0    0    0     0    7    0    10
Y+R:          4.0  4.0   4.0  4.0  4.0   4.0  4.0  4.0   4.0  4.0  4.0   4.0
Lanes:        0  0  1  1  0   1  0  2  0  0   0  0  0  0  0   2  0  0  0  1
------------|---------------||---------------||---------------||---------------|
Volume Module:AM Peak Hour
Base Vol:       0  513   299   28  152     0    0    0     0   80    0   173
Growth Adj:  1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
Initial Bse:    0  513   299   28  152     0    0    0     0   80    0   173
Added Vol:      0    0     0    0    0     0    0    0     0    0    0     0
Project:        0    0     0    0    0     0    0    0     0    0    0     0
Initial Fut:    0  513   299   28  152     0    0    0     0   80    0   173
User Adj:    1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
PHF Adj:     0.91 0.91  0.91 0.91 0.91  0.91 0.91 0.91  0.91 0.91 0.91  0.91
PHF Volume:     0  564   329   31  167     0    0    0     0   88    0   190
Reduct Vol:     0    0     0    0    0     0    0    0     0    0    0     0
Reduced Vol:    0  564   329   31  167     0    0    0     0   88    0   190
PCE Adj:     1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
MLF Adj:     1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
FinalVolume:    0  564   329   31  167     0    0    0     0   88    0   190
------------|---------------||---------------||---------------||---------------|
Saturation Flow Module:
Sat/Lane:    1900 1900  1900 1900 1900  1900 1900 1900  1900 1900 1900  1900
Adjustment:  0.92 0.99  0.95 0.92 1.00  0.92 0.92 1.00  0.92 0.83 1.00  0.92
Lanes:       0.00 1.24  0.76 1.00 2.00  0.00 0.00 0.00  0.00 2.00 0.00  1.00
Final Sat.:     0 2337  1362 1750 3800     0    0    0     0 3150    0  1750
------------|---------------||---------------||---------------||---------------|
Capacity Analysis Module:
Vol/Sat:     0.00 0.24  0.24 0.02 0.04  0.00 0.00 0.00  0.00 0.03 0.00  0.11
Crit Moves:       ****       ****                                         ****
Green Time:   0.0 30.3  30.3  7.0 37.3   0.0  0.0  0.0   0.0 13.7  0.0  13.7
Volume/Cap:  0.00 0.48  0.48 0.15 0.07  0.00 0.00 0.00  0.00 0.12 0.00  0.48
Delay/Veh:    0.0  9.9   9.9 24.2  4.5   0.0  0.0  0.0   0.0 18.5  0.0  21.0
User DelAdj: 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
AdjDel/Veh:   0.0  9.9   9.9 24.2  4.5   0.0  0.0  0.0   0.0 18.5  0.0  21.0
LOS by Move:    A    A     A    C    A     A    A    A     A   B-    A    C+
HCM2kAvgQ:      0    6     6    1    1     0    0    0     0    1    0     4
********************************************************************************
Note: Queue reported is the number of cars per lane.
```

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------------------------------------------------------------------------------
                          Planetary Ventures
                         MFA Hangar 3 Project
------------------------------------------------------------------------------
                    Level Of Service Computation Report
           2000 HCM Operations Method (Future Volume Alternative)
******************************************************************************
Intersection #6 Enterprise & Manila/Moffett Park
******************************************************************************
Cycle (sec):         100              Critical Vol./Cap.(X):        0.816
Loss Time (sec):       9              Average Delay (sec/veh):       33.3
Optimal Cycle:        72              Level Of Service:                C-
******************************************************************************
Street Name:             Enterprise                  Manila/Moffett Park
Approach:      North Bound      South Bound      East Bound       West Bound
Movement:     L  -  T  -  R   L  -  T  -  R   L  -  T  -  R   L  -  T  -  R
------------|----------------||----------------||----------------||----------------|
Control:        Protected        Protected        Protected        Protected
Rights:           Include          Include          Include          Include
Min. Green:     0    0     0    7    0    10    7   10     0    0   10    10
Y+R:          4.0  4.0   4.0  4.0  4.0   4.0  4.0  4.0   4.0  4.0  4.0   4.0
Lanes:        0  0  0  0  0   1  0  0  0  1   1  0  1  0  0   0  0  1  0  1
------------|----------------||----------------||----------------||----------------|
Volume Module:AM Peak Hour
Base Vol:       0    0     0  121    0    65  542  201     0    0  245   562
Growth Adj:  1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
Initial Bse:    0    0     0  121    0    65  542  201     0    0  245   562
Added Vol:      0    0     0    0    0     0    0    0     0    0    0     0
Project:        0    0     0    0    0     0    0    0     0    0    0     0
Initial Fut:    0    0     0  121    0    65  542  201     0    0  245   562
User Adj:    1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
PHF Adj:     0.90 0.90  0.90 0.90 0.90  0.90 0.90 0.90  0.90 0.90 0.90  0.90
PHF Volume:     0    0     0  134    0    72  602  223     0    0  272   624
Reduct Vol:     0    0     0    0    0     0    0    0     0    0    0     0
Reduced Vol:    0    0     0  134    0    72  602  223     0    0  272   624
PCE Adj:     1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
MLF Adj:     1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
FinalVolume:    0    0     0  134    0    72  602  223     0    0  272   624
------------|----------------||----------------||----------------||----------------|
Saturation Flow Module:
Sat/Lane:    1900 1900  1900 1900 1900  1900 1900 1900  1900 1900 1900  1900
Adjustment:  0.92 1.00  0.92 0.92 1.00  0.92 0.92 1.00  0.92 0.92 1.00  0.92
Lanes:       0.00 0.00  0.00 1.00 0.00  1.00 1.00 1.00  0.00 0.00 1.00  1.00
Final Sat.:     0    0     0 1750    0  1750 1750 1900     0    0 1900  1750
------------|----------------||----------------||----------------||----------------|
Capacity Analysis Module:
Vol/Sat:     0.00 0.00  0.00 0.08 0.00  0.04 0.34 0.12  0.00 0.00 0.14  0.36
Crit Moves:                              **** ****                      ****
Green Time:   0.0  0.0   0.0 10.0  0.0  10.0 39.8 81.0   0.0  0.0 41.2  41.2
Volume/Cap:  0.00 0.00  0.00 0.77 0.00  0.41 0.87 0.15  0.00 0.00 0.35  0.87
Delay/Veh:    0.0  0.0   0.0 62.3  0.0  43.8 38.7  2.1   0.0  0.0 20.4  37.5
User DelAdj: 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
AdjDel/Veh:   0.0  0.0   0.0 62.3  0.0  43.8 38.7  2.1   0.0  0.0 20.4  37.5
LOS by Move:    A    A     A    E    A     D   D+    A     A    A   C+    D+
HCM2kAvgQ:      0    0     0    6    0     3   21    2     0    0    6    22
******************************************************************************
Note: Queue reported is the number of cars per lane.
```

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--------------------------------------------------------------------------------
                            Planetary Ventures
                           MFA Hangar 3 Project
--------------------------------------------------------------------------------
                     Level Of Service Computation Report
           2000 HCM Operations Method (Future Volume Alternative)
********************************************************************************
Intersection #7 US 101 NB & Moffett Park
********************************************************************************
Cycle (sec):          60                Critical Vol./Cap.(X):         0.454
Loss Time (sec):       9                Average Delay (sec/veh):         5.4
Optimal Cycle:        30                Level Of Service:                  A
********************************************************************************
Street Name:                US 101 NB                       Moffett Park
Approach:      North Bound      South Bound      East Bound       West Bound
Movement:     L  -  T  -  R   L  -  T  -  R   L  -  T  -  R   L  -  T  -  R
------------|---------------||---------------||---------------||---------------|
Control:        Protected        Protected        Protected        Protected
Rights:           Include          Include          Include          Include
Min. Green:     7   10    10    7   10    10    7   10    10    7   10    10
Y+R:          4.0  4.0   4.0  4.0  4.0   4.0  4.0  4.0   4.0  4.0  4.0   4.0
Lanes:        0  0  0  0  0   0  0  0  0  0   0  0  1  0  1   1  0  1  0  0
------------|---------------||---------------||---------------||---------------|
Volume Module:AM Peak Hour
Base Vol:       0    0     0    0    0     0    0  341    13  176  711     0
Growth Adj:  1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
Initial Bse:    0    0     0    0    0     0    0  341    13  176  711     0
Added Vol:      0    0     0    0    0     0    0    0     0    0    0     0
Project:        0    0     0    0    0     0    0    0     0    0    0     0
Initial Fut:    0    0     0    0    0     0    0  341    13  176  711     0
User Adj:    1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
PHF Adj:     0.97 0.97  0.97 0.97 0.97  0.97 0.97 0.97  0.97 0.97 0.97  0.97
PHF Volume:     0    0     0    0    0     0    0  352    13  181  733     0
Reduct Vol:     0    0     0    0    0     0    0    0     0    0    0     0
Reduced Vol:    0    0     0    0    0     0    0  352    13  181  733     0
PCE Adj:     1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
MLF Adj:     1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
FinalVolume:    0    0     0    0    0     0    0  352    13  181  733     0
------------|---------------||---------------||---------------||---------------|
Saturation Flow Module:
Sat/Lane:    1900 1900  1900 1900 1900  1900 1900 1900  1900 1900 1900  1900
Adjustment:  0.92 1.00  0.92 0.92 1.00  0.92 0.92 1.00  0.92 0.92 1.00  0.92
Lanes:       0.00 0.00  0.00 0.00 0.00  0.00 0.00 1.00  1.00 1.00 1.00  0.00
Final Sat.:     0    0     0    0    0     0    0 1900  1750 1750 1900     0
------------|---------------||---------------||---------------||---------------|
Capacity Analysis Module:
Vol/Sat:     0.00 0.00  0.00 0.00 0.00  0.00 0.00 0.19  0.01 0.10 0.39  0.00
Crit Moves:                                  ****                ****
Green Time:   0.0  0.0   0.0  0.0  0.0   0.0  0.0 31.3  31.3 19.7 51.0   0.0
Volume/Cap:  0.00 0.00  0.00 0.00 0.00  0.00 0.00 0.35  0.01 0.32 0.45  0.00
Delay/Veh:    0.0  0.0   0.0  0.0  0.0   0.0  0.0  8.7   6.9 15.4  1.3   0.0
User DelAdj: 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
AdjDel/Veh:   0.0  0.0   0.0  0.0  0.0   0.0  0.0  8.7   6.9 15.4  1.3   0.0
LOS by Move:    A    A     A    A    A     A    A    A     A    B    A     A
HCM2kAvgQ:      0    0     0    0    0     0    0    4     0    3    4     0
********************************************************************************
Note: Queue reported is the number of cars per lane.
```

Planetary Ventures
MFA Hangar 3 Project

Level Of Service Computation Report
2000 HCM 4-Way Stop Method (Future Volume Alternative)

Intersection #8 Innovation & 11th

| | | | |
|---|---|---|---|
| Cycle (sec): | 100 | Critical Vol./Cap.(X): | 0.649 |
| Loss Time (sec): | 0 | Average Delay (sec/veh): | 14.4 |
| Optimal Cycle: | 0 | Level Of Service: | B |

| Street Name: | Innovation | | | | | | 11th | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach: | North Bound | | | South Bound | | | East Bound | | | West Bound | | |
| Movement: | L | T | R | L | T | R | L | T | R | L | T | R |
| Control: | Stop Sign | | | Stop Sign | | | Stop Sign | | | Stop Sign | | |
| Rights: | Include | | | Include | | | Include | | | Include | | |
| Min. Green: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lanes: | 1 1 | 0 1 | 0 | 1 0 | 1 1 | 0 | 1 0 | 0 1 | 1 | 0 0 | 1! 0 | 0 |
| Volume Module:AM Peak Hour | | | | | | | | | | | | |
| Base Vol: | 309 | 28 | 40 | 30 | 68 | 307 | 62 | 20 | 72 | 20 | 10 | 50 |
| Growth Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Initial Bse: | 309 | 28 | 40 | 30 | 68 | 307 | 62 | 20 | 72 | 20 | 10 | 50 |
| Added Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Project: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Initial Fut: | 309 | 28 | 40 | 30 | 68 | 307 | 62 | 20 | 72 | 20 | 10 | 50 |
| User Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| PHF Adj: | 0.82 | 0.82 | 0.82 | 0.82 | 0.82 | 0.82 | 0.82 | 0.82 | 0.82 | 0.82 | 0.82 | 0.82 |
| PHF Volume: | 377 | 34 | 49 | 37 | 83 | 374 | 76 | 24 | 88 | 24 | 12 | 61 |
| Reduct Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced Vol: | 377 | 34 | 49 | 37 | 83 | 374 | 76 | 24 | 88 | 24 | 12 | 61 |
| PCE Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| MLF Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| FinalVolume: | 377 | 34 | 49 | 37 | 83 | 374 | 76 | 24 | 88 | 24 | 12 | 61 |
| Saturation Flow Module: | | | | | | | | | | | | |
| Adjustment: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Lanes: | 2.00 | 0.41 | 0.59 | 1.00 | 1.00 | 1.00 | 1.00 | 0.43 | 1.57 | 0.25 | 0.12 | 0.63 |
| Final Sat.: | 960 | 224 | 319 | 477 | 513 | 577 | 417 | 202 | 746 | 120 | 60 | 300 |
| Capacity Analysis Module: | | | | | | | | | | | | |
| Vol/Sat: | 0.39 | 0.15 | 0.15 | 0.08 | 0.16 | 0.65 | 0.18 | 0.12 | 0.12 | 0.20 | 0.20 | 0.20 |
| Crit Moves: | **** | | | | | **** | **** | | | | **** | |
| Delay/Veh: | 14.4 | 10.2 | 10.2 | 10.6 | 10.8 | 18.8 | 12.5 | 10.9 | 10.6 | 11.5 | 11.5 | 11.5 |
| Delay Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| AdjDel/Veh: | 14.4 | 10.2 | 10.2 | 10.6 | 10.8 | 18.8 | 12.5 | 10.9 | 10.6 | 11.5 | 11.5 | 11.5 |
| LOS by Move: | B | B | B | B | B | C | B | B | B | B | B | B |
| ApproachDel: | | 13.6 | | | 16.8 | | | 11.4 | | | 11.5 | |
| Delay Adj: | | 1.00 | | | 1.00 | | | 1.00 | | | 1.00 | |
| ApprAdjDel: | | 13.6 | | | 16.8 | | | 11.4 | | | 11.5 | |
| LOS by Appr: | | B | | | C | | | B | | | B | |
| AllWayAvgQ: | 0.6 | 0.2 | 0.2 | 0.1 | 0.2 | 1.6 | 0.2 | 0.1 | 0.1 | 0.2 | 0.2 | 0.2 |

Note: Queue reported is the number of cars per lane.

```
--------------------------------------------------------------------------------
                              Planetary Ventures
                             MFA Hangar 3 Project
--------------------------------------------------------------------------------
                       Level Of Service Computation Report
            2000 HCM Operations Method (Future Volume Alternative)
********************************************************************************
Intersection #9 Innovation & Moffett Park
********************************************************************************
Cycle (sec):          60              Critical Vol./Cap.(X):         0.566
Loss Time (sec):       9              Average Delay (sec/veh):        11.7
Optimal Cycle:        39              Level Of Service:                 B+
********************************************************************************
Street Name:              Innovation                       Moffett Park
Approach:       North Bound      South Bound      East Bound       West Bound
Movement:     L  -  T  -  R   L  -  T  -  R   L  -  T  -  R   L  -  T  -  R
------------|----------------||----------------||----------------||----------------|
Control:        Protected        Protected        Protected        Protected
Rights:           Include          Include          Include          Include
Min. Green:     0    0     0    7    0    10   10   10     0    0   10    10
Y+R:          4.0  4.0   4.0  4.0  4.0   4.0  4.0  4.0   4.0  4.0  4.0   4.0
Lanes:        0  0  0  0  0   1  0  1! 0  0   1  0  2  0  0   0  0  2  0  1
------------|----------------||----------------||----------------||----------------|
Volume Module:AM Peak Hour
Base Vol:       0    0     0  114    0    80  114  190     0    0  841   549
Growth Adj:  1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
Initial Bse:    0    0     0  114    0    80  114  190     0    0  841   549
Added Vol:      0    0     0    0    0     0    0    0     0    0    0     0
Project:        0    0     0    0    0     0    0    0     0    0    0     0
Initial Fut:    0    0     0  114    0    80  114  190     0    0  841   549
User Adj:    1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
PHF Adj:     0.95 0.95  0.95 0.95 0.95  0.95 0.95 0.95  0.95 0.95 0.95  0.95
PHF Volume:     0    0     0  120    0    84  120  200     0    0  885   578
Reduct Vol:     0    0     0    0    0     0    0    0     0    0    0     0
Reduced Vol:    0    0     0  120    0    84  120  200     0    0  885   578
PCE Adj:     1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
MLF Adj:     1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
FinalVolume:    0    0     0  120    0    84  120  200     0    0  885   578
------------|----------------||----------------||----------------||----------------|
Saturation Flow Module:
Sat/Lane:    1900 1900  1900 1900 1900  1900 1900 1900  1900 1900 1900  1900
Adjustment:  0.92 1.00  0.92 0.92 1.00  0.92 0.92 1.00  0.92 0.92 1.00  0.92
Lanes:       0.00 0.00  0.00 1.42 0.00  0.58 1.00 2.00  0.00 0.00 2.00  1.00
Final Sat.:     0    0     0 2478    0  1022 1750 3800     0    0 3800  1750
------------|----------------||----------------||----------------||----------------|
Capacity Analysis Module:
Vol/Sat:     0.00 0.00  0.00 0.05 0.00  0.08 0.07 0.05  0.00 0.00 0.23  0.33
Crit Moves:                             **** ****                        ****
Green Time:   0.0  0.0   0.0 10.0  0.0  10.0 10.0 41.0   0.0  0.0 31.0  31.0
Volume/Cap:  0.00 0.00  0.00 0.29 0.00  0.49 0.41 0.08  0.00 0.00 0.45  0.64
Delay/Veh:    0.0  0.0   0.0 22.1  0.0  23.6 23.3  3.2   0.0  0.0  9.3  12.0
User DelAdj: 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
AdjDel/Veh:   0.0  0.0   0.0 22.1  0.0  23.6 23.3  3.2   0.0  0.0  9.3  12.0
LOS by Move:    A    A     A   C+    A     C    C    A     A    A    A     B
HCM2kAvgQ:      0    0     0    2    0     3    3    1     0    0    5     9
********************************************************************************
Note: Queue reported is the number of cars per lane.
```

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-------------------------------------------------------------------------------
                           Planetary Ventures
                          MFA Hangar 3 Project
-------------------------------------------------------------------------------
                    Level Of Service Computation Report
           2000 HCM Operations Method (Future Volume Alternative)
*******************************************************************************
Intersection #10 Mathilda & 5th
*******************************************************************************
Cycle (sec):          60                 Critical Vol./Cap.(X):         0.290
Loss Time (sec):      12                 Average Delay (sec/veh):        16.4
Optimal Cycle:        46                 Level Of Service:                  B
*******************************************************************************
Street Name:                Mathilda                            5th
Approach:      North Bound      South Bound      East Bound       West Bound
Movement:    L  -  T  -  R   L  -  T  -  R   L  -  T  -  R   L  -  T  -  R
------------|---------------||---------------||---------------||---------------|
Control:       Protected        Protected        Protected        Protected
Rights:          Include          Ignore           Include          Include
Min. Green:    7   10    10    7   10    10    7   10    10    7   10    10
Y+R:         4.0  4.0   4.0  4.0  4.0   4.0  4.0  4.0   4.0  4.0  4.0   4.0
Lanes:       2  0  2  1  0   1  0  3  0  9   2  0  1  0  1   2  0  0  1  0
------------|---------------||---------------||---------------||---------------|
Volume Module:AM Peak Hour
Base Vol:     45  448   216   91  243   267   23    8    15   44   11     8
Growth Adj:  1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
Initial Bse:  45  448   216   91  243   267   23    8    15   44   11     8
Added Vol:     0    0     0    0    0     0    0    0     0    0    0     0
Project:      26    0     0    0    0     0    0    0    24    0    0     0
Initial Fut:  71  448   216   91  243   267   23    8    39   44   11     8
User Adj:    1.00 1.00  1.00 1.00 1.00  0.00 1.00 1.00  1.00 1.00 1.00  1.00
PHF Adj:     0.89 0.89  0.89 0.89 0.89  0.00 0.89 0.89  0.89 0.89 0.89  0.89
PHF Volume:   80  503   243  102  273     0   26    9    44   49   12     9
Reduct Vol:    0    0     0    0    0     0    0    0     0    0    0     0
Reduced Vol:  80  503   243  102  273     0   26    9    44   49   12     9
PCE Adj:     1.00 1.00  1.00 1.00 1.00  0.00 1.00 1.00  1.00 1.00 1.00  1.00
MLF Adj:     1.00 1.00  1.00 1.00 1.00  0.00 1.00 1.00  1.00 1.00 1.00  1.00
FinalVolume:  80  503   243  102  273     0   26    9    44   49   12     9
------------|---------------||---------------||---------------||---------------|
Saturation Flow Module:
Sat/Lane:    1900 1900  1900 1900 1900  1900 1900 1900  1900 1900 1900  1900
Adjustment:  0.83 1.00  0.95 0.92 1.00  0.80 0.83 1.00  0.92 0.83 0.95  0.95
Lanes:       2.00 2.00  1.00 1.00 3.00  9.00 2.00 1.00  1.00 2.00 0.58  0.42
Final Sat.:  3150 3798  1800 1750 5700 13653 3150 1900  1750 3150 1042   758
------------|---------------||---------------||---------------||---------------|
Capacity Analysis Module:
Vol/Sat:     0.03 0.13  0.13 0.06 0.05  0.00 0.01 0.00  0.03 0.02 0.01  0.01
Crit Moves:       ****       ****                           **** ****
Green Time:  12.8 21.5  21.5  9.5 18.2   0.0  7.0 10.0  10.0  7.0 10.0  10.0
Volume/Cap:  0.12 0.37  0.38 0.37 0.16  0.00 0.07 0.03  0.15 0.13 0.07  0.07
Delay/Veh:   19.2 14.3  14.4 23.4 15.3   0.0 23.7 21.0  21.6 23.9 21.2  21.2
User DelAdj: 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
AdjDel/Veh:  19.2 14.3  14.4 23.4 15.3   0.0 23.7 21.0  21.6 23.9 21.2  21.2
LOS by Move:   B-    B     B    C    B     A    C   C+    C+    C   C+    C+
HCM2kAvgQ:      1    4     4    2    1     0    0    0     1    1    0     0
*******************************************************************************
Note: Queue reported is the number of cars per lane.
```

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--------------------------------------------------------------------------------
                          Planetary Ventures
                         MFA Hangar 3 Project
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                   Level Of Service Computation Report
          2000 HCM Operations Method (Future Volume Alternative)
********************************************************************************
Intersection #11 Mathilda & Moffett Park
********************************************************************************
Cycle (sec):          90               Critical Vol./Cap.(X):         0.940
Loss Time (sec):      12               Average Delay (sec/veh):        32.9
Optimal Cycle:       123               Level Of Service:                 C-
********************************************************************************
Street Name:                Mathilda                         Moffett Park
Approach:      North Bound      South Bound       East Bound       West Bound
Movement:     L  -  T  -  R   L  -  T  -  R    L  -  T  -  R    L  -  T  -  R
------------|----------------||----------------||----------------||----------------|
Control:       Protected        Protected         Protected         Protected
Rights:          Include          Include           Ignore            Include
Min. Green:     7   10     0     0   10    10     7    0    10     7   10    10
Y+R:          4.0  4.0   4.0   4.0  4.0   4.0   4.0  4.0   4.0   4.0  4.0   4.0
Lanes:        2  0  3  0  0    0  0  2  1  0    0  0  1! 0  1    1  1  0  1  0
------------|----------------||----------------||----------------||----------------|
Volume Module:AM Peak Hour
Base Vol:     1042 2033     0     0  359   501   121    0   114   572   55    80
Growth Adj:   1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
Initial Bse:  1042 2033     0     0  359   501   121    0   114   572   55    80
Added Vol:       0    0     0     0    0     0     0    0     0     0    0     0
Project:         0    0     0     0   24     0     0    0     0     0    0    26
Initial Fut:  1042 2033     0     0  383   501   121    0   114   572   55   106
User Adj:     1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  0.00  1.00 1.00  1.00
PHF Adj:      0.95 0.95  0.95  0.95 0.95  0.95  0.95 0.95  0.00  0.95 0.95  0.95
PHF Volume:   1097 2140     0     0  403   527   127    0     0   602   58   112
Reduct Vol:      0    0     0     0    0     0     0    0     0     0    0     0
Reduced Vol:  1097 2140     0     0  403   527   127    0     0   602   58   112
PCE Adj:      1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  0.00  1.00 1.00  1.00
MLF Adj:      1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  0.00  1.00 1.00  1.00
FinalVolume:  1097 2140     0     0  403   527   127    0     0   602   58   112
------------|----------------||----------------||----------------||----------------|
Saturation Flow Module:
Sat/Lane:     1900 1900  1900  1900 1900  1900  1900 1900  1900  1900 1900  1900
Adjustment:   0.83 1.00  0.92  0.92 1.00  0.92  0.95 0.95  0.92  0.94 0.95  0.95
Lanes:        2.00 3.00  0.00  0.00 2.00  1.00  1.00 0.00  1.00  2.00 0.34  0.66
Final Sat.:   3150 5700     0     0 3800  1750  1800    0  1750  3557  615  1185
------------|----------------||----------------||----------------||----------------|
Capacity Analysis Module:
Vol/Sat:      0.35 0.38  0.00  0.00 0.11  0.30  0.07 0.00  0.00  0.17 0.09  0.09
Crit Moves:   ****                    ****  ****                     ****
Green Time:   32.7 61.0   0.0   0.0 28.3  28.3   7.0  0.0   0.0  17.0 10.0  10.0
Volume/Cap:   0.96 0.55  0.00  0.00 0.34  0.96  0.91 0.00  0.00  0.90 0.85  0.85
Delay/Veh:    54.9 10.5   0.0   0.0 23.7  49.8  91.0  0.0   0.0  47.6 46.7  46.7
User DelAdj:  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
AdjDel/Veh:   54.9 10.5   0.0   0.0 23.7  49.8  91.0  0.0   0.0  47.6 46.7  46.7
LOS by Move:    D-   B+     A     A    C     D     F    A     A     D    D     D
HCM2kAvgQ:      24   10     0     0    4    21     7    0     0    12    8     8
********************************************************************************
Note: Queue reported is the number of cars per lane.
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                          Planetary Ventures
                         MFA Hangar 3 Project
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                   Level Of Service Computation Report
            2000 HCM Operations Method (Future Volume Alternative)
********************************************************************************
Intersection #12 Mathilda & Hwy 237 WB
********************************************************************************
Cycle (sec):         180              Critical Vol./Cap.(X):        0.350
Loss Time (sec):       9              Average Delay (sec/veh):        0.3
Optimal Cycle:        28              Level Of Service:                 A
********************************************************************************
Street Name:               Mathilda                        Hwy 237 WB
Approach:      North Bound      South Bound      East Bound       West Bound
Movement:     L  -  T  -  R   L  -  T  -  R   L  -  T  -  R   L  -  T  -  R
------------|---------------||---------------||---------------||---------------|
Control:        Protected        Protected        Protected        Protected
Rights:           Include          Include          Include          Include
Min. Green:     0   10     0     0   10    10     0    0     0     0    0     0
Y+R:          4.0  4.0   4.0   4.0  4.0   4.0   4.0  4.0   4.0   4.0  4.0   4.0
Lanes:        0  0  5  0  0    0  0  3  1  0    0  0  0  0  0    0  0  0  0  0
------------|---------------||---------------||---------------||---------------|
Volume Module:AM Peak Hour
Base Vol:       0 2965     0     0  808   259     0    0     0     0    0     0
Growth Adj:  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
Initial Bse:    0 2965     0     0  808   259     0    0     0     0    0     0
Added Vol:      0    0     0     0    0     0     0    0     0     0    0     0
Project:        0    0     0     0   24     0     0    0     0     0    0     0
Initial Fut:    0 2965     0     0  832   259     0    0     0     0    0     0
User Adj:    1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
PHF Adj:     0.94 0.94  0.94  0.94 0.94  0.94  0.94 0.94  0.94  0.94 0.94  0.94
PHF Volume:     0 3154     0     0  885   276     0    0     0     0    0     0
Reduct Vol:     0    0     0     0    0     0     0    0     0     0    0     0
Reduced Vol:    0 3154     0     0  885   276     0    0     0     0    0     0
PCE Adj:     1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
MLF Adj:     1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
FinalVolume:    0 3154     0     0  885   276     0    0     0     0    0     0
------------|---------------||---------------||---------------||---------------|
Saturation Flow Module:
Sat/Lane:    1900 1900  1900  1900 1900  1900  1900 1900  1900  1900 1900  1900
Adjustment:  0.92 1.00  0.92  0.92 1.00  0.95  0.92 1.00  0.92  0.92 1.00  0.92
Lanes:       0.00 5.00  0.00  0.00 3.01  0.99  0.00 0.00  0.00  0.00 0.00  0.00
Final Sat.:     0 9500     0     0 5717  1780     0    0     0     0    0     0
------------|---------------||---------------||---------------||---------------|
Capacity Analysis Module:
Vol/Sat:     0.00 0.33  0.00  0.00 0.15  0.15  0.00 0.00  0.00  0.00 0.00  0.00
Crit Moves:       ****        ****
Green Time:   0.0  171   0.0   0.0  171 171.0   0.0  0.0   0.0   0.0  0.0   0.0
Volume/Cap:  0.00 0.35  0.00  0.00 0.16  0.16  0.00 0.00  0.00  0.00 0.00  0.00
Delay/Veh:    0.0  0.4   0.0   0.0  0.3   0.3   0.0  0.0   0.0   0.0  0.0   0.0
User DelAdj: 1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
AdjDel/Veh:   0.0  0.4   0.0   0.0  0.3   0.3   0.0  0.0   0.0   0.0  0.0   0.0
LOS by Move:    A    A     A     A    A     A     A    A     A     A    A     A
HCM2kAvgQ:      0    3     0     0    1     1     0    0     0     0    0     0
********************************************************************************
Note: Queue reported is the number of cars per lane.
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-------------------------------------------------------------------------------
                             Planetary Ventures
                            MFA Hangar 3 Project
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                     Level Of Service Computation Report
           2000 HCM Operations Method (Future Volume Alternative)
*******************************************************************************
Intersection #13 Mathilda & Hwy 237 EB
*******************************************************************************
Cycle (sec):          50                 Critical Vol./Cap.(X):         0.763
Loss Time (sec):       9                 Average Delay (sec/veh):        17.7
Optimal Cycle:        50                 Level Of Service:                  B
*******************************************************************************
Street Name:                Mathilda                           Hwy 237 EB
Approach:      North Bound      South Bound      East Bound       West Bound
Movement:     L  -  T  -  R   L  -  T  -  R   L  -  T  -  R   L  -  T  -  R
------------|---------------||---------------||---------------||---------------|
Control:        Protected        Protected        Protected        Protected
Rights:           Ignore           Include          Include          Include
Min. Green:     0   10    10    7   10     0    7   10    10    0    0     0
Y+R:          4.0  4.0   4.0  4.0  4.0   4.0  4.0  4.0   4.0  4.0  4.0   4.0
Lanes:        0  0  5  0  2   1  0  3  0  0   2  0  0  0  1   0  0  0  0  0
------------|---------------||---------------||---------------||---------------|
Volume Module:AM Peak Hour
Base Vol:       0 1884   764   62  730     0 1074    0   105    0    0     0
Growth Adj:  1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
Initial Bse:    0 1884   764   62  730     0 1074    0   105    0    0     0
Added Vol:      0    0     0    0    0     0    0    0     0    0    0     0
Project:        0    0     0   24    0     0    0    0     0    0    0     0
Initial Fut:    0 1884   764   86  730     0 1074    0   105    0    0     0
User Adj:    1.00 1.00  0.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
PHF Adj:     0.94 0.94  0.00 0.94 0.94  0.94 0.94 0.94  0.94 0.94 0.94  0.94
PHF Volume:     0 2004     0   91  777     0 1143    0   112    0    0     0
Reduct Vol:     0    0     0    0    0     0    0    0     0    0    0     0
Reduced Vol:    0 2004     0   91  777     0 1143    0   112    0    0     0
PCE Adj:     1.00 1.00  0.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
MLF Adj:     1.00 1.00  0.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
FinalVolume:    0 2004     0   91  777     0 1143    0   112    0    0     0
------------|---------------||---------------||---------------||---------------|
Saturation Flow Module:
Sat/Lane:    1900 1900  1900 1900 1900  1900 1900 1900  1900 1900 1900  1900
Adjustment:  0.92 1.00  0.83 0.92 1.00  0.92 0.83 1.00  0.92 0.92 1.00  0.92
Lanes:       0.00 5.00  2.00 1.00 3.00  0.00 2.00 0.00  1.00 0.00 0.00  0.00
Final Sat.:     0 9500  3150 1750 5700     0 3150    0  1750    0    0     0
------------|---------------||---------------||---------------||---------------|
Capacity Analysis Module:
Vol/Sat:     0.00 0.21  0.00 0.05 0.14  0.00 0.36 0.00  0.06 0.00 0.00  0.00
Crit Moves:       ****       ****            ****
Green Time:   0.0 12.5   0.0  7.0 19.5   0.0 21.5  0.0  21.5  0.0  0.0   0.0
Volume/Cap:  0.00 0.84  0.00 0.37 0.35  0.00 0.84 0.00  0.15 0.00 0.00  0.00
Delay/Veh:    0.0 20.8   0.0 20.5 10.9   0.0 17.8  0.0   8.8  0.0  0.0   0.0
User DelAdj: 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
AdjDel/Veh:   0.0 20.8   0.0 20.5 10.9   0.0 17.8  0.0   8.8  0.0  0.0   0.0
LOS by Move:    A   C+     A   C+   B+     A    B    A     A    A    A     A
HCM2kAvgQ:      0    9     0    2    3     0   13    0     1    0    0     0
*******************************************************************************
Note: Queue reported is the number of cars per lane.
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Planetary Ventures
MFA Hangar 3 Project

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Scenario Report

| | |
|---|---|
| Scenario: | 2022 + Hangar 3 Demo Phase 2 - PM Peak |
| Command: | Default Command |
| Volume: | 2022 + Hangar 3 Demo Phase 2 - PM Peak |
| Geometry: | Existing |
| Impact Fee: | Default Impact Fee |
| Trip Generation: | Default Trip Generation |
| Trip Distribution: | Default Trip Distribution |
| Paths: | Default Path |
| Routes: | Default Route |
| Configuration: | Default Configuration |

Planetary Ventures
MFA Hangar 3 Project

Impact Analysis Report
Level Of Service

| Intersection | Base LOS | Base Del/ Veh | Base V/ C | Future LOS | Future Del/ Veh | Future V/ C | Change in |
|---|---|---|---|---|---|---|---|
| # 1 Ellis & Manila | D | 25.3 | 0.883 | D | 25.3 | 0.884 | + 0.001 V/C |
| # 2 Ellis & US 101 NB | C | 23.9 | 0.638 | C | 23.9 | 0.638 | + 0.004 D/V |
| # 3 Ellis & US 101 SB | C | 25.8 | 0.332 | C | 25.8 | 0.332 | + 0.005 D/V |
| # 4 Enterprise & 5th | A | 8.8 | 0.157 | A | 9.3 | 0.165 | + 0.008 V/C |
| # 5 Enterprise & 11th | B+ | 11.8 | 0.211 | B+ | 11.8 | 0.211 | + 0.000 D/V |
| # 6 Enterprise & Manila/Moffett Pa | B | 14.0 | 0.619 | B | 14.0 | 0.619 | + 0.000 D/V |
| # 7 US 101 NB & Moffett Park | B | 15.3 | 0.777 | B | 15.3 | 0.777 | + 0.000 D/V |
| # 8 Innovation & 11th | D | 25.1 | 0.932 | D | 25.1 | 0.932 | + 0.000 V/C |
| # 9 Innovation & Moffett Park | B | 15.7 | 0.539 | B | 15.7 | 0.539 | + 0.000 D/V |
| # 10 Mathilda & 5th | B- | 19.3 | 0.373 | B- | 19.6 | 0.406 | + 0.287 D/V |
| # 11 Mathilda & Moffett Park | D | 43.4 | 0.859 | D | 43.9 | 0.880 | + 0.473 D/V |
| # 12 Mathilda & Hwy 237 WB | A | 0.4 | 0.474 | A | 0.4 | 0.478 | + 0.003 D/V |
| # 13 Mathilda & Hwy 237 EB | B+ | 11.8 | 0.652 | B+ | 12.0 | 0.652 | + 0.121 D/V |

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                          Planetary Ventures
                         MFA Hangar 3  Project
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                     Level Of Service Computation Report
            2000 HCM 4-Way Stop Method (Future Volume Alternative)
********************************************************************************
Intersection #1 Ellis & Manila
********************************************************************************
Cycle (sec):         100                Critical Vol./Cap.(X):        0.884
Loss Time (sec):      12                Average Delay (sec/veh):       25.3
Optimal Cycle:         0                Level Of Service:                 D
********************************************************************************
Street Name:                 Ellis                              Manila
Approach:      North Bound      South Bound      East Bound       West Bound
Movement:     L  -  T  -  R   L  -  T  -  R   L  -  T  -  R   L  -  T  -  R
------------|---------------||---------------||---------------||---------------|
Control:        Stop Sign        Stop Sign        Stop Sign        Stop Sign
Rights:           Ignore          Include          Include          Include
Min. Green:     7   10    10    7   10    10    7   10    10    7   10    10
Lanes:        0  0  2  0  1   0  1  1  0  0   0  0  0  0  1   0  0  1! 0  0
------------|---------------||---------------||---------------||---------------|
Volume Module:PM Peak Hour
Base Vol:       0   69   255   13  250     0    0    0     0  552    0     8
Growth Adj:  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
Initial Bse:    0   69   255   13  250     0    0    0     0  552    0     8
Added Vol:      0    0     0    0    0     0    0    0     0    0    0     0
Project:        0    0     0    0    2     0    0    0     0    0    0     0
Initial Fut:    0   69   255   13  252     0    0    0     0  552    0     8
User Adj:    1.00 1.00  0.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
PHF Adj:     0.92 0.92  0.00  0.92 0.92  0.92  0.92 0.92  0.92  0.92 0.92  0.92
PHF Volume:     0   75     0   14  274     0    0    0     0  600    0     9
Reduct Vol:     0    0     0    0    0     0    0    0     0    0    0     0
Reduced Vol:    0   75     0   14  274     0    0    0     0  600    0     9
PCE Adj:     1.00 1.00  0.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
MLF Adj:     1.00 1.00  0.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
FinalVolume:    0   75     0   14  274     0    0    0     0  600    0     9
------------|---------------||---------------||---------------||---------------|
Saturation Flow Module:
Adjustment:  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
Lanes:       0.00 2.00  1.00  0.10 1.90  0.00  0.00 0.00  1.00  0.99 0.00  0.01
Final Sat.:     0 1026   570   53 1033     0    0    0   642  679    0    10
------------|---------------||---------------||---------------||---------------|
Capacity Analysis Module:
Vol/Sat:     xxxx 0.07  0.00  0.27 0.27  xxxx  xxxx xxxx  0.00  0.88 xxxx  0.88
Crit Moves:       ****        ****                        ****              ****
Delay/Veh:    0.0  9.9   0.0  11.3 11.2   0.0   0.0  0.0   0.0  33.9  0.0  33.9
Delay Adj:   1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
AdjDel/Veh:   0.0  9.9   0.0  11.3 11.2   0.0   0.0  0.0   0.0  33.9  0.0  33.9
LOS by Move:    *    A     *     B    B     *     *    *     *     D    *     D
ApproachDel:         9.9              11.2             xxxxxx             33.9
Delay Adj:          1.00              1.00              xxxxx             1.00
ApprAdjDel:          9.9              11.2             xxxxxx             33.9
LOS by Appr:           A                 B                  *                D
AllWayAvgQ:   0.0  0.1   0.0   0.3  0.3   0.0   0.0  0.0   0.0   4.9  4.9   4.9
********************************************************************************
Note: Queue reported is the number of cars per lane.
```

Planetary Ventures
MFA Hangar 3 Project

Level Of Service Computation Report
2000 HCM Operations Method (Future Volume Alternative)

Intersection #2 Ellis & US 101 NB

| | | | |
|---|---|---|---|
| Cycle (sec): | 55 | Critical Vol./Cap.(X): | 0.638 |
| Loss Time (sec): | 9 | Average Delay (sec/veh): | 23.9 |
| Optimal Cycle: | 40 | Level Of Service: | C |

| Street Name: | Ellis | | | | | | US 101 NB | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach: | North Bound | | | South Bound | | | East Bound | | | West Bound | | |
| Movement: | L | T | R | L | T | R | L | T | R | L | T | R |
| Control: | Split Phase | | | Split Phase | | | Protected | | | Protected | | |
| Rights: | Include | | | Include | | | Include | | | Include | | |
| Min. Green: | 7 | 10 | 10 | 7 | 10 | 10 | 7 | 10 | 10 | 7 | 10 | 10 |
| Y+R: | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lanes: | 0 1 | 1 0 | 0 | 0 0 | 1 1 | 0 | 0 0 | 0 0 | 0 | 0 1 | 0 0 | 2 |
| Volume Module:PM Peak Hour | | | | | | | | | | | | |
| Base Vol: | 252 | 268 | 0 | 0 | 467 | 356 | 0 | 0 | 0 | 237 | 2 | 50 |
| Growth Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Initial Bse: | 252 | 268 | 0 | 0 | 467 | 356 | 0 | 0 | 0 | 237 | 2 | 50 |
| Added Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Project: | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Initial Fut: | 252 | 268 | 0 | 0 | 469 | 356 | 0 | 0 | 0 | 237 | 2 | 50 |
| User Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| PHF Adj: | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 |
| PHF Volume: | 271 | 288 | 0 | 0 | 504 | 383 | 0 | 0 | 0 | 255 | 2 | 54 |
| Reduct Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced Vol: | 271 | 288 | 0 | 0 | 504 | 383 | 0 | 0 | 0 | 255 | 2 | 54 |
| PCE Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| MLF Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| FinalVolume: | 271 | 288 | 0 | 0 | 504 | 383 | 0 | 0 | 0 | 255 | 2 | 54 |
| Saturation Flow Module: | | | | | | | | | | | | |
| Sat/Lane: | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Adjustment: | 0.95 | 1.00 | 0.92 | 0.92 | 0.99 | 0.95 | 0.92 | 1.00 | 0.92 | 0.95 | 0.95 | 0.83 |
| Lanes: | 1.00 | 1.00 | 0.00 | 0.00 | 1.11 | 0.89 | 0.00 | 0.00 | 0.00 | 0.99 | 0.01 | 2.00 |
| Final Sat.: | 1792 | 1906 | 0 | 0 | 2102 | 1596 | 0 | 0 | 0 | 1785 | 15 | 3150 |
| Capacity Analysis Module: | | | | | | | | | | | | |
| Vol/Sat: | 0.15 | 0.15 | 0.00 | 0.00 | 0.24 | 0.24 | 0.00 | 0.00 | 0.00 | 0.14 | 0.14 | 0.02 |
| Crit Moves: | | **** | | | | **** | | | | | **** | |
| Green Time: | 13.0 | 13.0 | 0.0 | 0.0 | 20.7 | 20.7 | 0.0 | 0.0 | 0.0 | 12.3 | 12.3 | 12.3 |
| Volume/Cap: | 0.64 | 0.64 | 0.00 | 0.00 | 0.64 | 0.64 | 0.00 | 0.00 | 0.00 | 0.64 | 0.64 | 0.08 |
| Delay/Veh: | 38.9 | 38.9 | 0.0 | 0.0 | 15.1 | 15.1 | 0.0 | 0.0 | 0.0 | 22.7 | 22.7 | 16.9 |
| User DelAdj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| AdjDel/Veh: | 38.9 | 38.9 | 0.0 | 0.0 | 15.1 | 15.1 | 0.0 | 0.0 | 0.0 | 22.7 | 22.7 | 16.9 |
| LOS by Move: | D+ | D+ | A | A | B | B | A | A | A | C+ | C+ | B |
| HCM2kAvgQ: | 6 | 6 | 0 | 0 | 7 | 7 | 0 | 0 | 0 | 5 | 5 | 0 |

Note: Queue reported is the number of cars per lane.

```
--------------------------------------------------------------------------------
                         Planetary Ventures
                        MFA Hangar 3  Project
--------------------------------------------------------------------------------
                  Level Of Service Computation Report
          2000 HCM Operations Method (Future Volume Alternative)
********************************************************************************
Intersection #3 Ellis & US 101 SB
********************************************************************************
Cycle (sec):          40                Critical Vol./Cap.(X):        0.332
Loss Time (sec):       9                Average Delay (sec/veh):       25.8
Optimal Cycle:        36                Level Of Service:                 C
********************************************************************************
Street Name:                 Ellis                            US 101 SB
Approach:      North Bound      South Bound       East Bound       West Bound
Movement:     L  -  T  -  R   L  -  T  -  R   L  -  T  -  R   L  -  T  -  R
------------|---------------||---------------||---------------||---------------|
Control:        Protected        Protected        Protected        Protected
Rights:           Ignore          Include          Include          Include
Min. Green:     7   10    10    7   10    10    7   10    10    7   10    10
Y+R:          4.0  4.0   4.0  4.0  4.0   4.0  4.0  4.0   4.0  4.0  4.0   4.0
Lanes:        0  0  2  0  1   1  0  1  0  0   1  0  0  0  1   0  0  0  0  0
------------|---------------||---------------||---------------||---------------|
Volume Module:PM Peak Hour
Base Vol:       0  207   237  119  591     0  113    0   204    0    0     0
Growth Adj:  1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
Initial Bse:    0  207   237  119  591     0  113    0   204    0    0     0
Added Vol:      0    0     0    0    0     0    0    0     0    0    0     0
Project:        0    0     0    1    1     0    0    0     0    0    0     0
Initial Fut:    0  207   237  120  592     0  113    0   204    0    0     0
User Adj:    1.00 1.00  0.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
PHF Adj:     0.93 0.93  0.00 0.93 0.93  0.93 0.93 0.93  0.93 0.93 0.93  0.93
PHF Volume:     0  223     0  129  637     0  122    0   219    0    0     0
Reduct Vol:     0    0     0    0    0     0    0    0     0    0    0     0
Reduced Vol:    0  223     0  129  637     0  122    0   219    0    0     0
PCE Adj:     1.00 1.00  0.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
MLF Adj:     1.00 1.00  0.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
FinalVolume:    0  223     0  129  637     0  122    0   219    0    0     0
------------|---------------||---------------||---------------||---------------|
Saturation Flow Module:
Sat/Lane:    1900 1900  1900 1900 1900  1900 1900 1900  1900 1900 1900  1900
Adjustment:  0.92 1.00  0.92 0.92 1.00  0.92 0.92 1.00  0.92 0.92 1.00  0.92
Lanes:       0.00 2.00  1.00 1.00 1.00  0.00 1.00 0.00  1.00 0.00 0.00  0.00
Final Sat.:     0 3800  1750 1750 1900     0 1750    0  1750    0    0     0
------------|---------------||---------------||---------------||---------------|
Capacity Analysis Module:
Vol/Sat:     0.00 0.06  0.00 0.07 0.34  0.00 0.07 0.00  0.13 0.00 0.00  0.00
Crit Moves:       ****       ****                           ****
Green Time:   0.0 10.0   0.0  7.8 17.8   0.0 13.2  0.0  13.2  0.0  0.0   0.0
Volume/Cap:  0.00 0.23  0.00 0.38 0.75  0.00 0.21 0.00  0.38 0.00 0.00  0.00
Delay/Veh:    0.0 12.1   0.0 14.7 13.2   0.0 72.0  0.0  57.3  0.0  0.0   0.0
User DelAdj: 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
AdjDel/Veh:   0.0 12.1   0.0 14.7 13.2   0.0 72.0  0.0  57.3  0.0  0.0   0.0
LOS by Move:    A    B     A    B    B     A    E    A    E+    A    A     A
HCM2kAvgQ:      0    1     0    2    9     0    1    0     3    0    0     0
********************************************************************************
Note: Queue reported is the number of cars per lane.
```

```
2022 + Hangar 3 Demo Phase Tue Jun 7, 2022 11:20:31            Page 6-1
-------------------------------------------------------------------------------
                          Planetary Ventures
                         MFA Hangar 3  Project
-------------------------------------------------------------------------------
                    Level Of Service Computation Report
            2000 HCM 4-Way Stop Method (Future Volume Alternative)
*******************************************************************************
Intersection #4 Enterprise & 5th
*******************************************************************************
Cycle (sec):          100               Critical Vol./Cap.(X):         0.165
Loss Time (sec):        0               Average Delay (sec/veh):         9.3
Optimal Cycle:          0               Level Of Service:                  A
*******************************************************************************
Street Name:               Enterprise                            5th
Approach:      North Bound      South Bound      East Bound       West Bound
Movement:     L  -  T  -  R   L  -  T  -  R   L  -  T  -  R   L  -  T  -  R
------------|---------------||---------------||---------------||---------------|
Control:       Stop Sign        Stop Sign        Stop Sign        Stop Sign
Rights:          Include          Ignore           Ignore           Include
Min. Green:    0    0     0    0    0     0    0    0     0    0    0     0
Lanes:        1  0  0  1  0   0  0  1  0  0   0  1  0  1  0   0  1  0  0  1
------------|---------------||---------------||---------------||---------------|
Volume Module:PM Peak Hour
Base Vol:      0   19     5    0   97     0    0    9     9   38    1     0
Growth Adj:  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
Initial Bse:   0   19     5    0   97     0    0    9     9   38    1     0
Added Vol:     0    0     0    0    0     0    0    0     0    0    0     0
Project:       0    0     0    0    0     0    0   26     0    0   24     0
Initial Fut:   0   19     5    0   97     0    0   35     9   38   25     0
User Adj:    1.00 1.00  1.00  1.00 1.00  0.00  1.00 1.00  0.00  1.00 1.00  1.00
PHF Adj:     0.82 0.82  0.82  0.82 0.82  0.00  0.82 0.82  0.00  0.82 0.82  0.82
PHF Volume:    0   23     6    0  118     0    0   43     0   46   30     0
Reduct Vol:    0    0     0    0    0     0    0    0     0    0    0     0
Reduced Vol:   0   23     6    0  118     0    0   43     0   46   30     0
PCE Adj:     1.00 1.00  1.00  1.00 1.00  0.00  1.00 1.00  0.00  1.00 1.00  1.00
MLF Adj:     1.00 1.00  1.00  1.00 1.00  0.00  1.00 1.00  0.00  1.00 1.00  1.00
FinalVolume:   0   23     6    0  118     0    0   43     0   46   30     0
------------|---------------||---------------||---------------||---------------|
Saturation Flow Module:
Adjustment:  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
Lanes:       1.00 0.79  0.21  0.00 1.00  0.00  0.00 2.00  0.00  0.60 0.40  1.00
Final Sat.:   623  557   146     0  717     0     0 1060     0   332  218   648
------------|---------------||---------------||---------------||---------------|
Capacity Analysis Module:
Vol/Sat:     0.00 0.04  0.04  xxxx 0.17  xxxx  xxxx 0.04  xxxx  0.14 0.14  0.00
Crit Moves:       ****             ****             ****        ****
Delay/Veh:    0.0  7.9   7.9   0.0  8.9   0.0   0.0  9.6   0.0  10.1 10.1   0.0
Delay Adj:   1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
AdjDel/Veh:   0.0  7.9   7.9   0.0  8.9   0.0   0.0  9.6   0.0  10.1 10.1   0.0
LOS by Move:    *    A     A     *    A     *     *    A     *     B    B     *
ApproachDel:       7.9              8.9              9.6              10.1
Delay Adj:        1.00             1.00             1.00              1.00
ApprAdjDel:        7.9              8.9              9.6              10.1
LOS by Appr:         A                A                A                 B
AllWayAvgQ:   0.0  0.0   0.0   0.2  0.2   0.2   0.0  0.0   0.0   0.2  0.2   0.0
*******************************************************************************
Note: Queue reported is the number of cars per lane.

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Planetary Ventures
MFA Hangar 3 Project

Level Of Service Computation Report
2000 HCM Operations Method (Future Volume Alternative)

Intersection #5 Enterprise & 11th

| | | | |
|---|---|---|---|
| Cycle (sec): | 60 | Critical Vol./Cap.(X): | 0.211 |
| Loss Time (sec): | 9 | Average Delay (sec/veh): | 11.8 |
| Optimal Cycle: | 36 | Level Of Service: | B+ |

Street Name: Enterprise (North Bound / South Bound); 11th (East Bound / West Bound)

| Approach: | North Bound | | | South Bound | | | East Bound | | | West Bound | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Movement: | L | T | R | L | T | R | L | T | R | L | T | R |
| Control: | Protected | | | Protected | | | Protected | | | Protected | | |
| Rights: | Include | | | Include | | | Include | | | Include | | |
| Min. Green: | 0 | 10 | 10 | 7 | 10 | 0 | 0 | 0 | 0 | 7 | 0 | 10 |
| Y+R: | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lanes: | 0 0 1 1 0 | | | 1 0 2 0 0 | | | 0 0 0 0 0 | | | 2 0 0 0 1 | | |
| **Volume Module:PM Peak Hour** | | | | | | | | | | | | |
| Base Vol: | 0 | 104 | 92 | 147 | 510 | 0 | 0 | 0 | 0 | 238 | 0 | 43 |
| Growth Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Initial Bse: | 0 | 104 | 92 | 147 | 510 | 0 | 0 | 0 | 0 | 238 | 0 | 43 |
| Added Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Project: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Initial Fut: | 0 | 104 | 92 | 147 | 510 | 0 | 0 | 0 | 0 | 238 | 0 | 43 |
| User Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| PHF Adj: | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 |
| PHF Volume: | 0 | 116 | 102 | 163 | 567 | 0 | 0 | 0 | 0 | 264 | 0 | 48 |
| Reduct Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced Vol: | 0 | 116 | 102 | 163 | 567 | 0 | 0 | 0 | 0 | 264 | 0 | 48 |
| PCE Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| MLF Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| FinalVolume: | 0 | 116 | 102 | 163 | 567 | 0 | 0 | 0 | 0 | 264 | 0 | 48 |
| **Saturation Flow Module:** | | | | | | | | | | | | |
| Sat/Lane: | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Adjustment: | 0.92 | 1.00 | 0.95 | 0.92 | 1.00 | 0.92 | 0.92 | 1.00 | 0.92 | 0.83 | 1.00 | 0.92 |
| Lanes: | 0.00 | 1.04 | 0.96 | 1.00 | 2.00 | 0.00 | 0.00 | 0.00 | 0.00 | 2.00 | 0.00 | 1.00 |
| Final Sat.: | 0 | 1962 | 1736 | 1750 | 3800 | 0 | 0 | 0 | 0 | 3150 | 0 | 1750 |
| **Capacity Analysis Module:** | | | | | | | | | | | | |
| Vol/Sat: | 0.00 | 0.06 | 0.06 | 0.09 | 0.15 | 0.00 | 0.00 | 0.00 | 0.00 | 0.08 | 0.00 | 0.03 |
| Crit Moves: | | **** | | **** | | | | | | | | **** |
| Green Time: | 0.0 | 15.9 | 15.9 | 25.1 | 41.0 | 0.0 | 0.0 | 0.0 | 0.0 | 10.0 | 0.0 | 10.0 |
| Volume/Cap: | 0.00 | 0.22 | 0.22 | 0.22 | 0.22 | 0.00 | 0.00 | 0.00 | 0.00 | 0.50 | 0.00 | 0.16 |
| Delay/Veh: | 0.0 | 17.4 | 17.4 | 11.3 | 3.6 | 0.0 | 0.0 | 0.0 | 0.0 | 23.5 | 0.0 | 21.7 |
| User DelAdj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| AdjDel/Veh: | 0.0 | 17.4 | 17.4 | 11.3 | 3.6 | 0.0 | 0.0 | 0.0 | 0.0 | 23.5 | 0.0 | 21.7 |
| LOS by Move: | A | B | B | B+ | A | A | A | A | A | C | A | C+ |
| HCM2kAvgQ: | 0 | 2 | 2 | 2 | 2 | 0 | 0 | 0 | 0 | 3 | 0 | 1 |

Note: Queue reported is the number of cars per lane.

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                          Planetary Ventures
                         MFA Hangar 3  Project
--------------------------------------------------------------------------------
                     Level Of Service Computation Report
            2000 HCM Operations Method (Future Volume Alternative)
********************************************************************************
Intersection #6 Enterprise & Manila/Moffett Park
********************************************************************************
Cycle (sec):          60                Critical Vol./Cap.(X):         0.619
Loss Time (sec):       9                Average Delay (sec/veh):        14.0
Optimal Cycle:        39                Level Of Service:                  B
********************************************************************************
Street Name:               Enterprise                  Manila/Moffett Park
Approach:       North Bound      South Bound       East Bound       West Bound
Movement:     L  -  T  -  R    L  -  T  -  R    L  -  T  -  R    L  -  T  -  R
------------|---------------||---------------||---------------||---------------|
Control:        Protected        Protected        Protected        Protected
Rights:           Include          Include          Include          Include
Min. Green:     0    0     0    7    0    10    7   10     0    0   10    10
Y+R:          4.0  4.0   4.0  4.0  4.0   4.0  4.0  4.0   4.0  4.0  4.0   4.0
Lanes:        0  0  0  0  0    1  0  0  0  1    1  0  1  0  0    0  0  1  0  1
------------|---------------||---------------||---------------||---------------|
Volume Module:PM Peak Hour
Base Vol:       0    0     0  633    0   450  112  159     0    0  131   105
Growth Adj:  1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
Initial Bse:    0    0     0  633    0   450  112  159     0    0  131   105
Added Vol:      0    0     0    0    0     0    0    0     0    0    0     0
Project:        0    0     0    0    0     0    0    0     0    0    0     0
Initial Fut:    0    0     0  633    0   450  112  159     0    0  131   105
User Adj:    1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
PHF Adj:     0.94 0.94  0.94 0.94 0.94  0.94 0.94 0.94  0.94 0.94 0.94  0.94
PHF Volume:     0    0     0  673    0   479  119  169     0    0  139   112
Reduct Vol:     0    0     0    0    0     0    0    0     0    0    0     0
Reduced Vol:    0    0     0  673    0   479  119  169     0    0  139   112
PCE Adj:     1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
MLF Adj:     1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
FinalVolume:    0    0     0  673    0   479  119  169     0    0  139   112
------------|---------------||---------------||---------------||---------------|
Saturation Flow Module:
Sat/Lane:    1900 1900  1900 1900 1900  1900 1900 1900  1900 1900 1900  1900
Adjustment:  0.92 1.00  0.92 0.92 1.00  0.92 0.92 1.00  0.92 0.92 1.00  0.92
Lanes:       0.00 0.00  0.00 1.00 0.00  1.00 1.00 1.00  0.00 0.00 1.00  1.00
Final Sat.:     0    0     0 1750    0  1750 1750 1900     0    0 1900  1750
------------|---------------||---------------||---------------||---------------|
Capacity Analysis Module:
Vol/Sat:     0.00 0.00  0.00 0.38 0.00  0.27 0.07 0.09  0.00 0.00 0.07  0.06
Crit Moves:                  ****             ****                  ****
Green Time:   0.0  0.0   0.0 34.0  0.0  34.0  7.0 17.0   0.0  0.0 10.0  10.0
Volume/Cap:  0.00 0.00  0.00 0.68 0.00  0.48 0.58 0.31  0.00 0.00 0.44  0.38
Delay/Veh:    0.0  0.0   0.0 11.1  0.0   8.1 29.4 17.3   0.0  0.0 23.5  23.1
User DelAdj: 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
AdjDel/Veh:   0.0  0.0   0.0 11.1  0.0   8.1 29.4 17.3   0.0  0.0 23.5  23.1
LOS by Move:    A    A     A   B+    A     A    C    B     A    A    C     C
HCM2kAvgQ:      0    0     0   11    0     6    3    3     0    0    3     2
********************************************************************************
Note: Queue reported is the number of cars per lane.
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                            Planetary Ventures
                           MFA Hangar 3  Project
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                      Level Of Service Computation Report
           2000 HCM Operations Method (Future Volume Alternative)
********************************************************************************
Intersection #7 US 101 NB & Moffett Park
********************************************************************************
Cycle (sec):         60               Critical Vol./Cap.(X):         0.777
Loss Time (sec):      9               Average Delay (sec/veh):        15.3
Optimal Cycle:       55               Level Of Service:                  B
********************************************************************************
Street Name:                US 101 NB                         Moffett Park
Approach:      North Bound      South Bound      East Bound       West Bound
Movement:     L  -  T  -  R   L  -  T  -  R   L  -  T  -  R   L  -  T  -  R
------------|---------------||---------------||---------------||---------------|
Control:        Protected        Protected        Protected        Protected
Rights:           Include          Include          Include          Include
Min. Green:     7   10    10    7   10    10    7   10    10    7   10    10
Y+R:          4.0  4.0   4.0  4.0  4.0   4.0  4.0  4.0   4.0  4.0  4.0   4.0
Lanes:        0  0  0  0  0   0  0  0  0  0   0  0  1  0  1   1  0  1  0  0
------------|---------------||---------------||---------------||---------------|
Volume Module:PM Peak Hour
Base Vol:       0    0     0    0    0     0    0  666   140  507  287     0
Growth Adj:  1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
Initial Bse:    0    0     0    0    0     0    0  666   140  507  287     0
Added Vol:      0    0     0    0    0     0    0    0     0    0    0     0
Project:        0    0     0    0    0     0    0    0     0    0    0     0
Initial Fut:    0    0     0    0    0     0    0  666   140  507  287     0
User Adj:    1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
PHF Adj:     0.97 0.97  0.97 0.97 0.97  0.97 0.97 0.97  0.97 0.97 0.97  0.97
PHF Volume:     0    0     0    0    0     0    0  687   144  523  296     0
Reduct Vol:     0    0     0    0    0     0    0    0     0    0    0     0
Reduced Vol:    0    0     0    0    0     0    0  687   144  523  296     0
PCE Adj:     1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
MLF Adj:     1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
FinalVolume:    0    0     0    0    0     0    0  687   144  523  296     0
------------|---------------||---------------||---------------||---------------|
Saturation Flow Module:
Sat/Lane:    1900 1900  1900 1900 1900  1900 1900 1900  1900 1900 1900  1900
Adjustment:  0.92 1.00  0.92 0.92 1.00  0.92 0.92 1.00  0.92 0.92 1.00  0.92
Lanes:       0.00 0.00  0.00 0.00 0.00  0.00 0.00 1.00  1.00 1.00 1.00  0.00
Final Sat.:     0    0     0    0    0     0    0 1900  1750 1750 1900     0
------------|---------------||---------------||---------------||---------------|
Capacity Analysis Module:
Vol/Sat:     0.00 0.00  0.00 0.00 0.00  0.00 0.00 0.36  0.08 0.30 0.16  0.00
Crit Moves:                                       ****        ****
Green Time:   0.0  0.0   0.0  0.0  0.0   0.0  0.0 27.9  27.9 23.1 51.0   0.0
Volume/Cap:  0.00 0.00  0.00 0.00 0.00  0.00 0.00 0.78  0.18 0.78 0.18  0.00
Delay/Veh:    0.0  0.0   0.0  0.0  0.0   0.0  0.0 17.8   9.5 21.9  0.9   0.0
User DelAdj: 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
AdjDel/Veh:   0.0  0.0   0.0  0.0  0.0   0.0  0.0 17.8   9.5 21.9  0.9   0.0
LOS by Move:    A    A     A    A    A     A    A    B     A   C+    A     A
HCM2kAvgQ:      0    0     0    0    0     0    0   13     2   11    1     0
********************************************************************************
Note: Queue reported is the number of cars per lane.
```

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-------------------------------------------------------------------------------
                              Planetary Ventures
                             MFA Hangar 3  Project
-------------------------------------------------------------------------------

                       Level Of Service Computation Report
           2000 HCM 4-Way Stop Method (Future Volume Alternative)
*******************************************************************************
Intersection #8 Innovation & 11th
*******************************************************************************
Cycle (sec):          100               Critical Vol./Cap.(X):         0.932
Loss Time (sec):        0               Average Delay (sec/veh):        25.1
Optimal Cycle:          0               Level Of Service:                  D
*******************************************************************************
Street Name:               Innovation                            11th
Approach:      North Bound      South Bound      East Bound       West Bound
Movement:     L  -  T  -  R   L  -  T  -  R   L  -  T  -  R   L  -  T  -  R
-------------|---------------||---------------||---------------||---------------|
Control:        Stop Sign        Stop Sign        Stop Sign        Stop Sign
Rights:           Include          Include          Include          Include
Min. Green:    0    0     0    0    0     0    0    0     0    0    0     0
Lanes:        1  1  0  1  0   1  0  1  1  0   1  0  0  1  1   0  0  1! 0  0
-------------|---------------||---------------||---------------||---------------|
Volume Module:PM Peak Hour
Base Vol:     59   60    50   30   77    58  423   20   337   20   10    50
Growth Adj:  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
Initial Bse:  59   60    50   30   77    58  423   20   337   20   10    50
Added Vol:     0    0     0    0    0     0    0    0     0    0    0     0
Project:       0    0     0    0    0     0    0    0     0    0    0     0
Initial Fut:  59   60    50   30   77    58  423   20   337   20   10    50
User Adj:    1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
PHF Adj:     0.88 0.88  0.88  0.88 0.88  0.88  0.88 0.88  0.88  0.88 0.88  0.88
PHF Volume:   67   68    57   34   88    66  481   23   383   23   11    57
Reduct Vol:    0    0     0    0    0     0    0    0     0    0    0     0
Reduced Vol:  67   68    57   34   88    66  481   23   383   23   11    57
PCE Adj:     1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
MLF Adj:     1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
FinalVolume:  67   68    57   34   88    66  481   23   383   23   11    57
-------------|---------------||---------------||---------------||---------------|
Saturation Flow Module:
Adjustment:  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
Lanes:       1.04 1.07  0.89  1.00 1.14  0.86  1.00 0.11  1.89  0.25 0.13  0.62
Final Sat.:   441  477   432   418  513   413   516   68  1155   133   67   333
-------------|---------------||---------------||---------------||---------------|
Capacity Analysis Module:
Vol/Sat:     0.15 0.14  0.13  0.08 0.17  0.16  0.93 0.33  0.33  0.17 0.17  0.17
Crit Moves:  ****                   ****        ****                   ****
Delay/Veh:   12.3 11.6  10.8  11.6 11.9  11.1  50.1 11.4  11.3  10.7 10.7  10.7
Delay Adj:   1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
AdjDel/Veh:  12.3 11.6  10.8  11.6 11.9  11.1  50.1 11.4  11.3  10.7 10.7  10.7
LOS by Move:    B    B     B     B    B     B     F    B     B     B    B     B
ApproachDel:       11.6              11.6              32.3              10.7
Delay Adj:         1.00              1.00              1.00              1.00
ApprAdjDel:        11.6              11.6              32.3              10.7
LOS by Appr:          B                 B                 D                 B
AllWayAvgQ:    0.2  0.1   0.1   0.1  0.2   0.2   5.8  0.5   0.5   0.2  0.2   0.2
*******************************************************************************
Note: Queue reported is the number of cars per lane.
```

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--------------------------------------------------------------------------------
                           Planetary Ventures
                          MFA Hangar 3  Project
--------------------------------------------------------------------------------
                    Level Of Service Computation Report
            2000 HCM Operations Method (Future Volume Alternative)
********************************************************************************
Intersection #9 Innovation & Moffett Park
********************************************************************************
Cycle (sec):          60              Critical Vol./Cap.(X):         0.539
Loss Time (sec):       9              Average Delay (sec/veh):        15.7
Optimal Cycle:        39              Level Of Service:                  B
********************************************************************************
Street Name:              Innovation                      Moffett Park
Approach:       North Bound      South Bound       East Bound       West Bound
Movement:     L  -  T  -  R   L  -  T  -  R   L  -  T  -  R   L  -  T  -  R
------------|---------------||---------------||---------------||---------------|
Control:       Protected        Protected        Protected        Protected
Rights:          Include          Include          Include          Include
Min. Green:    0    0     0    7    0    10   10   10     0    0   10    10
Y+R:         4.0  4.0   4.0  4.0  4.0   4.0  4.0  4.0   4.0  4.0  4.0   4.0
Lanes:       0  0  0  0  0   1  0  1! 0  0   1  0  2  0  0   0  0  2  0  1
------------|---------------||---------------||---------------||---------------|
Volume Module:PM Peak Hour
Base Vol:      0    0     0  364    0   279   78  585     0    0  483    86
Growth Adj:  1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
Initial Bse:   0    0     0  364    0   279   78  585     0    0  483    86
Added Vol:     0    0     0    0    0     0    0    0     0    0    0     0
Project:       0    0     0    0    0     0    0    0     0    0    0     0
Initial Fut:   0    0     0  364    0   279   78  585     0    0  483    86
User Adj:    1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
PHF Adj:     0.95 0.95  0.95 0.95 0.95  0.95 0.95 0.95  0.95 0.95 0.95  0.95
PHF Volume:    0    0     0  383    0   294   82  616     0    0  508    91
Reduct Vol:    0    0     0    0    0     0    0    0     0    0    0     0
Reduced Vol:   0    0     0  383    0   294   82  616     0    0  508    91
PCE Adj:     1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
MLF Adj:     1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
FinalVolume:   0    0     0  383    0   294   82  616     0    0  508    91
------------|---------------||---------------||---------------||---------------|
Saturation Flow Module:
Sat/Lane:    1900 1900  1900 1900 1900  1900 1900 1900  1900 1900 1900  1900
Adjustment:  0.92 1.00  0.92 0.92 1.00  0.92 0.92 1.00  0.92 0.92 1.00  0.92
Lanes:       0.00 0.00  0.00 1.39 0.00  0.61 1.00 2.00  0.00 0.00 2.00  1.00
Final Sat.:    0    0     0 2441    0  1059 1750 3800     0    0 3800  1750
------------|---------------||---------------||---------------||---------------|
Capacity Analysis Module:
Vol/Sat:     0.00 0.00  0.00 0.16 0.00  0.28 0.05 0.16  0.00 0.00 0.13  0.05
Crit Moves:                             **** ****                  ****
Green Time:   0.0  0.0   0.0 27.7  0.0  27.7 10.0 23.3   0.0  0.0 13.3  13.3
Volume/Cap:  0.00 0.00  0.00 0.34 0.00  0.60 0.28 0.42  0.00 0.00 0.60  0.23
Delay/Veh:    0.0  0.0   0.0 10.4  0.0  13.0 22.4 13.6   0.0  0.0 22.2  19.4
User DelAdj: 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
AdjDel/Veh:   0.0  0.0   0.0 10.4  0.0  13.0 22.4 13.6   0.0  0.0 22.2  19.4
LOS by Move:    A    A     A   B+    A     B   C+    B     A    A   C+    B-
HCM2kAvgQ:      0    0     0    4    0     8    2    4     0    0    5     2
********************************************************************************
Note: Queue reported is the number of cars per lane.
```

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--------------------------------------------------------------------------------
                         Planetary Ventures
                        MFA Hangar 3  Project
--------------------------------------------------------------------------------
                   Level Of Service Computation Report
            2000 HCM Operations Method (Future Volume Alternative)
********************************************************************************
Intersection #10 Mathilda & 5th
********************************************************************************
Cycle (sec):          60                Critical Vol./Cap.(X):        0.406
Loss Time (sec):      12                Average Delay (sec/veh):       19.6
Optimal Cycle:        46                Level Of Service:                B-
********************************************************************************
Street Name:               Mathilda                            5th
Approach:      North Bound      South Bound      East Bound       West Bound
Movement:     L  -  T  -  R   L  -  T  -  R   L  -  T  -  R   L  -  T  -  R
------------|---------------||---------------||---------------||---------------|
Control:       Protected        Protected        Protected        Protected
Rights:          Include          Ignore           Include          Include
Min. Green:    7   10    10    7   10    10    7   10    10    7   10    10
Y+R:         4.0  4.0   4.0  4.0  4.0   4.0  4.0  4.0   4.0  4.0  4.0   4.0
Lanes:        2  0  2  1  0   1  0  3  0  9   2  0  1  0  1   2  0  0  1  0
------------|---------------||---------------||---------------||---------------|
Volume Module:PM Peak Hour
Base Vol:     12  314    43    3  626    26  138   16    94  282   14    29
Growth Adj:  1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
Initial Bse:  12  314    43    3  626    26  138   16    94  282   14    29
Added Vol:     0    0     0    0    0     0    0    0     0    0    0     0
Project:      24    0     0    0    0     0    0    0    26    0    0     0
Initial Fut:  36  314    43    3  626    26  138   16   120  282   14    29
User Adj:    1.00 1.00  1.00 1.00 1.00  0.00 1.00 1.00  1.00 1.00 1.00  1.00
PHF Adj:     0.86 0.86  0.86 0.86 0.86  0.00 0.86 0.86  0.86 0.86 0.86  0.86
PHF Volume:   42  365    50    3  728     0  160   19   140  328   16    34
Reduct Vol:    0    0     0    0    0     0    0    0     0    0    0     0
Reduced Vol:  42  365    50    3  728     0  160   19   140  328   16    34
PCE Adj:     1.00 1.00  1.00 1.00 1.00  0.00 1.00 1.00  1.00 1.00 1.00  1.00
MLF Adj:     1.00 1.00  1.00 1.00 1.00  0.00 1.00 1.00  1.00 1.00 1.00  1.00
FinalVolume:  42  365    50    3  728     0  160   19   140  328   16    34
------------|---------------||---------------||---------------||---------------|
Saturation Flow Module:
Sat/Lane:    1900 1900  1900 1900 1900  1900 1900 1900  1900 1900 1900  1900
Adjustment:  0.83 0.99  0.95 0.92 1.00  0.80 0.83 1.00  0.92 0.83 0.95  0.95
Lanes:       2.00 2.63  0.37 1.00 3.00  9.00 2.00 1.00  1.00 2.00 0.33  0.67
Final Sat.:  3150 4925   674 1750 5700 13653 3150 1900  1750 3150  586  1214
------------|---------------||---------------||---------------||---------------|
Capacity Analysis Module:
Vol/Sat:     0.01 0.07  0.07 0.00 0.13  0.00 0.05 0.01  0.08 0.10 0.03  0.03
Crit Moves:  ****                 ****                      **** ****
Green Time:   7.0 14.0  14.0  9.8 16.8   0.0 10.0 10.5  10.5 13.7 14.2  14.2
Volume/Cap:  0.11 0.32  0.32 0.01 0.46  0.00 0.31 0.06  0.46 0.46 0.12  0.12
Delay/Veh:   23.9 19.2  19.2 21.1 18.0   0.0 22.3 20.7  23.3 20.4 18.1  18.1
User DelAdj: 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00
AdjDel/Veh:  23.9 19.2  19.2 21.1 18.0   0.0 22.3 20.7  23.3 20.4 18.1  18.1
LOS by Move:    C   B-    B-   C+   B-     A   C+   C+     C   C+   B-    B-
HCM2kAvgQ:      1    2     2    0    4     0    2    0     3    4    1     1
********************************************************************************
Note: Queue reported is the number of cars per lane.
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Planetary Ventures
MFA Hangar 3 Project

Level Of Service Computation Report
2000 HCM Operations Method (Future Volume Alternative)

Intersection #11 Mathilda & Moffett Park

| | | | |
|---|---|---|---|
| Cycle (sec): | 140 | Critical Vol./Cap.(X): | 0.880 |
| Loss Time (sec): | 12 | Average Delay (sec/veh): | 43.9 |
| Optimal Cycle: | 117 | Level Of Service: | D |

| Street Name: | Mathilda | | | | | | Moffett Park | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach: | North Bound | | | South Bound | | | East Bound | | | West Bound | | |
| Movement: | L | T | R | L | T | R | L | T | R | L | T | R |
| Control: | Protected | | | Protected | | | Protected | | | Protected | | |
| Rights: | Include | | | Include | | | Ignore | | | Include | | |
| Min. Green: | 7 | 10 | 0 | 0 | 10 | 10 | 7 | 0 | 10 | 7 | 10 | 10 |
| Y+R: | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lanes: | 2 0 3 0 0 | | | 0 0 2 1 0 | | | 0 0 1! 0 1 | | | 1 1 0 1 0 | | |
| Volume Module:PM Peak Hour | | | | | | | | | | | | |
| Base Vol: | 271 | 525 | 0 | 0 | 2048 | 382 | 354 | 0 | 481 | 643 | 10 | 29 |
| Growth Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Initial Bse: | 271 | 525 | 0 | 0 | 2048 | 382 | 354 | 0 | 481 | 643 | 10 | 29 |
| Added Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Project: | 0 | 0 | 0 | 0 | 26 | 0 | 0 | 0 | 0 | 0 | 0 | 24 |
| Initial Fut: | 271 | 525 | 0 | 0 | 2074 | 382 | 354 | 0 | 481 | 643 | 10 | 53 |
| User Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 1.00 |
| PHF Adj: | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.00 | 0.94 | 0.94 | 0.94 |
| PHF Volume: | 288 | 559 | 0 | 0 | 2206 | 406 | 377 | 0 | 0 | 684 | 11 | 56 |
| Reduct Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced Vol: | 288 | 559 | 0 | 0 | 2206 | 406 | 377 | 0 | 0 | 684 | 11 | 56 |
| PCE Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 1.00 |
| MLF Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 1.00 |
| FinalVolume: | 288 | 559 | 0 | 0 | 2206 | 406 | 377 | 0 | 0 | 684 | 11 | 56 |
| Saturation Flow Module: | | | | | | | | | | | | |
| Sat/Lane: | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Adjustment: | 0.83 | 1.00 | 0.92 | 0.92 | 0.99 | 0.95 | 0.95 | 0.95 | 0.92 | 0.94 | 0.95 | 0.95 |
| Lanes: | 2.00 | 3.00 | 0.00 | 0.00 | 2.52 | 0.48 | 1.00 | 0.00 | 1.00 | 2.00 | 0.16 | 0.84 |
| Final Sat.: | 3150 | 5700 | 0 | 0 | 4728 | 871 | 1800 | 0 | 1750 | 3563 | 286 | 1514 |
| Capacity Analysis Module: | | | | | | | | | | | | |
| Vol/Sat: | 0.09 | 0.10 | 0.00 | 0.00 | 0.47 | 0.47 | 0.21 | 0.00 | 0.00 | 0.19 | 0.04 | 0.04 |
| Crit Moves: | **** | | | | **** | | **** | | | | **** | |
| Green Time: | 14.1 | 85.8 | 0.0 | 0.0 | 71.8 | 71.8 | 32.2 | 0.0 | 0.0 | 42.2 | 10.0 | 10.0 |
| Volume/Cap: | 0.91 | 0.16 | 0.00 | 0.00 | 0.91 | 0.91 | 0.91 | 0.00 | 0.00 | 0.64 | 0.52 | 0.52 |
| Delay/Veh: | 125.3 | 14.7 | 0.0 | 0.0 | 36.1 | 36.1 | 76.3 | 0.0 | 0.0 | 43.5 | 63.0 | 63.0 |
| User DelAdj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| AdjDel/Veh: | 125.3 | 14.7 | 0.0 | 0.0 | 36.1 | 36.1 | 76.3 | 0.0 | 0.0 | 43.5 | 63.0 | 63.0 |
| LOS by Move: | F | B | A | A | D+ | D+ | E- | A | A | D | E | E |
| HCM2kAvgQ: | 10 | 3 | 0 | 0 | 38 | 38 | 20 | 0 | 0 | 14 | 4 | 4 |

Note: Queue reported is the number of cars per lane.

Planetary Ventures
MFA Hangar 3 Project

Level Of Service Computation Report
2000 HCM Operations Method (Future Volume Alternative)

Intersection #12 Mathilda & Hwy 237 WB

| | | | |
|---|---|---|---|
| Cycle (sec): | 180 | Critical Vol./Cap.(X): | 0.478 |
| Loss Time (sec): | 9 | Average Delay (sec/veh): | 0.4 |
| Optimal Cycle: | 34 | Level Of Service: | A |

| Street Name: | Mathilda | | | | | | Hwy 237 WB | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach: | North Bound | | | South Bound | | | East Bound | | | West Bound | | |
| Movement: | L | T | R | L | T | R | L | T | R | L | T | R |
| Control: | Protected | | | Protected | | | Protected | | | Protected | | |
| Rights: | Include | | | Include | | | Include | | | Include | | |
| Min. Green: | 0 | 10 | 0 | 0 | 10 | 10 | 0 | 0 | 0 | 0 | 0 | 0 |
| Y+R: | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lanes: | 0 0 | 5 | 0 0 | 0 0 | 3 | 1 0 | 0 0 | 0 | 0 0 | 0 0 | 0 | 0 0 |
| **Volume Module:PM Peak Hour** | | | | | | | | | | | | |
| Base Vol: | 0 | 750 | 0 | 0 | 2634 | 540 | 0 | 0 | 0 | 0 | 0 | 0 |
| Growth Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Initial Bse: | 0 | 750 | 0 | 0 | 2634 | 540 | 0 | 0 | 0 | 0 | 0 | 0 |
| Added Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Project: | 0 | 0 | 0 | 0 | 26 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Initial Fut: | 0 | 750 | 0 | 0 | 2660 | 540 | 0 | 0 | 0 | 0 | 0 | 0 |
| User Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| PHF Adj: | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| PHF Volume: | 0 | 798 | 0 | 0 | 2830 | 574 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduct Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced Vol: | 0 | 798 | 0 | 0 | 2830 | 574 | 0 | 0 | 0 | 0 | 0 | 0 |
| PCE Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| MLF Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| FinalVolume: | 0 | 798 | 0 | 0 | 2830 | 574 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Saturation Flow Module:** | | | | | | | | | | | | |
| Sat/Lane: | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Adjustment: | 0.92 | 1.00 | 0.92 | 0.92 | 0.99 | 0.95 | 0.92 | 1.00 | 0.92 | 0.92 | 1.00 | 0.92 |
| Lanes: | 0.00 | 5.00 | 0.00 | 0.00 | 3.30 | 0.70 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Final Sat.: | 0 | 9500 | 0 | 0 | 6232 | 1265 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Capacity Analysis Module:** | | | | | | | | | | | | |
| Vol/Sat: | 0.00 | 0.08 | 0.00 | 0.00 | 0.45 | 0.45 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Crit Moves: | **** | | | | **** | | | | | | | |
| Green Time: | 0.0 | 171 | 0.0 | 0.0 | 171 | 171.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Volume/Cap: | 0.00 | 0.09 | 0.00 | 0.00 | 0.48 | 0.48 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Delay/Veh: | 0.0 | 0.2 | 0.0 | 0.0 | 0.5 | 0.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| User DelAdj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| AdjDel/Veh: | 0.0 | 0.2 | 0.0 | 0.0 | 0.5 | 0.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| LOS by Move: | A | A | A | A | A | A | A | A | A | A | A | A |
| HCM2kAvgQ: | 0 | 1 | 0 | 0 | 5 | 5 | 0 | 0 | 0 | 0 | 0 | 0 |

Note: Queue reported is the number of cars per lane.

```
--------------------------------------------------------------------------------
                              Planetary Ventures
                             MFA Hangar 3  Project
--------------------------------------------------------------------------------
                       Level Of Service Computation Report
             2000 HCM Operations Method (Future Volume Alternative)
********************************************************************************
Intersection #13 Mathilda & Hwy 237 EB
********************************************************************************
Cycle (sec):          60                Critical Vol./Cap.(X):         0.652
Loss Time (sec):       9                Average Delay (sec/veh):        12.0
Optimal Cycle:        42                Level Of Service:                 B+
********************************************************************************
Street Name:                Mathilda                          Hwy 237 EB
Approach:      North Bound      South Bound      East Bound       West Bound
Movement:     L  -  T  -  R    L  -  T  -  R    L  -  T  -  R    L  -  T  -  R
------------|----------------||----------------||----------------||----------------|
Control:        Protected        Protected        Protected        Protected
Rights:           Ignore           Include          Include          Include
Min. Green:     0   10    10     7   10     0     7    0    10     0    0     0
Y+R:          4.0  4.0   4.0   4.0  4.0   4.0   4.0  4.0   4.0   4.0  4.0   4.0
Lanes:        0  0  5  0  2    1  0  3  0  0    2  0  0  0  1    0  0  0  0  0
------------|----------------||----------------||----------------||----------------|
Volume Module:PM Peak Hour
Base Vol:       0  516   608   366 2298     0   231    0   254     0    0     0
Growth Adj:  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
Initial Bse:    0  516   608   366 2298     0   231    0   254     0    0     0
Added Vol:      0    0     0     0    0     0     0    0     0     0    0     0
Project:        0    0     0    26    0     0     0    0     0     0    0     0
Initial Fut:    0  516   608   392 2298     0   231    0   254     0    0     0
User Adj:    1.00 1.00  0.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
PHF Adj:     0.99 0.99  0.00  0.99 0.99  0.99  0.99 0.99  0.99  0.99 0.99  0.99
PHF Volume:     0  521     0   396 2321     0   233    0   257     0    0     0
Reduct Vol:     0    0     0     0    0     0     0    0     0     0    0     0
Reduced Vol:    0  521     0   396 2321     0   233    0   257     0    0     0
PCE Adj:     1.00 1.00  0.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
MLF Adj:     1.00 1.00  0.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
FinalVolume:    0  521     0   396 2321     0   233    0   257     0    0     0
------------|----------------||----------------||----------------||----------------|
Saturation Flow Module:
Sat/Lane:    1900 1900  1900  1900 1900  1900  1900 1900  1900  1900 1900  1900
Adjustment:  0.92 1.00  0.83  0.92 1.00  0.92  0.83 1.00  0.92  0.92 1.00  0.92
Lanes:       0.00 5.00  2.00  1.00 3.00  0.00  2.00 0.00  1.00  0.00 0.00  0.00
Final Sat.:     0 9500  3150  1750 5700     0  3150    0  1750     0    0     0
------------|----------------||----------------||----------------||----------------|
Capacity Analysis Module:
Vol/Sat:     0.00 0.05  0.00  0.23 0.41  0.00  0.07 0.00  0.15  0.00 0.00  0.00
Crit Moves:  ****                   ****                    ****
Green Time:   0.0 15.9   0.0  21.6 37.5   0.0  13.5  0.0  13.5   0.0  0.0   0.0
Volume/Cap:  0.00 0.21  0.00  0.63 0.65  0.00  0.33 0.00  0.65  0.00 0.00  0.00
Delay/Veh:    0.0 17.2   0.0  17.9  7.6   0.0  19.7  0.0  25.0   0.0  0.0   0.0
User DelAdj: 1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00  1.00 1.00  1.00
AdjDel/Veh:   0.0 17.2   0.0  17.9  7.6   0.0  19.7  0.0  25.0   0.0  0.0   0.0
LOS by Move:    A    B     A     B    A     A    B-    A     C     A    A     A
HCM2kAvgQ:      0    2     0     8   10     0     2    0     6     0    0     0
********************************************************************************
Note: Queue reported is the number of cars per lane.
```