



Sunnyvale

CITY OF SUNNYVALE FIRE STATION MASTER PLAN

09.21.21



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LATEST ISSUE:

SEPTEMBER 21, 2021

JULY 2, 2021

DECEMBER 23, 2020

FEBRUARY 12, 2020



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1. INTRODUCTION



INTRODUCTION

INTRODUCTION

Kitchell + Shah Kawasaki Architects (SKA) have been tasked by the City of Sunnyvale Fire Department with developing a Master Plan that includes a Facility Condition Assessment (FCA) to evaluate the current conditions of Sunnyvale's Fire Stations, and provide recommendations for the replacement and renovation of their existing fire stations.

As part of the Master Plan, Kitchell + SKA have provided written summaries on existing conditions, prototypical "best practices" for optimum operation, program requirements with prioritized needs, written analysis which includes detailed descriptions of each building component and system, and life-cycle cost analysis which includes repair and replacement costs over the next 30 years. The report also includes a list of program requirements with associated square footages for each fire station and their respective conceptual cost estimates and project schedules, which can be found in the Appendix.

INTRODUCTION



GOALS

During meetings between Sunnyvale Fire Department and Kitchell + SKA, the following goals were identified and used as guides in developing the recommendations.

- 1** Enable fire services to provide a high level of timely and professional service to the community.
- 2** Provide health and safety to the community and fire personnel.
- 3** Provide fire service facilities that are sustainable and do not negatively affect the environment.
- 4** Provide fire service facilities that are easy to maintain and have reduced operation and maintenance costs.



INTRODUCTION

PROCESS

The City of Sunnyvale Department of Public Safety has been serving the Sunnyvale community from its present locations since the 1960s. Today, with exception to Fire Station #5, which was constructed in 2016, all current operations are housed in buildings that are over 50 years old and past their expected useful service lives. Based on visual observations made during FCAs and input from fire department staff, renovation of the existing structures would immensely benefit the efficiency and safety of current operations.

Due to the likelihood for fires to occur, the City of Sunnyvale needs to consider renovating their fire station facilities to appropriately accommodate and equip fire fighters so they may continue to serve their community effectively.

Standards for fire station design have evolved since the 1960s largely due to new information regarding health, safety, and efficiency. Renovation of existing fire stations would allow the department to be healthier, safer, and more efficient in its operations. In the case a grant is awarded, Sunnyvale's Department of Public Safety will need to make informed decisions to disperse funds appropriately and update their fire stations.

Kitchell + SKA met with Sunnyvale Department of Public Safety personnel during the assessment process to gather input on various elements relevant to the study and to gain an understanding of the goals and objectives. Kitchell conducted a Facility Condition Assessment (FCA) to determine capital renewal and repair costs. SKA met with the Sunnyvale Department of Public Safety staff to develop space programs, which were developed to ensure the needs of both the operators and participants were met and remained within the space limits defined by the City.

The space programs provide data from staff interviews and establish needed program area. This data is located throughout the report and includes summaries of the required program areas for each fire station.



2. EXISTING CONDITIONS



EXISTING CONDITIONS

INTRODUCTION

The City of Sunnyvale has one of the nation's largest, fully-integrated Departments of Public Safety, wherein all personnel are trained as firefighters, police officers, and EMTs. The City has been operating in this model since 1950 and it has proven to be both efficient and cost-effective. This type of unified system is uncommon in public safety departments across the country. A unique result of having a fully-integrated department is that all personnel will be regularly using Sunnyvale's Fire Stations. Effectively, the renovation or replacement of the fire stations directly relate to the health of all Public Safety Officers, who use the facility for training, working, and living.

It is appropriate that this study is being prepared at this time to plan for the long-term renovation and/or replacement of Sunnyvale's Fire Stations. The evaluation considers the health risks and operational inefficiencies associated with not meeting modern Program requirements. Fire stations by nature produce hazardous and noxious work environments because they act as stores for toxins and carcinogens that are transferred from burning buildings via firefighters' Personal Protective equipment (PPE) into fire stations. Modern mechanical systems are necessary to aid in the filtration of the air, contributing to a healthier work environment.

The Best Practices chapter will explain the reasons behind current standards for fire station design, while this chapter categorically summarizes the existing conditions found in Sunnyvale's fire stations.

EXISTING CONDITIONS

ARCHITECTURAL

The exterior finish systems at most of the stations are in good condition and well maintained; however, there is evidence of water intrusion in select locations in most of the stations. Further investigation is needed to confirm if the intrusions are associated with roof leaks or utilities located above the ceilings. The station's interiors are showing their age. Doors and frames require repair or replacement, especially in the office areas and the apparatus bay's support spaces. The kitchen cabinets are worn and need to be repaired/refinished or replaced altogether. High traffic areas have worn flooring, base, and walls. Spaces that have exposed concrete floors, like the apparatus bays, are developing large cracks. Many buildings appear to have the original windows, which have single-pane glazing; these should be replaced with dual-glazed windows to provide better thermal performance. Many of the bathrooms in each station are worn, outdated, and lack accessible maneuvering spaces.

A full accessibility evaluation was not part of this building assessment; however, it is evident that the stations do not comply with current ADA (Americans with Disabilities Act) standards. There is no accessible parking or path of travel to the front entries, no fully accessible restrooms (both public and back of house), numerous locksets are non-compliant, and door clearances do not meet current standards.

STRUCTURAL

Sunnyvale Fire Stations 1, 2, 3, 4 & 6 were built in the 1960s. They are single-story buildings built with similar construction materials and framing layouts. The typical framing consists of a wood-framed roof supported by reinforced masonry walls that are supported by conventional reinforced concrete foundations. The first floor is a reinforced concrete ground floor slab-on-grade. Since the buildings were likely designed per the 1958 or 1961 Uniform Building Code (UBC), the construction design and detailing do not meet the requirements of the 1997 UBC which is the bench mark code for this type of constructed building, per ASCE-41 (Seismic Evaluation and Retrofit of Existing Buildings). Thus if a structural evaluation is required per Section 317 of the California Existing Building Code, retrofit of the building would likely be required. Some possible items that may need structural retrofit would be the out-of-plane wall anchorage and support to the roof diaphragm, collector detailing for shear transfer to the shear walls, and existing masonry shear walls.



EXISTING CONDITIONS

MECHANICAL

At most stations, the staff has described the HVAC systems as ineffective in maintaining heating and cooling throughout the living spaces, generally and specifically between the interior and exterior dorm rooms.

The HVAC equipment serving the living areas, including outdoor condensing units, furnaces, cooling coils, and thermostats, are approximately five years old and were in operational working order at the time of the site visits. Staff noted escaping vehicle exhaust from the apparatus bays is entering the living areas through the air distribution system. The air ducts are original to the buildings and should be replaced.

The vehicle exhaust systems, unit heaters, and exhaust fans serving the apparatus bays have been replaced since the building's original construction and, although operational, have exceeded their operating service lives and should be considered for replacement. In addition, the vehicle and room exhaust systems may not be working effectively, potentially allowing vehicle carbon monoxide to contaminate the living areas.

A new HVAC system replacement will improve system operating efficiencies and provide adequate ventilation in both the living rooms and apparatus bays.

PLUMBING

The plumbing piping systems consist of sanitary waste and vent with domestic hot and cold piping serving plumbing fixtures in both the living areas and apparatus bays. The plumbing fixtures in the lavatories, kitchens, and janitor rooms consist of both pressure assisted tank types and flush valve water closets, lavatories, shower stalls, kitchen and janitor sinks. All fixtures appeared to have been replaced since construction and were in good operating condition at the time of the site visits with no visible cracks in the fixtures or piping leaks observed.

The domestic water heating systems were in good operating condition serving shower's, kitchen sinks, lavatories, and janitor sinks. Domestic water in-line circulating pumps in the hot water piping systems provide a quick response to hot water needs at the plumbing fixtures. The pumps appeared to be new and in good operating condition.

The plumbing piping systems are primarily located behind finished surfaces and below slab and appear to be original. There were no visible leaks at the time of the site visits and piping appeared to be in working condition.

Overall the plumbing systems including fixtures, water heaters, pump and piping systems are in good operating condition with no immediate need for repair or replacement.



EXISTING CONDITIONS

ELECTRICAL

Power Distribution

The PG&E underground service typically enters the Fire Stations at the vehicle bays. PG&E services terminate in a meter, that then supplies the bulk of the stations. The majority of the panelboards in each fire station are original and are beyond their rated life.

Emergency Electrical Distribution

The stations contain Kohler, outdoor standby generators in weatherproof enclosures. No dates were indicated but it is assumed they were installed in the early 2000s based on air quality permits. The generators are supplied diesel fuel from a subgrade fuel tank. Current electrical codes require critical operations facilities to have a 72-hour back-up capacity, but the tanks do not appear to be large enough for this. The Fire Station transfer switches are a Kohler model, assumed to be installed at the same time as the generators and are also close to the end of their rated service lives.

Lighting

Interior lighting in the stations are primarily provided by 4-foot fluorescent fixtures with acrylic diffusers. Some lights were missing their diffusers and bare tubes are exposed. Building exteriors have several wall-paks, with diffusers showing yellowing due many years of exposure.

TELECOM

The stations have a main telecom closet each vehicle bay. Cables have been run in some areas thru exposed walls and ceilings. No fire rated sealant was observed and the closet area has limited service space. There are no cable management systems for the telecom cables.

FIRE ALARM

The stations have no central fire alarm panels. Single station smoke detectors, typically in sleeping areas and corridors outside of the dorm rooms, are present.



3. BEST PRACTICES



INTRODUCTION

Most fire stations in the Bay Area, including those in Sunnyvale, were built during the post WWII housing expansion from the 1950 through 1970. Fire services have substantially evolved since that time. With stricter building codes and better fire prevention methods, structural fires constitute a smaller percentage of calls while medical, rescue, and hazmat constitute greater percentages. To accommodate these broadened services, fire apparatus have increased in size as well as specialization. Fire stations have been constructed along with housing expansion, at more-or-less optimum distances to enable fire personnel to respond to emergency calls. As our populations have increased, residential and commercial construction has become taller and denser. Traffic has become congested, which affects the ability of fire services to respond quickly to incidents. We have also learned more and evolved as a society. The effects of earthquake and fire on structures are better understood. The health and safety of our first responders are of greater concern not only during emergencies but in their daily activities. Our societies have become more inclusive. The disabled are given access to our public facilities as much as the able-bodied. Females continue to increase as a larger percentage of our fire fighters. This chapter describes a number of the fire station

standards and best practices that have evolved since the construction of Sunnyvale's 1960s era fire stations.

Building codes represent the minimum requirements necessary to construct a building. The codes are broad and do not address the type of building or whether a building is functional or operational. With the exception of Station 2's Fire Training Facility (see subsection below), Sunnyvale's fire stations were designed to be code compliant at the time of construction. Other than that facility, Sunnyvale is not required to upgrade its fire stations to current code. The ADA is federal legislation. Meeting ADA is a requirement as opposed to a Best Practice, however for simplicity of this report it is listed below along with Best Practices. Best Practices are recommended by NFPA, and/or practiced by fire departments and those who specialize in fire station design. A chart is located at the end of this chapter that ranks the stations relative to those practices. Station 5, relocated and newly constructed in 2016, is currently the only station which substantially meets current best practices.

BEST PRACTICES

ESSENTIAL SERVICES

In 1986, the State of California passed the Essential Service Act. After 1986, essential service facilities such as fire stations were designed to not only survive earthquakes, but remain operational in order to provide emergency services. Training center buildings are not considered essential services. In 1990-1993 the City of Sunnyvale undertook the seismic strengthening of its existing fire stations. The City did so as an elective best practice. The structural design requirements of an essential service facility have been amended since 1986. As an example, the current Code provides additional requirements that help to assure that the apparatus doors will not jam after an earthquake (ASCE 7-10, Minimum Design Loads for Buildings and Other Structures).

OPERATIONS

A fire station can enhance or inhibit the operation contained within it. The requirements for Sunnyvale's fire stations have changed since the 1960s. Apparatus have grown larger. Medical calls are a larger percentage of the work. Developments are taller and denser requiring fire trucks in addition to engines. Traffic has increased and streets have become congested.

APPARATUS INGRESS/EGRESS

Apparatus must be able to safely ingress/egress a station. As noted in the Standards of Coverage report by City Gate (4/27/2018) traffic congestion on North Mathilda at rush hour is inhibiting apparatus from exiting the station. City Gate recommends relocation of the station to rectify this situation. Alternatively, replacement on the same site is cited as a possibility if the apparatus bays face West California rather than North Mathilda. A third and less expensive option is to add traffic signalization in order to allow the apparatus to exit the existing station onto North Mathilda. A fourth option could be to reverse the direction of apparatus in the apparatus bays such that apparatus enter from North Mathilda and exit onto West California. This will require removal and reinstallation of the Plymovent exhaust system and reconfiguration of the apparatus door controls. Sunnyvale's fire stations typically have at least one back-in bay with the remainder being drive-thru. Back-in bays are acceptable when apparatus bays do not face a major traffic artery or when the apparatus bay is used infrequently.

Sunnyvale's back-in bays are inboard, adjacent to the house, at the location normally reserved for the most active front line apparatus. Backing into these positions on a frequent basis poses potential safety risks for personnel as well as for pedestrians and traffic. It has been noted to be especially problematic at Fire Station 4 which fronts a major City artery, North Wolfe Road.



BEST PRACTICES

APPARATUS ACCOMMODATION

Sunnyvale's fire stations were designed for 1960s-era fire apparatus. The 12'x12' fire apparatus doors of Sunnyvale's stations are inadequate for modern fire apparatus which typically use 14'x14' door openings. When parked, fire apparatus should have a minimum 5' clearance on all sides so that personnel may quickly and safely access apparatus. At Sunnyvale's stations, these clearances are reduced to 3' in some instances. Station 2's apparatus room is not large enough to accommodate all of its apparatus. One apparatus and the command vehicle are parked outdoors causing premature weathering of these expensive assets. At Station 3, one of the apparatus bays has a fire truck which barely fits with inches to spare. This can only be rectified by building a new Station 3, or relocating the truck to a different station.

FLOOR PLAN EFFICIENCY FOR TURNOUT TIME

A fire station's "turnout time" is the time required by fire personnel to hear the dispatch message, don PPE, access their assigned apparatus and begin travel to the incident. As noted in the City Gate report (vol 2 pg 87), one of the contributors to turnout time is the floor plan layout. A fire station's floor plan should minimize travel distances and obstructions. New stations typically maintain 5 foot wide circulation paths throughout the fire station. Fire Station 2 has undergone several remodels including the addition of a training room and Battalion Chief quarters, conversion of open dormitories to individual sleep rooms, and expansion of the kitchen and dining area. Its relatively narrow and branching corridors impede turnout time. While the living quarters have been expanded to house additional personnel, the apparatus bays have not. One apparatus and the command vehicle are parked outdoors. This causes additional time to don PPE and cold start the apparatus, particularly in inclement weather.

TRAINING FACILITY

Fire Station 2 shares its site with the City's fire training facility. The training facility consists of a modular classroom/office building and a student locker room "temporarily" situated in the repurposed apparatus bay of the training tower. It is likely that the repurposing of this apparatus bay into a locker room was accomplished without a permit, as it is not in conformance with the building code. The locker room does not have bathrooms, HVAC, or ADA accommodations. The lobby of the tower contains the female lockers. Both of the temporary locker rooms also contain the student turnouts. There is cross contamination between soiled PPE and street clothing. There are no bathrooms or showers. There are no areas to decontaminate soiled PPE. The modular classroom/offices has one single-occupancy restroom serving over 50 potential occupants. According to the current code, a minimum of three single-occupancy restrooms are required. It is possible that a similar requirement was in effect at the time the classroom/office was constructed.

BEST PRACTICES

CARCINOGENS & INFECTIOUS DISEASE

Recent studies have shown that a large percentage of fire personnel have contracted cancer during active duty, or have an onset of cancer after retirement from fire services. This is attributed to exposure to contaminants (carcinogens) from structural fires, or exposure to carcinogens brought back to the fire house. A compiled list of studies is published by the NFPA (National Fire Protection Association) Research Foundation entitled Recommendations for Developing and Implementing a Fire Service Contamination Control Campaign, February 2018. According to this document, NFPA document 1581 is the best design reference document for carcinogen contaminate control in fire stations (Page 14). An easy to read article on the subject Clean by Design, NFPA Journal January 2018 is included in the Appendix. It discusses the design practice of zoning fire stations into three areas in order to isolate, control and reduce the spread of carcinogens: Hot (apparatus bay), Warm (transitional zones), and Cool (interior house). Implementing measures to reduce exposure to infectious disease and carcinogens has become one of the leading reasons for fire station replacement and renovation.

DECON CLEANING STATION

The decon cleaning station is for the cleaning of PPE, and other items exposed to carcinogens. It is to be distinct and separate from the medical cleaning and house cleaning station (NFPA 1581.5.6.4). It is located in or adjoins the apparatus bay “hot zone”. Sunnyvale’s stations typically have a small janitor’s closet and (decon) sink located in the apparatus bay. Currently, Sunnyvale sends its PPE and soiled rags out to a cleaning service, however decon cleaning still needs to occur at the station for helmets, SCBA (self-cleaning breathing apparatus) tanks, firefighting equipment, apparatus and the apparatus bay itself. It is recommended that new stations include decon rooms sized for the potential addition of an extractor and dryer. Decon cleaning is missing from the training center and should be added.

MEDICAL CLEANING STATION

According to NFPA, “Fire Departments that provide emergency medical services shall provide or have access to disinfecting facilities for the cleaning and disinfecting of emergency medical equipment.” (NFPA 1581.5.7.1). Sunnyvale provides Basic Life Support and EMS response. Santa Clara County provides Advance Life Support and paramedic response. Most items dispensed by Sunnyvale EMS staff are disposable. Providing medical sinks may be less important than providing separate decon and house cleaning sinks. However, if it is easily accomplished, providing medical sinks is recommended, considering that Sunnyvale may someday need to provide paramedic services by its own staff. At Station 5, a combination medical / hand wash sink should ideally be added at one door between the house and apparatus bay.

HOUSE CLEANING STATION

A third cleaning station is to be provided in the house (cold zone), solely dedicated to house cleaning. Typically, this includes a janitor sink and laundry facilities. Sunnyvale contracts with a laundry service for the cleaning of sheets. It is recommended that all fire stations have laundry facilities so that personnel can clean uniforms and bedding. Currently, only Stations 2 and 5 have laundry facilities. Only Station 5 has separate house and decon janitorial sinks. An internal house cleaning station, separate from decon (apparatus bay) and medical cleaning (transition zone) is recommended at all stations.



BEST PRACTICES

TRANSITION ZONE

The “warm” or transition zone is located between the “hot” apparatus bay and “cold” house zones of a fire station. In this zone the intention is to remove carcinogens before entering the house. Particulates are removed from boots and hands by means of floor mats and hand sinks. If hand sinks cannot be provided, then hand sanitizers should be placed at doors leading from the apparatus bay into the house. Similarly, while built-in floor mats are installed at new stations, a portable floor mat will suffice at existing stations. The air pressure of the house should be positive relative to the apparatus bays. Interior exhaust fans need to be interlocked with fresh make-up air. Doors between the house and apparatus bays require positive seals. Adding hand sanitizers and floor mats and checking door seals are relatively minor costs. It is recommended that Sunnyvale implement these measures at all stations at this time. New and remodeled stations should have hand wash sinks, built-in floor mats, positive interior pressure, and door seals.

PPE (TURNOUT) STORAGE

Fire personnel typically have one set of PPE that they utilize when on duty and a second spare set should the first set need cleaning. PPE should be stored in an isolated enclosed room with good fresh air circulation (NFPA 1581.5.5.4.1). PPE degrades over time. Exposure to ultra-violet or direct sunlight speeds up the process including off-gassing. At Sunnyvale’s fire stations PPE is stored in apparatus rooms where it has the potential to absorb diesel exhaust and other airborne contaminants. At Station 2’s training center, PPE is stored in the locker room. Contaminates have the potential to spread to the students street clothing and personal effects (NFPA 1581.5.5.4.2)

SCBA / OXYGEN REFILLING

The self-contained breathing apparatus (SCBA) and oxygen refilling should occur in a clean enclosed environment. Station 2 has a separate and compliant SCBA tank filling and maintenance area. SCBA refilling

occurs at Station 1 in an area open to the apparatus bay. Similarly, oxygen tank refilling occurs at Station 4 in an area open to the apparatus bay. These two stations are not compliant with NFPA 1852 and 1981. It is recommended that these stations be upgraded to include clean rooms for SCBA and Oxygen.

KITCHEN

Due to the extensive use by a relatively large number of rotating staff, NFPA 1581.5.2 recommends that kitchens be designed to a near commercial level. Separate sinks or areas are to be provided for food preparation and utensil cleaning. Non-permeable, seamless stainless steel counters with integrated sink have become the standard. With the exception of Station 5, Sunnyvale’s stations typically do not meet this standard.

FLOOR SURFACES

Seamless resilient flooring, or preferably polished/densified concrete floor are easy to clean and do not harbor carcinogens / infectious disease. Sunnyvale’s fire stations have carpet in their day rooms which should be removed. VCT, while acceptable, should eventually be replaced with seamless flooring or polished/densified concrete.

EXERCISE ROOMS

Exercise rooms should be large enough so that equipment does not overflow into the apparatus bays. During exercise, pores open up and the body can absorb air and particulates from the immediate environment. The exercise rooms for Fire Stations 3, 4 and 6 are extremely small. Exercise equipment has “flowed out” into the apparatus bays. Station 1’s exercise room is small, but there is an adjacent hallway area large enough to accommodate additional equipment. Fire Stations 2 and 5 have exercise rooms of adequate size.

BEST PRACTICES

ADA (AMERICANS WITH DISABILITIES ACT)

The Americans with Disabilities Act (ADA) is Federal legislation, which requires that facilities, both new and existing, be accessible to the disabled. The State of California has aligned its building codes to be consistent with the ADA. All new buildings are to be accessible. For remodels, a minimum of 20% of the remodel cost must go towards accessibility upgrades. The area of remodel, as well as the path of travel to the remodel area are required to be accessible. The Americans with Disability Act requires that all existing publicly funded facilities, including fire stations (whether a remodel is planned or not) have a program on file to bring the facility to full compliance over time. Only Station 5 appears to be in compliance with ADA.

GENDER ACCOMMODATION

Females continue to increase as a percentage of fire personnel. Most fire departments have or are in the process of converting older fire stations from open barracks with multi-occupancy bathrooms to single occupancy “dormettes” with single occupancy bathrooms. This is one area that Sunnyvale has been ahead of the curve, having completed this process for the fire stations around 1997. The City did so as an elective Best Practice. The temporary locker rooms at the training center at Station 2 do not provide privacy for females.

SUSTAINABILITY

For more than 55 years, Sunnyvale has maintained its fire stations in good condition. The City has improved the stations energy efficiency through HVAC (2013) and window (2008) replacements. Additional measures can continue to be incorporated. Sustainable buildings are resource-efficient, high performing and healthy. Sustainable design strategies employed for fire stations differ from those employed for other forms of buildings.

A fire station must be designed to withstand long-term use and abuse. Health and safety of personnel is paramount. Simple is better than complex. Natural is better than artificial. If light, fresh air, heating, and cooling can be introduced naturally into the building, long term operational and maintenance costs will be reduced. A drive-through apparatus bay has better natural ventilation and light than a back-in apparatus bay. Access to exterior spaces provides natural light and ventilation, improves storm water management, reduces heat island effect, and helps in relieving fire personnel stress. Interior finishes should be specified from natural and recycled materials, but such materials must be able to withstand constant use to minimize waste and disposal. For example, it is not enough to specify standard formaldehyde-free MDF for firehouse cabinetry. Unless the MDF has a plywood core, the hinges will pull off of cabinets due to constant use. Linoleum is a great choice for upper floors, as this natural material has integral color that does not wear through. Polished/densified concrete is an excellent fire station floor finish due to its sustainable features in addition to being low maintenance and infectious disease resistant.

Additional sustainable design strategies that work well in fire stations include radiant or VRF heating/cooling systems for individual control in dorm rooms, solar hot water panels to reduce energy consumption from extractors and laundry facilities, valves at apparatus wash areas to divert carcinogens from contamination of storm water systems, and PV panels integrated with roofing or doubling as shading canopies over parking to reduce the heat-island effect and protect vehicles. Sustainable features can add a higher initial cost to a project. The strategy should be to select features that minimizes negative effects to the environment, improve health, reduce life-cycle costs, and improves fire station operations.



BEST PRACTICES

OPERATIONAL ASSESSMENT OF EXISTING STATIONS

The chart below provides ratings for Sunnyvale's existing fire stations against current best practices.

CATEGORY	REFERENCE	STATION NUMBER						
		1	2	2T*	3	4	5	6
ESSENTIAL SERVICES								
Structurally Upgraded	ASCE 41-13	?	?	N/A	?	?		?
OPERATIONS								
Apparatus Ingress/Egress	Best Practice							
Apparatus Accomodation	Best Practice			N/A				
Circulation for Turnout	Best Practice			N/A				
Training Facility	Best Practice	N/A	N/A		N/A	N/A	N/A	N/A
CARCINOGEN & INFECTIOUS DISEASE								
Decon Cleaning	NFPA 1581.5.6.4							
Medical Cleaning	NFPA 1581.7			N/A				
Transition Zone	NFPA 1581.5.1.3			N/A				
House Cleaning	NFPA 1581.5.6			N/A				
PPE (Turnout) Storage	NFPA 1581.5.5.4.1							
SCBA/Oxygen Refilling	NFPA 1852.7.2			N/A	N/A		N/A	N/A
Kitchen	NFPA 1581.5.2			N/A				
Floor Surfaces	Best Practice							
Exercise Room	NFPA 1500.11.3.1			N/A				
ADA								
Parking/Entry	CAC 11B.404.2							
Restroom/Bathroom	CAC 11B.213.2							
Kitchen	CAC 11B.212.1			N/A				
GENDER ACCOMMODATION								
Gender Accommodation	Best Practice							
SUSTAINABILITY								
Sustainability	LEED							

CHART KEY:

	Meets best practice
	Marginally meets best practice
	Does not meet best practice

2T* Station 2 Training Facility

? Sunnyvale structurally reinforced its stations in 1990-1993. It is unknown whether they meet the current Essential Service requirements.



4. PROGRAM REQUIREMENTS



PROGRAM REQUIREMENTS

INTRODUCTION

The previous section describes the best practices instituted since the 1960s. Fire station program and site features that include best practices are described in this chapter. The Appendix contains the individual programs for each station. A program is a listing of the site features, rooms, and room square footages, required for a project. They are derived from the operational requirements discussed with DPS in response to the “Program Questionnaire”. The Appendix programs are for new fire stations, however they can also be used as a guideline for remodeling.

PROGRAM REQUIREMENTS

SITE PROGRAM

SITE SIZE

The site is to be of sufficient size to accommodate the particular program. In addition to topography and easements, the applicable zoning codes establish the maximum buildable area, maximum height and minimum setbacks allowed on the site. It is probable that the City's current fire station sites will support the larger new station programs contained in the Appendix if the single-story stations are reconstructed as two-story stations.

FRONT APRON

A concrete paved area is required between the apparatus doors and the street to provide site lines for safe egress, depth to accommodate apparatus turning radius, and often times, Planning Code building setbacks. It is also desirable to have enough depth to accommodate the parking of apparatus on the front apron, however, if the site depth is limited, it is more important that the rear apron have proper depth to enable drive-thru apparatus bays. To keep apparatus from bottoming out, transitions from the apron to the road should not be abrupt. Stations which exit onto major arterial roads may require control of traffic lights or flashing beacons.

REAR APRON

A rear apron secured by perimeter fencing and a motorized vehicular gate is required. While this is a good practice at any fire station, this is particularly important in Sunnyvale since firearms are stored in the station and in parked patrol cars. The rear apron provides apparatus access to the drive-thru fire apparatus bays. Sixty-five feet of clearance is required behind the apparatus doors in order to maneuver apparatus into the bays. The apron is to include employee parking, storage (including CERT), an emergency generator sized to provide 72 hours of power to the entire fire station, a covered trash/recycle enclosure and an apparatus washing area. To meet County code requirements, the apparatus washing area should have an automatic diverter valve so that water which is normally drained to the storm water system is diverted to a sand-oil separator before entering the sanitary sewer line.

The rear apron of Station 2 is oversized to accommodate training props including burn props and a training tower. In general, 65' of clearance should be provided on all sides of the training tower. This is based on the turning radius of the largest fire apparatus and adequate space to conduct drills.

VISITOR PARKING

It is recommended that the visitor parking area be located on the driveway leading to the rear apron. Satellite stations such as 3, 4 and 6 will have a limited number of visitors, whereas stations 1 and 2 will have a larger number of visitors.

FIRE STATION PATIO

The exterior patio is to be adjacent to the kitchen day room dining area. It may be located within the secure rear apron area.

TRAINING CENTER PATIO (STATION 2)

Provide a shaded patio adjacent to the classroom and from which trainees may observe the props. The patio is also used for breaks and lunch meals. Provide a water fountain, water bottle filling station, sink, chairs and tables. The patio covering, or a covered walkway should provide exterior access to the Turnout/PPE storage room and shop.



PROGRAM REQUIREMENTS

BUILDING PROGRAM

APPARATUS ROOM

Provide drive-thru apparatus bays with 14' high by 14' wide doors, in-swing 4-fold sliding doors facing the street, overhead aluminum sectional doors facing the rear apron. 4-fold doors require less maintenance than overhead doors, will last indefinitely and are less likely to jamb during an earthquake. Due to their high cost, four-fold doors are only recommended on the street (exit) side of the apparatus bay. The rear apron side can have overhead doors. All apparatus doors are to withstand the drift of exterior facades to reduce the potential of jamming during a seismic event (ASCE 7-10). Allow for a minimum of 5 feet of circulation around and between apparatus. Provide compressed air for tire filling, power drop cords to recharge batteries on each apparatus, trench floor drains under each apparatus, densified polished concrete floors, good natural (sustainability feature) and artificial lighting, apparatus exhaust ventilation (Plymovent), and good general room ventilation. The perimeter of the apparatus bay is to have fiber reinforce panels to a minimum of 4 feet in height to reduce damage to the interior walls. Doors leading from the apparatus bay to the house interior shall have latching doors with seals, walk off mats and adjacent hand sinks with electric eye faucets.

ALERT ALCOVE

Provide a 3'-4' wide counter for a printer with an incident status board mounted on the wall above. The base cabinet is to have ventilated doors with slide out trays for battery charging. The alert alcove is to be adjacent to the transition zone.

MEDICAL CLEANING STATION

Provide an alcove adjacent to the door leading from the Apparatus Room into the House. Provide a 5ft wide stainless steel sink unit with foot pedals and integral drain board. Adjacent to the drainboard, provide a 4'-5' wide counter. Above both, provide 9'-10' of upper cabinets to store medical supplies.

TRANSITION ZONE(S)

Provide integral walk off mats on both sides of door between the apparatus floor and house interior. The apparatus side walk off mat to be slatted with drain below. All doors to have seals and positive latches. The interior is to be positively pressured so that air flow from the interior into the apparatus bay. Adjacent to the doors provide a hand sink with electric sensor or a medical sink as noted above.

DECON PPE CLEANING STATION

Provide a room open to the apparatus bays and near the PPE Storage for cleaning PPE, apparatus equipment and tools. Provide a floor sink for filling buckets and hanging mops/squeegees, a 5-foot-wide stainless steel counter height sink unit with foot pedals and integral drain board, and space for a future extractor and PPE drying cabinet.

SHOP

Provide an alcove or room open to the apparatus room with a 24" deep galvanized steel counter with storage below. Provide a closet for sound isolation of the compressor which supplies piped air to the shop and the apparatus bays.

TURNOUT (PPE) STORAGE

The enclosed storage room is to be well ventilated with diffuse natural light and/or artificial light. Personal Protective garments degrades when subject to direct UV sunlight. Provide 24" wide wire lockers (Grid Gear).

SCBA

The SCBA (self-contained breathing apparatus) room contains an SCBA filling tank station, and storage racks for tanks and masks. Oxygen (medical) tanks may also be stored and/or filled (cascade system) in the SCBA room. Ideally provide a work bench for repair of tanks, masks and valves.

PROGRAM REQUIREMENTS

BUILDING PROGRAM (CONT'D)

GENERAL STORAGE

Provide an alcove or room open to the apparatus room. General storage will contain open industrial shelving for the storage of equipment, supplies and hose and floor space for a flammable liquid storage cabinet.

EXERCISE ROOM

The exercise room is to be acoustically separate from the dorms, and ideally have access to the rear apron. The flooring shall be made of recycled rubber, there shall be a 48" high fiber reinforced wainscot and a 10' high ceiling. Outlets are to be provided for a TV monitor. Fans for air circulation are to be provided.

ENTRY HALL/ LOBBY

Provide a small secured or semi-secured lobby adjacent to public restroom. The lobby can contain station memorabilia, easily cleaned bench seating, and should be observable from the station office.

CONFERENCE ROOM

Provide a conference room for station use that also can be used by the community by entering the secure lobby without entering the station.

PUBLIC RESTROOM

Provide a single occupancy multi-gender ADA compliant restroom with WC, sink, and urinal. Additional (non-ADA) restroom(s) will be required if the conference room exceeds 375 square feet.

STATION (WATCH ROOM) OFFICE

Provide a general open office area separated from the lobby by a counter. The open office is used for report writing, study and station communication. The station office is also used by patrol officers for writing reports and checking e-mail.

LIEUTENANT OFFICES

Provide a private office for the use of officers. Privacy is required for some meetings and phone calls.

CAPTAIN'S OFFICE AND DORM

Provide an office, dorm room, and private bathroom suite for use by the shift captain (Battalion Chief).

KITCHEN

Cabinets are to be constructed from plywood with MDF facing, plastic laminate and 3 mm edge banding. Countertops to be stainless steel, marine edged, integral (seamless) sinks and drain boards, stainless steel back boards and splashes. The main sink is to be 7" deep. The majority of the countertops are to be 38" in height. A 34" high by 60" wide ADA compliant stainless steel countertop with integral sink and open knee space is to be provided. Three shift pantry cabinets are to be provided. Overhead and base cabinets will contain shared staples, and kitchen supplies. The all-electric (sustainable) appliances include ranges with induction tops and convection ovens, refrigerators, and built in dishwashers. High-grade residential appliances are to be specified for easy replacement.

DINING ROOM

Provide a dining room contiguous with the day room and kitchen. The table should be large and rugged to accommodate meals, meetings and guests.

DAY ROOM

Provide a day room in a "great room" configuration contiguous with the dining room and kitchen. This provides flexible usage and a more comfortable living environment. The day room is to be furnished with adjustable lounge chairs and a television.

DORM ROOMS

Provide single occupancy dorm rooms each with one bed, (3) 30" wide lockers, 3'-4' wide desk, bed reading light. One dorm room is to be ADA compliant. All rooms to have egress windows.



PROGRAM REQUIREMENTS

BUILDING PROGRAM (CONT'D)

BATHROOMS

Provide single occupancy bathrooms (toilet + sink + shower). Showers are to have solid surfacing surrounds with coved inside corners and solid surface pans. Shower doors to be clear frameless glass. Walls to have a 4' high wainscot of large tiles with minimum grout lines. Floors and bases to be thin set terrazzo. Sink tops to be solid surface. Provide base cabinet below standard (non-ADA) sink/counters and open below ADA sinks. Provide (3) open or closed 12" width x 12" height x 8" depth storage shelves for sundries. One bathroom is to be ADA compliant.

UTILITY ROOMS (HOUSE CLEANING STATION)

Provide a utility room with a washer/dryer, linen closet, janitor sink, cleaning supplies and miscellaneous storage.

MECHANICAL, ELECTRICAL AND I.T. ROOMS

These rooms may be scattered or consolidated in the fire station and include space for HVAC units, hot water heating, fire risers, electrical switchgear, electrical sub-panels, and I.T. equipment.

PROGRAM REQUIREMENTS

TRAINING CENTER PROGRAM

LOBBY/ RECEPTION

The lobby/reception area will receive the public and an informal gathering/surge space just outside of the classroom.

PUBLIC RESTROOM

Provide a single occupancy unisex ADA restroom with WC, sink and urinal for public use.

OFFICES

Provide private offices for Training Officers. Privacy is required for some meetings and phone calls.

COPY / SUPPLY

Provide a copy supply room for administrative supplies and a copier/printer.

BREAK ROOM

Provide a break room for use by both the training staff and students. It also acts as a small meeting space. Include a minimum of 8 ft of counter, 19 cubic ft refrigerator, microwave and dishwasher. Wall space should be provided for vending machines.

CLASSROOM

The classroom space is a flexible space normally configured as a classroom for up to 30 students, but also re-configurable as a conference or meeting area. The walls contain both large LED monitors and white boards.

JANITORS CLOSET

Provide a supply closet including floor mop sink.

LOCKER ROOMS

Provide an easy to clean space with durable finishes. Include WC's, urinals, sinks and showers.

TURNOUT (PPE) STORAGE

The enclosed storage room is to be accessible from the covered patio, well ventilated with diffuse natural light and/or artificial light. Personal Protective garments degrades when subject to direct UV sunlight. Provide 18" wide wire lockers (Grid Gear).

SHOP

Provide a room accessible from the covered patio with a 24 inch deep galvanized steel counter with storage below. Provide a closet for sound isolation of the compressor which supplies piped air to the shop and the apparatus bays.

DECON PPE CLEANING STATION

Provide a room accessible from the covered patio and near the PPE Storage for cleaning PPE. Provide a floor sink for filling buckets and hanging mops/squeegees.

STORAGE

Provide general storage of training materials.

MECHANICAL, ELECTRICAL AND I.T. ROOMS

These rooms may be scattered or consolidated in the training center and include space for HVAC units, hot water heating, fire risers, electrical switchgear, electrical sub-panels, and I.T. equipment.





5. LIFE CYCLE COST ANALYSIS



LIFE CYCLE COST ANALYSIS

OVERVIEW

As part of the City of Sunnyvale Fire Department's continued growth, Kitchell and Shah Kawasaki Architects were requested by the City to prepare a master plan with the goal of remodeling areas of their facilities where necessary.

From the master plan, the City seeks to understand the estimated total life cycle cost of the fire stations in order to plan for future capital needs. The major areas of focus include the project's total replacement cost, annual maintenance & repair costs, and annual operational cost over life of the building.

SUMMARY

The Life Cycle Cost Analysis included in the Appendix models six Sunnyvale fire station expansion and alteration scenarios identified in the master plan. This analysis compares the existing buildings against possible alteration scenarios to estimate industry referenced operation, maintenance, and repair costs for each specific fire station to illustrate, categorize, and identify possible ongoing budgetary shifts. Comparisons of average annual operation, maintenance and repair costs and a conceptual annual budget timeline were prepared for each fire station. The timelines and scenarios presented are conceptual and are for illustration purposes only. The final alterations for each station have not been determined and none of these alterations have been budgeted or programmed.

The master plan identifies alterations and expansions of most stations under remodel or replacement scenarios, except Fire Station 5 which is modeled with existing conditions in mind due to its good current condition. Based on the scenarios modeled, the size of most stations increases and a corresponding increase in ongoing operational costs can be expected. The timelines in the analysis are conceptual only and are presented for illustration purposes.

Fire Stations 3, 4, and 6 may undergo similar alterations increasing the gross square footage of the stations by 195%. The cost model projects a 210% increase in the average annual maintenance and repair costs and a 150% increase in the average annual operational costs for these stations.

Fire Station 1 may expand by 250% of its existing gross square feet. This expansion indicates a 250% and 235% average annual increase in maintenance and repair and operational costs respectively.

Fire Station 2 has a potential gross square foot expansion of 220% which reflects a 115% and 205% average annual increase in maintenance and repair and operational costs respectively.



LIFE CYCLE COST ANALYSIS

PURPOSE

The purpose of this Life Cycle Cost Analysis is to identify existing facilities as part of the master plan project and develop a forecasting method that will allow the City to predict the total life cycle cost of maintaining and operating the facilities. The study consists of analyzing six fire stations and developing functional templates for each of them.

The study factors in the following major components:

Property Replacement Value (PRV)

Includes construction contingencies.

Total Maintenance & Repair (M&R) Costs

Includes preventative maintenance & minor repair, unscheduled maintenance, and repair & replacement.

Total Operational Costs

Includes custodial services, energy, grounds, maintenance and repair, pest control, refuse, road, security, telecommunication, and water & sewer.

ASSUMPTIONS

The following assumptions were made for the study:

Custodial services consist of cleaning all occupied rooms and removal of trash.

Energy consists of expenses of producing, purchasing, distributing, and storing energy. Utilities maintenance and supervision are not included.

Maintenance and Repair (M&R) includes business services for fire station, I.T. support, project management, services planning & engineering.

Pest Control includes insect and rodent control for both indoors and outdoors.

Refuse includes recycling and trash collection services. Removal of hazardous materials is not included.

Road Clearance includes snow removal, street cleaning, and sweeping of debris from any paved areas.

Security includes patrol services, monitoring equipment, and physical security assets.

Telecommunications include phone service and equipment. It also includes data services and equipment.

Water and Sewer includes sewage service, potable water, and irrigation water. Size is the total area within the asset area.

LIFE CYCLE COST ANALYSIS

NOTES

The Life Cycle Cost Analysis assumes the following conditions:

The estimated replacement costs per square foot and total replacement costs are based on typical buildings with assumed types and occupancies.

Costs are to mid-point of year and represent a 30-year projection, which includes mark-up and contingency factors consisting of the following:

- Estimating contingencies
- General Conditions
- Overhead / Profit
- Insurance bonds
- Construction contingencies
- Architect / Engineering fees
- Construction management
- Permits & fees

Costs do not include escalation. Life Cycle Costs are calculated on a per station basis. Capital Program Schedules were not taken into consideration. For purposes of uniformity, all construction is assumed to start in the first quarter of 2022.

DEFINITIONS

The following definitions are provided for the Average Annual M&R Cost Summary tables.

Preventative maintenance (PM) and minor repair include regular checks that prolongs a component's life.

Unscheduled Maintenance consists of emergency replacement or repairs that are not anticipated.

Repair and Replacement consist of scheduled replacement of components near the end of the component's life cycle.

Costs represent the average annual cost over a 30 year life cycle period. Refer to the 30 year maintenance and repair cost table for actual anticipated annual costs.





6. RECOMMENDATIONS



RECOMMENDATIONS

OPTION 1 (MINIMUM RECOMMENDED WORK)

The previous chapters described the best practices for fire station design and recommended programs for Sunnyvale's fire stations. For the first option, Kitchell and Shah Kawasaki Architects recommend addressing key deficiencies by remodeling existing stations and constructing new stations where major deficiencies cannot be solved through remodeling. The cost to implement this strategy is estimated to be approximately \$57,792,000 or 48% of the cost of constructing entirely new stations and remodeling Station 5, as described in Option 2. The work can be sequenced as follows:

Station	Cost
Cleaning Measures	\$3,000
Traffic Signal Modifications (Stations 1 & 4)	\$2,222,000
New Station 2	\$40,753,000
Remodel Station 1	\$4,032,000
Remodel Stations 3, 4 & 6	\$10,782,000
Total:	\$57,792,000

OPTION 2

With the exception of Station 5, Sunnyvale's fire stations were constructed in the 1960s. To bring the 1960s era stations fully up to today's standards, it would be less expensive to rebuild the stations than it would be to modify them. Station 5, on the other hand, would only require a few minor alterations to meet current standards. Three sinks, including medical sinks, and several floor mats would be added. The cost to bring Sunnyvale's stations to full compliance is approximately \$119,685,000.

Station	Cost
New Station 1	\$28,162,000
New Station 2	\$40,753,000
New Station 3	\$16,922,000
New Station 4	\$16,922,000
Remodel Station 5	\$4,000
New Station 6	\$16,922,000
Total:	\$119,685,000

The lifespan of renovated stations is expected to be between 40 and 50 years. The useful life of new stations is expected to be approximately 70 years.

RECOMMENDATIONS

Option 2 represents full replacements of all Stations except number 5. Strategies for Option 1, which incorporate a phased approach for alterations and new construction, are expanded further in the sections below.

CLEANING MEASURES

There are several inexpensive measures that can immediately be implemented to improve the health and safety of firefighters within the stations. It is recommended that hand sanitizers and floor mats be added to all station doors leading from the apparatus bay to the house interiors. Door seals and latches should be inspected and repaired. Signage should be placed on existing sinks to improve operations and reduce cross contamination.

TRAFFIC SIGNAL MODIFICATIONS

At Fire Station 1, fire apparatus currently have difficulty exiting onto North Mathilda during rush hours. This is affecting the ability of fire apparatus to respond to calls. At Fire Station 4, in order to back one of the apparatus into the station after returning from a call, DPS personnel must exit the apparatus, and attempt to stop traffic on North Wolfe. This is dangerous for personnel and the public. To improve response and safety, it is recommended that modifications be made to the traffic signals and street striping. See the memo issued by the City's traffic team in this report's Appendix.

NEW STATION 2

Fire Station 2, including the training center, has the largest number of issues needing correction. Some are code violations. Others are the result of numerous additions which have resulted in an inefficiently organized facility. It is recommended that the single-story fire station, SCBA building, and classroom building be rebuilt and consolidated into a sustainably designed two-story structure; that the tower prop have its apparatus bay restored; and that the paramedic trailer be relocated on or off site. It will be necessary for training functions to be temporarily suspended or moved off-site for the 17 month construction duration. A temporary fire Station 2 will be erected at the rear of the site during re-construction of

the station. The temporary station will consist of a modular housing unit and a "Sprung" apparatus tent structure. Once completed, the new station will create additional capacity or "surge space" so that the department is less constrained as other stations are being remodeled or reconstructed.

REMODEL STATION 1

The existing station is of sufficient size to incorporate key best practices. The remodel will include a new kitchen, SCBA refilling room, ADA bathroom, ADA parking, cleaning stations, HVAC, fire sprinklers, painting, roofing and finish upgrades. The modular housing unit from the Station 2 reconstruction will be relocated to the rear of Station 1 during construction. Apparatus will continue to respond from the existing apparatus bay.

REMODEL STATIONS 3, 4 & 6

Stations 3, 4 and 6 can be remodeled to incorporate key best practices. Since the remodels will be identical in each station, there will be economies in design, construction and management if the three projects were completed simultaneously. The remodels will include new kitchens, ADA bathrooms, ADA parking, cleaning stations, HVAC, fire sprinklers, painting, roofing and finish upgrades. Additions will be made to house new exercise rooms. Station personnel will be temporarily housed in modular housing units located at the rear of the stations. Apparatus will continue to respond from the existing apparatus bays.

The table on the following page shows the anticipated best practice status of Sunnyvale's stations by implementing the above recommendations.

RECOMMENDATIONS

OPERATIONAL ASSESSMENT OF NEW & REMODELED STATIONS (OPTION 1)

The chart below provides ratings for Sunnyvale's proposed new and remodeled fire stations against current best practices after recommended construction is completed.

CATEGORY	REFERENCE	STATION NUMBER						
		1	2	2T*	3	4	5	6
ESSENTIAL SERVICES		Remodel	New	New	Remodel	Remodel	N/A	Remodel
Structurally Upgraded	ASCE 41-13	?		N/A	?	?		?
OPERATIONS								
Apparatus Ingress/Egress	Best Practice							
Apparatus Accommodation	Best Practice			N/A	<1>			
Circulation for Turnout	Best Practice			N/A				
Training Facility	Best Practice	N/A	N/A		N/A	N/A	N/A	N/A
CARCINOGEN & INFECTIOUS DISEASE								
Decon Cleaning	NFPA 1581.5.6.4							
Medical Cleaning	NFPA 1581.7			N/A				
Transition Zone	NFPA 1581.5.1.3			N/A				
House Cleaning	NFPA 1581.5.6			N/A				
PPE (Turnout) Storage	NFPA 1581.5.5.4.1							
SCBA/Oxygen Refilling	NFPA 1852.7.2			N/A	N/A	N/A	N/A	N/A
Kitchen	NFPA 1581.5.2			N/A				
Floor Surfaces	Best Practice							
Exercise Room	NFPA 1500.11.3.1			N/A				
ADA								
Parking/Entry	CAC 11B.404.2							
Restroom/Bathroom	CAC 11B.213.2							
Kitchen	CAC 11B.212.1			N/A				
GENDER ACCOMMODATION								
Gender Accommodation	Best Practice							
SUSTAINABILITY								
Sustainability	LEED							

CHART KEY:

- Meets best practice
- Marginally meets best practice
- Does not meet best practice
- 2T* Station 2 Training Facility

? Sunnyvale structurally reinforced its stations in 1990-1993. It is unknown whether they meet the current Essential Service requirements.

<1> Station 3 currently has a truck which does not fit into the apparatus bay with proper circulation access.





7. APPENDIX





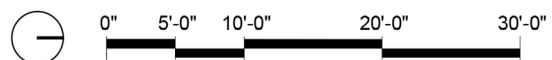
FIRE STATION NO. 1

171 N Mathilda Ave, Sunnyvale, CA 94086

The existing building at Fire Station #1 is a single-story, 5,577 sq.ft. concrete masonry structure built in the early 1960s. It is located at the intersection of N Mathilda and W California.

FIRE STATION NO. 1

EXISTING FLOOR PLAN



FIRE STATION NO. 1

PROGRAM REQUIREMENTS

Sunnyvale Fire Station 1 Program

Site Program Areas	Existing	New
Site Size	0.67 acre	0.67 acre
Front Apron	30'	15' min
Rear Apron	Not Secured	Secured
Back-up Generator	Yes, unknown capacity	72 hour whole house
Apparatus Wash Area	None	Required
Visitor Parking	No ADA, not striped	(1) ADA, (2) standard
Employee Parking	Not striped	(1) ADA, (12) standard
Fire Station Patio	Yes	Yes

Fire Station Program Areas	Net Area ¹	Comments	Net Area ¹	Comments
Apparatus Room	2,997	(2) 67'dp drive-thru bays (1) 44' dp back-in bay	5,700	(4) 75'x19' drive-thru bays
Alert Alcove	0		8	
Transition Zone(s)	0		20	
Med Cleaning / Supply	0		16	
Decon	37		200	
Shop	0	In Apparatus Room	100	
Turnout Locker Room	0	In Apparatus Room	240	(21) 24" lockers
SCBA / Oxygen Filling	0		200	
Hose / Storage	104		180	
Weight/Exercise Room	175		450	
Entry Hall/Lobby	0		100	
Conference Room	0		240	
Public Restroom	32		75	
Watch Room	84		200	
Lieutenant Office	134		120	
Team Coordinator Office	0		120	Adjacent to TC dorm
Captain Office / Dorm	0		420	Private bath
Kitchen	116		308	(3) 24" shift pantries, (2) 36"w refigs
Dining Room	116		210	
Day Room	311		420	
Dorm Rooms	425	(5)	720	(6) @ 120sf
Crew Bathrooms	214	(3) standard	340	(3) @ 80sf, (1) ADA @ 100sf
House Cleaning	0		80	
Storage	33		40	
Elect / Mech / I.T.	29		300	
Stairs	0		650	(2) Stairs
Elevator	0		180	
Total Net Area	4,807	sq.ft.	11,637	sq.ft.
Load Factor ²	1.16	Single-story	1.22	Two-story
Total Gross Fire Station Area	5,577	sq.ft.	14,197	sq.ft.

¹ Measured to the centerline of interior walls and inside face of exterior walls (BOMA definition)

² Accounts for corridors and exterior walls



FIRE STATION NO. 1

CONCEPTUAL PROJECT ESTIMATE (FOR NEW BUILDING)

ITEM	DESCRIPTION	QTY	UNIT	UNIT PRICE	TOTAL COST
	DEMOLISH (E) STRUCTURES	5,577	SF	\$20.00	\$111,540
	GENERAL SITEWORK	14,197	SF	\$80.00	\$1,135,760
	BUILDING	14,197	SF	\$980.00	\$13,913,060
	TEMPORARY FIRE STATION	1	LS	\$1,500,000	\$1,500,000
	EMERGENCY GENERATOR & TRANSFER SWITCH	1	LS	\$81,370	\$81,370
	ELECTRIC FIRE TRUCK CHARGING STATION	4	EA	\$25,000	\$100,000
SUBTOTAL HARD COSTS					\$16,841,730
CONTINGENCY					
	ESTIMATING CONTINGENCY	5.00%			\$842,087
SUBTOTAL CONSTRUCTION COSTS					\$17,683,817
ESCALATION					\$2,947,892
		16.67%			
SUBTOTAL CONSTRUCTION COSTS				\$1,453.24	\$20,631,709
CONSTRUCTION CONTINGENCY					\$1,031,585
		5.00%			
TOTAL CONSTRUCTION COSTS				\$1,525.91	\$21,663,294
NON-CONSTRUCTION COSTS					\$6,498,988
		30.00%			
TOTAL PROJECT COSTS:				\$1,983.68	\$28,162,282

FIRE STATION NO. 1

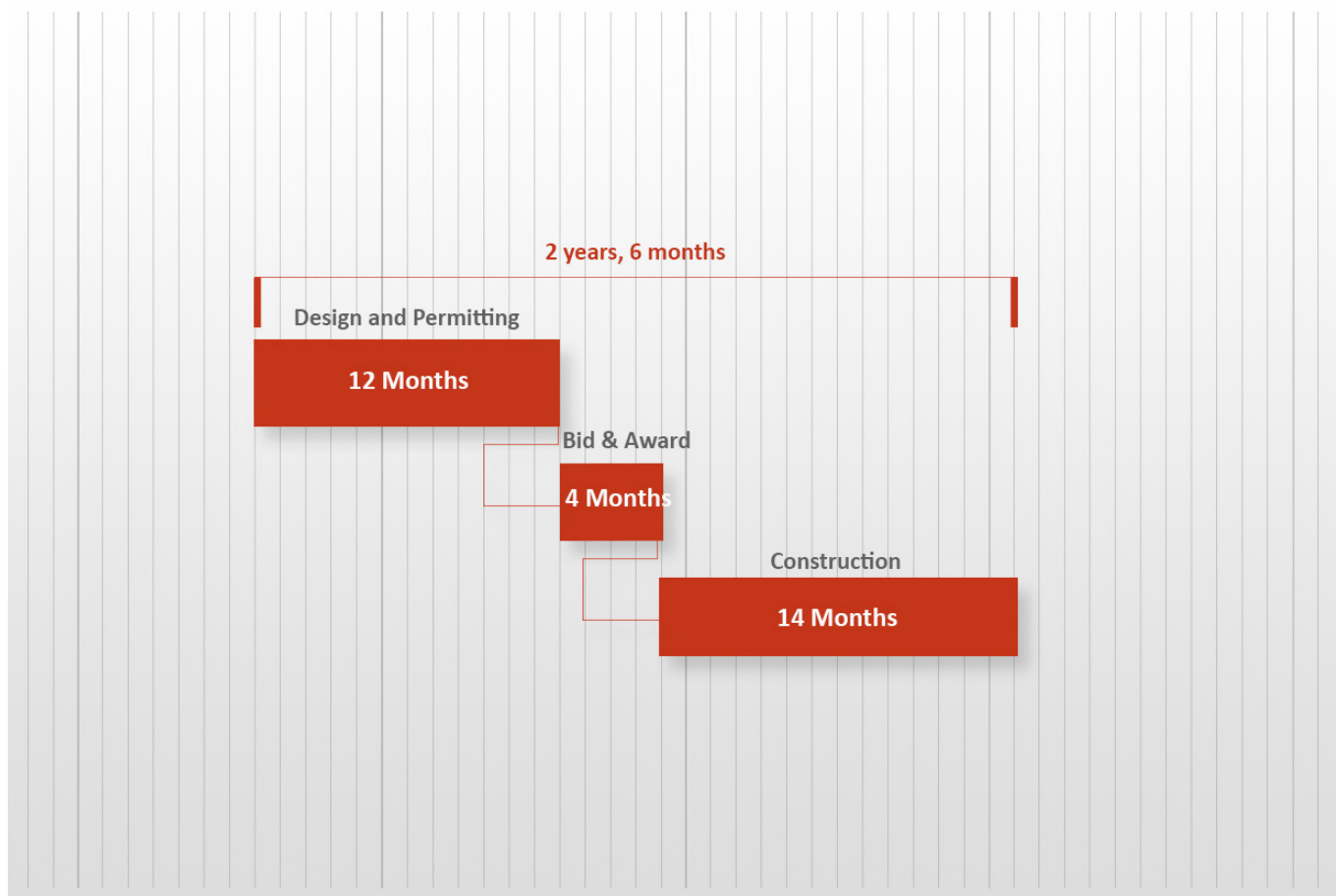
CONCEPTUAL PROJECT ESTIMATE (FOR REMODEL)

ITEM	DESCRIPTION	QTY	UNIT	UNIT PRICE	TOTAL COST
	GENERAL SITEWORK	5,577	SF	\$120.00	\$669,240
	TRAFFIC SIGNAL	1	LS	\$567,000	\$567,000
	DEFICIENCY COSTS, CAPITAL RENEWAL	1	LS	\$528,462	\$528,462
	NEW EXERCISE ROOM ADDITION COMPLETE	380	SF	\$1,000	\$380,000
	NEW EXTERIOR WINDOW IN CMU WALL	20	SF	\$200.00	\$4,000
	REPLACE EXT DOOR WITH SIDELIGHTS, 6'	1	LS	\$5,500	\$5,500
	REMOVE EXTERIOR WINDOW, INFILL WALL	100	SF	\$75.00	\$7,500
	CUT IN NEW INTERIOR DOOR	3	EA	\$3,500	\$10,500
	NEW OR INFILL INTERIOR PARTITION	400	SF	\$30.00	\$12,000
	INTERIOR CLOSET SLIDING DOORS	2	EA	\$2,500	\$5,000
	MISC. INTERIOR CONSTRUCTION	5,577	SF	\$40.00	\$223,080
	NEW KITCHEN CASEWORK	35	LF	\$700	\$24,500
	RANGE	1	EA	\$4,500.00	\$4,500
	NEW LAV	2	EA	\$2,500	\$5,000
	NEW WATER CLOSET	1	EA	\$3,500.00	\$3,500
	NEW ADA SHOWER	1	EA	\$8,000	\$8,000
	NEW MOP SINK	1	EA	\$3,000.00	\$3,000
	NEW KITCHEN SINK	1	EA	\$3,200	\$3,200
	FIXTURE ROUGH-INS, SLAB, WALL	3	EA	\$5,500.00	\$16,500
	REMOVE EXISTING SLIDING DOOR	1	LS	\$250	\$250
	REMOVE INTERIOR DOOR	4	EA	\$150.00	\$600
	REMOVE INTERIOR PARTITION	270	SF	\$50	\$13,500
	REMOVE CASEWORK	30	LF	\$40.00	\$1,200
	REMOVE KITCHEN EQUIPMENT	1	LS	\$1,500	\$1,500
	REMOVE / REINSTALL REFRIGERATOR	1	LS	\$750.00	\$750
	DEMO LAVATORY	2	EA	\$430	\$860
	DEMO WATER CLOSET	1	EA	\$500.00	\$500
	EMERGENCY GENERATOR & TRANSFER SWITCH	1	LS	\$81,370	\$81,370
	ELECTRIC FIRE TRUCK CHARGING STATION	4	EA	\$25,000	\$100,000
SUBTOTAL HARD COSTS					\$2,681,012
CONTINGENCY					
	ESTIMATING CONTINGENCY	20.00%			\$536,202
SUBTOTAL CONSTRUCTION COSTS					\$3,217,214
SUBTOTAL CONSTRUCTION COSTS & MARK-UPS					\$3,217,214
ESCALATION					\$536,310
		16.67%			
SUBTOTAL CONSTRUCTION COSTS				\$673.04	\$3,753,524
CONSTRUCTION CONTINGENCY					\$375,352
		10.00%			
TOTAL CONSTRUCTION COSTS				\$740.34	\$4,128,876
NON-CONSTRUCTION COSTS					\$1,238,663
		30.00%			
TOTAL PROJECT COSTS:				\$962.44	\$5,367,539



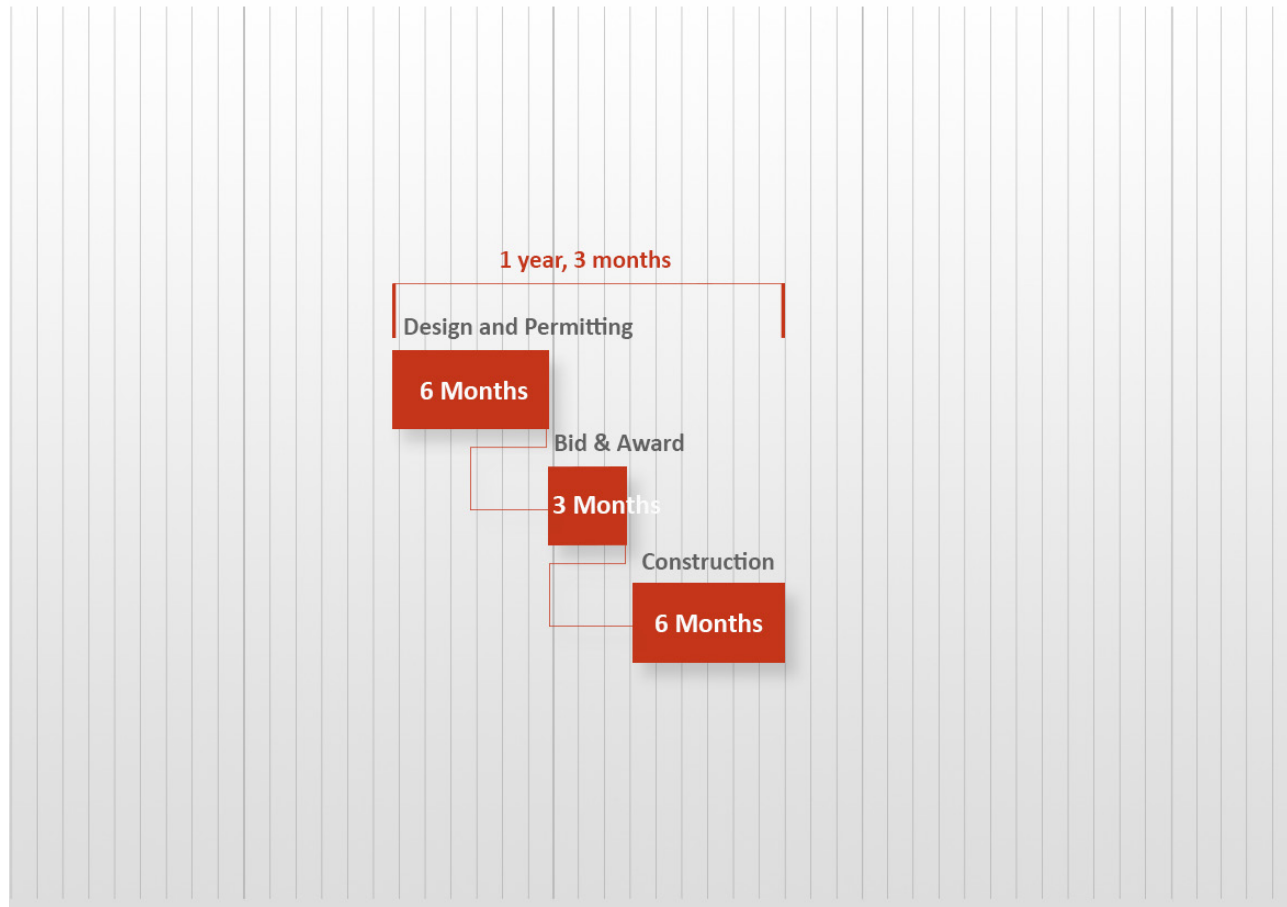
FIRE STATION NO. 1

CONCEPTUAL PROJECT SCHEDULE (FOR NEW BUILDING)



FIRE STATION NO. 1

CONCEPTUAL PROJECT SCHEDULE (FOR REMODEL)





FIRE STATION NO. 2

795 E Arques Ave, Sunnyvale, CA 94085

The existing building at Fire Station No. 2 is a single-story, 6,693 sq.ft. concrete masonry structure built in the early 1960s. It is located at the intersection of E Arques Ave and N Wolfe Rd.

FIRE STATION NO. 2

EXISTING FLOOR PLAN



FIRE STATION NO. 2

PROGRAM REQUIREMENTS

Sunnyvale Fire Station 2 Program

Site Program Spaces	Existing	New
Site Size	2.28 acres	3 acres
Front Apron	40'	15' min
Rear Apron	Not Secured. Training props	Secured. Training props
Back-up Generator	Yes, unknown capacity	Full station capacity
Apparatus Wash Area	None	Required
Visitor Parking	No ADA, not striped	(1) ADA, (17) standard
Employee Parking	Not striped	(2) ADA, (40) standard
Fire Station Patio	None	Yes
Training Center Patio	None	Yes

Fire Station Program Spaces	Net Area ¹	Comments	Net Area ¹	Comments
Apparatus Room	2,898	(2) 67'dp drive-thru bays (1) 44'dp back-in bay	5,700	(4) 75'x19' drive-thru bays
Alert Alcove	0		8	
Transition Zone(s)	0		20	
Med Cleaning / Supply	0		16	
Decon	37		200	
Shop	0	In Apparatus Room	100	
Turnout Locker Room	0	In Apparatus Room	270	(24) 24" lockers
SCBA / Oxygen Filling	0	In SCBA building	200	
Hose / Storage	189		180	
Weight/Exercise Room	487	Add area In separate building	450	
Entry Hall/Lobby	0		100	
Conference Room	0		240	
Public Restroom	32		75	
Watch Room	84		200	
Lieutenant Office	134		120	
Team Coordinator Office	0		120	Adjacent to TC dorm
Captain Office / Dorm	173	Murphy bed	420	Private bath
Kitchen	165		308	(3) 24" shift pantries, (2) 36"w refigs
Dining Room	234		210	
Day Room	307		420	
Dorm Rooms	656	(8)	840	(7) @ 120sf
Crew Bathrooms	298	(4)	340	(3) @ 80sf, (1) @ 100sf
House Cleaning	13	Washer / Dryer	80	
Storage	124		40	
Elect / Mech / I.T.	40		300	
Stairs	0		650	(2) Stairs
Elevator	0		180	Required
Total Net Area	5,871	sq.ft.	11,787	sq.ft.
Load Factor ²	1.14	Single-story	1.22	Two-story
Subtotal Gross Fire Station Area	6,693	sq.ft.	14,380	sq.ft.

FIRE STATION NO. 2

PROGRAM REQUIREMENTS

Sunnyvale Fire Station 2 Program						
			Existing		New	
SCBA Building Program Spaces	Net Area ¹	Comments		Net Area ¹	Comments	
SCBA	200			0		
Weight/Exercise Room	360			0		
Total Net Area	560			0		
Load Factor	1.00			1.00		
Subtotal Gross Building Area	560	sq.ft.		0	sq.ft.	
Training Center Program Spaces	Net Area ¹	Comments		Net Area ¹	Comments	
Lobby / Reception	0			600	Seating for 6 and (1) reception desk.	
Public Restroom	83	(1) single occupancy		240	(3) single occupancy	
Offices	432	(3) 144 sf offices		360	(3) 120sf offices	
Copy / Supplies	0	In Break Room and Class Room		100		
Break Room	324	Open Area (Not enclosed)		300	Seating for (8), kitchen: sink, micro, refrig	
Classroom	1155	Classroom for 30 students		1,100	Classroom for 30 students.	
Janitor Closet	0	Shared with restroom		50		
Men's Locker / Restroom	0	Temp housed in Apparatus Prop		700	(36) 12"W x 39"H lockers, (3) showers, (1) urinal, (2) WC's, (2) sinks	
Women's Locker / Restroom	0	Temp housed in Apparatus Prop		425	(12) 12"W x 39"H lockers, (2) showers, (2) WC's, (1) sink	
Turn-out	0	Temp housed in Apparatus Prop		330	(36) 18"W x 72"H PPE wire lockers.	
Shop	0			120		
Decon	0			80		
Storage	0			200		
I.T. / Telecom	0	On Classroom wall		80	(2) racks, wireless communication system.	
Elec / Mech	0	On building exterior		200		
Total Net Area	1,994			4,885		
Load Factor	1.09			1.25		
Subtotal Gross Building Area	2,178	sq.ft.		6,106	sq.ft.	
Total Gross Area	9,431	sq.ft.		20,486	sq.ft.	

¹ Measured to the centerline of interior walls and inside face of exterior walls (BOMA definition)

² Accounts for corridors and exterior walls



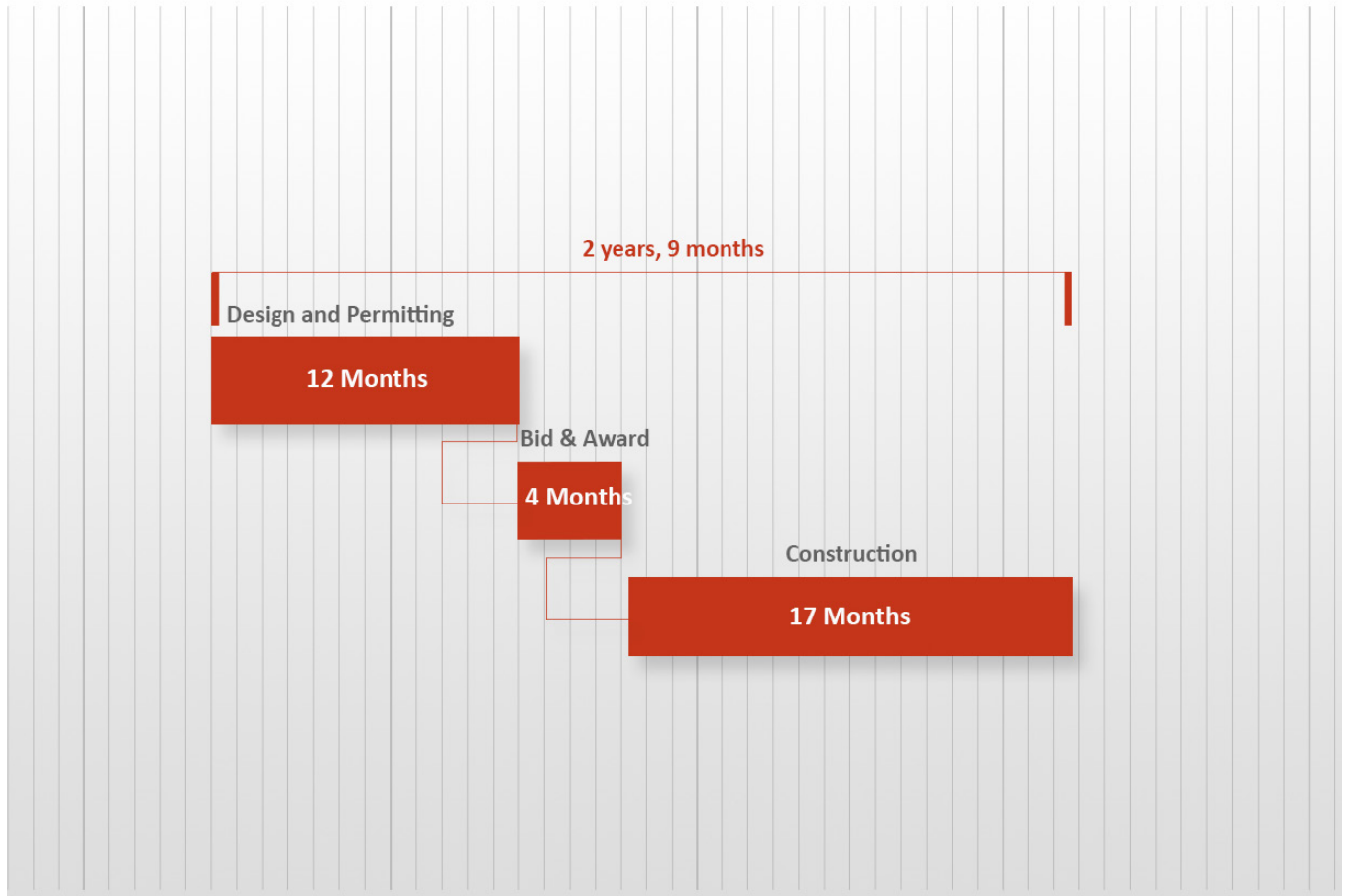
FIRE STATION NO. 2

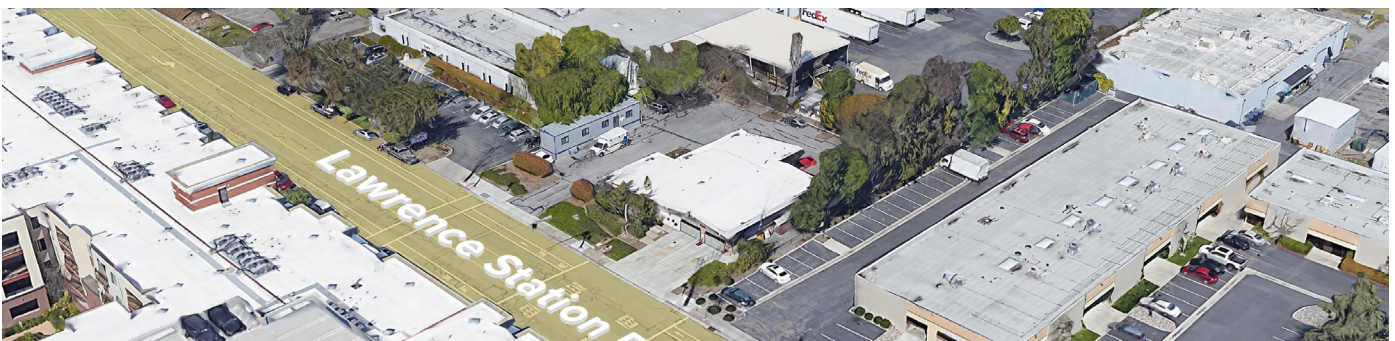
CONCEPTUAL PROJECT ESTIMATE (FOR NEW BUILDING)

ITEM	DESCRIPTION	QTY	UNIT	UNIT PRICE	TOTAL COST
	DEMOLISH (E) STRUCTURES	12,739	SF	\$20.00	\$254,780
	GENERAL SITEWORK	20,486	SF	\$65.00	\$1,331,590
	BUILDING	20,486	SF	\$980.00	\$20,076,280
	TEMPORARY FIRE STATION	1	LS	\$1,500,000	\$1,500,000
	EMERGENCY GENERATOR & TRANSFER SWITCH	1	LS	\$106,830	\$106,830
	ELECTRIC FIRE TRUCK CHARGING STATION	4	EA	\$25,000	\$100,000
SUBTOTAL HARD COSTS					\$23,369,480
CONTINGENCY					
	ESTIMATING CONTINGENCY	5.00%			\$1,168,474
SUBTOTAL CONSTRUCTION COSTS					\$24,537,954
ESCALATION					\$5,317,375
		21.67%			
SUBTOTAL CONSTRUCTION COSTS				\$1,457.35	\$29,855,329
CONSTRUCTION CONTINGENCY					\$1,492,766
		5.00%			
TOTAL CONSTRUCTION COSTS				\$1,530.22	\$31,348,095
NON-CONSTRUCTION COSTS					\$9,404,429
		30.00%			
TOTAL PROJECT COSTS:				\$1,989.29	\$40,752,524

FIRE STATION NO. 2

CONCEPTUAL PROJECT SCHEDULE (FOR NEW BUILDING)





FIRE STATION NO. 3, 4 & 6

996 S Wolfe Rd, Sunnyvale, CA 94086

910 Ticonderoga Dr, Sunnyvale, CA 94087

1282 Lawrence Station Rd, Sunnyvale, CA 94089

The three existing buildings at Fire Stations No. 3, 4, & 6 are single-story, 4,058 sq.ft. concrete masonry structures built in the early to mid 1960s.

FIRE STATION NO. 3, 4 & 6

EXISTING FLOOR PLAN



0" 5'-0" 10'-0" 20'-0" 30'-0"



FIRE STATION NO. 3, 4 & 6

PROGRAM REQUIREMENTS

Sunnyvale Fire Stations 3, 4, 6 Program

Site Program Spaces	Existing	New
Site Size	Station 3: 0.43 acre Station 4: 0.55 acre Station 6: 0.6 acre	0.43 acre min.
Front Apron	25'-30'	15' min
Rear Apron	Not secured	Secured
Back-up Generator	Yes, unknown capacity	Full station capacity
Apparatus Wash Area	None	Required
Visitor Parking	No ADA, not striped	(1) ADA, (1) standard
Employee Parking	Not striped	(1) ADA, (9) standard

Fire Station Program Spaces	Net Area ¹	Comments	Net Area ¹	Comments
Apparatus Room	1,595	(1) 49'dp drive-thru bay (1) 45'dp back-in bay	2,400	(2) 60'dp x20'w drive-thru bays
Alert Alcove	0		8	
Transition Zone(s)	0		20	
Med Cleaning / Supply	0		16	
Decon	37		120	
Shop	0	In Apparatus Room	100	
Turnout Locker Room	0	In Apparatus Room	180	(15) 24" lockers
SCBA / Oxygen Filling	0		0	
Hose / Storage	102		120	
Weight/Exercise Room	163		400	
Entry Hall/Lobby	0		70	
Conference Rm	0		0	
Public Restroom	26		75	
Watch Room	89		180	
Lieutenant Office	125		120	
Captain Office / Dorm	0		0	
Kitchen	105		240	(3) 20" shift pantries, (2) 36" w refigs
Dining Room	115		160	
Day Room	287		325	
Dorm Rms	399	(5)	600	(5) @ 120sf
Crew Bathrooms	225	(3) standard	260	(2) @ 80sf, (1) @ 100sf
House Cleaning	0		70	
Storage	54		30	
Elect / Mech / I.T.	60		210	
Stairs	0		620	(2) Stairs
Elevator	0		150	
Total Net Area	3,382	sq.ft.	6,474	sq.ft.
Load Factor ²	1.20	Single-story	1.22	Two-story
Total Gross Fire Station Area	4,058	sq.ft.	7,898	sq.ft.

¹ Measured to the centerline of interior walls and inside face of exterior walls (BOMA definition)

² Accounts for corridors and exterior walls

FIRE STATION NO. 3, 4 & 6

CONCEPTUAL PROJECT ESTIMATE (FOR NEW BUILDING)

ITEM	DESCRIPTION	QTY	UNIT	UNIT PRICE	TOTAL COST
	DEMOLISH (E) STRUCTURES	4,058	SF	\$20.00	\$81,160
	GENERAL SITEWORK	7,898	SF	\$80.00	\$631,840
	BUILDING	7,898	SF	\$980.00	\$7,740,040
	TEMPORARY FIRE STATION	1	LS	\$1,500,000	\$1,500,000
	EMERGENCY GENERATOR & TRANSFER SWITCH	1	LS	\$81,370	\$81,370
	ELECTRIC FIRE TRUCK CHARGING STATION	2	EA	\$25,000	\$50,000
SUBTOTAL HARD COSTS					\$10,084,410
CONTINGENCY					
	ESTIMATING CONTINGENCY	5.00%			\$504,221
SUBTOTAL CONSTRUCTION COSTS					\$10,588,631
ESCALATION					17.08%
SUBTOTAL CONSTRUCTION COSTS					\$12,397,169
				\$1,569.66	
CONSTRUCTION CONTINGENCY					5.00%
TOTAL CONSTRUCTION COSTS					\$13,017,027
				\$1,648.14	
NON-CONSTRUCTION COSTS					30.00%
TOTAL PROJECT COSTS:					\$2,142.58
					\$16,922,135



FIRE STATION NO. 3, 4 & 6

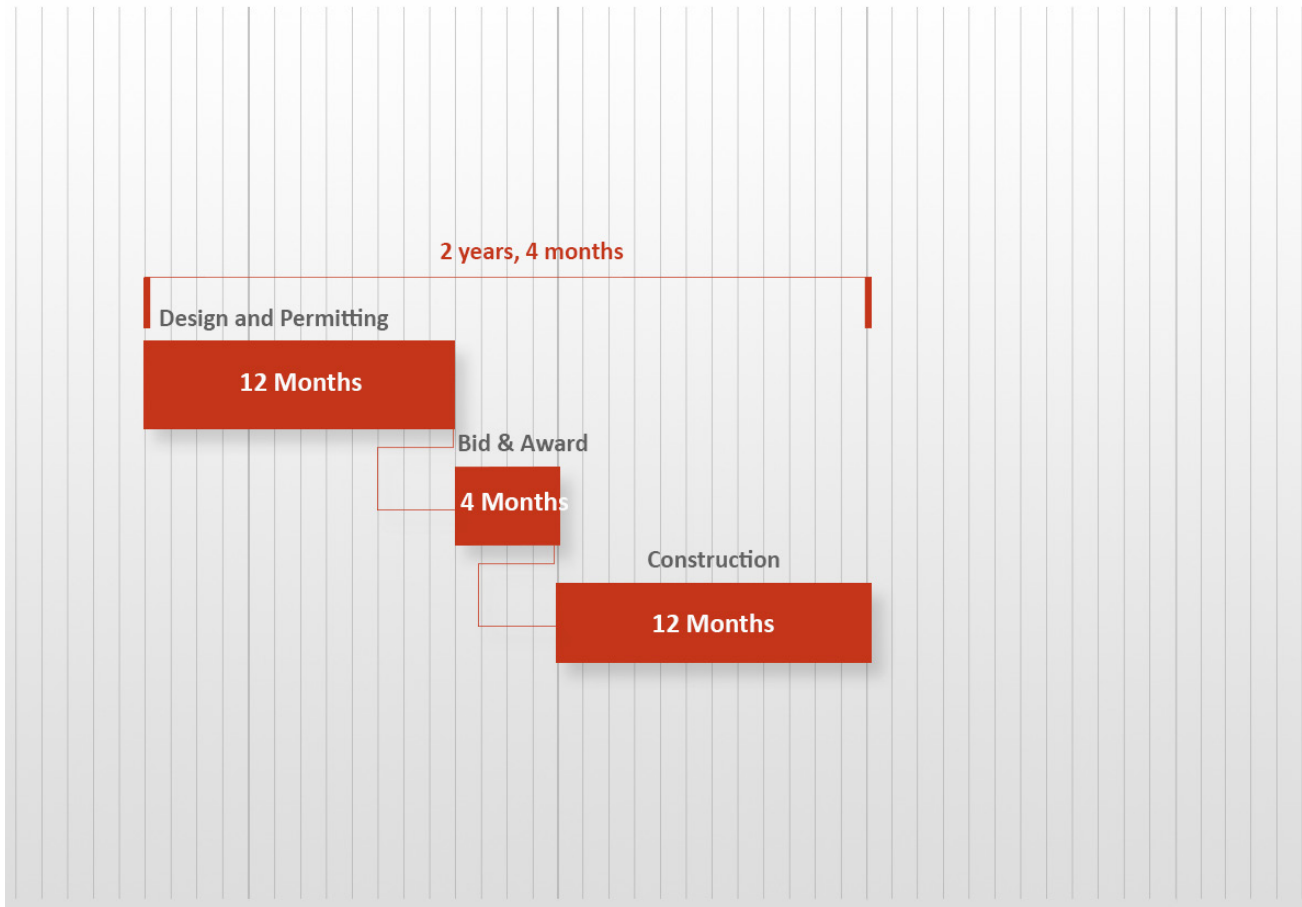
CONCEPTUAL PROJECT ESTIMATE (FOR REMODEL)

ITEM	DESCRIPTION	QTY	UNIT	UNIT PRICE	TOTAL COST
	GENERAL SITEWORK	4,438	SF	\$120.00	\$532,560
	TRAFFIC SIGNAL*	1	LS	\$567,000	\$567,000
	DEFICIENCY COSTS, CAPITAL RENEWAL	1	LS	\$528,462	\$528,462
	NEW SCBA ROOM	200	SF	\$1,000.00	\$200,000
	NEW EXTERIOR WINDOW IN CMU WALL	20	SF	\$200.00	\$4,000
	REPLACE EXT DOOR WITH SIDELIGHTS, 6'	1	LS	\$5,500.00	\$5,500
	REMOVE EXTERIOR WINDOW, INFILL WALL	100	SF	\$75.00	\$7,500
	CUT IN NEW INTERIOR DOOR	3	EA	\$3,500.00	\$10,500
	NEW OR INFILL INTERIOR PARTITION	400	SF	\$30.00	\$12,000
	INTERIOR CLOSET SLIDING DOORS	2	EA	\$2,500.00	\$5,000
	MISC. INTERIOR CONSTRUCTION	4,058	SF	\$40.00	\$162,320
	NEW KITCHEN CASEWORK	35	LF	\$700.00	\$24,500
	RANGE	1	EA	\$4,500.00	\$4,500
	NEW LAV	2	EA	\$2,500.00	\$5,000
	NEW WATER CLOSET	1	EA	\$3,500.00	\$3,500
	NEW ADA SHOWER	1	EA	\$8,000.00	\$8,000
	NEW MOP SINK	1	EA	\$3,000.00	\$3,000
	NEW KITCHEN SINK	1	EA	\$3,200.00	\$3,200
	FIXTURE ROUGH-INS, SLAB, WALL	3	EA	\$5,500.00	\$16,500
	REMOVE EXISTING SLIDING DOOR	1	LS	\$250.00	\$250
	REMOVE INTERIOR DOOR	4	EA	\$150.00	\$600
	REMOVE INTERIOR PARTITION	270	SF	\$50.00	\$13,500
	REMOVE CASEWORK	30	LF	\$40.00	\$1,200
	REMOVE KITCHEN EQUIPMENT	1	LS	\$1,500.00	\$1,500
	REMOVE / REINSTALL REFRIGERATOR	1	LS	\$750.00	\$750
	DEMO LAVATORY	2	EA	\$430.00	\$860
	DEMO WATER CLOSET	1	EA	\$500.00	\$500
	EMERGENCY GENERATOR & TRANSFER SWITCH	1	LS	\$81,370	\$81,370
	ELECTRIC FIRE TRUCK CHARGING STATION	2	EA	\$25,000	\$50,000
SUBTOTAL HARD COSTS					\$2,253,572
CONTINGENCY					
	ESTIMATING CONTINGENCY	20.00%			\$450,714
SUBTOTAL CONSTRUCTION COSTS					\$2,704,286
ESCALATION					\$315,590
		11.67%			
SUBTOTAL CONSTRUCTION COSTS				\$680.46	\$3,019,877
CONSTRUCTION CONTINGENCY					\$301,988
		10.00%			
TOTAL CONSTRUCTION COSTS				\$748.50	\$3,321,864
NON-CONSTRUCTION COSTS					\$996,559
		30.00%			
TOTAL PROJECT COSTS (STATIONS 3 & 6):				\$728.23	\$3,231,906
TOTAL PROJECT COSTS (STATION 4):				\$973.06	\$4,318,424

* Traffic signal cost applies only to Station 4

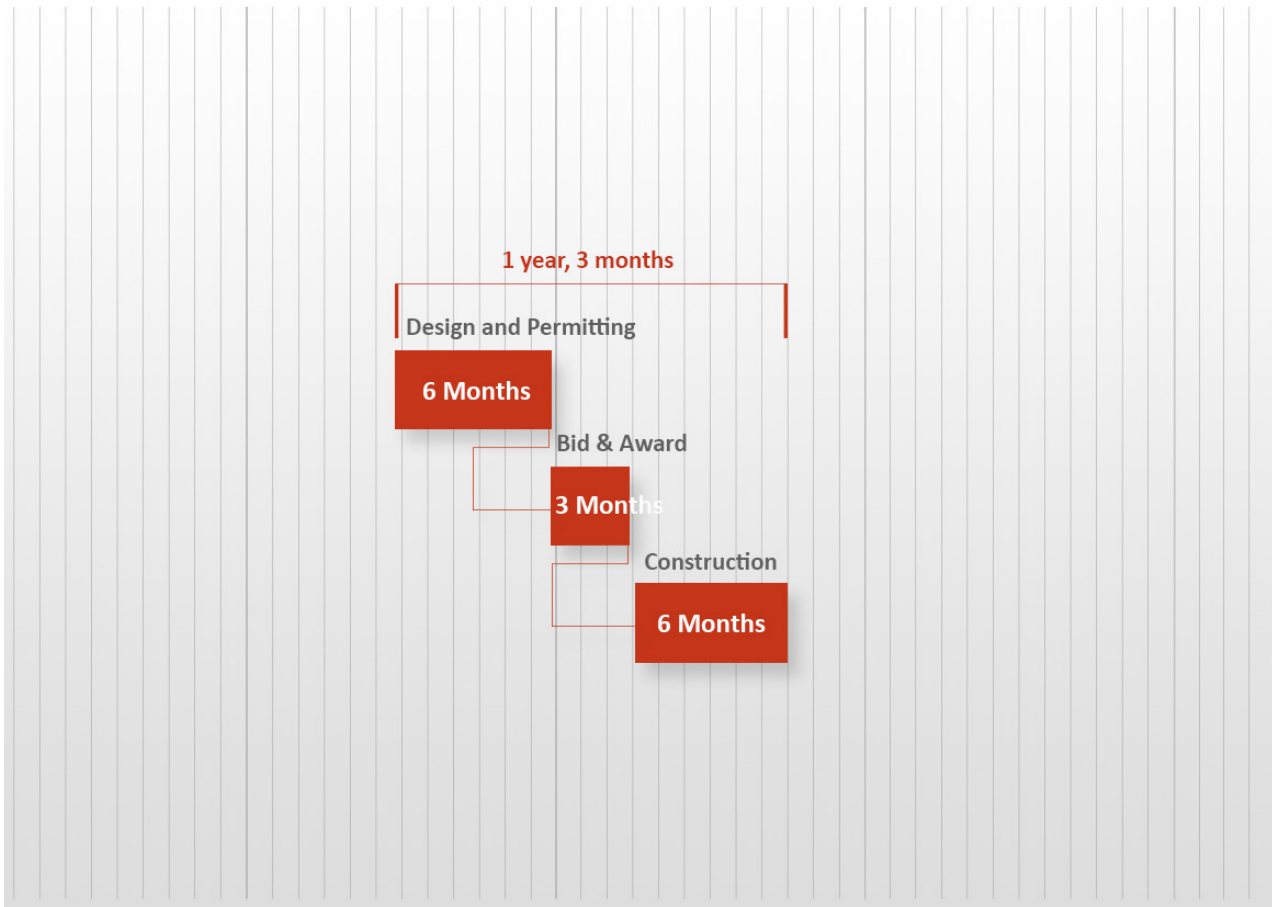
FIRE STATION NO. 3, 4 & 6

CONCEPTUAL PROJECT SCHEDULE (FOR NEW BUILDING)



FIRE STATION NO. 3, 4 & 6

CONCEPTUAL PROJECT SCHEDULE (FOR REMODEL)





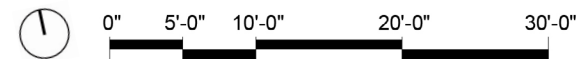
FIRE STATION NO. 5

1210 Bordeaux Dr, Sunnyvale, CA 94089

The existing building at Fire Station No. 5 is a single-story, 18,177 sq.ft. metal panel clad structure built in 2016. It is located on Bordeaux Dr.



FIRE STATION NO. 5 - EXISTING FLOOR PLAN



FIRE STATION NO. 5

PROGRAM REQUIREMENTS

Sunnyvale Fire Station 5 Program		
Site Program Spaces		Existing
Site Size	2.07 acres	
Front Apron	60'	
Rear Apron	Secured	
Back-up Generator	Yes, unknown capacity	
Apparatus Wash Area	None	
Visitor Parking	(1) ADA, (3) standard	
Employee Parking	(1) ADA, (5) standard	
Fire Station Patio	Yes	

Fire Station Program Spaces	Net Area ¹	Comments
Apparatus Room	4,368	(3) 70'dp drive-thru bays
Alert Alcove	0	
Med Supply	123	
Decon	247	
Shop	0	In Apparatus Room
Turnout Locker Room	235	
SCBA / Oxygen Filling	0	
Hose / Storage	0	
Weight/Exercise Room	409	
Entry Hall/Lobby	307	
Conference Rm	204	
Public Restroom	415	
Watch Room	391	
Lieutenant Office	217	
Captain Office / Dorm	0	
Kitchen	232	
Dining Room	227	
Day Room	564	
Dorm Rms	696	(6)
Crew Bathrooms	297	(1) ADA, (2) Standard
House Cleaning	0	In Decon
Storage	84	
Elect / Mech / IT	586	
Stairs	0	
Elevator	0	
Other	6,322	Police & Training
Total Net Area	15,924	sq.ft.
Load Factor ²	1.14	Single-story
Total Gross Fire Station Area	18,177	sq.ft.

¹ Measured to the centerline of interior walls and inside face of exterior walls (BOMA definition)

² Accounts for corridors and exterior walls



LIFE CYCLE COST ANALYSIS

The following section contains tables and figures relating to the Life Cycle Cost Analysis that was performed on the Fire Stations.

LIFE CYCLE COST ANALYSIS



FIRE STATION NO. 1
171 N. Mathilda Avenue

BUILDING SUMMARY TABLE

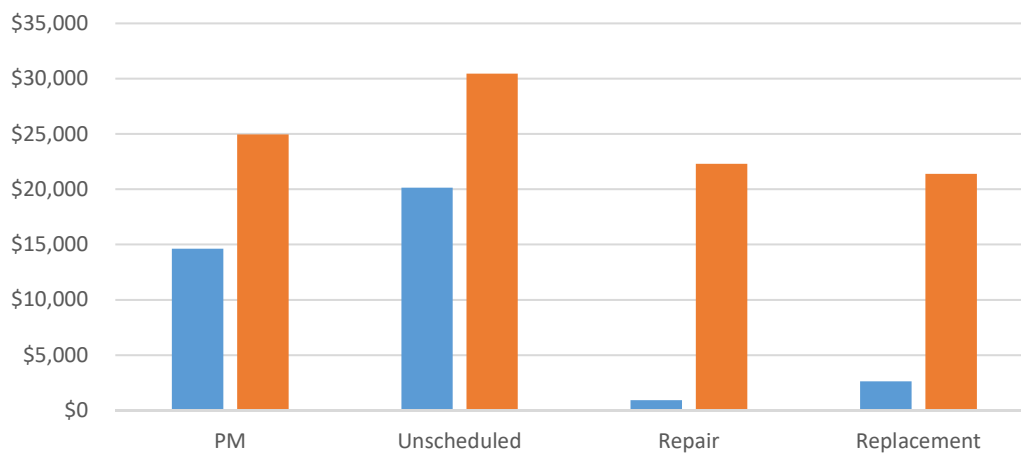
Fire Station 1 (Existing)	
Year Built	1964
Gross Square Feet	5,577 Sq Ft
Replacement Cost per SQFT	\$1,707
Property Replacement Value (PRV)	\$9,520,256

Fire Station 1 (New)	
New Facility	2024
Gross Square Feet	14,197 Sq Ft
Replacement Cost per SQFT	\$1,786
Property Replacement Value (PRV)	\$25,350,741*

* Does not include temporary facilities

AVERAGE ANNUAL M&R (MAINTENANCE & REPAIR) COST SUMMARY

Average M&R Costs



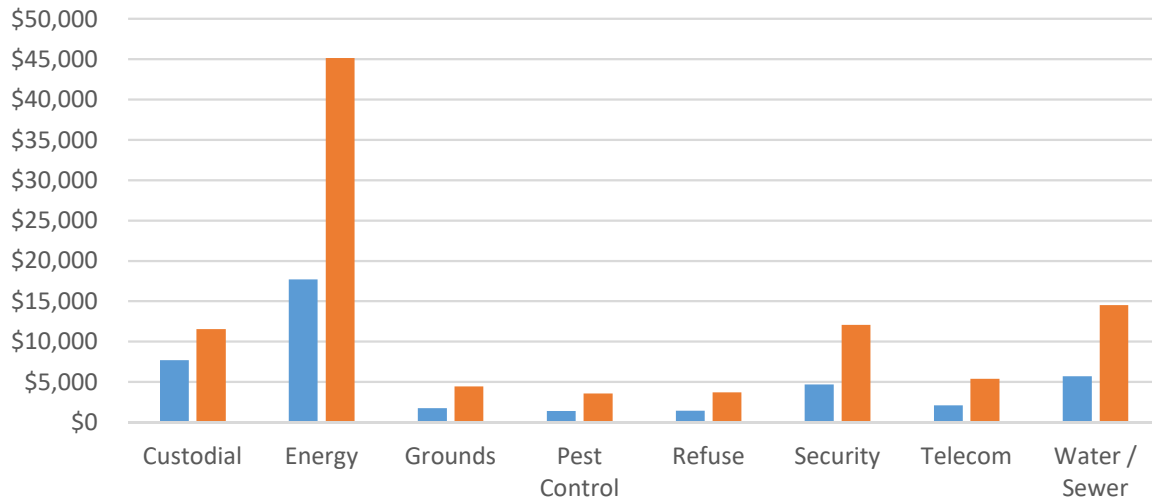
Categories	Fire Station 1 (Existing)	Fire Station 1 (New)
Size	5,577 Sq Ft	14,197 Sq Ft
PRV	\$9,520,256	\$25,350,741
PM	\$14,608	\$24,952
Unscheduled	\$20,153	\$30,462
Repair	\$916	\$22,289
Replacement	\$2,647	\$21,394
Total / Size	\$6.87	\$6.98
Total / PRV	0.40%	0.39%
Total	\$38,323	\$99,096



LIFE CYCLE COST ANALYSIS

AVERAGE ANNUAL OPERATIONS COST SUMMARY

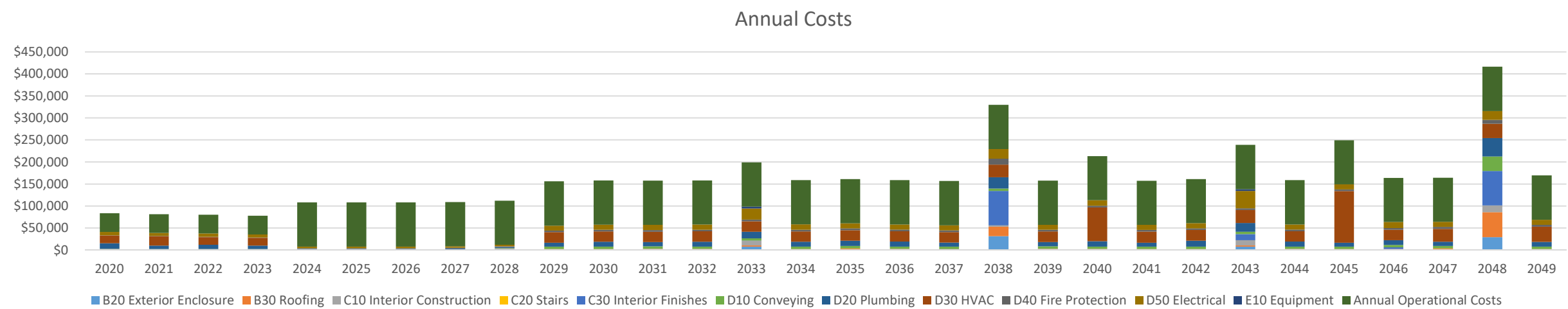
Average Operations Costs



Categories	Fire Station 1 (Existing)	Cost / Size	Percentage	Fire Station 1 (New)	Cost / Size	Percentage
Custodial	\$7,690	\$1.38	18.07%	\$11,537	\$0.81	11.49%
Energy	\$17,714	\$3.18	41.62%	\$45,150	\$3.18	44.96%
Grounds	\$1,744	\$0.31	4.10%	\$4,446	\$0.31	4.43%
Pest Control	\$1,401	\$0.25	3.29%	\$3,571	\$0.25	3.56%
Refuse	\$1,461	\$0.26	3.43%	\$3,725	\$0.26	3.71%
Security	\$4,723	\$0.85	11.10%	\$12,038	\$0.85	11.99%
Telecom	\$2,116	\$0.38	4.97%	\$5,393	\$0.38	5.37%
Water / Sewer	\$5,711	\$1.03	13.42%	\$14,558	\$1.03	14.50%
Total	\$42,560	\$7.64	100.00%	\$100,418	\$7.07	100.00%



LIFE CYCLE COST ANALYSIS (STATION 1)



Annual Costs Table

	Year	B20 Exterior Enclosure	B30 Roofing	C10 Interior Construction	C20 Stairs	C30 Interior Finishes	D10 Conveying	D20 Plumbing	D30 HVAC	D40 Fire Protection	D50 Electrical	E10 Equipment	Annual M&R Costs	Annual Operational Costs	Total
EXISTING	2020	\$0	\$1,875	\$649		\$0	\$509	\$12,271	\$17,878	\$644	\$7,415	\$0	\$41,241	\$42,563	\$83,804
	2021	\$0	\$1,875	\$0		\$0	\$509	\$8,025	\$20,871	\$644	\$7,082	\$0	\$39,006	\$42,563	\$81,569
	2022	\$0	\$1,875	\$0		\$0	\$509	\$9,804	\$17,331	\$644	\$7,415	\$0	\$37,578	\$42,563	\$80,141
	2023	\$0	\$1,875	\$0		\$0	\$509	\$8,025	\$17,331	\$644	\$7,082	\$0	\$35,466	\$42,563	\$78,029
NEW	2024	\$0	\$2,399	\$0	\$0	\$0	\$5,198	\$9,371	\$23,572	\$3,762	\$8,743	\$0	\$53,045	\$100,418	\$153,463
	2025	\$0	\$2,399	\$0	\$0	\$0	\$5,198	\$11,151	\$23,572	\$3,762	\$8,743	\$0	\$54,825	\$100,418	\$155,243
	2026	\$0	\$2,399	\$0	\$0	\$0	\$5,198	\$9,371	\$23,572	\$3,762	\$9,426	\$0	\$53,728	\$100,418	\$154,146
	2027	\$0	\$2,399	\$1,200	\$32	\$0	\$5,198	\$11,151	\$23,572	\$3,762	\$8,743	\$0	\$56,057	\$100,418	\$156,475
	2028	\$1,158	\$3,296	\$2,909	\$0	\$230	\$5,198	\$14,484	\$24,100	\$3,927	\$8,743	\$0	\$64,045	\$100,418	\$164,463
	2029	\$0	\$2,399	\$0	\$0	\$0	\$5,198	\$11,151	\$23,572	\$3,762	\$11,934	\$0	\$58,016	\$100,418	\$158,434
	2030	\$0	\$2,399	\$0	\$0	\$0	\$5,198	\$11,654	\$23,572	\$3,762	\$11,585	\$0	\$58,170	\$100,418	\$158,588
	2031	\$0	\$2,399	\$1,200	\$32	\$0	\$5,198	\$11,334	\$23,572	\$3,762	\$11,251	\$0	\$58,748	\$100,418	\$159,166
	2032	\$0	\$2,399	\$0	\$0	\$145	\$5,198	\$9,371	\$23,572	\$3,762	\$12,268	\$0	\$56,715	\$100,418	\$157,133
	2033	\$35,655	\$21,688	\$10,641	\$0	\$77,771	\$5,198	\$25,917	\$29,061	\$8,826	\$27,501	\$4,253	\$246,511	\$100,418	\$346,929
	2034	\$0	\$2,399	\$0	\$0	\$0	\$5,198	\$9,371	\$24,403	\$3,762	\$11,585	\$0	\$56,718	\$100,418	\$157,136
	2035	\$1,078	\$2,399	\$1,200	\$32	\$0	\$5,198	\$12,225	\$76,542	\$4,816	\$11,934	\$0	\$115,424	\$100,418	\$215,842
	2036	\$0	\$2,399	\$0	\$0	\$0	\$5,198	\$9,371	\$25,087	\$3,762	\$11,585	\$0	\$57,402	\$100,418	\$157,820
	2037	\$0	\$2,399	\$0	\$0	\$0	\$5,198	\$13,434	\$24,667	\$3,762	\$11,251	\$0	\$60,711	\$100,418	\$161,129
	2038	\$3,685	\$3,296	\$2,909	\$49	\$13,818	\$5,198	\$19,823	\$29,569	\$8,339	\$19,974	\$0	\$106,660	\$100,418	\$207,078
	2039	\$0	\$2,399	\$1,200	\$32	\$0	\$5,198	\$11,334	\$23,572	\$3,762	\$11,251	\$0	\$58,748	\$100,418	\$159,166
	2040	\$0	\$2,399	\$0	\$0	\$0	\$5,198	\$9,371	\$116,968	\$3,762	\$11,585	\$0	\$149,283	\$100,418	\$249,701
	2041	\$0	\$2,399	\$0	\$0	\$3,893	\$5,198	\$11,151	\$23,572	\$3,762	\$13,136	\$0	\$63,111	\$100,418	\$163,529
	2042	\$0	\$2,399	\$0	\$0	\$0	\$5,198	\$9,371	\$29,100	\$3,762	\$11,585	\$0	\$61,415	\$100,418	\$161,833
	2043	\$35,655	\$57,189	\$23,547	\$153	\$78,003	\$5,198	\$41,637	\$32,639	\$8,826	\$41,066	\$4,253	\$328,166	\$100,418	\$428,584
	2044	\$0	\$2,399	\$0	\$0	\$0	\$5,198	\$10,918	\$34,835	\$3,762	\$12,268	\$0	\$69,380	\$100,418	\$169,798
	2045	\$0	\$2,399	\$0	\$0	\$0	\$5,198	\$11,887	\$23,572	\$3,762	\$11,251	\$0	\$58,069	\$100,418	\$158,487
	2046	\$0	\$2,399	\$0	\$0	\$0	\$5,198	\$9,371	\$23,572	\$3,762	\$11,585	\$0	\$55,887	\$100,418	\$156,305
	2047	\$1,078	\$2,399	\$1,200	\$32	\$0	\$5,198	\$12,408	\$23,623	\$4,816	\$11,934	\$0	\$62,688	\$100,418	\$163,106
	2048	\$47,993	\$3,296	\$2,909	\$0	\$118,912	\$214,150	\$22,338	\$24,136	\$4,082	\$17,827	\$0	\$455,643	\$100,418	\$556,061
	2049	\$0	\$2,399	\$0	\$0	\$0	\$5,198	\$11,151	\$23,572	\$3,762	\$11,251	\$0	\$57,333	\$100,418	\$157,751
Total		\$126,302	\$146,644	\$49,564	\$362	\$292,772	\$346,136	\$388,241	\$874,577	\$117,686	\$378,999	\$8,506	\$2,729,789	\$2,781,120	\$5,510,909



LIFE CYCLE COST ANALYSIS



FIRE STATION NO. 2
795 E. Arques Avenue

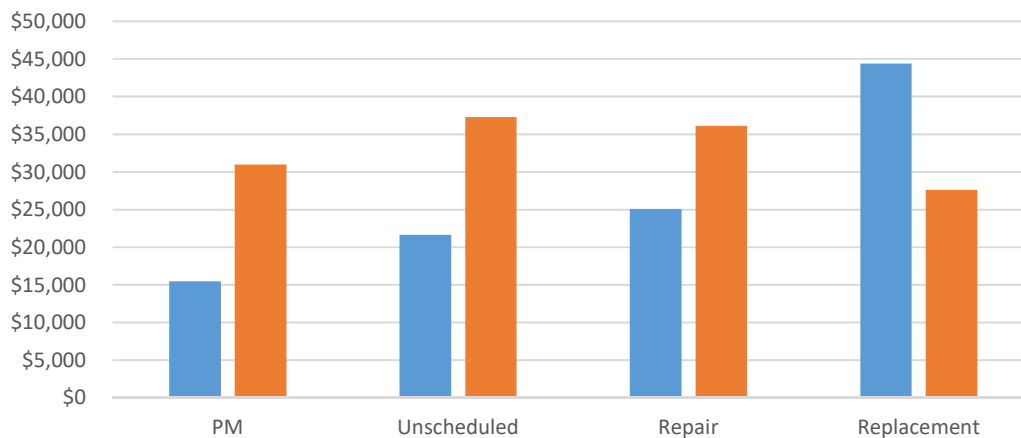
BUILDING SUMMARY TABLE

Fire Station 2 (Existing)		Fire Station 2 (New)	
Year Built	1964	New Facility	2025
Gross Square Feet	9,431 Sq Ft	Gross Square Feet	20,486 Sq Ft
Replacement Cost per SQFT	\$1,709	Replacement Cost per SQFT	\$1,844
Property Replacement Value (PRV)	\$16,119,486	Property Replacement Value (PRV)	\$37,776,093*

* Does not include temporary facilities

AVERAGE ANNUAL M&R (MAINTENANCE & REPAIR) COST SUMMARY

Average M&R Costs

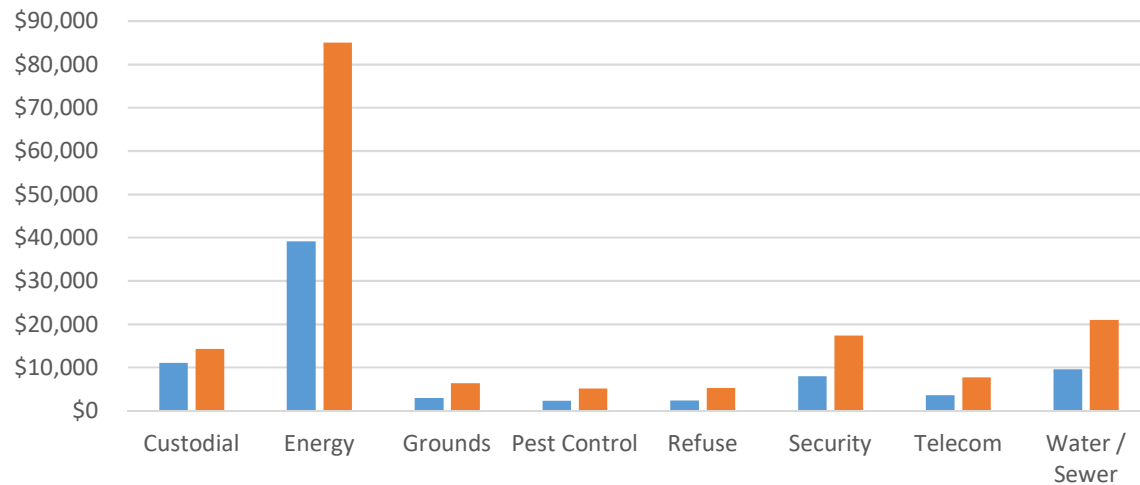


Categories	Fire Station 2 (Existing)	Fire Station 2 (New)
Size	9,431 Sq Ft	20,486 Sq Ft
PRV	\$16,119,486	\$37,776,093
PM	\$15,486	\$28,889
Unscheduled	\$21,670	\$34,760
Repair	\$25,067	\$33,686
Replacement	\$44,401	\$25,769
Total / Size	\$11.31	\$6.01
Total / PRV	0.66%	0.33%
Total	\$106,622	\$123,102

LIFE CYCLE COST ANALYSIS

AVERAGE ANNUAL OPERATIONS COST SUMMARY

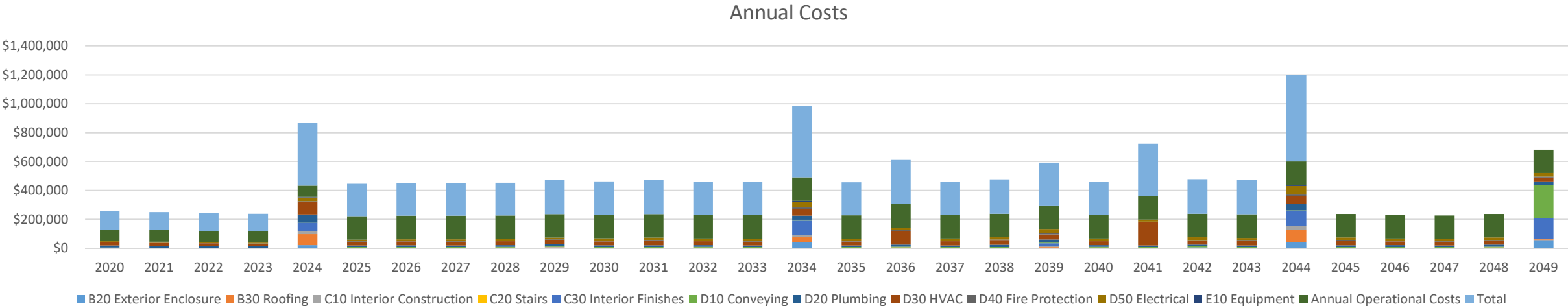
Average Operations Costs



Categories	Fire Station 2 (Existing)	Cost / Size	Percentage	Fire Station 2 (New)	Cost / Size	Percentage
Custodial	\$11,148	\$1.18	14.05%	\$14,341	\$0.70	8.82%
Energy	\$39,159	\$4.15	49.34%	\$85,063	\$4.15	52.34%
Grounds	\$2,953	\$0.31	3.72%	\$6,415	\$0.31	3.95%
Pest Control	\$2,372	\$0.25	2.99%	\$5,153	\$0.25	3.17%
Refuse	\$2,475	\$0.26	3.12%	\$5,376	\$0.26	3.31%
Security	\$7,997	\$0.85	10.08%	\$17,371	\$0.85	10.69%
Telecom	\$3,582	\$0.38	4.51%	\$7,782	\$0.38	4.79%
Water / Sewer	\$9,671	\$1.03	12.19%	\$21,007	\$1.03	12.93%
Total	\$79,360	\$8.41	100.00%	\$162,508	\$7.93	100.00%



LIFE CYCLE COST ANALYSIS (STATION 2)



Annual Costs Table

	Year	B20 Exterior Enclosure	B30 Roofing	C10 Interior Construction	C20 Stairs	C30 Interior Finishes	D10 Conveying	D20 Plumbing	D30 HVAC	D40 Fire Protection	D50 Electrical	E10 Equipment	Annual M&R Costs	Annual Operational Costs	Total
EXISTING	2020	\$0	\$3,175	\$973	\$0	\$0	\$764	\$14,586	\$23,112	\$894	\$6,339	\$0	\$49,843	\$79,360	\$129,203
	2021	\$0	\$3,175	\$0	\$0	\$0	\$764	\$9,301	\$24,415	\$894	\$7,364	\$0	\$45,913	\$79,360	\$125,273
	2022	\$0	\$3,175	\$0	\$0	\$0	\$764	\$11,604	\$19,621	\$894	\$6,339	\$0	\$42,397	\$79,360	\$121,757
	2023	\$0	\$3,175	\$0	\$0	\$0	\$764	\$9,301	\$19,372	\$894	\$6,339	\$0	\$39,845	\$79,360	\$119,205
	2024	\$22,645	\$75,976	\$23,422	\$0	\$53,024	\$764	\$57,741	\$85,870	\$5,935	\$27,610	\$2,126	\$355,113	\$79,360	\$434,473
NEW	2025	\$0	\$3,461	\$0	\$0	\$0	\$5,453	\$10,680	\$25,998	\$4,092	\$11,009	\$0	\$60,693	\$162,508	\$223,201
	2026	\$0	\$3,461	\$0	\$0	\$0	\$5,453	\$12,460	\$26,498	\$4,092	\$11,009	\$0	\$62,973	\$162,508	\$225,481
	2027	\$0	\$3,461	\$0	\$0	\$0	\$5,453	\$10,680	\$25,998	\$4,092	\$13,058	\$0	\$62,742	\$162,508	\$225,250
	2028	\$0	\$3,461	\$1,590	\$32	\$0	\$5,453	\$12,460	\$26,498	\$4,092	\$11,009	\$0	\$64,595	\$162,508	\$227,103
	2029	\$1,641	\$4,756	\$4,156	\$0	\$339	\$5,453	\$15,822	\$26,646	\$4,258	\$11,009	\$0	\$74,080	\$162,508	\$236,588
	2030	\$0	\$3,461	\$0	\$0	\$0	\$5,453	\$12,460	\$26,498	\$4,092	\$16,886	\$0	\$68,850	\$162,508	\$231,358
	2031	\$0	\$3,461	\$0	\$0	\$0	\$5,453	\$12,963	\$32,979	\$4,092	\$15,171	\$0	\$74,119	\$162,508	\$236,627
	2032	\$0	\$3,461	\$1,590	\$32	\$0	\$5,453	\$12,643	\$26,498	\$4,092	\$14,837	\$0	\$68,606	\$162,508	\$231,114
	2033	\$0	\$3,461	\$0	\$0	\$186	\$5,453	\$10,680	\$25,998	\$4,092	\$17,220	\$0	\$67,090	\$162,508	\$229,598
	2034	\$44,692	\$31,293	\$15,201	\$0	\$101,395	\$5,453	\$27,269	\$47,037	\$11,296	\$38,485	\$6,380	\$328,501	\$162,508	\$491,009
	2035	\$0	\$3,461	\$0	\$0	\$0	\$5,453	\$10,680	\$27,001	\$4,092	\$15,171	\$0	\$65,858	\$162,508	\$228,366
	2036	\$1,510	\$3,461	\$1,590	\$32	\$0	\$5,453	\$13,594	\$95,402	\$5,451	\$16,886	\$0	\$143,379	\$162,508	\$305,887
	2037	\$0	\$3,461	\$0	\$0	\$0	\$5,453	\$10,680	\$29,627	\$4,092	\$15,171	\$0	\$68,484	\$162,508	\$230,992
	2038	\$0	\$3,461	\$0	\$0	\$0	\$5,453	\$14,743	\$33,479	\$4,092	\$14,837	\$0	\$76,065	\$162,508	\$238,573
	2039	\$5,014	\$4,756	\$4,156	\$49	\$20,353	\$5,453	\$21,162	\$34,652	\$8,670	\$29,566	\$0	\$133,831	\$162,508	\$296,339
	2040	\$0	\$3,461	\$1,590	\$32	\$0	\$5,453	\$12,643	\$26,498	\$4,092	\$14,837	\$0	\$68,606	\$162,508	\$231,114
	2041	\$0	\$3,461	\$0	\$0	\$0	\$5,453	\$10,680	\$160,626	\$4,092	\$15,171	\$0	\$199,483	\$162,508	\$361,991
	2042	\$0	\$3,461	\$0	\$0	\$3,934	\$5,453	\$12,460	\$26,498	\$4,092	\$20,493	\$0	\$76,391	\$162,508	\$238,899
	2043	\$0	\$3,461	\$0	\$0	\$0	\$5,453	\$10,680	\$33,940	\$4,092	\$15,171	\$0	\$72,797	\$162,508	\$235,305
	2044	\$44,692	\$82,517	\$28,497	\$153	\$101,699	\$5,453	\$43,005	\$55,506	\$11,296	\$58,472	\$6,380	\$437,670	\$162,508	\$600,178
	2045	\$0	\$3,461	\$0	\$0	\$0	\$5,453	\$12,227	\$32,979	\$4,092	\$17,220	\$0	\$75,432	\$162,508	\$237,940
	2046	\$0	\$3,461	\$0	\$0	\$0	\$5,453	\$13,195	\$26,498	\$4,092	\$14,837	\$0	\$67,536	\$162,508	\$230,044
	2047	\$0	\$3,461	\$0	\$0	\$0	\$5,453	\$10,680	\$25,998	\$4,092	\$15,171	\$0	\$64,855	\$162,508	\$227,363
	2048	\$1,510	\$3,461	\$1,590	\$32	\$0	\$5,453	\$13,777	\$26,567	\$5,451	\$16,886	\$0	\$74,727	\$162,508	\$237,235
	2049	\$57,902	\$4,756	\$4,156	\$0	\$144,290	\$228,384	\$23,999	\$26,903	\$4,481	\$25,313	\$0	\$520,184	\$162,508	\$682,692
Total		\$179,606	\$285,974	\$88,511	\$362	\$425,220	\$363,076	\$474,855	\$1,125,212	\$134,070	\$518,886	\$14,886	\$3,610,658	\$4,459,500	\$8,070,158



LIFE CYCLE COST ANALYSIS



FIRE STATION NO. 3, 4 & 6

910 Ticonderoga Drive
1282 Lawrence Station Road
996 S. Wolfe Road

BUILDING SUMMARY TABLE

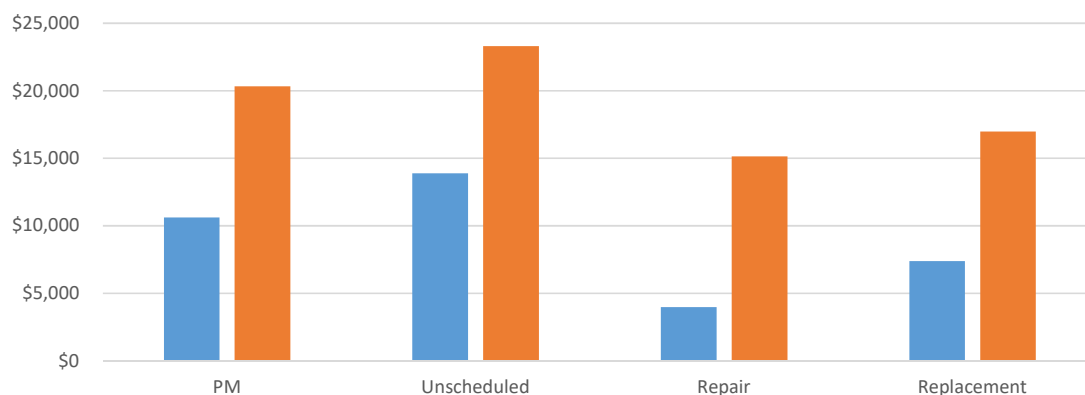
Fire Station 3, 4 & 6 (Existing)	
Year Built	
Fire Station 3	1960
Fire Station 4	1963
Fire Station 6	1963
Gross Square Feet	4,058 Sq Ft
Replacement Cost per SQFT	\$1,709
Property Replacement Value (PRV)	\$6,935,943

Fire Station 3, 4 & 6 (Renovation)	
Renovated Facility	2023
Gross Square Feet	7,898 Sq Ft
Replacement Cost per SQFT	\$1,713
Property Replacement Value (PRV)	\$13,529,177*

* Does not include temporary facilities

AVERAGE ANNUAL M&R (MAINTENANCE & REPAIR) COST SUMMARY

Average M&R Costs

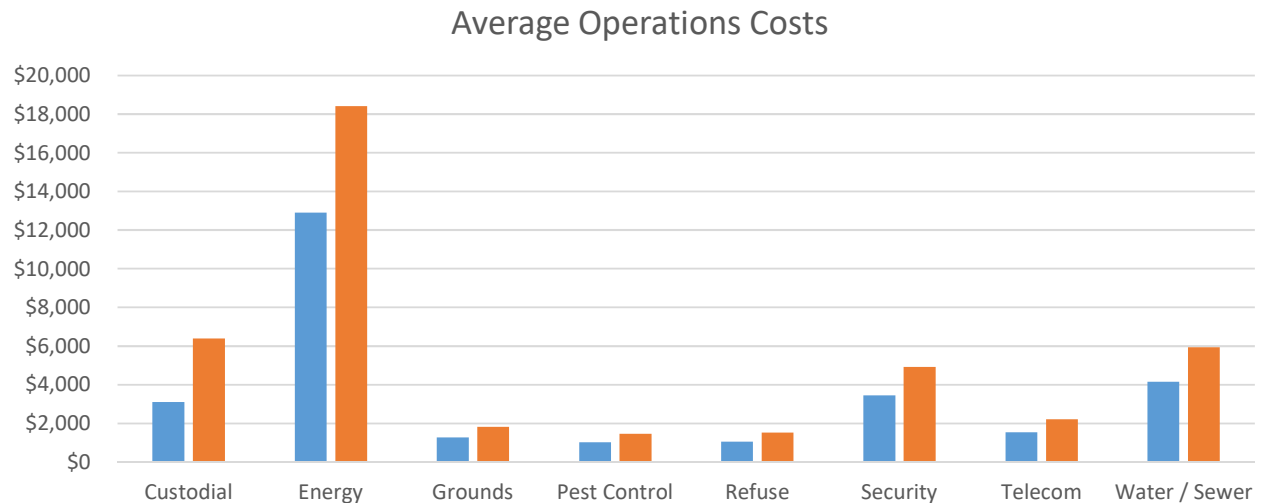


Categories	Fire Station 3, 4 & 6 (Existing)	Fire Station 3, 4 & 6 (Renovation)
Size	4,058 Sq Ft	7,898 Sq Ft
PRV	\$6,935,943	\$13,529,177
PM	\$10,613	\$20,317
Unscheduled	\$13,880	\$23,301
Repair	\$3,966	\$15,133
Replacement	\$7,384	\$16,973
Total / Size	\$8.83	\$9.59
Total / PRV	0.52%	0.56%
Total	\$35,844	\$75,723



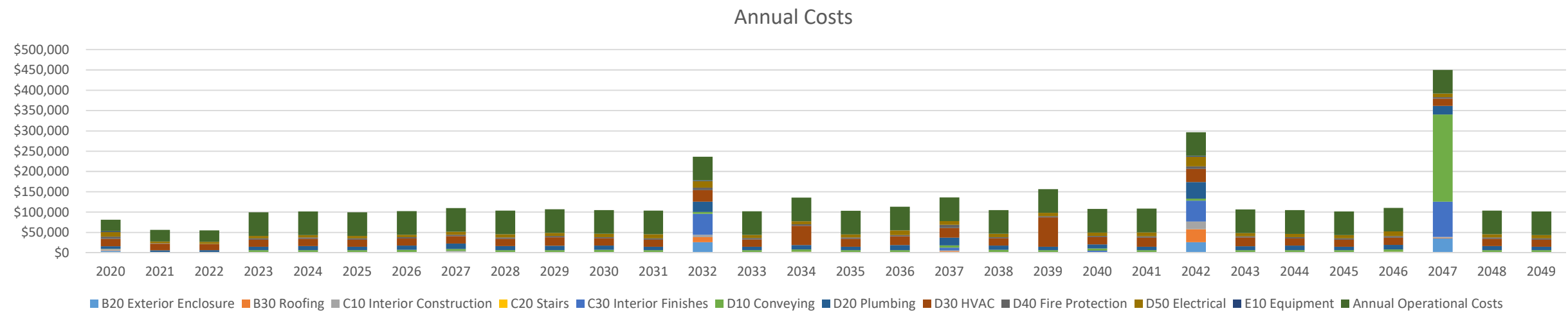
LIFE CYCLE COST ANALYSIS

AVERAGE ANNUAL OPERATIONS COST SUMMARY



Categories	Fire Station 3, 4 & 6 (Existing)	Cost / Size	Percentage	Fire Station 3, 4 & 6 (Renovation)	Cost / Size	Percentage
Custodial	\$3,111	\$0.77	10.91%	\$6,401	\$0.81	15.00%
Energy	\$12,905	\$3.18	45.25%	\$18,419	\$2.33	43.17%
Grounds	\$1,270	\$0.31	4.45%	\$1,814	\$0.23	4.25%
Pest Control	\$1,020	\$0.25	3.58%	\$1,456	\$0.18	3.41%
Refuse	\$1,064	\$0.26	3.73%	\$1,519	\$0.19	3.56%
Security	\$3,441	\$0.85	12.07%	\$4,911	\$0.62	11.51%
Telecom	\$1,541	\$0.38	5.40%	\$2,200	\$0.28	5.16%
Water / Sewer	\$4,161	\$1.03	14.59%	\$5,939	\$0.75	13.92%
Total	\$28,517	\$7.03	100.00%	\$42,659	\$5.40	100.00%

LIFE CYCLE COST ANALYSIS (STATION 3, 4 & 6)



Annual Costs Table

		B20 Exterior Enclosure	B30 Roofing	C10 Interior Construction	C20 Stairs	C30 Interior Finishes	D10 Conveying	D20 Plumbing	D30 HVAC	D40 Fire Protection	D50 Electrical	E10 Equipment	Annual M&R Costs	Annual Operational Costs	Total
EXISTING	2020	\$4,920	\$1,366	\$3,397	\$0	\$0	\$509	\$6,266	\$17,912	\$5,453	\$11,166	\$2,126	\$53,115	\$28,517	\$81,632
	2021	\$0	\$1,366	\$0	\$0	\$0	\$509	\$4,321	\$16,365	\$644	\$4,442	\$0	\$27,647	\$28,517	\$56,164
	2022	\$0	\$1,366	\$0	\$0	\$0	\$509	\$5,053	\$14,422	\$644	\$4,776	\$0	\$26,770	\$28,517	\$55,287
	2023	\$0	\$1,334	\$0	\$0	\$0	\$5,198	\$8,389	\$17,613	\$3,157	\$5,858	\$0	\$41,549	\$58,176	\$99,725
NEW	2024	\$0	\$1,334	\$0	\$0	\$0	\$5,198	\$10,169	\$17,863	\$3,157	\$5,858	\$0	\$43,579	\$58,176	\$101,755
	2025	\$0	\$1,334	\$0	\$0	\$0	\$5,198	\$8,389	\$17,613	\$3,157	\$5,858	\$0	\$41,549	\$58,176	\$99,725
	2026	\$0	\$1,334	\$778	\$32	\$0	\$5,198	\$10,169	\$17,863	\$3,157	\$5,858	\$0	\$44,389	\$58,176	\$102,565
	2027	\$675	\$1,833	\$1,558	\$0	\$121	\$5,198	\$13,465	\$18,244	\$3,323	\$7,706	\$0	\$52,123	\$58,176	\$110,299
	2028	\$0	\$1,334	\$0	\$0	\$0	\$5,198	\$10,169	\$17,863	\$3,157	\$8,039	\$0	\$45,760	\$58,176	\$103,936
	2029	\$0	\$1,334	\$0	\$0	\$0	\$5,198	\$10,673	\$21,103	\$3,157	\$7,706	\$0	\$49,171	\$58,176	\$107,347
	2030	\$0	\$1,334	\$778	\$32	\$0	\$5,198	\$10,352	\$17,863	\$3,157	\$8,039	\$0	\$46,753	\$58,176	\$104,929
	2031	\$0	\$1,334	\$0	\$0	\$104	\$5,198	\$8,389	\$17,613	\$3,157	\$9,998	\$0	\$45,793	\$58,176	\$103,969
	2032	\$26,464	\$12,064	\$5,700	\$0	\$51,389	\$5,198	\$24,881	\$28,440	\$6,014	\$16,097	\$2,126	\$178,373	\$58,176	\$236,549
	2033	\$0	\$1,334	\$0	\$0	\$0	\$5,198	\$8,389	\$18,114	\$3,157	\$7,706	\$0	\$43,898	\$58,176	\$102,074
	2034	\$647	\$1,334	\$778	\$32	\$0	\$5,198	\$11,166	\$47,011	\$3,696	\$8,039	\$0	\$77,901	\$58,176	\$136,077
	2035	\$0	\$1,334	\$0	\$0	\$0	\$5,198	\$8,389	\$19,427	\$3,157	\$7,706	\$0	\$45,211	\$58,176	\$103,387
	2036	\$0	\$1,334	\$0	\$0	\$0	\$5,198	\$12,453	\$21,353	\$3,157	\$11,665	\$0	\$55,160	\$58,176	\$113,336
	2037	\$2,286	\$1,833	\$1,558	\$49	\$7,272	\$5,198	\$18,804	\$24,060	\$7,734	\$9,508	\$0	\$78,302	\$58,176	\$136,478
	2038	\$0	\$1,334	\$778	\$32	\$0	\$5,198	\$10,352	\$17,863	\$3,157	\$8,039	\$0	\$46,753	\$58,176	\$104,929
	2039	\$0	\$1,334	\$0	\$0	\$0	\$5,198	\$8,389	\$72,237	\$3,157	\$7,706	\$0	\$98,021	\$58,176	\$156,197
	2040	\$0	\$1,334	\$0	\$0	\$3,851	\$5,198	\$10,169	\$17,863	\$3,157	\$8,039	\$0	\$49,611	\$58,176	\$107,787
	2041	\$0	\$1,334	\$0	\$0	\$0	\$5,198	\$8,389	\$22,228	\$3,157	\$9,998	\$0	\$50,304	\$58,176	\$108,480
	2042	\$26,464	\$31,813	\$18,185	\$153	\$51,530	\$5,198	\$40,581	\$32,674	\$6,014	\$23,663	\$2,126	\$238,401	\$58,176	\$296,577
	2043	\$0	\$1,334	\$0	\$0	\$0	\$5,198	\$9,937	\$21,103	\$3,157	\$7,706	\$0	\$48,435	\$58,176	\$106,611
	2044	\$0	\$1,334	\$0	\$0	\$0	\$5,198	\$10,905	\$17,863	\$3,157	\$8,039	\$0	\$46,496	\$58,176	\$104,672
	2045	\$0	\$1,334	\$0	\$0	\$0	\$5,198	\$8,389	\$17,613	\$3,157	\$7,706	\$0	\$43,397	\$58,176	\$101,573
	2046	\$647	\$1,334	\$778	\$32	\$0	\$5,198	\$11,349	\$17,918	\$3,696	\$11,665	\$0	\$52,617	\$58,176	\$110,793
	2047	\$35,610	\$1,833	\$1,558	\$0	\$87,093	\$214,150	\$20,916	\$18,465	\$3,409	\$8,693	\$0	\$391,727	\$58,176	\$449,903
	2048	\$0	\$1,334	\$0	\$0	\$0	\$5,198	\$10,169	\$17,863	\$3,157	\$8,039	\$0	\$45,760	\$58,176	\$103,936
	2049	\$0	\$1,334	\$0	\$0	\$104	\$5,198	\$8,389	\$17,613	\$3,157	\$7,706	\$0	\$43,501	\$58,176	\$101,677
Total		\$97,713	\$82,822	\$35,846	\$362	\$201,464	\$350,825	\$347,820	\$662,045	\$103,767	\$263,024	\$6,378	\$2,152,066	\$1,656,303	\$3,808,369



LIFE CYCLE COST ANALYSIS

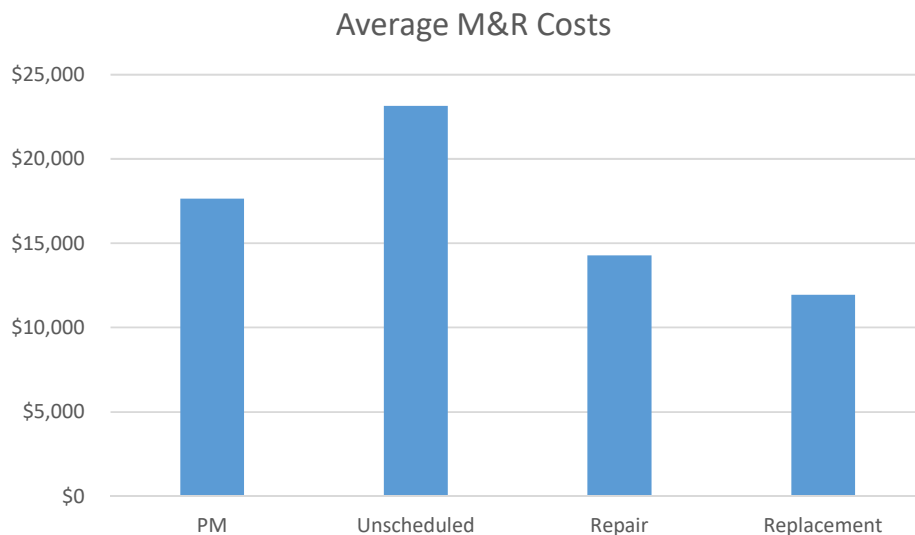


FIRE STATION NO. 5
1210 Bordeaux Drive

BUILDING SUMMARY TABLE

Fire Station 5 (Existing)	
Year Built	2016
Gross Square Feet	8,083 Sq Ft
Replacement Cost per SQFT	\$1,749
Property Replacement Value (PRV)	\$13,815,482

AVERAGE ANNUAL M&R (MAINTENANCE & REPAIR) COST SUMMARY

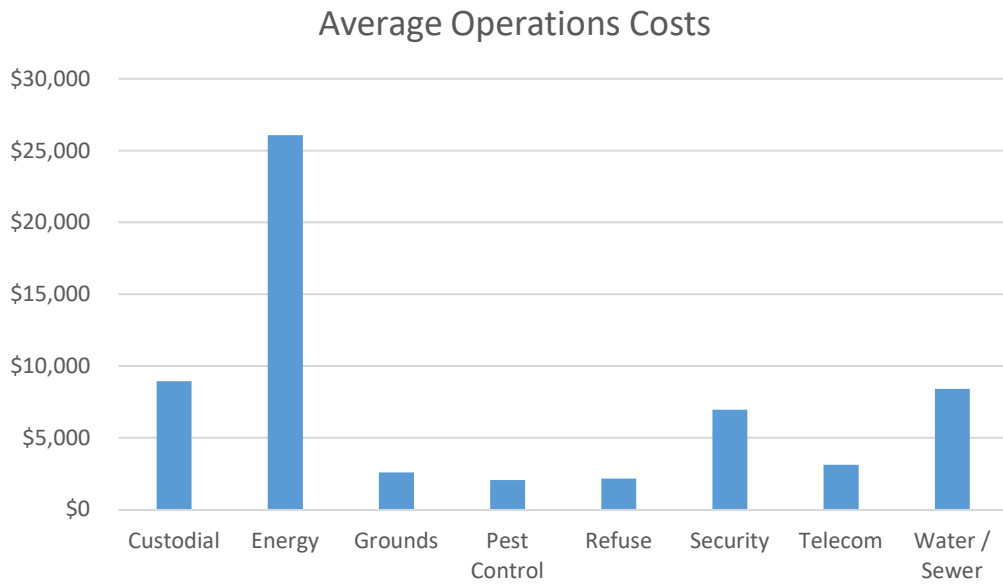


Average Annual Maintenance & Repair Costs	Fire Station 5 (Existing)
Size	8,083 Sq Ft
PRV	\$13,815,482
PM	\$17,653
Unscheduled	\$23,150
Repair	\$14,289
Replacement	\$11,950
Total / Size	\$8.29
Total / PRV	0.49%
Total	\$67,042



LIFE CYCLE COST ANALYSIS

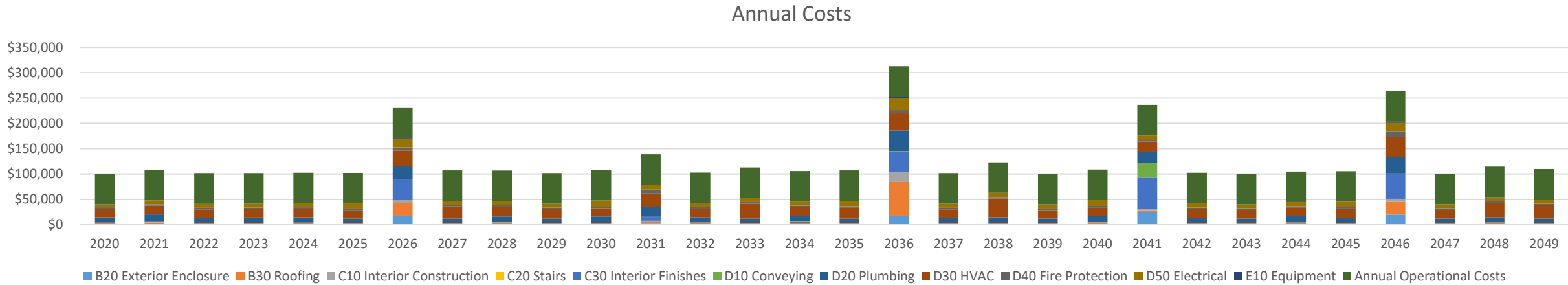
AVERAGE ANNUAL OPERATIONS COST SUMMARY



Categories	Fire Station 5 (Existing)	Cost / Size	Percentage
Custodial	\$8,940	\$1.11	14.83%
Energy	\$26,082	\$3.23	43.26%
Grounds	\$2,568	\$0.32	4.26%
Pest Control	\$2,063	\$0.26	3.42%
Refuse	\$2,152	\$0.27	3.57%
Security	\$6,954	\$0.86	11.53%
Telecom	\$3,115	\$0.39	5.17%
Water / Sewer	\$8,410	\$1.04	13.95%
Total	\$60,287	\$7.46	100.00%



LIFE CYCLE COST ANALYSIS



Annual Costs Table

Year	B20 Exterior Enclosure	B30 Roofing	C10 Interior Construction	C20 Stairs	C30 Interior Finishes	D10 Conveying	D20 Plumbing	D30 HVAC	D40 Fire Protection	D50 Electrical	E10 Equipment	Annual M&R Costs	Annual Operational Costs	Total
2020	\$0	\$2,721	\$811	\$0	\$0	\$509	\$10,131	\$16,539	\$3,114	\$5,848	\$0	\$39,673	\$60,287	\$99,960
2021	\$676	\$3,747	\$1,664	\$0	\$124	\$509	\$13,394	\$16,819	\$3,283	\$7,704	\$0	\$47,920	\$60,287	\$108,207
2022	\$0	\$2,727	\$0	\$0	\$0	\$510	\$10,151	\$16,572	\$3,121	\$8,046	\$0	\$41,127	\$60,287	\$101,414
2023	\$0	\$2,729	\$0	\$0	\$0	\$510	\$10,666	\$16,589	\$3,124	\$7,720	\$0	\$41,338	\$60,287	\$101,625
2024	\$0	\$2,732	\$814	\$0	\$0	\$511	\$10,355	\$16,605	\$3,127	\$8,062	\$0	\$42,206	\$60,287	\$102,493
2025	\$0	\$2,735	\$0	\$0	\$105	\$511	\$8,393	\$16,622	\$3,130	\$10,039	\$0	\$41,535	\$60,287	\$101,822
2026	\$17,729	\$24,833	\$6,117	\$0	\$41,041	\$512	\$24,951	\$31,257	\$6,077	\$16,314	\$2,139	\$170,970	\$60,287	\$231,257
2027	\$0	\$2,740	\$0	\$0	\$0	\$512	\$8,410	\$24,195	\$3,136	\$7,751	\$0	\$46,744	\$60,287	\$107,031
2028	\$652	\$2,743	\$817	\$0	\$0	\$513	\$11,059	\$18,703	\$3,731	\$8,094	\$0	\$46,312	\$60,287	\$106,599
2029	\$0	\$2,746	\$0	\$0	\$0	\$514	\$8,426	\$18,820	\$3,143	\$7,766	\$0	\$41,415	\$60,287	\$101,702
2030	\$0	\$2,749	\$0	\$0	\$0	\$514	\$12,539	\$16,705	\$3,146	\$11,772	\$0	\$47,425	\$60,287	\$107,712
2031	\$2,103	\$3,785	\$1,680	\$0	\$7,543	\$515	\$18,926	\$26,980	\$7,777	\$9,605	\$0	\$78,914	\$60,287	\$139,201
2032	\$0	\$2,754	\$821	\$0	\$0	\$515	\$10,438	\$16,738	\$3,152	\$8,127	\$0	\$42,545	\$60,287	\$102,832
2033	\$0	\$2,757	\$0	\$0	\$0	\$516	\$8,460	\$29,639	\$3,155	\$7,797	\$0	\$52,324	\$60,287	\$112,611
2034	\$0	\$2,760	\$0	\$0	\$3,907	\$516	\$10,274	\$16,772	\$3,158	\$8,143	\$0	\$45,530	\$60,287	\$105,817
2035	\$0	\$2,762	\$0	\$0	\$0	\$517	\$8,477	\$21,473	\$3,162	\$10,140	\$0	\$46,531	\$60,287	\$106,818
2036	\$17,907	\$66,166	\$18,897	\$0	\$41,519	\$517	\$41,143	\$33,733	\$6,138	\$24,344	\$2,161	\$252,525	\$60,287	\$312,812
2037	\$0	\$2,768	\$0	\$0	\$0	\$518	\$10,068	\$16,822	\$3,168	\$7,828	\$0	\$41,172	\$60,287	\$101,459
2038	\$0	\$2,771	\$0	\$0	\$0	\$518	\$11,064	\$36,911	\$3,171	\$8,176	\$0	\$62,611	\$60,287	\$122,898
2039	\$0	\$2,773	\$0	\$0	\$0	\$519	\$8,511	\$16,856	\$3,174	\$7,844	\$0	\$39,677	\$60,287	\$99,964
2040	\$660	\$2,776	\$827	\$0	\$0	\$519	\$11,379	\$16,903	\$3,776	\$11,891	\$0	\$48,731	\$60,287	\$109,018
2041	\$24,605	\$3,823	\$1,697	\$0	\$62,579	\$29,072	\$20,946	\$21,004	\$3,440	\$8,868	\$0	\$176,034	\$60,287	\$236,321
2042	\$0	\$2,782	\$0	\$0	\$0	\$520	\$10,356	\$16,907	\$3,184	\$8,208	\$0	\$41,957	\$60,287	\$102,244
2043	\$0	\$2,785	\$0	\$0	\$107	\$521	\$8,545	\$16,923	\$3,187	\$7,876	\$0	\$39,944	\$60,287	\$100,231
2044	\$0	\$2,787	\$830	\$0	\$0	\$521	\$11,962	\$16,940	\$3,190	\$8,225	\$0	\$44,455	\$60,287	\$104,742
2045	\$0	\$2,790	\$0	\$0	\$0	\$522	\$9,316	\$18,993	\$3,193	\$10,242	\$0	\$45,056	\$60,287	\$105,343
2046	\$19,528	\$25,334	\$6,240	\$0	\$49,399	\$522	\$32,901	\$38,700	\$10,727	\$17,481	\$2,182	\$203,014	\$60,287	\$263,301
2047	\$0	\$2,796	\$0	\$0	\$0	\$523	\$8,579	\$16,991	\$3,200	\$7,907	\$0	\$39,996	\$60,287	\$100,283
2048	\$0	\$2,799	\$834	\$0	\$0	\$523	\$10,607	\$27,923	\$3,203	\$8,258	\$0	\$54,147	\$60,287	\$114,434
2049	\$0	\$2,801	\$0	\$0	\$0	\$524	\$8,597	\$26,392	\$3,206	\$7,923	\$0	\$49,443	\$60,287	\$109,730
Total	\$83,860	\$193,971	\$42,049	\$0	\$206,324	\$44,043	\$389,024	\$643,026	\$114,493	\$287,999	\$6,482	\$2,011,271	\$1,808,610	\$3,819,881



PROGRAM QUESTIONNAIRE

The following section contains a program questionnaire regarding the needs of the Sunnyvale Fire Department.



PROGRAM QUESTIONNAIRE

QUESTIONNAIRE

1. Shift Schedules: What type of shift scheduling are you utilizing?

California swing: on-off-on-off-on-off-off-off-off

2. Fueling: Does the Department currently refuel diesel or gasoline at any of its stations?

No. If there are stations that do not have fuel tanks/dispensers, how/where is fueling accomplished? Corporate Yard near station 2 and Fire Headquarters near City Hall.

3. Apron Security: It appears that most DPS fire stations do not have fencing/security around the rear apron. SKA thinks this could be a problem for a facility containing law enforcement personnel. Please comment.

Only Station 5 has an operating security gate. Security fencing is necessary at all stations.

4. Trash Enclosure: What are the trash enclosure requirements of DPS and the City's vendor?

One to two dumpsters are required depending on size of station plus three recycle bins.

5. PPE Garment Cleaning: Does the Department currently use extractors to clean their PPE garments, or does the Department bag and send out PPE to be cleaned by vendor(s)?

There are extractors at stations 1&5, house washer and dryers at station 2&5. Crews deposit PPE at stations 1&5 to be cleaned by stations 1&5 crews. Crews can perform household wash dry at stations 2&5 but more often take them home to be cleaned. There is linen service for sheets, towels, dish towels, and apparatus towels. These are all place in blue pick-up bags that are picked up by linen service. Linen (including apparatus towels) are washed and co-mingled with other clients (hospital, prison etc.)

6. SCBA: Does the Department currently refill SCBA only at Station 2? How are SCBA tanks distributed to other stations?

SCBA is filled and serviced at Station 2. SCBA is filled but not serviced at Station 1. Crews drive to those stations drop off spent SCBA, and pick up charged SCBA.

7. Oxygen: Does the Department currently refill oxygen tanks at any of its stations? How are oxygen tanks distributed to other stations?

Oxygen is filled at Station 4. Crews drive to Station 4 to drop off spent and pick up filled tanks.

8. Medical Response: Does the City utilize outside vendors for medical response or transport?

City has EMT's on its fire apparatus. The County contracts a vendor to provide for ambulance transport and paramedics. The vendor provides trailers at Stations 2 and 6 for vendor use. Trailers have a day room but not sleeping quarters as paramedics are on a 12 hour shift. There is also one paramedic under contract to the County and provided to Sunnyvale on a Quick Response Vehicle (QRV). It is unlikely that Public Safety personnel will ever be trained to a paramedic level. It has been discussed that City may consider hiring a civilian paramedic. Current vendor contract comes up in 2022.

9. Medical Training: Are Department personnel trained as EMTs or Paramedics?

How are such personnel assigned to apparatus? Each truck and each engine are staffed by 2 DPS personnel. The rescue apparatus is staffed by 1-2 personnel. All personnel are trained EMTs. There are no City paramedics.

10. Medical Cleaning: Is there a need to clean any medical equipment at the stations?

EMT's need to clean their bags and equipment.

PROGRAM QUESTIONNAIRE

QUESTIONNAIRE (CONT'D)

11. Medical Storage: How are medical supplies re-provisioned on the apparatus and at the stations? What are the storage needs at the stations?

DPS maintains a supply inventory and resupplies from the vendor on a one-to-one basis.

12. Medical Drugs: How are drugs distributed/secured on apparatus and/or stations?

Narcan is stored on each apparatus in the first responder's medical bag.

13. Law Enforcement: Do Sunnyvale's fire stations need any special features to accommodate law enforcement?

Small hand-gun lockers should be provided since fire personnel are also law enforcement officers. Patrol vehicles come to stations to use restrooms and also prepare reports.

14. Data from City Gate Reports: The attached data was compiled from the City Gate reports dated 4/27/18. Please confirm that the data is current/correct.

Confirmed.

15. Standard of Coverage: Do you have any plans to add or subtract stations? Do you have any plans to change the type of apparatus within any station?

Six stations will be the service model for the foreseeable future. The battalion chief will remain at Fire Station 2.

16. CERT: Does the City have a CERT program? If so, what accommodations are provided to CERT at a fire station?

Station 2 has a CERT trailer.

17. Station 2 Training Props: Describe the training capabilities of all props on the facility including but not limited to class 1 or 2 burns, repelling, confined space, flashover, roof ventilation, hydrants, auto extraction & fire, drafting, and hydrant.

Class 1 burns are performed in a Conex box. They are no longer performed in the tower. The tower is used for repelling, confined space, scenarios, roof ventilation. There is no flashover or drafting. There are 2 hydrants and a reasonable sized yard for auto extraction or other exercises.

18. Station 2 as a Prop: Is Station 2 ever used as a prop? If so, describe how this works and how the station remains in-service to respond to calls.

Station 2's apparatus bay is sometimes used as a prop in which case, Station 2's apparatus are moved into the yard.

19. Off Premises Training: Do you have props at other facilities? Why are such props not at the Station 2 facility?

Most of what Sunnyvale needs is at Station 2. Wildland, trench, pick & pull (auto), water rescue, are accomplished off-site.

20. Additional Props: Ideally what additional props would you like to see at Station 2 or within Sunnyvale?

Additional props are not a priority.

21. Academies: How often do you host an academy for new recruits? What size is it? Do other districts participate?

Sunnyvale hosts an academy approximately 2 times per year for 17 weeks each. In recent years, the academy has grown to include recruits from numerous south bay fire departments.



PROGRAM QUESTIONNAIRE

QUESTIONNAIRE (CONT'D)

22. DPS Firefighter Training: Describe the frequency and size of DPS personnel training. Are DPS personnel in-service (need to respond) at the time of training?

The frequency varies but is approximately monthly. It takes a week to make sure all shifts are trained. Personnel are in-service so half of the shift could be at the facility half-day at a time.

23. Other Training: Describe other usages of the training facility including police, inter-agency, or leasing to outside agencies.

The facility is also used by Sunnyvale law enforcement.

24. Classroom Building: Describe existing classroom, office, and other program components and future needs if any.

The existing facility has a classroom for 30, a break room and (3) offices. It is necessary that an additional office, a conference room, locker room, and turnout room be added. Currently the apparatus bay of the tower has been converted to a temporary locker and turnout room.

25. Paramedic Building: What functions are performed in the Paramedic Building? If the Paramedic building accommodates an outside vendor, what is DPS's responsibility in regards to vendor accommodation?

Sunnyvale leases site space to the vendor who provides a modular trailer. The trailer contains a day room, but no sleeping accommodations.

26. SCBA/Exercise Building: Is there a particular reason SCBA is provided at Station 2 as opposed to another station? Describe who uses the exercise room. Is it Station 2 personnel, command and training officers? Do academy or others use it as well?

Station 2 is centrally located to provide SCBA to the department. The stand-alone building was not originally intended for exercise. Station 2 personnel, and department officers including training officers use the training room. Recruits do not.

27. Parking: Is there off-site parking for Station 2? Please describe.

There is no off-site parking available.

STRUCTURAL EVALUATION

The following section contains a structural evaluation report of Sunnyvale's Fire Stations.



STRUCTURAL EVALUATION

<i>Kitchell</i>	Project:	Sunnyvale Fire Stations		
	Proj. No.:	6598A3		
	Client:	Sunnyvale		
	Engr:	CR	Date:	2/11/2020
			Page:	1

Fire Station 1 & 2

General Building Data

Building Location	=	Sunnyvale, CA
Fire Station #1 address	=	171 N Mathilda Ave, Sunnyvale, CA 94086
Fire Station #2 address	=	795 E Arques Ave, Sunnyvale, CA 94085
Lateral System	=	Ordinary Reinforced Masonry Shear Walls with Wood Roof Diaphragm
Building Height	=	12 ft.
Building Area	=	7400 Sq-Ft. (General Plan Dimensions: 90' x 87')
Year Built	=	1965 (Approximately)
Foundations	=	Conventional Concrete strip and Spread Footings
Ground Floor Framing	=	Reinforced Concrete Slab-on-grade
As-Built Information	=	By Charles F Uhrhammer Structural Engineer - Palo Alto, CA Dated March 1964

2019 California Existing Building Code (CEBC), ASCE-7 & CBC

CEBC Section 317.3: Seismic Evaluation per ASCE 41 as required per CEBC 317.3

Risk Category	=	IV	(Essential Services Structure per CBC Chapter 16)
S_{DS}	=	1.2	(Design Spectral Accel at Short Periods)
Seismic Design Category	=	D	

ASCE 41-13 - Seismic Evaluation of Existing Building

Building Type (Table 3-1)	=	RM1	(Reinforced Masonry shear walls with flexible diaphragm)
Level of Performance	=	IO	(Immediate Occupancy - Essential Services Structure))
Level of Seismicity (Table 2-5)	=	High	
Height Limitation (Table 3-2)	=	1 Story	→ OK
Bench Mark Building (Table 4-6)	=	UBC 1997	→ Thus original construction does NOT conform.

→ Thus a Tiered evaluation of the structure would be required if a trigger was hit per CEBC 317.3. Also a voluntary structural evaluation could be initiated if the owner desired. Refer to the attached evaluation flowchart from ASCE-41. Also attached are the associated checklist for IO structure. A site observation, analysis and review the as-built drawing would be utilized to complete the checklist - per ASCE-41.

→ From the evaluation it would be determined if structural retrofit would be required.

Possible retrofit Items based on the checklist and brief review of the as-built drawings

→ Possible out-of-plane anchorage connections needed for exterior masonry walls to roof wood diaphragms along with diaphragm continuous cross-ties.

→ Collector detailing at the roof to transfer lateral loads to the masonry shear walls.

→ Verification of shear wall demand/capacity analysis.



STRUCTURAL EVALUATION

ATC Hazards by Location

Search Information

Address: 171 N Mathilda Ave, Sunnyvale, CA 94086, USA
Coordinates: 37.3820009, -122.033268
Elevation: 80 ft
Timestamp: 2020-02-11T02:22:07.299Z
Hazard Type: Seismic
Reference Document: ASCE7-16
Risk Category: IV
Site Class: D-default



Basic Parameters

Name	Value	Description
S_s	1.5	MCE_R ground motion (period=0.2s)
S_1	0.6	MCE_R ground motion (period=1.0s)
S_{MS}	1.8	Site-modified spectral acceleration value
S_{M1}	* null	Site-modified spectral acceleration value
S_{DS}	1.2	Numeric seismic design value at 0.2s SA
S_{D1}	* null	Numeric seismic design value at 1.0s SA

* See Section 11.4.8

Additional Information

Name	Value	Description
SDC	* null	Seismic design category
F_a	1.2	Site amplification factor at 0.2s
F_v	* null	Site amplification factor at 1.0s
CR_s	0.946	Coefficient of risk (0.2s)
CR_1	0.924	Coefficient of risk (1.0s)
PGA	0.607	MCE_G peak ground acceleration
F_{PGA}	1.2	Site amplification factor at PGA
PGA_M	0.729	Site modified peak ground acceleration
T_L	12	Long-period transition period (s)
S_{sRT}	1.965	Probabilistic risk-targeted ground motion (0.2s)
S_{sUH}	2.078	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
S_{sD}	1.5	Factored deterministic acceleration value (0.2s)
S_{1RT}	0.756	Probabilistic risk-targeted ground motion (1.0s)
S_{1UH}	0.819	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
S_{1D}	0.6	Factored deterministic acceleration value (1.0s)
$PGAd$	0.607	Factored deterministic acceleration value (PGA)

* See Section 11.4.8

The results indicated here DO NOT reflect any state or local amendments to the values or any delineation lines made during the building code adoption process. Users should confirm any output obtained from this tool with the local Authority Having Jurisdiction before proceeding with design.

Disclaimer

Hazard loads are provided by the U.S. Geological Survey [Seismic Design Web Services](#).

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STRUCTURAL EVALUATION

ATC Hazards by Location

Page 1 of 1

ATC Hazards by Location

Search Information

Address: 795 E Arques Ave, Sunnyvale, CA 94085
Coordinates: 37.3812954, -122.0122848
Elevation: 53 ft
Timestamp: 2020-02-11T02:24:26.074Z
Hazard Type: Seismic
Reference Document: ASCE7-16
Risk Category: IV
Site Class: D-default



Basic Parameters

Name	Value	Description
S _S	1.5	MCE _R ground motion (period=0.2s)
S ₁	0.6	MCE _R ground motion (period=1.0s)
S _{MS}	1.8	Site-modified spectral acceleration value
S _{M1}	* null	Site-modified spectral acceleration value
S _{DS}	1.2	Numeric seismic design value at 0.2s SA
S _{D1}	* null	Numeric seismic design value at 1.0s SA

* See Section 11.4.8

Additional Information

Name	Value	Description
SDC	* null	Seismic design category
F _a	1.2	Site amplification factor at 0.2s
F _v	* null	Site amplification factor at 1.0s
CR _S	0.951	Coefficient of risk (0.2s)
CR ₁	0.928	Coefficient of risk (1.0s)
PGA	0.548	MCE _G peak ground acceleration
F _{PGA}	1.2	Site amplification factor at PGA
PGA _M	0.658	Site modified peak ground acceleration
T _L	12	Long-period transition period (s)
SsRT	1.967	Probabilistic risk-targeted ground motion (0.2s)
SsUH	2.069	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
SsD	1.5	Factored deterministic acceleration value (0.2s)
S1RT	0.75	Probabilistic risk-targeted ground motion (1.0s)
S1UH	0.809	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
S1D	0.6	Factored deterministic acceleration value (1.0s)
PGAd	0.548	Factored deterministic acceleration value (PGA)

* See Section 11.4.8

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Disclaimer

STRUCTURAL EVALUATION

Engr: CR

Date: 2/11/2020

Page: 1

Fire Station 3

General Building Data

Building Location	=	Sunnyvale, CA
Fire Station #3 address	=	910 Ticonderoga Dr, Sunnyvale, CA 94087
Lateral System	=	Ordinary Reinforced Masonry Shear Walls with Wood Roof Diaphragm
Building Height	=	12 ft.
Building Area	=	4300 Sq-Ft. (General Plan Dimensions: 74' x 72')
Year Built	=	1961 (Approximately)
Foundations	=	Conventional Concrete strip and Spread Footings
Ground Floor Framing	=	Reinforced Concrete Slab-on-grade
As-Built Information	=	By L F Richards Architect - Santa Clara, CA Dated March 15, 1960

2019 California Existing Building Code (CEBC), ASCE-7 & CBC

CEBC Section 317.3: Seismic Evaluation per ASCE 41 as required per CEBC 317.3

Risk Category	=	IV (Essential Services Structure per CBC Chapter 16)
S_{DS}	=	1.462 (Design Spectral Accel at Short Periods)
Seismic Design Category	=	D

ASCE 41-13 - Seismic Evaluation of Existing Building

Building Type (Table 3-1)	=	RM1 (Reinforced Masonry shear walls with flexible diaphragm)
Level of Performance	=	IO (Immediate Occupancy - Essential Services Structure))
Level of Seismicity (Table 2-5)	=	High
Height Limitation (Table 3-2)	=	1 Story → OK
Bench Mark Building (Table 4-6)	=	UBC 1997 → Thus original construction does NOT conform.

→ Thus a Tiered evaluation of the structure would be required if a trigger was hit per CEBC 317.3. Also a voluntary structural evaluation could be initiated if the owner desired. Refer to the attached evaluation flowchart from ASCE-41. Also attached are the associated checklist for IO structure. A site observation, analysis and review the as-built drawing would be utilized to complete the checklist - per ASCE-41.

→ From the evaluation it would be determined if structural retrofit would be required.

Possible retrofit Items based on the checklist and brief review of the as-built drawings

- Possible out-of-plane anchorage connections needed for exterior masonry walls to roof wood diaphragms along with diaphragm continuous cross-ties.
- Collector detailing at the roof to transfer lateral loads to the masonry shear walls.
- Verification of shear wall demand/capacity analysis.



STRUCTURAL EVALUATION

ATC Hazards by Location

Search Information

Address: 910 Ticonderoga Dr, Sunnyvale, CA 94087

Coordinates: 37.3555257, -122.0508509

Elevation: 183 ft

Timestamp: 2020-02-11T03:16:14.664Z

Hazard Type: Seismic

Reference Document: ASCE7-16

Risk Category: IV

Site Class: D-default



Basic Parameters

Name	Value	Description
S_s	1.828	MCE_R ground motion (period=0.2s)
S_1	0.648	MCE_R ground motion (period=1.0s)
S_{MS}	2.193	Site-modified spectral acceleration value
S_{M1}	* null	Site-modified spectral acceleration value
S_{DS}	1.462	Numeric seismic design value at 0.2s SA
S_{D1}	* null	Numeric seismic design value at 1.0s SA

* See Section 11.4.8

▼Additional Information

Name	Value	Description
SDC	* null	Seismic design category
F_a	1.2	Site amplification factor at 0.2s
F_v	* null	Site amplification factor at 1.0s
CR_s	0.93	Coefficient of risk (0.2s)
CR_1	0.909	Coefficient of risk (1.0s)
PGA	0.752	MCE_G peak ground acceleration
$S1D$	0.648	Factored deterministic acceleration value (1.0s)
PGAd	0.752	Factored deterministic acceleration value (PGA)

* See Section 11.4.8

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STRUCTURAL EVALUATION

Engr: CR

Date: 2/11/2020

Page: 1

Fire Station 4

General Building Data

Building Location	=	Sunnyvale, CA
Fire Station #4 address	=	996 S Wolfe Rd, Sunnyvale, CA 94086
Lateral System	=	Ordinary Reinforced Masonry Shear Walls with Wood Roof Diaphragm
Building Height	=	12 ft.
Building Area	=	4300 Sq-Ft. (General Plan Dimensions: 74' x 72')
Year Built	=	1963 (Approximately)
Foundations	=	Conventional Concrete strip and Spread Footings
Ground Floor Framing	=	Reinforced Concrete Slab-on-grade
As-Built Information	=	By Charles F Uhrhammer Structural Engineer - Palo Alto, CA Dated May 5, 1962

2019 California Existing Building Code (CEBC), ASCE-7 & CBC

CEBC Section 317.3: Seismic Evaluation per ASCE 41 as required per CEBC 317.3

Risk Category	=	IV (Essential Services Structure per CBC Chapter 16)
S_{DS}	=	1.2 (Design Spectral Accel at Short Periods)
Seismic Design Category	=	D

ASCE 41-13 - Seismic Evaluation of Existing Building

Building Type (Table 3-1)	=	RM1 (Reinforced Masonry shear walls with flexible diaphragm)
Level of Performance	=	IO (Immediate Occupancy - Essential Services Structure))
Level of Seismicity (Table 2-5)	=	High
Height Limitation (Table 3-2)	=	1 Story → OK
Bench Mark Building (Table 4-6)	=	UBC 1997 → Thus original construction does NOT conform.

→ Thus a Tiered evaluation of the structure would be required if a trigger was hit per CEBC 317.3. Also a voluntary structural evaluation could be initiated if the owner desired. Refer to the attached evaluation flowchart from ASCE-41. Also attached are the associated checklist for IO structure. A site observation, analysis and review the as-built drawing would be utilized to complete the checklist - per ASCE-41.

→ From the evaluation it would be determined if structural retrofit would be required.

Possible retrofit Items based on the checklist and brief review of the as-built drawings

→ Possible out-of-plane anchorage connections needed for exterior masonry walls to roof wood diaphragms along with diaphragm continuous cross-ties.

→ Collector detailing at the roof to transfer lateral loads to the masonry shear walls.

→ Verification of shear wall demand/capacity analysis.



STRUCTURAL EVALUATION

ATC Hazards by Location

Search Information

Address: 996 S Wolfe Rd, Sunnyvale, CA 94086
Coordinates: 37.3564904, -122.013817
Elevation: 118 ft
Timestamp: 2020-02-11T03:20:19.219Z
Hazard Type: Seismic
Reference Document: ASCE7-16
Risk Category: IV
Site Class: D-default



Basic Parameters

Name	Value	Description
S_S	1.5	MCE_R ground motion (period=0.2s)
S_1	0.6	MCE_R ground motion (period=1.0s)
S_{MS}	1.8	Site-modified spectral acceleration value
S_{M1}	* null	Site-modified spectral acceleration value
S_{DS}	1.2	Numeric seismic design value at 0.2s SA
S_{D1}	* null	Numeric seismic design value at 1.0s SA

* See Section 11.4.8

▼Additional Information

Name	Value	Description
SDC	* null	Seismic design category
F_a	1.2	Site amplification factor at 0.2s
F_v	* null	Site amplification factor at 1.0s
CR_s	0.946	Coefficient of risk (0.2s)
CR_1	0.923	Coefficient of risk (1.0s)
PGA	0.614	MCE_G peak ground acceleration
F_{PGA}	1.2	Site amplification factor at PGA
PGA_M	0.736	Site modified peak ground acceleration
T_L	12	Long-period transition period (s)
S_{sRT}	1.973	Probabilistic risk-targeted ground motion (0.2s)
S_{sUH}	2.085	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
S_{sD}	1.5	Factored deterministic acceleration value (0.2s)
S_{1RT}	0.761	Probabilistic risk-targeted ground motion (1.0s)
S_{1UH}	0.824	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
S_{1D}	0.6	Factored deterministic acceleration value (1.0s)
PGA_d	0.614	Factored deterministic acceleration value (PGA)

* See Section 11.4.8

The results indicated here DO NOT reflect any state or local amendments to the values or any delineation lines made during the building code adoption process. Users should confirm any output obtained from this tool with the local Authority Having Jurisdiction before proceeding with design.

Disclaimer

Hazard loads are provided by the U.S. Geological Survey [Seismic Design Web Services](#).

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STRUCTURAL EVALUATION

Fire Station 6

General Building Data

Building Location	=	Sunnyvale, CA
Fire Station #6 address	=	1282 Lawrence Station Rd, Sunnyvale, CA 94089
Lateral System	=	Ordinary Reinforced Masonry Shear Walls with Wood Roof Diaphragm
Building Height	=	12 ft.
Building Area	=	4300 Sq-Ft. (General Plan Dimensions: 74' x 72')
Year Built	=	1965 (Approximately)
Foundations	=	Conventional Concrete strip and Spread Footings
Ground Floor Framing	=	Reinforced Concrete Slab-on-grade
As-Built Information	=	not provided at this time

2019 California Existing Building Code (CEBC), ASCE-7 & CBC

CEBC Section 317.3: Seismic Evaluation per ASCE 41 as required per CEBC 317.3

Risk Category	=	IV (Essential Services Structure per CBC Chapter 16)
S_{DS}	=	1.2 (Design Spectral Accel at Short Periods)
Seismic Design Category	=	D

ASCE 41-13 - Seismic Evaluation of Existing Building

Building Type (Table 3-1)	=	RM1 (Reinforced Masonry shear walls with flexible diaphragm)
Level of Performance	=	IO (Immediate Occupancy - Essential Services Structure))
Level of Seismicity (Table 2-5)	=	High
Height Limitation (Table 3-2)	=	1 Story → OK
Bench Mark Building (Table 4-6)	=	UBC 1997 → Thus original construction does NOT conform.

→ Thus a Tiered evaluation of the structure would be required if a trigger was hit per CEBC 317.3. Also a voluntary structural evaluation could be initiated if the owner desired. Refer to the attached evaluation flowchart from ASCE-41. Also attached are the associated checklist for IO structure. A site observation, analysis and review the as-built drawing would be utilized to complete the checklist - per ASCE-41.

→ From the evaluation it would be determined if structural retrofit would be required.

Possible retrofit Items based on the checklist and brief review of the as-built drawings

- Possible out-of-plane anchorage connections needed for exterior masonry walls to roof wood diaphragms along with diaphragm continuous cross-ties.
- Collector detailing at the roof to transfer lateral loads to the masonry shear walls.
- Verification of shear wall demand/capacity analysis.



STRUCTURAL EVALUATION

ATC Hazards by Location

Search Information

Address: 1282 Lawrence Station Rd, Sunnyvale, CA 94089
Coordinates: 37.4076084, -121.9955466
Elevation: 9 ft
Timestamp: 2020-02-11T03:26:25.504Z
Hazard Type: Seismic
Reference Document: ASCE7-16
Risk Category: IV
Site Class: D-default



Basic Parameters

Name	Value	Description
S_S	1.5	MCE_R ground motion (period=0.2s)
S_1	0.6	MCE_R ground motion (period=1.0s)
S_{MS}	1.8	Site-modified spectral acceleration value
S_{M1}	* null	Site-modified spectral acceleration value
S_{DS}	1.2	Numeric seismic design value at 0.2s SA
S_{D1}	* null	Numeric seismic design value at 1.0s SA

* See Section 11.4.8

▼Additional Information

Name	Value	Description
SDC	* null	Seismic design category
F_a	1.2	Site amplification factor at 0.2s
F_v	* null	Site amplification factor at 1.0s
CR_S	0.951	Coefficient of risk (0.2s)
CR_1	0.93	Coefficient of risk (1.0s)
PGA	0.537	MCE_G peak ground acceleration
F_{PGA}	1.2	Site amplification factor at PGA
$PGAM$	0.645	Site modified peak ground acceleration
T_L	12	Long-period transition period (s)
$SsRT$	2.035	Probabilistic risk-targeted ground motion (0.2s)
$SsUH$	2.139	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
SsD	1.5	Factored deterministic acceleration value (0.2s)
$S1RT$	0.764	Probabilistic risk-targeted ground motion (1.0s)
$S1UH$	0.821	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
$S1D$	0.6	Factored deterministic acceleration value (1.0s)
$PGAd$	0.537	Factored deterministic acceleration value (PGA)

* See Section 11.4.8

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STRUCTURAL EVALUATION

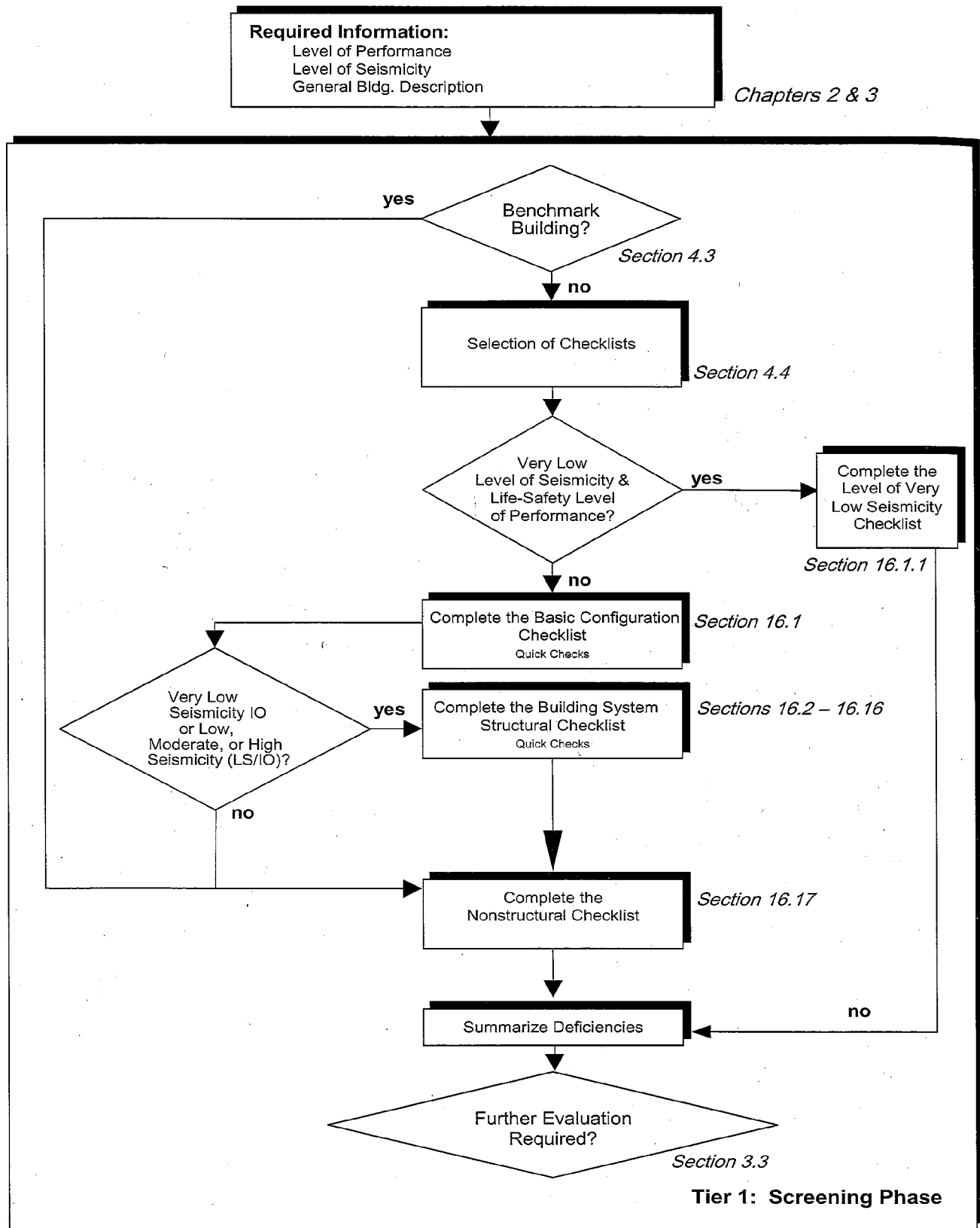


FIG. 4-1. Tier 1 Evaluation Process



STRUCTURAL EVALUATION

APPENDIX C SUMMARY DATA SHEET

BUILDING DATA

Building Name: _____ Date: _____
 Building Address: _____
 Latitude: _____ Longitude: _____ By: _____
 Year Built: _____ Year(s) Remodeled: _____ Original Design Code: _____
 Area (sf): _____ Length (ft): _____ Width (ft): _____
 No. of Stories: _____ Story Height: _____ Total Height: _____
 USE ☐ Industrial ☐ Office ☐ Warehouse ☐ Hospital ☐ Residential ☐ Educational ☐ Other: _____

CONSTRUCTION DATA

Gravity Load Structural System: _____
 Exterior Transverse Walls: _____ Openings? _____
 Exterior Longitudinal Walls: _____ Openings? _____
 Roof Materials/Framing: _____
 Intermediate Floors/Framing: _____
 Ground Floor: _____
 Columns: _____ Foundation: _____
 General Condition of Structure: _____
 Levels Below Grade? _____
 Special Features and Comments: _____

LATERAL-FORCE-RESISTING SYSTEM

	Longitudinal	Transverse
System:	_____	_____
Vertical Elements:	_____	_____
Diaphragms:	_____	_____
Connections:	_____	_____

EVALUATION DATA

BSE-1N Spectral Response Accelerations: S_{D1} = _____ S_{D1} = _____
 Soil Factors: Class = _____ F_a = _____ F_v = _____
 BSE-1E Spectral Response Accelerations: S_{S1} = _____ S_{S1} = _____
 Level of Seismicity: _____ Performance Level: _____
 Building Period: T = _____
 Spectral Acceleration: S_a = _____
 Modification Factor: $C_m C_1 C_2$ = _____ Building Weight: W = _____
 Pseudo Lateral Force: V = _____
 $C_m C_1 C_2 S_a W$ = _____

BUILDING CLASSIFICATION:

REQUIRED TIER 1 CHECKLISTS

	Yes	No
Basic Configuration Checklist	<input type="checkbox"/>	<input type="checkbox"/>
Building Type _____ Structural Checklist	<input type="checkbox"/>	<input type="checkbox"/>
Nonstructural Component Checklist	<input type="checkbox"/>	<input type="checkbox"/>

FURTHER EVALUATION REQUIREMENT:

Seismic Evaluation and Retrofit of Existing Buildings

STRUCTURAL EVALUATION

Project: _____

Location: _____

Completed by: _____

Date: _____

16.1.2IO IMMEDIATE OCCUPANCY BASIC CONFIGURATION CHECKLIST

Very Low Seismicity

Building System

General

- C NC N/A U LOAD PATH: The structure shall contain a complete, well-defined load path, including structural elements and connections, that serves to transfer the inertial forces associated with the mass of all elements of the building to the foundation. (Commentary: Sec. A.2.1.1. Tier 2: Sec. 5.4.1.1)
- C NC N/A U ADJACENT BUILDINGS: The clear distance between the building being evaluated and any adjacent building is greater than 4% of the height of the shorter building. This statement need not apply for the following building types: W1, W1a, and W2. (Commentary: Sec. A.2.1.2. Tier 2: Sec. 5.4.1.2)
- C NC N/A U MEZZANINES: Interior mezzanine levels are braced independently from the main structure or are anchored to the seismic-force-resisting elements of the main structure. (Commentary: Sec. A.2.1.3. Tier 2: Sec. 5.4.1.3)

Building Configuration

- C NC N/A U WEAK STORY: The sum of the shear strengths of the seismic-force-resisting system in any story in each direction shall not be less than 80% of the strength in the adjacent story above. (Commentary: Sec. A.2.2.2. Tier 2: Sec. 5.4.2.1)
- C NC N/A U SOFT STORY: The stiffness of the seismic-force-resisting system in any story shall not be less than 70% of the seismic-force-resisting system stiffness in an adjacent story above or less than 80% of the average seismic-force-resisting system stiffness of the three stories above. (Commentary: Sec. A.2.2.3. Tier 2: Sec. 5.4.2.2)
- C NC N/A U VERTICAL IRREGULARITIES: All vertical elements in the seismic-force-resisting system are continuous to the foundation. (Commentary: Sec. A.2.2.4. Tier 2: Sec. 5.4.2.3)
- C NC N/A U GEOMETRY: There are no changes in the net horizontal dimension of the seismic-force-resisting system of more than 30% in a story relative to adjacent stories, excluding one-story penthouses and mezzanines. (Commentary: Sec. A.2.2.5. Tier 2: Sec. 5.4.2.4)
- C NC N/A U MASS: There is no change in effective mass more than 50% from one story to the next. Light roofs, penthouses, and mezzanines need not be considered. (Commentary: Sec. A.2.2.6. Tier 2: Sec. 5.4.2.5)
- C NC N/A U TORSION: The estimated distance between the story center of mass and the story center of rigidity is less than 20% of the building width in either plan dimension. (Commentary: Sec. A.2.2.7. Tier 2: Sec. 5.4.2.6)

Low Seismicity: Complete the Following Items in Addition to the Items for Very Low Seismicity.

Geologic Site Hazards

- C NC N/A U LIQUEFACTION: Liquefaction-susceptible, saturated, loose granular soils that could jeopardize the building's seismic performance shall not exist in the foundation soils at depths within 50 ft under the building. (Commentary: Sec. A.6.1.1. Tier 2: 5.4.3.1)
- C NC N/A U SLOPE FAILURE: The building site is sufficiently remote from potential earthquake-induced slope failures or rockfalls to be unaffected by such failures or is capable of accommodating any predicted movements without failure. (Commentary: Sec. A.6.1.2. Tier 2: 5.4.3.1)
- C NC N/A U SURFACE FAULT RUPTURE: Surface fault rupture and surface displacement at the building site are not anticipated. (Commentary: Sec. A.6.1.3. Tier 2: 5.4.3.1)

Moderate and High Seismicity: Complete the Following Items in Addition to the Items for Low Seismicity.

Foundation Configuration

- C NC N/A U OVERTURNING: The ratio of the least horizontal dimension of the seismic-force-resisting system at the foundation level to the building height (base/height) is greater than 0.6S_w. (Commentary: Sec. A.6.2.1. Tier 2: Sec. 5.4.3.3)
- C NC N/A U TIES BETWEEN FOUNDATION ELEMENTS: The foundation has ties adequate to resist seismic forces where footings, piles, and piers are not restrained by beams, slabs, or soils classified as Site Class A, B, or C. (Commentary: Sec. A.6.2.2. Tier 2: Sec. 5.4.3.4)



STRUCTURAL EVALUATION

16.310 IMMEDIATE OCCUPANCY STRUCTURAL CHECKLIST FOR BUILDING TYPE W2: WOOD FRAMES, COMMERCIAL AND INDUSTRIAL

Very Low Seismicity

Seismic-Force-Resisting System

- | | | | | |
|---|----|-----|---|--|
| C | NC | N/A | U | REDUNDANCY: The number of lines of shear walls in each principal direction is greater than or equal to 2. (Commentary: Sec. A.3.2.1.1. Tier 2: Sec. 5.5.1.1) |
| C | NC | N/A | U | SHEAR STRESS CHECK: The shear stress in the shear walls, calculated using the Quick Check procedure of Section 4.5.3.3, is less than the following values (Commentary: Sec. A.3.2.7.1. Tier 2: Sec. 5.5.3.1.1):
Structural panel sheathing 1,000 lb/ft
Diagonal sheathing 700 lb/ft
Straight sheathing 100 lb/ft
All other conditions 100 lb/ft |
| C | NC | N/A | U | STUCCO (EXTERIOR PLASTER) SHEAR WALLS: Multi-story buildings do not rely on exterior stucco walls as the primary seismic-force-resisting system. (Commentary: Sec. A.3.2.7.2. Tier 2: Sec. 5.5.3.6.1) |
| C | NC | N/A | U | GYPSUM WALLBOARD OR PLASTER SHEAR WALLS: Interior plaster or gypsum wallboard is not used as shear walls on buildings more than one story high with the exception of the uppermost level of a multi-story building. (Commentary: Sec. A.3.2.7.3. Tier 2: Sec. 5.5.3.6.1) |
| C | NC | N/A | U | NARROW WOOD SHEAR WALLS: Narrow wood shear walls with an aspect ratio greater than 2-to-1 are not used to resist seismic forces. (Commentary: Sec. A.3.2.7.4. Tier 2: Sec. 5.5.3.6.1) |
| C | NC | N/A | U | WALLS CONNECTED THROUGH FLOORS: Shear walls have an interconnection between stories to transfer overturning and shear forces through the floor. (Commentary: Sec. A.3.2.7.5. Tier 2: Sec. 5.5.3.6.2) |
| C | NC | N/A | U | HILLSIDE SITE: For structures that are taller on at least one side by more than one-half story because of a sloping site, all shear walls on the downhill slope have an aspect ratio less than 1-to-2. (Commentary: Sec. A.3.2.7.6. Tier 2: Sec. 5.5.3.6.3) |
| C | NC | N/A | U | CRIPPLE WALLS: Cripple walls below first-floor-level shear walls are braced to the foundation with wood structural panels. (Commentary: Sec. A.3.2.7.7. Tier 2: Sec. 5.5.3.6.4) |
| C | NC | N/A | U | OPENINGS: Walls with openings greater than 80% of the length are braced with wood structural panel shear walls with aspect ratios of not more than 1.5-to-1 or are supported by adjacent construction through positive ties capable of transferring the seismic forces. (Commentary: Sec. A.3.2.7.8. Tier 2: Sec. 5.5.3.6.5) |
| C | NC | N/A | U | HOLD-DOWN ANCHORS: All shear walls have hold-down anchors, constructed per acceptable construction practices, attached to the end studs. (Commentary: Sec. A.3.2.7.9. Tier 2: Sec. 5.5.3.6.6) |

Connections

- | | | | | |
|---|----|-----|---|---|
| C | NC | N/A | U | WOOD POSTS: There is a positive connection of wood posts to the foundation. (Commentary: Sec. A.5.3.3. Tier 2: Sec. 5.7.3.3) |
| C | NC | N/A | U | WOOD SILLS: All wood sills are bolted to the foundation. (Commentary: Sec. A.5.3.4. Tier 2: Sec. 5.7.3.3) |
| C | NC | N/A | U | GIRDER/COLUMN CONNECTION: There is a positive connection using plates, connection hardware, or straps between the girder and the column support. (Commentary: Sec. A.5.4.1. Tier 2: Sec. 5.7.4.1) |

Foundation System

- | | | | | |
|---|----|-----|---|--|
| C | NC | N/A | U | DEEP FOUNDATIONS: Piles and piers are capable of transferring the lateral forces between the structure and the soil. (Commentary: Sec. A.6.2.3.) |
| C | NC | N/A | U | SLOPING SITES: The difference in foundation embedment depth from one side of the building to another shall not exceed one story high. (Commentary: Sec. A.6.2.4) |

STRUCTURAL EVALUATION

Low, Moderate, and High Seismicity: Complete the Following Items in Addition to the Items for Very Low Seismicity. Seismic-Force-Resisting System

C NC N/A U NARROW WOOD SHEAR WALLS: Narrow wood shear walls with an aspect ratio greater than 1.5-to-1 are not used to resist seismic forces. (Commentary: Sec. A.3.2.7.4. Tier 2: Sec. 5.5.3.6.1)

Diaphragms

C NC N/A U DIAPHRAGM CONTINUITY: The diaphragms are not composed of split-level floors and do not have expansion joints. (Commentary: Sec. A.4.1.1. Tier 2: Sec. 5.6.1.1)

C NC N/A U ROOF CHORD CONTINUITY: All chord elements are continuous, regardless of changes in roof elevation. (Commentary: Sec. A.4.1.3. Tier 2: Sec. 5.6.1.1)

C NC N/A U PLAN IRREGULARITIES: There is tensile capacity to develop the strength of the diaphragm at reentrant corners or other locations of plan irregularities. (Commentary: Sec. A.4.1.7. Tier 2: Sec. 5.6.1.4)

C NC N/A U DIAPHRAGM REINFORCEMENT AT OPENINGS: There is reinforcing around all diaphragm openings larger than 50% of the building width in either major plan dimension. (Commentary: Sec. A.4.1.8. Tier 2: Sec. 5.6.1.5)

C NC N/A U STRAIGHT SHEATHING: All straight sheathed diaphragms have aspect ratios less than 1-to-1 in the direction being considered. (Commentary: Sec. A.4.2.1. Tier 2: Sec. 5.6.2)

C NC N/A U SPANS: All wood diaphragms with spans greater than 12 ft consist of wood structural panels or diagonal sheathing. Wood commercial and industrial buildings may have rod-braced systems. (Commentary: Sec. A.4.2.2. Tier 2: Sec. 5.6.2)

C NC N/A U DIAGONALLY SHEATHED AND UNBLOCKED DIAPHRAGMS: All diagonally sheathed or unblocked wood structural panel diaphragms have horizontal spans less than 30 ft and aspect ratios less than or equal to 3-to-1. (Commentary: Sec. A.4.2.3. Tier 2: Sec. 5.6.2)

C NC N/A U OTHER DIAPHRAGMS: The diaphragm does not consist of a system other than wood, metal deck, concrete, or horizontal bracing. (Commentary: Sec. A.4.7.1. Tier 2: Sec. 5.6.5)

Connections

C NC N/A U WOOD SILL BOLTS: Sill bolts are spaced at 4 ft or less, with proper edge and end distance provided for wood and concrete. (Commentary: Sec. A.5.3.7. Tier 2: Sec. 5.7.3.3)



STRUCTURAL EVALUATION

16.17 NONSTRUCTURAL CHECKLIST

Life Safety Systems

- C NC N/A U LS-LMH; PR-LMH. FIRE SUPPRESSION PIPING: Fire suppression piping is anchored and braced in accordance with NFPA-13. (Commentary: Sec. A.7.13.1. Tier 2: Sec. 13.7.4)
- C NC N/A U LS-LMH; PR-LMH. FLEXIBLE COUPLINGS: Fire suppression piping has flexible couplings in accordance with NFPA-13. (Commentary: Sec. A.7.13.2. Tier 2: Sec. 13.7.4)
- C NC N/A U LS-LMH; PR-LMH. EMERGENCY POWER: Equipment used to power or control life safety systems is anchored or braced. (Commentary: Sec. A.7.12.1. Tier 2: Sec. 13.7.7)
- C NC N/A U LS-LMH; PR-LMH. STAIR AND SMOKE DUCTS: Stair pressurization and smoke control ducts are braced and have flexible connections at seismic joints. (Commentary: Sec. A.7.14.1. Tier 2: Sec. 13.7.6)
- C NC N/A U LS-MH; PR-MH. SPRINKLER CEILING CLEARANCE: Penetrations through panelized ceilings for fire suppression devices provide clearances in accordance with NFPA-13. (Commentary: Sec. A.7.13.3. Tier 2: Sec. 13.7.4)
- C NC N/A U LS-not required; PR-LMH. EMERGENCY LIGHTING: Emergency and egress lighting equipment is anchored or braced. (Commentary: Sec. A.7.3.1. Tier 2: Sec. 13.7.9)

Hazardous Materials

- C NC N/A U LS-LMH; PR-LMH. HAZARDOUS MATERIAL EQUIPMENT: Equipment mounted on vibration isolators and containing hazardous material is equipped with restraints or snubbers. (Commentary: Sec. A.7.12.2. Tier 2: 13.7.1)
- C NC N/A U LS-LMH; PR-LMH. HAZARDOUS MATERIAL STORAGE: Breakable containers that hold hazardous material, including gas cylinders, are restrained by latched doors, shelf lips, wires, or other methods. (Commentary: Sec. A.7.15.1. Tier 2: Sec. 13.8.4)
- C NC N/A U LS-MH; PR-MH. HAZARDOUS MATERIAL DISTRIBUTION: Piping or ductwork conveying hazardous materials is braced or otherwise protected from damage that would allow hazardous material release. (Commentary: Sec. A.7.13.4. Tier 2: Sec. 13.7.3 and 13.7.5)
- C NC N/A U LS-MH; PR-MH. SHUT-OFF VALVES: Piping containing hazardous material, including natural gas, has shut-off valves or other devices to limit spills or leaks. (Commentary: Sec. A.7.13.3. Tier 2: Sec. 13.7.3 and 13.7.5)
- C NC N/A U LS-LMH; PR-LMH. FLEXIBLE COUPLINGS: Hazardous material ductwork and piping, including natural gas piping, has flexible couplings. (Commentary: Sec. A.7.15.4, Tier 2: Sec. 13.7.3 and 13.7.5)
- C NC N/A U LS-MH; PR-MH. PIPING OR DUCTS CROSSING SEISMIC JOINTS: Piping or ductwork carrying hazardous material that either crosses seismic joints or isolation planes or is connected to independent structures has couplings or other details to accommodate the relative seismic displacements. (Commentary: Sec. A.7.13.6. Tier 2: Sec. 13.7.3, 13.7.5, and 13.7.6)

Partitions

- C NC N/A U LS-LMH; PR-LMH. UNREINFORCED MASONRY: Unreinforced masonry or hollow-clay tile partitions are braced at a spacing of at most 10 ft in Low or Moderate Seismicity, or at most 6 ft in High Seismicity. (Commentary: Sec. A.7.1.1. Tier 2: Sec. 13.6.2)
- C NC N/A U LS-LMH; PR-LMH. HEAVY PARTITIONS SUPPORTED BY CEILINGS: The tops of masonry or hollow-clay tile partitions are not laterally supported by an integrated ceiling system. (Commentary: Sec. A.7.2.1. Tier 2: Sec. 13.6.2)
- C NC N/A U LS-MH; PR-MH. DRIFT: Rigid cementitious partitions are detailed to accommodate the following drift ratios: in steel moment frame, concrete moment frame, and wood frame buildings, 0.02; in other buildings, 0.005. (Commentary: A.7.1.2 Tier 2: Sec. 13.6.2)

STRUCTURAL EVALUATION

- C NC N/A U DIAPHRAGM REINFORCEMENT AT OPENINGS: There is reinforcing around all diaphragm openings larger than 50% of the building width in either major plan dimension. (Commentary: Sec. A.4.1.8. Tier 2: Sec. 5.6.1.5)

Flexible Diaphragms

- C NC N/A U CROSS TIES: There are continuous cross ties between diaphragm chords. (Commentary: Sec. A.4.1.2. Tier 2: Sec. 5.6.1.2)
- C NC N/A U STRAIGHT SHEATHING: All straight sheathed diaphragms have aspect ratios less than 1-to-1 in the direction being considered. (Commentary: Sec. A.4.2.1. Tier 2: Sec. 5.6.2)
- C NC N/A U SPANS: All wood diaphragms with spans greater than 12 ft consist of wood structural panels or diagonal sheathing. (Commentary: Sec. A.4.2.2. Tier 2: Sec. 5.6.2)
- C NC N/A U DIAGONALLY SHEATHED AND UNBLOCKED DIAPHRAGMS: All diagonally sheathed or unblocked wood structural panel diaphragms have horizontal spans less than 30 ft and aspect ratios less than or equal to 3-to-1. (Commentary: Sec. A.4.2.3. Tier 2: Sec. 5.6.2)
- C NC N/A U NONCONCRETE FILLED DIAPHRAGMS: Untopped metal deck diaphragms or metal deck diaphragms with fill other than concrete shall consist of horizontal spans of less than 40 ft and have aspect ratios less than 4-to-1. (Commentary: Sec. A.4.3.1. and Tier 2: Sec. 5.6.3)
- C NC N/A U OTHER DIAPHRAGMS: The diaphragm does not consist of a system other than wood, metal deck, concrete, or horizontal bracing. (Commentary: Sec. A.4.7.1. Tier 2: Sec. 5.6.5)

Connections

- C NC N/A U STIFFNESS OF WALL ANCHORS: Anchors of concrete or masonry walls to wood structural elements are installed taut and are stiff enough to limit the relative movement between the wall and the diaphragm to no greater than 1/8 in. before engagement of the anchors. (Commentary: Sec. A.5.1.4. Tier 2: Sec. 5.7.1.2)
- C NC N/A U BEAM, GIRDER, AND TRUSS SUPPORTS: Beams, girders, and trusses supported by unreinforced masonry walls or pilasters have independent secondary columns for support of vertical loads. (Commentary: Sec. A.5.4.5. Tier 2: Sec. 5.7.4.4)



STRUCTURAL EVALUATION

- C NC N/A U LS-not required; PR-MH. LIGHT PARTITIONS SUPPORTED BY CEILINGS: The tops of gypsum board partitions are not laterally supported by an integrated ceiling system. (Commentary: Sec. A.7.2.1. Tier 2: Sec. 13.6.2)
- C NC N/A U LS-not required; PR-MH. STRUCTURAL SEPARATIONS: Partitions that cross structural separations have seismic or control joints. (Commentary: Sec. A.7.1.3. Tier 2: Sec. 13.6.2)
- C NC N/A U LS-not required; PR-MH. TOPS: The tops of ceiling-high framed or panelized partitions have lateral bracing to the structure at a spacing equal to or less than 6 ft. (Commentary: Sec. A.7.1.4. Tier 2: Sec. 13.6.2)

Ceilings

- C NC N/A U LS-MH; PR-LMH. SUSPENDED LATH AND PLASTER: Suspended lath and plaster ceilings have attachments that resist seismic forces for every 12 ft² of area. (Commentary: Sec. A.7.2.3. Tier 2: Sec. 13.6.4)
- C NC N/A U LS-MH; PR-LMH. SUSPENDED GYPSUM BOARD: Suspended gypsum board ceilings have attachments that resist seismic forces for every 12 ft² of area. (Commentary: Sec. A.7.2.3. Tier 2: Sec. 13.6.4)
- C NC N/A U LS-not required; PR-MH. INTEGRATED CEILINGS: Integrated suspended ceilings with continuous areas greater than 144 ft², and ceilings of smaller areas that are not surrounded by restraining partitions, are laterally restrained at a spacing no greater than 12 ft with members attached to the structure above. Each restraint location has a minimum of four diagonal wires and compression struts, or diagonal members capable of resisting compression. (Commentary: Sec. A.7.2.2. Tier 2: Sec. 13.6.4)
- C NC N/A U LS-not required; PR-MH. EDGE CLEARANCE: The free edges of integrated suspended ceilings with continuous areas greater than 144 ft² have clearances from the enclosing wall or partition of at least the following: in Moderate Seismicity, 1/2 in.; in High Seismicity, 3/4 in. (Commentary: Sec. A.7.2.4. Tier 2: Sec. 13.6.4)
- C NC N/A U LS-not required; PR-MH. CONTINUITY ACROSS STRUCTURE JOINTS: The ceiling system does not cross any seismic joint and is not attached to multiple independent structures. (Commentary: Sec. A.7.2.5. Tier 2: Sec. 13.6.4)
- C NC N/A U LS-not required; PR-H. EDGE SUPPORT: The free edges of integrated suspended ceilings with continuous areas greater than 144 ft² are supported by closure angles or channels not less than 2 in. wide. (Commentary: Sec. A.7.2.6. Tier 2: Sec. 13.6.4)
- C NC N/A U LS-not required; PR-H. SEISMIC JOINTS: Acoustical tile or lay-in panel ceilings have seismic separation joints such that each continuous portion of the ceiling is no more than 2500 ft² and has a ratio of long-to-short dimension no more than 4-to-1. (Commentary: Sec. A.7.2.7. Tier 2: 13.6.4)

Light Fixtures

- C NC N/A U LS-MH; PR-MH. INDEPENDENT SUPPORT: Light fixtures that weigh more per square foot than the ceiling they penetrate are supported independent of the grid ceiling suspension system by a minimum of two wires at diagonally opposite corners of each fixture. (Commentary: Sec. A.7.3.2. Tier 2: Sec. 13.6.4 and 13.7.9)
- C NC N/A U LS-not required; PR-H. PENDANT SUPPORTS: Light fixtures on pendant supports are attached at a spacing equal to or less than 6 ft and, if rigidly supported, are free to move with the structure to which they are attached without damaging adjoining components. (Commentary: A.7.3.3. Tier 2: Sec. 13.7.9)
- C NC N/A U LS-not required; PR-H. LENS COVERS: Lens covers on light fixtures are attached with safety devices. (Commentary: Sec. A.7.3.4. Tier 2: Sec. 13.7.9)

Cladding and Glazing

- C NC N/A U LS-MH; PR-MH. CLADDING ANCHORS: Cladding components weighing more than 10 lb/ft² are mechanically anchored to the structure at a spacing equal to or less than the following: for Life Safety in Moderate Seismicity, 6 ft; for Life Safety in High Seismicity and for Position Retention in any seismicity, 4 ft (Commentary: Sec. A.7.4.1. Tier 2: Sec. 13.6.1)
- C NC N/A U LS-MH; PR-MH. CLADDING ISOLATION: For steel or concrete moment frame buildings, panel connection are detailed to accommodate a story drift ratio of at least the following: for Life Safety in Moderate Seismicity, 0.01; for Life Safety in High Seismicity and for Position Retention in any seismicity, 0.02. (Commentary: Sec. A.7.4.3. Tier 2: Section 13.6.1)

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- C NC N/A U LS-MH; PR-MH. MULTI-STORY PANELS: For multi-story panels attached at more than one floor level, panel connections are detailed to accommodate a story drift ratio of at least the following: for Life Safety in Moderate Seismicity, 0.01; for Life Safety in High Seismicity and for Position Retention in any seismicity, 0.02. (Commentary: Sec. A.7.4.4. Tier 2: Sec. 13.6.1)
- C NC N/A U LS-MH; PR-MH. PANEL CONNECTIONS: Cladding panels are anchored out-of-plane with a minimum number of connections for each wall panel, as follows: for Life Safety in Moderate Seismicity, 2 connections; for Life Safety in High Seismicity and for Position Retention in any seismicity, 4 connections. (Commentary: Sec. A.7.4.5. Tier 2: Sec. 13.6.1.4)
- C NC N/A U LS-MH; PR-MH. BEARING CONNECTIONS: Where bearing connections are used, there is a minimum of two bearing connections for each cladding panel. (Commentary: Sec. A.7.4.6. Tier 2: Sec. 13.6.1.4)
- C NC N/A U LS-MH; PR-MH. INSERTS: Where concrete cladding components use inserts, the inserts have positive anchorage or are anchored to reinforcing steel. (Commentary: Sec. A.7.4.7. Tier 2: Sec. 13.6.1.4)
- C NC N/A U LS-MH; PR-MH. OVERHEAD GLAZING: Glazing panes of any size in curtain walls and individual interior or exterior panes over 16 ft² in area are laminated annealed or laminated heat-strengthened glass and are detailed to remain in the frame when cracked. (Commentary: Sec. A.7.4.8: Tier 2: Sec. 13.6.1.5)

Masonry Veneer

- C NC N/A U LS-LMH; PR-LMH. TIES: Masonry veneer is connected to the backup with corrosion-resistant ties. There is a minimum of one tie for every 2-2/3 ft², and the ties have spacing no greater than the following: for Life Safety in Low or Moderate Seismicity, 36 in.; for Life Safety in High Seismicity and for Position Retention in any seismicity, 24 in. (Commentary: Sec. A.7.5.1. Tier 2: Sec. 13.6.1.2)
- C NC N/A U LS-LMH; PR-LMH. SHELF ANGLES: Masonry veneer is supported by shelf angles or other elements at each floor above the ground floor. (Commentary: Sec. A.7.5.2. Tier 2: Sec. 13.6.1.2)
- C NC N/A U LS-LMH; PR-LMH. WEAKENED PLANES: Masonry veneer is anchored to the backup adjacent to weakened planes, such as at the locations of flashing. (Commentary: Sec. A.7.5.3. Tier 2: Sec. 13.6.1.2)
- C NC N/A U LS-LMH; PR-LMH. UNREINFORCED MASONRY BACKUP: There is no unreinforced masonry backup. (Commentary: Sec. A.7.7.2. Tier 2: Section 13.6.1.1 and 13.6.1.2)
- C NC N/A U LS-MH; PR-MH. STUD TRACKS: For veneer with metal stud backup, stud tracks are fastened to the structure at a spacing equal to or less than 24 in. on center. (Commentary: Sec. A.7.6.1. Tier 2: Section 13.6.1.1 and 13.6.1.2)
- C NC N/A U LS-MH; PR-MH. ANCHORAGE: For veneer with concrete block or masonry backup, the backup is positively anchored to the structure at a horizontal spacing equal to or less than 4 ft along the floors and roof. (Commentary: Sec. A.7.7.1. Tier 2: Section 13.6.1.1 and 13.6.1.2)
- C NC N/A U LS-not required; PR-MH. WEEP HOLES: In veneer anchored to stud walls, the veneer has functioning weep holes and base flashing. (Commentary: Sec. A.7.5.6. Tier 2: Section 13.6.1.2)
- C NC N/A U LS-not required; PR-MH. OPENINGS: For veneer with metal stud backup, steel studs frame window and door openings. (Commentary: Sec. A.7.6.2. Tier 2: Sec. 13.6.1.1 and 13.6.1.2)

Parapets, Cornices, Ornamentation, and Appendages

- C NC N/A U LS-LMH; PR-LMH. URM PARAPETS OR CORNICES: Laterally unsupported unreinforced masonry parapets or cornices have height-to-thickness ratios no greater than the following: for Life Safety in Low or Moderate Seismicity, 2.5; for Life Safety in High Seismicity and for Position Retention in any seismicity, 1.5. (Commentary: Sec. A.7.8.1. Tier 2: Sec. 13.6.5)
- C NC N/A U LS-LMH; PR-LMH. CANOPIES: Canopies at building exits are anchored to the structure at a spacing no greater than the following: for Life Safety in Low or Moderate Seismicity, 10 ft; for Life Safety in High Seismicity and for Position Retention in any seismicity, 6 ft. (Commentary: Sec. A.7.8.2. Tier 2: Sec. 13.6.6)
- C NC N/A U LS-MH; PR-LMH. CONCRETE PARAPETS: Concrete parapets with height-to-thickness ratios greater than 2.5 have vertical reinforcement. (Commentary: Sec. A.7.8.3. Tier 2: Sec. 13.6.5)
- C NC N/A U LS-MH; PR-LMH. APPENDAGES: Cornices, parapets, signs, and other ornamentation or appendages that extend above the highest point of anchorage to the structure or cantilever from components are reinforced and anchored to the structural system at a spacing equal to or less than 6 ft. This checklist item does not apply to parapets or cornices covered by other checklist items. (Commentary: Sec. A.7.8.4. Tier 2: Sec. 13.6.6)



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Masonry Chimneys

- C NC N/A U LS-LMH; PR-LMH. URM CHIMNEYS: Unreinforced masonry chimneys extend above the roof surface no more than the following: for Life Safety in Low or Moderate Seismicity, 3 times the least dimension of the chimney; for Life Safety in High Seismicity and for Position Retention in any seismicity, 2 times the least dimension of the chimney. (Commentary: Sec. A.7.9.1. Tier 2: 13.6.7)
- C NC N/A U LS-LMH; PR-LMH. ANCHORAGE: Masonry chimneys are anchored at each floor level, at the topmost ceiling level, and at the roof. (Commentary: Sec. A.7.9.2. Tier 2: 13.6.7)

Stairs

- C NC N/A U LS-LMH; PR-LMH. STAIR ENCLOSURES: Hollow-clay tile or unreinforced masonry walls around stair enclosures are restrained out-of-plane and have height-to-thickness ratios not greater than the following: for Life Safety in Low or Moderate Seismicity, 15-to-1; for Life Safety in High Seismicity and for Position Retention in any seismicity, 12-to-1. (Commentary: Sec. A.7.10.1. Tier 2: Sec. 13.6.2 and 13.6.8)
- C NC N/A U LS-LMH; PR-LMH. STAIR DETAILS: In moment frame structures, the connection between the stairs and the structure does not rely on shallow anchors in concrete. Alternatively, the stair details are capable of accommodating the drift calculated using the Quick Check procedure of Section 4.5.3.1 without including any lateral stiffness contribution from the stairs. (Commentary: Sec. A.7.10.2. Tier 2: 13.6.8)

Contents and Furnishings

- C NC N/A U LS-MH; PR-MH. INDUSTRIAL STORAGE RACKS: Industrial storage racks or pallet racks more than 12 ft high meet the requirements of ANSI/MH 16.1 as modified by ASCE 7 Chapter 15. (Commentary: Sec. A.7.11.1. Tier 2: Sec. 13.8.1)
- C NC N/A U LS-H; PR-MH. TALL NARROW CONTENTS: Contents more than 6 ft high with a height-to-depth or height-to-width ratio greater than 3-to-1 are anchored to the structure or to each other. (Commentary: Sec. A.7.11.2. Tier 2: Sec. 13.8.2)
- C NC N/A U LS-H; PR-H. FALL-PRONE CONTENTS: Equipment, stored items, or other contents weighing more than 20 lb whose center of mass is more than 4 ft above the adjacent floor level are braced or otherwise restrained. (Commentary: Sec. A.7.11.3. Tier 2: Sec. 13.8.2)
- C NC N/A U LS-not required; PR-MH. ACCESS FLOORS: Access floors more than 9 in. high are braced. (Commentary: Sec. A.7.11.4. Tier 2: Sec. 13.8.3)
- C NC N/A U LS-not required; PR-MH. EQUIPMENT ON ACCESS FLOORS: Equipment and other contents supported by access floor systems are anchored or braced to the structure independent of the access floor. (Commentary: Sec. A.7.11.5. Tier 2: Sec. 13.7.7 and 13.8.3)
- C NC N/A U LS-not required; PR-H. SUSPENDED CONTENTS: Items suspended without lateral bracing are free to swing from or move with the structure from which they are suspended without damaging themselves or adjoining components. (Commentary: A.7.11.6. Tier 2: Sec. 13.8.2)

Mechanical and Electrical Equipment

- C NC N/A U LS-H; PR-H. FALL-PRONE EQUIPMENT: Equipment weighing more than 20 lb whose center of mass is more than 4 ft above the adjacent floor level, and which is not in-line equipment, is braced. (Commentary: A.7.12.4. Tier 2: 13.7.1 and 13.7.7)
- C NC N/A U LS-H; PR-H. IN-LINE EQUIPMENT: Equipment installed in-line with a duct or piping system, with an operating weight more than 75 lb, is supported and laterally braced independent of the duct or piping system. (Commentary: Sec. A.7.12.5. Tier 2: Sec. 13.7.1)
- C NC N/A U LS-H; PR-MH. TALL NARROW EQUIPMENT: Equipment more than 6 ft high with a height-to-depth or height-to-width ratio greater than 3-to-1 is anchored to the floor slab or adjacent structural walls. (Commentary: Sec. A.7.12.6. Tier 2: Sec. 13.7.1 and 13.7.7)
- C NC N/A U LS-not required; PR-MH. MECHANICAL DOORS: Mechanically operated doors are detailed to operate at a story drift ratio of 0.01. (Commentary: Sec. A.7.12.7. Tier 2: Sec. 13.6.9)

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- C NC N/A U LS-not required; PR-H. SUSPENDED EQUIPMENT: Equipment suspended without lateral bracing is free to swing from or move with the structure from which it is suspended without damaging itself or adjoining components. (Commentary: Sec. A.7.12.8. Tier 2: Sec. 13.7.1 and 13.7.7)
- C NC N/A U LS-not required; PR-H. VIBRATION ISOLATORS: Equipment mounted on vibration isolators is equipped with horizontal restraints or snubbers and with vertical restraints to resist overturning. (Commentary: Sec. A.7.12.9. Tier 2: Sec. 13.7.1)
- C NC N/A U LS-not required; PR-H. HEAVY EQUIPMENT: Floor-supported or platform-supported equipment weighing more than 400 lb is anchored to the structure. (Commentary: Sec. A.7.12.10. Tier 2: 13.7.1 and 13.7.7)
- C NC N/A U LS-not required; PR-H. ELECTRICAL EQUIPMENT: Electrical equipment is laterally braced to the structure. (Commentary: Sec. A.7.12.11. Tier 2: 13.7.7)
- C NC N/A U LS-not required; PR-H. CONDUIT COUPLINGS: Conduit greater than 2.5 in. trade size that is attached to panels, cabinets, or other equipment and is subject to relative seismic displacement has flexible couplings or connections. (Commentary: Sec. A.7.12.12. Tier 2: 13.7.8)

Piping

- C NC N/A U LS-not required; PR-H. FLEXIBLE COUPLINGS: Fluid and gas piping has flexible couplings. (Commentary: Sec. A.7.13.2. Tier 2: Sec. 13.7.3 and 13.7.5)
- C NC N/A U LS-not required; PR-H. FLUID AND GAS PIPING: Fluid and gas piping is anchored and braced to the structure to limit spills or leaks. (Commentary: Sec. A.7.13.4. Tier 2: Sec. 13.7.3 and 13.7.5)
- C NC N/A U LS-not required; PR-H. C-CLAMPS: One-sided C-clamps that support piping larger than 2.5 in. in diameter are restrained. (Commentary: Sec. A.7.13.5. Tier 2: Sec. 13.7.3 and 13.7.5)
- C NC N/A U LS-not required; PR-H. PIPING CROSSING SEISMIC JOINTS: Piping that crosses seismic joints or isolation planes or is connected to independent structures has couplings or other details to accommodate the relative seismic displacements. (Commentary: Sec. A.7.13.6. Tier 2: Sec. 13.7.3 and Sec. 13.7.5)

Ducts

- C NC N/A U LS-not required; PR-H. DUCT BRACING: Rectangular ductwork larger than 6 ft² in cross-sectional area and round ducts larger than 28 in. in diameter are braced. The maximum spacing of transverse bracing does not exceed 30 ft. The maximum spacing of longitudinal bracing does not exceed 60 ft. (Commentary: Sec. A.7.14.2. Tier 2: Sec. 13.7.6)
- C NC N/A U LS-not required; PR-H. DUCT SUPPORT: Ducts are not supported by piping or electrical conduit. (Commentary: Sec. A.7.14.3. Tier 2: Sec. 13.7.6)
- C NC N/A U LS-not required; PR-H. DUCTS CROSSING SEISMIC JOINTS: Ducts that cross seismic joints or isolation planes or are connected to independent structures have couplings or other details to accommodate the relative seismic displacements. (Commentary: Sec. A.7.14.5. Tier 2: Sec. 13.7.6)

Elevators

- C NC N/A U LS-H; PR-H. RETAINER GUARDS: Sheaves and drums have cable retainer guards. (Commentary: Sec. A.7.16.1. Tier 2: 13.8.6)
- C NC N/A U LS-H; PR-H. RETAINER PLATE: A retainer plate is present at the top and bottom of both car and counterweight. (Commentary: Sec. A.7.16.2. Tier 2: 13.8.6)
- C NC N/A U LS-not required; PR-H. ELEVATOR EQUIPMENT: Equipment, piping, and other components that are part of the elevator system are anchored. (Commentary: Sec. A.7.16.3. Tier 2: 13.8.6)
- C NC N/A U LS-not required; PR-H. SEISMIC SWITCH: Elevators capable of operating at speeds of 150 ft/min or faster are equipped with seismic switches that meet the requirements of ASME A17.1 or have trigger levels set to 20% of the acceleration of gravity at the base of the structure and 50% of the acceleration of gravity in other locations. (Commentary: Sec. A.7.16.4. Tier 2: 13.8.6)



STRUCTURAL EVALUATION

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| C | NC | N/A | U | LS-not required; PR-H. SHAFT WALLS: Elevator shaft walls are anchored and reinforced to prevent toppling into the shaft during strong shaking. (Commentary: Sec. A.7.16.5. Tier 2: 13.8.6) |
| C | NC | N/A | U | LS-not required; PR-H. COUNTERWEIGHT RAILS: All counterweight rails and divider beams are sized in accordance with ASME A17.1. (Commentary: Sec. A.7.16.6. Tier 2: 13.8.6) |
| C | NC | N/A | U | LS-not required; PR-H. BRACKETS: The brackets that tie the car rails and the counterweight rail to the structure are sized in accordance with ASME A17.1. (Commentary: Sec. A.7.16.7. Tier 2: 13.8.6) |
| C | NC | N/A | U | LS-not required; PR-H. SPREADER BRACKET: Spreader brackets are not used to resist seismic forces. (Commentary: Sec. A.7.16.8. Tier 2: 13.8.6) |
| C | NC | N/A | U | LS-not required; PR-H. GO-SLOW ELEVATORS: The building has a go-slow elevator system. (Commentary: Sec. A.7.16.9. Tier 2: 13.8.6) |

