NEEDS ASSESSMENT

PENDLETON FIRE DEPARTMENT

OUR HISTORY. OUR FUTURE. OUR PROMISE.

The values of our founder, Tom Mackenzie, remain the hallmarks of our firm. Upon this foundation we have, steadily and intentionally, built a team of experts focused on delivering the highest level of design excellence in service to our clients. This mark is our signature and our bond.

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The information in this document has been obtained from sources believed reliable. Our findings have been based on limited information and on-site observation. Because of the limited scope of our initial review, these preliminary findings should not be used as a principal basis for any decision relating to the site and/or building, and confirmation of the information contained within this document with the applicable government body may be necessary.

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INTRODUCTION

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City of Pendleton Design Team

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Mackenzie

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Construction Focus, Inc.

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PROJECT INTRODUCTION

The Pendleton Fire Department is seeking to address serious issues at their existing Fire Station 1, built in 1959. The objective is to develop a facility to better meet their needs and goals; provide a more efficient operational model and layout; better align with the current space demand for the Fire Department; and allow for future prospective staff and facility growth.

To aid the City of Pendleton with these efforts, the City selected Mackenzie to assist with an evaluation of the existing conditions of the current facility and work with staff to determine an anticipated building space needs program for a replacement facility; and provide a conceptual plan and cost estimate for the building.

Mackenzie, established in 1960 and based in Portland, Oregon, provides an integrated design approach to projects, including architecture, structural engineering, landscape architecture, civil engineering, land use planning, transportation planning and interior design services. Mackenzie's Public Projects team specializes in municipal and emergency response facility design, space needs evaluations, and bond campaign assistance. In the past decade, Mackenzie has worked on publicly funded projects in Oregon and Washington for more than 50 counties and municipalities, providing design and engineering services for more than 40 fire facilities, 18 Fire facilities and six municipal office buildings.

Our goal at the beginning of the process was to develop a build-out to meet the 30-year needs of the Pendleton Fire Department. The program Mackenzie developed supports the Department's long-term space and site needs, and accounts for future on-site training. To accommodate the 30-year needs of the Department, the envisioned facility is approximately 18,415 SF, and requires about 1 ½ acres of land. Based on the findings in this report, Mackenzie has provided an estimate of anticipated project costs required to fund the selected scheme, inclusive of construction, consultant, and owner costs.

The information contained within this report provides a detailed overview of Mackenzie's work with the Pendleton Fire Department. All steps involved in this process have been documented and organized based on the associated task, and are contained within the pages of this report for the City of Pendleton's consideration. Recommendations for next steps have been outlined at the end of the Executive Summary.

EXECUTIVE SUMMARY

Fire station design is unique in that the building and all its functions are tools required to most effectively and efficiently enhance agency operations and safety. Fire station design focuses on functionality and meeting the stringent requirements associated with protection and security of the building, its staff, and the communities they serve. Jurisdictional, state, and federal criteria for safety, security and operational procedures drive these requirements and invariably impact design considerations. These criteria ensure that facilities are not only able to improve operational efficiency on a day-to-day basis, but are capable of evolving over the life of the building, resisting and responding to emergency events, providing critical services for the citizens of Pendleton, enhancing the built environment of the surrounding area with a strong civic presence, and encouraging investment in the community.

The following report encompasses the primary tasks requested by the Pendleton Fire Department to determine the feasibility of a replacement facility for Station 1 in meeting the criteria stated above:

1) Site Investigation / Existing Conditions
2) Program Development
3) Precedent Facilities / Facility Tour
4) Potential Site Evaluation
5) Plan Development
6) Visioning / Public Outreach
7) Conceptual Design
8) Cost Development

Process and Methodology
Mackenzie employed programming, communication, consensus-building, and goal-setting techniques to ensure that the final report meets the expectations of the stakeholders involved in the process. Using a multidisciplinary approach, extensive public project experience, and lessons learned on previous fire station and public building projects, the team provided architectural, structural, space planning, site planning and land use planning services to meet the project objectives and deliverables.

Mackenzie worked with the City of Pendleton and Pendleton Fire Department staff to confirm the key stakeholders who needed to be involved throughout the design process and to support and strengthen dialogue between the Design Team and the City.

Task #1: Site Investigation / Existing Conditions Assessment
Mackenzie toured the existing facility at 911 SW Court Ave to examine and document current operations as well as space and structural deficiencies, as they pertain to the seismic design requirements of an essential facility. This evaluation set the stage for future programming dialogue around operational requirements, department culture, and required adjacencies—both those indicative of fire station facilities in general as well as those unique to the Pendleton Fire Department. The preliminary focus of this task was to concentrate on examination and documentation of existing infrastructure, access and current circulation, secure and public parking, ADA compliance, life safety compliance and additional land use regulatory requirements.
Primary concerns noted through evaluation of the existing facilities include:

- Based on the age and condition of Fire Station 1, the facility does not meet basic code related

structural requirements, let alone those required of essential facilities.

- Due to the age of the facility, some of the existing building materials likely contain hazardous materials, such as asbestos.
- There are no fire sprinklers present throughout the facility. Facilities containing residential occupancies are required by code to have fully automatic fire protection, and smoke detection and alarm systems.
- There is a shortage of available space to effectively and efficiently operate within the confines of the existing facility.
- The systems of the building are well past their useful life and are not scaled appropriately for the building.
- The facility does not provide for the proper ADA improvements required of public facilities such as accessible door hardware, and accessible clearances in kitchen and restroom facilities.
- Due to site constraints, there is a lack of adequate on-site parking for staff, public vehicles, and visitors.
- Energy code deficiencies are evident throughout the facility: there is insufficient insulation at exterior walls and roof, and inadequate thermal performance at windows and doors.
- The facility lacks appropriate facilities for female staff.

Task #2: Program Development

In conjunction with examination of present conditions, Mackenzie worked closely with the Pendleton Fire Department staff to better understand the current space needs and projected those needs out based on a 30-year forecast. To do so, Mackenzie guided the Fire Department through the process of space needs identification and required space allocations. From that, the Design Team developed a program matrix that identified the required spaces, their approximate size and amenities to be provided within them. In addition to the primary functional space of the facility, the team projected circulation space and requirements for utilitarian areas, such as mechanical, electrical, and data room spaces to comprise a complete, comprehensive programming document. Evaluation of the space needs program determined that a facility of approximately 18,415 square feet would be necessary by the end of the 30-year forecast window.

The programing process also included a discussion of site-related requirements identified during the staff interviews (secure parking, visitor parking, staff patio area, recycling, fueling, emergency generator etc.) to determine an appropriate site area able to accommodate both building and site program elements. 30-year projections indicate a demand for approximately 24 paved parking stalls for the public, 18 spaces for staff vehicles, exterior break-out space adjacent to the main entrance for the public, outdoor space adjacent to the living quarters for staff, and ample site area to accommodate future training activities.

Mackenzie validated these identified growth projections and space needs through the evaluation of comparable facilities within similar jurisdictions in the region (see page 04-04 for trending spreadsheet).

Task #3: Precedent Facilities / Facility Tours

In this task, Mackenzie arranged tours of three comparable fire stations with key Fire Department staff.

These stations were:
Lake Oswego Fire Department – Station 214
Tualatin Valley Fire & Rescue – Station 53
Hillsboro Fire Department – Station 6

These facilities were selected based on similar size and specific program requirements to that of the Pendleton Fire program. The intent of these tours was to observe recently completed facilities, learn how those agencies developed the design to meet their needs, and challenge assumptions that were made during the program development in Task 2. While on these tours, particular attention was given to the flow of spaces, durability of materials and finishes used, and how the building is aging. These tours are a great tool to test assumptions made by key staff during programming, in that seeing the layout of a space or size of a room sometimes will steer one to adjust their expectations of how big to make a space or confirm the assumption made. Lessons learned or items to be refined were discussed at the conclusion of the tours and relevant items were clarified in the program as a final approved document.

Task #4: Potential Site Evaluation
Mackenzie worked with the City to develop a list of five possible sites potentially suitable for development. Each site was evaluated using selection criteria (developed by Mackenzie specific to fire station facility and site design) as well as impacts to response time throughout the Department's service area. Evaluation criteria included zoning impacts, geographic considerations, site access, public presence, and compatibility with neighborhood, location, proximity to other city/government functions, site development costs, property availability, expansion opportunities and ability to meet program requirements. Each site was evaluated on its ability to accommodate each criterion, including resulting response time findings, and given a score between 1 (lowest) - 4 (highest). Once evaluated, each score was then tallied to determine the overall score for the individual sites. The site with the highest score in response to the criteria was then identified as the preferred site for the project.

Based on this process, and utilizing programming data, adjacency requirements and operational necessities, Mackenzie identified the Old St. Anthony's Hospital site as best suited to meet the needs of the Fire Department. This site was then used as the basis for further design development.

Task #5: Plan Development
After programming had been confirmed, Mackenzie prepared a series of four development scenarios on the Old St. Anthony's Hospital site to evaluate the operational flow and larger programming adjacencies of the site and building. Each development scenario was considered based on both its strengths and weaknesses; and of these development scenarios, the Design Team advanced the two concepts that best met the functional needs of the department to illustrate in more detailed the spatial adjacencies and relationships specific to fire facility requirements. These concepts were developed to graphically represent programming functions and their relationships to each other while also taking into consideration department culture, work philosophies and general circulation.

Both concepts identified a two-story facility to provide responders the best access to the apparatus bay from within the structure, with the difference between the two being the location of the second floor, which was either directly above the administrative area (Scheme 3), or over the apparatus bay (Scheme 4). After consideration, the Fire Department elected to advance Scheme 3 due to the advantages over Scheme 4 described in that section. Once selected, Scheme 3 was advanced to a level reflective of a conceptual site plan and building floor plan. Each plan identified specific spatial use, sizes, accommodations and adjacencies to other spaces. These preliminary site plans and floor plans were developed based on the information gathered during the previous tasks and reviewed with the Fire Department to obtain approval of the preferred scheme.

Task #6: Project Visioning

Task #6 entailed development of the exterior character of the facility through studies aimed at understanding the City of Pendleton's key architectural and geographic influences, and evaluating characteristics of similar municipal facilities within other communities. Mackenzie presented a series of images to the project team, and through discussion landed upon the imagery that best reflected the City's vision, and could be used to direct the Final Conceptual Design.

Task #7: Concept Design Finalization

Building on the approved site and building layout, and taking into account the vision for the exterior character of the building as expressed by the Fire Department, Mackenzie developed a series of massing sketches that described the form and material quality of the facility. Of the three options developed, the Fire Department selected one concept option (Concept C) for further refinement. The selected scheme incorporated details consistent with the surrounding neighborhood context while maintaining a strong civic statement through use of building materials and street presence. Mackenzie then developed a computer-generated rendering of the selected conceptual design to more clearly describe the intended application of building materials and give better definition to the building form that could be better utilized in the Cost Development task following this task.

Task #8: Cost Development

Based on the selected conceptual design, Construction Focus, Inc., Developed an opinion of probable construction cost for the new Fire station and associated site development improvements for the project. These cost projections were comprised of the opinion of costs related to the anticipated raw construction costs and anticipated general contractor margins based on a publicly funded project requiring prevailing wage rates for construction.

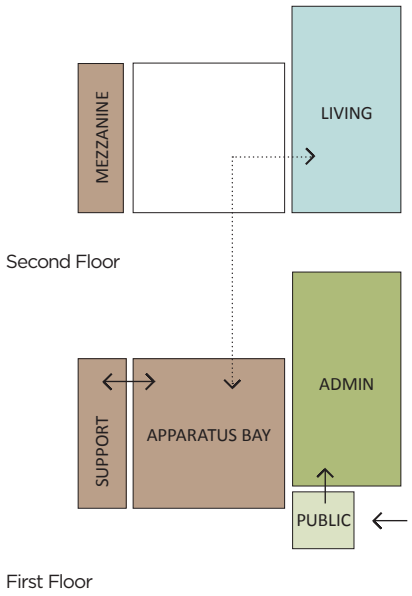
In conjunction with the development of the construction costs, Mackenzie prepared cost forecasts for consultant costs, including architectural/engineering fees, construction management fees, special inspections, geotechnical inspections, etc. Additionally, Mackenzie worked with the Pendleton

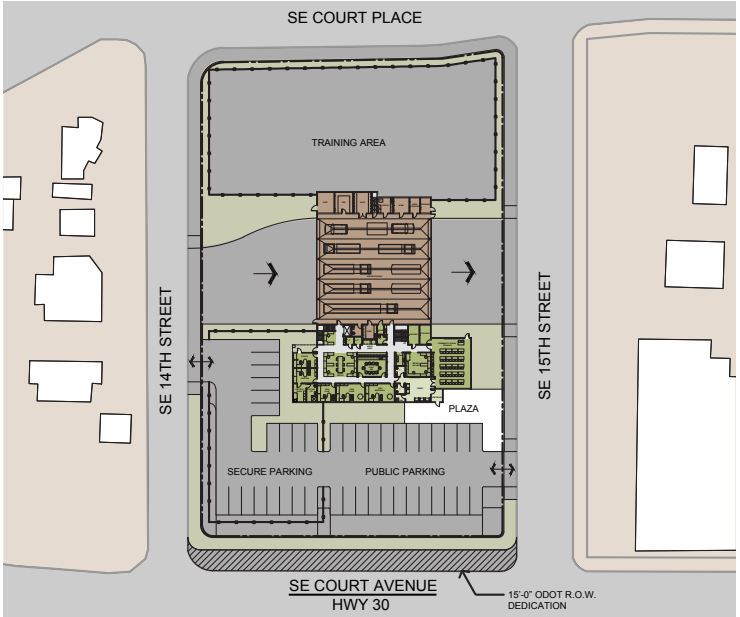
Fire Department to evaluate and compile potential owner costs, including fixtures, furnishings and equipment, lockers and shelving, fitness equipment, moving costs, and applicable permit fees. A final cost matrix was prepared providing a comprehensive look at all anticipated costs, which were also summarized to reflect the construction cost, consultant costs and owner costs.

PENDLETON FIRE STATION 1		
Construction Cost - Building	$3,322,398	
Construction Cost - Site	$703,273	
Construction Cost - Street Improvements	$382,342	
Total Construction Costs	**$4,408,013**	
	LOW	**HIGH**
Contingency	$462,841	$969,763
General Conditions	$356,388	$407,300
Profit & Overhead	$326,859	$373,533
Performance Bond	$46,616	$52,347
Inflation	$220,401	$440,801
Total Consultant Costs	**$767,547.85**	
Total Owner Costs	**$864,107.58**	
Total Project Cost Range:	**$7,452,773.43**	**$8,397,396.40**

SUMMARY OF RECOMMENDATIONS

- Examination of the existing fire station building and site has found that the required building program developed based on a 30-year projection as described within this report cannot be accommodated by the existing site. Similarly, the building's condition, structural deficiencies, existing hazardous materials, lack of ADA requirements, and outdated systems as described in this report do not make the reuse of the building for an essential facility practical or cost-effective.
- Our recommendation is for the Pendleton Fire Department to move forward with a replacement of Station 1 on an alternate property that meets their operational and essential facility requirements.





NEXT STEPS

- **Determine Availability and Cost of the Property**
  At the time of this report, the cost of the preferred site was unavailable, and therefore an estimated allowance was included in the project cost estimate. Before the project budget is finalized, the availability and cost of the preferred site should be determined.
- **Establish a Desired Time Line and Budget for the Project**
  Based on the findings of Mackenzie's analysis, it is determined that the overall projected costs of the project as described in this report are estimated to be between $7,452,773 and $8,397,396. It is encouraged that the Department agree on an expectation of project costs and schedule development to provide clear direction to those that represent the Department and their consultants.
- **Determine Funding Mechanism**
  Confirm the funding mechanism(s) the Department expects to pursue to complete the project. Once determined, the Department should assess the financial impact, if any, to the local community in comparison to previous voter approvals, and the timing for pursuing the selected funding mechanism.
- **Begin the Public Outreach/Campaign Process**
  Begin the process of presenting the need for the project to local community. This effort should entail community visioning sessions to allow attendees to observe the condition of the existing station, as well as presenting the findings of the Needs Assessment process. A process for outreach to local community organizations and private business with an interest in the project should be developed and executed. Provide consistent updates and feedback to the community to ensure that the message reaches as many people as possible. Identify advocates for your project and solicit their participation in the assembly of a Public Advisory Committee (PAC). This committee should be comprised of local community members, either active in, or supportive of the needs of the City of Pendleton and the Pendleton Fire Department.

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EXISTING FACILITY ASSESSMENT

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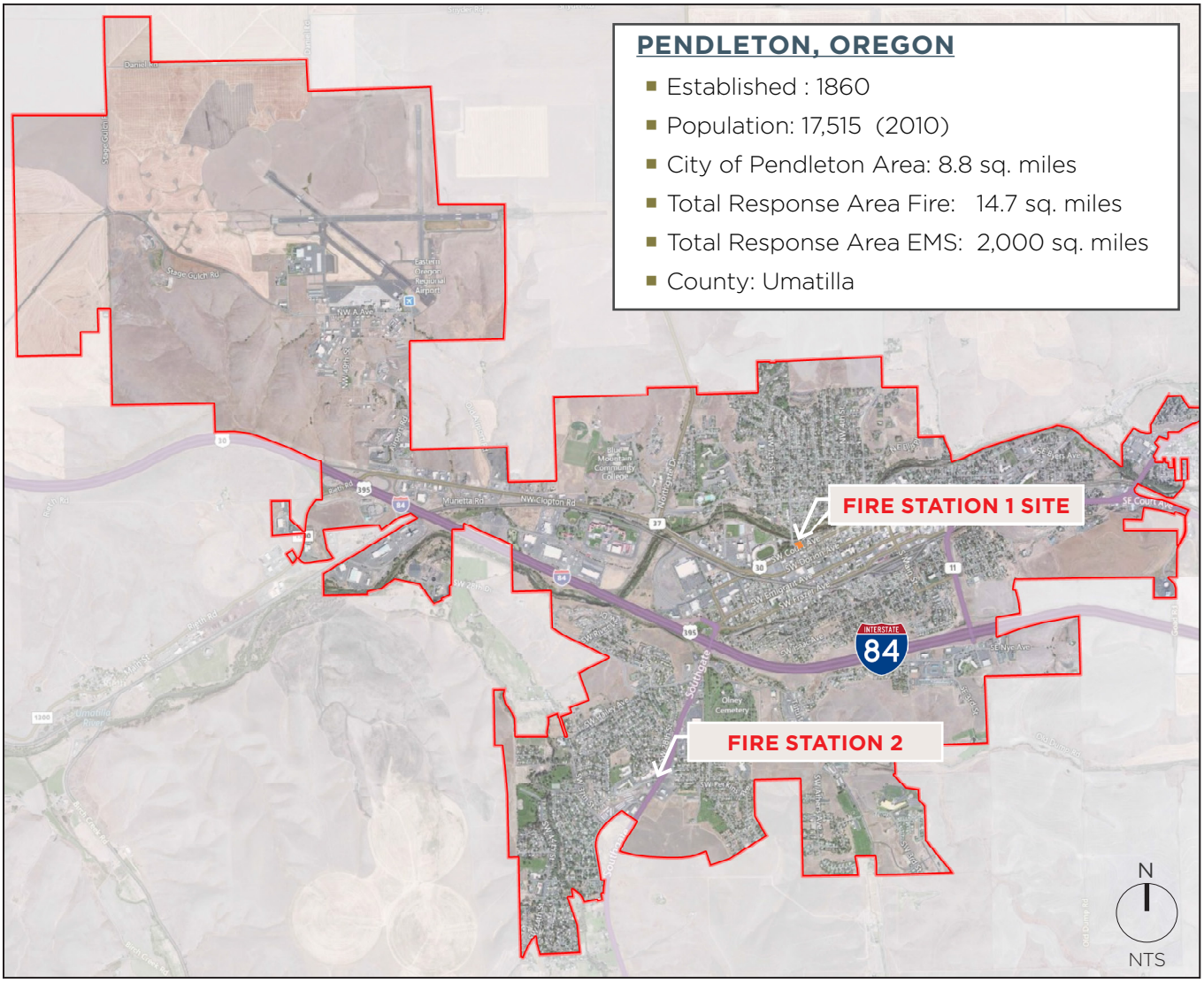
EXISTING FACILITY ASSESSMENT

The Pendleton Fire Department services a population of 17,515 within a district of 14.7 square miles. The Department accounts for 3 fire stations, 9 apparatus, and 32 employees with an average total number of responses per year of 2,558.

Station 1 is a single story building, which occupies approximately 10,900 square feet at 911 SW Court Avenue in Pendleton, Oregon. It was built in 1959 and staffs 7 twenty-four hour employees and 3 day-shift employees.

Mackenzie performed an architectural, structural, and high level building systems observation of the existing building, including review of its current use, operational deficiencies, and structural condition. Mackenzie's primary observations have been summarized with photo identification noted on the following floor and site plans and subsequent pages of this section.



EVALUATION OF DEFICIENCIES

Overall, from our observation, the current condition of the building is not suitable to meet the needs of the Pendleton Fire Department. Of primary concern is the lack of structural capacity required for Immediate Occupancy classification of Essential Facilities, the degradation of interior and exterior building materials as well as safety concerns for both staff and the general public resulting from the inadequacy of the condition of the facility. Beyond those aspects, interior spaces are undersized and over-utilized to meet the Department's current needs, and is non-compliant towards ADA (The Americans with Disabilities Act) and Oregon Energy Code standards.

Operational Deficiencies

The existing building and site are not sized adequately to serve the use intended by the Fire Department for this facility. The station site and adjacent residential lot currently serving as living quarters for the Fire Department's resident program provides limited parking for staff and the public, and as a result does not allow for the existing hose tower to be used for training purposes due to the congestion created. The apparatus bays are currently back in bays, not drive-thru requiring apparatus to potentially block traffic periodically on Hwy 30 when returning from a call.

With respect to the building itself, most all interior spaces are undersized and provide no accommodation for future growth. Living spaces within the facility do not provide equitable space for both male and female staff and as such, creates severe privacy issues between the sexes; administrative space throughout the facility is minimal at best and has security issues with how the reception area interacts with the public lobby. There is no dedicated communications room; paging equipment is currently located in a storage room; and the fitness room lacks clear height for required equipment.

The support areas lack the necessary improvements to adequately support the maintenance demands of the Department at this location; and in some circumstances have required equipment (ie turn-out gear and other PPE) to be stored in locations that cause those items to deteriorate over a much shorter amount of time.

Building Code Deficiencies

As it relates to current code requirements, there is a number of building code related deficiencies present in the existing facility. The existing building does not have a fully-automatic fire sprinkler system required of current code for a facility of this type; proper fire separation between specific occupancies is not in place; due to the size of the facility, two accessible exits are required but only one is provided; egress throughout the facility is not signed appropriately; general lighting levels are lower than that required by code; and there are a number of material and floor transitions that could cause tripping hazards in the event of an emergency.

Energy Code Deficiencies

The structure is inadequately insulated from the exterior environment. Energy code requirements have changed significantly since the structure was completed and the R-value of the exterior walls are not sufficient to maintain the temperature of the interior in a cost-effective manner. In addition to being under-insulated, there are a number of thermal breaks around the exterior envelope of the building, including single-pane windows, un-insulated doors, and inadequate ventilation within the fitness area.

Building Material Deficiencies
The general condition of the building shell and interior indicate that, though the facility appears to be well maintained, the age of existing construction has extended well beyond its useful life. Among other things, there are routine moisture issues due to limited roof slope and standing water. There are several leaks throughout the building that have been patched as a result of this issue.

Due to the age of the facility, and through discussion with Fire Department staff, we believe hazardous materials are present on site in both the ceiling tile and flooring material, as well as a number of instances of lead paint. Because of the concern of this issue, we would recommend that the City have a hazardous material survey completed on the facility to ensure that the material is encapsulated and does not pose a threat to the building occupants.

Building System Deficiencies
Similar to the building materials, the existing building systems appear to be at, or nearing, the end of their useful life as well. Any improvements to the building would require a full replacement of the existing HVAC system, specifically to address the lack of ventilation within the apparatus bay which contributes to the migration of carcinogens into other spaces within the facility.

ADA Deficiencies
Due to the age of the facility, there are a number of areas that do not meet current building code requirements for ADA accessibility. New and remodeled Title II structures are required to meet ADA requirements. Fire Stations are classified as Title II structures. New construction is required to be in full compliance of ADA requirements, facilities that undergo additions or remodels must spend up to 25% of the total new construction cost to bring the project into compliance with current ADA accessibility requirements or closer to compliance by removing architectural barriers. Some of the areas observed as non-compliant were access from public way, accessible parking stalls, loading zone and access to the building, stair and handrail construction, sink/counter height, faucet controls, clearances at kitchen, toilets, transaction counter, door hardware and floor level transitions.

Structural Deficiencies Summary
The building consists of two distinct volumes: a west side and lower east side. The west section contains a large apparatus room of approximately 5500 SF, along with several smaller rooms, including an alarm room, battery room, chemical storage room, and furnace room. There are two overhead doors to provide access to the apparatus room on the south side of the building and one on the west side. The roof height in this section of the building is approximately 17 feet. The east section of the building contains the employee dormitories, day room, kitchen, and offices, and is about 3600 SF in size. The roof height in this section of the building is approximately 12 feet.

The building's floor is concrete slab-on-grade – six inches thick at the apparatus room and four inches thick elsewhere. The roof in the apparatus room is metal deck supported by steel open web joists and steel wide flange girders. The roof over the chief's office and the conference room is 5/8" plywood supported by wood joists framing into wood-framed partitions. The roof over the remaining building

area is 3" timber decking spanning between glulam beams and wood-framed partitions. The exterior walls are concrete walls varying from eight- to ten-inch thickness. These walls take the majority of the structure's gravity loads and act as shear walls, forming the building's lateral force resisting system. The small wall sections located in between the apparatus bays do not meet the code requirements to be considered shear wall piers and therefore were analyzed as concrete columns as part of a moment frame system instead.

The Tier 1 screening phase identified numerous structural and non-structural items as non-compliant. Non-compliant issues require further evaluation in order to determine their full impact on the seismic performance of the building, but these issues are a relatively good indicator of potential performance issues. A summary of non-compliant issues is presented below organized by each checklist. Copies of the Tier 1 checklists and calculations are included in this report in the Appendix.

ASCE 41-13 has different checklists depending on the building construction type. This building type is classified as a combination of C1, concrete moment frame construction and C2a, concrete shear wall construction with flexible diaphragms.

Summary of Specific Structural Deficiencies (ASCE 41-13 Tier 1 Evaluation)

Immediate Occupancy Basic Configuration Checklist

- Load Transfer: The concrete walls are not connected to the wood diaphragm in the east section of the building, resulting in an incomplete load path for the transfer of both in-plane and out-of-plane forces. The roof would need to be re-roofed and connected to the concrete walls either by straps or wood blocking to make this item compliant with the ASCE 41-13 requirements. In addition, there are incomplete load path issues at the offsets of the two building sections. The shear walls at these locations are not properly connected to the building structure to drag the lateral forces into the opposite section of the building. Drag struts would need to be added in these areas to transfer the force across to the opposite exterior wall.

- Adjacent Buildings: There is a car repairs shop located adjacent to the fire department at the current site, with little to no separation between the walls of the two buildings. The ASCE 41-13 manual requires a seismic separation of a minimum of 8 inches between the two buildings for this checklist item to be compliant. The absence of a seismic joint between these buildings presents an issue because the buildings could collide at this interface if shaken at different frequencies during an earthquake, which would cause significant damage to the west wall of the fire station. Thus, the west wall should be analyzed and designed for the pounding force that could be caused by the

collisions with the repair shop wall to determine if the current design is sufficient or if strengthening measures need to be taken.

- Liquefaction: According to the Oregon Department of Geology and Mineral Industries (DOGAMI) Statewide Geohazards Viewer, the current site of the Pendleton Fire Station lies in an area that is considered to have a moderate risk of liquefaction in the event of an earthquake. Hiring a geotechnical engineer to take samples and perform soil testing would clarify whether liquefaction is a concern with the specific soils located at this site. If the potential for liquefaction was confirmed, ground improvements could be conducted to remedy this issue.

- Footing Elements: The Tier 1 checklist requires footings to be interconnected. The footings supporting this structure are not tied together because there are no dowels connecting the footings to the slab on grade. Thus, in an earthquake, there is an increased risk of the footings moving relative to each other and causing increased damage to the structure from this differential movement. To correct this issue, a portion of the slab adjacent to the footings would need to be removed in order to place slab-to-footing dowels and re-poured after the dowels have been placed.

Immediate Occupancy Structural Checklist for Building Types C2a

- Wall Reinforcing: There is insufficient reinforcing in the center wall oriented north-south, in the north wall at the apparatus room, and at the wall piers in the south wall in between the apparatus bays. This deficiency represents an increased risk of a non-ductile failure in these wall elements. A potential option to strengthen the walls that do not have sufficient reinforcing steel is to apply a fiber-reinforced polymer coating.

- Diaphragms: The wood diaphragm over the chief's office and conference room area and the metal deck over the apparatus room both exceed the allowable horizontal spans given in the ASCE 41-13 manual. The shear capacity of both diaphragms could be analyzed to determine if there is sufficient strength in the current configuration despite the long span lengths. If it is determined that there is insufficient capacity, the wood diaphragm can be strengthened by adding wood blocking to the unsupported plywood panel edges and by placing a new piece of wood structural panel over the existing diaphragm to increase the shear strength. The metal deck could be strengthened by removing the roofing and attaching the deck to the supports at a closer spacing or using an attachment method with a higher capacity.

Immediate Occupancy Structural Checklist for Building Type C1

- Redundancy: The concrete moment frame formed by the small sections of wall in between the apparatus bays does not meet the requirements for redundancy because there are only two bays in the moment frame, when the minimum is three. This provision is included to determine if the structure has enough redundancy to allow it to remain in good structural condition if an earthquake was to cause failure of one of the bays in the moment frame. In order to remedy this issue, the force

path would need to be designed such that the lateral force is being taken by the concrete wall adjacent to the apparatus bays, instead of going through these moment frames.

- Column Shear Stress: The columns in between the apparatus bays had insufficient shear strength to resist the lateral forces anticipated. These columns were likely not designed to resist these forces because it was thought that the adjacent concrete wall would take all of the lateral force at the south end of the building. Again, drag struts would need to be added to ensure that the force is being carried through the building and into this solid wall, instead of through the columns in the apparatus bays.
- Column Reinforcing: The columns did not meet the reinforcement spacing requirements for elements of a concrete moment frame, which increases the chance of a non-ductile failure. Therefore, stiffening elements should be added to these wall sections.
- Strong Column/Weak Beam: The moment capacity of the beams in the concrete moment frames is greater than the moment capacity of the columns. To limit damage to a structure, it is more desirable to have failures in a beam than in a column. Thus, new structures are designed with greater strength in the columns compared to the beams to prevent column failure if the full moment demand in the beams is reached. To determine if this condition is a concern for the building, a more detailed calculation to check the moment capacity of the columns at a nearly elastic state should be performed.
- Joint Eccentricity: The eccentricity between the girder and column center lines at the columns between the apparatus bays is more than 20 percent of the smallest column plan dimension. Eccentricities at these joints should be minimized because they can cause high torsion forces on the joint area, resulting in high shear stresses. The girders could be connected to these columns at a point closer to the column center line to avoid this issue.
- Plan Irregularities: The reentrant corner adjacent to the apparatus bay presents a concern because large tensile and compressive forces typically develop at these locations. The fix for this issue would be to add a drag strut to take the lateral forces instead of having the concrete moment frames resist these forces.

Nonstructural Checklist

- Several nonstructural items were identified as being noncompliant. For a full list of these items, refer to Checklist 16.17 in the Appendix. These items could be addressed through a tenant improvement to bring them all into compliance with the ASCE 41 requirements.
- In addition to these findings, there are some components of the building that were unable to be analyzed at this time due to the lack of information provided in the drawings for the existing building. Structurally, the drawings did not give an indication as to whether increased reinforcement was placed above and to the sides of the wall openings in some locations. This added reinforcement is necessary to make up for the weakness in the structure created by the openings. If this reinforcement is not present, stiffening elements can be added on the interior of the structure to strengthen the openings. There were also non structural items that were marked as unknown due to lack of information, which can be found in Checklist 16.17 in the Appendix.

EXISTING FIRE STATION 1

N
NTS

LOCATION

- 911 SW Court Avenue
  Pendleton, OR 97321

YEAR BUILT

- 1959; Selective Remodel 1983

SITE SIZE

- 32,234 SF (0.74 acre)

BUILDING SIZE

- 10,900 SF (includes mezzanine)

PARKING ON-SITE

- 6 Public Spaces
- 14 Staff Spaces

FLOORS

- 1 Story with mezzanine

ZONING

- Central Commercial Mixed Use (C-MU)

FIRE SPRINKLERS

- No

CONSTRUCTION TYPE

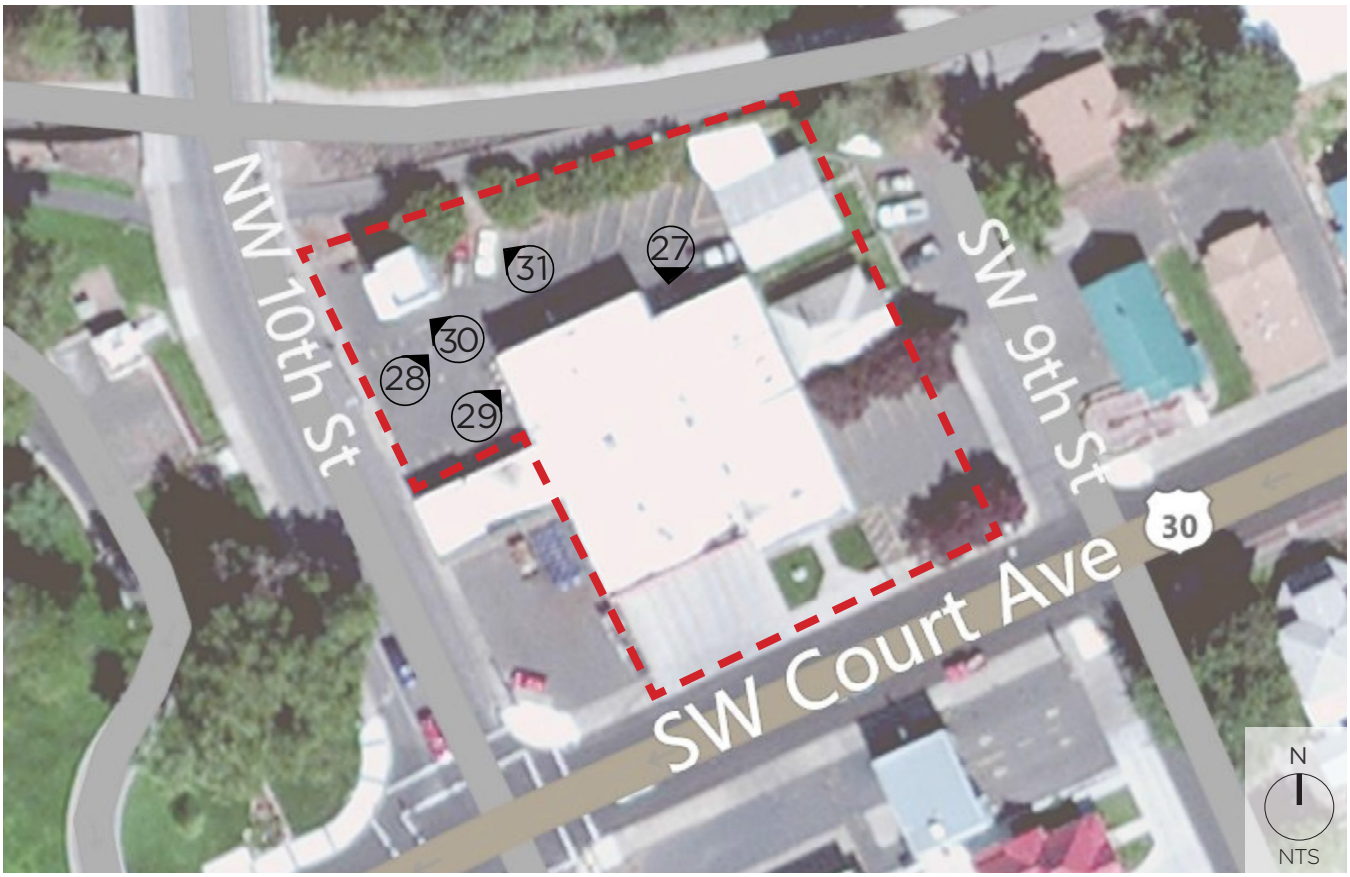
- III-B

STAFFING

- 4 (24-hour emergency services)
- 3 day-shift staff

Existing Facility Site

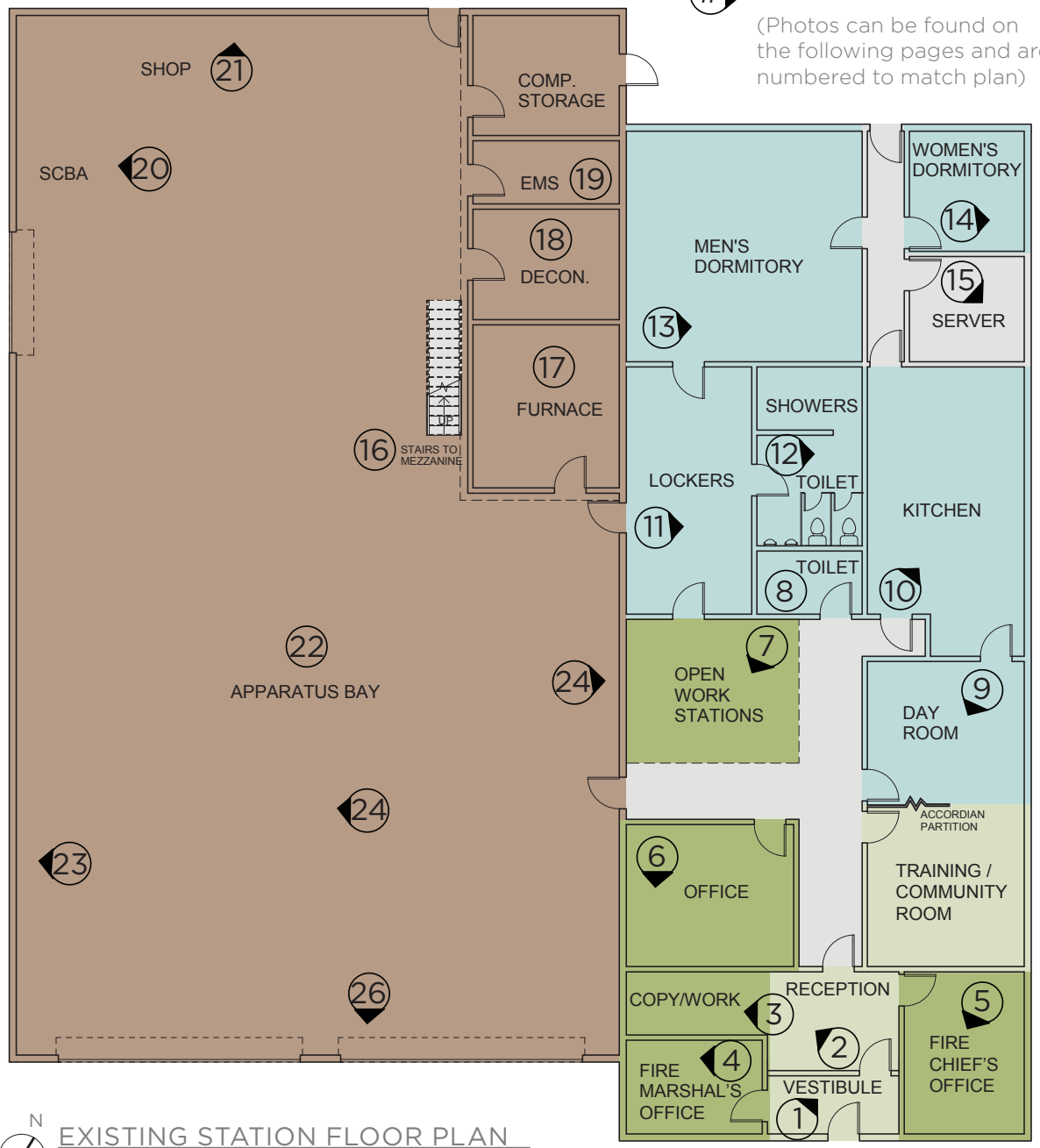
VIEW OF FIRE STATION 1 FROM SOUTHWEST COURT AVENUE



AERIAL SITE PLAN OF FIRE STATION 1

EXISTING FACILITY FLOOR PLAN

CIRCULATION
PUBLIC AREA
ADMINISTRATION
LIVING AREAS
APPARATUS BAY
PHOTO LOCATION
(Photos can be found on the following pages and are numbered to match plan)



N

EXISTING STATION FLOOR PLAN

N.T.S.

Existing Conditions

Fire Station 1

2140426.00

1. PUBLIC ENTRY

- Cramped, narrow space
- No public seating or waiting area
- Lack of security
- Does not meet ADA maneuvering clearance requirements

2. ADMINISTRATION/RECEPTION

- Undersized for the necessary functions it is currently used for
- Lack of storage
- Lack of security
- Lack of proper temperature control and ventilation
- Non-ADA compliant counters
- Lack of guest seating

3. RECORD WORK AREA

- Currently located in a corridor width space, cramped with poor circulation and limited amount of floor
- No work area
- Lack of storage, overflowing with records and storage (file cabinets, shelves, and boxes)
- Doe not meet ADA maneuvering clearance requirements

4. FIRE MARSHAL'S OFFICE

- Lack of storage
- No exterior view
- Lack of security
- Lack of proper temperature control and ventilation
- Lack of table/desk space for laying out plans for plan review

Existing Facility Interior

5. CHIEF'S OFFICE

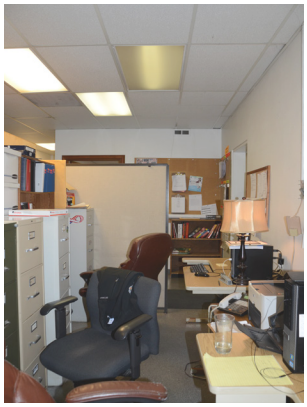
- Adequately sized
- No exterior view
- Lack of proper temperature control and ventilation

6. CAPTAIN'S OFFICE

- Office spaces within the facility are limited and undersized. There is a lack of available space for file cabinets and guest seating for private conference. This limitation is worsened by the further lack of conference space within the facility for confidential or sensitive discussions
- Lack of proper temperature control and ventilation
- Lack of proper power

7. FIREFIGHTER WORK AREA

- Lack of storage
- No privacy
- Administration areas of the station are under-sized for current needs.
- Low voltage and power issues (lack of outlets)



8. PUBLIC/WOMEN'S BATHROOM

- Shared public and employee, should be separated
- No ADA accessible shower stall

9. TRAINING/DAY ROOM

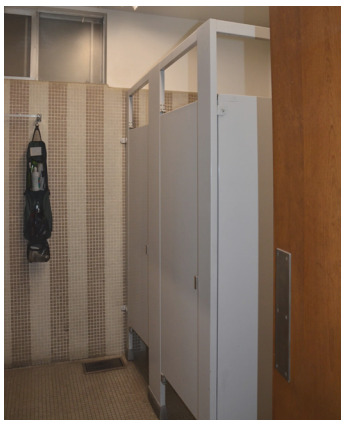
- Multiple building functions are overlapping and crowded into small spaces
- No visual or acoustical separation between the two functions
- AV issues
- Unsecure, separate public access not provided
- No natural light

10. KITCHEN

- Kitchen facilities do not meet ADA accessibility standards
- Lack of storage
- Outdated appliances

11. MEN'S LOCKER ROOM

- Lack of privacy
- No separate changing areas for male and female staff
- Hazardous materials are likely throughout the facility due to the age of the building
- No built-in emergency lighting provided in facility



12. MEN'S SHOWER / BATHROOM

- The bathroom in the facility is older, cramped, and provides very little privacy for staff
- Restroom facilities do not meet ADA accessibility standards
- Plumbing and sewage back-up issues

13. BUNK ROOM

- Inadequate space for male and female sleeping accommodations and shower/ locker rooms
- Lack of proper temperature control and ventilation
- No natural light
- No privacy
- Low voltage and power issues

14. FEMALE BUNK ROOM

- Limited use if increase in female staff
- Inadequate space
- Overflowing with storage which limits is functionality
- No exterior view
- Lack of proper temperature control and ventilation issue

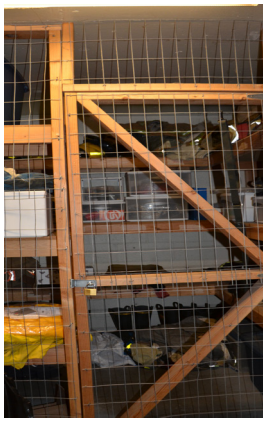
15. SERVER ROOM

- No dedicated communications room
- No paging equipment in the facility
- Cramped, due to multiuse of the space

16. PHYSICAL TRAINING

- No natural light
- Non-ADA access to physical training room
- Low-ceiling
- Lack of proper temperature control and ventilation
- Inadequate electrical
- Exposed to carcinogenic exhaust fumes from apparatus bay

Existing Facility Interior



17. FURNACE ROOM

- Lacks proper ventilation
- Overflowing with storage
- Building significantly deficient in storage

18. DECONTAMINATION ROOM

- Laundry and decontamination area are not separated
- No clear delineation of the function of the room
- Chemical storage
- Non-ADA compliant
- Sewage problems

19. EMS STORAGE

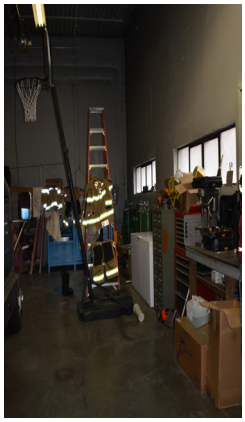
- Lack of work space
- Lack of storage
- EMS Supply space not code complaint. Inadequate storage
- Wash backboards in separate location due to lack of dedicated space within the decontamination space

20. SCBA/COMPRESSOR

- Located within the apparatus bay
- Not properly secured or housed for storage

21. SHOP

- Existing exterior walls are deteriorating
- Lack of proper storage and organization of tools
- Lack of work table



22. APPARATUS BAY

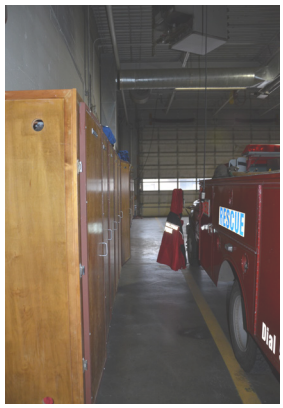
- Hazardous working conditions related to exposure to vehicle exhaust
- Inadequate clearances for emergency vehicles within apparatus bay
- Does not include any drive-thru bays
- Malfunctioning overhead doors

23. HOSE STORAGE

- Lack of space and storage
- Located within apparatus bay, cramped and hard to maneuver

24. TURNOUT STORAGE

- Turnout gears exposed to air contaminants
- Insufficient space within apparatus bay to house rigs and equipment



Existing Facility

25. ADA ACCESSIBILITY

- Lack of proper thresholds
- Non ADA compliant door hardware

26. OVERHEAD DOORS

- Inadequate thermal performance at doors.
- No weather-stripping (seals) at doors.

27. BUILDING SIDING

- Inadequate thermal performance at windows and doors.
- Single pane windows. No weather-stripping (seals) at doors.
- Moisture penetration through exterior walls

28. PARKING

- Inadequate parking for staff and volunteer staff
- Insufficient space for maneuvering a vehicle

29. EXTERIOR / SITE

- The paving is showing signs of buckling, fatigue and degradation. This will continue to worsen with time until complete failure of stressed areas.

30. TRAINING TOWER

- Training tower does not meet current NFPA standards and is a security risk
- Training tower is currently used for overflow storage and lawn maintenance storage due to the lack of sufficient storage space in the building

31. GENERATOR

- Generator appears to be in good general condition and able to carry the load of the fire station in an event of a power outage.
- Lack of proper vehicle barriers

NATIONAL FIRE PROTECTION ASSOCIATION STANDARDS

- "The National Fire Protection Association (NFPA) is an international nonprofit organization established in 1896. The company's mission is to reduce the worldwide burden of fire and other hazards on quality of life by providing and advocating consensus codes and standards, research, training, and education." (*www.nfpa.org*)
- The following table lists compliance with standards set forth by the National Fire Protection Association (NFPA). The sections listed below are the relevant sections for this study in reference to the existing Pendleton Fire Station 1.

NFPA SECTION	DESCRIPTION	COMPLIANCE
NFPA 1	Fire Suppression Sprinklers	NO
NFPA 1221	Station Alerting and Communication System	NO
NFPA 1581	Minimum Sleeping Area	NO
	PPE Cleaning Area	NO
	EMS Decontamination Area	NO
NFPA 1851	Turnout Gear Storage	
	UV Exposure Protection	NO
	Thermal Exposure Protection	NO

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PROGRAM DEVELOPMENT

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PROGRAMMING SUMMARY

Mackenzie began the programming effort by working closely with Pendleton Fire Department staff to review the station needs and requirements. Using a combination of this document and past experience with fire facilities, all while incorporating current staff feedback, Mackenzie determined current space needs and forecast future needs that will accommodate Department functions for the next 30 years, and beyond.

The initial program totalled 18,415 SF, and after rigorous staff review the Fire Department confirmed the square footage meets the necessary spaces for functionality. Mackenzie has developed space standards (*see pages 02-11 to 02-13*) that are used to organize and indicate the spaces and sizes typically required by a fire facility of this size.

Of the required 18,415 SF of building area, 7,937 SF is comprised of the apparatus bay and its support functions. As part of the calculation, the building square footage requirement includes a 20% increase for general building circulation and interstitial space (i.e. wall thicknesses), which has been found to be an average escalation for facilities of this type. The programming effort was followed by tours of comparable facilities which were used as a tool to test assumptions and validate the information developed during the programming phase (*see page 03-03*).

SPACE USE	SQUARE FOOTAGE AT MOVE-IN
APPARATUS BAY AND SUPPORT	7,937 SF
LIVING QUARTERS	4,546 SF
ADMINISTRATION AND BUILDING SUPPORT	3,350 SF
COMMUNITY	2,582 SF
TOTAL (INCLUDES 20% CIRCULATION)	**18,415 SF**

PARKING	
PUBLIC PARKING	4,800 SF (24 STALLS)
STAFF PARKING	3,600 SF (18 STALLS)

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Space / Room Use	Staffing Requirements			Space Requirements			Space Size			Room Type	Total Required Square Footage			Comments
	Exist	2015	2045	Exist	2015	2045	W	L	Area		Exist	2015	2045	
Department:	**Pendleton Fire Department - Space Requirements Summary**													
Apparatus Bay and Support Rooms	0	0	0									7937	7937	
Living Quarters	0	0	0									3778	4546	
Administration and Building Supports	0	0	0									4704	4704	
Community / Training Rooms	0	0	0									2582	2582	
														Acres
SUBTOTAL	0	0	0									19001	19769	
TOTAL BUILDING SQUARE FOOTAGE	0	0	0								10908	19001	19769	0.45
TOTAL EXTERIOR REQUIREMENTS														
TOTAL SITE REQUIREMENTS														

Space / Room Use	Staffing Requirements			Space Requirements			Space Size			Room Type	Total Required Square Footage			Comments
	Exist	2015	2045	Exist	2015	2045	W	L	Area		Exist	2015	2045	
Department:									**Apparatus Bay and Support Rooms**					
Apparatus Bay														
Apparatus Bay				4	5	5	15	85	1275		5398	6375	6375	5 Bay, Based on double loaded drive thru bays 12' x 14' OH doors, High ceiling Concrete floor, Drinking fountain, Trench drains, Hand washing / Eye washing stations at entry points to main building
Group Total	0	0	0								5398	6375	6375	
Apparatus Support Rooms														
Turnout Lockers				0	30	30	4	2	8		0	240	240	(30) Turnout Lockers min; Ready Rack type system, Dedicated ventilation and exhaust Located within Apparatus Room
Decontamination				1	1	1	12	12	144		159	144	144	Floor sink, Decon Shower, Eyewash, Stainless steel counter and sink, Extractor, Commercial grade dryer, Hooks for drying w/ extra ventilation, Detergent Dispenser, Cleaning supplies
Shop Area				1	1	1	16	18	288		84	288	288	Tools and Spare part storage w/ work areas counters and benches; open to app bay
Equipment Supply Room/PPE				1	1	1	12	20	240		215	240	240	Truck cleaning supplies, flares, chains, etc. in cabinet; unissued turnout lockers
SCBA				0	1	1	12	12	144		0	144	144	work/storage, Cascade System
EMS Supply				1	1	1	16	18	288		84	288	288	Temperature controlled; long & narrow w/ shelves on all walls; island in the middle w/ drawers & elec.
Hose Storage				0	1	1	8	10	80		0	80	80	Dbl. doors
Unisex Toilet				0	1	1	6	8	48		0	48	48	Within Apparatus Bay
Fire Riser				0	1	1	0	0	0		0	0	0	Open to Apparatus Bay Protected with bollards
Miscellaneous Storage				0	1	1	0	0	0		0	0	0	Size and Location TBD Possible Mezzanine
Ground Maintenance Equipment Storage				0	1	1	9	10	90		0	90	90	Lawn mower, weed eater, power washer, Fuel/paint storage cabinets Exterior door
Group Total	0	0	0								542	1562	1562	
TOTAL SQUARE FOOTAGE *(Apparatus Bay and Related Rooms)*											5940	7937	7937	

Space / Room Use	Staffing Requirements			Space Requirements			Space Size			Room Type	Total Required Square Footage			Comments
	Exist	2015	2045	Exist	2015	2045	W	L	Area		Exist	2015	2045	
Department:										**Living Quarters**				
Living Quarters														
Career Bunk Rooms				4	4	6	9	12	108		1130	432	648	Bed, desk, wardrobe Lockers in corridor
Resident Bunk Rooms				3	3	6	9	12	108		1130	324	648	Bed, desk, wardrobe Prefer Resident Bunk rooms to be separated
Unisex Toilet/Shower				1	4	5	10	10	100		246	400	500	Single Occupant shower/toilet combination
Kitchen				1	1	1	15	20	300		372	300	300	(1) Sink, (4) Refrigerator, (3) Microwave, (2) 4 burner stove, (2) dishwasher, (4) pantry BBQ area screened and located off of Kitchen Across from FD dining
Dining				0	1	1	12	16	192		0	192	192	Table for 8 to 10
Day Room				1	1	1	20	30	600		178	600	600	Dayroom, Dining Room, Kitchen open to each other grand room; Seating for 6-8
Emergency Supply Closet				0	1	1	8	8	64		0	64	64	Emergency supply - food, water, etc.
Physical Training				1	1	1	20	30	600		667	600	600	Treadmill, stair stepper, weights, universal machine
Laundry / Closet				0	1	1	8	16	128		0	128	128	Stacked residential 2 washer/2 dryer, Counter w/ sink, Ironing board
Work/Study/Library				0	1	1	9	12	108		0	108	108	Study area for Residents / Quiet Area Overflow Bunk Room
Group Total	0	0	0								3723	3148	3788	
GENERAL CIRCULATION (20%)												630	758	
TOTAL SQUARE FOOTAGE *(Living Quarters)*												3778	4546	

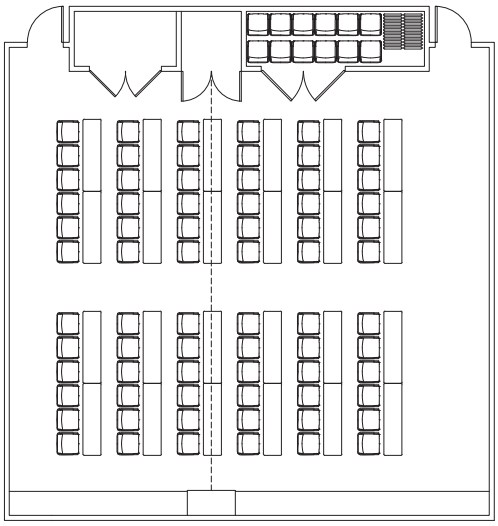
Space / Room Use	Staffing Requirements			Space Requirements			Space Size			Room Type	Total Required Square Footage			Comments
	Exist	2015	2045	Exist	2015	2045	W	L	Area		Exist	2015	2045	
Department:									**Administration / Building Support**					
Administration														
Chief's Office				1	1	1	14	22	308	OFFICE	211	308	308	desk, table, files
Fire Marshall's Office				1	1	1	14	22	308	OFFICE	113	308	308	desk, drafting table, files plan room Adjacent to office
Plan Review Room				0	1	1	14	22	308	OFFICE	113	308	308	Adjacent to Fire Marshall's Office
Captain's Office				1	1	1	10	14	140	OFFICE	120	140	140	desk, guest chair
Captain's Bunk Room				0	1	1	9	12	108	OFFICE	0	108	108	best, desk, wardrobe
Captain's Toilet/Shower				0	1	1	10	10	100	OFFICE	0	100	100	shower, toilet, lav, cabinets
Conference Room				0	1	1	14	24	336		0	336	336	Seating for 12
Police Office				0	1	1	10	14	140	OFFICE	0	140	140	separate exterior entrance
Reception/Billing				1	1	1	12	16	192	OPEN	125	192	192	desk adjacent to storage; (2) workstations
Archive Storage				0	1	1	10	10	100			100	100	adjacent to reception
Shared Open Office - Firefighters				1	1	1	16	18	288	OPEN	293	288	288	(4) Workstations / Report Writing
Work / Supply / Copy				1	1	1	10	16	160	OPEN	89	160	160	Volunteer mail boxes, bulletin board for postings; Adjacent entry Copy/fax machine; supply cabinet Adjacent to Apparatus Bay
Radio Room				0	1	1	6	8	48		0	48	48	Charging Station for radios
Group Total	0	0	0								1064	2536	2536	
Building Support														
Electrical				1	1	1	10	16	160		127	160	160	
IT Server Room				1	1	1	6	8	48		127	48	48	Includes server rack
Stairs				0	4	4	10	20	200		0	800	800	(2) Stairs
Elevator				0	2	2	10	10	100		0	200	200	(1) Elevator
Elevator Equipment Room				0	1	1	8	10	80		0	80	80	
Mechanical Shaft				0	1	1	6	8	48		0	48	48	
Janitor Closet				0	2	2	4	6	24		0	48	48	One per floor. Toilet paper, paper towels, mops, sink, etc. Second floor adjacent to Bunk Rooms. First floor adjacent to Training Room.
Group Total	0	0	0								254	1384	1384	
Subtotal Admin. & Building Support	0	0	0								1318	3920	3920	
GENERAL CIRCULATION (20%)												784	784	

Space / Room Use	Staffing Requirements			Space Requirements			Space Size			Room Type	Total Required Square Footage			Comments
	Exist	2015	2045	Exist	2015	2045	W	L	Area		Exist	2015	2045	
Department:										**Community / Training Rooms**				
Community / Training Rooms														
Community / Training				1	1	1	35	40	1400		356	1400	1400	(24-32) Occupants - Classroom Seating Possible EOC
A/V Room				0	1	1	4	5	20		0	20	20	Access through storage room
Public Restrooms				0	2	2	10	20	200		0	400	400	per code requirement
Lobby				1	1	1	12	16	192		55	192	192	Emergency phone outside entry; Showcase Plaque Display case … etc. Seating for 4
EOC Storage Closet				0	1	1	4	5	20		0	20	20	Secure EOC storage, radio station
Community / Training Storage				0	1	1	10	12	120		0	120	120	Chairs, tables, etc. Sized for 50% capacity
Group Total	0	0	0								411	2152	2152	
GENERAL CIRCULATION (20%)												430	430	
TOTAL SQUARE FOOTAGE *(Community / Training Rooms)*												2582	2582	

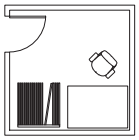
Space / Room Use	Staffing Requirements			Space Requirements			Space Size			Room Type	Total Required Square Footage			Comments
	Exist	2015	2045	Exist	2015	2045	W	L	Area		Exist	2015	2045	
Department:									**Exterior Requirements**					
Parking														
Public Parking - Community Rm/Training				0	24	24	10	20	200		0	4800	4800	
Staff Parking				0	18	18	10	20	200		0	3600	3600	Secure Parking
Site Elements														
Training Grounds				0	1	1	0	0	0		0	0	0	Open Area for Training in Parking Area Training Tower
Storm Water Retention Pond				0	1	1	0	0	0		0	0	0	
Generator				1	1	1	12	16	192		120	192	192	Screened; Includes 4'-0" clearances, Concrete pad req'd
Trash / Recycling				0	1	1	10	20	200		0	200	200	Verify trash requirements w/ provider
Pump Test Fit				0	1	1	0	0	0		0	0	0	
On Site Hydrant				0	1	1	0	0	0		0	0	0	
Patio				0	1	1	15	25	375		0	375	375	BBQ; Adjacent to Dining Area

SPACE STANDARDS

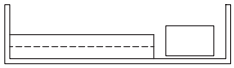
- Based on existing emergency response facilities, past experience, and general architectural standards, space standards have been developed and depicted to aid in efficiently comparing space sizes for offices, support spaces, and primary functions unique to this particular type of facility, a fire station.
- These space standards have been utilized in the development and validation of identified program elements.



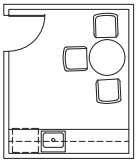
SHARED ROOM LAYOUTS



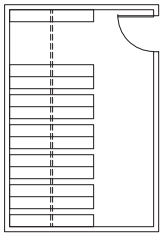
PLAN REVIEW
10X10



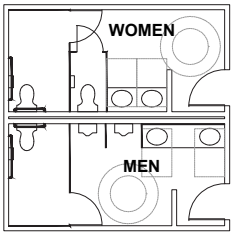
COPY ROOM
18X5



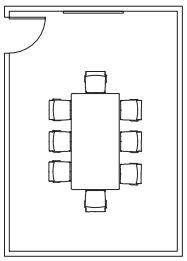
LOUNGE
10X12



RECORDS ROOM
12X18



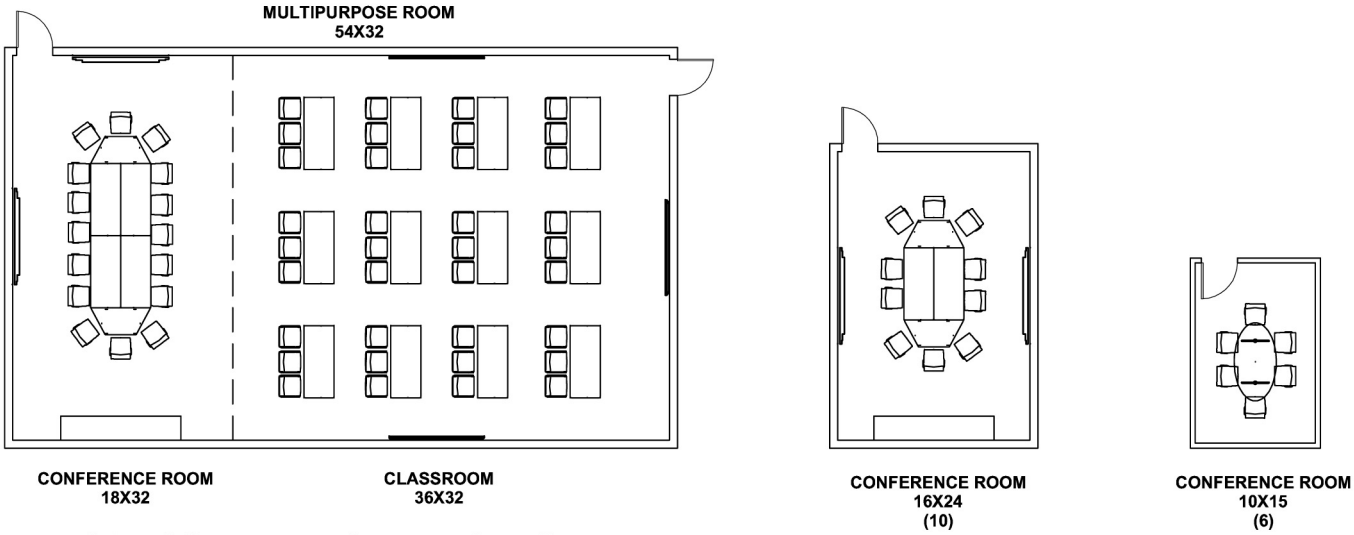
TOILET ROOM
18X18



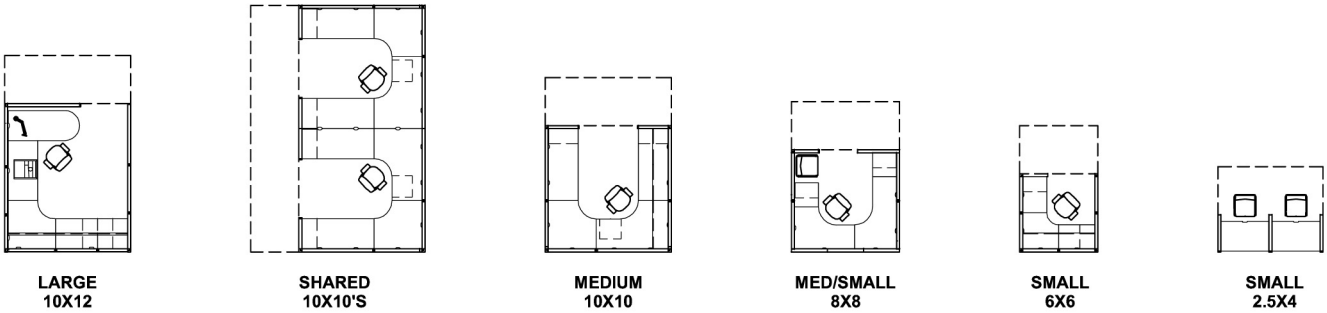
CONFERENCE
14X20

TYPICAL OFFICE SUPPORT ROOM LAYOUTS

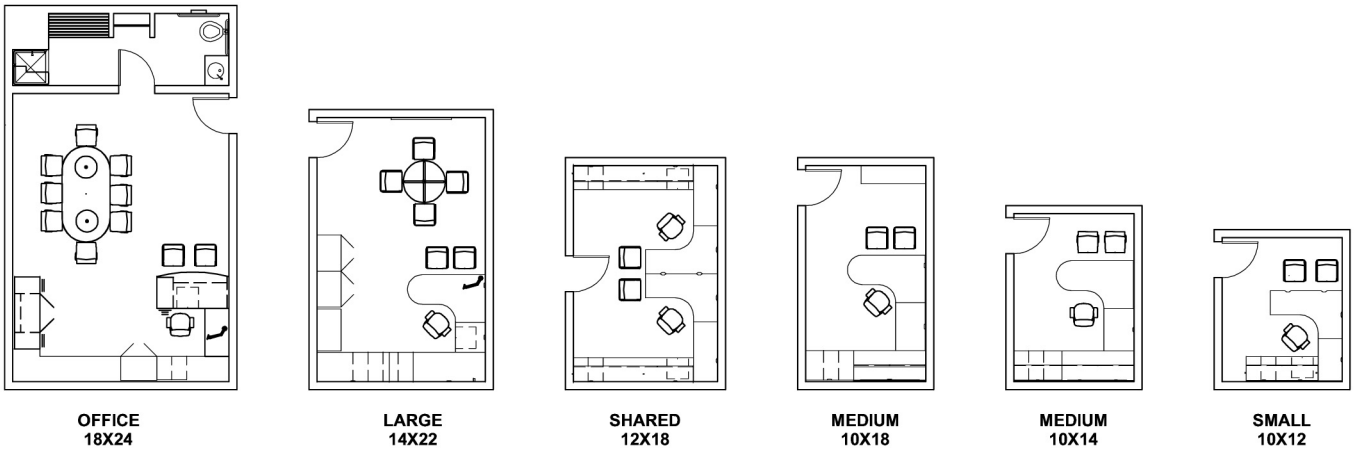
Scale 1/16” = 1’-0”



TYPICAL CONFERENCE LAYOUTS



TYPICAL CUBICLE LAYOUTS



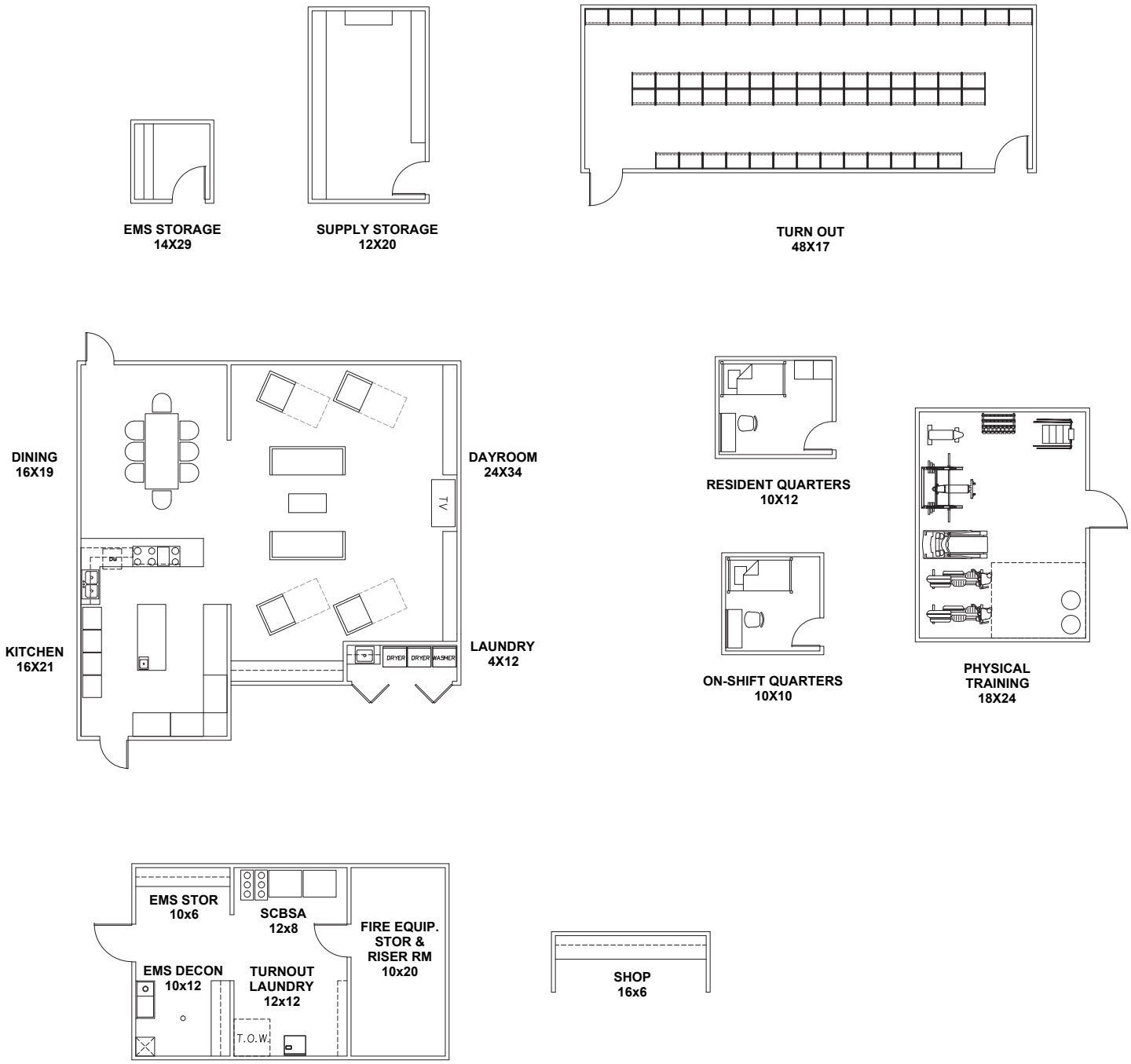
TYPICAL OFFICE LAYOUTS

Space Standards

Scale 1/16" = 1'-0"

City of Pendleton

July 2015



TYPICAL APPARATUS BAY SUPPORT ROOM LAYOUTS

Scale 1/16" = 1'-0"

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PRECEDENT FACILITIES/ FACILITY TOUR

3

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PRECEDENT FACILITIES

Facility Tours

Mackenzie and key members of Pendleton Fire Department toured three stations in communities with demographics similar to Pendleton. Upon completion of the facility tours the group met to review each facility and identify elements of design and functionality that should be taken into account during programming and design of Pendleton's station. The group identified the following design concepts that should be considered in the improved facility:

- The group noted that TVF&R and Lake Oswego dedicated space within the apparatus bay for turnout gear in lieu of a dedicated room.
- Lake Oswego dedicated space within the main lobby for memorabilia and old apparatus.
- HIllsboro Training Room integrated data and power into floor boxes for training and EOC.
- Hillsboro and TVF&R's integration of tap out system with interior lighting.

Facility Comparisons

The following chart on pages 03-04 and 03-05 presents a comparison of fire stations to both illustrate differences and show commonalities among them.

Individual fire station programs, and thus space needs, can vary greatly due to a number of factors, including:

- Primary function(s) of the station
- Number of staff on duty or housed in the facility
- Department/district structure
- Staffing approach (e.g., volunteer, career, combined)
- Unique or specialized elements (e.g., resident program, EMS, water rescue, training elements)

Differences among these elements impact the layout and size of a facility and make direct, apple-to-apple comparisons between stations challenging. The size of the apparatus bay—driven by the quantity and type of equipment it houses—is a key variable in station size. For example, a single fire station may be responsible for responding to commercial and residential structure fires, wildland fires, or water rescue calls, with specialized rigs to respond to these varying emergency needs. The presence of ladder trucks, as an example, will necessitate a greater bay depth than is typical. There may be the need for tender rigs if the department serves an area without hydrants; the greater the extent of that area the larger the number of required tender rigs may be.

The rooms and support functions off the apparatus bay will vary correspondingly in size and quantity to meet the service and support needs of the specific rigs housed in the facility. The size and makeup of the staff will, in turn, drive the size and layout of the administrative areas and living quarters. The more staff on duty at one time, the greater the needed quantity of bunk rooms, showers and toilets and the larger the day room, kitchen and dining areas will likely be. The ways in which a department interacts with the public will also influence station size. For example, a rural district providing preliminary triage or basic medical screening and care will require facilities that a station without these services would not.

PROJECT	WALLA WALLA FIRE STATION 2	DUNDEE FIRE & RESCUE	LA GRANDE FIRE
LOCATION	Walla Walla, WA	Dundee, OR	La Grande, OR
YEAR COMPLETE	2006	2014	2002
SITE SIZE	2.0 acres	1.5 acres	1.75 acres
APPARATUS BAY	7,000 sf	8,184 sf	6,600 sf
LIVING QUARTERS	4,500 sf	2,850 sf	6,250 sf
ADMINISTRATION	3,000 sf	2,797 sf	3,950 sf
PUBLIC	1,100 sf	1,574 sf	1,200 sf
TOTAL SQ. FT.	15,600 sf	17,623 sf †	18,000 sf
RESIDENT PROGRAM	YES	YES	YES
BUNK ROOMS	6	4	7
RESPONSE AREA	10 sq. mi (Fire) / 1,270 sq. mi (EMS)	13 sq. mi	6 sq. mi (Fire) / 2,035 sq. mi (EMS)
POPULATION SERVED	31,000 (Fire) / 59,000 (EMS)	5,500	15,000 (Fire) / 25,000 (EMS)
QUANTITY OF STATIONS IN DISTRICT	2	1	1
STAFFING	Career/Volunteer	Career/Volunteer	Career/Volunteer
STATION TYPE	Headquarters	Headquarters	Headquarters

* Response Area is not reflective of surrounding rural areas for EMS.
† Includes Training Tower sq.. footage

FACILITY COMPARISONS

HOOD RIVER FIRE	BUCKLEY FIRE	COOS BAY STATION 1	HILLSBORO FIRE CHERRY LANE
Hood River, OR	Buckley, WA	Coos Bay, OR	Hillsboro, OR
2012	2012	2010	2010
1.22 acres	3.65 acres	2.0 acres	6.29 acres
8,660 sf	5,180 sf	9,000 sf	7,576 sf
5,608 sf	4,250 sf	7,750 sf	1,974 sf
4,460 sf	3,250 sf	3,750 sf	5,868 sf
1,148 sf	1,447 sf	1,500 sf	1,254 sf
21,528 sf	19,413 sf	22,000 sf	16,672 sf
YES	YES	YES	YES
10	11	12	8
110 sq. mi	6.5 sq. mi*	17 sq. mi	23.9 sq. mi
7,300/10,000 (tourist/yr)	7,200/15,000 (tourist/yr)	23,000	97,370
1	1	3	5
Career/Volunteer	Career/Volunteer	Career/Volunteer	Career/Volunteer
Headquarters	Headquarters	Headquarters	Headquarters

TVF&R - FIRE STATION 53

STATION STATISTICS
8480 SW Scholls Ferry Rd
Beaverton, OR 97008

- Built in 2010
- 12,368 square foot station
- $2.2 million used from general obligation bond (In November 2006, 68.6% of voters approved a $77.5 million general obligation bond for capital improvements. The projects funded by this bond are occurring throughout the entire Tualatin Valley Fire and Rescue service area and are expected to improve and maintain response to emergency incidents over the next 50 years.)
- Response Area is 7.20 square miles
- 14 full-time personnel
- 2,957 Incident Count in 2008

COMMUNITY ROOM

PHYSICAL TRAINING

APPARATUS BAY

DECONTAMINATION

FIRE POLE

OFFICE

DAY ROOM / KITCHEN

PATIO

HILLSBORO FIRE - CHERRY LANE

STATION STATISTICS
21880 NW Cherry Lane
Hillsboro, OR 97124

- Built in 2010
- 16,672 square foot station
- $3.0 million
- 9,635 Incident Count for the Hillsboro Fire Department (5 staffed fire stations) in 2013-2014
- The facility has a LEED Gold Rating
- The facility was designed as a base for volunteer firefighters as well as one career engine company.

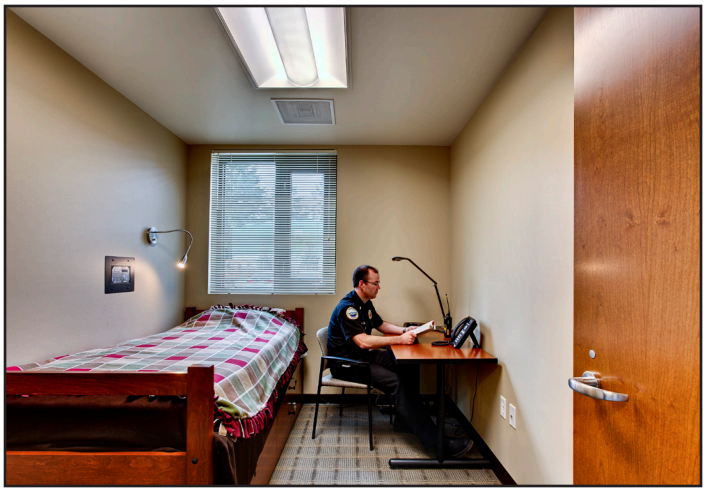
OFFICE

PHYSICAL TRAINING

APPARATUS BAY

TURNOUT LOCKERS

EMS STORAGE



BUNK ROOM

KITCHEN / DINING

COMMUNITY ROOM

LAKE OSWEGO - MAIN STATION

STATION STATISTICS
300 B Avenue
Lake Oswego, OR 97034

- Built in 1995
- 10,482 square foot station
- Site: 25,776 square ft
- The station staffs Paramedics with nine career personnel that work three separate 24 hour shifts. Each shift has a company officer, an apparatus operator, and a firefighter. It includes crew members certified in Dive Rescue operations, 3 Battalion Chiefs, a medic unit and a Dive Rescue vehicle.
- Approximately 3,000 incident reports per year

DISPLAY APPARATUS

COMMUNITY / TRAINING ROOM

OFFICE

CAPTAIN'S QUARTERS - OFFICE & BUNK ROOM

BUNK

KITCHEN

DAY ROOM

APPARATUS BAY

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POTENTIAL SITES EVALUATION

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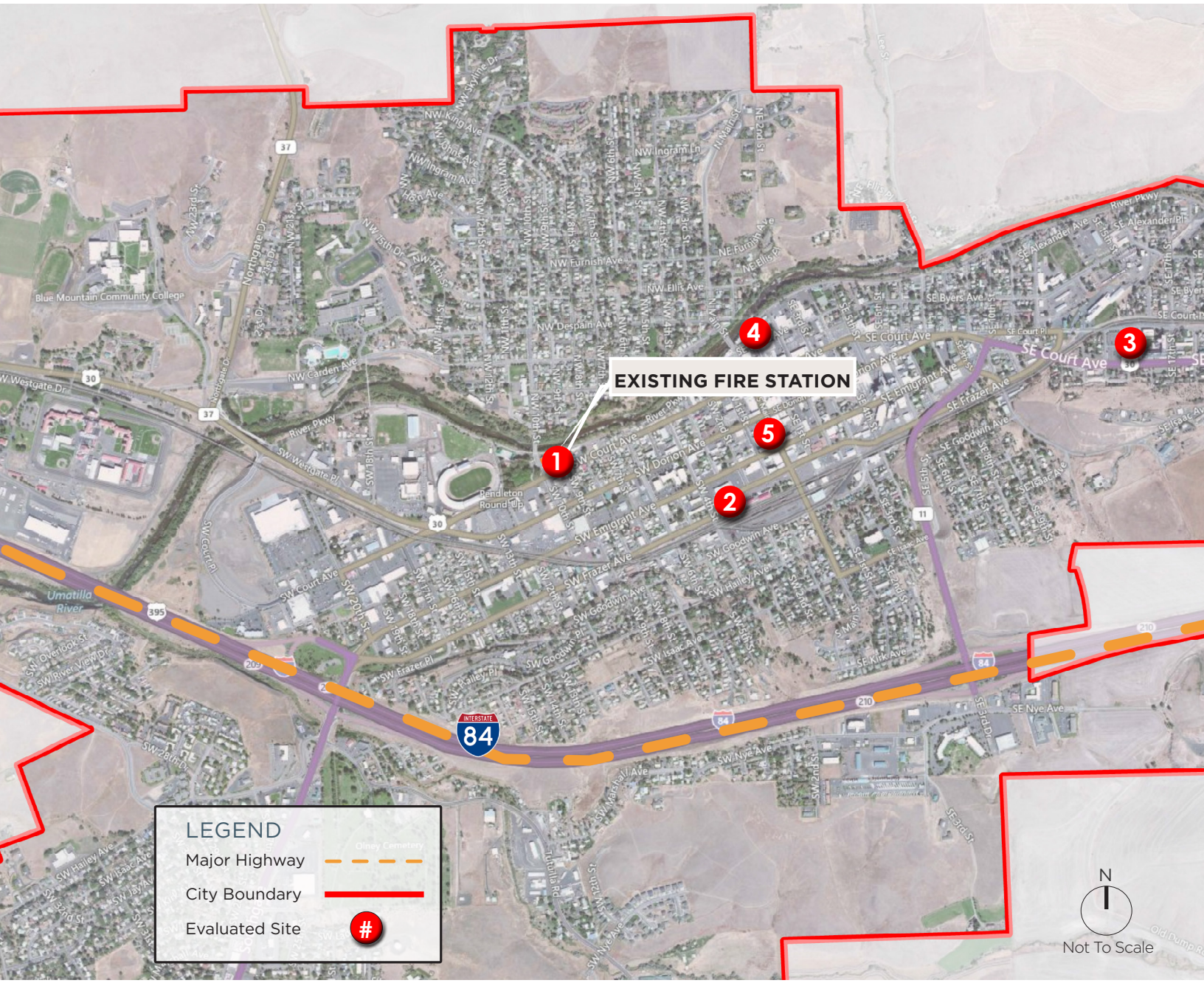
MAP OF POTENTIAL SITES



The current site conditions and development criteria for the four sites selected by the City of Pendleton are outlined in the following Land Use Matrix. The zoning for each of the sites allows for construction of a multi-use building permitted outright.

Shown above is a map showing the city limits and the selected sites.

- SITE 1: Existing Fire Station 1
- SITE 2: Baxter
- SITE 3: Old St. Anthony Hospital
- SITE 4: Elk's Lodge
- SITE 5: Bank of America Parking Lot

SITE 1: EXISTING SITE

LOCATION

- 911 SW Court Avenue
  Pendleton, OR
- Tax Lot: 2N3210AC00100

SIZE

- 0.74 Acres

ZONING

- C-MU (Central Commercial Mixed Use)

TRANSPORTATION ACCESS

- Court Avenue (Highway 30)

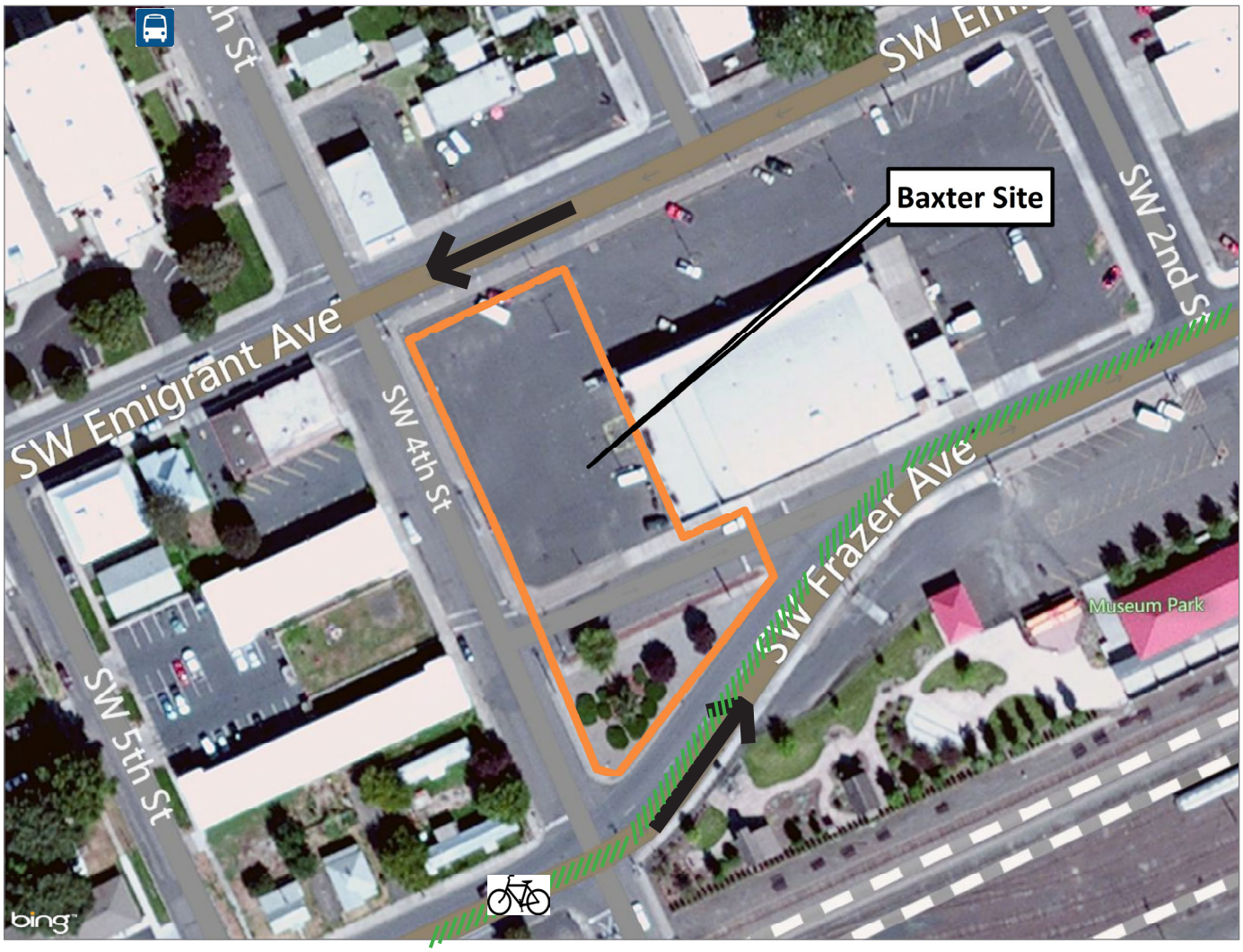
SITE INFORMATION

- Building Setbacks:

C-MU

No setbacks are required except to conform to Visual Clearance requirements.

- Maximum Building Coverage: No Max.
- Max. Building Height: No Limit
- Minimum Parking Ratio: 1 SPACE / EMPLOYEE ON SHIFT



SITE 2: BAXTER SITE

LOCATION

- 336 Emigrant Avenue
  Pendleton, OR
- Tax Lot: 2N3210AD03600; 2N3210AD11000

SIZE

- 0.87 Acres

ZONING

- C-MU (Central Commercial Mixed Use)

TRANSPORTATION ACCESS

- SE Emigrant Avenue
- SW 4th Street

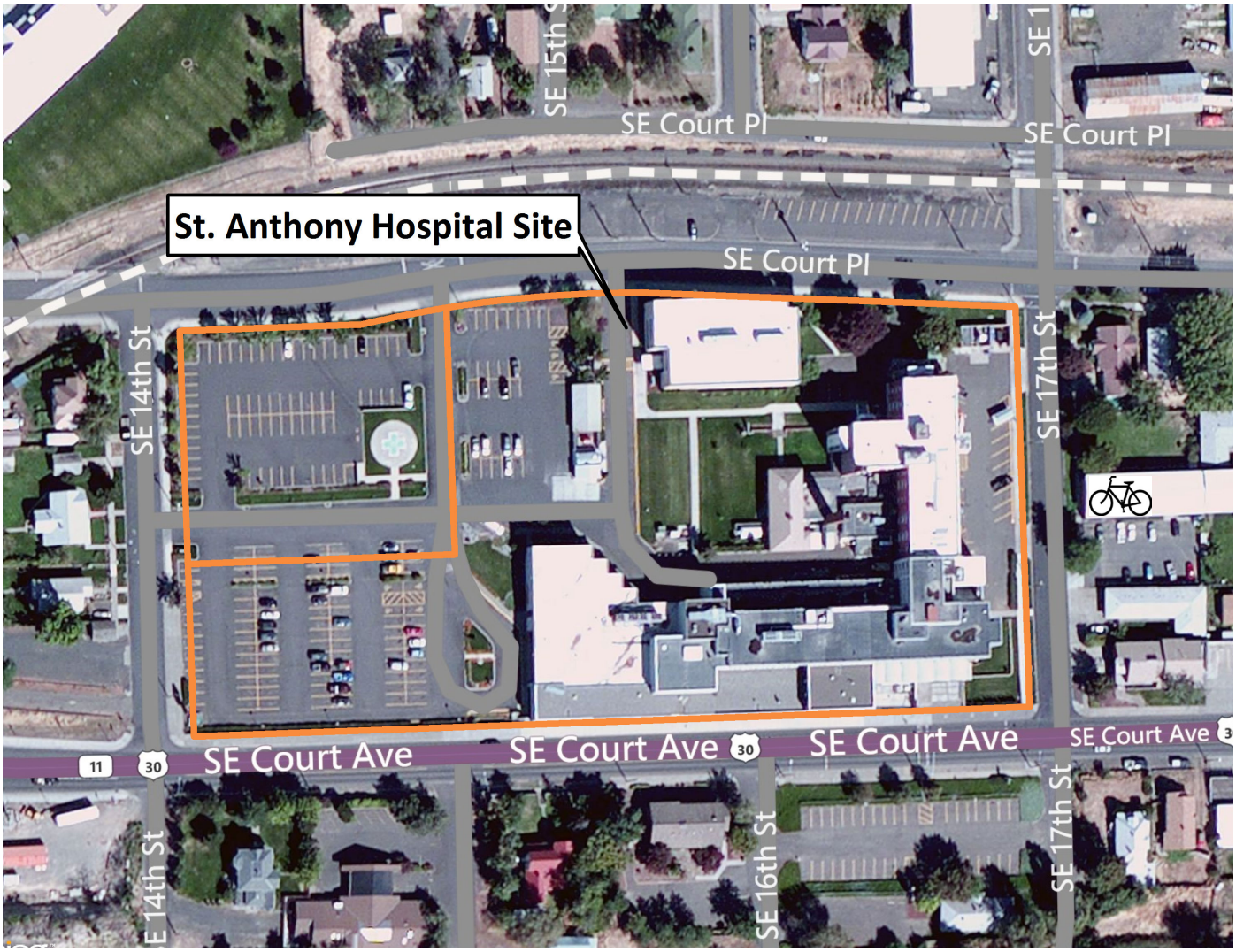
SITE INFORMATION

- Building Setbacks:

C-MU

No setbacks are required except to conform to Visual Clearance requirements.

- Maximum Building Coverage: No Max.; Maximum Parking Coverage 50%
- Max. Building Height: No Limit
- Minimum Parking Ratio:
  1 SPACE / EMPLOYEE ON SHIFT



SITE 3: OLD ST. ANTHONY HOSPITAL

LOCATION

- 1601 SE Court Avenue
  Pendleton, OR
- Tax Lot: 2N3211AA01900, 2N3211AA01901

SIZE

- 1.07 Acre (NW Parcel) ; 4.84 Acre
- Total: 5.91 Acres

ZONING

- C-3 Service Commercial

TRANSPORTATION ACCESS

- SE Court Avenue
- SE Court Place

SITE INFORMATION

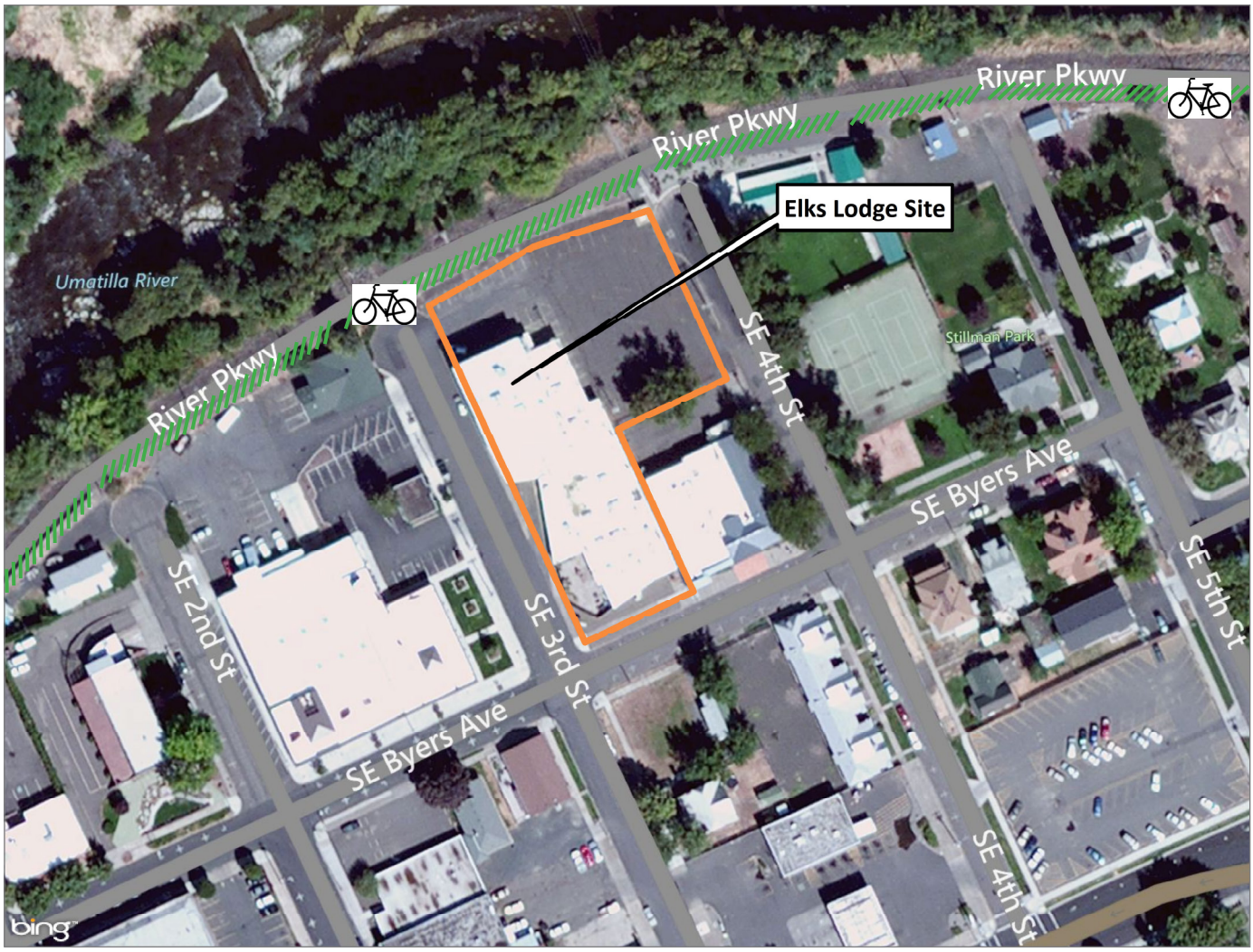
- Building Setbacks:

C-3

No setbacks are required except when property abuts residential zone.

North: Abuts residential across the street therefore landscape area may be required by Planning Commission.

- Maximum Building Coverage: No Max.;
- Max. Building Height: 50 Feet
- Minimum Parking Ratio: 1 SPACE / EMPLOYEE ON SHIFT



SITE 4: ELK'S LODGE SITE

LOCATION

- 14 SE 3rd Street
  Pendleton, OR
- Tax Lot: 2N321CC04000; 2N3202CC03700

SIZE

- 1.09 Acres

ZONING

- C-MU (Central Commercial Mixed Use)

TRANSPORTATION ACCESS

- SE 3rd Street
- SE Byers Avenue

SITE INFORMATION

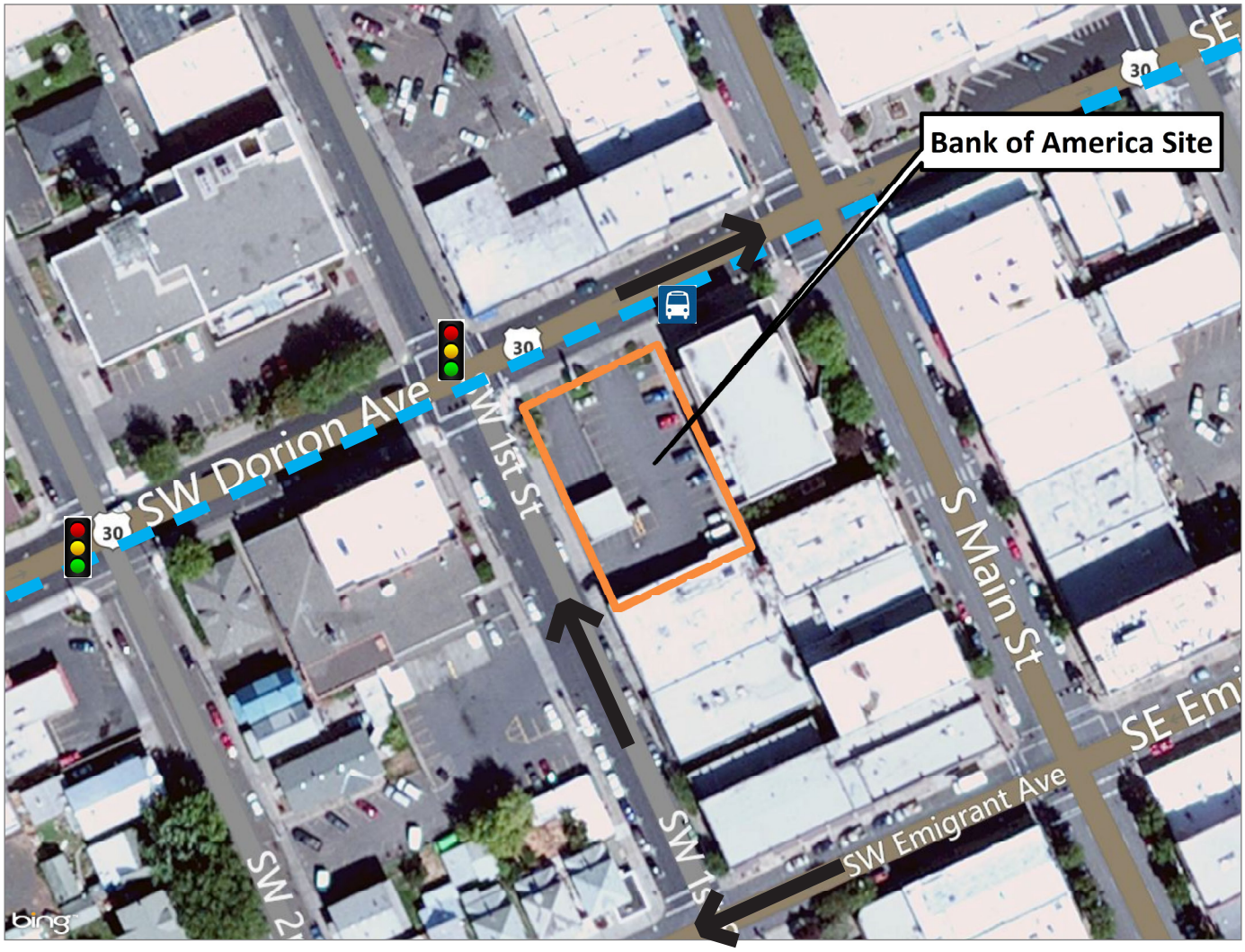
- Building Setbacks:

C-MU

No setbacks are required except to conform to Visual Clearance requirements, with the exception of:

East: 15 ft abutting residential or commercial;

- Maximum Building Coverage: No Max.; Maximum Parking Coverage 50%
- Max. Building Height: No Limit
- Minimum Parking Ratio: 1 SPACE / EMPLOYEE ON SHIFT



SITE 5: BANK OF AMERICA PARKING SITE

LOCATION

- 301 South Main Street
  Pendleton, OR
- Tax Lot: 2N3210AA12000

SIZE

- 0.34 Acres

ZONING

- C-MU (Central Commercial Mixed Use)

TRANSPORTATION ACCESS

- SW Dorian Avenue
- SW 1st Street

SITE INFORMATION

- Building Setbacks:

C-MU

No setbacks are required except to conform to Visual Clearance requirements.

- Maximum Building Coverage: No Max.; Maximum Parking Coverage 30%
- Max. Building Height: No Limit
- Minimum Parking Ratio: 1 SPACE / EMPLOYEE ON SHIFT

	SITE 1: EXISTING	SITE 2: BAXTER
PROPERTY ADDRESS	911 SW COURT AVE	336 SW EMIGRANT AVE
SITE AREA	32235 sq. ft tax lot / **32,235 sq. ft (~0.74 acres) usable**	37897 sq. ft tax lot / **37,897 sq. ft (~0.87 acres) usable**
TAX LOT(S)	2N3210AC00100	2N3210AD03600; 2N3210AD11000
OWNER	CITY OF PENDLETON	MB REAL PROPERTIES, LLC
ZONE & JURISDICTION	C-MU (Central Commercial Mixed Use) City of Pendleton	C-MU (Central Commercial Mixed Use) City of Pendleton
OVERLAY ZONE	Since this site is within the River Quarter, civic buildings require a conditional use permit. River Quarter (Note: the overlay zones impose architectural and streetscape design standards)	Downtown Plan Area, Railroad Subdistrict (Note: the overlay zones impose architectural and streetscape design standards)
ALLOWED USE	Generally, Government, Public, or Semi-Public Uses are permitted if the gross floor area of any proposed building is less than 25,000 square feet and a conditional use permit would be required if the gross floor area is more than 25,000 square feet.	Government, Public, or Semi-Public Uses are permitted if the gross floor area of any proposed building is less than 25,000 square feet. A conditional use permit would be required if the gross floor area is more than 25,000 square feet.
FLOOR AREA RATIO	N/A	N/A
MIN. LANDSCAPE REQUIREMENTS	All parking areas shall be adequately landscaped at the rate of at least forty (40) square feet per required off street parking space, unless otherwise approved by the Planning Commission.	All parking areas shall be adequately landscaped at the rate of at least forty (40) square feet per required off street parking space, unless otherwise approved by the Planning Commission.
MAX. LOT COVERAGE	No Max. Lot Coverage	No maximum lot coverage (4.04.3). However, no more than 50% of the buildable may be devoted to surface parking due to location within the Downtown Plan Area.
MIN. PARKING RATIO	1 SPACE PER EMPLOYEE ON SHIFT	1 SPACE PER EMPLOYEE ON SHIFT
MAX. BUILDING HEIGHT	No Limit	No Limit
BUILDING SETBACKS	No setbacks are required for this site except to conform to Vision Clearnace requirements for corner lots.	No setbacks are required for this site except to conform to Vision Clearance requirements for corner lots.
PARKING SETBACKS	In Commercial zones, parking areas should be, whenever possible, located behind the plane established by the front façade of the building for which the parking is being provided. The parking should be located to the rear of the building to the maximum extent possible. Locating the parking lot in front of the building (between the fronting, public right-of-way and the building) should be avoided. The required parking minimums in Section 8.03 may be reduced by 25% for developments with the parking located behind the building. For parking areas located beside a building, and behind the plane established by the front façade may have a 10% reduction in their required parking.	In Commercial zones, parking areas should be, whenever possible, located behind the plane established by the front façade of the building for which the parking is being provided. The parking should be located to the rear of the building to the maximum extent possible. Locating the parking lot in front of the building (between the fronting, public right-of-way and the building) should be avoided. The required parking minimums in Section 8.03 may be reduced by 25% for developments with the parking located behind the building. For parking areas located beside a building, and behind the plane established by the front façade may have a 10% reduction in their required parking.

	SITE 3: OLD ST ANTHONY HOSPITAL
PROPERTY ADDRESS	1601 SE COURT AVENUE
SITE AREA	1.07 acre site and 4.84 acre site (5.91 acres) / **44,480 sq. ft (~1.09 acres) usable**
TAX LOT(S)	2N3211AA01900, 2N3211AA01901
OWNER	ST. ANTHONY'S HOSPITAL
ZONE & JURISDICTION	C-3 Service Commercial City of Pendleton
OVERLAY ZONE	N/A
ALLOWED USE	Generally, Government, Public, or Semi-Public Uses are permitted if the gross floor area of any proposed building is less than 25,000 square feet and a conditional use permit would be required if the gross floor area is more than 25,000 square feet.
FLOOR AREA RATIO	N/A
MIN. LANDSCAPE REQUIREMENTS	All parking areas shall be adequately landscaped at the rate of at least forty (40) square feet per required off street parking space, unless otherwise approved by the Planning Commission. Except in the Central Area Parking District, all parking areas adjacent to public sidewalks shall be buffered from the sidewalk (except at gateways and openings) with a minimum of four feet of landscape area with vegetation consistent with the requirements of Section 8.01. (Note: this site is outside the Central Area Parking District)
MAX. LOT COVER-AGE	No maximum in commercial zones (4.04.3)
MIN. PARKING RATIO	1 SPACE PER EMPLOYEE ON SHIFT
MAX. BUILDING HEIGHT	50 feet (4.04.4)
BUILDING SETBACKS	No setbacks required in commercial zones, except when property abuts a residential zone—in this case the north site boundary is across the street from a residential zone. (Landscaped areas may be required by Planning Commission to buffer commercial use from residential use). Development on corner lots shall observe Vision Clearance standards. (4.04.2)
PARKING SETBACKS	In Commercial zones, parking areas should be, whenever possible, located behind the plane established by the front façade of the building for which the parking is being provided. The parking should be located to the rear of the building to the maximum extent possible. Locating the parking lot in front of the building (between the fronting, public right-of-way and the building) should be avoided. The required parking minimums in Section 8.03 may be reduced by 25% for developments with the parking located behind the building. For parking areas located beside a building, and behind the plane established by the front façade may have a 10% reduction in their required parking.

SITE 4: ELK'S LODGE	SITE 5: BANK OF AMERICA
14 SE 3RD STREET	CORNER OF SW DORION AVENUE AND SW FIRST STREET
47480 sq. ft tax lots / **44,480 sq. ft (~1.09 acres) usable**	14810 sq. ft tax lot / **14,810 sq. ft (~0.34 scres) usable**
2N321CC04000; 2N3202CC03700	2N3210AA12000
BPOE #288 PENDLETON LODGE	ELIZABETH AND GARY ROBINSON
C-MU (Central Commercial Mixed Use) City of Pendleton	C-MU (Central Commercial Mixed Use) City of Pendleton
Downtown Plan Area (Note: the overlay zones impose architectural and streetscape design standards)	Downtown Plan Area, Downtown Core, and the South Main Historic District (Note: the overlay zones impose architectural and streetscape design standards)
Government, Public, or Semi-Public Uses are permitted if the gross floor area of any proposed building is less than 25,000 square feet. A conditional use permit would be required if the gross floor area is more than 25,000 square feet.	Government, Public, or Semi-Public Uses are permitted if the gross floor area of any proposed building is less than 25,000 square feet. A conditional use permit would be required if the gross floor area is more than 25,000 square feet.
N/A	N/A
All parking areas shall be adequately landscaped at the rate of at least forty (40) square feet per required off street parking space, unless otherwise approved by the Planning Commission.	All parking areas shall be adequately landscaped at the rate of at least forty (40) square feet per required off street parking space, unless otherwise approved by the Planning Commission. Except in the Central Area Parking District, all parking areas adjacent to public sidewalks shall be buffered from the sidewalk (except at gateways and openings) with a minimum of four feet of landscape area with vegetation consistent with the requirements of Section 8.01.
No maximum lot coverage (4.04.3). However, no more than 50% of the buildable may be devoted to surface parking due to location within the Downtown Plan Area.	No maximum lot coverage (4.04.3). However, no more than 30% of the buildable may be devoted to surface parking due to location within the Downtown Core.
1 SPACE PER EMPLOYEE ON SHIFT	1 SPACE PER EMPLOYEE ON SHIFT
No Limit	No Limit
Commercial Zones (4.04.2). Construction must conform to Vision Clearance requirements for corner lots. No setbacks required on the north, west, and south boundaries. The east boundary must match the setback of the R-2 Medium Density Residential zone across the street (which has a 15-foot front setback requirement)	No setbacks are required for this site except to conform to Vision Clearance requirements for corner lots.
In Commercial zones, parking areas should be, whenever possible, located behind the plane established by the front façade of the building for which the parking is being provided. The parking should be located to the rear of the building to the maximum extent possible. Locating the parking lot in front of the building (between the fronting, public right-of-way and the building) should be avoided. The required parking minimums in Section 8.03 may be reduced by 25% for developments with the parking located behind the building. For parking areas located beside a building, and behind the plane established by the front façade may have a 10% reduction in their required parking.	In Commercial zones, parking areas should be, whenever possible, located behind the plane established by the front façade of the building for which the parking is being provided. The parking should be located to the rear of the building to the maximum extent possible. Locating the parking lot in front of the building (between the fronting, public right-of-way and the building) should be avoided. The required parking minimums in Section 8.03 may be reduced by 25% for developments with the parking located behind the building. For parking areas located beside a building, and behind the plane established by the front façade may have a 10% reduction in their required parking.

IMPORTANCE FACTOR SCORING CRITERIA

1. **COST OF LAND:**
Ranking evaluates the availability of property for purchase and assessed purchase price of each property.

2. **COST OF SITE DEVELOPMENT:**
Ranking evaluates anticipated development costs of the property, including but not limited to existing infrastructure, hazardous material remediation, demolition of existing structures and topographical challenges.

3. **SIZE OF SITE:**
Ranking evaluates the usable site acreage available for development within the property boundaries.

4. **SHAPE OF SITE:**
Ranking evaluates the shape of the site, with particular emphasis on irregularities that present challenges to parking and building layout, access, visibility and general efficiencies.

5. **POTENTIAL FOR MULTI-USE:**
Ranking evaluates multiple use opportunities for expansion of the Fire facility, co-location of other city functions within the confines of the site, supported access, parking and general placement of a new Fire facility.

6. **PUBLIC ACCESS TO SITE – VEHICLE:**
Ranking evaluates vehicular access to and from the site for both the public and the Fire Department. Vehicular access evaluations took into consideration proximity to major arterial streets and highways, visibility and way-finding and ease of circulation once on site.

7. **PUBLIC ACCESS TO SITE – TRANSIT:**
Ranking evaluates proximity to public transit infrastructure including light rail stations and bus stops, as well as frequency of routes.

8. **PUBLIC ACCESS TO SITE – PEDESTRIAN / BICYCLE:**
Ranking evaluates the ease of access for pedestrians and bicycles to and from the site.

9. **VISIBILITY AND PROMINENCE:**
Ranking evaluates the visibility and prominence the site offers for placement and development of a new civic structure for the City of Pendleton. Visibility and prominence can be impacted by alternative parameters such as size and shape of site, natural constraints such as terrain and floodplains and available positioning within the site for the building and parking.

10. PROXIMITY TO GOVERNMENT FUNCTIONS:
Ranking evaluates the proximity of the site to other civic structures, functions and property owned by the City of Pendleton.

11. NEIGHBORHOOD CONTEXT:
Ranking evaluates the context of the site and surrounding property. Evaluations took into account the nature of a Fire department and the scale of the facility as it relates to adjacent commercial, industrial or residential properties.

12. POSITIONING FACILITY ON SITE:
Ranking evaluates the flexibility of positioning the facility on the site to maximize visibility and prominence, security and potential for multi-use.

13. SECURITY:
Ranking evaluates the ability to appropriately locate the facility, public parking, secure parking and access to and from the site in a manner that supports the safety and security parameters associated with a Fire facility.

14. TRAFFIC CONGESTION:
Ranking evaluates street infrastructure, signals, one-way and two-way streets and potential traffic impacts associated with development of a new Fire facility.

15. EXPANSION TO ADJACENT SITES:
Ranking evaluated on the prospective site's direct adjacency to potential future property that could be acquired for either future expansion or development of alternative City functions.

16. PROXIMITY TO GEOGRAPHIC CENTER:
Ranking evaluates the property's proximity to Pendleton's city center. As a central headquarters, centralizing the facility within the service area is essential while coupling placement with close proximity to major vehicular streets, arterials and highways.

17. CURRENT OWNERSHIP:
Ranking evaluates the current ownership of the property, required purchase for multiple parcels and difficulties associated with land acquisition of property.

18. LAND USE:
Ranking evaluates the current use allowance (permitted outright or through a conditional use) and other general zoning regulations.

19. RESPONSE TIME STUDY:
Ranking evaluates the property's proximity to response areas, based on the response time study conducted by Coelo. (See Appendix A)

IMPORTANCE FACTOR MATRIX

RANKED: 1 - 4
(1: LEAST SUITED; 4: MOST SUITED)

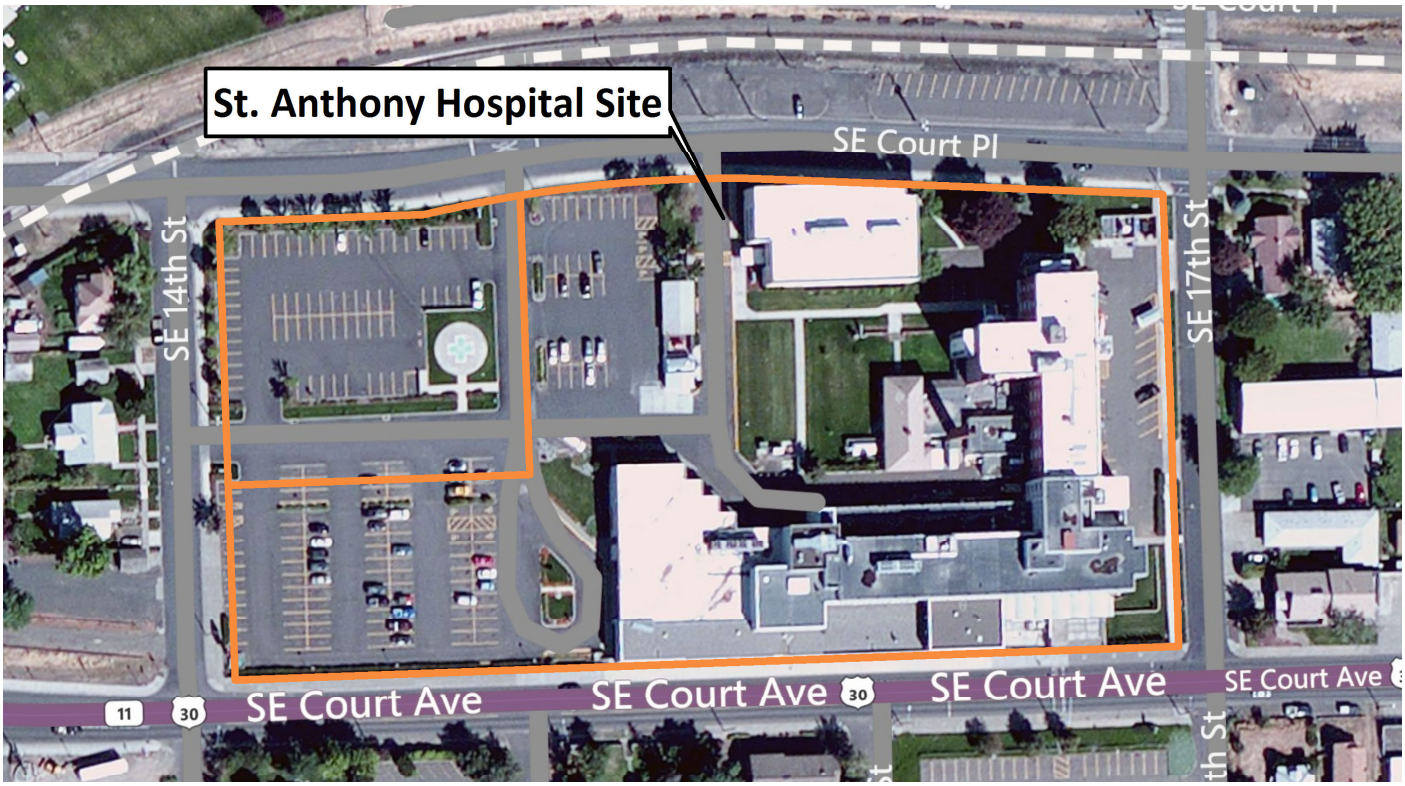
1. COST OF LAND
2. COST OF SITE DEVELOPMENT
3. SIZE OF SITE
4. SHAPE OF SITE
5. POTENTIAL FOR MULTI-USE
6. PUBLIC ACCESS TO SITE - VEHICLE
7. PUBLIC ACCESS TO SITE - TRANSIT
8. PUBLIC ACCESS TO SITE - PEDESTRIAN / BICYCLE
9. VISIBILITY AND PROMINENCE
10. PROXIMITY TO GOVERNMENT FUNCTIONS
11. NEIGHBORHOOD CONTEXT
12. POSITIONING FACILITY ON SITE
13. SECURITY
14. TRAFFIC CONGESTION
15. EXPANSION TO ADJACENT SITES
16. PROXIMITY TO GEOGRAPHIC CENTER
17. CURRENT OWNERSHIP
18. LAND USE
19. RESPONSE TIME STUDY

ASSESSMENT SCORE

CUMULATIVE RANK (BASED ON AVERAGE SCORE)

	SITE 1: EXISTING STATION 1	SITE 2: BAXTER	SITE 3: OLD ST. ANTHONY HOSPITAL	SITE 4: ELK'S LODGE
1.	4.0	1.5	3.0	3.0
2.	2.5	1.0	4.0	2.5
3.	1.0	2.0	4.0	3.0
4.	1.0	2.0	4.0	3.0
5.	2.5	2.0	4.0	1.5
6.	3.0	1.0	4.0	2.0
7.	3.5	2.0	2.5	2.0
8.	4.0	2.0	2.0	2.0
9.	2.5	4.0	2.5	1.0
10.	3.0	4.0	1.5	1.5
11.	2.5	1.5	4.0	2.0
12.	1.5	1.5	4.0	3.0
13.	2.0	2.0	4.0	2.0
14.	2.5	1.0	4.0	2.5
15.	1.5	1.0	4.0	3.0
16.	2.5	4.0	1.0	2.5
17.	4.0	1.0	2.5	2.5
18.	3.0	2.5	4.0	2.0
19.	3.0	4.0	1.5	2.0
	49.50	**40.00**	**60.50**	**43.00**
	2nd	**4th**	**1st**	**3rd**

PREFERRED SITE



OLD ST. ANTHONY HOSPITAL SITE

N

Not To Scale

PROPERTY NAME	GROSS SITE AREA	BUILDING AREA	BUILDING HEIGHT	PARKING COUNT
SITE 3 - OLD ST. ANTHONY SITE OPTION	1.07 Acres (NW Corner); 4.84 Acres Total: 5.91 Acres	Building Footprint: Approx. 18, 500 SF	2 Story	18 Visitor 24 Secure

Upon confirmation of the program size, it was determined that a facility of approximately 18,415 square feet and a parking demand of 24 public parking and 18 staff parking spaces were required to meet the 30-year needs of the city. These projections were utilized to appropriately assess and determine the capacity of each of the site options selected by the City of Pendleton and documented in the previous pages.

Initially, this effort focused on five potential sites noted on the map on page 04-03. Each site was first evaluated to determine if any critical flaws were present, such as whether or not the site was available for purchase or lease, appropriate site area, availability of public utilities needed to serve the development, required need for public improvements beyond the area of the site, and access limitations, etc. Each parameter was considered by Mackenzie and the City of Pendleton, and the initial investigation site of Old St. Anthony Hospital was determined to best address the initial evaluation criteria completed by Department staff.

Upon selection of the site, Mackenzie developed a preliminary site diagram for the site based on the programmed size of each department and the required site improvements to describe how

the site might specifically accommodate the proposed project as well as projecting rough construction costs based on unit pricing for the option. This effort entailed developing a more refined block diagram from the selected adjacency diagram and testing its orientation on the chosen site.

The Old St. Anthony Hospital site has the advantage of being located on Hwy 30 just on the outskirts of downtown Pendleton. The site is accessible from SE 14th St and SE 15th St, just off of Hwy 30 or SE Court Pl, allowing for drive thru bays and ample room for a future training area. A disadvantage to this site is the required half street improvement of SE 15th St for complete access to the site.

This configuration has public parking and the entry sequence as prominent features at the front of the site, with two access points from SE 14th St and SE 15th St. The test fits, the building and site are tucked into one corner of the site in order to minimize unused space and allow for a future training area.

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PLAN DEVELOPMENT

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PLAN DEVELOPMENT

Public safety facilities are unique in that the relationships of all elements are closely linked to the ability of the fire department to efficiently and effectively serve the community. Having an understanding of the relative sizes, proximity, and relationships between spaces is key. In conjunction with developing the future space-needs program for the Pendleton Fire Department, Mackenzie prepared a series of site development scenarios to evaluate the operational flow and larger programming adjacencies of the site and building. For a comprehensive analysis, the Design Team advanced the two adjacency concepts that best met the functional needs of the department, and used diagrams to illustrate in detail the spatial relationships specific to fire facility requirements. These concepts were developed to graphically represent programming functions and their relationships to each other while also taking into consideration department culture, division work philosophies and general circulation.

All four initial site development options looked at locating the Apparatus Bay in line with SE 14th Ave to provide drive-thru bays with access onto SE 15th Avenue as well as and easily accessible route onto SE Court Place and SE Court Avenue. The options subsequently compared the position of the living quarters, administrative functions, and community spaces in relationship to the Apparatus Bay as well site access, training areas, and parking (both for the staff of the fire station and public parking).

One of the key criteria evaluated was turnout time: how fast employees can get to the Apparatus Bay from wherever they are within the facility when a call comes in. The adjacency and block diagrams also specifically looked at separation of operation traffic flow and public traffic, access points to the site, apparatus turning radius, and the sequence of entry for the public.

PLAN DEVELOPMENT STEPS

1. Site Analysis 06-04
2. Site Development Scenarios 06-06
3. Adjacency Diagrams 06-08
4. Block Diagrams 06-10
5. Selected Site and Floor Plans 06-13

1

2

3

4

6

5

Context Photos

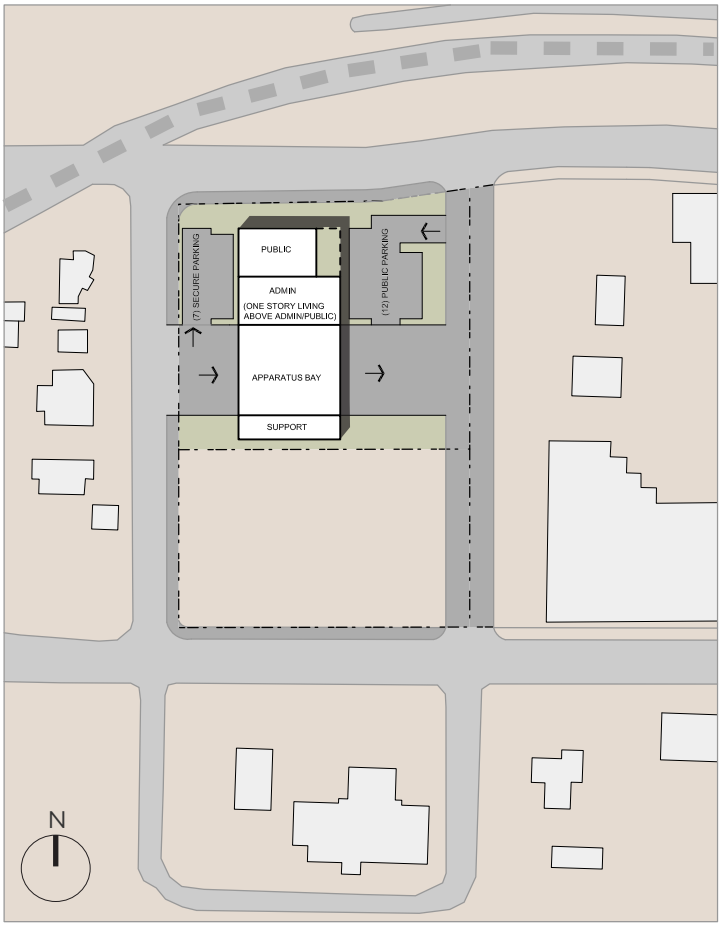
City of Pendleton

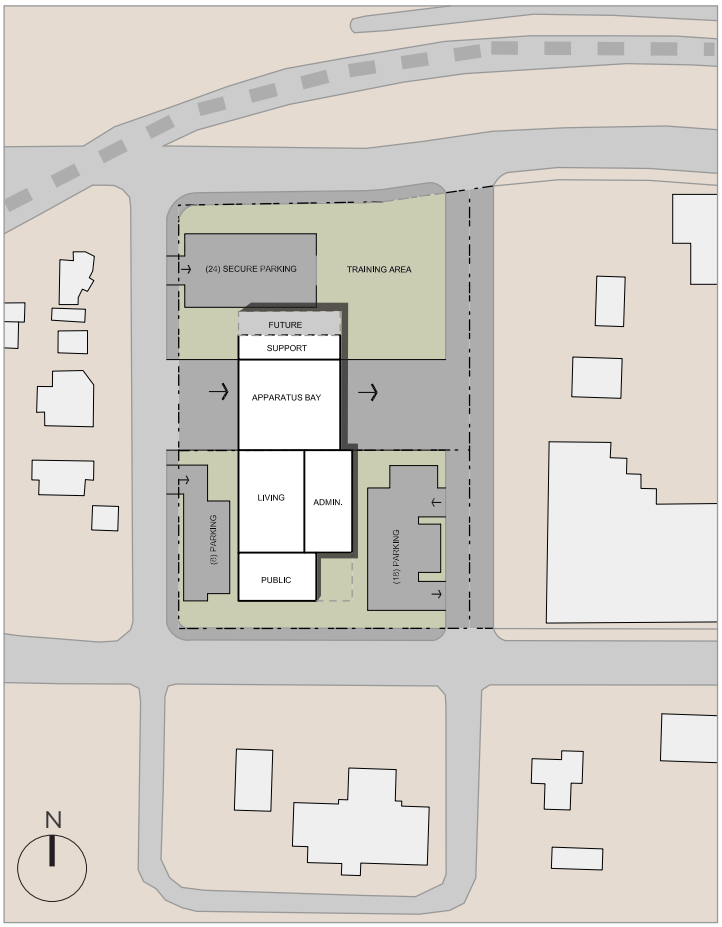
July 2015

SITE ANALYSIS

The new fire facility will be located on the Old St Anthony Site and include the NW parcel of land between SE Court Place to the North and SE Court Avenue (Highway 30) to the South, and SE 14th Street to the West and SE 15th Street to the East. Mackenzie spent time on and around the site observing and photographing the surrounding buildings and context in order to better understand how best to design a new fire station well-suited for Pendleton, Oregon.

Downtown Pendleton Map





SCHEME 1

ADVANTAGES

- A compact floor plan
- Separate public and staff parking

DISADVANTAGES

- Limited parking
- No room for future training area or future growth

SCHEME 2

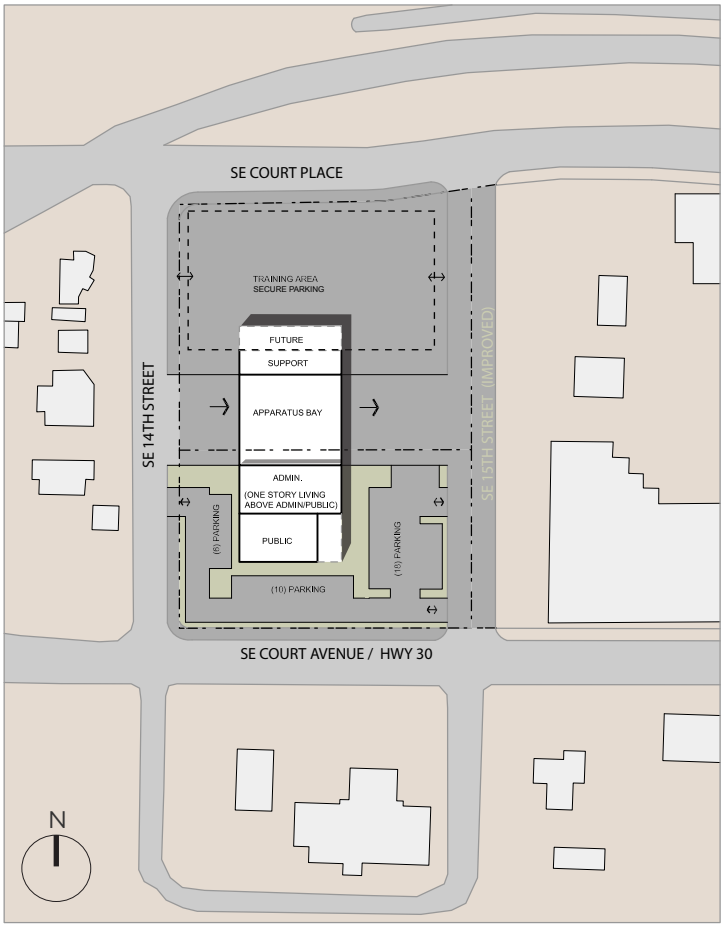
ADVANTAGES

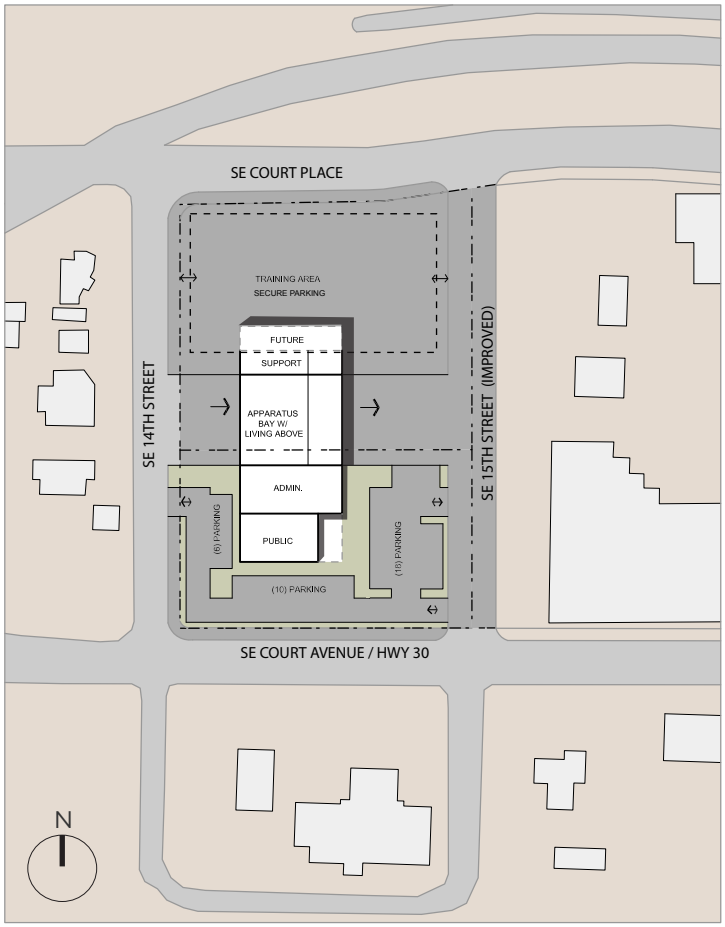
- Large public plaza

DISADVANTAGES

- A large building footprint due to all program elements located on one level
- Limited room for future training area
- Staff parking displaced from central building wing and pedestrian access crosses over Apparatus Bay apron.

SITE DEVELOPMENT SCENARIOS





SCHEME 3

ADVANTAGES

- Ideal orientation for Administration and Living functions with regards to solar, sound, and privacy.

DISADVANTAGES

- Limited secure parking. Administrative staff would share parking with the public.

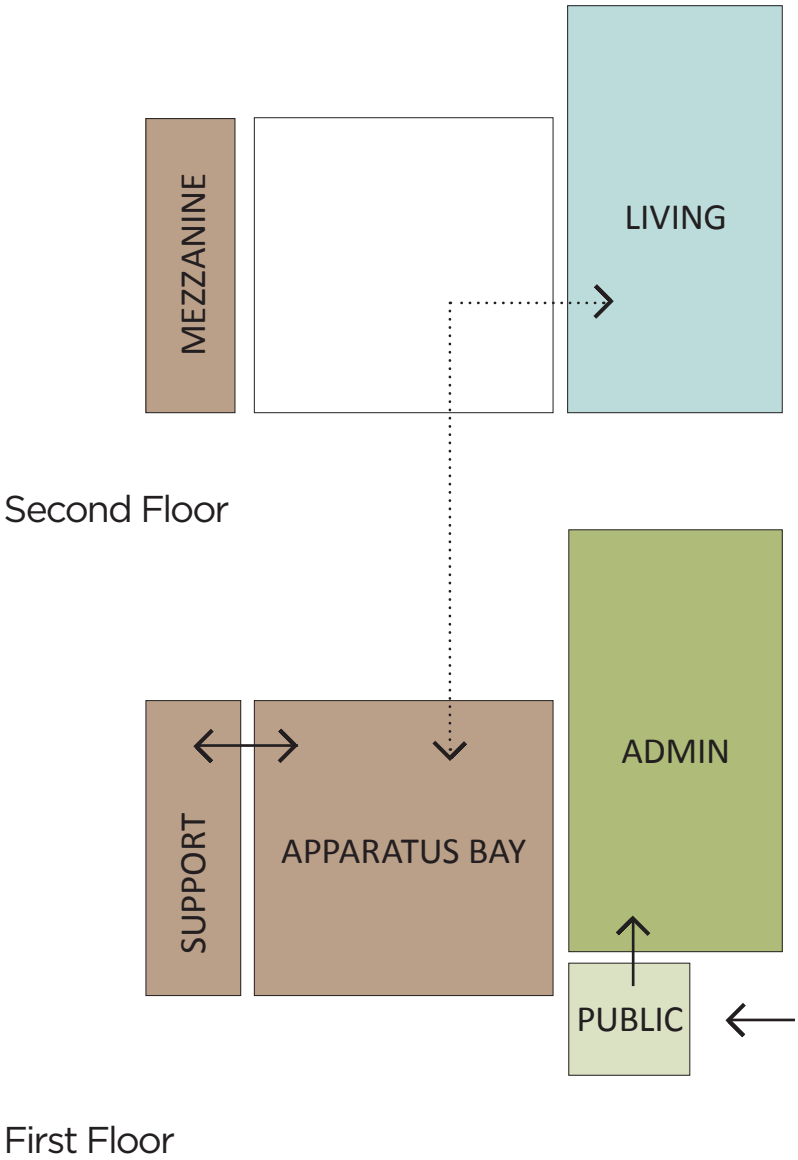
SCHEME 4

ADVANTAGES

- Living Quarters has direct access to the outside

DISADVANTAGES

- A lower ceiling in the Apparatus Bay due to the Living Quarters located above it.
- 70% of the building facade faces west or east which presents challenges with controlling glare and heat gain.



SCHEME 3

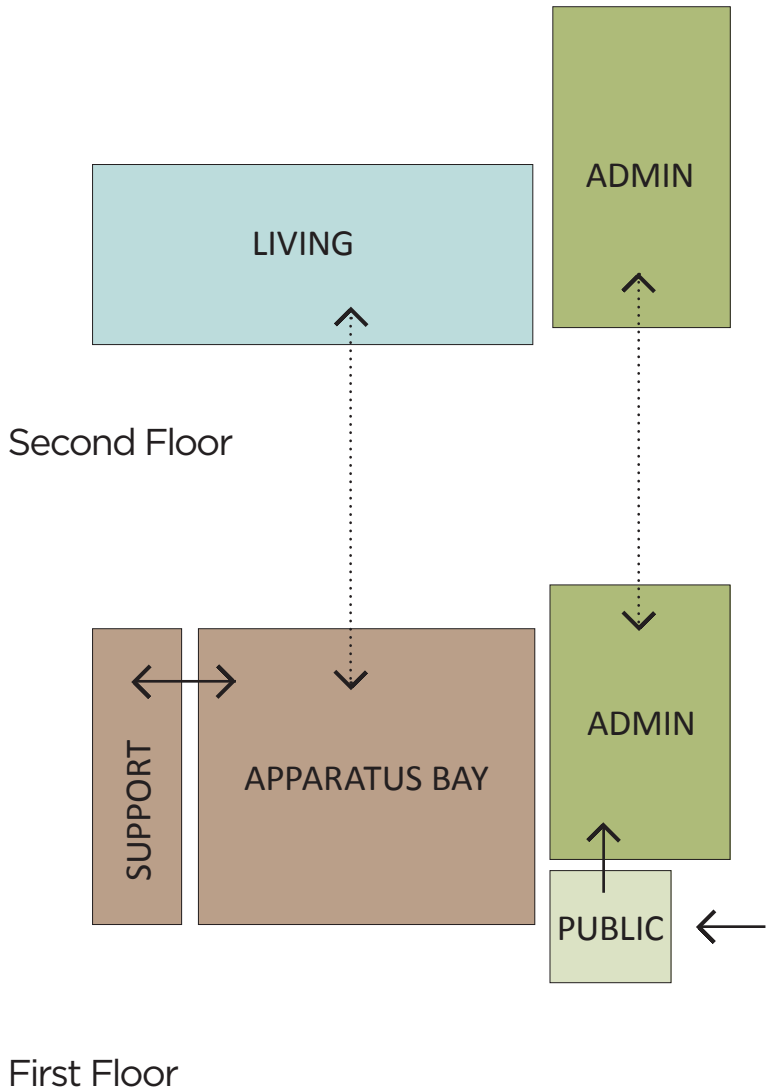
ADVANTAGES

- Clear height of Apparatus Bay provides opportunity for mezzanine above support area.
- Structural loads are minimized over Apparatus Bay and structure can potentially clear span.
- Minimized building envelope area

DISADVANTAGES

- Compact building footprint
- Key interior Administrative and living spaces may have limited access to daylight due to configuration of building footprint.
- Slightly longer travel distance from Living to Apparatus Bay in comparison to Scheme 1

ADJACENCY DIAGRAMS



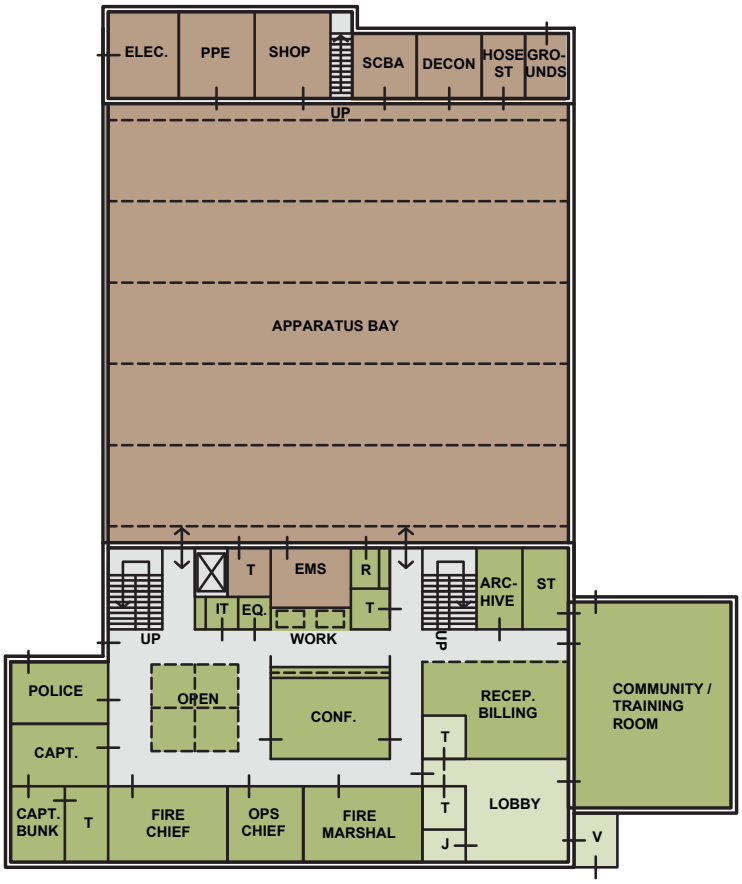
SCHEME 4

ADVANTAGES

- Compact building footprint
- Closest proximity from living quarters to Apparatus Bay.
- Greater level of privacy between living quarters and Administration.

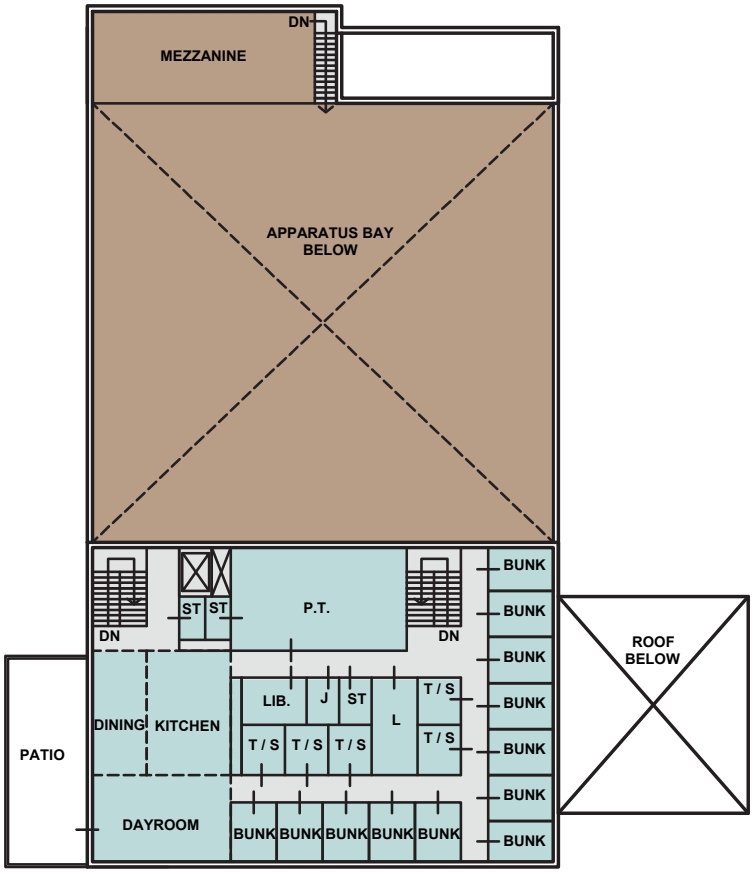
DISADVANTAGES

- Occupied space above Apparatus Bay increases the structural loads which requires columns in Apparatus Bay.
- Increased building envelope area, due to living quarters above Apparatus Bay.



First Floor Block Diagram

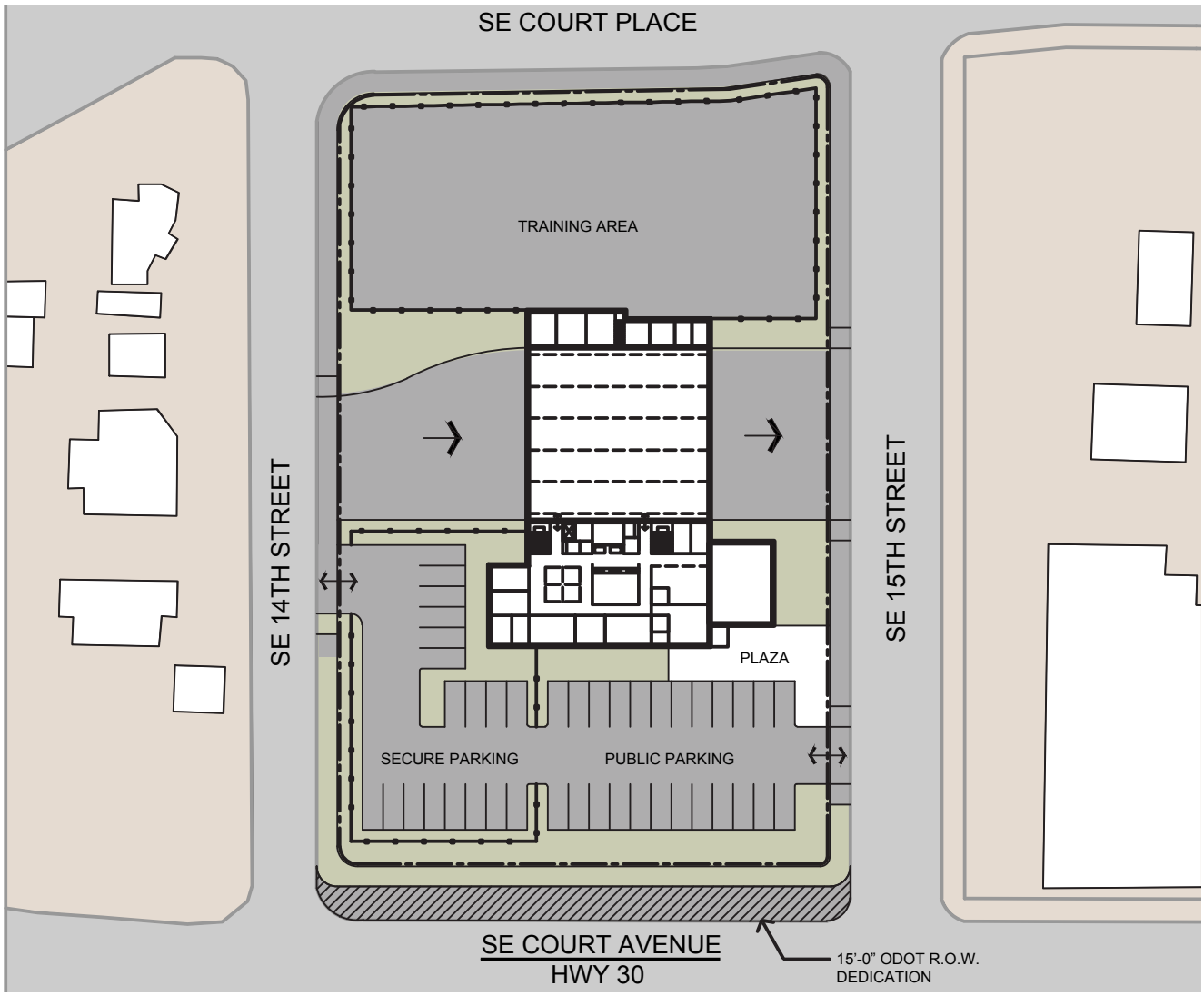
N.T.S.



Second Floor Block Diagram

N.T.S.

BLOCK DIAGRAMS



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Site Plan

1" = 80'-0"

SCHEME 1

SITE SUMMARY

- Total Site Area: 69,901 SF
- Public Parking: 24 Stalls
- Secure Parking: 18 Stalls

BUILDING SUMMARY

- First Floor: 14,839 SF
- Second Floor: 6,699 SF
- Total SF: 21,538 SF

LEGEND

- CIRCULATION
- APPARATUS BAY
- PUBLIC AREAS
- ADMINISTRATION
- LIVING AREAS

Block Diagrams - Scheme 3

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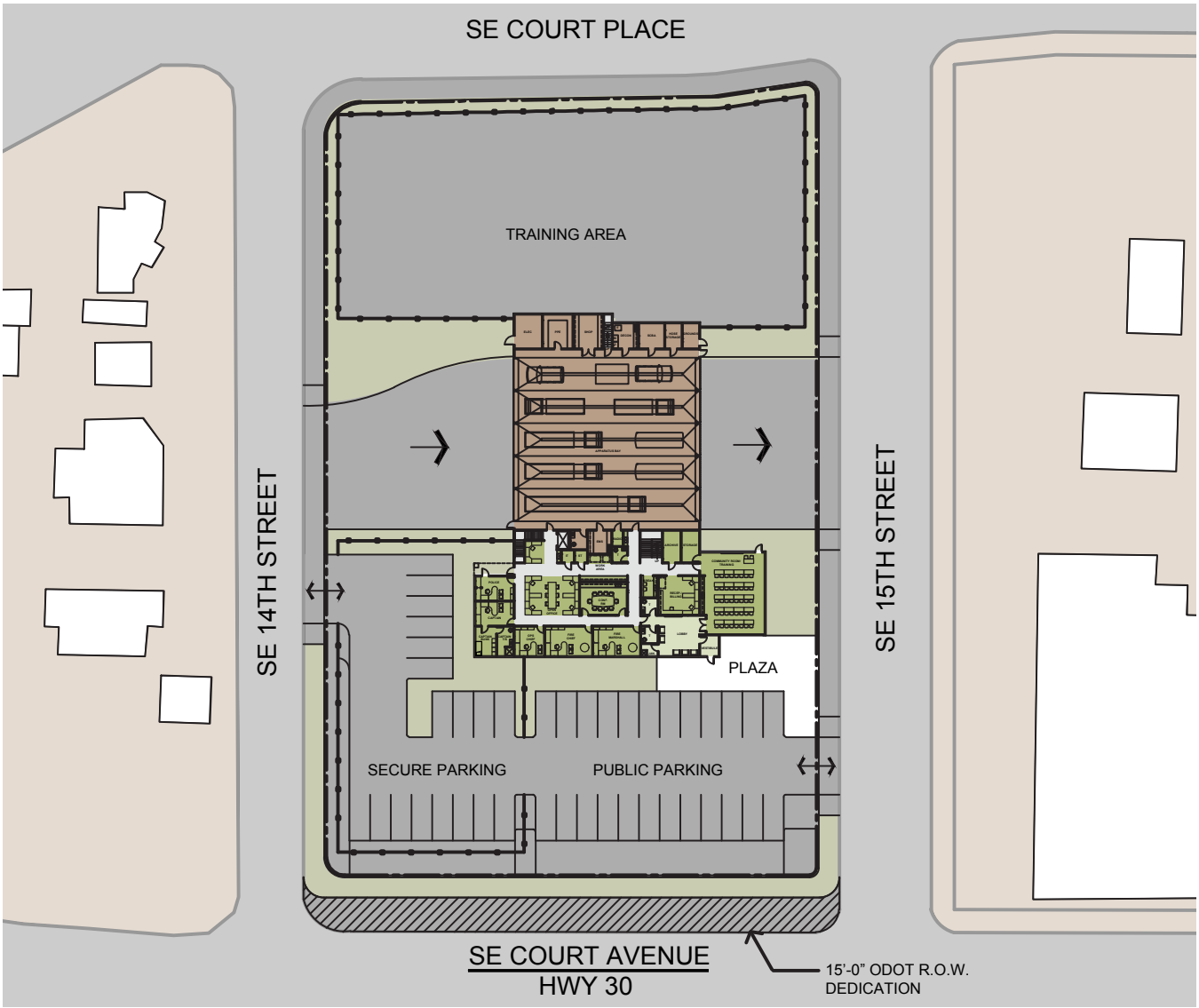
SELECTED PLAN

"Scheme 3" was selected by the Department as the preferred adjacency and site plan.

The approved site plan and floor plans were developed based on feedback received during review of the preliminary site plan options and block diagram schemes. During this discussion, additional site elements were identified and the plans were further refined to meet Department expectations, honing in on programmed square footages, increasing efficiencies, and taking into consideration the utilization of natural light.

SITE SUMMARY

Total Site Area:	69,900 SF
Shared Parking:	24 Stalls
Secure Parking:	18 Stalls



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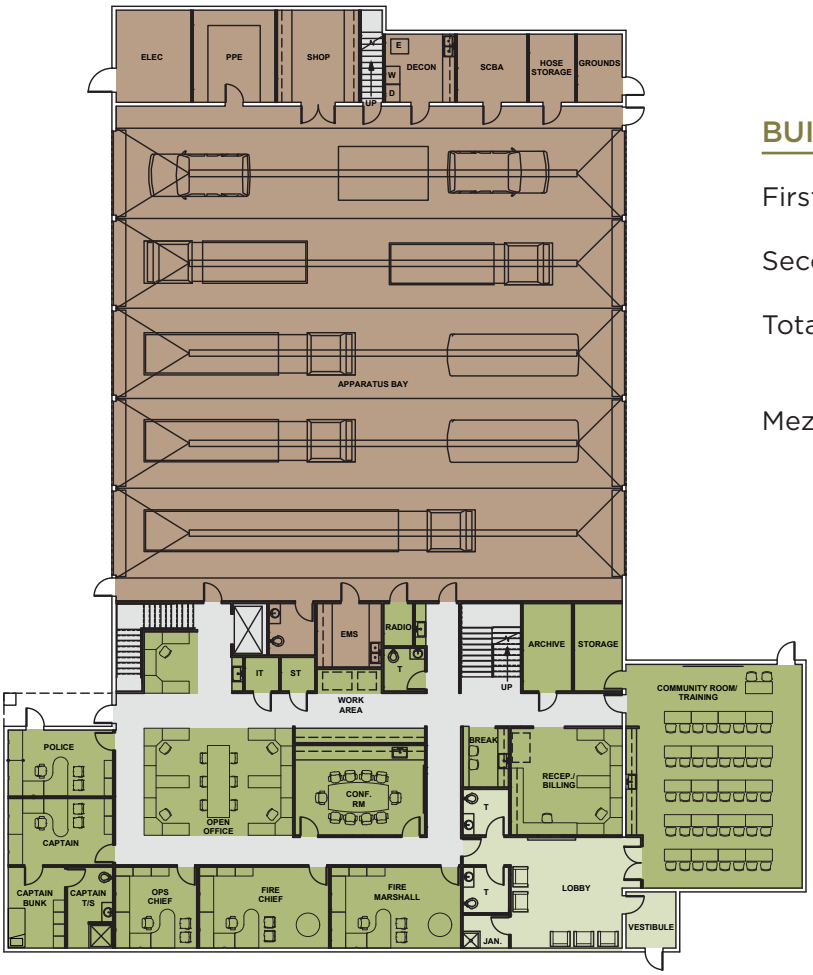
Site Plan

1" = 80'-0"

Selected Site Plan



BUILDING SUMMARY:

First Floor:	14,839 SF
Second Floor:	6,699 SF
Total:	21,538 SF
Mezzanine:	679 SF

N

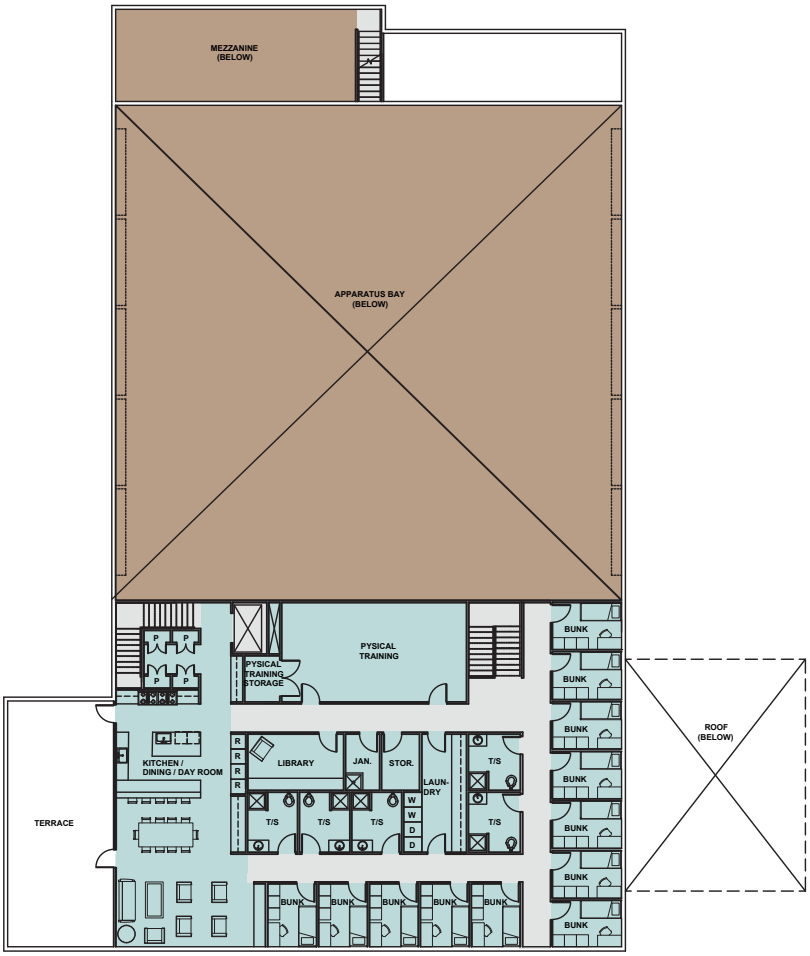
First Floor Plan

1/32" = 1'-0"

The block diagram for Scheme 3 was further refined to a floor plan level of detail in coordination with the Fire Department. Access points into rooms, furniture, and equipment were added to further evaluate the proposed scheme and verify the design met Department's requirements.

As you enter the vestibule and the lobby area, the reception area affords a clear line of site to the front door, entry to the training/community room, and access to the secure office area. The private offices are aligned along the wall with work areas and the conference room located internally. A small break area for the staff has been added. All vertical circulation is centrally located within the building with hand wash stations located from the apparatus bay to the office area.

The apparatus bay support rooms are located on the north side of the building with a full mezzanine level for storage.



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Second Floor Plan

1/32" = 1'-0"

The second floor is comprised of the living quarters, making a clear distinction between living quarters and administration. The bunk rooms are located on the East and South walls with the Toilet/Shower rooms located internally. The day room, dining, and kitchen are all open to each other and have access to a roof top patio for barbecuing, etc. The physical training room is strategically located above apparatus support rooms so that sound will not resonate over the administration area.

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VISIONING/ PUBLIC OUTREACH

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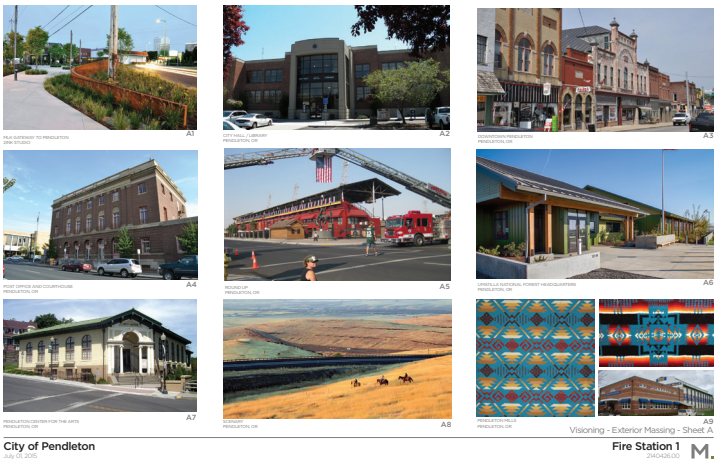
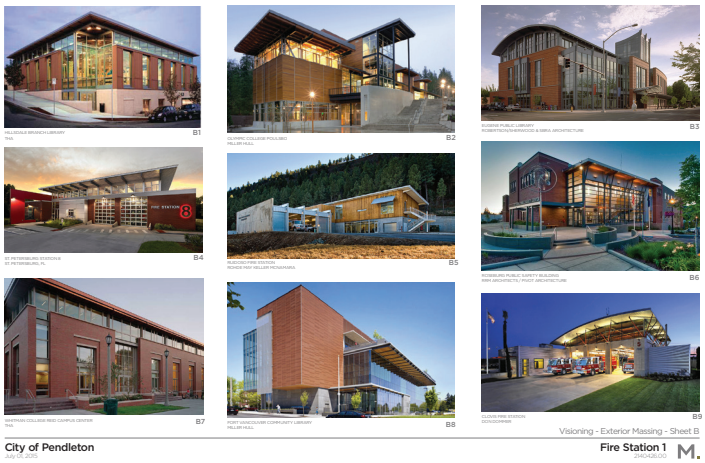
VISIONING / PUBLIC OUTREACH

The goal of the visioning meeting was to provide Pendleton the opportunity to solicit aesthetic design feedback from a select group of people.

The Visioning imagery includes relevant precedent facilities and contextual images from Pendleton and its surrounding area. A subsequent discussion with the group helped to develop key words and phrases identified as high priorities for the City of Pendleton. This allowed Mackenzie to design the massing of the building to meet the needs and wants of the community.





PENDLETON MILLS
PENDLETON, OR

PENDLETON ROUND-UP
PENDLETON, OR

OLD PENDLETON CITY HALL
PENDLETON, OR

HIGHLANDS FIRE STATION
WARD YOUNG ARCHITECTS

MOUNTAIN VIEW FIRE STATION 5
MOUNTAIN VIEW, CA

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CONCEPTUAL DESIGN

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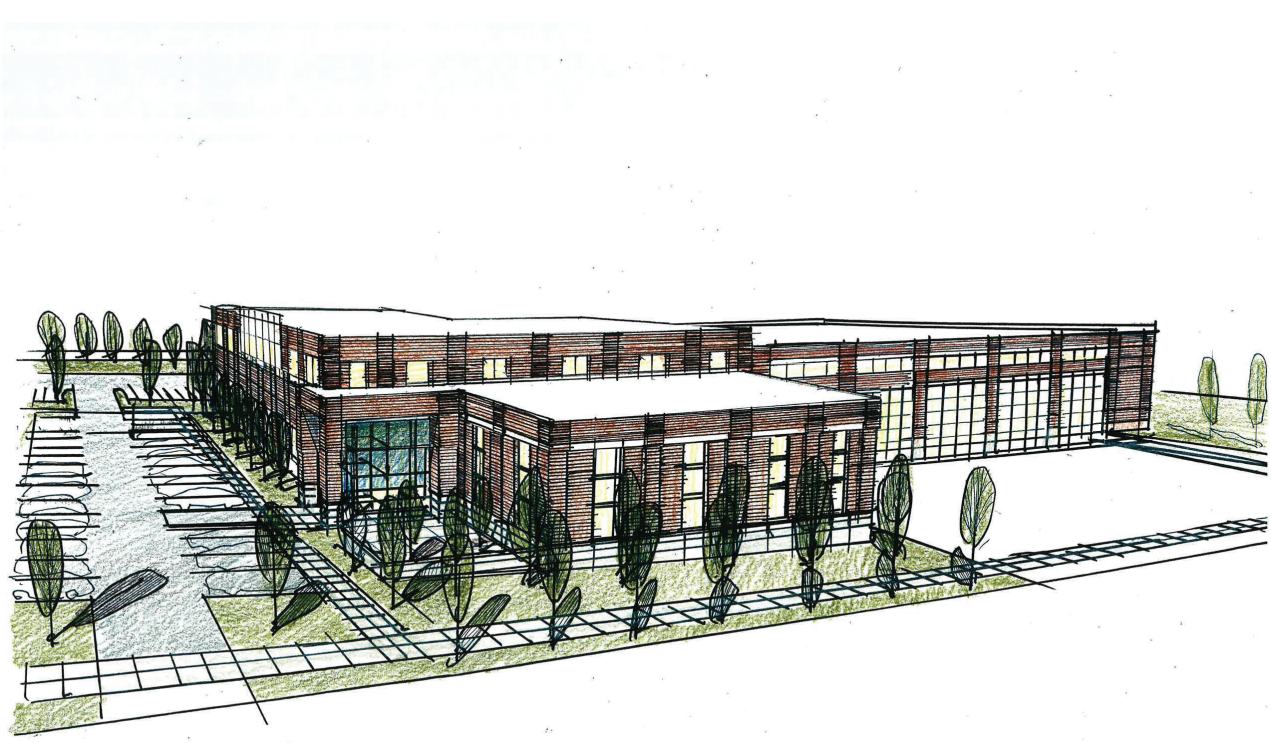
CONCEPTUAL DESIGN

Following cues from the visioning process, the Design Team worked with the City and Fire Department to craft a conceptual design molded from the key concepts.

Important considerations were that the building use materials representative of the city, consider the neighboring properties for use and scale, and the building responses to a desire for street frontage and urban scale along Hwy 30. The design's construction techniques and approaches have sought to be responsible, cost-effective, long-lasting, and low maintenance.

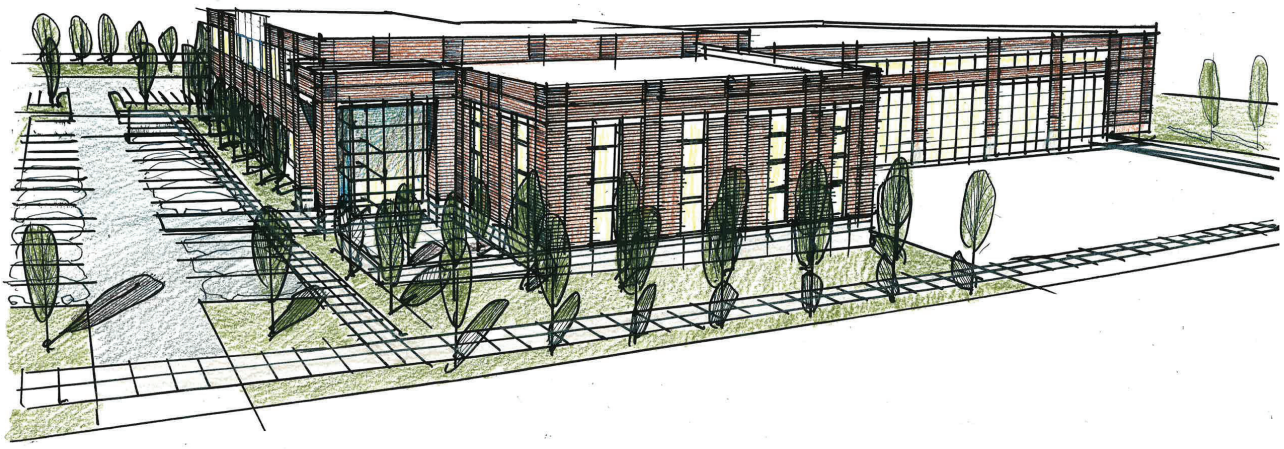
To assist the Department to visualize design options, Mackenzie produced massing studies of the new building, using the approved site and floor plans. The options utilize similar material palettes to achieve aesthetic and formal massing that speaks to the City of Pendleton.

The following pages illustrate the progression of the design.

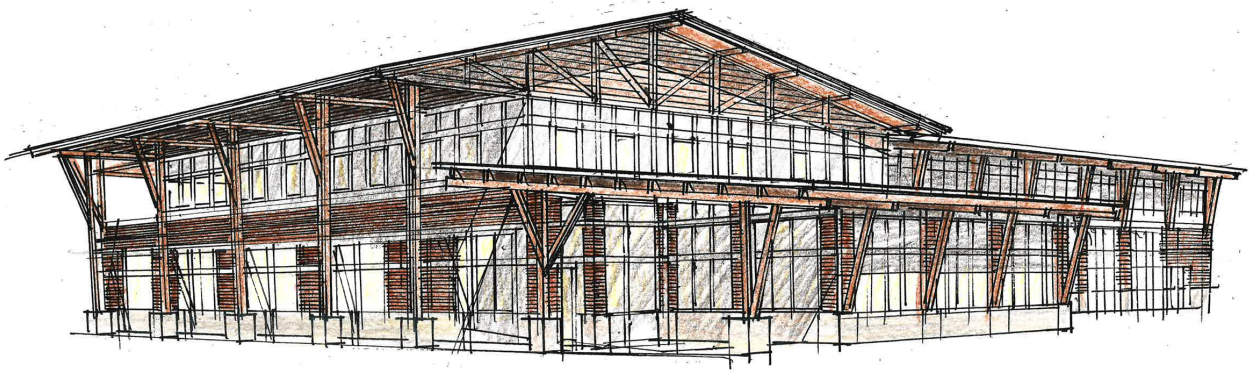


Concept A

PRELIMINARY OPTIONS



Concept B

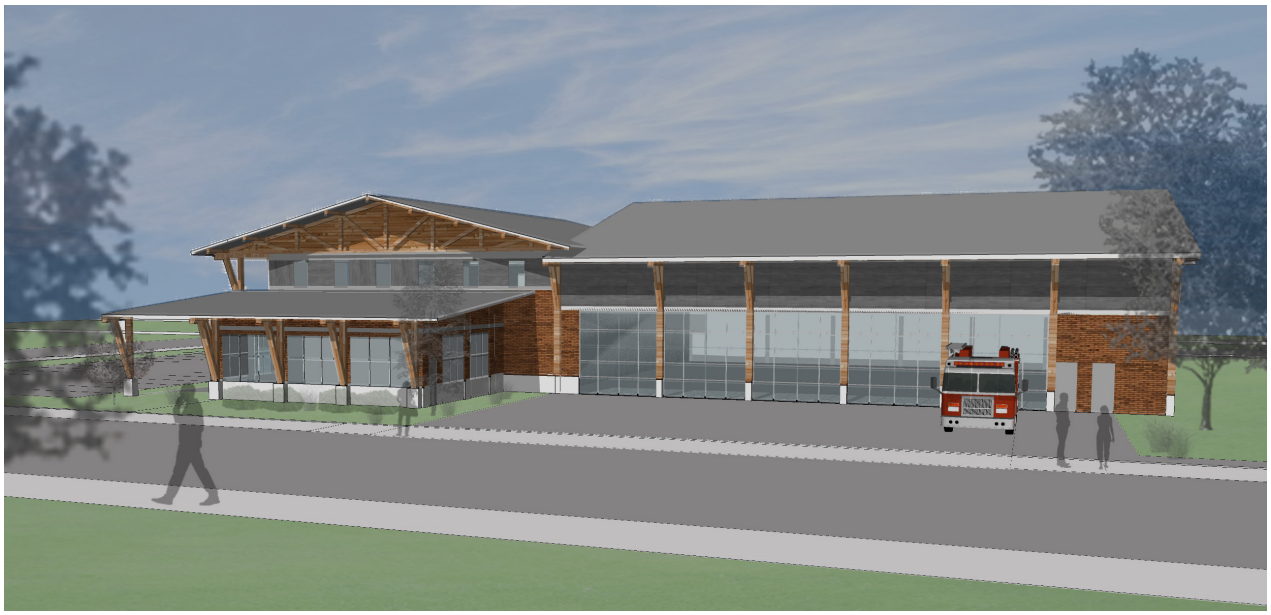


Concept C

SELECTED CONCEPT DESIGN

The Fire Department selected to proceed with Option C with the gabled roof. The design implements the historic qualities found in the old city hall building (ie the old fire station). The selected material palette reinforces the overall longevity of the building, both physically due to the durability of the materials and in terms of the external perception of the facility. The masonry projects a solid foundation for the building. Responding to the open wood truss roof system of the Round-Up, the sloped roof system captures the essence while still responding to the sense of permanence and civic quality with the masonry.

Entry View



Apparatus Bay View

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PROJECT COST DEVELOPMENT

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COST SUMMARY

Following completion of the conceptual design, Mackenzie evaluated cost impacts of the fire facility to meet Department needs for the next 30 years. The following cost summary shows projections of a total development cost, including estimated construction costs, design costs, and owner costs.

Development costs of a project are not limited to construction costs alone and require consideration of other variables. These variables differ between new construction and renovation or expansion, and invariably change from one project to the next depending on site conditions, existing building conditions, building codes, seismic zones and the environment of the construction industry. Differences between estimates arise depending on the design approach, construction costs, and design and engineering costs. Owner costs for furniture, fixtures and equipment are often constant, based on a predetermined budget set by the Department. New construction can often differ substantially due to the single variable of land acquisition. This cost, coupled with higher construction costs, often leads to this being a more expensive option.

PENDLETON FIRE STATION 1

Construction Cost - Building		$3,322,398
Construction Cost - Site		$703,273
Construction Cost - Street Improvements		$382,342
Total Construction Costs		**$4,408,013**
	LOW	**HIGH**
Contingency	$462,841	$969,763
General Conditions	$356,388	$407,300
Profit & Overhead	$326,859	$373,533
Performance Bond	$46,616	$52,347
Inflation	$220,401	$440,801
Total Consultant Costs		**$767,547.85**
Total Owner Costs		**$864,107.58**
Total Project Cost Range:	**$7,452,773.43**	**$8,397,396.40**

Construction costs reflect the raw costs incurred by a general contractor for overhead and profit, bonding and insurance, securing of materials and general construction of the site and building. In addition to the identified construction costs, a design contingency is recommended to ensure dollars are carried through construction for owner changes, design omissions, unforeseen conditions or jurisdictional requirements, among others. A high and a low range of Construction Cost contingency has been calculated in the Project Cost Summaries, shown on the following pages.

Consultant costs reflect the costs incurred for project management and design of the project from conceptual design through construction administration. Though design fees can vary, these costs are generally factored using a fee based on the construction costs for the project. In addition to architectural and engineering services, costs include marketing materials and required services such as topographical surveys and special inspections. A contingency is provided for this category for any unforeseen or additionally requested design services throughout the project.

Owner costs reflect the costs generally incurred directly by the owner throughout the project. This includes all items the owner may wish to contract separately from the general construction of the project. Additional owner-related costs include relocation into the new facility, legal documentation and counsel for project documents and issuances, and jurisdictional fees associated with design review, building permits, SDCs, TIF fees and BOLI fees. A contingency is provided in this category for any unforeseen or undefined costs not currently represented.

The Jurisdictional Fee Summary reflects a preliminary estimate of the fees which will be assessed by the governing jurisdiction. This information is based on the information available at the date of the report, and the actual fees may vary at the time of permit application or issuance. For the purposes of this estimate, any fees that are expected to be credited back once the permit is issued have been removed from the summary.

The following project development cost estimate examines the construction values of the programmed design concept. The design concept has been estimated for a high range and a low range, with details of scope and assumptions detailed in the Statement of Probable Costs, found in Appendix B.

PROJECT COST ESTIMATE

Estimate of Total Project Costs - Low Range

Construction Cost of Facility			
Building Hardcost	**$3,322,398.00**	$157.74	per Building SF
Site Hardcost	**$703,273.00**	$33.39	per Building SF
Street Improvements Hardcost	**$382,342.00**	$18.15	per Building SF
General Conditions	$356,388.00	7% of Combined Hardcost	
Bonds & Insurances	$46,616.00	1% of Combined Hardcost	
Overhead & Profit	$326,859.00	6% of Combined Hardcost	
Inflation (1 year)	$220,401.00	5% of Combined Hardcost	
Contingency	$462,841.00	10% of Combined Hardcost	
Total Construction Costs	**$5,821,118.00**	$276.38	per SF

Consultants Costs		
A/E Design and Construction - Base	$596,665.00	10.25% of Total Construction Cost
A/E LEED Design and Documentation	$0.00	N/A
Reimbursables	$29,833.00	5% of fee
Marketing Materials	$5,000.00	Allowance
Topo and Boundary Survey	$7,500.00	Allowance
Special Inspections	$25,000.00	Allowance
Geotechnical Services	$20,000.00	Allowance
Environmental Services	$0.00	N/A
Hazardous Material Survey/Testing	$0.00	N/A
Commissioning	$30,000.00	Recommended, Not required
Arborist	$0.00	N/A
Subtotal - Consultants	$713,998.00	
Consultants Contingency	$53,549.85	7.50%
Total Consultants Costs	**$767,547.85**	$36.44 per SF

Owner Costs		
Land Acquisition	$279,655.00	$6.00 / SF (Site Area - 1.07 acres)
Fixtures, Furniture & Equipment (FF&E)	$210,620.00	$10 per SF Allowance
Lockers/Shelving	$125,000.00	Allowance
Fitness Equipment	$15,000.00	Allowance
Telephone/Data Equipment	$42,124.00	$2 per SF Allowance
LEED Registration	$0.00	N/A
Moving Allowance	$15,000.00	Allowance
Temporary Facilities	$0.00	N/A
Permit Fees	$116,422.00	Building Permits - 2% of Total Construction Cost
Subtotal - Owner Costs	**$803,821.00**	
Owner Contingency	$60,286.58	7.50% of Owner Costs
Total Owner Costs	**$864,107.58**	$41.03 per SF

Total Project Cost	**$7,452,773.43**	**$353.85 per SF**

Building Size:	*21,062 SF*

Exclusions: Off-site improvements to public right-of-way or utilities

PROJECT COST ESTIMATE

Estimate of Total Project Costs - High Range

Construction Cost of Facility			
Building Hardcost	**$3,322,398.00**	$157.74	per Building SF
Site Hardcost	**$703,273.00**	$33.39	per Building SF
Street Improvements Hardcost	**$382,342.00**	$18.15	per Building SF
General Conditions	$407,300.00	7% of Combined Hardcost	
Bonds & Insurances	$52,347.00	1% of Combined Hardcost	
Overhead & Profit	$373,553.00	6% of Combined Hardcost	
Inflation (1 year)	$440,801.00	10% of Combined Hardcost	
Contingency	$969,763.00	20% of Combined Hardcost	
Total Construction Costs	**$6,651,777.00**	$315.82	per SF

Consultants Costs		
A/E Design and Construction - Base	$681,807.00	10.25% of Total Construction Cost
A/E LEED Design and Documentation	$0.00	N/A
Reimbursables	$34,090.00	5% of fee
Marketing Materials	$5,000.00	Allowance
Topo and Boundary Survey	$7,500.00	Allowance
Special Inspections	$25,000.00	Allowance
Geotechnical Services	$20,000.00	Allowance
Environmental Services	$0.00	N/A
Hazardous Material Survey/Testing	$0.00	N/A
Commissioning	$30,000.00	Recommended, Not required
Arborist	$0.00	N/A
Subtotal - Consultants	$803,397.00	
Consultants Contingency	$60,254.78	7.50%
Total Consultants Costs	**$863,651.78**	$41.01 per SF

Owner Costs		
Land Acquisition	$279,655.00	$6.00 / SF (Site Area - 1.07 acres)
Fixtures, Furniture & Equipment (FF&E)	$210,620.00	$10 per SF Allowance
Lockers/Shelving	$125,000.00	Allowance
Fitness Equipment	$15,000.00	Allowance
Telephone/Data Equipment	$42,124.00	$2 per SF Allowance
LEED Registration	$0.00	N/A
Moving Allowance	$15,000.00	Allowance
Temporary Facilities	$0.00	N/A
Permit Fees	$133,036.00	Building Permits - 2% of Total Construction Cost
Subtotal - Owner Costs	**$820,435.00**	
Owner Contingency	$61,532.63	7.50% of Owner Costs
Total Owner Costs	**$881,967.63**	$41.87 per SF

Total Project Cost	**$8,397,396.40**	**$398.70 per SF**

Building Size:	*21,062 SF*

Exclusions: Off-site improvements to public right-of-way or utilities

FACILITY COST COMPARISON

PROJECT	BUCKLEY FIRE	HILLSBORO FIRE - JONES FARM
LOCATION	Buckley, WA	Hillsboro, OR
YEAR COMPLETE	2012	2012
CONSTRUCTION TYPE	Wood & Metal Framing w/ Cement Board Siding and Brick Veneer	Structural Masonry
BUILDING SIZE	21,232 sf *	13,458 sf
STORIES	SINGLE	SINGLE
BUILDING COST per sf	$140.44 per sf	$191.62 per sf
SITE COST per sf of building	$35.39 per sf of building	$25.28 per sf of building
OFF-SITE COST per sf of building	$0	$18.61 per sf of building
TOTAL CONSTRUCTION COST per sf of building	**$175.83 per sf of building**	**$235.51 per sf of building**
FINAL CONSTRUCTION COST ESTIMATE per sf of building	**$185.97 per sf of building**	**$227.96 per sf of building**
LOW BID (AVERAGE BID) per sf of building	**$160.32 ($181.18) per sf of building**	**$226.33 ($244.17) per sf of building**

* - Mezzanine not included

† - Based on Mackenzie's preliminary estimate validated by Construction Focus, Inc.

HOOD RIVER FIRE	DELAKE FIRE	AVERAGE BUILT COST	PENDLETON FIRE STATION 1
Hood River, OR	Lincoln City, OR		Pendleton, OR
2012	2009		conceptual design
Structural Masonry and Wood Framing w/ Cement Board Siding	Wood Framing w/ Cement Board Siding		Strutural Steel w/ Combination of Brick Veneer and Reinforced CMU walls
21,528 sf	4,574 sf		21,062, sf *
TWO	SINGLE		TWO STORY
$127.33 per sf	$171.36 per sf	**$169.55**	$157.74 † per sf
$18.12 per sf of building	$41.22 per sf of building	**$28.02**	$33.39 † per sf of building
$7.60 per sf of building	$0	**$5.97**	$18.15 † per sf of building
$153.05 per sf of building	**$212.58 per sf of building**	**$214.97**	**$276.38 † per sf of building**
$190.45 per sf of building	**$275.28 per sf of building**		**N/A**
$139.67 ($146.51) per sf of building	**$199.58 ($234.08) per sf of building**		**N/A**

Facility Cost Comparison

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RESPONSE TIME STUDY

APPENDIX A

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Pendleton Fire Department
Station Placement
Response Time Simulation Study

Coelo Company of Design
July 15, 2015

1 Executive Summary

The Pendleton Fire Department is considering four alternate locations for reconstructing or relocating its main fire station. Coelo Company of Design ("we") used the Code3Simulator modeling software to simulate the effects of these locations on initial incident response times according to the City of Pendleton's established performance metric: the 80th percentile of initial response time to emergent fire and EMS calls within the city limits.

Our analysis predicts that target response times for all options will be within a relatively narrow range (maximum likelihood = 16 seconds variation, 95% confidence under 20 seconds variation). The existing Station 1 location (911 SW Court Avenue) will provide the worst performance, primarily because of the significant traffic delay associated with daytime response. Simulation results predict that 1601 SE Court Avenue will most likely perform 3-6 seconds better; 14 SE Third, 9-11 seconds better; and 336 SE Emigrant, 15-18 seconds better. The advantages of the latter two options are largely due to their positions relative to a pronounced "hot spot" of activity in the downtown core area. Simulation results probably slightly over-state the advantages of 336 SE Emigrant and 14 SE Third, because they do not account for traffic effects at these locations.

Different areas of the city are affected differently by the alternate scenarios. Performance also varies slightly but not systematically by major category of incident.

2 Study Objectives

In January, 2015, we were chartered by Pendleton Fire Department to evaluate four potential locations for Fire Station 1 with respect to response time. During the course of the study, one site was found to be architecturally unsuitable. Also, in April, 2015, an additional property (the former St. Anthony's Hospital site) became available for consideration and we adjusted the analysis to include this option in early May.

Objectives of the study were to:

1. Predict initial response time at the 80th percentile for emergent calls within City limits for each proposed scenario;
2. Provide breakdowns of these statistics by time and geography
3. Assess confidence in the predictions
4. Present findings in verbal, written and graphic form to Pendleton Fire command staff
5. Provide all necessary data and methods to audit and recreate results independently.

The scenarios to be studied were:

1) Rebuild/renovate Station 1 at its existing location, 911 SW Court Avenue.
2) Relocate Station 1 to 336 SE Emigrant Avenue
3) Relocate Station to 1601 SE Court Avenue (former St. Anthony's Hospital site; option added in April, 2015)
4) Relocate Station 1 to 14 SE 3rd St
5) Relocate Station 1 to SE 1st and Dorion (this option was removed from consideration in March)

During the course of the study, site analysis and facility requirements programming by Mackenzie staff indicated that Scenario 5 was not viable due to site limitations. Data regarding Scenario 5 is not presented in this study, but is available in the full digital project archive.

3 Methodology

3.1 Predictive Analysis Methodology

We used our Code3Simulator software (version 2.6.2369.3273) to perform predictive analysis on two years of Pendleton Fire Department incident data. Code3Simulator is a discrete event simulator that "replays" incident history against alternate deployment scenarios and generates detailed and aggregate statistics for each scenario or "model." These statistics are presented in maps, charts and tables designed by the user, A number of Code3Simulator graphics appear later in this report. We created one model for each station location scenario, ran these scenarios against two years' historical call data, and compared predicted initial response times along several axes.

3.2 Data Receipt, Analysis and Import

We received incident data from City GIS analyst Katey Jones. With minor reformatting, we were able to import this data (5340 records, spanning the period 1/1/2013 to 12/31/2014) into Code3Simulator. Original data is contained in the file `Pendleton2013_2014RawResponseData.xlsx` (3/3/20154 16:29, 657kb) in the data archive.

The Code3Simulator import tool "sanitizes" call information in compliance with the Health Insurance Portability and Accountability Act of 1996 (HIPAA) – it rounds all street addresses to the nearest hundred-block, and rounds incident locations to the nearest 200 feet.

The result of importing call data was 5340 unique incidents spanning 1/1/2013 to 12/31/2014. Five import errors were detected, all due to missing X/Y coordinates for locations that appeared to be related to Interstate 84 or State Highway 30. Input data dispatch times did not contain a significant seconds field, so time statistics on observed data were necessarily limited.

We also received a GIS shapefile (PendletonCityLimits.shp, 34kb, 2/9/2015 10:43) from Ms. Jones containing a polygon outline of the corporation limits of the City of Pendleton. This was successfully imported into Code3Simulator and applied to all models.

OpenStreetMaps™ and GreatMaps™ data for the City of Pendleton and surrounding area were downloaded from the OpenStreetMaps open source community on 2/5/2015.

3.3 Model Construction

We built Code3Simulator models of all the proposed station locations. Station complements were as follows across all models:

	Station 1 (relocated per model)	Station 2 (fixed at current location)
Apparatus	C 21-01 (command vehicle) E 21-11 (engine)	E 21-12 (engine) M 21-72 (medic)

	M 21-71 (medic) W 21-51 (wildland) Backup unit*	W 21-41 (wildland) Backup unit*
Staff	Duty chief Lieutenant Engineer Firefighter Callback staff*	Engineer Firefighter Callback staff*

* Callback staff and backup units were available with a 12-minute turnout time delay to backfill openings when all frontline resources were deployed at the time of a new call. The 12-minute figure was deemed credible by Chief Walker, but could not be empirically confirmed.

Turnout times were analyzed for existing data. This analysis was limited by the fact that all times supplied were rounded to the nearest minute; however, meaningful signals were extracted, suggesting turnout times for the most frequent emergent calls (Code 3 medical calls) centered around 1.05 minutes, consistent with departmental goals. This figure was used as a default turnout time for all stations, apparatus and incident causes.

However, anecdotal reports suggested that the current Station 1 location was subject to extended delays due to traffic during weekday hours. This belief was partially confirmed by an informal study requested by Chief Walker, who requested crews to measure departure delays due to traffic on weekdays; he reported a figure of 45 seconds. Our models incorporated this delay into turnout times; in all cases, turnout time was set at 1.05 minutes, EXCEPT for Station 1 at 911 SW Court Avenue during weekday hours of 0700-1900, when the turnout time was set at 1.80 minutes (45 seconds greater than the default).

Scene times were modeled consistently by major call category, based on figures provided by Chief Walker.

3.4 Simulation, Results Filtering, Analysis

All models were run against a total of 5340 calls, representing nearly the entire call volume from 1/1/2013 through 12/31/2014.

Simulation results (containing detailed predictions of the behavior of each unit on each call) were saved, and subsequently filtered to include emergent calls within the City of Pendleton. Emergent calls were defined as nature codes falling into the categories shown below:

- 100*: fires
- 300*: Medical incidents (excluding outbound inter-facility transfers)
- 400*: Hazardous condition
- 600*: Well-intentioned false alarm.

This filtering resulted in a final dataset of 3440 calls with simulated unit behaviors.

These results sets were analyzed to compare the performance of each location option with respect to initial response time. The City's adopted performance metric of the 80th percentile

initial response time (i.e., the time such that 80% of initial responses occur within that time) was used for most comparative analyses. These analyses are presented in the following sections.

3.5 Addition of St. Anthony's Site

In late April, Pendleton Fire Department command staff encountered the opportunity to consider an additional site: the former St. Anthony's Hospital complex, in the 1600 block of SE Court Avenue. The study objectives were amended to include consideration of this site, and exclude the site at First St. and Dorion Avenue. Alternate street entrances facing SE Court Avenue and SE Court Place were modeled. It was found that these subtle differences (amounting to 150' of travel at most) were not amenable to modeling in Code3Simulator. The Court Avenue entrance was used for the remainder of the analysis.

3.6 Validation

Simulation predictions were validated by several methods:

- Sensitivity analysis consisting of 20x50% jackknife subsampling was conducted to determine the sensitivity of predictions to inherent fluctuation in supplied incident data. These results are presented in the following section.
- Simulated call history for 30 randomly selected individual calls (0.87% of study data) were manually audited by Chief Benedict, with no errors found. Audit included validating dispatch assignments, travel times, scene times and in-service times.
- Chief Benedict also manually audited predicted travel routes for 10 calls (0.29% of study data) individually selected for distributed geographic coverage, again with no errors found.
- Coelo staff broke down all analyses by cause, time and geography and reviewed with PFD command staff at several intermediate checkpoints. No significant unexpected effects were found in these reviews.

4 Findings

This section presents the findings of the simulation and analysis phases of the study. All data presented here are subject to the simulation and filtering protocols described in Section 3.4.

4.1 Overall Comparison

All four models retained for study performed within a relatively narrow range on the 80th percentile target metric. Rankings by overall and median subsampled performance were consistent, in the following order:

Rank	Option	80th Percentile (Absolute)	Difference From Optimal	80th Percentile (Subsample Median)
1	[2] 336 SE Emigrant	6.61	0.00 (0:00)	6.60
2	[4] 14 SE Third	6.71	0.10 (0:06)	6.72

3	[3] 1601 SE Court	6.82	0.21 (0:13)	6.81
4	[1] 911 SW Court	6.91	0.30 (0:18)	6.89

The sensitivity analysis presented in the following charts is the result of 20x50% jackknife subsampling of all predicted data. In this procedure, simulations are run against the entire call dataset (excluding calls causes inaccurate simulation, because units are presumed available for calls when they would actually be committed to excluded calls). Then, random subsamples are selected and the target metric (80th percentile initial response time) is calculated for each. This procedure enables us to assess confidence that observed effects are not due to accidents of the input data. Subsampling results are presented in the two following figures.

In Figure 1, we show the results of the individual subsamples. This shows the relative performance of each model in each subsample. For example, in Subsample 6, the four models' 80th percentile response times were 6.93, 6.69, 6.89 and 6.77 minutes respectively for models 1, 2, 3 and 4. The relative performance of the different models is quite consistent across the subsamples, despite the fact that the absolute numbers fluctuate somewhat depending on the content of data in each subsample.

Figure 1: Subsampling Results

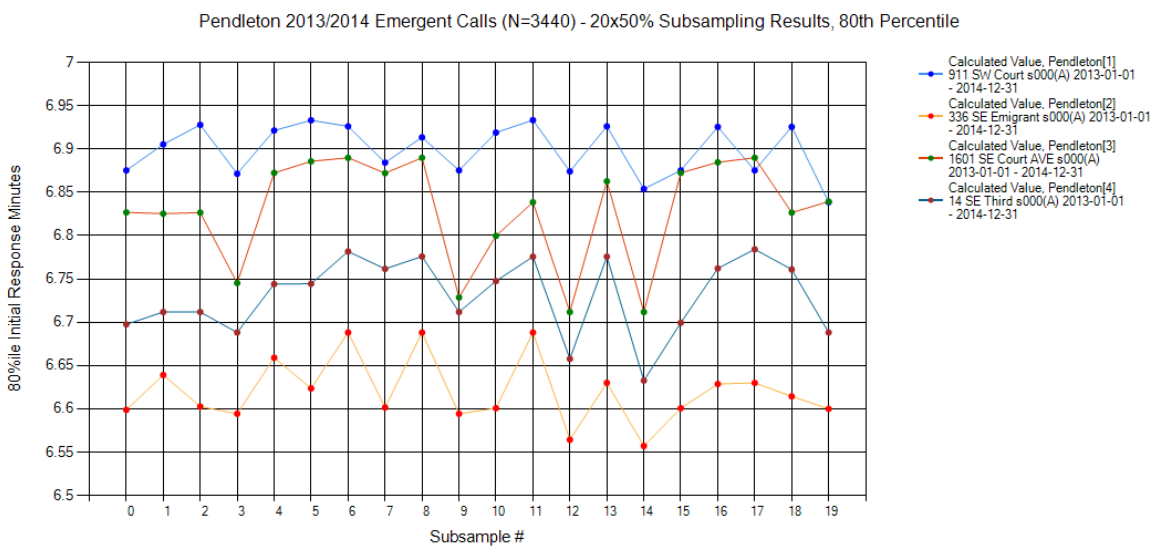


Figure 2 shows the distribution of *differences* among the models. The dark blue horizontal lines indicate the 50th percentile of differences between models across all subsamples, the translucent blue bars represent the middle 67% of data, and the "whiskers" show the extent of the middle 90% of data. Differences are shown relative to the 14 SE Third site.

Figure 2: Sensitivity Chart (Differences)

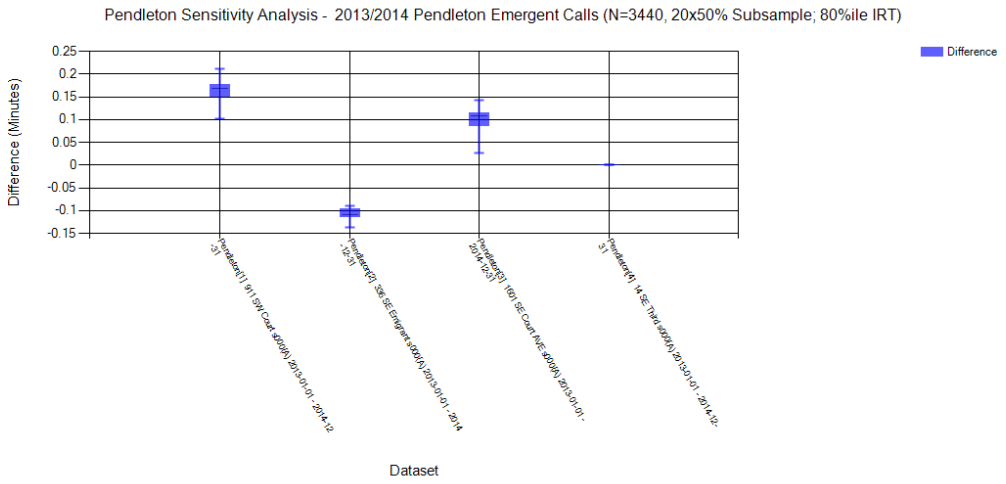
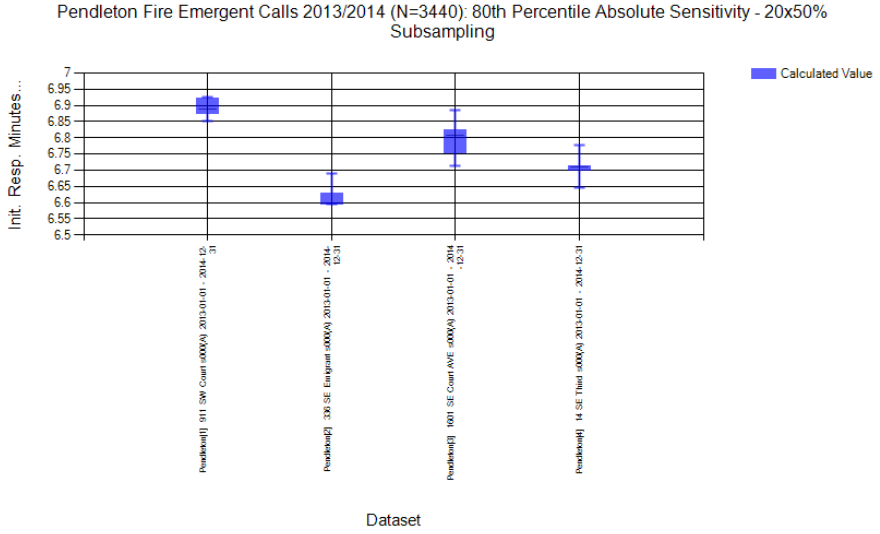


Figure 3 shows the sensitivity analysis on the direct 80th percentile values. Whiskers, boxes and horizontal bars again respectively show the middle 90%, middle 2/3 and median of 80th percentile initial response times across all subsamples by model.

Figure 3: Sensitivity Chart (Absolute)



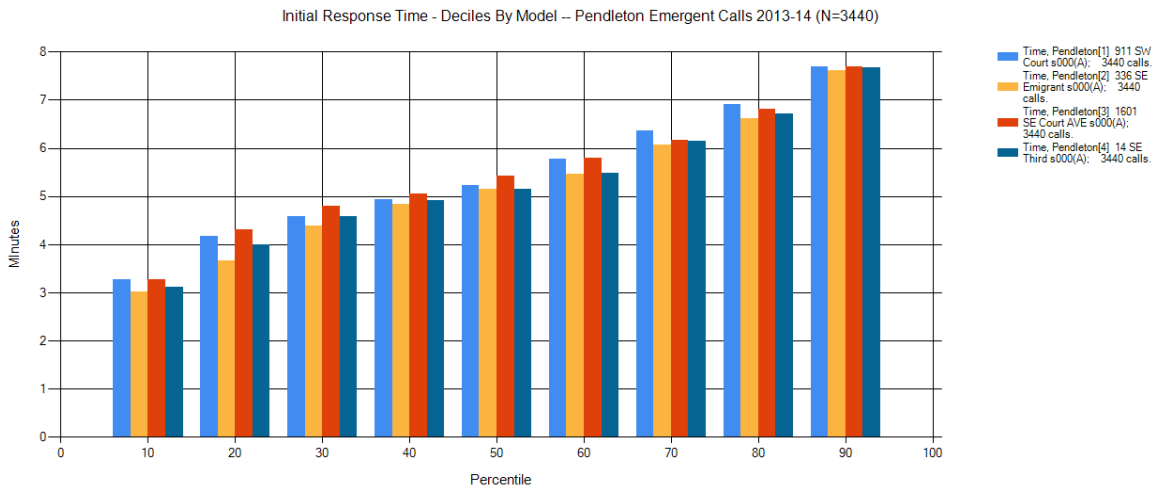
Conclusions that can be drawn from this chart, relative to the 80th percentile of initial response times, include:

- First and foremost, that we can claim high confidence that the observed effects are not due to flukes in the input data. Input data from two years are included, and subsampling results are highly consistent.

- there is a 95% likelihood that the SE Emigrant Avenue option will outperform all other options by at least 0.08 minutes (5 seconds);
- there is 83% likelihood that the worst-case difference between the former St. Anthony's site and the fastest option (SE Emigrant) will be no more than 0.22 minutes (13 seconds);
- The former St. Anthony's site will likely outperform the current location by a small margin (this conclusion is difficult to quantify in probability terms).

This analysis focused on the 80th percentile of initial response times, the key metric established by the City of Pendleton. For the sake of completeness, we also compared the full spectrum of deciles for initial response time across all three location options as shown in the chart below.

Figure 4: Full Decile Spectrum



Note that the relationship among the models is not consistent across the full range of percentiles. Option 3 is roughly equivalent to, or even slightly worse than, Option 1 at the lower percentiles (best cases), but begins to outperform slightly at the higher percentiles (worst cases). This suggests that Option 3 is marginally better than Option 1 for a conservative strategy.

4.2 Breakdown Comparisons (Time and Cause)

The charts below provide breakdowns of 80th percentile initial response time by day of week and incident cause.

In this figure we see that the relative ordering of the location options remains relatively consistent, although the magnitude of differences varies across incident cause categories.

Figure 5: 80thPercentile Times by Cause

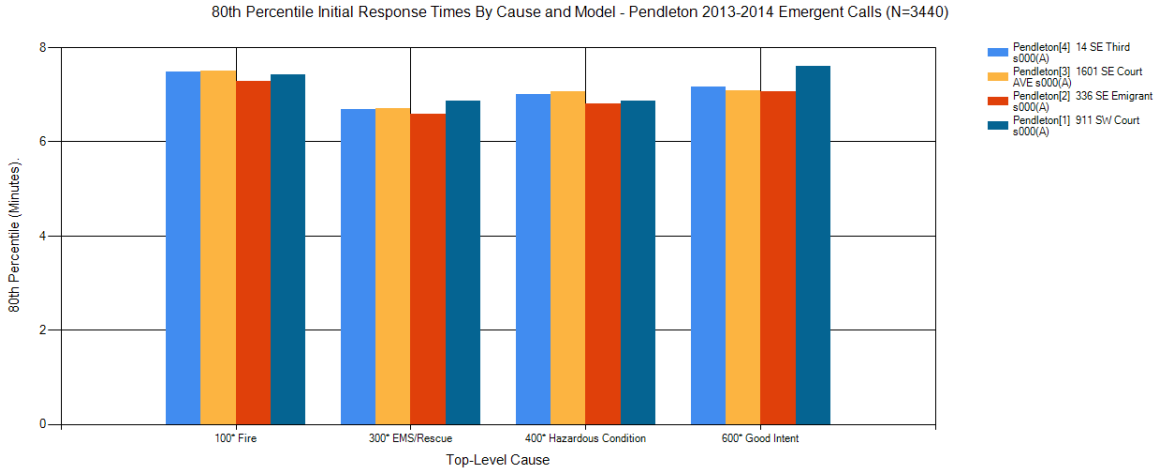
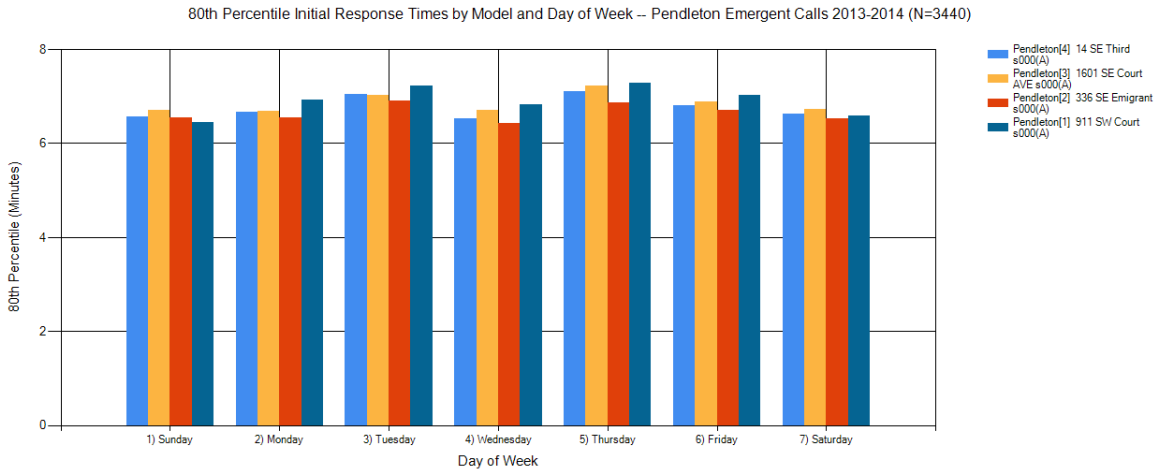


Figure 6: 80th Percentile Times by Day of Week

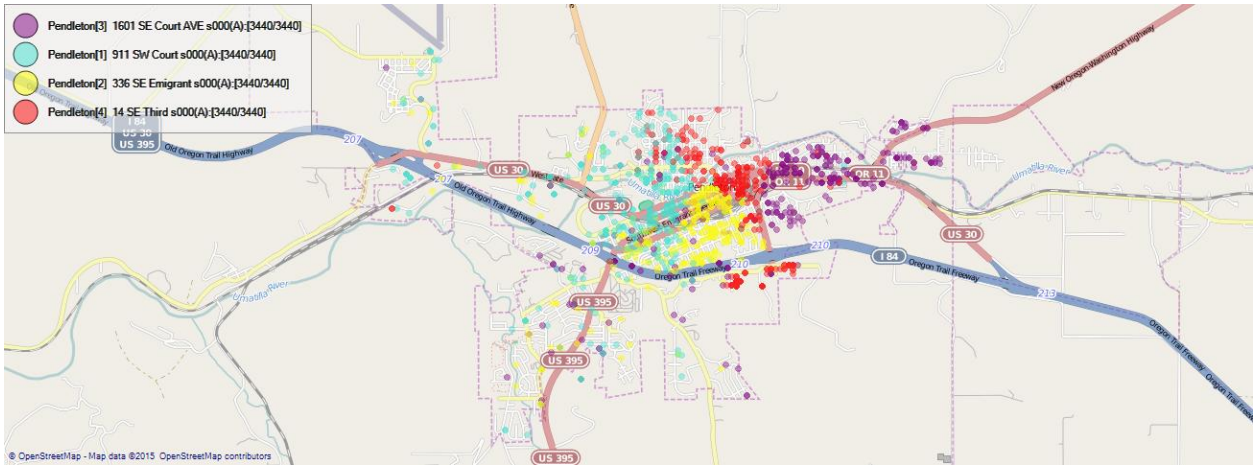


The key finding from this chart is that the weekday/daytime traffic delay reported by Chief Walker and the crews is significant: the inferiority of the 911 SW Court Avenue location disappears on weekends when the delay is not present in the simulation.

4.3 Geographic Comparisons

This section covers geographic aspects of the comparison of the models' performance.

Figure 7: Comparison Map



The map above depicts the relative strengths of the various models. Each point indicates one call in the dataset for which one model significantly out-performs the other two models, as indicated by the color keys for each model. Brighter colors indicate stronger superiority of the indicated model. For example, a pale red dot indicates that Model 4 slightly outperformed the other three models; a dark purple dot indicates that Model 3 strongly outperforms.

The following maps present the four models one by one. In each map, every call is represented as a colored dot, with the predicted initial response time for each call coded in color, shaded from 3 minutes in green to 7 minutes or greater in red.

Figure 8: [Model 1] 911 SW Court- 3 to 7 Minute Response Map

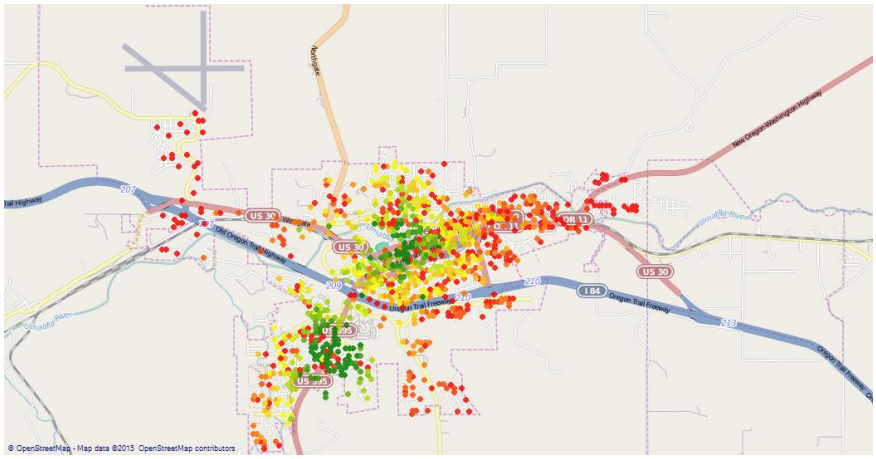


Figure 9: [Model 2] 336 SE Emigrant - 3 to 7 Minute Response Map

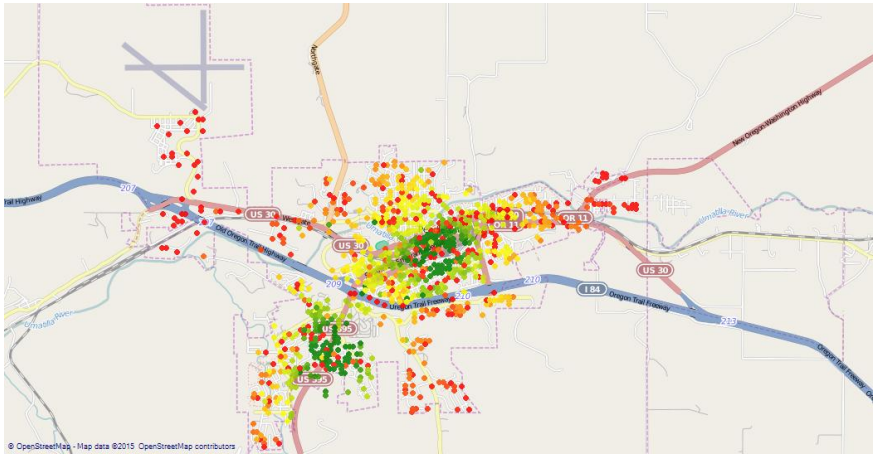


Figure 10: [Model 3] 1601 SE Court Ave - 3 to 7 Minute Response Map

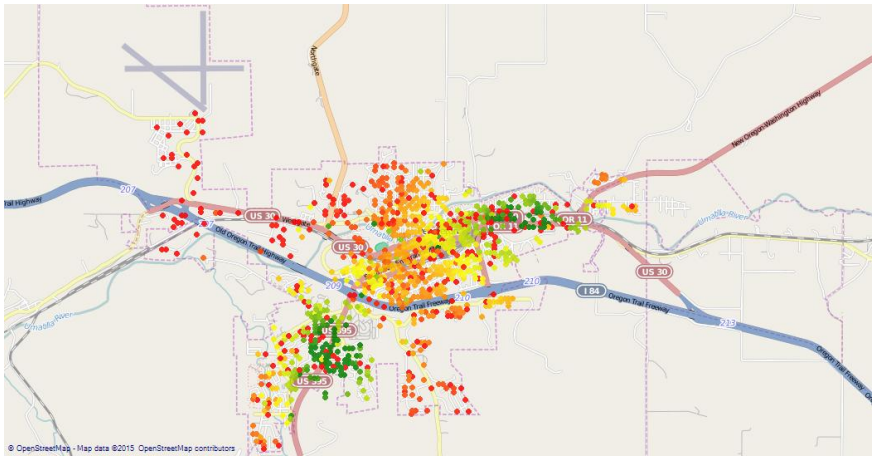
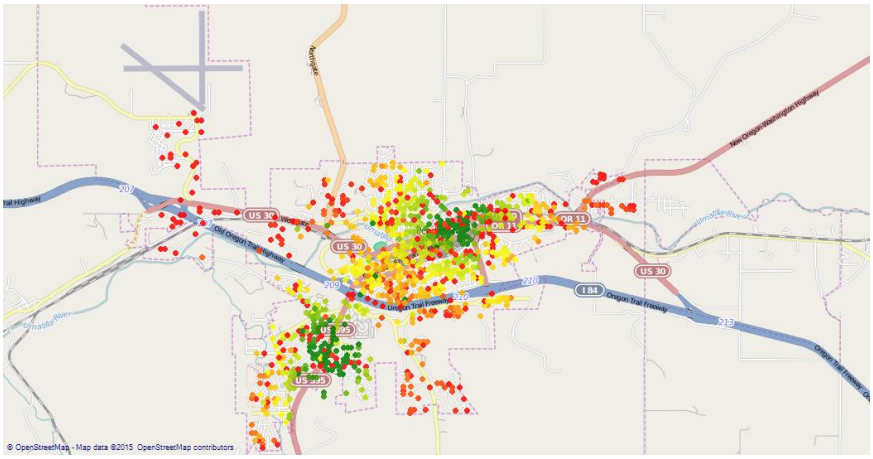


Figure 11: [Model 4] 14 SE Third - 3 to 7 Minute Response Map



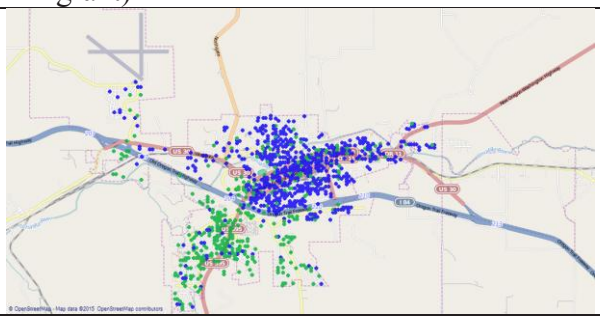
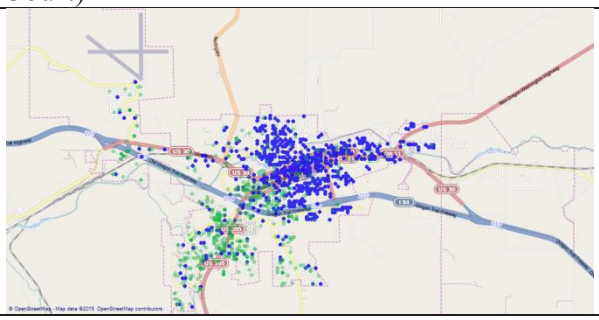
Not surprisingly, each model performs best in the vicinity of the proposed location of Station 1 within that model. There are individual outlier calls, typically related to a primary resource being unavailable to handle a call to which it would ordinarily be first due.

4.3.1 First Due Areas

Plotting colored points by first-arriving station for Options 2 and 3 highlights differences in coverage areas exposed by moving Station 1 to the former St. Anthony's site. This analysis is not rigorous (based on the limitations on travel time input discussed earlier), but suggests that:

1. existing first due areas, divided roughly at I-84 are well chosen for the current station location and would be reasonable for options 2 and 4 as well;
2. but that planners may want to consider adjusting first-due areas slightly north and east if relocation to the former St. Anthony's site is chosen, perhaps using Highway 30 and SE 6th Street as the respective boundaries.

Again, this analysis is not rigorous, and should be confirmed with deeper study via GIS or simulation based on more accurate response time data.

First Arriving Stations (Option 2: 336 SE Emigrant)	First Arriving Stations (Option 3: 1601 SE Court)
	

4.4 Rationale

The relative performance of the models is easily understood when the data from the maps above is taken in the context of the overall distribution of emergent incidents in Pendleton. The two maps below show incident density gradients (commonly called "heat maps") at two different scales within the city of Pendleton. The maps are graduated by relative probability of an incident in the vicinity of any point on the map, with no color indicating almost no probability of an incident, through green and yellow which indicate low and increasing probabilities, to red, indicating maximum probability of an emergent incident. Like many cities, Pendleton features a "hot spot" of incident density in the downtown core. The relative performance of the four models can largely be explained by the positioning of the relocated Station 1, relative to the center of this "hot spot." In particular, the 336 Emigrant location performs most strongly because it is nearly centered in the "hot spot."

Figure 12: Emergent Call Density

Examining this "hot spot" more closely, we find that the vast majority (318 of 362, or 87%) of these incidents are medical in nature, with the 321 nature code.

Figure 14: Downtown Call Sampling

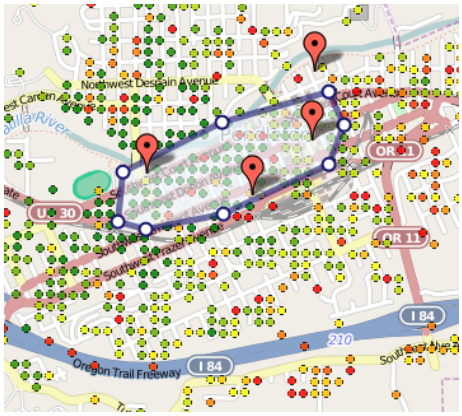
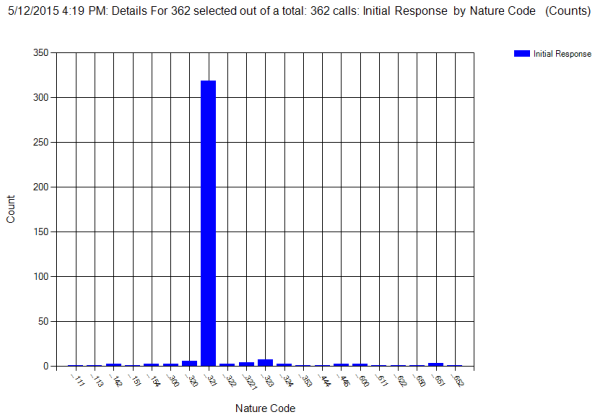


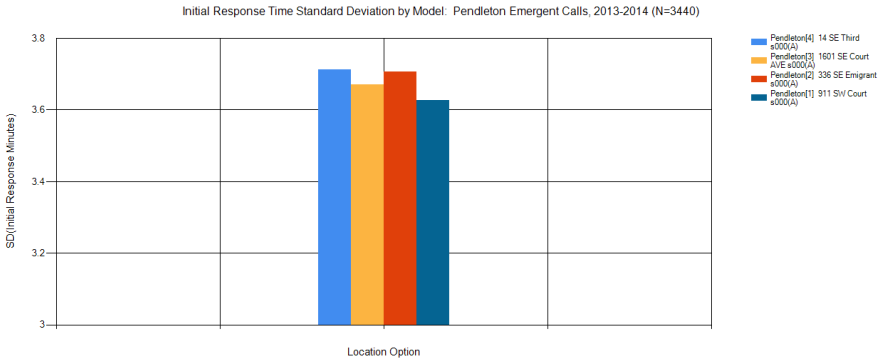
Figure 13: Downtown Call Nature Distribution



4.4.1 Response Time Variability

Given the dynamics presented above, it is reasonable to expect more variable performance from the higher-performing models: placing a station close to the center of the "hot spot" optimizes the experience of the large population of callers in this area, at the expense of those in the outskirts of the City. This expectation is supported by comparing standard deviations of initial response times across options, as shown in the chart below.

Figure 15: Initial Response Variability



Interpretation: the standard deviation is a measure of variability in a set of numbers. This chart supports the hypothesis that the locations with the <u>best</u> initial response performance (Options 2 and 4) will also have slightly <u>less consistent</u> performance. The lower-performing options (1 and 3) appear to provide slightly more consistent treatment of all callers. This effect is small, however: the total span of variability across all options amounts to 0.084 minutes, or 5.04 seconds.

4.5 Assumptions and Limitations

This study was subject to the following assumptions and limitations:

1. **Limitation**: Input data timestamp precision was limited to minutes. This led to decreased precision in simulated turnout times and travel speeds, particularly for shorter responses. E.g., if an incident is shown as responding at 14:43and on-scene at 14:44, the total response time could be anywhere from 1 to 119 seconds (14:43:59 to 14:44:00 vs. 14:43:00 to 14:44:59).
2. **Limitation**: Travel speed was estimated on the basis of distance traveled (longer runs tend to happen at higher speeds). The distance/speed curve was calibrated based on travel times from input data provided by Pendleton Fire Department, subject to the limitation above, with reasonably good results (provided in the data archive). This method does not account for variation by time of day or day of year. Only accurate GPS-based travel data (not available in this jurisdiction) can provide highly detailed input for more precise travel speed modeling.

3. **Assumption**: 911 SW Court Avenue is subject to a 45-second traffic delay uniformly throughout weekdays. This was empirically observed by responding crews at various times at Chief Walker's request, but not validated systematically over time by mechanical means.
4. **Limitation**: Similar traffic delays were not modeled for the 336 SE Emigrant or 14 SE Third sites, since there was no similar empirical data available. Anecdotal reports from command staff suggest that there is at least some traffic effect at these sites, particularly during weekday hours, so benefits of these sites are probably slightly overstated.
5. **Limitation**: The scope of this study is limited to prediction of initial response time to the population of incidents considered. It does not evaluate important considerations such as patient care metrics; unit utilization/reliability; related factors such as training convenience and efficacy; planned or expected growth and demographic change; or intangibles such as morale and service quality. Accordingly, it should be considered as only one of a broad spectrum of considerations important to a long-term strategic decision.
6. **Assumption**: On-scene times and turnout delays for callback-staffed units were based on reasonable assumptions from Chief Walker that could not be independently validated, due to lack of timestamped data.
7. **Limitation**: when the data analysis was complete, we realized that the 2013 data contained 64 emergent EMS calls to the former St. Anthony's site. This data had the potential to artificially skew simulation results in favor of Option [3], since response times would be low to these incidents, and such calls are unlikely to occur in the future. A rapid error analysis indicated that 50th, 70th and 80th percentile times for this option (the option most affected by inclusion of this data) would be altered by no more than 0.26%, so findings and conclusions of this study can be considered intact.
8. **Limitation**: the study did not account for response delays due to railroad traffic, which is a significant effect according to Pendleton Fire Department command staff. There is no quantitative data for railroad-related traffic delays in Pendleton, so there was no basis on which to perform modeling of this effect. It is anticipated that this effect will apply to all station locations, as (1) key railroad grade crossings affect all proposed station locations; (2) several "flyovers" enable responding crews to avoid railroad impediments on crucial travel routes; and (3) several geographic "islands" that can be isolated by railroad traffic are equally accessible/inaccessible to all station locations. Effects of railroad-related delays could be evaluated in followon studies.

5 Conclusions

Based on the foregoing methods, analysis and findings, we offer the following conclusions for the City of Pendleton:

1. Observed effects are robust with respect to fluctuations in input data.
2. Based solely on 80th percentile initial response time, the location options rank as shown below, with maximum likelihood improvements in 80th percentile response time shown, relative to current location:
    a. First, [2] 336 SE Emigrant (~16 second improvement)
    b. Second, [4] 14 SE Third (~11 second improvement)
    c. Third, [3] 1601 SE Court (~5 second improvement)

d. Fourth [1] 911 SW Court (Current location – improvement not applicable)

Note that traffic effects for 911 SW Court are simulated as described above, but no such effects are simulated for 336 SE Emigrant or 14 SE Third, so their advantages relative to 1601 SE Court are likely to be slightly overstated in the above figures.

3. Other strategic considerations appear to be leading the City to select Option [3], 1601 SE Court. This is most likely to improve response times compared to the current location by about six seconds, but not as significantly as the other options.
4. Simulation analysis was not detailed enough to evaluate alternate street entrances in the former St. Anthony's site. Strategic judgment based on traffic engineering, fire service experience and site analysis should be relied upon to design site layout, approach and egress.
5. If the 1601 SE Court site is selected, command staff may wish to re-evaluate first-due district boundaries. If this course is pursued, more rigorous Code3Simulator or GIS analysis should be performed as part of the decision-making process.
6. It is recommended that the City evaluate methods to acquire more precise and accurate operational data regarding its Fire Department units. Such data will be invaluable in evaluating and adjusting operations on an ongoing basis.

6 Appendix: Data Archive Contents

An archive of data used in and created for this study is supplied with this report. An overview of the contents is as follows:

- PendletonFireReportDraft20150612.pdf: Final report draft
- Option{N}ResultsFull.zip: compressed folders containing full simulation results for option {n}. (E.g., Option3ResultsFull.zip contains results for Option [3], 1601 SE Court). Results contain 5340 simulated incidents, including all calls, both emergent and non-emergent, within and outside of the City of Pendleton. The compressed folder also contains the Code3Simulator model data used to define the simulation, as well as the call file (incidents) used to drive the simulation.
- Option{N}ResultsFiltered.zip: similar compressed folders containing filtered results. These results contain ONLY emergent calls WITHIN Pendleton city limits. Total count if incidents is 3440. These results were used to prepare the final report.
- Binaries(directory): complete binary files comprising the version of Code3Simulator used to perform this analysis. Note that Code3Simulator is not operable without a license file available by separate purchase.
- Analysis20150511 (directory): charts created for the presentation to Pendleton Fire Department command staff on May 12, 2015.
- Analysis20150610 (directory): additional charts created to refine concepts presented in the final report.
- Config (directory): key files containing configuration settings required to operate Code3Simulator and perform mapping and routing for this analysis.

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SUPPORTING COST ESTIMATES

APPENDIX B

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Construction FOCUS
Integrated Project Solutions

October 19, 2015
Revision #1

CITY OF PENDLETON
PENDLETON FIRE STATION

STATEMENT OF PROBABLE COST

Prepared for:
Mackenzie
Portland, OR

Prepared by:
Steve Gunn

President
Construction Focus, Inc.

LOC	ITEM	DESCRIPTION	QNTY	UNIT	$/UNIT	TOTAL $
	PENDLETON FIRE STATION					
		Ground Floor Gross Area	15,292	SF		
		2nd Floor Gross Area	5,770	SF		
		Building Gross Area	21,062	SF		
	Concrete					247,856
	Pad footing	3'l x 3'w x 12"d	29	EA	450.00	13,050
	Continuous footing	2'w x 12"d	269	LF	48.00	12,912
	Continuous footing	2'w x 24"d	284	LF	80.00	22,720
	Column	28"l x 28"w x 4'h w/ftg	4	EA	1,300.00	5,200
	Slab on grade	6"t	8,342	SF	8.10	67,570
	Slab on grade	4"t	6,950	SF	7.35	51,083
2nd Flr	Concrete topping	2" non-struct	6,547	SF	3.00	19,641
	Stemwall	4"w x 2.5'd	673	SF	32.00	21,520
	Stemwall	8"w x 2.5'd	710	SF	36.00	25,560
	Elevator pit	slab/walls	1	LS	8,600.00	8,600
	Precast Concrete					10,400
	Composite header	8"hx2.5"t comp cast stone	130	LF	80.00	10,400
	Masonry					164,676
Wall	Masonry	8x8x16_CMU wall_grout/reinf	850	SF	17.00	14,450
Veneer	Masonry	brick veneer_4x3x16	2,099	SF	22.00	46,178
Wall	Masonry	structural brick_8x4x16	3,716	SF	28.00	104,048
	Steel					115,154
	Stl column	HSS x 20'h	23	EA	1,050.00	24,150
	Moment frames		7	EA	4,500.00	31,500
	Stl beam	WF beams	410	LF	75.00	30,750
	Roof framing	WF roof framing	1,162	SF	17.00	19,754
	Stl bollard	6" round_4'h	20	EA	450.00	9,000
	Rough Carpentry					295,258
Exterior	Wall framing	2x6 @16o.c.	5,515	SF	4.80	26,470
Walls	Plywood sheathing	shear ply	5,515	SF	1.35	7,445
Interior	Wall framing	2x4 @16o.c.	16,780	SF	3.75	62,925
	Fastener	structural fasteners	1	LS	2,500.00	2,500
Floor	Floor framing	TJI framing/shtg	6,547	SF	6.50	42,556
	Roof framing	gang nail trusses/shtg	18,350	SF	7.80	143,133
Elec	Plywood sheathing	fire rated ply	360	SF	1.75	630
	Wd stairs/landing	1 flt w/landing_railing	3	SET	3,200.00	9,600
	Finish Carpentry					51,968
Living	Ext wood trim	8" fascia band	269	LF	16.00	4,304
Apparatus	Ext wood trim	8" fascia band	284	LF	16.00	4,544
Exterior	Wood col	ext. casing cols.	28	EA	1,540.00	43,120
	Casework					134,260
	Base cabinet w/ doors	p-lam	250	LF	225.00	56,250
	Upper cabinet w/doors	p-lam	170	LF	132.00	22,440
	Countertop	solid surface	542	SF	90.00	48,780
	Countertop	stainless steel	23	SF	120.00	2,760
	Work station	p-lam counter	30	SF	45.00	1,350
	Countertop	mdf	76	SF	30.00	2,280
	Shelving	p-lam	16	LF	25.00	400

LOC	ITEM	DESCRIPTION	QNTY	UNIT	$/UNIT	TOTAL $
	Insulation					31,898
Wall	Insulation	thermal R-25	5,515	SF	1.10	6,066
	Vapor barrier	building wrap	5,515	SF	2.25	12,408
	Insulation	acoustic batt	16,780	SF	0.80	13,424
	Cladding					31,212
Living	Wood siding	Hardie plank	1,466	SF	8.90	13,047
Apparatus	Wood siding	Hardie plank	2,041	SF	8.90	18,165
	Roofing and Sheet Metal					236,766
	Metal roofing	std seam/1/2"cvr bd/R-30	18,350	SF	12.00	220,205
	Downspout	prefinished sht mtl	240	LF	9.00	2,160
	Flashing	misc	21,062	SF	0.50	10,531
	Gutter	prefinished sht mtl_custom	430	LF	9.00	3,870
	Waterproofing and Sealants					3,892
	Waterproofing	bentonite	368	SF	6.50	2,392
	Sealant	allowance	1	LS	1,500.00	1,500
	Doors, Frames, and Hardware					184,956
	Swing door	3x7 hm_hm frm	20	EA	1,200.00	24,000
	Swing door	3x7 sc wd_hm frm	51	EA	1,500.00	76,500
	Overhead door	steel_alum frm_full glz_14x14	5	EA	8,664.30	43,322
	Overhead door	steel_alum frm_1/2 glz_14x14	5	EA	8,226.90	41,135
	Glass & Glazing					98,790
Exterior	Storefront	Kawneer 451UT/glaz	957	SF	70.00	66,990
	Storefront door	3x7 alum	2	EA	2,000.00	4,000
	Window	casement	360	SF	61.25	22,050
	Reception window	alum_pass-thru_6x4	1	EA	800.00	800
	Glazing	mirror	225	SF	22.00	4,950
	Floor Coverings					100,373
	Flooring	carpet tile	6,150	SF	4.50	27,675
	Flooring	polished concrete	5,026	SF	9.00	45,238
	Flooring	sealed concrete	8,198	SF	1.50	12,297
	Flooring	rubber sports mat	556	SF	7.00	3,892
Stairs	Flooring	rubber treads/risers	240	SF	16.00	3,840
	Flooring	walk-off mat	100	SF	8.50	850
	Wall base	4" rubber	3,464	LF	1.90	6,582
	Ceilings					96,773
196	ACT	2x4_ceiling grid w/ act	11,119	SF	5.75	63,934
	Gypsum board	5/8"_gyp board_LVL-4	9,122	SF	3.60	32,839
	Wall Board and Wall Coverings					127,224
	Gypsum bd	5/8"_gyp board_LVL-4	35,260	SF	3.60	126,936
	Wallcover	FRP	50	SF	5.75	288
	Painting and Finishing					52,869
	Painting @ door/frame	2 top coats	20	EA	95.00	1,900
	Stain/seal @ door/frame	2 top coats	51	EA	110.00	5,610
	Painting @ gypbd	prime + 2 top coats	33,497	SF	0.75	25,123
	Masonry sealer	vandal res	3,716	SF	2.50	9,290
	Painting @ exposed structure	prime + 2 top coats	9,122	SF	1.20	10,946

LOC	ITEM	DESCRIPTION	QNTY	UNIT	$/UNIT	TOTAL $
	Light Gage Framing					2,720
	Furring	1 1/2" @24"o.c.	850	SF	1.80	1,530
	Furring	7/8" @24"o.c.	850	SF	1.40	1,190
	Lockers and Shelving					16,400
	Lockers	2x2 turnout storage lockers	36	EA	300.00	10,800
	Lockers	shop lockers 3x6	8	EA	700.00	5,600
	Specialties and Equipment					32,880
	Equipment	extractor cabinet	1	EA	1,500.00	1,500
	Fire extinguisher & cabinet		8	EA	350.00	2,800
	Room signage	frosted glass/ss standoffs	64	RM	120.00	7,680
	Signage	lg ss exterior signage	2	EA	5,000.00	10,000
	Toilet accessories	foldable baby changing station	2	EA	250.00	500
	Toilet accessories	various types	40	EA	120.00	4,800
	Whiteboards		1	LS	5,600.00	5,600
	Vertical Transport					65,000
	Elevator	hydraulic/3000#/2-stop	1	EA	65,000.00	65,000
	Furnishings					7,424
	Window treatment	cloth roller shades	957	SF	5.50	5,264
	Window treatment	blackout shades	360	SF	6.00	2,160
	Fire Sprinklers					63,186
	Fire protection	riser/mains/drops/heads	21,062	SF	3.00	63,186
	Plumbing					377,833
	Fixtures	rough-in/set/finish	41	EA	2,696.35	110,550
Elevator	Sump pump		1	EA	3,000.00	3,000
	Hose bibs		4	EA	800.00	3,200
	Accessories	cleanouts/floor drains	21,062	SF	1.50	31,593
	Domestic water piping/insulation		1,640	LF	52.50	86,100
	Waste piping		760	LF	79.00	60,040
	Trench drains		342	LF	175.00	59,850
Grille	Gas piping		1	LS	1,500.00	1,500
	Miscellaneous	tests/permits/coord/GCs	1	LS	22,000.00	22,000
	HVAC					298,736
Offices	HVAC	VRF/ducted air handlers	11,962	SF	18.00	215,316
Apparatus	HVAC	exhaust/IR heat/MUA	8,342	SF	10.00	83,420
	Electrical					473,895
	Electrical	power and lighting	21,062	SF	19.00	400,178
	Low voltage		21,062	SF	3.50	73,717
					PENDLETON FIRE STATION HARDCOST	3,322,398

SITEWORK

Project Gross Area	53,482	SF
Site Net Area	38,190	SF
Building Ground Floor Area	15,292	SF

	Building Pad					56,220
	Footing excavation		750	CY	38.00	28,500

LOC	ITEM	DESCRIPTION	QNTY	UNIT	$/UNIT	TOTAL $
	Footing backfill		990	TON	28.00	27,720
	Earthwork					141,125
	Mobilization		1	LS	4,500.00	4,500
	Traffic/ped control		1	LS	3,000.00	3,000
	Temp erosion control		1	LS	2,500.00	2,500
	Surveying		1	LS	4,000.00	4,000
	Excavation		3,000	BCY	24.00	72,000
	CR rock 6",8"		2,205	TN	25.00	55,125
	Hardscapes & Curbs					138,298
	Aspalt pave 3"		165	TN	90.00	14,850
	Sidewalk 4"		5,752	SF	6.00	34,512
	Plaza concrete 4"		1,100	SF	8.00	8,800
	Apron concrete 6"		6,617	SF	8.00	52,936
	16" Vertical curb		1,600	LF	17.00	27,200
	Site Improvements					126,190
	Trash enclosure	slab/cmu walls/gates	1	EA	10,000.00	10,000
North	Retaining wall		660	SF	60.00	39,600
	Monument sign	allowance	1	EA	8,000.00	8,000
	Flagpole		1	EA	5,500.00	5,500
	Antennae tower		1	EA	15,000.00	15,000
	Bike rack	stl-loop_galv	4	EA	350.00	1,400
	Benches		4	EA	1,500.00	6,000
	Fencing	blk vinyl chain link	672	LF	45.00	30,240
	Gate	blk vinyl chain link 20'l	2	EA	3,500.00	7,000
	Striping	cars and lanes	1	LS	1,200.00	1,200
	Handicap symbols		5	EA	175.00	875
	Handicap signs		5	EA	275.00	1,375
	Landscaping					17,946
	Landscaping	topsoil-12"/plants/irrig	3,988	SF	4.50	17,946
	Storm					31,855
	8" PVC storm		439	LF	45.00	19,755
	Catch basin		6	EA	1,500.00	9,000
	3 Way valve & vault		1	EA	3,100.00	3,100
	Sanitary					18,937
	6" Sani pipe		161	LF	67.00	10,787
	Sanitary cleanout		1	EA	550.00	550
	Oil water seperator		1	EA	6,500.00	6,500
	Connect to mainline		1	EA	1,100.00	1,100
	Water					31,702
	6" Fireline w/trench		91	LF	102.00	9,282
	2" Hot tap		2	EA	1,800.00	3,600
	2" Dom water		74	LF	30.00	2,220
	2" Water meter & vault		1	EA	3,600.00	3,600
	6" DDCV vault		1	EA	13,000.00	13,000
	Site Electrical					141,000
	Site lighting		12	EA	3,500.00	42,000
	Generator	60KW	1	EA	70,000.00	70,000
	Conduits		300	LF	30.00	9,000

LOC	ITEM	DESCRIPTION	QNTY	UNIT	$/UNIT	TOTAL $
	Site laterals		500	LF	40.00	20,000
					SITEWORK HARDCOST	703,273
	STREET WORK					
		Project Gross Area	27,135	SF		
	Street Construction					382,342
	Mobilization		1	LS	4,500.00	4,500
	Traffic/ped control		1	LS	3,000.00	3,000
	Temp erosion control		1	LS	2,500.00	2,500
	Surveying		1	LS	4,000.00	4,000
	Retaining wall removal		60	LF	130.00	7,800
	Excavation w/demo		1,130	CY	24.00	27,120
	Embankment		300	CY	35.00	10,500
	Crushed rock base		1,162	TON	25.00	29,050
	Asphalt paving		424	TON	90.00	38,160
	Curb & gutter		848	LF	22.00	18,656
	Sidewalk		5,936	SF	6.00	35,616
	Catch basin/inlet		4	EA	2,300.00	9,200
	Storm piping		424	LF	45.00	19,080
	Striping		1	LS	800.00	800
	Street lights	decorative	10	EA	8,000.00	80,000
	Landscaping		4,240	SF	6.50	27,560
	Trees		54	EA	1,200.00	64,800
					STREET WORK HARDCOST	382,342
					HARDCOST TOTAL	4,408,013

The above HARDCOST TOTAL does not include typical general contractor markups.
Those plus contingencies are listed below as part of a Low-High Range.
Variables include fluctuations in market conditions, material selections, and design considerations.
The Cost Estimate Range will be consolidated as we move closer to the actual Bid Date.

LOW RANGE		Markups:	HIGH RANGE	
@ 5%:	220,401	Inflation & Market Conditions	@ 10%:	440,801
@ 10%:	462,841	Contingency	@ 20%:	969,763
	356,388	Gen Conditions @ 7%:		407,300
	326,859	Profit & Overhead @ 6%:		373,553
	46,616	Performance Bond:		52,347
	1,413,104	**Markup Subtotals:**		2,243,765
	5,821,117	**BASE BID TOTAL**		**6,651,778**

NOTES

Refer to the Design Narrative for more detailed information.

HVAC (offices/living): Split system.

HVAC (apparatus): General exhaust, with roof mount fans and low wall, filtered make up air. Five (5) tube infrared heaters. CO/NO2 detection. Standalone controls. Exhaust and heated make up air for garage ancillary rooms

Wage rates: BOLI
This estimate assumes competitive bidding by local contractors
Add 7% to this estimate if a CMGC is used

EXCLUSIONS

Design fees, permit fees, system development fees, utility hookup charges, testing, BOLI fee.
Hazardous materials abatement, moving expenses, fireproofing.
Appliances
Overexcavation, rock excavation, wet weather sitework.

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ASCE 41-13 STRUCTURAL ANALYSIS

APPENDIX C

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ASCE 41-13 STRUCTUAL ANALYSIS

The seismic evaluation was conducted using ASCE 41-13 Seismic Evaluation and Retrofit of Existing Buildings. This document is not a code, but a nationally-recognized standard used by engineers to evaluate and retrofit existing buildings. Previously there were two separate documents for the evaluation and retrofit of existing buildings, ASCE 31 and ASCE 41, respectively. Recently these documents were combined into the updated version, ASCE 41-13, to help alleviate some of the inconsistencies that occurred when a building transitioned from seismic evaluation to the retrofit/upgrade process. New building codes include many provisions that require or encourage design and detailing practices that improve the seismic performance of a building, including regular building configuration, ductile detailing, and high quality materials. Most existing buildings will not meet these criteria that new construction would be designed and detailed for; however, it is recognized that these existing structural systems still have capacity that the new code doesn't recognize. The ASCE 41-13 includes guidelines and methods for evaluating the capacities of existing structural elements that might otherwise be insufficient when analyzed using the new building code provisions.

Within the ASCE 41-13 there are four building Performance Levels (lower to higher performance): Collapse Prevention (5-E), Life Safety (3-C), Immediate Occupancy (1-B), and Operational (1-A). Unless otherwise required by code (i.e. emergency response facilities, prisons, or other essential facilities), the majority of buildings are designed for the Performance Level of Life Safety (LS). The LS performance level is meant to ensure the safety of building occupants; however, buildings with this performance level will likely experience significant damage that may or may not be repaired or occupied after the earthquake. For critical facilities that need to retain full function immediately post-earthquake to provide emergency response to the community, such as a fire station, the building is evaluated to the higher standard of Operational. It should be noted that the Operational and Immediate Occupancy criteria are the same for the structural evaluation. The difference in the two levels is that the equipment is operational, see Figure 1. Figure 2 includes a brief summary of each performance level and the anticipated damage for a building designed to each performance level.

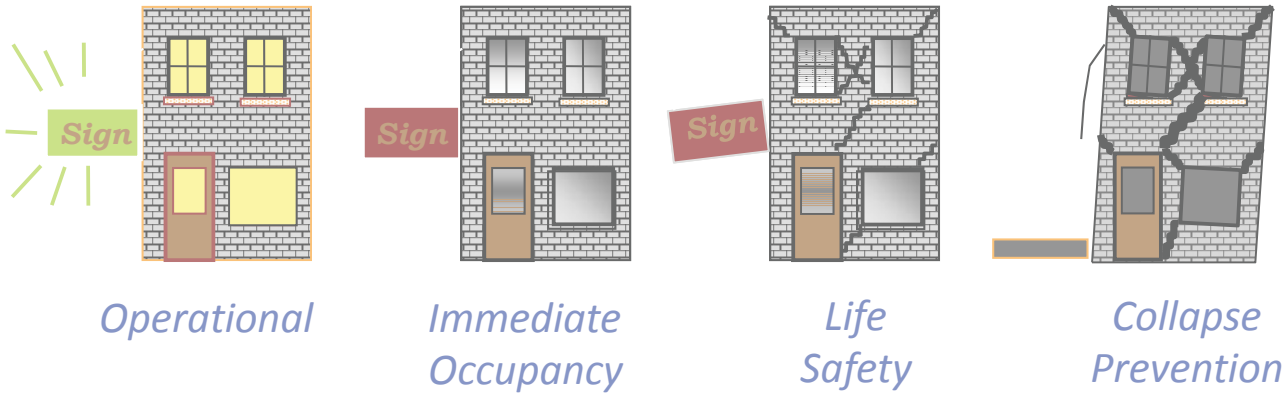

Figure 1

Table C2-3. Damage Control and Building Performance Levels

	Target Building Performance Levels			
	Collapse Prevention Level (5-D)	Life Safety Level (3-C)	Immediate Occupancy Level (1-B)	Operational Level (1-A)
Overall damage	Severe	Moderate	Light	Very light
Structural components	Little residual stiffness and strength to resist lateral loads, but gravity load-bearing columns and walls function. Large permanent drifts. Some exits blocked. Building is near collapse in aftershocks and should not continue to be occupied.	Some residual strength and stiffness left in all stories. Gravity-load-bearing elements function. No out-of-plane failure of walls. Some permanent drift. Damage to partitions. Continued occupancy might not be likely before repair. Building might not be economical to repair.	No permanent drift. Structure substantially retains original strength and stiffness. Continued occupancy likely.	No permanent drift. Structure substantially retains original strength and stiffness. Minor cracking of facades, partitions, and ceilings as well as structural elements. All systems important to normal operation are functional. Continued occupancy and use highly likely.
Nonstructural components	Extensive damage. Infills and unbraced parapets failed or at incipient failure.	Falling hazards, such as parapets, mitigated, but many architectural, mechanical, and electrical systems are damaged.	Equipment and contents are generally secure but might not operate due to mechanical failure or lack of utilities. Some cracking of facades, partitions, and ceilings as well as structural elements. Elevators can be restarted. Fire protection operable.	Negligible damage occurs. Power and other utilities are available, possibly from standby sources.
Comparison with performance intended for typical buildings designed to codes or standards for new buildings, for the design earthquake	Significantly more damage and greater life safety risk.	Somewhat more damage and slightly higher life safety risk.	Less damage and low life safety risk.	Much less damage and very low life safety risk.

Figure 2

ASCE 41-13 incorporates a multi-tier methodology for evaluating existing structures. Tier 1, which was chosen for this analysis, is a preliminary screening phase which utilizes a checklist approach to identify potential seismic hazards. It should be noted that at this stage, any identified risks are preliminary and may or may not be justifiable using a higher tier analysis. Tier 2 and Tier 3 are the evaluation and detailed evaluation phases respectively, which were not conducted at this time. If a deficiency is identified in the Tier 1 screening phase, further Tier 2 or Tier 3 analysis can be used to show the specific item is acceptable. After the seismic evaluation is completed, ASCE 41-13 may be used to complete a seismic retrofit design to address issues identified in the evaluation stage. As a part of the Tier 1 screening phases, various analyses or “Quick Checks” are to be performed where specifically required. Not all items that pass the quick check will necessarily meet more detailed checks, nor are they guaranteed to meet current code requirements.

The Tier 1 analysis consists of a visual survey which was conducted on January 21, 2015. For each of the Tier 1 checklist items, an evaluation of Compliant (C), Non-compliant (NC), or Not Applicable (N/A) is marked. NC does not necessarily mean that the issue cannot be justified with a higher tier evaluation phase. It only indicates that the item does not pass the Tier 1 screening criteria.

SCOPE AND LIMITATIONS

This limited Tier 1 analysis is based on site observations of only readily visible items and evaluation of available drawing documents listed herein. It should be noted that other deficiencies might exist that have not been identified by this screening phase and quick checks. In addition, no material or other testing was performed at this time for review. Limited Tier 1 quick check calculations have been performed and a more in-depth detailed analysis may be performed, though it is likely to have minimal impact on the results of this evaluation.

EVALUATION RESULTS

This building was evaluated for a seismic event with a probability of exceedance of 10% in 50 years or a 500 year event (BSE-1N) for a Performance Level of Operational. This is the same design earthquake ground motion hazard that new buildings are designed to. The level of seismicity was determined at the site and compared to the ASCE 41-13 level definitions (see Table 2-5). For this fire station, SDS=0.351 and SD1=0.201; therefore, the site is considered to be in an area of high seismicity.

Based on this seismicity definition and an Operational performance objective, the required checklists can be determined, see Table 4-7. The Basic Configuration, Immediate Occupancy Structural Checklists, and Position Retention Nonstructural checklists are required.

Table 2-5. Level of Seismicity Definitions

Level of Seismicity[a]	S_{DS}	S_{D1}
Very low	<0.167 g	<0.067 g
Low	≥0.167 g <0.33 g	≥0.067 g <0.133 g
Moderate	≥0.33 g <0.50 g	≥0.133 g <0.20 g
High	≥ 0.50 g	≥0.20 g

[a]The higher level of seismicity defined by S_{DS} or S_{D1} shall govern.

Table 4-7. Checklists Required for a Tier 1 Screening

		Required Checklists[a]					
Level of Seismicity[b]	Level of Building Performance[c]	Very Low Seismicity Checklist (Sec 16.1.1)	Basic Configuration Checklist (Sec. 16.1.2)	Life Safety Checklist (Sec. 16.2LS through 16.15LS)	Immediate Occupancy Checklist (Sec. 16.2IO through 16.15IO)	Life Safety Nonstructural Checklist (Sec. 16.17)	Position Retention Nonstructural Checklist (Sec. 16.17)
Very low	LS	X					
Very low	IO		X		X		X
Low	LS		X	X		X	
Low	IO		X		X		X
Moderate	LS		X	X		X	
Moderate	IO		X		X		X
High	LS		X	X		X	
High	IO		X		X		X

[a]An X designates the checklist that must be completed for a Tier 1 screening as a function of the level of seismicity and level of performance.
[b]Defined in Section 2.5.
[c]LS = Life Safety Performance Level, and IO = Immediate Occupancy Performance Level (defined in Section 2.3.3).

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 stiffnessof 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 Additionto 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 $0.6S_a$. (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)

16.10IO IMMEDIATE OCCUPANCY STRUCTURAL CHECKLIST FOR BUILDING TYPES C2: CONCRETE SHEAR WALLS WITH STIFF DIAPHRAGMS AND C2A: CONCRETE SHEAR WALLS WITH FLEXIBLE DIAPHRAGMS

Very Low Seismicity

Seismic-Force-Resisting System

C NC N/A U COMPLETE FRAMES: Steel or concrete frames classified as secondary components form a complete vertical-load-carrying system. (Commentary: Sec. A.3.1.6.1. Tier 2: Sec. 5.5.2.5.1)

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 concrete shear walls, calculated using the Quick Check procedure of Section 4.5.3.3, is less than the greater of 100 lb/in.^{2} or $2\sqrt{f'_c}$. (Commentary: Sec. A.3.2.2.1. Tier 2: Sec. 5.5.3.1.1)

C NC N/A U REINFORCING STEEL: The ratio of reinforcing steel area to gross concrete area is not less than 0.0012 in the vertical direction and 0.0020 in the horizontal direction. The spacing of reinforcing steel is equal to or less than 18 in. (Commentary: Sec. A.3.2.2.2. Tier 2: Sec. 5.5.3.1.3)

Connections

C NC N/A U WALL ANCHORAGE AT FLEXIBLE DIAPHRAGMS: Exterior concrete or masonry walls that are dependent on flexible diaphragms for lateral support are anchored for out-of-plane forces at each diaphragm level with steel anchors, reinforcing dowels, or straps that are developed into the diaphragm. Connections have adequate strength to resist the connection force calculated in the Quick Check procedure of Section 4.5.3.7. (Commentary: Sec. A.5.1.1. Tier 2: Sec. 5.7.1.1)

C NC N/A U TRANSFER TO SHEAR WALLS: Diaphragms are connected for transfer of loads to the shear walls, and the connections are able to develop the lesser of the shear strength of the walls or diaphragms. (Commentary: Sec. A.5.2.1. Tier 2: Sec. 5.7.2)

C NC N/A U FOUNDATION DOWELS: Wall reinforcement is doweled into the foundation, and the dowels are able to develop the lesser of the strength of the walls or the uplift capacity of the foundation. (Commentary: Sec. A.5.3.5. Tier 2: Sec. 5.7.3.4)

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)

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 DEFLECTION COMPATIBILITY: Secondary components have the shear capacity to develop the flexural strength of the components and are compliant with the following items: COLUMN-BAR SPLICES, BEAM-BAR SPLICES, COLUMN-TIE SPACING, STIRRUP SPACING, and STIRRUP AND TIE HOOK in the Immediate Occupancy Structural Checklist for Building Type C1. (Commentary: Sec. A.3.1.6.2. Tier 2: Sec. 5.5.2.5.2)

C NC N/A U FLAT SLABS: Flat slabs or plates not part of seismic-force-resisting system have continuous bottom steel through the column joints. (Commentary: Sec. A.3.1.6.3. Tier 2: Sec. 5.5.2.5.3)

C NC N/A U COUPLING BEAMS: The stirrups in coupling beams over means of egress are spaced at or less than $d/2$ and are anchored into the confined core of the beam with hooks of 135 degrees or more. The ends of both walls to which the coupling beam is attached are supported at each end to resist vertical loads caused by overturning. Coupling beams have the capacity in shear to develop the uplift capacity of the adjacent wall. (Commentary: Sec.A.3.2.2.3. Tier 2: Sec. 5.5.3.2.1)

C NC N/A U OVERTURNING: All shear walls have aspect ratios less than 4-to-1. Wall piers need not be considered. (Commentary: Sec. A.3.2.2.4. Tier 2: Sec. 5.5.3.1.4)

C NC N/A U CONFINEMENT REINFORCING: For shear walls with aspect ratios greater than 2-to-1, the boundary elements are confined with spirals or ties with spacing less than $8d_b$. (Commentary: Sec. A.3.2.2.5. Tier 2: Sec. 5.5.3.2.2)

C NC N/A U WALL REINFORCING AT OPENINGS: There is added trim reinforcement around all wall openings with a dimension greater than three times the thickness of the wall. (Commentary: Sec. A.3.2.2.6. Tier 2: Sec. 5.5.3.1.5)

C NC N/A U WALL THICKNESS: Thicknesses of bearing walls are not less than 1/25 the unsupported height or length, whichever is shorter, nor less than 4 in. (Commentary: Sec. A.3.2.2.7. Tier 2: Sec. 5.5.3.1.2)

Connections

C NC N/A U UPLIFT AT PILE CAPS: Pile caps shall have top reinforcement, and piles are anchored to the pile caps; the pile cap reinforcement and pile anchorage are able to develop the tensile capacity of the piles. (Commentary: Sec. A.5.3.8.Tier 2: Sec. 5.7.3.5)

Diaphragms (Flexible or Stiff)

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 OPENINGS AT SHEAR WALLS: Diaphragm openings immediately adjacent to the shear walls are less than 15% of the wall length. (Commentary: Sec. A.4.1.4. Tier 2: Sec. 5.6.1.3)

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)

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 consist of horizontal spans of less than 40 ft and have aspect ratios less than 4-to-1. (Commentary: Sec. A.4.3.1. 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)

16.9IO IMMEDIATE OCCUPANCY STRUCTURAL CHECKLIST FOR BUILDING TYPE C1: CONCRETE MOMENT FRAMES

Very Low Seismicity

Seismic-Force-Resisting System

C NC N/A U REDUNDANCY: The number of lines of moment frames in each principal direction is greater than or equal to 2. The number of bays of moment frames in each line is greater than or equal to 3. (Commentary: Sec. A.3.1.1.1. Tier 2: Sec. 5.5.1.1)

C NC N/A U INTERFERING WALLS: All concrete and masonry infill walls placed in moment frames are isolated from structural elements. (Commentary: Sec. A.3.1.2.1. Tier 2: Sec. 5.5.2.1.1)

C NC N/A U COLUMN SHEAR STRESS CHECK: The shear stress in the concrete columns, calculated using the Quick Check procedure of Section 4.5.3.2, is less than the greater of 100 lb/in.^{2} or $2\sqrt{f'_c}$. (Commentary: Sec. A.3.1.4.1. Tier 2: Sec. 5.5.2.1.4)

C NC N/A U COLUMN AXIAL STRESS CHECK: The axial stress caused by unfactored gravity loads in columns subjected to overturning demands is less than $0.13f'_c$. Alternatively, the axial stress caused by overturning forces alone, calculated using the Quick Check procedure of Section 4.5.3.6, is less than $0.30f'_c$. (Commentary: Sec. A.3.1.4.2. Tier 2: Sec. 5.5.2.1.3)

Connections

C NC N/A U CONCRETE COLUMNS: All concrete columns are doweled into the foundation, and the dowels are able to develop the tensile capacity of reinforcement in columns of the seismic-force-resisting system. (Commentary: Sec. A.5.3.2. Tier 2: Sec. 5.7.3.1)

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

Seismic-Force-Resisting System

C NC N/A U FLAT SLAB FRAMES: The seismic-force-resisting system is not a frame consisting of columns and a flat slab or plate without beams. (Commentary: Sec. A.3.1.4.3. Tier 2: Sec. 5.5.2.3.1)

C NC N/A U PRESTRESSED FRAME ELEMENTS: The seismic-force-resisting frames shall not include any prestressed or posttensioned elements where the average prestress exceeds the lesser of 700 lb/in.^{2} or $f'_c/6$ at potential hinge locations. The average prestress is calculated in accordance with the Quick Check procedure of Section 4.5.3.8. (Commentary: Sec. A.3.1.4.4. Tier 2: Sec. 5.5.2.3.2)

C NC N/A U CAPTIVE COLUMNS: There are no columns at a level with height/depth ratios less than 75% of the nominal height/depth ratio of the typical columns at that level. (Commentary: Sec. A.3.1.4.5. Tier 2: Sec. 5.5.2.3.3)

C NC N/A U NO SHEAR FAILURES: The shear capacity of frame members is able to develop the moment capacity at the ends of the members. (Commentary: Sec. A.3.1.4.6. Tier 2: Sec. 5.5.2.3.4)

C NC N/A U STRONG COLUMN—WEAK BEAM: The sum of the moment capacity of the columns is 20% greater than that of the beams at frame joints. (Commentary: Sec. A.3.1.4.7. Tier 2: Sec. 5.5.2.1.5)

C NC N/A U BEAM BARS: At least two longitudinal top and two longitudinal bottom bars extend continuously throughout the length of each frame beam. At least 25% of the longitudinal bars provided at the joints for either positive or negative moment are continuous throughout the length of the members. (Commentary: Sec. A.3.1.4.8. Tier 2: Sec. 5.5.2.3.5)

C NC N/A U COLUMN-BAR SPLICES: All column-bar lap splice lengths are greater than $50d_b$ and are enclosed by ties spaced at or less than $8d_b$. Alternatively, column bars are spliced with mechanical couplers with a capacity of at least 1.25 times the nominal yield strength of the spliced bar. (Commentary: Sec. A.3.1.4.9. Tier 2: Sec. 5.5.2.3.6)

C NC N/A U BEAM-BAR SPLICES: The lap splices or mechanical couplers for longitudinal beam reinforcing are not located within $l_b/4$ of the joints and shall not be located in the vicinity of potential plastic hinge locations. (Commentary: Sec. A.3.1.4.10. Tier 2: Sec. 5.5.2.3.6)

C NC N/A U COLUMN-TIE SPACING: Frame columns have ties spaced at or less than $d/4$ throughout their length and at or less than $8d_b$ at all potential plastic hinge locations. (Commentary: Sec. A.3.1.4.11. Tier 2: Sec. 5.5.2.3.7)

C NC N/A U STIRRUP SPACING: All beams have stirrups spaced at or less than $d/2$ throughout their length. At potential plastic hinge locations, stirrups are spaced at or less than the minimum of $8d_b$ or $d/4$. (Commentary: Sec. A.3.1.4.12. Tier 2: Sec. 5.5.2.3.7)

C NC N/A U JOINT TRANSVERSE REINFORCING: Beam–column joints have ties spaced at or less than $8d_b$. (Commentary: Sec. A.3.1.4.13. Tier 2: Sec. 5.5.2.3.8)

C NC N/A U JOINT ECCENTRICITY: There are no eccentricities larger than 20% of the smallest column plan dimension between girder and column centerlines. (Commentary: Sec. A.3.1.4.14. Tier 2: Sec. 5.5.2.3.9)

C NC N/A U STIRRUP AND TIE HOOKS: The beam stirrups and column ties are anchored into the member cores with hooks of 135 degrees or more. (Commentary: Sec. A.3.1.4.15. Tier 2: Sec. 5.5.2.3.10)

C NC N/A U DEFLECTION COMPATIBILITY: Secondary components have the shear capacity to develop the flexural strength of the components and are Compliant with the following items: COLUMN-BAR SPLICES, BEAM-BAR SPLICES, COLUMN-TIE SPACING, STIRRUP SPACING, and STIRRUP AND TIE HOOKS. (Commentary: Sec. A.3.1.6.2. Tier 2: Sec. 5.5.2.5.2)

C NC N/A U FLAT SLABS: Flat slabs or plates not part of the seismic-force-resisting system have continuous bottom steel through the column joints. (Commentary: Sec. A.3.1.6.3. Tier 2: Sec. 5.5.2.5.3)

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 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)

Connections

C NC N/A U UPLIFT AT PILE CAPS: Pile caps have top reinforcement, and piles are anchored to the pile caps; the pile cap reinforcement and pile anchorage are able to develop the tensile capacity of the piles. (Commentary: Sec. A.5.3.8. Tier 2: Sec. 5.7.3.5)

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)

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 ft^2 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 ft^2 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 ft^2, 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 ft^2 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 ft^2 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 ft^2 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/ft^2 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 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.7.4.3. Tier 2: Section 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 ft^2 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 ft^2, 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)

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)

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. A7.13.6. 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 ft^2 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)

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)

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