MACKENZIE.

DESIGN DRIVEN | CLIENT FOCUSED

West Side Fire Department - Station #1

Seismic Assessment

Prepared January 23, 2018

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SECTION 1: INTRODUCTION

SECTION 2: ASSESSMENT

SECTION 3: RECOMMENDATIONS

APPENDICES

WEST SIDE FIRE
Neighbor Helping Neighbor since 1948

Prepared for:

West Side Fire
Department
4250 Barrett Road
Hood River, OR 97031

Prepared by:

Mackenzie
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1515 SE Water Ave., #100
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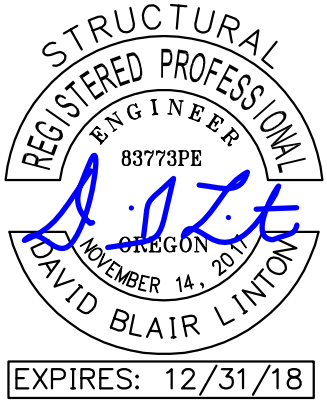
Project Number

2170545.00
January 23, 2018



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1. INTRODUCTION

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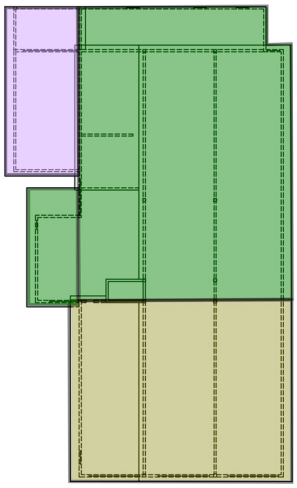
EXECUTIVE SUMMARY

An ASCE 41-13 Tier 1 seismic evaluation of the existing West Side Fire Station #1 was conducted for the West Side Fire Department. As part of the review, a site visit was conducted on October 27, 2017. The fire station has several significant deficiencies in the structure that do not meet the standards for a critical infrastructure building that provides a performance level of Operational after a seismic event. The primary deficiencies include inadequate shear walls, drag connections from the shear walls to the diaphragms, and anchorage of the shear walls to the foundation. These deficiencies and the deficiencies identified in the checklists must be addressed and upgraded to meet Operational performance standards. A cost estimate was prepared for the proposed seismic upgrades with an anticipated total project cost as follows:

- Construction: $ 805,838
- Consultants: $ 374,257
- Owner: $ 71,500
- **Total:** **$1,251,595** *($209.16/SF)*



Project Summary Information						
Building Part	Building Part Name	Included in Retrofit	Year Built	Building Type***	Nonstructural Retrofits Included in Scope Y/N***	Previous Seismic Retrofit Y/N*** (Year if Yes)
A	Apparatus Bay	Y	Estimated 1949	W2	Y	N
B	Support Spaces	Y	Estimated 1960	W2	Y	N
C	Storage Area	Y	Estimated 2005	W2	Y	N
***Entries required ONLY for building parts included in proposed seismic retrofit.						
Nonstructural deficiencies posing life safety risk MUST be included in the scope of work and budget.						
Seismic fragility inputs for existing buildings with previous seismic retrofits MUST be adjusted to reflect previous seismic retrofit measures completed for a building part.						
Total Retrofit Cost ($)					$1,251,595	
Retrofit Square Feet (ft^2)					5,984	
Retrofit Cost Per Square Foot ($/ft^2)					$209.16	**Yes/No**
Is the station within a tsunami, FEMA flood zone or other high hazard area? If so provide documentation.						No

ASCE 41-13 ANALYSIS BACKGROUND

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. 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;

Figure 1
Building performance levels

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), most 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 for structural evaluation the Operational and Immediate Occupancy criteria are the same. The difference in the two levels is that the support systems and equipment are operational; see Figure 1. Figure 2 includes a summary of each performance level and the anticipated damage for a building designed to each performance level.

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 to completion 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.

Figure 2
Damage Control and Building Performance Labels

	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.

Source: *Table C2-3, page 35; ASCE Standard – ASCE/SEI 41-13: American Society of Civil Engineers – Seismic Evaluation and Retrofit of Existing Buildings*

The Tier 1 analysis consists of a visual survey, which was conducted on October 27, 2017. For each of the Tier 1 checklist items, an evaluation of Compliant (C), Non-compliant (NC), Not Applicable (N/A), or Unknown (U) is marked. NC does not necessarily mean that the issue cannot be justified with a higher tier evaluation phase; rather, only that it does not pass the Tier 1 screening criteria.

SCOPE AND LIMITATIONS

The Tier 1 analysis and retrofit scheme 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. The checklists and preliminary quick calculations of retrofits were performed using ASCE 41-13 standards. New retrofit concepts may have been designed using ASCE 7-10 where deemed appropriate, which produce a conservative design for evaluation at this time.

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2. ASSESSMENT

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EXISTING BUILDING DESCRIPTION

The West Side Fire Station #1 is located at 4250 Barrett Road in Hood River, Oregon. The building is wood framed with a stick-framed upper roof with several steps and pitches, a wood framed hose tower, an attic level diaphragm that frames into exterior wood stud walls, or interior glulam girders. The glulam girders are supported by wood columns. The original building, which consists of the apparatus bay, was originally a barn-type structure. A subsequent addition was added at an unknown date to include the kitchen, training room, kitchen, mezzanine and office. There is a small basement underneath the mezzanine, that has concrete walls and a concrete floor above. The exterior wood stud walls bear on a concrete stem wall that presumably sit on continuous strip footings of unknown size.

There were no existing drawings for the building available to review. A geotechnical report was not available to review.

Figure 3
East elevation

Figure 4
North elevation

Figure 5
North elevation, west corner

Figure 6
West elevation, north side

Figure 7
West elevation

Figure 8
West elevation, south side

Figure 9
Hose Tower at West elevation

Figure 10
South elevation

STATION EVALUATION

Evaluation Criteria

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 to which new buildings are designed. The level of seismicity was determined at the site and compared to the ASCE 41-13 level definitions; see Figure 9. For this fire station, the design short period acceleration is SXS=0.505 which classifies the site as an area of high seismicity.

Based on this seismicity definition and an Operational performance objective, the required checklists can be determined, as seen in Figure 10. The Basic Configuration, Immediate Occupancy Structural Checklists, and Position Retention Nonstructural checklists are required.

ASCE 41-13 has different checklists depending on the building construction type. This building type is classified as a W1, Wood Light Frames.

Summary of ASCE 41-13 Tier 1 Evaluation

The The Tier 1 screening phase identified numerous structural and non-structural items as non-compliant. Non-compliant issues require further evaluation 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 some noncompliant issues is presented below organized by each checklist. Copies of the Tier 1 checklists and calculations are included in this report in Appendices A and B. To clearly document the deficiencies

Figure 11
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.*

Source: *Table 2-5, page 49; ASCE Standard – ASCE/SEI 41-13: American Society of Civil Engineers – Seismic Evaluation and Retrofit of Existing Buildings*

Figure 12
Checklists Required for a Tier 1 Screening

Level of Seismicity[b]	Level of Building Performance[c]	Required Checklists[a]: 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).

Source: *Table 4-7, page 67; ASCE Standard – ASCE/SEI 41-13: American Society of Civil Engineers – Seismic Evaluation and Retrofit of Existing Buildings*

and their associated retrofits, every non-compliant category listed below is identified in a table in Section 3 so the reader can clearly identify the retrofit associated with it.

Immediate Occupancy Basic Configuration Checklist

Load Path – A clear lateral load path to transfer seismic forces from the walls, into the roof diaphragm, into the main lateral force resisting system, and then out into the foundations is required for compliance. The lateral force resisting system is deficient in several areas, particularly along the west wall in the apparatus bays which has several large openings for overhead doors. Drawings were not available to verify the as-built foundations, but they are assumed to be non-compliant, as they would need to be large to resist overturning forces and reduce seismic bearing pressure.

Vertical Irregularities – The attic space contains several wood shear walls from the attic floor to the upper roof diaphragms that terminate at the attic floor and do not run continuous down to the foundation.

Immediate Occupancy Structural Checklist for Building Type W2

- **Shear Stress Check** – Existing shear walls are assumed to be unblocked, non-structural sheathing, resulting in low capacities.
- **Wood Sills, Diaphragm Connectivity** – The extent of the connections and foundation anchorage for wood framed walls is unknown.
- **Wood Posts** – Several wood columns rest on concrete curbs or plinths that do not have any apparent positive connection to the foundation.
- **Hold-Down Anchors** – It is assumed that shear walls do not have hold downs to resist overturning forces at each pier.
- **Sheathing/Unblocked Diaphragms** – The roof framing is assumed to be unblocked, greatly reducing the diaphragm capacity.
- **Diaphragm Continuity** – Several diaphragm discontinuities occur at the upper roof.
- **Wood Sill Bolts** – It is assumed that the shear walls do not have adequate sill anchorage to resist seismic shear forces.

Non-Structural Checklist

- **Fire Suppression Piping** – Fire suppression piping should have proper lateral bracing and flexible couplings when necessary. It appeared some bracing was in place, but a further study may be necessary to determine if it is adequate.
- **Hazardous Materials and Shut-off Valves** – Gas cylinders and other hazardous materials should be tied down to prevent movement. It did appear that several were tied down, but other conditions were

unknown. If any distribution systems carry hazardous materials, they should have shut-off valves.

- **Integrated Ceilings, Edge Clearance and Support** – Suspended ceilings should have proper lateral restraints and allow for lateral movement.
- **Light Fixtures Lens Covers** – Light fixtures should have lens covers attached with safety devices to catch falling debris from the light fixture.
- **Parapets** – Anchorage of parapets to the structure is unknown.
- **Canopies** – Canopies at building exits should be anchored at 6 ft for high seismic areas. The anchorage of the exterior canopy over the office entrance could pose a falling hazard and may block an exit in a seismic event.
- **Tall Narrow Contents** – Several shelving units, storage units, and pieces of equipment appear to have a height-to-width ratio greater than 3:1 and are not anchored to the floor or walls. During a seismic event, these pose a falling hazard.
- **Fall Prone Contents** - Equipment or stored items weighing more than 20 lbs and located more than 4 ft above the floor should be braced or anchored to structure. A detailed survey of equipment/ contents was not conducted, but some stored items appear to have met these criteria.
- **Suspended Contents/Equipment** – Equipment suspended without lateral bracing should be able to swing from or move with the structure from which it is suspended without damaging other components.
- **Mechanical Doors** – It is unknown if the apparatus bay doors of this station are detailed to operate at a story drift ratio of 0.01, which could leave the doors inoperable after a seismic event.
- **Heavy Equipment** – Floor-supported equipment weighing more than 400 lbs should be anchored to the structure. It appeared that most of the equipment was properly anchored, but this should be investigated further.
- **Flexible Couplings** – Fluid and gas piping should have flexible couplings to accommodate any lateral movement. There were no observed flexible couplings at the pipes entering the basement wall, however more conditions may exist and should be investigated further.
- **Piping** – Fluid and gas piping should be anchored and braced to the structure to limit spills or leaks. A detailed investigation was not conducted; however, only some piping was noted to meet this requirement.
- **Ducts** – Large ducts should be braced. The maximum unbraced span should not exceed 30 ft.

3. RECOMMENDATIONS

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RETROFIT RECOMMENDATIONS

Prior to retrofitting and design, material testing of key structural elements must be completed as required by ASCE 41-13 for a performance level greater than life safety.

The Tier 1 structural deficiencies listed will require further evaluation (ASCE 41-13 Tier 2 or 3 analyses) for the design of the seismic retrofits listed below. For a facility such as a fire station, to meet the Operational Performance Level, each of these items will need to be further evaluated and brought up to meet current code requirements. The following narrative and table describes the approximate scope of one possible upgrade scheme to address the identified deficiencies. Plans and details of the upgrade scheme are provided in Appendix C.

Structural Retrofits:

Task 1: Wood shear walls should be re-nailed with smaller nail spacing. See the Foundation/Attic Framing Plan for details and locations. Hold-downs should be added on each side of wood shear wall piers. Assume Simpson HDU5 hold downs or equivalent with epoxy anchorage into existing foundation. See the Foundation/Attic Framing Plan for details and locations. The shear wall-to-diaphragm connection is assumed to be insufficient. Add blocking and clips to provide a positive connection between the roof diaphragm and shear walls. Additional sill anchors need to be added at wood shear walls to connect them to their foundations. The on-center spacing of sill bolts should be 3 feet on center or less.

Task 2: There is inadequate lateral support in the building's transverse direction. Add two special moment frames at the apparatus bay doors and the building's interior. The moment frame columns will replace existing glulam girder columns. The existing glulam girders will need to be shored, the existing column and footing demoed, and a new footing be installed. The existing glulam girders would then be hangered off the moment frame columns.

Task 3: There is no continuous roof diaphragm across the structure. The existing roof consists of several discontinuous diaphragms with a large continuous step in the longitudinal direction, and several steps on the west side of the building in the transverse direction. The design intent is to create a single structural diaphragm at the attic floor level to address the upper roof discontinuities.

Task 4: Enhance the existing hose tower to resist seismic forces. It is assumed that the hose tower is wood framed.

Non-Structural Retrofits:

The purpose of this report and site visit was primarily a structural seismic assessment of the main station. If the decision is made to seismically retrofit and continue using the main station, a more detailed survey of non-structural components (ceilings, fire suppression systems, mechanical systems, light fixtures, etc.) should be made and any deficiencies should be addressed. The list below addresses some possible non-structural deficiencies and general solutions.

Task 5: Life Safety Systems: Emergency power to be anchored to slabs or supplement bracing added to prevent lateral movement. Emergency lighting should be properly anchored to walls or laterally braced to structure if hanging lights are present. Verify that fire suppression piping is properly braced.

- Hazardous Materials: Gas cylinders and storage tanks should be restrained from lateral movement. It appeared that many of the gas cylinders were placed in cabinets; however, some hazardous material storage tanks may not be properly secured. Ensure shut-off valves are available for distributed hazardous materials (natural gas, gasoline, etc.) or are operational if present.

Task Summary Table			Drawings	
Task #	Deficiency	Description	Keynote #	SK#
1	Load Path Shear Stress Check Wood Sill Bolts Diaphragm Connectivity Hold Down Anchors	Existing shear walls are not adequate to resist seismic forces. The sill anchorage and hold down anchorage are unknown and are assumed to be inadequate.	1, 8, 9, 14	2, 3, 4
2	Load Path Shear Stress Check	Inadequate lateral support in building's transverse direction. Add (2) moment frames and enhance existing wood shear walls.	2, 3, 4	–
3	Load Path Diaphragm Stress Check Diaphragm Continuity Vertical Irregularities Sheathing/Unblocked Diaphragm	No continuous diaphragm at upper roof. Provide structural diaphragm in attic and connect to shear walls and moment frames.	5, 6, 7	1
4	Load Path	Enhance existing hose tower to resist seismic forces.	11, 12	–
5	Wood Posts	Provide positive connections of wood posts to foundation.	16	–
6	Life Safety Systems Hazardous Materials Ceilings Light Fixtures Cladding Furnishings Mechanical & Electrical Ducts & Piping	Non-structural components are not properly braced or restrained to prevent lateral movement during a seismic event.	–	–

- Ceilings: Supplemental attachments of gypsum board/ lath and plaster ceiling systems may be required. Add screws or nails as necessary. Provide edge distances and support for suspended ceilings, add lateral bracing if necessary.
- Light Fixtures: Add lens covers to light fixtures as required.
- Cladding: Provide proper attachment of exterior panels to structure. Ensure glazing with appropriate specifications is used.
- Parapets: All parapets should be tied back to the roof diaphragm.
- Contents & Furnishings: Use shelf lips on storage racks, bungee cords, wires, or anchorage to slab for contents that are likely to fall or tip in a seismic event.
- Mechanical & Electrical Equipment: Ensure proper slab anchorage for air compressor, water heater, and other mechanical equipment that is critical to station operations.
- Ducts/Piping: Mechanical ducts or fluid/gas piping should be properly braced to restrain lateral movement. Flexible couplings should be added to pipes at attachment to appliances or similar to allow movement.
- Architectural elements affected by the structural retrofit may have to be replaced due to demolition or access issues when applying the structural retrofit recommendations. This includes, but is not limited to, roofing, siding, and new paint.

CONCLUSIONS

The Tier 1 analysis has revealed that the building has multiple structural and non-structural seismic deficiencies which would not meet current seismic design standards for an essential facility. Based on the site and existing building information available at this time the retrofit would address the deficiencies identified in the Tier 1 checklists to meet Operational standards. A thorough, Tier 2 analysis of the building in conjunction with materials testing and geotechnical investigation would need to be conducted to provide a comprehensive upgrade design for the facility. The complete analysis and design development for those repairs is an effort that is beyond the scope of this investigation. Depending on the results of this additional analysis/investigation, there may be changes to the list of repairs above. Functionality and fire life safety deficiencies have not been addressed and are outside the scope of this report.

Once a complete analysis and design of a seismic upgrade has been submitted and construction has been completed, the West Side Fire Station #1 can expect to remain occupied and functional after a seismic event of the size expected in the region.

COST CONSIDERATIONS

Following completion of the seismic assessment, Mackenzie evaluated cost impacts of the rehabilitation scheme. The following cost summary projects a total development cost, including estimated construction costs, design costs and owner costs.

The most significant construction costs are associated with Tasks 1 and 2.

Task 1 involves enhancing the existing exterior wood walls by adding additional nailing, which required the removal and replacement of the exterior siding. Task 1 also includes the addition of sill anchorage and hold downs, which is assumed to be installed by removing a 2’ strip from the exterior sheathing to expose the sill. It is assumed that the exposed wall will need to be re-insulated per current code, and the entire exterior building will receive new siding.

Task 2 involves the addition of two moment frames to the structure. Since the moment frame columns are located at existing columns, there is additional demo and shoring of the existing structure that would be required.

The cost of a project is 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.

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, an escalation cost that reflects the expected start of construction has been added. Furthermore, a design contingency is recommended to ensure dollars are carried through construction for owner changes, design omissions, unforeseen conditions or jurisdictional requirements, among others.

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 geotechnical analysis and special inspections. A contingency is provided for this category for any unforeseen or additionally requested design and/or engineering services throughout the project.

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

The following project development cost estimate examines the construction values of the programmed design concept based on the anticipated Construction, Consultant and Owner Costs. Detailed break-out of the anticipated construction costs and permit costs have been provided in Appendix D to describe elements proposed.

Project Cost Summary

West Side Fire Station 1 - Project Cost Summary

12/18/2017

			Comments
Construction Cost of Facility			
General Contractor Construction Cost	**$428,274**	$71.57	per SF
Escalation Start of Construction - Fall 2019	$51,393	12%	6% per year
Construction Contingency	$143,900	30%	
General Conditions	$59,748	9%	
CMGC Process	$40,300	5%	
Profit & Overhead	$72,361	9%	
Bonds & Insurances	$9,862	12%	
Total Construction Costs	**$805,838**	$134.67	per SF
Consultants Costs			
A/E Design	$160,000	20%	of GCC Cost
Reimbursables	$16,000	10%	of A/E Design and Construction
As-builting building	$7,500	Allowance	
A/E LEED Design and Documentation	$0	Not required	
CM/GC Preconstruction Services	$35,000	Allowance	5k per month
Owner's Project Manager	$32,234	4%	of GC Cost
Topo and Boundary Survey	$3,500	Allowance	
ASCE 41 Materials Testing	$15,000	Allowance	
Special Inspections	$18,000	Estimate	
Geotechnical Services	$18,000	Estimate	
Environmental Services	$0	Not required	
Hazardous Material Survey/Testing/Mitigation Specs	$15,000	Estimate	
Abatement	$20,000	Estimate	
Subtotal - Consultants	**$340,234**		
Consultants Contingency	$34,023	10%	of Consultants Costs
Total Consultants Costs	**$374,257**	$62.54	per SF
Owner Costs			
Lawyer Contract Review	$7,500	Allowance	
Fixtures, Furniture & Equipment (FF&E)	$15,000	Estimated to replace	
Moving Allowance	$7,500	Move to temporary facility	
Temporary Facilities	$25,000	Tents for apparatus	
Permit Fees	$10,000	Estimate	
Subtotal - Owner Costs	**$65,000**		
Owner Contingency	$6,500	10%	of Owner Costs
Total Owner Costs	**$71,500**	$11.95	per SF

Total Project Cost	**$1,251,595**	**$209.16 per SF**

Building Size: *5,984 SF*

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

A. ASCE 41-13 CHECKLIST

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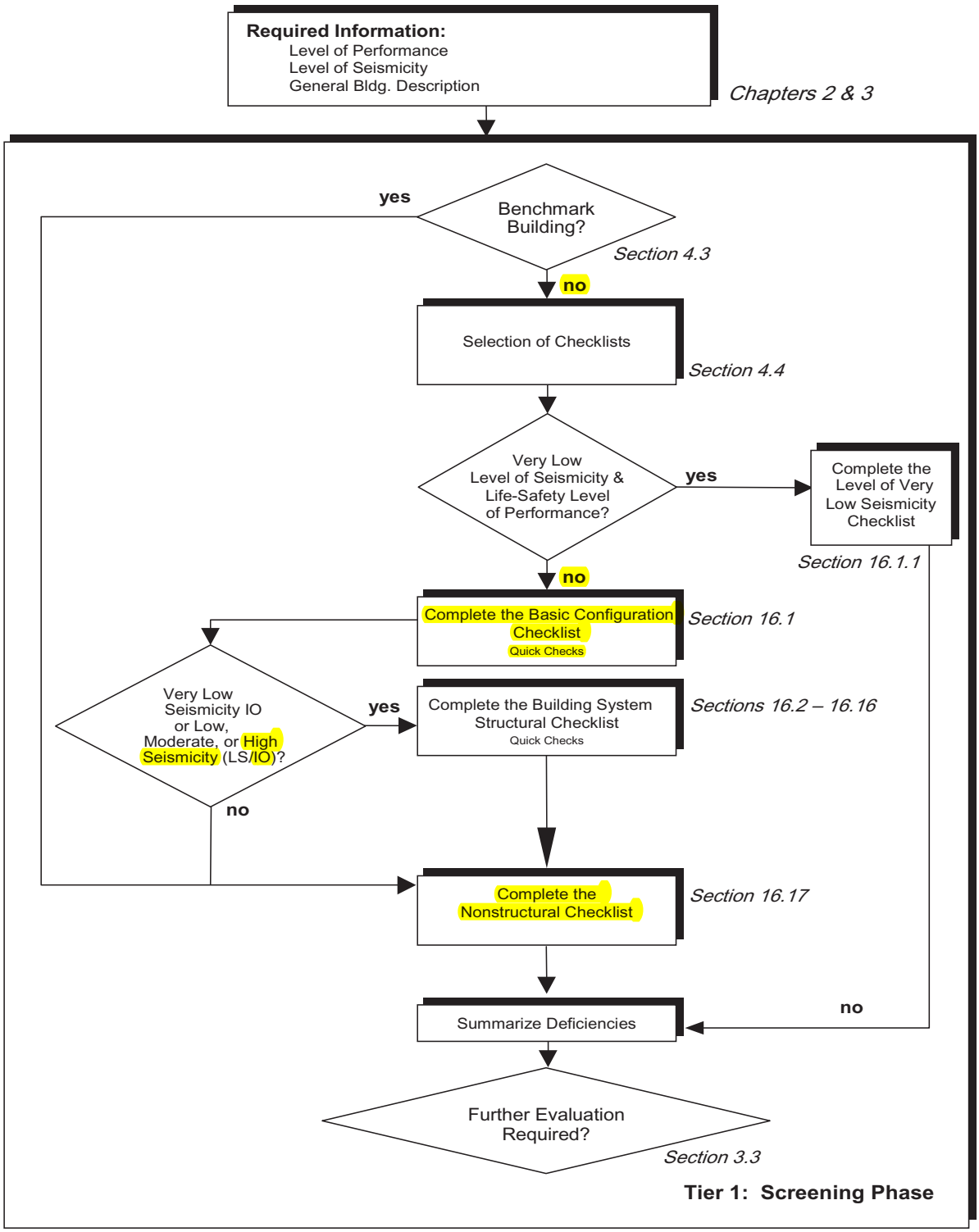

FIG. 4-1. Tier 1 Evaluation Process

Project: HOOD RIVER STATION 1 Location: 4250 BARRETT DR, HOOD RIVER OR 97031

Completed by: TSK Date: OCTOBER 27, 2017

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)

Project: HOOD RIVER STATION 1 Location: 4250 BARRETT DR, HOOD RIVER OR 97031

Completed by: TSK Date: OCTOBER 27, 2017

16.3IO IMMEDIATE OCCUPANCY STRUCTURAL CHECKLIST FOR BUILDING TYPE W2: WOOD FRAMES, COMMERCIAL AND INDUSTRIAL

Very Low Seismicity

Seismic-Force-Resisting System

(C) NC N/A U REDUNDANCY: The number of lines of shear walls in each principal direction is greater than or equal to 2. (Commentary: Sec. A.3.2.1.1. Tier 2: Sec. 5.5.1.1)

C (NC) N/A U SHEAR STRESS CHECK: The shear stress in the shear walls, calculated using the Quick Check procedure of Section 4.5.3.3, is less than the following values (Commentary: Sec. A.3.2.7.1. Tier 2: Sec. 5.5.3.1.1):

Structural panel sheathing	1,000 lb/ft
Diagonal sheathing	700 lb/ft
Straight sheathing	100 lb/ft
All other conditions	100 lb/ft

C NC (N/A) U STUCCO (EXTERIOR PLASTER) SHEAR WALLS: Multi-story buildings do not rely on exterior stucco walls as the primary seismic-force-resisting system. (Commentary: Sec. A.3.2.7.2. Tier 2: Sec. 5.5.3.6.1)

C NC (N/A) U GYPSUM WALLBOARD OR PLASTER SHEAR WALLS: Interior plaster or gypsum wallboard is not used as shear walls on buildings more than one story high with the exception of the uppermost level of a multi-story building. (Commentary: Sec. A.3.2.7.3. Tier 2: Sec. 5.5.3.6.1)

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

C NC (N/A) U WALLS CONNECTED THROUGH FLOORS: Shear walls have an interconnection between stories to transfer overturning and shear forces through the floor. (Commentary: Sec. A.3.2.7.5. Tier 2: Sec. 5.5.3.6.2)

C NC (N/A) U HILLSIDE SITE: For structures that are taller on at least one side by more than one-half story because of a sloping site, all shear walls on the downhill slope have an aspect ratio less than 1-to-2. (Commentary: Sec. A.3.2.7.6. Tier 2: Sec. 5.5.3.6.3)

C NC (N/A) U CRIPPLE WALLS: Cripple walls below first-floor-level shear walls are braced to the foundation with wood structural panels. (Commentary: Sec. A.3.2.7.7. Tier 2: Sec. 5.5.3.6.4)

C (NC) N/A U OPENINGS: Walls with openings greater than 80% of the length are braced with wood structural panel shear walls with aspect ratios of not more than 1.5-to-1 or are supported by adjacent construction through positive ties capable of transferring the seismic forces. (Commentary: Sec. A.3.2.7.8. Tier 2: Sec. 5.5.3.6.5)

C NC N/A (U) HOLD-DOWN ANCHORS: All shear walls have hold-down anchors, constructed per acceptable construction practices, attached to the end studs. (Commentary: Sec. A.3.2.7.9. Tier 2: Sec. 5.5.3.6.6)

Connections

C (NC) N/A U WOOD POSTS: There is a positive connection of wood posts to the foundation. (Commentary: Sec. A.5.3.3. Tier 2: Sec. 5.7.3.3)

C NC N/A (U) WOOD SILLS: All wood sills are bolted to the foundation. (Commentary: Sec. A.5.3.4. Tier 2: Sec. 5.7.3.3)

(C) NC N/A U GIRDER/COLUMN CONNECTION: There is a positive connection using plates, connection hardware, or straps between the girder and the column support. (Commentary: Sec. A.5.4.1. Tier 2: Sec. 5.7.4.1)

Foundation System

C NC (N/A) U DEEP FOUNDATIONS: Piles and piers are capable of transferring the lateral forces between the structure and the soil. (Commentary: Sec. A.6.2.3.)

C NC (N/A) U SLOPING SITES: The difference in foundation embedment depth from one side of the building to another shall not exceed one story high. (Commentary: Sec. A.6.2.4)

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

Seismic-Force-Resisting System

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

Diaphragms

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

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

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

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

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

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

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

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

Connections

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

Project: HOOD RIVER STATION 1 Location: 4250 BARRETT DR, HOOD RIVER OR 97031

Completed by: TSK Date: OCTOBER 27, 2017

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. MULTI-STORY PANELS: For multi-story panels attached at more than one floor level, panel connections are detailed to accommodate a story drift ratio of at least the following: for Life Safety in Moderate Seismicity, 0.01; for Life Safety in High Seismicity and for Position Retention in any seismicty, 0.02. (Commentary: Sec. A.7.4.4. Tier 2: Sec. 13.6.1)

C NC (N/A) U LS-MH; PR-MH. PANEL CONNECTIONS: Cladding panels are anchored out-of-plane with a minimum number of connections for each wall panel, as follows: for Life Safety in Moderate Seismicity, 2 connections; for Life Safety in High Seismicity and for Position Retention in any seismicity, 4 connections. (Commentary: Sec. A.7.4.5. Tier 2: Sec. 13.6.1.4)

C NC (N/A) U LS-MH; PR-MH. BEARING CONNECTIONS: Where bearing connections are used, there is a minimum of two bearing connections for each cladding panel. (Commentary: Sec. A.7.4.6. Tier 2: Sec. 13.6.1.4)

C NC (N/A) U LS-MH; PR-MH. INSERTS: Where concrete cladding components use inserts, the inserts have positive anchorage or are anchored to reinforcing steel. (Commentary: Sec. A.7.4.7. Tier 2: Sec. 13.6.1.4)

C NC (N/A) U LS-MH; PR-MH. OVERHEAD GLAZING: Glazing panes of any size in curtain walls and individual interior or exterior panes over 16 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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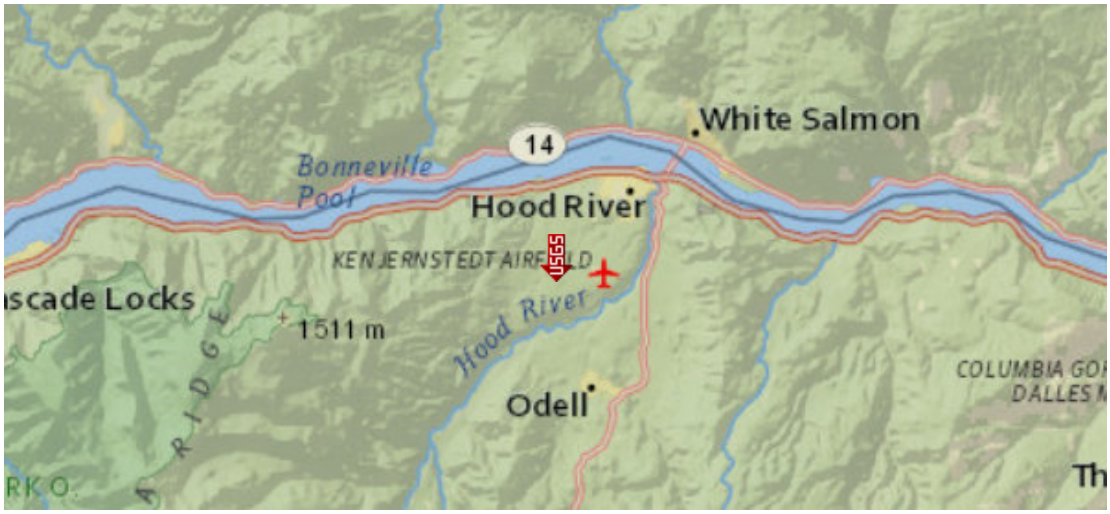
USGS Design Maps Summary Report

User–Specified Input

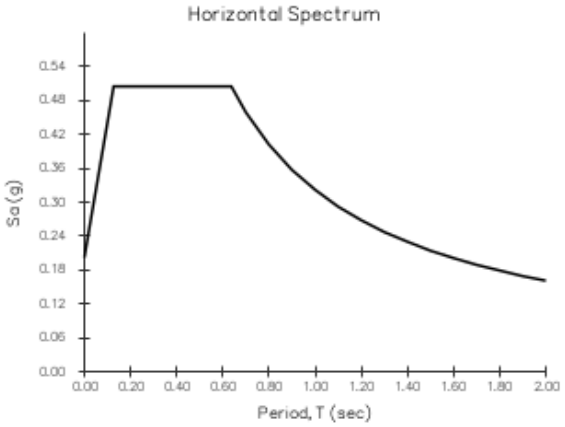
Report Title	West Side Fire Station #1 Fri November 10, 2017 00:19:44 UTC
Building Code Reference Document	ASCE 41-13 Retrofit Standard, BSE-1N (which utilizes USGS hazard data available in 2008)
Site Coordinates	45.67855°N, 121.56376°W
Site Soil Classification	Site Class D – "Stiff Soil"

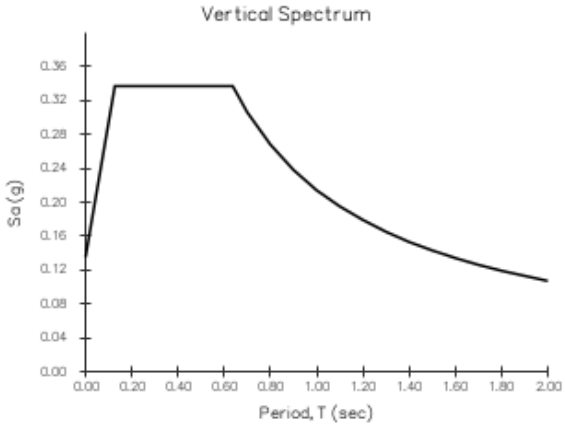


USGS–Provided Output

$S_{XS,BSE-1N}$ 0.505 g

$S_{X1,BSE-1N}$ 0.322 g





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MASSING

@ THP ROOF ASSEMBLY (ASSUMED)

ROOFING	2.5
PLY (TOP)	2.1
JOISTS	3
MISC	1.5
4x DECKING	10.2
CEILING JOISTS	2.5
2x SOFFIT DECKING	5
HEAVY TIMBER FRAMING	3
MISC	2

USE 32 PSF TOTAL DL

OR USE 12 PSF @ "UNDERBUILD"
& 20 PSF @ CEILING DIAPH.

@ THP WALL ASSEMBLY ⇒ 2x6 STUD WALL ⇒ 12 PSF DL

$$W = \underbrace{(32^{PSF})(98' \times 43')}_{\text{Roof } \Sigma = 136^{k}} + (20^{PSF})(15' \times 28' + 10' \times 20') + (20^{PSF})(10' \times 43')$$

$$+ \underbrace{(12^{PSF})(145'/2)(98' + 4' + 43' + 28' + 10' + 20' + 40')}_{\text{TALL WALL } \Sigma = 22^{k}}$$

$$+ \underbrace{(12^{PSF})(8'/2)(10' + 43' + 10' + 15' + 28' + 15' + 10' + 20' + 10')}_{\text{LOW WALL } \Sigma = 8^{k}}$$

$$+ \underbrace{(12^{PSF})(8' + 10' + 8' + 10')(30' \pm) + (20^{PSF})(8' \times 10')}_{\text{HOSE TOWER } \Sigma = 2^{k}}$$

$\Sigma W = 188^{k}$

WEST SIDE STA. 1 — MASSING / TIER 1 (1)

By TSK
Date 11/9/17
Job # 2170545
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PSEUDO SEIS. FORCE (LSP) §7.4.1.3

$V = C_1 C_2 C_m S_a W$ (7-21) $T = C_t h_n^{\beta}$ (7-18)

$= (0.02)(20' \pm)^{(0.75)} = 0.195$

$= (1.4)(1)(0.505) W$

$= 0.707 W = 0.707(188^k) = 133^k$

TAKE ½ of SHEAR INTO EAST & WEST WALLS (ASSUME "OTHER" SHEATHING)

$v_{EAST\ WALL} = 133^k/2 / 98' = 0.678^{k/l}$

$v_{WEST\ WALLS} = 133^k/2 / 40' + 28' = 0.978^{k/l}$

$\gg 0.1^{k/l}$ NOT COMPLIANT

SIMILARLY NON COMPLIANT AT NORTH & SOUTH WALLS, QED.

COMPARE ANTICIPATED SHEARWALL CAPACITIES

(ASSUME, WILL ACHIEVE)

CODE. BLDG ASSUME HORIZ. DECK $k_m Q_{CE} = (1)(1)(120^{plf})(1.5)$ (m)

$= 180^{plf}$

@ ½" PLY w/ 8d @ 6" oc UNBLOCKED $k_m Q_{CE} = (1)(1.5)(520^{plf})(1.5)(0.5)$ (EXPECTED STR, UNBLK)

$= 585^{plf} < 678^{plf}$ N.G.

ADD 8d @ 3" oc NET SPAC. NO BLOCKING $k_m Q_{CE} = (1)(1.5)(980^{plf})(0.5) = 735^{plf}$ = ok

REMOVE SIDING &

THEN NAIL BACK w/ 8d @ 3" oc NET SPACING

WEST SIDE STA 1 – TIER1 CALCS (1)

By TSK

Date 11/9/17

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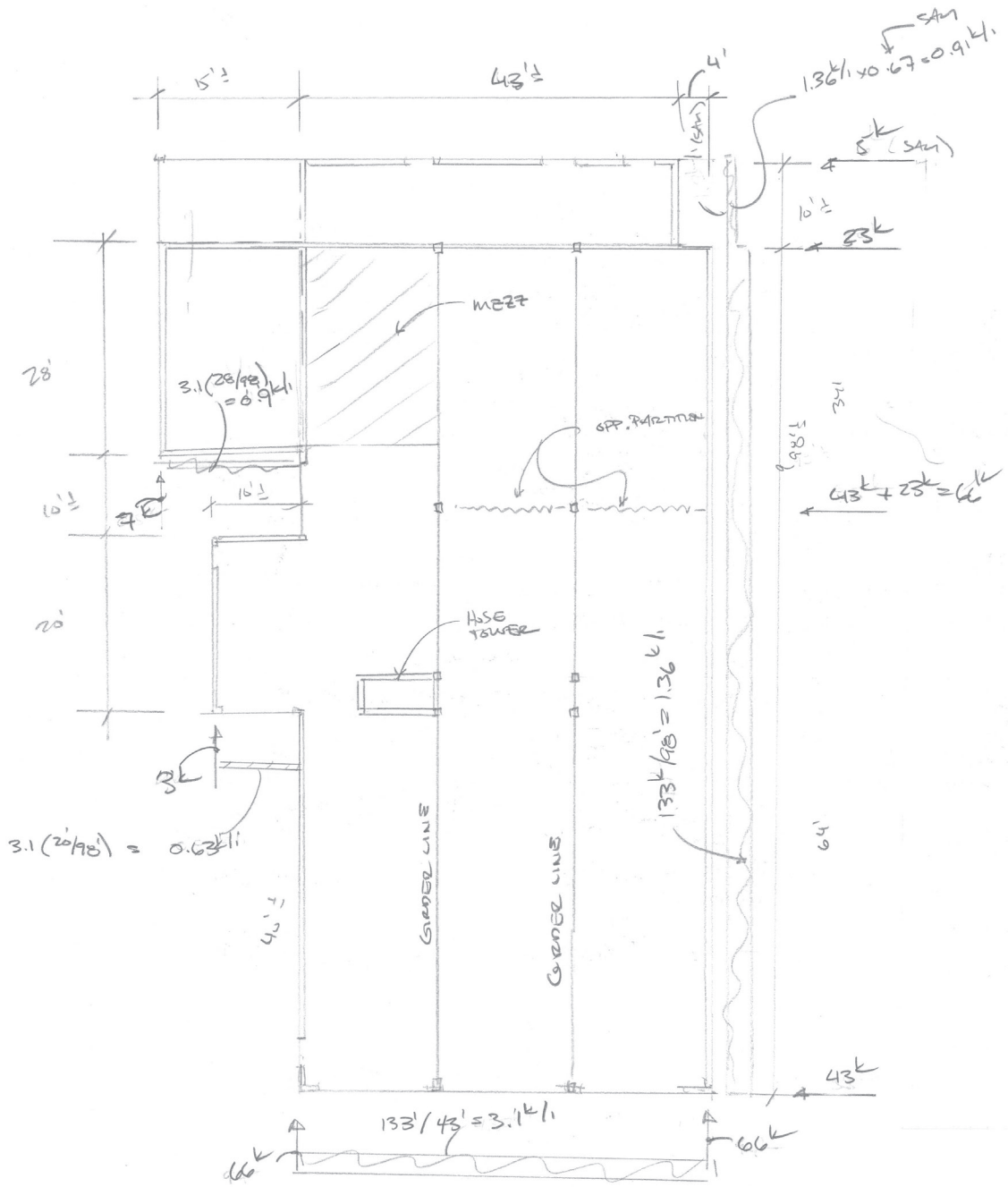

WEST SIDE STA 1 – RAM SKETCH/FL REACTIONS

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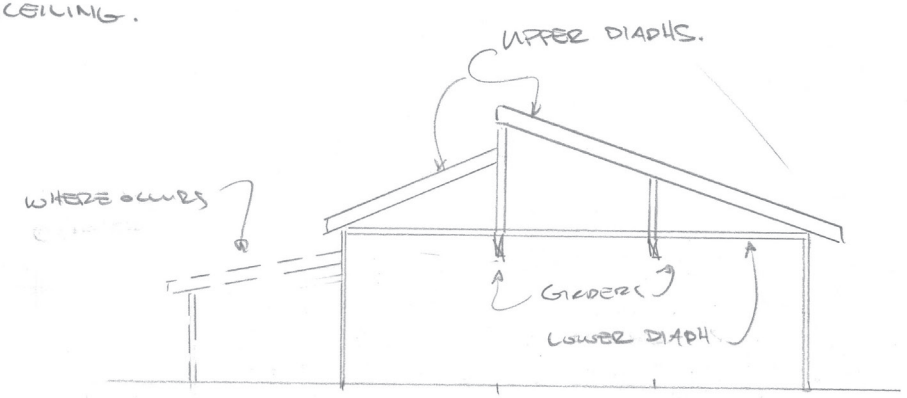
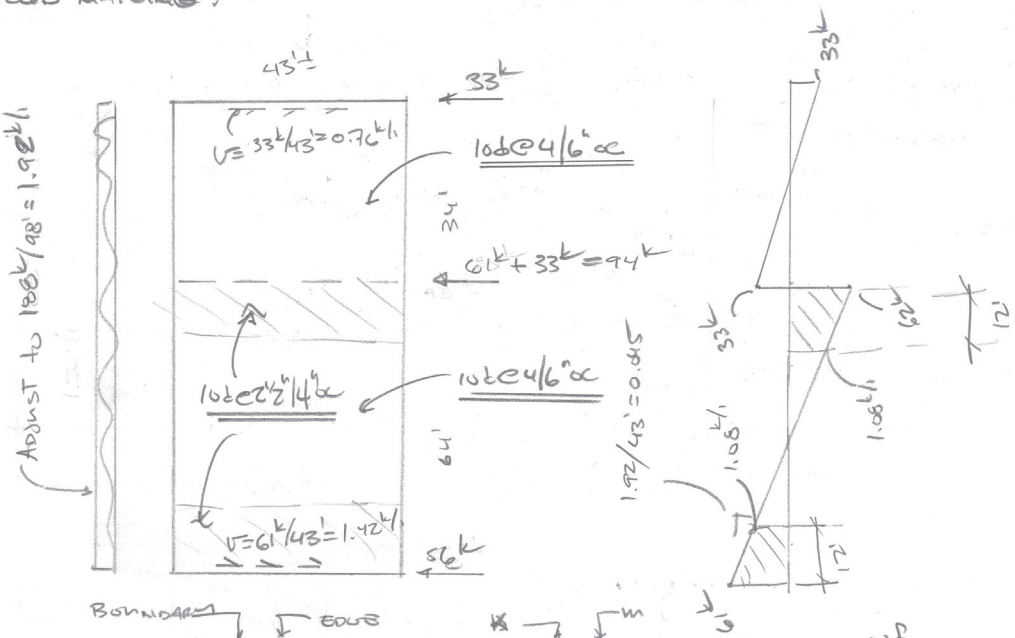
△ DIAPHRAGMS APPEAR TO OCCUR @ ROOF PLANES & ACROSS BLDG @ (E) CEILING.



△ PROPOSE TO SHEATH LOWER DIAPH @ T.O. CEILING JOISTS, SIZE REQ'D MATCHING.



FOR 15/32" w/ 10d @ 2½"/4" oc Q_{CE} = (1)(1.5)(1060 plf) = 1590 plf

" " 4"/6" " = (1)(1)(720 plf) = 1080 plf

" " 6"/6" " = (1)(1)(540 plf) = 810 plf

WEST SIDE STA 1 – DIAPHRAGM CHECKS (1)

By TSK

Date 11/9/17

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IN LONGIT DIR.

DEMAND = 978 plf — ok.

USE 15/32" w/ 10d @ 4/6" oc (kmQCE = 1080 plf)

WEST SIDE STA 1 – DIAPH CHECKS (2)

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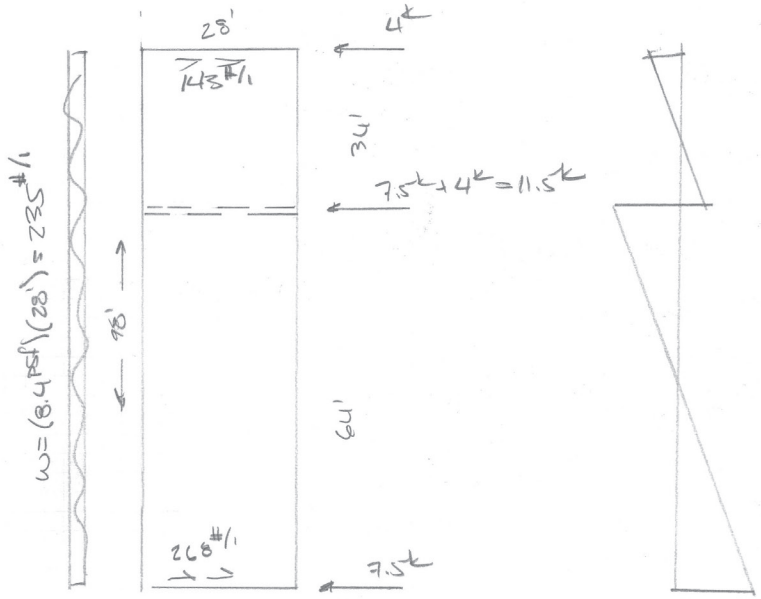
VERIFY IF UPPER DIAPHS CAN SELF SPAN

STY UPPER ROOFS HAVE INERTIAL FORCES OF

$(12^{PSF})(0.707) = 8.4^{PSF}$

@ DIAPH (D1)



ASSUME 3/8" PLY W/ 6d @ 6" OC UNBLOCKED IS EXISTING

$\phi V_{CS} = (1)(1.5)(250^{\#/'})(1.5) = 563^{\#/'}$

↑ EXPECTED STR.

(E) UPPER DIAPH SHEATHING IS LIKELY OK TO SELF-SPAN

* DIAPHS (D2) TO (D6) OK BY INSPECTION

WEST SIDE STAIR - DIAPH. CHECKS

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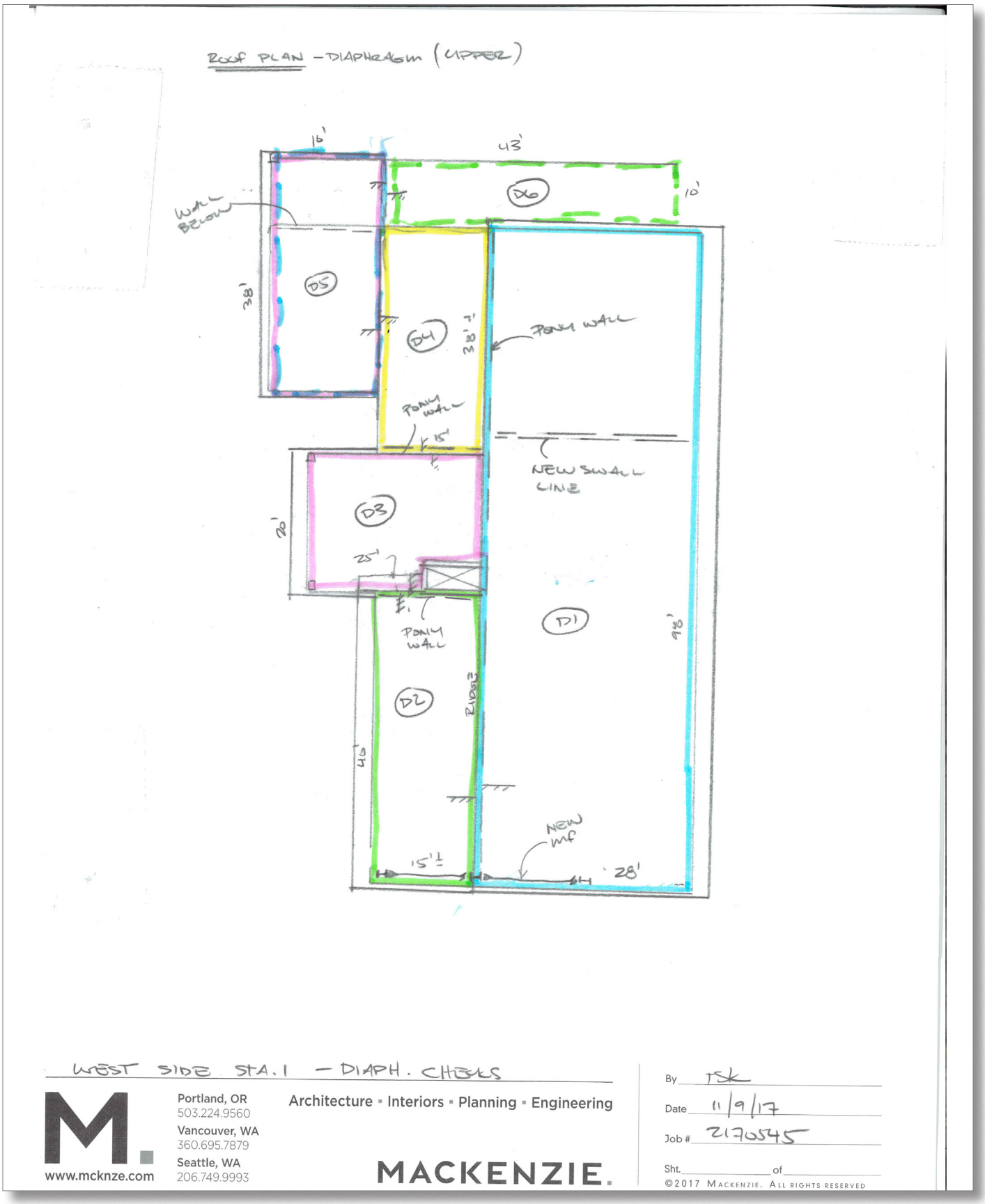
ROOF PLAN – DIAPHRAGM (UPPER)
16'
43'
10'
WALL BELOW
D6
D5
38'
D4
38'
PONY WALL
PONY WALL
15'
NEW SHEAR LINE
D3
20'
25'
D1
98'
PONY WALL
D2
40'
NEW MF
15'1/2
28'
WEST SIDE STA.1 – DIAPH. CHECKS
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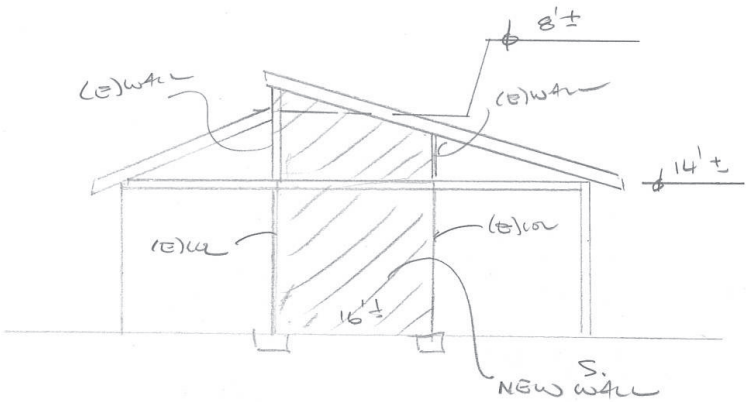
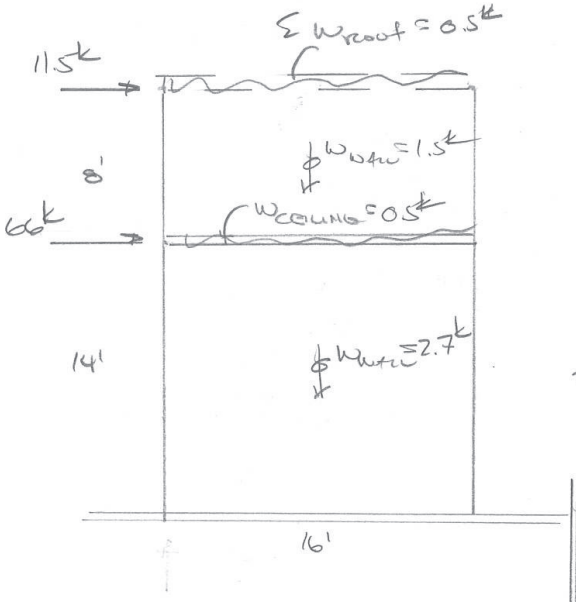
SIZE WOOD SHEARWALL @ INTERIOR





$V_{MAX} = \frac{66^k + 11.5^k}{16'} = 4.8^{k/l}$

CONVERT TO FIND SWALL FROM NDS TABLE

$V_{NDS} = \frac{4.8^{k/l}}{1.5} = 3.23^{k/l}$

$3.23/2 = 1.615^{k/l}$ (2 = #SIDES)

3x6 @ 16" oc WALL
w/ 19/32" STRUCT I E4 SIDE
w/ 10d @ 2/3" oc
BNDRY, FIELD

WEST SIDE STA. 1 — INT. SHEARWALL (1)

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ESTIMATE HOLDOWN FORCE

$M_{OT} = (11.5^k \times 22') + (66^k)(14') = 1177^{1k}$

$M_{RZ} = 0.9(0.5^k + 1.5^k + 10.5^k + 12.7^k) = 4.5^{1k}$

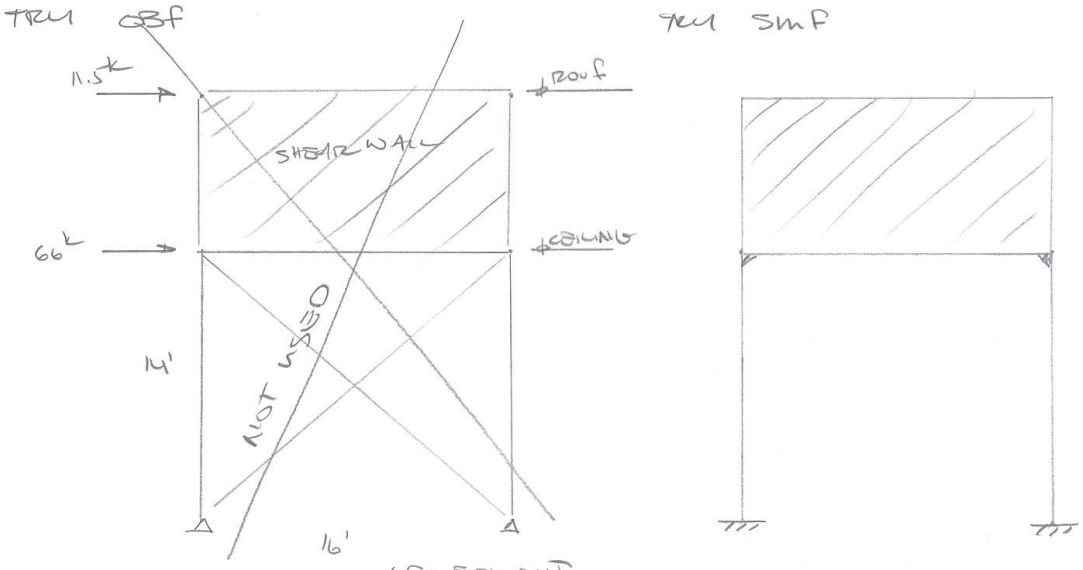
$T = \frac{1177 - 4.5}{16' - 1'} = 78^k$!!

FOR 4 HDU14-SDS 2.5

$T_{ADJ} = 14.445^k / 1.6 \times 3.32 = 29.9^k$

(2) HDU14-SDS2.5 STILL ISN'T ENOUGH

CONSIDER ALT SYSTEM



WEST SIDE STA. 1 – INT. SHEARWALL (2) LFR ELEMENT

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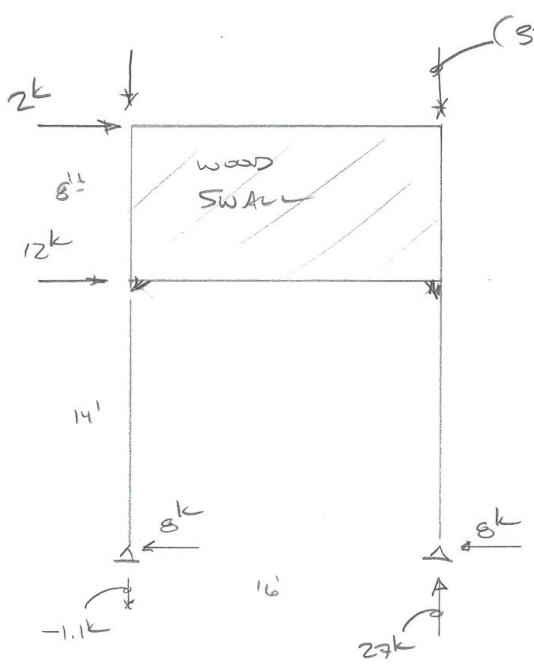
SIZE FRAMES PER ASCE 7-10 (FOR BREVITY)

ASSUME R = 6.5
I = 1.5
S_{DS} = 0.5

$$C_S = \frac{0.5 \times 1.5}{6.5} = 0.115 \Rightarrow V_{BASE\ SHEAR} = (188^k)(0.115) = 21.7^k$$

SCALE LOADS BY 21.7/133 = 0.163



SET DRIFT TO 0.015

14' x 12 x 0.015 = 2.52"

$\Delta_{ALL\ EL} = 2.52"/4.5 = 0.56"$

C_D WOOD WALL

PER RISA

W21x93 COLS

W18 x 71 BEAM

SEE REVISED GEOMETRY & FRAME SIZES PER SIMPSON

SIZE PAD FTG

$$b_{REQD} = \sqrt{\frac{27^k}{1.5^{ksf}}} = 4.2' \Rightarrow 5' \times 5' \text{SQ} \times 24" \text{ THICK}$$

PROVIDE SIMILAR FRAME (2 BAYS) @ APP BAY

WEST SIDE STA. 1 – INT. LFRAME (3)

By TSK
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Job # 217054S

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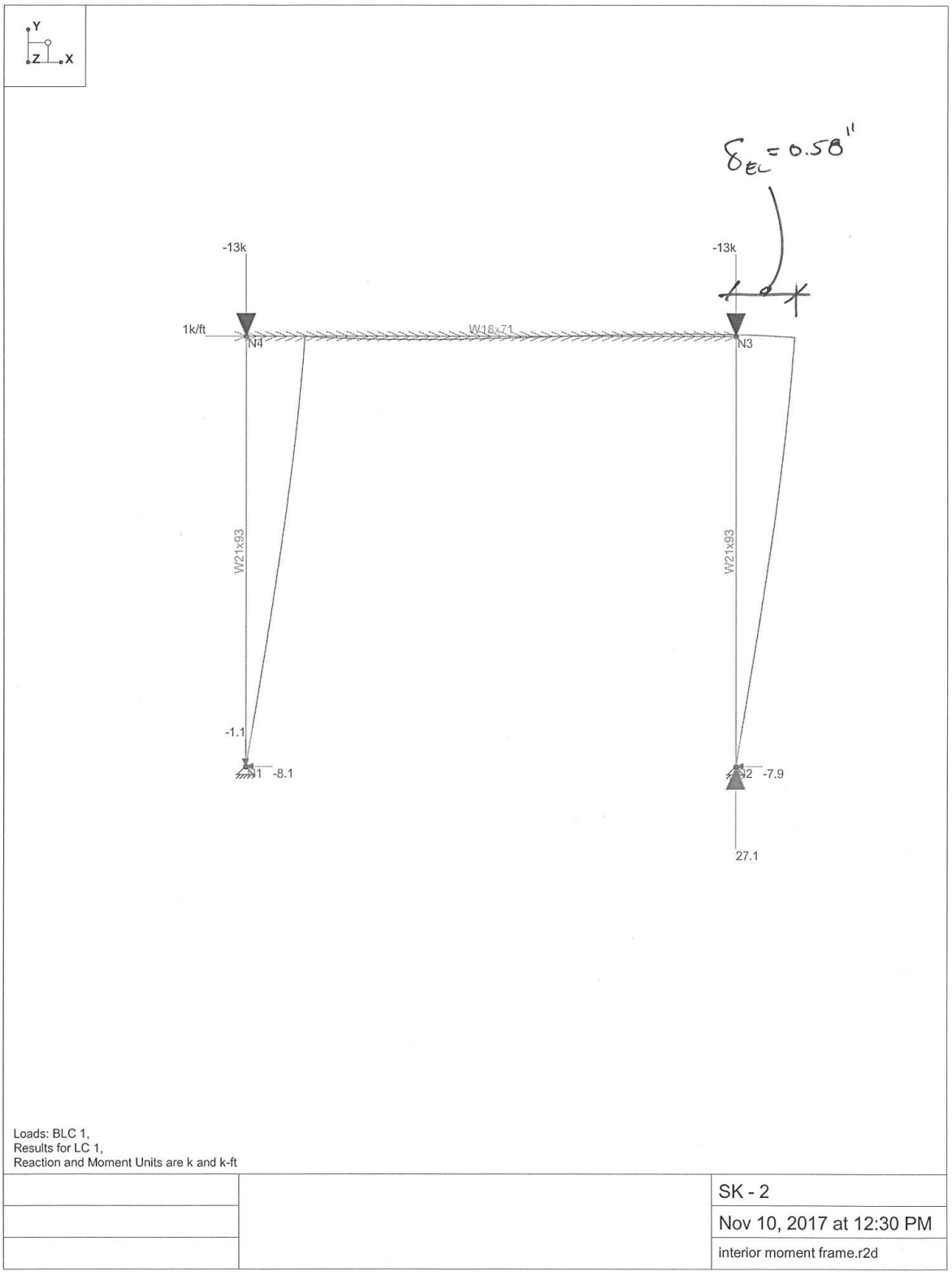
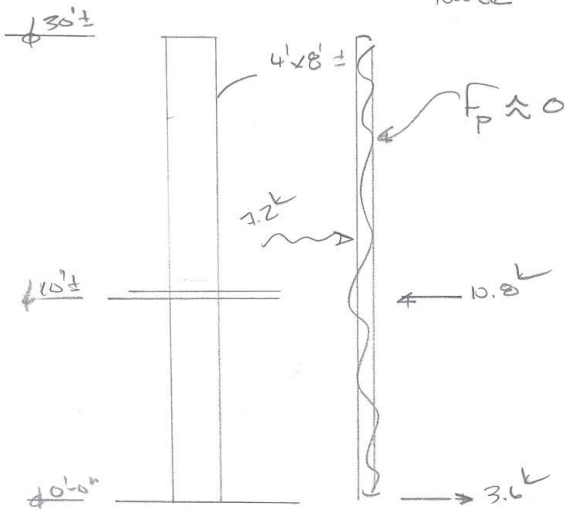

Y
Z
X
$\delta_{EL} = 0.58"$
-13k
-13k
1k/ft
W18x71
N4
N3
W21x93
W21x93
-1.1
N1 -8.1
N2 -7.9
27.1
Loads: BLC 1,
Results for LC 1,
Reaction and Moment Units are k and k-ft
SK - 2
Nov 10, 2017 at 12:30 PM
interior moment frame.r2d

REVIEW HOSE TOWER

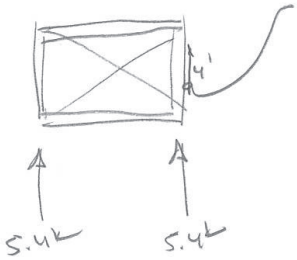
ASSUME WOOD CONSTRUCTION & SHEATHED

$W_{TOWER} = (12PSF)(2)(4'+8') = 288^{\#/'}$

USE $300^{\#/'}$



$F_p \approx 0.8(300^{\#/'}) = 240^{\#/'}$



$V = 5.4^k/4' = 1.35^{k/'}$

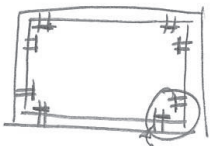
USE ½" PLY W/ #10d@3" OC BLOCKED

($k_m Q_{CE} = 1.47^{k/'}$)

VERT STRAPS TO RESIST TENSION COUPLE

$T = 46'^k/4' = 11.5^k$

CMST16 IS GOOD FOR $4.5^k/1.6 \times 3.32 = 9.34^k$



(2) CMST16 EA CORNER x 15'-0" CENTER ON CEILING ROOF

WEST STA. 1 – HOSE TOWER

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C. UPGRADE SCHEME

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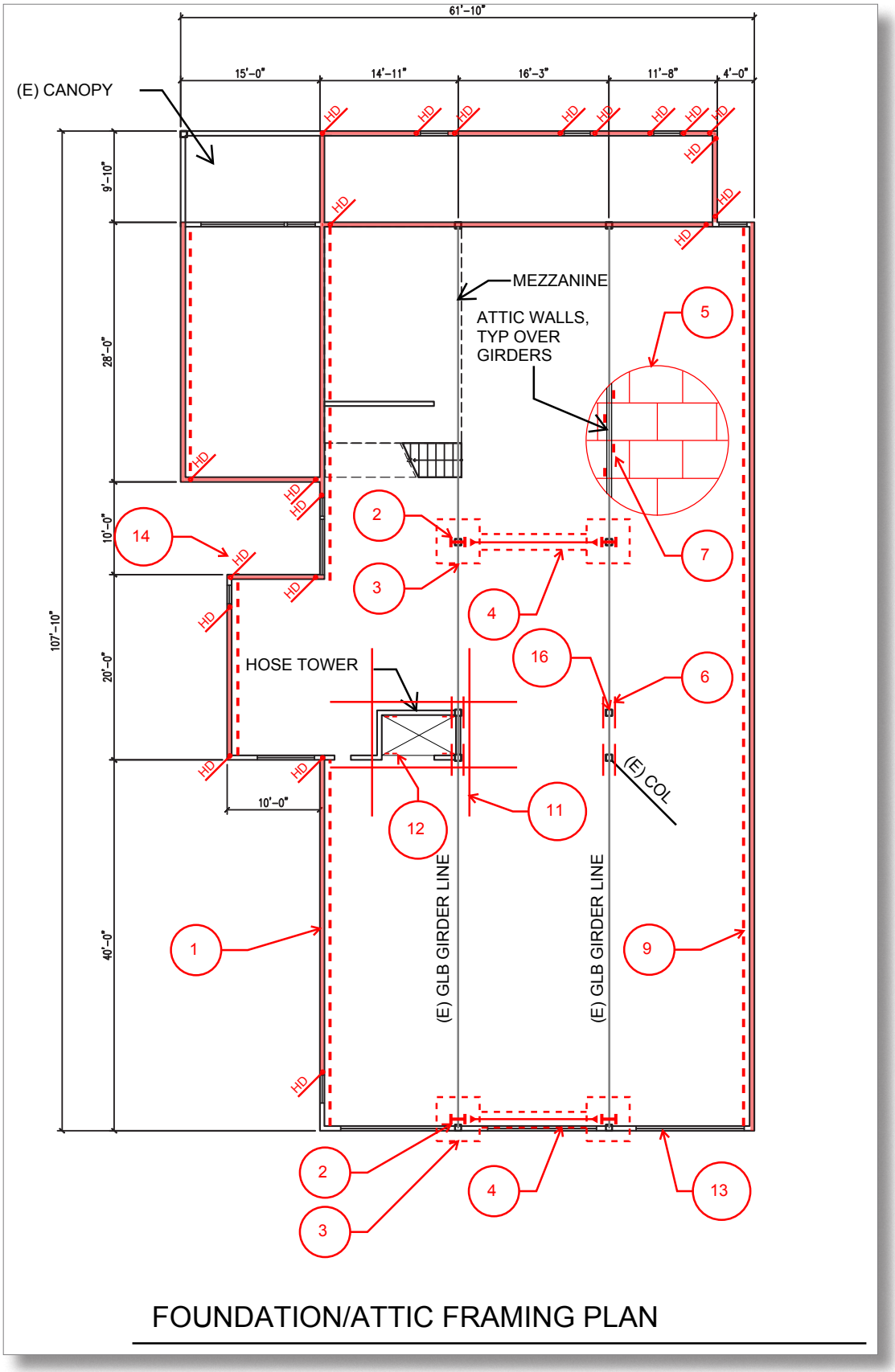
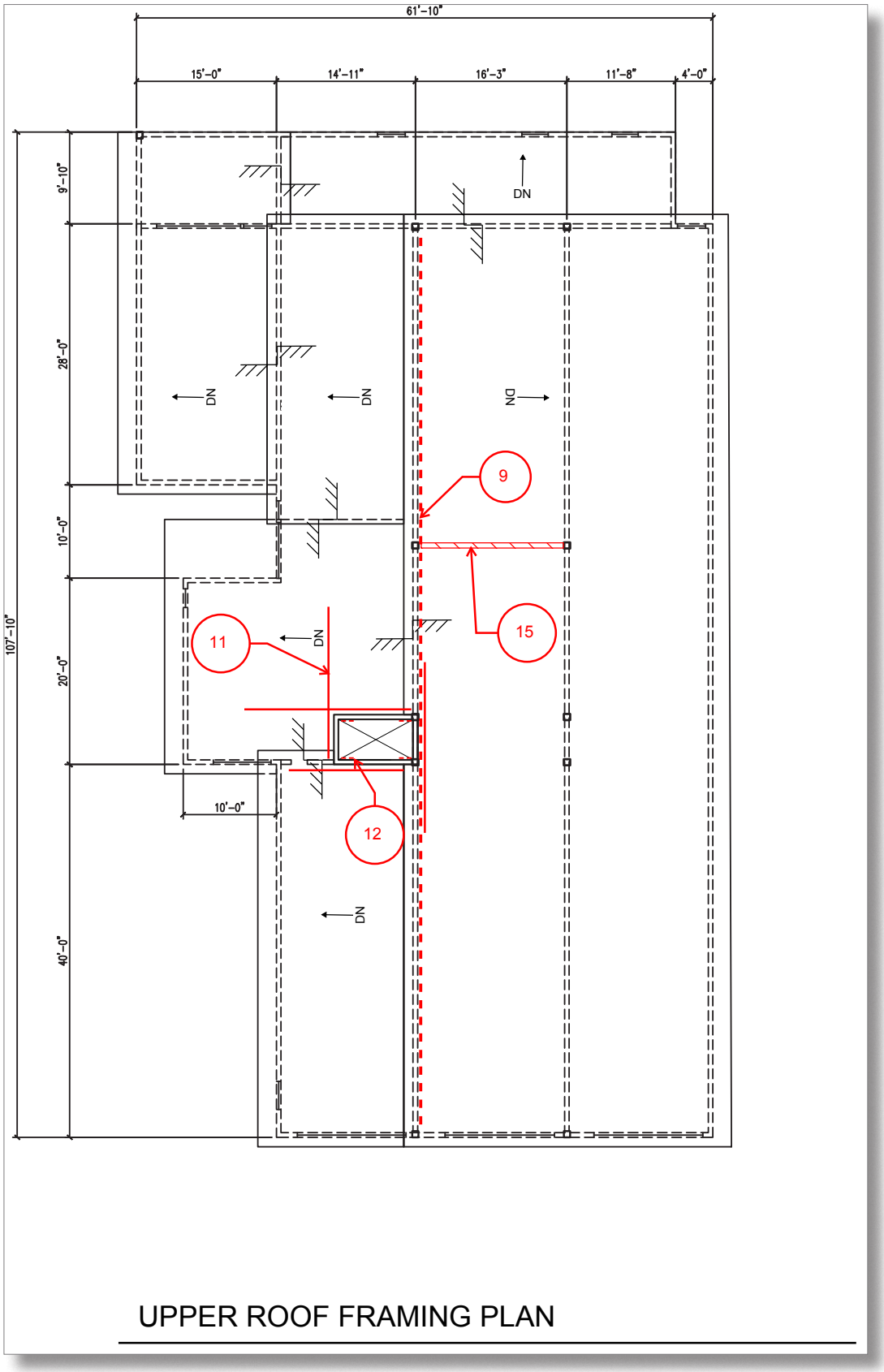
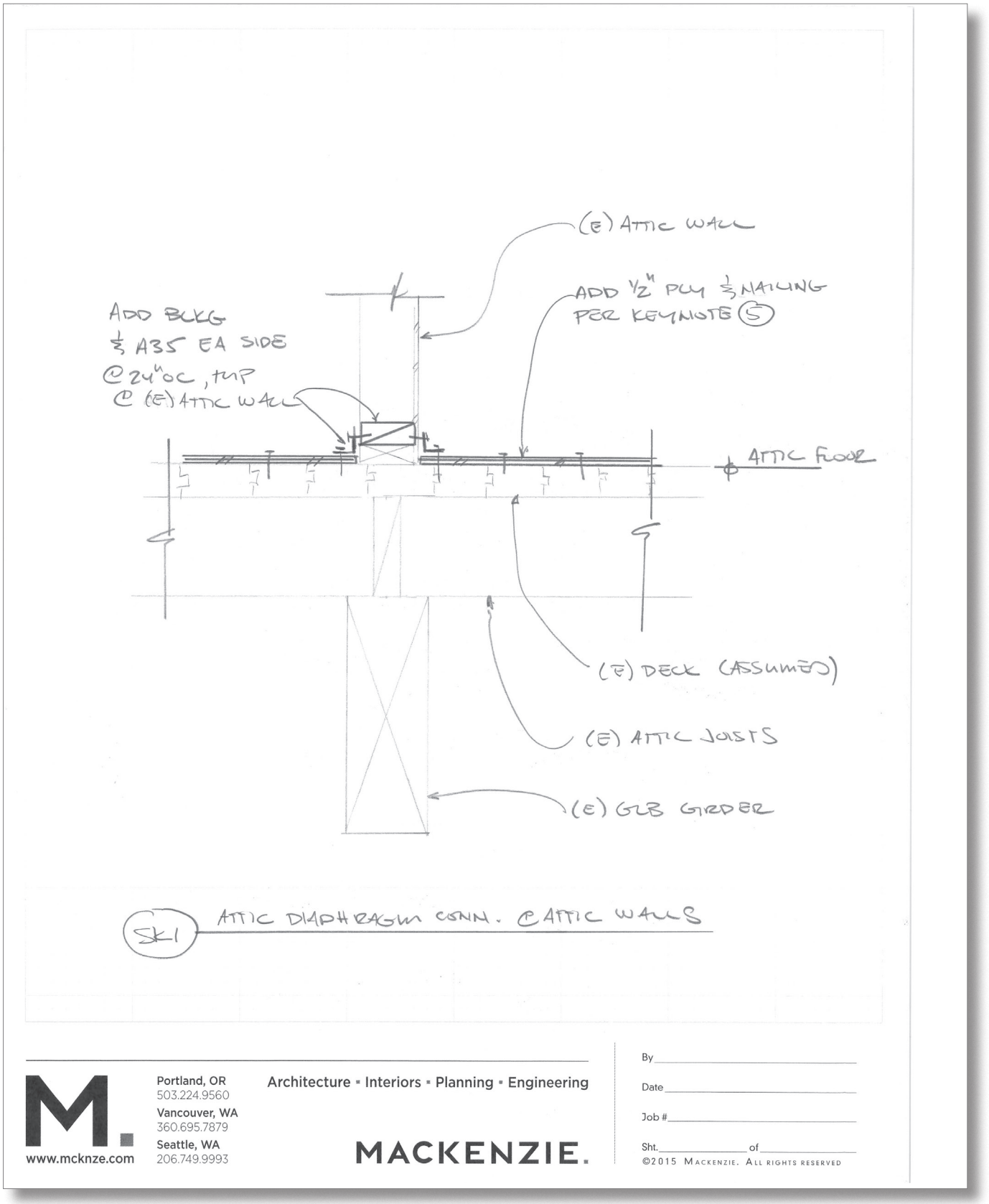


FOUNDATION/ATTIC FRAMING PLAN


61'-10"
15'-0"
14'-11"
16'-3"
11'-8"
4'-0"
9'-10"
28'-0"
10'-0"
20'-0"
40'-0"
107'-10"
10'-0"
DN
9
11
15
12
UPPER ROOF FRAMING PLAN

Keynotes	
#	Description
1	REMOVE EXISTING SIDING AND RENAIL SHEATHING W/ 8D @ 3"OC NET SPACING, TYP @ ALL EXTERIOR WALLS HIGHLIGHTED.
2	MOMENT FRAME, W16X57 COLUMNS AND W16X45 BEAMS TYP, (2) FRAMES TOTAL. SEE DETAIL SK3 FOR SIMPSON MOMENT FRAME ELEVATION.
3	SHORE EXISTING GLULAM GIRDERS AND DEMO EXISTING COLUMN AND PAD FOOTING. REPLACE FOOTING WITH 5'SQ x 2'-0" THICK W/ (6) #6 BARS EA WAY TOP AND BOTTOM. HANG GLULAM GIRDERS OFF MOMENT FRAME TOP NAILER WITH SIMPSON HWPH HANGERS, TYP AT ALL MOMENT FRAME COLUMNS.
4	2'-6" WIDE x 2'-0" THICK GRADE BEAM WITH (5) #7 BARS LONGIT AND #4 HOOPS @ 6" oc.
5	ADD 1/2" STRUCTURAL SHEATHING TO TOP OF ATTIC FLOOR ASSEMBLY WITH 10d AT 6"oc AT PANEL EDGES.
6	CONTUNITY TIES, ASSUME (2) SIMPSON MSTC28 STRAPS AT ALL GIRDER SPLICES.
7	ADD DIAPHRAGM CONNECTION ACROSS ATTIC WALLS, SEE DETAIL SK1.
8	ADD SILL ANCHORS AT HIGHLIGHTED SHEAR WALLS FROM KEYNOTE 1. ASSUME 1/2" DIA SIMPSON TITEN HD @ 3'-0 oc.
9	ADD BLOCKING AND CLIPS TO ATTACH DIAPHRAGM TO SHEAR WALLS FROM KEYNOTE 1, SEE DETAIL SK2.
10	ADD SIMPSON CMST16 x 15'-0" STRAPS AT ATTIC DIAPHRAGM AND UPPER ROOF DIAPHRAGM ON ALL SIDES OF HOSE TOWER.
11	ADD (2) SIMPSON CMST16 x 15-0" AND BLOCKING VERTICALLY EACH CORNER OF HOSE TOWER. CENTER ON UPPER ROOF DIAPHRAGM.
12	REPLACE EXISTING APP BAY DOORS (3) TOTAL.
13	ADD HOLDOWNS AT ENDS OF SHEAR WALLS WHERE INDICATED. ASSUME SIMPSON HD5-SDS2.5 W/ 5/8" DIA EPOXY ANCHOR AND 12" EMBEDMENT.
14	ADD NEW SHEAR WALL ABOVE MOMENT FRAME. ASSUME 1/2" SHEATHING BLOCKED WITH 10d & 6"oc AT PANEL EDGES.
15	PROVIDE POSITIVE CONNECTION BETWEEN EXISTING COLUMNS AND FOUNDATION. ASSUME L6x4x3/8x0'-6" EA SIDE OF COLUMN W/ 1/2" LAG SCREW AT COLUMN, AND 1/2" SIMPSON TITEN-HD AT SLAB.

Task Summary Table			Drawings	
Task #	Deficiency	Description	Keynote #	SK#
1	Load Path, Shear Stress Check, Wood Sill Bolts, Diaphragm Connectivity, Hold Down Anchors	Existing shear walls are not adequate to resist seismic forces. The sill anchorage and hold down anchorage are unknown and are assumed to be inadequate.	1, 8, 9, 14	2
2	Load Path Shear Stress Check	Inadequate lateral support in building's transverse direction. Add (2) moment frames and enhance existing wood shear walls.	2, 3, 4	3
3	Load Path, Diaphragm Stress Check, Diaphragm Continuity Vertical Irregularities Sheathing/Unblocked Diaphragm	No continuous diaphragm at upper roof. Provide structural diaphragm in attic and connect to shear walls and moment frames.	5, 6, 7	1, 2
4	Load Path	Enhance existing hose tower to resist seismic forces.	11, 12	–
5	Wood Posts	Provide positive connections of wood posts to foundation.	16	–
6	Life Safety Systems, Hazardous Materials, Ceilings, Light Fixtures, Cladding, Furnishings, Mechanical & Electrical, Ducts & Piping	Non-structural components are not properly braced or restrained to prevent lateral movement during a seismic event.	–	–



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By
Date
Job #
Sht. of

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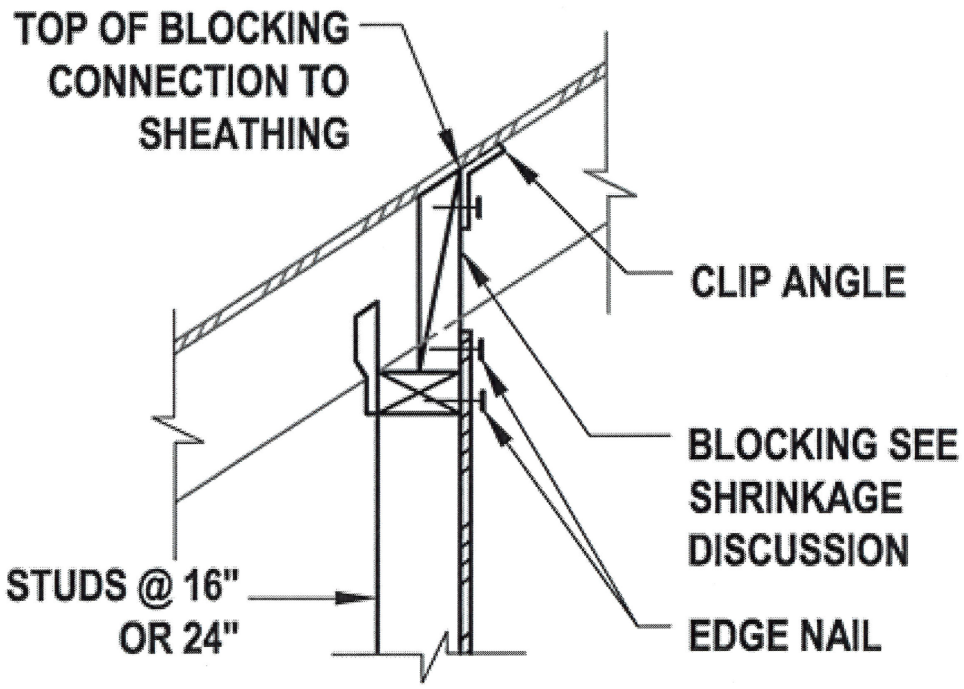
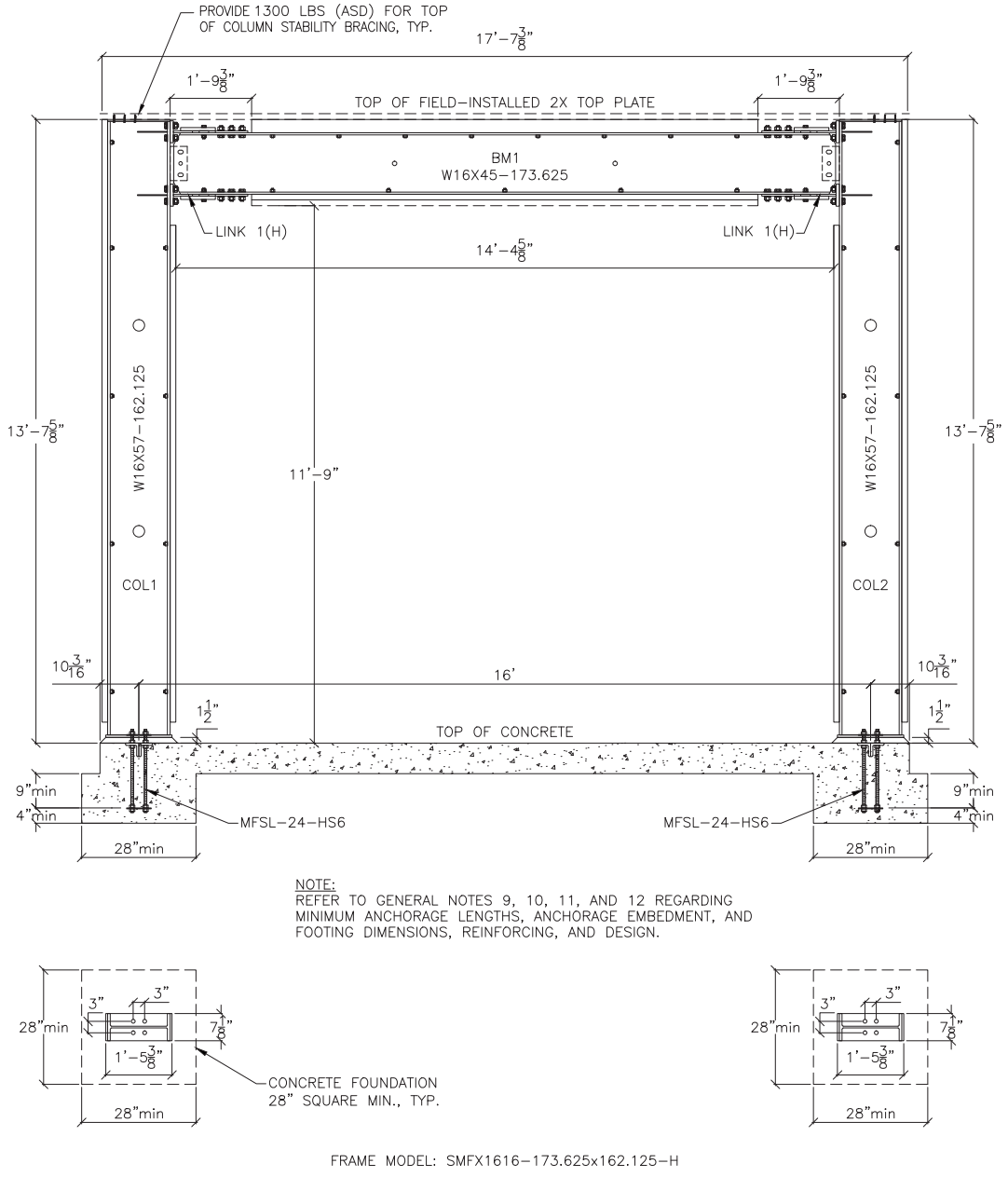


SK2 DIAPHRAGM TO SHEAR WALL CONNECTION



FRAME ELEVATION

SK3 SIMPSON MOMENT FRAME ELEVATION

D. COST ESTIMATE

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Construction FOCUS
Integrated Project Solutions

December 18, 2017
Revision #1

WEST SIDE FIRE DEPARTMENT
FIRE STATION #1 SEISMIC UPGRADES

STATEMENT OF PROBABLE COST

Prepared for:
Mackenzie
Portland, OR

Prepared by:
Steve Gunn

President
Construction Focus, Inc.

WEST SIDE FIRE DEPARTMENT
STATION #1 SEISMIC UPGRADES
SORTED BY TASK
Statement of Probable Cost

LOC	ITEM	DESCRIPTION	QNTY	UNIT	$/UNIT	TOTAL $
	SEISMIC UPGRADES					
		Building Gross Area	5,984	SF		
		Mezzanine Gross Area	343	SF		
		Ground Floor Gross Area	5,641	SF		
	Task #1 - Shear Walls					202,865
	Demo ceiling	x_gyp bd	55	SF	2.31	127
	Demo wall finish	x_gyp bd	646	SF	1.97	1,273
	Demo finish	x_siding/wrb	5,036	SF	4.41	22,209
	Demo sheathing	x_ply sheathing	714	SF	2.78	1,985
	Salvage casework	r/r_casework	26	LF	34.08	886
	Salvage equip.	r/r_elec pnls/meter/switch	1	EA	4,500.00	4,500
	Salvage equip.	r/r_wall ductwork/piping	1	LS	800.00	800
	Salvage equip.	r/r_wall-mount HVAC unit	1	EA	900.00	900
	Blocking	DF 2x4	320	LF	7.10	2,272
	Blocking	DF 2x6	357	LF	7.20	2,570
	Miscellaneous blocking and bracing		440	LF	7.20	3,168
	Nailing	renail existing ply sheathing	4,527	SF	1.18	5,342
	Wall sheathing	1/2" APA rated	714	SF	2.61	1,864
	Rainscreen	1x nailer system	5,036	SF	2.95	14,856
	Clip	A35 @ 24" OC	160	EA	5.27	843
	Holdown	simp HD5-SDS2.5 w/5/8" epox	21	EA	143.16	3,006
	Sill anchor	1/2" simp titen HD	127	EA	12.58	1,598
	Finish carpentry	casings & trims	162	LF	12.02	1,947
	Batt insulation	R-19	714	SF	1.25	893
	WRB	Blueskin	5,036	SF	2.36	11,885
	Sealant		1	LS	500.00	500
	Siding	Hardi-lap	5,036	SF	10.52	52,979
	Siding trim	fiber cement	5,036	SF	8.17	41,144
	Gypsum bd: wall	5/8"_type: X LVL 4	646	SF	4.80	3,101
	Patch/replace ceiling	5/8"_type: X LVL 4	55	SF	6.50	358
	Paint: ceiling	prime/2 top ct on gyp bd	55	SF	1.00	55
	Paint: wall	prime/2 top ct on gyp bd	646	SF	1.00	646
	Paint: cladding	2 top ct on hardi	5,036	SF	2.20	11,079
	Plumbing fixtures	remove/re-install	3	FIX	1,400.00	4,200
	HVAC ducting	relocate for access	90	LF	32.00	2,880
	Electrical fixtures & conduit	relocate for access	12	EA	250.00	3,000
	Task #2 - Moment Frames					152,920
	Demo ceiling	x_wd pnl	68	SF	3.23	220
	Demo column	x_wd col	4	EA	83.16	333
	Demo door	x_overhead door	3	EA	900.00	2,700
	Demo footing	x_pad ftg	4	EA	1,290.50	5,162
	Salvage door	r/r_modify accordian	46	LF	15.00	690
	Salvage sign	r/r_wall plaque at transom	3	EA	136.32	409

WEST SIDE FIRE DEPARTMENT
STATION #1 SEISMIC UPGRADES
SORTED BY TASK
Statement of Probable Cost

LOC	ITEM	DESCRIPTION	QNTY	UNIT	$/UNIT	TOTAL $
	Sawcut & demo slab	x_6"_conc for new ftg	245	SF	12.00	2,938
	Excavation	dig & haul	23	BCY	75.00	1,739
	Backfill	crushed rock	21	TN	70.00	1,468
	Grade beam	gb_2.5'w x 2'd	24	LF	65.00	1,560
	Pad ftg	pf_5'l x 5'w x 2'd	4	EA	1,200.00	4,800
	SOG patch	6"t conc w/ reinf&dowels	245	SF	16.00	3,917
	Simpson Strong Frame	supply & erect	2	EA	13,434.49	26,869
	Hanger	simp HWPH	4	EA	9.82	39
	Shoring	for glulam girder	33	LF	60.00	1,980
	Plates	DF 2x6 @ strong frames	86	LF	7.68	660
	Casing @ moment frames	DF 2x6	176	LF	7.68	1,352
	Overhead door	steel_hm frm_1/2 glz_12'x12'	3	EA	9,360.00	28,080
	Ceiling	wood paneling	68	SF	28.00	1,904
	Flooring	epoxy	4,367	SF	15.00	65,505
	Paint: ceiling	prime/2 top ct on wd pnl	68	SF	1.00	68
	Paint: wood casing	3 top ct on wd	176	LF	3.00	528
	Task #3 - Continuous Diaphragm					36,844
	Salvage insulation	r/r_attic batts	4,585	SF	0.75	3,439
	Clips	A35 @ 24" OC	188	EA	5.27	991
	Strap	MSTC28	28	LF	4.31	121
	Attic floor sheathing	1/2_APA rated	4,585	SF	6.58	30,169
	Shear wall framing	2x4 @ 16o.c.	125	SF	3.71	464
	Wall sheathing	1/2" APA rated	125	SF	2.61	326
	Blocking	DF 2x4	188	LF	7.10	1,335
	Task #4 - Hose Tower Bracing					1,970
	Strap	CMST 16	240	LF	4.66	1,118
	Blocking	DF 2x4	120	LF	7.10	852
	Task #5 - Wood Post to Slab Connection					723
	Angle	L6x4x3/8x6" w/ 1/2" titen hd	8	EA	90.39	723
	Task #6 - Non-Structural Seismic Bracing					32,952
	Anchorage	ceilings	5,984	SF	0.25	1,496
	Anchorage	equipment	8	EA	170.00	1,360
	Anchorage	gas cyclinders/shut-off valves	2	EA	190.00	380
	Storage	add shelf lips and cords	36	EA	49.08	1,767
	Glazing verification	glazing meets code	168	SF	90.00	15,120
	Plumbing piping	seismic bracing	90	LF	14.00	1,260
	Plumbing piping	flex coupling	11	EA	140.00	1,540
	Ductwork support	seismic bracing	5,984	SF	0.40	2,394
	Lighting	compliant lens covers	28	EA	180.00	5,040

3/3

WEST SIDE FIRE DEPARTMENT
STATION #1 SEISMIC UPGRADES
SORTED BY TASK
Statement of Probable Cost

LOC	ITEM	DESCRIPTION	QNTY	UNIT	$/UNIT	TOTAL $
	Generator bracing	seismic bracing	1	EA	800.00	800
	Emergency lighting	seismic bracing	5,984	SF	0.30	1,795
		HARDCOST TOTAL				428,274

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	
@ 3%:	12,848	Inflation (1.5 years)	@ 12%:	51,393
@ 15%:	66,168	Contingency	@ 30%:	143,900
	32,850	CMGC process		40,300
	48,613	Gen Conditions @ 9%:		59,748
	58,875	Profit & Overhead @ 10%:		72,361
	8,566	Performance Bond:		9,862
	227,920	**Markup Subtotals:**		377,565
	656,194	**BASE BID TOTAL**		**805,838**

Refer to the "Scope of Work" for more detailed information.

NOTES
Wage rates: BOLI
CMGC selection

EXCLUSIONS
Design fees, permit fees, system development fees, utility hookup charges, testing, BOLI fee.
Hazardous materials abatement, moving expenses, anti-graffiti coating, fireproofing.
Roofing and related sheet metal work. Low voltage electrical work.
Overexcavation, rock excavation, wet weather sitework.

ABBREVIATIONS

EA= Each	SF=Square Feet	BCY=Bank Cubic Yard
LF= Linear Feet	LS=Lump Sum	TN=Ton
SY=Square Yard	OPNG=Opening	LB=Pounds
PR=Pair	HT=Height	