Exhibit A

SEISMIC EVALUATION REPORT

Charleston Fire District

Seismic Assessment for
Fire Station 1
92342 Cape Arago Highway
Coos Bay, OR 97420

Prepared for:
Mick Sneddon
Fire Chief

January 23, 2026
22045.00

Prepared By:
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STRUCTURAL
REGISTERED PROFESSIONAL
ENGINEER
64298 PE
OREGON
May 9, 2006
BRIAN T. KNIGHT

EXPIRES: 6/30/2027

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	Yes	1985	URM	Yes	No
B	Office & Living Space	Yes	1985	W1a	Yes	No
***Entries required **ONLY** for building parts included in proposed seismic retrofit. If building part was previously or is currently being retrofitted, please list the building part's Risk Category and retrofit design Performance Objective, if known.						
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	$2,498,100					
Retrofit Square Feet	5,753 SF					
Retrofit Cost Per Square Feet	$434.23					**Yes, or No?**
Is the campus within a tsunami**, FEMA flood zone, landslide/slope instability, liquefaction potential or other high hazard area? **If so, provide documentation (e.g. the Oregon Statewide Hazards Viewer by DOGAMI).** ** Projects within the code defined Tsunami Design Zone require consultation with DOGAMI prior to application submittal. Applicant shall include such documentation with the application.						**Yes** See Section 6

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1. Project Background

The goal of this evaluation of the Charleston Fire District Fire Station 1 (Station 1) is to determine the expected performance during a design basis earthquake. The purpose of our seismic evaluation is to identify the structural and nonstructural deficiencies that exist at Station 1. The evaluation will then be used as the basis for developing a suitable strengthening scheme for the structural system. In addition, the evaluation will assist us in identifying the nonstructural components requiring seismic hardening (i.e., anchorage and/or bracing).

Our work is based on the following:

1. A review of available construction documents for the original building prepared by Harlan Miller Associates PC Architects, dated 1985.

2. A review of available construction documents for the building addition prepared by Edward W. Riley, dated 1997.

3. A site visit by Brian Knight, PE, SE, of IMEG Consultants Corp. on June 30, 2022, to verify the as-built conditions of the building's structural and nonstructural systems.

2. Candidate Qualifications

Oregon Administrative Rule (OAR) 123-051-0300 provides the requirements for applicants to be eligible for a Seismic Rehabilitation Grant. Per these requirements, the building must be a fire station, police station, sheriff's office, or other facility used by state, county, district, or municipal law enforcement agencies. Station 1 is owned and operated by the Charleston Fire District and meets the requirements of OAR 123-051-0300 and is therefore an eligible candidate for the Seismic Rehabilitation Grant Program.

We believe Station 1 is a good candidate for seismic strengthening based on the criteria highlighted in **Table 1**.

TABLE 1 – Candidate Summary	
Criteria	**Response**
Is the building in good condition?	Yes
Is the building a functional part of the community?	Yes
Is the building part of the community's emergency response (RC IV)?	Yes
Is the cost of a rehabilitation low relative to a new building cost?	Yes
Is the seismic rehabilitation cost less than the allowable grant maximum?	Yes
Is the building in an area of high seismicity?	Yes
Does the building have non-ductile structural systems?	Yes
Does the building have vertical or horizontal irregularities?	Yes

3. Evaluation Criteria and Methodology

For our evaluation of the Station 1, we used ASCE Standard 41-17, "Seismic Evaluation and Retrofit of Existing Buildings" published by the American Society of Civil Engineers (ASCE). ASCE 41 is the nationally recognized Standard for seismic assessment and evaluation of existing buildings. The goal of ASCE 41 is to identify the "weak links" in a building's lateral force resisting system that can lead to significant failure and/or collapse. In addition, ASCE 41 will identify typical nonstructural hazards that may pose a life-safety risk to occupants or a business interruption (i.e., operations) risk to the building.

The methodology utilizes a series of checklists that address possible seismic hazards. Checklists are included in the Standard for all the major structural systems, nonstructural elements, and geologic and site hazards. The evaluating engineer addresses each statement and determines whether it is compliant or noncompliant. Compliant statements identify conditions that are acceptable. Noncompliant statements identify conditions that need further investigation. In some cases, the Standard specifies additional calculations that may be performed to address a noncompliant statement. In other cases, a detailed analysis of the building must be performed.

ASCE 41-17 provides Performance Objectives based on a building's Risk Category which are to be used for the evaluation and retrofit of existing buildings. For our evaluation, we have used the Basic Performance Objective for Existing Buildings (BPOE) for Risk Category IV structures. For this performance objective, the building is evaluated to the Life Safety (LS) structural performance level and Hazards Reduced (HR) nonstructural performance level for the BSE-2E seismic hazard and to the Immediate Occupancy (IO) structural performance level and Position Retention (PR) nonstructural performance level for the BSE-1E seismic hazard.

The intent of the IO Structural Performance Level for BSE-1E is:

> *After a design earthquake, the basic vertical and lateral force resisting systems retain nearly all of their pre-earthquake strength, and very limited damage to both structural and nonstructural components is anticipated during the design earthquake which require some minor repairs, but the critical parts of the building are habitable.*

The intent of the LS Structural Performance Level for BSE-2E is:

> *After the earthquake, the structure has damaged components but there is some margin against either partial or total structural collapse that remains. The damaged structure is not an imminent collapse risk although some structural elements are severely damaged. The building will retain at least some of its strength against collapse and should prevent loss of human life. However, there may be injuries and the building could potentially be damaged beyond the point of economical repair.*

The intent of the PR Nonstructural Performance Level for BSE-1E is:

> *After a design earthquake, the nonstructural components might be damaged to the extent that they cannot immediately function but are secured in place so that damages caused by falling, toppling, or breaking of utility connection is avoided. Building access and Life Safety Systems, including doors, stairways, elevators, emergency lighting, fire alarms, and fire suppression systems, generally remain available and operable, provided that power and utility services are available.*

The intent of the HR Nonstructural Performance Level for BSE-2E is:

> *After a design earthquake, the nonstructural components are damaged and could potentially create falling hazards, but high hazard nonstructural components as defined in Chapter 13 of ASCE 7-16, are secured to prevent falling into areas of public assembly or those falling hazards from those components could pose a risk to life safety for many people. Preservation of Egress, protection of fire suppression systems, and similar life safety issues are not addressed.*

In other words, the IO Structural Performance Level and PR Nonstructural Performance Level are meant to ensure that a building will continue to remain in operation immediately following a major earthquake. The LS Structural Peformance Level and HR Nonstructural Peformance Level permit structural damage but ensure the structural integrity of a building after a major earthquake and that occupants are able to evacuate safely. **Figure 1** graphically shows the performance level differences.

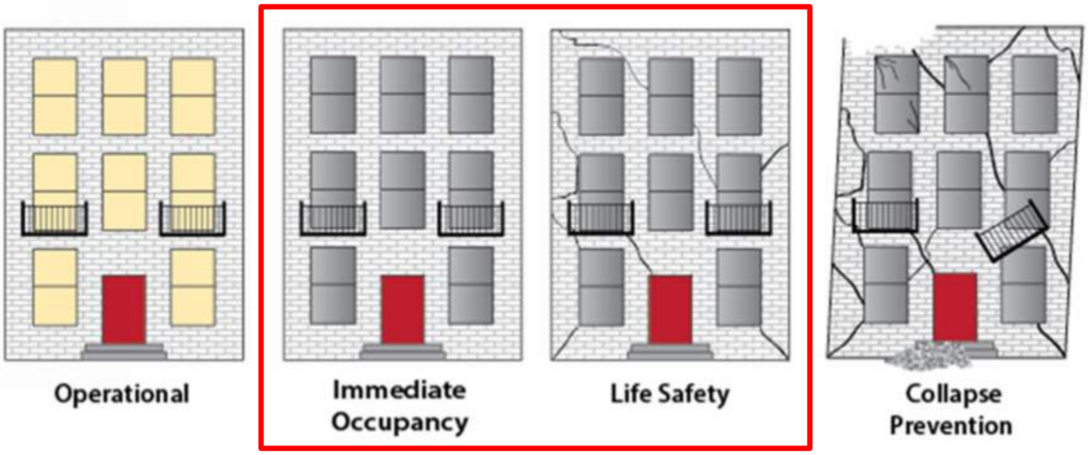


Figure 1: Structural Performance Level

4. Building Description

Station 1 is a 5,753-square-foot, single-story, light wood frame and unreinforced masonry (URM) wall building originally constructed in 1985. An addition and a roof over-framing were performed in 1997 and 2009 respectfully. The building is T-shaped in plan, approximately 80 feet by 110 feet, with a maximum roof height of approximately 20 feet. The building consists of an apparatus bay, mezzanine, office and living space. See **Figure 2** for a Building Part Map and **Appendix A** for photos of the building.

For Building Part A, the roof system consists of asphalt shingles over plywood sheathing supported by 2x wood trusses. The roof trusses are supported on each end by light framed wood bearing walls. The wood bearing walls are supported by URM walls on a shallow concrete foundation. Due to the method of construction in the apparatus bay there is a potentially unstable "hinge point" where the wood stud walls sit on top of the 8 foot tall URM walls below. The apparatus bay mezzanine floor consists of plywood supported by wood joist framing spanning between URM bearing walls and wood stud bearing walls. The foundation system consists of shallow concrete wall footings beneath bearing walls.

The lateral system for Building Part A consists of under-reinforced concrete masonry unit (CMU) shear walls and plywood shear walls. In accordance with ASCE 41-17, Section A.3.2.4.2, CMU walls lacking minimum reinforcing shall be considered as URM, which is the case for this building. The roof diaphragm is considered flexible relative to the walls that support it. The lateral loads from the roof diaphragm are transferred to the plywood and URM shear walls below. The gravity and lateral loads are then transferred to the soil via shallow concrete footings.

For Building Part B, the roof system consists of asphalt shingles over plywood sheathing supported by 2x wood trusses. The roof trusses are supported by light framed wood bearing walls. The wood bearing walls are supported by a shallow concrete foundation. The mezzanine floor consists of plywood sheathing over wood joist spanning between wood stud bearing walls. The foundation system consists of shallow concrete wall footings beneath bearing walls.

The lateral system of Building Part B consists of plywood shear walls. The roof diaphragm is considered flexible relative to the walls that support it. The lateral loads from the roof diaphragm are transferred to the plywood shear walls below. The gravity and lateral loads are then transferred to the soil via shallow concrete footings.

After reviewing the drawings and as-built condition, the lateral force resisting system and the ASCE 41 building types are classified as **URM: Unreinforced Masonry Bearing Walls with Flexible Diaphragms** for Building Part A and **W1a: Light Wood Frame Residential and Commercial Buildings Larger than 3,000 Square Feet** for Building Part B.

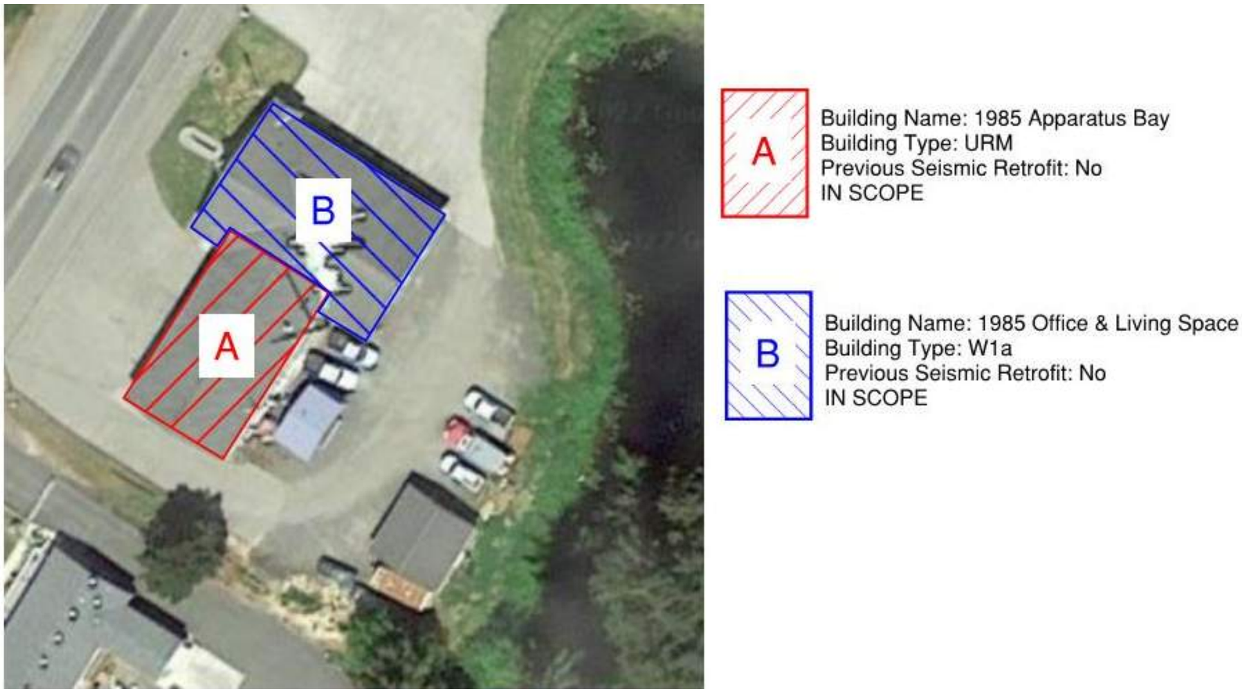


Figure 2: Building Part Map

5. Existing Material Test Results

An onsite investigation was performed solely to verify the as-built conditions. No materials testing was performed as part of our evaluation.

6. Site Description and Seismicity

The level of seismicity of the site is based on the BSE-2N event based in section 2.5 of ASCE 41-17. Using maps developed by the United States Geologic Survey (USGS), the short period spectral acceleration, S_S, is 1.758g and the long period spectral acceleration, S_1, is 0.863g. The building is assumbed to be founded on "stiff" soil of varying depths. As a result, the site soil classification is Class "D". Amplification factors used to account for the soil conditions at the site are F_V = 1.7 and F_A = 1.2. Based on ASCE 41-17 Table 2-4, the building is located at a high seismicity area.

TABLE 2 - Site Specific Seismicity (BSE-2N)	
Soil Density	Stiff
ASCE 7-16 Soil Classification	D
Short Period Spectral Acceleration (S_S)	1.758
Long Period Spectral Acceleration (S_1)	0.863
Soil Condition Amplification Factors (F_V / F_A)	1.7 / 1.2
FEMA 154 RVS Seismicity Zone	Very High
ASCE 41-17 Level of Seismicity	High

The ground motions used for the ASCE 41 evaluation are based on the BSE-2E event. Using maps developed by USGS, the long period spectral response acceleration parameter, S_{X1}, is 1.01g and the short period spectral acceleration parameter, S_{XS}, is 1.473g.

Using the ASCE 41-17 checklists, the geologic hazards that were assessed as part of this engineering evaluation include liquefaction, slope failure, and surface fault rupture potential. Using the DOGAMI Oregon HazVu website, these potential hazards were evaluated. The plot from Statewide Geohazards Viewer can be seen in **Appendix F**.

The project is located within a liquefaction hazard area as identified by the DOGAMI Oregon HazVu. Due to the severity of the hazard and the recommendation of our geotechnical consultant (see **Appendix F**), we have included mitigation for this hazard within the scope of the retrofit.

The building is located within a landslide hazard area as identified by the DOGAMI Oregon HazVu. To ensure that an acceptable level of due diligence was performed during the application phase of the project, a geotechnical engineer was consulted and made recommendations based on available information with respect to severity. Per the geotechnical letter, attached in **Appendix F**, landsliding is not a design consideration and mitigation is not required.

The DOGAMI Oregon HazVu identifies Station 1 is within a Tsunami Inundation Zone. Representatives from IMEG and the Charleston Fire District met with DOGAMI to evaluate the tsunami inundation risk and to discuss mitigation approaches. A letter from DOGAMI describing that consultation is included in **Appendix F**.

7. Building Deficiencies & Recommended Strengthening Measures

Using the procedures of ASCE 41, we have identified several deficiencies in the lateral force resisting system. The ASCE 41 Tier 1 checklists used to identify the structural and nonstructural deficiencies are attached as **Appendix E**. Based on the identified deficiencies and building condition, we have developed a conceptual strengthening scheme (see **Appendix B**) for the Station 1. Please note, since the ASCE 41 building type of Station 1 is identified as URM, if the seismic grant is awarded, the final strengthening requirements will be based on Tier 3 procedures specified in ASCE 41.

The strengthening measures are recommendations intended to provide a general discussion of the potential strengthening/hardening measures likely needed for this building. However, they are conceptual and do not constitute a final engineered solution.

7.1 Structural Deficiencies & Strengthening Measures

Numerous structural deficiencies have been identified at Station 1. All structural deficiencies and the strengthening measures are summarized in **Table 3**.

TABLE 3 – STRUCTURAL **Deficiencies & Strengthening Measures** Immediate Occupancy Performance Level			
Item Number	**Component Type**	**Deficiency**	**Strengthening Measure**
S1	Load Path	The structure does not contain a complete, well-defined load path with structural elements and connections that serve to transfer inertial forces associated with mass of elements to the building foundation.	Provide complete load path for transfer of inertial forces to building foundation.
S2	Vertical Irregularities	Vertical elements in the seismic-force-resisting system are not all continuous to the foundation.	Brace "hinge point" with HSS strongbacks from foundation to roof.
S3	Liquefaction	DOGAMI Oregon HazVu has identified the site as susceptible to liquefaction.	Install micropiles at footings and grade beams to limit differential settlement.
S4	Narrow Wood Shear Walls	Narrow wood shear walls with an aspect ratio less than 2-to-1 are not used to resist seismic forces.	Strengthen wood shear walls with blocking and hold-downs at wood shear walls with an aspect ratio greater than 2 to 1.
S5	Wall Connected Through Floors	Shear walls don't have an interconnection between stories to transfer overturning and shear forces through the floors.	Interconnect all shear walls between mezzanine and main level.

TABLE 3 – STRUCTURAL Deficiencies & Strengthening Measures continued			
Item Number	**Component Type**	**Deficiency**	**Strengthening Measure**
S6	Openings	Walls with openings greater than 80% of the length are not braced with wood structural panel shear walls with aspect ratios of not more than 1.5-to-1 and are not supported by adjacent construction through positive ties capable of transferring the seismic forces.	Add new vertical lateral element or connect to adjacent construction through positive ties capable of transferring the seismic forces.
S7	Hold-down Anchors	All shear walls do not have hold-down anchors attached to the end studs constructed in accordance with acceptable construction practices.	Install hold-down anchors at shear walls where needed to resist uplift for overturning seismic loads.
S8	Narrow Wood Shear Walls	Narrow wood shear walls with an aspect ratio less than 1.5-to-1 are not used to resist seismic forces.	Add new vertical lateral element or connect to adjacent construction through positive ties capable of transferring the seismic forces.
S9	Roof Chord Continuity	All chord elements are not continuous, regardless of changes in roof elevation.	Add diaphragm chords.
S10	Plan Irregularities	There is not adequate tensile capacity to develop the strength of the diaphragm at reentrant corners or other locations of plan irregularities.	Add diaphragm reinforcing at reentrant corners or other plan irregularities.
S11	Diagonally Sheathed and Unblocked Diaphragms	All diagonally sheathed or unblocked wood structural panel diaphragms have horizontal spans greater than 30 ft. and aspect ratios greater than 3-to-1.	Reinforce plywood diaphragm with adequate nailing and blocking.
S12	Shear Stress Check	The shear stress in the unreinforced masonry shear walls is more than 30 lb/in.^{2} for clay units and 70 lb/in.^{2} for concrete units.	Strengthen wall or add new lateral force resisting elements.

TABLE 3 – STRUCTURAL Deficiencies & Strengthening Measures continued			
Item Number	**Component Type**	**Deficiency**	**Strengthening Measure**
S13	Wall Anchorage	Exterior concrete or masonry walls that are dependent on the diaphragm for lateral support are not anchored for out-of-plane forces at each diaphragm level with steel anchors, reinforcing dowels, or straps that are developed into the diaphragm.	Add wall anchorage connections.
S14	Transfer to Shear Walls	Diaphragms are not connected for transfer of seismic forces to the shear walls, and the connections are not able to develop the lesser of the shear strength of walls or diaphragms.	Add in-plane connection between shear walls and diaphragm.
S15	Cross Ties	There are no continuous cross ties between diaphragm chords	Add tension ties and supplemental framing for continuous cross ties
S16	Stiffness of Wall Anchors	Anchors of concrete or masonry walls to wood structural elements are not installed taut and stiff enough to limit the relative movement between the wall and the diaphragm before engagement of the anchors.	Install anchors to improve connection stiffness to limit relative movement between the wall and the diaphragms.
S17	Torsion	The estimated distance between the story center of mass and the story center of rigidity is greater than 20% of the building width in either plan dimension.	Install new steel moment frame to address torsional effects.

7.2 Nonstructural Deficiencies & Strengthening Measures

Numerous nonstructural deficiencies have been identified at Station 1. All nonstructural deficiencies and the strengthening measures are summarized in **Table 4**.

TABLE 4 – NONSTRUCTURAL Deficiencies & Strengthening Measures Position Retention Performance Level			
Item Number	**Component Type**	**Deficiency**	**Strengthening Measure**
N1	Hazardous Material Storage	Breakable containers that hold hazardous materials, including gas cylinders, are not restrained by latched doors, shelf lips, wires, or other methods.	Restrain breakable containers that contain hazardous materials in hazardous material storage cabinets will be anchored/braced to the structure.
N2	Shutoff Valves	Piping containing hazardous material, including natural gas, does not have shutoff valves or other devices to limit spills or leaks.	Add shutoff valves or other devices to limit spills or leaks.
N3	Flexible Couplings	Hazardous material piping, including natural gas piping, does not have flexible couplings.	Add flexible couplings to hazardous material piping and fluid and gas piping.
N4	Industrial Storage Racks	Industrial storage racks or pallet racks more than 12 ft. high don't meet the requirements.	Brace and/or anchor all racks more than 6 ft. high to the structure or to each other.
N5	Tall Narrow Contents	Contents more than 6 ft. high with a height-to-depth ratio greater than 3-to-1 are not anchored to the structure or to each other.	Brace and/or anchor all contents more than 6 ft. high to the structure or to each other.
N6	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 not anchored to the floor slab or adjacent structural walls.	Cabinets and Lockers more than 6 ft. high or with a height-to-depth ratio exceeding 3:1 are to be anchored to ground.

8. Construction Cost Estimate

An engineer's opinion of probable cost has been prepared based on the developed seismic strengthening scheme (**Appendix B**) and is attached as **Appendix C**. The cost estimate addresses all seismic strengthening required. The cost estimate includes construction costs, contingencies and necessary soft costs required to complete the scope of work. A summary of the cost estimate is provided in **Table 5**.

TABLE 5 – Cost Estimate Summary	
Construction Category	**Cost Estimate**
Engineering	$319,757
Construction Management	$69,947
Construction	$1,715,362
Relocation	$59,954
Contingency	$333,080
Total	**$2,498,100**
Total Area	5,753 Square Feet
$/Square Feet	$434.23

The cost estimate included in this report has been reviewed by the engineer responsible for the evaluation and seismic strengthening schemes of Station 1.

9. Benefit Cost Analysis

The benefit cost analysis (BCA) is performed using the BCA spreadsheet provided by the Oregon Business Development Department-Infrastructure Finance Authority (OBDD-IFA) as required by the SRGP (Seismic Rehabilitation Grant Program). The BCA tool considers the net present value of costs associated with damage to the building and its contents, displacements costs, loss of functionality costs, and casualties. The building contents value is based on insured value replacement cost provided by the District. Default building data and fragility curve information are provided in the BCA tool.

The BCA score for Station 1 is **2.443**, which suggests this project is a strong candidate for seismic strengthening and should be considered for grant funding.

10. Rapid Visual Screening

The Department of Geology and Mineral Industries (DOGAMI) completed many Rapid Visual Screening (RVS) assessments for public facilities throughout Oregon. However, for the purpose of this report, new RVS reports were created to align with this seismic evaluation. Attached in **Appendix F** are the RVS reports created using the FEMA P-154 Data Collection Form for Station 1.

11. Limitations

The opinions and recommendations presented in this report were developed with the care commonly used as the state of practice of the profession. No other warranties are included, either expressed or implied, as to the professional advice included in this report.

This report has been prepared for Charleston Fire District and is used solely in its evaluation of the seismic safety of the building included herein. This report has not been prepared for use by other parties and may not contain sufficient information for the purposes of other parties or uses. If you have any comments or questions regarding this evaluation, please contact us.

12. Certification Statement

IMEG Consultants Corp. has reviewed Charleston Fire Station 1, noted the deficiencies in the Tier 1 checklists, developed seismic retrofit solutions to rectify the deficiencies, and a cost estimate for the project. The design engineer certifies the retrofit scope of work includes strengthening measures of all the structural and nonstructural deficiencies identified in the report and all items required to perform the work. The design engineer certifies the cost estimate includes all the retrofit's scope of work elements.

Brian Knight, PE, SE

Appendix A

BUILDING PHOTOS

Image 1: Northwest Elevation

Image 2: Southeast Elevation

Image 3: West Elevation

Image 4: South Elevation with URM Walls Below Wood Bearing Walls

Image 5: Northeast Elevation

Image 6: Training Room


Image 7: Unbraced Shelving


Image 8: Roof Truss Overbuild Framing

Image 9: Unanchored Equipment

Image 10: Unbraced Suspended Equipment & URM Wall Below Wood Stud Wall "Hinge" Point

Appendix B

CONCEPTUAL SEISMIC STRENGTHENING SCHEME

CHARLESTON FIRE STATION #1 SEISMIC REHABILITATION GRANT STRENGTHENING CONCEPTS

SHEET INDEX	
SHEET ID	SHEET TITLE
G1	COVER SHEET
S1	FOUNDATION STRENGTHENING PLAN
S2	SECOND FLOOR / ORIGINAL ROOF STRENGTHENING PLAN
S3	ROOF STRENGTHENING PLAN

PROJECT NARRATIVE

THE INTENT OF THESE DRAWINGS IS TO ILLUSTRATE THE SCHEMATIC SEISMIC REHABILITATION TASKS TO RECTIFY THE LISTED SEISMIC AND NONSTRUCTURAL DEFICIENCIES. THESE SCHEMATIC DRAWINGS HAVE BEEN PREPARED USING THE CURRENT OREGON STRUCTURAL SPECIALTY CODE (OSSC) AND ASCE 41 (SEISMIC REHABILITATION OF EXISTING BUILDINGS) STANDARD.

THE TARGET FOR REHABILITATION IS TO IMMEDIATE OCCUPANCY (IO) STRUCTURAL PERFORMANCE LEVEL AND A POSITION RETENTION NONSTRUCTURAL PERFORMANCE LEVEL AT THE BSE-1E SEISMIC EVENT AND THE LIFE SAFETY (LS) STRUCTURAL PERFORMANCE LEVEL AND HAZARDS REDUCED NONSTRUCTURAL PERFORMANCE LEVEL AT THE BSE-2E SEISMIC EVENT.

THE (IO) STRUCTURAL PERFORMANCE LEVEL MEANS THAT AFTER A DESIGN EARTHQUAKE, THE BASIC VERTICAL AND LATERAL FORCE RESISTING SYSTEMS RETAIN NEARLY ALL OF THEIR PRE-EARTHQUAKE STRENGTH AND STIFFNESS. VERY LIMITED DAMAGE TO BOTH THE STRUCTURAL AND NONSTRUCTURAL COMPONENTS IS ANTICIPATED DURING THE DESIGN EARTHQUAKE WHICH REQUIRE SOME MINOR REPAIRS, BUT MAY NOT BE REQUIRED PRIOR TO REOCCUPANCY. THE RISK OF LIFE THREATENING INJURY AS A RESULT OF STRUCTURAL DAMAGE IS VERY LOW.

PROJECT INCLUDES SEISMIC REHABILITATION FOR THE ENTIRE FIRE STATION BUILDING.

STRUCTURAL DEFICIENCIES

S1. THE STRUCTURE DOES NOT CONTAIN A COMPLETE, WELL-DEFINED LOAD PATH WITH STRUCTURAL ELEMENTS AND CONNECTIONS THAT SERVE TO TRANSFER INERTIAL FORCES ASSOCIATED WITH MASS OF ELEMENTS TO THE BUILDING FOUNDATION.
S2. VERTICAL ELEMENTS IN THE SEISMIC-FORCE-RESISTING SYSTEM ARE NOT ALL CONTINUOUS TO THE FOUNDATION.
S3. DOGAMI OREGON HAZVU HAS IDENTIFIED THE SITE AS SUSCEPTIBLE TO LIQUEFACTION.
S4. NARROW WOOD SHEAR WALLS WITH AN ASPECT RATIO LESS THAN 2-TO-1 ARE USED TO RESIST SEISMIC FORCES.
S5. SHEAR WALLS DON'T HAVE AN INTERCONNECTION BETWEEN STORIES TO TRANSFER OVERTURNING AND SHEAR FORCES THROUGH THE FLOORS.
S6. WALLS WITH OPENINGS GREATER THAN 80% OF THE LENGTH ARE NOT BRACED WITH WOOD STRUCTURAL PANEL SHEAR WALLS WITH ASPECT RATIOS OF NOT MORE THAN 1.5-TO-1 AND ARE NOT SUPPORTED BY ADJACENT CONSTRUCTION THROUGH POSITIVE TIES CAPABLE OF TRANSFERRING THE SEISMIC FORCES.
S7. ALL SHEAR WALLS DO NOT HAVE HOLD-DOWN ANCHORS ATTACHED TO THE END STUDS CONSTRUCTED IN ACCORDANCE WITH ACCEPTABLE CONSTRUCTION PRACTICES.
S8. NARROW WOOD SHEAR WALLS WITH AN ASPECT RATIO LESS THAN 1.5-TO-1 ARE USED TO RESIST SEISMIC FORCES.
S9. ALL CHORD ELEMENTS ARE NOT CONTINUOUS, REGARDLESS OF CHANGES IN ROOF ELEVATION.
S10. THERE IS NOT ADEQUATE TENSILE CAPACITY TO DEVELOP THE STRENGTH OF THE DIAPHRAGM AT REENTRANT CORNERS OR OTHER LOCATIONS OF PLAN IRREGULARITIES.
S11. ALL DIAGONALLY SHEATHED OR UNBLOCKED WOOD STRUCTURAL PANEL DIAPHRAGMS HAVE HORIZONTAL SPANS GREATER THAN 30 FT. AND ASPECT RATIOS GREATER THAN 3-TO-1.
S12. THE SHEAR STRESS IN THE UNREINFORCED MASONRY SHEAR WALLS IS MORE THAN 70 LB/IN^2.
S13. EXTERIOR CONCRETE OR MASONRY WALLS THAT ARE DEPENDENT ON THE DIAPHRAGM FOR LATERAL SUPPORT ARE NOT ANCHORED FOR OUT-OF-PLANE FORCES AT EACH DIAPHRAGM LEVEL WITH STEEL ANCHORS, REINFORCING DOWELS, OR STRAPS THAT ARE DEVELOPED INTO THE DIAPHRAGM.
S14. DIAPHRAGMS ARE NOT CONNECTED FOR TRANSFER OF SEISMIC FORCES TO THE SHEAR WALLS, AND THE CONNECTIONS ARE NOT ABLE TO DEVELOP THE LESSER OF THE SHEAR STRENGTH OF THE WALLS OR DIAPHRAGMS.

STRUCTURAL DEFICIENCIES

S15. THERE ARE NO CONTINUOUS CROSS TIES BETWEEN DIAPHRAGM CHORDS.
S16. ANCHORS OF CONCRETE OR MASONRY WALLS TO WOOD STRUCTURAL ELEMENTS ARE NOT INSTALLED TAUT AND STIFF ENOUGH TO LIMIT THE RELATIVE MOVEMENT BETWEEN THE WALL AND THE DIAPHRAGM TO NO GREATER THAN 1/8 INCH BEFORE ENGAGEMENT OF THE ANCHORS
S17. THE ESTIMATED DISTANCE BETWEEN THE STORY CENTER OF MASS AND THE STORY CENTER OF RIGIDITY IS GREATER THAN 20% OF THE BUILDING WIDTH IN EITHER PLAN DIMENSION.

NONSTRUCTURAL DEFICIENCIES

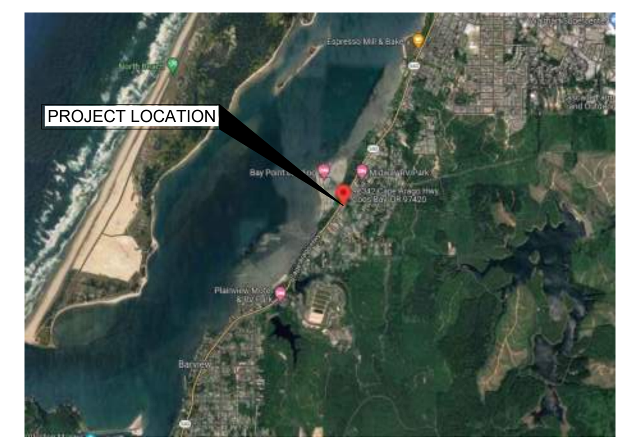
N1. BREAKABLE CONTAINERS THAT HOLD HAZARDOUS MATERIALS, INCLUDING GAS CYLINDERS, ARE NOT RESTRAINED BY LATCHED DOORS, SHELF LIPS, WIRES, OR OTHER METHODS.
N2. PIPING CONTAINING HAZARDOUS MATERIAL, INCLUDING NATURAL GAS, DOES NOT HAVE SHUTOFF VALVES OR OTHER DEVICES TO LIMIT SPILLS OR LEAKS.
N3. HAZARDOUS MATERIAL PIPING, INCLUDING NATURAL GAS PIPING, DOES NOT HAVE FLEXIBLE COUPLINGS.
N4. INDUSTRIAL STORAGE RACKS OR PALLET RACKS MORE THAN 12 FEET HIGH DON'T MEET THE REQUIREMENTS.
N5. CONTENTS MORE THAN 6 FEET HIGH WITH A HEIGHT-TO-DEPTH RATIO GREATER THAN 3-TO-1 ARE NOT ANCHORED TO THE STRUCTURE OR TO EACH OTHER.
N6. EQUIPMENT MORE THAN 6 FEET HIGH WITH A HEIGHT-TO-DEPTH OR HEIGHT-TO-WEIGHT RATIO GREATER THAN 3-TO-1 IS NOT ANCHORED TO THE FLOOR SLAB OR ADJACENT STRUCTURAL WALLS.

ALL NONSTRUCTURAL DEFICIENCIES WILL BE MITIGATED AS SHOWN IN TABLE 4 IN THIS REPORT UNLESS SPECIFICALLY NOTED OTHERWISE ON THE CONCEPTUAL STRENGTHENING SCHEME DRAWINGS.

NOTE:
HATCH INDICATES PROJECT SCOPE.

1 SITE MAP/BUILDING PARTS IDENTIFICATION

NORTH



2 VICINITY MAP

NORTH

3 STATE MAP

NORTH

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CHARLESTON FIRE STATION #1
SEISMIC REHABILITATION GRANT STRENGTHENING CONCEPTS
92342 CAPE ARAGO HWY
COOS BAY, OR 97420

DATE: 12/15/2024
JOB NUMBER: 22045.00
PAGE REFERENCE:

SHEET NO.
G1

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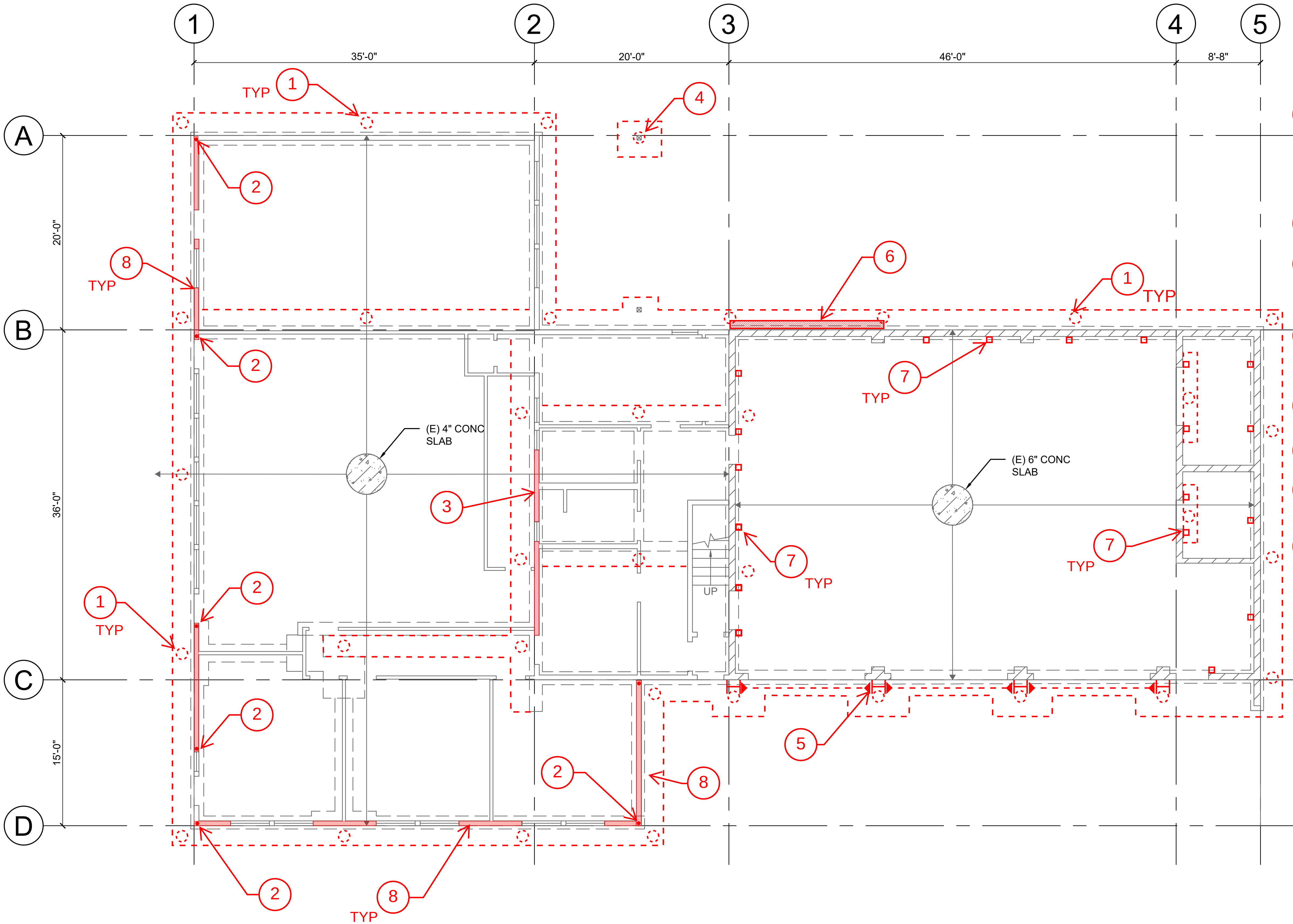

1 FOUNDATION STRENGTHENING PLAN
SCALE: 3/32"=1'-0"

KEYED NOTES:

1. DEMO (E) SLAB (AS APPLICABLE) AND EXCAVATE AS REQUIRED TO ADD 2'-6" WIDE x 3'-0" THICK GRADE BEAM W/ MICROPILES AT 20'-0" MAX SPACING OR WHERE SHOWN. REPAIR SLAB AFTER STRENGTHENING WORK IS COMPLETE. (S3)
2. ADD HOLDOWNS AT EACH END OF SHEAR WALL (S4, S7, S8)
3. DEMO (E) INTERIOR FINISHES AND RE-NAIL (E) SHEATHING W/ 10d NAILS AT 4" OC AT PANEL EDGES AND 12" OC IN FIELD, BLOCK PANEL EDGES (S4, S8)
4. SHORE (E) WOOD POST, DEMO (E) FOOTING AND EXCAVATE AS REQUIRED TO ADD MICROPILE AND NEW ISOLATED 3'-0" x 3'-0" CONCRETE FOOTING. (S3)
5. PROVIDE STEEL MOMENT FRAME AND GRADE BEAM AT FRONT OF APPARATUS BAY (S12, S17)
6. ADD NEW CONCRETE SHEAR WALL (S12)
7. ADD HSS STRONGBACKS FOR OUT-OF-PLANE WALL BRACING AT 8'-0" OC OR WHERE SHOWN. (S1, S13)
8. DEMO EXISTING SIDING AND SUPPLEMENT NAILING IN EXISTING PLYWOOD SHEATHING TO ATTAIN 10d NAILING AT 4" OC AT PANEL EDGES AND 12" OC IN FIELD. PROVIDE SIMPSON STRAPS OVER EXISTING WINDOWS AS REQ'D TO STRENGTHEN PERFORATED SHEAR WALL. (S4, S6, S8)

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CHARLESTON FIRE STATION #1
SEISMIC REHABILITATION GRANT STRENGTHENING CONCEPTS
92342 CAPE ARAGO HWY
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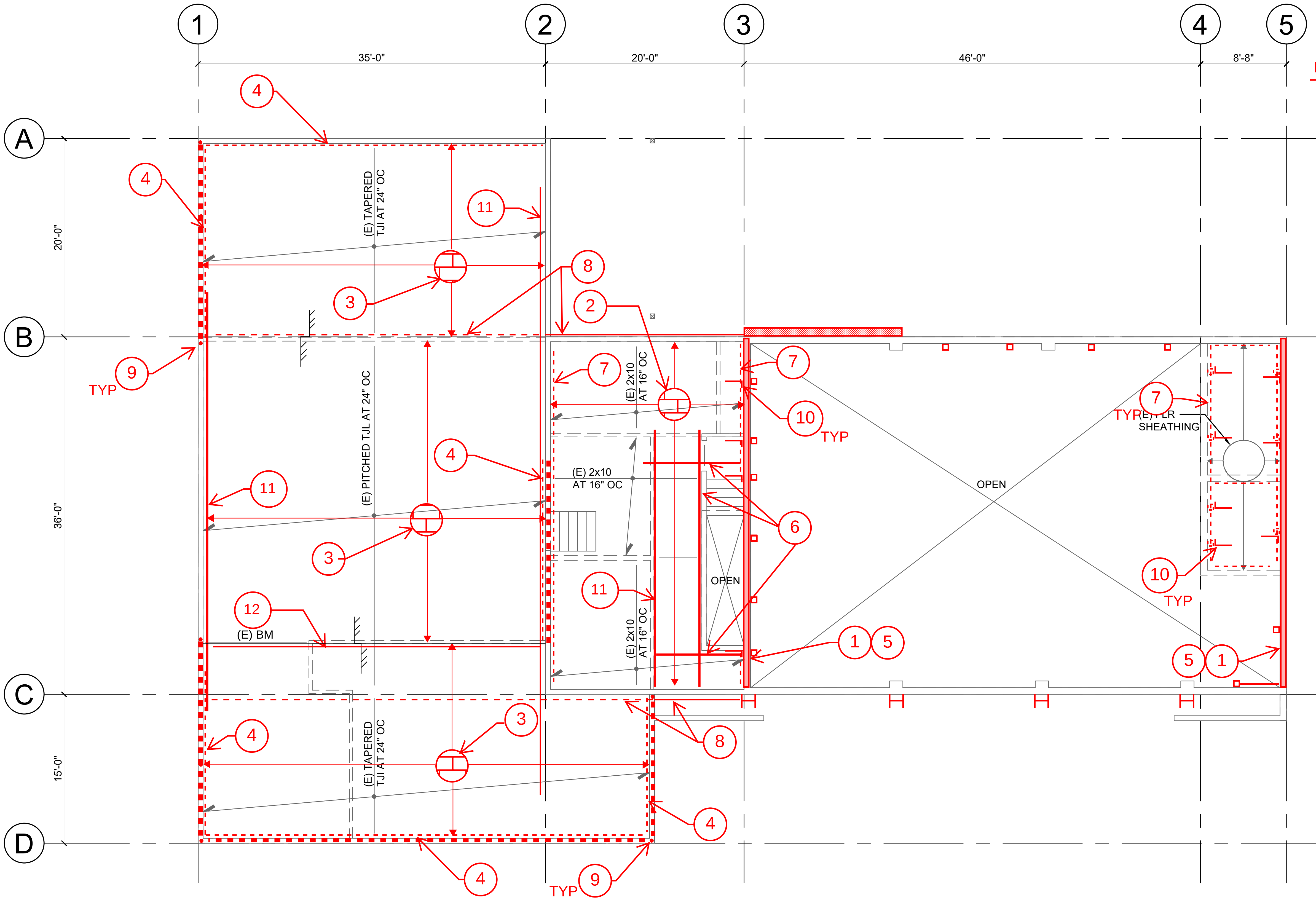
SHEET NO.
S1



1 ATTIC AND 2ND FLOOR STRENGTHENING PLAN

SCALE: 3/32"=1'-0"

NORTH

KEYED NOTES:

1. DEMO INTERIOR FINISHES, ADD 15/32" PLYWOOD SHEATHING TO (E) GABLE WALL ABOVE CMU. NAIL PLYWOOD W/ 10d NAILS AT 4" OC AT PANEL EDGES AND 12" OC IN FIELD (S1, S2)
2. SUPPLEMENT NAILING IN EXISTING PLYWOOD SHEATHING TO ATTAIN 10d NAIL AT 6" OC AT PANEL EDGES AND 12" OC IN FIELD (S11)
3. NAIL (E) 5/8" SHEATHING W/ 10d NAILS AT 6" OC AT PANEL EDGES AND 12" OC IN FIELD AND BLOCK PANEL EDGES. (S11)
4. ADD IN-PLANE CONNECTION BETWEEN ATTIC DIAPHRAGM AND WOOD SHEARWALL BELOW AND PROVIDE IN-PLANE CONNECTION FROM OVER-FRAMED WALL ABOVE TO WOOD SHEAR WALL BELOW (S1, S14)
5. PROVIDE ADDITIONAL SILL BOLTS WHERE WOOD SHEARWALL TRANSFERS LOAD TO CMU WALL BELOW. (S1, S16)
6. ADD STRAP AND BLKG FOR REINFORCEMENT AT DIAPHRAGM OPENING OR RE-ENTRANT CORNER (S1, S10)
7. ADD IN-PLANE CONNECTION BETWEEN FLOOR/MEZZANINE DIAPHRAGM AND SHEAR WALL BELOW (S1, S14)
8. INSTALL HSS COLLECTOR AT ATTIC AND/OR FLOOR DIAPHRAGM TO COLLECT AND TRANSFER IN-PLANE FORCES INTO THE CONC SHEAR WALL OR MOMENT FRAME (S1, S14)
9. ADD SIMPSON STRAPS TO TRANSFER OVERTURNING FORCES TO WALL BELOW AT WALL SPLICE. (S5, S7)
10. DEMO (E) CEILING AND WALL FINISH (WHERE OCCURS) TO ADD OUT-OF-PLANE ANCHORS BETWEEN HSS AND MEZZANINE OR FLOOR DIAPHRAGM AT 8'-0" OC OR WHERE SHOWN. REPAIR CEILING AND WALL FINISHES ONCE COMPLETE. (S13)
11. PROVIDE STRAP AND BLOCKING TO DRAG LOAD TO WOOD SHEARWALLS AND CREATE A COMPLETE LOAD PATH (S1)
12. PROVIDE IN-PLANE CONNECTION TO MAINTAIN CONTINUITY AT DIAPHRAGM STEP (S1)

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CHARLESTON FIRE STATION #1
SEISMIC REHABILITATION GRANT STRENGTHENING CONCEPTS
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DATE: 12/15/2024
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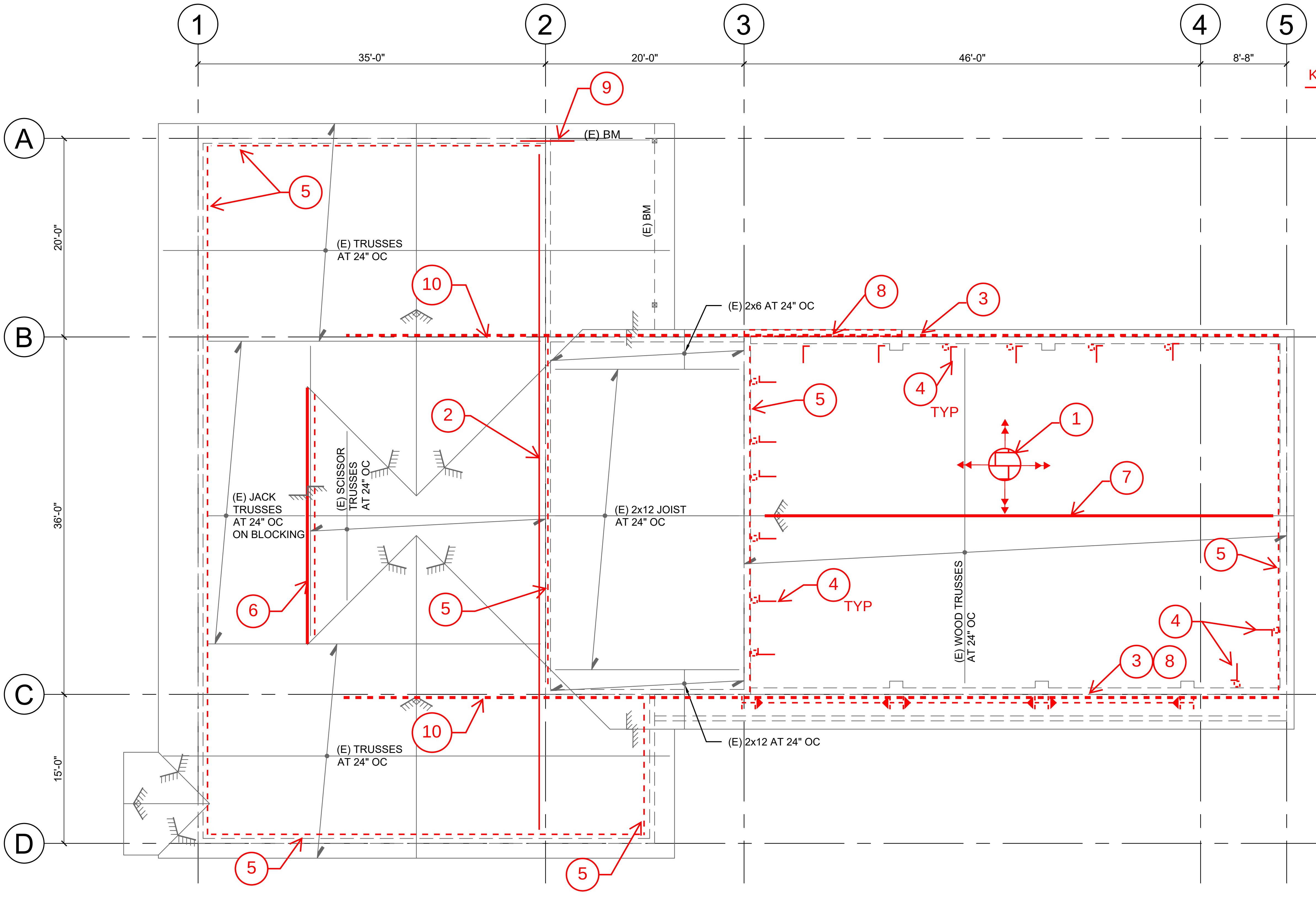
PAGE REFERENCE:

SHEET NO.
S2



1 ROOF STRENGTHENING PLAN
SCALE: 3/32"=1'-0"

KEYED NOTES:

1. DEMO (E) ROOFING TO SUPPLEMENT NAILING IN EXISTING PLYWOOD SHEATHING TO ATTAIN 10d NAILING AT 6" OC AT PANEL EDGES AND 12" OC IN FIELD, ADD BLKG AT PANEL EDGES AS REQUIRED. REPLACE ROOFING (S11)
2. PROVIDE SIMPSON STRAP AND BLOCKING TO CREATE A COLLECTOR TO DRAG LOAD TO SHEAR-WALL (S1)
3. ADD HSS COLLECTOR BELOW ROOF, TO CREATE CHORDS, PROVIDE BLKG AND IN-PLANE CONNECTION (S1, S9, S14)
4. DEMO (E) CEILING AND WALL FINISH (WHERE OCCURS) TO ADD OUT-OF-PLANE ANCHORS BETWEEN HSS AND ROOF DIAPHRAGM AT 8'-0" OC OR WHERE SHOWN. REPAIR CEILING AND WALL FINISHES ONCE COMPLETE. (S13)
5. ADD IN-PLANE CONNECTION BETWEEN ROOF DIAPHRAGM AND SHEAR WALL BELOW (S14)
6. INSTALL 15/32" PLYWOOD SHEATHING OVER (E) TRUSS AND PROVIDE IN-PLANE CONNECTION AT DIAPHRAGM STEP (S1)
7. PROVIDE BLKG AND STRAPPING TO CREATE A CONTINUOUS CROSS TIE (S15)
8. CONNECT HSS COLLECTOR TO CONCRETE SHEAR WALL OR MOMENT FRAME TO TRANSFER IN-PLANE FORCES. (S14)
9. PROVIDE SIMPSON STRAP TO TIE PATIO ROOF TO SHEAR WALL (S1)
10. PROVIDE NAILING, SIMPSON CLIPS, AND BLOCKING AS REQUIRED TO TRANSFER LOAD FROM GABLE ROOF DIAPHRAGM TO COLLECTOR BELOW (S1, S14)

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CHARLESTON FIRE STATION #1
SEISMIC REHABILITATION GRANT STRENGTHENING CONCEPTS
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JOB NUMBER: 22045.00
PAGE REFERENCE:

SHEET NO.
S3

Appendix D

BENEFIT COST ANALYSIS WORKSHEET

Oregon Seismic Rehabilitation Grant Application: Benefit-Cost Analysis

Entity:	Charleston Fire District		
Point of Contact	Mick Sneddon		
Telephone:	541-435-7071		
E-Mail:	charchief8201@gmail.com		
BCA File Name:	Charleston-SRGP-BCA-Tool-2025	BCA Date:	12/2/2025

Building Name:	Charleston Fire District Station 1
Site ID:	Coos_fir05A
Facility Use:	Fire Station

Is the Building in the Oregon BCA Tool Database: Yes or No? **No**

How Many Structurally Different Building Parts Are There?

User-Defined	Database
2	Not Listed

Unique Building ID Number	Building Part Square Footage	Percent of Total SF	Percent of Occupancy	Percent of Operating Budget	Building Part Being Retrofitted?
Coos_fir05AA	3,172	55.14%			Yes
Coos_fir05AB	2,581	44.86%			Yes
Totals:	5,753	100.00%			

Seismic Retrofit Cost Estimate per SRGP Application: **$2,498,100**

Benefit-Cost Analysis: Summary Results
Charleston Fire District Station 1

Building Part	Benefits
Coos_fir05AA	$4,580,943
Coos_fir05AB	$1,522,916
Total Benefits	**$6,103,859**
Total Cost	**$2,498,100**
Benefit-Cost Ratio	**2.443**

Benefits by Category Avoided Damages and Losses	
Building Damage	$372,337
Contents Damage	$3,450,292
Displacement Costs	$19,121
Loss of Function Costs	$193,183
Casualties	$2,068,926
Total	**$6,103,859**

Occupancy Data

For benefit-cost analysis, the average occupancy on a 24/7/365 basis is used for casualty calculations.
Enter data below ONLY for the occupancy categories applicable to this building - all other green cell entries should be left blank.
There are entries below for: employees, visitors, students, meetings or special events and patients.

NOTE: for buildings with similar occupancies each month, complete the tables on the left side only.

NOTE: For buildings with different summer occupancies, complete the tables both on the left and right sides. If this does not apply, enter "0" for number of summer months

Employees: 12 Months per Year or Academic Year for Schools

Day of Week	Time of Day	Hours per Day	Average Employees in Building	Calculated 24/7/365 Occupancy
Monday - Friday	Day	8	6	1.425
Monday - Friday	Evening	8	4	0.950
Monday - Friday	Night	8	4	0.950
Saturday	Day	8	4	0.190
Saturday	Evening	8	4	0.190
Saturday	Night	8	4	0.190
Sunday	Day	8	4	0.190
Sunday	Evening	8	4	0.190
Sunday	Night	8	4	0.190
			Subtotal:	4.464

Employees: Summer Months — Number of Months:

Day of Week	Time of Day	Hours per Day	Average Employees in Building	Calculated 24/7/365 Occupancy
Monday - Friday	Day			
Monday - Friday	Evening			
Monday - Friday	Night			
Saturday	Day			
Saturday	Evening			
Saturday	Night			
Sunday	Day			
Sunday	Evening			
Sunday	Night			
			Subtotal:	

Visitors: 12 Months per Year or Academic Year for Schools

Day of Week	Average Number of Visitors Per Day	Average Time in Building (Minutes per Visitor)	Calculated 24/7/365 Occupancy
Monday - Friday	10	60	0.297
Saturday	15	30	0.045
Sunday	3	30	0.009
		Subtotal:	0.350

Visitors: Summer Months — Number of Months:

Day of Week	Average Number of Visitors Per Day	Average Time in Building (Minutes per Visitor)	Calculated 24/7/365 Occupancy
Monday - Friday			
Saturday			
Sunday			
		Subtotal:	

K-12 Students: Academic Year

Average Daily Number of Students:	
Hours per Day:	
Days per Year:	
Calculated 24/7/365 Occupancy:	

K-12 Students: Summer School

Average Daily Number of Students:	
Hours per Day:	
Days per Year:	
Calculated 24/7/365 Occupancy:	

College Students: Academic Year

Number of Weeks per Year of Classes:

Course	Class Duration (hours)	Number of Class Periods per Week	Average Number of Students per Class	Calculated 24/7/365 Occupancy
1 Hr. Courses	1			
1.5 Hr. Courses	1.5			
2 Hr. Courses	2			
3 Hr. Courses	3			
Other	N/A			
Other	N/A			
			Subtotal:	

College Students: Summer School

Number of Weeks per Year of Classes:

Course	Class Duration (hours)	Number of Class Periods per Week	Average Number of Students per Class	Calculated 24/7/365 Occupancy
1 Hr. Courses	1			
1.5 Hr. Courses	1.5			
2 Hr. Courses	2			
3 Hr. Courses	3			
Other	N/A			
Other	N/A			
			Subtotal:	

Occupancy Data

Meetings, Sports Events etc.						
Event	**Events per Year**	**People per Event**	**Average Time spent at Event (hours per person)**	**Calculated 24/7/365 Occupancy**	**Where is this event primarily held?**	**Event Occupancy Allocation Description**
Board Meetings	12	10	1.5	0.021	Coos_fir05AB	Nearly all attendees are in Coos_fir05AB.
Budget Meetings	1	15	2	0.003	Coos_fir05AB	Nearly all attendees are in Coos_fir05AB.
Firefighter Training	60	20	2.5	0.342	Default	Occupancy spread per 'Main' tab percentages.
Community Group M	100	20	2	0.457	Default	Occupancy spread per 'Main' tab percentages.
Pancake Feed	1	600	1	0.068	Default	Occupancy spread per 'Main' tab percentages.
School Tours	4	20	2	0.018	Default	Occupancy spread per 'Main' tab percentages.
Civl Service Commis	4	4	1	0.002	Coos_fir05AB	Nearly all attendees are in Coos_fir05AB.
Volunteer Work Sche	104	20	2	0.475	Default	Occupancy spread per 'Main' tab percentages.
			Subtotal:	**1.387**		

Patients			
Total Number of In-Patient Beds:			
Average Daily Number of In-Patients			
Average Percentage Occupancy			
Day of Week	**Average Number of Out-Patients per Day**	**Average Time in Building (Hours per person)**	**Calculated 24/7/365 Occupancy**
Monday - Friday			
Saturday			
Sunday			
		Out-Patients:	
		In-Patients:	
		Total Patients:	

Occupancy Data

SUMMARY OCCUPANCY DATA:
Average 24/7/365 Occupancy

Occupancy Category	12 Months or Academic Year	Summer	Combined
Employees	4.464		4.464
Visitors	0.350		0.350
Students: K-12			
Students: College			
Meetings & Special Events	1.387	N/A	1.387
Patients		N/A	
Subtotals:	6.201		6.201
Avg 24/7/365 Occupancy:	6.201		

DATA DOCUMENTATION: OCCUPANCY	
Provide brief documentation below and/or references to other documents included with your application (with page number), for the sources of the occupancy data and estimates.	
Employees: Numbers	
Employees: Hours Per Day	
Visitors: Number Per Day	
Visitors: Average Time in Building	
K-12 Students: Number	
K-12 Students: Hours Per Day	
K-12 Students: Days Per Year	
Additional Comments Re: above Occupancy Data	
College Student Occupancy Data	

Meetings, Sports Events and Other Special Events	
NOTES:	It is <u>NOT</u> necessary to provide separate documentation for every special event listed. Rather, provide an Overview Statement of the sources of special event occupancy estimates.
	Provide specific documentation for high occupancy events or very frequent events with high Calculated 24/7/365 Occupancy, especially for occupancies that appear "unusual" or potentially "out of bounds."
Overview Statement Re: Sources of Special Events Occupancy Estimates	

Hospital Patient Data	
Number of Patient Beds	
Average Daily Number of In-Patients	
Average Daily Number of Out-Patients	
Average Time in Building for Out-Patients	

Annual Operating Budget for this Facility

Employees:

	Classification	Number of FTEs[1]	Average Annual Salary per Employee	Total Benefits as Percent of Salary	Annual Salary and Benefits
1	Fire Chief	1	$170,000	36.00%	$231,200
2	Captain/ Duty Officer	1	$121,000	47.00%	$177,870
3	Lieutenant/ Duty Officer	2	$92,000	36.00%	$250,240
4	Firefighter/ Engineer	3	$81,000	37.00%	$332,910
5					$0
6					$0
7					$0
8					$0
9					$0
10					$0
	Total Number of FTEs:	7.00		Subtotal:	$992,220

[1] FTEs: Full time equivalents

Other Building Expenses

Category		Annual Cost
Supplies		$5,000
Building Maintenance		$7,000
Utilities		$18,000
Insurance		$35,000
Rent		$0
Average Annual Capital Goods		$5,000
OTHER: specify below		
Percent of District Office/Headquarters Annual Operating Budget Attributed to This Building:		$0
If rent is zero (building owned), a proxy rent is calculated automatically, based on the value of the building:		$372,507
	Subtotal:	$442,507

Total Building Annual Operating Budget:	$1,434,727

For entities with multiple facilities, a fraction of the operating budget for a District Office of Headquarters building may be attributed to the building being retrofitted. That is, the annual operating budget for the building above may include part of the operating budget for the District Office or Headquarters Building.
If so, complete the following tables:

District Office/Headquarters Building Employees

	Classification	Number of FTEs[1]	Average Annual Salary per Employee	Total Benefits as Percent of Salary	Annual Salary and Benefits
1					$0
2					$0
3					$0
4					$0
5					$0
6					$0
7					$0
8					$0
9					$0
10					$0
	Total Number of FTEs:	0.00		Subtotal:	$0

District Office/Headquarters Building Expenses

Category		Annual Cost
Supplies		
Building maintenance		
Utilities		
Insurance		
Rent		
Average Annual Capital Goods		
OTHER: specify below		
Enter replacement value of building:		
If rent is zero (building owned), a proxy rent is calculated		$0
	Subtotal:	$0

Total Annual Operating Budget for District Office/Headquarters Building:	$0

DOCUMENTATION: ANNUAL OPERATING BUDGET	
NOTE:	**The Annual Operating Budget is used as a "proxy" for the value of services provided from a building and is used to count the benefits of avoiding loss of service in future earthquake events.**
Operating Budget by Categories	
Percent of District Office or Headquarters Annual Operating Budget Attributed to the Facility	

Building Part A: Data for Benefit-Cost Analysis

Building Name:	**Charleston Fire District Station 1**
Building ID:	**Coos_fir05AA**
Building Part Name / Description:	**Apparatus Bay**

Evaluation for Building Part A

Seismic Hazard Data		
Region of Seismicity	Moderately High	
PGA Ground Motion (g)	2% in 50 year	0.510
	5% in 50 year	0.338
	10% in 50 year	0.201
	20% in 50 year	0.083
Spectral Accelerations (g)	S_{xs}, 2% in 50 year	1.036
	S_{x1}, 2% in 50 year	0.761
	S_{xs}, 10% in 50 year	0.423
	S_{x1}, 10% in 50 year	0.275

Data Entry Item	User Entered Values	Default Values	Used for BCA
Site Data			
County	Coos		Coos
Decimal Latitude	43.37093		43.37093
Decimal Longitude	123.29191		123.29191
Soil Type	D		D
Construction Data			
Primary Structure Type (FEMA 154)	URM		URM
Number of Stories	1		1
Year Built	1985		1985
Rapid Visual Screening Data			
Pre-Code	No	Yes	No
Post-Benchmark		No	No
Existing Severe Vertical Irregularity	Yes		Yes
Existing Moderate Vertical Irregularity	No		No
Existing Plan Irregularity	Yes		Yes
Are Existing Structural Irregularities (RVS) resolved by the Structural Retrofit plan?			
Severe Vertical Irregularity is Resolved	Yes	No	Yes
Moderate Vertical Irregularity is Resolved		N/A	N/A
Plan Irregularity is Resolved	Yes	No	Yes
Building Data			
Historic Importance		None	None
Historic Adjustment Modifier	N/A	N/A	1.00
Building Square Footage - SF	3,172	3,172	3,172
Building Replacement - $/SF		$925.00	$925
Building Replacement Value - $	N/A	N/A	$2,934,100
Historic Building Replacement - $/SF	N/A	N/A	$925
Historic Building Replacement Value - $	N/A	N/A	$2,934,100
Contents Value - % of Building Value	1799%	100%	1799%
Displacement Costs - $/SF/month		$2.75	$2.75
Displacement Costs - One Time		$3.25	$3.25
Average Annual Occupancy	3.40	3.42	3.40
Annual Operating Budget	$0	$791,057	$791,057
Seismic Fragility Curves			
Before Mitigation			
Slight Damage State		0.11	0.11
Moderate Damage State		0.15	0.15
Extensive Damage State		0.24	0.24
Complete Damage State		0.35	0.35
Beta		0.66	0.66
After Mitigation			
Retrofit Building Type	C2	URM	C2
Risk Category		IV	IV
Slight Damage State		0.28	0.28
Moderate Damage State		0.52	0.52
Extensive Damage State		1.04	1.04
Complete Damage State		1.78	1.78
Beta		0.62	0.62

Data Documentation: Building Part A	
Brief documentation and/or refs to other docs included with your app (inc. pg #) MUST BE PROVIDED below whenever a User Entered Value (Column C) is given that intends to override a Database Default Value in Column D. If no justification is given, the User Input will not be used.	
Soil Type	
Primary Structure Type	
Number of Stories	
Year Built	
Severe Vertical Irregularity	Strengthening apparatus bay walls to stabilize wall hinge point will address irregularity.
Moderate Vertical Irregularity	
Plan Irregularity	Adding steel moment frame will address torsion plan irregularity.
Pre-Code	Based on guidance from DOGAMI, 1974 is pre-code.
Post-Benchmark	
Historic Importance (if not none)	
Building Square Footage	
Building Replacement Value $/SF	
Contents Value % of Building Value	Insured replacement cost of building contents including fire trucks and all firefighting equipment equals $3,450,000 per Fire Chief and insurance policy in effect at time of application.
Displacement Costs One Time	
Displacement Costs $/SF/month	
Fragility Curve Parameters Before Mitigation	
Fragility Curve Parameters After Mitigation	
Other Comments	

Building Part B: Data for Benefit-Cost Analysis

Building Name:	**Charleston Fire District Station 1**
Building ID:	**Coos_fir05AB**
Building Part Name / Description:	**Office & Living Space**

Evaluation for Building Part B

Seismic Hazard Data		
Region of Seismicity	Very High	
PGA Ground Motion (g)	2% in 50 year	1.126
	5% in 50 year	0.716
	10% in 50 year	0.464
	20% in 50 year	0.195
Spectral Accelerations (g)	S_{xs}, 2% in 50 year	2.210
	S_{x1}, 2% in 50 year	1.440
	S_{xs}, 10% in 50 year	0.933
	S_{x1}, 10% in 50 year	0.574

Data Entry Item	User Entered Values	Default Values	Used for BCA
Site Data			
County	Coos		Coos
Decimal Latitude	43.37107		43.37107
Decimal Longitude	124.2917923		124.2917923
Soil Type	D		D
Construction Data			
Primary Structure Type (FEMA 154)	W1A		W1A
Number of Stories	1		1
Year Built	1985		1985
Rapid Visual Screening Data			
Pre-Code		No	No
Post-Benchmark		Yes	Yes
Existing Severe Vertical Irregularity	Yes		Yes
Existing Moderate Vertical Irregularity	No		No
Existing Plan Irregularity	Yes		Yes
Are Existing Structural Irregularities (RVS) resolved by the Structural Retrofit plan?			
Severe Vertical Irregularity is Resolved	Yes	No	Yes
Moderate Vertical Irregularity is Resolved		N/A	N/A
Plan Irregularity is Resolved	Yes	No	Yes
Building Data			
Historic Importance		None	None
Historic Adjustment Modifier	N/A	N/A	1.00
Building Square Footage - SF	2,581	2,581	2,581
Building Replacement - $/SF		$925.00	$925
Building Replacement Value - $	N/A	N/A	$2,387,425
Historic Building Replacement - $/SF	N/A	N/A	$925
Historic Building Replacement Value - $	N/A	N/A	$2,387,425
Contents Value - % of Building Value		100%	100%
Displacement Costs - $/SF/month		$2.75	$2.75
Displacement Costs - One Time		$3.25	$3.25
Average Annual Occupancy	2.80	2.78	2.80
Annual Operating Budget	$0	$643,669	$643,669
Seismic Fragility Curves			
Before Mitigation			
Slight Damage State		0.13	0.13
Moderate Damage State		0.21	0.21
Extensive Damage State		0.41	0.41
Complete Damage State		0.64	0.64
Beta		0.66	0.66
After Mitigation			
Retrofit Building Type		W1A	W1A
Risk Category		IV	IV
Slight Damage State		0.32	0.32
Moderate Damage State		0.76	0.76
Extensive Damage State		1.79	1.79
Complete Damage State		3.02	3.02
Beta		0.62	0.62

Data Documentation: Building Part B	
Brief documentation and/or refs to other docs included with your app (inc. pg #) MUST BE PROVIDED below whenever a User Entered Value (Column C) is given that intends to override a Database Default Value in Column D. If no justification is given, the User Input will not be used.	
Soil Type	
Primary Structure Type	
Number of Stories	
Year Built	
Severe Vertical Irregularity	Strengthening Part A and B common wall to stabilize wall hinge point will address irregularity.
Moderate Vertical Irregularity	
Plan Irregularity	Adding roof diaphragm reinforcing at re-entrant corners to address plan irregularity.
Pre-Code	
Post-Benchmark	
Historic Importance (if not none)	
Building Square Footage	
Building Replacement Value $/SF	
Contents Value % of Building Value	
Displacement Costs One Time	
Displacement Costs $/SF/month	
Fragility Curve Parameters Before Mitigation	
Fragility Curve Parameters After Mitigation	
Other Comments	

Appendix E

ASCE 41-17 TIER 1 CHECKLISTS

17-3 Immediate Occupancy Basic Configuration Checklist

Very Low Seismicity

Building System - General

	C	NC	N/A	U	EVALUATION STATEMENT	COMMENT
S1		X			LOAD PATH: The structure contains 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. *(Tier 2: Sec. 5.4.1.1; Commentary: Sec. A.2.1.1)*	Apparatus Bay walls contain hinge-point with wood frame above half-height CMU walls
			X		ADJACENT BUILDINGS: The clear distance between the building being evaluated and any adjacent building is greater than 0.5% of the height of the shorter building in low seismicity, 1.0% in moderate seismici ty, and 3.0% in high seismicity. (Tier 2: Sec. 5.4.1.2; Commentary: Sec. A.2.1.2)	
	X				MEZZANINES: Interior mezzanine levels are braced independently from the main structure or are anchored to the seismic-force-resisting elements of the main structure. *(Tier 2: Sec. 5.4.1.3; Commentary: Sec. A.2.1.3)*	

Building System – Building Configuration

	C	NC	N/A	U	EVALUATION STATEMENT	COMMENT
			X		WEAK STORY: The sum of the shear strengths of the seismic-force-resisting system in any story in each direction is not less than 80% of the strength in the adjacent story above. *(Tier 2: Sec. 5.4.2.1; Commentary: Sec. A.2.2.2)*	
			X		SOFT STORY: The stiffness of the seismic-force-resisting system in any story is not less than 70% of the seismic-force-resisting system stiffness in an adjacent story above or less than 80% of the average seismic-force-resisting system stiffness of the three stories above. *(Tier 2: Sec. 5.4.2.2; Commentary: Sec. A.2.2.3)*	
S2		X			VERTICAL IRREGULARITIES: All vertical elements in the seismic-force- resisting system are continuous to the foundation. *(Tier 2: Sec. 5.4.2.3; Commentary: Sec. A.2.2.4)*	Wood shear walls above CMU shear walls
			X		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. *(Tier 2: Sec. 5.4.2.4; Commentary: Sec. A.2.2.5)*	
			X		MASS: There is no change in effective mass of more than 50% from one story to the next. Light roofs, penthouses, and mezzanines need not be considered. *(Tier 2: Sec. 5.4.2.5; Commentary: Sec. A.2.2.6)*	
S17		X			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. *(Tier 2: Sec. 5.4.2.6; Commentary: Sec. A.2.2.7)*	Torsion Potential

17-3 Immediate Occupancy Basic Configuration Checklist

Low Seismicity

(Complete the Following Items in Addition to the Items for Very Low Seismicity)

Geologic Site Hazards

	C	NC	N/A	U	EVALUATION STATEMENT	COMMENT
S3		X			LIQUEFACTION: Liquefaction-susceptible, saturated, loose granular soils that could jeopardize the building's seismic performance do not exist in the foundation soils at depths within 50 ft (15.2 m) under the building. *(Tier 2: Sec. 5.4.3.1; Commentary: Sec. A.6.1.1)*	Moderate liquefaction potential. Mitigation is included in the scheme.
	X				SLOPE FAILURE: The building site is located away from potential earthquake-induced slope failures or rockfalls so that it is unaffected by such failures or is capable of accommodating any predicted movements without failure. *(Tier 2: Sec. 5.4.3.1; Commentary: Sec. A.6.1.2)*	
	X				SURFACE FAULT RUPTURE: Surface fault rupture and surface displacement at the building site are not anticipated. *(Tier 2: Sec. 5.4.3.1 ; Commentary: Sec.A.6.1.3)*	

Moderate and High Seismicity

(Complete the Following Items in Addition to the Items for Low Seismicity)

Foundation Configuration

C	NC	N/A	U	EVALUATION STATEMENT	COMMENT
X				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 $0.6S_a$. *(Tier 2: Sec. 5.4.3.3; Commentary: Sec. A.6.2.1)*	
		X		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. *(Tier 2: Sec. 5.4.3.4; Commentary: Sec. A.6.2.2)*	

Note: C = Compliant, NC = Noncompliant, N/A = Not Applicable, and U = Unknown.

17-5. Immediate Occupancy Checklist for Building Types W1 and W1a

Very Low

Seismic-Force-Resisting System

	C	NC	N/A	U	EVALUATION STATEMENT	COMMENT
	X				REDUNDANCY: The number of lines of shear walls in each principal direction is greater than or equal to 2. *(Tier 2: Sec. 5.5.1.1; Commentary: Sec. A.3.2.1.1)*	
	X				SHEAR STRESS CHECK: The shear stress in the shear walls, calculated using the Quick Check procedure of Section 4.4.3.3, is less than the following values: Structural panel sheathing, 1,000 lb/ft (14.6 kN/m); Diagonal sheathing, 700 lb/ft (10.2 kN/m); Straight sheathing, 100 lb/ft (1.5 kN/m); All other conditions, 100 lb/ft (1.5 kN/m). *(Tier 2: Sec. 5.5.3.1.1 ; Commentary: Sec.A.3.2.7.1)*	
			X		STUCCO (EXTERIOR PLASTER) SHEAR WALLS: Multi-story buildings do not rely on exterior stucco walls as the primary seismic-force-resisting system. *(Tier 2: Sec. 5.5.3.6.1; Commentary: Sec. A.3.2.7.2)*	
	X				GYPSUM WALLBOARD OR PLASTER SHEAR WALLS: Interior plaster or gypsum wallboard is not used for shear walls on buildings more than one story high with the exception of the uppermost level of a multi-story building. *(Tier 2: Sec. 5.5.3.6.1; Commentary: Sec. A.3.2.7.3)*	
S4		X			NARROW WOOD SHEAR WALLS: Narrow wood shear walls with an aspect ratio greater than 2-to-1 are not used to resist seismic forces. *(Tier 2: Sec. 5.5.3.6.1; Commentary: Sec. A.3.2.7.4)*	Exterior walls aspect ratio > 2:1
S5		X			WALLS CONNECTED THROUGH FLOORS: Shear walls have an interconnection between stories to transfer overturning and shear forces through the floor. *(Tier 2: Sec. 5.5.3.6.2; Commentary: Sec. A.3.2.7.5)*	Walls not connected through 2nd Floor/Mezzanine
			X		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. *(Tier 2: Sec. 5.5.3.6.3; Commentary: Sec. A.3.2.7.6)*	
			X		CRIPPLE WALLS: Cripple walls below first-floor-level shear walls are braced to the foundation with wood structural panels. *(Tier 2: Sec. 5.5.3.6.4; Commentary: Sec. A.3.2.7.7)*	
S6		X			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. *(Tier 2: Sec. 5.5.3.6.5; Commentary: Sec. A.3.2.7.8)*	Front of building at street with numerous openings

Connections

C	NC	N/A	U	EVALUATION STATEMENT	COMMENT
		X		WOOD POSTS: There is a positive connection of wood posts to the foundation. *(Tier 2: Sec. 5.7.3.3; Commentary: Sec. A.5.3.3)*	
X				WOOD SILLS: All wood sills are bolted to the foundation. *(Tier 2: Sec. 5.7.3.3; Commentary: Sec. A.5.3.4)*	

17-5. Immediate Occupancy Checklist for Building Types W1 and W1a

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

Foundation System

C	NC	N/A	U	EVALUATION STATEMENT	COMMENT
		X		DEEP FOUNDATIONS: Piles and piers are capable of transferring the lateral forces between the structure and the soil. *(Commentary: Sec. A.6.2.3)*	
		X		SLOPING SITES: The difference in foundation embedment depth from one side of the building to another does not exceed one story. *(Commentary: 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	EVALUATION STATEMENT	COMMENT
S7		X			HOLD-DOWN ANCHORS: All shear walls have hold-down anchors attached to the end studs constructed in accordance with acceptable construction practices. *(Tier 2: Sec. 5.5.3.6.6; Commentary: Sec. A.3.2.7.9)*	Original Drawings show no holdowns
S8		X			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. *(Tier 2: Sec. 5.5.3.6.1; Commentary: Sec. A.3.2.7.4)*	Exterior walls aspect ratio > 1.5:1

Diaphragms

	C	NC	N/A	U	EVALUATION STATEMENT	COMMENT
	X				DIAPHRAGM CONTINUITY: The diaphragms are not composed of split-level floors and do not have expansion joints. *(Tier 2: Sec. 5.6.1.1; Commentary: Sec. A.4.1.1)*	
S9		X			ROOF CHORD CONTINUITY: All chord elements are continuous, regardless of changes in roof elevation. *(Tier 2: Sec. 5.6.1.1; Commentary: Sec. A.4.1.3)*	Roof diaphragm chords not present
S10		X			PLAN IRREGULARITIES: There is tensile capacity to develop the strength of the diaphragm at reentrant corners or other locations of plan irregularities. *(Tier 2: Sec. 5.6.1.4; Commentary: Sec. A.4.1.7)*	Reinforcing at reentrant corners not present
	X				DIAPHRAGM REINFORCEMENT AT OPENINGS: There is reinforcing around all diaphragm openings larger than 50% of the building width in either major plan dimension. *(Tier 2: Sec. 5.6.1.5; Commentary: Sec. A.4.1.8)*	
			X		STRAIGHT SHEATHING: All straight-sheathed diaphragms have aspect ratios less than 1-to-1 in the direction being considered. *(Tier 2: Sec. 5.6.2; Commentary: Sec. A.4.2.1)*	

17-5. Immediate Occupancy Checklist for Building Types W1 and W1a

	C	NC	N/A	U	EVALUATION STATEMENT	COMMENT
	X				SPANS: All wood diaphragms with spans greater than 12 ft (3.7 m) consist of wood structural panels or diagonal sheathing. *(Tier 2: Sec. 5.6.2; Commentary: Sec. A.4.2.2)*	
S11		X			DIAGONALLY SHEATHED AND UNBLOCKED DIAPHRAGMS: All diagonally sheathed or unblocked wood structural panel diaphragms have horizontal spans less than 30 ft (9.1 m) and aspect ratios less than or equal to 3-to-1. *(Tier 2: Sec. 5.6.2; Commentary: Sec. A.4.2.3)*	Spans > 30ft and unblocked
	X				OTHER DIAPHRAGMS: The diaphragms do not consist of a system other than wood, metal deck, concrete, or horizontal bracing. *(Tier 2: Sec. 5.6.5; Commentary: Sec. A.4.7.1)*	

Connections

C	NC	N/A	U	EVALUATION STATEMENT	COMMENT
X				WOOD SILL BOLTS: Sill bolts are spaced at 4 ft (1.2 m) or less, with acceptable edge and end distance provided for wood and concrete. *(Tier 2: Sec. 5.7.3.3; Commentary: Sec. A.5.3.7)*	

Note: C = Compliant, NC = Noncompliant, N/A = Not Applicable, and U = Unknown.

17-37. Immediate Occupancy Structural Checklist for Building Types URM and URMa

Very Low Seismicity

Seismic-Force-Resisting System

	C	NC	N/A	U	EVALUATION STATEMENT	COMMENT
	X				REDUNDANCY: The number of lines of shear walls in each principal direction is greater than or equal to 2. *(Tier 2: Sec. 5.5.1.1; Commentary: Sec. A.3.2.1.1)*	
S12		X			SHEAR STRESS CHECK: The shear stress in the unreinforced masonry shear walls, calculated using the Quick Check procedure of Section 4.4.3.3, is less than 30 lb/in.^2 (0.21 MPa) for clay units and 70 lb/in.^2 (0.48 MPa) for concrete units. *(Tier 2: Sec. 5.5.3.1.1; Commentary: Sec. A.3.2.4.1)*	CMU walls do not pass quick check.

Connections

	C	NC	N/A	U	EVALUATION STATEMENT	COMMENT
S13		X			WALL ANCHORAGE: Exterior concrete or masonry walls that are dependent on the diaphragm 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 strength to resist the connection force calculated in the Quick Check procedure of Section 4.4.3.7. *(Tier 2: Sec. 5.7.1.1; Commentary: Sec. A.5.1.1)*	CMU walls not anchored for out-of-plane demands
	X				WOOD LEDGERS: The connection between the wall panels and the diaphragm does not induce cross-grain bending or tension in the wood ledgers. *(Tier 2: Sec. 5.7.1.3; Commentary: Sec. A.5.1.2)*	
S14		X			TRANSFER TO SHEAR WALLS: Diaphragms are connected for transfer of seismic forces to the shear walls, and the connections are able to develop the lesser of the shear strength of the walls or diaphragms. *(Tier 2: Sec. 5.7.2; Commentary: Sec. A.5.2.1)*	In-plane connection not adequate to transfer expected diaphragm demands
			X		GIRDER–COLUMN CONNECTION: There is a positive connection using plates, connection hardware, or straps between the girder and the column support. *(Tier 2: Sec. 5.7.4.1; Commentary: Sec. A.5.4.1)*	

Foundation System

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

17-37. Immediate Occupancy Structural Checklist for Building Types URM and URMa

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	EVALUATION STATEMENT	COMMENT
X				PROPORTIONS: The height-to-thickness ratio of the shear walls at each story is less than the following: top story of multi-story building, 9; first story of multi-story building, 15; all other conditions, 13. *(Tier 2: Sec. 5.5.3.1.2; Commentary: Sec. A.3.2.5.2)*	
		X		MASONRY LAYUP: Filled collar joints of multi-wythe masonry walls have negligible voids. *(Tier 2: Sec. 5.5.3.4.1; Commentary: Sec. A.3.2.5.3)*	

Flexible Diapghragms

	C	NC	N/A	U	EVALUATION STATEMENT	COMMENT
S15		X			CROSS TIES: There are continuous cross ties between diaphragm chords. *(Tier 2: Sec. 5.6.1.2; Commentary: Sec. A.4.1.2)*	Cross ties not present
			X		STRAIGHT SHEATHING: All straight-sheathed diaphragms have aspect ratios less than 1-to-1 in the direction being considered. *(Tier 2: Sec. 5.6.2; Commentary: Sec. A.4.2.1)*	
	X				SPANS: All wood diaphragms with spans greater than 12 ft (3.6 m) consist of wood structural panels or diagonal sheathing. *(Tier 2: Sec. 5.6.2; Commentary: Sec. A.4.2.2)*	
			X		DIAGONALLY SHEATHED AND UNBLOCKED DIAPHRAGMS: All diagonally sheathed or unblocked wood structural panel diaphragms have horizontal spans less than 30 ft (9.2 m) and aspect ratios less than or equal to 3-to-1. *(Tier 2: Sec. 5.6.2; Commentary: Sec. A.4.2.3)*	
			X		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 (12.2 m) and have aspect ratios less than 4-to-1. *(Tier 2: Sec. 5.6.3; Commentary: Sec. A.4.3.1)*	
			X		OTHER DIAPHRAGMS: Diaphragms do not consist of a system other than wood, metal deck, concrete, or horizontal bracing. *(Tier 2: Sec. 5.6.5; Commentary: Sec. A.4.7.1)*	

Connections

	C	NC	N/A	U	EVALUATION STATEMENT	COMMENT
S16		X			STIFFNESS OF WALL ANCHORS: Anchors of concrete or masonry walls to wood structural elements are installed taut and are stiff enough to limit the relative movement between the wall and the diaphragm to no greater than 1/8 in. (3 mm) before engagement of the anchors. *(Tier 2: Sec. 5.7.1.2; Commentary: Sec. A.5.1.4)*	CMU walls not anchored for out-of-plane demands

17-37. Immediate Occupancy Structural Checklist for Building Types URM and URMa

C	NC	N/A	U	EVALUATION STATEMENT	COMMENT
X				BEAM, GIRDER, AND TRUSS SUPPORTS: Beams, girders, and trusses supported by unreinforced masonry walls or pilasters have independent secondary columns for support of vertical loads. *(Tier 2: Sec. 5.7.4.4; Commentary: Sec. A.5.4.5)*	

Note: C = Compliant, NC = Noncompliant, N/A = Not Applicable, and U = Unknown.

17-38. Nonstructural Checklist

Life Safety Systems

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

Hazardous Materials

	C	NC	N/A	U	EVALUATION STATEMENT[a,b]	COMMENT
			X		HR—LMH; LS—LMH; PR—LMH. HAZARDOUS MATERIAL EQUIPMENT: Equipment mounted on vibration isolators and containing hazardous material is equipped with restraints or snubbers. *(Tier 2: Sec. 13.7.1; Commentary: Sec. A.7.12.2)*	
N1		X			HR—LMH; 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. *(Tier 2: Sec. 13.8.3; Commentary: Sec. A.7.15.1)*	Breakable containers with hazardous contents were not observed to be restrained.
			X		HR—MH; 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. *(Tier 2: Sec. 13.7.3, 13.7.5; Commentary: Sec. A.7.13.4)*	
N2		X			HR—MH; LS—MH; PR—MH. SHUTOFF VALVES: Piping containing hazardous material, including natural gas, has shutoff valves or other devices to limit spills or leaks. *(Tier 2: Sec. 13.7.3, 13.7.5; Commentary: Sec. A.7.13.3)*	None observed. Insufficient protection (shutoff valves or other devices) to limit spills/leaks from piping containing hazardous materials. Installation of shutoff valves may be appropriate to limit seismic risk.

17-38. Nonstructural Checklist

	C	NC	N/A	U	EVALUATION STATEMENT[a,b]	COMMENT
N3		X			HR—LMH; LS—LMH; PR—LMH. FLEXIBLE COUPLINGS: Hazardous material ductwork and piping, including natural gas piping, have flexible couplings. *(Tier 2: Sec. 13.7.3, 13.7.5; Commentary: Sec. A.7.15.4)*	No flexible couplings present where piping crosses dissimilar materials.
			X		HR—MH; 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. *(Tier 2: Sec. 13.7.3, 13.7.5, 13.7.6; Commentary: Sec. A.7.13.6)*	

Partitions

C	NC	N/A	U	EVALUATION STATEMENT[a,b]	COMMENT
		X		HR—LMH; LS—LMH; PR—LMH. UNREINFORCED MASONRY: Unreinforced masonry or hollow-clay tile partitions are braced at a spacing of at most 10 ft (3.0 m) in Low or Moderate Seismicity, or at most 6 ft (1.8 m) in High Seismicity. *(Tier 2: Sec. 13.6.2; Commentary: Sec. A.7.1.1)*	
		X		HR—LMH; 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. *(Tier 2: Sec. 13.6.2; Commentary: Sec. A.7.2.1)*	
		X		HR—not required; 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. *(Tier 2: Sec. 13.6.2; Commentary: Sec. A.7.1.2)*	
		X		HR—not required; 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. *(Tier 2: Sec. 13.6.2; Commentary: Sec. A.7.2.1)*	
		X		HR—not required; LS—not required; PR—MH. STRUCTURAL SEPARATIONS: Partitions that cross structural separations have seismic or control joints. *(Tier 2: Sec. 13.6.2; Commentary: Sec. A.7.1.3)*	
		X		HR—not required; 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 (1.8 m). *(Tier 2: Sec. 13.6.2; Commentary: Sec. A.7.1.4)*	

Ceilings

C	NC	N/A	U	EVALUATION STATEMENT[a,b]	COMMENT
		X		HR—H; LS—MH; PR—LMH. SUSPENDED LATH AND PLASTER: Suspended lath and plaster ceilings have attachments that resist seismic forces for every 12 ft^2 (1.1 m^2) of area. *(Tier 2: Sec. 13.6.4; Commentary: Sec. A.7.2.3)*	

17-38. Nonstructural Checklist

C	NC	N/A	U	EVALUATION STATEMENT[a,b]	COMMENT
		X		HR—not required; LS—MH; PR—LMH. SUSPENDED GYPSUM BOARD: Suspended gypsum board ceilings have attachments that resist seismic forces for every 12 ft² (1.1 m²) of area. *(Tier 2: Sec. 13.6.4; Commentary: Sec. A.7.2.3)*	
		X		HR—not required; LS—not required; PR—MH. INTEGRATED CEILINGS: Integrated suspended ceilings with continuous areas greater than 144 ft² (13.4 m²) and ceilings of smaller areas that are not surrounded by restraining partitions are laterally restrained at a spacing no greater than 12 ft (3.6 m) 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. *(Tier 2: Sec. 13.6.4; Commentary: Sec. A.7.2.2)*	
		X		HR—not required; LS—not required; PR—MH. EDGE CLEARANCE: The free edges of integrated suspended ceilings with continuous areas greater than 144 ft² (13.4 m²) have clearances from the enclosing wall or partition of at least the following: in Moderate Seismicity, 1/2 in. (13 mm); in High Seismicity, 3/4 in. (19 mm). *(Tier 2: Sec. 13.6.4; Commentary: Sec. A.7.2.4)*	
		X		HR—not required; 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. *(Tier 2: Sec. 13.6.4; Commentary: Sec. A.7.2.5)*	
		X		HR—not required; LS—not required; PR—H. EDGE SUPPORT: The free edges of integrated suspended ceilings with continuous areas greater than 144 ft² (13.4 m²) are supported by closure angles or channels not less than 2 in. (51 mm) wide. *(Tier 2: Sec. 13.6.4 ; Commentary: Sec. A.7.2.6)*	
		X		HR—not required; 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 2,500 ft² (232.3 m²) and has a ratio of long-to-short dimension no more than 4-to-1. *(Tier 2: Sec. 13.6.4; Commentary: Sec. A.7.2.7)*	

Light Fixtures

C	NC	N/A	U	EVALUATION STATEMENT[a,b]	COMMENT
		X		HR—not required; 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. *(Tier 2: Sec. 13.6.4, 13.7.9; Commentary: Sec. A.7.3.2)*	
		X		HR—not required; LS—not required; PR—H. PENDANT SUPPORTS: Light fixtures on pendant supports are attached at a spacing equal to or less than 6 ft. Unbraced suspended fixtures are free to allow a 360-degree range of motion at an angle not less than 45 degrees from horizontal without contacting adjacent components. Alternatively, if rigidly supported and/or braced, they are free to move with the structure to which they are	

17-38. Nonstructural Checklist

C	NC	N/A	U	EVALUATION STATEMENT[a,b]	COMMENT
				attached without damaging adjoining components. Additionally, the connection to the structure is capable of accommodating the movement without failure. *(Tier 2: Sec. 13.7.9; Commentary: Sec. A.7.3.3)*	
X				HR—not required; LS—not required; PR—H. LENS COVERS: Lens covers on light fixtures are attached with safety devices. *(Tier 2: Sec. 13.7.9; Commentary: Sec. A.7.3.4)*	

Cladding and Glazing

C	NC	N/A	U	EVALUATION STATEMENT[a,b]	COMMENT
		X		HR—MH; LS—MH; PR—MH. CLADDING ANCHORS: Cladding components weighing more than 10 lb/ft² (0.48 kN/m²) are mechanically anchored to the structure at a spacing equal to or less than the following: for Life Safety in Moderate Seismicity, 6 ft (1.8 m); for Life Safety in High Seismicity and for Position Retention in any seismicity, 4 ft (1.2 m) *(Tier 2: Sec. 13.6.1; Commentary: Sec. A.7.4.1)*	
		X		HR—not required; LS—MH; PR—MH. CLADDING ISOLATION: For steel or concrete moment-frame buildings, panel connections are detailed to accommodate a story drift ratio by the use of rods attached to framing with oversize holes or slotted holes 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, and the rods have a length-to-diameter ratio of 4.0 or less. *(Tier 2: Sec. 13.6.1; Commentary: Sec. A.7.4.3)*	
		X		HR—MH; 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 by the use of rods attached to framing with oversize holes or slotted holes 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, and the rods have a length-to-diameter ratio of 4.0 or less. *(Tier 2: Sec. 13.6.1; Commentary: Sec. A.7.4.4)*	
		X		HR—not required; LS—MH; PR—MH. THREADED RODS: Threaded rods for panel connections detailed to accommodate drift by bending of the rod have a length-to-diameter ratio greater than 0.06 times the story height in inches for Life Safety in Moderate Seismicity and 0.12 times the story height in inches for Life Safety in High Seismicity and Position Retention in any seismicity. *(Tier 2: Sec. 13.6.1; Commentary: Sec. A.7.4.9)*	
		X		HR—MH; 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. *(Tier 2: Sec. 13.6.1.4; Commentary: Sec. A.7.4.5)*	
		X		HR—MH; LS—MH; PR—MH. BEARING CONNECTIONS: Where bearing connections are used, there is a minimum of two bearing connections for each cladding panel. *(Tier 2: Sec. 13.6.1.4; Commentary: Sec. A.7.4.6)*	

17-38. Nonstructural Checklist

C	NC	N/A	U	EVALUATION STATEMENT[a,b]	COMMENT
		X		HR—MH; LS—MH; PR—MH. INSERTS: Where concrete cladding components use inserts, the inserts have positive anchorage or are anchored to reinforcing steel. *(Tier 2: Sec. 13.6.1.4; Commentary: Sec. A.7.4.7)*	
		X		HR—not required; LS—MH; PR—MH. OVERHEAD GLAZING: Glazing panes of any size in curtain walls and individual interior or exterior panes more than 16 ft^2 (1.5 m^2) in area are laminated annealed or laminated heat-strengthened glass and are detailed to remain in the frame when cracked. *(Tier 2: Sec. 13.6.1.5; Commentary: Sec. A.7.4.8)*	

Masonry Veneer

C	NC	N/A	U	EVALUATION STATEMENT[a,b]	COMMENT
		X		HR—not required; 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 (0.25 m^2), and the ties have spacing no greater than the following: for Life Safety in Low or Moderate Seismicity, 36 in. (914 mm); for Life Safety in High Seismicity and for Position Retention in any seismicity, 24 in. (610 mm). *(Tier 2: Sec. 13.6.1.2; Commentary: Sec. A.7.5.1)*	
		X		HR—not required; LS—LMH; PR—LMH. SHELF ANGLES: Masonry veneer is supported by shelf angles or other elements at each floor above the ground floor. *(Tier 2: Sec. 13.6.1.2; Commentary: Sec. A.7.5.2)*	
		X		HR—not required; LS—LMH; PR—LMH. WEAKENED PLANES: Masonry veneer is anchored to the backup adjacent to weakened planes, such as at the locations of flashing. *(Tier 2: Sec. 13.6.1.2; Commentary: Sec. A.7.5.3)*	
		X		HR—LMH; LS—LMH; PR—LMH. UNREINFORCED MASONRY BACKUP: There is no unreinforced masonry backup. *(Tier 2: Sec. 13.6.1.1, 13.6.1.2; Commentary: Sec. A.7.7.2)*	
		X		HR—not required; LS—MH; PR—MH. STUD TRACKS: For veneer with coldformed steel stud backup, stud tracks are fastened to the structure at a spacing equal to or less than 24 in. (610 mm) on center. *(Tier 2: Sec. 13.6.1.1, 13.6.1.2; Commentary: Sec. A.7.6.)*	
		X		HR—not required; 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. *(Tier 2: Sec. 13.6.1.1, 13.6.1.2; Commentary: Sec. A.7.7.1)*	
		X		HR—not required; LS—not required; PR—MH. WEEP HOLES: In veneer anchored to stud walls, the veneer has functioning weep holes and base flashing. *(Tier 2: Sec. 13.6.1.2; Commentary: Sec. A.7.5.6)*	

17-38. Nonstructural Checklist

		X		HR—not required; LS—not required; PR—MH. OPENINGS: For veneer with cold-formed-steel stud backup, steel studs frame window and door openings. *(Tier 2: Sec. 13.6.1.1, 13.6.1.2; Commentary: Sec. A.7.6.2)*	

Parapets, Cornices, Ornamentation, and Appendages

C	NC	N/A	U	EVALUATION STATEMENT[a,b]	COMMENT
		X		HR—LMH; LS—LMH; PR—LMH. URM PARAPETS OR CORNICES: Laterally unsupported unreinforced masonry parapets or cornices have height-tothickness 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. *(Tier 2: Sec. 13.6.5; Commentary: Sec. A.7.8.1)*	
		X		HR—not required; 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 (3.0 m); for Life Safety in High Seismicity and for Position Retention in any seismicity, 6 ft (1.8 m). *(Tier 2: Sec. 13.6.6; Commentary: Sec. A.7.8.2)*	
		X		HR—H; LS—MH; PR—LMH. CONCRETE PARAPETS: Concrete parapets with height-to-thickness ratios greater than 2.5 have vertical reinforcement. *(Tier 2: Sec. 13.6.5; Commentary: Sec. A.7.8.3)*	
		X		HR—MH; 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 (1.8 m). This evaluation statement item does not apply to parapets or cornices covered by other evaluation statements. *(Tier 2: Sec. 13.6.6; Commentary: Sec. A.7.8.4)*	

Masonry Chimneys

C	NC	N/A	U	EVALUATION STATEMENT[a,b]	COMMENT
		X		HR—LMH; 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. *(Tier 2: Sec. 13.6.7; Commentary: Sec. A.7.9.1)*	
		X		HR—LMH; LS—LMH; PR—LMH. ANCHORAGE: Masonry chimneys are anchored at each floor level, at the topmost ceiling level, and at the roof. *(Tier 2: Sec. 13.6.7; Commentary: Sec. A.7.9.2)*	

17-38. Nonstructural Checklist

Stairs

C	NC	N/A	U	EVALUATION STATEMENT[a,b]	COMMENT
		X		HR—not required; 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. *(Tier 2: Sec. 13.6.2, 13.6.8; Commentary: Sec. A.7.10.1)*	
		X		HR—not required; LS—LMH; PR—LMH. STAIR DETAILS: The connection between the stairs and the structure does not rely on post-installed anchors in concrete or masonry, and the stair details are capable of accommodating the drift calculated using the Quick Check procedure of Section 4.4.3.1 for moment-frame structures or 0.5 in. for all other structures without including any lateral stiffness contribution from the stairs. *(Tier 2: Sec. 13.6.8; Commentary: Sec. A.7.10.2)*	

Contents and Furnishings

	C	NC	N/A	U	EVALUATION STATEMENT[a,b]	COMMENT
N4		X			HR—LMH; LS—MH; PR—MH. INDUSTRIAL STORAGE RACKS: Industrial storage racks or pallet racks more than 12 ft high meet the requirements of ANSI/RMI MH 16.1 as modified by ASCE 7, Chapter 15. *(Tier 2: Sec. 13.8.1; Commentary: Sec. A.7.11.1)*	Storage racks with height-to-depth ratio greater than 3-1 not anchored.
N5		X			HR—not required; LS—H; PR—MH. TALL NARROW CONTENTS: Contents more than 6 ft (1.8 m) 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. *(Tier 2: Sec. 13.8.2; Commentary: Sec. A.7.11.2)*	Tall narrow storage with height-to-depth ratio greater than 3-1 not anchored.
			X		HR—not required; LS—H; PR—H. FALL-PRONE CONTENTS: Equipment, stored items, or other contents weighing more than 20 lb (9.1 kg) whose center of mass is more than 4 ft (1.2 m) above the adjacent floor level are braced or otherwise restrained. *(Tier 2: Sec. 13.8.2; Commentary: Sec. A.7.11.3)*	
			X		HR—not required; LS—not required; PR—MH. ACCESS FLOORS: Access floors more than 9 in. (229 mm) high are braced. *(Tier 2: Sec. 13.6.10; Commentary: Sec. A.7.11.4)*	
			X		HR—not required; 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. *(Tier 2: Sec. 13.7.7 13.6.10; Commentary: Sec. A.7.11.5)*	
			X		HR—not required; 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. *(Tier 2: Sec. 13.8.2; Commentary: Sec. A.7.11.6)*	

17-38. Nonstructural Checklist

Mechanical and Electrical Equipment

	C	NC	N/A	U	EVALUATION STATEMENT[a,b]	COMMENT
			X		HR—not required; LS—H; PR—H. FALL-PRONE EQUIPMENT: Equipment weighing more than 20 lb (9.1 kg) whose center of mass is more than 4 ft (1.2 m) above the adjacent floor level, and which is not in-line equipment, is braced. *(Tier 2: Sec. 13.7.1 13.7.7; Commentary: Sec. A.7.12.4)*	
			X		HR—not required; 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 (34.0 kg), is supported and laterally braced independent of the duct or piping system. *(Tier 2: Sec. 13.7.1; Commentary: Sec. A.7.12.5)*	
N6		X			HR—not required; LS—H; PR—MH. TALL NARROW EQUIPMENT: Equipment more than 6 ft (1.8 m) 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. *(Tier 2: Sec. 13.7.1 13.7.7; Commentary: Sec. A.7.12.6)*	Existing equipment with height-to-depth ratio greater than 3-1 not anchored.
			X		HR—not required; LS—not required; PR—MH. MECHANICAL DOORS: Mechanically operated doors are detailed to operate at a story drift ratio of 0.01. *(Tier 2: Sec. 13.6.9; Commentary: Sec. A.7.12.7)*	
			X		HR—not required; 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. *(Tier 2: Sec. 13.7.1, 13.7.7; Commentary: Sec. A.7.12.8)*	
	X				HR—not required; 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. *(Tier 2: Sec. 13.7.1; Commentary: Sec. A.7.12.9)*	
	X				HR—not required; LS—not required; PR—H. HEAVY EQUIPMENT: Floorsupported or platform-supported equipment weighing more than 400 lb (181.4 kg) is anchored to the structure. *(Tier 2: Sec. 13.7.1, 13.7.7; Commentary: Sec. A.7.12.10)*	
	X				HR—not required; LS—not required; PR—H. ELECTRICAL EQUIPMENT: Electrical equipment is laterally braced to the structure. *(Tier 2: Sec. 13.7.7; Commentary: Sec. A.7.12.11)*	
			X		HR—not required; LS—not required; PR—H. CONDUIT COUPLINGS: Conduit greater than 2.5 in. (64 mm) trade size that is attached to panels, cabinets, or other equipment and is subject to relative seismic displacement has flexible couplings or connections. *(Tier 2: Sec. 13.7.8; Commentary: Sec. A.7.12.12)*	

Piping

C	NC	N/A	U	EVALUATION STATEMENT[a,b]	COMMENT
		X		HR—not required; LS—not required; PR—H. FLEXIBLE COUPLINGS: Fluid and gas piping has flexible couplings. *(Tier 2: Sec. 13.7.3, 13.7.5; Commentary: Sec. A.7.13.2)*	

17-38. Nonstructural Checklist

C	NC	N/A	U	EVALUATION STATEMENT[a,b]	COMMENT
X				HR—not required; 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. *(Tier 2: Sec. 13.7.3, 13.7.5; Commentary: Sec. A.7.13.4)*	
		X		HR—not required; LS—not required; PR—H. C-CLAMPS: One-sided C-clamps that support piping larger than 2.5 in. (64 mm) in diameter are restrained. *(Tier 2: Sec. 13.7.3, 13.7.5; Commentary: Sec. A.7.13.5)*	
		X		HR—not required; 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. *(Tier 2: Sec. 13.7.3, 13.7.5; Commentary: Sec. A.7.13.6)*	

Ducts

C	NC	N/A	U	EVALUATION STATEMENT[a,b]	COMMENT
		X		HR—not required; LS—not required; PR—H. DUCT BRACING: Rectangular ductwork larger than 6 ft^2 (0.56 m^2) in cross-sectional area and round ducts larger than 28 in. (711 mm) in diameter are braced. The maximum spacing of transverse bracing does not exceed 30 ft (9.2 m). The maximum spacing of longitudinal bracing does not exceed 60 ft (18.3 m). *(Tier 2: Sec. 13.7.6; Commentary: Sec. A.7.14.2)*	
		X		HR—not required; LS—not required; PR—H. DUCT SUPPORT: Ducts are not supported by piping or electrical conduit. *(Tier 2: Sec. 13.7.6; Commentary: Sec. A.7.14.3)*	
		X		HR—not required; 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. *(Tier 2: Sec. 13.7.6; Commentary: Sec. A.7.14.4)*	

Elevators

C	NC	N/A	U	EVALUATION STATEMENT[a,b]	COMMENT
		X		HR—not required; LS—H; PR—H. RETAINER GUARDS: Sheaves and drums have cable retainer guards. *(Tier 2: Sec. 13.7.11; Commentary: Sec. A.7.16.1)*	
		X		HR—not required; LS—H; PR—H. RETAINER PLATE: A retainer plate is present at the top and bottom of both car and counterweight. *(Tier 2: Sec. 13.7.11; Commentary: Sec. A.7.16.2)*	
		X		HR—not required; LS—not required; PR—H. ELEVATOR EQUIPMENT: Equipment, piping, and other components that are part of the elevator system are anchored. *(Tier 2: Sec. 13.7.11; Commentary: Sec. A.7.16.3)*	

17-38. Nonstructural Checklist

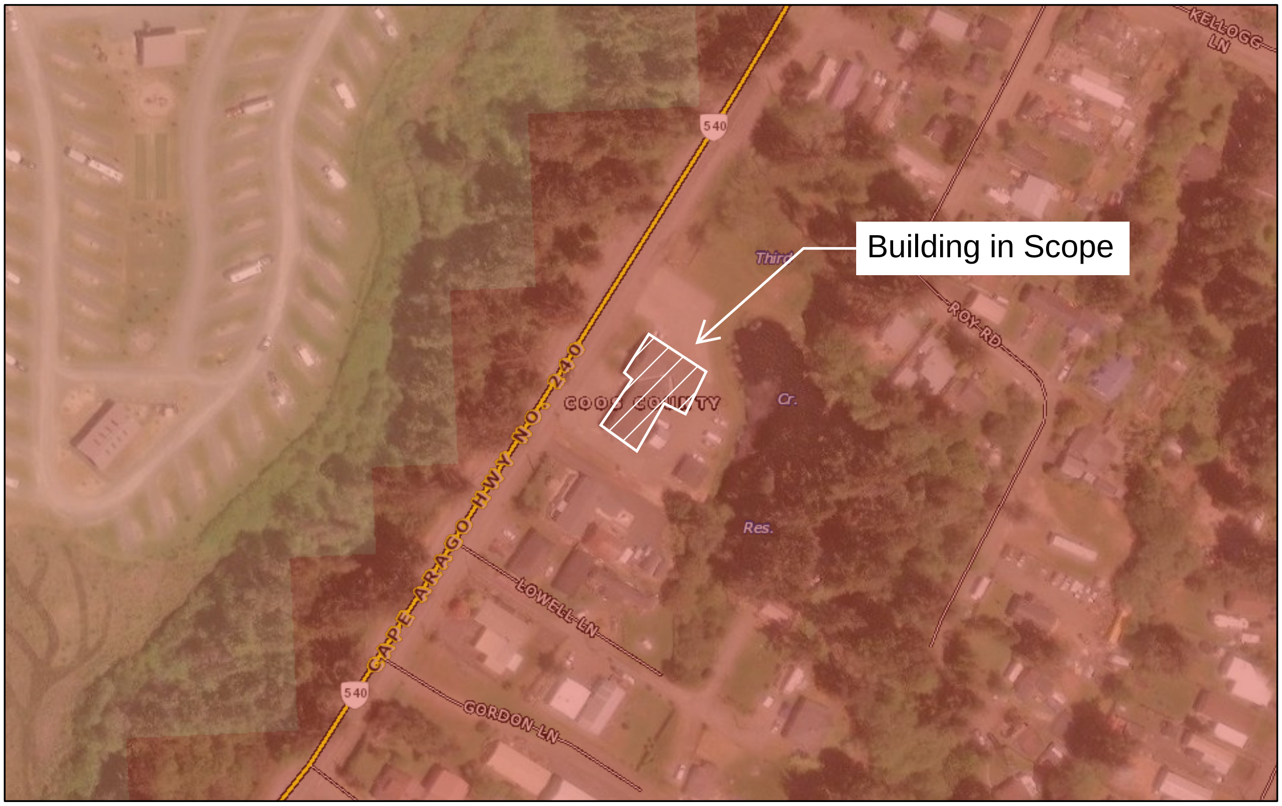
C	NC	N/A	U	EVALUATION STATEMENT[a,b]	COMMENT
		X		HR—not required; LS—not required; PR—H. SEISMIC SWITCH: Elevators capable of operating at speeds of 150 ft/min (0.30 m/min) or faster are equipped with seismic switches that meet the requirements of ASME A17.1 or have trigger levels set to 20% of the acceleration of gravity at the base of the structure and 50% of the acceleration of gravity in other locations. *(Tier 2: Sec. 13.7.11; Commentary: Sec. A.7.16.4)*	
		X		HR—not required; LS—not required; PR—H. SHAFT WALLS: Elevator shaft walls are anchored and reinforced to prevent toppling into the shaft during strong shaking. *(Tier 2: Sec. 13.7.11; Commentary: Sec. A.7.16.5)*	
		X		HR—not required; LS—not required; PR—H. COUNTERWEIGHT RAILS: All counterweight rails and divider beams are sized in accordance with ASME A17.1. *(Tier 2: Sec. 13.7.11; Commentary: Sec. A.7.16.6)*	
		X		HR—not required; 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. *(Tier 2: Sec. 13.7.11; Commentary: Sec. A.7.16.7)*	
		X		HR—not required; LS—not required; PR—H. SPREADER BRACKET: Spreader brackets are not used to resist seismic forces. *(Tier 2: Sec. 13.7.11; Commentary: Sec. A.7.16.8)*	
		X		HR—not required; LS—not required; PR—H. GO-SLOW ELEVATORS: The building has a go-slow elevator system. *(Tier 2: Sec. 13.7.11; Commentary: Sec. A.7.16.9)*	

Note: C = Compliant, NC = Noncompliant, N/A = Not Applicable, and U = Unknown.
[a] Performance Level: HR = Hazards Reduced, LS = Life Safety, and PR = Position Retention.
[b] Level of Seismicity: L = Low, M = Moderate, and H = High

Appendix F

DOGAMI HAZARDS, RVS, GEOTECHNICAL INFORMATION & TSUNAMI CONSULT LETTER

Charleston Fire Station 1 - Liquefaction



October 18, 2023

Liquefaction_Susceptibility_Map

None

Very Low

Low

Moderate

High

Very High

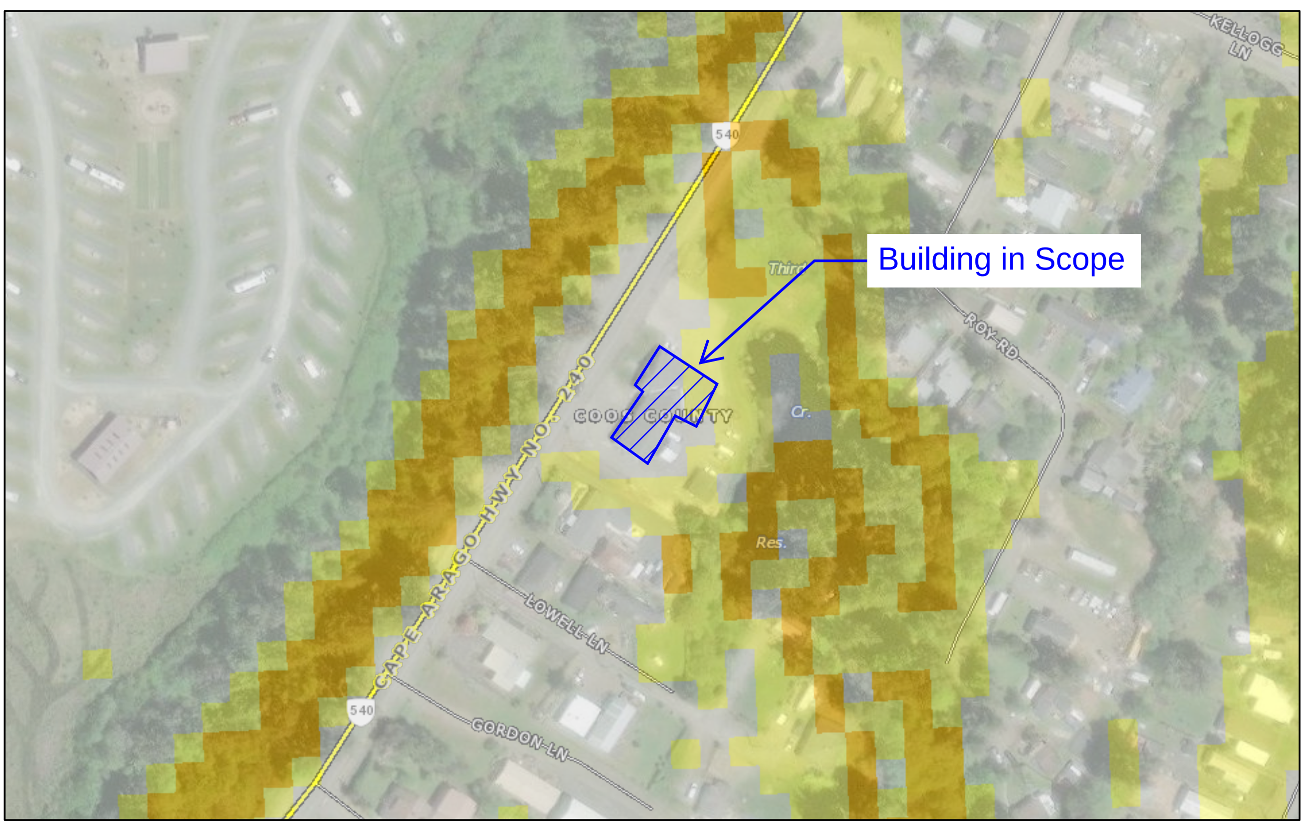
1:2,400

0 0.01 0.03 0.05 mi

0 0.02 0.04 0.09 km

Maxar, Microsoft, Oregon Department of Transportation, Geographic Information Services Unit

Charleston Fire Station 1 - Landslide



October 18, 2023

Detailed Susceptibility Reference Maps

Deep Susceptibility

Low susceptibility to deep landslides

Moderate susceptibility to deep landslides

High susceptibility to deep landslides

Shallow Susceptibility

Low susceptibility to shallow landslides

1:2,400

0 0.01 0.03 0.05 mi

0 0.02 0.04 0.09 km

Maxar, Microsoft, Oregon Department of Transportation, Geographic Information Services Unit

Charleston Fire Station 1 - Flood

October 18, 2023

- Floodway
- 100-Year Floodplain
- 500-Year Floodplain
- 2015 FEMA Q3 Flood
- 2015 State Digitized Flood

1:2,400

0 0.01 0.03 0.05 mi

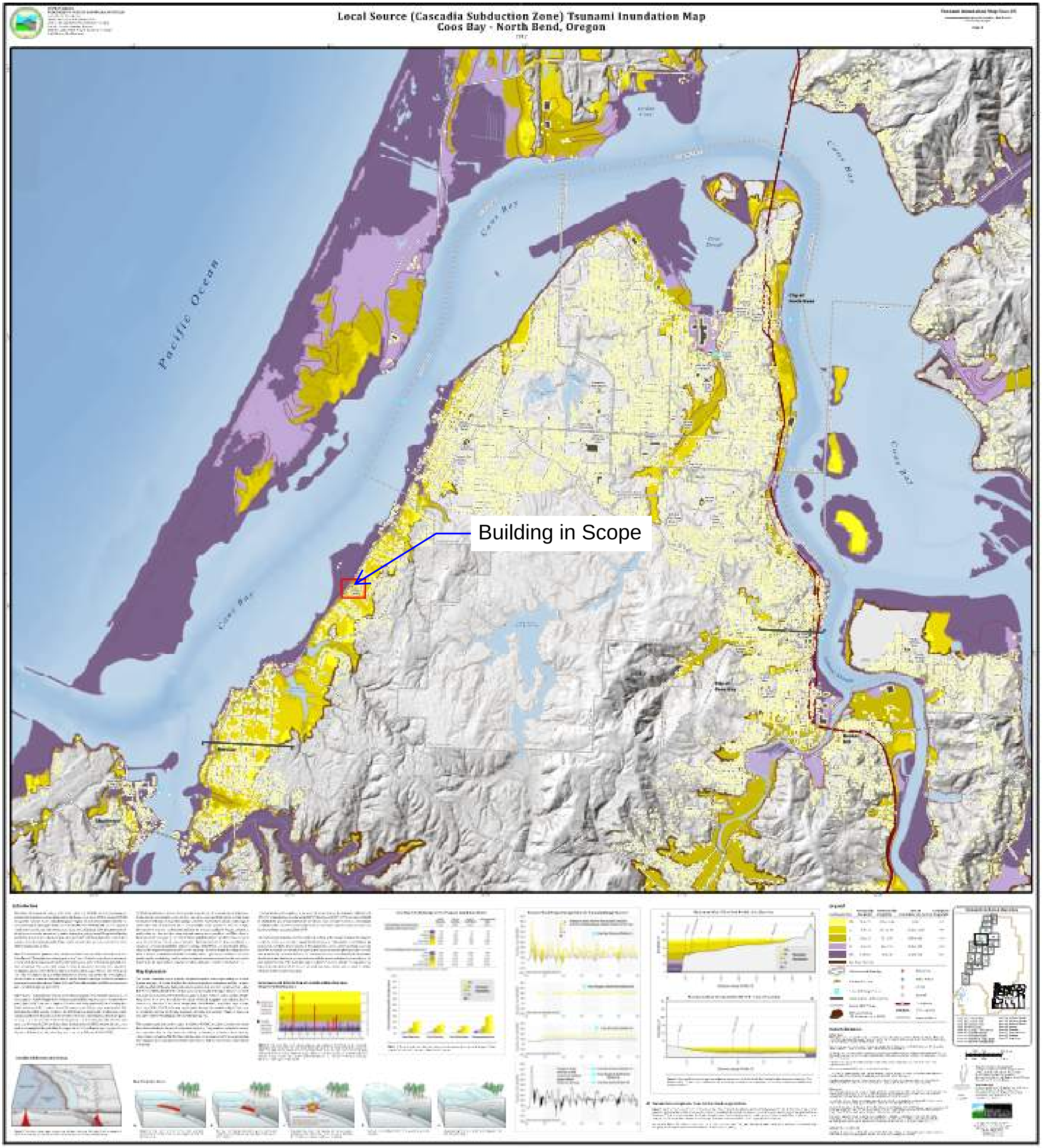
0 0.02 0.04 0.09 km

Maxar, Microsoft, Oregon Department of Transportation, Geographic Information Services Unit

Charleston Fire Station 1 - Tsunami

Legend

Earthquake Size		Average Slip Range (ft)	Maximum Slip Range (ft)	Time to Accumulate Slip (years)	Earthquake Magnitude
	XXL	59 to 72	118 to 144	1,200	~9.1
	XL	56 to 72	115 to 144	1,050 to 1,200	~9.1
	L	36 to 49	72 to 98	650 to 800	~9.0
	M	23 to 30	46 to 62	425 to 525	~8.9
	SM	13 to 16	30 to 36	275 to 300	~8.7
	XXL Wet/Dry Zone				


Local Source (Cascadia Subduction Zone) Tsunami Inundation Map
Coos Bay - North Bend, Oregon
Pacific Ocean
Coos Bay
Coos Bay
Coos Bay
Coos Bay
Building in Scope

Rapid Visual Screening of Buildings for Potential Seismic Hazards
FEMA P-154 Data Collection Form

Coos_fir05AA **Level 1**
VERY HIGH Seismicity

Address: **92342 Cape Arago Highway**
Coos Bay, OR Zip: **97420**
Other Identifiers: **Apparatus Bay (Part A)**
Building Name: **Charleston Fire Station 1**
Use: **Fire Station**
Latitude: **43.37093** Longitude: **-124.29191**
S_S: **1.5** S_1: **0.739**
Screener(s): **Brian Knight** Date/Time: **10/5/2022**

No. Stories: Above Grade: 1 Below Grade: ____ Year Built: **1985** ☐ EST
Total Floor Area (sq. ft.): **3,172 = Part A** Code Year: **1982**
Additions: ☐ None ☒ Yes, Year(s) Built: **1997**

Occupancy: Assembly, Commercial, Emer. Services, ☐ Historic, ☐ Shelter, Industrial, Office, School, ☐ Government, Utility, Warehouse, Residential, # Units: ____

Soil Type: ☐A Hard Rock ☐B Avg Rock ☐C Dense Soil ☒D Stiff Soil ☐E Soft Soil ☐F Poor Soil DNK *If DNK, assume Type D.*

Geologic Hazards: Liquefaction: Yes/No/DNK Landslide: Yes/No/DNK Surf. Rupt.: Yes/No/DNK

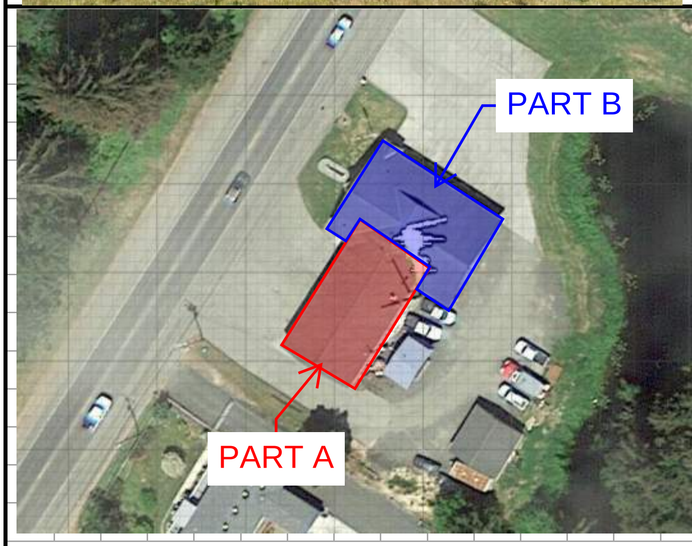
Adjacency: ☐ Pounding ☐ Falling Hazards from Taller Adjacent Building

Irregularities: ☒ Vertical (type/severity) **Out-of-Plane Setback, Severe**
☒ Plan (type) **Torsion**

Exterior Falling Hazards: ☐ Unbraced Chimneys ☐ Heavy Cladding or Heavy Veneer ☐ Parapets ☐ Appendages ☐ Other: ____

COMMENTS:

PART A BUILDING TYPE URM
PART B BUILDING TYPE W1a



SKETCH

☐ Additional sketches or comments on separate page

BASIC SCORE, MODIFIERS, AND FINAL LEVEL 1 SCORE, S_{L1}

FEMA BUILDING TYPE	Do Not Know	W1	W1A	W2	S1 (MRF)	S2 (BR)	S3 (LM)	S4 (RC SW)	S5 (URM INF)	C1 (MRF)	C2 (SW)	C3 (URM INF)	PC1 (TU)	PC2	RM1 (FD)	RM2 (RD)	URM	MH
Basic Score		**2.1**	**1.9**	**1.8**	**1.5**	**1.4**	**1.6**	**1.4**	**1.2**	**1.0**	**1.2**	**0.9**	**1.1**	**1.0**	**1.1**	**1.1**	**0.9**	**1.1**
Severe Vertical Irregularity, V_{L1}		-0.9	-0.9	-0.9	-0.8	-0.7	-0.8	-0.7	-0.7	-0.7	-0.8	-0.6	-0.7	-0.7	-0.7	-0.7	-0.6	NA
Moderate Vertical Irregularity, V_{L1}		-0.6	-0.5	-0.5	-0.4	-0.4	-0.5	-0.4	-0.3	-0.4	-0.4	-0.3	-0.4	-0.4	-0.4	-0.4	-0.3	NA
Plan Irregularity, P_{L1}		-0.7	-0.7	-0.6	-0.5	-0.5	-0.6	-0.4	-0.4	-0.4	-0.5	-0.3	-0.5	-0.4	-0.4	-0.4	-0.3	NA
Pre-Code		-0.3	-0.3	-0.3	-0.3	-0.2	-0.3	-0.2	-0.1	-0.1	-0.2	0.0	-0.2	-0.1	-0.2	-0.2	0.0	0.0
Post-Benchmark		1.9	1.9	2.0	1.0	1.1	1.1	1.5	NA	1.4	1.7	NA	1.5	1.7	1.6	1.6	NA	0.5
Soil Type A or B		0.5	0.5	0.4	0.3	0.3	0.4	0.3	0.2	0.2	0.3	0.1	0.3	0.2	0.3	0.3	0.1	0.1
Soil Type E (1-3 stories)		0.0	-0.2	-0.4	-0.3	-0.2	-0.2	-0.2	-0.1	-0.1	-0.2	0.0	-0.2	-0.1	-0.2	-0.2	0.0	-0.1
Soil Type E (> 3 stories)		-0.4	-0.4	-0.4	-0.3	-0.3	NA	-0.3	-0.1	-0.1	-0.3	-0.1	NA	-0.1	-0.2	-0.2	0.0	NA
Minimum Score, S_{MIN}		*0.7*	*0.7*	*0.7*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*	*0.3*	*0.3*	*0.3*	*0.2*	*0.2*	*0.3*	*0.3*	*0.2*	*1.0*

FINAL LEVEL 1 SCORE, $S_{L1} \geq S_{MIN}$: 0.0

FEMA 154 Collapse Potential = Very High

EXTENT OF REVIEW

Exterior: ☐ Partial ☒ All Sides ☐ Aerial
Interior: ☐ None ☐ Visible ☒ Entered
Drawings Reviewed: ☒ Yes ☐ No
Soil Type Source: **DNK**
Geologic Hazards Source: **USGS.gov**
Contact Person: **Brian Knight**

LEVEL 2 SCREENING PERFORMED?

☐ Yes, Final Level 2 Score, S_{L2} ____ ☒ No
Nonstructural hazards? ☐ Yes ☒ No

OTHER HAZARDS

Are There Hazards That Trigger A Detailed Structural Evaluation?

☐ Pounding potential (unless S_{L2} > cut-off, if known)
☐ Falling hazards from taller adjacent building
☐ Geologic hazards or Soil Type F
☐ Significant damage/deterioration to the structural system

ACTION REQUIRED

Detailed Structural Evaluation Required?

☐ Yes, unknown FEMA building type or other building
☒ Yes, score less than cut-off
☒ Yes, other hazards present
☐ No

Detailed Nonstructural Evaluation Recommended? *(check one)*

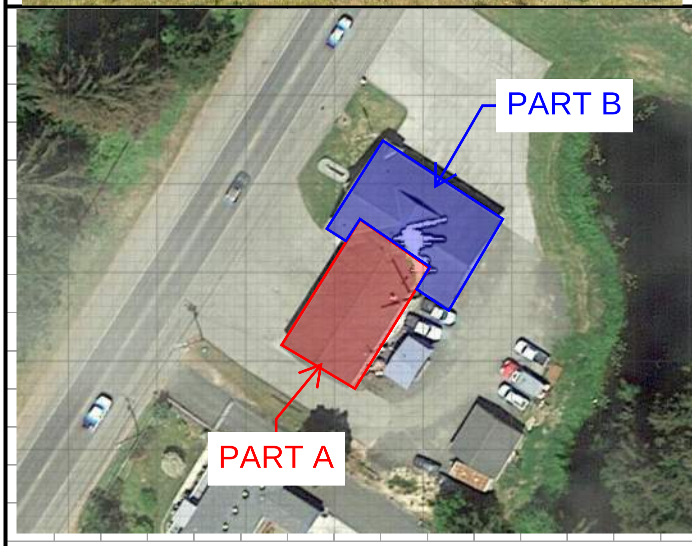
☒ Yes, nonstructural hazards identified that should be evaluated
☐ No, nonstructural hazards exist that may require mitigation, but a detailed evaluation is not necessary
☐ No, no nonstructural hazards identified ☐ DNK

Where information cannot be verified, screener shall note the following: EST = Estimated or unreliable data OR DNK = Do Not Know

Legend: MRF = Moment-resisting frame, BR = Braced frame, RC = Reinforced concrete, SW = Shear wall, URM INF = Unreinforced masonry infill, TU = Tilt up, MH = Manufactured Housing, LM = Light metal, FD = Flexible diaphragm, RD = Rigid diaphragm

Rapid Visual Screening of Buildings for Potential Seismic Hazards
FEMA P-154 Data Collection Form

Coos_fir05AB **Level 1**
VERY HIGH Seismicity



SKETCH

Address: 92342 Cape Arago Highway
Coos Bay, OR **Zip:** 97420
Other Identifiers: Office (Part B)
Building Name: Charleston Fire Station 1
Use: Fire Station
Latitude: 43.37107 **Longitude:** -124.29179
S_S: 1.5 **S_1:** 0.739
Screener(s): Brian Knight **Date/Time:** 10/5/2022

No. Stories: Above Grade: 1 Below Grade: ____ **Year Built:** 1985 ☐ EST
Total Floor Area (sq. ft.): 2,581 = Part B **Code Year:** 1982
Additions: ☐ None ☒ Yes, Year(s) Built: 1997, 2009

Occupancy: Assembly, Commercial, Emer. Services, ☐ Historic, ☐ Shelter, Industrial, Office, School, ☐ Government, Utility, Warehouse, Residential, # Units: ____

Soil Type: ☐ A Hard Rock ☐ B Avg Rock ☐ C Dense Soil ☒ D Stiff Soil ☐ E Soft Soil ☐ F Poor Soil **DNK** *If DNK, assume Type D.*

Geologic Hazards: Liquefaction: Yes/No/DNK Landslide: Yes/No/DNK Surf. Rupt.: Yes/No/DNK

Adjacency: ☐ Pounding ☐ Falling Hazards from Taller Adjacent Building

Irregularities: ☒ Vertical (type/severity) Out-of-Plane Setback, Severe
☒ Plan (type) Reentrant Corners

Exterior Falling Hazards: ☐ Unbraced Chimneys ☐ Heavy Cladding or Heavy Veneer ☐ Parapets ☐ Appendages ☐ Other: ____

COMMENTS:

Building Part A is type URM
Building Part B is type W1a

☐ Additional sketches or comments on separate page

BASIC SCORE, MODIFIERS, AND FINAL LEVEL 1 SCORE, S_{L1}

FEMA BUILDING TYPE	Do Not Know	W1	W1A	W2	S1 (MRF)	S2 (BR)	S3 (LM)	S4 (RC SW)	S5 (URM INF)	C1 (MRF)	C2 (SW)	C3 (URM INF)	PC1 (TU)	PC2	RM1 (FD)	RM2 (RD)	URM	MH
Basic Score		**2.1**	**1.9**	**1.8**	**1.5**	**1.4**	**1.6**	**1.4**	**1.2**	**1.0**	**1.2**	**0.9**	**1.1**	**1.0**	**1.1**	**1.1**	**0.9**	**1.1**
Severe Vertical Irregularity, V_{L1}		-0.9	-0.9	-0.9	-0.8	-0.7	-0.8	-0.7	-0.7	-0.7	-0.8	-0.6	-0.7	-0.7	-0.7	-0.7	-0.6	NA
Moderate Vertical Irregularity, V_{L1}		-0.6	-0.5	-0.5	-0.4	-0.4	-0.5	-0.4	-0.3	-0.4	-0.4	-0.3	-0.4	-0.4	-0.4	-0.4	-0.3	NA
Plan Irregularity, P_{L1}		-0.7	-0.7	-0.6	-0.5	-0.5	-0.6	-0.4	-0.4	-0.4	-0.5	-0.3	-0.5	-0.4	-0.4	-0.4	-0.3	NA
Pre-Code		-0.3	-0.3	-0.3	-0.3	-0.2	-0.3	-0.2	-0.1	-0.1	-0.2	0.0	-0.2	-0.1	-0.2	-0.2	0.0	0.0
Post-Benchmark		1.9	1.9	2.0	1.0	1.1	1.1	1.5	NA	1.4	1.7	NA	1.5	1.7	1.6	1.6	NA	0.5
Soil Type A or B		0.5	0.5	0.4	0.3	0.3	0.4	0.3	0.2	0.2	0.3	0.1	0.3	0.2	0.3	0.3	0.1	0.1
Soil Type E (1-3 stories)		0.0	-0.2	-0.4	-0.3	-0.2	-0.2	-0.2	-0.1	-0.1	-0.2	0.0	-0.2	-0.1	-0.2	-0.2	0.0	-0.1
Soil Type E (> 3 stories)		-0.4	-0.4	-0.4	-0.3	-0.3	NA	-0.3	-0.1	-0.1	-0.3	-0.1	NA	-0.1	-0.2	-0.2	0.0	NA
Minimum Score, S_{MIN}		*0.7*	*0.7*	*0.7*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*	*0.3*	*0.3*	*0.3*	*0.2*	*0.2*	*0.3*	*0.3*	*0.2*	*1.0*

FINAL LEVEL 1 SCORE, $S_{L1} \geq S_{MIN}$: 2.2

FEMA 154 Collapse Potential = Low

EXTENT OF REVIEW

Exterior: ☐ Partial ☒ All Sides ☐ Aerial
Interior: ☐ None ☐ Visible ☒ Entered
Drawings Reviewed: ☒ Yes ☐ No
Soil Type Source: DNK
Geologic Hazards Source: USGS.gov
Contact Person: Brian Knight

LEVEL 2 SCREENING PERFORMED?

☐ Yes, Final Level 2 Score, S_{L2} ____ ☒ No
Nonstructural hazards? ☐ Yes ☒ No

OTHER HAZARDS

Are There Hazards That Trigger A Detailed Structural Evaluation?

☐ Pounding potential (unless S_{L2} > cut-off, if known)
☐ Falling hazards from taller adjacent building
☐ Geologic hazards or Soil Type F
☐ Significant damage/deterioration to the structural system

ACTION REQUIRED

Detailed Structural Evaluation Required?

☐ Yes, unknown FEMA building type or other building
☐ Yes, score less than cut-off
☒ Yes, other hazards present
☐ No

Detailed Nonstructural Evaluation Recommended? *(check one)*

☒ Yes, nonstructural hazards identified that should be evaluated
☐ No, nonstructural hazards exist that may require mitigation, but a detailed evaluation is not necessary
☐ No, no nonstructural hazards identified ☐ DNK

Where information cannot be verified, screener shall note the following: EST = Estimated or unreliable data OR DNK = Do Not Know

Legend: MRF = Moment-resisting frame; BR = Braced frame; RC = Reinforced concrete; SW = Shear wall; URM INF = Unreinforced masonry infill; TU = Tilt up; MH = Manufactured Housing; LM = Light metal; FD = Flexible diaphragm; RD = Rigid diaphragm

Geotechnical ▪ Environmental ▪ Special Inspections
Columbia West Engineering, Inc

Vancouver, Washington • Phone: 360-823-2900
Portland, Oregon • Phone: 971-384-1666
www.columbiawestengineering.com

October 10, 2024

WRK Structural and Seismic Engineers
215 West 12th Street, Suite 202
Vancouver, WA 98660

Attn: Brian Knight

Re: Preliminary Geologic Hazards Assessment
Charleston Fire Department – Station 1
92342 Cape Arago Highway
Coos Bay, Oregon
CWE Project: WRK-4-01-8

INTRODUCTION

Columbia West Engineering, Inc. (Columbia West) is pleased to provide this preliminary geologic hazards assessment for Station 1 of the Charleston Fire Department in Coos Bay, Oregon. The station is located at 92342 Cape Arago Highway.

This assessment will be used to support applications for funding of possible improvements to the facility. Our work should be considered preliminary and geotechnical design and construction recommendations are not provided in this assessment.

SITE CONDITIONS

SURFACE CONDITIONS

Surface conditions at the station are based on information reviewed on GoogleEarth™ and topographic data obtained from the Oregon Department of Geology and Mineral Industries (DOGAMI) LiDAR viewer website.[1,2] Topography was downloaded from the LiDAR website and viewed in ArcGIS.

The station is located on an elevated terrace above the outlet of Coos Bay to the Pacific Ocean. The station is bounded by undeveloped land to the north and east, residential property to the south, and Cape Arago Highway to the west. The existing station consists of an operations/office area to the north and three apparatus bays to the south. A small storage building is also present in the extreme east portion of the property. The station is generally surrounded by asphalt concrete parking areas and drive aisles. A drainage/wetland area with a small pond is present east of the improvements at the site.

The topography at the station is flat to gently sloping with an average elevation of 40 feet. Approximately 100 feet west of the station and across Cape Arago Highway, the topography slopes downward at 2H:1V to an elevation of approximately 10 feet toward the outlet of Coos

[1] GoogleEarth: https://earth.google.com
[2] DOGAMI LiDAR: https://gis.dogami.oregon.gov/maps/lidarviewer/

Bay. Approximately 100 feet east of the station, the topography grades upward to an elevation of approximately 50 feet at grades between 2H:1V and 3H:1V. The topography north and south of the station is relatively flat.

SUBSURFACE CONDITIONS

Geologic Mapping

Based on geologic mapping, the near-surface geologic conditions at the station consist of Pleistocene-aged Seven Devils marine terrace deposits consisting of weakly consolidated to unconsolidated sands.[3]

Web Soil Survey Mapping

The Natural Resources Conservation Service Web Soil Survey indicates the near-surface soil at the site consists of Bandon and Bullards sandy loam comprised of approximately 5 feet of sand.[4] The materials are described as being derived from sandy marine deposits. The soil is defined as having moderately high to high saturated hydraulic conductivity.

LiDAR Review

Columbia West reviewed grayscale LiDAR mapping from DOGAMI to observe topographic landforms and past landsliding in the area. The LiDAR shading clearly shows the drainage/wetland area and small slopes to the west and east of the site. The slope east of the site appears uniform and landslide features are not apparent. The slope west of Cape Arago Highway is slightly irregular and may include landslide or erosional features.

Water Well Logs

We reviewed available water well logs from the Oregon Water Resources Department as part of this assessment.[5] Well logs in the site vicinity indicate sand with variable proportions of silt is present in the upper 20 feet below ground surface (BGS). Below a depth of approximately 20 feet BGS the subsurface conditions transition to sand with low fines content. The sand extends to depths of more than 70 feet BGS. Several well logs indicate that the sand becomes denser at a depth of approximately 50 feet BGS. Groundwater is typically present between depths of 15 and 20 feet BGS on nearby wells logs.

Site Exploration

A cone penetration test (CPT) was completed at the fire station to assess the preliminary liquefaction potential at the site. The CPT was advanced to refusal at a depth of approximately 45 feet BGS. Subsurface conditions in the CPT were interpreted as sand with varying levels of fines (silt and clay) from the ground surface to the maximum depth of the CPT. Pore water pressure dissipation testing in the CPT indicates the groundwater is approximately 15 feet BGS.

---

[3] Madin, I.P., McInelly, G.W., and Kelsey, H.M., Geologic map of the Charleston quadrangle, Coos County, Oregon Department of Geology and Mineral Industries, GMS 94, 1:24,000
[4] Web Soil Survey: https://websoilsurvey.nrcs.usda.gov/app/
[5] Oregon Water Resources Department: https://apps.wrd.state.or.us/apps/gw/wl_well_report_map/Default.aspx

MAPPED GEOLOGIC HAZARDS

We reviewed mapped geologic hazards presented on the DOGAMI HazVu website in the approximate time period this assessment was prepared.[6] A summary of geologic hazards at the site is presented in Table 1.

Table 1. DOGAMI HazVu Geologic Hazard Summary

Location	Cascadia Earthquake Expected Shaking	Flood Hazard Zone	Tsunami Hazard Zone	Volcano Hazard Zone	Liquefaction Hazard	Fault Rupture (closest fault)	Landslide Hazard Zone	Closest Historical Landslide
Charleston FD – Station 1	Severe	None	Yes - XXL1 Zone	None	High	None (>25 miles)	Moderate	None

DISCUSSION

GENERAL

Mapped geologic hazards that may affect the site are Cascadia earthquake shaking, tsunamis, liquefaction, and landsliding. A discussion of each is presented below.

CASCADIA EARTHQUAKE SHAKING

The Cascadia subduction zone is the region where the Juan de Fuca Plate is being subducted beneath the North American Plate. This subduction is occurring in the coastal region between Vancouver Island and northern California. Evidence has accumulated suggesting that this subduction zone has generated eight great earthquakes in the last 4,000 years, with the most recent event occurring approximately 300 years ago.[7] The fault trace is mapped approximately 50 to 120 kilometers off the Oregon Coast. A subduction interface earthquake that occurs between the interface of the Juan de Fuca Plate and North American Plate is capable of generating earthquake magnitudes of M_W 9.0, which will result in strong shaking that will diminish with distance away from the interface of the tectonic plates.

The site is located approximately 1.75 miles east of the Oregon Coast. Based on the distance from the interface of the tectonic plates to the site, severe shaking is expected. Due to the potential for liquefaction at the site, a site-specific seismic evaluation should be completed to determine the appropriate seismic design parameters for the station.

TSUNAMI

The station is mapped in the XXL1 Local Tsunami evacuation zone. Based on correspondence with WRK Structural and Seismic Engineers, we understand this hazard has been discussed with DOGAMI and the Charleston Fire Chief and improvements are acceptable, provided the fire district understands risks with the XXL1 shaking scenario.

[6] DOGAMI HazVu: https://gis.dogami.oregon.gov/maps/hazvu/
[7] Weaver, C.S. and Shedlock, K.M., 1991, Program for earthquake hazards assessment in the Pacific Northwest: U.S. Geological Survey Circular 1067, 29 pgs.

LIQUEFACTION
Liquefaction is caused by a rapid increase in pore water pressure that reduces the effective stress between soil particles. Granular soil, which relies on interparticle friction for strength, undergoes a loss of strength until the excess pore pressures dissipate. In general, loose, saturated sand soil with low silt and clay content is the most susceptible to liquefaction. Silty soil with low plasticity can be susceptible to strain softening under relatively higher levels of ground shaking. Strain-softened soil has volumetric strains much smaller than liquefiable soil due to matrix effects.

We completed preliminary analysis of liquefaction potential at the site using information collected in the CPT. Analysis indicates the sand between approximately 22 and 32 feet BGS is potentially liquefiable during a design-level seismic event and we anticipate seismic settlement of up to 4 inches could occur. Accordingly, we anticipate that micropiles that extend into the non-liquefiable sand below 32 feet BGS will be required to support potential improvements.

The analysis above is preliminary and a drilled boring will need to be completed at the site to refine the analysis and provide final design and construction recommendations for potential improvements.

LANDSLIDING
Portions of the site are mapped as having a moderate landslide hazard. The landslide hazard is associated with the slopes west and east of the site. As previously described, these slopes range from 20 to 30 feet in height with maximum gradients of 2H:1V. All portions of the station are located more than 100 feet from the top or bottom of these slopes. Due to the heights and the distances of the slopes from the station, any potential landsliding that could occur would not encroach on the fire station. Accordingly, it is our opinion that landsliding is not a design consideration at the site.

CONCLUSIONS
Based on review of available information, there is a low risk of geologic hazards, with the exception of liquefaction, affecting the fire station and proposed improvements. If improvements are completed, we anticipate that micropiles will be required and foundations will need to be structurally tied together.

Our conclusions are based on available information, and a geotechnical investigation and report may be required to confirm the assumptions in this assessment and provide geotechnical design and construction recommendations for future work.

LIMITATIONS
We have prepared this assessment for use by WRK Structural and Seismic Engineers for use in grant applications for improvements to the described facilities. The information in this assessment is based on review of available literature and conclusions, and interpretations should not be construed as warranty of the subsurface conditions and are not applicable to other sites.

Within the limitations of scope, schedule, and budget, our services have been executed in accordance with generally accepted practices in this area at the time this report was prepared. No warranty, express or implied, should be understood.

Please do not hesitate to contact us if you have questions or require additional information.

Sincerely,

Nick Paveglio, PE
Principal Engineer

REGISTERED PROFESSIONAL ENGINEER
86690
OREGON
May 8, 2012
NICHOLAS N. PAVEGLIO
EXPIRES: 12/31/24

NNP:kat

Attachments

Document ID: WRK-4-01-8-101024-geol.docx

Oregon
Tina Kotek, Governor

Department of Geology and Mineral Industries
Coastal Field Office
PO Box 1033
Newport, OR 97365
(541) 819-9023
www.oregon.gov/dogami
www.OregonTsunami.org

7 July 2023

Ms. Gloria Zacharias, PCED
Seismic Program & Policy Coordinator
Business Oregon.

Dear Gloria:

Re: Seismic Rehabilitation Grant Program – Charleston Fire Station Seismic Upgrade

Business Oregon overseas seismic rehabilitation grants for critical facilities built throughout the State of Oregon, including facilities located in a tsunami zone. The Charleston Fire District is requesting financial support to seismically reinforce their Fire station 1 building located at 92342 Cape Arago Highway, Coos Bay, OR 97420. To receive their seismic grant, Charleston is required to consult with DOGAMI to evaluate their tsunami inundation risk and to discuss mitigation approaches. This letter describes the results of our consultation with Mr. Brian Knight (WRK Engineers) and Fire Chief Mark Sneddon held via Teams video conferencing on 17 May 2023. Also, in attendance at the meeting was Mr. Jason McClaughry (DOGAMI Program Manager) and Dr. Lalo Guerrero (DOGAMI Geologic Hazard Specialist).

Figure 1 presents a tsunami inundation map for the area surrounding the Charleston Fire Station 1 site[1] and is a derivative of the original Tsunami Inundation Map series (TIMs) published by DOGAMI in 2013. **Figure 1** includes five tsunami inundation scenarios developed by DOGAMI termed small (SM1), medium (M1), Large (L1), eXtra-Large (XL), eXtra-eXtra-Large (XXL), which are based on five different modeled earthquake events of increasing magnitude (and hence accumulated fault slip) occurring on the Cascadia subduction zone (CSZ) (Witter and others, 2011). Of these, the XXL1 tsunami inundation scenario is associated with the largest amount of accumulated slip and accordingly produces the largest tsunami and for that reason was adopted by the State of Oregon for tsunami evacuation purposes. According to Witter and others (2013), the defined earthquake size classes correspond to approximate recurrence rates as follows: SM1, 1/2,000 yr; M1, 1/1,000 yr; L1, 1/3,333 yr; and XL, < 1/10,000 yr; recurrence for the XXL1 event is not known. These recurrences are derived from a record of 19 great earthquakes that triggered tsunamis over the past 10,000 years, with the average recurrence being ~500 years. Of note also, the last known event took place 323 years ago in 1700.

In addition to the scenarios developed by DOGAMI, the American Society of Civil Engineers (ASCE) produced a 2,475-year probabilistic tsunami inundation zone that is used for engineering purposes, particularly for the design of risk category IV buildings. This line is included for information purposes.

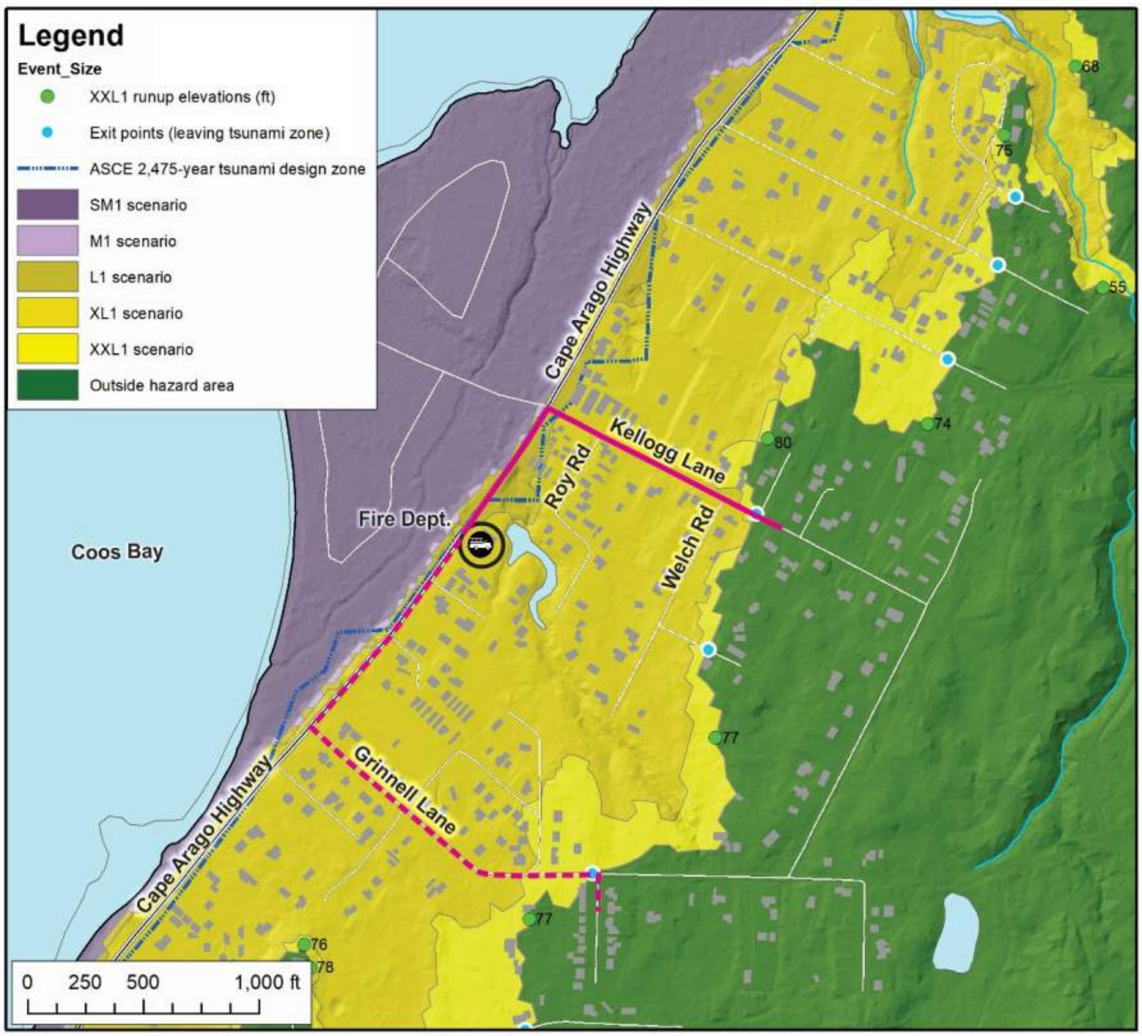
Included in **Figure 1** is the location of the Fire Station (circled) and the currently recognized tsunami evacuation routes (solid magenta lines) and is based on recent evacuation modeling undertaken by DOGAMI staff (Gabel and others, 2019). As can be seen in **Figure 1**, the fire station is not affected by

[1] https://www.oregongeology.org/pubs/tim/p-TIM-Coos-05.htm

the SM1, M1 or L1 local CSZ scenarios but is inundated by events greater than and including the XL1 scenario. In addition, the fire station is outside of the 2,475-year tsunami design zone developed by the ASCE. As can be seen in **Figure 1** the fire station is relatively close to high ground, and evacuation out of the inundation zone may be accomplished along the following routes:

- an initial northward route along the Cape Arago Highway, before turning east on Kellogg Lane (total distance ~1,700 ft / 0.32 mi). This is the preferred evacuation route that is incorporated into the fire stations emergency plans for a Cascadia event.
- a second evacuation route could also be used. This additional route travels initially south along the Cape Arago Highway, before turning east on Grinnell Lane (total distance ~2,600 ft / 0.49 mi). This is a back-up route should evacuation along Kellogg Lane become compromised.

Figure 1: Map showing the five Cascadia tsunami inundation zones for the Charleston Fire Station 1 site, ASCE 2,475-year tsunami design zone, along with the existing planned evacuation route (solid magenta line) and optional secondary evacuation route (dash magenta line).



Mr. Knight provided an overview of the planned fire station seismic remediation, while Fire Chief Sneddon spoke about the preparation work they have been doing locally. The goal of the seismic remediation is to enable the crew (two people on shift, 24/7) and equipment to initially survive the earthquake. However, we did discuss the added challenges they face with respect to a Cascadia tsunami inundating this area. As noted above, the fire station is affected by tsunamis greater than and including an XL1 scenario. However, this scenario has a low probability of occurrence relative to the other scenarios (e.g. M1), which would not directly impact the site. Rebuilding the fire station outside of the tsunami zone was discussed, however, this is not feasible at this time. Fire Chief Sneddon also discussed how they might respond following the disaster, including establishing an Emergency Operations Center up on Crown Point Road outside the tsunami zone. This site is well south of the Charleston Fire Station 1 location. Although access to Barview from Kellogg Lane along various forest roads outside of the inundation zone may be feasible, fire crews are likely to have to contend with damage to the forest roads, including downed trees. Access across Joe Ney Slough is also likely to be compromised due to the likely failure of the bridge. Consideration of an alternative EOC in the vicinity of Barview should therefore be also considered.

Based on our 17 May 2023 meeting it is apparent that the Charleston Fire Station staff are fully aware of the challenge posed by a Cascadia tsunami event. For example, the Fire Chief recognizes that a Cascadia tsunami is expected to arrive at approximately 23 minutes after the onset of earthquake shaking and will fully inundate the community within 26 minutes; the earthquake shaking could be 3-5 minutes long depending on the magnitude of the earthquake. Overall, the Fire Station is located close to high ground, the distance being about 1,700 ft (0.32 mi) along the primary route. Staff will need to move quickly in order to reach high ground, as the tsunami is expected to reach the site approximately 18 minutes after the main earthquake shaking ceases.

Please let me know if you have further questions or need additional assistance.

Jonathan Allan, Ph.D., RG
Coastal Geomorphologist

Cc:
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