Seismic Evaluation Report For:

LOOKINGGLASS FIRE STATION

7173 Lookingglass Rd, Roseburg, OR 97471
Lookingglass Rural Fire District

Prepared By:
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JULY 08, 2014
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EXPIRES: 06-30-22

ZCS
ENGINEERING
ARCHITECTURE

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	Area A	Y	1978	RM-2	Y	N
*** Entries required **ONLY** for building parts included in proposed seismic retrofit						
Nonstructural deficiencies posing life safety risk **MUST** be included in the scope of work and budget.						
Seismic fragility inputs for existing buildings with **previous seismic retrofits MUST** be adjusted to reflect previous seismic retrofit measures completed for a building part.						
Total Retrofit Cost	$2,492,350					
Retrofit Square Feet	6,000					
Retrofit Cost per Square Foot	$415					
Is the campus within a tsunami, FEMA flood zone, landslide/slope instability, liquefaction potential or other high hazard area? **If so, provide documentation.**						No, see Appendix D

Engineering Report Checklist		
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1.0 Project Introduction

Lookingglass Rural Fire District is located in Roseburg, Oregon in Douglas County. The Department operates 1 station located within the community which is the property of interest, Lookingglass Fire Station. The Department has retained ZCS Engineering and Architecture (ZCS) to perform a seismic evaluation of Lookingglass Fire Station that provides the Department with an objective, comprehensive analysis of the condition of the building's seismic resisting systems. The purpose of the evaluation is to determine the seismic lateral resisting system deficiencies when compared to buildings designed using modern building codes. This evaluation was performed in accordance with the American Society of Civil Engineers "Seismic Rehabilitation of Existing Buildings ASCE/SEI 41-17".

SEISMIC EVALUATION SNAPSHOT	
Street Address	7173 Lookingglass RD, Roseburg, OR 97471
Evaluation Standard	ASCE 41-17 (Tier 1 Analysis)
Target Building Performance Level	Immediate Occupancy – BSE-1E; Life Safety – BSE-2E
Target Non-Structural Performance Level	Position Retention – BSE-1E; Hazards Reduced – BSE-2E
ASCE 41 Building Type	RM-2
Site Soil Classification	D
Seismic Zone Hazard Level	Moderately High
Cost Estimate	$2,492,350

2.0 Building Description

The Lookingglass Fire Station (Area A) was built in 1978 and is composed of precast concrete roof panels that are supported by the Exterior reinforced masonry walls on three sides of the building. At the apparatus bay doors, a continuous concrete beam supports the precast panels. The exterior CMU wall and pilasters are supported on conventional strip and spread footings. The floor of the fire station is a slab on grade with a maintenance pit that is no longer in use. Inside of the building is a mezzanine with offices and a briefing room below. The mezzanine is supported on reinforced masonry walls and conventional 2x stud walls. The floor is constructed 2x floor joist and glulam beams with plywood floor sheathing.

Photographs of the building parts included in this report are located in Appendix A.

A
Construction Year: 1978
Building Name: Fire Station
Construction Type: RM-2
In Scope?: Yes

Figure 1
Lookingglass Fire Station Seismic Retrofit Key

3.0 Definition of Building Types

After reviewing the facility and the existing drawings we have determined the lateral system is defined as RM-2. Per ASCE 41-17 the subject structure's lateral system is defined as:

Reinforced Masonry Bearing Walls with Stiff Diaphragms RM2 – These buildings are similar to RM1 buildings, except that the diaphragms consist of metal deck with concrete fill, precast concrete planks, tees, or double-tees, with or without a cast-in-place concrete topping slab and are stiff relative to the walls. The floor and roof framing is supported on interior steel or concrete frames or interior reinforced masonry walls. The foundation system is permitted to consist of a variety of elements.

4.0 Seismic Evaluation Methodology

The subject structure was evaluated using information gathered from site observations, available historic construction documents, and interviews with District staff. This information was then utilized to perform a structural evaluation as outlined in the American Society of Civil Engineer's "Seismic Evaluation and Retrofit of Existing Buildings – ASCE 41-17" (ASCE 41-17). ASCE 41-17 is referenced as the standard for seismic evaluations of existing buildings by the International Existing Building Code (IEBC) which is referenced by the Oregon Structural Specialty Code (OSSC). Further, ASCE 41-17 is the evaluation tool required by the Seismic Rehabilitation Grant Program for grant applications.

ASCE 41-17 provides several levels of evaluation (Tiers 1-3) depending on the level of evaluation and/or retrofit being performed. The Tier 1 evaluation is a quick checklist selected based on the type of construction and the performance objective of the building and is the baseline tool for preliminary seismic evaluations. In the case of this evaluation, a Tier 1 was performed to identify the likely structural deficiencies requiring retrofit to meet the performance objective stated below.

The OSSC classifies buildings into risk categories based on the type of building and occupancy type. The building's risk category informs the required performance objective post retrofit. Risk categories I and II cover low risk structures. Risk category III includes school buildings that are not required to be used as emergency shelters and are relatively low occupancy. Risk category IV includes emergency service buildings and school buildings that are required to be designed as emergency shelters (high occupancy spaces). Figure 2, below, identifies the performance objective for each risk category.

The primary objective of the adjusting performance objectives relative to risk category is to ensure that the subject building is capable of performing in the necessary manner following a seismic event. In the case of a risk category III building, the intention is to ensure that the building is adequately stable following an earthquake to provide egress for occupants out of the building. Prior to reoccupation, the building would need evaluated and significant structural damage preventing reoccupation may be present. For risk category IV structures, the intent is that the building can be inspected then immediately reoccupied following a seismic event to function in its intended role as an emergency service building or as a high occupancy space capable of acting as an emergency structure.

In accordance with the table below, this section A of this building is categorized as a risk category IV structure(s) and WAS/WERE evaluated to meet the Limited Safety structural performance and Hazards Reduced nonstructural performance level for BSE-2E loading and the Immediate Occupancy structural performance and Position Retention nonstructural performance level for BSE-1E loading.

Table 2-2. Scope of Assessment Required for Tier 1 and Tier 2 with the Basic Performance Objective for Existing Buildings (BPOE)

Risk Category	Tier 1 and 2[a]	
	BSE-1E	BSE-2E
I and II	Not evaluated	Collapse Prevention Structural Performance
	Life Safety Nonstructural Performance (3-C)	Hazards Reduced Nonstructural Performance[b] (5-D)
III	Not evaluated	Limited Safety Structural Performance[c]
	Position Retention Nonstructural Performance (2-B)	Hazards Reduced Nonstructural Performance[b] (4-D)
IV	Immediate Occupancy Structural Performance	Life Safety Structural Performance[d]
	Position Retention Nonstructural Performance (1-B)	Hazards Reduced Nonstructural Performance[b] (3-D)

[a] For Tier 1 and 2 assessments of Risk Categories I–III, Structural Performance for the BSE-1E is not explicitly evaluated.
[b] Compliance with ASCE 7 provisions for new construction is deemed to comply.
[c] For Risk Category III, the Tier 1 screening checklists shall be based on the Collapse Prevention Performance Level (S-5), except that checklist statements using the Quick Check procedures of Section 4.4.3 shall be based on M_s factors taken as the average of the values for Life Safety and Collapse Prevention.
[d] For Risk Category IV, the Tier 1 screening checklists shall be based on the Collapse Prevention Performance Level (S-5), except that checklist statements using the Quick Check procedures of Section 4.4.3 shall be based on M_s factors for Life Safety.

Figure 2

Building Performance Objectives

Source: Table 2-2, ASCE 41-17: American Society of Civil Engineers – Seismic Evaluation and Retrofit of Existing Buildings

5.0 Seismicity

Seismic design is based on site specific parameters that relate to the location of the building relative to faults and the soil that supports the building. The United States Geologic Survey has developed seismic design data that is utilized to perform the calculations specified in ASCE 41-17. The table below summarizes the factors appropriate for computing the seismic lateral loads for the design earthquake specified in ASCE 41-17.

SITE SPECIFIC SEISMICITY	
Soil Density	Dense
ASCE 7-16 Soil Classification	Site Class D
BSE-1E:	
S_{xs}	0.207
S_{x1}	0.159
BSE-2E:	
S_{xs}	0.788
S_{x1}	0.657
Soil Condition Amplification Factors (F_V, F_A)	F_v = 2.4 - F_a = 1.6
ASCE 41 Site Seismicity	Moderately High

Source: SEAOC and OSHPD Seismic Design Maps, https://seismicmaps.org/

6.0 Site Specific Hazards

Site specific hazards were assessed as part of our engineering evaluation. The hazards evaluated in our analysis included liquefaction, slope failure, surface fault rupture, and tsunami potential. These potential hazards were evaluated using ASCE 41-17 guidelines, as well as information provided by the online Oregon HazVu: Statewide Geohazards Viewer, maintained by the Department of Geology and Mineral Industries (DOGAMI). Tsunami risk was evaluated using the ASCE Tsunami Hazard Tool. Results from the HazVu analysis are included in Appendix D. Unless noted below, the hazards listed above are not present at the site.

Liquefaction

This project is located within a liquefaction hazard area as identified by the DOGAMI Oregon HazVu. Due to the severity of the hazard and our knowledge of the local subsurface conditions, we have included mitigation for the hazard within the scope of the retrofit.

7.0 Deficiencies and Repairs

The table below summarizes both the structural and nonstructural deficiencies noted in the Tier 1 evaluation and states both the proposed retrofit methodology and the plan key note that corresponds to the scope items in the preliminary plans and the cost estimate. See Appendix B for complete Tier 1 check sheets. Drawings illustrating the proposed retrofit measures are attached in Appendix C.

Tier 1 Deficiency Description	Deficiency Statement	Repair Statement	Plan Key Note
LOAD PATH	The structure does not contain a complete, well-defined load path, including structural elements and connections, that serves to transfer the inertial forces associated with the mass of all elements of the building to the foundation.	Provide a complete, well-defined load path by installing new elements and connections as needed to transfer inertial forces from all elements of the building to the foundation.	S1
MEZZANINES	Interior mezzanine levels are not braced independently from the main structure or are not anchored to the seismic-force-resisting elements of the main structure.	Provide an independent bracing system and anchor the mezzanine to the seismic-force-resisting elements of the main structure.	S2
LIQUEFACTION	Liquefaction-susceptible, saturated, loose granular soils that could jeopardize the buildings seismic performance exist in the foundation soils at the depths within 50 ft under the building.	Provide deep foundations solutions to depths as indicated in future geotech report. Provide new grade beams and pile caps as required for deep foundations.	S3
TIES BETWEEN FOUNDATION ELEMENTS	The foundation does not have 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.	Provide grade beams to tie existing foundations together.	S4
SHEAR STRESS CHECK	The shear stress in the reinforced masonry shear walls, calculated using the Quick Check procedure of Section 4.4.3.3, is greater than 70 lb/in.2	Provide additional lateral resisting elements.	S5
WOOD LEDGERS	The connection between the wall panels and the diaphragm induces cross-grain bending or tension in the wood ledgers.	Install new out-of-plane anchorage.	S6
TOPPING SLAB	Precast concrete diaphragm elements are not interconnected by a continuous reinforced concrete topping slab.	strengthen existing precast panel connections using fiber-reinforced polymer (FRP).	S7

EMERGENCY POWER	Equipment used to power or control Life Safety systems is not anchored or braced.	Anchor and brace equipment used to power or control Life Safety system.	N1
EMERGENCY LIGHTING	Emergency and egress lighting equipment is not anchored or braced.	Anchor and brace emergency and egress lighting equipment.	N2
HAZARDOUS MATERIAL EQUIPMENT	Equipment mounted on vibration isolators and containing hazardous material is not equipped with restraints or snubbers.	Install restraints or snubbers for equipment mounted on vibration isolators and containing hazardous material.	N3
HAZARDOUS MATERIAL STORAGE	Breakable containers that hold hazardous material, including gas cylinders, are not restrained by latched doors, shelf lips, wires, or other methods.	Provide restraints for breakable containers that hold hazardous material.	N4
HAZARDOUS MATERIAL DISTRIBUTION	Piping or ductwork conveying hazardous materials is not braced or otherwise protected from damage that would allow hazardous material release.	Brace piping or ductwork conveying hazardous materials.	N5
SHUTOFF VALVES	Piping containing hazardous material, including natural gas, does not have shut off valves or other devices to limit spills or leaks.	Install shut off valves for piping containing hazardous material, including natural gas.	N6
FLEXIBLE COUPLINGS	Hazardous material ductwork and piping, including natural gas piping, do not have flexible couplings.	Install flexible couplings for ductwork and piping containing hazardous material, including natural gas piping.	N7
HEAVY PARTITIONS SUPPORTED BY CEILINGS	The tops of masonry or hollow-clay tile partitions are laterally supported by an integrated ceiling system.	Independently brace the tops of masonry or hollow-clay tile partitions.	N8
LENS COVERS	Lens covers on light fixtures are not attached with safety devices.	Install safety devices for light fixture lens covers.	N9
TALL NARROW CONTENTS	Contents more than 6 ft high with a height-to-depth or height-to-width ratio greater than 3-to-1 are not anchored to the structure or to each other.	Anchor contents to the structure.	N10
IN-LINE EQUIPMENT	Equipment installed in line with a duct or piping system, with an operating weight more than 75 lb, is not supported or laterally braced independent of the duct or piping system.	Independently support and laterally brace equipment with an operating weight more than 75 lb installed in line with a duct or piping system.	N11
MECHANICAL DOORS	Mechanically operated doors are not detailed to operate at a story drift ratio of 0.01.	Remove and replace with doors detailed to operate at a story drift ration of 0.01.	N12

VIBRATION ISOLATORS	Equipment mounted on vibration isolators is not equipped with horizontal restraints or snubbers and with vertical restraints to resist overturning.	Install horizontal restraints or snubbers and vertical restraints to resist overturning for equipment mounted on vibration isolators.	N13
FLEXIBLE COUPLINGS	Fluid and gas piping does not have flexible couplings.	Install flexible couplings for fluid and gas piping.	N14
FLUID AND GAS PIPING	Fluid and gas piping is not anchored or braced to the structure to limit spills or leaks.	Anchor and brace fluid and gas piping to the structure.	N15

In addition to the structural and nonstructural deficiencies noted above, the gravity load resisting system was reviewed to identify obvious insufficient gravity components. Insufficient gravity elements can cause failure during seismic events. These gravity deficiencies are based on visual observations of the existing structural elements. No formal structural analysis was performed during this evaluation of the gravity resisting element.

Based upon ZCS's previous experience and discussions with site personnel the building contains hazardous materials. These materials will need to be dealt with on a case-by-case basis as they are encountered during the project.

8.0 Preliminary Construction Cost Estimate

The attached engineer's opinion of probable cost has been developed by ZCS. ZCS has a successful record of completing seismic rehabilitation projects within the State of Oregon. The prices provided in the attached cost estimate have been developed using the extensive list of past projects as a baseline for this project. These prices are based on Oregon BOLI wage rates. The cost estimate is broken down into multiple line items associated with each major task (general conditions, foundation, structural steel, MEP, etc) associated with the rehabilitation. Additional line items are included for design associated permit costs, and owner construction management. A complete breakdown of the cost estimate can be found in Appendix E.

Special Notes

- It should be noted that the cost per square-foot of the this retrofit may seem abnormally high. The higher-than-average costs are a result of several factors including the following:
    - The building is significantly smaller than a building typically retrofit under the program. This results in less economy of scale on the project and increased costs for individual cost estimate line items.
    - The building is in a liquefaction zone and the costs to mitigate the liquefaction hazard are included in the cost estimate.

DIRECT COST	
Construction	$1,842,500
Engineering	$296,200
Construction Management	$ 59,500
Relocation	$26,600
Construction Contingency	$267,450
TOTALS AND SUMMARY	
Total Cost Estimate	**$2,492,350**
Match Funds	**$0.00**
Total Amount Requested from SRGP	**$2,492,350**
Total Area	**6,000 S.F.**
Cost/Square Foot	**$415**

9.0 Conclusion and Certification Statement

The findings described in this report have been limited to the lateral force-resisting structural system and general assessment of the gravity force-resisting elements. Based on our visual observations, we find the structure to be in relatively good condition and generally safe for occupancy. No significant damage to the existing structural system was discovered.

Given the current condition of the structure, the current code section on existing buildings does not mandate that upgrades are required unless the building is scheduled for repairs, alterations, additions, or change in occupancy. To clarify, upgrades outlined in this report are strictly at the discretion of the Department.

Please contact our office if you would like to discuss our findings. Please review the attached schematic drawings that can be used to refine a scope and budget.

Certification Statement

ZCS Engineering & Architecture's professional staff has reviewed the subject building and the deficiencies noted in the Tier 1 evaluation, developed seismic retrofit solutions to rectify the deficiencies, and developed the engineering cost estimate. The project cost estimate was developed by ZCS based on unit costs from our extensive list of past seismic retrofit projects as a baseline. We certify to the best of our knowledge, based on known and readily identifiable existing conditions, that all the seismic deficiencies present in the building are included in the retrofit scope of work and that all the retrofit's scope of work elements are included in the cost estimate.

Matthew R. Smith, PE, SE

Appendix A: Figures

Figure 1: NORTH ELEVATION

Figure 2: EAST ELEVATION

Figure 3: SOUTH ELEVATION

Figure 4: WEST ELEVATION

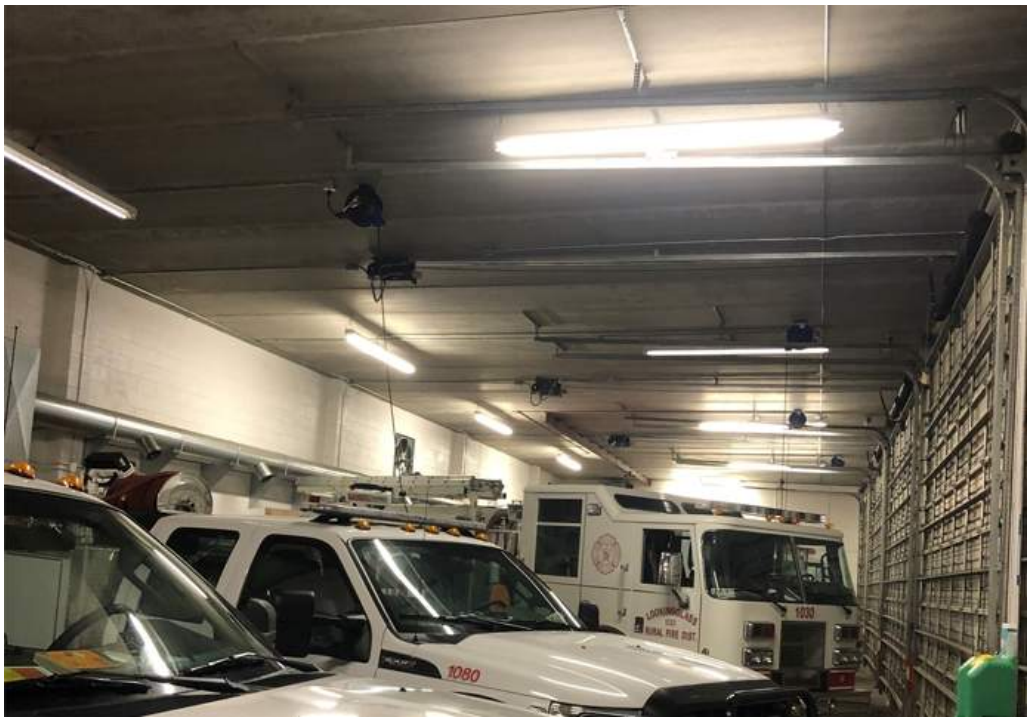

Figure 5: INTERIOR MAINTENANCE SHOP

Figure 6: INTRIOR MEZZANINE

Appendix B:
Tier 1 Check Sheets

ASCE 41-17 Tier 1 Checklists

FIRM:	ZCS Engineering and Architecture
PROJECT NAME:	Lookingglass Fire District
SEISMICITY LEVEL:	High
PROJECT NUMBER:	G-1502-22
COMPLETED BY:	KDM
DATE COMPLETED:	2/3/2022
REVIEWED BY:	MRS
REVIEW DATE:	REB. 2022

Legend: C = Compliant, NC = Noncompliant, N/A = Not Applicable, U = Unknown

17.17IO Structural Checklist for Building Types RM1: Reinforced Masonry Bearing Walls with Flexible Diaphragms and RM2: Reinforced Masonry Bearing Walls with Stiff Diaphragms

Table 17-35. Immediate Occupancy Structural Checklist for Building Types RM1 and RM2

Status				Evaluation Statement	Tier 2 Reference	Commentary Reference	Comments
Very Low Seismicity							
Seismic-Force-Resisting System							
C ☒	**NC** ☐	**N/A** ☐	**U** ☐	REDUNDANCY: The number of lines of shear walls in each principal direction is greater than or equal to 2.	5.5.1.1	A.3.2.1.1	More than (2) shear walls in each direction
C ☐	**NC** ☒	**N/A** ☐	**U** ☐	SHEAR STRESS CHECK: The shear stress in the reinforced masonry shear walls, calculated using the Quick Check procedure of Section 4.4.3.3, is less than 70 lb/in.^{2} (4.83 MPa).	5.5.3.1.1	A.3.2.4.1	Shear stress is exceeded.
C ☒	**NC** ☐	**N/A** ☐	**U** ☐	REINFORCING STEEL: The total vertical and horizontal reinforcing steel ratio in reinforced masonry walls is greater than 0.002 of the wall with the minimum of 0.0007 in either of the two directions; the spacing of reinforcing steel is less than 48 in., and all vertical bars extend to the top of the walls.	5.5.3.1.3	A.3.2.4.2	Steel matches these ratios and is fully vertical
Connections							
C ☒	**NC** ☐	**N/A** ☐	**U** ☐	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.	5.7.1.1	A.5.1.1	Attachment at top of wall occurs
C ☐	**NC** ☒	**N/A** ☐	**U** ☐	WOOD LEDGERS: The connection between the wall panels and the diaphragm does not induce cross-grain bending or tension in the wood ledgers.	5.7.1.3	A.5.1.2	Wood ledgers do not have out of plane attachments.
C ☒	**NC** ☐	**N/A** ☐	**U** ☐	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.	5.7.2	A.5.2.1	Attachment at top of wall occurs

Legend: C = Compliant, NC = Noncompliant, N/A = Not Applicable, U = Unknown

C	NC	N/A	U				
☒	☐	☐	☐	FOUNDATION DOWELS: Wall reinforcement is doweled into the foundation, and the dowels are able to develop the lesser of the strength of the walls or the uplift capacity of the foundation.	5.7.3.4	A.5.3.5	Rebar is present
C	**NC**	**N/A**	**U**	GIRDER–COLUMN CONNECTION: There is a positive connection using plates, connection hardware, or straps between the girder and the column support.	5.7.4.1	A.5.4.1	Rebar is present
☒	☐	☐	☐				
Stiff Diaphragms							
C	**NC**	**N/A**	**U**	TOPPING SLAB: Precast concrete diaphragm elements are interconnected by a continuous reinforced concrete topping slab.	5.6.4	A.4.5.1	No topping slab
☐	☒	☐	☐				
C	**NC**	**N/A**	**U**	TOPPING SLAB TO WALLS OR FRAMES: Reinforced concrete topping slabs that interconnect the precast concrete diaphragm elements are doweled for transfer of forces into the shear wall or frame elements.	5.7.2	A.5.2.3	No topping slab
☐	☐	☒	☐				
Foundation System							
C	**NC**	**N/A**	**U**	DEEP FOUNDATIONS: Piles and piers are capable of transferring the lateral forces between the structure and the soil.		A.6.2.3	No deep foundation
☐	☐	☒	☐				
C	**NC**	**N/A**	**U**	SLOPING SITES: The difference in foundation embedment depth from one side of the building to another does not exceed one story.		A.6.2.4	No sloping site.
☒	☐	☐	☐				

Status				Evaluation Statement	Tier 2 Reference	Commentary Reference	Comments
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**	REINFORCING AT WALL OPENINGS: All wall openings that interrupt rebar have trim reinforcing on all sides.	5.5.3.1.5	A.3.2.4.3	Reinforcement occurs at wall openings
☒	☐	☐	☐				
C	**NC**	**N/A**	**U**	PROPORTIONS: The height-to-thickness ratio of the shear walls at each story is less than 30.	5.5.3.1.2	A.3.2.4.4	Meets ratio
☒	☐	☐	☐				
Diaphragms (Stiff or Flexible)							
C	**NC**	**N/A**	**U**	OPENINGS AT SHEAR WALLS: Diaphragm openings immediately adjacent to the shear walls are less than 15% of the wall length.	5.6.1.3	A.4.1.4	No diaphragm openings at shear walls
☒	☐	☐	☐				

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C	NC	N/A	U				
☒	☐	☐	☐	OPENINGS AT EXTERIOR MASONRY SHEAR WALLS: Diaphragm openings immediately adjacent to exterior masonry shear walls are not greater than 4 ft (1.2 m) long.	5.6.1.3	A.4.1.6	No openings
C	**NC**	**N/A**	**U**				
☐	☐	☒	☐	PLAN IRREGULARITIES: There is tensile capacity to develop the strength of the diaphragm at reentrant corners or other locations of plan irregularities.	5.6.1.4	A.4.1.7	No plan irregularities
C	**NC**	**N/A**	**U**				
☐	☐	☒	☐	DIAPHRAGM REINFORCEMENT AT OPENINGS: There is reinforcing around all diaphragm openings larger than 50% of the building width in either major plan dimension.	5.6.1.5	A.4.1.8	No openings
Flexible Diaphragms							
C	**NC**	**N/A**	**U**				
☐	☐	☒	☐	CROSS TIES: There are continuous cross ties between diaphragm chords.	5.6.1.2	A.4.1.2	Rigid diaphragm
C	**NC**	**N/A**	**U**				
☐	☐	☒	☐	STRAIGHT SHEATHING: All straight-sheathed diaphragms have aspect ratios less than 1-to-1 in the direction being considered.	5.6.2	A.4.2.1	Rigid diaphragm
C	**NC**	**N/A**	**U**				
☐	☐	☒	☐	SPANS: All wood diaphragms with spans greater than 12 ft (3.6 m) consist of wood structural panels or diagonal sheathing.	5.6.2	A.4.2.2	Rigid diaphragm
C	**NC**	**N/A**	**U**				
☐	☐	☒	☐	DIAGONALLY SHEATHED AND UNBLOCKED DIAPHRAGMS: All diagonally sheathed or unblocked wood structural panel diaphragms have horizontal spans less than 30 ft (9.2 m) and aspect ratios less than or equal to 3-to-1.	5.6.2	A.4.2.3	Rigid diaphragm
C	**NC**	**N/A**	**U**				
☐	☐	☒	☐	NONCONCRETE FILLED DIAPHRAGMS: Untopped metal deck diaphragms or metal deck diaphragms with fill other than concrete consist of horizontal spans of less than 40 ft (12.2 m) and have aspect ratios less than 4-to-1.	5.6.3	A.4.3.1	Rigid diaphragm
C	**NC**	**N/A**	**U**				
☐	☐	☒	☐	OTHER DIAPHRAGMS: Diaphragms do not consist of a system other than wood, metal deck, concrete, or horizontal bracing.	5.6.5	A.4.7.1	Rigid diaphragm
Connections							
C	**NC**	**N/A**	**U**				
☐	☐	☒	☐	STIFFNESS OF WALL ANCHORS: Anchors of concrete or masonry walls to wood structural elements are installed taut and are stiff enough to limit the relative movement between the wall and the diaphragm to no greater than 1/8 in. before engagement of the anchors.	5.7.1.2	A.5.1.4	No out of plane attachments

Legend: C = Compliant, NC = Noncompliant, N/A = Not Applicable, U = Unknown

ASCE 41-17 Tier 1 Checklists

FIRM:	ZCS Engineering and Architecture
PROJECT NAME:	Lookingglass Fire District
SEISMICITY LEVEL:	High
PROJECT NUMBER:	G-1502-22
COMPLETED BY:	KDM
DATE COMPLETED:	2/3/2022
REVIEWED BY:	MRS
REVIEW DATE:	REB. 2022

Legend: C = Compliant, NC = Noncompliant, N/A = Not Applicable, U = Unknown

17.19 Nonstructural Checklist

Table 17-38. Nonstructural Checklist

Status				Evaluation Statement[a,b]	Tier 2 Reference	Commentary Reference	Comments
Life Safety Systems							
C ☐	**NC** ☐	**N/A** ☒	**U** ☐	**HR—not required; LS—LMH; PR—LMH**. FIRE SUPPRESSION PIPING: Fire suppression piping is anchored and braced in accordance with NFPA-13.	13.7.4	A.7.13.1	No sprinklers
C ☐	**NC** ☐	**N/A** ☒	**U** ☐	**HR—not required; LS—LMH; PR—LMH**. FLEXIBLE COUPLINGS: Fire suppression piping has flexible couplings in accordance with NFPA-13.	13.7.4	A.7.13.2	No sprinklers
C ☐	**NC** ☒	**N/A** ☐	**U** ☐	**HR—not required; LS—LMH; PR—LMH**. EMERGENCY POWER: Equipment used to power or control Life Safety systems is anchored or braced.	13.7.7	A.7.12.1	Items are unbraced
C ☐	**NC** ☐	**N/A** ☒	**U** ☐	**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.	13.7.6	A.7.14.1	Does not occur
C ☐	**NC** ☐	**N/A** ☒	**U** ☐	**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.	13.7.4	A.7.13.3	Does not occur
C ☐	**NC** ☒	**N/A** ☐	**U** ☐	**HR—not required; LS—not required; PR—LMH.** EMERGENCY LIGHTING: Emergency and egress lighting equipment is anchored or braced.	13.7.9	A.7.3.1	Items no braced
Hazardous Materials							
C ☐	**NC** ☒	**N/A** ☐	**U** ☐	**HR—LMH; LS—LMH; PR—LMH**. HAZARDOUS MATERIAL EQUIPMENT: Equipment mounted on vibration isolators and containing hazardous material is equipped with restraints or snubbers.	13.7.1	A.7.12.2	Items no braced
C ☐	**NC** ☒	**N/A** ☐	**U** ☐	**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.	13.8.3	A.7.15.1	Items no braced
C ☐	**NC** ☒	**N/A** ☐	**U** ☐	**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.	13.7.3 13.7.5	A.7.13.4	Items no braced
C ☐	**NC** ☒	**N/A** ☐	**U** ☐	**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.	13.7.3 13.7.5	A.7.13.3	No shut off valves occur
C ☐	**NC** ☒	**N/A** ☐	**U** ☐	**HR—LMH; LS—LMH; PR—LMH**. FLEXIBLE COUPLINGS: Hazardous material ductwork and piping, including natural gas piping, have flexible couplings.	13.7.3 13.7.5	A.7.15.4	Flexible couplings do not occur

Legend: C = Compliant, NC = Noncompliant, N/A = Not Applicable, U = Unknown

C	NC	N/A	U				
☐	☐	☒	☐	**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.	13.7.3 13.7.5 13.7.6	A.7.13.6	No seismic joints
Partitions							
C	**NC**	**N/A**	**U**				
☐	☐	☒	☐	**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.	13.6.2	A.7.1.1	Does not occur
C	**NC**	**N/A**	**U**				
☐	☒	☐	☐	**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.	13.6.2	A.7.2.1	Not braced at top of wall
C	**NC**	**N/A**	**U**				
☒	☐	☐	☐	**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.	13.6.2	A.7.1.2	adequate to accommodate drift
C	**NC**	**N/A**	**U**				
☒	☐	☐	☐	**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.	13.6.2	A.7.2.1	top of walls are attached
C	**NC**	**N/A**	**U**				
☐	☐	☒	☐	**HR—not required; LS—not required; PR—MH**. STRUCTURAL SEPARATIONS: Partitions that cross structural separations have seismic or control joints.	13.6.2	A.7.1.3	no seismic joints
C	**NC**	**N/A**	**U**				
☒	☐	☐	☐	**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).	13.6.2	A.7.1.4	partitions are attached at top
Ceilings							
C	**NC**	**N/A**	**U**				
☐	☐	☒	☐	**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.	13.6.4	A.7.2.3	Does not occur
C	**NC**	**N/A**	**U**				
☐	☐	☒	☐	**HR—not required; LS—MH; PR—LMH**. SUSPENDED GYPSUM BOARD: Suspended gypsum board ceilings have attachments that resist seismic forces for every 12 ft^2 (1.1 m^2) of area.	13.6.4	A.7.2.3	Does not occur

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C	NC	N/A	U				
☐	☐	☒	☐	**HR—not required; LS—not required; PR—MH**. INTEGRATED CEILINGS: Integrated suspended ceilings with continuous areas greater than 144 ft^2 (13.4 m^2) 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.	13.6.4	A.7.2.2	Does not occur
C	**NC**	**N/A**	**U**				
☐	☐	☒	☐	**HR—not required; LS—not required; PR—MH**. EDGE CLEARANCE: The free edges of integrated suspended ceilings with continuous areas greater than 144 ft^2 (13.4 m^2) 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).	13.6.4	A.7.2.4	Does not occur
C	**NC**	**N/A**	**U**				
☐	☐	☒	☐	**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.	13.6.4	A.7.2.5	No seismic joints
C	**NC**	**N/A**	**U**				
☐	☐	☒	☐	**HR—not required; LS—not required; PR—H**. EDGE SUPPORT: The free edges of integrated suspended ceilings with continuous areas greater than 144 ft^2 (13.4 m^2) are supported by closure angles or channels not less than 2 in. (51 mm) wide.	13.6.4	A.7.2.6	Does not occur
C	**NC**	**N/A**	**U**				
☐	☐	☒	☐	**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 ft^2 (232.3 m^2) and has a ratio of long-to-short dimension no more than 4-to-1.	13.6.4	A.7.2.7	No seismic joints
Light Fixtures							
C	**NC**	**N/A**	**U**				
☐	☐	☒	☐	**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.	13.6.4 13.7.9	A.7.3.2	Does not occur

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C	NC	N/A	U				
☐	☐	☒	☐	**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 attached without damaging adjoining components. Additionally, the connection to the structure is capable of accommodating the movement without failure.	13.7.9	A.7.3.3	Does not occur
C	**NC**	**N/A**	**U**				
☐	☒	☐	☐	**HR—not required; LS—not required; PR—H**. LENS COVERS: Lens covers on light fixtures are attached with safety devices.	13.7.9	A.7.3.4	Lens covers not rated with safety glass
Cladding and Glazing							
C	**NC**	**N/A**	**U**				
☐	☐	☒	☐	**HR—MH; LS—MH; PR—MH**. CLADDING ANCHORS: Cladding components weighing more than 10 lb/ft^2 (0.48 kN/m^2) are mechanically anchored to the structure at a spacing equal to or less than the following: for Life Safety in Moderate Seismicity, 6 ft (1.8 m); for Life Safety in High Seismicity and for Position Retention in any seismicity, 4 ft (1.2 m)	13.6.1	A.7.4.1	No heavy cladding
C	**NC**	**N/A**	**U**				
☐	☐	☒	☐	**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.	13.6.1	A.7.4.3	cladding is structure
C	**NC**	**N/A**	**U**				
☐	☐	☒	☐	**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.	13.6.1	A.7.4.4	single story

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C	NC	N/A	U				
☐	☐	☒	☐	**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.	13.6.1	A.7.4.9	Does not occur
C	**NC**	**N/A**	**U**				
☐	☐	☒	☐	**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.	13.6.1.4	A.7.4.5	Cladding is structure
C	**NC**	**N/A**	**U**				
☐	☐	☒	☐	**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.	13.6.1.4	A.7.4.6	Cladding is structure
C	**NC**	**N/A**	**U**				
☐	☐	☒	☐	**HR—MH; LS—MH; PR—MH**. INSERTS: Where concrete cladding components use inserts, the inserts have positive anchorage or are anchored to reinforcing steel.	13.6.1.4	A.7.4.7	Cladding is structure
C	**NC**	**N/A**	**U**				
☐	☐	☒	☐	**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.	13.6.1.5	A.7.4.8	no overhead glazing
Masonry Veneer							
C	**NC**	**N/A**	**U**				
☐	☐	☒	☐	**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).	13.6.1.2	A.7.5.1	Cladding is structure
C	**NC**	**N/A**	**U**				
☐	☐	☒	☐	**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.	13.6.1.2	A.7.5.2	Cladding is structure
C	**NC**	**N/A**	**U**				
☐	☐	☒	☐	**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.	13.6.1.2	A.7.5.3	Cladding is structure

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C	NC	N/A	U				
☐	☐	☒	☐	**HR—LMH; LS—LMH; PR—LMH**. UNREINFORCED MASONRY BACKUP: There is no unreinforced masonry backup.	13.6.1.1 13.6.1.2	A.7.7.2	URM does not ocur
C	**NC**	**N/A**	**U**				
☐	☐	☒	☐	**HR—not required; LS—MH; PR—MH**. STUD TRACKS: For veneer with cold-formed steel stud backup, stud tracks are fastened to the structure at a spacing equal to or less than 24 in. (610 mm) on center.	13.6.1.1 13.6.1.2	A.7.6.1	CFS does not ocur
C	**NC**	**N/A**	**U**				
☐	☐	☒	☐	**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.	13.6.1.1 13.6.1.2	A.7.7.1	Masonry requiring anchorage does not occur
C	**NC**	**N/A**	**U**				
☐	☐	☒	☐	**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.	13.6.1.2	A.7.5.6	Weep holes are not required
C	**NC**	**N/A**	**U**				
☐	☐	☒	☐	**HR—not required; LS—not required; PR—MH**. OPENINGS: For veneer with cold-formed-steel stud backup, steel studs frame window and door openings.	13.6.1.1 13.6.1.2	A.7.6.2	CFS does not occur
Parapets, Cornices, Ornamentation, and Appendages							
C	**NC**	**N/A**	**U**				
☐	☐	☒	☐	**HR—LMH; LS—LMH; PR—LMH**. URM PARAPETS OR CORNICES: Laterally unsupported unreinforced masonry parapets or cornices have height-to-thickness ratios no greater than the following: for Life Safety in Low or Moderate Seismicity, 2.5; for Life Safety in High Seismicity and for Position Retention in any seismicity, 1.5.	13.6.5	A.7.8.1	No parapets occur
C	**NC**	**N/A**	**U**				
☐	☐	☒	☐	**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).	13.6.6	A.7.8.2	No canopies occur
C	**NC**	**N/A**	**U**				
☐	☐	☒	☐	**HR—H; LS—MH; PR—LMH**. CONCRETE PARAPETS: Concrete parapets with height-to-thickness ratios greater than 2.5 have vertical reinforcement.	13.6.5	A.7.8.3	No parapets occur
C	**NC**	**N/A**	**U**				
☐	☐	☒	☐	**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.	13.6.6	A.7.8.4	No appendages occur

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C	NC	N/A	U				
Masonry Chimneys							
☐	☐	☒	☐	**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.	13.6.7	A.7.9.1	No Chimney occurs
☐	☐	☒	☐	**HR—LMH; LS—LMH; PR—LMH**. ANCHORAGE: Masonry chimneys are anchored at each floor level, at the topmost ceiling level, and at the roof.	13.6.7	A.7.9.2	No Chimney occurs
Stairs							
☐	☐	☒	☐	**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.	13.6.2 13.6.8	A.7.10.1	URM does not occur
☒	☐	☐	☐	**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.	13.6.8	A.7.10.2	stairs are not dependent on attachment
Contents and Furnishings							
☐	☐	☒	☐	**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.	13.8.1	A.7.11.1	Does not occur
☐	☒	☐	☐	**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.	13.8.2	A.7.11.2	storage contents needs bracing
☐	☐	☒	☐	**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.	13.8.2	A.7.11.3	items above 4' does not exceed 20 lbs

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C	NC	N/A	U				
☐	☐	☒	☐	**HR—not required; LS—not required; PR—MH**. ACCESS FLOORS: Access floors more than 9 in. (229 mm) high are braced.	13.6.10	A.7.11.4	No access floors
C	**NC**	**N/A**	**U**				
☐	☐	☒	☐	**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.	13.7.7 13.6.10	A.7.11.5	No access floors
C	**NC**	**N/A**	**U**				
☒	☐	☐	☐	**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.	13.8.2	A.7.11.6	suspended contents are free to swing.
Mechanical and Electrical Equipment							
C	**NC**	**N/A**	**U**				
☐	☐	☒	☐	**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.	13.7.1 13.7.7	A.7.12.4	Items do not occur
C	**NC**	**N/A**	**U**				
☐	☒	☐	☐	**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.	13.7.1	A.7.12.5	equipment not braced
C	**NC**	**N/A**	**U**				
☐	☐	☒	☐	**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.	13.7.1 13.7.7	A.7.12.6	does not occur
C	**NC**	**N/A**	**U**				
☐	☒	☐	☐	**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.	13.6.9	A.7.12.7	Doors do not allow for drift
C	**NC**	**N/A**	**U**				
☐	☐	☒	☐	**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.	13.7.1 13.7.7	A.7.12.8	items do not occur
C	**NC**	**N/A**	**U**				
☐	☒	☐	☐	**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.	13.7.1	A.7.12.9	Equipment not mounted on vibration isolators
C	**NC**	**N/A**	**U**				
☐	☐	☒	☐	**HR—not required; LS—not required; PR—H**. HEAVY EQUIPMENT: Floor-supported or platform-supported equipment weighing more than 400 lb (181.4 kg) is anchored to the structure.	13.7.1 13.7.7	A.7.12.10	Does not occur

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C	NC	N/A	U				
☒	☐	☐	☐	**HR—not required; LS—not required; PR—H**. ELECTRICAL EQUIPMENT: Electrical equipment is laterally braced to the structure.	13.7.7	A.7.12.11	Electrical equipment is attached
☐	☐	☒	☐	**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.	13.7.8	A.7.12.12	Conduit size does not occur
Piping							
☐	☒	☐	☐	**HR—not required; LS—not required; PR—H**. FLEXIBLE COUPLINGS: Fluid and gas piping has flexible couplings.	13.7.3 13.7.5	A.7.13.2	Flexible couplings do not occur
☐	☒	☐	☐	**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.	13.7.3 13.7.5	A.7.13.4	piping is not anchored properly
☐	☐	☒	☐	**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.	13.7.3 13.7.5	A.7.13.5	conduit size does not occur
☐	☐	☒	☐	**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.	13.7.3 13.7.5	A.7.13.6	Seismic gaps do not occur
Ducts							
☐	☐	☒	☐	**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).	13.7.6	A.7.14.2	Duct sizes do not occur
☒	☐	☐	☐	**HR—not required; LS—not required; PR—H**. DUCT SUPPORT: Ducts are not supported by piping or electrical conduit.	13.7.6	A.7.14.3	Ducts do no support piping
☐	☐	☒	☐	**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.	13.7.6	A.7.14.4	No seismic joints occur.
Elevators							
☐	☐	☒	☐	**HR—not required; LS—H; PR—H**. RETAINER GUARDS: Sheaves and drums have cable retainer guards.	13.7.11	A.7.16.1	Elevator does not occur
☐	☐	☒	☐	**HR—not required; LS—H; PR—H**. RETAINER PLATE: A retainer plate is present at the top and bottom of both car and counterweight.	13.7.11	A.7.16.2	Elevator does not occur

Legend: C = Compliant, NC = Noncompliant, N/A = Not Applicable, U = Unknown

C	NC	N/A	U				
☐	☐	☒	☐	**HR—not required; LS—not required; PR—H**. ELEVATOR EQUIPMENT: Equipment, piping, and other components that are part of the elevator system are anchored.	13.7.11	A.7.16.3	Elevator does not occur
☐	☐	☒	☐	**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.	13.7.11	A.7.16.4	Elevator does not occur
☐	☐	☒	☐	**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.	13.7.11	A.7.16.5	Elevator does not occur
☐	☐	☒	☐	**HR—not required; LS—not required; PR—H**. COUNTERWEIGHT RAILS: All counterweight rails and divider beams are sized in accordance with ASME A17.1.	13.7.11	A.7.16.6	Elevator does not occur
☐	☐	☒	☐	**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.	13.7.11	A.7.16.7	Elevator does not occur
☐	☐	☒	☐	**HR—not required; LS—not required; PR—H**. SPREADER BRACKET: Spreader brackets are not used to resist seismic forces.	13.7.11	A.7.16.8	Elevator does not occur
☐	☐	☒	☐	**HR—not required; LS—not required; PR—H**. GO-SLOW ELEVATORS: The building has a go-slow elevator system.	13.7.11	A.7.16.9	Elevator does not occur

[a] Performance Level: HR = Hazards Reduced, LS = Life Safety, and PR = Position Retention.

[b] Level of Seismicity: L = Low, M = Moderate, and H = High.

ASCE 41-17 Tier 1 Checklists

FIRM:	ZCS Engineering and Architecture
PROJECT NAME:	Lookingglass Fire District
SEISMICITY LEVEL:	High
PROJECT NUMBER:	G-1502-22
COMPLETED BY:	KDM
DATE COMPLETED:	2/3/2022
REVIEWED BY:	MRS
REVIEW DATE:	REB. 2022

Legend: C = Compliant, NC = Noncompliant, N/A = Not Applicable, U = Unknown

17.1.2IO Basic Configuration Checklist

Table 17-3. Immediate Occupancy Basic Configuration Checklist

Status				Evaluation Statement	Tier 2 Reference	Commentary Reference	Comments
Very Low Seismicity							
Building System—General							
C ☐	**NC** ☒	**N/A** ☐	**U** ☐	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.	5.4.1.1	A.2.1.1	No diaphragm present and no lateral support at front of wall.
C ☐	**NC** ☐	**N/A** ☒	**U** ☐	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 seismicity, and 3.0% in high seismicity.	5.4.1.2	A.2.1.2	No adjacent building
C ☐	**NC** ☒	**N/A** ☐	**U** ☐	MEZZANINES: Interior mezzanine levels are braced independently from the main structure or are anchored to the seismic-force-resisting elements of the main structure.	5.4.1.3	A.2.1.3	Not adequately attached to wall.
Building System—Building Configuration							
C ☐	**NC** ☐	**N/A** ☒	**U** ☐	WEAK STORY: The sum of the shear strengths of the seismic-force-resisting system in any story in each direction is not less than 80% of the strength in the adjacent story above.	5.4.2.1	A.2.2.2	Single story building.
C ☐	**NC** ☐	**N/A** ☒	**U** ☐	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.	5.4.2.2	A.2.2.3	Single story building.
C ☒	**NC** ☐	**N/A** ☐	**U** ☐	VERTICAL IRREGULARITIES: All vertical elements in the seismic-force-resisting system are continuous to the foundation.	5.4.2.3	A.2.2.4	No steps in building

Legend: C = Compliant, NC = Noncompliant, N/A = Not Applicable, U = Unknown

Status				Evaluation Statement	Tier 2 Reference	Commentary Reference	Comments
C ☐	NC ☐	N/A ☒	U ☐	GEOMETRY: There are no changes in the net horizontal dimension of the seismic-force-resisting system of more than 30% in a story relative to adjacent stories, excluding one-story penthouses and mezzanines.	5.4.2.4	A.2.2.5	Single story building
C ☐	NC ☐	N/A ☒	U ☐	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.	5.4.2.5	A.2.2.6	Single story building
C ☒	NC ☐	N/A ☐	U ☐	TORSION: The estimated distance between the story center of mass and the story center of rigidity is less than 20% of the building width in either plan dimension.	5.4.2.6	A.2.2.7	Symmetrical building layout
Low Seismicity (Complete the Following Items in Addition to the Items for Very Low Seismicity)							
Geologic Site Hazards							
C ☐	NC ☒	N/A ☐	U ☐	LIQUEFACTION: Liquefaction-susceptible, saturated, loose granular soils that could jeopardize the building's seismic performance do not exist in the foundation soils at depths within 50 ft (15.2 m) under the building.	5.4.3.1	A.6.1.1	Moderate risk for liquefaction
C ☒	NC ☐	N/A ☐	U ☐	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.	5.4.3.1	A.6.1.2	Slope failure does not occur
C ☒	NC ☐	N/A ☐	U ☐	SURFACE FAULT RUPTURE: Surface fault rupture and surface displacement at the building site are not anticipated.	5.4.3.1	A.6.1.3	Surface fault rupture does not occur.

Legend: C = Compliant, NC = Noncompliant, N/A = Not Applicable, U = Unknown

Status				Evaluation Statement	Tier 2 Reference	Commentary Reference	Comments
Moderate and High Seismicity (Complete the Following Items in Addition to the Items for Low Seismicity)							
Foundation Configuration							
C ☒	**NC** ☐	**N/A** ☐	**U** ☐	OVERTURNING: The ratio of the least horizontal dimension of the seismic-force-resisting system at the foundation level to the building height (base/height) is greater than $0.6S_a$.	5.4.3.3	A.6.2.1	Does not exceed ratio
C ☐	**NC** ☒	**N/A** ☐	**U** ☐	TIES BETWEEN FOUNDATION ELEMENTS: The foundation has ties adequate to resist seismic forces where footings, piles, and piers are not restrained by beams, slabs, or soils classified as Site Class A, B, or C.	5.4.3.4	A.6.2.2	Liquefaction may occur and no piles are present.

Legend: C = Compliant, NC = Noncompliant, N/A = Not Applicable, U = Unknown

ASCE 41-17 Tier 1 Checklists

FIRM:	ZCS Engineering and Architecture
PROJECT NAME:	Lookingglass Fire District
SEISMICITY LEVEL:	High
PROJECT NUMBER:	G-1502-22
COMPLETED BY:	KDM
DATE COMPLETED:	2/3/2022
REVIEWED BY:	MRS
REVIEW DATE:	REB. 2022

Legend: C = Compliant, NC = Noncompliant, N/A = Not Applicable, U = Unknown

Project Name Lookingglass Fire District
Project Number G-1502-22

17.3IO Structural Checklist for Building Type W2: Wood Frames, Commercial and Industrial

Table 17-7. Immediate Occupancy Checklist for Building Type W2

Status				Evaluation Statement	Tier 2 Reference	Commentary Reference	Comments
Very Low Seismicity							
Seismic-Force-Resisting System							
C ☒	**NC** ☐	**N/A** ☐	**U** ☐	REDUNDANCY: The number of lines of shear walls in each principal direction is greater than or equal to 2.	5.5.1.1	A.3.2.1.1	multiple wall lines
C ☐	**NC** ☒	**N/A** ☐	**U** ☐	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)	5.5.3.1.1	A.3.2.7.1	does not pass shear stress
C ☐	**NC** ☐	**N/A** ☒	**U** ☐	STUCCO (EXTERIOR PLASTER) SHEAR WALLS: Multi-story buildings do not rely on exterior stucco walls as the primary seismic-force-resisting system.	5.5.3.6.1	A.3.2.7.2	no plaster occurs
C ☒	**NC** ☐	**N/A** ☐	**U** ☐	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.	5.5.3.6.1	A.3.2.7.3	Not used for shear walls
C ☒	**NC** ☐	**N/A** ☐	**U** ☐	NARROW WOOD SHEAR WALLS: Narrow wood shear walls with an aspect ratio greater than 2-to-1 are not used to resist seismic forces.	5.5.3.6.1	A.3.2.7.4	meets ratio
C ☐	**NC** ☐	**N/A** ☒	**U** ☐	WALLS CONNECTED THROUGH FLOORS: Shear walls have an interconnection between stories to transfer overturning and shear forces through the floor.	5.5.3.6.2	A.3.2.7.5	Single floor
C ☐	**NC** ☐	**N/A** ☒	**U** ☐	HILLSIDE SITE: For structures that are taller on at least one side by more than one-half story because of a sloping site, all shear walls on the downhill slope have an aspect ratio less than 1-to-2.	5.5.3.6.3	A.3.2.7.6	Level site
C ☐	**NC** ☐	**N/A** ☒	**U** ☐	CRIPPLE WALLS: Cripple walls below first-floor-level shear walls are braced to the foundation with wood structural panels.	5.5.3.6.4	A.3.2.7.7	No cripple walls occur

Legend: C = Compliant, NC = Noncompliant, N/A = Not Applicable, U = Unknown

Status				Evaluation Statement	Tier 2 Reference	Commentary Reference	Comments
C ☐	NC ☐	N/A ☒	U ☐	OPENINGS: Walls with openings greater than 80% of the length are braced with wood structural panel shear walls with aspect ratios of not more than 1.5-to-1 or are supported by adjacent construction through positive ties capable of transferring the seismic forces.	5.5.3.6.5	A.3.2.7.8	no large openings in wall
C ☐	NC ☐	N/A ☒	U ☐	HOLD-DOWN ANCHORS: All shear walls have hold-down anchors attached to the end studs constructed in accordance with acceptable construction practices.	5.5.3.6.6	A.3.2.7.9	Holdowns are not required.
Connections							
C ☒	NC ☐	N/A ☐	U ☐	WOOD POSTS: There is a positive connection of wood posts to the foundation.	5.7.3.3	A.5.3.3	positive attachment at post
C ☐	NC ☒	N/A ☐	U ☐	WOOD SILLS: All wood sills are bolted to the foundation.	5.7.3.3	A.5.3.4	bolts do not occur
C ☒	NC ☐	N/A ☐	U ☐	GIRDER–COLUMN CONNECTION: There is a positive connection using plates, connection hardware, or straps between the girder and the column support.	5.7.4.1	A.5.4.1	positive connection at post
Foundation System							
C ☐	NC ☐	N/A ☒	U ☐	DEEP FOUNDATIONS: Piles and piers are capable of transferring the lateral forces between the structure and the soil.		A.6.2.3	Deep foundations do not occur
C ☐	NC ☐	N/A ☒	U ☐	SLOPING SITES: The difference in foundation embedment depth from one side of the building to another does not exceed one story high.		A.6.2.4	Level site
Low, Moderate, and High Seismicity (Complete the Following Items in Addition to the Items for Very Low Seismicity)							
Seismic-Force-Resisting System							
C ☒	NC ☐	N/A ☐	U ☐	NARROW WOOD SHEAR WALLS: Narrow wood shear walls with an aspect ratio greater than 1.5-to-1 are not used to resist seismic forces.	5.5.3.6.1	A.3.2.7.4	Meets ratio
Diaphragms							
C ☒	NC ☐	N/A ☐	U ☐	DIAPHRAGM CONTINUITY: The diaphragms are not composed of split-level floors and do not have expansion joints.	5.6.1.1	A.4.1.1	Do not have expansion joints

Legend: C = Compliant, NC = Noncompliant, N/A = Not Applicable, U = Unknown

C	NC	N/A	U				
☒	☐	☐	☐	ROOF CHORD CONTINUITY: All chord elements are continuous, regardless of changes in roof elevation.	5.6.1.1	A.4.1.3	chords are continuous
C	NC	N/A	U				
☐	☐	☒	☐	DIAPHRAGM REINFORCEMENT AT OPENINGS: There is reinforcing around all diaphragm openings larger than 50% of the building width in either major plan dimension.	5.6.1.5	A.4.1.8	No large openings occur
C	NC	N/A	U				
☐	☐	☒	☐	STRAIGHT SHEATHING: All straight-sheathed diaphragms have aspect ratios less than 1-to-1 in the direction being considered.	5.6.2	A.4.2.1	Straight sheathing does not occur
C	NC	N/A	U				
☒	☐	☐	☐	SPANS: All wood diaphragms with spans greater than 12 ft (3.6 m) consist of wood structural panels or diagonal sheathing.	5.6.2	A.4.2.2	Wood structural panels at all diaphragms for wood structures
C	NC	N/A	U				
☐	☐	☒	☐	DIAGONALLY SHEATHED AND UNBLOCKED DIAPHRAGMS: All diagonally sheathed or unblocked wood structural panel diaphragms have horizontal spans less than 30 ft (9.2 m) and have aspect ratios less than or equal to 3-to-1.	5.6.2	A.4.2.3	Diagonal sheathing does not occur
C	NC	N/A	U				
☐	☐	☒	☐	OTHER DIAPHRAGMS: The diaphragms do not consist of a system other than wood, metal deck, concrete, or horizontal bracing.	5.6.5	A.4.7.1	Only plywood occurs
Connections							
C	NC	N/A	U				
☐	☒	☐	☐	WOOD SILL BOLTS: Sill bolts are spaced at 4 ft or less with acceptable edge and end distance provided for wood and concrete.	5.7.3.3	A.5.3.7	Bolts are not present.

Legend: C = Compliant, NC = Noncompliant, N/A = Not Applicable, U = Unknown

Appendix C: Schematic Seismic Retrofit Drawings

LOOKINGGLASS FIRE STATION SEISMIC RETROFIT

PRELIMINARY DESIGN

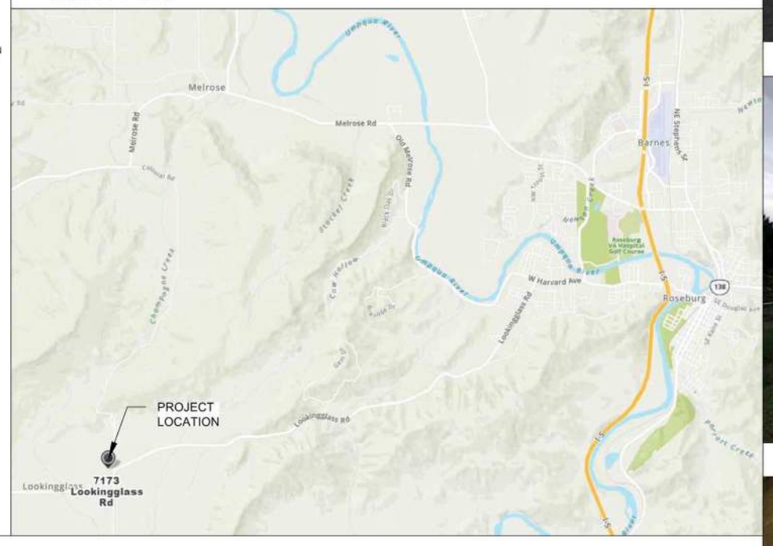
LOOKINGGLASS RFD
7173 LOOKINGGLASS ROAD
ROSEBURG, OR 97471

ABBREVIATIONS

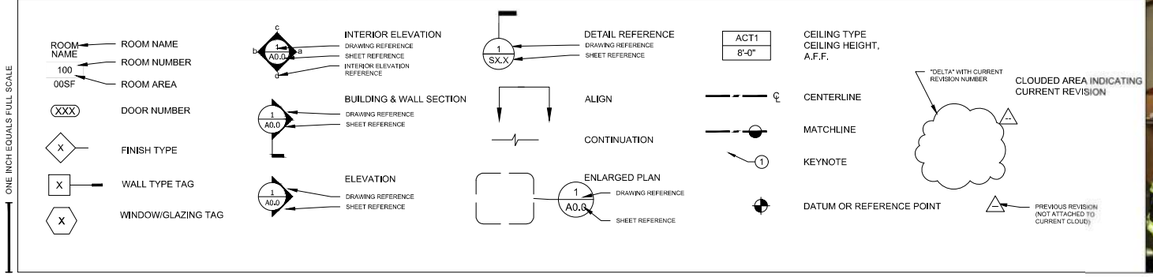
ABBREVIATIONS			
(E)	EXISTING	L.P.	LOW POINT
(N)	NEW	M.C.	MEDICINE CABINET
(R)	REMOVE	M.D.F.	MEDIUM DENSITY FIBERBOARD
A.C.	ASPHALT CONCRETE	M.D.O.	MEDIUM DENSITY OVERLAY
A.C.B.	ACOUSTICAL BOARD	MEMB.	MEMBRANE
A.C.P.	ACOUSTICAL PANEL	MH.	MANHOLE
A.C.T.	ACOUSTICAL CEILING TILE	MIR.	MIRROR
A.D.	AREA DRAIN	M.O.	MASONRY OPENING
ADJ.	ADJUSTABLE	M.P.	MIDPOINT
A.F.	ACCESS FLOORING	M.S.	MACHINE SCREW
AGGR.	AGGREGATE	MTD.	MOUNTED
A..F.	ABOVE FINISHED FLOOR	MUL.	MULLION
BD.	BOARD	NOM.	NOMINAL
BITUM.	BITUMINOUS	N.T.S.	NOT TO SCALE
BKP.	BACKING PLATE	OBS.	OBSCURE
BM.	BEAM	O.C.	ON CENTER
BOT./B.O.	BOTTOM/BOTTOM OF	O.C.D.	OVERHEAD COILING DOOR
C.B.	CATCH BASIN	O.C.G	OVERHEAD COILING GRILLE
CEM.	CEMENT	O.D.	OUTSIDE DIAMETER
CER.	CERAMIC	O.F.C.I.	OWNER FURNISHED CONTRACTOR INSTALLED
C.G.	CORNER GUARD	O.F.D.	OVERFLOW DRAIN
C.I.	CAST IRON	O.F.O.I.	OWNER FURNISHED OWNER INSTALLED
C.J	CONTROL JOINT	OH.	OPPOSITE HAND
CLG.	CEILING	PL.	PLATE
CLKG.	CAULKING	P.LAM.	PLASTIC LAMINATE
CLO.	CLOSET	PLAS.	PLASTER
CLR.	CLEAR	P.C.P.	PORTLAND CEMENT PLASTER
CMU	CONCRETE MASONRY UNIT	PR.	PAIR
C.O.	CASED OPENING	PTN.	PARTITION
CONN	CONNECTION	R.C.P.	REFLECTED CEILING PLAN
CORR.	CORRIDOR	R.D.	ROOF DRAIN
CPT.	CARPET	RL.	RELOCATE
CTSK.	COUNTERSUNK	R.O.	ROUGH OPENING
C.T.	CERAMIC TILE	RWD.	REDWOOD
CTR.	CENTER	R.W.L.	RAIN WALL LEADER
D.F.	DRINKING FOUNTAIN	REV.	REVERSED
DET.	DETAIL	S.C.	SOLID CORE
DISP.	DISPENSER	S.C.D.	SEE CIVIL DRAWINGS
DR.	DOOR	SHR.	SHOWER
DWR.	DRAWER	S.J.	SCORE JOINT
D.S.	DOWNSPOUT	S.L.D.	SEE LANDSCAPING DRAWINGS
D.S.A.	DRY STANDPIPE	S.M.	SHEET METAL
E.J.	EXPANSION JOINT	S.M.D	SEE MECHANICAL DRAWINGS
EL.	ELEVATION	S.O.G.	SLAB ON GRADE
EXPO.	EXPOSED	S.S.D.	SEE STRUCTURAL DRAWINGS
EXP.	EXPANSION	S.S.	STAINLESS STEEL
F.A.	FIRE ALARM	STR.	STRUCTURAL
FB.	FLAT BAR	S.T.S.	SELF TAPPING SCREW
F.D.	FLOOR DRAIN	SUSP.	SUSPENDED
FDN.	FOUNDATION	TRD.	TREAD
FE	FIRE EXTINGUISHER	T.B.	TOWEL BAR
F.A.	FLAT HEAD	T.C.	TOP OF CURB
F.O.C	FACE OF CONCRETE	T&G.	TONGUE AND GROOVE
F.O.F	FACE OF FINISH	THK.	THICK
F.O.S.	FACE OF STUDS	T.P.	TOP OF PAVEMENT
F.S.	FULL SIZE	T.W.	TOP OF WALL
FTG.	FOOTING	V.I.F.	VERIFY IN FIELD
FUT.	FUTURE	V.T.R.	VENT THROUGH ROOF
G.A.	GAUGE	W.C.	WATER CLOSET
G.L.	GRID LINE	W.O.	WINDOW OPENING
GLB.	GLULAM BEAM		
G.B.	GRAB BAR		
GND.	GROUND		
GYP.	GYPSUM		
G.W.B.	GYPSUM WALL BOARD		
H.B.	HOSE BIBB		
H.C.	HOLLOW CORE		
H.M.	HOLLOW METAL		
J.B.	JUNCTION BOX		
J.O.H.	JAMB OPENING HEIGHT		
J.O.W.	JAMB WIDTH		
JT.	JOINT		
LAM.	LAMINATE		

SHEET INDEX

VICINITY MAP



SYMBOLS



ONE INCH EQUALS FULL SCALE

NORTH EXTERIOR ELEVATION:

EAST EXTERIOR ELEVATION:

SOUTH EXTERIOR ELEVATION:

WEST EXTERIOR ELEVATION:

INTERIOR MEZZANINE:

INTERIOR VEHICLE BAYS:

ZCS ENGINEERING ARCHITECTURE
127 NW D Street, Grants Pass, Oregon 97526 | 541-479-3865

LOOKINGGLASS RFD
7173 LOOKINGGLASS RD.
ROSEBURG, OR 97471

LOOKINGGLASS FIRE STATION SEISMIC RETROFIT

LRFD 1000

STRUCTURAL REGISTERED PROFESSIONAL ENGINEER
OREGON
JUNE 06, 2014
MATTHEW R. SMITH
EXPIRES: 06-30-22

PRELIMINARY - NOT FOR CONSTRUCTION

REVISION ID:	DATE:

PROJECT NO:	G-1502-22
DRAWN:	PWR
CHECKED:	MRS
DATE:	FEB. 2022

COVER SHEET

G0.0

PRELIMINARY DESIGN

TRUE/PROJECT NORTH

*SITE PLAN NOT TO SCALE

ONE INCH EQUALS FULL SCALE

ZCS
ENGINEERING
ARCHITECTURE
127 NW D Street, Grants Pass, Oregon 97526 | 541-479-3865

LOOKINGGLASS RFD
7173 LOOKINGGLASS RD.
ROSEBURG, OR 97471

LOOKINGGLASS FIRE STATION SEISMIC RETROFIT

LRFD 1000

STRUCTURAL ENGINEER
REGISTERED PROFESSIONAL ENGINEER
OREGON
JUNE 08, 2014
MATTHEW R. SMITH
EXPIRES: 06-30-22

-PRELIMINARY-
NOT FOR CONSTRUCTION

REVISION ID:	DATE:

PROJECT NO:	G-1502-22
DRAWN:	PWR
CHECKED:	MRS
DATE:	FEB. 2022

BUILDING KEY PLAN

A1.1

PRELIMINARY DESIGN

STRUCTURAL REPAIRS:

S1. PROVIDE A COMPLETE, WELL-DEFINED LOAD PATH BY INSTALLING NEW ELEMENTS AND CONNECTIONS AS NEEDED TO TRANSFER INERTIAL FORCES FROM ALL ELEMENTS OF THE BUILDING TO THE FOUNDATION.
- FRP DIAPHRAGM STRENGTHENING.
- INFILL MAINTENANCE TRENCH.
- RE-NAIL EXISTING PLYWOOD FLOOR SHEATHING AT MEZZANINE.

S2. PROVIDE AN INDEPENDENT BRACING SYSTEM AND ANCHOR THE MEZZANINE TO THE SEISMIC-FORCE-RESISTING ELEMENTS OF THE MAIN STRUCTURE.
- SHEATH EXISTING SHEAR WALLS.

S3. PROVIDE DEEP FOUNDATIONS SOLUTIONS TO DEPTHS AS INDICATED IN FUTURE GEOTECH REPORT. PROVIDE NEW GRADE BEAMS AND PILE CAPS AS REQUIRED FOR DEEP FOUNDATIONS.

S4. PROVIDE GRADE BEAMS TO TIE THE EXISTING FOUNDATION TOGETHER.

S5. PROVIDE ADDITIONAL LATERAL RESISTING ELEMENTS.
- NEW CMU SHEAR WALL.

S6. INSTALL NEW OUT-OF-PLANE ANCHORAGE.

S7. STRENGTHEN EXISTING PRECAST PANEL CONNECTIONS USING FIBER-REINFORCED POLYMER (FRP).

NON-STRUCTURAL REPAIRS:

N1. ANCHOR AND BRACE EQUIPMENT USED TO POWER OR CONTROL LIFE SAFETY SYSTEM.

N2. ANCHOR AND BRACE EMERGENCY AND EGRESS LIGHTING EQUIPMENT.

N3. INSTALL RESTRAINTS OR SNUBBERS FOR EQUIPMENT MOUNTED ON VIBRATION ISOLATORS AND CONTAINING HAZARDOUS MATERIAL.

N4. PROVIDE RESTRAINTS FOR BREAKABLE CONTAINERS THAT HOLD HAZARDOUS MATERIAL.

N5. BRACE PIPING OR DUCTWORK CONVEYING HAZARDOUS MATERIALS.

N6. INSTALL SHUT OFF VALVES FOR PIPING CONTAINING HAZARDOUS MATERIAL, INCLUDING NATURAL GAS.

N7. INSTALL FLEXIBLE COUPLINGS FOR DUCTWORK AND PIPING CONTAINING HAZARDOUS MATERIAL, INCLUDING NATURAL GAS PIPING.

N8. INDEPENDENTLY BRACE THE TOPS OF MASONRY.

N9. INSTALL SAFETY DEVICES FOR LIGHT FIXTURE LENS COVERS.

N10. ANCHOR CONTENTS TO THE STRUCTURE.

N11. INDEPENDENTLY SUPPORT AND LATERALLY BRACE EQUIPMENT WITH AN OPERATING WEIGHT MORE THAN 75 LB INSTALLED IN LINE WITH A DUCT OR PIPING SYSTEM.

N12. REMOVE AND REPLACE WITH DOORS DETAILED TO OPERATE AT A STORY DRIFT RATION OF 0.01.

N13. INSTALL HORIZONTAL RESTRAINTS OR SNUBBERS AND VERTICAL RESTRAINTS TO RESIST OVERTURNING FOR EQUIPMENT MOUNTED ON VIBRATION ISOLATORS.

N14. INSTALL FLEXIBLE COUPLINGS FOR FLUID AND GAS PIPING.

N15. ANCHOR AND BRACE FLUID AND GAS PIPING TO THE STRUCTURE.

ZCS
ENGINEERING
ARCHITECTURE
127 NW D Street, Grants Pass,
Oregon 97526 | 541-479-3865

LOOKINGGLASS RFD
7173 LOOKINGGLASS RD.
ROSEBURG, OR 97471

LOOKINGGLASS FIRE STATION SEISMIC RETROFIT

LRFD 1000

STRUCTURAL ENGINEER
REGISTERED PROFESSIONAL ENGINEER
OREGON
MATTHEW R. SMITH
OCT. 08, 2014
EXPIRES: 06-30-22

PRELIMINARY - NOT FOR CONSTRUCTION

REVISION ID:	DATE:

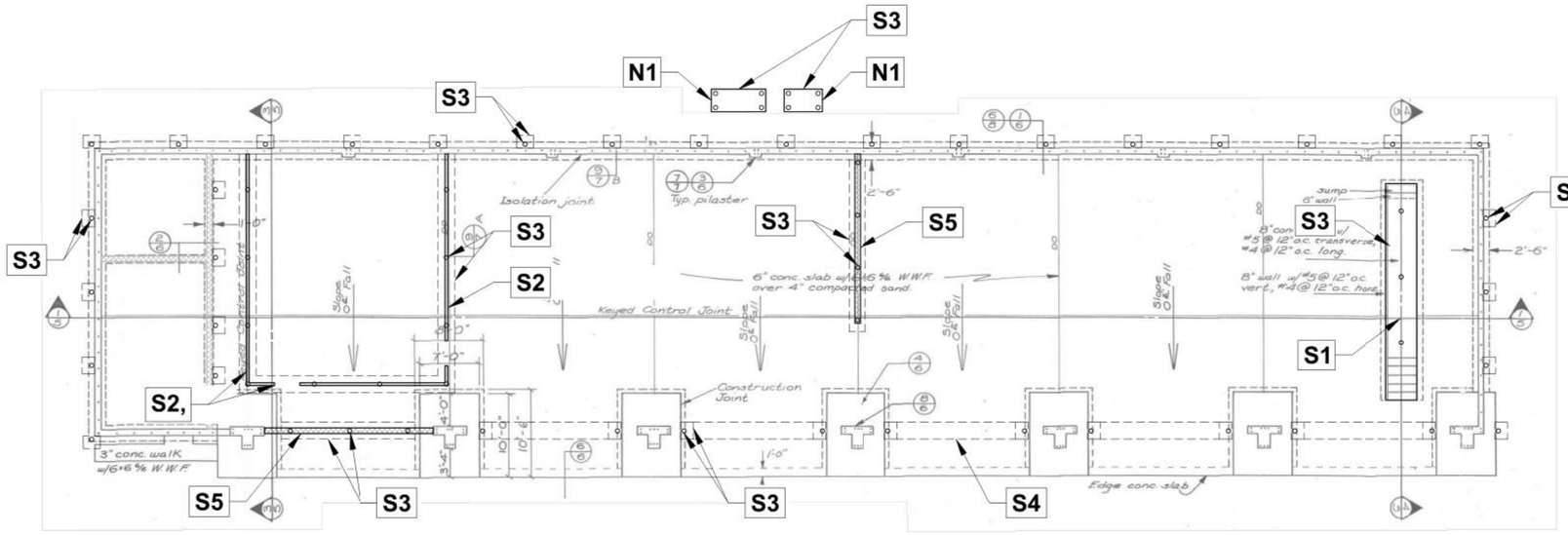
PROJECT NO:	G-1502-22
DRAWN:	PWR
CHECKED:	MRS
DATE:	FEB. 2022

REPAIR KEY NOTES

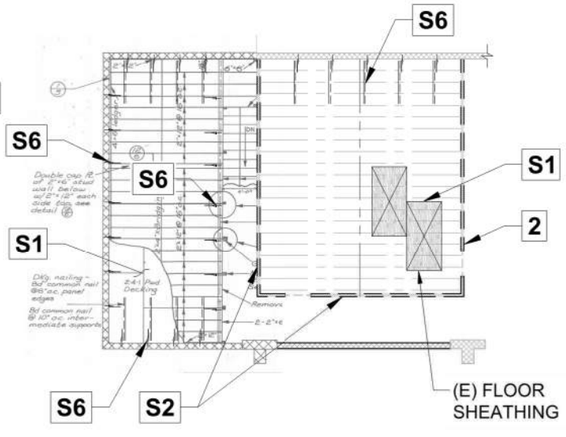
S1.1

PRELIMINARY DESIGN

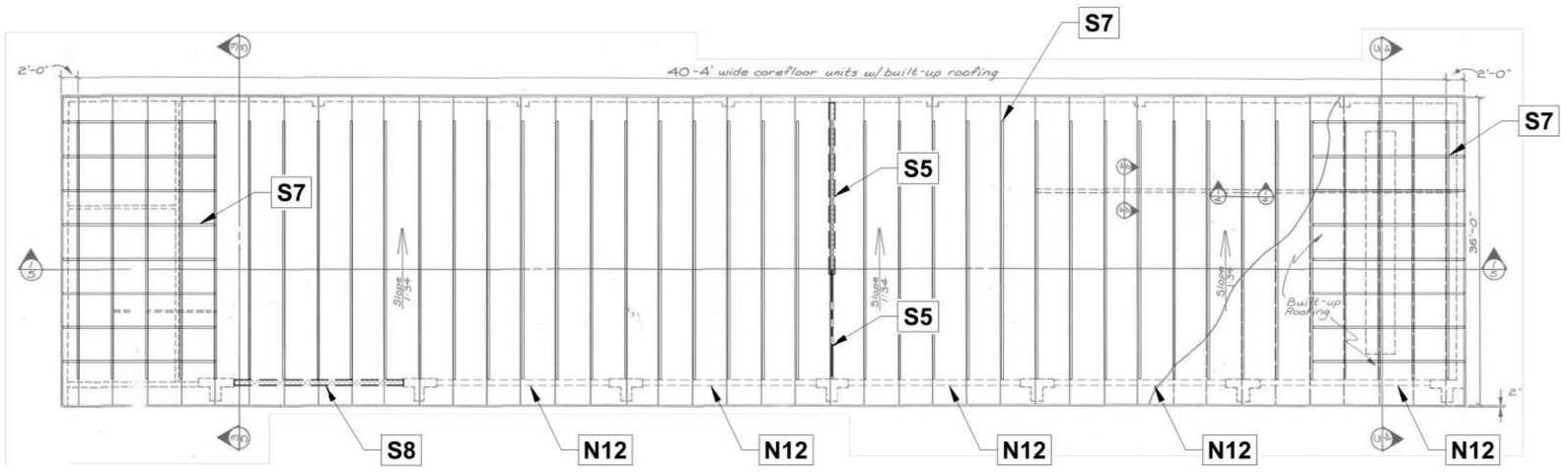
ONE INCH EQUALS FULL SCALE



1 S2.1 **FOUNDATION PLAN** 1/8"= 1'-0"



3 S2.1 **STORAGE FLOOR FRAMING PLAN** 1/8"= 1'-0"



2 S2.1 **ROOF FRAMING PLAN** 1/8"= 1'-0"

ONE INCH EQUALS FULL SCALE

ZCS ENGINEERING ARCHITECTURE
127 NW D Street, Grants Pass, Oregon 97526 | 541-479-3865

LOOKINGGLASS RFD
7173 LOOKINGGLASS RD.
ROSEBURG, OR 97471

LOOKINGGLASS FIRE STATION SEISMIC RETROFIT

LRFD 1000

STRUCTURAL REGISTERED PROFESSIONAL ENGINEER OREGON DEC. 08, 2014 MATTHEW R. SMITH EXPIRES: 06-30-22

-PRELIMINARY- NOT FOR CONSTRUCTION

△ REVISION ID:	DATE:

PROJECT NO:	G-1502-22
DRAWN:	PWR
CHECKED:	MRS
DATE:	FEB. 2022

FOUNDATION, STORAGE FLOOR FRAMING & ROOF FRAMING PLANS

S2.1

PRELIMINARY DESIGN

Appendix D:
Geotechnical Information

7173 Lookingglass Rd, Roseburg, OR 97471, USA

Latitude, Longitude: 43.18092000000001, -123.486614

Date	2/24/2022, 6:29:56 PM
Design Code Reference Document	ASCE41-17
Custom Probability	
Site Class	D - Default (See Section 11.4.3)

Type	Description	Value
Hazard Level		BSE-2N
S_S	spectral response (0.2 s)	0.911
S_1	spectral response (1.0 s)	0.508
S_{XS}	site-modified spectral response (0.2 s)	1.093
S_{X1}	site-modified spectral response (1.0 s)	0.91
F_a	site amplification factor (0.2 s)	1.2
F_v	site amplification factor (1.0 s)	1.792
ssuh	max direction uniform hazard (0.2 s)	1.055
crs	coefficient of risk (0.2 s)	0.864
ssrt	risk-targeted hazard (0.2 s)	0.911
ssd	deterministic hazard (0.2 s)	1.611
s1uh	max direction uniform hazard (1.0 s)	0.594
cr1	coefficient of risk (1.0 s)	0.855
s1rt	risk-targeted hazard (1.0 s)	0.508
s1d	deterministic hazard (1.0 s)	0.863

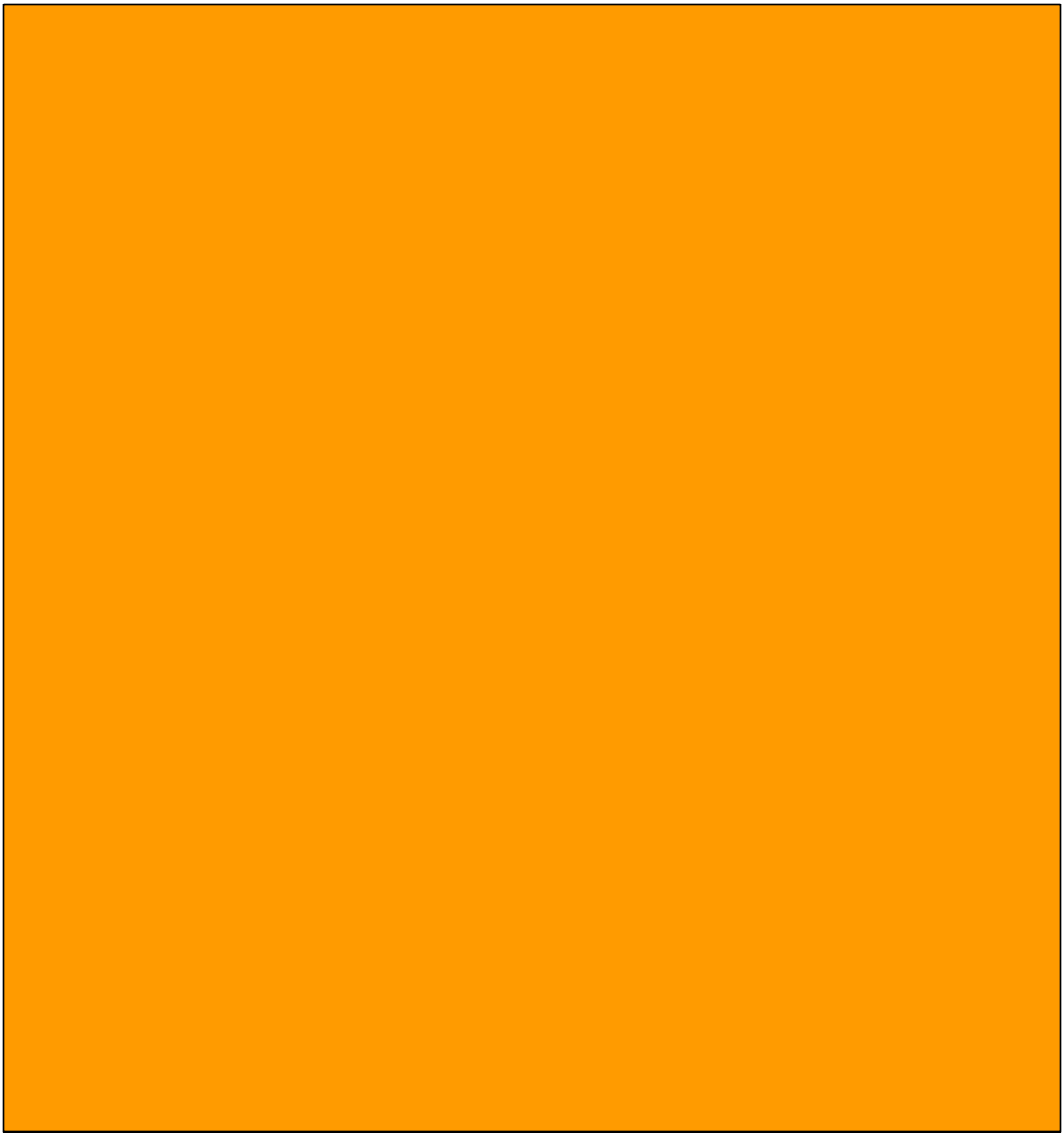
Type	Description	Value
Hazard Level		BSE-1N
S_{XS}	site-modified spectral response (0.2 s)	0.729
S_{X1}	site-modified spectral response (1.0 s)	0.607

Type	Description	Value
Hazard Level		BSE-2E
S_S	spectral response (0.2 s)	0.595
S_1	spectral response (1.0 s)	0.334
S_{XS}	site-modified spectral response (0.2 s)	0.788
S_{X1}	site-modified spectral response (1.0 s)	0.657
f_a	site amplification factor (0.2 s)	1.324
f_v	site amplification factor (1.0 s)	1.966

Type	Description	Value
Hazard Level		BSE-1E
S_S	spectral response (0.2 s)	0.129
S_1	spectral response (1.0 s)	0.066
S_{XS}	site-modified spectral response (0.2 s)	0.207
S_{X1}	site-modified spectral response (1.0 s)	0.159
F_a	site amplification factor (0.2 s)	1.6
F_v	site amplification factor (1.0 s)	2.4

Type	Description	Value
Hazard Level		TL Data
T-Sub-L	Long-period transition period in seconds	16

/LTXHIDFWLRQ +D]DUG 0DS



)HEUXDU\

+LJK

0RGHUDWH

/RZ

PL

NP

6XUIDFH)DXOW 5XSWXUH +D]DUG

)HEUXDU\

$FWLYH)DXOWV

PL

NP

/DQGVOLGH +D]DUG 0DS

)HEUXDU\

/DQGVOLGH +D]DUG

PL

NP

- /RZ /DQGVOLGLQJ 8QOLNHO\
- 0RGHUDWH /DQGVOLGLQJ 3RVVLEOH
- +LJK /DQGVOLGLQJ /LNHO\
- 9HU\ +LJK ([LVWLQJ /DQGVOLGH

Appendix E: Construction Cost Estimate Worksheets

ENGINEER'S OPINION OF PROBABLE COST - LOOKINGGLASS FIRE STATION SEISMIC REHABILITATION

SUMMARY

Description	Deficiencies (Ref. Seismic Evaluation Report Sec. 7.0)	Quantity	Units	Unit Price	Total Price for Construction Item
GENERAL CONDITIONS					
General Conditions		10%	%		$ 138,430.00
Preconstruction Services		2%	%		$ 27,686.00
Escalation		7%	%		$ 108,529.12
Bonding & Insurance		3%	%		$ 46,512.48
Contractor Profit & Overhead		5%	%		$ 77,520.80
				General Conditions Subtotal	$ 398,678.40
Non-Structural Elements					
Misc MEP	N1, N2, N3, N4, N5, N6, N7 N9, N11, N13, N14	1	Lump Sum	$ 89,200.00	$ 89,200.00
Misc Non-Structural	N8, N10	1	Lump Sum	$ 35,700.00	$ 35,700.00
Garage Doors	N12	5	EA	$ 25,000.00	$ 125,000.00
				Non-Structural Subtotal	$ 249,900.00
Construction Cost Per Building Part					
				Building Part 'A' Subtotal	$ 1,134,400.00
				Sub-Total Construction Cost	$ 1,783,000.00
				Contingency 15%	$ 267,450.00
				Total Construction Cost	$ 2,050,450.00
Cost Estimate Summary					
Engineering					$ 296,200.00
Architectural Consulting				$ 30,800.00	
Structural / Rehabilitation Engineering				$ 225,500.00	
Geotechnical Consulting				$ 18,500.00	
Materials Testing for Design				$ 16,400.00	
Seismic Feasibility Study Reimbursement				$ 5,000.00	
Construction Management					$ 59,500.00
Construction					$ 1,842,500.00
Sub-Total Construction Cost				$ 1,783,000.00	
Special Inspection Services for Construction				$ 18,500.00	
Permitting Fees				$ 41,000.00	
Relocation of FF&E					$ 26,700.00
Contingency					$ 267,450.00
				Total Project Funding Requirement	$ 2,492,350.00

ENGINEER'S OPINION OF PROBABLE COST - LOOKINGGLASS FIRE STATION SEISMIC REHABILITATION

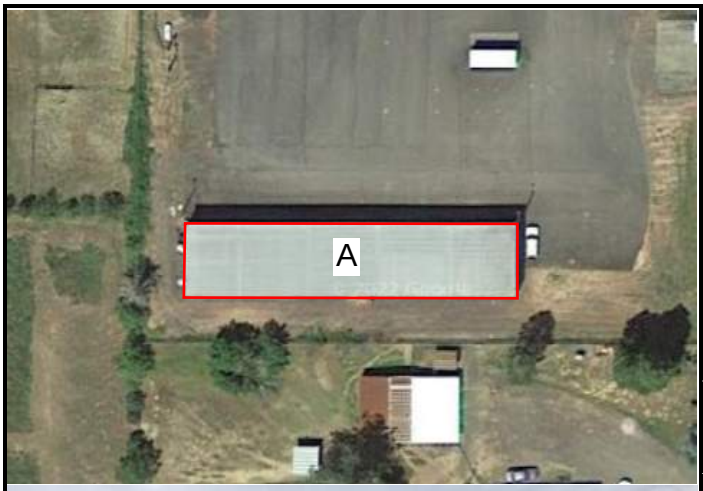
BUILDING PART - 'A'

Description	Deficiencies (Ref. Seismic Evaluation Report Sec. 7.0)	Quantity	Units	Unit Price	Total Price for Construction Item
Demolition & Asbestos Abatement					
Soft Demolition	S1,S2,S5,S6	800	Square Foot	$ 2.00	$ 1,600.00
Abatement	S5,S7	6000	Square Foot	$ 5.00	$ 30,000.00
TPO / Comp / Metal Roof Demo	S5,S7	6000	Square Foot	$ 2.00	$ 12,000.00
Hard Demolition	S3	1500	Square Foot	$ 20.00	$ 30,000.00
			Demolition & Asbestos Subtotal		$ 73,600.00
Foundation / Floor Strengthening Construction					
Shear Wall Footings - Wood Walls	S3	80	Linear Foot	$ 300.00	$ 24,000.00
Shear Wall Footings - CMU / Concrete	S3,S5	50	Linear Foot	$ 300.00	$ 15,000.00
Bolting of Extg Walls to footings	S2	80	Linear Foot	$ 35.00	$ 2,800.00
Diaphragm Attachments - Out-of-Plane	S6	270	Linear Foot	$ 50.00	$ 13,500.00
Diaphragm Attachments - In-Plane Shear	S2	200	Linear Foot	$ 20.00	$ 4,000.00
Re-Nail Existing Plywood	S1	1300	Square Foot	$ 3.00	$ 3,900.00
Micropile	S3	76	Each	$ 5,000.00	$ 380,000.00
Concrete Repair & Patching	S1, S3	1800	Square Foot	$ 15.00	$ 27,000.00
Deep Foundation Mobilization	S3	1	Each	$ 20,000.00	$ 20,000.00
Pile Cap	S3	42	Each	$ 4,000.00	$ 168,000.00
			Foundation Level Subtotal		$ 658,200.00
Wall Strengthening Construction					
Sheathing of Existing Walls	S2	1000	Square Foot	$ 5.00	$ 5,000.00
New CMU / Concrete Shear Walls	S5	900	Square Foot	$ 30.00	$ 27,000.00
Interior Wall Finish Repair	S1,S2,S5,S6	800	Square Foot	$ 2.00	$ 1,600.00
Painting	S1,S2,S5,S6	6000	Square Foot	$ 3.00	$ 18,000.00
			Wall Strengthening Subtotal		$ 51,600.00
Roof Strengthening Construction					
Diaphragm Attachments - Out-of-Plane	S1,S7	320	Linear Foot	$ 50.00	$ 16,000.00
New 6" polyisociurinate rigid insulation	S5,S7	6000	Square Foot	$ 15.00	$ 90,000.00
New 3-ply Built Up Roof	S5,S7	6000	Square Foot	$ 17.00	$ 102,000.00
Ceiling Repair	S1,S2,S6	1000	Square Foot	$ 3.00	$ 3,000.00
FRP Diaphragm Strengthening	S7	2800	Square Foot	$ 50.00	$ 140,000.00
			Roof Strengthening Subtotal		$ 351,000.00
			Building Part 'A' - Total Construction Cost		$ 1,134,400.00

Appendix F:
Rapid Visual Screening

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

Level 1
MODERATELY HIGH Seismicity



SKETCH

Address: 7173 LOOKINGGLASS RD
ROSEBURG, OR **Zip:** 97471
Other Identifiers:
Building Name: LOOKINGGLASS FIRE STATION
Use: Fire Station
Latitude: 43.1809493365521960 **Longitude:** 123.4864986651905
S_S: 0.911g **S_1:** 0.508g
Screener(s): ZCS - KDM **Date/Time:** 2/17/2022

No. Stories: Above Grade: 1 Below Grade: **Year Built:** 1978 ☐ EST
Total Floor Area (sq. ft.): 6000 **Code Year:** Unknown
Additions: ■ None ☐ Yes, Year(s) Built:

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)
■ Plan (type) Torsion

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

COMMENTS:

☐ 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	**4.1**	**3.7**	**3.2**	**2.3**	**2.2**	**2.9**	**2.2**	**2.0**	**1.7**	**2.1**	**1.4**	**1.8**	**1.5**	**1.8**	**1.8**	**1.2**	**2.2**
Severe Vertical Irregularity, V_{L1}	-1.3	-1.3	-1.3	-1.1	-1.0	-1.2	-1.0	-0.9	-1.0	-1.1	-0.8	-1.0	-0.9	-1.0	-1.0	-0.8	NA
Moderate Vertical Irregularity, V_{L1}	-0.8	-0.8	-0.8	-0.7	-0.6	-0.8	-0.6	-0.6	-0.6	-0.6	-0.5	-0.6	-0.6	-0.6	-0.6	-0.5	NA
Plan Irregularity, P_{L1}	-1.3	-1.2	-1.1	-0.9	-0.8	-1.0	-0.8	-0.7	-0.7	-0.9	-0.6	-0.8	-0.7	-0.7	-0.7	-0.5	NA
Pre-Code	-0.8	-0.9	-0.9	-0.5	-0.5	-0.7	-0.6	-0.2	-0.4	-0.7	-0.1	-0.4	-0.3	-0.5	-0.5	-0.1	-0.3
Post-Benchmark	1.5	1.9	2.3	1.4	1.4	1.0	1.9	NA	1.9	2.1	NA	2.1	2.4	2.1	2.1	NA	1.2
Soil Type A or B	0.3	0.6	0.9	0.6	0.9	0.3	0.9	0.9	0.6	0.8	0.7	0.9	0.7	0.8	0.8	0.6	0.9
Soil Type E (1-3 stories)	0.0	-0.1	-0.3	-0.4	-0.5	0.0	-0.4	-0.5	-0.2	-0.2	-0.4	-0.5	-0.3	-0.4	-0.4	-0.3	-0.5
Soil Type E (> 3 stories)	-0.5	-0.8	-1.2	-0.7	-0.7	NA	-0.7	-0.6	-0.6	-0.8	-0.4	NA	-0.5	-0.6	-0.7	-0.3	NA
Minimum Score, S_{MIN}	*1.6*	*1.2*	*0.8*	*0.5*	*0.5*	*0.9*	*0.5*	*0.5*	*0.3*	*0.3*	*0.3*	*0.3*	*0.2*	*0.3*	*0.3*	*0.2*	*1.4*

FINAL LEVEL 1 SCORE, $S_{L1} \geq S_{MIN}$: 1.1 FEMA P-154 Collapse Potential Moderate (>1%)

EXTENT OF REVIEW

Exterior: ☐ Partial ■ All Sides ☐ Aerial
Interior: ☐ None ☐ Visible ■ Entered
Drawings Reviewed: ■ Yes ☐ No
Soil Type Source: Assumed
Geologic Hazards Source: DOGAMI
Contact Person:

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