Development Services

From Concept to Construction

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APPEAL SUMMARY

Status: Decision Rendered

Appeal ID: 27738	**Project Address:** 4350 NW Front Ave, Ways 2 Bldg
Hearing Date: 5/11/22	**Appellant Name:** Trent Lee Tinney
Case No.: B-004	**Appellant Phone:** 4257530495
Appeal Type: Building	**Plans Examiner/Inspector:** Jason Butler-Brown, Amit Kumar
Project Type: commercial	**Stories:** 1 **Occupancy:** F-1 **Construction Type:** Type I
Building/Business Name: Greenbrier Gunderson - Ways 2	**Fire Sprinklers:** Yes - Everywhere
Appeal Involves: other: Repair of an Existing Structure	**LUR or Permit Application No.:**
Plan Submitted Option: pdf [File 1] [File 2] [File 3]	**Proposed use:** Manufacturing, Group F-1

APPEAL INFORMATION SHEET

Appeal item 1

Code Section	ASCE 7-16 Table 12.13-2 & 12.13.9.2.1
Requires	2019 OSSC Section 1613.1 Scope: “Every structure […] shall be designed and constructed to resist the effects of earthquake motions in accordance with Chapter[s…] 12 of ASCE 7, as applicable. ASCE 7-16 Section 12.12.9.2 Shallow Foundations: “Building structures shall be permitted to be supported on shallow foundations provided […] the geotechnical investigation report indicates that permanent horizontal ground displacement induced by lateral spreading associated with MCEG earthquake motions does not exceed the value in Table 12.13-2. ASCE 7-16 Table 12.13-2 provides an upper bound limit on the horizontal ground displacement from lateral spreading for shallow foundations beyond which deep foundations are required. Section 12.13.9.2.1 requires design and detailing of shallow foundations which requires substantial interconnection among spread footings.
Code Modification or Alternate Requested	Although preliminary geotechnical investigation has found that lateral spreading is likely to exceed the limits in ASCE Table 12.13-2, based on our preliminary structural analysis of the building, we believe that, when modified as proposed, the steel superstructure will be able to sustain applicable seismic demands and maintain an appropriately low risk of collapse. In addition, the few occupants that would be expected to be in the building during an earthquake will have unobstructed access to exits and, if required, additional exists can be provided. Consequently, it is our opinion that when modified as proposed, the building will have adequate seismic performance characteristics, including a level of safety and reliability much greater than existing before the recent roof collapse.

Proposed Design	The heavy timber roof structure collapsed from snow and we're simply trying to replace the roof structure of the building. The new roof structure will be of steel construction and much lighter than the previous roof. Given that the new roof structure for the building will be much lighter in comparison to the collapsed timber bowstring roof, greatly reducing overall seismic and gravity demands; and given that the superstructure will be greatly enhanced to meet building code requirements for new construction in accordance with the PCC, we believe that the building will be able to tolerate design level lateral spreading and differential displacements without catastrophic collapse.
Reason for alternative	Our case for appeal is based on the expected performance of the building according to the performance goals stated in Section 1.1 of NEHRP, including 1) reasonable assurance of seismic performance that will avoid serious injury and life loss due to structure collapse, and 2) preserve means of egress. Given that the new roof structure for the building will be much lighter in comparison to the collapsed timber bowstring roof, greatly reducing overall seismic and gravity demands; and given that the superstructure will be greatly enhanced to meet building code requirements for new construction in accordance with the PCC, we believe that the building will be able to tolerate design level lateral spreading and differential displacements without catastrophic collapse.

APPEAL DECISION

Omission of seismic requirements required by roof replacement: Granted provided:

1. Rigorous analysis and detailed calculations that incorporates analysis of connections and member stresses to demonstrate that the structure will not collapse when subjected to differential settlement and lateral displacements shall be provided as part of the permit submittal.

2. The design team demonstrates through rigorous analysis that the building is reasonably safe from collapse and maintains safe egress when subject to seismic shaking and associated displacements due to liquefaction to be verified at time of plan review.

3. The building occupancy classification must not change or increase in hazard from its current designation.

Appellant may contact Kevin Wells (503-823-5618) with questions.

The Administrative Appeal Board finds with the conditions noted, that the information submitted by the appellant demonstrates that the approved modifications or alternate methods are consistent with the intent of the code; do not lessen health, safety, accessibility, life, fire safety or structural requirements; and that special conditions unique to this project make strict application of those code sections impractical.

Pursuant to City Code Chapter 24.10, you may appeal this decision to the Building Code Board of Appeal within 90 calendar days of the date this decision is published. For information on the appeals process, go to www.portlandoregon.gov/bds/appealsinfo, call (503) 823-7300 or come in to the Development Services Center.

0 25.5' 50' 100' 200'

SCALE: 1:50

KEY	
ROADWAY	
PROPERTY BOUNDARY	
WORK AREA	
BUILDINGS NOT IN SCOPE	
UNION PACIFIC RAILWAY	

N

NOTES:

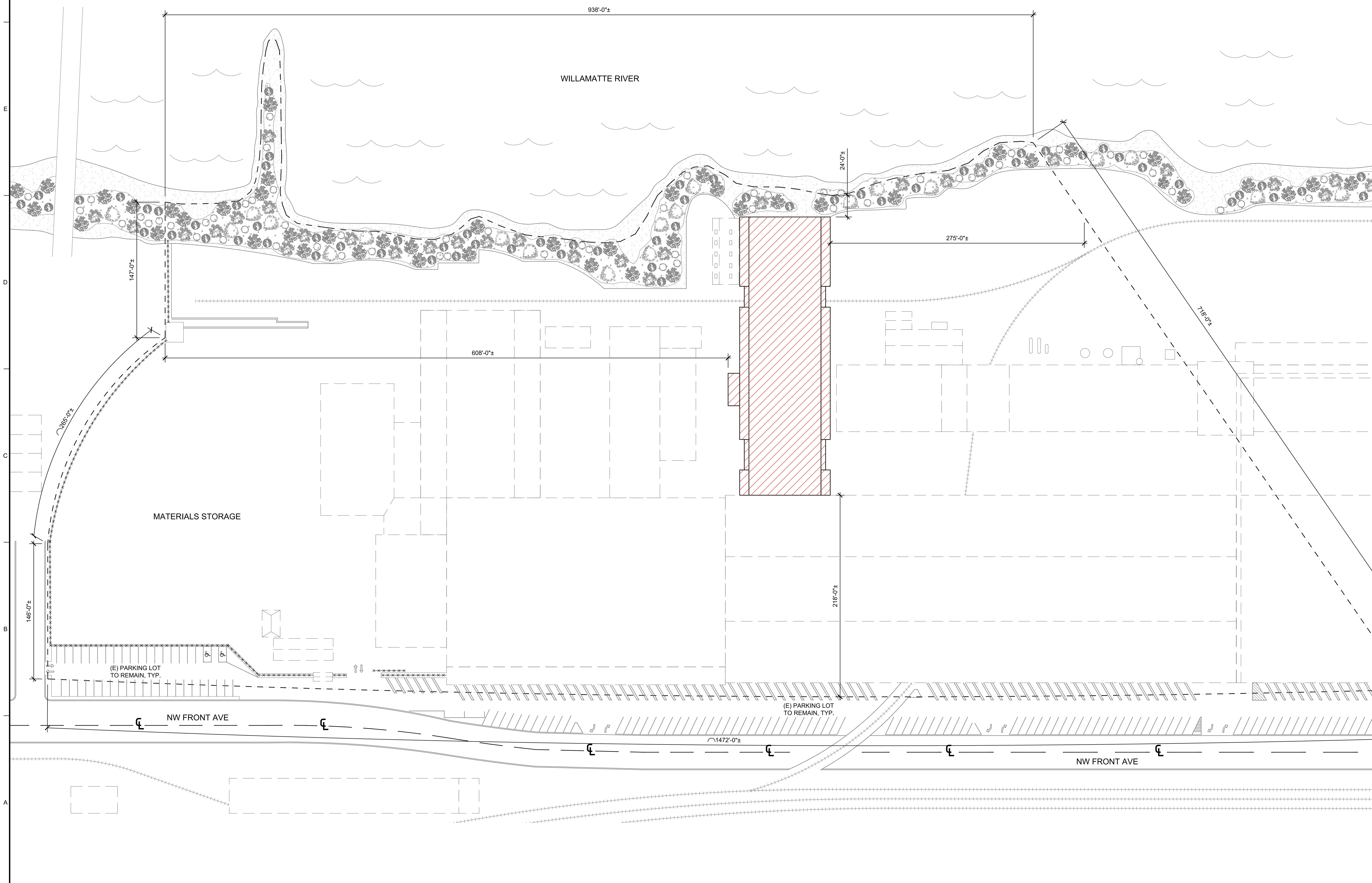
1. NO CHANGES TO EXISTING UNDERGROUND UTILITIES, OVERHEAD POWER LINES, SIDEWALKS, DRIVEWAY, OR STORM WATER DRAINAGE ARE PROPOSED IN THIS WORK.

INFORMATION SHOWN ON THIS DRAWING IS FROM ONE OR MORE OF THE FOLLOWING SOURCES AND IS NOT BASED ON BOUNDARY LINE OR TOPOGRAPHICAL SURVEY:

1. LIMITED VISUAL OBSERVATION BY WJE
2. GOOGLE EARTH IMAGERY
3. PROPERTY INFORMATION FROM MULTNOMAH COUNTY: https://www.portlandmaps.com/

GUNDERSON LLC

PROPERTY ID: P415743
SITE ADDRESS: 4350 NW FRONT AVE, PORTLAND, OR 97210
PROPERTY CLASS: PERSONAL PROPERTY INDUSTRIAL
LEGAL DESCRIPTION: TL 57 SEC 20 1N 1E
OWNER: GUNDERSON LLC.
4350 NW FRONT AVE, PORTLAND, OR 97210



WJE ENGINEERS ARCHITECTS MATERIALS SCIENTISTS

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Atlanta | Austin | Boston | Chicago | Cleveland | Dallas | Denver | Detroit
Honolulu | Houston | Indianapolis | Los Angeles | Minneapolis | New Haven
New York | Philadelphia | Pittsburgh | Portland | Princeton | Raleigh
San Antonio | San Diego | San Francisco | Seattle | South Florida
Washington, D.C. | London, England

Consultants

Project

Greenbrier
Gunderson Ways 2
Building Repair
4350 NW Front Avenue
Portland, OR 97210

Client

The Greenbrier Companies
4350 NW Front Avenue
Portland, OR 97210

Mark	Date	Description

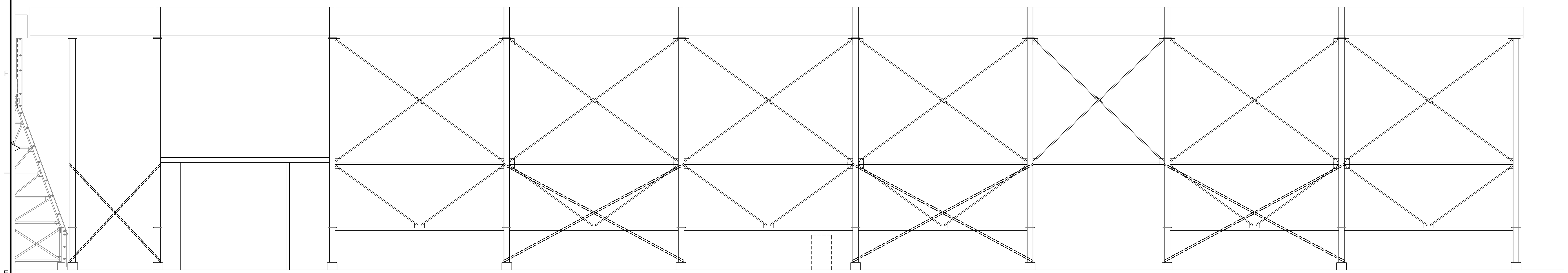
0 1/2" 1" 2"
THIS SHEET PLOTS FULL SIZE AT 24x36 (INCHES)

Project No.	2021.1080
Date	13 APRIL 2022
Drawn	BRS
Checked	TLT / ZTS / ZAM
Scale	AS NOTED

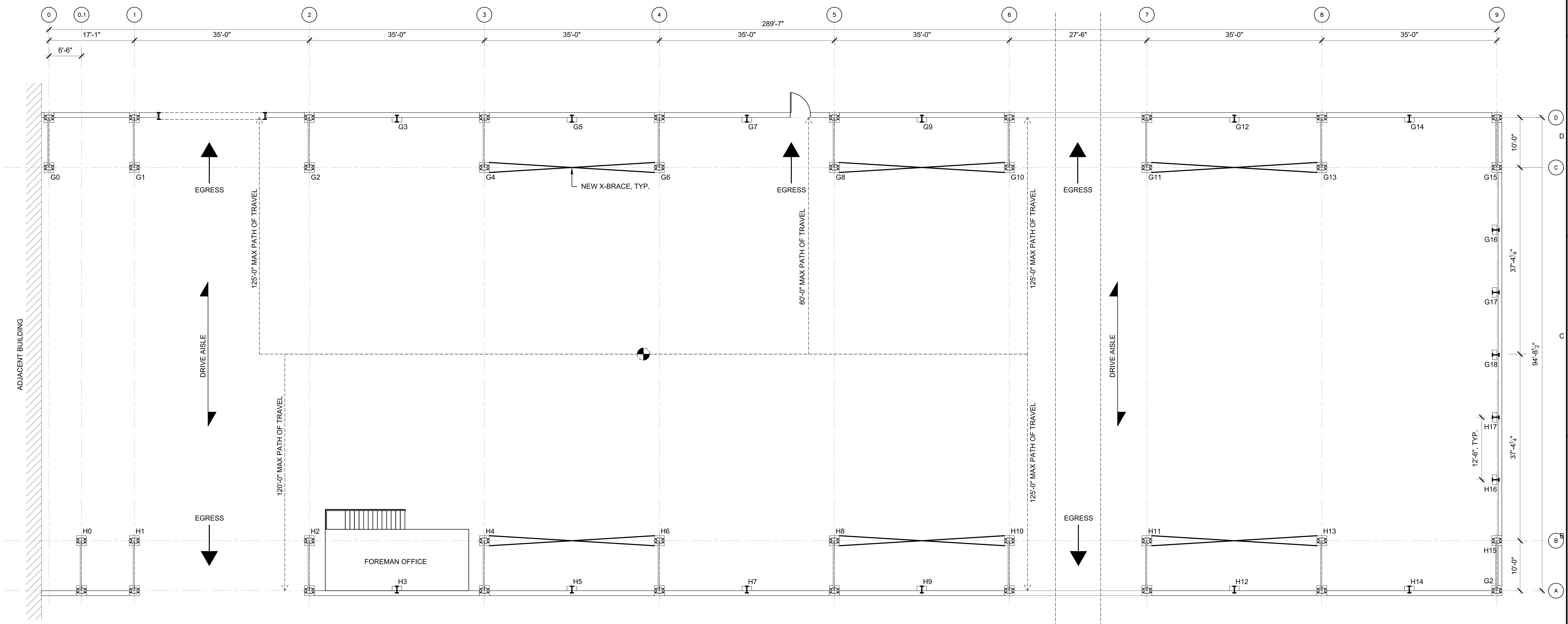
SITE PLAN

Sheet Title

Sheet No. **G003**



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



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

N

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Scale	AS NOTED

EGRESS PLAN

Sheet Title

Sheet No. **G004**

Plotted: 4/13/2022 11:43 AM by Schuman, Brad File Name: C:\Users\bschum\OneDrive - Wiss, Janney, Elstner Associates, Inc\Seattle Current\2021.1080 Greenbrier\2021.1080 Greenbrier.dwg

PO Box 2338
Santa Cruz, CA 95063

15 April 2022

Trent L. Tinney
Senior Associate
Wiss, Janney, Elstner Associates, Inc.
960 South Harney Street, Seattle, WA 98108

via email:
ttinney@wje.com

Re: Building Code Appeal – Seismic Performance
Ways 2 Repairs, Greenbrier Gunderson Facility
4700 WI/NW Front Avenue, Portland, Oregon

Dear Trent,

As stated in the Building Code Appeal application, the Ways 2 building's displacement tolerance, high bays, open egress, and low occupancy combine to achieve the life-safety intent of the building code seismic design provisions. This letter provides supplemental technical detail in support of granting the requested exemption to the lateral displacement limits in ASCE 7-16 Table 12.13-2.

Background

The original building covered Shipways No. 2, a sloping rail that formerly descended from present yard grades into the Willamette River. The foundation was modified with reinforced concrete tie walls before the ways was filled to create a level floor in 1977. In the current configuration, the building is bounded on the north end by the sloping Willamette Riverbank and on three sides by flat ground covered.

Snow loads collapsed the former timber bowstring truss roof in February 2021. Based on the extent of damage to the lateral force resisting system as determined by Wiss, Janney, Elstner, Associates (WJE), Portland City Code Section 24.85.055.B requires that the repaired building meet current building code requirements for new structures. Under MCE-level shaking, the expected free-field lateral spread displacement at the Ways 2 site exceeds the Code limit. The low occupancy and structural configuration of the building, though, suggest that a Building Code Appeal has technical merit and is an appropriate way forward to allow the roof replacement to proceed.

Performance Standard

The most current seismic provisions in the US model code system, FEMA P-2082 [FEMA 2020] establishes that the building code seeks to provide reasonable assurance of seismic performance that will:

1. Avoid serious injury and life loss due to:
   a. Structure collapse
   b. Failure of nonstructural components or systems
   c. Release of hazardous materials
2. Preserve means of egress
3. Avoid loss of essential functions in critical facilities, and
4. Reduce structural and nonstructural repair costs where practicable.

Several of these objectives are unimportant to the Ways 2 repair project. Specifically, the structure will not store hazardous materials, is not a critical facility, and is not intricate or active enough to be sensitive to repair costs. The remaining performance objectives are:

1. Avoid serious injury and loss of life due to structure collapse.
2. Avoid serious injury and loss of life due to nonstructural system failure, and
3. Preserve means of egress following a damaging earthquake.

Mitigating Factors

Large Settlement Tolerance

The building is a single-story steel frame structure; it can tolerate very large differential settlement and lateral displacement without risk of collapse. Specifically, the 35-ft bay width can tolerate up to 6.3 inches of differential settlement between footings according to ASCE 7-16 Table 12.13-3. Geotechnical computations [Atlas Geotechnical 2022] indicate that differential settlement is expected to about half that.

Reinforced Concrete Foundation Ties

The 1977 drawings show reinforced concrete walls tying all footings together along both longitudinal walls (the direction of potential lateral spread.) The walls are 8 inches thick and extend from present floor elevations, down 7 to 17 feet, to the footings that bear below the prior shipways rails.

These robust grade beams are not accessible for verification and are not considered in the deformation analyses. Regardless, they connect the column bases together in a way that mitigates the lateral spread magnitude.

Wall Opening Egress

The structure has a single man-door and four bay-wide openings in the walls (two per side), and therefore very low risk of blocked or inhibited egress. All exits are at ground level, without stairs or ramps. Further, the building has no furniture, rack storage, portable tools, or equipment that could topple to block access to the wall openings. The building configuration, and specifically the unimpeded large wall openings, assures unimpeded egress.

Low Occupancy

The Ways 2 structure has very low occupancy, a few workers generally, with no permanent workstations or equipment. With so few occupants, the risk posed by the structure during an earthquake is much smaller than for other buildings of comparable size.

As an example of how the Code requirements vary in proportion to risk, agricultural storage structures generally are exempt from most code requirements because such structures are intended only for incidental human occupancy and represent an exceptionally low risk to human life [FEMA 2020]. The Ways 2 structure has slightly higher use than an exempt structure, but in combination with the wall openings and other factors the low occupancy is a credible factor when considering a Building Code Appeal.

Delay in Lateral Displacements

Geotechnical analyses indicate that the Willamette riverbank slope adjacent to the building's north end is neither prone to:

- instability under pseudo-static loading or
- "flow" type failures resulting from inadequate post-earthquake shear strength, typically due to liquefaction.

The former type of instability is often evaluated using some fraction of peak ground acceleration and approximates an instantaneous load. The latter type of instability typically occurs towards or at the end of strong motion, after liquefaction has developed, but can also be considered an instantaneous (or rapid) failure. Neither type of failure is expected at the Ways 2 site.

On the other hand, liquefaction induced lateral spreading, which is expected to affect the north side of the Ways 2 site, leads to progressive ground failure that begins sometime after the onset liquefaction [Kramer 2008]. Generally, the chronology is as follows:

1. Earthquake shaking begins.
2. Pore-pressures in liquefaction susceptible soils begin to increase with each earthquake loading cycle.
3. The onset of liquefaction occurs as pore pressures become sufficiently large.
4. Significant shear strains begin to accumulate with each subsequent loading cycle.
5. Strong ground motion ends and permanent displacements reach their maximum value.

The time between Steps 1 and 5 above is non-negligible, especially for this site where the liquefaction hazard over the service life of the building is dominated by a Cascadia interface earthquake with a modest peak ground acceleration, but a large magnitude and therefore many loading cycles [e.g., Idriss and Boulanger 2004 and Lasley et al. 2017]. Kramer et al. [2016] considered 18 different ground motion records that met specific filtering criteria and computed an approximate time to liquefaction triggering. Their results generally show 10+ seconds between the beginning of strong ground motion and the onset of liquefaction. The delay in the onset of liquefaction was more pronounced in the few subduction records included in their database.

The building is not expected to be suitable for continued occupancy after the MCE-level earthquake, but the damaging deformations are not expected to happen at the beginning of shaking. In the intervening time it is expected that the few building occupants, if any, will exit through the wall openings.

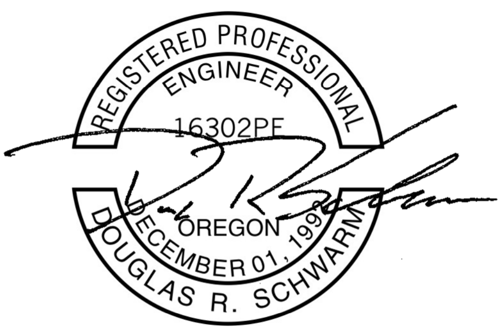
Summary

The various mitigating factors at the Ways 2 building create an interesting dichotomy where:

1. The existing building is not likely to satisfy the Building Code's seismic displacement requirements as described in ASCE 7-16 Table 12.13-2, yet
2. Considering the open egress, buried foundation ties, delayed nature of the lateral ground displacements, and low occupancy, the building almost certainly satisfies the intent of the current recommended seismic provisions.

On this basis, we support granting an exemption through a Building Code Appeal and suggest that conditions of the appeal approval, if any, focus on preserving the egress and occupancy building features that mitigate earthquake risk.

Yours sincerely,



Douglas R. Schwarm, P.E.
Chief Engineer

References

Idriss, I.M., & Boulanger, R.W. (2004). "Semi-Empirical Procedures for Evaluating Liquefaction Potential During Earthquakes." Invited Paper for the 11th International Conference on Soil dynamics and Earthquake Engineering. January 7-9 Berkeley, CA.

Kramer, Steve & Sideras, S.S. & Greenfield, Mike. (2016). The timing of liquefaction and its utility in liquefaction hazard evaluation. Soil Dynamics and Earthquake Engineering. 91. 10.1016/j.soildyn.2016.07.025.

Kramer, Steve. (2008). Evaluation of liquefaction hazards in Washington State. Washington State Dept. Trans. Rep. WA-RD 668.1.

Lasley, Sam & Green, Russell & Rodriguez-Marek, Adrian. (2017). Number of Equivalent Stress Cycles for Liquefaction Evaluations in Active Tectonic and Stable Continental Regimes. Journal of Geotechnical and Geoenvironmental Engineering. 143. 04016116-1. 10.1061/(ASCE)GT.1943-5606.0001629.