

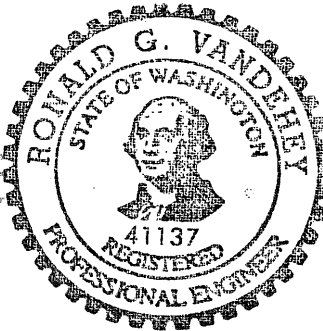


RA Long High School Portico Stone Repair
2903 Nichols Blvd, Longview, WA
Brittelle Architecture Inc

April 14, 2026
Project No. 260364
6 pages

Ronald G. Vandehy

Digitally signed by Ronald G. Vandehy
DN: cn=Ronald G. Vandehy, o=The
G-Ronald Shires Vandehy Co-
Consulting Engineers, Inc.,
L=Portland, G=Oregon, C=US,
OID.2.5.4.97="NTRUS+GR-137788"
Date: 2026.04.28 13:50:18 -0700



4/28/2026

Project Design Criteria

Structural System Information

Building Code: 2021 Washington State Building Code
Risk Category: III
Structural System: Building Structure
Importance Factors: $I_s = 1.10$ $I_l = 1.15$ $I_w = 1.00$ $I_e = 1.25$

Loading Information

	Dead	Live	Live Point	Snow
(N) Panel	717 lbs			

Deflection Criteria

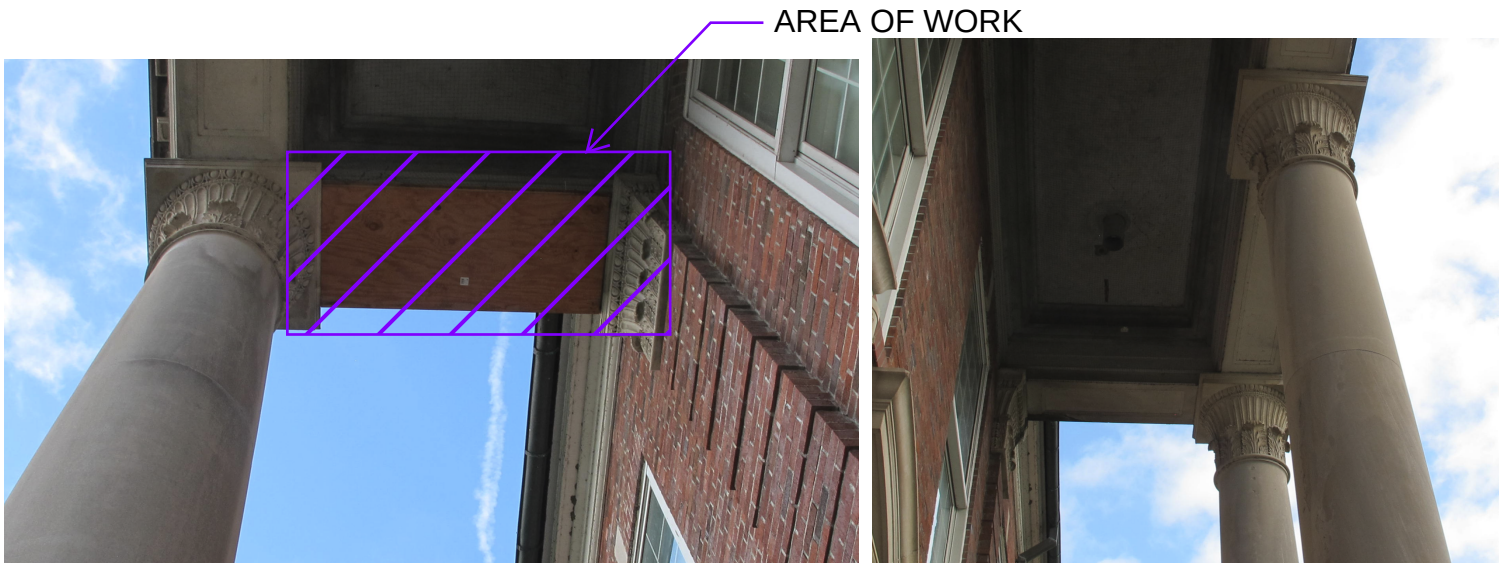
	Dead	Live/Wind	Snow
(N) Panel			

Seismic Loading

See next page for seismic design values.

Scope of Work

Provide structural calculations and drawings for the repair or replacement of the damaged Portico stones at RA Longview.



(E) concrete panel is 4"-6" thick, (N) panel will be 4" thick.
Other dimensions will be identical.

(E) structural elements do not need to be re-evaluated
because (N) loading is decreased from (E)



9600 SW Oak St #400
Portland, OR 97223

503.246.1250
miller-se.com

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Location 2903 Nichols Blvd, Longview, WA

Client Brittell Architecture Inc

By SJD

Ck'd

Date 4/14/2026

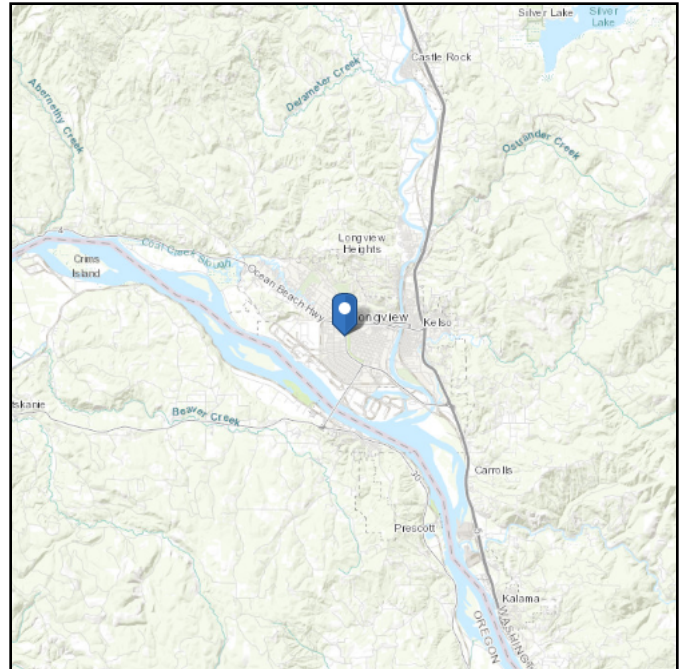
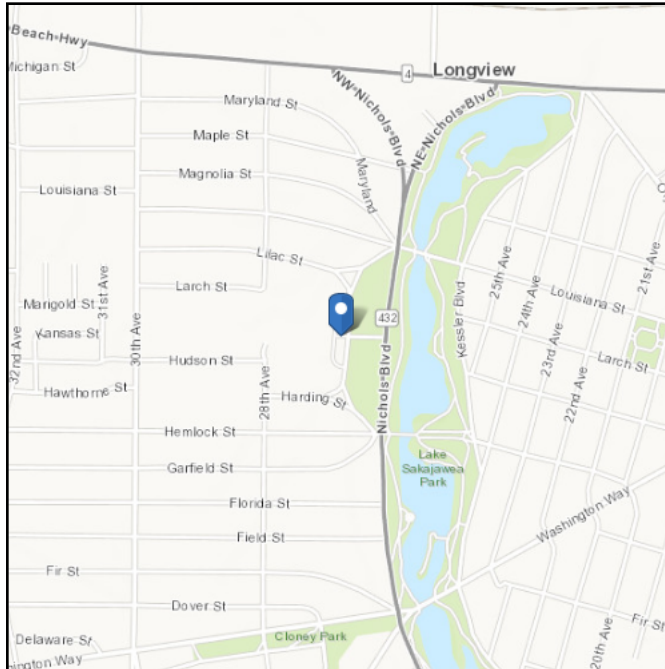
Page 1 of 6

ASCE Hazards Report

Address:
No Address at This Location

Standard: ASCE/SEI 7-16
Risk Category: III
Soil Class: D - Default (see Section 11.4.3)

Latitude: 46.140469
Longitude: -122.954972
Elevation: 20.14200270163068 ft (NAVD 88)



Seismic

Site Soil Class: D - Default (see Section 11.4.3)

Results:

S_S :	0.903	S_{D1} :	N/A
S_1 :	0.439	T_L :	16
F_a :	1.2	PGA :	0.414
F_v :	N/A	PGA_M :	0.496
S_{MS} :	1.083	F_{PGA} :	1.2
S_{M1} :	N/A	I_e :	1.25
S_{DS} :	0.722	C_v :	1.251

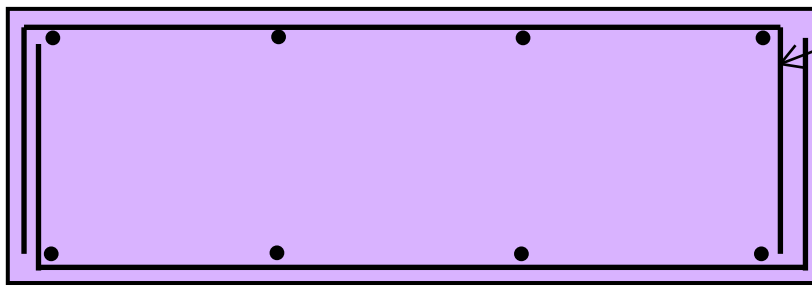
Ground motion hazard analysis may be required. See ASCE/SEI 7-16 Section 11.4.8.

Data Accessed: Mon Apr 13 2026

Date Source: [USGS Seismic Design Maps](https://seismicdesignmaps.org/)

Damaged Ceiling Panel:

(E) is 4"-6" thick, Use 4" for new panel



#4 rebar reinforcing in precast panel

27"

Designed to match (E)

74.875"

$4" \times 74.875" \times 27" = 8086.5 \text{ in}^3 / 12^3 = 4.67 \text{ ft}^3 \times 150 \text{ psf} = 701.95 \text{ lbs}$
 $(27" \times 4) + (72.875" \times 2) / 12 = 21.15' \text{ rebar} \times 0.668 \text{ plf} = 14.16 \text{ lbs}$
 $701.95 \text{ lbs} + 14.16 \text{ lbs} \sim 717 \text{ lbs}$

Fasteners into (E) channels (1/2" thick steel)

For reference (ESR-1976):

TABLE 2—ALLOWABLE TENSILE PULL-OUT LOADS (P_{NOV}/Ω), pounds-force^{1,2,3,4,5}

Screw Designation	Nominal Diameter (in.)	Steel $F_u = 45 \text{ ksi}$, Applied Factor of Safety, $\Omega=3.0$										
		Design Thickness of Member Not in Contact with the Screw Head (in)										
		0.018	0.024	0.030	0.036	0.048	0.060	0.075	0.105	0.125	0.187	0.250
10-16	0.190	44	58	73	87	116	145	182	254	303	6	6
12-14, 12-24	0.216	50	66	83	99	132	165	207	289	344	515	689
1/4"-14, 1/4"-28	0.250	57	77	96	115	153	191	239	335	398	596	797

For Slt: 1 inch = 25.4 mm, 1 lbf = 4.45 N, 1 ksi = 6.89 MPa.

¹For tension connections, the least of the allowable pull-out, pullover, and fastener tension strength found in Tables 2, 3, and 5, respectively, must be used for design.

²ANSI/ASME standard screw diameters were used in the calculations and are listed in the tables.

³The allowable pull-over capacity for other member thickness can be determined by interpolating within the table.

⁴To calculate LRFD values, multiply values in table by the ASD safety factor of 3.0 and multiply again with the LRFD Φ factor of 0.5.

⁵For $F_u = 58 \text{ ksi}$, multiply values by 1.29; for $F_u = 65 \text{ ksi}$, multiply values by 1.44.

⁶Outside drilling capacity limits.

Good for up to 0.5" per ESR

$\Omega_o = 2$ per ASCE 7-16 Table 13.5-1 for ceiling applications

Table includes $\Omega = 3$ (Conservative)

Controlled by tensile pullout value = 797 lbs
 $717 \text{ lbs} / 10 \text{ fasteners} = 71.7 \text{ lbs} < 797 \text{ lbs}$

Use (10) teks 1/4-28 x 8"

Climaseal 5 Coating for exterior applications

TABLE 3—ALLOWABLE TENSILE PULLOVER LOADS (P_{NOV}/Ω), pounds-force^{1,2,3,4,5}

Screw Designation	Nominal Diameter (in.)	Head or Integral Washer Diameter (in.)	Steel $F_u = 45 \text{ ksi}$, Applied Factor of Safety, $\Omega=3.0$										
			Design Thickness of Member in Contact with the Screw Head (in)										
			0.018	0.024	0.030	0.036	0.048	0.060	0.075	0.105	0.125	0.187	0.250
Hex Washer Head (HWH)													
10-16	0.190	0.400	162	216	270	324	432	540	675	945	1125	6	6
12-14, 12-24	0.216	0.415	168	224	280	336	448	560	700	980	1167	1746	2334
12-24	0.216	0.500	203	270	338	405	540	675	844	1181	1406	2104	2813
1/4"-14	0.250	0.500	203	270	338	405	540	675	844	1181	1406	2104	2813
1/4"-14, 1/4"-28	0.250	0.415	168	224	280	336	448	560	700	980	1167	1746	2334
HWH with Serrations													
10-16	0.190	0.435	176	235	294	352	470	587	734	1028	1223	6	6
1/4"-14	0.250	0.610	203	270	338	405	540	675	844	1181	1406	2104	6
Phillips Pan Head													
10-16	0.190	0.365	148	197	246	296	394	493	616	862	1027	6	6

For Slt: 1 inch = 25.4 mm, 1 lbf = 4.45 N, 1 ksi = 6.89 MPa.

¹For tension connections, the lower of the allowable pull-out, pullover, and fastener tension strength found in Tables 2, 3, and 5, respectively must be used for design.

²ANSI/ASME standard screw diameters were used in the calculations and are listed in the tables.

³The allowable pull-over capacity for other member thickness can be determined by interpolating within the table.

⁴To calculate LRFD values, multiply values in table by the ASD safety factor of 3.0 and multiply again with the LRFD Φ factor of 0.5.

⁵For $F_u = 58 \text{ ksi}$, multiply values by 1.29; for $F_u = 65 \text{ ksi}$, multiply values by 1.44.

⁶Outside drilling capacity limits.

TABLE 5—FASTENER STRENGTH OF SCREWS^{1,2,3,4,5}

SCREW DESIGNATION	DIAMETER (in.)	ALLOWABLE FASTENER STRENGTH		NOMINAL FASTENER STRENGTH	
		Tensile, P_{t}/Ω (lbf)	Shear, P_{s}/Ω (lbf)	Tensile, P_{t} (lbf)	Shear, P_{s} (lbf)
10-16	0.190	885	573	2654	1718
12-14	0.216	1184	724	3551	2171
12-24	0.216	1583	885	4750	2654
1/4"-14	0.250	1605	990	4816	2970
1/4"-28	0.250	1922	1308	5767	3925

For Slt: 1 inch = 25.4 mm, 1 lbf = 4.45 N.

¹For tension connections, the least of the allowable pull-out, pullover, and fastener tension strength found in Tables 2, 3, and 5, respectively, must be used for design.

²For shear connection, the lower of the allowable shear (bearing) and the allowable fastener shear strength found in Table 4 and 5, respectively, must be used for design.

³See Section 4.1 for fastener spacing and end distance requirements.

⁴Nominal strengths are based on laboratory tests.

⁵To calculate LRFD values, multiply nominal strength values by the LRFD Φ factor of 0.5.



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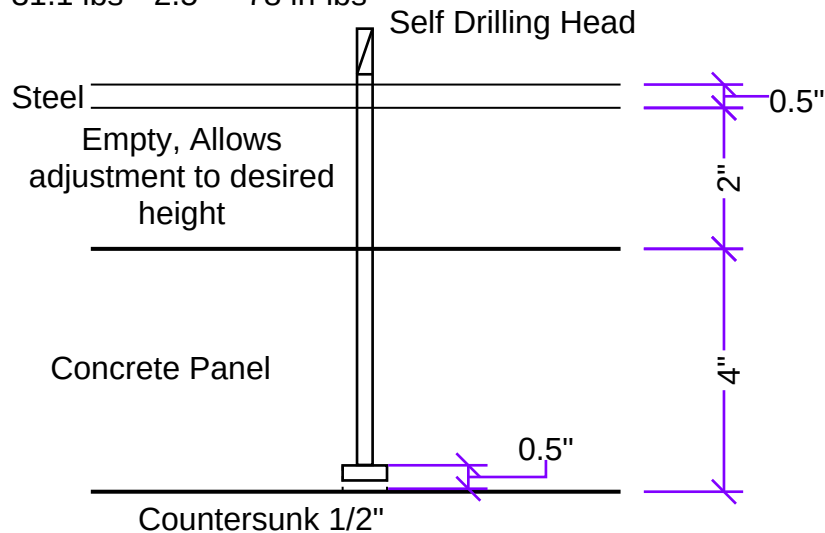
Date 4/14/2026

Page 3 of 6

Site Class:	D (default)	Section 20.3, Table 20.3-1
Seismic Design Category:	D	Section 11.6
Risk Category:	III	Table 1.5-1 Note: Exception 2 of Section 11.4.8 has been satisfied, therefore site specific geotech report is not required
S_s	0.903 g	Figure 22-1
S_1	0.439 g	Figure 22-2
F_a	1.20	Table 11.4-1 (Linear interpolation is used)
F_v	1.86	Table 11.4-2 (Linear interpolation is used)
S_{MS}	1.084	Eqn. 11.4-1
S_{M1}	0.817	Eqn. 11.4-2
S_{DS}	0.722	Eqn. 11.4-3
S_{D1}	0.545	Eqn. 11.4-4
I_p	1.50	Section 13.1.3
a_p	1.0	Table 13.6-1
R_p	2.5	Table 13.6-1
z	30 ft, Component attachment elevation w/ respect to grade	
h	40 ft, Structure roof elevation with respect to grade	
F_p	0.433 * W_p	Eqn. 13.3-1
OR	1.734 * W_p	Eqn. 13.3-2
Not less than	0.325 * W_p	Eqn. 13.3-3

F_p	=	0.433	* W_p
$0.2S_{DS}W_p$	=	0.144	* W_p

Sec. 13.3.1.2

 $0.433 * 717 \text{ lbs} = 310.5 \text{ lbs} / 10 \text{ fasteners} = 31.1 \text{ lbs}$
 $1308 \text{ lbs (Shear Capacity previous page)} > 31.1 \text{ lbs}$
GOOD for shear
 $31.1 \text{ lbs} * 2.5" = 78 \text{ in-lbs}$

 $32 \text{ ksi} * 0.25^3 \text{ (nominal fastener diameter)} / 6 * 0.9 \text{ LRFD} = 600 \text{ in-lbs}$
 $600 \text{ in-lbs} > 78 \text{ in-lbs}$ **GOOD**

Grout also present to resist lateral force due to seismic

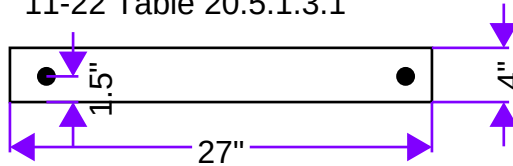


Plank Design, Concrete Beam

Use GFRP reinforcing for reduced cover and corrosion resistance

$f_{fu} = C_E f_{fu}^*$ (ACI 440 11-22 Section 20.2.2.1) design tensile strength
 $f_{fu}^* = 18.1\text{k}$ ultimate (see reference on next page) / $(0.45"/2)^2 \pi = 113.8\text{ ksi}$
 $C_E = 0.85$ (concrete exposed to weather)
 $113.8\text{ ksi} * 0.85 = 96.05\text{ ksi}$

1.5" cover per ACI 440
11-22 Table 20.5.1.3.1



Bending - ACI 318-11

$\phi =$	0.65	
$M =$	1.2	ft-k
Load Factor =	1.40	
Factored Moment (M_u) =	1.7	ft-k
$f_{fu} =$	96.05	ksi
$f'_c =$	2500	psi

$$150\text{ pcf} * 4"/12 * 2.25' = 225\text{ psf}$$
$$= (0+225)*6.5^2/8/1000$$

Bar Size =	#4	
Bar Quantity =	2	bars
Layers =	1	
$A_s =$	0.4	in ² total
$b =$	27	in
$h =$	4	in
Clear dist. =	1.5	in
$d =$	2.25	in = $4 - 1.5 - 0.5 * 0.5$
$\lambda =$	1.00	
$\beta_1 =$	0.85	
$a =$	0.670	in
$M_{allowable} = \phi M_n =$	4.0	ft-k > 1.7 ft-k OK
$A_s, \text{min.} =$	0.13	in ² < 0.4 OK
$c =$	0.79	in
$\epsilon_t =$	0.0056	> 0.005, tension controlled

Temperature steel ratio =	0.0021	times cross sectional area
Temperature steel =	0.0037	> 0.00212156571549804 OK

Use (2) #4 bars

Add transverse reinforcing at 16" oc

Beam Shear - 11.2.1.1

$\phi =$	0.75	
$V =$	689	lb
Load Factor =	1.40	
Factored Shear (V_u) =	965	lb
$V_c =$	6075	lb = $2 * (2500)^{0.5} * 2.25 * 27$
$\phi V_c / 2 =$	2278	lb > 965, no shear steel required

Shear Reinforcing Design: Not Required

Plank can span 6.5' and support its own weight





4EQ STRUCTURAL BAR®



4EQ Structural Bar® is a high-strength composite reinforcing bar from MST-BAR®. It is the first GFRP rebar to pass all performance requirements of ICC-ES Acceptance Criteria AC454 and to be issued an ESR report by ICC-ES. 4EQ Structural Bar® is made with code-compliant Vinyl Ester Resin & corrosion-proof ECR Glass Fibers to give your reinforced concrete centuries of serviceability.



4EQ Structural Bar® is an ASTM D7957 Certified Building Material.

ADVANTAGES

- **ICC-ES ESR 4664**

Meets all ACI standard for reinforcement under ACI 440.1.

- **Code Compliant**

Can be used in 2018 & 2021 IBC and IRC concrete reinforced designs.

- **Cost Effective**

Less \$\$ than epoxy coated and plain steel rebar.

- **Rust-Proof**

Impervious to chloride ion and chemical attack.

- **Nonconductive & Nonferrous**

Ideal for projects with electromagnetic

sensitivity.

- **High Performance in All Climates**

Stronger reinforcement in freeze-thaw regions & guaranteed longevity in coastal regions compared to steel rebar.

- **Superior Crack Control**

80% less crack initiation compared to traditional steel rebar due to high bond strength.

- **Chemical Resistant / No Waterproofing**

Impervious to de-icing salts and corrosive chemicals and eliminates the need for costly waterproofing agents.

PHYSICAL & MECHANICAL PROPERTIES

BAR DIMENSIONS

0.45 in. Diameter

CROSS-SECTIONAL AREA

0.16 in²

BAR COMPOSITION

Vinyl Ester Resin & ECR Glass Fiber

BAR PROFILE

Integral Rib Design (No Sand-Coating Required)

ULTIMATE TENSILE FORCE

18.1 kips (80.5 kN)

ELASTIC MODULUS

9427 ksi (65 GPa)

SHEAR STRENGTH

32.9 ksi (227 MPa)

PULL-OUT CAPACITY

3600 psi (24.8 MPa)

APPLICATIONS

4EQ Structural Bar® replaces steel rebar for most structural design concrete elements. Design Manual (DM-4EQMST) is available with examples. AGS Concrete Design software is also available through the MST-BAR® manufacturer website. 4EQ Structural Bar® is not currently tested to support seismic elements in Seismic Design Category D & E.

HANDLING & INSTALLATION

Always wear gloves when handling 4EQ Structural Bar® to protect against fiberglass splinters. Avoid direct contact with skin. When cutting 4EQ Structural Bar®, use a diamond blade for best results. Tie and chair 4EQ Structural Bar® as you would steel rebar. Generally, minimum lap splice length of 24 inches is sufficient unless otherwise specified.

To learn more about 4EQ Structural Bar® and additional high modulus of elasticity MST-BAR® composite rebar products, or to request pricing, give us a call or visit us on the web.

TUF-N-LITE, LLC
(513) 472-8400
info@tufnlite.com
www.tufnlite.com