



ACUTE ENGINEERING

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Structural Calculations

| | | | |
|--------------------------|---|--|--|
| Project Name: | Salem City Cole Park Restroom Structure (Salem) 11100621 | | |
| Project Location: | 600 S 300 W | | |
| | Salem, Utah 84653 | | |
| Project Number: | 11100621 | | |
| Date: | 7/20/2021 | | |

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1. Design Criteria

Project information

Address / location * = 600 S 300 W

Area / subdivision

Area / subdiv. No. 1 = Other

City, county = Salem (0 county)

State, Zip Code = Utah 84653

* The structural calculations report and corresponding construction documents are valid for a single use at the project location and shall not be reused, copied, or reproduced without written consent.

Jurisdiction / occupancy information

Jurisdiction = Utah

Building code = Utah Code, Title 15A

Model building code = 2018 IBC 2018 IBC 101.2

Use and occupancy classification = Assembly - worship, recreation, amusement (A-3)

Risk category = Not occupancy categories I, III, IV (II)

** Building code compliance of non-structural issues is not addressed. Refer to the architect or designer for compliance.

Deferred submittals

Prefabricated metal plate wood trusses - roof (truss manufacturer)



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Environmental load parameters

Earthquake

Latitude, longitude = 40.045584, -111.680828
 Mapped short period $S_s = 1.595$ 2018 IBC Figure 1613.2.1(1)
 Mapped 1-sec. period $S_1 = 0.596$ 2018 IBC Figure 1613.2.1(2)

Wind

Basic design wind speed $V = 105$ mph 2018 IBC Figure 1609.3(1), 1609.3(2), 1609.3(3)
 Exposure category = C 2018 IBC 1609.4.3

Soil

Geotechnical design basis †

Area / subdiv. No. 1 = Presumptive values, 2018 IBC Table 1806.2
 Minimum frost cover = 30 in. 2018 IBC 1809.5
 Site class = D-Default
 Special requirements = None

Lateral active press. = 30 psf/ft
 Lateral at-rest press. = 60 psf/ft
 Lateral passive press. = 150 psf/ft
 Coeff. of friction = 0.25
 Allow. vert. bearing $Q_a = 1500$ psf
 Min. cont. footing = 18 in.
 Min. spot footing = 20 in.

† It is recommended that a geotechnical investigation be conducted unless satisfactory data from adjacent areas is available that demonstrates an investigation is not necessary for any of the conditions in 2018 IBC 1803.5.1-12. The structural calculations report and corresponding construction documents are only valid for the soil parameters listed herein. The design professional in responsible charge shall be notified if observations or field conditions differ.

Snow

Elevation (max) = 4645 ft

Rain

15-min. rainfall intensit = 4.01 in/hr
 60-min. rainfall intensit = 1.67 in/hr



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2.1 Loads - Snow

Ground snow loads

(ASCE 7-16 Chap. 7.2)

| | |
|------------------|---------------------------------|
| Basis | = Utah amend. 2018 IBC 1608.1.2 |
| Elevation | = 4645 ft |
| Ground snow load | Pg = 34 psf |

Flat roof snow loads

(ASCE 7-16 Chap. 7.3)

| | | |
|--------------------------|--|-----------------------------------|
| Basis | = ASCE 7-16 Equation 7.3-1 | |
| Roof exposure definition | = Not fully exposed or sheltered (ASCE 7-16 Table 7.3-1, Notes a and b). | |
| Roof exposure | = Partial | ASCE 7-16 Table 7.3-1 (notes a,b) |
| Terrain category (wind) | = C | |
| Exposure factor | Ce = 1 | ASCE 7-16 Table 7.3-1 |
| Roof thermal condition | = Not unheated nor a continuously heated greenhouse (ASCE 7-16 Table 7.3-2). | |
| Thermal factor | Ct = 1 | ASCE 7-16 Table 7.3-2 |
| Risk category | = II | |
| Snow importance factor | Is = 1 | ASCE 7-16 Table 1.5-2 |
| Flat roof snow load | Pf = 24 psf | ASCE 7-16 Equation 7.3-1 |

Sloped roof snow loads

(ASCE 7-16 Chap. 7.4)

| | | |
|--------------------|--|-------------------------------|
| Basis | = ASCE 7-16 Equation 7.4-1 | |
| Roof surface | = Non-slippery (asphalt shingles, wood shingles, or shakes). | |
| Roof slope | = 18 deg. | |
| Roof slope factor | Cs = 1 | ASCE 7-16 Chap. C7.4 |
| Eave snow load | Peave = 24 psf | Utah amend. 2018 IBC 1608.1.1 |
| Balanced snow load | Ps = 24 psf | ASCE 7-16 Equation 7.4-1 |

Unbalanced roof snow loads

(ASCE 7-16 Chap. 7.6)

Hip and gable roofs

| | | |
|-------------------------|----------------|--------------------------|
| Eave to ridge distance | W = ft | |
| Roof system | = Truss | |
| Snow density | gamma = 18 pcf | ASCE 7-16 Equation 7.7-1 |
| Height of balanced snow | Hb = 1 ft | ASCE 7-16 Chap. 7.7.1 |
| Unbalanced snow load | Ps = 24 psf | ASCE 7-16 Chap. 7.6.1 |



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2.2 Loads - Dead / Live

Roof dead loads

(2018 IBC 1606, ASCE 7-16 Table C3.1-1a)

| | | |
|---------------------------------------|-----------------------|-------------------------|
| Asphalt shingles | = 2 psf | ASCE 7-16 Table C3.1-1a |
| Felt or ready roofing, roof sheathing | = 3 psf | ASCE 7-16 Table C3.1-1a |
| Wood trusses, misc | = 5 psf | Estimated |
| Insulation, gypsum sheathing | = 5 psf | ASCE 7-16 Table C3.1-1a |
| Roof DL No. 1 | Total = 15 psf | |

Floor dead loads

(2018 IBC 1606, ASCE 7-16 Table C3.1-1a)

| | |
|----------------|----------------------|
| | = 0 psf |
| | = 0 psf |
| | = 0 psf |
| | = 0 psf |
| Floor DL No. 1 | Total = 0 psf |
| | = 0 psf |
| Floor DL No. 2 | Total = 0 psf |

Wall dead loads

(2018 IBC 1606, ASCE 7-16 Table C3.1-1a)

| | | |
|-------------------------------------|----------|-------------------------|
| Masonry walls: 8" CMU fully grouted | = 87 psf | ASCE 7-16 Table C3.1-1a |
|-------------------------------------|----------|-------------------------|

Roof live loads

(2018 IBC 1607)

| Occupancy or use | Unif. (psf) | Conc. (lb) | Ref. |
|-------------------------------|-------------|------------|------------------------------|
| Roofs (ordinary construction) | = 20 | 300 | 2018 IBC Table 1607.1 No. 26 |

Floor live loads

(2018 IBC 1607)

| Occupancy or use | Unif. (psf) | Conc. (lb) | Ref. |
|------------------|-------------|------------|------|
| | = | | |
| | = | | |
| | = | | |

Load sets

| Live load (occupancy or use) | (psf) | Dead load | (psf) | Abbrev. |
|------------------------------|-------|---------------|-------|---------|
| Flat roof snow load | 24 | Roof DL No. 1 | 15 | S 24 15 |



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Deflection limits (L/limit)

(2018 IBC 1604.3.1)

| Construction | | L | S or W | D+L |
|---|---|-----|--------|-----|
| Roof members (supporting plaster ceiling) | = | 360 | 360 | 240 |
| Floor members (joists) | = | 480 | | 240 |
| Floor members (beams/headers) | = | 360 | | 240 |
| Exterior walls and interior partitions (with other brit | = | | 240 | |



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2.3 Loads - Earthquake

Seismic Design Criteria

(2018 IBC 1613.2, ASCE 7-16 Chap. 11)

Mapped acceleration parameters

Latitude = 40.046
 Longitude = -111.681
 MCE short period Ss = 1.595 g
 MCE 1.0 sec. period S1 = 0.596 g

Design acceleration parameters

Site class = D-Default
 Site coefficient Fa = 1.2
 Site coefficient Fv = 1.704
 Adjusted short period SMS = 1.91 Design short period SDS = 1.28
 Adjusted 1.0 sec. period SM1 = 1.02 Design 1.0 sec. period SD1 = 0.68
 Risk category = II
 IBC Seismic design category = D

Dead loads

(2018 IBC 1606; ASCE 7-16 Chap. 12.7.2, Table C3.1-1a)

Effective seismic snow weight = 0 psf Utah Amend. 2018 IBC 1613.1.1
 Roof DL No. 1 = 15 psf
 Floor DL No. 1 = 0 psf
 = 0 psf
 Masonry walls: 8" CMU fully grouted = 87 psf



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Equivalent Lateral Force Procedure

(ASCE 7-16 Chap. 12.8)

Primary LFRS

| | |
|--------------------------------|--------------------------|
| Basic structural system | = Bearing wall systems |
| Seismic force-resisting system | = Special RM shear walls |

Structural design parameters

| | | |
|---------------------------------|-------------|-------------------------------|
| Response modification factor | R = 5 | ASCE 7-16 Table 12.2-1 No. A7 |
| System overstrength factor | Omega = 2.5 | ASCE 7-16 Table 12.2-1 No. A7 |
| Deflection amplification factor | Cd = 3.5 | ASCE 7-16 Table 12.2-1 No. A7 |
| Building height limit | = 160 ft | ASCE 7-16 Table 12.2-1 No. A7 |

Fundamental period

| | | |
|--------------------------------|-----------------|---------------------------|
| Structure type | = All other | |
| Approximate period parameter | Ct = 0.02 | ASCE 7-16 Table 12.8-2 |
| Approximate period parameter | x = 0.75 | ASCE 7-16 Table 12.8-2 |
| Height above base | = 10.5 ft | |
| Approximate fundamental period | Ta = 0.117 sec. | ASCE 7-16 Equation 12.8-7 |
| Approximate fundamental freq. | n = 8.57 hz | |
| Long period transition period | TL = 8 sec. | ASCE 7-16 Figure 22-14 |

Seismic base shear

| | | |
|------------------------------|---------------|------------------------------|
| Seismic importance factor | Ie = 1.00 | ASCE 7-16 Table 1.5-2 |
| Seismic response coefficient | Csmin = 0.056 | ASCE 7-16 Equations 12.8-5,6 |
| Seismic response coefficient | Csmax = 1.161 | ASCE 7-16 Equations 12.8-3,4 |
| Seismic response coefficient | Cs = 0.26 | ASCE 7-16 Equation 12.8-2 |
| Seismic base shear (LRFD) | V = 17180 lb | ASCE 7-16 Equation 12.8-1 |

Weight Parameters

| | Exterior Wall | | Roof | | Floor + Int Wall | | Total Weight (lb) | |
|-------|---------------|--------------|--------------|-----------|------------------|-----------|-------------------|--------------|
| | Trib. | Permt 1 (ft) | Permt 2 (ft) | Area (sf) | Weight (psf) | Area (sf) | | Weight (psf) |
| 1 | 5 | 120 | 0 | 1,008 | 15 | 0 | 0 | 67,320 |
| Total | | | | | | | | 67,320 |

Seismic Lateral Loads

(ASCE 7-16 Chap. 12.8.3)

| Level | Height (ft) | Floor (in) | Hx (ft) | Cvx | Fx (lb) | Vx (Shear walls) | |
|-------|-------------|------------|---------|-----|---------|------------------|----------|
| | | | | | | LRFD (lb) | ASD (lb) |
| 1 | 10.0 | 0 | 10.50 | 1.0 | 17,180 | 17,180 | 12,026 |



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2.4 Loads - Wind

Design wind pressure

(2018 IBC 1609, ASCE 7-16 Chap. 26)

Terrain exposure

Surface roughness (upwind) = Open terrain with scattered obstructions having heights generally less than 30 ft.

| | | |
|-----------------------|--------------|-------------------------|
| Exposure category | = C | 2018 IBC 1609.4.3 |
| Terrain exp. constant | alpha = 9.5 | ASCE 7-16 Table 26.11-1 |
| Terrain exp. constant | Zg = 900 | ASCE 7-16 Table 26.11-1 |
| Terrain exp. constant | Zmin = 15 ft | ASCE 7-16 Table 26.11-1 |
| Topographic factor | Kzt = 1 | ASCE 7-16 Chap. 26.8.2 |

Basic wind pressure

| | | |
|----------------------------|---|--------------------------------------|
| Basic design wind speed | V = 105 mph | 2018 IBC Figure 1609.3(1), 1609.3(2) |
| Structure type | = Buildings - MWFRS | |
| Wind directionality factor | Kd = 0.85 | ASCE 7-16 Table 26.6-1 |
| Risk category | = II | 2018 IBC Table 1604.5 |
| Approx. fundamental freq. | = 8.57 hz | |
| Structure type | = Rigid | ASCE 7-16 Chap. 26.2 |
| Gust effect factor | G = 0.85 | ASCE 7-16 Chap. 26.11.1 |
| Enclosure | = Enclosed (A building having less than 4 sq ft of openings in each wall) | |
| Roof pitch | = 4:12 | |
| Internal pressure coeff. | GCpi = 0.18 | ASCE 7-16 Chap. 26.13, Table 26.13 |
| Basic velocity pressure | q = 20.28 psf | ASCE 7-16 Equation 26.10-1 |

Directional Procedure: Components and cladding

(ASCE 7-16 Chap. 30.3)

| | | |
|---------------------------------|----------------|---------------------------------|
| Roof mean height | h = 12.9 ft | ASCE 7-16 Chap. 26.2 |
| Effective wind area (component) | Aeff = 31 sf | |
| Velocity press. exp. coeff. | Kh = 0.85 | ASCE 7-16 Table 26.10-1 Note 1. |
| Velocity pressure | qh = 17.21 psf | ASCE 7-16 Equation 26.10-1 |

| Pressure coefficient | End | | Interior | |
|----------------------|---------------|-------|----------|---------------------------|
| Positive | GCp = 0.91 | 0.91 | | ASCE 7-16 Figure 30.3-1 |
| Negative | GCp = -1.23 | -1.01 | | ASCE 7-16 Figure 30.3-1 |
| Maximum pressure | max p = 24.21 | 20.54 | psf | ASCE 7-16 Equation 30.3-1 |



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Elevation Geometry

| Level | Trib. Height (ft) | Horiz. dim. (ft) | | Max roof Elev. (ft) | Front Proj. A (sf) | | Side Proj. A (sf) | |
|-------|----------------------|------------------|------|------------------------|--------------------|--------|-------------------|--------|
| | | Front | Side | | Gable | Sloped | Gable | Sloped |
| 1 | 5.0 | 26 | 34 | 15.25 | 67 | 0 | 0 | 173 |

Directional Procedure: MWFRS external pressure coefficients

(ASCE 7-16 Chap. 26.10, Figure 27.3-1 weighted Cp for sloped / gabled area)

| Level | Front, Cp | | | | Side, Cp | | | |
|-------|-----------|---------|---------|--------|----------|---------|---------|--------|
| | Windward | | Leeward | | Windward | | Leeward | |
| Roof | Max Cp | Min Cp | Max Cp | Min Cp | Max Cp | Min Cp | Max Cp | Min Cp |
| 1 | 0.80 | 0.80 | -0.44 | -0.44 | -0.08 | -0.55 | -0.57 | -0.57 |
| Walls | Windward | Leeward | Side | | Windward | Leeward | Side | |
| | 0.80 | -0.44 | -0.70 | | 0.80 | -0.50 | -0.70 | |

Directional Procedure: MWFRS wind pressures

(ASCE 7-16 Chap. 26.10.1, Table 26.10-1)

| Level | Elev. (ft) | Kz | qz (psf) | Front pressure (psf) | | | Side pressure (psf) | | |
|------------------|------------|------|----------|----------------------|-------|-------|---------------------|-------|-------|
| | | | | +GCpi | -GCpi | Total | +GCpi | -GCpi | Total |
| Walls - Leeward | | | | | | | | | |
| Max h | 10.50 | 0.85 | 17.21 | -9.51 | -3.32 | | -10.41 | -4.22 | |
| Walls - Windward | | | | | | | | | |
| 1 | 10.50 | 0.85 | 17.21 | 8.61 | 14.80 | 18.12 | 8.61 | 14.80 | 19.02 |
| Roofs - Leeward | | | | | | | | | |
| 1 | 15.25 | 0.85 | 17.27 | -9.55 | -3.33 | | -11.54 | -5.32 | |
| Roofs - Windward | | | | | | | | | |
| 1 | 15.25 | 0.85 | 17.27 | 8.64 | 14.85 | 18.18 | -11.12 | 1.97 | 7.29 |

Directional Procedure: Wind Lateral Loads

(ASCE 7-16 Chap. 27.2-27.3)

| Level | Front | | | | Side | | | |
|-------|---------------|--------------|------------------|------------------|---------------|--------------|------------------|------------------|
| | Walls (lb) | Roof (lb) | Fx (ASD) (lb) | Vx (ASD) (lb) | Walls (lb) | Roof (lb) | Fx (ASD) (lb) | Vx (ASD) (lb) |
| 1 | 1,413 | 731 | 2,144 | 2,144 | 1,940 | 756 | 2,697 | 2,697 |



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3.1 LFRS - Wood Sheathing / Diaphragms

Sheathing analysis

APA Engineered Wood Construction Guide, Form No. E30W (2016 APA)

| Location | Applied loads (OOP) | | | Sheathing | | Support spacing (in.) | Allow LL (psf) | Result |
|----------|---------------------|----------|----------|-----------|--------|-----------------------|-------------------|--------|
| | Label | LL (psf) | DL (psf) | Size | Rating | | | |
| Roof | S 24 15 | 24 | 15 | 7/16" | 24/16 | 24 | 41 | OK 41% |

Diaphragm parameters

| Level | Seismic Fpx | Transverse (front) | | Longitudinal (side) | | Minimum Sheathing Thickness | Diaphragm Nailing | | |
|-------|----------------|--------------------|--------------------|---------------------|--------------------|-----------------------------------|-------------------|---------|-----------|
| | | Wind | Horz. dim. (ft) | Wind | Horz. dim. (ft) | | Edge 1 | Edge 2 | Blocking |
| | | MWFRS | | MWFRS | | | 8d @ 6" | 8d @ 6" | Unblocked |
| 1 | 12,026 | 2,144 | 26 | 2,697 | 34 | 7/16" | 8d @ 6" | 8d @ 6" | Unblocked |

Diaphragm analysis

| Level | Max Span (ft) | Reaction Load (lb) | | Diaphragm Line L (ft) | Diaphragm Layout | Wind | | Seismic | |
|-------------------------------|------------------|--------------------|---------|--------------------------|---------------------|---------|-------------|---------|-------------|
| | | Wind | Seismic | | | v (plf) | Allow (plf) | v (plf) | Allow (plf) |
| Transverse (front) direction | | | | | | | | | |
| 1 | 26 | 1,072 | 6,013 | 34 | Case 1 | 32 | 322.5 | 177 | 230 |
| Longitudinal (side) direction | | | | | | | | | |
| 1 | 24 | 952 | 4,244 | 26 | Case 3 | 37 | 237.5 | 163 | 170 |

Chord Analysis

| Level | Max Span (ft) | Depth (ft) | % Total Load | Chord | | Allow (lb) |
|-------------------------------|------------------|------------|-----------------|------------|--------------------|------------|
| | | | | Force (lb) | Collector Type | |
| Transverse (front) direction | | | | | | |
| 1 | 26 | 34 | 100% | 1,150 | TP Splice (12) 16d | 2,700 |
| Longitudinal (side) direction | | | | | | |
| 1 | 34 | 26 | 100% | 1,966 | TP Splice (12) 16d | 2,700 |

Strut Analysis

| Level | Line Length (ft) | Strut Length (ft) | % Total Load | Strut | | Allow (lb) |
|-------------------------------|---------------------|----------------------|-----------------|------------|--------------------|------------|
| | | | | Force (lb) | Collector Type | |
| Transverse (front) direction | | | | | | |
| 1 | 34 | 15 | 50% | 2,653 | TP Splice (12) 16d | 2,700 |
| Longitudinal (side) direction | | | | | | |
| 1 | 26 | 11 | 50% | 2,544 | TP Splice (12) 16d | 2,700 |



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3.2 LFRS - Masonry Shear Walls

Level 1 - Transverse LFRS (2018 IBC 2305)

Wind lateral load (ASD) = 2,144 lb
Seismic lateral load (ASD) = 12,026 lb

| Line | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|------|-------|-------|---|---|---|---|---|---|---|----|----|----|----|----|----|
| W = | 1,072 | 1,072 | | | | | | | | | | | | | |
| E = | 6,013 | 6,013 | | | | | | | | | | | | | |

| Line | Wall segment | | Opening (ft) | | LFRS | | | | | Anchorage | | Hold-down | |
|------|--------------|--------|--------------|-------|-------|------|-------|---------|-------|-----------|------|-----------|------|
| | L (ft) | h (ft) | b total | h max | Type | Wind | Allow | Seismic | Allow | D (in.) | Type | T (lb) | Type |
| 1 | 34 | 10 | 0 | 0 | MASON | 32 | 294 | 575 | 294 | 0.46 | | 0 | |
| 2 | 34 | 10 | 0 | 0 | MASON | 32 | 294 | 575 | 294 | 0.46 | | 0 | |

Level 1 - Longitudinal LFRS (2018 IBC 2305)

Wind lateral load (ASD) = 2,697 lb
Seismic lateral load (ASD) = 12,026 lb

| Line | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O |
|------|-------|-------|---|---|---|---|---|---|---|---|---|---|---|---|---|
| W = | 1,348 | 1,348 | | | | | | | | | | | | | |
| E = | 6,013 | 6,013 | | | | | | | | | | | | | |

| Line | Wall segment | | Opening (ft) | | LFRS | | | | | Anchorage | | Hold-down | |
|------|--------------|--------|--------------|-------|-------|------|-------|---------|-------|-----------|------|-----------|------|
| | L (ft) | h (ft) | b total | h max | Type | Wind | Allow | Seismic | Allow | D (in.) | Type | T (lb) | Type |
| A | 17.33 | 10 | 0 | 0 | MASON | 78 | 577 | 1,128 | 577 | 0.46 | | 0 | |
| B | 7 | 10 | 0 | 0 | MASON | 193 | 1,429 | 2,792 | 1,429 | 0.46 | | 0 | |



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| Summary | | MW-1 | Shear Line B |
|------------------------------------|------------------|-------------------------------|----------------------------|
| Mark | MW-1 | Final Design | |
| Height | 10.0 ft | Quantity | Bar Spacing |
| Wythes | 1 | Vertical | 1 #4 32 |
| Length | 7.0 ft | Horizontal | 2 #4 40 |
| Bond Layout | Running | | |
| Result | Adequate by 5% | | |
| Material Parameters | | | |
| CMU Properties | | Shape Properties | |
| f'm | = 2.0 ksi | b (out-of-plane) | = 32 in |
| epsilon-mu | = 0.0025 in./in. | Net Area | = 141.2 in ² /b |
| fr | = #REF! #REF! | Unit Weight | = Normal Weight |
| Steel | | Mcr | = 4.2 k-ft/b |
| fy | = 60 ksi | Block Size | = 8x8x16 |
| Es | = 29000 ksi | Design Weight | = 58.0 psf |
| Load Summary - In-plane | | | |
| Vx Seismic | = 11.2 kip | Mx Seismic | = 111.7 k-ft |
| R-Value | = 5 | Mx Wind | = 22.5 k-ft |
| Vx Wind | = 2.2 kip | Mux | = 111.7 k-ft |
| Vux | = 11.2 kip | Load Comb. | = 6 |
| Load Summary - Out-of-plane | | | |
| Vy Seismic | = 0.2 kip/b | My Seismic | = 0.2 k-ft/b |
| R-Value | = 5 | My Wind | = 0.6 k-ft/b |
| Vy Wind | = 0.2 kip/b | Muy | = 4.2 k-ft/b |
| Vuy | = 0.3 kip/b | Load Comb. | = 4 |
| Load Summary - Vertical | | | |
| Dead | 0.03 k/ft | Pu | = 1.074133 k/b |
| Live | 0.00 k/ft | | = 2.8196 kip |
| Snow | 0.05 k/ft | Load Comb. | = 3 |
| Self Weight | 0.29 k/ft | | |
| In-plane Analysis | | | |
| Flexure Strength @ Pu | | Nominal Shear Strength | |
| φMn | = 117.2 k-ft | φVn | = 55.1 k |
| Result | = OK 4% | Result | = OK 79% |
| Out-of-plane Analysis | | | |
| Flexure Strength @ Pu | | Nominal Shear Strength | |
| φMn | = 3.6 k-ft/b | φVn | = 8.5 k/b |
| Result | = OK 82% | Result | = OK 97% |
| Reinforcement Limitations | | | |
| Vertical | | Horizontal | |
| Minimum | = OK 36% | Minimum | = OK 36% |
| Maximum | = OK 85% | | |



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| Summary | | MW-2 | Shear Line A |
|------------------------------------|------------------|-------------------------------|----------------------------|
| Mark | MW-2 | | |
| Height | 10.0 ft | Final Design | |
| Wythes | 1 | | Quantity Bar Spacing |
| Length | 17.3 ft | Vertical | 1 #4 32 |
| Bond Layout | Running | Horizontal | 2 #4 48 |
| Result | Adequate by 24% | | |
| Material Parameters | | | |
| CMU Properties | | Shape Properties | |
| f'm | = 2.0 ksi | b (out-of-plane) | = 32 in |
| epsilon-mu | = 0.0025 in./in. | Net Area | = 141.2 in ² /b |
| fr | = #REF! #REF! | Unit Weight | = Normal Weight |
| Steel | | Mcr | = 4.2 k-ft/b |
| fy | = 60 ksi | Block Size | = 8x8x16 |
| Es | = 29000 ksi | Design Weight | = 58.0 psf |
| Load Summary - In-plane | | | |
| Vx Seismic | = 11.2 kip | Mx Seismic | = 111.7 k-ft |
| R-Value | = 5 | Mx Wind | = 22.5 k-ft |
| Vx Wind | = 2.2 kip | Mux | = 111.7 k-ft |
| Vux | = 11.2 kip | Load Comb. | = 6 |
| Load Summary - Out-of-plane | | | |
| Vy Seismic | = 0.2 kip/b | My Seismic | = 0.2 k-ft/b |
| R-Value | = 5 | My Wind | = 0.6 k-ft/b |
| Vy Wind | = 0.2 kip/b | Muy | = 4.2 k-ft/b |
| Vuy | = 0.3 kip/b | Load Comb. | = 4 |
| Load Summary - Vertical | | | |
| Dead | 0.03 k/ft | Pu | = 1.074133 k/b |
| Live | 0.00 k/ft | | = 6.980524 kip |
| Snow | 0.05 k/ft | Load Comb. | = 3 |
| Self Weight | 0.29 k/ft | | |
| In-plane Analysis | | | |
| Flexure Strength @ Pu | | Nominal Shear Strength | |
| φMn | = 616.5 k-ft | φVn | = 125.2 k |
| Result | = OK 81% | Result | = OK 91% |
| Out-of-plane Analysis | | | |
| Flexure Strength @ Pu | | Nominal Shear Strength | |
| φMn | = 3.6 k-ft/b | φVn | = 8.5 k/b |
| Result | = OK 82% | Result | = OK 97% |
| Reinforcement Limitations | | | |
| Vertical | | Horizontal | |
| Minimum | = OK 24% | Minimum | = OK 24% |
| Maximum | = OK 85% | | |



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4.1 VFRS - Wood Bearing Walls

Not Applicable in this situation.



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4.2 VFRS - Wood Joists

Not applicable in this situation.



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4.3 VFRS - Beams / Posts

| Summary | | | | ML-1 | | | |
|-------------------------------|----------|-----------------|-----------------|-------------------------------|----------|---------------|---------------|
| Mark | = | ML-1 | | Final Design | | | |
| Clear Span | = | 10 | ft. | Quantity | Bar Size | Spacing (in.) | |
| Design Span | = | 10.67 | ft. | Longitudinal | 1 | #4 | T&B |
| Depth | = | 24 | in. | Stirrups | | None | |
| Wythes | = | 1 | | | | | |
| Result | = | Adequate by 39% | | | | | |
| Material Parameters | | | | Shape Properties | | | |
| epsilon-mu | | | | epsilon-mu | | | |
| f'm | = | 2.0 | ksi | Unit Weight | = | Normal Weight | |
| epsilon-m | = | 0.0025 | in./in. | Mcr | = | 16.29 | k-ft |
| Steel | | | | Block Size | = | 8x8x16 | |
| fy | = | 60 | ksi | Design Weight | = | 84 | psf |
| Es | = | 29000 | ksi | | | | |
| Distributed Loads | | | | | | | |
| Label | SL (psf) | LL (psf) | DL (psf) | Load Start | | Load End | |
| | | | | Trib (ft) | x1 (ft) | Trib (ft) | x2 (ft) |
| Snow | 24 | 0 | 15 | 2.00 | 0.00 | 2.00 | 10.67 |
| 0 | #N/A | #N/A | #N/A | 0.00 | 0.00 | 0.00 | |
| 0 | #N/A | #N/A | #N/A | 0.00 | | 0.00 | |
| 0 | #N/A | #N/A | #N/A | 0.00 | | 0.00 | |
| DL1 | 0 | 0 | 700 | 1.00 | 0.00 | 1.00 | 10.67 |
| DL2 | 0 | 0 | 0 | 1.00 | 0.00 | 1.00 | 10.67 |
| Self Weight | | = | 168 | plf | | | |
| Point Loads | | | | | | | |
| Label | Snow | Live | Dead | x (ft) | | | |
| PL1 | | | | | | | |
| PL2 | | | | | | | |
| PL3 | | | | | | | |
| PL4 | | | | | | | |
| In-Plane Analysis | | | | | | | |
| Flexure Strength | | | | Minimum Flexure Reinforcement | | | |
| phi-Mn | = | 19.6 | k-ft | 1.3Mcr | = | 21.2 | k-ft |
| Result | = | OK | 39% | Result | = | OK | 3 As PROVIDED |
| Maximum Flexure Reinforcement | | | | Nominal Shear Strength | | | |
| As max | = | 1.74 | in ² | phi-Vn | = | 16.0 | k |
| Result | = | OK | 77% | Result | = | OK | 58% |



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| Summary | | MC-1 (LINTEL END) | | | |
|---|-------------------|---------------------|---|---------|-----|
| Mark | = .1 (LINTEL END) | | | | |
| Width | = 16 in. | Final Design | | | |
| Wythes | = 1 | Quantity | Bar | Spacing | |
| Lintel Span | = 10.0 ft | Vertical | 1 | #4 | 8 |
| Result | = Adequate by 60% | Ties | 1 | #4 | 24 |
| Material Parameters | | | | | |
| epsilon-mu | | | Shape Properties | | |
| f'm | = 2.0 ksi | Unit Weight | = Normal Weight | | |
| epsilon-m | = 0.0025 in./in. | Mcr | = #REF! k-ft | | |
| bond layout | = Stack | Block Size | = 8x8x16 | | |
| Steel | | | Design Weight | = 84 | psf |
| fy | = 60 ksi | | | | |
| Es | = 29000 ksi | | | | |
| Load Summary | | | | | |
| Mux | = 16.69 k-ft | Muy | = 2.85 | k-ft | |
| Pu | = 10.07 kip | Vuy | = 0.95 | kip | |
| Strength Analysis | | | | | |
| Flexure Strength @ Pu - In-plane | | | Flexure Strength @ Pu - Out-of-plane | | |
| phi-Mn | = 15.2 k-ft | phi-Mn | = 7.5 | k-ft | |
| Result | = OK 170% | Result | = OK | 60% | |
| Axial Strength | | | Nominal Shear Strength | | |
| phi-Pn | = 107.6 kip | Vn | = 14.0 | kip | |
| Result | = OK 91% | Result | = OK | 93% | |



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5.1 Foundation - Concrete Walls / Footings

Foundation Walls and Footings

ACI 318-14 Section 14

| Foundation Wall | | | | Line Loads | | | Point Loads | | | Continuous Footing | | | Spot Footing | | |
|-----------------|------|------|--------|--------------|--------------|-------------|--------------|--------------|-------------|--------------------|-------|-------------|--------------|-------|--------|
| Section | Mark | Soil | | RLL (plf) | FLL (plf) | DL (plf) | RLL (plf) | FLL (plf) | DL (plf) | Brg. Press. | | Brg. Press. | | | |
| | | (ft) | Result | | | | | | | Mark | (psf) | Result | Mark | (psf) | Result |
| 1 | FW3 | 2.5 | 16% | 336 | 0 | 1,380 | 0 | 0 | 0 | FT20 | 1,030 | 31% | | | |
| 2 | FW3 | 2.5 | 16% | 48 | 0 | 1,635 | 0 | 0 | 0 | FT20 | 1,010 | 33% | | | |
| 3 | | | | 336 | 0 | 1,080 | 0 | 0 | 0 | FT18 | 944 | 37% | | | |