Building 900 Renovation

Central Kitsap School District

December 20, 2019

Prepared for:
Rice Fergus Miller

STRUCTURAL CALCULATIONS

SETH EDWARD STAPLETON
STATE OF WASHINGTON
44739
STRUCTURAL ENGINEER
PROFESSIONAL ENGINEER

Prepared By:

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File No. 262018.024

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Client	Rice Fergus Miller	Sheet	of
Project	Bldg 900 Renovation	Design by	SES
		Date	
		Checked by	
Project No.	262019.034	Date	

CRITERIA

Permit Number: 19-05911

DESIGN SUMMARY

Building 900 is an existing wood-framed and CMU masonry structure, built in the 1970's for the Central Kitsap High School. The Central Kitsap School District is renovating the building and it will provide space for Administration Offices, Classrooms and a Library.

Building 900 is evaluated and renovated in accordance with the International Existing Building Code (IEBC) 2015 Edition, with Washington State amendments and the ASCE 41-13 Standard.

CODES AND REFERENCES

General

- 2015 International Existing Building Code with WA state amendments
- ASCE 41-13 Seismic Rehabilitation of Existing Buildings
- SEAW Snow Load Analysis for Washington, 2010 Edition

Concrete

- ACI 318-14 Building Code Requirements for Structural Concrete
- PCI Design Handbook Precast and Prestressed Concrete, Seventh Edition (2010)

Steel

- AISC 325-11 Steel Construction Manual, 14th Edition (2011)
- AISC 341-10 Seismic Provisions for Structural Steel Buildings (2010)
- AISC Hollow Structural Sections Connections Manual
- AWS D1.1-2010 Structural Welding Code – Steel

Wood

- ANSI/AF&PA-2015 National Design Specification for Wood Construction
- AITC Timber Construction Manual, Sixth Edition

Catalogs and Miscellaneous

- Simpson Strong-Tie Catalog

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MATERIAL PROPERTIES

Concrete

Type	Normal Weight
Foundations	f'_c = 3,500 psi
Slab-on-Grade	f'_c = 4,000 psi
Retaining Walls	f'_c = 4,500 psi

Reinforcing Steel

Typical	ASTM A615, Grade 60

Structural Steel

Wide Flanges	ASTM A992, Grade 50
Plates	ASTM A36
Angles and Channels	ASTM A36
Rods	ASTM A36
Pipe	ASTM A53, Type E or S, Grade B, f_y = 35 ksi
Tubes	ASTM A500, Grade B, f_y = 46 ksi
Base Plates	ASTM A36
Connection Mat'l, Embedded Plates	ASTM A36
Bolts	ASTM A325
Anchor Rods in Concrete/Masonry	ASTM F1554, Grade 36
Welding Electrodes	E70XX
Headed Shear Studs	ASTM A108, AWS D1.1 Grade B, f_u = 60 ksi

Masonry

CMU	ASTM C90, Grade N, Type 1, Medium Weight
Assembly Strength	f'_m = 1500 psi
Grout	Min. Compressive Strength = 2000 psi
Mortar	Type S

Wood

Wall Studs and Plates	Doug-Fir No. 2 & Better, F_b = 900 psi
Joists and Planking	Doug-Fir No. 2 & Better, F_b = 900 psi
Beams and Stringers	Doug-Fir No. 1, F_b = 1350 psi
Posts (4x)	Doug-Fir No. 1, F_b = 1500 psi
Posts (6x and larger)	Doug-Fir No. 1, F_b = 1000 psi
Glu-lam Beams	24F-V4, F_b = 2400 psi

FOUNDATIONS AND SOILS

Soil properties and allowable bearing pressures are based on original design documents.

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LIVE LOADS

Roof Live Loads

Snow Load	28 psf (non-reducible) Includes Is = 1.1

Floor Live Loads

Office	50 psf (reducible) + 20 psf partition, or 2 k point load
Exit Corridors, Stairways	100 psf (reducible) 80 psf (above 1st floor)
Assembly Areas	100 psf (non-reducible)

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DEAD LOADS

Roof Dead Loads

Light Frame Construction:

Roofing		7 psf
Plywood Sheathing		2 psf
Wood Joists / Beams		5 psf
Ceiling		3 psf
Lights, ducts, etc.		3 psf
	Beam DL =	20 psf

Floor Dead Loads

Light Frame Construction:

2" Lightweight Topping Slab		21 psf
Plywood Sheathing		2 psf
Wood Joists / Beams		6 psf
Ceiling		3 psf
Lights, ducts, etc.		3 psf
	Beam DL =	35 psf

Wall Dead Loads

8" CMU	55 psf
4" Brick	45 psf

Stair Dead Loads

Steel Framing	15 psf
Concrete Fill	25 psf
	40 psf

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SEISMIC LOADS

Loads Based on ASCE 41-13

Performance Level	Damage Control (between LS and IO)
Seismic Force Resisting System	Reinforced Masonry (CMU)
$S_{S\text{-}1E}$	0.512g
$S_{1\text{-}1E}$	0.192g
$S_{XS\text{-}1E}$	0.710g
$S_{X1\text{-}1E}$	0.390g
$S_{S\text{-}2E}$	1.010g
$S_{1\text{-}2E}$	0.407g
$S_{XS\text{-}2E}$	1.110g
$S_{XS\text{-}2E}$	0.650g

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CIVIL ENGINEERING
STRUCTURAL ENGINEERING
PLANNING
SURVEYING

August 13, 2018
File No. 262018.054/00101

Mr. Steve Rice
Rice Fergus Miller Architecture & Planning
275 Fifth Street, Suite 100
Bremerton, WA 98337

Subject: Central Kitsap School District 900 Building
ASCE 41-13 Tier 1 Seismic Evaluation

Dear Mr. Rice:

We understand that the Central Kitsap School District (CKSD) is considering renovating the 900 building located on the campus of Central Kitsap High School. The intent would be to convert the existing building into a multi-use building that would include administration space for the school district and a community library. A seismic evaluation of the existing building was performed in accordance with the ASCE 41-13 Tier 1 procedure to identify potential seismic deficiencies in the building and recommend concept-level seismic upgrades to mitigate the deficiencies.

Background

Building 900 is an approximately 42,000-square-foot, partial-three-story building located on a sloping grade. The building was originally built in the mid 1970s and is constructed of a variety of materials including reinforced masonry, precast concrete, steel, and wood. The building consists of two structures separated by a 1-inch seismic gap.

The north end is a one-story, 3,500-square-foot building constructed with 8-inch-thick precast concrete sandwich panels (insulation in the middle of thin concrete walls) which compose the vertical- and lateral-force-resisting systems (LFRS) of the building. Roof panels are supported by glulam beams. As-builts for the construction of roof panels and framing were not available for review because these were identified as bidder designed elements in the as-built drawings.

The main building is a partial-three-story building and approximately 38,000 square feet in size. The building construction is a mix of reinforced concrete masonry unit (CMU), concrete, steel, and wood. The majority of the exterior perimeter walls and interior partition walls are partially grouted 8-inch-thick CMU walls and compose most of the vertical- and lateral-force-resisting systems (LFRS) of the building. The exterior CMU wall along the north end of the building is 12 inches thick. The walls toward the south and southeast end of the building are partially and fully below the grade. The below-grade walls are constructed as 12-inch retaining walls, and the above-grade walls are 7-3/4-inch-thick concrete walls with a 4-inch brick veneer. The concrete walls transition to CMU walls at the floors above.

In the main building, the floor panels at the main floor and the partial second floor appear to be wood construction with 2-inch-thick, lightweight concrete topping and supported on glulam beams and girders. As-built drawings with information on floor framing and sheathing are not available for review because these were identified as bidder designed elements in the as-built drawings. The roof framing for the three-story portion of the main building consists of 2x6 joists spanning between glulam hip trusses. The roof diaphragm appears to be 1/2-inch-thick plywood over wood joists. The remainder of the lower roof framing appears to be constructed of roof panel overlaid on glulam beams spanning in the east-west direction at 15 feet on center. As-built information documenting the roof panel and the size of the glulam beams is not available for review because these were identified as bidder designed elements in the as-built drawings.

The building also has an open corridor along the west façade to access the rooms on each floor. The corridor roof and floor framing are supported by concrete columns with brick veneer and partial-height precast wall panels forming a railing type barrier. The foundation of the building is composed of concrete spread footings under columns and continuous spread footings under exterior and interior CMU walls and precast concrete panels. Only limited as-built drawings for the building are available. Therefore, information pertaining to the roof and floor framing systems, diaphragm construction, and details of some member connections are unknown, because these were identified as bidder designed elements in the as-built drawings.

ASCE 41-13 Seismic Evaluation Criteria

The current standard for the seismic evaluation and retrofit of existing buildings is the ASCE 41-13, *Seismic Evaluation and Retrofit of Existing Buildings*. ASCE 41-13 provides screening and evaluation procedures used to identify potential seismic deficiencies that may require further investigation or hazard mitigation. It presents a three-tiered review process that is implemented by following a series of predefined checklists and "quick check" structural calculations. Each successive tier is designed to perform an increasingly refined evaluation procedure for seismic deficiencies identified in previous tiers in the process.

The Tier 1 checklists in ASCE 41-13 are specific to each common building type and contain seismic evaluation statements based on observed structural damage in past earthquakes. These checklists screen for potential seismic deficiencies by examining the lateral-force-resisting systems and details of construction that have historically caused poor seismic performance in similar buildings. Tier 1 screenings include basic "Quick Check" analyses for primary components of the lateral system: in this building's case, the shear walls and wall anchorage. They also include prescriptive checks for proper seismic detailing of connections, diaphragm spans and continuity, and overall system configuration. Use of ASCE 41-13 for seismic evaluations requires buildings be classified from a group of common building types. Building 900 is classified as Precast or Tilt-Up Concrete Shear Walls (with flexible diaphragms), PC1, for the Gymnasium building, and Reinforced Masonry Shear Walls (with flexible diaphragms), RM1, for the rest of the building. Both buildings were checked for Life Safety criteria. The ASCE 41-13 Tier 1 Preliminary Seismic Evaluation structural checklist was completed and is included for reference.

Findings & Conclusions

The results of the structural seismic evaluation indicate that the building has multiple seismic deficiencies, including an inadequate seismic separation joint, overstressed CMU shear walls, inadequate wall thickness at precast walls, cross-grain bending at wood ledgers, long diaphragm spans, lack of cross-ties and beam connections.

The seismic separation between the precast building and the adjacent main building is 1 inch, which is greater than 4 percent of the height of the shorter precast building. Buildings with inadequate separation may impact each other by pounding during seismic events, which may cause extensive damage on both buildings. This deficiency can be mitigated by removing a portion of the building, by tying the buildings together structurally to force them to respond as a single structure, or by stiffening the taller building by adding supplementary concrete shear walls.

The precast concrete wall panels are sandwich panels. The precast panels are 8 inches thick but have 2 inches of insulation sandwiched between 3 inches of concrete on each side. Due to the thickness and height of the sections of concrete, the walls are considered slender walls. The load bearing slender walls are susceptible to buckling out-of-plane under the axial loading and have a higher potential for damage. The slender walls can be strengthened by overlaying a fiber composite or adding supplementary concrete walls to reduce the load that the walls have to resist. It is Reid Middleton's understanding that the current proposal is to demolish the portion of the building composed of the precast panels which would alleviate this deficiency and the seismic separation deficiency previously noted.

The CMU walls running in the east-west direction are overstressed near the center of the building. The overstressed walls may impact the overall strength of the building.

To mitigate this deficiency, new concrete shear walls can be added in the east-west direction. These walls may be able to be cast against specific wall piers to limit the impact to the interior of the structure.

The CMU wall along Grid N-70 between Grids EW-45 and EW-145 are discontinuous at the ground floor. In lieu of a supporting wall below, the walls are supported by steel columns and beams at the ground floor. Creating a discontinuous lateral load path increases the forces in the supporting elements and requires the supporting element to transfer lateral forces to surrounding systems. This deficiency can be mitigated by infilling some of the window openings at the ground floor level and providing supplementary concrete walls to provide a continuous lateral load path to foundation. A more-detailed analysis may also indicate that the support elements have adequate capacity for an adequate discontinuous lateral load path.

The plywood diaphragms appear to be unblocked and exceed the 40-foot maximum span. Unblocked diaphragms have lower capacities than those that are blocked. The diaphragm can be enhanced by adding additional blocking and nailing at the diaphragm panel edges. Blocked diaphragms at panel edges have more strength to transfer lateral forces than those that are unblocked at panel edges. As an alternate, the span of the diaphragms could be reduced by adding shear walls near the center of the spans. This would also help to reduce the loads applied to the existing shear walls and may limit the required upgrades to the overstressed walls.

There are multiple connections that have insufficient capacity. There is a lack of cross-ties between the diaphragm chords, and the wood ledger induces cross grain bending at the roof area composed of trusses. Walls that are not adequately anchored to the diaphragms may separate from the structure. Wall anchorage strength can be increased by providing supplementary tension ties and diaphragm cross-ties.

In addition, it is unclear from review of the as-built drawings what ledger connection was typically used and also if two ties are present at the glulam beam to pilaster connections. Additional investigation is required to confirm the glulam beam connections and to determine if cross grain bending is present in the typical ledger connection. The alternate connection shown in the as-built drawings would require additional analysis.

Building 900 does not meet the Life Safety performance level as determined by the ASCE 41-13 Tier 1 evaluation. During a design-level earthquake, extensive damage of the lateral-force-resisting elements may occur, posing a risk to the building occupants. It is recommended that the building be upgraded to meet the Life Safety performance objective. Attached to this letter are concept-level upgrade drawings for improvement of the lateral force resisting system (LFRS) to meet the LS performance objective. The upgrade concept involves adding and strengthening existing shear walls, upgrading the diaphragm, and multiple framing connections.

Thank you for allowing us the opportunity to assist you with this project. If you need any clarification or additional information, please call.

Sincerely,

Reid Middleton, Inc.

Katherine R. Brawner, P.E.
Project Engineer

Corbin M. Hammer, P.E., S.E.
Principal Engineer

Attachments
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16.1.2LS Life Safety Basic Configuration Checklist

The evaluation statements represent general configuration issues applicable for most buildings based on observed earthquake structural damage during actual earthquakes. This checklist should be completed for all buildings in Very Low, Low, Moderate, and High Seismicity for Life Safety Performance Levels.

Each of the evaluation statements in this checklist shall be marked Compliant (C), Noncompliant (NC), Unknown (U), or Not Applicable (N/A) for a Tier 1 screening. Compliant statements identify issues that are acceptable according to the criteria of this standard, whereas noncompliant and unknown statements identify issues that require further investigation. Certain statements may not apply to the building being evaluated. For noncompliant and unknown evaluation statements, the design professional may choose to conduct further investigation using the corresponding Tier 2 evaluation procedure; corresponding section numbers are in parentheses after each evaluation statement.

Very Low Seismicity

Building System

General

C	NC	N/A	U	EVALUATION STATEMENT	COMMENT
X				LOAD PATH: The structure shall 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. (Commentary: Sec. A.2.1.1. Tier 2: Sec. 5.4.1.1)	
	X			ADJACENT BUILDINGS: The clear distance between the building being evaluated and any adjacent building is greater than 4% of the height of the shorter building. This statement need not apply for the following building types: W1, W1a, and W2. (Commentary: Sec. A.2.1.2. Tier 2: Sec. 5.4.1.2)	1-inch wide seismic separation between precast concrete building and masonry building.
		X		MEZZANINES: Interior mezzanine levels are braced independently from the main structure or are anchored to the seismic-force-resisting elements of the main structure. (Commentary: Sec. A.2.1.3. Tier 2: Sec. 5.4.1.3)	No mezzanine.

Building Configuration

C	NC	N/A	U	EVALUATION STATEMENT	COMMENT
X				WEAK STORY: The sum of the shear strengths of the seismic-force-resisting system in any story in each direction shall not be less than 80% of the strength in the adjacent story above. (Commentary: Sec. A.2.2.2. Tier 2: Sec. 5.4.2.1)	
X				SOFT STORY: The stiffness of the seismic-force-resisting system in any story shall not be 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. (Commentary: Sec. A.2.2.3. Tier 2: Sec. 5.4.2.2)	
X				VERTICAL IRREGULARITIES: All vertical elements in the seismic-force-resisting system are continuous to the foundation. (Commentary: Sec. A.2.2.4. Tier 2: Sec. 5.4.2.3)	

16.1.2LS Life Safety Basic Configuration Checklist

C	NC	N/A	U	EVALUATION STATEMENT	COMMENT
X				GEOMETRY: There are no changes in the net horizontal dimension of the seismic-force-resisting system of more than 30% in a story relative to adjacent stories, excluding one-story penthouses and mezzanines. (Commentary: Sec. A.2.2.5. Tier 2: Sec. 5.4.2.4)	
X				MASS: There is no change in effective mass more than 50% from one story to the next. Light roofs, penthouses, and mezzanines need not be considered. (Commentary: Sec. A.2.2.6. Tier 2: Sec. 5.4.2.5)	
X				TORSION: The estimated distance between the story center of mass and the story center of rigidity is less than 20% of the building width in either plan dimension. (Commentary: Sec. A.2.2.7. Tier 2: Sec. 5.4.2.6)	

Low Seismicity: Complete the Following Items in Addition to the Items for Very Low Seismicity.

Geologic Site Hazards

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

16.1.2LS Life Safety Basic Configuration Checklist

Moderate and High Seismicity: **Complete the Following Items in Addition to the Items for Low Seismicity.**

Foundation Configuration

C	NC	N/A	U	EVALUATION STATEMENT	COMMENT
X				OVERTURNING: The ratio of the least horizontal dimension of the seismic-force-resisting system at the foundation level to the building height (base/height) is greater than $0.6S_a$. (Commentary: Sec. A.6.2.1. Tier 2: Sec. 5.4.3.3)	
X				TIES BETWEEN FOUNDATION ELEMENTS: The foundation has ties adequate to resist seismic forces where footings, piles, and piers are not restrained by beams, slabs, or soils classified as Site Class A, B, or C. (Commentary: Sec. A.6.2.2. Tier 2: Sec. 5.4.3.4)	Footings are tied with slab-on-grade.

16.12LS Life Safety Structural Checklist for Building Types PC1: Precast or Tilt-Up Concrete Shear Walls with Flexible Diaphragms and PC1A: Precast or Tilt-Up Concrete Shear Walls with Stiff Diaphragms

This Life Safety Structural Checklist shall be completed where required by Table 4-7 and where the building configuration complies with the description of PC1 or PC1a building type defined in Table 3-1. Tier 1 screening shall include on-site investigation and condition assessment as required by Section 4.2.1.

Each of the evaluation statements in this checklist shall be marked Compliant (C), Noncompliant (NC), Not Applicable (N/A), or Unknown (U) for a Tier 1 screening. Compliant statements identify issues that are acceptable according to the criteria of this standard, whereas noncompliant and unknown statements identify issues that require further investigation. Certain statements may not apply to the buildings being evaluated. For noncompliant and unknown evaluation statements, the design professional may choose to conduct further investigation using the corresponding Tier 2 evaluation procedure; corresponding section numbers are in parentheses after each evaluation statement.

Low Seismicity

Connections

C	NC	N/A	U	EVALUATION STATEMENT	COMMENT
X				WALL ANCHORAGE: Exterior concrete or masonry walls that are dependent on the diaphragm for lateral support are anchored for out-of-plane forces at each diaphragm level with steel anchors, reinforcing dowels, or straps that are developed into the diaphragm. Connections shall have adequate strength to resist the connection force calculated in the Quick Check procedure of Section 4.5.3.7. (Commentary: Sec. A.5.1.1. Tier 2: Sec. 5.7.1.1)	

Moderate Seismicity: Complete the Following Items in Addition to the Items for Low Seismicity

Seismic-Force-Resisting System

C	NC	N/A	U	EVALUATION STATEMENT	COMMENT
X				REDUNDANCY: The number of lines of shear walls in each principal direction is greater than or equal to 2. (Commentary: Sec. A.3.2.1.1. Tier 2: Sec. 5.5.1.1)	
X				WALL SHEAR STRESS CHECK: The shear stress in the precast panels, calculated using the Quick Check procedure of Section 4.5.3.3, is less than the greater of 100 lb/in.^{2} or $2\sqrt{f'_c}$. (Commentary: Sec. A.3.2.3.1. Tier 2: Sec. 5.5.3.1.1)	
	X			REINFORCING STEEL: The ratio of reinforcing steel area to gross concrete area is not less than 0.0012 in the vertical direction and 0.0020 in the horizontal direction. (Commentary: Sec. A.3.2.3.2. Tier 2: Sec. 5.5.3.1.3)	Welded wire fabric between discrete piers.
	X			WALL THICKNESS: Thicknesses of bearing walls shall not be less than 1/40 the unsupported height or length, whichever is shorter, nor less than 4 in. (Commentary: Sec. A.3.2.3.5. Tier 2: Sec. 5.5.3.1.2)	3" on each side of 2" insulated panels for 8-inch thick insulated sandwich panels.

16.12LS Life Safety Structural Checklist for Building Types PC1: Precast or Tilt-Up Concrete Shear Walls with Flexible Diaphragms and PC1A: Precast or Tilt-Up Concrete Shear Walls with Stiff Diaphragms

Diaphragms

C	NC	N/A	U	EVALUATION STATEMENT	COMMENT
		X		TOPPING SLAB: Precast concrete diaphragm elements are interconnected by a continuous reinforced concrete topping slab with a minimum thickness of 2 in. (Commentary: Sec. A.4.5.1. Tier 2: Sec. 5.6.4)	

Connections

C	NC	N/A	U	EVALUATION STATEMENT	COMMENT
	X			WOOD LEDGERS: The connection between the wall panels and the diaphragm does not induce cross-grain bending or tension in the wood ledgers. (Commentary: Sec. A.5.1.2. Tier 2: Sec. 5.7.1.3)	
X				TRANSFER TO SHEAR WALLS: Diaphragms are connected for transfer of seismic forces to the shear walls. (Commentary: Sec. A.5.2.1. Tier 2: Sec. 5.7.2)	
X				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. (Commentary: Sec. A.5.2.3. Tier 2: Sec. 5.7.2)	
X				GIRDER–COLUMN CONNECTION: There is a positive connection using plates, connection hardware, or straps between the girder and the column support. (Commentary: Sec. A.5.4.1. Tier 2: Sec. 5.7.4.1)	

High Seismicity: Complete the Following Items in Addition to the Items for Low and Moderate Seismicity

Seismic-Force-Resisting System

C	NC	N/A	U	EVALUATION STATEMENT	COMMENT
		X		DEFLECTION COMPATIBILITY FOR RIGID DIAPHRAGMS: Secondary components have the shear capacity to develop the flexural strength of the components. (Commentary: Sec. A.3.1.6.2. Tier 2: Sec. 5.5.2.5.2)	Flexible diaphragm (wood)
X				WALL OPENINGS: The total width of openings along any perimeter wall line constitutes less than 75% of the length of any perimeter wall when the wall piers have aspect ratios of less than 2-to-1. (Commentary: Sec. A.3.2.3.3. Tier 2: Sec. 5.5.3.3.1)	

16.12LS Life Safety Structural Checklist for Building Types PC1: Precast or Tilt-Up Concrete Shear Walls with Flexible Diaphragms and PC1A: Precast or Tilt-Up Concrete Shear Walls with Stiff Diaphragms

Diaphragms

C	NC	N/A	U	EVALUATION STATEMENT	COMMENT
	X			CROSS TIES IN FLEXIBLE DIAPHRAGMS: There are continuous cross ties between diaphragm chords. (Commentary: Sec. A.4.1.2. Tier 2: Sec. 5.6.1.2)	As-built drawings not fully legible but appears detailing is not present.
X				STRAIGHT SHEATHING: All straight sheathed diaphragms have aspect ratios less than 2-to-1 in the direction being considered. (Commentary: Sec. A.4.2.1. Tier 2: Sec. 5.6.2)	Plywood called out and appears to be straight sheathed to allow for strap connections and nailing.
X				SPANS: All wood diaphragms with spans greater than 24 ft consist of wood structural panels or diagonal sheathing. (Commentary: Sec. A.4.2.2. Tier 2: Sec. 5.6.2)	
	X			DIAGONALLY SHEATHED AND UNBLOCKED DIAPHRAGMS: All diagonally sheathed or unblocked wood structural panel diaphragms have horizontal spans less than 40 ft and aspect ratios less than or equal to 4-to-1. (Commentary: Sec. A.4.2.3. Tier 2: Sec. 5.6.2)	Span exceeds 40 ft and appears to be unblocked.
X				OTHER DIAPHRAGMS: The diaphragm does not consist of a system other than wood, metal deck, concrete, or horizontal bracing. (Commentary: Sec. A.4.7.1. Tier 2: Sec. 5.6.5)	

Connections

C	NC	N/A	U	EVALUATION STATEMENT	COMMENT
X				MINIMUM NUMBER OF WALL ANCHORS PER PANEL: There are at least two anchors from each precast wall panel into the diaphragm elements. (Commentary: Sec. A.5.1.3. Tier 2: Sec. 5.7.1.4)	
X				PRECAST WALL PANELS: Precast wall panels are connected to the foundation. (Commentary: Sec. A.5.3.6. Tier 2: Sec. 5.7.3.4)	
		X		UPLIFT AT PILE CAPS: Pile caps have top reinforcement, and piles are anchored to the pile caps. (Commentary: Sec. A.5.3.8. Tier 2: Sec. 5.7.3.5)	
	X			GIRDERS: Girders supported by walls or pilasters have at least two ties securing the anchor bolts unless provided with independent stiff wall anchors with adequate strength to resist the connection force calculated in the Quick Check procedure of Section 4.5.3.7. (Commentary: Sec. A.5.4.2. Tier 2: Sec. 5.7.4.2)	

16.15LS Life Safety Structural Checklist for Building Types RM1: Reinforced Masonry Bearing Walls with Flexible Diaphragms and RM2: Reinforced Masonry Bearing Walls with Stiff Diaphragms

This Life Safety Structural Checklist shall be completed where required by Table 4-7 and where the building configuration complies with the description of RM1 or RM2 building type defined in Table 3-1. Tier 1 screening shall include on-site investigation and condition assessment as required by Section 4.2.1.

Each of the evaluation statements in this checklist shall be marked Compliant (C), Noncompliant (NC), Not Applicable (N/A), or Unknown (U) for a Tier 1 screening. Compliant statements identify issues that are acceptable according to the criteria of this standard, whereas noncompliant and unknown statements identify issues that require further investigation. Certain statements may not apply to the buildings being evaluated. For noncompliant and unknown evaluation statements, the design professional may choose to conduct further investigation using the corresponding Tier 2 evaluation procedure; corresponding section numbers are in parentheses after each evaluation statement.

Low and Moderate Seismicity

Seismic-Force-Resisting System

C	NC	N/A	U	EVALUATION STATEMENT	COMMENT
X				REDUNDANCY: The number of lines of shear walls in each principal direction is greater than or equal to 2. (Commentary: Sec. A.3.2.1.1. Tier 2: Sec. 5.5.1.1)	
	X			SHEAR STRESS CHECK: The shear stress in the reinforced masonry shear walls, calculated using the Quick Check procedure of Section 4.5.3.3, is less than 70 $lb/in.^2$. (Commentary: Sec. A.3.2.4.1. Tier 2: Sec. 5.5.3.1.1)	
X				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. (Commentary: Sec. A.3.2.4.2. Tier 2: Sec. 5.5.3.1.3)	

Stiff Diaphragms

C	NC	N/A	U	EVALUATION STATEMENT	COMMENT
		X		TOPPING SLAB: Precast concrete diaphragm elements are interconnected by a continuous reinforced concrete topping slab. (Commentary: Sec. A.4.5.1. Tier 2: Sec. 5.6.4)	

16.15LS Life Safety Structural Checklist for Building Types RM1: Reinforced Masonry Bearing Walls with Flexible Diaphragms and RM2: Reinforced Masonry Bearing Walls with Stiff Diaphragms

Connections

C	NC	N/A	U	EVALUATION STATEMENT	COMMENT
X				WALL ANCHORAGE: Exterior concrete or masonry walls that are dependent on the diaphragm for lateral support are anchored for out-of-plane forces at each diaphragm level with steel anchors, reinforcing dowels, or straps that are developed into the diaphragm. Connections shall have adequate strength to resist the connection force calculated in the Quick Check procedure of Section 4.5.3.7. (Commentary: Sec. A.5.1.1. Tier 2: Sec. 5.7.1.1)	
	X			WOOD LEDGERS: The connection between the wall panels and the diaphragm does not induce cross-grain bending or tension in the wood ledgers. (Commentary: Sec. A.5.1.2. Tier 2: Sec. 5.7.1.3)	Detail B/S10
X			X	TRANSFER TO SHEAR WALLS: Diaphragms are connected for transfer of seismic forces to the shear walls. (Commentary: Sec. A.5.2.1. Tier 2: Sec. 5.7.2)	
		X		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. (Commentary: Sec. A.5.2.3. Tier 2: Sec. 5.7.2)	
X				FOUNDATION DOWELS: Wall reinforcement is doweled into the foundation. (Commentary: Sec. A.5.3.5. Tier 2: Sec. 5.7.3.4)	
	X			GIRDER–COLUMN CONNECTION: There is a positive connection using plates, connection hardware, or straps between the girder and the column support. (Commentary: Sec. A.5.4.1. Tier 2: Sec. 5.7.4.1)	

High Seismicity: Complete the Following Items in Addition to the Items for Low and Moderate Seismicity

Stiff Diaphragms

C	NC	N/A	U	EVALUATION STATEMENT	COMMENT
X				OPENINGS AT SHEAR WALLS: Diaphragm openings immediately adjacent to the shear walls are less than 25% of the wall length. (Commentary: Sec. A.4.1.4. Tier 2: Sec. 5.6.1.3)	
X				OPENINGS AT EXTERIOR MASONRY SHEAR WALLS: Diaphragm openings immediately adjacent to exterior masonry shear walls are not greater than 8 ft long. (Commentary: Sec. A.4.1.6. Tier 2: Sec. 5.6.1.3)	

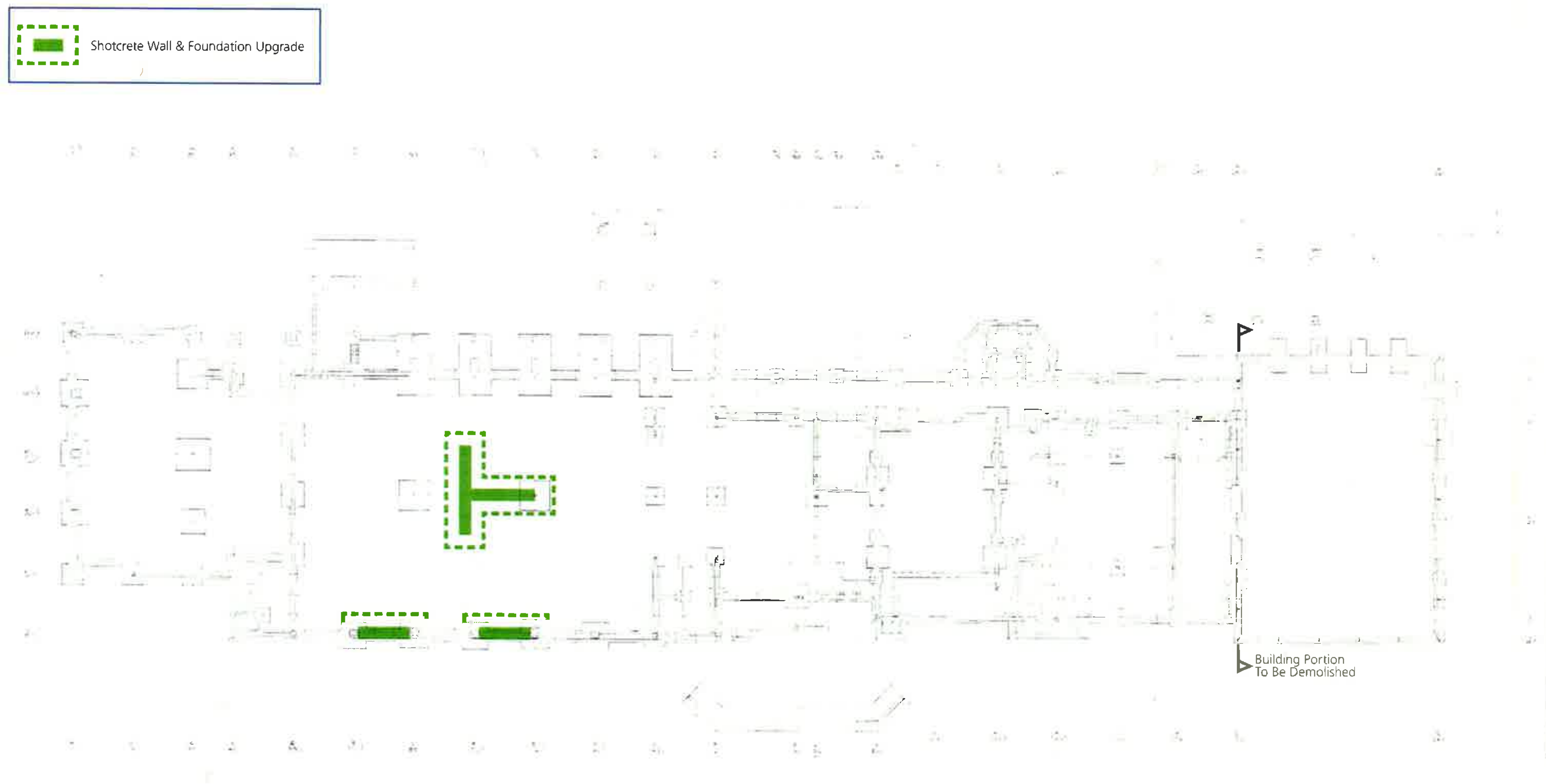
16.15LS Life Safety Structural Checklist for Building Types RM1: Reinforced Masonry Bearing Walls with Flexible Diaphragms and RM2: Reinforced Masonry Bearing Walls with Stiff Diaphragms

Flexible Diaphragms

C	NC	N/A	U	EVALUATION STATEMENT	COMMENT
	X			CROSS TIES: There are continuous cross ties between diaphragm chords. (Commentary: Sec. A.4.1.2. Tier 2: Sec. 5.6.1.2)	As-built drawings not fully legible but appears detailing is not present.
X				OPENINGS AT SHEAR WALLS: Diaphragm openings immediately adjacent to the shear walls are less than 25% of the wall length. (Commentary: Sec. A.4.1.4. Tier 2: Sec. 5.6.1.3)	
X				OPENINGS AT EXTERIOR MASONRY SHEAR WALLS: Diaphragm openings immediately adjacent to exterior masonry shear walls are not greater than 8 ft long. (Commentary: Sec. A.4.1.6. Tier 2: Sec. 5.6.1.3)	
X				STRAIGHT SHEATHING: All straight sheathed diaphragms have aspect ratios less than 2-to-1 in the direction being considered. (Commentary: Sec. A.4.2.1. Tier 2: Sec. 5.6.2)	
X				SPANS: All wood diaphragms with spans greater than 24 ft consist of wood structural panels or diagonal sheathing. (Commentary: Sec. A.4.2.2. Tier 2: Sec. 5.6.2)	
	X			DIAGONALLY SHEATHED AND UNBLOCKED DIAPHRAGMS: All diagonally sheathed or unblocked wood structural panel diaphragms have horizontal spans less than 40 ft and aspect ratios less than or equal to 4-to-1. (Commentary: Sec. A.4.2.3. Tier 2: Sec. 5.6.2)	Span exceeds 40 ft and appears to be unblocked.
X				OTHER DIAPHRAGMS: The diaphragm shall not consist of a system other than wood, metal deck, concrete, or horizontal bracing. (Commentary: Sec. A.4.7.1. Tier 2: Sec. 5.6.5)	

Connections

C	NC	N/A	U	EVALUATION STATEMENT	COMMENT
X				STIFFNESS OF WALL ANCHORS: Anchors of concrete or masonry walls to wood structural elements are installed taut and are stiff enough to limit the relative movement between the wall and the diaphragm to no greater than 1/8 in. before engagement of the anchors. (Commentary: Sec. A.5.1.4. Tier 2: Sec. 5.7.1.2)	



NOTES:

1. Wall locations are not final and may be moved to accomodate the final architectural layout
2. Steel braced frames may be used in place of concrete walls

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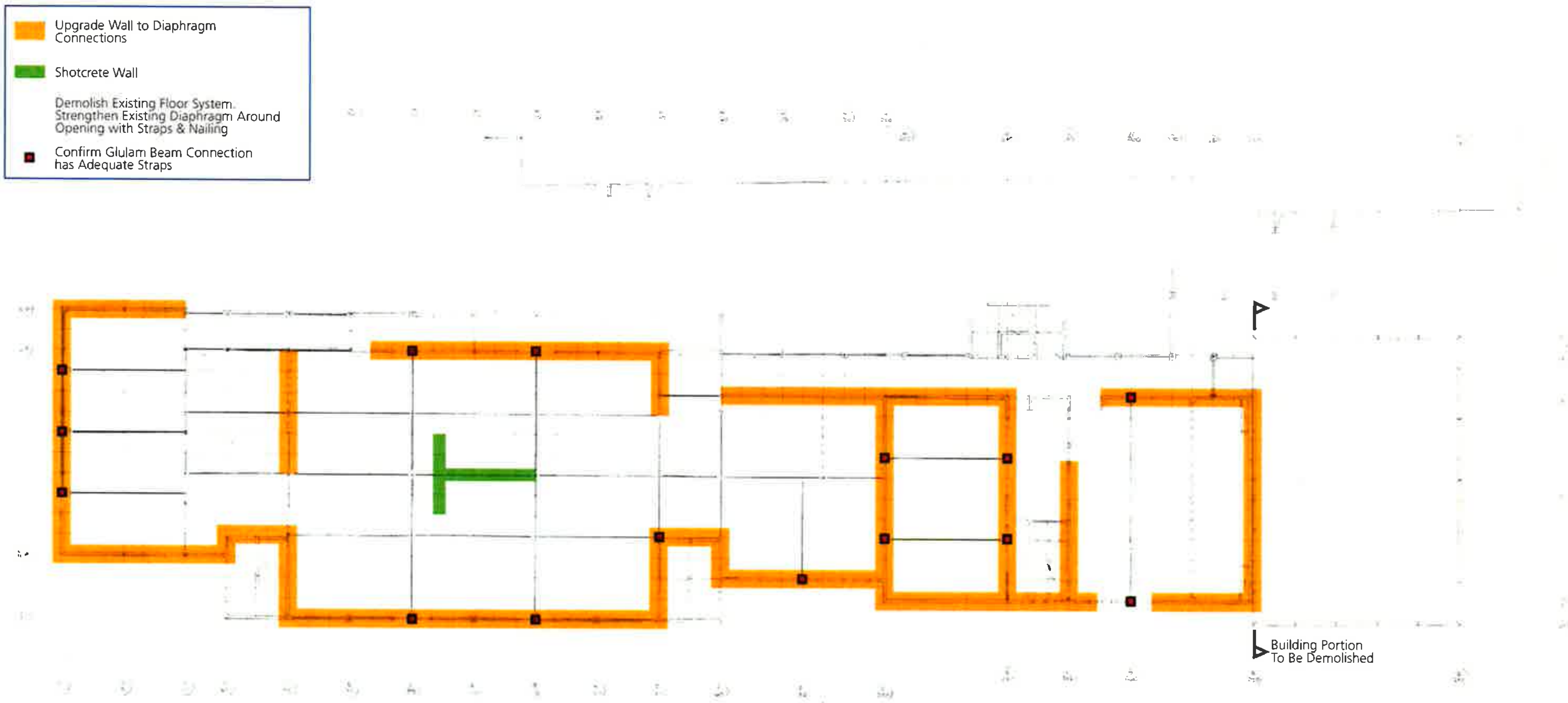
Building 990 Upgrade Concepts
Central Kitsap School District – August 2018

Figure 1 - Foundation / Lower Floor

Permit Number: **19-05911**



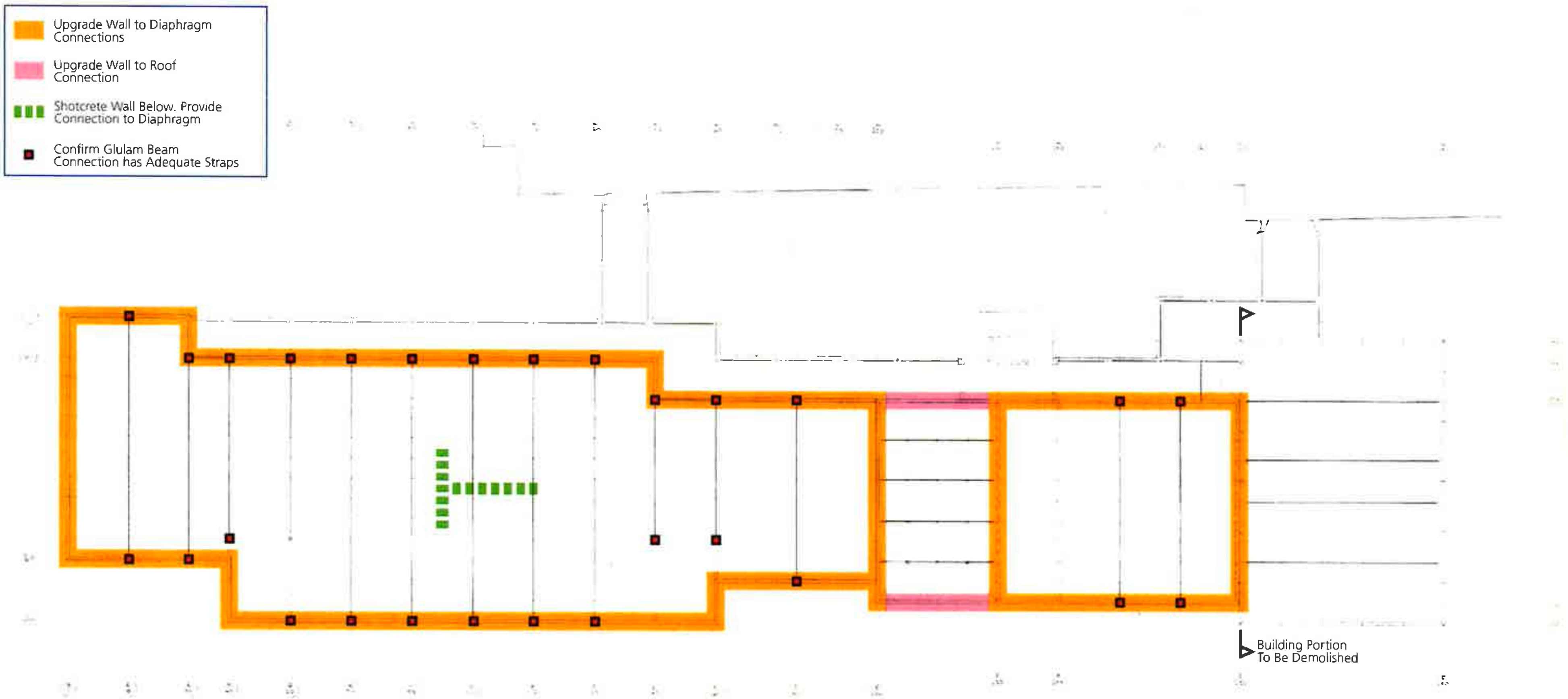
NOTES:
1. Wall locations are not final and may be moved to accomodate the final architectural layout
2. Steel braced frames may be used in place of concrete walls

ReidMiddleton RICEfergusMILLER

Building 990 Upgrade Concepts
Central Kitsap School District – August 2018

Figure 2 - Upper Floor

Permit Number: 19-05911



NOTES:
1. Wall locations are not final and may be moved to accomodate the final architectural layout
2. Steel braced frames may be used in place of concrete walls

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Building 990 Upgrade Concepts
Central Kitsap School District – August 2018

Figure 3 - Roof Plan

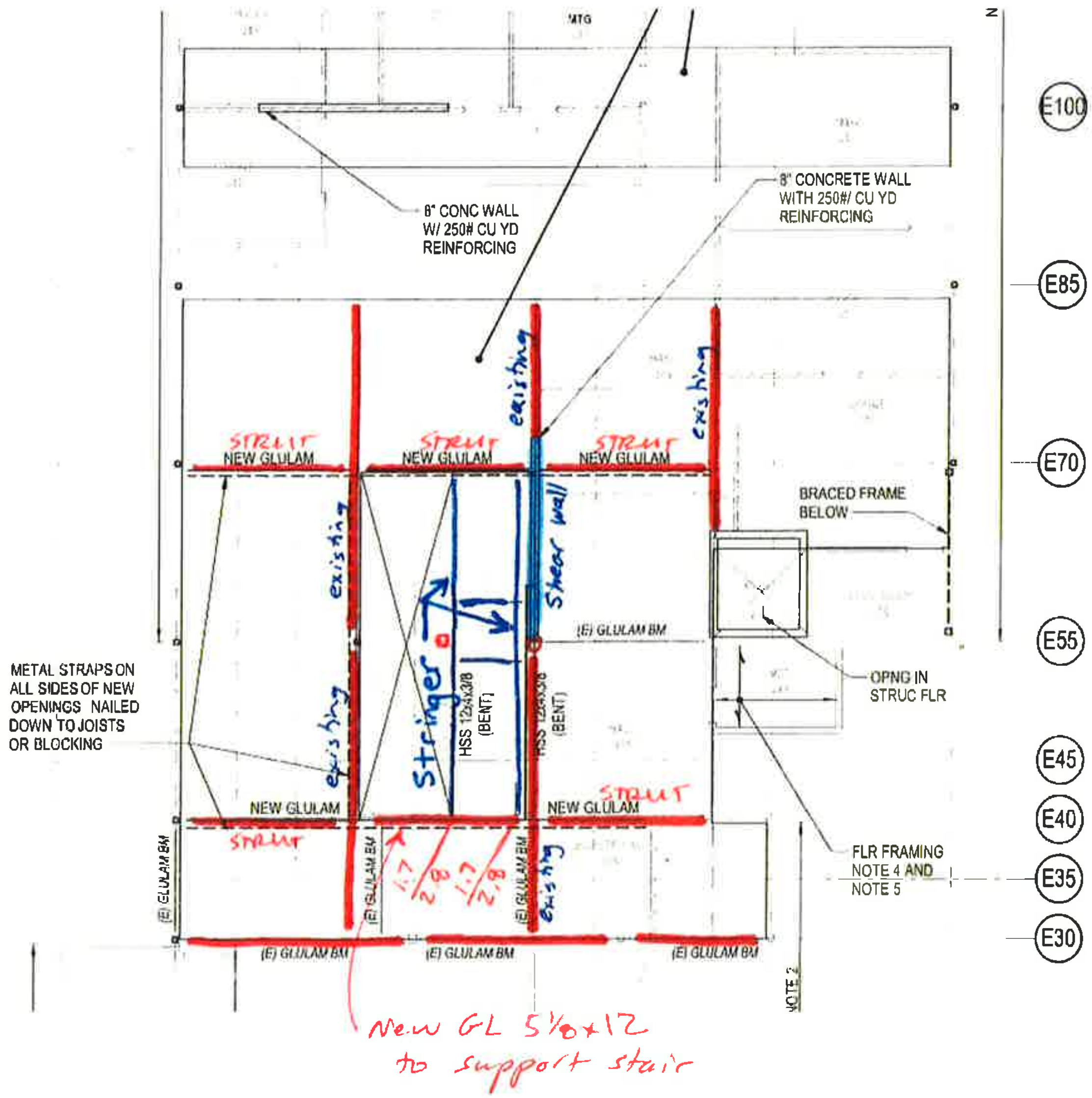
Permit Number: 19-05911

Reid Middleton
728 134th Street SW · Suite 200
Everett, Washington 98204
Ph: 425 741-3800
Fax: 425 741-3900

Client: Rice Fergus Miller
Project: Bldg 900 Renovation
Project No.: 262019.034
Sheet ___ of ___
Design by: SES
Date:
Checked by:
Date:

GRAVITY FRAMING

Permit Number: 19-05911



FLOOR PLAN: 2ND FLOOR
Bldg 900 Renovation

Permit Number: 19-05911

Gravity Beam Design

Stair Stringer

RAM SBeam v5.01

12/19/19 14:16:59

STEEL CODE: AISC 360-05 LRFD

SPAN INFORMATION (ft): I-End (0.00,0.00) J-End (16.00,0.00)

Beam Size (User Selected) = HSS12X4X3/16 Fy = 46.0 ksi
Total Beam Length (ft) = 16.00
Mp (kip-ft) = 75.13
Top flange not braced by decking.

LINE LOADS (k/ft):

Load	Dist (ft)	DL	LL
1	0.000	0.018	0.000
	16.000	0.018	0.000
2	0.000	0.193	0.350
	16.000	0.193	0.350

SHEAR (Ultimate): Max Vu (1.2DL+1.6LL) = 6.51 kips 0.90Vn = 92.89 kips

MOMENTS (Ultimate):

Span	Cond	LoadCombo	Mu kip-ft	@ ft	Lb ft	Cb	Phi	Phi*Mn kip-ft
Center	Max +	1.2DL+1.6LL	26.0	8.0	16.0	1.14	0.90	66.68
Controlling		1.2DL+1.6LL	26.0	8.0	16.0	1.14	0.90	66.68

REACTIONS (kips):

	Left	**Right**
DL reaction	1.69	1.69
Max +LL reaction	2.80	2.80
Max +total reaction (factored)	6.51	6.51

DEFLECTIONS:

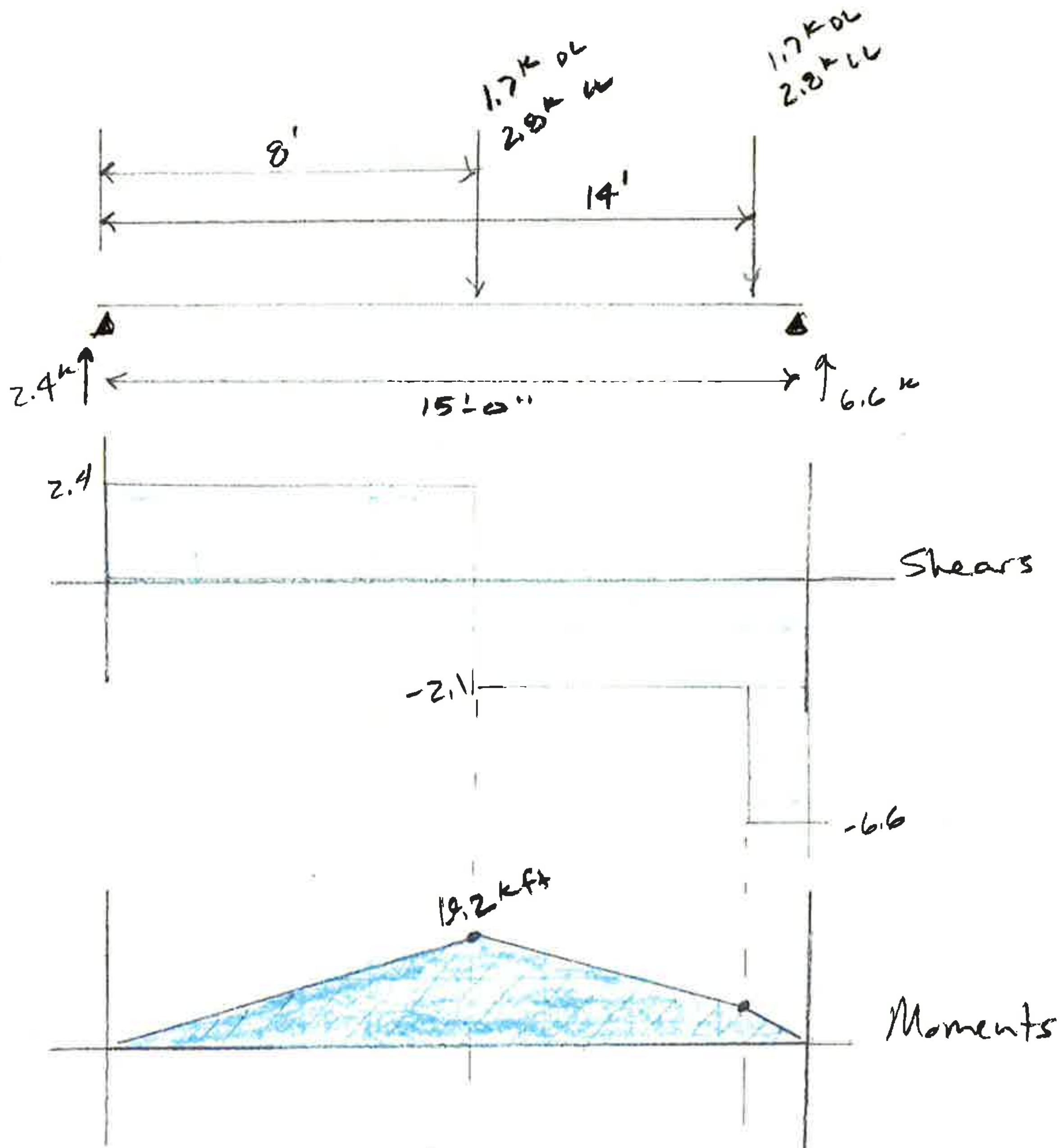
Dead load (in)	at	8.00 ft	=	-0.117	L/D	=	1641
Live load (in)	at	8.00 ft	=	-0.194	L/D	=	990
Net Total load (in)	at	8.00 ft	=	-0.311	L/D	=	618

Reid Middleton
www.reidmiddleton.com

Client: RFM
Project: Bldg 900
Project No. 262019.034

Sheet ___ of ___
Design by: SES
Date: 12/19/19
Checked by:
Date:

BEAM SUPPORTING STAIRS



$\Delta_{max} = \frac{PL^3}{48EI}$ $EI = \frac{PL^3}{48\Delta_{max}} = \frac{PL^3 \times 360}{48L} = 1{,}094 \times 10^6$

∴ 5 1/8 × 12 GLULAM

$EI = 1{,}328 \times 10^6$ ✓

$V_{max} = 9.84^k$ ✓

$M_{max} = 24.6^{k\text{-}ft}$ ✓

Permit Number: 19-05911

DOUGLAS FIR 24F - V3/V4/V8

F_b = 2400 psi
F_v = 240 psi
E = 1800 ksi
$F_{c\perp}$ = 650 psi

b x d (in) (in)	M_{allow} (ft-k) = F_b' * S C_D = 1.0	= 1.15	= 1.6	V_{allow} (k) = 2/3 * Fv' * b * d C_D = 1.0	= 1.15	= 1.6	EI (lb-in^2 x 10^6)	I (in^4)	S (in^3)	C_V[a]
5 1/8 x 6	6.15	7.07	9.84	4.92	5.66	7.87	166.05	92.25	30.75	1.00
5 1/8 x 7 1/2	9.61	11.05	15.38	6.15	7.07	9.84	324.32	180.18	48.05	1.00
5 1/8 x 9	13.84	15.91	22.14	7.38	8.49	11.81	560.42	311.34	69.19	1.00
5 1/8 x 10 1/2	18.83	21.66	30.14	8.61	9.90	13.78	889.92	494.40	94.17	1.00
5 1/8 x 12	24.60	28.29	39.36	9.84	11.32	15.74	1,328.40	738.00	123.00	1.00
5 1/8 x 13 1/2	30.92	35.56	49.47	11.07	12.73	17.74	1,891.41	1050.79	155.67	0.99
5 1/8 x 15	37.77	43.44	60.44	12.30	14.15	19.68	2,594.53	1441.41	192.19	0.98
5 1/8 x 16 1/2	43.47	49.99	69.56	13.53	15.56	21.65	3,453.32	1918.51	232.55	0.93
5 1/8 x 18	51.29	58.98	82.06	14.76	16.97	23.62	4,483.35	2490.75	276.75	0.93
5 1/8 x 19 1/2	59.71	68.67	95.54	15.99	18.39	25.58	5,700.19	3166.77	324.80	0.92
5 1/8 x 21	68.74	79.05	109.99	17.22	19.80	27.55	7,119.39	3955.22	376.69	0.91
5 1/8 x 22 1/2	78.37	90.12	125.39	18.45	21.22	29.52	8,756.54	4864.75	432.42	0.91
5 1/8 x 24	88.59	101.88	141.75	19.68	22.63	31.49	10,627.20	5904.00	492.00	0.90
5 1/8 x 25 1/2	96.59	111.08	154.54	20.91	24.05	33.46	12,746.93	7081.63	555.42	0.87
5 1/8 x 27	107.67	123.82	172.27	22.14	25.46	35.42	15,131.31	8406.28	622.69	0.86
5 1/8 x 28 1/2	119.32	137.22	190.91	23.37	26.88	37.39	17,795.89	9886.61	693.80	0.86
5 1/8 x 30	131.53	151.26	210.45	24.60	28.29	39.36	20,756.25	11531.25	768.75	0.86
5 1/8 x 31 1/2	144.31	165.96	230.90	25.83	29.70	41.33	24,027.95	13348.86	847.55	0.85
5 1/8 x 33	154.17	177.29	246.67	27.06	31.12	43.30	27,626.57	15348.09	930.19	0.83
5 1/8 x 34 1/2	167.75	192.92	268.41	28.29	32.53	45.26	31,567.66	17537.59	1016.67	0.83
5 1/8 x 36	181.88	209.16	291.01	29.52	33.95	47.23	35,866.80	19926.00	1107.00	0.82

[a]The preceding table assumes the following values. Refer to NDS 5.3.6 to determine actual C_V.

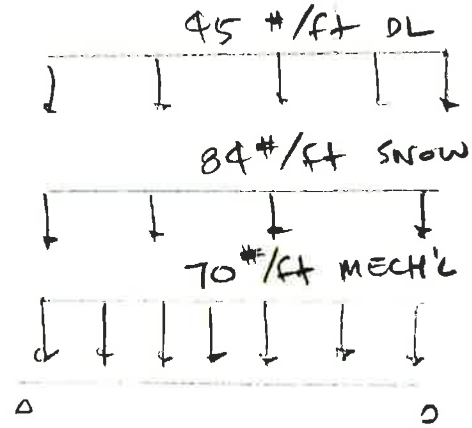
$C_V = (21/L)^{1/x} (12/d)^{1/x} (5.125/b)^{1/x} \le 1.0$

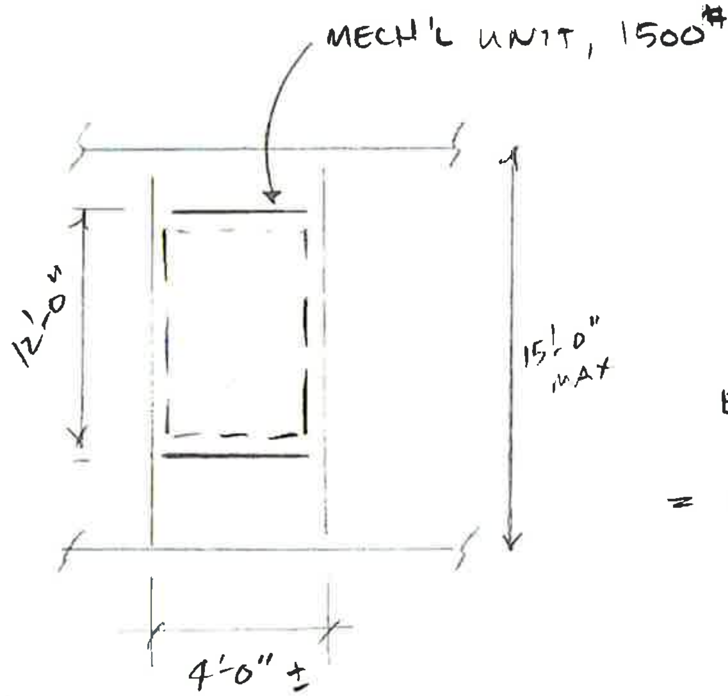
1.0 x = 10

L ≤ 20' for depths up to 15"
20' ≤ L ≤ 30' for depths up to 24"
30' ≤ L ≤ 40' for depths up to 31½"
40' ≤ L ≤ 50' for depths up to 36"

[b]For non-prismatic members, notched members (NDS 3.4.3.2), members subject to impact or cyclic loading, or shear design of bending members at connections (NDS 3.4.3.3), the design value for shear shall be multiplied by a factor of 0.8 (190 psi). For the determination of radial tension design values (NDS 5.2.2), the design value for shear shall be multiplie by a factor of 0.7 for DF-L (170 psi) and SP or by 0.8 (190 psi) for all other species.

ROOF FRAMING: Mechanical Unit Supports





$EI_{req'd} = 675 w L^3$

$= 453.4 \times 10^6$ #-in^2

$V_{max} = 1{,}493$ # $M_{max} = \frac{wL^2}{8} = 5{,}597$ #-ft

3 1/8 x 12 $V_{all} = 6{,}900$ # $M_{all} = 17{,}250$ #-ft

$EI = 810 \times 10^6$ #-in^2 ✓ okay

USE HU3.25/12 HANGER $V_{all} = 4{,}030$ # ✓

DOUGLAS FIR 24F - V3/V4/V8

F_b = 2400 psi
F_v = 240 psi
E = 1800 ksi
$F_{c\perp}$ = 650 psi

b x d (in) (in)	M_{allow} (ft-k) = F_b' * S			V_{allow} (k) = 2/3 * Fv' * b * d			EI	I	S	
	C_D = 1.0	= 1.15	= 1.6	C_D = 1.0	= 1.15	= 1.6	(lb-in² x 10⁶)	(in⁴)	(in³)	C_V[a]
3 1/8 x 6	3.75	4.31	6.00	3.00	3.45	4.80	101.25	56.25	18.75	1.00
3 1/8 x 7 1/2	5.86	6.74	9.38	3.75	4.31	6.00	197.75	109.86	29.30	1.00
3 1/8 x 9	8.44	9.70	13.50	4.50	5.18	7.20	341.72	189.84	42.19	1.00
3 1/8 x 10 1/2	11.48	13.21	18.38	5.25	6.04	8.40	542.64	301.46	57.42	1.00
3 1/8 x 12	15.00	17.25	24.00	6.00	6.90	9.60	810.00	450.00	75.00	1.00
3 1/8 x 13 1/2	18.98	21.83	30.38	6.75	7.76	10.80	1,153.30	640.72	94.92	1.00
3 1/8 x 15	23.44	26.95	37.50	7.50	8.63	12.00	1,582.03	878.91	117.19	1.00
3 1/8 x 16 1/2	27.85	32.03	44.56	8.25	9.49	13.20	2,105.68	1169.82	141.80	0.98
3 1/8 x 18	32.86	37.79	52.57	9.00	10.35	14.40	2,733.75	1518.75	168.75	0.97
3 1/8 x 19 1/2	38.26	44.00	61.21	9.75	11.21	15.60	3,475.72	1930.96	198.05	0.97
3 1/8 x 21	44.04	50.65	70.47	10.50	12.08	16.80	4,341.09	2411.72	229.69	0.96
3 1/8 x 22 1/2	50.21	57.74	80.34	11.25	12.94	18.00	5,339.36	2966.31	263.67	0.95
3 1/8 x 24	56.76	65.27	90.82	12.00	13.80	19.20	6,480.00	3600.00	300.00	0.95
3 1/8 x 25 1/2	61.88	71.17	99.01	12.75	14.66	20.40	7,772.52	4318.07	338.67	0.91
3 1/8 x 27	68.98	79.33	110.37	13.50	15.53	21.60	9,226.41	5125.78	379.69	0.91
3 1/8 x 28 1/2	76.45	87.91	122.31	14.25	16.39	22.80	10,851.15	6028.42	423.05	0.90
3 1/8 x 30	84.27	96.91	134.83	15.00	17.25	24.00	12,656.25	7031.25	468.75	0.90
3 1/8 x 31 1/2	92.46	106.32	147.93	15.75	18.11	25.20	14,651.19	8139.55	516.80	0.89
3 1/8 x 33	98.77	113.59	158.03	16.50	18.98	26.40	16,845.47	9358.59	567.19	0.87
3 1/8 x 34 1/2	107.48	123.60	171.96	17.25	19.84	27.60	19,248.57	10693.65	619.92	0.87
3 1/8 x 36	116.53	134.01	186.45	18.00	20.70	28.80	21,870.00	12150.00	675.00	0.86

[a]The preceding table assumes the following values. Refer to NDS 5.3.6 to determine actual C_V.

$C_V = (21/L)^{1/x} (12/d)^{1/x} (5.125/b)^{1/x} \leq 1.0$

x = 10

L ≤ 20' for depths up to 15"
20' ≤ L ≤ 30' for depths up to 24"
30' ≤ L ≤ 40' for depths up to 31½"
40' ≤ L ≤ 50' for depths up to 36"

[b]For non-prismatic members, notched members (NDS 3.4.3.2), members subject to impact or cyclic loading, or shear design of bending members at connections (NDS 3.4.3.3), the design value for shear shall be multiplied by a factor of 0.8 (190 psi). For the determination of radial tension design values (NDS 5.2.2), the design value for shear shall be multiplie by a factor of 0.7 for DF-L (170 psi) and SP or by 0.8 (190 psi) for all other species.

Face-Mount Hangers — I-Joists, Glulam and SCL

These products are available with additional corrosion protection. For more information, see p. 15.

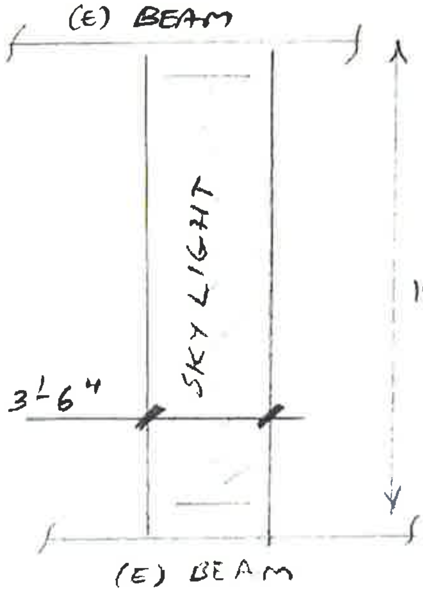
Codes: See p. 12 for Code Reference Key Chart.

Actual Joist Size (in.)	Model No.	Carried Member				Dimensions (in.)			Min./Max.	Fasteners (in.)		Allowable Loads							Code Ref.
		Glulam	SCL	I-joist	Web Stiff Reqd.	W	H	B		Face	Joist	DF/SP Species Header				SPF/HF Species Header			
												Uplift (160)	Floor (100)	Snow (115)	Roof (125)	Floor (100)	Snow (115)	Roof (125)	
2½ x 16	IUS2.56/16			•	—	2⅝	16	2	Min.	(14) 0.148 x 3	—	70	1,660	1,805	1,805	1,425	1,555	1,555	
									Max.	(16) 0.148 x 3	—	70	1,805	1,805	1,805	1,555	1,555	1,555	
	MIU2.56/16			•	—	2 9/16	15 7/16	2½	—	(24) 0.162 x 3½	(2) 0.148 x 1½	230	3,455	3,920	4,045	2,970	3,370	3,480	
	U314			•	✓	2 9/16	10½	2	—	(16) 0.162 x 3½"	(6) 0.148 x 1½"	970	1,945	2,205	2,375	1,675	1,895	2,045	
	HU316 / HUC316			•	✓	2 9/16	14⅛	2½	—	(20) 0.162 x 3½	(8) 0.148 x 1½	1,515	2,975	3,360	3,610	2,565	2,895	3,110	IBC, FL, LA
2½ x 18	MIU2.56/18			•	—	2 9/16	17 7/16	2½	—	(26) 0.162 x 3½	(2) 0.148 x 1½	230	3,745	4,045	4,045	3,220	3,480	3,480	
	HU316 / HUC316			•	✓	2 9/16	14⅛	2½	—	(20) 0.162 x 3½"	(8) 0.148 x 1½"	1515	2,975	3,360	3,610	2,565	2,895	3,110	
2½ x 20	MIU2.56/20			•	—	2 9/16	19 7/16	2½	—	(28) 0.162 x 3½	(2) 0.148 x 1½	230	4,030	4,060	4,060	3,465	3,495	3,495	
2½ x 22 to 26	MIU2.56/20			•	✓	2 9/16	19 7/16	2½	—	(28) 0.162 x 3½	(2) 0.148 x 1½	230	4,030	4,060	4,060	3,465	3,495	3,495	
2 9/16 x 9¼ to 26	2 9/16" wide joists use the same hangers as 2½" wide joists and have the same loads.																		
3 x 9½	MIU3.12/9			•	—	3⅛	9 1/16	2½	—	(16) 0.162 x 3½	(2) 0.148 x 1½	230	2,305	2,615	2,820	1,980	2,245	2,425	
3 x 11⅞	HU210-2 / HUC210-2			•	✓	3⅛	8 13/16	2½	Max.	(18) 0.162 x 3½	(10) 0.148 x 3	1,795	2,680	3,020	3,250	2,305	2,605	2,800	IBC, FL, LA
	MIU3.12/11			•	—	3⅛	11⅛	2½	—	(20) 0.162 x 3½	(2) 0.148 x 1½	230	2,880	3,135	3,135	2,475	2,695	2,695	
	HU212-2 / HUC212-2			•	✓	3⅛	10 9/16	2½	Max.	(22) 0.162 x 3½	(10) 0.148 x 3	1,795	3,275	3,695	3,970	2,820	3,180	3,425	
	HU3.25/12 / HUC3.25/12	•				3¼	11¾	2½	—	(24) 0.162 x 3½	(12) 0.148 x 3	1,795	3,570	4,030	4,335	3,075	3,470	3,735	—
	HU3 25/16 / HUC3 25/16	•			—	3¼	13 13/16	2½	Min.	(20) 0.162 x 3½	(8) 0.148 x 3	1,515	2,975	3,360	3,610	2,560	2,890	3,105	—
		•							Max.	(26) 0.162 x 3½	(12) 0.148 x 3	1,795	3,870	4,365	4,695	3,330	3,755	4,040	
3⅛ glulam	HUCQ210-2-SDS	•				3¼	9	3	—	(12) ¼" x 2½" SDS	(6) ¼" x 2½" SDS	2,345	4,315	4,315	4,315	3,600	3,710	3,710	FL
	HGUS3.25/10	•				3¼	8⅝	4	—	(46) 0.162 x 3½	(16) 0.162 x 3½	4,095	9,100	9,100	9,100	7,825	7,825	7,825	IBC, FL
	HGUS3.25/12	•				3¼	10⅝	4	—	(56) 0.162 x 3½	(20) 0.162 x 3½	5,040	9,400	9,400	9,400	8,085	8,085	8,085	
	LGU3.25-SDS	•			—	3¼	8 to 30	4½	—	(16) ¼" x 2½" SDS	(12) ¼" x 2½" SDS	5,555	6,720	7,310	7,310	4,840	5,265	5,265	
3½ x 5¼	HHUS46	•	•		—	3⅝	5⅛	3	—	(14) 0.162 x 3½	(6) 0.162 x 3½	1,320	2,785	3,155	3,405	2,395	2,715	2,930	
	HGUS46	•	•		—	3⅝	4 7/16	4	—	(20) 0.162 x 3½	(8) 0.162 x 3½	2,155	4,360	4,885	5,230	3,750	4,200	4,500	
	HUS48	•	•		—	3 9/16	6 15/16	2	—	(6) 0.162 x 3½	(6) 0.162 x 3½	1,320	1,595	1,815	1,960	1,365	1,555	1,680	
3½ x 7¼	HHUS48	•	•		—	3⅝	7⅛	3	—	(22) 0.162 x 3½	(8) 0.162 x 3½	1,780	4,210	4,770	5,140	3,615	4,095	4,415	
	HGUS48	•	•		—	3⅝	7 1/16	4	—	(36) 0.162 x 3½	(12) 0.162 x 3½	3,235	7,460	7,460	7,460	6,415	6,415	6,415	
	IUS3.56/9.5			•	—	3⅝	9½	2	—	(10) 0.148 x 3	—	70	1,185	1,345	1,455	1,020	1,160	1,250	
	MIU3.56/9	•	•	•	—	3 9/16	8 13/16	2½	—	(16) 0.162 x 3½	(2) 0.148 x 1½	210	2,305	2,615	2,820	1,980	2,245	2,425	
	U410	•	•	•	✓	3 9/16	8⅜	2	—	(14) 0.162 x 3½	(6) 0.148 x 3	970	2,015	2,285	2,465	1,735	1,965	2,120	
	HUS410	•	•		—	3 9/16	8 15/16	2	—	(8) 0.162 x 3½	(8) 0.162 x 3½	2,990	2,125	2,420	2,615	1,820	2,070	2,240	
3½ x 9½	HHUS410	•	•		—	3⅝	9	3	—	(30) 0.162 x 3½	(10) 0.162 x 3½	3,565	5,635	6,380	6,445	4,845	5,486	5,545	
	HU410/HUC410	•	•	•	✓	3 9/16	8⅝	2½	—	(36) 0.162 x 3½	(12) 0.162 x 3½	3,235	7,460	7,460	7,460	6,415	6,415	6,415	
	HUCQ410-SDS	•	•		—	3 9/16	9	3	—	(12) ¼" x 2½" SDS	(6) ¼" x 2½" SDS	2,265	4,500	4,500	4,500	3,240	3,240	3,240	
	HGUS410	•	•		—	3⅝	9 1/16	4	—	(46) 0.162 x 3½	(16) 0.162 x 3½	4,095	9,100	9,100	9,100	7,825	7,825	7,825	IBC, FL, LA
	LGU3.63-SDS	•	•		—	3⅝	8 to 30	4½	—	(16) ¼" x 2½" SDS	(12) ¼" x 2½" SDS	5,555	6,720	6,720	6,720	4,840	4,840	4,840	
	MGU3.63-SDS	•	•		—	3⅝	9¼ to 30	4½	—	(24) ¼" x 2½" SDS	(16) ¼" x 2½" SDS	7,260	9,450	9,450	9,450	6,805	6,805	6,805	
	IUS3 56/11.88			•	—	3⅝	11⅞	2	—	(12) 0.148 x 3	—	70	1,420	1,615	1,745	1,220	1,390	1,485	
	MIU3.56/11			•		3 9/16	11⅛	2½		(20) 0.162 x 3½	(2) 0.148 x 1½	210	2,880	3,135	3,135	2,475	2,695	2,695	
	U414	•	•	•	✓	3 9/16	10	2	—	(16) 0.162 x 3½	(6) 0.148 x 3	970	2,305	2,615	2,820	1,980	2,245	2,425	
	HHUS410	•	•		—	3⅝	9	3	—	(30) 0.162 x 3½	(10) 0.162 x 3½	3,565	5,635	6,380	6,445	4,845	5,486	5,545	
	HUS412	•	•			3 9/16	10½	2		(10) 0.162 x 3½	(10) 0.162 x 3½	3,435	2,660	3,025	3,265	2,275	2,590	2,795	
3½ x 11⅞	HU412 / HUC412	•	•		—	3 9/16	10 9/16	2½	Min.	(16) 0.162 x 3½	(6) 0.148 x 3	1,135	2,380	2,685	2,890	2,050	2,315	2,490	
									Max	(22) 0.162 x 3½	(10) 0.148 x 3	1,795	3,275	3,695	3,970	2,820	3,180	3,425	
	HUCQ412 SDS	•	•		—	3 9/16	11			(14) ¼" x 2½" SDS	(6) ¼" x 2½" SDS	2,265	5,045	5,045	5,045	3,630	3,630	3,630	
	HGUS412	•	•			3⅝	10 7/16	4		(56) 0.162 x 3½	(20) 0.162 x 3½	5,040	9,400	9,400	9,400	8,085	8,085	8,085	
	LGU3 63-SDS	•	•			3⅝	8 to 30	4½		(16) ¼" x 2½" SDS	(12) ¼" x 2½" SDS	5,555	6,720	6,720	6,720	4,840	4,840	4,840	
	MGU3 63-SDS	•	•			3⅝	9¼ to 30	4½		(24) ¼" x 2½" SDS	(16) ¼" x 2½" SDS	7,260	9,450	9,450	9,450	6,805	6,805	6,805	
	HGU3 63-SDS	•	•		—	3⅝	11 to 30	4½		(36) ¼" x 2½" SDS	(24) ¼" x 2½" SDS	9,460	13,160	13,160	13,160	9,475	9,475	9,475	

See footnotes on p. 150.

Permit Number: 19-05911

ROOF FRAMING: Skylight supports



SPAN = 15'-0"

TRIB = $\frac{3'-6"}{2} + \frac{2'-0"}{2} = 2.75'$

DL = 15 PSF

SNOW = 28 PSF

w_{DL} = 41.3 PLF

w_{LL} = 77 PLF

$EI_{req'd} = 675 w L^3 = 175.4 \times 10^6$ #-in²

→ (2) 2x10 or (2) 2x12
EI_{min} = 316.58 #-in²

V_{max} = 887# Vall = 3,330# ✓ okay

∴ use LUS28 hanger Vall = 1490# ✓ okay

$M_{max} = \frac{wL^2}{8}$ = 3327 #-ft Mall = 4,060 #-ft ✓ okay

DOUGLAS FIR-LARCH #2 (WWPA/WCLIB)

F_b = 900 psi
F_v = 180 psi
E = 1600 ksi
$F_{c\perp}$ = 625 psi

	M_{allow} (ft-k) = F_b' * S			V_{allow} (k) = 2/3 * Fv' * b * d			EI	I	S	
Size	C_D = 1.0	= 1.15	= 1.6	C_D = 1.0	= 1.15	= 1.6	(lb-in^2 x 10^6)	(in^4)	(in^3)	C_F
(1) 2x4	0.34 [0.40]	0.40 [0.46]	0.55 [0.63]	0.63	0.72	1.01	8.57	5.36	3.063	1.5
(1) 2x6	0.74 [0.85]	0.85 [0.98]	1.18 [1.36]	0.99	1.14	1.58	33.28	20.80	7.563	1.3
(2) 2x6	1.47 [1.70]	1.70 [1.95]	2.36 [2.71]	1.98	2.28	3.17	66.55	41.59	15.13	1.3
(3) 2x6	2.54	2.93	4.07	2.97	3.42	4.75	99.83	62.39	22.69	1.3
(4) 2x6	3.39	3.90	5.43	3.96	4.55	6.34	133.10	83.19	30.25	1.3
(1) 2x8	1.18 [1.36]	1.36 [1.56]	1.89 [2.18]	1.31	1.50	2.09	76.22	47.64	13.14	1.2
(2) 2x8	2.37 [2.72]	2.72 [3.13]	3.78 [4.35]	2.61	3.00	4.18	152.43	95.27	26.28	1.2
(3) 2x8	4.08	4.69	6.53	3.92	4.50	6.26	228.65	142.91	39.42	1.2
(4) 2x8	5.44	6.26	8.70	5.22	6.00	8.35	304.86	190.54	52.56	1.2
(1) 2x10	1.76 [2.03]	2.03 [2.33]	2.82 [3.25]	1.67	1.91	2.66	158.29	98.93	21.39	1.1
(2) 2x10	3.53 [4.06]	4.06 [4.67]	5.65 [6.49]	3.33	3.83	5.33	316.58	197.86	42.78	1.1
(3) 2x10	6.09	7.00	9.74	5.00	5.74	7.99	474.87	296.80	64.17	1.1
(4) 2x10	8.12	9.34	12.99	6.66	7.66	10.66	633.16	395.73	85.56	1.1
(1) 2x12	2.37 [2.73]	2.73 [3.14]	3.80 [4.37]	2.03	2.33	3.24	284.77	177.98	31.64	1.0
(2) 2x12	4.75 [5.46]	5.46 [6.28]	7.59 [8.73]	4.05	4.66	6.48	569.53	355.96	63.28	1.0
(3) 2x12	8.19	9.42	13.10	6.08	6.99	9.72	854.30	533.94	94.92	1.0
(4) 2x12	10.92	12.55	17.47	8.10	9.32	12.96	1,139.07	711.92	126.56	1.0

Notes: Repetitive Member Factor is used for all (3) 2x_ and (4) 2x_ beams (bending only)
[Repetitive Member Factor for (1) 2x_ and (2) 2x_ beams in brackets]

SIMPSON Strong-Tie

Face-Mount Hangers – Solid Sawn Lumber (DF/SP)

These products are available with additional corrosion protection. For more information, see p. 15.

SS For stainless-steel fasteners, see p. 21

SD Many of these products are approved for installation with Strong-Drive® SD Connector screws. See pp. 335–337 for more information.

Joist Size	Model No.	Ga.	Dimensions (in.) W	H	B	Min./Max.	Fasteners (in.) Header	Joist	DF/SP Allowable Loads Uplift (160)	Floor (100)	Snow (115)	Roof (125)	Installed Cost Index (ICI)	Code Ref.
Sawn Lumber Sizes														
2x10	LUS28	18	1 9/16	6 5/8	1 3/4	—	(6) 0.148 x 3	(4) 0.148 x 3	1,165	1,100	1,260	1,350	Lowest	
	LU28	20	1 9/16	6 3/8	1 1/2	—	(8) 0.162 x 3 1/2	(6) 0.148 x 1 1/2	850	1,110	1,180	1,180	13%	
	LUS210	18	1 9/16	7 13/16	1 3/4	—	(8) 0.148 x 3	(4) 0.148 x 3	1,165	1,335	1,530	1,640	15%	
	LU210	20	1 9/16	7 13/16	1 1/2	—	(10) 0.162 x 3 1/2	(6) 0.148 x 1 1/2	850	1,390	1,580	1,615	28%	
	U210	16	1 9/16	7 13/16	2	—	(10) 0.162 x 3 1/2	(6) 0.148 x 1 1/2	990	1,440	1,565	1,565	76%	
	LUC210Z	18	1 9/16	7 3/4	1 3/4	—	(10) 0.162 x 3 1/2	(6) 0.148 x 1 1/2	985	1,185	1,345	1,455	180%	
	HU210	14	1 9/16	7 1/8	2 1/4	—	(8) 0.162 x 3 1/2	(4) 0.148 x 1 1/2	605	1,190	1,345	1,440	225%	
	HUS210	16	1 5/8	9	3	—	(30) 0.162 x 3 1/2	(10) 0.162 x 3 1/2	2,635	5,450	5,795	5,830	450%	IBC, FL, LA
	HGUS210	12	1 5/8	9 1/8	5	—	(46) 0.162 x 3 1/2	(16) 0.162 x 3 1/2	2,090	9,100	9,100	9,100	•	
DBL 2X10	LUS28-2	18	3 1/8	7	2	—	(6) 0.162 x 3 1/2	(4) 0.162 x 3 1/2	1,060	1,315	1,490	1,610	Lowest	
	LUS210-2	18	3 1/8	9	2	—	(8) 0.162 x 3 1/2	(6) 0.162 x 3 1/2	1,445	1,830	2,075	2,245	34%	
	U210-2	16	3 1/8	8 1/2	2	—	(14) 0.162 x 3 1/2	(6) 0.148 x 3	990	2,015	2,280	2,465	88%	
	HUS210-2	14	3 1/8	9 3/16	2	—	(8) 0.162 x 3 1/2	(8) 0.162 x 3 1/2	3,270	2,110	2,385	2,575	217%	
	HU210-2 / HUC210-2	14	3 1/8	8 13/16	2 1/2	Min.	(14) 0.162 x 3 1/2	(6) 0.148 x 3	1,135	2,085	2,350	2,520	441%	
		14	3 1/8	8 13/16	2 1/2	Max.	(18) 0.162 x 3 1/2	(10) 0.148 x 3	1,895	2,680	3,020	3,250	467%	
	HUCQ210-2-SDS	14	3 1/4	9	3	—	(12) 1/4 x 2 1/2 SDS	(6) 1/4 x 2 1/2 SDS	2,345	4,315	4,315	4,315	•	FL
	HHUS210-2	14	3 5/16	9 5/32	3		(30) 0.162 x 3 1/2	(10) 0.162 x 3 1/2	3,550	5,705	6,435	6,485	•	IBC, FL, LA
TPL 2X10	LUS28-3	18	4 5/8	6 1/4	2	—	(6) 0.162 x 3 1/2	(4) 0.162 x 3 1/2	1,060	1,315	1,490	1,610	•	IBC, FL
	LUS210-3	18	4 5/8	8 3/16	2	—	(8) 0.162 x 3 1/2	(6) 0.162 x 3 1/2	1,445	1,830	2,075	2,245	•	
	U210-3	16	4 5/8	7 3/4	2	—	(14) 0.162 x 3 1/2	(6) 0.148 x 3	990	2,015	2,280	2,465	•	
	HU210-3 / HUC210-3	14	4 11/16	8 1/8	2 1/2	Min.	(14) 0.162 x 3 1/2	(6) 0.148 x 3	1,135	2,085	2,350	2,520	•	IBC, FL, LA
		14	4 11/16	8 1/16	2 1/2	Max.	(18) 0.162 x 3 1/2	(10) 0.148 x 3	1,895	2,680	3,020	3,250	•	
	HHUS210-3	14	4 11/16	8 7/8	3	—	(30) 0.162 x 3 1/2	(10) 0.162 x 3 1/2	3,405	5,630	6,375	6,485	•	FL
	HGUS210-3	12	4 15/16	9 1/8	4	—	(46) 0.162 x 3 1/2	(16) 0.162 x 3 1/2	4,095	9,100	9,100	9,100	•	IBC, FL
	HUCQ210-3-SDS	14	4 5/8	9	3	—	(12) 1/4 x 2 1/2 SDS	(6) 1/4 x 2 1/2 SDS	2,345	4,315	4,315	4,315	•	FL
QUAD 2x10	HU210-4 / HUC210-4	14	6 1/8	8 3/8	2 1/2	Min.	(14) 0.162 x 3 1/2	(6) 0.162 x 3 1/2	1,345	2,085	2,350	2,520	•	IBC, FL
		14	6 1/8	8 3/8	2 1/2	Max.	(18) 0.162 x 3 1/2	(8) 0.162 x 3 1/2	1,795	2,680	3,020	3,250	•	IBC, FL
	HHUS210-4	14	6 1/8	8 7/8	3	—	(30) 0.162 x 3 1/2	(10) 0.162 x 3 1/2	3,405	5,630	6,375	6,485	•	FL
	HGUS210-4	12	6 9/16	9 1/8	4	—	(46) 0.162 x 3 1/2	(16) 0.162 x 3 1/2	4,095	9,100	9,100	9,100	•	IBC, FL
2x12	LUS210	18	1 9/16	7 13/16	1 3/4	—	(8) 0.148 x 3	(4) 0.148 x 3	1,165	1,335	1,530	1,640	Lowest	
	LU210	20	1 9/16	7 13/16	1 1/2	—	(10) 0.162 x 3 1/2	(6) 0.148 x 1 1/2	850	1,390	1,580	1,615	11%	
	U210	16	1 9/16	7 13/16	2	—	(10) 0.162 x 3 1/2	(6) 0.148 x 1 1/2	990	1,440	1,565	1,565	53%	
	LUC210Z	18	1 9/16	7 3/4	1 3/4	—	(10) 0.162 x 3 1/2	(6) 0.148 x 1 1/2	985	1,185	1,345	1,455	180%	
	HU212	14	1 9/16	9	2 1/4	—	(10) 0.162 x 3 1/2	(6) 0.148 x 1 1/2	1,135	1,490	1,680	1,800	347%	
	HUS210	16	1 5/8	9	3	—	(30) 0.162 x 3 1/2	(10) 0.162 x 3 1/2	2,635	5,450	5,795	5,830	378%	
DBL 2x12	LUS210-2	18	3 1/8	9	2	—	(8) 0.162 x 3 1/2	(6) 0.162 x 3 1/2	1,445	1,830	2,075	2,245	Lowest	IBC, FL, LA
	U210-2	16	3 1/8	8 1/2	2	—	(14) 0.162 x 3 1/2	(6) 0.148 x 3	990	2,015	2,280	2,465	40%	
	LUS214-2	18	3 1/8	10 15/16	2	—	(10) 0.162 x 3 1/2	(6) 0.162 x 3 1/2	1,445	2,110	2,395	2,590	56%	
	HUS210-2	14	3 1/8	9 3/16	2	—	(8) 0.162 x 3 1/2	(8) 0.162 x 3 1/2	3,270	2,110	2,385	2,575	•	
	HUS212-2	14	3 1/8	10 3/4	2	—	(10) 0.162 x 3 1/2	(10) 0.162 x 3 1/2	3,435	2,635	2,985	3,220	•	
	HU212-2 / HUC212-2	14	3 1/8	10 9/16	2 1/2	Min.	(16) 0.162 x 3 1/2	(6) 0.148 x 3	1,135	2,385	2,690	2,880	•	
		14	3 1/8	10 9/16	2 1/2	Max.	(22) 0.162 x 3 1/2	(10) 0.148 x 3	1,895	3,275	3,695	3,970	411%	
	HUCQ210-2-SDS	14	3 1/4	9	3	—	(12) 1/4 x 2 1/2 SDS	(6) 1/4 x 2 1/2 SDS	2,345	4,315	4,315	4,315	•	FL
TPL 2x12	LUS210-3	18	4 5/8	8 3/16	2	—	(8) 0.162 x 3 1/2	(6) 0.162 x 3 1/2	1,445	1,830	2,075	2,245	•	IBC, FL
	HU212-3 / HUC212-3	14	4 11/16	9 13/16	2 1/2	Min.	(16) 0.162 x 3 1/2	(6) 0.148 x 3	1,135	2,385	2,690	2,880	•	
		14	4 11/16	9 13/16	2 1/2	Max.	(22) 0.162 x 3 1/2	(10) 0.148 x 3	1,895	3,275	3,695	3,970	•	IBC, FL, LA
	U210-3	16	4 5/8	7 3/4	2	—	(14) 0.162 x 3 1/2	(6) 0.148 x 3	990	2,015	2,280	2,465	•	
	HUCQ210-3-SDS	14	4 5/8	9	3	—	(12) 1/4 x 2 1/2 SDS	(6) 1/4 x 2 1/2 SDS	2,345	4,315	4,315	4,315	•	FL

See footnotes on p. 108

Codes: See p. 12 for Code Reference Key Chart

Solid Sawn Joist Hangers

Permit Number: 19-05911

ReidMiddleton

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Everett, Washington 98204
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Client Rice Fergus Miller
Project Bldg 900 Renovation
Project No. 262019.034

Sheet of
Design by JDJ
Date
Checked by
Date

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Client RFM
Project 900 Bldg Renovation
Project No. 262019.034

Sheet ___ of ___
Design by SES
Date 4/16/19
Checked by
Date

Bldg 900 weights:

2nd Floor: Elev. 94'-0"

3½" slab and metal form deck	37 psf
STEEL JOISTS @ 24" oc	3 PSF
STEEL GIRDERS W21x44	2 PSF
CEILING	3 PSF
MECH'L / ELEC'L	3 PSF
FINISHES	2 PSF
	50 PSF

3rd + 4th Floor: 110' - 124'

2" lightweight conc	21 PSF
WOOD JOISTS + GLULAMS + PLYWOOD	6 PSF
CEILING	3 PSF
MECH'L	3 PSF
FINISHES	2 PSF
	35 PSF

8" CMU WALLS GROUTED 48" oc EA WAY 55 psf

4" BRICK VENEER 45 PSF

Exterior Wall Braces / Tension Ties

Wall weight W = 100 PSF × 15' = 1500 PLF
Tie spacing 4' ⇒ 6,000# per anchor

$S_{DS} = 0.90$

$0.4 S_{DS} \times 2 \times 1.25 W_p = 0.9 W = 5{,}400\#$ at EA. ANCHOR

5/8"Φ EXPANSION BOLT CAPACITY IN TENSION = 2,219 #

NOMINAL STRENGTH = 1620 #

Install additional anchors

LTT20B ULTIMATE MINUS 1 S.D. = 3455 #

∴ ADD LTT 20B TIES @ 48" OC AT CONDITIONS WHERE JOIST ARE PARALLEL TO WALL

↑ TO SUPPLEMENT EXISTING ANCHORS

AVERAGE: 2,219
+3,455
5,674 # PER 48"

DCR = 0.95 ✓ okay

3/4" J-BOLT IN TENSION ACI 530-13

$A_{pt} = \pi l_b^2 = 3.14(5^2) = 78.5 \text{ in}^2$

$B_{anb} = 4(78.5)\sqrt{1500 \text{ psi}} = 12,161^{\#}$

$B_{ans} = 0.44 \text{ in}^2 \times 36 \text{ ksi} = 15,8400^{\#}$

$B_{anp} = 1.5(1500 \text{psi})(1.5)(0.75)$
$+ 300\pi(5'' + 1.5'' + 0.75)0.75 = 7,653^{\#}$

$\phi = 1.0$ (Nominal strength) $= 7,653^{\#}$

$DCR = \dfrac{5,400^{\#}}{7,653^{\#}} = 0.71$ okay ✓

∴ ANCHORS AT JOISTS PERP TO WALL ARE ACCEPTABLE

SIMPSON Strong-Tie®

LTP4/LTP5/A34/A35

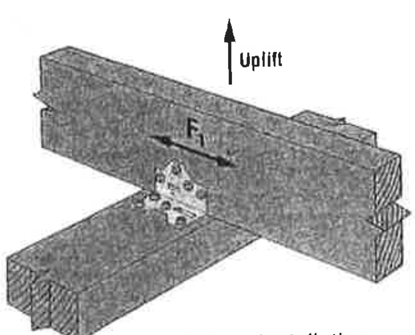
Framing Angles and Plates (cont.)

These products are available with additional corrosion protection. For more information, see p. 18.

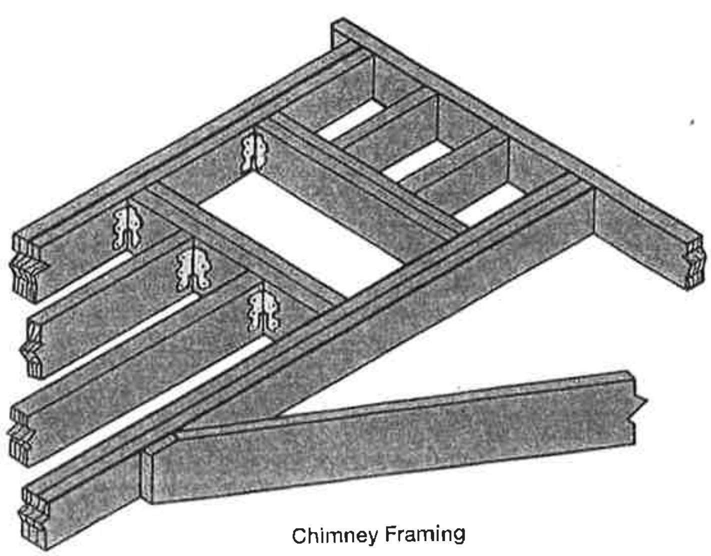
These products are approved for installation with the Strong-Drive® SD Connector screw. See pp. 39–40 for more information.

Model No.	Type of Connection	Fasteners	Direction of Load	DF/SP Allowable Loads			SPF/HF Allowable Loads			Code Ref.
				Floor (100)	Roof (125)	(160)	Floor (100)	Roof (125)	(160)	
A34	1	(8) 8d x 1½"	F_1	395	485	515	340	415	445	IP1, L5, L18, FL
			F_2[6]	395	455	455	340	390	390	
	1	(8) #9 x 1½" SD	F_1	395	485	515	340	415	445	I27, L5, FL
			F_2	395	455	455	340	390	390	
			Uplift	240	240	240	170	170	170	170
A35	2	(9) 8d x 1½"	A_1, E	295	365	395	255	315	340	IP1, L5, L18, FL
			C_1	210	210	210	180	180	180	
	3	(12) 8d x 1½"	A_2	295	365	380	255	315	325	
			C_2	295	365	370	255	315	320	
			D	230	230	230	200	200	200	
	4	(12) 8d x 1½"	F_1	595	695	695	510	600	600	
			F_2[6]	595	670	670	510	575	575	
	5	(12) #6 x ½" SPAX	F_1	420	420	420	360	360	360	170
LTP4	6	(12) 8d x 1½"	G	580	670	670	500	570	575	IP1, L5, L18, FL
			H	580	600	600	500	515	515	
LTP5	7	(12) 8d x 1½"	G	580	620	620	500	535	535	IP1, L18, FL
			H	545	545	545	470	470	470	

1. Allowable loads are for one angle. When angles are installed on each side of the joist, the minimum joist thickness is 3".
2. Some illustrations show connections that could cause cross-grain tension or bending of the wood during loading if not reinforced sufficiently. In this case, mechanical reinforcement should be considered.
3. LTP4 can be installed over ⅜" wood structural panel sheathing with 8d x 1½" nails and achieve 0.72 of the listed load, or over ½" and achieve 0.64 of the listed load. 8d commons will achieve 100% load.
4. LTP4 satisfies the IRC continuously sheathed portal frame (CS-PF) framing anchor requirements when installed over raised wood floor framing per Figure R602.10.6.4.
5. The LTP5 may be installed over wood structural panel sheathing up to ½" thick using 8d x 1½" nails with no reduction in load.
6. Connectors are required on both sides to achieve F_2 loads in both directions.
7. **Fasteners:** 8d x 1½" = 0.131" dia. x 1½" long; SPAX #6 x ½" = 0.138" dia. x ½" long. See pp. 26–27 for other nail sizes and information.



A34 Uplift Installation



Chimney Framing

Straps and Ties

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BUILDING DEAD LOAD TOTALS

ROOF

	LOAD	AREA	W (k)
DIAPHRAGM	20psf	19,150#	383.0k
CMU WALLS	100psf	7880#	788.0k

T = 1171 k

LEVEL 3 FLOOR (MEZZ)

	LOAD	AREA	W (k)
DIAPHRAGM	35psf	2250#	78.8k
CMU WALLS	100psf	2250#	225.0k

T = 303.8 k

LEVEL 2 FLOOR

	LOAD	AREA	W (k)
DIAPHRAGM	35psf	16,350#	572.3k
CMU WALLS	100psf	12,975#	1297.5k
WALK WAYS	50psf	2800#	140.0k

T = 2009.8k

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LEVEL 1 FLOOR

	LOAD	AREA	W (K)
DIAPHRAGM	50psf	3200 #	160.0k
CMU WALLS	100 psf	2240 #	224.0k

T = 384.0k

TOTAL W = 3868.6k

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ASCE 41-13: LINEAR STATIC PROCEDURE (SEC. 7.4.1)

I.D.:

MAPPED SPECTRAL RESPONSE ACCELERATION:				**Ref:**
BSE-2E mapped short period accel.:E	S_{S2M} =	1.01 g		2.4.1.3
BSE-2E mapped accel. @ T=1 s:	S_{12M} =	0.407 g		2.4.1.3
BSE-1E mapped short period accel.:	S_{S1M} =	0.512 g		2.4.1.4
BSE-1E mapped accel. @ T=1 s:	S_{11M} =	0.192 g		2.4.1.4
BSE-2N mapped short period accel.:	S_{S2NM} =	1.401		2.4.1.1
BSE-2N mapped accel. @ T=1 s:	S_{12NM} =	0.559		2.4.1.1
BSE-2E controlling short period accel.:	S_{S2} = MIN(S_{S2M},S_{S2NM}) =		1.01 g	2.4.1.3
BSE-2E controlling accel. @ T=1 s:	S_{12} = MIN(S_{12M},S_{12NM}) =		0.407 g	2.4.1.3
BSE-1E controlling short period accel.:	S_{S1} = MIN(S_{S1M},2/3*S_{S2NM}) =		0.512 g	2.4.1.4
BSE-1E controlling accel. @ T=1 s:	S_{11} = MIN(S_{11M},2/3*S_{12NM}) =		0.192 g	2.4.1.4
MODIFIED SPECTRAL RESPONSE PARAMETERS:				**Ref:**
Site class:		D		2.4.1.6
BSE-2E acceleration site coefficient:	F_{a2} =	1.10		Table 2-3
BSE-2E velocity site coefficient:	F_{v2} =	1.59		Table 2-4
BSE-1E acceleration site coefficient:	F_{a1} =	1.39		Table 2-3
BSE-1E velocity site coefficient:	F_{v1} =	2.03		Table 2-4
BSE-2N acceleration site coefficient:	F_{a2N} =	1.00		2.5/2.4.1.6
BSE-2N velocity site coefficient:	F_{v2N} =	1.50		2.5/2.4.1.6
BSE-2E design short period accel.:	S_{XS2} = F_{a2}*S_{S2} =		1.11 g	2.4.1.6
BSE-2E design 1 sec. period accel.:	S_{X12} = F_{v2}*S_{12} =		0.65 g	2.4.1.6
BSE-1E design short period accel.:	S_{XS1} = F_{a1}*S_{S1} =		0.71 g	2.4.1.6
BSE-1E design 1 sec. period accel.:	S_{X11} = F_{v1}*S_{11} =		0.39 g	2.4.1.6
ASCE 7 design short period accel:	S_{DS} = 2/3*F_{a2N}*S_{S2NM} =		0.93 g	2.5
ASCE 7 design 1 sec. period accel:	S_{D1} = 2/3*F_{v1N}*S_{12NM} =		0.56 g	2.5
Seismicity zone:	Zone of seismicity is		**HIGH**	2.5
RESPONSE SPECTRA CHARACTERISTIC PERIODS:				**Ref:**
BSE-2E spectra:	T_{S2} = S_{X12}/(S_{XS2}) =		0.59 s	2.4.1.7.1
	T_{02} = 0.2*T_{S2} =		0.12 s	2.4.1.7.1
BSE-1E spectra:	T_{S1} = S_{X11}/(S_{XS1}) =		0.55 s	2.4.1.7.1
	T_{01} = 0.2*T_{S1} =		0.11 s	2.4.1.7.1
STRUCTURE DYNAMIC PROPERTIES:				**Ref:**
Building seismic weight:	W =	3868.6 k		7.4.1.3
Number of stories:	n =	2		7.4.1.3
Effective damping ratio:	β =	5 %		7.2.3.6
Damping coefficients:	B_1 =	1.0		2.4.1.7.1
Lateral system:		Wood buildings		7.4.1.2.2
Period coefficient:	C_t =	0.020		7.4.1.2.2
Period exponent:	β =	0.75		7.4.1.2.2
Building height:	h_n =	41.5 ft		7.4.1.2.2
Calculated period	T_c =	s		7.4.1.2.1
Empirical period:	T_e = C_t*h_n^{β} =		0.33 s	7.4.1.2.2
Fundamental period:	T =	0.33 s		7.4.1.2.2

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ASCE 41-13: LINEAR STATIC PROCEDURE (SEC. 7.4.1)

I.D.:

			Ref
m_{max} @ BSE-2E:	m_{max2}	2.0	7.4.1.3.1
m_{max} @ BSE-1E:	m_{max1}	2.0	7.4.1.3.1

PSEUDO-LATERAL LOAD: **Ref:**

BSE-2E spectral acceleration:	S_{a2} = 1.104 g				2.4.1.7.1
BSE-1E spectral acceleration:	S_{a1} = 0.710 g				2.4.1.7.1
Effective mass factor:	C_m = 1.0				7.4.1.3.1
BSE-2E mod. factors product	$C_{12}*C_{22}$ = 1.10				7.4.1.3.1
BSE-1E mod. factors product	$C_{11}*C_{21}$ = 1.10				7.4.1.3.1
BSE-2E pseudo lateral load:	$V_2 = C_{12}C_{22}C_mS_{a2}W$ =	**1.215 W =**	**4700**	**k**	7.4.1.3.1
BSE-1E pseudo lateral load:	$V_1 = C_{11}C_{21}C_mS_{a1}W$ =	**0.781 W =**	**3022**	**k**	7.4.1.3.1

FORCE DISTRIBUTION CALCULATIONS: **Ref:**

Story force:	$F_x = w_x*h_x^k/(\Sigma w_x*h_x^k)*V$ =	see table	7.4.1.3.2
	k = IF(T<=0.5,1,IF(T>=2.5,2,1+(T-0.5)/2)) =	1.000	7.4.1.3.2
	$\Sigma w_x*h_x^k$ =	89867	7.4.1.3.2
Diaphragm force:	$F_{px} = V_x*w_x/W_x$ =	see table	7.4.1.3.4

Story Name	Story Weight w_x (k)	Story Height h_x (ft)	$w_x*h_x^k$	BSE-2E Story Force F_{x2} (k)	BSE-1E Story Force F_{x1} (k)	BSE-2E Story Shear V_{x2} (k)	BSE-1E Story Shear V_{x1} (k)	Total Weight Above W_x (k)	BSE-2E Diaph. Force F_{px2} (k)	BSE-1E Diaph. Force F_{px1} (k)
ROOF	1171	41.5	48597	2541	1634	2541	1634	1171	2541	1634
Mezz	303.8	30	9114	477	307	3018	1941	1474.8	622	400
Level 2	2009.8	16	32157	1682	1081	4700	3022	3484.6	2711	1743
Level 1	384	0	0	0	0	4700	3022	3868.6	466	300

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ASCE 41-13: LINEAR STATIC PROCEDURE (SEC. 7.4.1)

I.D.:

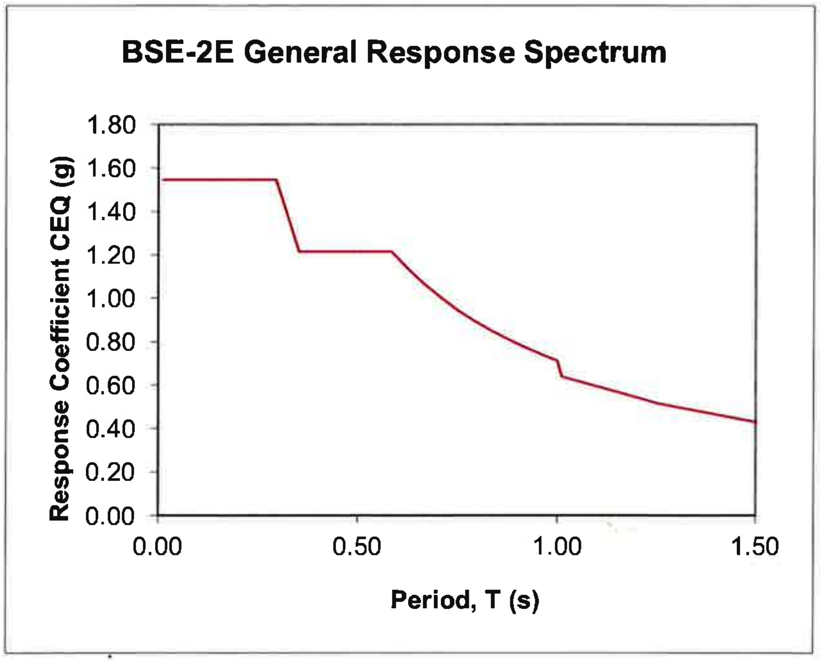
ACCELERATION RESPONSE SPECTRA:

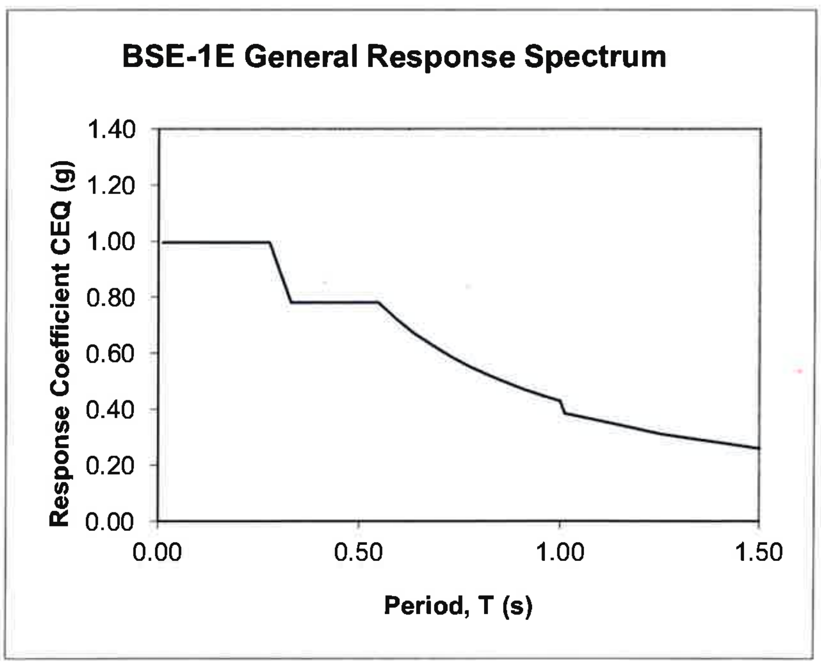
	BSE-2E		BSE-1E	
	T (s)	C_{EQ} (g)	T (s)	C_{EQ} (g)
	0.01	1.55	0.01	0.99
	0.02	1.55	0.02	0.99
	0.04	1.55	0.03	0.99
	0.05	1.55	0.04	0.99
	0.06	1.55	0.05	0.99
	0.07	1.55	0.07	0.99
	0.08	1.55	0.08	0.99
	0.09	1.55	0.09	0.99
	0.11	1.55	0.10	0.99
T_0 =	0.12	1.55	0.11	0.99
	0.18	1.55	0.16	0.99
	0.23	1.55	0.22	0.99
	0.29	1.55	0.27	0.99
	0.35	1.21	0.33	0.78
	0.41	1.21	0.38	0.78
	0.47	1.21	0.44	0.78
	0.53	1.21	0.49	0.78
T_S =	0.59	1.21	0.55	0.78
	0.63	1.13	0.59	0.72
	0.67	1.06	0.64	0.67
	0.71	1.00	0.68	0.63
	0.75	0.95	0.73	0.59
	0.79	0.90	0.77	0.55
	0.83	0.85	0.82	0.52
	0.88	0.81	0.86	0.50
	0.92	0.78	0.91	0.47
	0.96	0.74	0.95	0.45
	1.00	0.71	1.00	0.43
	1.01	0.64	1.01	0.39
	1.25	0.52	1.25	0.31
	1.50	0.43	1.50	0.26
	1.75	0.37	1.75	0.22
	2.00	0.32	2.00	0.19
	3.00	0.22	3.00	0.13
	4.00	0.16	4.00	0.10

$C_{EQ} = C_1C_2C_mS_{XS}[(5/B_1-2)*T/T_S+0.4]$ @ $T<=T_0$

$C_{EQ} = C_1C_2C_mS_{XS}/B_1$ @ $T_0<T<=T_S$

$C_{EQ} = C_1C_2C_mS_{X1}/(B_1*T)$ @ $T>T_S$





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DIAPHRAGM LOADS

	BSE-1E	BSE-2E	AREA
ROOF	1634k	2541k	19150#
MEZZ	400k	622k	2250#
Level 2	1743k	2711k	19150#
Level 1	300k	466k	3200#

NORTH/SOUTH DIRECTION (ROOF)

BETWEEN GRIDS E290 + E160

T. AREA = 7750# BSE-1E = 661.3k BSE-2E = 1028.3k

WALKWAY AREA = 1450# MAIN BLDG AREA = 6300#

WALKWAY LOAD => BSE-1E = 123.7k BSE-2E = 192.4k

MAIN BLDG LOAD => BSE-1E = 537.6k BSE-2E = 835.9k

BETWEEN GRIDS E160 to E40

T. AREA = 9000# BSE-1E = 767.9k BSE-2E = 1194.2k

WALKWAY AREA = 1350# MAIN BLDG AREA = 7650#

WALKWAY LOAD => BSE-1E = 115.2k BSE-2E = 179.1k

MAIN BLDG LOAD => BSE-1E = 652.7k BSE-2E = 1015.1k

BETWEEN GRIDS E40 to E0

T. AREA = 2400# BSE-1E = 204.8k BSE-2E = 318.5k

WALKWAY A = 100#

WALKWAY LOAD => BSE-1E = 8.5k BSE-2E = 13.3k

MAIN BLDG => BSE-1E = 196.3k BSE-2E = 305.2k

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MEZZ.
BETWEEN GRDS E245 TO E200

BSE-1E = 400^k BSE-2E = 622^k

LEVEL 2
BETWEEN GRIDS E290 TO E160

TRIB AREA = 7750# BSE-1E = 705.4^k BSE-2E = 1,097.1^k

WALKWAY AREA = 1450# MAIN BLDG. AREA = 6300#

WALKWAY LOAD => BSE-1E = 132.0^k BSE-2E = 205.3^k

MAIN BLDG LOAD => BSE-1E = 573.4^k BSE-2E = 891.8^k

BETWEEN GRIDS E160 TO E40

TRIB AREA = 9000# BSE-1E = 819.2^k BSE-2E = 1274.1^k

WALKWAY AREA = 1350# MAIN BLDG. AREA = 7650#

WALKWAY LOAD => BSE-1E = 122.9^k BSE-2E = 191.1^k

MAIN BLDG LOAD => BSE-1E = 696.3^k BSE-2E = 1083.0^k

BETWEEN GRIDS E40 TO E0

TRIB AREA = 2400# BSE-1E = 218.4^k BSE-2E = 339.8^k

WALKWAY AREA = 100# MAIN BLDG AREA = 2300#

WALKWAY LOAD => BSE-1E = 9.1^k BSE-2E = 14.2^k

MAIN BLDG LOAD => BSE-1E = 209.3^k BSE-2E = 325.6^k

LEVEL 1
BETWEEN GRIDS E40 to E0

AREA = 3179 # BSE-1E = 300k BSE-2E = 466k

EAST/WEST DIRECTION
(ROOF)
BETWEEN GRIDS E290 TO E245 AREA = 2600 #
BSE-1E = 221.8k BSE-2E = 345.0k

BETWEEN GRIDS E245 TO E E230 AREA = 1050 #
BSE-1E = 89.6k BSE-2E = 139.3k

BETWEEN GRIDS E230 TO E200 AREA = 1900 #
BSE-1E = 162.1k BSE-2E = 252.1k

BETWEEN GRIDS E200 TO E160 AREA = 2200 #
BSE-1E = 187.7k BSE-2E = 291.9k

BETWEEN GRIDS E160 TO E 145 AREA = 1125 #
BSE-1E = 96.0k BSE-2E = 149.3k

BETWEEN GRIDS E145 TO E100 AREA = 3375 #
BSE-1E = 288.0k BSE-2E = 447.8k

BETWEEN GRIDS E100 TO E55 AREA = 3375 #
BSE-1E = 288.0k BSE-2E = 447.8k

BETWEEN GRIDS E55 TO E40 AREA = 1125 #
BSE-1E = 96.0k BSE-2E = 149.3k

BETWEEN GRIDS E40 TO E0 AREA = 2400 #
BSE-1E = 204.8k BSE-2E = 318.5k

LEVEL MEZZ

BETWEEN GRIDS E245 TO E230 A = 750#

BSE-1E = 133.3k BSE-2E = 207.3k

BETWEEN GRIDS E230 TO E200 A = 1500

BSE-1E = 266.7k BSE-2E = 414.7k

LEVEL 2

BETWEEN GRIDS E290 TO E245 A = 2600#

BSE-1E = 236.6k BSE-2E = 368.1k

BETWEEN GRIDS E245 TO E230 A = 1050#

BSE-1E = 95.6k BSE-2E = 148.6k

BETWEEN GRIDS E230 TO E200 A = 1900#

BSE-1E = 172.9k BSE-2E = 269.0k

BETWEEN GRIDS E200 TO E160 A = 2200#

BSE-1E = 200.2k BSE-2E = 311.4k

BETWEEN GRIDS E160 TO E145 A = 1125#

BSE-1E = 102.4k BSE-2E = 159.3k

BETWEEN GRIDS E145 TO E100 A = 3375#

BSE-1E = 307.2k BSE-2E = 477.8k

BETWEEN GRIDS E100 TO E55 A = 3375#

BSE-1E = 307.2k BSE-2E = 477.8k

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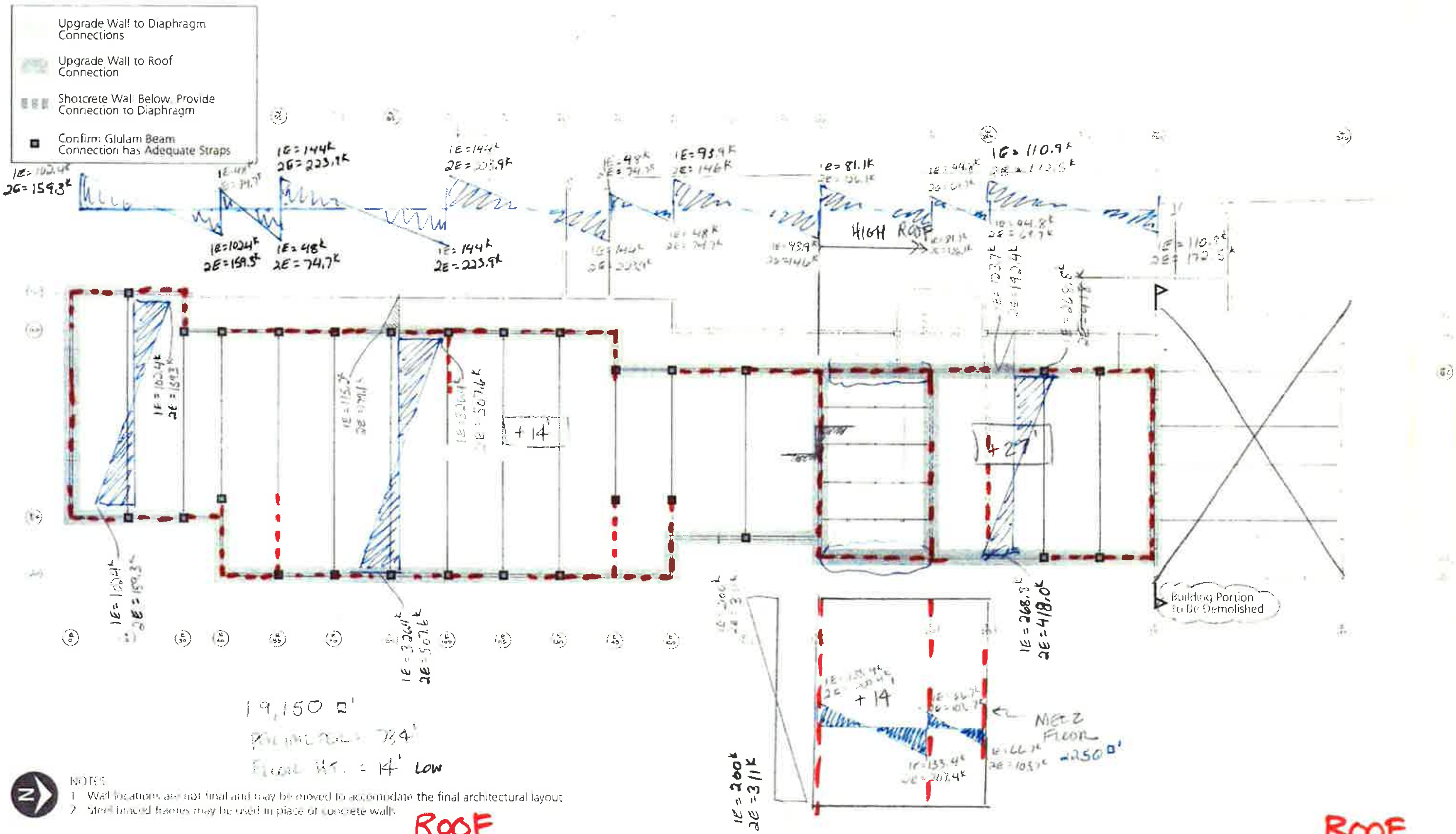
BETWEEN GRIDS E55 TO E45 A = 1125 ft
BSE-1E = 102.4^k BSE-2E = 159.3^k

BETWEEN GRIDS E40 TO E0 A = 2400 ft
BSE-1E = 218.4^k BSE-2E = 339.8^k

LEVEL 1
BETWEEN GRIDS E55 TO E0 A = 3200 ft

BSE-1E = 300^k BSE-2E = 466^k

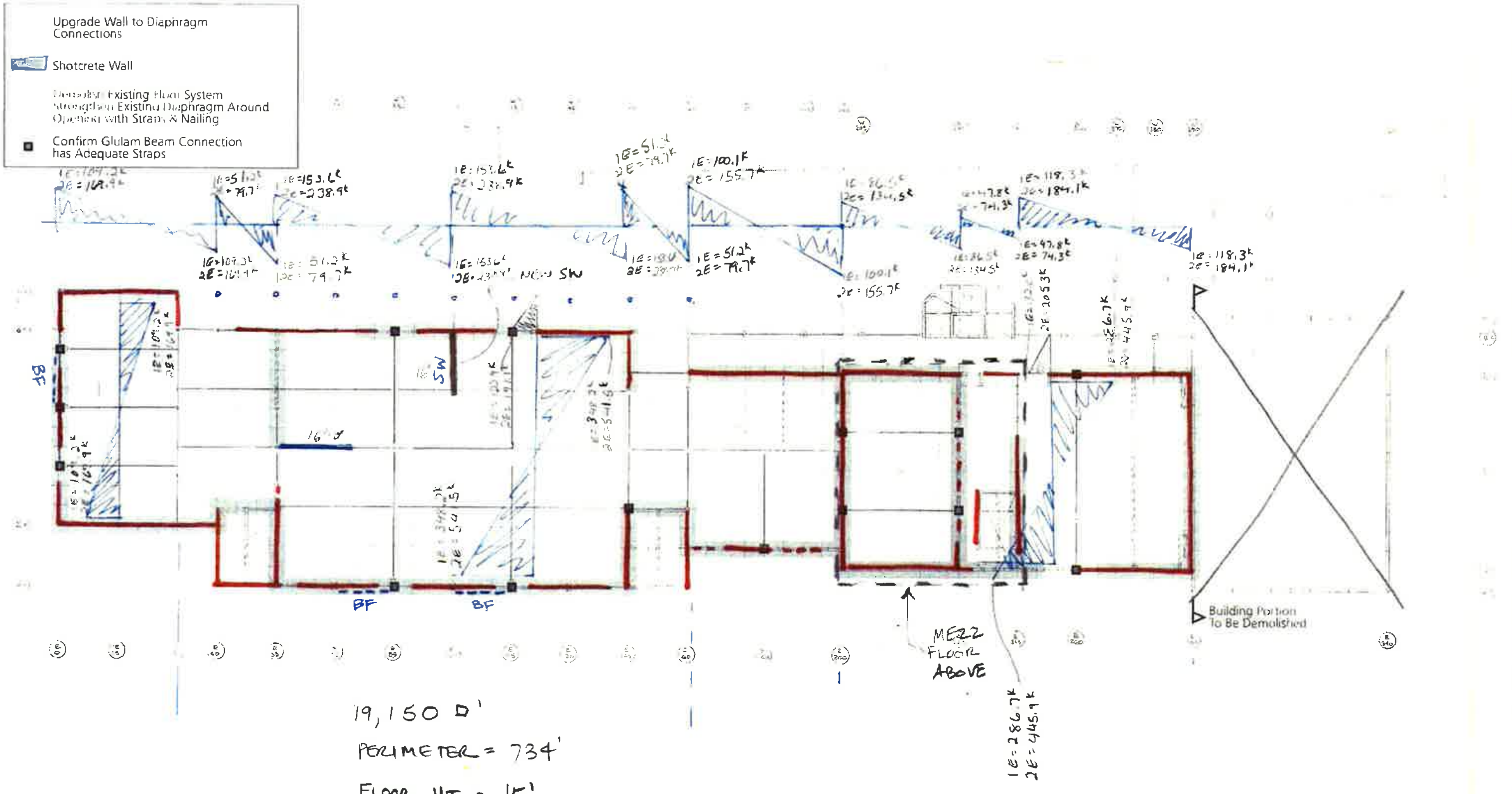


NOTES:
1. Wall locations are not final and may be moved to accommodate the final architectural layout
2. Steel braced frames may be used in place of concrete walls

Building 990 Upgrade Concepts
Central Kitsap School District – August 2018

Figure 3 - Roof Plan

Permit Number: 19-05911



NOTES:
1. Wall locations are not final and may be moved to accomodate the final architectural layout
2. Steel braced frames may be used in place of concrete walls

3RD FLR (LEVEL2)

3RD FLR

Building 990 Upgrade Concepts
Central Kitsap School District – August 2018

Figure 2 - Upper Floor

Permit Number: 19-05911

NOTES
1. Wall locations are not final and may be moved to accommodate the final architectural layout
2. Steel braced frames may be used in place of concrete walls

Building 990 Upgrade Concepts
Central Kitsap School District – August 2018

Figure 1 - Foundation / Lower Floor

Permit Number: 19-05911

Reid Middleton
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Client
Project
Project No.

Sheet ___ of ___
Design by
Date
Checked by
Date

WALL LENGTH

E 290 TO E 160
@ ROOF
GRID S20 = 112 ft (25' PIER)
GRID S70 = 72 ft (30' PIER)
GRID E290 = 50 ft
GRID E245 = 30 ft
GRID E230 = 25 ft (5' PIER)
GRID E 200 = 46 ft (22' PIER)
GRID E 160 = 20 ft

E 160 TO E 40
GRID S10 = 71 ft (10' PIER)
GRID S75 = 98 ft (8' PIER)
GRID E 145 = 35 ft (10' PIER)
GRID E 100 = 16 ft (concrete SW)
GRID E 55 = 20 ft
GRID E 40 = 20 ft

E 40 TO E 0
GRID S 0 = 30 ft
GRID S 60 = 33 ft (15' PIER)
GRID E 0 = 30 ft

E 290 TO E 160
@ LEVEL 2
GRID S 20 = 93 ft (7' PIER)
GRID S 70 = 105 ft (16' PIER)
GRID E290 = 41 ft (10' PIER)
GRID E 245 = 27 ft
GRID E 230 = 50 ft
GRID E 200 = 44 ft (9' PIER)
GRID E 160 = 16 ft

E 160 TO E 40
GRID S 10 = 75 ft (CONC. SW)
GRID S 75 = 30 ft + 2 B.F. (15'/[illegible]
GRID E 145 = 33 ft (13' PIER)
GRID E 100 = 16 ft (CONC. SW)
GRID E 55 = 20 ft
GRID E 40 = 20 ft

E 40 TO E 0
GRID S 0 = 30 ft
GRID S 60 = 40 ft
GRID E 0 = 15 ft + B.F.

Permit Number: 19-05911

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Client:	RFM	Designed By:	JJ
Project:	900 Bldg	Date:	12/18/2019
		Checked By:	
Project No:	262019.034	Date:	

ASCE 41-13 Reinforced Masonry DCRs

Legend		
Input		
Calculated		
DCR/Check		

General Inputs		
Pier ID	Grid E0	
Location/Gridline	E0	
f'm (psi)	810	Table 11-2(a)
Em (ksi)	729	TMS 402-13, Sec 4.2.2.2.1
fme (psi)	1053	Table 11-1
fy (ksi)	40	
fye (ksi)	52	
Es (ksi)	29000	
Masonry Denisty (pcf)	125	
Nominal Pier Length (ft)	15	
Pier Height (H)	14.00	
Wall thickness (in)	8	
Roof Trib (SF)	113	
Roof DL (psf)	20	
Roof SL (psf)	25	
Mezz Trib (SF)	0	
Mezz DL (psf)	0	
Mezz LL (psf)	0	
2nd FLR Trib (SF)	60	
2nd FLR DL (psf)	35	
2nd FLR LL (psf)	40	
Shearline Tot Shear (kips)	211.6	BSE-1E
Shearline Tot Length (ft)	30	
Applicable Wall Trib Length (ft)	15	
Seismic Axial Load (kips)	0.0	Holdown Force From Wall Above
Holdown to Wall Centroid (ft)	0.0	
IO, LS, CP	LS	

General Calculation		
Wall Self-Weight (kips)	17.5	
DL (kips)	4.4	Super-imposed DL @ Top of Wall
LL (kips)	2.4	
SL (kips)	2.8	
$1.1(Q_D + Q_L + 0.2{*}Q_S)$	27.3	Eq. 7-1
$0.9(Q_D)$	19.7	Eq. 7-2
Shear/Unit Length (kip/ft)	7.1	
Wall Shear (Q_E) (kips)	105.8	
Moment Generated from Holdown (kip*ft)	0.0	About Centroid of Wall

Wall Demands		
P (kips)	27.3	Eq. 7-34
P (kips)	19.7	Eq. 7-34
V (kips)	105.8	
M (kip*ft)	1481.2	

Lower-Bound Vertical Compressive Strength		
K	1	Table 6-1
r (in)	0.535	Weak Axis Radius of Gyration
h/r	314	
P_{CL} (kip)	38	TMS 402-13, Eq. 9-19, Eq. 9-20
KP_{CL} (kip)	38	
J	2	LS
C_1C_2	1.1	
$Q_G+(Q_E)/(JC1C2)$ (kip)	27.3	
DCR	0.73	

Determine FC vs DC Table 11-6		
Mu/(Vudv)	0.08	
γ	1.0	#5 Bars or smaller
Vn (kips) upperbound	246	TMS 402-13, Eq. 9-22
Vn (kips) upperbound	-	TMS 402-13, Eq. 9-23
Vnm (kip)	163.1	TMS 402-13, Sec 9.3.4.1.2.1
Vn (kip)	163.1	TMS 402-13, Equation 9-21
Holdown Anchor Rod As (in^2)	0.31	At one wall end
a (in)	2.4	
Distance from Edge of Wall to Rod (in)	4	
d (in)	176	
Mn (kip*ft)	467	
Ve (kip)	33	
Shear vs. Flexure Control	Flexure Control	
An (in^2)	1440	
f_{ae} (psi)	19.0	
Shear vs. Force Controlled	N/A	

Determine m-factors Table 11-6		
fae/fme	0.018	
L/heff	1.07	
As (in^2)	0.31	Total Vertical Reinforcement
ρ_v	0.00022	
Av (in^2)	0.3	Total Vertical Reinforcement
ρ_h	0.0002	
$\rho_g$fye/fme	0.022	
m-factor	6.7	
m-factor restriction	7	
m-factor used	6.7	

Deformation Control DCRs		
Shear DCR	0.10	
Moment DCR	0.48	

Force Control DCRs		
Shear DCR	-	
Moment DCR	-	

Out-Of-Plane Capacity TMS 402-13, Sec 9.3.5		
d (in)	4	
a (in)	0.3	
Mn (kip*ft)	10.2	

Out-Of-Plane Demands TMS 402-13 Sec 9.3.5 & ASCE 41-13 Section 11.3.5-->7.2.11		
χ	1.3	ASCE 41-13, Table 7-2, LS
Sxs,1E	0.71	
h (ft)	14	Full Wall Height
w (psf)	100.0	Elevation Wall Unit Weight
Fp*L (plf)	553.8	ASCE 41-13, Eq. 7-13
Fp_min*L (plf)	195.0	ASCE 41-13, Eq. 7-14
Mu,o (kip*ft)	13.57	
n	39.8	
tsp (in)	8	
c (in)	0.4	TMS 402-13, Eq. 9-35
Ieff = Icr (in^4)	412	TMS 402-13, Eq. 9-34
Pe (kips)	105	TMS 402-13, Eq. 9-33
Ψ	1.351	TMS 402-13, Eq. 9-32
ΨMu,o (kip*ft)	18.33	TMS 402-13, Eq. 9-31

Out-Of-Plane DCR, Sec 11.3.5.3		
Flexure DCR	0.8	

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Client: RFM
Project: 900 Bldg
Project No: 262019.034

ASCE 41-13 Reinforc

Legend		
Input		
Calculated		
DCR/Check		
General Inputs		
Pier ID	Grid E0	
Location/Gridline	E0	
f'm (psi)	810	Table 11-2(a)
Em (ksi)	729	TMS 402-13, Sec 4.2.2.2.1
fme (psi)	1053	Table 11-1
fy (ksi)	40	
fye (ksi)	52	
Es (ksi)	29000	
Masonry Denisty (pcf)	125	
Nominal Pier Length (ft)	15	
Pier Height (H)	14.00	
Wall thickness (in)	8	
Roof Trib (SF)	113	
Roof DL (psf)	20	
Roof SL (psf)	25	
Mezz Trib (SF)	0	
Mezz DL (psf)	0	
Mezz LL (psf)	0	
2nd FLR Trib (SF)	60	
2nd FLR DL (psf)	35	
2nd FLR LL (psf)	40	
Shearline Tot Shear (kips)	211.6	BSE-1E
Shearline Tot Length (ft)	30	
Applicable Wall Trib Length (ft)	15	
Seismic Axial Load (kips)	0.0	Holdown Force From Wall Above
Holdown to Wall Centroid (ft)	0.0	
IO, LS, CP	LS	
General Calculation		
Wall Self-Weight (kips)	17.5	
DL (kips)	4.4	Super-imposed DL @ Top of Wall
LL (kips)	2.4	
SL (kips)	2.8	
$1.1(Q_D + Q_L + 0.2*Q_S)$	27.3	Eq. 7-1
$0.9(Q_D)$	19.7	Eq. 7-2
Shear/Unit Length (kip/ft)	7.1	
Wall Shear (Q_E) (kips)	105.8	
Moment Generated from Holdown (kip*ft)	0.0	About Centroid of Wall
Wall Demands		
P (kips)	27.3	Eq. 7-34
P (kips)	19.7	Eq. 7-34
V (kips)	105.8	
M (kip*ft)	1481.2	
Lower-Bound Vertical Compressive Strength		
K	1	Table 6-1
r (in)	0.535	Weak Axis Radius of Gyration
h/r	314	
P_{CL} (kip)	38	TMS 402-13, Eq. 9-19, Eq. 9-20
KP_{CL} (kip)	38	
J	2	LS
C_1C_2	1.1	
$Q_G+(Q_E)/(JC1C2)$ (kip)	27.3	
DCR	0.73	

Permit Number: 19-05911

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Project:	900 Bldg	Date:	12/18/2019
		Checked By:	
Project No:	262019.034	Date:	

ASCE 41-13 Reinforced Masonry DCRs

Legend		
Input		
Calculated		
DCR/Check		
General Inputs		
Pier ID	Grid E0	
Location/Gridline	E0	
f'm (psi)	810	Table 11-2(a)
Em (ksi)	729	TMS 402-13, Sec 4.2.2.2.1
fme (psi)	1053	Table 11-1
fy (ksi)	40	
fye (ksi)	52	
Es (ksi)	29000	
Masonry Denisty (pcf)	125	
Nominal Pier Length (ft)	15	
Pier Height (H)	14.00	
Wall thickness (in)	8	
Roof Trib (SF)	113	
Roof DL (psf)	20	
Roof SL (psf)	25	
Mezz Trib (SF)	0	
Mezz DL (psf)	0	
Mezz LL (psf)	0	
2nd FLR Trib (SF)	60	
2nd FLR DL (psf)	35	
2nd FLR LL (psf)	40	
Shearline Tot Shear (kips)	329.2	BSE-2E
Shearline Tot Length (ft)	30	
Applicable Wall Trib Length (ft)	15	
Seismic Axial Load (kips)	0.0	Holdown Force From Wall Above
Holdown to Wall Centroid (ft)	0.0	
IO, LS, CP	CP	
General Calculation		
Wall Self-Weight (kips)	17.5	
DL (kips)	4.4	Super-imposed DL @ Top of Wall
LL (kips)	2.4	
SL (kips)	2.8	
$1.1(Q_D + Q_L + 0.2{*}Q_S)$	27.3	Eq. 7-1
$0.9(Q_D)$	19.7	Eq. 7-2
Shear/Unit Length (kip/ft)	11.0	
Wall Shear (Q_E) (kips)	164.6	
Moment Generated from Holdown (kip*ft)	0.0	About Centroid of Wall
Wall Demands		
P (kips)	27.3	Eq. 7-34
P (kips)	19.7	Eq. 7-34
V (kips)	164.6	
M (kip*ft)	2304.4	
Lower-Bound Vertical Compressive Strength		
K	1	Table 6-1
r (in)	0.609	Weak Axis Radius of Gyration
h/r	276	
P_{CL} (kip)	49	TMS 402-13, Eq. 9-19, Eq. 9-20
KP_{CL} (kip)	49	
J	2	LS
C_1C_2	1.1	
$Q_G+(Q_E)/(JC1C2)$ (kip)	27.3	
DCR	0.55	

Determine FC vs DC Table 11-6		
Mu/(Vudv)	0.08	
γ	1.0	#5 Bars or smaller
Vn (kips) upperbound	246	TMS 402-13, Eq. 9-22
Vn (kips) upperbound	-	TMS 402-13, Eq. 9-23
Vnm (kip)	163.1	TMS 402-13, Sec 9.3.4.1.2.1
Vn (kip)	163.1	TMS 402-13, Equation 9-21
Holdown Anchor Rod As (in^2)	0.31	At one wall end
a (in)	2.4	
Distance from Edge of Wall to Rod (in)	4	
d (in)	176	
Mn (kip*ft)	467	
Ve (kip)	33	
Shear vs. Flexure Control	Flexure Control	
An (in^2)	1440	
f_{ae} (psi)	19.0	
Shear vs. Force Controlled	NA	
Determine m-factors Table 11-6		
fae/fme	0.018	
L/heff	1.07	
As (in^2)	0.62	Total Vertical Reinforcement
ρ_v	0.00043	
Av (in^2)	0.6	Total Vertical Reinforcement
ρ_h	0.0005	
$\rho_g$fye/fme	0.044	
m-factor	7.2	
m-factor restriction	7	
m-factor used	7.0	
Deformation Control DCRs		
Shear DCR	0.14	
Moment DCR	0.70	
Force Control DCRs		
Shear DCR	-	
Moment DCR	-	
Out-Of-Plane Capacity TMS 402-13, Sec 9.3.5		
d (in)	4	
a (in)	0.4	
Mn (kip*ft)	14.0	
Out-Of-Plane Demands TMS 402-13 Sec 9.3.5 & ASCE 41-13 Section 11.3.5-->7.2.11		
χ	1	ASCE 41-13, Table 7-2, CP
Sxs,1E	1.11	
h (ft)	14	Full Wall Height
w (psf)	[illegible]	Elevation Wall Unit Weight
Fp*L (plf)	[illegible]	ASCE 41-13, Eq. 7-13
Fp_min*L (plf)	150.0	ASCE 41-13, Eq. 7-14
Mu,o (kip*ft)	16.32	
n	32.0	
tsp (in)	8	
c (in)	[illegible]	TMS 402-13, Eq. 9-35
Ieff = Icr (in^4)	534	TMS 402-13, Eq. 9-34
Pe (kips)	136	TMS 402-13, Eq. 9-33
Ψ	1.251	TMS 402-13, Eq. 9-32
ΨMu,o (kip*ft)	20.41	TMS 402-13, Eq. 9-31
Out-Of-Plane DCR, Sec 11.3.5.3		
Flexure DCR	0.7	

Permit Number: 19-05911

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Project:	900 Bldg	Date:	12/18/2019
		Checked By:	
Project No:	262019.034	Date:	

ASCE 41-13 Reinforced Masonry DCRs

Legend		
Input		
Calculated		
DCR/Check		

General Inputs		
Pier ID	Grid E0	
Location/Gridline	E0	
f'm (psi)	810	Table 11-2(a)
Em (ksi)	729	TMS 402-13, Sec 4.2.2.2.1
fme (psi)	1053	Table 11-1
fy (ksi)	40	
fye (ksi)	52	
Es (ksi)	29000	
Masonry Denisty (pcf)	125	
Nominal Pier Length (ft)	30	
Pier Height (H)	14.00	
Wall thickness (in)	8	
Roof Trib (SF)	113	
Roof DL (psf)	20	
Roof SL (psf)	25	
Mezz Trib (SF)	0	
Mezz DL (psf)	0	
Mezz LL (psf)	0	
2nd FLR Trib (SF)	0	
2nd FLR DL (psf)	35	
2nd FLR LL (psf)	40	
Shearline Tot Shear (kips)	102.4	BSE-1E
Shearline Tot Length (ft)	30	
Applicable Wall Trib Length (ft)	30	
Seismic Axial Load (kips)	0.0	Holdown Force From Wall Above
Holdown to Wall Centroid (ft)	0.0	
IO, LS, CP	LS	

General Calculation		
Wall Self-Weight (kips)	35.0	
DL (kips)	2.3	Super-imposed DL @ Top of Wall
LL (kips)	0.0	
SL (kips)	2.0	
$1.1(Q_D + Q_L + 0.2*Q_S)$	41.6	Eq. 7-1
$0.9(Q_D)$	33.5	Eq. 7-2
Shear/Unit Length (kip/ft)	3.4	
Wall Shear (Q_E) (kips)	102.4	
Moment Generated from Holdown (kip*ft)	0.0	About Centroid of Wall

Wall Demands		
P (kips)	41.6	Eq. 7-34
P (kips)	33.5	Eq. 7-34
V (kips)	102.4	
M (kip*ft)	1433.6	

Lower-Bound Vertical Compressive Strength		
K	1	Table 6-1
r (in)	0.519	Weak Axis Radius of Gyration
h/r	324	
P_{CL} (kip)	71	TMS 402-13, Eq. 9-19, Eq. 9-20
KP_{CL} (kip)	71	
J	2	LS
C_1C_2	1.1	
$Q_G+(Q_E)/(JC1C2)$ (kip)	41.6	
DCR	0.59	

Determine FC vs DC Table 11-6		
Mu/(Vudv)	0.04	
γ	1.0	#5 Bars or smaller
Vn (kips) upperbound	492	TMS 402-13, Eq. 9-22
Vn (kips) upperbound	-	TMS 402-13, Eq. 9-23
Vnm (kip)	330.6	TMS 402-13, Sec 9.3.4.1.2.1
Vn (kip)	330.6	TMS 402-13, Equation 9-21
Holdown Anchor Rod As (in^2)	0.31	At one wall end
a (in)	2.4	
Distance from Edge of Wall to Rod (in)	4	
d (in)	356	
Mn (kip*ft)	1358	
Ve (kip)	97	
Shear vs. Flexure Control	Flexure Control	
An (in^2)	2880	
f_{ae} (psi)	14.4	
Shear vs. Force Controlled	NA	

Determine m-factors Table 11-6		
fae/fme	0.014	
L/heff	2.14	
As (in^2)	0.62	Total Vertical Reinforcement
ρ_v	0.00022	
Av (in^2)	0.6	Total Vertical Reinforcement
ρ_h	0.0005	
$\rho_g$fye/fme	0.033	
m-factor	6.7	
m-factor restriction	7	
m-factor used	6.7	

Deformation Control DCRs		
Shear DCR	0.05	
Moment DCR	0.16	

Force Control DCRs		
Shear DCR	-	
Moment DCR	-	

Out-Of-Plane Capacity TMS 402-13, Sec 9.3.5		
d (in)	4	
a (in)	0.3	
Mn (kip*ft)	18.8	

Out-Of-Plane Demands TMS 402-13 Sec 9.3.5 & ASCE 41-13 Section 11.3.5-->7.2.11		
χ	1.3	ASCE 41-13, Table 7-2, LS
Sxs,1E	0.71	
h (ft)	14	Full Wall Height
w (psf)	100.0	Elevation Wall Unit Weight
Fp*L (plf)	1107.6	ASCE 41-13, Eq. 7-13
Fp_min*L (plf)	390.0	ASCE 41-13, Eq. 7-14
Mu,o (kip*ft)	27.14	
n	39.8	
tsp (in)	5	
c (in)	0.4	TMS 402-13, Eq. 9-35
Ieff = Icr (in^4)	776	TMS 402-13, Eq. 9-34
Pe (kips)	166	TMS 402-13, Eq. 9-33
Ψ	1.265	TMS 402-13, Eq. 9-32
ΨMu,o (kip*ft)	34.35	TMS 402-13, Eq. 9-31

Out-Of-Plane DCR, Sec 11.3.5.3		
Flexure DCR	0.8	

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Client:	RFM
Project:	900 Bldg
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ASCE 41-13 Reinforc

Legend		
Input		
Calculated		
DCR/Check		
General Inputs		
Pier ID	Grid E0	
Location/Gridline	E0	
f'm (psi)	810	Table 11-2(a)
Em (ksi)	729	TMS 402-13, Sec 4.2.2.2.1
fme (psi)	1053	Table 11-1
fy (ksi)	40	
fye (ksi)	52	
Es (ksi)	29000	
Masonry Denisty (pcf)	125	
Nominal Pier Length (ft)	30	
Pier Height (H)	14.00	
Wall thickness (in)	8	
Roof Trib (SF)	113	
Roof DL (psf)	20	
Roof SL (psf)	25	
Mezz Trib (SF)	0	
Mezz DL (psf)	0	
Mezz LL (psf)	0	
2nd FLR Trib (SF)	0	
2nd FLR DL (psf)	35	
2nd FLR LL (psf)	40	
Shearline Tot Shear (kips)	102.4	BSE-1E
Shearline Tot Length (ft)	30	
Applicable Wall Trib Length (ft)	30	
Seismic Axial Load (kips)	0.0	Holdown Force From Wall Above
Holdown to Wall Centroid (ft)	0.0	
IO, LS, CP	LS	
General Calculation		
Wall Self-Weight (kips)	35.0	
DL (kips)	2.3	Super-imposed DL @ Top of Wall
LL (kips)	0.0	
SL (kips)	2.8	
$1.1(Q_D + Q_L + 0.2*Q_S)$	41.6	Eq. 7-1
$0.9(Q_D)$	33.5	Eq. 7-2
Shear/Unit Length (kip/ft)	3.4	
Wall Shear (Q_E) (kips)	102.4	
Moment Generated from Holdown (kip*ft)	0.0	About Centroid of Wall
Wall Demands		
P (kips)	41.6	Eq. 7-34
P (kips)	33.5	Eq. 7-34
V (kips)	102.4	
M (kip*ft)	1433.6	
Lower-Bound Vertical Compressive Strength		
K	1	Table 6-1
r (in)	0.519	Weak Axis Radius of Gyration
h/r	324	
P_{CL} (kip)	71	TMS 402-13, Eq. 9-19, Eq. 9-20
KP_{CL} (kip)	71	
J	2	LS
C_1C_2	1.1	
$Q_G+(Q_E)/(JC1C2)$ (kip)	41.6	
DCR	0.59	

Permit Number: 19-05911

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Project:	900 Bldg	Date:	12/18/2019
		Checked By:	
Project No:	262019.034	Date:	

ASCE 41-13 Reinforced Masonry DCRs

Legend		
Input		
Calculated		
DCR/Check		

General Inputs		
Pier ID	Grid E0	
Location/Gridline	E0	
f'm (psi)	810	Table 11-2(a)
Em (ksi)	729	TMS 402-13, Sec 4.2.2.2.1
fme (psi)	1053	Table 11-1
fy (ksi)	40	
fye (ksi)	52	
Es (ksi)	29000	
Masonry Denisty (pcf)	125	
Nominal Pier Length (ft)	30	
Pier Height (H)	14.00	
Wall thickness (in)	8	
Roof Trib (SF)	113	
Roof DL (psf)	20	
Roof SL (psf)	25	
Mezz Trib (SF)	0	
Mezz DL (psf)	0	
Mezz LL (psf)	0	
2nd FLR Trib (SF)	0	
2nd FLR DL (psf)	35	
2nd FLR LL (psf)	40	
Shearline Tot Shear (kips)	159.3	BSE-2E
Shearline Tot Length (ft)	30	
Applicable Wall Trib Length (ft)	30	
Seismic Axial Load (kips)	0.0	Holdown Force From Wall Above
Holdown to Wall Centroid (ft)	0.0	
IO, LS, CP	CP	

General Calculation		
Wall Self-Weight (kips)	35.0	
DL (kips)	2.3	Super-imposed DL @ Top of Wall
LL (kips)	0.0	
SL (kips)	2.8	
$1.1(Q_D + Q_L + 0.2*Q_S)$	41.6	Eq. 7-1
$0.9(Q_D)$	33.5	Eq. 7-2
Shear/Unit Length (kip/ft)	5.3	
Wall Shear (Q_E) (kips)	159.3	
Moment Generated from Holdown (kip*ft)	0.0	About Centroid of Wall

Wall Demands		
P (kips)	41.6	Eq. 7-34
P (kips)	33.5	Eq. 7-34
V (kips)	159.3	
M (kip*ft)	2230.2	

Lower-Bound Vertical Compressive Strength		
K	1	Table 6-1
r (in)	0.562	Weak Axis Radius of Gyration
h/r	299	
P_{CL} (kip)	83	TMS 402-13, Eq. 9-19, Eq. 9-20
KP_{CL} (kip)	83	
J	2	LS
C_1C_2	1.1	
$Q_G+(Q_E)/(JC1C2)$ (kip)	41.6	
DCR	0.50	

Determine FC vs DC Table 11-6		
Mu/(Vudv)	0.04	
γ	1.0	#5 Bars or smaller
Vn (kips) upperbound	492	TMS 402-13, Eq. 9-22
Vn (kips) upperbound	-	TMS 402-13, Eq. 9-23
Vnm (kip)	330.6	TMS 402-13, Sec 9.3.4.1.2.1
Vn (kip)	330.6	TMS 402-13, Equation 9-21
Holdown Anchor Rod As (in^2)	0.31	At one wall end
a (in)	2.4	
Distance from Edge of Wall to Rod (in)	4	
d (in)	356	
Mn (kip*ft)	1358	
Ve (kip)	97	
Shear vs. Flexure Control	Flexure Control	
An (in^2)	2880	
f_{ae} (psi)	14.4	
Shear vs. Force Controlled	NA	

Determine m-factors Table 11-6		
fae/fme	0.014	
L/heff	2.14	
As (in^2)	0.93	Total Vertical Reinforcement
ρ_v	0.00032	
Av (in^2)	0.9	Total Vertical Reinforcement
ρ_h	0.0007	
$\rho_g$fye/fme	0.050	
m-factor	7.5	
m-factor restriction	7	
m-factor used	7.0	

Deformation Control DCRs		
Shear DCR	0.07	
Moment DCR	0.33	

Force Control DCRs		
Shear DCR	-	
Moment DCR	-	

Out-Of-Plane Capacity TMS 402-13, Sec 9.3.5		
d (in)	4	
a (in)	0.3	
Mn (kip*ft)	22.6	

Out-Of-Plane Demands TMS 402-13 Sec 9.3.5 & ASCE 41-13 Section 11.3.5-->7.2.11		
χ	1	ASCE 41-13, Table 7-2, CP
Sxs,1E	1.11	
h (ft)	14	Full Wall Height
w (psf)	100.0	Elevation Wall Unit Weight
Fp*L (plf)	1332.0	ASCE 41-13, Eq. 7-13
Fp_min*L (plf)	300.0	ASCE 41-13, Eq. 7-14
Mu,o (kip*ft)	32.63	
n	39.8	
tsp (in)	8	
c (in)	0.4	TMS 402-13, Eq. 9-35
Ieff = Icr (in^4)	909	TMS 402-13, Eq. 9-34
Pe (kips)	232	TMS 402-13, Eq. 9-33
Ψ	1.219	TMS 402-13, Eq. 9-32
ΨMu,o (kip*ft)	39.77	TMS 402-13, Eq. 9-31

Out-Of-Plane DCR, Sec 11.3.5.3		
Flexure DCR	0.8	

Permit Number: 19-05911

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Project:	900 Bldg	Date:	12/18/2019
		Checked By:	
Project No:	262019.034	Date:	

ASCE 41-13 Reinforced Masonry DCRs

Legend		
Input		
Calculated		
DCR/Check		

General Inputs		
Pier ID	Grid E40	
Location/Gridline	E40	
f'm (psi)	810	Table 11-2(a)
Em (ksi)	729	TMS 402-13, Sec 4.2.2.2.1
fme (psi)	1053	Table 11-1
fy (ksi)	40	
fye (ksi)	52	
Es (ksi)	29000	
Masonry Denisty (pcf)	125	
Nominal Pier Length (ft)	20	
Pier Height (H)	14.00	
Wall thickness (in)	8	
Roof Trib (SF)	300	
Roof DL (psf)	20	
Roof SL (psf)	25	
Mezz Trib (SF)	0	
Mezz DL (psf)	0	
Mezz LL (psf)	0	
2nd FLR Trib (SF)	150	
2nd FLR DL (psf)	35	
2nd FLR LL (psf)	40	
Shearline Tot Shear (kips)	310.8	BSE-1E
Shearline Tot Length (ft)	20	
Applicable Wall Trib Length (ft)	20	
Seismic Axial Load (kips)	0.0	Holdown Force From Wall Above
Holdown to Wall Centroid (ft)	0.0	
IO, LS, CP	LS	

General Calculation		
Wall Self-Weight (kips)	23.3	
DL (kips)	11.3	Super-imposed DL @ Top of Wall
LL (kips)	6.0	
SL (kips)	7.5	
$1.1(Q_D + Q_L + 0.2^*Q_S)$	46.3	Eq. 7-1
$0.9(Q_D)$	31.1	Eq. 7-2
Shear/Unit Length (kip/ft)	15.5	
Wall Shear (Q_E) (kips)	310.8	
Moment Generated from Holdown (kip*ft)	0.0	About Centroid of Wall

Wall Demands		
P (kips)	46.3	Eq. 7-34
P (kips)	31.1	Eq. 7-34
V (kips)	310.8	
M (kip*ft)	4351.2	

Lower-Bound Vertical Compressive Strength		
K	1	Table 6-1
r (in)	0.534	Weak Axis Radius of Gyration
h/r	315	
P_{CL} (kip)	50	TMS 402-13, Eq. 9-19, Eq. 9-20
KP_{CL} (kip)	50	
J	2	LS
C_1C_2	1.1	
Q_G+(Q_E)/(JC1C2) (kip)	46.3	
DCR	0.93	

Determine FC vs DC Table 11-6		
Mu/(Vudv)	0.06	
γ	1.0	#5 Bars or smaller
Vn (kips) upperbound	328	TMS 402-13, Eq. 9-22
Vn (kips) upperbound	-	TMS 402-13, Eq. 9-23
Vnm (kip)	220.7	TMS 402-13, Sec 9.3.4.1.2.1
Vn (kip)	220.7	TMS 402-13, Equation 9-21
Holdown Anchor Rod As (in^2)	0.61	At one wall end
a (in)	4.7	
Distance from Edge of Wall to Rod (in)	4	
d (in)	236	
Mn (kip*ft)	1081	
Ve (kip)	77	
Shear vs. Flexure Control	Flexure Control	
An (in^2)	1920	
f_{ae} (psi)	24.1	
Shear vs. Force Controlled	NA	

Determine m-factors Table 11-6		
fae/fme	0.023	
L/heff	1.43	
As (in^2)	0.31	Total Vertical Reinforcement
ρ_v	0.00016	
Av (in^2)	0.3	Total Vertical Reinforcement
ρ_h	0.0002	
$\rho_g$fye/fme	0.019	
m-factor	6.8	
m-factor restriction	7	
m-factor used	6.8	

Deformation Control DCRs		
Shear DCR	0.21	
Moment DCR	0.60	

Force Control DCRs		
Shear DCR	-	
Moment DCR	-	

Out-Of-Plane Capacity TMS 402-13, Sec 9.3.5		
d (in)	4	
a (in)	0.4	
Mn (kip*ft)	13.8	

Out-Of-Plane Demands TMS 402-13 Sec 9.3.5 & ASCE 41-13 Section 11.3.5-->7.2.11		
χ	1.3	ASCE 41-13, Table 7-2, LS
Sxs,1E	0.71	
h (ft)	14	Full Wall Height
w (psf)	100.0	Elevation Wall Unit Weight
Fp*L (plf)	738.4	ASCE 41-13, Eq. 7-13
Fp_min*L (plf)	260.0	ASCE 41-13, Eq. 7-14
Mu,o (kip*ft)	18.09	
n	39.8	
tsp (in)	8	
c (in)	0.5	TMS 402-13, Eq. 9-35
Ieff = Icr (in^4)	547	TMS 402-13, Eq. 9-34
Pe (kips)	140	TMS 402-13, Eq. 9-33
Ψ	1.497	TMS 402-13, Eq. 9-32
ΨMu,o (kip*ft)	27.07	TMS 402-13, Eq. 9-31

Out-Of-Plane DCR, Sec 11.3.5.3		
Flexure DCR	0.5	

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		Checked By:	
Project No:	262019.034	Date:	

ASCE 41-13 Reinforced Masonry DCRs

Legend		
Input		
Calculated		
DCR/Check		

General Inputs		
Pier ID	Grid E40	
Location/Gridline	E40	
f'm (psi)	810	Table 11-2(a)
Em (ksi)	729	TMS 402-13, Sec 4.2.2.2.1
fme (psi)	1053	Table 11-1
fy (ksi)	40	
fye (ksi)	52	
Es (ksi)	29000	
Masonry Denisty (pcf)	125	
Nominal Pier Length (ft)	20	
Pier Height (H)	14.00	
Wall thickness (in)	8	
Roof Trib (SF)	300	
Roof DL (psf)	20	
Roof SL (psf)	25	
Mezz Trib (SF)	0	
Mezz DL (psf)	0	
Mezz LL (psf)	0	
2nd FLR Trib (SF)	150	
2nd FLR DL (psf)	35	
2nd FLR LL (psf)	40	
Shearline Tot Shear (kips)	483.6	BSE-2E
Shearline Tot Length (ft)	20	
Applicable Wall Trib Length (ft)	20	
Seismic Axial Load (kips)	0.0	Holdown Force From Wall Above
Holdown to Wall Centroid (ft)	0.0	
IO, LS, CP	CP	

General Calculation		
Wall Self-Weight (kips)	23.3	
DL (kips)	11.3	Super-imposed DL @ Top of Wall
LL (kips)	6.0	
SL (kips)	7.5	
$1.1(Q_D + Q_L + 0.2*Q_S)$	46.3	Eq. 7-1
$0.9(Q_D)$	31.1	Eq. 7-2
Shear/Unit Length (kip/ft)	24.2	
Wall Shear (Q_E) (kips)	483.6	
Moment Generated from Holdown (kip*ft)	0.0	About Centroid of Wall

Wall Demands		
P (kips)	46.3	Eq. 7-34
P (kips)	31.1	Eq. 7-34
V (kips)	483.6	
M (kip*ft)	6770.4	

Lower-Bound Vertical Compressive Strength		
K	1	Table 6-1
r (in)	0.590	Weak Axis Radius of Gyration
h/r	285	
P_{CL} (kip)	61	TMS 402-13, Eq. 9-19, Eq. 9-20
KP_{CL} (kip)	61	
J	2	LS
C_1C_2	1.1	
$Q_G+(Q_E)/(JC1C2)$ (kip)	46.3	
DCR	0.75	

Determine FC vs DC Table 11-6		
Mu/(Vudv)	0.06	
γ	1.0	#5 Bars or smaller
Vn (kips) upperbound	328	TMS 402-13, Eq. 9-22
Vn (kips) upperbound	-	TMS 402-13, Eq. 9-23
Vnm (kip)	220.7	TMS 402-13, Sec 9.3.4.1.2.1
Vn (kip)	220.7	TMS 402-13, Equation 9-21
Holdown Anchor Rod As (in^2)	0.61	At one wall end
a (in)	4.7	
Distance from Edge of Wall to Rod (in)	4	
d (in)	236	
Mn (kip*ft)	1081	
Ve (kip)	77	
Shear vs. Flexure Control	Flexure Control	
An (in^2)	1920	
f_{ae} (psi)	24.1	
Shear vs. Force Controlled	NA	

Determine m-factors Table 11-6		
fae/fme	0.023	
L/heff	1.43	
As (in^2)	0.62	Total Vertical Reinforcement
ρ_g	0.00032	
Av (in^2)	0.6	Total Vertical Reinforcement
ρ_h	0.0005	
$\rho_g$fye/fme	0.039	
m-factor	7.4	
m-factor restriction	7	
m-factor used	7.0	

Deformation Control DCRs		
Shear DCR	0.31	
Moment DCR	0.89	

Force Control DCRs		
Shear DCR	-	
Moment DCR	-	

Out-Of-Plane Capacity TMS 402-13, Sec 9.3.5		
d (in)	4	
a (in)	0.5	
Mn (kip*ft)	17.6	

Out-Of-Plane Demands TMS 402-13 Sec 9.3.5 & ASCE 41-13 Section 11.3.5-->7.2.11		
χ	1	ASCE 41-13, Table 7-2, CP
Sxs,1E	1.11	
h (ft)	14	Full Wall Height
w (psf)	100.0	Elevation Wall Unit Weight
Fp*L (plf)	888.0	ASCE 41-13, Eq. 7-13
Fp_min*L (plf)	200.0	ASCE 41-13, Eq. 7-14
Mu,o (kip*ft)	21.76	
n	39.8	
tsp (in)	8	
c (in)	0.6	TMS 402-13, Eq. 9-35
Ieff = Icr (in^4)	669	TMS 402-13, Eq. 9-34
Pe (kips)	170	TMS 402-13, Eq. 9-33
Ψ	1.373	TMS 402-13, Eq. 9-32
ΨMu,o (kip*ft)	29.87	TMS 402-13, Eq. 9-31

Out-Of-Plane DCR, Sec 11.3.5.3		
Flexure DCR	0.8	

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		Checked By:	
Project No:	262019.034	Date:	

ASCE 41-13 Reinforced Masonry DCRs

Legend		
Input		
Calculated		
DCR/Check		

General Inputs		
Pier ID	Grid E40	
Location/Gridline	E40	
f'm (psi)	810	Table 11-2(a)
Em (ksi)	729	TMS 402-13, Sec 4.2.2.2.1
fme (psi)	1053	Table 11-1
fy (ksi)	40	
fye (ksi)	52	
Es (ksi)	29000	
Masonry Denisty (pcf)	125	
Nominal Pier Length (ft)	20	
Pier Height (H)	14.00	
Wall thickness (in)	8	
Roof Trib (SF)	300	
Roof DL (psf)	20	
Roof SL (psf)	25	
Mezz Trib (SF)	0	
Mezz DL (psf)	0	
Mezz LL (psf)	0	
2nd FLR Trib (SF)	0	
2nd FLR DL (psf)	35	
2nd FLR LL (psf)	40	
Shearline Tot Shear (kips)	150.4	BSE-1E
Shearline Tot Length (ft)	20	
Applicable Wall Trib Length (ft)	20	
Seismic Axial Load (kips)	0.0	Holdown Force From Wall Above
Holdown to Wall Centroid (ft)	0.0	
IO, LS, CP	LS	

General Calculation		
Wall Self-Weight (kips)	23.3	
DL (kips)	0.0	Super-imposed DL @ Top of Wall
LL (kips)	0.0	
SL (kips)	7.5	
$1.1(Q_D + Q_L + 0.2^*Q_S)$	33.9	Eq. 7-1
$0.9(Q_D)$	28.4	Eq. 7-2
Shear/Unit Length (kip/ft)	7.5	
Wall Shear (Q_L) (kips)	150.4	
Moment Generated from Holdown (kip*ft)	0.0	About Centroid of Wall

Wall Demands		
P (kips)	33.9	Eq. 7-34
P (kips)	26.4	Eq. 7-34
V (kips)	150.4	
M (kip*ft)	2105.6	

Lower-Bound Vertical Compressive Strength		
K	1	Table 6-1
r (in)	0.516	Weak Axis Radius of Gyration
h/r	325	
P_{CL} (kip)	47	TMS 402-13, Eq. 9-19, Eq. 9-20
KP_{CL} (kip)	47	
J	2	LS
C_1C_2	1.1	
$Q_G+(Q_E)/(JC1C2)$ (kip)	33.9	
DCR	0.73	

Determine FC vs DC Table 11-6		
Mu/(Vudv)	0.06	
γ	1.0	#5 Bars or smaller
Vn (kips) upperbound	328	TMS 402-13, Eq. 9-22
Vn (kips) upperbound	-	TMS 402-13, Eq. 9-23
Vnm (kip)	219.5	TMS 402-13, Sec 9.3.4.1.2.1
Vn (kip)	219.5	TMS 402-13, Equation 9-21
Holdown Anchor Rod As (in^2)	0.61	At one wall end
a (in)	4.7	
Distance from Edge of Wall to Rod (in)	4	
d (in)	236	
Mn (kip*ft)	589	
Ve (kip)	71	
Shear vs. Flexure Control	Flexure Control	
An (in^2)	1920	
f_{ae} (psi)	17.7	
Shear vs. Force Controlled	NA	

Determine m-factors Table 11-6		
fae/fme	0.017	
L/heff	1.43	
As (in^2)	0.31	Total Vertical Reinforcement
ρ_v	0.00016	
Av (in^2)	0.3	Total Vertical Reinforcement
ρ_h	0.0002	
$\rho_g$fye/fme	0.019	
m-factor	6.8	
m-factor restriction	7	
m-factor used	6.8	

Deformation Control DCRs		
Shear DCR	0.10	
Moment DCR	0.31	

Force Control DCRs		
Shear DCR	-	
Moment DCR	-	

Out-Of-Plane Capacity TMS 402-13, Sec 9.3.5		
d (in)	4	
a (in)	0.3	
Mn (kip*ft)	12.5	

Out-Of-Plane Demands TMS 402-13 Sec 9.3.5 & ASCE 41-13 Section 11.3.5-->7.2.11		
χ	1.3	ASCE 41-13, Table 7-2, LS
Sxs,1E	0.71	
h (ft)	14	Full Wall Height
w (psf)	100.0	Elevation Wall Unit Weight
Fp*L (plf)	738.4	ASCE 41-13, Eq. 7-13
Fp_min*L (plf)	200.0	ASCE 41-13, Eq. 7-14
Mu,o (kip*ft)	18.09	
n	29.9	
tsp (in)	8	
c (in)	0.3	TMS 402-13, Eq. 9-35
Ieff = Icr (in^4)	512	TMS 402-13, Eq. 9-34
Pe (kips)	130	TMS 402-13, Eq. 9-33
Ψ	1.351	TMS 402-13, Eq. 9-32
ΨMu,o (kip*ft)	24.44	TMS 402-13, Eq. 9-31

Out-Of-Plane DCR, Sec 11.3.5.3		
Flexure DCR	0.3	

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Project No:	262019.034	Date:	

ASCE 41-13 Reinforced Masonry DCRs

Legend		
Input		
Calculated		
DCR/Check		

General Inputs		
Pier ID	Grid E40	
Location/Gridline	E40	
f'm (psi)	810	Table 11-2(a)
Em (ksi)	729	TMS 402-13, Sec 4.2.2.2.1
fme (psi)	1053	Table 11-1
fy (ksi)	40	
fye (ksi)	52	
Es (ksi)	29000	
Masonry Denisty (pcf)	125	
Nominal Pier Length (ft)	20	
Pier Height (H)	14.00	
Wall thickness (in)	8	
Roof Trib (SF)	300	
Roof DL (psf)	20	
Roof SL (psf)	25	
Mezz Trib (SF)	0	
Mezz DL (psf)	0	
Mezz LL (psf)	0	
2nd FLR Trib (SF)	0	
2nd FLR DL (psf)	35	
2nd FLR LL (psf)	40	
Shearline Tot Shear (kips)	234	BSE-2E
Shearline Tot Length (ft)	20	
Applicable Wall Trib Length (ft)	20	
Seismic Axial Load (kips)	0.0	Holdown Force From Wall Above
Holdown to Wall Centroid (ft)	0.0	
IO, LS, CP	CP	

General Calculation		
Wall Self-Weight (kips)	23.3	
DL (kips)	6.0	Super-imposed DL @ Top of Wall
LL (kips)	0.0	
SL (kips)	7.5	
$1.1(Q_D + Q_L + 0.2^*Q_S)$	33.9	Eq. 7-1
$0.9(Q_D)$	26.4	Eq. 7-2
Shear/Unit Length (kip/ft)	11.7	
Wall Shear (Q_E) (kips)	234	
Moment Generated from Holdown (kip*ft)	0.0	About Centroid of Wall

Wall Demands		
P (kips)	33.9	Eq. 7-34
P (kips)	26.4	Eq. 7-34
V (kips)	234	
M (kip*ft)	3276.0	

Lower-Bound Vertical Compressive Strength		
K	1	Table 6-1
r (in)	0.578	Weak Axis Radius of Gyration
h/r	290	
P_{CL} (kip)	59	TMS 402-13, Eq. 9-19, Eq. 9-20
KP_{CL} (kip)	59	
J	2	LS
C_1C_2	1.1	
$Q_G+(Q_E)/(JC1C2)$ (kip)	33.9	
DCR	0.58	

Determine FC vs DC Table 11-6		
Mu/(Vudv)	0.06	
γ	1.0	#5 Bars or smaller
Vn (kips) upperbound	328	TMS 402-13, Eq. 9-22
Vn (kips) upperbound	-	TMS 402-13, Eq. 9-23
Vnm (kip)	219.5	TMS 402-13, Sec 9.3.4.1.2.1
Vn (kip)	219.5	TMS 402-13, Equation 9-21
Holdown Anchor Rod As (in^2)	0.61	At one wall end
a (in)	4.7	
Distance from Edge of Wall to Rod (in)	4	
d (in)	236	
Mn (kip*ft)	939	
Ve (kip)	71	
Shear vs. Flexure Control	Flexure Control	
An (in^2)	1920	
f_{ae} (psi)	17.7	
Shear vs. Force Controlled	NA	

Determine m-factors Table 11-6		
fae/fme	0.017	
L/heff	1.43	
As (in^2)	0.62	Total Vertical Reinforcement
ρ_v	0.00032	
Av (in^2)	0.6	Total Vertical Reinforcement
ρ_h	0.0005	
$\rho_E$fye/fme	0.039	
m-factor	7.5	
m-factor restriction	7	
m-factor used	7.0	

Deformation Control DCRs		
Shear DCR	0.15	
Moment DCR	0.47	

Force Control DCRs		
Shear DCR	-	
Moment DCR	-	

Out-Of-Plane Capacity TMS 402-13, Sec 9.3.5		
d (in)	4	
a (in)	0.4	
Mn (kip*ft)	16.3	

Out-Of-Plane Demands TMS 402-13 Sec 9.3.5 & ASCE 41-13 Section 11.3.5-->7.2.11		
χ	1	ASCE 41-13, Table 7-2, CP
Sxs,1E	1.11	
h (ft)	14	Full Wall Height
w (psf)	100.0	Elevation Wall Unit Weight
Fp*L (plf)	888.0	ASCE 41-13, Eq. 7-13
Fp_min*L (plf)	200.0	ASCE 41-13, Eq. 7-14
Mu,o (kip*ft)	21.76	
n	39.8	
tsp (in)	8	
c (in)	0.5	TMS 402-13, Eq. 9-35
Ieff = Icr (in^4)	642	TMS 402-13, Eq. 9-34
Pe (kips)	164	TMS 402-13, Eq. 9-33
Ψ	1.261	TMS 402-13, Eq. 9-32
ΨMu,o (kip*ft)	27.44	TMS 402-13, Eq. 9-31

Out-Of-Plane DCR, Sec 11.3.5.3		
Flexure DCR	0.3	

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		Checked By:	
Project No:	262019.034	Date:	

ASCE 41-13 Reinforced Masonry DCRs

Legend		
Input		
Calculated		
DCR/Check		

General Inputs		
Pier ID	Grid E55	
Location/Gridline	E55	
f'm (psi)	810	Table 11-2(a)
Em (ksi)	729	TMS 402-13, Sec 4.2.2.2.1
fme (psi)	1053	Table 11-1
fy (ksi)	40	
fye (ksi)	52	
Es (ksi)	29000	
Masonry Denisty (pcf)	125	
Nominal Pier Length (ft)	20	
Pier Height (H)	14.00	
Wall thickness (in)	8	
Roof Trib (SF)	300	
Roof DL (psf)	20	
Roof SL (psf)	25	
Mezz Trib (SF)	0	
Mezz DL (psf)	0	
Mezz LL (psf)	0	
2nd FLR Trib (SF)	150	
2nd FLR DL (psf)	35	
2nd FLR LL (psf)	40	
Shearline Tot Shear (kips)	396.8	BSE-1E
Shearline Tot Length (ft)	20	
Applicable Wall Trib Length (ft)	20	
Seismic Axial Load (kips)	0.0	Holdown Force From Wall Above
Holdown to Wall Centroid (ft)	0.0	
IO, LS, CP	LS	

General Calculation		
Wall Self-Weight (kips)	23.3	
DL (kips)	11.3	Super-imposed DL @ Top of Wall
LL (kips)	6.0	
SL (kips)	7.5	
$1.1(Q_D + Q_L + 0.2*Q_S)$	46.3	Eq. 7-1
$0.9(Q_D)$	31.1	Eq. 7-2
Shear/Unit Length (kip/ft)	19.8	
Wall Shear (Q_E) (kips)	396.8	
Moment Generated from Holdown (kip*ft)	0.0	About Centroid of Wall

Wall Demands		
P (kips)	46.3	Eq. 7-34
P (kips)	31.1	Eq. 7-34
V (kips)	396.8	
M (kip*ft)	5555.2	

Lower-Bound Vertical Compressive Strength		
K	1	Table 6-1
r (in)	0.534	Weak Axis Radius of Gyration
h/r	315	
P_{CL} (kip)	50	TMS 402-13, Eq. 9-19, Eq. 9-20
KP_{CL} (kip)	50	
J	2	LS
C_1C_2	1.1	
$Q_G+(Q_E)/(JC1C2)$ (kip)	46.3	
DCR	0.93	

Determine FC vs DC Table 11-6		
Mu/(Vudv)	0.06	
γ	1.0	#5 Bars or smaller
Vn (kips) upperbound	328	TMS 402-13, Eq. 9-22
Vn (kips) upperbound	-	TMS 402-13, Eq. 9-23
Vnm (kip)	220.7	TMS 402-13, Sec 9.3.4.1.2.1
Vn (kip)	220.7	TMS 402-13, Equation 9-21
Holdown Anchor Rod As (in^2)	0.61	At one wall end
a (in)	4.7	
Distance from Edge of Wall to Rod (in)	4	
d (in)	236	
Mn (kip*ft)	1081	
Ve (kip)	77	
Shear vs. Flexure Control	Flexure Control	
An (in^2)	1920	
f_{ae} (psi)	24.1	
Shear vs. Force Controlled	NA	

Determine m-factors Table 11-6		
fae/fme	0.023	
L/heff	1.43	
As (in^2)	0.31	Total Vertical Reinforcement
ρ_v	0.00016	
Av (in^2)	0.3	Total Vertical Reinforcement
ρ_h	0.0002	
$\rho_g$fye/fme	0.019	
m-factor	6.8	
m-factor restriction	7	
m-factor used	6.8	

Deformation Control DCRs		
Shear DCR	0.27	
Moment DCR	0.76	

Force Control DCRs		
Shear DCR	-	
Moment DCR	-	

Out-Of-Plane Capacity TMS 402-13, Sec 9.3.5		
d (in)	4	
a (in)	0.4	
Mn (kip*ft)	13.8	

Out-Of-Plane Demands TMS 402-13 Sec 9.3.5 & ASCE 41-13 Section 11.3.5-->7.2.11		
χ	1.3	ASCE 41-13, Table 7-2, LS
Sxs,1E	0.71	
h (ft)	14	Full Wall Height
w (psf)	100.0	Elevation Wall Unit Weight
Fp*L (plf)	738.4	ASCE 41-13, Eq. 7-13
Fp_min*L (plf)	260.0	ASCE 41-13, Eq. 7-14
Mu,o (kip*ft)	18.09	
n	39.8	
tsp (in)	8	
c (in)	0.5	TMS 402-13, Eq. 9-35
Ieff = Icr (in^4)	547	TMS 402-13, Eq. 9-34
Pe (kips)	140	TMS 402-13, Eq. 9-33
Ψ	1.497	TMS 402-13, Eq. 9-32
ΨMu,o (kip*ft)	27.07	TMS 402-13, Eq. 9-31

Out-Of-Plane DCR, Sec 11.3.5.3		
Flexure DCR	0.9	

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Project No:	262019.034	Date:	

ASCE 41-13 Reinforced Masonry DCRs

Legend		
Input		
Calculated		
DCR/Check		

General Inputs		
Pier ID	Grid E55	
Location/Gridline	E55	
f'm (psi)	810	Table 11-2(a)
Em (ksi)	729	TMS 402-13, Sec 4.2.2.2.1
fme (psi)	1053	Table 11-1
fy (ksi)	40	
fye (ksi)	52	
Es (ksi)	29000	
Masonry Denisty (pcf)	125	
Nominal Pier Length (ft)	20	
Pier Height (H)	14.00	
Wall thickness (in)	8	
Roof Trib (SF)	350	
Roof DL (psf)	20	
Roof SL (psf)	25	
Mezz Trib (SF)	0	
Mezz DL (psf)	0	
Mezz LL (psf)	0	
2nd FLR Trib (SF)	300	
2nd FLR DL (psf)	35	
2nd FLR LL (psf)	40	
Shearline Tot Shear (kips)	617.2	BSE-2E
Shearline Tot Length (ft)	20	
Applicable Wall Trib Length (ft)	20	
Seismic Axial Load (kips)	0.0	Holdown Force From Wall Above
Holdown to Wall Centroid (ft)	0.0	
IO, LS, CP	CP	

General Calculation		
Wall Self-Weight (kips)	23.3	
DL (kips)	17.5	Super-imposed DL @ Top of Wall
LL (kips)	12.0	
SL (kips)	8.8	
$1.1(Q_D + Q_L + 0.2*Q_S)$	60.0	Eq. 7-1
$0.9(Q_D)$	35.8	Eq. 7-2
Shear/Unit Length (kip/ft)	30.9	
Wall Shear (Q_E) (kips)	617.2	
Moment Generated from Holdown (kip*ft)	0.0	About Centroid of Wall

Wall Demands		
P (kips)	60.0	Eq. 7-34
P (kips)	36.3	Eq. 7-34
V (kips)	617.2	
M (kip*ft)	8640.8	

Lower-Bound Vertical Compressive Strength		
K	1	Table 6-1
r (in)	0.604	Weak Axis Radius of Gyration
h/r	278	
P_{CL} (kip)	64	TMS 402-13, Eq. 9-19, Eq. 9-20
KP_{CL} (kip)	64	
J	2	LS
C_1C_2	1.1	
$Q_G+(Q_E)/(JC1C2)$ (kip)	60.0	
DCR	0.94	

Determine FC vs DC Table 11-6		
Mu/(Vudv)	0.06	
γ	1.0	#5 Bars or smaller
Vn (kips) upperbound	328	TMS 402-13, Eq. 9-22
Vn (kips) upperbound	-	TMS 402-13, Eq. 9-23
Vnm (kip)	222.1	TMS 402-13, Sec 9.3.4.1.2.1
Vn (kip)	222.1	TMS 402-13, Equation 9-21
Holdown Anchor Rod As (in^2)	0.61	At one wall end
a (in)	4.7	
Distance from Edge of Wall to Rod (in)	4	
d (in)	236	
Mn (kip*ft)	1191	
Ve (kip)	85	
Shear vs. Flexure Control	Flexure Control	
An (in^2)	1920	
f_{ae} (psi)	31.3	
Shear vs. Force Controlled	NA	

Determine m-factors Table 11-6		
fae/fme	0.030	
L/heff	1.43	
As (in^2)	0.62	Total Vertical Reinforcement
ρ_v	0.00032	
Av (in^2)	0.6	Total Vertical Reinforcement
ρ_h	0.0005	
$\rho_g$fye/fme	0.039	
m-factor	7.3	
m-factor restriction	8	
m-factor used	7.3	

Deformation Control DCRs		
Shear DCR	0.38	
Moment DCR	0.99	

Force Control DCRs		
Shear DCR	-	
Moment DCR	-	

Out-Of-Plane Capacity TMS 402-13, Sec 9.3.5		
d (in)	4	
a (in)	0.5	
Mn (kip*ft)	19.1	

Out-Of-Plane Demands TMS 402-13 Sec 9.3.5 & ASCE 41-13 Section 11.3.5-->7.2.11		
χ	1	ASCE 41-13, Table 7-2, CP
Sxs,1E	1.11	
h (ft)	14	Full Wall Height
w (psf)	100.0	Elevation Wall Unit Weight
Fp*L (plf)	333.0	ASCE 41-13, Eq. 7-13
Fp _min*L (plf)	200.0	ASCE 41-13, Eq. 7-14
Mu,o (kip*ft)	11.75	
n	39.6	
tsp (in)	8	
c (in)	0.7	TMS 402-13, Eq. 9-35
Ieff = Icr (in^4)	609	TMS 402-13, Eq. 9-34
Pe (kips)	173	TMS 402-13, Eq. 9-33
Ψ	1.508	TMS 402-13, Eq. 9-32
ΨMu,o (kip*ft)	17.81	TMS 402-13, Eq. 9-31

Out-Of-Plane DCR, Sec 11.3.5.3		
Flexure DCR	0.8	

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Project No:	262019.034	Date:	

ASCE 41-13 Reinforced Masonry DCRs

Legend		
Input		
Calculated		
DCR/Check		
General Inputs		
Pier ID	Grid E55	
Location/Gridline	E55	
f'm (psi)	810	Table 11-2(a)
Em (ksi)	729	TMS 402-13, Sec 4.2.2.2.1
fme (psi)	1053	Table 11-1
fy (ksi)	40	
fye (ksi)	52	
Es (ksi)	29000	
Masonry Denisty (pcf)	125	
Nominal Pier Length (ft)	20	
Pier Height (H)	14.00	
Wall thickness (in)	8	
Roof Trib (SF)	300	
Roof DL (psf)	20	
Roof SL (psf)	25	
Mezz Trib (SF)	0	
Mezz DL (psf)	0	
Mezz LL (psf)	0	
2nd FLR Trib (SF)	0	
2nd FLR DL (psf)	35	
2nd FLR LL (psf)	40	
Shearline Tot Shear (kips)	192	BSE-1E
Shearline Tot Length (ft)	20	
Applicable Wall Trib Length (ft)	20	
Seismic Axial Load (kips)	0.0	Holdown Force From Wall Above
Holdown to Wall Centroid (ft)	0.0	
IO, LS, CP	LS	
General Calculation		
Wall Self-Weight (kips)	23.3	
DL (kips)	6.0	Super-imposed DL @ Top of Wall
LL (kips)	0.0	
SL (kips)	7.5	
$1.1(Q_D + Q_L + 0.2*Q_S)$	33.9	Eq. 7-1
$0.9(Q_D)$	25.4	Eq. 7-2
Shear/Unit Length (kip/ft)	9.6	
Wall Shear (Q_E) (kips)	192	
Moment Generated from Holdown (kip*ft)	0.0	About Centroid of Wall
Wall Demands		
P (kips)	33.9	Eq. 7-34
P (kips)	26.4	Eq. 7-34
V (kips)	192	
M (kip*ft)	2688.0	
Lower-Bound Vertical Compressive Strength		
K	1	Table 6-1
r (in)	0.516	Weak Axis Radius of Gyration
h/r	325	
P_{CL} (kip)	47	TMS 402-13, Eq. 9-19, Eq. 9-20
KP_{CL} (kip)	47	
J	2	LS
C_1C_2	1.1	
$Q_G+(Q_E)/(JC1C2)$ (kip)	33.9	
DCR	0.73	

Determine FC vs DC Table 11-6		
Mu/(Vudv)	0.06	
γ	1.0	#5 Bars or smaller
Vn (kips) upperbound	328	TMS 402-13, Eq. 9-22
Vn (kips) upperbound	-	TMS 402-13, Eq. 9-23
Vnm (kip)	219.5	TMS 402-13, Sec 9.3.4.1.2.1
Vn (kip)	219.5	TMS 402-13, Equation 9-21
Holdown Anchor Rod As (in^2)	0.61	At one wall end
a (in)	4.7	
Distance from Edge of Wall to Rod (in)	4	
d (in)	236	
Mn (kip*ft)	989	
Ve (kip)	72	
Shear vs. Flexure Control	Flexure Control	
An (in^2)	1920	
f_{ae} (psi)	17.7	
Shear vs. Force Controlled	NA	
Determine m-factors Table 11-6		
fae/fme	0.017	
L/heff	1.43	
As (in^2)	0.31	Total Vertical Reinforcement
ρ_v	0.00016	
Av (in^2)	0.3	Total Vertical Reinforcement
ρ_h	0.0002	
$\rho_g$fye/fme	0.019	
m-factor	6.8	
m-factor restriction	7	
m-factor used	6.8	
Deformation Control DCRs		
Shear DCR	0.13	
Moment DCR	0.40	
Force Control DCRs		
Shear DCR	-	
Moment DCR	-	
Out-Of-Plane Capacity TMS 402-13, Sec 9.3.5		
d (in)	4	
a (in)	0.3	
Mn (kip*ft)	12.5	
Out-Of-Plane Demands TMS 402-13 Sec 9.3.5 & ASCE 41-13 Section 11.3.5-->7.2.11		
χ	1.3	ASCE 41-13, Table 7-2, LS
Sxs,1E	0.71	
h (ft)	14	Full Wall Height
w (psf)	100.0	Elevation Wall Unit Weight
Fp*L (plf)	732.4	ASCE 41-13, Eq. 7-13
Fp_min*L (plf)	262.0	ASCE 41-13, Eq. 7-14
Mu,o (kip*ft)	18.09	
n	39.8	
tsp (in)	8	
c (in)	0.4	TMS 402-13, Eq. 9-35
Ieff = Icr (in^4)	512	TMS 402-13, Eq. 9-34
Pe (kips)	131	TMS 402-13, Eq. 9-33
Ψ	1.351	TMS 402-13, Eq. 9-32
Ψ*Mu,o (kip*ft)	24.44	TMS 402-13, Eq. 9-31
Out-Of-Plane DCR, Sec 11.3.5.3		
Flexure DCR	0.3	

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Project No:	262019.034	Date:	

ASCE 41-13 Reinforced Masonry DCRs

Legend		
Input		
Calculated		
DCR/Check		

General Inputs		
Pier ID	Grid E55	
Location/Gridline	E55	
f'm (psi)	810	Table 11-2(a)
Em (ksi)	729	TMS 402-13, Sec 4.2.2.2.1
fme (psi)	1053	Table 11-1
fy (ksi)	40	
fye (ksi)	52	
Es (ksi)	29000	
Masonry Denisty (pcf)	125	
Nominal Pier Length (ft)	20	
Pier Height (H)	14.00	
Wall thickness (in)	8	
Roof Trib (SF)	300	
Roof DL (psf)	20	
Roof SL (psf)	25	
Mezz Trib (SF)	0	
Mezz DL (psf)	0	
Mezz LL (psf)	0	
2nd FLR Trib (SF)	0	
2nd FLR DL (psf)	35	
2nd FLR LL (psf)	40	
Shearline Tot Shear (kips)	298.6	BSE-2E
Shearline Tot Length (ft)	20	
Applicable Wall Trib Length (ft)	20	
Seismic Axial Load (kips)	0.0	Holdown Force From Wall Above
Holdown to Wall Centroid (ft)	0.0	
IO, LS, CP	CP	

General Calculation		
Wall Self-Weight (kips)	23.3	
DL (kips)	6.0	Super-imposed DL @ Top of Wall
LL (kips)	0.0	
SL (kips)	7.5	
$1.1(Q_D + Q_L + 0.2*Q_S)$	33.9	Eq. 7-1
$0.9(Q_D)$	26.4	Eq. 7-2
Shear/Unit Length (kip/ft)	14.9	
Wall Shear (Q_E) (kips)	298.6	
Moment Generated from Holdown (kip*ft)	0.0	About Centroid of Wall

Wall Demands		
P (kips)	33.9	Eq. 7-34
P (kips)	26.4	Eq. 7-34
V (kips)	298.6	
M (kip*ft)	4180.4	

Lower-Bound Vertical Compressive Strength		
K	1	Table 6-1
r (in)	0.578	Weak Axis Radius of Gyration
h/r	290	
P_{CL} (kip)	59	TMS 402-13, Eq. 9-19, Eq. 9-20
KP_{CL} (kip)	59	
J	2	LS
C_1C_2	1.1	
$Q_G+(Q_E)/(JC1C2)$ (kip)	33.9	
DCR	0.58	

Determine FC vs DC Table 11-6		
Mu/(Vudv)	0.06	
γ	1.0	#5 Bars or smaller
Vn (kips) upperbound	328	TMS 402-13, Eq. 9-22
Vn (kips) upperbound	-	TMS 402-13, Eq. 9-23
Vnm (kip)	219.5	TMS 402-13, Sec 9.3.4.1.2.1
Vn (kip)	219.5	TMS 402-13, Equation 9-21
Holdown Anchor Rod As (in^2)	0.61	At one wall end
a (in)	4.7	
Distance from Edge of Wall to Rod (in)	4	
d (in)	236	
Mn (kip*ft)	569	
Ve (kip)	72	
Shear vs. Flexure Control	Flexure Control	
An (in^2)	1920	
f_{ae} (psi)	17.7	
Shear vs. Force Controlled	NA	

Determine m-factors Table 11-6		
fae/fme	0.017	
L/heff	1.43	
As (in^2)	0.62	Total Vertical Reinforcement
ρ_v	0.00032	
Av (in^2)	0.6	Total Vertical Reinforcement
ρ_h	0.0005	
$\rho_g$fye/fme	0.039	
m-factor	7.5	
m-factor restriction	7	
m-factor used	7.0	

Deformation Control DCRs		
Shear DCR	0.19	
Moment DCR	0.60	

Force Control DCRs		
Shear DCR	-	
Moment DCR	-	

Out-Of-Plane Capacity TMS 402-13, Sec 9.3.5		
d (in)	4	
a (in)	0.4	
Mn (kip*ft)	16.3	

Out-Of-Plane Demands TMS 402-13 Sec 9.3.5 & ASCE 41-13 Section 11.3.5-->7.2.11		
χ	1	ASCE 41-13, Table 7-2, CP
Sxs,1E	1.11	
h (ft)	14	Full Wall Height
w (psf)	100.0	Elevation Wall Unit Weight
Fp*L (plf)	288.0	ASCE 41-13, Eq. 7-13
Fp_min*L (plf)	200.0	ASCE 41-13, Eq. 7-14
Mu,o (kip*ft)	21.76	
n	39.8	
tsp (in)	3.8	
c (in)	0.5	TMS 402-13, Eq. 9-35
Ieff = Icr (in^4)	642	TMS 402-13, Eq. 9-34
Pe (kips)	164	TMS 402-13, Eq. 9-33
Ψ	1.261	TMS 402-13, Eq. 9-32
ΨMu,o (kip*ft)	27.44	TMS 402-13, Eq. 9-31

Out-Of-Plane DCR, Sec 11.3.5.3		
Flexure DCR	0.8	

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Project No:	262019.034	Date:	

ASCE 41-13 Reinforced Masonry DCRs

Legend		
Input		
Calculated		
DCR/Check		

General Inputs		
Pier ID	Grid E145	
Location/Gridline	E145	
f'm (psi)	810	Table 11-2(a)
Em (ksi)	729	TMS 402-13, Sec 4.2.2.2.1
fme (psi)	1053	Table 11-1
fy (ksi)	40	
fye (ksi)	52	
Es (ksi)	29000	
Masonry Denisty (pcf)	125	
Nominal Pier Length (ft)	13	
Pier Height (H)	14.00	
Wall thickness (in)	8	
Roof Trib (SF)	195	
Roof DL (psf)	20	
Roof SL (psf)	25	
Mezz Trib (SF)	0	
Mezz DL (psf)	0	
Mezz LL (psf)	0	
2nd FLR Trib (SF)	52	
2nd FLR DL (psf)	35	
2nd FLR LL (psf)	40	
Shearline Tot Shear (kips)	396.8	BSE-1E
Shearline Tot Length (ft)	33	
Applicable Wall Trib Length (ft)	13	
Seismic Axial Load (kips)	0.0	Holdown Force From Wall Above
Holdown to Wall Centroid (ft)	0.0	
IO, LS, CP	LS	

General Calculation		
Wall Self-Weight (kips)	15.2	
DL (kips)	5.7	Super-imposed DL @ Top of Wall
LL (kips)	2.1	
SL (kips)	4.9	
$1.1(Q_D + Q_L + 0.2*Q_S)$	26.3	Eq. 7-1
$0.9(Q_D)$	18.8	Eq. 7-2
Shear/Unit Length (kip/ft)	12.0	
Wall Shear (Q_E) (kips)	156.3151515	
Moment Generated from Holdown (kip*ft)	0.0	About Centroid of Wall

Wall Demands		
P (kips)	26.3	Eq. 7-34
P (kips)	18.8	Eq. 7-34
V (kips)	156.3151515	
M (kip*ft)	2188.4	

Lower-Bound Vertical Compressive Strength		
K	1	Table 6-1
r (in)	0.559	Weak Axis Radius of Gyration
h/r	300	
P_{CL} (kip)	36	TMS 402-13, Eq. 9-19, Eq. 9-20
KP_{CL} (kip)	36	
J	2	LS
C_1C_2	1.1	
$Q_G+(Q_E)/(JC1C2)$ (kip)	26.3	
DCR	0.74	

Determine FC vs DC Table 11-6		
Mu/(Vudv)	0.09	
γ	1.0	#5 Bars or smaller
Vn (kips) upperbound	213	TMS 402-13, Eq. 9-22
Vn (kips) upperbound	-	TMS 402-13, Eq. 9-23
Vnm (kip)	141.0	TMS 402-13, Sec 9.3.4.1.2.1
Vn (kip)	141.0	TMS 402-13, Equation 9-21
Holdown Anchor Rod As (in^2)	0.62	At one wall end
a (in)	4.8	
Distance from Edge of Wall to Rod (in)	4	
d (in)	152	
Mn (kip*ft)	544	
Ve (kip)	39	
Shear vs. Flexure Control	Flexure Control	
An (in^2)	1248	
f_{ae} (psi)	21.1	
Shear vs. Force Controlled	NA	

Determine m-factors Table 11-6		
fae/fme	0.020	
L/heff	0.93	
As (in^2)	0.31	Total Vertical Reinforcement
ρ_v	0.00025	
Av (in^2)	0.3	Total Vertical Reinforcement
ρ_h	0.0002	
$\rho_g$fye/fme	0.024	
m-factor	6.4	
m-factor restriction	7	
m-factor used	6.4	

Deformation Control DCRs		
Shear DCR	0.17	
Moment DCR	0.51	

Force Control DCRs		
Shear DCR	-	
Moment DCR	-	

Out-Of-Plane Capacity TMS 402-13, Sec 9.3.5		
d (in)	4	
a (in)	0.4	
Mn (kip*ft)	9.9	

Out-Of-Plane Demands TMS 402-13 Sec 9.3.5 & ASCE 41-13 Section 11.3.5-->7.2.11		
χ	1.3	ASCE 41-13, Table 7-2, LS
Sxs,1E	0.71	
h (ft)	14	Full Wall Height
w (psf)	100.0	Elevation Wall Unit Weight
Fp*L (plf)	480.0	ASCE 41-13, Eq. 7-13
Fp_min*L (plf)	168.0	ASCE 41-13, Eq. 7-14
Mu,o (kip*ft)	11.76	
n	30.3	
tsp (in)	8	
c (in)	0.6	TMS 402-13, Eq. 9-35
Ieff = Icr (in^4)	293	TMS 402-13, Eq. 9-34
Pe (kips)	100	TMS 402-13, Eq. 9-33
Ψ	1.360	TMS 402-13, Eq. 9-32
ΨMu,o (kip*ft)	15.99	TMS 402-13, Eq. 9-31

Out-Of-Plane DCR, Sec 11.3.5.3		
Flexure DCR	0.7	

Permit Number: 19-05911

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Client:	RFM	Designed By:	JJ
Project:	900 Bldg	Date:	12/18/2019
		Checked By:	
Project No:	262019.034	Date:	

ASCE 41-13 Reinforced Masonry DCRs

Legend		
Input		
Calculated		
DCR/Check		

General Inputs		
Pier ID	Grid E145	
Location/Gridline	E145	
f'm (psi)	810	Table 11-2(a)
Em (ksi)	729	TMS 402-13, Sec 4.2.2.2.1
fme (psi)	1053	Table 11-1
fy (ksi)	40	
fye (ksi)	52	
Es (ksi)	29000	
Masonry Denisty (pcf)	125	
Nominal Pier Length (ft)	13	
Pier Height (H)	14.00	
Wall thickness (in)	8	
Roof Trib (SF)	195	
Roof DL (psf)	20	
Roof SL (psf)	25	
Mezz Trib (SF)	0	
Mezz DL (psf)	0	
Mezz LL (psf)	0	
2nd FLR Trib (SF)	52	
2nd FLR DL (psf)	35	
2nd FLR LL (psf)	40	
Shearline Tot Shear (kips)	617.2	BSE-2E
Shearline Tot Length (ft)	33	
Applicable Wall Trib Length (ft)	13	
Seismic Axial Load (kips)	0.0	Holdown Force From Wall Above
Holdown to Wall Centroid (ft)	0.0	
IO, LS, CP	CP	

General Calculation		
Wall Self-Weight (kips)	15.2	
DL (kips)	5.7	Super-imposed DL @ Top of Wall
LL (kips)	2.1	
SL (kips)	4.9	
$1.1(Q_D + Q_L + 0.2*Q_S)$	26.3	Eq. 7-1
$0.9(Q_D)$	18.8	Eq. 7-2
Shear/Unit Length (kip/ft)	18.7	
Wall Shear (Q_E) (kips)	243.1393939	
Moment Generated from Holdown (kip*ft)	0.0	About Centroid of Wall

Wall Demands		
P (kips)	26.3	Eq. 7-34
P (kips)	18.8	Eq. 7-34
V (kips)	243.1393939	
M (kip*ft)	3404.0	

Lower-Bound Vertical Compressive Strength		
K	1	Table 6-1
r (in)	0.559	Weak Axis Radius of Gyration
h/r	300	
P_{CL} (kip)	36	TMS 402-13, Eq. 9-19, Eq. 9-20
KP_{CL} (kip)	36	
J	2	LS
C_1C_2	1.1	
$Q_G+(Q_E)/(JC1C2)$ (kip)	26.3	
DCR	0.74	

Determine FC vs DC Table 11-6		
Mu/(Vudv)	0.09	
γ	1.0	#5 Bars or smaller
Vn (kips) upperbound	213	TMS 402-13, Eq. 9-22
Vn (kips) upperbound	-	TMS 402-13, Eq. 9-23
Vnm (kip)	141.0	TMS 402-13, Sec 9.3.4.1.2.1
Vn (kip)	141.0	TMS 402-13, Equation 9-21
Holdown Anchor Rod As (in^2)	0.62	At one wall end
a (in)	4.8	
Distance from Edge of Wall to Rod (in)	4	
d (in)	152	
Mn (kip*ft)	544	
Ve (kip)	39	
Shear vs. Flexure Control	Flexure Control	
An (in^2)	1248	
f_{ae} (psi)	21.1	
Shear vs. Force Controlled	NA	

Determine m-factors Table 11-6		
fae/fme	0.020	
L/heff	0.93	
As (in^2)	0.31	Total Vertical Reinforcement
ρ_v	0.00025	
Av (in^2)	0.3	Total Vertical Reinforcement
ρ_h	0.0002	
$\rho_g$fye/fme	0.024	
m-factor	7.5	
m-factor restriction	7	
m-factor used	7.0	

Deformation Control DCRs		
Shear DCR	0.25	
Moment DCR	0.89	

Force Control DCRs		
Shear DCR	-	
Moment DCR	-	

Out-Of-Plane Capacity TMS 402-13, Sec 9.3.5		
d (in)	4	
a (in)	0.4	
Mn (kip*ft)	9.9	

Out-Of-Plane Demands TMS 402-13 Sec 9.3.5 & ASCE 41-13 Section 11.3.5-->7.2.11		
χ	1	ASCE 41-13, Table 7-2, CP
Sxs,1E	1.11	
h (ft)	14	Full Wall Height
w (psf)	100.0	Elevation Wall Unit Weight
Fp*L (plf)	377.2	ASCE 41-13, Eq. 7-13
Fp_min*L (plf)	130.0	ASCE 41-13, Eq. 7-14
Mu,o (kip*ft)	11.14	
n	39.9	
tsp (in)	8	
c (in)	0.5	TMS 402-13, Eq. 9-35
Ieff = Icr (in^4)	185	TMS 402-13, Eq. 9-34
Pe (kips)	150	TMS 402-13, Eq. 9-33
Ψ	1.730	TMS 402-13, Eq. 9-32
ΨMu,o (kip*ft)	19.23	TMS 402-13, Eq. 9-31

Out-Of-Plane DCR, Sec 11.3.5.3		
Flexure DCR	0.9	

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Project No:	262019.034	Date:	

ASCE 41-13 Reinforced Masonry DCRs

Legend		
Input		
Calculated		
DCR/Check		

General Inputs		
Pier ID	Grid E145	
Location/Gridline	E145	
f'm (psi)	810	Table 11-2(a)
Em (ksi)	729	TMS 402-13, Sec 4.2.2.2.1
fme (psi)	1053	Table 11-1
fy (ksi)	40	
fye (ksi)	52	
Es (ksi)	29000	
Masonry Denisty (pcf)	125	
Nominal Pier Length (ft)	10	
Pier Height (H)	14.00	
Wall thickness (in)	8	
Roof Trib (SF)	195	
Roof DL (psf)	20	
Roof SL (psf)	25	
Mezz Trib (SF)	0	
Mezz DL (psf)	0	
Mezz LL (psf)	0	
2nd FLR Trib (SF)	0	
2nd FLR DL (psf)	35	
2nd FLR LL (psf)	40	
Shearline Tot Shear (kips)	192	BSE-1E
Shearline Tot Length (ft)	35	
Applicable Wall Trib Length (ft)	10	
Seismic Axial Load (kips)	0.0	Holdown Force From Wall Above
Holdown to Wall Centroid (ft)	0.0	
IO, LS, CP	LS	

General Calculation		
Wall Self-Weight (kips)	11.7	
DL (kips)	3.9	Super-imposed DL @ Top of Wall
LL (kips)	0.0	
SL (kips)	4.9	
$1.1(Q_D + Q_L + 0.2*Q_S)$	18.2	Eq. 7-1
$0.9(Q_D)$	14.0	Eq. 7-2
Shear/Unit Length (kip/ft)	5.5	
Wall Shear (Q_L) (kips)	54.857142856	
Moment Generated from Holdown (kip*ft)	0.0	About Centroid of Wall

Wall Demands		
P (kips)	18.2	Eq. 7-34
P (kips)	14.0	Eq. 7-34
V (kips)	54.857142855	
M (kip*ft)	768.0	

Lower-Bound Vertical Compressive Strength		
K	1	Table 6-1
r (in)	0.585	Weak Axis Radius of Gyration
h/r	287	
P_{CL} (kip)	30	TMS 402-13, Eq. 9-19, Eq. 9-20
KP_{CL} (kip)	30	
J	2	LS
C_1C_2	1.1	
$Q_G+(Q_E)/(JC1C2)$ (kip)	18.2	
DCR	0.60	

Determine FC vs DC Table 11-6		
Mu/(Vudv)	0.12	
γ	1.0	#5 Bars or smaller
Vn (kips) upperbound	164	TMS 402-13, Eq. 9-22
Vn (kips) upperbound	-	TMS 402-13, Eq. 9-23
Vnm (kip)	107.0	TMS 402-13, Sec 9.3.4.1.2.1
Vn (kip)	107.0	TMS 402-13, Equation 9-21
Holdown Anchor Rod As (in^2)	0.62	At one wall end
a (in)	4.8	
Distance from Edge of Wall to Rod (in)	4	
d (in)	116	
Mn (kip*ft)	367	
Ve (kip)	26	
Shear vs. Flexure Control	Flexure Control	
An (in^2)	960	
f_{ae} (psi)	19.0	
Shear vs. Force Controlled	NA	

Determine m-factors Table 11-6		
fae/fme	0.018	
L/heff	0.71	
As (in^2)	0.31	Total Vertical Reinforcement
ρ_v	0.00032	
Av (in^2)	0.3	Total Vertical Reinforcement
ρ_h	0.0002	
$\rho_g$fye/fme	0.027	
m-factor	6.0	
m-factor restriction	7	
m-factor used	6.0	

Deformation Control DCRs		
Shear DCR	0.09	
Moment DCR	0.35	

Force Control DCRs		
Shear DCR	-	
Moment DCR	-	

Out-Of-Plane Capacity TMS 402-13, Sec 9.3.5		
d (in)	4	
a (in)	0.4	
Mn (kip*ft)	8.4	

Out-Of-Plane Demands TMS 402-13 Sec 9.3.5 & ASCE 41-13 Section 11.3.5-->7.2.11		
χ	1.3	ASCE 41-13, Table 7-2, LS
Sxs,1E	0.71	
h (ft)	14	Full Wall Height
w (psf)	100.0	Elevation Wall Unit Weight
Fp*L (plf)	369.2	ASCE 41-13, Eq. 7-13
Fp_min*L (plf)	130.0	ASCE 41-13, Eq. 7-14
Mu,o (kip*ft)	9.05	
n	39.8	
tsp (in)	8	
c (in)	0.5	TMS 402-13, Eq. 9-35
Ieff = Icr (in^4)	328	TMS 402-13, Eq. 9-34
Pe (kips)	84	TMS 402-13, Eq. 9-33
Ψ	1.278	TMS 402-13, Eq. 9-32
ΨMu,o (kip*ft)	11.56	TMS 402-13, Eq. 9-31

Out-Of-Plane DCR, Sec 11.3.5.3		
Flexure DCR	0.8	

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		Checked By:	
Project No:	262019.034	Date:	

ASCE 41-13 Reinforced Masonry DCRs

Legend		
Input		
Calculated		
DCR/Check		
General Inputs		
Pier ID	Grid E14S	
Location/Gridline	E14S	
f'm (psi)	810	Table 11-2(a)
Em (ksi)	729	TMS 402-13, Sec 4.2.2.2.1
fme (psi)	1053	Table 11-1
fy (ksi)	40	
fye (ksi)	52	
Es (ksi)	29000	
Masonry Denisty (pcf)	125	
Nominal Pier Length (ft)	10	
Pier Height (H)	14.00	
Wall thickness (in)	8	
Roof Trib (SF)	195	
Roof DL (psf)	20	
Roof SL (psf)	25	
Mezz Trib (SF)	0	
Mezz DL (psf)	0	
Mezz LL (psf)	0	
2nd FLR Trib (SF)	0	
2nd FLR DL (psf)	35	
2nd FLR LL (psf)	40	
Shearline Tot Shear (kips)	298.6	BSE-2E
Shearline Tot Length (ft)	35	
Applicable Wall Trib Length (ft)	10	
Seismic Axial Load (kips)	0.0	Holdown Force From Wall Above
Holdown to Wall Centroid (ft)	0.0	
IO, LS, CP	CP	
General Calculation		
Wall Self-Weight (kips)	11.7	
DL (kips)	3.9	Super-imposed DL @ Top of Wall
LL (kips)	0.0	
SL (kips)	4.8	
$1.1(Q_D + Q_L + 0.2*Q_S)$	18.2	Eq. 7-1
$0.9(Q_D)$	14.0	Eq. 7-2
Shear/Unit Length (kip/ft)	8.5	
Wall Shear (Q_E) (kips)	85.31428571	
Moment Generated from Holdown (kip*ft)	0.0	About Centroid of Wall
Wall Demands		
P (kips)	18.2	Eq. 7-34
P (kips)	14.0	Eq. 7-34
V (kips)	85.31428571	
M (kip*ft)	1194.4	
Lower-Bound Vertical Compressive Strength		
K	1	Table 6-1
r (in)	0.585	Weak Axis Radius of Gyration
h/r	287	
P_{CL} (kip)	30	TMS 402-13, Eq. 9-19, Eq. 9-20
KP_{CL} (kip)	30	
J	2	LS
C_1C_2	1.1	
$Q_G+(Q_E)/(JC1C2)$ (kip)	18.2	
DCR	0.60	

Determine FC vs DC Table 11-6		
Mu/(Vudv)	0.12	
γ	1.0	#5 Bars or smaller
Vn (kips) upperbound	164	TMS 402-13, Eq. 9-22
Vn (kips) upperbound	-	TMS 402-13, Eq. 9-23
Vnm (kip)	107.0	TMS 402-13, Sec 9.3.4.1.2.1
Vn (kip)	107.0	TMS 402-13, Equation 9-21
Holdown Anchor Rod As (in^2)	0.62	At one wall end
a (in)	4.8	
Distance from Edge of Wall to Rod (in)	4	
d (in)	116	
Mn (kip*ft)	367	
Ve (kip)	26	
Shear vs. Flexure Control	Flexure Control	
An (in^2)	960	
f_{ae} (psi)	19.0	
Shear vs. Force Controlled	NA	
Determine m-factors Table 11-6		
fae/fme	0.018	
L/heff	0.71	
As (in^2)	0.31	Total Vertical Reinforcement
ρ_v	0.00032	
Av (in^2)	0.3	Total Vertical Reinforcement
ρ_h	0.0002	
$\rho_g$fye/fme	0.027	
m-factor	7.1	
m-factor restriction	7	
m-factor used	7.0	
Deformation Control DCRs		
Shear DCR	0.11	
Moment DCR	0.46	
Force Control DCRs		
Shear DCR	-	
Moment DCR	-	
Out-Of-Plane Capacity TMS 402-13, Sec 9.3.5		
d (in)	4	
a (in)	0.4	
Mn (kip*ft)	8.4	
Out-Of-Plane Demands TMS 402-13 Sec 9.3.5 & ASCE 41-13 Section 11.3.5-->7.2.11		
χ	1	ASCE 41-13, Table 7-2, CP
Sxs,1E	1.11	
h (ft)	14	Full Wall Height
w (psf)	103.0	Elevation Wall Unit Weight
Fp*L (plf)	444.0	ASCE 41-13, Eq. 7-13
Fp _min*L (plf)	120.0	ASCE 41-13, Eq. 7-14
Mu,o (kip*ft)	10.88	
n	39.8	
tsp (in)	8	
c (in)	0.5	TMS 402-13, Eq. 9-35
Ieff = Icr (in^4)	322	TMS 402-13, Eq. 9-34
Pe (kips)	84	TMS 402-13, Eq. 9-33
Ψ	1.278	TMS 402-13, Eq. 9-32
ΨMu,o (kip*ft)	13.90	TMS 402-13, Eq. 9-31
Out-Of-Plane DCR, Sec 11.3.5.3		
Flexure DCR	0.8	

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Project No:	262019.034	Date:	

ASCE 41-13 Reinforced Masonry DCRs

Legend		
Input		
Calculated		
DCR/Check		

General Inputs		
Pier ID	Grid E160	
Location/Gridline	E160	
f'm (psi)	810	Table 11-2(a)
Em (ksi)	729	TMS 402-13, Sec 4.2.2.2.1
fme (psi)	1053	Table 11-1
fy (ksi)	40	
fye (ksi)	52	
Es (ksi)	29000	
Masonry Denisty (pcf)	125	
Nominal Pier Length (ft)	16	
Pier Height (H)	14.00	
Wall thickness (in)	8	
Roof Trib (SF)	224	
Roof DL (psf)	20	
Roof SL (psf)	25	
Mezz Trib (SF)	0	
Mezz DL (psf)	0	
Mezz LL (psf)	0	
2nd FLR Trib (SF)	224	
2nd FLR DL (psf)	35	
2nd FLR LL (psf)	40	
Shearline Tot Shear (kips)	293.2	BSE-1E
Shearline Tot Length (ft)	44	
Applicable Wall Trib Length (ft)	16	
Seismic Axial Load (kips)	0.0	Holdown Force From Wall Above
Holdown to Wall Centroid (ft)	0.0	
IO, LS, CP	LS	

General Calculation		
Wall Self-Weight (kips)	18.7	
DL (kips)	12.3	Super-imposed DL @ Top of Wall
LL (kips)	[illegible]	
SL (kips)	5.6	
$1.1(Q_D + Q_L + 0.2*Q_S)$	45.2	Eq. 7-1
$0.9(Q_D)$	27.9	Eq. 7-2
Shear/Unit Length (kip/ft)	6.7	
Wall Shear (Q_E) (kips)	106.6181818	
Moment Generated from Holdown (kip*ft)	0.0	About Centroid of Wall

Wall Demands		
P (kips)	45.2	Eq. 7-34
P (kips)	27.9	Eq. 7-34
V (kips)	106.6181818	
M (kip*ft)	1492.7	

Lower-Bound Vertical Compressive Strength		
K	1	Table 6-1
r (in)	0.560	Weak Axis Radius of Gyration
h/r	300	
P_{CL} (kip)	44	TMS 402-13, Eq. 9-19, Eq. 9-20
KP_{CL} (kip)	44	
J	2	LS
C_1C_2	1.1	
$Q_G+(Q_E)/(JC1C2)$ (kip)	45.2	
DCR	1.03	

Determine FC vs DC Table 11-6		
Mu/(Vudv)	0.07	
γ	1.0	#5 Bars or smaller
Vn (kips) upperbound	262	TMS 402-13, Eq. 9-22
Vn (kips) upperbound	-	TMS 402-13, Eq. 9-23
Vnm (kip)	176.1	TMS 402-13, Sec 9.3.4.1.2.1
Vn (kip)	176.1	TMS 402-13, Equation 9-21
Holdown Anchor Rod As (in^2)	0.31	At one wall end
a (in)	2.4	
Distance from Edge of Wall to Rod (in)	4	
d (in)	188	
Mn (kip*ft)	627	
Ve (kip)	45	
Shear vs. Flexure Control	Flexure Control	
An (in^2)	1536	
f_{ae} (psi)	29.4	
Shear vs. Force Controlled	NA	

Determine m-factors Table 11-6		
fae/fme	0.028	
L/heff	1.14	
As (in^2)	0.31	Total Vertical Reinforcement
ρ_v	0.00020	
Av (in^2)	0.3	Total Vertical Reinforcement
ρ_h	0.0002	
$\rho_g$fye/fme	0.021	
m-factor	6.6	
m-factor restriction	7	
m-factor used	6.6	

Deformation Control DCRs		
Shear DCR	0.09	
Moment DCR	0.36	

Force Control DCRs		
Shear DCR	-	
Moment DCR	-	

Out-Of-Plane Capacity TMS 402-13, Sec 9.3.5		
d (in)	4	
a (in)	0.5	
Mn (kip*ft)	12.7	

Out-Of-Plane Demands TMS 402-13 Sec 9.3.5 & ASCE 41-13 Section 11.3.5-->7.2.11		
χ	1.3	ASCE 41-13, Table 7-2, LS
Sxs,1E	0.71	
h (ft)	14	Full Wall Height
w (psf)	100.0	Elevation Wall Unit Weight
Fp*L (plf)	520.7	ASCE 41-13, Eq. 7-13
Fp_min*L (plf)	200.0	ASCE 41-13, Eq. 7-14
Mu,o (kip*ft)	14.47	
n	39.8	
tsp (in)	8	
c (in)	0.6	TMS 402-13, Eq. 9-35
Ieff = Icr (in^4)	481	TMS 402-13, Eq. 9-34
Pe (kips)	123	TMS 402-13, Eq. 9-33
Ψ	1.582	TMS 402-13, Eq. 9-32
ΨMu,o (kip*ft)	22.90	TMS 402-13, Eq. 9-31

Out-Of-Plane DCR, Sec 11.3.5.3		
Flexure DCR	0.8	

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Project No:	262019.034	Date:	

ASCE 41-13 Reinforced Masonry DCRs

Legend		
Input		
Calculated		
DCR/Check		

General Inputs		
Pier ID	Grid E160	
Location/Gridline	E160	
f'm (psi)	810	Table 11-2(a)
Em (ksi)	729	TMS 402-13, Sec 4.2.2.2.1
fme (psi)	1053	Table 11-1
fy (ksi)	40	
fye (ksi)	52	
Es (ksi)	29000	
Masonry Denisty (pcf)	125	
Nominal Pier Length (ft)	16	
Pier Height (H)	14.00	
Wall thickness (in)	8	
Roof Trib (SF)	224	
Roof DL (psf)	20	
Roof SL (psf)	25	
Mezz Trib (SF)	0	
Mezz DL (psf)	0	
Mezz LL (psf)	0	
2nd FLR Trib (SF)	224	
2nd FLR DL (psf)	35	
2nd FLR LL (psf)	40	
Shearline Tot Shear (kips)	456.1	BSE-2E
Shearline Tot Length (ft)	44	
Applicable Wall Trib Length (ft)	16	
Seismic Axial Load (kips)	0.0	Holdown Force From Wall Above
Holdown to Wall Centroid (ft)	0.0	
IO, LS, CP	CP	

General Calculation		
Wall Self-Weight (kips)	15.7	
DL (kips)	12.3	Super-imposed DL @ Top of Wall
LL (kips)	9.0	
SL (kips)	5.5	
$1.1(Q_D + Q_L + 0.2*Q_S)$	45.2	Eq. 7-1
$0.9(Q_D)$	27.9	Eq. 7-2
Shear/Unit Length (kip/ft)	10.4	
Wall Shear (Q_E) (kips)	165.8545455	
Moment Generated from Holdown (kip*ft)	0.0	About Centroid of Wall

Wall Demands		
P (kips)	45.2	Eq. 7-34
P (kips)	27.9	Eq. 7-34
V (kips)	165.8545455	
M (kip*ft)	2322.0	

Lower-Bound Vertical Compressive Strength		
K	1	Table 6-1
r (in)	0.621	Weak Axis Radius of Gyration
h/r	27.1	
P_{CL} (kip)	53	TMS 402-13, Eq. 9-19, Eq. 9-20
KP_{CL} (kip)	55	
J	2	LS
C_1C_2	1.1	
$Q_G+(Q_E)/(JC1C2)$ (kip)	45.2	
DCR	0.83	

Determine FC vs DC Table 11-6		
Mu/(Vudv)	0.07	
γ	1.0	#5 Bars or smaller
Vn (kips) upperbound	262	TMS 402-13, Eq. 9-22
Vn (kips) upperbound	-	TMS 402-13, Eq. 9-23
Vnm (kip)	176.1	TMS 402-13, Sec 9.3.4.1.2.1
Vn (kip)	176.1	TMS 402-13, Equation 9-21
Holdown Anchor Rod As (in^2)	0.31	At one wall end
a (in)	2.4	
Distance from Edge of Wall to Rod (in)	4	
d (in)	188	
Mn (kip*ft)	527	
Ve (kip)	45	
Shear vs. Flexure Control	Flexure Control	
An (in^2)	1536	
f_{ae} (psi)	29.4	
Shear vs. Force Controlled	NA	

Determine m-factors Table 11-6		
fae/fme	0.028	
L/heff	1.14	
As (in^2)	0.62	Total Vertical Reinforcement
ρ_v	0.00040	
Av (in^2)	0.6	Total Vertical Reinforcement
ρ_h	0.0005	
$\rho_g$fye/fme	0.043	
m-factor	7.1	
m-factor restriction	7	
m-factor used	7.0	

Deformation Control DCRs		
Shear DCR	0.13	
Moment DCR	0.53	

Force Control DCRs		
Shear DCR	-	
Moment DCR	-	

Out-Of-Plane Capacity TMS 402-13, Sec 9.3.5		
d (in)	4	
a (in)	0.6	
Mn (kip*ft)	13.3	

Out-Of-Plane Demands TMS 402-13 Sec 9.3.5 & ASCE 41-13 Section 11.3.5-->7.2.11		
χ	1	ASCE 41-13, Table 7-2, LS
Sxs,1E	1.11	
h (ft)	14	Full Wall Height
w (psf)	100.0	Elevation Wall Unit Weight
Fp*L (plf)	710.4	ASCE 41-13, Eq. 7-13
Fp_min*L (plf)	160.0	ASCE 41-13, Eq. 7-14
Mu,o (kip*ft)	17.40	
n	39.8	
tsp (in)	8	
c (in)	0.7	TMS 402-13, Eq. 9-35
Ieff = Icr (in^4)	592	TMS 402-13, Eq. 9-34
Pe (kips)	151	TMS 402-13, Eq. 9-33
Ψ	1.427	TMS 402-13, Eq. 9-32
ΨMu,o (kip*ft)	24.84	TMS 402-13, Eq. 9-31

Out-Of-Plane DCR, Sec 11.3.5.3		
Flexure DCR	0.7	

Permit Number: 19-05911

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Client:	RFM	Designed By:	JJ
Project:	900 Bldg	Date:	12/18/2019
		Checked By:	
Project No:	262019.034	Date:	

ASCE 41-13 Reinforced Masonry DCRs

Legend		
Input		
Calculated		
DCR/Check		

General Inputs		
Pier ID	Grid E160	
Location/Gridline	E160	
f'm (psi)	810	Table 11-2(a)
Em (ksi)	729	TMS 402-13, Sec 4.2.2.2.1
fme (psi)	1053	Table 11-1
fy (ksi)	40	
fye (ksi)	52	
Es (ksi)	29000	
Masonry Denisty (pcf)	125	
Nominal Pier Length (ft)	20	
Pier Height (H)	14.00	
Wall thickness (in)	8	
Roof Trib (SF)	224	
Roof DL (psf)	20	
Roof SL (psf)	25	
Mezz Trib (SF)	0	
Mezz DL (psf)	0	
Mezz LL (psf)	0	
2nd FLR Trib (SF)	0	
2nd FLR DL (psf)	35	
2nd FLR LL (psf)	40	
Shearline Tot Shear (kips)	141.9	BSE-1E
Shearline Tot Length (ft)	20	
Applicable Wall Trib Length (ft)	20	
Seismic Axial Load (kips)	0.0	Holdown Force From Wall Above
Holdown to Wall Centroid (ft)	0.0	
IO, LS, CP	LS	

General Calculation		
Wall Self-Weight (kips)	23.3	
DL (kips)	4.5	Super-imposed DL @ Top of Wall
LL (kips)	0.0	
SL (kips)	5.6	
$1.1(Q_D + Q_L + 0.2*Q_S)$	31.8	Eq. 7-1
$0.9(Q_D)$	25.0	Eq. 7-2
Shear/Unit Length (kip/ft)	7.1	
Wall Shear (Q_E) (kips)	141.9	
Moment Generated from Holdown (kip*ft)	0.0	About Centroid of Wall

Wall Demands		
P (kips)	31.8	Eq. 7-34
P (kips)	25.0	Eq. 7-34
V (kips)	141.9	
M (kip*ft)	1986.6	

Lower-Bound Vertical Compressive Strength		
K	1	Table 6-1
r (in)	0.509	Weak Axis Radius of Gyration
h/r	330	
P_{CL} (kip)	45	TMS 402-13, Eq. 9-19, Eq. 9-20
KP_{CL} (kip)	45	
J	2	LS
C_1C_2	1.1	
$Q_G+(Q_E)/(JC1C2)$ (kip)	31.8	
DCR	0.70	

Determine FC vs DC Table 11-6		
Mu/(Vudv)	0.06	
γ	1.0	#5 Bars or smaller
Vn (kips) upperbound	328	TMS 402-13, Eq. 9-22
Vn (kips) upperbound	-	TMS 402-13, Eq. 9-23
Vnm (kip)	219.2	TMS 402-13, Sec 9.3.4.1.2.1
Vn (kip)	219.2	TMS 402-13, Equation 9-21
Holdown Anchor Rod As (in^2)	0.31	At one wall end
a (in)	2.4	
Distance from Edge of Wall to Rod (in)	4	
d (in)	236	
Mn (kip*ft)	732	
Ve (kip)	52	
Shear vs. Flexure Control	Flexure Control	
An (in^2)	1920	
f_{ae} (psi)	16.6	
Shear vs. Force Controlled	NA	

Determine m-factors Table 11-6		
fae/fme	0.016	
L/heff	1.43	
As (in^2)	0.31	Total Vertical Reinforcement
ρ_v	0.00016	
Av (in^2)	0.3	Total Vertical Reinforcement
ρ_h	0.0002	
$\rho_g$fye/fme	0.019	
m-factor	6.8	
m-factor restriction	7	
m-factor used	6.8	

Deformation Control DCRs		
Shear DCR	0.10	
Moment DCR	0.40	

Force Control DCRs		
Shear DCR	-	
Moment DCR	-	

Out-Of-Plane Capacity TMS 402-13, Sec 9.3.5		
d (in)	4	
a (in)	0.3	
Mn (kip*ft)	12.0	

Out-Of-Plane Demands TMS 402-13 Sec 9.3.5 & ASCE 41-13 Section 11.3.5-->7.2.11		
χ	1.3	ASCE 41-13, Table 7-2, LS
Sxs,1E	0.71	
h (ft)	14	Full Wall Height
w (psf)	100.0	Elevation Wall Unit Weight
Fp*L (plf)	733.4	ASCE 41-13, Eq. 7-13
Fp _min*L (plf)	280.0	ASCE 41-13, Eq. 7-14
Mu,o (kip*ft)	18.08	
n	30.2	
tsp (in)	8	
c (in)	0.4	TMS 402-13, Eq. 9-35
Ieff = Icr (in^4)	493	TMS 402-13, Eq. 9-34
Pe (kips)	127	TMS 402-13, Eq. 9-33
Ψ	1.335	TMS 402-13, Eq. 9-32
ΨMu,o (kip*ft)	24.14	TMS 402-13, Eq. 9-31

Out-Of-Plane DCR, Sec 11.3.5.3		
Flexure DCR	0.9	

Permit Number: 19-05911

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Project:	900 Bldg	Date:	12/18/2019
		Checked By:	
Project No:	262019.034	Date:	

ASCE 41-13 Reinforced Masonry DCRs

Legend		
Input	(yellow)	
Calculated	(green)	
DCR/Check	(blue)	

General Inputs		
Pier ID	Grid E160	
Location/Gridline	E160	
f'm (psi)	810	Table 11-2(a)
Em (ksi)	729	TMS 402-13, Sec 4.2.2.2.1
fme (psi)	1053	Table 11-1
fy (ksi)	40	
fye (ksi)	52	
Es (ksi)	29000	
Masonry Denisty (pcf)	125	
Nominal Pier Length (ft)	20	
Pier Height (H)	14.00	
Wall thickness (in)	8	
Roof Trib (SF)	224	
Roof DL (psf)	20	
Roof SL (psf)	25	
Mezz Trib (SF)	0	
Mezz DL (psf)	0	
Mezz LL (psf)	0	
2nd FLR Trib (SF)	0	
2nd FLR DL (psf)	35	
2nd FLR LL (psf)	40	
Shearline Tot Shear (kips)	220.7	BSE-2E
Shearline Tot Length (ft)	20	
Applicable Wall Trib Length (ft)	20	
Seismic Axial Load (kips)	0.0	Holdown Force From Wall Above
Holdown to Wall Centroid (ft)	0.0	
IO, LS, CP	CP	

General Calculation		
Wall Self-Weight (kips)	23.3	
DL (kips)	4.5	Super-imposed DL @ Top of Wall
LL (kips)	0.0	
SL (kips)	5.6	
$1.1(Q_D + Q_L + 0.2*Q_S)$	31.3	Eq. 7-1
$0.9(Q_D)$	25.0	Eq. 7-2
Shear/Unit Length (kip/ft)	11.0	
Wall Shear (Q_E) (kips)	220.7	
Moment Generated from Holdown (kip*ft)	0.0	About Centroid of Wall

Wall Demands		
P (kips)	31.8	Eq. 7-34
P (kips)	25.0	Eq. 7-34
V (kips)	220.7	
M (kip*ft)	3089.8	

Lower-Bound Vertical Compressive Strength		
K	1	Table 6-1
r (in)	0.573	Weak Axis Radius of Gyration
h/r	293	
P_{CL} (kip)	58	TMS 402-13, Eq. 9-19, Eq. 9-20
KP_{CL} (kip)	58	
J	2	LS
C_1C_2	1.1	
$Q_G+(Q_E)/(JC1C2)$ (kip)	31.8	
DCR	0.55	

Determine FC vs DC Table 11-6		
Mu/(Vudv)	0.06	
γ	1.0	#5 Bars or smaller
Vn (kips) upperbound	328	TMS 402-13, Eq. 9-22
Vn (kips) upperbound	-	TMS 402-13, Eq. 9-23
Vnm (kip)	219.2	TMS 402-13, Sec 9.3.4.1.2.1
Vn (kip)	219.2	TMS 402-13, Equation 9-21
Holdown Anchor Rod As (in^2)	0.31	At one wall end
a (in)	2.4	
Distance from Edge of Wall to Rod (in)	4	
d (in)	236	
Mn (kip*ft)	732	
Ve (kip)	52	
Shear vs. Flexure Control	Flexure Control	
An (in^2)	1920	
f_{ae} (psi)	16.6	
Shear vs. Force Controlled	NA	

Determine m-factors Table 11-6		
fae/fme	0.016	
L/heff	1.43	
As (in^2)	0.62	Total Vertical Reinforcement
ρ_v	0.00032	
Av (in^2)	0.6	Total Vertical Reinforcement
ρ_h	0.0005	
$\rho_g$fye/fme	0.039	
m-factor	7.5	
m-factor restriction	7	
m-factor used	7.0	

Deformation Control DCRs		
Shear DCR	0.14	
Moment DCR	0.60	

Force Control DCRs		
Shear DCR	-	
Moment DCR	-	

Out-Of-Plane Capacity TMS 402-13, Sec 9.3.5		
d (in)	4	
a (in)	0.4	
Mn (kip*ft)	15.9	

Out-Of-Plane Demands TMS 402-13 Sec 9.3.5 & ASCE 41-13 Section 11.3.5-->7.2.11		
χ	1	ASCE 41-13, Table 7-2, CP
Sxs,1E	1.11	
h (ft)	14	Full Wall Height
w (psf)	100.0	Elevation Wall Unit Weight
Fp*L (plf)	559.0	ASCE 41-13, Eq. 7-13
Fp_min*L (plf)	280.0	ASCE 41-13, Eq. 7-14
Mu,o (kip*ft)	11.75	
n	29.8	
tsp (in)	8	
c (in)	0.5	TMS 402-13, Eq. 9-35
Ieff = Icr (in^4)	430	TMS 402-13, Eq. 9-34
Pe (kips)	161	TMS 402-13, Eq. 9-33
Ψ	1.247	TMS 402-13, Eq. 9-32
ΨMu,o (kip*ft)	27.13	TMS 402-13, Eq. 9-31

Out-Of-Plane DCR, Sec 11.3.5.3		
Flexure DCR	0.8	

Permit Number: 19-05911

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Project:	900 Bldg	Date:	12/18/2019
		Checked By:	
Project No:	262019.034	Date:	

ASCE 41-13 Reinforced Masonry DCRs

Legend		
Input		
Calculated		
DCR/Check		
General Inputs		
Pier ID	Grid E200	
Location/Gridline	E200	
f'm (psi)	810	Table 11-2(a)
Em (ksi)	729	TMS 402-13, Sec 4.2.2.2.1
fme (psi)	1053	Table 11-1
fy (ksi)	40	
fye (ksi)	52	
Es (ksi)	29000	
Masonry Denisty (pcf)	125	
Nominal Pier Length (ft)	9	
Pier Height (H)	7.00	
Wall thickness (in)	8	
Roof Trib (SF)	216	
Roof DL (psf)	20	
Roof SL (psf)	25	
Mezz Trib (SF)	0	
Mezz DL (psf)	0	
Mezz LL (psf)	0	
2nd FLR Trib (SF)	216	
2nd FLR DL (psf)	35	
2nd FLR LL (psf)	40	
Shearline Tot Shear (kips)	546.2	BSE-1E
Shearline Tot Length (ft)	44	
Applicable Wall Trib Length (ft)	9	
Seismic Axial Load (kips)	0.0	Holdown Force From Wall Above
Holdown to Wall Centroid (ft)	0.0	
IO, LS, CP	LS	
General Calculation		
Wall Self-Weight (kips)	5.3	
DL (kips)	11.9	Super-imposed DL @ Top of Wall
LL (kips)	8.6	
SL (kips)	5.4	
$1.1(Q_D + Q_L + 0.2*Q_S)$	29.5	Eq. 7-1
$0.9(Q_D)$	15.4	Eq. 7-2
Shear/Unit Length (kip/ft)	12.4	
Wall Shear (Q_E) (kips)	111.7227273	
Moment Generated from Holdown (kip*ft)	0.0	About Centroid of Wall
Wall Demands		
P (kips)	29.5	Eq. 7-34
P (kips)	15.4	Eq. 7-34
V (kips)	111.7227273	
M (kip*ft)	782.1	
Lower-Bound Vertical Compressive Strength		
K	1	Table 6-1
r (in)	0.597	Weak Axis Radius of Gyration
h/r	141	
P_{CL} (kip)	113	TMS 402-13, Eq. 9-19, Eq. 9-20
KP_{CL} (kip)	113	
J	2	LS
C_1C_2	1.1	
$Q_G+(Q_E)/(JC1C2)$ (kip)	29.5	
DCR	0.26	

Determine FC vs DC Table 11-6		
Mu/(Vudv)	0.07	
γ	1.0	#5 Bars or smaller
Vn (kips) upperbound	148	TMS 402-13, Eq. 9-22
Vn (kips) upperbound	-	TMS 402-13, Eq. 9-23
Vnm (kip)	99.3	TMS 402-13, Sec 9.3.4.1.2.1
Vn (kip)	99.3	TMS 402-13, Equation 9-21
Holdown Anchor Rod As (in^2)	0.31	At one wall end
a (in)	2.4	
Distance from Edge of Wall to Rod (in)	4	
d (in)	104	
Mn (kip*ft)	233	
Ve (kip)	31	
Shear vs. Flexure Control	Flexure Control	
An (in^2)	864	
f_{ae} (psi)	34.2	
Shear vs. Force Controlled	NA	
Determine m-factors Table 11-6		
fae/fme	0.032	
L/heff	1.29	
As (in^2)	0.31	Total Vertical Reinforcement
ρ_v	0.00036	
Av (in^2)	0.3	Total Vertical Reinforcement
ρ_h	0.0005	
$\rho_g$fye/fme	0.040	
m-factor	5.9	
m-factor restriction	7	
m-factor used	5.9	
Deformation Control DCRs		
Shear DCR	0.19	
Moment DCR	0.55	
Force Control DCRs		
Shear DCR	-	
Moment DCR	-	
Out-Of-Plane Capacity TMS 402-13, Sec 9.3.5		
d (in)	4	
a (in)	0.6	
Mn (kip*ft)	8.6	
Out-Of-Plane Demands TMS 402-13 Sec 9.3.5 & ASCE 41-13 Section 11.3.5-->7.2.11		
χ	1.3	ASCE 41-13, Table 7-2, LS
Sxs,1E	0.71	
h (ft)	14	Full Wall Height
w (psf)	100.0	Elevation Wall Unit Weight
Fp*L (plf)	332.3	ASCE 41-13, Eq. 7-13
Fp_min*L (plf)	117.0	ASCE 41-13, Eq. 7-14
Mu,o (kip*ft)	8.14	
n	39.8	
tsp (in)	8	
c (in)	0.7	TMS 402-13, Eq. 9-35
Ieff = Icr (in^4)	308	TMS 402-13, Eq. 9-34
Pe (kips)	314	TMS 402-13, Eq. 9-33
Ψ	1.103	TMS 402-13, Eq. 9-32
ΨMu,o (kip*ft)	8.99	TMS 402-13, Eq. 9-31
Out-Of-Plane DCR, Sec 11.3.5.3		
Flexure DCR	0.5	

Permit Number: 19-05911

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Client: RFM
Project: 900 Bldg
Project No: 262019.034

ASCE 41-13 Reinforc

Legend		
Input		
Calculated		
DCR/Check		

General Inputs		
Pier ID	Grid E200	
Location/Gridline	E200	
f'm (psi)	810	Table 11-2(a)
Em (ksi)	729	TMS 402-13, Sec 4.2.2.2.1
fme (psi)	1053	Table 11-1
fy (ksi)	40	
fye (ksi)	52	
Es (ksi)	29000	
Masonry Denisty (pcf)	125	
Nominal Pier Length (ft)	9	
Pier Height (H)	7.00	
Wall thickness (in)	8	
Roof Trib (SF)	216	
Roof DL (psf)	20	
Roof SL (psf)	25	
Mezz Trib (SF)	0	
Mezz DL (psf)	0	
Mezz LL (psf)	0	
2nd FLR Trib (SF)	216	
2nd FLR DL (psf)	35	
2nd FLR LL (psf)	40	
Shearline Tot Shear (kips)	546.2	BSE-1E
Shearline Tot Length (ft)	44	
Applicable Wall Trib Length (ft)	9	
Seismic Axial Load (kips)	0.0	Holdown Force From Wall Above
Holdown to Wall Centroid (ft)	0.0	
IO, LS, CP	LS	

General Calculation		
Wall Self-Weight (kips)	5.3	
DL (kips)	11.9	Super-imposed DL @ Top of Wall
LL (kips)	8.6	
SL (kips)	5.4	
$1.1(Q_D + Q_L + 0.2*Q_S)$	29.5	Eq. 7-1
$0.9(Q_D)$	15.4	Eq. 7-2
Shear/Unit Length (kip/ft)	12.4	
Wall Shear (Q_E) (kips)	111.7227273	
Moment Generated from Holdown (kip*ft)	0.0	About Centroid of Wall

Wall Demands		
P (kips)	29.5	Eq. 7-34
P (kips)	15.4	Eq. 7-34
V (kips)	111.7227273	
M (kip*ft)	782.1	

Lower-Bound Vertical Compressive Strength		
K	1	Table 6-1
r (in)	0.597	Weak Axis Radius of Gyration
h/r	141	
P_{CL} (kip)	113	TMS 402-13, Eq. 9-19, Eq. 9-20
KP_{CL} (kip)	113	
J	2	LS
C_1C_2	1.1	
$Q_G+(Q_E)/(JC1C2)$ (kip)	29.5	
DCR	0.26	

Permit Number: 19-05911

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Project No:	262019.034	Date:	

ASCE 41-13 Reinforced Masonry DCRs

Legend		
Input		
Calculated		
DCR/Check		

General Inputs		
Pier ID	Grid E200	
Location/Gridline	E200	
f'm (psi)	810	Table 11-2(a)
Em (ksi)	729	TMS 402-13, Sec 4.2.2.2.1
fme (psi)	1053	Table 11-1
fy (ksi)	40	
fye (ksi)	52	
Es (ksi)	29000	
Masonry Denisty (pcf)	125	
Nominal Pier Length (ft)	9	
Pier Height (H)	7.00	
Wall thickness (in)	8	
Roof Trib (SF)	216	
Roof DL (psf)	20	
Roof SL (psf)	25	
Mezz Trib (SF)	0	
Mezz DL (psf)	0	
Mezz LL (psf)	0	
2nd FLR Trib (SF)	216	
2nd FLR DL (psf)	35	
2nd FLR LL (psf)	40	
Shearline Tot Shear (kips)	769.7	BSE-2E
Shearline Tot Length (ft)	44	
Applicable Wall Trib Length (ft)	9	
Seismic Axial Load (kips)	0.0	Holdown Force From Wall Above
Holdown to Wall Centroid (ft)	0.0	
IO, LS, CP	CP	

General Calculation		
Wall Self-Weight (kips)	5.3	
DL (kips)	11.9	Super-imposed DL @ Top of Wall
LL (kips)	8.6	
SL (kips)	5.4	
$1.1(Q_D + Q_L + 0.2*Q_S)$	29.5	Eq. 7-1
$0.9(Q_D)$	15.4	Eq. 7-2
Shear/Unit Length (kip/ft)	17.5	
Wall Shear (Q_E) (kips)	157.4386364	
Moment Generated from Holdown (kip*ft)	0.0	About Centroid of Wall

Wall Demands		
P (kips)	29.5	Eq. 7-34
P (kips)	15.4	Eq. 7-34
V (kips)	157.4386364	
M (kip*ft)	1102.1	

Lower-Bound Vertical Compressive Strength		
K	1	Table 6-1
r (in)	0.597	Weak Axis Radius of Gyration
h/r	141	
P_{CL} (kip)	113	TMS 402-13, Eq. 9-19, Eq. 9-20
KP_{CL} (kip)	113	
J	2	LS
C_1C_2	1.1	
$Q_G+(Q_E)/(JC1C2)$ (kip)	29.5	
DCR	0.28	

Determine FC vs DC Table 11-6		
Mu/(Vudv)	0.07	
γ	1.0	#5 Bars or smaller
Vn (kips) upperbound	148	TMS 402-13, Eq. 9-22
Vn (kips) upperbound	-	TMS 402-13, Eq. 9-23
Vnm (kip)	99.3	TMS 402-13, Sec 9.3.4.1.2.1
Vn (kip)	99.3	TMS 402-13, Equation 9-21
Holdown Anchor Rod As (in^2)	0.31	At one wall end
a (in)	2.4	
Distance from Edge of Wall to Rod (in)	4	
d (in)	104	
Mn (kip*ft)	238	
Ve (kip)	34	
Shear vs. Flexure Control	Flexure Control	
An (in^2)	864	
f_{ae} (psi)	34.2	
Shear vs. Force Controlled	NA	

Determine m-factors Table 11-6		
fae/fme	0.032	
L/heff	1.29	
As (in^2)	0.31	Total Vertical Reinforcement
ρ_v	0.00036	
Av (in^2)	0.3	Total Vertical Reinforcement
ρ_h	0.0005	
$\rho_x$fye/fme	0.040	
m-factor	7.2	
m-factor restriction	7	
m-factor used	7.0	

Deformation Control DCRs		
Shear DCR	0.33	
Moment DCR	0.56	

Force Control DCRs		
Shear DCR	-	
Moment DCR	-	

Out-Of-Plane Capacity TMS 402-13, Sec 9.3.5		
d (in)	4	
a (in)	0.6	
Mn (kip*ft)	8.6	

Out-Of-Plane Demands TMS 402-13 Sec 9.3.5 & ASCE 41-13 Section 11.3.5-->7.2.11		
χ	1	ASCE 41-13, Table 7-2, CP
Sxs,1E	1.11	
h (ft)	14	Full Wall Height
w (psf)	100.0	Elevation Wall Unit Weight
Fp*L (plf)	399.6	ASCE 41-13, Eq. 7-13
Fp_min*L (plf)	90.0	ASCE 41-13, Eq. 7-14
Mu,o (kip*ft)	9.79	
n	39.3	
tsp (in)	8	
c (in)	0.7	TMS 402-13, Eq. 9-35
Ieff = Icr (in^4)	300	TMS 402-13, Eq. 9-34
Pe (kips)	314	TMS 402-13, Eq. 9-33
Ψ	1.104	TMS 402-13, Eq. 9-32
ΨMu,o (kip*ft)	10.81	TMS 402-13, Eq. 9-31

Out-Of-Plane DCR, Sec 11.3.5.3		
Flexure DCR	0.5	

Permit Number: 19-05911

ReidMiddleton
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Ph: 425 741-3800
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Client:	RFM	Designed By:	JJ
Project:	900 Bldg	Date:	12/18/2019
		Checked By:	
Project No:	262019.034	Date:	

ASCE 41-13 Reinforced Masonry DCRs

Legend		
Input		
Calculated		
DCR/Check		
General Inputs		
Pier ID	Grid E200	
Location/Gridline	E200	
f'm (psi)	810	Table 11-2(a)
Em (ksi)	729	TMS 402-13, Sec 4.2.2.2.1
fme (psi)	1053	Table 11-1
fy (ksi)	40	
fye (ksi)	52	
Es (ksi)	29000	
Masonry Denisty (pcf)	125	
Nominal Pier Length (ft)	22	
Pier Height (H)	14.00	
Wall thickness (in)	8	
Roof Trib (SF)	216	
Roof DL (psf)	20	
Roof SL (psf)	25	
Mezz Trib (SF)	0	
Mezz DL (psf)	0	
Mezz LL (psf)	0	
2nd FLR Trib (SF)	0	
2nd FLR DL (psf)	35	
2nd FLR LL (psf)	40	
Shearline Tot Shear (kips)	308.4	BSE-1E
Shearline Tot Length (ft)	46	
Applicable Wall Trib Length (ft)	22	
Seismic Axial Load (kips)	0.0	Holdown Force From Wall Above
Holdown to Wall Centroid (ft)	0.0	
IO, LS, CP	LS	
General Calculation		
Wall Self-Weight (kips)	25.7	
DL (kips)	4.3	Super-imposed DL @ Top of Wall
LL (kips)	0.0	
SL (kips)	5.4	
$1.1(Q_D + Q_L + 0.2*Q_S)$	34.2	Eq. 7-1
$0.9(Q_D)$	27.0	Eq. 7-2
Shear/Unit Length (kip/ft)	6.7	
Wall Shear (Q_E) (kips)	147.4556522	
Moment Generated from Holdown (kip*ft)	0.0	About Centroid of Wall
Wall Demands		
P (kips)	34.2	Eq. 7-34
P (kips)	27.0	Eq. 7-34
V (kips)	147.4556522	
M (kip*ft)	2064.9	
Lower-Bound Vertical Compressive Strength		
K	1	Table 6-1
r (in)	0.560	Weak Axis Radius of Gyration
h/r	300	
P_{CL} (kip)	61	TMS 402-13, Eq. 9-19, Eq. 9-20
KP_{CL} (kip)	61	
J	2	LS
C_1C_2	1.1	
$Q_G+(Q_E)/(JC1C2)$ (kip)	34.2	
DCR	0.56	

Determine FC vs DC Table 11-6		
Mu/(Vudv)	0.05	
γ	1.0	#5 Bars or smaller
Vn (kips) upperbound	361	TMS 402-13, Eq. 9-22
Vn (kips) upperbound	-	TMS 402-13, Eq. 9-23
Vnm (kip)	241.5	TMS 402-13, Sec 9.3.4.1.2.1
Vn (kip)	241.5	TMS 402-13, Equation 9-21
Holdown Anchor Rod As (in^2)	0.31	At one wall end
a (in)	2.4	
Distance from Edge of Wall to Rod (in)	4	
d (in)	260	
Mn (kip*ft)	840	
Ve (kip)	61	
Shear vs. Flexure Control	Flexure Control	
An (in^2)	2112	
f_{ae} (psi)	16.2	
Shear vs. Force Controlled	NA	
Determine m-factors Table 11-6		
fae/fme	0.015	
L/heff	1.57	
As (in^2)	0.62	Total Vertical Reinforcement
ρ_v	0.00029	
Av (in^2)	0.6	Total Vertical Reinforcement
ρ_h	0.0005	
$\rho_g$fye/fme	0.037	
m-factor	6.5	
m-factor restriction	7	
m-factor used	6.5	
Deformation Control DCRs		
Shear DCR	0.09	
Moment DCR	0.38	
Force Control DCRs		
Shear DCR	-	
Moment DCR	-	
Out-Of-Plane Capacity TMS 402-13, Sec 9.3.5		
d (in)	4	
a (in)	0.3	
Mn (kip*ft)	16.5	
Out-Of-Plane Demands TMS 402-13 Sec 9.3.5 & ASCE 41-13 Section 11.3.5-->7.2.11		
χ	1.3	ASCE 41-13, Table 7-2, LS
Sxs,1E	0.71	
h (ft)	14	Full Wall Height
w (psf)	100.0	Elevation Wall Unit Weight
Fp*L (plf)	812.2	ASCE 41-13, Eq. 7-13
Fp_min*L (plf)	226.0	ASCE 41-13, Eq. 7-14
Mu,o (kip*ft)	19.90	
n	39.6	
tsp (in)	8	
c (in)	0.4	TMS 402-13, Eq. 9-35
Ieff = Icr (in^4)	653	TMS 402-13, Eq. 9-34
Pe (kips)	169	TMS 402-13, Eq. 9-33
Ψ	1.253	TMS 402-13, Eq. 9-32
ΨMu,o (kip*ft)	24.94	TMS 402-13, Eq. 9-31
Out-Of-Plane DCR, Sec 11.3.5.3		
Flexure DCR	0.7	

Permit Number: 19-05911

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Project:	900 Bldg	Date:	12/18/2019
		Checked By:	
Project No:	262019.034	Date:	

ASCE 41-13 Reinforced Masonry DCRs

Legend		
Input		
Calculated		
DCR/Check		

General Inputs		
Pier ID	Grid E200	
Location/Gridline	E200	
f'm (psi)	810	Table 11-2(a)
Em (ksi)	729	TMS 402-13, Sec 4.2.2.2.1
fme (psi)	1053	Table 11-1
fy (ksi)	40	
fye (ksi)	52	
Es (ksi)	29000	
Masonry Denisty (pcf)	125	
Nominal Pier Length (ft)	22	
Pier Height (H)	14.00	
Wall thickness (in)	8	
Roof Trib (SF)	216	
Roof DL (psf)	20	
Roof SL (psf)	25	
Mezz Trib (SF)	0	
Mezz DL (psf)	0	
Mezz LL (psf)	0	
2nd FLR Trib (SF)	0	
2nd FLR DL (psf)	35	
2nd FLR LL (psf)	40	
Shearline Tot Shear (kips)	479.5	BSE-2E
Shearline Tot Length (ft)	46	
Applicable Wall Trib Length (ft)	22	
Seismic Axial Load (kips)	0.0	Holdown Force From Wall Above
Holdown to Wall Centroid (ft)	0.0	
IO, LS, CP	CP	

General Calculation		
Wall Self-Weight (kips)	23.7	
DL (kips)	4.3	Super-imposed DL @ Top of Wall
LL (kips)	0.0	
SL (kips)	5.4	
$1.1(Q_D + Q_L + 0.2*Q_S)$	34.2	Eq. 7-1
$0.9(Q_D)$	27.0	Eq. 7-2
Shear/Unit Length (kip/ft)	10.4	
Wall Shear (Q_E) (kips)	229.326087	
Moment Generated from Holdown (kip*ft)	0.0	About Centroid of Wall

Wall Demands		
P (kips)	34.2	Eq. 7-34
P (kips)	27.0	Eq. 7-34
V (kips)	229.326087	
M (kip*ft)	3210.6	

Lower-Bound Vertical Compressive Strength		
K	1	Table 6-1
r (in)	0.560	Weak Axis Radius of Gyration
h/r	300	
P_{CL} (kip)	61	TMS 402-13, Eq. 9-19, Eq. 9-20
KP_{CL} (kip)	61	
J	2	LS
C_1C_2	1.1	
$Q_G+(Q_E)/(JC1C2)$ (kip)	34.2	
DCR	0.56	

Determine FC vs DC Table 11-6		
Mu/(Vudv)	0.05	
γ	1.0	#5 Bars or smaller
Vn (kips) upperbound	361	TMS 402-13, Eq. 9-22
Vn (kips) upperbound	-	TMS 402-13, Eq. 9-23
Vnm (kip)	241.5	TMS 402-13, Sec 9.3.4.1.2.1
Vn (kip)	241.5	TMS 402-13, Equation 9-21
Holdown Anchor Rod As (in^2)	0.31	At one wall end
a (in)	2.4	
Distance from Edge of Wall to Rod (in)	4	
d (in)	260	
Mn (kip*ft)	839	
Ve (kip)	61	
Shear vs. Flexure Control	Flexure Control	
An (in^2)	2112	
f_{ae} (psi)	16.2	
Shear vs. Force Controlled	NA	

Determine m-factors Table 11-6		
fae/fme	0.015	
L/heff	1.57	
As (in^2)	0.62	Total Vertical Reinforcement
ρ_v	0.00029	
Av (in^2)	0.6	Total Vertical Reinforcement
ρ_h	0.0005	
$\rho_g$fye/fme	0.037	
m-factor	7.5	
m-factor restriction	7	
m-factor used	7.0	

Deformation Control DCRs		
Shear DCR	0.14	
Moment DCR	0.54	

Force Control DCRs		
Shear DCR	-	
Moment DCR	-	

Out-Of-Plane Capacity TMS 402-13, Sec 9.3.5		
d (in)	4	
a (in)	0.3	
Mn (kip*ft)	16.5	

Out-Of-Plane Demands TMS 402-13 Sec 9.3.5 & ASCE 41-13 Section 11.3.5-->7.2.11		
χ	1	ASCE 41-13, Table 7-2, CP
Sxs,1E	1.11	
h (ft)	14	Full Wall Height
w (psf)	100.0	Elevation Wall Unit Weight
Fp*L (plf)	976.3	ASCE 41-13, Eq. 7-13
Fp_min*L (plf)	220.0	ASCE 41-13, Eq. 7-14
Mu,o (kip*ft)	23.93	
n	36.0	
tsp (in)	8	
c (in)	0.4	TMS 402-13, Eq. 9-35
Ieff = Icr (in^4)	663	TMS 402-13, Eq. 9-34
Pe (kips)	169	TMS 402-13, Eq. 9-33
Ψ	1.253	TMS 402-13, Eq. 9-32
ΨMu,o (kip*ft)	30.00	TMS 402-13, Eq. 9-31

Out-Of-Plane DCR, Sec 11.3.5.3		
Flexure DCR	0.8	

Permit Number: 19-05911

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Project:	900 Bldg	Date:	12/18/2019
		Checked By:	
Project No:	262019.034	Date:	

ASCE 41-13 Reinforced Masonry DCRs

Legend		
Input		
Calculated		
DCR/Check		
General Inputs		
Pier ID	Grid E230	
Location/Gridline	E230	
f'm (psi)	810	Table 11-2(a)
Em (ksi)	729	TMS 402-13, Sec 4.2.2.2.1
fme (psi)	1053	Table 11-1
fy (ksi)	40	
fye (ksi)	52	
Es (ksi)	29000	
Masonry Denisty (pcf)	125	
Nominal Pier Length (ft)	50	
Pier Height (H)	14.00	
Wall thickness (in)	8	
Roof Trib (SF)	1125	
Roof DL (psf)	20	
Roof SL (psf)	25	
Mezz Trib (SF)	400	
Mezz DL (psf)	35	
Mezz LL (psf)	40	
2nd FLR Trib (SF)	400	
2nd FLR DL (psf)	35	
2nd FLR LL (psf)	40	
Shearline Tot Shear (kips)	460.3	BSE-1E
Shearline Tot Length (ft)	50	
Applicable Wall Trib Length (ft)	50	
Seismic Axial Load (kips)	0.0	Holdown Force From Wall Above
Holdown to Wall Centroid (ft)	0.0	
IO, LS, CP	LS	
General Calculation		
Wall Self-Weight (kips)	53.3	
DL (kips)	50.5	Super-imposed DL @ Top of Wall
LL (kips)	32.0	
SL (kips)	28.1	
$1.1(Q_D + Q_L + 0.2*Q_S)$	161.1	Eq. 7-1
$0.9(Q_D)$	93.0	Eq. 7-2
Shear/Unit Length (kip/ft)	9.2	
Wall Shear (Q_E) (kips)	460.3	
Moment Generated from Holdown (kip*ft)	0.0	About Centroid of Wall
Wall Demands		
P (kips)	161.1	Eq. 7-34
P (kips)	98.0	Eq. 7-34
V (kips)	460.3	
M (kip*ft)	6444.2	
Lower-Bound Vertical Compressive Strength		
K	1	Table 6-1
r (in)	0.551	Weak Axis Radius of Gyration
h/r	305	
P_{CL} (kip)	132	TMS 402-13, Eq. 9-19, Eq. 9-20
KP_{CL} (kip)	132	
J	2	LS
C_1C_2	1.1	
$Q_G+(Q_E)/(JC1C2)$ (kip)	161.1	
DCR	1.22	

Determine FC vs DC Table 11-6		
Mu/(Vudv)	0.02	
γ	1.0	#5 Bars or smaller
Vn (kips) upperbound	820	TMS 402-13, Eq. 9-22
Vn (kips) upperbound	-	TMS 402-13, Eq. 9-23
Vnm (kip)	565.3	TMS 402-13, Sec 9.3.4.1.2.1
Vn (kip)	565.3	TMS 402-13, Equation 9-21
Holdown Anchor Rod As (in^2)	0.31	At one wall end
a (in)	2.4	
Distance from Edge of Wall to Rod (in)	4	
d (in)	596	
Mn (kip*ft)	5470	
Ve (kip)	391	
Shear vs. Flexure Control	Flexure Control	
An (in^2)	4800	
f_{ae} (psi)	33.6	
Shear vs. Force Controlled	NA	
Determine m-factors Table 11-6		
fae/fme	0.032	
L/heff	3.57	
As (in^2)	0.62	Total Vertical Reinforcement
ρ_v	0.00013	
Av (in^2)	0.6	Total Vertical Reinforcement
ρ_h	0.0005	
$\rho_g$fye/fme	0.029	
m-factor	6.8	
m-factor restriction	7	
m-factor used	6.8	
Deformation Control DCRs		
Shear DCR	0.12	
Moment DCR	0.17	
Force Control DCRs		
Shear DCR	-	
Moment DCR	-	
Out-Of-Plane Capacity TMS 402-13, Sec 9.3.5		
d (in)	4	
a (in)	0.5	
Mn (kip*ft)	38.5	
Out-Of-Plane Demands TMS 402-13 Sec 9.3.5 & ASCE 41-13 Section 11.3.5-->7.2.11		
χ	1.3	ASCE 41-13, Table 7-2, LS
Sxs,1E	0.71	
h (ft)	14	Full Wall Height
w (psf)	100.0	Elevation Wall Unit Weight
Fp*L (plf)	1846.0	ASCE 41-13, Eq. 7-13
Fp _min*L (plf)	650.0	ASCE 41-13, Eq. 7-14
Mu,o (kip*ft)	45.23	
n	39.8	
tsp (in)	8	
c (in)	0.6	TMS 402-13, Eq. 9-35
Ieff = Icr (in^4)	1456	TMS 402-13, Eq. 9-34
Pe (kips)	371	TMS 402-13, Eq. 9-33
Ψ	1.767	TMS 402-13, Eq. 9-32
ΨMu,o (kip*ft)	79.92	TMS 402-13, Eq. 9-31
Out-Of-Plane DCR, Sec 11.3.5.3		
Flexure DCR	0.8	

Permit Number: 19-05911

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Client:	RFM	Designed By:	JJ
Project:	900 Bldg	Date:	12/18/2019
		Checked By:	
Project No:	262019.034	Date:	

ASCE 41-13 Reinforced Masonry DCRs

Legend		
Input	(yellow)	
Calculated	(green)	
DCR/Check	(blue)	

General Inputs		
Pier ID	Grid E230	
Location/Gridline	E230	
f'm (psi)	810	Table 11-2(a)
Em (ksi)	729	TMS 402-13, Sec 4.2.2.2.1
fme (psi)	1053	Table 11-1
fy (ksi)	40	
fye (ksi)	52	
Es (ksi)	29000	
Masonry Denisty (pcf)	125	
Nominal Pier Length (ft)	50	
Pier Height (H)	14.00	
Wall thickness (in)	8	
Roof Trib (SF)	1125	
Roof DL (psf)	20	
Roof SL (psf)	25	
Mezz Trib (SF)	400	
Mezz DL (psf)	35	
Mezz LL (psf)	40	
2nd FLR Trib (SF)	400	
2nd FLR DL (psf)	35	
2nd FLR LL (psf)	40	
Shearline Tot Shear (kips)	715.7	BSE-2E
Shearline Tot Length (ft)	50	
Applicable Wall Trib Length (ft)	50	
Seismic Axial Load (kips)	0.0	Holdown Force From Wall Above
Holdown to Wall Centroid (ft)	0.0	
IO, LS, CP	CP	

General Calculation		
Wall Self-Weight (kips)	58.3	
DL (kips)	50.5	Super-imposed DL @ Top of Wall
LL (kips)	32.0	
SL (kips)	28.1	
$1.1(Q_D + Q_L + 0.2*Q_S)$	161.1	Eq. 7-1
$0.9(Q_D)$	98.0	Eq. 7-2
Shear/Unit Length (kip/ft)	14.3	
Wall Shear (Q_E) (kips)	715.7	
Moment Generated from Holdown (kip*ft)	0.0	About Centroid of Wall

Wall Demands		
P (kips)	161.1	Eq. 7-34
P (kips)	98.0	Eq. 7-34
V (kips)	715.7	
M (kip*ft)	10019.8	

Lower-Bound Vertical Compressive Strength		
K	1	Table 6-1
r (in)	0.592	Weak Axis Radius of Gyration
h/r	284	
P_{CL} (kip)	154	TMS 402-13, Eq. 9-19, Eq. 9-20
KP_{CL} (kip)	154	
J	2	LS
C_1C_2	1.1	
$Q_G+(Q_E)/(JC1C2)$ (kip)	161.1	
DCR	1.05	

Determine FC vs DC Table 11-6		
Mu/(Vudv)	0.02	
γ	1.0	#5 Bars or smaller
Vn (kips) upperbound	820	TMS 402-13, Eq. 9-22
Vn (kips) upperbound	-	TMS 402-13, Eq. 9-23
Vnm (kip)	565.3	TMS 402-13, Sec 9.3.4.1.2.1
Vn (kip)	565.3	TMS 402-13, Equation 9-21
Holdown Anchor Rod As (in^2)	0.31	At one wall end
a (in)	2.4	
Distance from Edge of Wall to Rod (in)	4	
d (in)	595	
Mn (kip*ft)	5470	
Ve (kip)	391	
Shear vs. Flexure Control	Flexure Control	
An (in^2)	4800	
f_{ae} (psi)	33.6	
Shear vs. Force Controlled	NA	

Determine m-factors Table 11-6		
fae/fme	0.032	
L/heff	3.57	
As (in^2)	1.24	Total Vertical Reinforcement
ρ_v	0.00026	
Av (in^2)	1.2	Total Vertical Reinforcement
ρ_h	0.0009	
$\rho_g$fye/fme	0.058	
m-factor	7.3	
m-factor restriction	7	
m-factor used	7.0	

Deformation Control DCRs		
Shear DCR	0.18	
Moment DCR	0.26	

Force Control DCRs		
Shear DCR	-	
Moment DCR	-	

Out-Of-Plane Capacity TMS 402-13, Sec 9.3.5		
d (in)	4	
a (in)	0.5	
Mn (kip*ft)	45.9	

Out-Of-Plane Demands TMS 402-13 Sec 9.3.5 & ASCE 41-13 Section 11.3.5-->7.2.11		
χ	1	ASCE 41-13, Table 7-2, CP
Sxs,1E	1.11	
h (ft)	14	Full Wall Height
w (psf)	100.0	Elevation Wall Unit Weight
Fp*L (plf)	2220.0	ASCE 41-13, Eq. 7-13
Fp _min*L (plf)	500.0	ASCE 41-13, Eq. 7-14
Mu,o (kip*ft)	54.39	
n	39.8	
tsp (in)	8	
c (in)	0.7	TMS 402-13, Eq. 9-35
Ieff = Icr (in^4)	1682	TMS 402-13, Eq. 9-34
Pe (kips)	429	TMS 402-13, Eq. 9-33
Ψ	1.602	TMS 402-13, Eq. 9-32
ΨMu,o (kip*ft)	87.12	TMS 402-13, Eq. 9-31

Out-Of-Plane DCR, Sec 11.3.5.3		
Flexure DCR	0.3	

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		Checked By:	
Project No:	262019.034	Date:	

ASCE 41-13 Reinforced Masonry DCRs

Legend		
Input		
Calculated		
DCR/Check		

General Inputs		
Pier ID	Grid E230	
Location/Gridline	E230	
f'm (psi)	810	Table 11-2(a)
Em (ksi)	729	TMS 402-13, Sec 4.2.2.2.1
fme (psi)	1053	Table 11-1
fy (ksi)	40	
fye (ksi)	52	
Es (ksi)	29000	
Masonry Denisty (pcf)	125	
Nominal Pier Length (ft)	6	
Pier Height (H)	7.00	
Wall thickness (in)	8	
Roof Trib (SF)	158	
Roof DL (psf)	20	
Roof SL (psf)	25	
Mezz Trib (SF)	56	
Mezz DL (psf)	35	
Mezz LL (psf)	40	
2nd FLR Trib (SF)	0	
2nd FLR DL (psf)	35	
2nd FLR LL (psf)	40	
Shearline Tot Shear (kips)	326	BSE-1E
Shearline Tot Length (ft)	25	
Applicable Wall Trib Length (ft)	6	
Seismic Axial Load (kips)	0.0	Holdown Force From Wall Above
Holdown to Wall Centroid (ft)	0.0	
IO, LS, CP	LS	

General Calculation		
Wall Self-Weight (kips)	3.5	
DL (kips)	5.1	Super-imposed DL @ Top of Wall
LL (kips)	2.2	
SL (kips)	4.0	
$1.1(Q_D + Q_L + 0.2*Q_S)$	12.8	Eq. 7-1
$0.9(Q_D)$	7.8	Eq. 7-2
Shear/Unit Length (kip/ft)	13.0	
Wall Shear (Q_E) (kips)	78.24	
Moment Generated from Holdown (kip*ft)	0.0	About Centroid of Wall

Wall Demands		
P (kips)	12.8	Eq. 7-34
P (kips)	7.8	Eq. 7-34
V (kips)	78.24	
M (kip*ft)	547.7	

Lower-Bound Vertical Compressive Strength		
K	1	Table 6-1
r (in)	0.630	Weak Axis Radius of Gyration
h/r	133	
P_{CL} (kip)	85	TMS 402-13, Eq. 9-19, Eq. 9-20
KP_{CL} (kip)	85	
J	2	LS
C_1C_2	1.1	
$Q_G+(Q_E)/(JC1C2)$ (kip)	12.8	
DCR	0.15	

Determine FC vs DC Table 11-6		
Mu/(Vudv)	0.10	
γ	1.0	#5 Bars or smaller
Vn (kips) upperbound	98	TMS 402-13, Eq. 9-22
Vn (kips) upperbound	-	TMS 402-13, Eq. 9-23
Vnm (kip)	64.6	TMS 402-13, Sec 9.3.4.1.2.1
Vn (kip)	64.6	TMS 402-13, Equation 9-21
Holdown Anchor Rod As (in^2)	0.31	At one wall end
a (in)	2.4	
Distance from Edge of Wall to Rod (in)	4	
d (in)	68	
Mn (kip*ft)	112	
Ve (kip)	16	
Shear vs. Flexure Control	Flexure Control	
An (in^2)	576	
f_{ae} (psi)	22.2	
Shear vs. Force Controlled	NA	

Determine m-factors Table 11-6		
fae/fme	0.021	
L/heff	0.86	
As (in^2)	0.31	Total Vertical Reinforcement
ρ_v	0.00054	
Av (in^2)	0.3	Total Vertical Reinforcement
ρ_h	0.0005	
$\rho_g$fye/fme	0.049	
m-factor	5.3	
m-factor restriction	7	
m-factor used	5.3	

Deformation Control DCRs		
Shear DCR	0.23	
Moment DCR	0.93	

Force Control DCRs		
Shear DCR	-	
Moment DCR	-	

Out-Of-Plane Capacity TMS 402-13, Sec 9.3.5		
d (in)	4	
a (in)	0.5	
Mn (kip*ft)	6.3	

Out-Of-Plane Demands TMS 402-13 Sec 9.3.5 & ASCE 41-13 Section 11.3.5-->7.2.11		
χ	1.3	ASCE 41-13, Table 7-2, LS
Sxs,1E	0.71	
h (ft)	14	Full Wall Height
w (psf)	100.0	Elevation Wall Unit Weight
Fp*L (plf)	221.5	ASCE 41-13, Eq. 7-13
Fp _min*L (plf)	78.0	ASCE 41-13, Eq. 7-14
Mu,o (kip*ft)	5.43	
n	39.8	
tsp (in)	8	
c (in)	0.7	TMS 402-13, Eq. 9-35
Ieff = Icr (in^4)	229	TMS 402-13, Eq. 9-34
Pe (kips)	233	TMS 402-13, Eq. 9-33
Ψ	1.058	TMS 402-13, Eq. 9-32
ΨMu,o (kip*ft)	5.74	TMS 402-13, Eq. 9-31

Out-Of-Plane DCR, Sec 11.3.5.3		
Flexure DCR	0.4	

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Project:	900 Bldg
Project No:	262019.034

ASCE 41-13 Reinforc

Legend		
Input		
Calculated		
DCR/Check		

General Inputs		
Pier ID	Grid E230	
Location/Gridline	E230	
f'm (psi)	810	Table 11-2(a)
Em (ksi)	729	TMS 402-13, Sec 4.2.2.2.1
fme (psi)	1053	Table 11-1
fy (ksi)	40	
fye (ksi)	52	
Es (ksi)	29000	
Masonry Denisty (pcf)	125	
Nominal Pier Length (ft)	6	
Pier Height (H)	7.00	
Wall thickness (in)	8	
Roof Trib (SF)	158	
Roof DL (psf)	20	
Roof SL (psf)	25	
Mezz Trib (SF)	56	
Mezz DL (psf)	35	
Mezz LL (psf)	40	
2nd FLR Trib (SF)	0	
2nd FLR DL (psf)	35	
2nd FLR LL (psf)	40	
Shearline Tot Shear (kips)	326	BSE-1E
Shearline Tot Length (ft)	25	
Applicable Wall Trib Length (ft)	6	
Seismic Axial Load (kips)	0.0	Holdown Force From Wall Above
Holdown to Wall Centroid (ft)	0.0	
IO, LS, CP	LS	

General Calculation		
Wall Self-Weight (kips)	3.5	
DL (kips)	5.1	Super-imposed DL @ Top of Wall
LL (kips)	2.2	
SL (kips)	4.0	
$1.1(Q_D + Q_L + 0.2*Q_S)$	12.8	Eq. 7-1
$0.9(Q_D)$	7.8	Eq. 7-2
Shear/Unit Length (kip/ft)	13.0	
Wall Shear (Q_E) (kips)	78.24	
Moment Generated from Holdown (kip*ft)	0.0	About Centroid of Wall

Wall Demands		
P (kips)	12.8	Eq. 7-34
P (kips)	7.8	Eq. 7-34
V (kips)	78.24	
M (kip*ft)	547.7	

Lower-Bound Vertical Compressive Strength		
K	1	Table 6-1
r (in)	0.630	Weak Axis Radius of Gyration
h/r	133	
P_{CL} (kip)	85	TMS 402-13, Eq. 9-19, Eq. 9-20
KP_{CL} (kip)	85	
J	2	LS
C_1C_2	1.1	
$Q_G+(Q_E)/(JC1C2)$ (kip)	12.8	
DCR	0.15	

Permit Number: 19-05911

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Project:	900 Bldg	Date:	12/18/2019
		Checked By:	
Project No:	262019.034	Date:	

ASCE 41-13 Reinforced Masonry DCRs

Legend		
Input		
Calculated		
DCR/Check		

General Inputs		
Pier ID	Grid E230	
Location/Gridline	E230	
f'm (psi)	810	Table 11-2(a)
Em (ksi)	729	TMS 402-13, Sec 4.2.2.2.1
fme (psi)	1053	Table 11-1
fy (ksi)	40	
fye (ksi)	52	
Es (ksi)	29000	
Masonry Denisty (pcf)	125	
Nominal Pier Length (ft)	6	
Pier Height (H)	7.00	
Wall thickness (in)	8	
Roof Trib (SF)	325	
Roof DL (psf)	20	
Roof SL (psf)	25	
Mezz Trib (SF)	300	
Mezz DL (psf)	35	
Mezz LL (psf)	40	
2nd FLR Trib (SF)	0	
2nd FLR DL (psf)	35	
2nd FLR LL (psf)	40	
Shearline Tot Shear (kips)	506.9	BSE-2E
Shearline Tot Length (ft)	25	
Applicable Wall Trib Length (ft)	6	
Seismic Axial Load (kips)	0.0	Holdown Force From Wall Above
Holdown to Wall Centroid (ft)	0.0	
IO, LS, CP	CP	

General Calculation		
Wall Self-Weight (kips)	3.5	
DL (kips)	17.0	Super-imposed DL @ Top of Wall
LL (kips)	12.0	
SL (kips)	8.1	
$1.1(Q_D + Q_L + 0.2*Q_S)$	37.5	Eq. 7-1
$0.9(Q_D)$	18.5	Eq. 7-2
Shear/Unit Length (kip/ft)	20.3	
Wall Shear (Q_E) (kips)	121.656	
Moment Generated from Holdown (kip*ft)	0.0	About Centroid of Wall

Wall Demands		
P (kips)	37.5	Eq. 7-34
P (kips)	18.5	Eq. 7-34
V (kips)	121.656	
M (kip*ft)	851.6	

Lower-Bound Vertical Compressive Strength		
K	1	Table 6-1
r (in)	0.691	Weak Axis Radius of Gyration
h/r	122	
P_{CL} (kip)	102	TMS 402-13, Eq. 9-19, Eq. 9-20
KP_{CL} (kip)	102	
J	2	LS
C_1C_2	1.1	
$Q_G+(Q_E)/(JC1C2)$ (kip)	37.5	
DCR	0.37	

Determine FC vs DC Table 11-6		
Mu/(Vudv)	0.10	
γ	1.0	#5 Bars or smaller
Vn (kips) upperbound	98	TMS 402-13, Eq. 9-22
Vn (kips) upperbound	-	TMS 402-13, Eq. 9-23
Vnm (kip)	67.2	TMS 402-13, Sec 9.3.4.1.2.1
Vn (kip)	67.2	TMS 402-13, Equation 9-21
Holdown Anchor Rod As (in^2)	0.31	At one wall end
a (in)	2.4	
Distance from Edge of Wall to Rod (in)	4	
d (in)	68	
Mn (kip*ft)	172	
Ve (kip)	25	
Shear vs. Flexure Control	Flexure Control	
An (in^2)	576	
f_{ae} (psi)	65.2	
Shear vs. Force Controlled	NA	

Determine m-factors Table 11-6		
fae/fme	0.062	
L/heff	0.86	
As (in^2)	0.31	Total Vertical Reinforcement
ρ_v	0.00054	
Av (in^2)	0.3	Total Vertical Reinforcement
ρ_h	0.0005	
$\rho_v$fye/fme	0.049	
m-factor	4.9	
m-factor restriction	7	
m-factor used	4.9	

Deformation Control DCRs		
Shear DCR	0.37	
Moment DCR	1.00	

Force Control DCRs		
Shear DCR	-	
Moment DCR	-	

Out-Of-Plane Capacity TMS 402-13, Sec 9.3.5		
d (in)	4	
a (in)	1.1	
Mn (kip*ft)	8.9	

Out-Of-Plane Demands TMS 402-13 Sec 9.3.5 & ASCE 41-13 Section 11.3.5-->7.2.11		
χ	1	ASCE 41-13, Table 7-2, CP
Sxs,1E	1.11	
h (ft)	14	Full Wall Height
w (psf)	100.0	Elevation Wall Unit Weight
Fp*L (plf)	266.4	ASCE 41-13, Eq. 7-13
Fp_min*L (plf)	60.0	ASCE 41-13, Eq. 7-14
Mu,o (kip*ft)	6.53	
n	39.8	
tsp (in)	8	
c (in)	1.3	TMS 402-13, Eq. 9-35
Ieff = Icr (in^4)	275	TMS 402-13, Eq. 9-34
Pe (kips)	280	TMS 402-13, Eq. 9-33
Ψ	1.155	TMS 402-13, Eq. 9-32
ΨMu,o (kip*ft)	7.54	TMS 402-13, Eq. 9-31

Out-Of-Plane DCR, Sec 11.3.5.3		
Flexure DCR	0.8	

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		Checked By:	
Project No:	262019.034	Date:	

ASCE 41-13 Reinforced Masonry DCRs

Legend		
Input		
Calculated		
DCR/Check		

General Inputs		
Pier ID	Grid E245	
Location/Gridline	E245	
f'm (psi)	810	Table 11-2(a)
Em (ksi)	729	TMS 402-13, Sec 4.2.2.2.1
fme (psi)	1053	Table 11-1
fy (ksi)	40	
fye (ksi)	52	
Es (ksi)	29000	
Masonry Denisty (pcf)	125	
Nominal Pier Length (ft)	27	
Pier Height (H)	14.00	
Wall thickness (in)	8	
Roof Trib (SF)	405	
Roof DL (psf)	20	
Roof SL (psf)	25	
Mezz Trib (SF)	202	
Mezz DL (psf)	35	
Mezz LL (psf)	40	
2nd FLR Trib (SF)	405	
2nd FLR DL (psf)	35	
2nd FLR LL (psf)	40	
Shearline Tot Shear (kips)	388.5	BSE-1E
Shearline Tot Length (ft)	27	
Applicable Wall Trib Length (ft)	27	
Seismic Axial Load (kips)	0.0	Holdown Force From Wall Above
Holdown to Wall Centroid (ft)	0.0	
IO, LS, CP	LS	

General Calculation		
Wall Self-Weight (kips)	31.5	
DL (kips)	29.3	Super-imposed DL @ Top of Wall
LL (kips)	24.3	
SL (kips)	10.1	
$1.1(Q_D + Q_L + 0.2^*Q_S)$	95.9	Eq. 7-1
$0.9(Q_D)$	54.8	Eq. 7-2
Shear/Unit Length (kip/ft)	14.4	
Wall Shear (Q_E) (kips)	388.5	
Moment Generated from Holdown (kip*ft)	0.0	About Centroid of Wall

Wall Demands		
P (kips)	95.9	Eq. 7-34
P (kips)	54.8	Eq. 7-34
V (kips)	388.5	
M (kip*ft)	5439.0	

Lower-Bound Vertical Compressive Strength		
K	1	Table 6-1
r (in)	0.549	Weak Axis Radius of Gyration
h/r	306	
P_{CL} (kip)	71	TMS 402-13, Eq. 9-19, Eq. 9-20
KP_{CL} (kip)	71	
J	2	LS
C_1C_2	1.1	
$Q_G+(Q_E)/(JC1C2)$ (kip)	95.9	
DCR	1.35	

Determine FC vs DC Table 11-6		
Mu/(Vudv)	0.04	
γ	1.0	#5 Bars or smaller
Vn (kips) upperbound	443	TMS 402-13, Eq. 9-22
Vn (kips) upperbound	-	TMS 402-13, Eq. 9-23
Vnm (kip)	303.1	TMS 402-13, Sec 9.3.4.1.2.1
Vn (kip)	303.1	TMS 402-13, Equation 9-21
Holdown Anchor Rod As (in^2)	0.31	At one wall end
a (in)	2.4	
Distance from Edge of Wall to Rod (in)	4	
d (in)	320	
Mn (kip*ft)	1784	
Ve (kip)	127	
Shear vs. Flexure Control	Flexure Control	
An (in^2)	2592	
f_{ae} (psi)	37.0	
Shear vs. Force Controlled	NA	

Determine m-factors Table 11-6		
fae/fme	0.035	
L/heff	1.93	
As (in^2)	0.31	Total Vertical Reinforcement
ρ_v	0.00012	
Av (in^2)	0.3	Total Vertical Reinforcement
ρ_h	0.0002	
$\rho_g$fye/fme	0.017	
m-factor	6.9	
m-factor restriction	7	
m-factor used	6.9	

Deformation Control DCRs		
Shear DCR	0.19	
Moment DCR	0.44	

Force Control DCRs		
Shear DCR	-	
Moment DCR	-	

Out-Of-Plane Capacity TMS 402-13, Sec 9.3.5		
d (in)	4	
a (in)	0.5	
Mn (kip*ft)	20.9	

Out-Of-Plane Demands TMS 402-13 Sec 9.3.5 & ASCE 41-13 Section 11.3.5-->7.2.11		
χ	1.3	ASCE 41-13, Table 7-2, LS
Sxs,1E	0.71	
h (ft)	14	Full Wall Height
w (psf)	100.0	Elevation Wall Unit Weight
Fp*L (plf)	996.8	ASCE 41-13, Eq. 7-13
Fp _min*L (plf)	351.0	ASCE 41-13, Eq. 7-14
Mu,o (kip*ft)	24.42	
n	39.8	
tsp (in)	8	
c (in)	0.6	TMS 402-13, Eq. 9-35
Ieff = Icr (in^4)	781	TMS 402-13, Eq. 9-34
Pe (kips)	193	TMS 402-13, Eq. 9-33
Ψ	1.929	TMS 402-13, Eq. 9-32
ΨMu,o (kip*ft)	47.11	TMS 402-13, Eq. 9-31

Out-Of-Plane DCR, Sec 11.3.5.3		
Flexure DCR	1.0	

Permit Number: 19-05911

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Project No:	262019.034	Date:	

ASCE 41-13 Reinforced Masonry DCRs

Legend		
Input		
Calculated		
DCR/Check		
General Inputs		
Pier ID	Grid E245	
Location/Gridline	E245	
f'm (psi)	810	Table 11-2(a)
Em (ksi)	729	TMS 402-13, Sec 4.2.2.2.1
fme (psi)	1053	Table 11-1
fy (ksi)	40	
fye (ksi)	52	
Es (ksi)	29000	
Masonry Denisty (pcf)	125	
Nominal Pier Length (ft)	27	
Pier Height (H)	14.00	
Wall thickness (in)	8	
Roof Trib (SF)	405	
Roof DL (psf)	20	
Roof SL (psf)	25	
Mezz Trib (SF)	202	
Mezz DL (psf)	35	
Mezz LL (psf)	40	
2nd FLR Trib (SF)	405	
2nd FLR DL (psf)	35	
2nd FLR LL (psf)	40	
Shearline Tot Shear (kips)	604.3	BSE-2E
Shearline Tot Length (ft)	27	
Applicable Wall Trib Length (ft)	27	
Seismic Axial Load (kips)	0.0	Holdown Force From Wall Above
Holdown to Wall Centroid (ft)	0.0	
IO, LS, CP	CP	
General Calculation		
Wall Self-Weight (kips)	31.5	
DL (kips)	29.3	Super-imposed DL @ Top of Wall
LL (kips)	24.3	
SL (kips)	10.1	
$1.1(Q_D + Q_L + 0.2^*Q_S)$	95.9	Eq. 7-1
$0.9(Q_D)$	54.8	Eq. 7-2
Shear/Unit Length (kip/ft)	22.4	
Wall Shear (Q_E) (kips)	604.3	
Moment Generated from Holdown (kip*ft)	0.0	About Centroid of Wall
Wall Demands		
P (kips)	95.9	Eq. 7-34
P (kips)	54.8	Eq. 7-34
V (kips)	604.3	
M (kip*ft)	8460.2	
Lower-Bound Vertical Compressive Strength		
K	1	Table 6-1
r (in)	0.587	Weak Axis Radius of Gyration
h/r	286	
P_{CL} (kip)	81	TMS 402-13, Eq. 9-19, Eq. 9-20
KP_{CL} (kip)	81	
J	2	LS
C_1C_2	1.1	
$Q_G+(Q_E)/(JC1C2)$ (kip)	95.9	
DCR	1.18	

Determine FC vs DC Table 11-6		
Mu/(Vudv)	0.04	
γ	1.0	#5 Bars or smaller
Vn (kips) upperbound	443	TMS 402-13, Eq. 9-22
Vn (kips) upperbound	-	TMS 402-13, Eq. 9-23
Vnm (kip)	303.1	TMS 402-13, Sec 9.3.4.1.2.1
Vn (kip)	303.1	TMS 402-13, Equation 9-21
Holdown Anchor Rod As (in^2)	0.31	At one wall end
a (in)	2.4	
Distance from Edge of Wall to Rod (in)	4	
d (in)	320	
Mn (kip*ft)	1784	
Ve (kip)	127	
Shear vs. Flexure Control	Flexure Control	
An (in^2)	2592	
f_{ae} (psi)	37.0	
Shear vs. Force Controlled	NA	
Determine m-factors Table 11-6		
fae/fme	0.035	
L/heff	1.93	
As (in^2)	0.62	Total Vertical Reinforcement
ρ_v	0.00024	
Av (in^2)	0.6	Total Vertical Reinforcement
ρ_h	0.0005	
$\rho_e$fye/fme	0.035	
m-factor	7.7	
m-factor restriction	7	
m-factor used	7.0	
Deformation Control DCRs		
Shear DCR	0.28	
Moment DCR	0.68	
Force Control DCRs		
Shear DCR	-	
Moment DCR	-	
Out-Of-Plane Capacity TMS 402-13, Sec 9.3.5		
d (in)	4	
a (in)	0.6	
Mn (kip*ft)	24.6	
Out-Of-Plane Demands TMS 402-13 Sec 9.3.5 & ASCE 41-13 Section 11.3.5-->7.2.11		
χ	1	ASCE 41-13, Table 7-2, CP
Sxs,1E	1.11	
h (ft)	14	Full Wall Height
w (psf)	100.0	Elevation Wall Unit Weight
Fp*L (plf)	1198.8	ASCE 41-13, Eq. 7-13
Fp_min*L (plf)	270.0	ASCE 41-13, Eq. 7-14
Mu,o (kip*ft)	29.37	
n	35.8	
tsp (in)	8	
c (in)	0.7	TMS 402-13, Eq. 9-35
Ieff = Icr (in^4)	892	TMS 402-13, Eq. 9-34
Pe (kips)	227	TMS 402-13, Eq. 9-33
Ψ	1.729	TMS 402-13, Eq. 9-32
ΨMu,o (kip*ft)	50.77	TMS 402-13, Eq. 9-31
Out-Of-Plane DCR, Sec 11.3.5.3		
Flexure DCR	0.3	

Permit Number: 19-05911

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Project No:	262019.034	Date:	

ASCE 41-13 Reinforced Masonry DCRs

Legend		
Input		
Calculated		
DCR/Check		

General Inputs		
Pier ID	Grid E245	
Location/Gridline	E245	
f'm (psi)	810	Table 11-2(a)
Em (ksi)	729	TMS 402-13, Sec 4.2.2.2.1
fme (psi)	1053	Table 11-1
fy (ksi)	40	
fye (ksi)	52	
Es (ksi)	29000	
Masonry Denisty (pcf)	125	
Nominal Pier Length (ft)	30	
Pier Height (H)	14.00	
Wall thickness (in)	8	
Roof Trib (SF)	405	
Roof DL (psf)	20	
Roof SL (psf)	25	
Mezz Trib (SF)	202	
Mezz DL (psf)	35	
Mezz LL (psf)	40	
2nd FLR Trib (SF)	0	
2nd FLR DL (psf)	35	
2nd FLR LL (psf)	40	
Shearline Tot Shear (kips)	222.4	BSE-1E
Shearline Tot Length (ft)	30	
Applicable Wall Trib Length (ft)	30	
Seismic Axial Load (kips)	0.0	Holdown Force From Wall Above
Holdown to Wall Centroid (ft)	0.0	
IO, LS, CP	LS	

General Calculation		
Wall Self-Weight (kips)	35.0	
DL (kips)	15.2	Super-imposed DL @ Top of Wall
LL (kips)	8.1	
SL (kips)	10.1	
$1.1(Q_D + Q_L + 0.2*Q_S)$	66.3	Eq. 7-1
$0.9(Q_D)$	45.2	Eq. 7-2
Shear/Unit Length (kip/ft)	7.4	
Wall Shear (Q_E) (kips)	222.4	
Moment Generated from Holdown (kip*ft)	0.0	About Centroid of Wall

Wall Demands		
P (kips)	66.3	Eq. 7-34
P (kips)	45.2	Eq. 7-34
V (kips)	222.4	
M (kip*ft)	3113.6	

Lower-Bound Vertical Compressive Strength		
K	1	Table 6-1
r (in)	0.550	Weak Axis Radius of Gyration
h/r	305	
P_{CL} (kip)	80	TMS 402-13, Eq. 9-19, Eq. 9-20
KP_{CL} (kip)	80	
J	2	LS
C_1C_2	1.1	
$Q_G+(Q_E)/(JC1C2)$ (kip)	66.3	
DCR	0.83	

Determine FC vs DC Table 11-6		
Mu/(Vudv)	0.04	
γ	1.0	#5 Bars or smaller
Vn (kips) upperbound	492	TMS 402-13, Eq. 9-22
Vn (kips) upperbound	-	TMS 402-13, Eq. 9-23
Vnm (kip)	333.5	TMS 402-13, Sec 9.3.4.1.2.1
Vn (kip)	333.5	TMS 402-13, Equation 9-21
Holdown Anchor Rod As (in^2)	0.31	At one wall end
a (in)	2.4	
Distance from Edge of Wall to Rod (in)	4	
d (in)	356	
Mn (kip*ft)	1702	
Ve (kip)	122	
Shear vs. Flexure Control	Flexure Control	
An (in^2)	2880	
f_{ae} (psi)	23.0	
Shear vs. Force Controlled	NA	

Determine m-factors Table 11-6		
fae/fme	0.022	
L/heff	2.14	
As (in^2)	0.62	Total Vertical Reinforcement
ρ_v	0.00022	
Av (in^2)	0.6	Total Vertical Reinforcement
ρ_h	0.0005	
$\rho_g$fye/fme	0.033	
m-factor	6.7	
m-factor restriction	7	
m-factor used	6.7	

Deformation Control DCRs		
Shear DCR	0.10	
Moment DCR	0.27	

Force Control DCRs		
Shear DCR	-	
Moment DCR	-	

Out-Of-Plane Capacity TMS 402-13, Sec 9.3.5		
d (in)	4	
a (in)	0.4	
Mn (kip*ft)	22.2	

Out-Of-Plane Demands TMS 402-13 Sec 9.3.5 & ASCE 41-13 Section 11.3.5-->7.2.11		
χ	1.3	ASCE 41-13, Table 7-2, LS
Sxs,1E	0.71	
h (ft)	14	Full Wall Height
w (psf)	100.0	Elevation Wall Unit Weight
Fp*L (plf)	1107.6	ASCE 41-13, Eq. 7-13
Fp_min*L (plf)	390.0	ASCE 41-13, Eq. 7-14
Mu,o (kip*ft)	27.14	
n	39.2	
tsp (in)	8	
c (in)	0.5	TMS 402-13, Eq. 9-35
Ieff = Icr (in^4)	872	TMS 402-13, Eq. 9-34
Pe (kips)	222	TMS 402-13, Eq. 9-33
Ψ	1.425	TMS 402-13, Eq. 9-32
ΨMu,o (kip*ft)	38.67	TMS 402-13, Eq. 9-31

Out-Of-Plane DCR, Sec 11.3.5.3		
Flexure DCR	0.8	

Permit Number: 19-05911

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Client:	RFM	Designed By:	JJ
Project:	900 Bldg	Date:	12/18/2019
		Checked By:	
Project No:	262019.034	Date:	

ASCE 41-13 Reinforced Masonry DCRs

Legend		
Input		
Calculated		
DCR/Check		

General Inputs		
Pier ID	Grid E245	
Location/Gridline	E245	
f'm (psi)	810	Table 11-2(a)
Em (ksi)	729	TMS 402-13, Sec 4.2.2.2.1
fme (psi)	1053	Table 11-1
fy (ksi)	40	
fye (ksi)	52	
Es (ksi)	29000	
Masonry Denisty (pcf)	125	
Nominal Pier Length (ft)	30	
Pier Height (H)	14.00	
Wall thickness (in)	8	
Roof Trib (SF)	405	
Roof DL (psf)	20	
Roof SL (psf)	25	
Mezz Trib (SF)	202	
Mezz DL (psf)	35	
Mezz LL (psf)	40	
2nd FLR Trib (SF)	0	
2nd FLR DL (psf)	35	
2nd FLR LL (psf)	40	
Shearline Tot Shear (kips)	345.9	BSE-2E
Shearline Tot Length (ft)	30	
Applicable Wall Trib Length (ft)	30	
Seismic Axial Load (kips)	0.0	Holdown Force From Wall Above
Holdown to Wall Centroid (ft)	0.0	
IO, LS, CP	CP	

General Calculation		
Wall Self-Weight (kips)	35.0	
DL (kips)	15.2	Super-imposed DL @ Top of Wall
LL (kips)	8.1	
SL (kips)	10.1	
$1.1(Q_D + Q_L + 0.2*Q_S)$	66.3	Eq. 7-1
$0.9(Q_D)$	45.2	Eq. 7-2
Shear/Unit Length (kip/ft)	11.5	
Wall Shear (Q_E) (kips)	345.9	
Moment Generated from Holdown (kip*ft)	0.0	About Centroid of Wall

Wall Demands		
P (kips)	66.3	Eq. 7-34
P (kips)	45.2	Eq. 7-34
V (kips)	345.9	
M (kip*ft)	4842.6	

Lower-Bound Vertical Compressive Strength		
K	1	Table 6-1
r (in)	0.587	Weak Axis Radius of Gyration
h/r	286	
P_{CL} (kip)	91	TMS 402-13, Eq. 9-19, Eq. 9-20
KP_{CL} (kip)	91	
J	2	LS
C_1C_2	1.1	
$Q_G+(Q_E)/(JC1C2)$ (kip)	66.3	
DCR	0.73	

Determine FC vs DC Table 11-6		
Mu/(Vudv)	0.04	
γ	1.0	#5 Bars or smaller
Vn (kips) upperbound	492	TMS 402-13, Eq. 9-22
Vn (kips) upperbound	-	TMS 402-13, Eq. 9-23
Vnm (kip)	333.5	TMS 402-13, Sec 9.3.4.1.2.1
Vn (kip)	333.5	TMS 402-13, Equation 9-21
Holdown Anchor Rod As (in^2)	0.31	At one wall end
a (in)	2.4	
Distance from Edge of Wall to Rod (in)	4	
d (in)	356	
Mn (kip*ft)	1702	
Ve (kip)	122	
Shear vs. Flexure Control	Flexure Control	
An (in^2)	2880	
f_{ae} (psi)	23.0	
Shear vs. Force Controlled	NA	

Determine m-factors Table 11-6		
fae/fme	0.022	
L/heff	2.14	
As (in^2)	0.93	Total Vertical Reinforcement
ρ_v	0.00032	
Av (in^2)	0.9	Total Vertical Reinforcement
ρ_h	0.0007	
$\rho_g$fye/fme	0.050	
m-factor	7.5	
m-factor restriction	7	
m-factor used	7.0	

Deformation Control DCRs		
Shear DCR	0.15	
Moment DCR	0.41	

Force Control DCRs		
Shear DCR	-	
Moment DCR	-	

Out-Of-Plane Capacity TMS 402-13, Sec 9.3.5		
d (in)	4	
a (in)	0.4	
Mn (kip*ft)	25.9	

Out-Of-Plane Demands TMS 402-13 Sec 9.3.5 & ASCE 41-13 Section 11.3.5-->7.2.11		
χ	1	ASCE 41-13, Table 7-2, CP
Sxs,1E	1.11	
h (ft)	14	Full Wall Height
w (psf)	100.0	Elevation Wall Unit Weight
Fp*L (plf)	1332.0	ASCE 41-13, Eq. 7-13
Fp_min*L (plf)	200.0	ASCE 41-13, Eq. 7-14
Mu,o (kip*ft)	32.63	
n	30.6	
tsp (in)	8	
c (in)	0.6	TMS 402-13, Eq. 9-35
Ieff = Icr (in^4)	225	TMS 402-13, Eq. 9-34
Pe (kips)	255	TMS 402-13, Eq. 9-33
Ψ	1.355	TMS 402-13, Eq. 9-32
ΨMu,o (kip*ft)	44.22	TMS 402-13, Eq. 9-31

Out-Of-Plane DCR, Sec 11.3.5.3		
Flexure DCR	0.8	

Permit Number: 19-05911

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Project:	900 Bldg	Date:	12/18/2019
		Checked By:	
Project No:	262019.034	Date:	

ASCE 41-13 Reinforced Masonry DCRs

Legend		
Input		
Calculated		
DCR/Check		

General Inputs		
Pier ID	Grid E290	
Location/Gridline	E290	
f'm (psi)	810	Table 11-2(a)
Em (ksi)	729	TMS 402-13, Sec 4.2.2.2.1
fme (psi)	1053	Table 11-1
fy (ksi)	40	
fye (ksi)	52	
Es (ksi)	29000	
Masonry Denisty (pcf)	125	
Nominal Pier Length (ft)	10	
Pier Height (H)	7.00	
Wall thickness (in)	8	
Roof Trib (SF)	75	
Roof DL (psf)	20	
Roof SL (psf)	25	
Mezz Trib (SF)	0	
Mezz DL (psf)	0	
Mezz LL (psf)	0	
2nd FLR Trib (SF)	75	
2nd FLR DL (psf)	35	
2nd FLR LL (psf)	40	
Shearline Tot Shear (kips)	229.2	BSE-1E
Shearline Tot Length (ft)	41	
Applicable Wall Trib Length (ft)	10	
Seismic Axial Load (kips)	0.0	Holdown Force From Wall Above
Holdown to Wall Centroid (ft)	0.0	
IO, LS, CP	LS	

General Calculation		
Wall Self-Weight (kips)	5.8	
DL (kips)	4.1	Super-imposed DL @ Top of Wall
LL (kips)	3.0	
SL (kips)	1.9	
$1.1(Q_D + Q_L + 0.2*Q_S)$	14.7	Eq. 7-1
$0.9(Q_D)$	9.0	Eq. 7-2
Shear/Unit Length (kip/ft)	5.6	
Wall Shear (Q_E) (kips)	55.90243902	
Moment Generated from Holdown (kip*ft)	0.0	About Centroid of Wall

Wall Demands		
P (kips)	14.7	Eq. 7-34
P (kips)	9.0	Eq. 7-34
V (kips)	55.90243902	
M (kip*ft)	391.3	

Lower-Bound Vertical Compressive Strength		
K	1	Table 6-1
r (in)	0.534	Weak Axis Radius of Gyration
h/r	157	
P_{CL} (kip)	100	TMS 402-13, Eq. 9-19, Eq. 9-20
KP_{CL} (kip)	100	
J	2	LS
C_1C_2	1.1	
$Q_G+(Q_E)/(JC1C2)$ (kip)	14.7	
DCR	0.15	

Determine FC vs DC Table 11-6		
Mu/(Vudv)	0.06	
γ	1.0	#5 Bars or smaller
Vn (kips) upperbound	164	TMS 402-13, Eq. 9-22
Vn (kips) upperbound	-	TMS 402-13, Eq. 9-23
Vnm (kip)	108.6	TMS 402-13, Sec 9.3.4.1.2.1
Vn (kip)	108.6	TMS 402-13, Equation 9-21
Holdown Anchor Rod As (in^2)	0.31	At one wall end
a (in)	2.4	
Distance from Edge of Wall to Rod (in)	4	
d (in)	116	
Mn (kip*ft)	204	
Ve (kip)	29	
Shear vs. Flexure Control	Flexure Control	
An (in^2)	960	
f_{ae} (psi)	15.3	
Shear vs. Force Controlled	NA	

Determine m-factors Table 11-6		
fae/fme	0.015	
L/heff	1.43	
As (in^2)	0.31	Total Vertical Reinforcement
ρ_v	0.00032	
Av (in^2)	0.3	Total Vertical Reinforcement
ρ_h	0.0005	
$\rho_g$fye/fme	0.039	
m-factor	6.4	
m-factor restriction	7	
m-factor used	6.4	

Deformation Control DCRs		
Shear DCR	0.06	
Moment DCR	0.30	

Force Control DCRs		
Shear DCR	-	
Moment DCR	-	

Out-Of-Plane Capacity TMS 402-13, Sec 9.3.5		
d (in)	4	
a (in)	0.3	
Mn (kip*ft)	6.8	

Out-Of-Plane Demands TMS 402-13 Sec 9.3.5 & ASCE 41-13 Section 11.3.5-->7.2.11		
χ	1.3	ASCE 41-13, Table 7-2, LS
Sxs,1E	0.71	
h (ft)	14	Full Wall Height
w (psf)	120.0	Elevation Wall Unit Weight
Fp*L (plf)	355.2	ASCE 41-13, Eq. 7-13
Fp _min*L (plf)	13[illegible]	ASCE 41-13, Eq. 7-14
Mu,o (kip*ft)	9.05	
n	39.8	
tsp (in)	2	
c (in)	0.4	TMS 402-13, Eq. 9-35
Ieff = Icr (in^4)	273	TMS 402-13, Eq. 9-34
Pe (kips)	279	TMS 402-13, Eq. 9-33
Ψ	1.056	TMS 402-13, Eq. 9-32
ΨMu,o (kip*ft)	9.55	TMS 402-13, Eq. 9-31

Out-Of-Plane DCR, Sec 11.3.5.3		
Flexure DCR	0.6	

Permit Number: 19-05911

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Project:	900 Bldg	Date:	12/18/2019
		Checked By:	
Project No:	262019.034	Date:	

ASCE 41-13 Reinforced Masonry DCRs

Legend		
Input		
Calculated		
DCR/Check		

General Inputs		
Pier ID	Grid E290	
Location/Gridline	E290	
f'm (psi)	810	Table 11-2(a)
Em (ksi)	729	TMS 402-13, Sec 4.2.2.2.1
fme (psi)	1053	Table 11-1
fy (ksi)	40	
fye (ksi)	52	
Es (ksi)	29000	
Masonry Denisty (pcf)	125	
Nominal Pier Length (ft)	10	
Pier Height (H)	7.00	
Wall thickness (in)	8	
Roof Trib (SF)	75	
Roof DL (psf)	20	
Roof SL (psf)	25	
Mezz Trib (SF)	0	
Mezz DL (psf)	0	
Mezz LL (psf)	0	
2nd FLR Trib (SF)	75	
2nd FLR DL (psf)	35	
2nd FLR LL (psf)	40	
Shearline Tot Shear (kips)	356.6	BSE-2E
Shearline Tot Length (ft)	41	
Applicable Wall Trib Length (ft)	10	
Seismic Axial Load (kips)	0.0	Holdown Force From Wall Above
Holdown to Wall Centroid (ft)	0.0	
IO, LS, CP	CP	

General Calculation		
Wall Self-Weight (kips)	5.8	
DL (kips)	4.1	Super-imposed DL @ Top of Wall
LL (kips)	3.0	
SL (kips)	1.9	
$1.1(Q_D + Q_L + 0.2*Q_S)$	14.7	Eq. 7-1
$0.9(Q_D)$	8.9	Eq. 7-2
Shear/Unit Length (kip/ft)	8.7	
Wall Shear (Q_E) (kips)	85.97560975	
Moment Generated from Holdown (kip*ft)	0.0	About Centroid of Wall

Wall Demands		
P (kips)	14.7	Eq. 7-34
P (kips)	[illegible]	Eq. 7-34
V (kips)	85.97560976	
M (kip*ft)	601.8	

Lower-Bound Vertical Compressive Strength		
K	1	Table 6-1
r (in)	0.534	Weak Axis Radius of Gyration
h/r	157	
P_{CL} (kip)	100	TMS 402-13, Eq. 9-19, Eq. 9-20
KP_{CL} (kip)	100	
J	2	LS
C_1C_2	1.1	
$Q_G+(Q_E)/(JC1C2)$ (kip)	14.7	
DCR	0.15	

Determine FC vs DC Table 11-6		
Mu/(Vudv)	0.06	
γ	1.0	#5 Bars or smaller
Vn (kips) upperbound	164	TMS 402-13, Eq. 9-22
Vn (kips) upperbound	-	TMS 402-13, Eq. 9-23
Vnm (kip)	108.6	TMS 402-13, Sec 9.3.4.1.2.1
Vn (kip)	108.6	TMS 402-13, Equation 9-21
Holdown Anchor Rod As (in^2)	0.31	At one wall end
a (in)	2.4	
Distance from Edge of Wall to Rod (in)	4	
d (in)	116	
Mn (kip*ft)	204	
Ve (kip)	29	
Shear vs. Flexure Control	Flexure Control	
An (in^2)	960	
f_{ae} (psi)	15.3	
Shear vs. Force Controlled	NA	

Determine m-factors Table 11-6		
fae/fme	0.015	
L/heff	1.43	
As (in^2)	0.31	Total Vertical Reinforcement
ρ_v	0.00032	
Av (in^2)	0.3	Total Vertical Reinforcement
ρ_h	0.0005	
$\rho_g$fye/fme	0.039	
m-factor	7.5	
m-factor restriction	7	
m-factor used	7.0	

Deformation Control DCRs		
Shear DCR	0.11	
Moment DCR	0.43	

Force Control DCRs		
Shear DCR	-	
Moment DCR	-	

Out-Of-Plane Capacity TMS 402-13, Sec 9.3.5		
d (in)	4	
a (in)	0.3	
Mn (kip*ft)	6.8	

Out-Of-Plane Demands TMS 402-13 Sec 9.3.5 & ASCE 41-13 Section 11.3.5-->7.2.11		
χ	1	ASCE 41-13, Table 7-2, CP
Sxs,1E	1.11	
h (ft)	14	Full Wall Height
w (psf)	100.0	Elevation Wall Unit Weight
Fp*L (plf)	414.0	ASCE 41-13, Eq. 7-13
Fp _min*L (plf)	100.0	ASCE 41-13, Eq. 7-14
Mu,o (kip*ft)	10.28	
n	39.8	
tsp (in)	8	
c (in)	0.4	TMS 402-13, Eq. 9-35
Ieff = Icr (in^4)	373	TMS 402-13, Eq. 9-34
Pe (kips)	279	TMS 402-13, Eq. 9-33
Ψ	1.036	TMS 402-13, Eq. 9-32
ΨMu,o (kip*ft)	11.48	TMS 402-13, Eq. 9-31

Out-Of-Plane DCR, Sec 11.3.5.3		
Flexure DCR	0.8	

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Client:	RFM	Designed By:	JJ
Project:	900 Bldg	Date:	12/18/2019
		Checked By:	
Project No:	262019.034	Date:	

ASCE 41-13 Reinforced Masonry DCRs

Legend		
Input		
Calculated		
DCR/Check		

General Inputs		
Pier ID	Grid E290	
Location/Gridline	E290	
f'm (psi)	810	Table 11-2(a)
Em (ksi)	729	TMS 402-13, Sec 4.2.2.2.1
fme (psi)	1053	Table 11-1
fy (ksi)	40	
fye (ksi)	52	
Es (ksi)	29000	
Masonry Denisty (pcf)	125	
Nominal Pier Length (ft)	50	
Pier Height (H)	27.00	
Wall thickness (in)	8	
Roof Trib (SF)	75	
Roof DL (psf)	20	
Roof SL (psf)	25	
Mezz Trib (SF)	0	
Mezz DL (psf)	0	
Mezz LL (psf)	0	
2nd FLR Trib (SF)	0	
2nd FLR DL (psf)	35	
2nd FLR LL (psf)	40	
Shearline Tot Shear (kips)	110.9	BSE-1E
Shearline Tot Length (ft)	50	
Applicable Wall Trib Length (ft)	50	
Seismic Axial Load (kips)	0.0	Holdown Force From Wall Above
Holdown to Wall Centroid (ft)	0.0	
IO, LS, CP	LS	

General Calculation		
Wall Self-Weight (kips)	112.5	
DL (kips)	1.5	Super-imposed DL @ Top of Wall
LL (kips)	0.0	
SL (kips)	1.9	
$1.1(Q_D + Q_L + 0.2*Q_S)$	125.8	Eq. 7-1
$0.9(Q_D)$	102.6	Eq. 7-2
Shear/Unit Length (kip/ft)	2.2	
Wall Shear (Q_E) (kips)	110.9	
Moment Generated from Holdown (kip*ft)	0.0	About Centroid of Wall

Wall Demands		
P (kips)	125.8	Eq. 7-34
P (kips)	102.6	Eq. 7-34
V (kips)	110.9	
M (kip*ft)	2994.3	

Lower-Bound Vertical Compressive Strength		
K	1	Table 6-1
r (in)	0.742	Weak Axis Radius of Gyration
h/r	437	
P_{CL} (kip)	67	TMS 402-13, Eq. 9-19, Eq. 9-20
KP_{CL} (kip)	67	
J	2	LS
C_1C_2	1.1	
$Q_G+(Q_E)/(JC1C2)$ (kip)	125.8	
DCR	1.87	

Determine FC vs DC Table 11-6		
Mu/(Vudv)	0.05	
γ	1.0	#5 Bars or smaller
Vn (kips) upperbound	820	TMS 402-13, Eq. 9-22
Vn (kips) upperbound	-	TMS 402-13, Eq. 9-23
Vnm (kip)	561.3	TMS 402-13, Sec 9.3.4.1.2.1
Vn (kip)	561.3	TMS 402-13, Equation 9-21
Holdown Anchor Rod As (in^2)	0.31	At one wall end
a (in)	2.4	
Distance from Edge of Wall to Rod (in)	4	
d (in)	596	
Mn (kip*ft)	5700	
Ve (kip)	211	
Shear vs. Flexure Control	Flexure Control	
An (in^2)	4800	
f_{ae} (psi)	26.2	
Shear vs. Force Controlled	NA	

Determine m-factors Table 11-6		
fae/fme	0.025	
L/heff	1.85	
As (in^2)	4.03	Total Vertical Reinforcement
ρ_v	0.00084	
Av (in^2)	4.0	Total Vertical Reinforcement
ρ_h	0.0016	
$\rho_g$fye/fme	0.118	
m-factor	4.9	
m-factor restriction	7	
m-factor used	4.9	

Deformation Control DCRs		
Shear DCR	0.04	
Moment DCR	0.11	

Force Control DCRs		
Shear DCR	-	
Moment DCR	-	

Out-Of-Plane Capacity TMS 402-13, Sec 9.3.5		
d (in)	4	
a (in)	0.7	
Mn (kip*ft)	73.8	

Out-Of-Plane Demands TMS 402-13 Sec 9.3.5 & ASCE 41-13 Section 11.3.5-->7.2.11		
χ	1.3	ASCE 41-13, Table 7-2, LS
Sxs,1E	0.71	
h (ft)	14	Full Wall Height
w (psf)	[illegible]	Elevation Wall Unit Weight
Fp*L (plf)	[illegible]	ASCE 41-13, Eq. 7-13
Fp_min*L (plf)	650.0	ASCE 41-13, Eq. 7-14
Mu,o (kip*ft)	45.23	
n	20.8	
tsp (in)	8	
c (in)	0.9	TMS 402-13, Eq. 9-35
Ieff = Icr (in^4)	[illegible]	TMS 402-13, Eq. 9-34
Pe (kips)	131	TMS 402-13, Eq. 9-33
Ψ	[illegible]	TMS 402-13, Eq. 9-32
ΨMu,o (kip*ft)	148.25	TMS 402-13, Eq. 9-31

Out-Of-Plane DCR, Sec 11.3.5.3		
Flexure DCR	0.8	

Permit Number: 19-05911

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Client:	RFM	Designed By:	JJ
Project:	900 Bldg	Date:	12/18/2019
		Checked By:	
Project No:	262019.034	Date:	

ASCE 41-13 Reinforced Masonry DCRs

Legend		
Input		
Calculated		
DCR/Check		

General Inputs		
Pier ID	Grid E290	
Location/Gridline	E290	
f'm (psi)	810	Table 11-2(a)
Em (ksi)	729	TMS 402-13, Sec 4.2.2.2.1
fme (psi)	1053	Table 11-1
fy (ksi)	40	
fye (ksi)	52	
Es (ksi)	29000	
Masonry Denisty (pcf)	125	
Nominal Pier Length (ft)	50	
Pier Height (H)	14.00	
Wall thickness (in)	8	
Roof Trib (SF)	75	
Roof DL (psf)	20	
Roof SL (psf)	25	
Mezz Trib (SF)	0	
Mezz DL (psf)	0	
Mezz LL (psf)	0	
2nd FLR Trib (SF)	0	
2nd FLR DL (psf)	35	
2nd FLR LL (psf)	40	
Shearline Tot Shear (kips)	172.5	BSE-2E
Shearline Tot Length (ft)	50	
Applicable Wall Trib Length (ft)	50	
Seismic Axial Load (kips)	0.0	Holdown Force From Wall Above
Holdown to Wall Centroid (ft)	0.0	
IO, LS, CP	CP	

General Calculation		
Wall Self-Weight (kips)	58.3	
DL (kips)	1.5	Super-imposed DL @ Top of Wall
LL (kips)	0.0	
SL (kips)	1.9	
$1.1(Q_D + Q_L + 0.2*Q_S)$	66.2	Eq. 7-1
$0.9(Q_D)$	53.9	Eq. 7-2
Shear/Unit Length (kip/ft)	3.5	
Wall Shear (Q_E) (kips)	172.5	
Moment Generated from Holdown (kip*ft)	0.0	About Centroid of Wall

Wall Demands		
P (kips)	66.2	Eq. 7-34
P (kips)	53.9	Eq. 7-34
V (kips)	172.5	
M (kip*ft)	2415.0	

Lower-Bound Vertical Compressive Strength		
K	1	Table 6-1
r (in)	0.702	Weak Axis Radius of Gyration
h/r	239	
P_{CL} (kip)	224	TMS 402-13, Eq. 9-19, Eq. 9-20
KP_{CL} (kip)	224	
J	2	LS
C_1C_2	1.1	
$Q_G+(Q_E)/(JC1C2)$ (kip)	66.2	
DCR	0.30	

Determine FC vs DC Table 11-6		
Mu/(Vudv)	0.02	
γ	1.0	#5 Bars or smaller
Vn (kips) upperbound	820	TMS 402-13, Eq. 9-22
Vn (kips) upperbound	-	TMS 402-13, Eq. 9-23
Vnm (kip)	554.3	TMS 402-13, Sec 9.3.4.1.2.1
Vn (kip)	554.3	TMS 402-13, Equation 9-21
Holdown Anchor Rod As (in^2)	0.31	At one wall end
a (in)	2.4	
Distance from Edge of Wall to Rod (in)	4	
d (in)	596	
Mn (kip*ft)	3284	
Ve (kip)	235	
Shear vs. Flexure Control	Flexure Control	
An (in^2)	4800	
f_{ae} (psi)	13.8	
Shear vs. Force Controlled	NA	

Determine m-factors Table 11-6		
fae/fme	0.013	
L/heff	3.57	
As (in^2)	4.03	Total Vertical Reinforcement
ρ_v	0.00084	
Av (in^2)	4.0	Total Vertical Reinforcement
ρ_h	0.0030	
$\rho_g$fye/fme	0.190	
m-factor	4.5	
m-factor restriction	7	
m-factor used	4.5	

Deformation Control DCRs		
Shear DCR	0.07	
Moment DCR	0.16	

Force Control DCRs		
Shear DCR	-	
Moment DCR	-	

Out-Of-Plane Capacity TMS 402-13, Sec 9.3.5		
d (in)	4	
a (in)	0.6	
Mn (kip*ft)	66.4	

Out-Of-Plane Demands TMS 402-13 Sec 9.3.5 & ASCE 41-13 Section 11.3.5-->7.2.11		
χ	1	ASCE 41-13, Table 7-2, CP
Sxs,1E	1.11	
h (ft)	14	Full Wall Height
w (psf)	100.0	Elevation Wall Unit Weight
Fp*L (plf)	2240.0	ASCE 41-13, Eq. 7-13
Fp _min*L (plf)	[illegible]	ASCE 41-13, Eq. 7-14
Mu,o (kip*ft)	54.89	
n	32.8	
tsp (in)	8	
c (in)	0.7	TMS 402-13, Eq. 9-35
Ieff = Icr (in^4)	2553	TMS 402-13, Eq. 9-34
Pe (kips)	602	TMS 402-13, Eq. 9-33
Ψ	1.124	TMS 402-13, Eq. 9-32
ΨMu,o (kip*ft)	[illegible]	TMS 402-13, Eq. 9-31

Out-Of-Plane DCR, Sec 11.3.5.3		
Flexure DCR	0.4	

Permit Number: 19-05911

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Project:	900 Bldg	Date:	12/18/2019
		Checked By:	
Project No:	262019.034	Date:	

ASCE 41-13 Reinforced Masonry DCRs

Legend		
Input		
Calculated		
DCR/Check		
General Inputs		
Pier ID	Grid 50	
Location/Gridline	50	
f'm (psi)	810	Table 11-2(a)
Em (ksi)	729	TMS 402-13, Sec 4.2.2.2.1
fme (psi)	1053	Table 11-1
fy (ksi)	40	
fye (ksi)	52	
Es (ksi)	29000	
Masonry Denisty (pcf)	125	
Nominal Pier Length (ft)	30	
Pier Height (H)	14.00	
Wall thickness (in)	8	
Roof Trib (SF)	60	
Roof DL (psf)	20	
Roof SL (psf)	25	
Mezz Trib (SF)	0	
Mezz DL (psf)	0	
Mezz LL (psf)	0	
2nd FLR Trib (SF)	60	
2nd FLR DL (psf)	35	
2nd FLR LL (psf)	40	
Shearline Tot Shear (kips)	211.6	BSE-1E
Shearline Tot Length (ft)	30	
Applicable Wall Trib Length (ft)	30	
Seismic Axial Load (kips)	0.0	Holdown Force From Wall Above
Holdown to Wall Centroid (ft)	0.0	
IO, LS, CP	LS	
General Calculation		
Wall Self-Weight (kips)	35.0	
DL (kips)	3.3	Super-imposed DL @ Top of Wall
LL (kips)	2.4	
SL (kips)	1.5	
$1.1(Q_D + Q_L + 0.2^*Q_S)$	45.1	Eq. 7-1
$0.9(Q_D)$	34.5	Eq. 7-2
Shear/Unit Length (kip/ft)	7.1	
Wall Shear (Q_E) (kips)	211.6	
Moment Generated from Holdown (kip*ft)	0.0	About Centroid of Wall
Wall Demands		
P (kips)	45.1	Eq. 7-34
P (kips)	34.5	Eq. 7-34
V (kips)	211.6	
M (kip*ft)	2962.4	
Lower-Bound Vertical Compressive Strength		
K	1	Table 6-1
r (in)	0.521	Weak Axis Radius of Gyration
h/r	323	
P_{CL} (kip)	71	TMS 402-13, Eq. 9-19, Eq. 9-20
KP_{CL} (kip)	71	
J	2	LS
C_1C_2	1.1	
$Q_G+(Q_E)/(JC1C2)$ (kip)	45.1	
DCR	0.63	

Determine FC vs DC Table 11-6		
Mu/(Vudv)	0.04	
γ	1.0	#5 Bars or smaller
Vn (kips) upperbound	492	TMS 402-13, Eq. 9-22
Vn (kips) upperbound	-	TMS 402-13, Eq. 9-23
Vnm (kip)	330.8	TMS 402-13, Sec 9.3.4.1.2.1
Vn (kip)	330.8	TMS 402-13, Equation 9-21
Holdown Anchor Rod As (in^2)	0.31	At one wall end
a (in)	2.4	
Distance from Edge of Wall to Rod (in)	4	
d (in)	356	
Mn (kip*ft)	1386	
Ve (kip)	99	
Shear vs. Flexure Control	Flexure Control	
An (in^2)	2880	
f_{ae} (psi)	15.7	
Shear vs. Force Controlled	NA	
Determine m-factors Table 11-6		
fae/fme	0.015	
L/heff	2.14	
As (in^2)	0.62	Total Vertical Reinforcement
ρ_v	0.00022	
Av (in^2)	0.6	Total Vertical Reinforcement
ρ_h	0.0005	
$\rho_g$fye/fme	0.033	
m-factor	6.7	
m-factor restriction	7	
m-factor used	6.7	
Deformation Control DCRs		
Shear DCR	0.10	
Moment DCR	0.12	
Force Control DCRs		
Shear DCR	-	
Moment DCR	-	
Out-Of-Plane Capacity TMS 402-13, Sec 9.3.5		
d (in)	4	
a (in)	0.3	
Mn (kip*ft)	19.0	
Out-Of-Plane Demands TMS 402-13 Sec 9.3.5 & ASCE 41-13 Section 11.3.5-->7.2.11		
χ	1.3	ASCE 41-13, Table 7-2, LS
Sxs,1E	0.71	
h (ft)	14	Full Wall Height
w (psf)	100.0	Elevation Wall Unit Weight
Fp*L (plf)	1107.6	ASCE 41-13, Eq. 7-13
Fp_min*L (plf)	390.0	ASCE 41-13, Eq. 7-14
Mu,o (kip*ft)	27.14	
n	39.8	
tsp (in)	8	
c (in)	0.4	TMS 402-13, Eq. 9-35
Ieff = Icr (in^4)	781	TMS 402-13, Eq. 9-34
Pe (kips)	199	TMS 402-13, Eq. 9-33
Ψ	1.293	TMS 402-13, Eq. 9-32
ΨMu,o (kip*ft)	35.08	TMS 402-13, Eq. 9-31
Out-Of-Plane DCR, Sec 11.3.S.3		
Flexure DCR	0.8	

Permit Number: 19-05911

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Project:	900 Bldg	Date:	12/18/2019
		Checked By:	
Project No:	262019.034	Date:	

ASCE 41-13 Reinforced Masonry DCRs

Legend		
Input		
Calculated		
DCR/Check		
General Inputs		
Pier ID	Grid 50	
Location/Gridline	50	
f'm (psi)	810	Table 11-2(a)
Em (ksi)	729	TMS 402-13, Sec 4.2.2.2.1
fme (psi)	1053	Table 11-1
fy (ksi)	40	
fye (ksi)	52	
Es (ksi)	29000	
Masonry Denisty (pcf)	125	
Nominal Pier Length (ft)	30	
Pier Height (H)	14.00	
Wall thickness (in)	8	
Roof Trib (SF)	60	
Roof DL (psf)	20	
Roof SL (psf)	25	
Mezz Trib (SF)	0	
Mezz DL (psf)	0	
Mezz LL (psf)	0	
2nd FLR Trib (SF)	60	
2nd FLR DL (psf)	35	
2nd FLR LL (psf)	40	
Shearline Tot Shear (kips)	329.2	BSE-2E
Shearline Tot Length (ft)	30	
Applicable Wall Trib Length (ft)	30	
Seismic Axial Load (kips)	0.0	Holdown Force From Wall Above
Holdown to Wall Centroid (ft)	0.0	
IO, LS, CP	CP	
General Calculation		
Wall Self-Weight (kips)	35.0	
DL (kips)	3.3	Super-imposed DL @ Top of Wall
LL (kips)	2.4	
SL (kips)	1.5	
$1.1(Q_D + Q_L + 0.2 * Q_S)$	45.1	Eq. 7-1
$0.9(Q_D)$	34.5	Eq. 7-2
Shear/Unit Length (kip/ft)	11.0	
Wall Shear (Q_E) (kips)	329.2	
Moment Generated from Holdown (kip*ft)	0.0	About Centroid of Wall
Wall Demands		
P (kips)	45.1	Eq. 7-34
P (kips)	34.5	Eq. 7-34
V (kips)	329.2	
M (kip*ft)	4608.8	
Lower-Bound Vertical Compressive Strength		
K	1	Table 6-1
r (in)	0.563	Weak Axis Radius of Gyration
h/r	298	
P_{CL} (kip)	84	TMS 402-13, Eq. 9-19, Eq. 9-20
KP_{CL} (kip)	84	
J	2	LS
C_1C_2	1.1	
$Q_G+(Q_E)/(JC1C2)$ (kip)	45.1	
DCR	0.54	

Determine FC vs DC Table 11-6		
Mu/(Vudv)	0.04	
γ	1.0	#5 Bars or smaller
Vn (kips) upperbound	492	TMS 402-13, Eq. 9-22
Vn (kips) upperbound	-	TMS 402-13, Eq. 9-23
Vnm (kip)	330.8	TMS 402-13, Sec 9.3.4.1.2.1
Vn (kip)	330.8	TMS 402-13, Equation 9-21
Holdown Anchor Rod As (in^2)	0.31	At one wall end
a (in)	2.4	
Distance from Edge of Wall to Rod (in)	4	
d (in)	356	
Mn (kip*ft)	1386	
Ve (kip)	99	
Shear vs. Flexure Control	Flexure Control	
An (in^2)	2880	
f_{ae} (psi)	15.7	
Shear vs. Force Controlled	NA	
Determine m-factors Table 11-6		
fae/fme	0.015	
L/heff	2.14	
As (in^2)	0.93	Total Vertical Reinforcement
ρ_v	0.00032	
Av (in^2)	0.9	Total Vertical Reinforcement
ρ_h	0.0007	
$\rho_g$fye/fme	0.050	
m-factor	7.5	
m-factor restriction	7	
m-factor used	7.0	
Deformation Control DCRs		
Shear DCR	0.14	
Moment DCR	0.88	
Force Control DCRs		
Shear DCR	-	
Moment DCR	-	
Out-Of-Plane Capacity TMS 402-13, Sec 9.3.5		
d (in)	4	
a (in)	0.4	
Mn (kip*ft)	22.8	
Out-Of-Plane Demands TMS 402-13 Sec 9.3.5 & ASCE 41-13 Section 11.3.5-->7.2.11		
χ	1	ASCE 41-13, Table 7-2, CP
Sxs,1E	1.11	
h (ft)	14	Full Wall Height
w (psf)	[illegible]	Elevation Wall Unit Weight
Fp*L (plf)	[illegible]	ASCE 41-13, Eq. 7-13
Fp_min*L (plf)	[illegible]	ASCE 41-13, Eq. 7-14
Mu,o (kip*ft)	32.53	
n	39.2	
tsp (in)	[illegible]	
c (in)	[illegible]	TMS 402-13, Eq. 9-35
Ieff = Icr (in^4)	[illegible]	TMS 402-13, Eq. 9-34
Pe (kips)	233	TMS 402-13, Eq. 9-33
Ψ	[illegible]	TMS 402-13, Eq. 9-32
ΨMu,o (kip*ft)	[illegible]	TMS 402-13, Eq. 9-31
Out-Of-Plane DCR, Sec 11.3.5.3		
Flexure DCR	0.8	

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Project: 900 Bldg		Date:	12/18/2019
		Checked By:	
Project No: 262019.034		Date:	

ASCE 41-13 Reinforced Masonry DCRs

Legend		
Input		
Calculated		
DCR/Check		

General Inputs		
Pier ID	Grid 50	
Location/Gridline	50	
f'm (psi)	810	Table 11-2(a)
Em (ksi)	729	TMS 402-13, Sec 4.2.2.2.1
fme (psi)	1053	Table 11-1
fy (ksi)	40	
fye (ksi)	52	
Es (ksi)	29000	
Masonry Denisty (pcf)	125	
Nominal Pier Length (ft)	30	
Pier Height (H)	14.00	
Wall thickness (in)	8	
Roof Trib (SF)	20	
Roof DL (psf)	20	
Roof SL (psf)	25	
Mezz Trib (SF)	0	
Mezz DL (psf)	0	
Mezz LL (psf)	0	
2nd FLR Trib (SF)	0	
2nd FLR DL (psf)	35	
2nd FLR LL (psf)	40	
Shearline Tot Shear (kips)	102.4	BSE-1E
Shearline Tot Length (ft)	30	
Applicable Wall Trib Length (ft)	30	
Seismic Axial Load (kips)	0.0	Holdown Force From Wall Above
Holdown to Wall Centroid (ft)	0.0	
IO, LS, CP	LS	

General Calculation		
Wall Self-Weight (kips)	35.0	
DL (kips)	0.4	Super-imposed DL @ Top of Wall
LL (kips)	0.0	
SL (kips)	0.5	
$1.1(Q_D + Q_L + 0.2 \cdot Q_S)$	39.1	Eq. 7-1
$0.9(Q_D)$	31.9	Eq. 7-2
Shear/Unit Length (kip/ft)	3.4	
Wall Shear (Q_E) (kips)	102.4	
Moment Generated from Holdown (kip*ft)	0.0	About Centroid of Wall

Wall Demands		
P (kips)	39.1	Eq. 7-34
P (kips)	31.9	Eq. 7-34
V (kips)	102.4	
M (kip*ft)	1433.6	

Lower-Bound Vertical Compressive Strength		
K	1	Table 6-1
r (in)	0.705	Weak Axis Radius of Gyration
h/r	238	
P_{CL} (kip)	136	TMS 402-13, Eq. 9-19, Eq. 9-20
KP_{CL} (kip)	136	
J	2	LS
C_1C_2	1.1	
$Q_G+(Q_E)/(JC1C2)$ (kip)	39.1	
DCR	0.29	

Determine FC vs DC Table 11-6		
Mu/(Vudv)	0.04	
γ	1.0	#5 Bars or smaller
Vn (kips) upperbound	492	TMS 402-13, Eq. 9-22
Vn (kips) upperbound	-	TMS 402-13, Eq. 9-23
Vnm (kip)	330.2	TMS 402-13, Sec 9.3.4.1.2.1
Vn (kip)	330.2	TMS 402-13, Equation 9-21
Holdown Anchor Rod As (in^2)	0.31	At one wall end
a (in)	2.4	
Distance from Edge of Wall to Rod (in)	4	
d (in)	356	
Mn (kip*ft)	1309	
Ve (kip)	93	
Shear vs. Flexure Control	Flexure Control	
An (in^2)	2880	
f_{ae} (psi)	13.6	
Shear vs. Force Controlled	NA	

Determine m-factors Table 11-6		
fae/fme	0.013	
L/heff	2.14	
As (in^2)	2.48	Total Vertical Reinforcement
ρ_v	0.00086	
Av (in^2)	2.5	Total Vertical Reinforcement
ρ_h	0.0018	
$\rho_g$fye/fme	0.134	
m-factor	4.7	
m-factor restriction	7	
m-factor used	4.7	

Deformation Control DCRs		
Shear DCR	0.07	
Moment DCR	0.73	

Force Control DCRs		
Shear DCR	-	
Moment DCR	-	

Out-Of-Plane Capacity TMS 402-13, Sec 9.3.5		
d (in)	4	
a (in)	0.6	
Mn (kip*ft)	40.5	

Out-Of-Plane Demands TMS 402-13 Sec 9.3.5 & ASCE 41-13 Section 11.3.5-->7.2.11		
χ	1.3	ASCE 41-13, Table 7-2, LS
Sxs,1E	0.71	
h (ft)	14	Full Wall Height
w (psf)	100.0	Elevation Wall Unit Weight
Fp*L (plf)	1107.6	ASCE 41-13, Eq. 7-13
Fp_min*L (plf)	390.0	ASCE 41-13, Eq. 7-14
Mu,o (kip*ft)	27.14	
n	39.8	
tsp (in)	8	
c (in)	0.7	TMS 402-13, Eq. 9-35
Ieff = Icr (in^4)	1433	TMS 402-13, Eq. 9-34
Pe (kips)	365	TMS 402-13, Eq. 9-33
Ψ	1.120	TMS 402-13, Eq. 9-32
ΨMu,o (kip*ft)	30.38	TMS 402-13, Eq. 9-31

Out-Of-Plane DCR, Sec 11.3.5.3		
Flexure DCR	0.8	

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		Checked By:	
Project No:	262019.034	Date:	

ASCE 41-13 Reinforced Masonry DCRs

Legend		
Input		
Calculated		
DCR/Check		

General Inputs		
Pier ID	Grid 50	
Location/Gridline	50	
f'm (psi)	810	Table 11-2(a)
Em (ksi)	729	TMS 402-13, Sec 4.2.2.2.1
fme (psi)	1053	Table 11-1
fy (ksi)	40	
fye (ksi)	52	
Es (ksi)	29000	
Masonry Denisty (pcf)	125	
Nominal Pier Length (ft)	30	
Pier Height (H)	14.00	
Wall thickness (in)	8	
Roof Trib (SF)	20	
Roof DL (psf)	20	
Roof SL (psf)	25	
Mezz Trib (SF)	0	
Mezz DL (psf)	0	
Mezz LL (psf)	0	
2nd FLR Trib (SF)	0	
2nd FLR DL (psf)	35	
2nd FLR LL (psf)	40	
Shearline Tot Shear (kips)	159.3	BSE-2E
Shearline Tot Length (ft)	30	
Applicable Wall Trib Length (ft)	30	
Seismic Axial Load (kips)	0.0	Holdown Force From Wall Above
Holdown to Wall Centroid (ft)	0.0	
IO, LS, CP	CP	

General Calculation		
Wall Self-Weight (kips)	35.0	
DL (kips)	0.4	Super-imposed DL @ Top of Wall
LL (kips)	0.0	
SL (kips)	0.5	
$1.1(Q_D + Q_L + 0.2 * Q_S)$	39.1	Eq. 7-1
$0.9(Q_D)$	31.9	Eq. 7-2
Shear/Unit Length (kip/ft)	5.3	
Wall Shear (Q_E) (kips)	159.3	
Moment Generated from Holdown (kip*ft)	0.0	About Centroid of Wall

Wall Demands		
P (kips)	39.1	Eq. 7-34
P (kips)	31.9	Eq. 7-34
V (kips)	159.3	
M (kip*ft)	2230.2	

Lower-Bound Vertical Compressive Strength		
K	1	Table 6-1
r (in)	0.705	Weak Axis Radius of Gyration
h/r	238	
P_{CL} (kip)	136	TMS 402-13, Eq. 9-19, Eq. 9-20
KP_{CL} (kip)	136	
J	2	LS
C_1C_2	1.1	
$Q_G + (Q_E)/(JC1C2)$ (kip)	39.1	
DCR	0.29	

Determine FC vs DC Table 11-6		
Mu/(Vudv)	0.04	
γ	1.0	#5 Bars or smaller
Vn (kips) upperbound	492	TMS 402-13, Eq. 9-22
Vn (kips) upperbound	-	TMS 402-13, Eq. 9-23
Vnm (kip)	330.2	TMS 402-13, Sec 9.3.4.1.2.1
Vn (kip)	330.2	TMS 402-13, Equation 9-21
Holdown Anchor Rod As (in^2)	0.31	At one wall end
a (in)	2.4	
Distance from Edge of Wall to Rod (in)	4	
d (in)	356	
Mn (kip*ft)	1309	
Ve (kip)	93	
Shear vs. Flexure Control	Flexure Control	
An (in^2)	2880	
f_{ae} (psi)	13.6	
Shear vs. Force Controlled	NA	

Determine m-factors Table 11-6		
fae/fme	0.013	
L/heff	2.14	
As (in^2)	2.48	Total Vertical Reinforcement
ρ_v	0.00086	
Av (in^2)	2.5	Total Vertical Reinforcement
ρ_h	0.0018	
$\rho_t$fye/fme	0.134	
m-factor	5.7	
m-factor restriction	7	
m-factor used	5.7	

Deformation Control DCRs		
Shear DCR	0.08	
Moment DCR	0.30	

Force Control DCRs		
Shear DCR	-	
Moment DCR	-	

Out-Of-Plane Capacity TMS 402-13, Sec 9.3.5		
d (in)	4	
a (in)	0.6	
Mn (kip*ft)	40.5	

Out-Of-Plane Demands TMS 402-13 Sec 9.3.5 & ASCE 41-13 Section 11.3.5-->7.2.11		
χ	1	ASCE 41-13, Table 7-2, CP
Sxs,1E	1.11	
h (ft)	14	Full Wall Height
w (psf)	100.0	Elevation Wall Unit Weight
Fp*L (plf)	1332.0	ASCE 41-13, Eq. 7-13
Fp_min*L (plf)	300.0	ASCE 41-13, Eq. 7-14
Mu,o (kip*ft)	32.63	
n	[illegible]	
tsp (in)	8	
c (in)	0.7	TMS 402-13, Eq. 9-35
Ieff = Icr (in^4)	[illegible]	TMS 402-13, Eq. 9-34
Pe (kips)	365	TMS 402-13, Eq. 9-33
Ψ	1.120	TMS 402-13, Eq. 9-32
ΨMu,o (kip*ft)	36.54	TMS 402-13, Eq. 9-31

Out-Of-Plane DCR, Sec 11.3.5.3		
Flexure DCR	0.4	

Permit Number: 19-05911

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Project:	900 Bldg	Date:	12/18/2019
		Checked By:	
Project No:	262019.034	Date:	

ASCE 41-13 Reinforced Masonry DCRs

Legend		
Input		
Calculated		
DCR/Check		

General Inputs		
Pier ID	Grid S10	
Location/Gridline	S10	
f'm (psi)	810	Table 11-2(a)
Em (ksi)	729	TMS 402-13, Sec 4.2.2.2.1
fme (psi)	1053	Table 11-1
fy (ksi)	40	
fye (ksi)	52	
Es (ksi)	29000	
Masonry Denisty (pcf)	125	
Nominal Pier Length (ft)	10	
Pier Height (H)	14.00	
Wall thickness (in)	8	
Roof Trib (SF)	20	
Roof DL (psf)	20	
Roof SL (psf)	25	
Mezz Trib (SF)	0	
Mezz DL (psf)	0	
Mezz LL (psf)	0	
2nd FLR Trib (SF)	0	
2nd FLR DL (psf)	35	
2nd FLR LL (psf)	40	
Shearline Tot Shear (kips)	441.6	BSE-1E
Shearline Tot Length (ft)	71	
Applicable Wall Trib Length (ft)	10	
Seismic Axial Load (kips)	0.0	Holdown Force From Wall Above
Holdown to Wall Centroid (ft)	0.0	
IO, LS, CP	LS	

General Calculation		
Wall Self-Weight (kips)	12.7	
DL (kips)	0.4	Super-imposed DL @ Top of Wall
LL (kips)	0.0	
SL (kips)	0.5	
$1.1(Q_D + Q_L + 0.2*Q_S)$	13.4	Eq. 7-1
$0.9(Q_D)$	10.5	Eq. 7-2
Shear/Unit Length (kip/ft)	6.2	
Wall Shear (Q_E) (kips)	62.1971831	
Moment Generated from Holdown (kip*ft)	0.0	About Centroid of Wall

Wall Demands		
P (kips)	13.4	Eq. 7-34
P (kips)	10.9	Eq. 7-34
V (kips)	62.1971831	
M (kip*ft)	870.8	

Lower-Bound Vertical Compressive Strength		
K	1	Table 6-1
r (in)	0.559	Weak Axis Radius of Gyration
h/r	300	
P_{CL} (kip)	28	TMS 402-13, Eq. 9-19, Eq. 9-20
KP_{CL} (kip)	28	
J	2	LS
C_1C_2	1.1	
$Q_G+(Q_E)/(JC1C2)$ (kip)	13.4	
DCR	0.49	

Determine FC vs DC Table 11-6		
Mu/(Vudv)	0.12	
γ	1.0	#5 Bars or smaller
Vn (kips) upperbound	164	TMS 402-13, Eq. 9-22
Vn (kips) upperbound	-	TMS 402-13, Eq. 9-23
Vnm (kip)	106.2	TMS 402-13, Sec 9.3.4.1.2.1
Vn (kip)	106.2	TMS 402-13, Equation 9-21
Holdown Anchor Rod As (in^2)	0.31	At one wall end
a (in)	2.4	
Distance from Edge of Wall to Rod (in)	4	
d (in)	116	
Mn (kip*ft)	223	
Ve (kip)	16	
Shear vs. Flexure Control	Flexure Control	
An (in^2)	960	
f_{ae} (psi)	12.9	
Shear vs. Force Controlled	NA	

Determine m-factors Table 11-6		
fae/fme	0.013	
L/heff	0.71	
As (in^2)	0.31	Total Vertical Reinforcement
ρ_v	0.00032	
Av (in^2)	0.3	Total Vertical Reinforcement
ρ_h	0.0002	
$\rho_g$fye/fme	0.027	
m-factor	6.1	
m-factor restriction	7	
m-factor used	6.1	

Deformation Control DCRs		
Shear DCR	0.10	
Moment DCR	0.54	

Force Control DCRs		
Shear DCR	-	
Moment DCR	-	

Out-Of-Plane Capacity TMS 402-13, Sec 9.3.5		
d (in)	4	
a (in)	0.3	
Mn (kip*ft)	7.4	

Out-Of-Plane Demands TMS 402-13 Sec 9.3.5 & ASCE 41-13 Section 11.3.5-->7.2.11		
χ	1.3	ASCE 41-13, Table 7-2, LS
Sxs,1E	0.71	
h (ft)	14	Full Wall Height
w (psf)	100.0	Elevation Wall Unit Weight
Fp*L (plf)	363.2	ASCE 41-13, Eq. 7-13
Fp _min*L (plf)	130.0	ASCE 41-13, Eq. 7-14
Mu,o (kip*ft)	9.05	
n	39.8	
tsp (in)	8	
c (in)	0.4	TMS 402-13, Eq. 9-35
Ieff = Icr (in^4)	300	TMS 402-13, Eq. 9-34
Pe (kips)	77	TMS 402-13, Eq. 9-33
Ψ	1.212	TMS 402-13, Eq. 9-32
ΨMu,o (kip*ft)	10.96	TMS 402-13, Eq. 9-31

Out-Of-Plane DCR, Sec 11.3.5.3		
Flexure DCR	0.7	

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Project No:	262019.034	Date:	

ASCE 41-13 Reinforced Masonry DCRs

Legend		
Input		
Calculated		
DCR/Check		

General Inputs		
Pier ID	Grid S10	
Location/Gridline	S10	
f'm (psi)	810	Table 11-2(a)
Em (ksi)	729	TMS 402-13, Sec 4.2.2.2.1
fme (psi)	1053	Table 11-1
fy (ksi)	40	
fye (ksi)	52	
Es (ksi)	29000	
Masonry Denisty (pcf)	125	
Nominal Pier Length (ft)	10	
Pier Height (H)	14.00	
Wall thickness (in)	8	
Roof Trib (SF)	20	
Roof DL (psf)	20	
Roof SL (psf)	25	
Mezz Trib (SF)	0	
Mezz DL (psf)	0	
Mezz LL (psf)	0	
2nd FLR Trib (SF)	0	
2nd FLR DL (psf)	35	
2nd FLR LL (psf)	40	
Shearline Tot Shear (kips)	686.7	BSE-2E
Shearline Tot Length (ft)	71	
Applicable Wall Trib Length (ft)	10	
Seismic Axial Load (kips)	0.0	Holdown Force From Wall Above
Holdown to Wall Centroid (ft)	0.0	
IO, LS, CP	CP	

General Calculation		
Wall Self-Weight (kips)	11.7	
DL (kips)	0.4	Super-imposed DL @ Top of Wall
LL (kips)	0.0	
SL (kips)	0.5	
$1.1(Q_D + Q_L + 0.2*Q_S)$	13.4	Eq. 7-1
$0.9(Q_D)$	10.5	Eq. 7-2
Shear/Unit Length (kip/ft)	9.7	
Wall Shear (Q_E) (kips)	96.71830986	
Moment Generated from Holdown (kip*ft)	0.0	About Centroid of Wall

Wall Demands		
P (kips)	13.4	Eq. 7-34
P (kips)	10.3	Eq. 7-34
V (kips)	96.71830986	
M (kip*ft)	1354.1	

Lower-Bound Vertical Compressive Strength		
K	1	Table 6-1
r (in)	0.553	Weak Axis Radius of Gyration
h/r	300	
P_{CL} (kip)	28	TMS 402-13, Eq. 9-19, Eq. 9-20
KP_{CL} (kip)	28	
J	2	LS
C_1C_2	1.1	
$Q_G+(Q_E)/(JC1C2)$ (kip)	13.4	
DCR	0.49	

Determine FC vs DC Table 11-6		
Mu/(Vudv)	0.12	
γ	1.0	#5 Bars or smaller
Vn (kips) upperbound	164	TMS 402-13, Eq. 9-22
Vn (kips) upperbound	-	TMS 402-13, Eq. 9-23
Vnm (kip)	106.2	TMS 402-13, Sec 9.3.4.1.2.1
Vn (kip)	106.2	TMS 402-13, Equation 9-21
Holdown Anchor Rod As (in^2)	0.31	At one wall end
a (in)	2.4	
Distance from Edge of Wall to Rod (in)	4	
d (in)	116	
Mn (kip*ft)	223	
Ve (kip)	16	
Shear vs. Flexure Control	Flexure Control	
An (in^2)	960	
f_{ae} (psi)	13.9	
Shear vs. Force Controlled	NA	

Determine m-factors Table 11-6		
fae/fme	0.013	
L/heff	0.71	
As (in^2)	0.31	Total Vertical Reinforcement
ρ_v	0.00032	
Av (in^2)	0.3	Total Vertical Reinforcement
ρ_h	0.0002	
$\rho_g$fye/fme	0.027	
m-factor	7.2	
m-factor restriction	7	
m-factor used	7.0	

Deformation Control DCRs		
Shear DCR	0.13	
Moment DCR	0.87	

Force Control DCRs		
Shear DCR	-	
Moment DCR	-	

Out-Of-Plane Capacity TMS 402-13, Sec 9.3.5		
d (in)	4	
a (in)	0.3	
Mn (kip*ft)	7.4	

Out-Of-Plane Demands TMS 402-13 Sec 9.3.5 & ASCE 41-13 Section 11.3.5-->7.2.11		
χ	1	ASCE 41-13, Table 7-2, CP
Sxs,1E	1.11	
h (ft)	14	Full Wall Height
w (psf)	100.0	Elevation Wall Unit Weight
Fp*L (plf)	444.0	ASCE 41-13, Eq. 7-13
Fp_min*L (plf)	100.0	ASCE 41-13, Eq. 7-14
Mu,o (kip*ft)	10.88	
n	39.3	
tsp (in)	8	
c (in)	0.4	TMS 402-13, Eq. 9-35
Ieff = Icr (in^4)	300	TMS 402-13, Eq. 9-34
Pe (kips)	77	TMS 402-13, Eq. 9-33
Ψ	1.222	TMS 402-13, Eq. 9-32
ΨMu,o (kip*ft)	13.18	TMS 402-13, Eq. 9-31

Out-Of-Plane DCR, Sec 11.3.5.3		
Flexure DCR	0.8	

Permit Number: 19-05911

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Project No:	262019.034	Date:	

ASCE 41-13 Reinforced Masonry DCRs

Legend		
Input		
Calculated		
DCR/Check		
General Inputs		
Pier ID	Grid 520 between E220 & E205	
Location/Gridline	520	
f'm (psi)	810	Table 11-2(a)
Em (ksi)	729	TMS 402-13, Sec 4.2.2.2.1
fme (psi)	1053	Table 11-1
fy (ksi)	40	
fye (ksi)	52	
Es (ksi)	29000	
Masonry Denisty (pcf)	125	
Nominal Pier Length (ft)	7	
Pier Height (H)	6.00	
Wall thickness (in)	8	
Roof Trib (SF)	14	
Roof DL (psf)	20	
Roof SL (psf)	25	
Mezz Trib (SF)	0	
Mezz DL (psf)	0	
Mezz LL (psf)	0	
2nd FLR Trib (SF)	14	
2nd FLR DL (psf)	35	
2nd FLR LL (psf)	40	
Shearline Tot Shear (kips)	1011.2	BSE-1E
Shearline Tot Length (ft)	93	
Applicable Wall Trib Length (ft)	7	
Seismic Axial Load (kips)	0.0	Holdown Force From Wall Above
Holdown to Wall Centroid (ft)	0.0	
IO, LS, CP	LS	

General Calculation		
Wall Self-Weight (kips)	3.5	
DL (kips)	0.8	Super-imposed DL @ Top of Wall
LL (kips)	0.6	
SL (kips)	0.4	
$1.1(Q_D + Q_L + 0.2*Q_S)$	5.4	Eq. 7-1
$0.9(Q_D)$	3.8	Eq. 7-2
Shear/Unit Length (kip/ft)	10.9	
Wall Shear (Q_E) (kips)	76.11182796	
Moment Generated from Holdown (kip*ft)	0.0	About Centroid of Wall
Wall Demands		
P (kips)	5.4	Eq. 7-34
P (kips)	3.8	Eq. 7-34
V (kips)	76.11182796	
M (kip*ft)	456.7	
Lower-Bound Vertical Compressive Strength		
K	1	Table 6-1
r (in)	0.559	Weak Axis Radius of Gyration
h/r	129	
P_{CL} (kip)	106	TMS 402-13, Eq. 9-19, Eq. 9-20
KP_{CL} (kip)	106	
J	2	LS
C_1C_2	1.1	
$Q_G+(Q_E)/(JC1C2)$ (kip)	5.4	
DCR	0.05	

Determine FC vs DC Table 11-6		
Mu/(Vudv)	0.08	
γ	1.0	#5 Bars or smaller
Vn (kips) upperbound	115	TMS 402-13, Eq. 9-22
Vn (kips) upperbound	-	TMS 402-13, Eq. 9-23
Vnm (kip)	75.0	TMS 402-13, Sec 9.3.4.1.2.1
Vn (kip)	75.0	TMS 402-13, Equation 9-21
Holdown Anchor Rod As (in^2)	0.31	At one wall end
a (in)	2.4	
Distance from Edge of Wall to Rod (in)	4	
d (in)	80	
Mn (kip*ft)	107	
Ve (kip)	18	
Shear vs. Flexure Control	Flexure Control	
An (in^2)	672	
f_{ae} (psi)	8.0	
Shear vs. Force Controlled	NA	
Determine m-factors Table 11-6		
fae/fme	0.008	
L/heff	1.17	
As (in^2)	0.31	Total Vertical Reinforcement
ρ_v	0.00046	
Av (in^2)	0.3	Total Vertical Reinforcement
ρ_h	0.0005	
$\rho_g$fye/fme	0.049	
m-factor	6.3	
m-factor restriction	7	
m-factor used	6.3	
Deformation Control DCRs		
Shear DCR	0.16	
Moment DCR	0.68	
Force Control DCRs		
Shear DCR		
Moment DCR		

Out-Of-Plane Capacity TMS 402-13, Sec 9.3.5		
d (in)	4	
a (in)	0.3	
Mn (kip*ft)	5.2	
Out-Of-Plane Demands TMS 402-13 Sec 9.3.5 & ASCE 41-13 Section 11.3.5-->7.2.11		
χ	1.3	ASCE 41-13, Table 7-2, LS
Sxs,1E	0.71	
h (ft)	14	Full Wall Height
w (psf)	100.0	Elevation Wall Unit Weight
Fp*L (plf)	258.4	ASCE 41-13, Eq. 7-13
Fp_min*L (plf)	91.0	ASCE 41-13, Eq. 7-14
Mu,o (kip*ft)	6.32	
n	39.3	
tsp (in)	8	
c (in)	0.4	TMS 402-13, Eq. 9-35
Ieff = Icr (in^4)	110	TMS 402-13, Eq. 9-34
Pe (kips)	292	TMS 402-13, Eq. 9-33
Ψ	1.019	TMS 402-13, Eq. 9-32
ΨMu,o (kip*ft)	6.45	TMS 402-13, Eq. 9-31
Out-Of-Plane DCR, Sec 11.3.5.3		
Flexure DCR	0.6	

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Project No:	262019.034	Date:	

ASCE 41-13 Reinforced Masonry DCRs

Legend		
Input		
Calculated		
DCR/Check		

General Inputs		
Pier ID	Grid S20 between E220 & E205	
Location/Gridline	S20	
f'm (psi)	810	Table 11-2(a)
Em (ksi)	729	TMS 402-13, Sec 4.2.2.2.1
fme (psi)	1053	Table 11-1
fy (ksi)	40	
fye (ksi)	52	
Es (ksi)	29000	
Masonry Denisty (pcf)	125	
Nominal Pier Length (ft)	7	
Pier Height (H)	6.00	
Wall thickness (in)	8	
Roof Trib (SF)	28	
Roof DL (psf)	20	
Roof SL (psf)	25	
Mezz Trib (SF)	0	
Mezz DL (psf)	0	
Mezz LL (psf)	0	
2nd FLR Trib (SF)	28	
2nd FLR DL (psf)	35	
2nd FLR LL (psf)	40	
Shearline Tot Shear (kips)	1572.6	BSE-2E
Shearline Tot Length (ft)	93	
Applicable Wall Trib Length (ft)	7	
Seismic Axial Load (kips)	0.0	Holdown Force From Wall Above
Holdown to Wall Centroid (ft)	0.0	
IO, LS, CP	CP	

General Calculation		
Wall Self-Weight (kips)	3.5	
DL (kips)	1.5	Super-imposed DL @ Top of Wall
LL (kips)	1.1	
SL (kips)	0.7	
$1.1(Q_D + Q_L + 0.2*Q_S)$	6.9	Eq. 7-1
$0.9(Q_D)$	4.5	Eq. 7-2
Shear/Unit Length (kip/ft)	16.9	
Wall Shear (Q_E) (kips)	118.3677419	
Moment Generated from Holdown (kip*ft)	0.0	About Centroid of Wall

Wall Demands		
P (kips)	6.9	Eq. 7-34
P (kips)	4.5	Eq. 7-34
V (kips)	118.3677419	
M (kip*ft)	710.2	

Lower-Bound Vertical Compressive Strength		
K	1	Table 6-1
r (in)	0.566	Weak Axis Radius of Gyration
h/r	127	
P_{CL} (kip)	109	TMS 402-13, Eq. 9-19, Eq. 9-20
KP_{CL} (kip)	109	
J	2	LS
C_1C_2	1.1	
$Q_G+(Q_E)/(JC1C2)$ (kip)	6.9	
DCR	0.06	

Determine FC vs DC Table 11-6		
Mu/(Vudv)	0.08	
γ	1.0	#5 Bars or smaller
Vn (kips) upperbound	115	TMS 402-13, Eq. 9-22
Vn (kips) upperbound	-	TMS 402-13, Eq. 9-23
Vnm (kip)	75.1	TMS 402-13, Sec 9.3.4.1.2.1
Vn (kip)	75.1	TMS 402-13, Equation 9-21
Holdown Anchor Rod As (in^2)	0.31	At one wall end
a (in)	2.4	
Distance from Edge of Wall to Rod (in)	4	
d (in)	80	
Mn (kip*ft)	111	
Ve (kip)	19	
Shear vs. Flexure Control	Flexure Control	
An (in^2)	672	
f_{ae} (psi)	10.3	
Shear vs. Force Controlled	NA	

Determine m-factors Table 11-6		
fae/fme	0.010	
L/heff	1.17	
As (in^2)	0.31	Total Vertical Reinforcement
ρ_v	0.00046	
Av (in^2)	0.3	Total Vertical Reinforcement
ρ_h	0.0005	
$\rho_g$fye/fme	0.049	
m-factor	7.3	
m-factor restriction	7	
m-factor used	7.0	

Deformation Control DCRs		
Shear DCR	0.22	
Moment DCR	0.31	

Force Control DCRs		
Shear DCR	-	
Moment DCR	-	

Out-Of-Plane Capacity TMS 402-13, Sec 9.3.5		
d (in)	4	
a (in)	0.4	
Mn (kip*ft)	5.4	

Out-Of-Plane Demands TMS 402-13 Sec 9.3.5 & ASCE 41-13 Section 11.3.5-->7.2.11		
χ	1	ASCE 41-13, Table 7-2, CP
Sxs,1E	1.11	
h (ft)	14	Full Wall Height
w (psf)	100.0	Elevation Wall Unit Weight
Fp*L (plf)	310.8	ASCE 41-13, Eq. 7-13
Fp_min*L (plf)	70.0	ASCE 41-13, Eq. 7-14
Mu,o (kip*ft)	7.61	
n	39.8	
tsp (in)	8	
c (in)	0.4	TMS 402-13, Eq. 9-35
Ieff = Icr (in^4)	215	TMS 402-13, Eq. 9-34
Pe (kips)	299	TMS 402-13, Eq. 9-33
Ψ	1.024	TMS 402-13, Eq. 9-32
ΨMu,o (kip*ft)	7.80	TMS 402-13, Eq. 9-31

Out-Of-Plane DCR, Sec 11.3.5.3		
Flexure DCR	0.7	

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		Checked By:	
Project No:	262019.034	Date:	

ASCE 41-13 Reinforced Masonry DCRs

Legend		
Input		
Calculated		
DCR/Check		

General Inputs		
Pier ID	Grid S20 between E220 & E205	
Location/Gridline	S20	
f'm (psi)	810	Table 11-2(a)
Em (ksi)	729	TMS 402-13, Sec 4.2.2.2.1
fme (psi)	1053	Table 11-1
fy (ksi)	40	
fye (ksi)	52	
Es (ksi)	29000	
Masonry Denisty (pcf)	125	
Nominal Pier Length (ft)	25	
Pier Height (H)	27.00	
Wall thickness (in)	8	
Roof Trib (SF)	50	
Roof DL (psf)	20	
Roof SL (psf)	25	
Mezz Trib (SF)	0	
Mezz DL (psf)	0	
Mezz LL (psf)	0	
2nd FLR Trib (SF)	0	
2nd FLR DL (psf)	35	
2nd FLR LL (psf)	40	
Shearline Tot Shear (kips)	392.5	BSE-1E
Shearline Tot Length (ft)	112	
Applicable Wall Trib Length (ft)	25	
Seismic Axial Load (kips)	0.0	Holdown Force From Wall Above
Holdown to Wall Centroid (ft)	0.0	
IO, LS, CP	LS	

General Calculation		
Wall Self-Weight (kips)	55.3	
DL (kips)	1.0	Super-Imposed DL @ Top of Wall
LL (kips)	0.0	
SL (kips)	1.3	
$1.1(Q_D + Q_L + 0.2*Q_S)$	63.3	Eq. 7-1
$0.9(Q_D)$	51.5	Eq. 7-2
Shear/Unit Length (kip/ft)	3.5	
Wall Shear (Q_E) (kips)	87.61160714	
Moment Generated from Holdown (kip*ft)	0.0	About Centroid of Wall

Wall Demands		
P (kips)	63.3	Eq. 7-34
P (kips)	51.5	Eq. 7-34
V (kips)	87.61160714	
M (kip*ft)	2365.5	

Lower-Bound Vertical Compressive Strength		
K	1	Table 6-1
r (in)	0.752	Weak Axis Radius of Gyration
h/r	431	
P_{CL} (kip)	35	TMS 402-13, Eq. 9-19, Eq. 9-20
KP_{CL} (kip)	35	
J	2	LS
C_1C_2	1.1	
$Q_G+(Q_E)/(JC1C2)$ (kip)	63.3	
DCR	1.81	

Determine FC vs DC Table 11-6		
Mu/(Vudv)	0.09	
γ	1.0	#5 Bars or smaller
Vn (kips) upperbound	410	TMS 402-13, Eq. 9-22
Vn (kips) upperbound	-	TMS 402-13, Eq. 9-23
Vnm (kip)	275.2	TMS 402-13, Sec 9.3.4.1.2.1
Vn (kip)	275.2	TMS 402-13, Equation 9-21
Holdown Anchor Rod As (in^2)	0.31	At one wall end
a (in)	2.4	
Distance from Edge of Wall to Rod (in)	4	
d (in)	296	
Mn (kip*ft)	1570	
Ve (kip)	58	
Shear vs. Flexure Control	Flexure Control	
An (in^2)	2400	
f_{ae} (psi)	26.4	
Shear vs. Force Controlled	NA	

Determine m-factors Table 11-6		
fae/fme	0.025	
L/heff	0.93	
As (in^2)	2.17	Total Vertical Reinforcement
ρ_v	0.00090	
Av (in^2)	2.2	Total Vertical Reinforcement
ρ_h	0.0008	
$\rho_g$fye/fme	0.086	
m-factor	4.6	
m-factor restriction	7	
m-factor used	4.6	

Deformation Control DCRs		
Shear DCR	0.07	
Moment DCR	0.32	

Force Control DCRs		
Shear DCR	-	
Moment DCR	-	

Out-Of-Plane Capacity TMS 402-13, Sec 9.3.5		
d (in)	4	
a (in)	0.8	
Mn (kip*ft)	41.7	

Out-Of-Plane Demands TMS 402-13 Sec 9.3.5 & ASCE 41-13 Section 11.3.5-->7.2.11		
χ	1.3	ASCE 41-13, Table 7-2, LS
Sxs,1E	0.71	
h (ft)	14	Full Wall Height
w (psf)	100.0	Elevation Wall Unit Weight
Fp*L (plf)	223.0	ASCE 41-13, Eq. 7-13
Fp_min*L (plf)	325.0	ASCE 41-13, Eq. 7-14
Mu,o (kip*ft)	22.61	
n	39.8	
tsp (in)	8	
c (in)	1.0	TMS 402-13, Eq. 9-35
Ieff = Icr (in^4)	1357	TMS 402-13, Eq. 9-34
Pe (kips)	93	TMS 402-13, Eq. 9-33
Ψ	3.125	TMS 402-13, Eq. 9-32
ΨMu,o (kip*ft)	70.67	TMS 402-13, Eq. 9-31

Out-Of-Plane DCR, Sec 11.3.5.3		
Flexure DCR	0.8	

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Project: 900 Bldg
Project No: 262019.034

ASCE 41-13 Reinforc

Legend		
Input		
Calculated		
DCR/Check		

General Inputs		
Pier ID	Grid S20 between E220 & E205	
Location/Gridline	S20	
f'm (psi)	810	Table 11-2(a)
Em (ksi)	729	TMS 402-13, Sec 4.2.2.2.1
fme (psi)	1053	Table 11-1
fy (ksi)	40	
fye (ksi)	52	
Es (ksi)	29000	
Masonry Denisty (pcf)	125	
Nominal Pier Length (ft)	25	
Pier Height (H)	27.00	
Wall thickness (in)	8	
Roof Trib (SF)	50	
Roof DL (psf)	20	
Roof SL (psf)	25	
Mezz Trib (SF)	0	
Mezz DL (psf)	0	
Mezz LL (psf)	0	
2nd FLR Trib (SF)	0	
2nd FLR DL (psf)	35	
2nd FLR LL (psf)	40	
Shearline Tot Shear (kips)	392.5	BSE-1E
Shearline Tot Length (ft)	112	
Applicable Wall Trib Length (ft)	25	
Seismic Axial Load (kips)	0.0	Holdown Force From Wall Above
Holdown to Wall Centroid (ft)	0.0	
IO, LS, CP	LS	

General Calculation		
Wall Self-Weight (kips)	56.3	
DL (kips)	1.0	Super-imposed DL @ Top of Wall
LL (kips)	0.0	
SL (kips)	1.3	
$1.1(Q_D + Q_L + 0.2*Q_S)$	63.3	Eq. 7-1
$0.9(Q_D)$	51.5	Eq. 7-2
Shear/Unit Length (kip/ft)	3.5	
Wall Shear (Q_E) (kips)	87.61160714	
Moment Generated from Holdown (kip*ft)	0.0	About Centroid of Wall

Wall Demands		
P (kips)	63.3	Eq. 7-34
P (kips)	51.5	Eq. 7-34
V (kips)	87.61160714	
M (kip*ft)	2365.5	

Lower-Bound Vertical Compressive Strength		
K	1	Table 6-1
r (in)	0.752	Weak Axis Radius of Gyration
h/r	431	
P_{CL} (kip)	35	TMS 402-13, Eq. 9-19, Eq. 9-20
KP_{CL} (kip)	35	
J	2	LS
C_1C_2	1.1	
$Q_G+(Q_E)/(JC1C2)$ (kip)	63.3	
DCR	1.83	

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Project:	900 Bldg	Date:	12/18/2019
		Checked By:	
Project No:	262019.034	Date:	

ASCE 41-13 Reinforced Masonry DCRs

Legend		
Input		
Calculated		
DCR/Check		
General Inputs		
Pier ID	Grid S20 between E220 & E205	
Location/Gridline	S20	
f'm (psi)	810	Table 11-2(a)
Em (ksi)	729	TMS 402-13, Sec 4.2.2.2.1
fme (psi)	1053	Table 11-1
fy (ksi)	40	
fye (ksi)	52	
Es (ksi)	29000	
Masonry Denisty (pcf)	125	
Nominal Pier Length (ft)	25	
Pier Height (H)	14.00	
Wall thickness (in)	8	
Roof Trib (SF)	50	
Roof DL (psf)	20	
Roof SL (psf)	25	
Mezz Trib (SF)	0	
Mezz DL (psf)	0	
Mezz LL (psf)	0	
2nd FLR Trib (SF)	0	
2nd FLR DL (psf)	35	
2nd FLR LL (psf)	40	
Shearline Tot Shear (kips)	921.4	BSE-2E
Shearline Tot Length (ft)	112	
Applicable Wall Trib Length (ft)	25	
Seismic Axial Load (kips)	0.0	Holdown Force From Wall Above
Holdown to Wall Centroid (ft)	0.0	
IO, LS, CP	CP	
General Calculation		
Wall Self-Weight (kips)	29.2	
DL (kips)	1.0	Super-imposed DL @ Top of Wall
LL (kips)	0.0	
SL (kips)	1.3	
$1.1(Q_n + Q_l + 0.2*Q_s)$	33.5	Eq. 7-1
$0.9(Q_n)$	27.2	Eq. 7-2
Shear/Unit Length (kip/ft)	8.2	
Wall Shear (Q_F) (kips)	205.6696429	
Moment Generated from Holdown (kip*ft)	0.0	About Centroid of Wall
Wall Demands		
P (kips)	33.5	Eq. 7-34
P (kips)	27.2	Eq. 7-34
V (kips)	[illegible]	
M (kip*ft)	[illegible]	
Lower-Bound Vertical Compressive Strength		
K	1	Table 6-1
r (in)	0.534	Weak Axis Radius of Gyration
h/r	315	
P_{CL} (kip)	63	TMS 402-13, Eq. 9-19, Eq. 9-20
KP_{CL} (kip)	63	
J	2	LS
C_1C_2	1.1	
$Q_G+(Q_E)/(JC1C2)$ (kip)	33.5	
DCR	0.53	

Determine FC vs DC Table 11-6		
Mu/(Vudv)	0.05	
γ	1.0	#5 Bars or smaller
Vn (kips) upperbound	410	TMS 402-13, Eq. 9-22
Vn (kips) upperbound	-	TMS 402-13, Eq. 9-23
Vnm (kip)	274.4	TMS 402-13, Sec 9.3.4.1.2.1
Vn (kip)	274.4	TMS 402-13, Equation 9-21
Holdown Anchor Rod As (in^2)	0.31	At one wall end
a (in)	2.4	
Distance from Edge of Wall to Rod (in)	4	
d (in)	296	
Mn (kip*ft)	972	
Ve (kip)	69	
Shear vs. Flexure Control	Flexure Control	
An (in^2)	2400	
f_{ae} (psi)	13.9	
Shear vs. Force Controlled	NA	
Determine m-factors Table 11-6		
fae/fme	0.013	
L/heff	1.79	
As (in^2)	0.62	Total Vertical Reinforcement
ρ_v	0.00026	
Av (in^2)	0.6	Total Vertical Reinforcement
ρ_h	0.0005	
$\rho_g$fye/fme	0.036	
m-factor	7.6	
m-factor restriction	7	
m-factor used	7.0	
Deformation Control DCRs		
Shear DCR	0.11	
Moment DCR	0.42	
Force Control DCRs		
Shear DCR	-	
Moment DCR	-	
Out-Of-Plane Capacity TMS 402-13, Sec 9.3.5		
d (in)	4	
a (in)	0.3	
Mn (kip*ft)	15.7	
Out-Of-Plane Demands TMS 402-13 Sec 9.3.5 & ASCE 41-13 Section 11.3.5-->7.2.11		
χ	1	ASCE 41-13, Table 7-2, CP
Sxs,1E	1.11	
h (ft)	14	Full Wall Height
w (psf)	100.0	Elevation Wall Unit Weight
Fp*L (plf)	1010.0	ASCE 41-13, Eq. 7-13
Fp_min*L (plf)	250.0	ASCE 41-13, Eq. 7-14
Mu,o (kip*ft)	27.20	
n	59.5	
tsp (in)	0	
c (in)	0.4	TMS 402-13, Eq. 9-35
Ieff = Icr (in^4)	324	TMS 402-13, Eq. 9-34
Pe (kips)	474	TMS 402-13, Eq. 9-33
Ψ	1.237	TMS 402-13, Eq. 9-32
ΨMu,o (kip*ft)	33.65	TMS 402-13, Eq. 9-31
Out-Of-Plane DCR, Sec 11.3.5.3		
Flexure DCR	0.9	

Permit Number: 19-05911

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		Checked By:	
Project No:	262019.034	Date:	

ASCE 41-13 Reinforced Masonry DCRs

Legend		
Input		
Calculated		
DCR/Check		

General Inputs		
Pier ID	Grid S60	
Location/Gridline	S60	
f'm (psi)	810	Table 11-2(a)
Em (ksi)	729	TMS 402-13, Sec 4.2.2.2.1
fme (psi)	1053	Table 11-1
fy (ksi)	40	
fye (ksi)	52	
Es (ksi)	29000	
Masonry Denisty (pcf)	125	
Nominal Pier Length (ft)	40	
Pier Height (H)	14.00	
Wall thickness (in)	8	
Roof Trib (SF)	80	
Roof DL (psf)	20	
Roof SL (psf)	25	
Mezz Trib (SF)	0	
Mezz DL (psf)	0	
Mezz LL (psf)	0	
2nd FLR Trib (SF)	80	
2nd FLR DL (psf)	35	
2nd FLR LL (psf)	40	
Shearline Tot Shear (kips)	211.6	BSE-1E
Shearline Tot Length (ft)	40	
Applicable Wall Trib Length (ft)	40	
Seismic Axial Load (kips)	0.0	Holdown Force From Wall Above
Holdown to Wall Centroid (ft)	0.0	
IO, LS, CP	LS	

General Calculation		
Wall Self-Weight (kips)	46.7	
DL (kips)	4.4	Super-imposed DL @ Top of Wall
LL (kips)	3.2	
SL (kips)	2.0	
$1.1(Q_D + Q_L + 0.2*Q_S)$	60.1	Eq. 7-1
$0.9(Q_D)$	46.0	Eq. 7-2
Shear/Unit Length (kip/ft)	5.3	
Wall Shear (Q_E) (kips)	211.6	
Moment Generated from Holdown (kip*ft)	0.0	About Centroid of Wall

Wall Demands		
P (kips)	60.1	Eq. 7-34
P (kips)	46.0	Eq. 7-34
V (kips)	211.6	
M (kip*ft)	2962.4	

Lower-Bound Vertical Compressive Strength		
K	1	Table 6-1
r (in)	0.496	Weak Axis Radius of Gyration
h/r	339	
P_{CL} (kip)	86	TMS 402-13, Eq. 9-19, Eq. 9-20
KP_{CL} (kip)	86	
J	2	LS
C_1C_2	1.1	
$Q_G+(Q_E)/(JC1C2)$ (kip)	60.1	
DCR	0.70	

Determine FC vs DC Table 11-6		
Mu/(Vudv)	0.03	
γ	1.0	#5 Bars or smaller
Vn (kips) upperbound	656	TMS 402-13, Eq. 9-22
Vn (kips) upperbound	-	TMS 402-13, Eq. 9-23
Vnm (kip)	443.0	TMS 402-13, Sec 9.3.4.1.2.1
Vn (kip)	443.0	TMS 402-13, Equation 9-21
Holdown Anchor Rod As (in^2)	0.31	At one wall end
a (in)	2.4	
Distance from Edge of Wall to Rod (in)	4	
d (in)	476	
Mn (kip*ft)	2309	
Ve (kip)	165	
Shear vs. Flexure Control	Flexure Control	
An (in^2)	3840	
f_{ae} (psi)	15.7	
Shear vs. Force Controlled	NA	

Determine m-factors Table 11-6		
fae/fme	0.015	
L/heff	2.86	
As (in^2)	0.61	Total Vertical Reinforcement
ρ_v	0.00016	
Av (in^2)	0.6	Total Vertical Reinforcement
ρ_h	0.0005	
$\rho_g$fye/fme	0.030	
m-factor	6.7	
m-factor restriction	7	
m-factor used	6.7	

Deformation Control DCRs		
Shear DCR	0.07	
Moment DCR	0.19	

Force Control DCRs		
Shear DCR	-	
Moment DCR	-	

Out-Of-Plane Capacity TMS 402-13, Sec 9.3.5		
d (in)	4	
a (in)	0.3	
Mn (kip*ft)	22.7	

Out-Of-Plane Demands TMS 402-13 Sec 9.3.5 & ASCE 41-13 Section 11.3.5-->7.2.11		
χ	1.3	ASCE 41-13, Table 7-2, LS
Sxs,1E	0.71	
h (ft)	14	Full Wall Height
w (psf)	100.0	Elevation Wall Unit Weight
Fp*L (plf)	1476.8	ASCE 41-13, Eq. 7-13
Fp_min*L (plf)	520.0	ASCE 41-13, Eq. 7-14
Mu,o (kip*ft)	36.18	
n	39.8	
tsp (in)	8	
c (in)	0.3	TMS 402-13, Eq. 9-35
Ieff = Icr (in^4)	944	TMS 402-13, Eq. 9-34
Pe (kips)	241	TMS 402-13, Eq. 9-33
Ψ	1.333	TMS 402-13, Eq. 9-32
ΨMu,o (kip*ft)	48.24	TMS 402-13, Eq. 9-31

Out-Of-Plane DCR, Sec 11.3.5.3		
Flexure DCR	1.0	

Permit Number: 19-05911

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Project No: 262019.034

ASCE 41-13 Reinforc

Legend		
Input		
Calculated		
DCR/Check		
General Inputs		
Pier ID	Grid S60	
Location/Gridline	S60	
f'm (psi)	810	Table 11-2(a)
Em (ksi)	729	TMS 402-13, Sec 4.2.2.2.1
fme (psi)	1053	Table 11-1
fy (ksi)	40	
fye (ksi)	52	
Es (ksi)	29000	
Masonry Denisty (pcf)	125	
Nominal Pier Length (ft)	40	
Pier Height (H)	14.00	
Wall thickness (in)	8	
Roof Trib (SF)	80	
Roof DL (psf)	20	
Roof SL (psf)	25	
Mezz Trib (SF)	0	
Mezz DL (psf)	0	
Mezz LL (psf)	0	
2nd FLR Trib (SF)	80	
2nd FLR DL (psf)	35	
2nd FLR LL (psf)	40	
Shearline Tot Shear (kips)	211.6	BSE-1E
Shearline Tot Length (ft)	40	
Applicable Wall Trib Length (ft)	40	
Seismic Axial Load (kips)	0.0	Holdown Force From Wall Above
Holdown to Wall Centroid (ft)	0.0	
IO, LS, CP	LS	
General Calculation		
Wall Self-Weight (kips)	46.7	
DL (kips)	4.4	Super-imposed DL @ Top of Wall
LL (kips)	3.2	
SL (kips)	2.0	
$1.1(Q_D + Q_L + 0.2*Q_S)$	60.1	Eq. 7-1
$0.9(Q_D)$	46.0	Eq. 7-2
Shear/Unit Length (kip/ft)	5.3	
Wall Shear (Q_L) (kips)	211.6	
Moment Generated from Holdown (kip*ft)	0.0	About Centroid of Wall
Wall Demands		
P (kips)	60.1	Eq. 7-34
P (kips)	45.0	Eq. 7-34
V (kips)	211.6	
M (kip*ft)	2962.4	
Lower-Bound Vertical Compressive Strength		
K	1	Table 6-1
r (in)	0.496	Weak Axis Radius of Gyration
h/r	339	
P_{CL} (kip)	86	TMS 402-13, Eq. 9-19, Eq. 9-20
KP_{CL} (kip)	86	
J	2	LS
C_1C_2	1.1	
$Q_G+(Q_E)/(JC1C2)$ (kip)	60.1	
DCR	0.70	

Permit Number: 19-05911

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Project:	900 Bldg	Date:	12/18/2019
		Checked By:	
Project No:	262019.034	Date:	

ASCE 41-13 Reinforced Masonry DCRs

Legend		
Input		
Calculated		
DCR/Check		

General Inputs		
Pier ID	Grid 560	
Location/Gridline	560	
f'm (psi)	810	Table 11-2(a)
Em (ksi)	729	TMS 402-13, Sec 4.2.2.2.1
fme (psi)	1053	Table 11-1
fy (ksi)	40	
fye (ksi)	52	
Es (ksi)	29000	
Masonry Denisty (pcf)	125	
Nominal Pier Length (ft)	40	
Pier Height (H)	14.00	
Wall thickness (in)	8	
Roof Trib (SF)	80	
Roof DL (psf)	20	
Roof SL (psf)	25	
Mezz Trib (SF)	0	
Mezz DL (psf)	0	
Mezz LL (psf)	0	
2nd FLR Trib (SF)	80	
2nd FLR DL (psf)	35	
2nd FLR LL (psf)	40	
Shearline Tot Shear (kips)	329.2	BSE-2E
Shearline Tot Length (ft)	40	
Applicable Wall Trib Length (ft)	40	
Seismic Axial Load (kips)	0.0	Holdown Force From Wall Above
Holdown to Wall Centroid (ft)	0.0	
IO, LS, CP	CP	

General Calculation		
Wall Self-Weight (kips)	46.7	
DL (kips)	4.4	Super-imposed DL @ Top of Wall
LL (kips)	3.2	
SL (kips)	2.0	
$1.1(Q_D + Q_L + 0.2 \cdot Q_S)$	60.1	Eq. 7-1
$0.9(Q_D)$	46.0	Eq. 7-2
Shear/Unit Length (kip/ft)	8.2	
Wall Shear (Q_E) (kips)	329.2	
Moment Generated from Holdown (kip*ft)	0.0	About Centroid of Wall

Wall Demands		
P (kips)	60.1	Eq. 7-34
P (kips)	46.0	Eq. 7-34
V (kips)	329.2	
M (kip*ft)	4608.8	

Lower-Bound Vertical Compressive Strength		
K	1	Table 6-1
r (in)	0.532	Weak Axis Radius of Gyration
h/r	316	
P_{CL} (kip)	99	TMS 402-13, Eq. 9-19, Eq. 9-20
KP_{CL} (kip)	99	
J	2	LS
C_1C_2	1.1	
$Q_G+(Q_E)/(JC1C2)$ (kip)	60.1	
DCR	0.61	

Determine FC vs DC Table 11-6		
Mu/(Vudv)	0.03	
γ	1.0	#5 Bars or smaller
Vn (kips) upperbound	656	TMS 402-13, Eq. 9-22
Vn (kips) upperbound	-	TMS 402-13, Eq. 9-23
Vnm (kip)	443.0	TMS 402-13, Sec 9.3.4.1.2.1
Vn (kip)	443.0	TMS 402-13, Equation 9-21
Holdown Anchor Rod As (in^2)	0.31	At one wall end
a (in)	2.4	
Distance from Edge of Wall to Rod (in)	4	
d (in)	476	
Mn (kip*ft)	2309	
Ve (kip)	165	
Shear vs. Flexure Control	Flexure Control	
An (in^2)	3840	
f_{ae} (psi)	15.7	
Shear vs. Force Controlled	NA	

Determine m-factors Table 11-6		
fae/fme	0.015	
L/heff	2.86	
As (in^2)	0.93	Total Vertical Reinforcement
ρ_v	0.00024	
Av (in^2)	0.9	Total Vertical Reinforcement
ρ_h	0.0007	
$\rho_h$fye/fme	0.046	
m-factor	7.5	
m-factor restriction	7	
m-factor used	7.0	

Deformation Control DCRs		
Shear DCR	0.11	
Moment DCR	0.29	

Force Control DCRs		
Shear DCR	-	
Moment DCR	-	

Out-Of-Plane Capacity TMS 402-13, Sec 9.3.5		
d (in)	4	
a (in)	0.3	
Mn (kip*ft)	26.6	

Out-Of-Plane Demands TMS 402-13 Sec 9.3.5 & ASCE 41-13 Section 11.3.5-->7.2.11		
χ	1	ASCE 41-13, Table 7-2, CP
Sxs,1E	1.11	
h (ft)	14	Full Wall Height
w (psf)	100.0	Elevation Wall Unit Weight
Fp*L (plf)	1776.0	ASCE 41-13, Eq. 7-13
Fp_min*L (plf)	400.0	ASCE 41-13, Eq. 7-14
Mu,o (kip*ft)	43.51	
n	39.8	
tsp (in)	8	
c (in)	0.4	TMS 402-13, Eq. 9-35
Ieff = Icr (in^4)	1087	TMS 402-13, Eq. 9-34
Pe (kips)	277	TMS 402-13, Eq. 9-33
Ψ	1.277	TMS 402-13, Eq. 9-32
ΨMu,o (kip*ft)	55.58	TMS 402-13, Eq. 9-31

Out-Of-Plane DCR, Sec 11.3.5.3		
Flexure DCR	0.9	

Permit Number: 19-05911

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Project:	900 Bldg	Date:	12/18/2019
		Checked By:	
Project No:	262019.034	Date:	

ASCE 41-13 Reinforced Masonry DCRs

Legend		
Input		
Calculated		
DCR/Check		
General Inputs		
Pier ID	Grid S60	
Location/Gridline	S60	
f'm (psi)	810	Table 11-2(a)
Em (ksi)	729	TMS 402-13, Sec 4.2.2.2.1
fme (psi)	1053	Table 11-1
fy (ksi)	40	
fye (ksi)	52	
Es (ksi)	29000	
Masonry Denisty (pcf)	125	
Nominal Pier Length (ft)	15	
Pier Height (H)	14.00	
Wall thickness (in)	8	
Roof Trib (SF)	80	
Roof DL (psf)	20	
Roof SL (psf)	25	
Mezz Trib (SF)	0	
Mezz DL (psf)	0	
Mezz LL (psf)	0	
2nd FLR Trib (SF)	0	
2nd FLR DL (psf)	35	
2nd FLR LL (psf)	40	
Shearline Tot Shear (kips)	102.4	BSE-1E
Shearline Tot Length (ft)	33	
Applicable Wall Trib Length (ft)	15	
Seismic Axial Load (kips)	0.0	Holdown Force From Wall Above
Holdown to Wall Centroid (ft)	0.0	
IO, LS, CP	LS	
General Calculation		
Wall Self-Weight (kips)	17.5	
DL (kips)	1.5	Super-imposed DL @ Top of Wall
LL (kips)	0.0	
SL (kips)	2.0	
$1.1(Q_D + Q_L + 0.2*Q_S)$	21.5	Eq. 7-1
$0.9(Q_D)$	17.2	Eq. 7-2
Shear/Unit Length (kip/ft)	3.1	
Wall Shear (Q_E) (kips)	46.54545455	
Moment Generated from Holdown (kip*ft)	0.0	About Centroid of Wall
Wall Demands		
P (kips)	21.5	Eq. 7-34
P (kips)	17.2	Eq. 7-34
V (kips)	46.54545455	
M (kip*ft)	651.6	
Lower-Bound Vertical Compressive Strength		
K	1	Table 6-1
r (in)	0.522	Weak Axis Radius of Gyration
h/r	322	
P_{CL} (kip)	36	TMS 402-13, Eq. 9-19, Eq. 9-20
KP_{CL} (kip)	36	
J	2	LS
C_1C_2	1.1	
$Q_G+(Q_E)/(JC1C2)$ (kip)	21.5	
DCR	0.60	

Determine FC vs DC Table 11-6		
Mu/(Vudv)	0.08	
γ	1.0	#5 Bars or smaller
Vn (kips) upperbound	246	TMS 402-13, Eq. 9-22
Vn (kips) upperbound	-	TMS 402-13, Eq. 9-23
Vnm (kip)	162.5	TMS 402-13, Sec 9.3.4.1.2.1
Vn (kip)	162.5	TMS 402-13, Equation 9-21
Holdown Anchor Rod As (in^2)	0.31	At one wall end
a (in)	2.4	
Distance from Edge of Wall to Rod (in)	4	
d (in)	176	
Mn (kip*ft)	431	
Ve (kip)	31	
Shear vs. Flexure Control	Flexure Control	
An (in^2)	1440	
f_{ae} (psi)	14.9	
Shear vs. Force Controlled	NA	
Determine m-factors Table 11-6		
fae/fme	0.014	
L/heff	1.07	
As (in^2)	0.31	Total Vertical Reinforcement
ρ_v	0.00022	
Av (in^2)	0.3	Total Vertical Reinforcement
ρ_h	0.0002	
$\rho_g$fye/fme	0.022	
m-factor	6.7	
m-factor restriction	7	
m-factor used	6.7	
Deformation Control DCRs		
Shear DCR	0.04	
Moment DCR	0.23	
Force Control DCRs		
Shear DCR	-	
Moment DCR	-	
Out-Of-Plane Capacity TMS 402-13, Sec 9.3.5		
d (in)	4	
a (in)	0.3	
Mn (kip*ft)	9.5	
Out-Of-Plane Demands TMS 402-13 Sec 9.3.5 & ASCE 41-13 Section 11.3.5-->7.2.11		
χ	1.3	ASCE 41-13, Table 7-2, LS
Sxs,1E	0.71	
h (ft)	14	Full Wall Height
w (psf)	[illegible]	Elevation Wall Unit Weight
Fp*L (plf)	553.0	ASCE 41-13, Eq. 7-13
Fp _min*L (plf)	155.0	ASCE 41-13, Eq. 7-14
Mu,o (kip*ft)	13.57	
n	32.6	
tsp (in)	8	
c (in)	0.4	TMS 402-13, Eq. 9-35
Ieff = Icr (in^4)	312	TMS 402-13, Eq. 9-34
Pe (kips)	[illegible]	TMS 402-13, Eq. 9-33
Ψ	1.273	TMS 402-13, Eq. 9-32
ΨMu,o (kip*ft)	17.27	TMS 402-13, Eq. 9-31
Out-Of-Plane DCR, Sec 11.3.5.3		
Flexure DCR	0.8	

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Project No:	262019.034	Date:	

ASCE 41-13 Reinforced Masonry DCRs

Legend		
Input		
Calculated		
DCR/Check		

General Inputs		
Pier ID	Grid S60	
Location/Gridline	S60	
f'm (psi)	810	Table 11-2(a)
Em (ksi)	729	TMS 402-13, Sec 4.2.2.2.1
fme (psi)	1053	Table 11-1
fy (ksi)	40	
fye (ksi)	52	
Es (ksi)	29000	
Masonry Denisty (pcf)	125	
Nominal Pier Length (ft)	15	
Pier Height (H)	14.00	
Wall thickness (in)	8	
Roof Trib (SF)	80	
Roof DL (psf)	20	
Roof SL (psf)	25	
Mezz Trib (SF)	0	
Mezz DL (psf)	0	
Mezz LL (psf)	0	
2nd FLR Trib (SF)	0	
2nd FLR DL (psf)	35	
2nd FLR LL (psf)	40	
Shearline Tot Shear (kips)	159.3	BSE-2E
Shearline Tot Length (ft)	33	
Applicable Wall Trib Length (ft)	15	
Seismic Axial Load (kips)	0.0	Holdown Force From Wall Above
Holdown to Wall Centroid (ft)	0.0	
IO, LS, CP	CP	

General Calculation		
Wall Self-Weight (kips)	17.5	
DL (kips)	1.6	Super-imposed DL @ Top of Wall
LL (kips)	0.0	
SL (kips)	2.0	
$1.1(Q_D + Q_L + 0.2*Q_S)$	21.5	Eq. 7-1
$0.9(Q_D)$	17.2	Eq. 7-2
Shear/Unit Length (kip/ft)	4.8	
Wall Shear (Q_E) (kips)	72.40909091	
Moment Generated from Holdown (kip*ft)	0.0	About Centroid of Wall

Wall Demands		
P (kips)	21.5	Eq. 7-34
P (kips)	17.2	Eq. 7-34
V (kips)	72.40909091	
M (kip*ft)	1013.7	

Lower-Bound Vertical Compressive Strength		
K	1	Table 6-1
r (in)	0.601	Weak Axis Radius of Gyration
h/r	250	
P_{CL} (kip)	48	TMS 402-13, Eq. 9-19, Eq. 9-20
KP_{CL} (kip)	48	
J	2	LS
C_1C_2	1.1	
$Q_G+(Q_E)/(JC1C2)$ (kip)	21.5	
DCR	0.35	

Determine FC vs DC Table 11-6		
Mu/(Vudv)	0.08	
γ	1.0	#5 Bars or smaller
Vn (kips) upperbound	246	TMS 402-13, Eq. 9-22
Vn (kips) upperbound	-	TMS 402-13, Eq. 9-23
Vnm (kip)	162.5	TMS 402-13, Sec 9.3.4.1.2.1
Vn (kip)	162.5	TMS 402-13, Equation 9-21
Holdown Anchor Rod As (in^2)	0.31	At one wall end
a (in)	2.4	
Distance from Edge of Wall to Rod (in)	4	
d (in)	176	
Mn (kip*ft)	451	
Ve (kip)	31	
Shear vs. Flexure Control	Flexure Control	
An (in^2)	1440	
f_{ee} (psi)	14.9	
Shear vs. Force Controlled	NA	

Determine m-factors Table 11-6		
fae/fme	0.014	
L/heff	1.07	
As (in^2)	0.62	Total Vertical Reinforcement
ρ_v	0.00043	
Av (in^2)	0.6	Total Vertical Reinforcement
ρ_h	0.0005	
$\rho_g$fye/fme	0.041	
m-factor	7.3	
m-factor restriction	7	
m-factor used	7.0	

Deformation Control DCRs		
Shear DCR	0.09	
Moment DCR	0.34	

Force Control DCRs		
Shear DCR	-	
Moment DCR	-	

Out-Of-Plane Capacity TMS 402-13, Sec 9.3.5		
d (in)	4	
a (in)	0.4	
Mn (kip*ft)	13.3	

Out-Of-Plane Demands TMS 402-13 Sec 9.3.5 & ASCE 41-13 Section 11.3.5-->7.2.11		
χ	1	ASCE 41-13, Table 7-2, CP
Sxs,1E	1.11	
h (ft)	14	Full Wall Height
w (psf)	100.0	Elevation Wall Unit Weight
Fp*L (plf)	555.0	ASCE 41-13, Eq. 7-13
Fp_min*L (plf)	150.0	ASCE 41-13, Eq. 7-14
Mu,o (kip*ft)	16.22	
n	[illegible]	
tsp (in)	8	
c (in)	0.5	TMS 402-13, Eq. 9-35
Ieff = Icr (in^4)	520	TMS 402-13, Eq. 9-34
Pe (kips)	190	TMS 402-13, Eq. 9-33
Ψ	[illegible]	TMS 402-13, Eq. 9-32
ΨMu,o (kip*ft)	17.47	TMS 402-13, Eq. 9-31

Out-Of-Plane DCR, Sec 11.3.5.3		
Flexure DCR	0.7	

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		Checked By:	
Project No:	262019.034	Date:	

ASCE 41-13 Reinforced Masonry DCRs

Legend		
Input		
Calculated		
DCR/Check		
General Inputs		
Pier ID	Grid S70 between E175 & E160	
Location/Gridline	S70	
f'm (psi)	810	Table 11-2(a)
Em (ksi)	729	TMS 402-13, Sec 4.2.2.2.1
fme (psi)	1053	Table 11-1
fy (ksi)	40	
fye (ksi)	52	
Es (ksi)	29000	
Masonry Denisty (pcf)	125	
Nominal Pier Length (ft)	6	
Pier Height (H)	6.00	
Wall thickness (in)	8	
Roof Trib (SF)	12	
Roof DL (psf)	20	
Roof SL (psf)	25	
Mezz Trib (SF)	0	
Mezz DL (psf)	0	
Mezz LL (psf)	0	
2nd FLR Trib (SF)	12	
2nd FLR DL (psf)	35	
2nd FLR LL (psf)	40	
Shearline Tot Shear (kips)	755.5	BSE-1E
Shearline Tot Length (ft)	105	
Applicable Wall Trib Length (ft)	6	
Seismic Axial Load (kips)	0.0	Holdown Force From Wall Above
Holdown to Wall Centroid (ft)	0.0	
IO, LS, CP	LS	
General Calculation		
Wall Self-Weight (kips)	3.0	
DL (kips)	0.7	Super-Imposed DL @ Top of Wall
LL (kips)	0.5	
SL (kips)	0.3	
$1.1(Q_D + Q_L + 0.2*Q_S)$	4.6	Eq. 7-1
$0.9(Q_D)$	3.3	Eq. 7-2
Shear/Unit Length (kip/ft)	7.2	
Wall Shear (Q_E) (kips)	43.17142857	
Moment Generated from Holdown (kip*ft)	0.0	About Centroid of Wall
Wall Demands		
P (kips)	4.5	Eq. 7-34
P (kips)	3.3	Eq. 7-34
V (kips)	43.17142857	
M (kip*ft)	259.0	
Lower-Bound Vertical Compressive Strength		
K	1	Table 6-1
r (in)	0.587	Weak Axis Radius of Gyration
h/r	123	
P_{CL} (kip)	100	TMS 402-13, Eq. 9-19, Eq. 9-20
KP_{CL} (kip)	100	
J	2	LS
C_1C_2	1.1	
$Q_G+(Q_E)/(JC1C2)$ (kip)	4.6	
DCR	0.05	

Determine FC vs DC Table 11-6		
Mu/(Vudv)	0.09	
γ	1.0	#5 Bars or smaller
Vn (kips) upperbound	98	TMS 402-13, Eq. 9-22
Vn (kips) upperbound	-	TMS 402-13, Eq. 9-23
Vnm (kip)	63.9	TMS 402-13, Sec 9.3.4.1.2.1
Vn (kip)	63.9	TMS 402-13, Equation 9-21
Holdown Anchor Rod As (in^2)	0.31	At one wall end
a (in)	2.4	
Distance from Edge of Wall to Rod (in)	4	
d (in)	68	
Mn (kip*ft)	87	
Ve (kip)	15	
Shear vs. Flexure Control	Flexure Control	
An (in^2)	576	
f_{ae} (psi)	8.0	
Shear vs. Force Controlled	NA	
Determine m-factors Table 11-6		
fae/fme	0.008	
L/heff	1.00	
As (in^2)	0.31	Total Vertical Reinforcement
ρ_v	0.00054	
Av (in^2)	0.3	Total Vertical Reinforcement
ρ_h	0.0005	
$\rho_g$fye/fme	0.053	
m-factor	6.1	
m-factor restriction	7	
m-factor used	6.1	
Deformation Control DCRs		
Shear DCR	0.11	
Moment DCR	0.48	
Force Control DCRs		
Shear DCR	-	
Moment DCR	-	
Out-Of-Plane Capacity TMS 402-13, Sec 9.3.5		
d (in)	4	
a (in)	0.4	
Mn (kip*ft)	5.0	
Out-Of-Plane Demands TMS 402-13 Sec 9.3.5 & ASCE 41-13 Section 11.3.5-->7.2.11		
χ	1.3	ASCE 41-13, Table 7-2, LS
Sxs,1E	0.71	
h (ft)	14	Full Wall Height
w (psf)	100.0	Elevation Wall Unit Weight
Fp*L (plf)	221.5	ASCE 41-13, Eq. 7-13
Fp_min*L (plf)	73.0	ASCE 41-13, Eq. 7-14
Mu,o (kip*ft)	5.43	
n	33.3	
tsp (in)	8	
c (in)	0.5	TMS 402-13, Eq. 9-35
Ieff = Icr (in^4)	193	TMS 402-13, Eq. 9-34
Pe (kips)	273	TMS 402-13, Eq. 9-33
Ψ	1.017	TMS 402-13, Eq. 9-32
ΨMu,o (kip*ft)	5.52	TMS 402-13, Eq. 9-31
Out-Of-Plane DCR, Sec 11.3.5.3		
Flexure DCR	0.5	

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Project No: 262019.034

ASCE 41-13 Reinforce

	Legend	
Input		
Calculated		
DCR/Check		
	General Inputs	
Pier ID	Grid S70 between E175 & E160	
Location/Gridline	S70	
f'm (psi)	810	Table 11-2(a)
Em (ksi)	729	TMS 402-13, Sec 4.2.2.2.1
fme (psi)	1053	Table 11-1
fy (ksi)	40	
fye (ksi)	52	
Es (ksi)	29000	
Masonry Denisty (pcf)	125	
Nominal Pier Length (ft)	6	
Pier Height (H)	6.00	
Wall thickness (in)	8	
Roof Trib (SF)	12	
Roof DL (psf)	20	
Roof SL (psf)	25	
Mezz Trib (SF)	0	
Mezz DL (psf)	0	
Mezz LL (psf)	0	
2nd FLR Trib (SF)	12	
2nd FLR DL (psf)	35	
2nd FLR LL (psf)	40	
Shearline Tot Shear (kips)	755.5	BSE-1E
Shearline Tot Length (ft)	105	
Applicable Wall Trib Length (ft)	6	
Seismic Axial Load (kips)	0.0	Holdown Force From Wall Above
Holdown to Wall Centroid (ft)	0.0	
IO, LS, CP	LS	
	General Calculation	
Wall Self-Weight (kips)	3.0	
DL (kips)	0.7	Super-imposed DL @ Top of Wall
LL (kips)	0.5	
SL (kips)	0.3	
$1.1(Q_D + Q_L + 0.2*Q_S)$	4.6	Eq. 7-1
$0.9(Q_D)$	3.3	Eq. 7-2
Shear/Unit Length (kip/ft)	7.2	
Wall Shear (Q_E) (kips)	43.17142857	
Moment Generated from Holdown (kip*ft)	0.0	About Centroid of Wall
	Wall Demands	
P (kips)	4.6	Eq. 7-34
P (kips)	3.3	Eq. 7-34
V (kips)	43.17142857	
M (kip*ft)	259.0	
	Lower-Bound Vertical Compressive Strength	
K	1	Table 6-1
r (in)	0.587	Weak Axis Radius of Gyration
h/r	123	
P_{CL} (kip)	100	TMS 402-13, Eq. 9-19, Eq. 9-20
KP_{CL} (kip)	100	
J	2	LS
C_1C_2	1.1	
$Q_G+(Q_E)/(JC1C2)$ (kip)	4.6	
DCR	0.05	

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Project No:	262019.034	Date:	

ASCE 41-13 Reinforced Masonry DCRs

Legend		
Input		
Calculated		
DCR/Check		

General Inputs		
Pier ID	Grid S70 between E175 & E160	
Location/Gridline	S70	
f'm (psi)	810	Table 11-2(a)
Em (ksi)	729	TMS 402-13, Sec 4.2.2.2.1
fme (psi)	1053	Table 11-1
fy (ksi)	40	
fye (ksi)	52	
Es (ksi)	29000	
Masonry Denisty (pcf)	125	
Nominal Pier Length (ft)	6	
Pier Height (H)	6.00	
Wall thickness (in)	8	
Roof Trib (SF)	12	
Roof DL (psf)	20	
Roof SL (psf)	25	
Mezz Trib (SF)	0	
Mezz DL (psf)	0	
Mezz LL (psf)	0	
2nd FLR Trib (SF)	12	
2nd FLR DL (psf)	35	
2nd FLR LL (psf)	40	
Shearline Tot Shear (kips)	1174.9	BSE-2E
Shearline Tot Length (ft)	105	
Applicable Wall Trib Length (ft)	6	
Seismic Axial Load (kips)	0.0	Holdown Force From Wall Above
Holdown to Wall Centroid (ft)	0.0	
IO, LS, CP	CP	

General Calculation		
Wall Self-Weight (kips)	3.0	
DL (kips)	0.7	Super-imposed DL @ Top of Wall
LL (kips)	0.5	
SL (kips)	0.3	
$1.1(Q_D + Q_L + 0.2*Q_S)$	4.6	Eq. 7-1
$0.9(Q_D)$	3.3	Eq. 7-2
Shear/Unit Length (kip/ft)	11.2	
Wall Shear (Q_E) (kips)	67.13714286	
Moment Generated from Holdown (kip*ft)	0.0	About Centroid of Wall

Wall Demands		
P (kips)	4.6	Eq. 7-34
P (kips)	3.3	Eq. 7-34
V (kips)	67.13714286	
M (kip*ft)	402.8	

Lower-Bound Vertical Compressive Strength		
K	1	Table 6-1
r (in)	0.587	Weak Axis Radius of Gyration
h/r	123	
P_{CL} (kip)	100	TMS 402-13, Eq. 9-19, Eq. 9-20
KP_{CL} (kip)	100	
J	2	LS
C_1C_2	1.1	
$Q_G+(Q_E)/(JC1C2)$ (kip)	4.6	
DCR	0.05	

Determine FC vs DC Table 11-6		
Mu/(Vudv)	0.09	
γ	1.0	#5 Bars or smaller
Vn (kips) upperbound	98	TMS 402-13, Eq. 9-22
Vn (kips) upperbound	-	TMS 402-13, Eq. 9-23
Vnm (kip)	63.9	TMS 402-13, Sec 9.3.4.1.2.1
Vn (kip)	63.9	TMS 402-13, Equation 9-21
Holdown Anchor Rod As (in^2)	0.31	At one wall end
a (in)	2.4	
Distance from Edge of Wall to Rod (in)	4	
d (in)	68	
Mn (kip*ft)	87	
Ve (kip)	15	
Shear vs. Flexure Control	Flexure Control	
An (in^2)	576	
f_{ae} (psi)	[illegible]	
Shear vs. Force Controlled	NA	

Determine m-factors Table 11-6		
fae/fme	0.008	
L/heff	1.00	
As (in^2)	0.31	Total Vertical Reinforcement
ρ_v	0.00054	
Av (in^2)	0.3	Total Vertical Reinforcement
ρ_h	0.0005	
$\rho_g$fye/fme	0.053	
m-factor	7.2	
m-factor restriction	7	
m-factor used	7.0	

Deformation Control DCRs		
Shear DCR	0.15	
Moment DCR	0.58	

Force Control DCRs		
Shear DCR	-	
Moment DCR	-	

Out-Of-Plane Capacity TMS 402-13, Sec 9.3.5		
d (in)	4	
a (in)	0.4	
Mn (kip*ft)	5.0	

Out-Of-Plane Demands TMS 402-13 Sec 9.3.5 & ASCE 41-13 Section 11.3.5-->7.2.11		
χ	1	ASCE 41-13, Table 7-2, CP
Sxs,1E	1.11	
h (ft)	14	Full Wall Height
w (psf)	100.0	Elevation Wall Unit Weight
Fp*L (plf)	[illegible]	ASCE 41-13, Eq. 7-13
Fp_min*L (plf)	[illegible]	ASCE 41-13, Eq. 7-14
Mu,o (kip*ft)	6.59	
n	[illegible]	
tsp (in)	[illegible]	
c (in)	[illegible]	TMS 402-13, Eq. 9-35
Ieff = Icr (in^4)	[illegible]	TMS 402-13, Eq. 9-34
Pe (kips)	275	TMS 402-13, Eq. 9-33
Ψ	1.017	TMS 402-13, Eq. 9-32
ΨMu,o (kip*ft)	[illegible]	TMS 402-13, Eq. 9-31

Out-Of-Plane DCR, Sec 11.3.5.3		
Flexure DCR	[illegible]	

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Everett, Washington 98204
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Client:	RFM	Designed By:	JJ
Project:	900 Bldg	Date:	12/18/2019
		Checked By:	
Project No:	262019.034	Date:	

ASCE 41-13 Reinforced Masonry DCRs

Legend		
Input		
Calculated		
DCR/Check		

General Inputs		
Pier ID	Grid S70 between E175 & E160	
Location/Gridline	S70	
f'm (psi)	810	Table 11-2(a)
Em (ksi)	729	TMS 402-13, Sec 4.2.2.2.1
fme (psi)	1053	Table 11-1
fy (ksi)	40	
fye (ksi)	52	
Es (ksi)	29000	
Masonry Denisty (pcf)	125	
Nominal Pier Length (ft)	30	
Pier Height (H)	27.00	
Wall thickness (in)	8	
Roof Trib (SF)	60	
Roof DL (psf)	20	
Roof SL (psf)	25	
Mezz Trib (SF)	0	
Mezz DL (psf)	0	
Mezz LL (psf)	0	
2nd FLR Trib (SF)	0	
2nd FLR DL (psf)	35	
2nd FLR LL (psf)	40	
Shearline Tot Shear (kips)	268.8	BSE-1E
Shearline Tot Length (ft)	72	
Applicable Wall Trib Length (ft)	30	
Seismic Axial Load (kips)	0.0	Holdown Force From Wall Above
Holdown to Wall Centroid (ft)	0.0	
IO, LS, CP	LS	

General Calculation		
Wall Self-Weight (kips)	67.5	
DL (kips)	1.2	Super-imposed DL @ Top of Wall
LL (kips)	0.0	
SL (kips)	1.5	
$1.1(Q_G + Q_L + 0.2*Q_S)$	75.9	Eq. 7-1
$0.9(Q_G)$	61.8	Eq. 7-2
Shear/Unit Length (kip/ft)	3.7	
Wall Shear (Q_E) (kips)	112	
Moment Generated from Holdown (kip*ft)	0.0	About Centroid of Wall

Wall Demands		
P (kips)	75.9	Eq. 7-34
P (kips)	61.8	Eq. 7-34
V (kips)	112	
M (kip*ft)	3024.0	

Lower-Bound Vertical Compressive Strength		
K	1	Table 6-1
r (in)	0.745	Weak Axis Radius of Gyration
h/r	435	
P_{CL} (kip)	41	TMS 402-13, Eq. 9-19, Eq. 9-20
KP_{CL} (kip)	41	
J	2	LS
C_1C_2	1.1	
$Q_G+(Q_E)/(JC1C2)$ (kip)	75.9	
DCR	1.86	

Determine FC vs DC Table 11-6		
Mu/(Vudv)	0.08	
γ	1.0	#5 Bars or smaller
Vn (kips) upperbound	492	TMS 402-13, Eq. 9-22
Vn (kips) upperbound	-	TMS 402-13, Eq. 9-23
Vnm (kip)	332.4	TMS 402-13, Sec 9.3.4.1.2.1
Vn (kip)	332.4	TMS 402-13, Equation 9-21
Holdown Anchor Rod As (in^2)	0.31	At one wall end
a (in)	2.4	
Distance from Edge of Wall to Rod (in)	4	
d (in)	356	
Mn (kip*ft)	2195	
Ve (kip)	81	
Shear vs. Flexure Control	Flexure Control	
An (in^2)	2880	
f_{ae} (psi)	26.4	
Shear vs. Force Controlled	NA	

Determine m-factors Table 11-6		
fae/fme	0.025	
L/heff	1.11	
As (in^2)	2.48	Total Vertical Reinforcement
ρ_v	0.00086	
Av (in^2)	2.5	Total Vertical Reinforcement
ρ_h	0.0010	
$\rho_g$fye/fme	0.090	
m-factor	4.9	
m-factor restriction	7	
m-factor used	4.9	

Deformation Control DCRs		
Shear DCR	0.07	
Moment DCR	0.28	

Force Control DCRs		
Shear DCR	-	
Moment DCR	-	

Out-Of-Plane Capacity TMS 402-13, Sec 9.3.5		
d (in)	4	
a (in)	0.8	
Mn (kip*ft)	48.6	

Out-Of-Plane Demands TMS 402-13 Sec 9.3.5 & ASCE 41-13 Section 11.3.5-->7.2.11		
χ	1.3	ASCE 41-13, Table 7-2, LS
Sxs,1E	0.71	
h (ft)	14	Full Wall Height
w (psf)	100.0	Elevation Wall Unit Weight
Fp*L (plf)	1107.5	ASCE 41-13, Eq. 7-13
Fp_min*L (plf)	2000.0	ASCE 41-13, Eq. 7-14
Mu,o (kip*ft)	27.14	
n	29.0	
tsp (in)	8	
c (in)	0.9	TMS 402-13, Eq. 9-35
Ieff = Icr (in^4)	1600	TMS 402-13, Eq. 9-34
Pe (kips)	110	TMS 402-13, Eq. 9-33
Ψ	3.240	TMS 402-13, Eq. 9-32
ΨMu,o (kip*ft)	[illegible]	TMS 402-13, Eq. 9-31

Out-Of-Plane DCR, Sec 11.3.5.3		
Flexure DCR	0.8	

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ASCE 41-13 Reinforced Masonry DCRs

Legend		
Input		
Calculated		
DCR/Check		

General Inputs		
Pier ID	Grid S70 between E175 & E160	
Location/Gridline	S70	
f'm (psi)	810	Table 11-2(a)
Em (ksi)	729	TMS 402-13, Sec 4.2.2.2.1
fme (psi)	1053	Table 11-1
fy (ksi)	40	
fye (ksi)	52	
Es (ksi)	29000	
Masonry Denisty (pcf)	125	
Nominal Pier Length (ft)	30	
Pier Height (H)	14.00	
Wall thickness (in)	8	
Roof Trib (SF)	60	
Roof DL (psf)	20	
Roof SL (psf)	25	
Mezz Trib (SF)	0	
Mezz DL (psf)	0	
Mezz LL (psf)	0	
2nd FLR Trib (SF)	0	
2nd FLR DL (psf)	35	
2nd FLR LL (psf)	40	
Shearline Tot Shear (kips)	729	BSE-2E
Shearline Tot Length (ft)	72	
Applicable Wall Trib Length (ft)	30	
Seismic Axial Load (kips)	0.0	Holdown Force From Wall Above
Holdown to Wall Centroid (ft)	0.0	
IO, LS, CP	CP	

General Calculation		
Wall Self-Weight (kips)	35.0	
DL (kips)	1.2	Super-Imposed DL @ Top of Wall
LL (kips)	0.0	
SL (kips)	1.5	
$1.1(Q_D + Q_L + 0.2*Q_S)$	40.2	Eq. 7-1
$0.9(Q_D)$	32.6	Eq. 7-2
Shear/Unit Length (kip/ft)	10.1	
Wall Shear (Q_E) (kips)	303.75	
Moment Generated from Holdown (kip*ft)	0.0	About Centroid of Wall

Wall Demands		
P (kips)	40.2	Eq. 7-34
P (kips)	32.6	Eq. 7-34
V (kips)	303.75	
M (kip*ft)	4252.5	

Lower-Bound Vertical Compressive Strength		
K	1	Table 6-1
r (in)	0.706	Weak Axis Radius of Gyration
h/r	238	
P_{CL} (kip)	136	TMS 402-13, Eq. 9-19, Eq. 9-20
KP_{CL} (kip)	136	
J	2	LS
C_1C_2	1.1	
$Q_G+(Q_E)/(JC1C2)$ (kip)	40.2	
DCR	0.30	

Determine FC vs DC Table 11-6		
Mu/(Vudv)	0.04	
γ	1.0	#5 Bars or smaller
Vn (kips) upperbound	492	TMS 402-13, Eq. 9-22
Vn (kips) upperbound	-	TMS 402-13, Eq. 9-23
Vnm (kip)	330.4	TMS 402-13, Sec 9.3.4.1.2.1
Vn (kip)	330.4	TMS 402-13, Equation 9-21
Holdown Anchor Rod As (in^2)	0.31	At one wall end
a (in)	2.4	
Distance from Edge of Wall to Rod (in)	4	
d (in)	356	
Mn (kip*ft)	1330	
Ve (kip)	95	
Shear vs. Flexure Control	Flexure Control	
An (in^2)	2880	
f_{ae} (psi)	13.9	
Shear vs. Force Controlled	NA	

Determine m-factors Table 11-6		
fae/fme	0.013	
L/heff	2.14	
As (in^2)	2.48	Total Vertical Reinforcement
ρ_v	0.00086	
Av (in^2)	2.5	Total Vertical Reinforcement
ρ_h	0.0018	
$\rho_g$fye/fme	0.134	
m-factor	5.7	
m-factor restriction	7	
m-factor used	5.7	

Deformation Control DCRs		
Shear DCR	0.16	
Moment DCR	0.58	

Force Control DCRs		
Shear DCR	-	
Moment DCR	-	

Out-Of-Plane Capacity TMS 402-13, Sec 9.3.5		
d (in)	4	
a (in)	0.6	
Mn (kip*ft)	40.6	

Out-Of-Plane Demands TMS 402-13 Sec 9.3.5 & ASCE 41-13 Section 11.3.5-->7.2.11		
χ	1	ASCE 41-13, Table 7-2, CP
Sxs,1E	1.11	
h (ft)	14	Full Wall Height
w (psf)	100.0	Elevation Wall Unit Weight
Fp*L (plf)	1332.0	ASCE 41-13, Eq. 7-13
Fp_min*L (plf)	300.0	ASCE 41-13, Eq. 7-14
Mu,o (kip*ft)	32.63	
n	39.8	
tsp (in)	8	
c (in)	0.7	TMS 402-13, Eq. 9-35
Ieff = Icr (in^4)	1437	TMS 402-13, Eq. 9-34
Pe (kips)	366	TMS 402-13, Eq. 9-33
Ψ	1.123	TMS 402-13, Eq. 9-32
ΨMu,o (kip*ft)	36.65	TMS 402-13, Eq. 9-31

Out-Of-Plane DCR, Sec 11.3.5.3		
Flexure DCR	0.4	

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Project No:	262019.034	Date:	

ASCE 41-13 Reinforced Masonry DCRs

Legend		
Input		
Calculated		
DCR/Check		
General Inputs		
Pier ID	Grid S75 either wall	
Location/Gridline	S75	
f'm (psi)	810	Table 11-2(a)
Em (ksi)	729	TMS 402-13, Sec 4.2.2.2.1
fme (psi)	1053	Table 11-1
fy (ksi)	40	
fye (ksi)	52	
Es (ksi)	29000	
Masonry Denisty (pcf)	125	
Nominal Pier Length (ft)	15	
Pier Height (H)	14.00	
Wall thickness (in)	8	
Roof Trib (SF)	30	
Roof DL (psf)	20	
Roof SL (psf)	25	
Mezz Trib (SF)	0	
Mezz DL (psf)	0	
Mezz LL (psf)	0	
2nd FLR Trib (SF)	30	
2nd FLR DL (psf)	35	
2nd FLR LL (psf)	40	
Shearline Tot Shear (kips)	674.6	BSE-1E
Shearline Tot Length (ft)	60	
Applicable Wall Trib Length (ft)	15	
Seismic Axial Load (kips)	0.0	Holdown Force From Wall Above
Holdown to Wall Centroid (ft)	0.0	
IO, LS, CP	LS	
General Calculation		
Wall Self-Weight (kips)	17.5	
DL (kips)	1.7	Super-imposed DL @ Top of Wall
LL (kips)	1.2	
SL (kips)	0.8	
$1.1(Q_D + Q_L + 0.2*Q_S)$	22.6	Eq. 7-1
$0.9(Q_D)$	17.2	Eq. 7-2
Shear/Unit Length (kip/ft)	11.2	
Wall Shear (Q_E) (kips)	168.65	
Moment Generated from Holdown (kip*ft)	0.0	About Centroid of Wall
Wall Demands		
P (kips)	22.6	Eq. 7-34
P (kips)	17.2	Eq. 7-34
V (kips)	168.65	
M (kip*ft)	2361.1	
Lower-Bound Vertical Compressive Strength		
K	1	Table 6-1
r (in)	0.221	Weak Axis Radius of Gyration
h/r	[illegible]	
P_{CL} (kip)	35	TMS 402-13, Eq. 9-19, Eq. 9-20
KP_{CL} (kip)	35	
J	2	LS
C_1C_2	1.1	
$Q_G+(Q_E)/(JC1C2)$ (kip)	22.6	
DCR	[illegible]	

Determine FC vs DC Table 11-6		
Mu/(Vudv)	0.08	
γ	1.0	#5 Bars or smaller
Vn (kips) upperbound	246	TMS 402-13, Eq. 9-22
Vn (kips) upperbound	-	TMS 402-13, Eq. 9-23
Vnm (kip)	162.5	TMS 402-13, Sec 9.3.4.1.2.1
Vn (kip)	162.5	TMS 402-13, Equation 9-21
Holdown Anchor Rod As (in^2)	0.31	At one wall end
a (in)	2.4	
Distance from Edge of Wall to Rod (in)	4	
d (in)	176	
Mn (kip*ft)	432	
Ve (kip)	31	
Shear vs. Flexure Control	Flexure Control	
An (in^2)	1440	
f_{ae} (psi)	15.7	
Shear vs. Force Controlled	NA	
Determine m-factors Table 11-6		
fae/fme	0.015	
L/heff	1.07	
As (in^2)	0.31	Total Vertical Reinforcement
ρ_v	0.00022	
Av (in^2)	0.3	Total Vertical Reinforcement
ρ_h	0.0002	
$\rho_g$fye/fme	0.022	
m-factor	6.7	
m-factor restriction	7	
m-factor used	6.7	
Deformation Control DCRs		
Shear DCR	[illegible]	
Moment DCR	[illegible]	
Force Control DCRs		
Shear DCR	-	
Moment DCR	-	
Out-Of-Plane Capacity TMS 402-13, Sec 9.3.5		
d (in)	4	
a (in)	0.3	
Mn (kip*ft)	9.5	
Out-Of-Plane Demands TMS 402-13 Sec 9.3.5 & ASCE 41-13 Section 11.3.5-->7.2.11		
χ	1.3	ASCE 41-13, Table 7-2, LS
Sxs,1E	0.71	
h (ft)	14	Full Wall Height
w (psf)	100.0	Elevation Wall Unit Weight
Fp*L (plf)	[illegible]	ASCE 41-13, Eq. 7-13
Fp_min*L (plf)	[illegible]	ASCE 41-13, Eq. 7-14
Mu,o (kip*ft)	[illegible]	
n	[illegible]	
tsp (in)	8	
c (in)	[illegible]	TMS 402-13, Eq. 9-35
Ieff = Icr (in^4)	[illegible]	TMS 402-13, Eq. 9-34
Pe (kips)	100	TMS 402-13, Eq. 9-33
Ψ	[illegible]	TMS 402-13, Eq. 9-32
ΨMu,o (kip*ft)	17.54	TMS 402-13, Eq. 9-31
Out-Of-Plane DCR, Sec 11.3.5.3		
Flexure DCR	0.8	

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ASCE 41-13 Reinforced Masonry DCRs

Legend		
Input		
Calculated		
DCR/Check		
General Inputs		
Pier ID	Grid 575 either wall	
Location/Gridline	575	
f'm (psi)	810	Table 11-2(a)
Em (ksi)	729	TMS 402-13, Sec 4.2.2.2.1
fme (psi)	1053	Table 11-1
fy (ksi)	40	
fye (ksi)	52	
Es (ksi)	29000	
Masonry Denisty (pcf)	125	
Nominal Pier Length (ft)	15	
Pier Height (H)	14.00	
Wall thickness (in)	8	
Roof Trib (SF)	150	
Roof DL (psf)	20	
Roof SL (psf)	25	
Mezz Trib (SF)	0	
Mezz DL (psf)	0	
Mezz LL (psf)	0	
2nd FLR Trib (SF)	150	
2nd FLR DL (psf)	35	
2nd FLR LL (psf)	40	
Shearline Tot Shear (kips)	1049.1	BSE-2E
Shearline Tot Length (ft)	60	
Applicable Wall Trib Length (ft)	15	
Seismic Axial Load (kips)	0.0	Holdown Force From Wall Above
Holdown to Wall Centroid (ft)	0.0	
IO, LS, CP	CP	
General Calculation		
Wall Self-Weight (kips)	17.5	
DL (kips)	8.3	Super-imposed DL @ Top of Wall
LL (kips)	6.0	
SL (kips)	2.8	
$1.1(Q_D + Q_L + 0.2*Q_S)$	35.8	Eq. 7-1
$0.9(Q_D)$	23.2	Eq. 7-2
Shear/Unit Length (kip/ft)	17.5	
Wall Shear (Q_E) (kips)	262.275	
Moment Generated from Holdown (kip*ft)	0.0	About Centroid of Wall
Wall Demands		
P (kips)	35.8	Eq. 7-34
P (kips)	23.2	Eq. 7-34
V (kips)	262.275	
M (kip*ft)	3671.9	
Lower-Bound Vertical Compressive Strength		
K	1	Table 6-1
r (in)	0.619	Weak Axis Radius of Gyration
h/r	271	
P_{CL} (kip)	51	TMS 402-13, Eq. 9-19, Eq. 9-20
KP_{CL} (kip)	51	
J	2	LS
C_1C_2	1.1	
$Q_G+(Q_E)/(JC1C2)$ (kip)	35.8	
DCR	0.70	

Determine FC vs DC Table 11-6		
Mu/(Vudv)	0.08	
γ	1.0	#5 Bars or smaller
Vn (kips) upperbound	246	TMS 402-13, Eq. 9-22
Vn (kips) upperbound	-	TMS 402-13, Eq. 9-23
Vnm (kip)	164.0	TMS 402-13, Sec 9.3.4.1.2.1
Vn (kip)	164.0	TMS 402-13, Equation 9-21
Holdown Anchor Rod As (in^2)	0.31	At one wall end
a (in)	2.4	
Distance from Edge of Wall to Rod (in)	4	
d (in)	176	
Mn (kip*ft)	518	
Ve (kip)	37	
Shear vs. Flexure Control	Flexure Control	
An (in^2)	1440	
f_{ae} (psi)	24.8	
Shear vs. Force Controlled	NA	
Determine m-factors Table 11-6		
fae/fme	0.024	
L/heff	1.07	
As (in^2)	0.62	Total Vertical Reinforcement
ρ_v	0.00043	
Av (in^2)	0.6	Total Vertical Reinforcement
ρ_h	0.0005	
$\rho_g$fye/fme	0.024	
m-factor	7.1	
m-factor restriction	8	
m-factor used	7.1	
Deformation Control DCRs		
Shear DCR	0.21	
Moment DCR	1.00	
Force Control DCRs		
Shear DCR	-	
Moment DCR	-	
Out-Of-Plane Capacity TMS 402-13, Sec 9.3.5		
d (in)	4	
a (in)	0.5	
Mn (kip*ft)	15.0	
Out-Of-Plane Demands TMS 402-13 Sec 9.3.5 & ASCE 41-13 Section 11.3.5-->7.2.11		
χ	1	ASCE 41-13, Table 7-2, CP
Sxs,2E	1.11	
h (ft)	14	Full Wall Height
w (psf)	100.0	Elevation Wall Unit Weight
Fp*L (plf)	666.0	ASCE 41-13, Eq. 7-13
Fp_min*L (plf)	550.0	ASCE 41-13, Eq. 7-14
Mu,o (kip*ft)	16.32	
n	20.0	
tsp (in)	8	
c (in)	0.6	TMS 402-13, Eq. 9-35
Ieff = Icr (in^4)	552	TMS 402-13, Eq. 9-34
Pe (kips)	541	TMS 402-13, Eq. 9-33
Ψ	1.340	TMS 402-13, Eq. 9-32
ΨMu,o (kip*ft)	21.87	TMS 402-13, Eq. 9-31
Out-Of-Plane DCR, Sec 11.3.5.3		
Flexure DCR	0.7	

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Input		
Calculated		
DCR/Check		
General Inputs		
Pier ID	Grid S75 either wall	
Location/Gridline	S75	
f'm (psi)	810	Table 11-2(a)
Em (ksi)	729	TMS 402-13, Sec 4.2.2.2.1
fme (psi)	1053	Table 11-1
fy (ksi)	40	
fye (ksi)	52	
Es (ksi)	29000	
Masonry Denisty (pcf)	125	
Nominal Pier Length (ft)	8	
Pier Height (H)	14.00	
Wall thickness (in)	8	
Roof Trib (SF)	16	
Roof DL (psf)	20	
Roof SL (psf)	25	
Mezz Trib (SF)	0	
Mezz DL (psf)	0	
Mezz LL (psf)	0	
2nd FLR Trib (SF)	0	
2nd FLR DL (psf)	35	
2nd FLR LL (psf)	40	
Shearline Tot Shear (kips)	326.4	BSE-1E
Shearline Tot Length (ft)	98	
Applicable Wall Trib Length (ft)	8	
Seismic Axial Load (kips)	0.0	Holdown Force From Wall Above
Holdown to Wall Centroid (ft)	0.0	
IO, LS, CP	LS	
General Calculation		
Wall Self-Weight (kips)	9.3	
DL (kips)	0.8	Super-imposed DL @ Top of Wall
LL (kips)	0.0	
SL (kips)	0.4	
$1.1(Q_D + Q_L + 0.2*Q_S)$	10.7	Eq. 7-1
$0.9(Q_D)$	8.7	Eq. 7-2
Shear/Unit Length (kip/ft)	3.3	
Wall Shear (Q_E) (kips)	26.64489796	
Moment Generated from Holdown (kip*ft)	0.0	About Centroid of Wall
Wall Demands		
P (kips)	10.7	Eq. 7-34
P (kips)	8.7	Eq. 7-34
V (kips)	26.64489796	
M (kip*ft)	373.0	
Lower-Bound Vertical Compressive Strength		
K	1	Table 6-1
r (in)	0.713	Weak Axis Radius of Gyration
h/r	236	
P_{CL} (kip)	24	TMS 402-13, Eq. 9-19, Eq. 9-20
KP_{CL} (kip)	24	
J	2	LS
C_1C_2	1.1	
$Q_G+(Q_E)/(JC1C2)$ (kip)	10.7	
DCR	0.44	

Determine FC vs DC Table 11-6		
Mu/(Vudv)	0.15	
γ	1.0	#5 Bars or smaller
Vn (kips) upperbound	131	TMS 402-13, Eq. 9-22
Vn (kips) upperbound	-	TMS 402-13, Eq. 9-23
Vnm (kip)	83.8	TMS 402-13, Sec 9.3.4.1.2.1
Vn (kip)	83.8	TMS 402-13, Equation 9-21
Holdown Anchor Rod As (in^2)	0.31	At one wall end
a (in)	2.4	
Distance from Edge of Wall to Rod (in)	4	
d (in)	92	
Mn (kip*ft)	160	
Ve (kip)	11	
Shear vs. Flexure Control	Flexure Control	
An (in^2)	768	
f_{ae} (psi)	13.9	
Shear vs. Force Controlled	NA	
Determine m-factors Table 11-6		
fae/fme	0.013	
L/heff	0.57	
As (in^2)	0.31	Total Vertical Reinforcement
ρ_v	0.00040	
Av (in^2)	0.3	Total Vertical Reinforcement
ρ_h	0.0002	
$\rho_g$fye/fme	0.031	
m-factor	5.6	
m-factor restriction	7	
m-factor used	5.6	
Deformation Control DCRs		
Shear DCR	0.06	
Moment DCR	0.42	
Force Control DCRs		
Shear DCR	-	
Moment DCR	-	
Out-Of-Plane Capacity TMS 402-13, Sec 9.3.5		
d (in)	4	
a (in)	0.4	
Mn (kip*ft)	6.7	
Out-Of-Plane Demands TMS 402-13 Sec 9.3.5 & ASCE 41-13 Section 11.3.5-->7.2.11		
χ	1.3	ASCE 41-13, Table 7-2, LS
Sxs,1E	0.71	
h (ft)	14	Full Wall Height
w (psf)	100.0	Elevation Wall Unit Weight
Fp*L (plf)	295.4	ASCE 41-13, Eq. 7-13
Fp_min*L (plf)	104.0	ASCE 41-13, Eq. 7-14
Mu,o (kip*ft)	7.24	
n	39.8	
tsp (in)	8	
c (in)	0.5	TMS 402-13, Eq. 9-35
Ieff = Icr (in^4)	265	TMS 402-13, Eq. 9-34
Pe (kips)	68	TMS 402-13, Eq. 9-33
Ψ	1.188	TMS 402-13, Eq. 9-32
ΨMu,o (kip*ft)	8.60	TMS 402-13, Eq. 9-31
Out-Of-Plane DCR, Sec 11.3.5.3		
Flexure DCR	0.6	

Permit Number: 19-05911

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Ph: 425 741-3800
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Client:	RFM	Designed By:	JJ
Project:	900 Bldg	Date:	12/18/2019
		Checked By:	
Project No:	262019.034	Date:	

ASCE 41-13 Reinforced Masonry DCRs

Legend		
Input		
Calculated		
DCR/Check		
General Inputs		
Pier ID	Grid S75 either wall	
Location/Gridline	S75	
f'm (psi)	810	Table 11-2(a)
Em (ksi)	729	TMS 402-13, Sec 4.2.2.2.1
fme (psi)	1053	Table 11-1
fy (ksi)	40	
fye (ksi)	52	
Es (ksi)	29000	
Masonry Denisty (pcf)	125	
Nominal Pier Length (ft)	8	
Pier Height (H)	14.00	
Wall thickness (in)	8	
Roof Trib (SF)	16	
Roof DL (psf)	20	
Roof SL (psf)	25	
Mezz Trib (SF)	0	
Mezz DL (psf)	0	
Mezz LL (psf)	0	
2nd FLR Trib (SF)	0	
2nd FLR DL (psf)	35	
2nd FLR LL (psf)	40	
Shearline Tot Shear (kips)	507.6	BSE-2E
Shearline Tot Length (ft)	98	
Applicable Wall Trib Length (ft)	8	
Seismic Axial Load (kips)	0.0	Holdown Force From Wall Above
Holdown to Wall Centroid (ft)	0.0	
IO, LS, CP	CP	
General Calculation		
Wall Self-Weight (kips)	9.3	
DL (kips)	0.3	Super-imposed DL @ Top of Wall
LL (kips)	0.0	
SL (kips)	0.4	
$1.1(Q_D + Q_L + 0.2*Q_S)$	10.7	Eq. 7-1
$0.9(Q_D)$	8.7	Eq. 7-2
Shear/Unit Length (kip/ft)	5.2	
Wall Shear (Q_E) (kips)	41.43673469	
Moment Generated from Holdown (kip*ft)	0.0	About Centroid of Wall
Wall Demands		
P (kips)	10.7	Eq. 7-34
P (kips)	8.7	Eq. 7-34
V (kips)	41.43673469	
M (kip*ft)	580.1	
Lower-Bound Vertical Compressive Strength		
K	1	Table 6-1
r (in)	0.588	Weak Axis Radius of Gyration
h/r	285	
P_{CL} (kip)	24	TMS 402-13, Eq. 9-19, Eq. 9-20
KP_{CL} (kip)	24	
J	2	LS
C_1C_2	1.1	
$Q_G+(Q_E)/(JC1C2)$ (kip)	10.7	
DCR	0.44	

Determine FC vs DC Table 11-6		
Mu/(Vudv)	0.15	
γ	1.0	#5 Bars or smaller
Vn (kips) upperbound	131	TMS 402-13, Eq. 9-22
Vn (kips) upperbound	-	TMS 402-13, Eq. 9-23
Vnm (kip)	83.8	TMS 402-13, Sec 9.3.4.1.2.1
Vn (kip)	83.8	TMS 402-13, Equation 9-21
Holdown Anchor Rod As (in^2)	0.31	At one wall end
a (in)	2.4	
Distance from Edge of Wall to Rod (in)	4	
d (in)	92	
Mn (kip*ft)	160	
Ve (kip)	11	
Shear vs. Flexure Control	Flexure Control	
An (in^2)	768	
f_{ae} (psi)	13.9	
Shear vs. Force Controlled	NA	
Determine m-factors Table 11-6		
fae/fme	0.013	
L/heff	0.57	
As (in^2)	0.31	Total Vertical Reinforcement
ρ_v	0.00040	
Av (in^2)	0.3	Total Vertical Reinforcement
ρ_h	0.0002	
$\rho_g$fye/fme	0.031	
m-factor	6.9	
m-factor restriction	7	
m-factor used	6.9	
Deformation Control DCRs		
Shear DCR	0.07	
Moment DCR	0.51	
Force Control DCRs		
Shear DCR	-	
Moment DCR	-	
Out-Of-Plane Capacity TMS 402-13, Sec 9.3.5		
d (in)	4	
a (in)	0.4	
Mn (kip*ft)	6.7	
Out-Of-Plane Demands TMS 402-13 Sec 9.3.5 & ASCE 41-13 Section 11.3.5-->7.2.11		
χ	1	ASCE 41-13, Table 7-2, CP
Sxs,1E	1.11	
h (ft)	14	Full Wall Height
w (psf)	100.0	Elevation Wall Unit Weight
Fp*L (plf)	355.2	ASCE 41-13, Eq. 7-13
Fp _min*L (plf)	80.0	ASCE 41-13, Eq. 7-14
Mu,o (kip*ft)	8.70	
n	39.8	
tsp (in)	8	
c (in)	0.5	TMS 402-13, Eq. 9-35
Ieff = Icr (in^4)	265	TMS 402-13, Eq. 9-34
Pe (kips)	68	TMS 402-13, Eq. 9-33
Ψ	1.188	TMS 402-13, Eq. 9-32
ΨMu,o (kip*ft)	10.34	TMS 402-13, Eq. 9-31
Out-Of-Plane DCR, Sec 11.3.5.3		
Flexure DCR	0.7	

CONC. SW CHECK

GRID S 40

$L_w = 16\,ft$ $t = 8\,in$ #5 @ 12" o.c. EA WAY

	ROOF	TOTAL
BSE-1E (LS) =	326.4^k	674.6^k
BSE-2E (CP) =	507.6^k	1049.1^k

$h = 14'\text{-}0''$ $f'_{cl} = f'_c = 4000\,psi$ $f_{yl} = f_y = 60{,}000\,psi$

$f'_{ce} = 1.5 \cdot 4000\,psi = 6000\,psi$

$f_{ye} = 1.25 \cdot 60{,}000\,psi = 75{,}000\,psi$

$V_{uD}(BSE\text{-}1E) = 674.6^k$ $M_{uD}(BSE\text{-}1E) = 9{,}444.4\,k\text{-}ft$

$V_{uD}(BSE\text{-}2E) = 1049.1^k$ $M_{uD}(BSE\text{-}2E) = 14{,}687.4\,k\text{-}ft$

$A_{cv} = (16' \cdot 12''/ft) \times 8'' = 1536\,in^2$

$h_w/l_w = 28'/16' = 1.75$ $\alpha_c = 2.5$ $\lambda = 1.0$

$\rho_t = (0.31 \times 2)/12\,in/8\,in = 0.0065$

$V_n = 1536\,in^2 [2.5 \cdot 1 \cdot \sqrt{6000\,psi} + 0.0065(75{,}000\,psi)]$

$= 1{,}046.2\,kips < (10)A_{cp}\sqrt{f'_c} = \frac{10 \cdot 1536\,in^2 \sqrt{6000\,psi}}{1000\,\#/k} = 1{,}189.8\,kips$

$V_{CE} = V_n = 1{,}046.2^k$

$DCR_V(BSE\text{-}1E) = \frac{674.6^k}{1046.2^k} = 0.64$

$DCR_V(BSE\text{-}2E) = \frac{1049.1^k}{1046.2^k} = 1.00$

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$DCR_m = M_{UD}/M_{CE}$

$P_G = 1.1(Q_D + Q_L + Q_S)$ $\quad P_G = 0.9Q_D$

TRIB AREA = (10ft x 16ft) = 160ft²

$Q_D = (20psf \times 160ft^2) + (35psf \times 160ft^2) + (100psf \times 14' \times 16')$

$= 31,200\# = 31.2^k$

$Q_L = 25\%(40psf \times 160ft^2) = 1600\# = 1.6^k$

$Q_S = 0$ (Snow less than 30psf)

$P_{G\,min} = 1.1(31.2^k + 1.6^k) = 36.1^k$

$P_{G\,max} = 0.9(31.2^k) = 28.1^k$

$\phi M_n = 7232$ k-FT (PER SP COL w/ #6 @ 12" o.c.)

$DCR_m(BSE\text{-}1E) = \dfrac{9444.4^{k\text{-}ft} \div (2)^m}{7232\,k\text{-}FT} = 0.65$

$DCR_m(BSE\text{-}2E) = \dfrac{14687.4\,k\text{-}FT \div 2.5^m}{7232\,k\text{-}FT} = 0.812$

∴ USE 2 CURTAINS #6 @ 12" o.c.

CONC. SW

GRID E 100

$L_w = 16'$ $t_w = 8''$ (2) #5 @ 12" o.c. EA WAY

BSE-1E (LS) = 595.2^k

BSE-2E (CP) = 925.6^k

$h = 14'\text{-}0''$ $f'_{cl} = f'_c = 4000\text{psi}$ $f_{yl} = f_y = 60{,}000\text{psi}$

$f'_{cE} = 1.5 \cdot 4000\text{psi} = 6000\text{psi}$

$f_{yE} = 1.25 \cdot 60{,}000\text{psi} = 75{,}000\text{psi}$

V_{UD} (BSE-1E) = 595.2^k M_{UD} (BSE-1E) = 8332.8 K-FT

V_{UD} (BSE-2E) = 925.6^k M_{UD} (BSE-2E) = 12,958.4 K-FT

$A_{cv} = (16' \cdot 12''/\text{ft}) \times 8'' = 1536\text{in}^2$

$h_w/l_w = 14'/16' = 0.875$ $\alpha_c = 3.0$ $\lambda = 1.0$

$\rho_t = (0.31 \times 2)/12\text{in}/8\text{in} = 0.0065$

$V_n = 1536\text{in}^2 [3.0 \cdot 1 \cdot \sqrt{6000\text{psi}} + 0.0065(75{,}000\text{psi})]$

$= 1{,}105.7\text{K} < (10) A_{cp}\sqrt{f'_c} = \dfrac{10 \cdot 1536\text{in}^2 \sqrt{6000\text{psi}}}{1000\,\#/\text{K}} = 1189.8^k$

$V_{cE} = V_n = 1105.7\text{K}$

DCR_v (BSE-1E) $= \dfrac{595.2^k}{1105.7^k} = 0.54$

DCR_v (BSE-2E) $= \dfrac{925.6^k}{1105.7^k} = 0.84$ OK

$DCR_m = M_{uD} / M_{cE}$

$P_g = 1.1(Q_D + Q_L + Q_S)$ $P_G = 0.9 \cdot Q_D$

TRIB AREA = 160 ft²

$Q_D = 31.2^k$

$QL = 1.6^k$

$QS = 0$

$P_{G\,MIN} = 1.1(31.2^k + 1.6^k) = 36.1^k$

$P_{G\,MAX} = 0.9(31.2^k) = 28.1^k$

$\phi M_n = 7232$ K-FT (PER SPCOL w/ #6 @ 12" o.c.)

$DCR_m(BSE\text{-}1E) = \dfrac{8332.8\,\text{K-FT} \div 2^m}{7232\,\text{K-FT}} = 0.58$

$DCR_m(BSE\text{-}2E) = \dfrac{12{,}958.4\,\text{K-FT} \div 2.5^m}{7232\,\text{K-FT}} = 0.72$

OK

∴ USE 2-CURTAINS of #6 @ 12" o.c.

spColumn v6.00
Computer program for the Strength Design of Reinforced Concrete Sections

StructurePoint

Permit Number: 19-05911

Contents

List of Figures

1. General Information

File Name	untitled.col
Project	900 BLDG
Column	SW S40
Engineer	JDJ
Code	ACI 318-14
Bar Set	ASTM A615
Units	English
Run Option	Investigation
Run Axis	X - axis
Slenderness	Not Considered
Column Type	Structural

2. Material Properties

2.1. Concrete

Type	Standard	
f'_c	4	ksi
E_c	3605	ksi
f_c	3.4	ksi
ε_u	0.003	in/in
β_1	0.85	

2.2. Steel

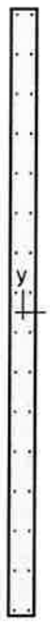
Type	Standard	
f_y	75	ksi
E_s	29000	ksi
ε_{yt}	0.00258621	in/in

3. Section

3.1. Shape and Properties

Type	Rectangular	
Width	8	in
Depth	192	in
A_g	1536	in^2
I_x	4.71859e+006	in^4
I_y	8192	in^4
r_x	55.4256	in
r_y	2.3094	in
X_o	0	in
Y_o	0	in

3.2. Section Figure



Rectangular 8 x 192 in 0.92% reinf.

Figure 1: Column section

4. Reinforcement

4.1. Bar Set: ASTM A615

Bar	Diameter	Area	Bar	Diameter	Area	Bar	Diameter	Area
	in	in²		in	in²		in	in²
#3	0.38	0.11	#4	0.50	0.20	#5	0.63	0.31
#6	0.75	0.44	#7	0.88	0.60	#8	1.00	0.79
#9	1.13	1.00	#10	1.27	1.27	#11	1.41	1.56
#14	1.69	2.25	#18	2.26	4.00			

4.2. Confinement and Factors

Confinement type	Other
For #10 bars or less	#3 ties
For larger bars	#4 ties
Capacity Reduction Factors	
Axial compression, (a)	1
Tension controlled ϕ, (b)	1
Compression controlled ϕ, (c)	1

4.3. Arrangement

Pattern	Equal spacing
Bar layout	Rectangular
Cover to	Transverse bars
Clear cover	1 in
Bars	32 #6

Total steel area, A_s	14.08 in^2
Rho	0.92 %
Minimum clear spacing	3.75 in

(Note: Rho < 1.0%)

5. Factored Loads and Moments with Corresponding Capacities

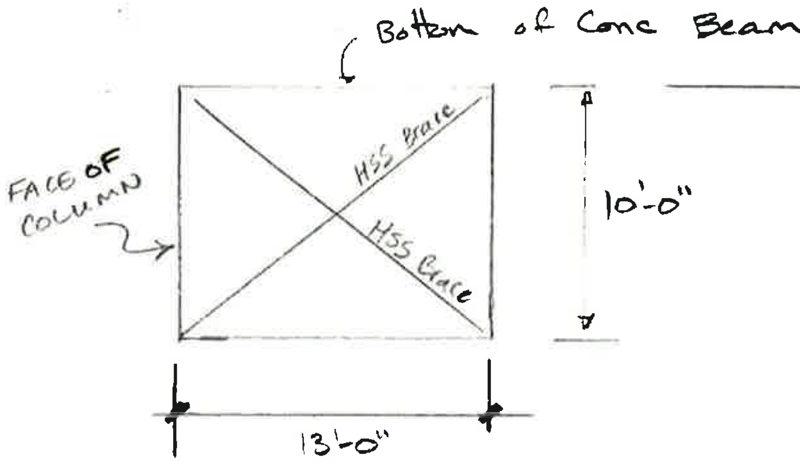
No	P_u kip	M_{ux} k-ft	ϕM_{nx} k-ft	$\phi M_n/M_u$	NA Depth in	d_t Depth in	ε_t	ϕ
1	36.10	5875.00	7409.54	1.261	31.20	190.25	0.01529	1.000

Reid Middleton
www.reidmiddleton.com

Client: RFM
Project: Bldg 900 Renovation
Project No. 262019.034

Sheet ___ of ___
Design by: SES
Date: 12/20/19
Checked by: ___
Date: ___

BRACED FRAME - GRID S75

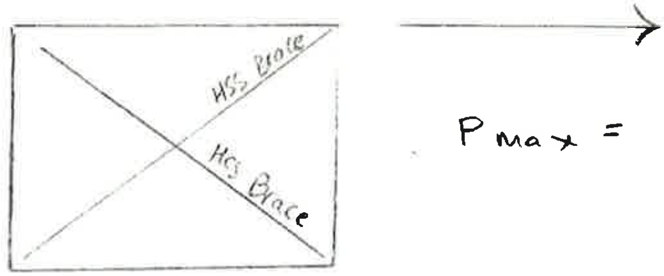


BSE-1E 84.4 k
BSE-2E 131.2 k

$P_{max} = 84.4 \times \frac{16.4}{13} = 106^k$

$= 131.2 \times \frac{16.4}{13} = 166^k$

BRACED FRAME - GRID E0



BSE - 1E 105.8 k
BSE - 2E 164.6 k

$P_{max} = 105.8 \times \frac{16.4}{13} = 133^k$

$164.6 \times \frac{16.4}{13} = 208^k$

Damage Control (BSE-1E) m = 2.5 tension, 2.5 comp

Limited Safety (BSE-2E) m = 4.8 tension, 4.8 comp

Expected brace strength HSS 4x4x1/4 = 66 k compression

$66 \times m = 2.5 = 166^k > 133^k$ okay

$66 \times m = 4.8 = 317^k > 208^k$ okay