Degenkolb

Rating form completed by
Jack Wegleitner, Jay Yin

Text in green is to be part of UC Santa Cruz building database and may be part of UCOP database

REGISTERED PROFESSIONAL ENGINEER
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No. 4521
STRUCTURAL
STATE OF CALIFORNIA

6/28/19

DATE: 2019-06-30

UC Santa Cruz building seismic ratings

Social Sciences 1 South,

CAAN #7920
Social Sciences 1 Santa Cruz CA 95064
UCSC Campus: UC Santa Cruz

Rating summary	Entry	Notes
UC Seismic Performance Level (rating)	V (Poor)	
Rating basis	Tier 1	ASCE 41-17[1]
Date of rating	2019	
Recommended UC Santa Cruz priority category for retrofit	Category B	Priority A=Retrofit ASAP Priority B=Retrofit at next permit application
Ballpark total construction cost to retrofit to IV rating[2]	Medium (~$50/sf-$200/sf)	See recommendations on further evaluation and retrofit.
Is 2018-2019 rating required by UCOP?	Yes	
Further evaluation recommended?	Yes	Focus on brace connections, beams in the chevron braces, and braced frame columns. Also investigate pounding between structures.

[1] We translate this Tier 1 evaluation to a Seismic Performance Level rating using professional judgment. Noncompliant items in the Tier 1 evaluation do not automatically put a building into a particular rating category, but we evaluate such items along with the combination of building features and potential deficiencies, focused on the potential for collapse or serious damage to the gravity supporting structure that may threaten occupant safety. See Section III B of the UC Seismic Policy and Method B of Section 321 of the 2016 California Existing Building Code.

[2] Per Section 3.A.4.i of the Seismic Program Guidebook, the cost includes all construction cost necessitated by the seismic retrofit, including restoration of finishes and any triggered work on utilities or accessibility. It does not include soft costs such as design fees or campus costs. The cost is in 2019 dollars.

Building information used in this evaluation

- Architectural drawings by Esherick Homsey Dodge and Davis Architects and Planners "College 9 Academic" as-built dated 15 Nov 1991, Sheets A0.1-A9.21.
- Structural drawings by SOH and Associates "College 9 Academic" as-built dated 15 Nov 1991, Sheets S1-S39.
- University of California building database information, “Social Science 1,” provided by Jose Sanchez (UCSC) on 2018-11-20.

Additional building information known to exist

None.

Scope for completing this form

Reviewed structural drawings and performed a site visit to confirm as-builts. Evaluated nonstructural life-safety hazards during site visit. Completed an ASCE41-17 Tier 1 evaluation

Brief description of structure

The Social Science 1 building is part of the College Nine campus on UCSC's main campus. The building was designed in 1985 by Esherick Homsey Dodge and Davis Architects and Planners and SOH and Associates. Construction was completed in 1994.

The building site slopes with a partial basement on the down slope side for mechanical rooms. Concrete walls form the basement and act as retaining walls as well as shear walls for the above structure.

The building is divided into two regular braced frame structures separated by a seismic joint. The braced frame extends four stories above the basement and lands on top of the basement walls.

There is one large lecture hall in the southern portion of the building. A transfer truss supports a column above the lecture hall to avoid landing a column in the middle of the lecture hall. The other spaces in the building are either small classrooms, labs, or office buildings.

Identification of levels: Level 1 has one mechanical room. Approximately 90% of the level is unoccupied crawl space due to the sloping site.

Levels 2-5 are occupied offices with a lecture hall on the ground floor (Floor 1-5).

Foundation system: The site is sloped and the foundations are at varying levels. The building is on shallow foundations. There are spread footings below columns and strip footings below walls.

Structural system for vertical (gravity) load: The gravity system consists of concrete over metal deck supported on steel beams. Beams are supported by steel columns that frame into walls and footings below. The column base plate is anchored to either the concrete shear wall or spread footing below it.

Structural system for lateral forces: Steel concentric braced frame for four levels over basement level concrete shear walls. The braces are wide flange sections. There are two separate braced frame superstructures with a seismic gap that share a common concrete shear wall basement. There are two frame lines of braces in each direction of each structure. Each frame line has two bays of braces in it. On the south side there is an additional bay of bracing in the transverse direction in the middle of the structure

Brief description of seismic deficiencies and expected seismic performance including mechanism of nonlinear response and structural behavior modes

The columns on the lower floors of the braced frame have a lower strength than required based on the quick checks. The beams in the chevron braces do not have the required strength to resist the combine buckling and yielding demands of the brace pair. The brace to the gusset connection cannot withstand the expected tensile yield force of the brace as required in AISC 341-10. The main deficiencies are the net section and at the welds connecting the gusset to the brace.

Structural deficiency	Affects rating?	Structural deficiency	Affects rating?
Lateral system stress check (wall shear, column shear or flexure, or brace axial as applicable)	Y	Openings at shear walls (concrete or masonry)	N
Load path	N	Liquefaction	N
Adjacent buildings	Y	Slope failure	N
Weak story	N	Surface fault rupture	N
Soft story	N	Masonry or concrete wall anchorage at flexible diaphragm	N
Geometry (vertical irregularities)	N	URM wall height-to-thickness ratio	N
Torsion	N	URM parapets or cornices	N
Mass – vertical irregularity	N	URM chimney	N
Cripple walls	N	Heavy partitions braced by ceilings	N
Wood sills (bolting)	N	Appendages	N
Diaphragm continuity	N		

Summary of review of non-structural life-safety concerns, including at exit routes.[3]

No nonstructural life-safety concerns seen in or around the structure.

UCOP non-structural checklist item	Life safety hazard?	UCOP non-structural checklist item	Life safety hazard?
Heavy ceilings, feature or ornamentation above large lecture halls, auditoriums, lobbies or other areas where large numbers of people congregate	N	Unrestrained hazardous materials storage	N
Heavy masonry or stone veneer above exit ways and public access areas	N	Masonry chimneys	N
Unbraced masonry parapets, cornices or other ornamentation above exit ways and public access areas	N	Unrestrained natural gas-fueled equipment such as water heaters, boilers, emergency generators, etc.	N

Discussion of rating

The following noncompliance in the Tier 1 checklist form the basis of rating:

1. The columns fail the axial stress quick check on the lower floors
2. The connection strength is not adequate to develop the full yield capacity of the brace where the brace net section is coped at the gusset. The weld of the brace to the gusset also does not have enough capacity to transfer the full yield capacity of the brace.
3. The beams in the chevron brace configuration do not have adequate flexural strength capable of resisting the vertical load due to simultaneous yielding and buckling of the brace pair.

Recommendations for further evaluation or retrofit

A Tier 3 evaluation and a retrofit of the building are recommended based on the deficiencies found.

A retrofit of this building would consist of strengthening the brace framed columns at the lower level and the beams in the chevron braces. The net section of the brace and the brace to gusset weld must be strengthened. Pounding between the two structures should also be investigate further.

[3] For these Tier 1 evaluations, we do not visit all spaces of the building; we rely on campus staff to report to us their understanding of if and where nonstructural hazards may occur.

Peer review of rating

This seismic evaluation was discussed in a peer review meeting on 28 May 2019. Reviewers present were Bret Lizundia of R+C and Joe Maffei of Maffei Structural Engineers. Comments from the reviewers have been incorporated into this report. The reviewers agreed with the assigned rating.

Additional building data	Entry	Notes
Latitude	37.002390	
Longitude	-122.058126	
Are there other structures besides this one under the same CAAN#	Yes	Social Sciences 1 North.
Number of stories above lowest perimeter grade	5	
Number of stories (basements) below lowest perimeter grade	0	
Building occupiable area (OGSF)	10,000 sq ft	
Risk Category per 2016 CBC Table 1604.5	II	
Building structural height, h_n	56 ft.	Structural height defined per ASCE 7-16 Section 11.2
Coefficient for period, C_t	0.02	Estimated using ASCE 41-17 equation 4-4 and 7-18
Coefficient for period, β	0.75	Estimated using ASCE 41-17 equation 4-4 and 7-18
Estimated fundamental period Longitudinal	0.409 sec	Estimated using ASCE 41-17 equation 4-4 and 7-18
Site data		
975 yr hazard parameters S_s, S_1	1.291, 0.49	
Site class	D	
Site class basis	Geotech[4]	See footnote below
Site parameters F_a, F_v	1.2, 1.81	
Ground motion parameters S_{cs}, S_{c1}	1.549, 0.887	
S_a at building period	1.549	
Site V_{s30}	900 ft/s	
V_{s30} basis	Estimated	Estimated based on site classification D
Liquefaction potential	Low	
Liquefaction assessment basis	County Map	See footnote 4
Landslide potential	Low	
Landslide assessment basis	County Map	See footnote 4

[4] Determination of site class and assessment of geotechnical hazards are based on correspondence with Pacific Crest Geotechnical Engineers and Nolan, Zinn, and Associates Geologists. [*Revised Geology and Geologic Hazards, Santa Cruz Campus, University of California*, Job # 04003-SC 13 May 2005]. Site class is taken as D throughout the main campus of UC Santa Cruz. The following links provide hazard maps for liquefaction, landslide, and fault rupture:
https://gis.santacruzcounty.us/mapgallery/Emergency%20Management/Hazard%20Mitigation/LiquifactionMap2009.pdf
https://gis.santacruzcounty.us/mapgallery/Emergency%20Management/Hazard%20Mitigation/LandslideMap2009.pdf
https://gis.santacruzcounty.us/mapgallery/Emergency%20Management/Hazard%20Mitigation/FaultZoneMap2009.pdf

Active fault-rupture hazard identified at site?	No	
Fault rupture assessment basis	County Map	See footnote below
Site-specific ground motion study?	No	
Applicable code		
Applicable code or approx. date of original construction	Built: 1994 Code: 1985 CBC	
Applicable code for partial retrofit	None	No partial retrofit
Applicable code for full retrofit	None	No full retrofit
Model building data		
Model building type North-South	Steel,S2 - Steel Braced Frames (with Stiff Diaphragm) Concrete,C2 - Concrete Shear Walls (with Stiff Diaphragms) Steel,S1a - Steel Moment Frames (with Flexible Diaphragm)	
Model building type East-West	Steel,S2 - Steel Braced Frames (with Stiff Diaphragm) Concrete,C2 - Concrete Shear Walls (with Stiff Diaphragms) Steel,S1a - Steel Moment Frames (with Flexible Diaphragm)	
FEMA P-154 score	No	Not included here because we performed ASCE 41 Tier 1 evaluation.
Previous ratings		
Most recent rating	Unknown	
Date of most recent rating	Unknown	
2nd most recent rating	-	
Date of 2nd most recent rating	-	
3rd most recent rating	-	
Date of 3rd most recent rating	-	
Appendices		
ASCE 41 Tier 1 checklist included here?	Yes	Refer to attached checklist file in Appendix A.

University of California, Santa Cruz
ASCE 41-17 Tier 1 Seismic Evaluation
7920.1 - Social Science 1

Appendix A
ASCE 41-17 Checklists

UC Campus:	Santa Cruz			Date:	5/23/2019		
Building CAAN:	7920	Auxiliary CAAN:	7920.1	By Firm:	Degenkolb Engineers		
Building Name:	Social Sciences 1			Initials:	JSW	Checked:	
Building Address:	Social Sciences 1, Santa Cruz, CA 95064			Page:	1	of	3

ASCE 41-17
Collapse Prevention Basic Configuration Checklist

LOW SEISMICITY

BUILDING SYSTEMS - *GENERAL*

C	NC	N/A	U	Description
●	○	○	○	LOAD PATH: The structure contains a complete, well-defined load path, including structural elements and connections, that serves to transfer the inertial forces associated with the mass of all elements of the building to the foundation. (Commentary: Sec. A.2.1.1. Tier 2: Sec. 5.4.1.1) **Comments:**
○	●	○	○	ADJACENT BUILDINGS: The clear distance between the building being evaluated and any adjacent building is greater than 0.25% of the height of the shorter building in low seismicity, 0.5% in moderate seismicity, and 1.5% in high seismicity. (Commentary: Sec. A.2.1.2. Tier 2: Sec. 5.4.1.2) **Comments:** Southern portion of building separated from northern portion by 8 5/8" seismic joint per Arch drawings. Southern portion 55' tall. 1.5% of 55' is 9.75" so NC
●	○	○	○	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) **Comments:**

BUILDING SYSTEMS - *BUILDING CONFIGURATION*

C	NC	N/A	U	Description
●	○	○	○	WEAK STORY: The sum of the shear strengths of the seismic-force-resisting system in any story in each direction is not less than 80% of the strength in the adjacent story above. (Commentary: Sec. A2.2.2. Tier 2: Sec. 5.4.2.1) **Comments:**
●	○	○	○	SOFT STORY: The stiffness of the seismic-force-resisting system in any story is not less than 70% of the seismic-force-resisting system stiffness in an adjacent story above or less than 80% of the average seismic-force-resisting system stiffness of the three stories above. (Commentary: Sec. A.2.2.3. Tier 2: Sec. 5.4.2.2) **Comments:**
●	○	○	○	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) **Comments:**

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ASCE 41-17
Collapse Prevention Basic Configuration Checklist

C	NC	N/A	U	
◉	○	○	○	GEOMETRY: There are no changes in the net horizontal dimension of the seismic-force-resisting system of more than 30% in a story relative to adjacent stories, excluding one-story penthouses and mezzanines. (Commentary: Sec. A.2.2.5. Tier 2: Sec. 5.4.2.4) **Comments:**
◉	○	○	○	MASS: There is no change in effective mass of more than 50% from one story to the next. Light roofs, penthouses, and mezzanines need not be considered. (Commentary: Sec. A.2.2.6. Tier 2: Sec. 5.4.2.5) **Comments:**
◉	○	○	○	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) **Comments:** Symmetric towers above the concrete basement level.

MODERATE SEISMICITY (COMPLETE THE FOLLOWING ITEMS IN ADDITION TO THE ITEMS FOR LOW SEISMICITY)

GEOLOGIC SITE HAZARD

C	NC	N/A	U	Description
◉	○	○	○	LIQUEFACTION: Liquefaction-susceptible, saturated, loose granular soils that could jeopardize the building's seismic performance do not exist in the foundation soils at depths within 50 ft (15.2m) under the building. (Commentary: Sec. A.6.1.1. Tier 2: 5.4.3.1) **Comments:**
◉	○	○	○	SLOPE FAILURE: The building site is located away from potential earthquake-induced slope failures or rockfalls so that it is unaffected by such failures or is capable of accommodating any predicted movements without failure. (Commentary: Sec. A.6.1.2. Tier 2: 5.4.3.1) **Comments:**
◉	○	○	○	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) **Comments:**

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ASCE 41-17
Collapse Prevention Basic Configuration Checklist

HIGH SEISMICITY (COMPLETE THE FOLLOWING ITEMS IN addition TO THE ITEMS FOR MODERATE SEISMICITY)

FOUNDATION CONFIGURATION

	Description
C ○ NC ● N/A ○ U ○	OVERTURNING: The ratio of the least horizontal dimension of the seismic-force-resisting system at the foundation level to the building height (base/height) is greater than $0.6S_a$. (Commentary: Sec. A.6.2.1. Tier 2: Sec. 5.4.3.3) **Comments:** South Tower Governs 34.833/55=0.622 0.6*1.97=1.182
C ● NC ○ N/A ○ U ○	TIES BETWEEN FOUNDATION ELEMENTS: The foundation has ties adequate to resist seismic forces where footings, piles, and piers are not restrained by beams, slabs, or soils classified as Site Class A, B, or C. (Commentary: Sec. A.6.2.2. Tier 2: Sec. 5.4.3.4) **Comments:** Spread footings restrained by strip footings and walls.

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ASCE 41-17
Collapse Prevention Structural Checklist For Building Type C2-C2A

Low And Moderate Seismicity

Seismic-Force-Resisting System

	Description
C ● NC ○ N/A ○ U ○	COMPLETE FRAMES: Steel or concrete frames classified as secondary components form a complete vertical-load-carrying system. (Commentary: Sec. A.3.1.6.1. Tier 2: Sec. 5.5.2.5.1) **Comments:**
C ● NC ○ N/A ○ U ○	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) **Comments:** One shear wall and one braced frame in the longitudinal direction at each foundation level. Two shear walls in the transverse direction.
C ● NC ○ N/A ○ U ○	SHEAR STRESS CHECK: The shear stress in the concrete shear walls, calculated using the Quick Check procedure of Section 4.4.3.3, is less than the greater of 100 lb/in.^{2} (0.69 MPa) or $2\sqrt{f'_c}$. (Commentary: Sec. A.3.2.2.1. Tier 2: Sec. 5.5.3.1.1) **Comments:** See quick checks
C ● NC ○ N/A ○ U ○	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.3.2.2.2. Tier 2: Sec. 5.5.3.1.3) **Comments:** See quick checks

Connections

	Description
C ○ NC ○ N/A ● U ○	WALL ANCHORAGE AT FLEXIBLE DIAPHRAGMS: Exterior concrete or masonry walls that are dependent on flexible diaphragms for lateral support are anchored for out-of-plane forces at each diaphragm level with steel anchors, reinforcing dowels, or straps that are developed into the diaphragm. Connections have strength to resist the connection force calculated in the Quick Check procedure of Section 4.4.3.7. (Commentary: Sec. A.5.1.1. Tier 2: Sec. 5.7.1.1) **Comments:**
C ● NC ○ N/A ○ U ○	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) **Comments:** Slab reinforcement continued into shear walls or beam parallel to shear wall has shear studs

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Collapse Prevention Structural Checklist For Building Type C2-C2A

C	NC	N/A	U	
◉	○	○	○	FOUNDATION DOWELS: Wall reinforcement is doweled into the foundation with vertical bars equal in size and spacing to the vertical wall reinforcing directly above the foundation. (Commentary: Sec. A.5.3.5. Tier 2: Sec. 5.7.3.4) **Comments:** Indicated in drawings

High Seismicity (Complete The Following Items In Addition To The Items For Low And Moderate Seismicity)

Seismic-Force-Resisting System

				Description
C	NC	N/A	U	DEFLECTION COMPATIBILITY: 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) **Comments:**
◉	○	○	○	
C	NC	N/A	U	FLAT SLABS: Flat slabs or plates not part of the seismic-force-resisting system have continuous bottom steel through the column joints. (Commentary: Sec. A.3.1.6.3. Tier 2: Sec. 5.5.2.5.3) **Comments:**
○	○	◉	○	
C	NC	N/A	U	COUPLING BEAMS: The ends of both walls to which the coupling beam is attached are supported at each end to resist vertical loads caused by overturning. (Commentary: Sec. A.3.2.2.3. Tier 2: Sec. 5.5.3.2.1) **Comments:** No coupling beams are present
○	○	◉	○	

Diaphragms (Stiff Or Flexible)

				Description
C	NC	N/A	U	DIAPHRAGM CONTINUITY: The diaphragms are not composed of split-level floors and do not have expansion joints. (Commentary: Sec. A.4.1.1. Tier 2: Sec. 5.6.1.1) **Comments:** No split level diaphragms
◉	○	○	○	
C	NC	N/A	U	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) **Comments:**
○	○	◉	○	

Flexible Diaphragms

				Description

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ASCE 41-17
Collapse Prevention Structural Checklist For Building Type C2-C2A

C	NC	N/A	U	
○	○	◉	○	CROSS TIES: There are continuous cross ties between diaphragm chords. (Commentary: Sec. A.4.1.2. Tier 2: Sec. 5.6.1.2) **Comments:**
○	○	◉	○	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) **Comments:**
○	○	◉	○	SPANS: All wood diaphragms with spans greater than 24 ft (7.3 m) consist of wood structural panels or diagonal sheathing. (Commentary: Sec. A.4.2.2. Tier 2: Sec. 5.6.2) **Comments:**
○	○	◉	○	DIAGONALLY SHEATHED AND UNBLOCKED DIAPHRAGMS: All diagonally sheathed or unblocked wood structural panel diaphragms have horizontal spans less than 40 ft (12.2 m) and aspect ratios less than or equal to 4-to-1. (Commentary: Sec. A.4.2.3. Tier 2: Sec. 5.6.2) **Comments:**
○	○	◉	○	OTHER DIAPHRAGMS: Diaphragms do 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) **Comments:**

Connections

		Description
C	NC N/A U	
○	○ ◉ ○	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) **Comments:** Spread and strip footings utilized

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ASCE 41-17
Collapse Prevention Structural Checklist For Building Type S2-S2A

LOW SEISMICITY

SEISMIC-FORCE-RESISTING SYSTEM

C	NC	N/A	U	Description
●	○	○	○	REDUNDANCY: The number of lines of braced frames in each principal direction is greater than or equal to 2. (Commentary: Sec. A.3.3.1.1. Tier 2: Sec. 5.5.1.1) **Comments:**
○	●	○	○	COLUMN AXIAL STRESS CHECK: The axial stress caused by gravity loads in columns subjected to overturning forces is less than $0.10F_y$. Alternatively, the axial stress caused by overturning forces alone, calculated using the Quick Check procedure of Section 4.4.3.6, is less than $0.30F_y$. (Commentary: Sec. A.3.1.3.2. Tier 2: Sec. 5.5.2.1.3) **Comments:** See Calcs
●	○	○	○	BRACE AXIAL STRESS CHECK: The axial stress in the diagonals, calculated using the Quick Check procedure of Section 4.4.3.4, is less than $0.50F_y$. (Commentary: Sec. A.3.3.1.2. Tier 2: Sec. 5.5.4.1) **Comments:**

CONNECTIONS

C	NC	N/A	U	Description
●	○	○	○	TRANSFER TO STEEL FRAMES: Diaphragms are connected for transfer of seismic forces to the steel frames. (Commentary: Sec. A.5.2.2. Tier 2: Sec. 5.7.2) **Comments:**
●	○	○	○	STEEL COLUMNS: The columns in seismic-force-resisting frames are anchored to the building foundation. (Commentary: Sec. A.5.3.1. Tier 2: Sec. 5.7.3.1) **Comments:**

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ASCE 41-17
Collapse Prevention Structural Checklist For Building Type S2-S2A

MODERATE SEISMICITY (COMPLETE THE FOLLOWING ITEMS IN ADDITION TO THE ITEMS FOR LOW SEISMICITY)

SEISMIC-FORCE-RESISTING SYSTEM

	Description
C ● NC ○ N/A ○ U ○	REDUNDANCY: The number of braced bays in each line is greater than 2. (Commentary: Sec. A.3.3.1.1. Tier 2: Sec. 5.5.1.1) **Comments:**
C ● NC ○ N/A ○ U ○	CONNECTION STRENGTH: All the brace connections develop the buckling capacity of the diagonals. (Commentary: Sec. A.3.3.1.5. Tier 2: Sec. 5.5.4.4) **Comments:** Existing gusset to brace connection geometry is compact, buckling capacity of the diagonals can be developed by inspection.
C ● NC ○ N/A ○ U ○	COMPACT MEMBERS: All brace elements meet compact section requirements in accordance with AISC 360, Table B4.1. (Commentary: Sec. A.3.3.1.7. Tier 2: Sec. 5.5.4) **Comments:**
C ● NC ○ N/A ○ U ○	K-BRACING: The bracing system does not include K-braced bays. (Commentary: Sec. A.3.3.2.1. Tier 2: Sec. 5.5.4.6) **Comments:**

HIGH SEISMICITY (COMPLETE THE FOLLOWING ITEMS IN ADDITION TO THE ITEMS FOR LOW AND MODERATE SEISMICITY)

SEISMIC-FORCE-RESISTING SYSTEM

	Description
C ● NC ○ N/A ○ U ○	COLUMN SPLICES: All column splice details located in braced frames develop 50% of the tensile strength of the column. (Commentary: Sec. A.3.3.1.3. Tier 2: Sec. 5.5.4.2) **Comments:** CJP welds in tension are controlled by the base metal

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Building Address:	Social Sciences 1, Santa Cruz, CA 95064			Page:	3	of	4

ASCE 41-17
Collapse Prevention Structural Checklist For Building Type S2-S2A

C	NC	N/A	U	
●	○	○	○	SLENDERNESS OF DIAGONALS: All diagonal elements required to carry compression have *Kl*/*r* ratios less than 200. (Commentary: Sec. A.3.3.1.4. Tier 2: Sec. 5.5.4.3) **Comments:**
○	●	○	○	CONNECTION STRENGTH: All the brace connections develop the yield capacity of the diagonals. (Commentary: Sec. A.3.3.1.5. Tier 2: Sec. 5.5.4.4) **Comments:** DCR of connection for net section rupture and weld strength above 1.0. See calculations
●	○	○	○	COMPACT MEMBERS: All brace elements meet section requirements in accordance with AISC 341, Table D1.1, for moderately ductile members. (Commentary: Sec. A.3.3.1.7. Tier 2: Sec.5.5.4) **Comments:**
○	●	○	○	CHEVRON BRACING: Beams in chevron, or V-braced, bays are capable of resisting the vertical load resulting from the simultaneous yielding and buckling of the brace pairs. (Commentary: Sec. A.3.3.2.3. Tier 2: Sec. 5.5.4.6) **Comments:** DCR of beam in bending is greater than 1.0. See calculations
●	○	○	○	CONCENTRICALLY BRACED FRAME JOINTS: All the diagonal braces frame into the beam–column joints concentrically. (Commentary: Sec. A.3.3.2.4. Tier 2: Sec. 5.5.4.8) **Comments:**

DIAPHRAGMS (STIFF OR FLEXIBLE)

				Description
C	NC	N/A	U	
●	○	○	○	OPENINGS AT FRAMES: Diaphragm openings immediately adjacent to the braced frames extend less than 25% of the frame length. (Commentary: Sec. A.4.1.5. Tier 2: Sec. 5.6.1.3) **Comments:**

FLEXIBLE DIAPHRAGMS

				Description
C	NC	N/A	U	
○	○	●	○	CROSS TIES: There are continuous cross ties between diaphragm chords. (Commentary: Sec. A.4.1.2. Tier 2: Sec. 5.6.1.2) **Comments:**

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ASCE 41-17
Collapse Prevention Structural Checklist For Building Type S2-S2A

C	NC	N/A	U	
○	○	◉	○	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) **Comments:**
○	○	◉	○	SPANS: All wood diaphragms with spans greater than 24 ft (7.3 m) consist of wood structural panels or diagonal sheathing. (Commentary: Sec. A.4.2.2. Tier 2: Sec. 5.6.2) **Comments:**
○	○	◉	○	DIAGONALLY SHEATHED AND UNBLOCKED DIAPHRAGMS: All diagonally sheathed or unblocked wood structural panel diaphragms have horizontal spans less than 40 ft (12.2 m) and aspect ratios less than or equal to 4-to-1. (Commentary: Sec. A.4.2.3. Tier 2: Sec. 5.6.2) **Comments:**
○	○	◉	○	OTHER DIAPHRAGMS: Diaphragms do 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) **Comments:**

Note: **C** = Compliant **NC** = Noncompliant **N/A** = Not Applicable **U** = Unknown

University of California, Santa Cruz
ASCE 41-17 Tier 1 Seismic Evaluation
7920.1 - Social Science 1

Appendix B
Quick Check Calculations

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Subject:	Global Data	**Job Number:**	B9956006.00	**Date:**	06/28/19
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GLOBAL DATA

ASCE 41-17 SEISMIC EVALUATION & RETROFIT OF EXISTING BUILDINGS
CHAPTER 4 - TIER 1 EVALUATION
LINEAR STATIC PROCEDURE
COLLAPSE PREVENTION
BSE-2E HAZARD LEVEL

SITE DATA:

Latitude:		37.00236	°N	Social Science 1	*USGS Seismic Design Map Application:*	
Longitude:		122.05809	°W	Santa Cruz, CA 95064	*http://geohazards.usgs.gov/hazardtool/application.php*	
Site Class:		D (default)		(Stiff Soil)	Site Class	[ASCE 41-17, §2.4.1.6]
S_S	=	1.291	g	(USGS) (5% / 50 years)	USGS Mapped (T = 0.2 sec)	[ASCE 41-17, §2.4.1.3]
S_1	=	0.490	g	(USGS) (5% / 50 years)	USGS Mapped (T = 1.0 sec)	[ASCE 41-17, §2.4.1.3]
F_a	=	1.200		(Site Class D)	Site Coefficient (T = 0.2 sec)	[ASCE 7-16, Table 11.4-1]
F_v	=	1.810		(Site Class D)	Site Coefficient (T = 1.0 sec)	[ASCE 7-16, Table 11.4-2]
S_{XS}	=	1.549	g	= F_a S_S	Site-Adjusted Design (T = 0.2 sec)	[ASCE 41-17, Eq. 2-1]
S_{X1}	=	0.887	g	= F_v S_1	Site-Adjusted Design (T = 1.0 sec)	[ASCE 41-17, Eq. 2-2]

BUILDING DATA:

Building Type:	S2		(Steel Braced Frames with Stiff Diaphragms)	[ASCE 41-17, Table 3-1]
Year Built:	1989			
Number of Stories:	5	stories		
Parapet Height:	9.00	ft		
Roof Height:	56.00	ft		
Total Area:	14,800	sf		

Level	Height [ft]	Elevation [ft]	$Length_{N-S}$ [ft]	$Length_{E-W}$ [ft]	Area [sf]	Diaphragm Stiffness	Diaphragm Description
Roof	10.0	56.0	80	37	2,960	Rigid	Concrete Fill over Metal Deck
5th	12.0	46.0	80	37	2,960	Rigid	Concrete Fill over Metal Deck
4th	12.0	34.0	80	37	2,960	Rigid	Concrete Fill over Metal Deck
3rd	12.0	22.0	80	37	2,960	Rigid	Concrete Fill over Metal Deck
2nd	10.0	10.0	80	37	2,960	Rigid	Concrete Fill over Metal Deck
1st	0.0	0.0	80	37	2,960	Rigid	Concrete Fill over Metal Deck

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Subject:	Weight Take Off	**Job Number:**	B9956006.00	**Date:**	06/28/19
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WEIGHT TAKEOFF

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CHAPTER 4 - TIER 1 EVALUATION
LINEAR STATIC PROCEDURE
COLLAPSE PREVENTION
BSE-2E HAZARD LEVEL

ROOF TYPE: ROOF

		Roofing / Re-roofing		@	5.0	psf	5.0 psf	y
0.5	in	Rock Ballast (Gravel)		@	8.0	psf per inch	0.0 psf	n
3	ply	Ready Roofing		@	0.3	psf per ply	0.0 psf	n
5	ply	Felt Roofing		@	0.5	psf per ply	0.0 psf	n
0.25	in	Slate		@	40.0	psf per inch	0.0 psf	n
		Shingles	(Asphalt)	@	2.0	psf	0.0 psf	n
		Copper or Tin		@	1.0	psf	0.0 psf	n
		Corrugated Asbestos-Cement		@	4.0	psf	0.0 psf	n
		Waterproofing Membranes	(Smooth Bituminous)	@	1.5	psf	0.0 psf	n
		Cement Tiles		@	16.0	psf	0.0 psf	n
		Clay Tiles	(Spanish)	@	19.0	psf	0.0 psf	n
		Mortar Bed for Clay Tiles		@	10.0	psf	0.0 psf	n
		Roof Insulation		@	1.0	psf	1.0 psf	y
1	in	Insulation	(Rigid)	@	1.5	psf per inch	0.0 psf	n
1	in	Insulation Boards	(Fibrous Glass)	@	1.1	psf per inch	0.0 psf	n
3	in	Vermiculite Concrete		@	2.5	psf per inch	0.0 psf	n
0.5	in	Fire Proofing		@	2.0	psf per inch	0.0 psf	n
		Diaphragm - core planks		@	35.0	psf	0.0 psf	n
2.5	in	Concrete Slab	(Normal Weight)	@	12.5	psf per inch	0.0 psf	n
4.75	in	Concrete Fill	(Light Weight)	@	9.2	psf per inch	0.0 psf	n
0.5	in	Concrete Overpour	(Light Weight)	@	9.2	psf per inch	0.0 psf	n
18	ga	Bare Metal Deck		@	3.0	psf	3.0 psf	y
2	in	Wood Decking		@	2.5	psf per inch	0.0 psf	n
2	in	Wood Sheathing		@	3.0	psf per inch	0.0 psf	n
0.5	in	Plywood		@	3.2	psf per inch	0.0 psf	n
		Framing		@	20.0	psf	0.0 psf	n
6.66	ft O.C.	Steel Beams		@	26.0	plf	3.9 psf	y
20	ft O.C.	Steel Girders		@	35.0	plf	1.8 psf	y
2	ft O.C.	Wood Sub-Purlins		@	1.8	plf	0.0 psf	n
8	ft O.C.	Wood Purlins		@	3.0	plf	0.0 psf	n
20	ft O.C.	Wood Girders		@	5.0	plf	0.0 psf	n
12.75	ft O.C.	Concrete Beams		@	800.0	plf	0.0 psf	n
20	ft O.C.	Concrete Girders		@	300.0	plf	0.0 psf	n
12.00	ft trib. ht.	Typical Columns	(A_{trib} = 400 sf)	@	49.0	plf	1.5 psf	y
		Ceiling		@	5.0	psf	5.0 psf	y
0.5	in	Gypsum Board Ceiling		@	4.4	psf per inch	0.0 psf	n
		Acoustical Fiber Board		@	1.0	psf	0.0 psf	n
		Plaster Ceiling	(On Tile)	@	5.0	psf	0.0 psf	n
		Suspended Metal Lath & Plaster	(Gypsum Plaster)	@	10.0	psf	0.0 psf	n
		Suspended Steel Channel System		@	2.0	psf	0.0 psf	n
		Suspended Wood Furring System		@	2.5	psf	0.0 psf	n
		T-bar Ceiling System		@	3.0	psf	0.0 psf	n
100%	floor area	Interior Partitions	(Below)	@	5.0	psf	5.0 psf	y
		M.E.P.		@	5.0	psf	5.0 psf	y
		Miscellaneous		@	1.9	psf	1.9 psf	y
		Percast Fascia (4sqft)		@	47.1	psf	0.0 psf	n
		Other		@	1.0	psf	0.0 psf	n
		Other		@	1.0	psf	0.0 psf	n
		Other		@	1.0	psf	0.0 psf	n
		Other		@	1.0	psf	0.0 psf	n
						ROOF WEIGHT =	**33.0 psf**	

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Subject:	Weight Take Off	**Job Number:**	B9956006.00	**Date:**	06/28/19
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WEIGHT TAKEOFF

ASCE 41-17 SEISMIC EVALUATION & RETROFIT OF EXISTING BUILDINGS
CHAPTER 4 - TIER 1 EVALUATION
LINEAR STATIC PROCEDURE
COLLAPSE PREVENTION
BSE-2E HAZARD LEVEL

FLOOR TYPE: FLR-5

		Flooring		@	15.0	psf	15.0 psf	y
1	in	Floor Tiles	(Terrazzo)	@	13.0	psf per inch	0.0 psf	n
0.75	in	Wood Flooring	(Hardwood)	@	4.6	psf per inch	0.0 psf	n
2	in	Wood Blocks		@	3.3	psf per inch	0.0 psf	n
2	in	Asphalt Blocks		@	12.0	psf per inch	0.0 psf	n
0.75	in	Mastic		@	12.0	psf per inch	0.0 psf	n
1	in	Cement Finish		@	12.0	psf per inch	0.0 psf	n
2	in	Mortar Bed		@	12.0	psf per inch	0.0 psf	n
2	in	Floor Fill	(Stone Concrete)	@	12.0	psf per inch	0.0 psf	n
0.75	in	Subflooring		@	4.0	psf per inch	0.0 psf	n
		Marble & Mortar, Stone Concrete		@	33.0	psf	0.0 psf	n
		Solid Flat Tile, 1-in Mortar Base		@	23.0	psf	0.0 psf	n
		Floor Insulation		@	1.0	psf	1.0 psf	y
1	in	Insulation	(Rigid)	@	1.5	psf per inch	0.0 psf	n
1	in	Insulation Boards	(Fibrous Glass)	@	1.1	psf per inch	0.0 psf	n
3	in	Vermiculite Concrete		@	2.5	psf per inch	0.0 psf	n
0.5	in	Fire Proofing		@	2	psf per inch	0.0 psf	n
		Diaphragm		@	20.0	psf	0.0 psf	n
3	in	Concrete Slab	(Normal Weight)	@	12.5	psf per inch	0.0 psf	n
4.25	in	Concrete Fill	(Light Weight)	@	9.2	psf per inch	39.0 psf	y
0.5	in	Concrete Overpour	(Light Weight)	@	9.2	psf per inch	0.0 psf	n
18	ga	Bare Metal Deck		@	3.0	psf	3.0 psf	y
2	in	Wood Decking		@	2.5	psf per inch	0.0 psf	n
2	in	Wood Sheathing		@	3.0	psf per inch	0.0 psf	n
0.5	in	Plywood		@	3.2	psf per inch	0.0 psf	n
		Framing		@	20.0	psf	0.0 psf	n
10	ft O.C.	Steel Beams		@	31.0	plf	3.1 psf	y
20	ft O.C.	Steel Girders		@	40.0	plf	2.0 psf	y
2	ft O.C.	Wood Sub-Purlins		@	1.8	plf	0.0 psf	n
8	ft O.C.	Wood Purlins		@	3.0	plf	0.0 psf	n
20	ft O.C.	Wood Girders		@	5.0	plf	0.0 psf	n
8	ft O.C.	Concrete Beams		@	200.0	plf	0.0 psf	n
20	ft O.C.	Concrete Girders		@	300.0	plf	0.0 psf	n
12.0	ft trib. ht.	Typical Columns	(A_{trib} = 400 sf)	@	60.0	plf	1.8 psf	y
		Ceiling		@	5.0	psf	5.0 psf	y
0.5	in	Gypsum Board Ceiling		@	4.4	psf per inch	0.0 psf	n
		Acoustical Fiber Board		@	1.0	psf	0.0 psf	n
		Plaster Ceiling	(On Tile)	@	5.0	psf	0.0 psf	n
		Suspended Metal Lath & Plaster	(Gypsum Plaster)	@	10.0	psf	0.0 psf	n
		Suspended Steel Channel System		@	2.0	psf	0.0 psf	n
		Suspended Wood Furring System		@	2.5	psf	0.0 psf	n
		T-bar Ceiling System		@	3.0	psf	0.0 psf	n
100%	floor area	Interior Partitions	(Above & Below)	@	10.0	psf	10.0 psf	y
		M.E.P.		@	5.0	psf	5.0 psf	y
		Miscellaneous		@	1.1	psf	1.1 psf	y
		Other		@	1.0	psf	0.0 psf	n
		Other		@	1.0	psf	0.0 psf	n
		Other		@	1.0	psf	0.0 psf	n
		Other		@	1.0	psf	0.0 psf	n
		Other		@	1.0	psf	0.0 psf	n

FLR-5 WEIGHT = 86.0 psf

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Subject:	Weight Take Off	**Job Number:**	B9956006.00	**Date:**	06/28/19
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WEIGHT TAKEOFF

ASCE 41-17 SEISMIC EVALUATION & RETROFIT OF EXISTING BUILDINGS
CHAPTER 4 - TIER 1 EVALUATION
LINEAR STATIC PROCEDURE
COLLAPSE PREVENTION
BSE-2E HAZARD LEVEL

FLOOR TYPE: FLR-4

		Flooring		@	15.0	psf	15.0 psf	y
1	in	Floor Tiles	(Terrazzo)	@	13.0	psf per inch	0.0 psf	n
0.75	in	Wood Flooring	(Hardwood)	@	4.6	psf per inch	0.0 psf	n
2	in	Wood Blocks		@	3.3	psf per inch	0.0 psf	n
2	in	Asphalt Blocks		@	12.0	psf per inch	0.0 psf	n
0.75	in	Mastic		@	12.0	psf per inch	0.0 psf	n
1	in	Cement Finish		@	12.0	psf per inch	0.0 psf	n
2	in	Mortar Bed		@	12.0	psf per inch	0.0 psf	n
2	in	Floor Fill	(Stone Concrete)	@	12.0	psf per inch	0.0 psf	n
0.75	in	Subflooring		@	4.0	psf per inch	0.0 psf	n
		Marble & Mortar, Stone Concrete		@	33.0	psf	0.0 psf	n
		Solid Flat Tile, 1-in Mortar Base		@	23.0	psf	0.0 psf	n
		Floor Insulation		@	1.0	psf	1.0 psf	y
1	in	Insulation	(Rigid)	@	1.5	psf per inch	0.0 psf	n
1	in	Insulation Boards	(Fibrous Glass)	@	1.1	psf per inch	0.0 psf	n
3	in	Vermiculite Concrete		@	2.5	psf per inch	0.0 psf	n
0.5	in	Fire Proofing		@	2	psf per inch	0.0 psf	n
		Diaphragm		@	20.0	psf	0.0 psf	n
3	in	Concrete Slab	(Normal Weight)	@	12.5	psf per inch	0.0 psf	n
4.25	in	Concrete Fill	(Light Weight)	@	9.2	psf per inch	39.0 psf	y
0.5	in	Concrete Overpour	(Light Weight)	@	9.2	psf per inch	0.0 psf	n
18	ga	Bare Metal Deck		@	3.0	psf	3.0 psf	y
2	in	Wood Decking		@	2.5	psf per inch	0.0 psf	n
2	in	Wood Sheathing		@	3.0	psf per inch	0.0 psf	n
0.5	in	Plywood		@	3.2	psf per inch	0.0 psf	n
		Framing		@	20.0	psf	0.0 psf	n
10	ft O.C.	Steel Beams		@	31.0	plf	3.1 psf	y
20	ft O.C.	Steel Girders		@	40.0	plf	2.0 psf	y
2	ft O.C.	Wood Sub-Purlins		@	1.8	plf	0.0 psf	n
8	ft O.C.	Wood Purlins		@	3.0	plf	0.0 psf	n
20	ft O.C.	Wood Girders		@	5.0	plf	0.0 psf	n
8	ft O.C.	Concrete Beams		@	200.0	plf	0.0 psf	n
20	ft O.C.	Concrete Girders		@	300.0	plf	0.0 psf	n
12.0	ft trib. ht.	Typical Columns	(A_{trib} = 400 sf)	@	60.0	plf	1.8 psf	y
		Ceiling		@	5.0	psf	5.0 psf	y
0.5	in	Gypsum Board Ceiling		@	4.4	psf per inch	0.0 psf	n
		Acoustical Fiber Board		@	1.0	psf	0.0 psf	n
		Plaster Ceiling	(On Tile)	@	5.0	psf	0.0 psf	n
		Suspended Metal Lath & Plaster	(Gypsum Plaster)	@	10.0	psf	0.0 psf	n
		Suspended Steel Channel System		@	2.0	psf	0.0 psf	n
		Suspended Wood Furring System		@	2.5	psf	0.0 psf	n
		T-bar Ceiling System		@	3.0	psf	0.0 psf	n
100%	floor area	Interior Partitions	(Above & Below)	@	10.0	psf	10.0 psf	y
		M.E.P.		@	5.0	psf	5.0 psf	y
		Miscellaneous		@	1.1	psf	1.1 psf	y
		Other		@	1.0	psf	0.0 psf	n
		Other		@	1.0	psf	0.0 psf	n
		Other		@	1.0	psf	0.0 psf	n
		Other		@	1.0	psf	0.0 psf	n
		Other		@	1.0	psf	0.0 psf	n

FLR-4 WEIGHT = 86.0 psf

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Subject:	Weight Take Off	**Job Number:**	B9956006.00	**Date:**	06/28/19
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WEIGHT TAKEOFF

ASCE 41-17 SEISMIC EVALUATION & RETROFIT OF EXISTING BUILDINGS
CHAPTER 4 - TIER 1 EVALUATION
LINEAR STATIC PROCEDURE
COLLAPSE PREVENTION
BSE-2E HAZARD LEVEL

FLOOR TYPE: FLR-3

		Flooring		@	15.0	psf	15.0 psf	y
1	in	Floor Tiles	(Terrazzo)	@	13.0	psf per inch	0.0 psf	n
0.75	in	Wood Flooring	(Hardwood)	@	4.6	psf per inch	0.0 psf	n
2	in	Wood Blocks		@	3.3	psf per inch	0.0 psf	n
2	in	Asphalt Blocks		@	12.0	psf per inch	0.0 psf	n
0.75	in	Mastic		@	12.0	psf per inch	0.0 psf	n
1	in	Cement Finish		@	12.0	psf per inch	0.0 psf	n
2	in	Mortar Bed		@	12.0	psf per inch	0.0 psf	n
2	in	Floor Fill	(Stone Concrete)	@	12.0	psf per inch	0.0 psf	n
0.75	in	Subflooring		@	4.0	psf per inch	0.0 psf	n
		Marble & Mortar, Stone Concrete		@	33.0	psf	0.0 psf	n
		Solid Flat Tile, 1-in Mortar Base		@	23.0	psf	0.0 psf	n
		Floor Insulation		@	1.0	psf	1.0 psf	y
1	in	Insulation	(Rigid)	@	1.5	psf per inch	0.0 psf	n
1	in	Insulation Boards	(Fibrous Glass)	@	1.1	psf per inch	0.0 psf	n
3	in	Vermiculite Concrete		@	2.5	psf per inch	0.0 psf	n
0.5	in	Fire Proofing		@	2	psf per inch	0.0 psf	n
		Diaphragm		@	20.0	psf	0.0 psf	n
3	in	Concrete Slab	(Normal Weight)	@	12.5	psf per inch	0.0 psf	n
4.25	in	Concrete Fill	(Light Weight)	@	9.2	psf per inch	39.0 psf	y
0.5	in	Concrete Overpour	(Light Weight)	@	9.2	psf per inch	0.0 psf	n
18	ga	Bare Metal Deck		@	3.0	psf	3.0 psf	y
2	in	Wood Decking		@	2.5	psf per inch	0.0 psf	n
2	in	Wood Sheathing		@	3.0	psf per inch	0.0 psf	n
0.5	in	Plywood		@	3.2	psf per inch	0.0 psf	n
		Framing		@	20.0	psf	0.0 psf	n
10	ft O.C.	Steel Beams		@	31.0	plf	3.1 psf	y
20	ft O.C.	Steel Girders		@	40.0	plf	2.0 psf	y
2	ft O.C.	Wood Sub-Purlins		@	1.8	plf	0.0 psf	n
8	ft O.C.	Wood Purlins		@	3.0	plf	0.0 psf	n
20	ft O.C.	Wood Girders		@	5.0	plf	0.0 psf	n
8	ft O.C.	Concrete Beams		@	200.0	plf	0.0 psf	n
20	ft O.C.	Concrete Girders		@	300.0	plf	0.0 psf	n
12.0	ft trib. ht.	Typical Columns	(A_{trib} = 400 sf)	@	60.0	plf	1.8 psf	y
		Ceiling		@	5.0	psf	5.0 psf	y
0.5	in	Gypsum Board Ceiling		@	4.4	psf per inch	0.0 psf	n
		Acoustical Fiber Board		@	1.0	psf	0.0 psf	n
		Plaster Ceiling	(On Tile)	@	5.0	psf	0.0 psf	n
		Suspended Metal Lath & Plaster	(Gypsum Plaster)	@	10.0	psf	0.0 psf	n
		Suspended Steel Channel System		@	2.0	psf	0.0 psf	n
		Suspended Wood Furring System		@	2.5	psf	0.0 psf	n
		T-bar Ceiling System		@	3.0	psf	0.0 psf	n
100%	floor area	Interior Partitions	(Above & Below)	@	10.0	psf	10.0 psf	y
		M.E.P.		@	5.0	psf	5.0 psf	y
		Miscellaneous		@	1.1	psf	1.1 psf	y
		Other		@	1.0	psf	0.0 psf	n
		Other		@	1.0	psf	0.0 psf	n
		Other		@	1.0	psf	0.0 psf	n
		Other		@	1.0	psf	0.0 psf	n
		Other		@	1.0	psf	0.0 psf	n
						FLR-3 WEIGHT =	**86.0 psf**	

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BSE-2E HAZARD LEVEL

FLOOR TYPE: FLR-2

		Flooring		@	15.0	psf	15.0 psf	y
1	in	Floor Tiles	(Terrazzo)	@	13.0	psf per inch	0.0 psf	n
0.75	in	Wood Flooring	(Hardwood)	@	4.6	psf per inch	0.0 psf	n
2	in	Wood Blocks		@	3.3	psf per inch	0.0 psf	n
2	in	Asphalt Blocks		@	12.0	psf per inch	0.0 psf	n
0.75	in	Mastic		@	12.0	psf per inch	0.0 psf	n
1	in	Cement Finish		@	12.0	psf per inch	0.0 psf	n
2	in	Mortar Bed		@	12.0	psf per inch	0.0 psf	n
2	in	Floor Fill	(Stone Concrete)	@	12.0	psf per inch	0.0 psf	n
0.75	in	Subflooring		@	4.0	psf per inch	0.0 psf	n
		Marble & Mortar, Stone Concrete		@	33.0	psf	0.0 psf	n
		Solid Flat Tile, 1-in Mortar Base		@	23.0	psf	0.0 psf	n
		Floor Insulation		@	1.0	psf	1.0 psf	y
1	in	Insulation	(Rigid)	@	1.5	psf per inch	0.0 psf	n
1	in	Insulation Boards	(Fibrous Glass)	@	1.1	psf per inch	0.0 psf	n
3	in	Vermiculite Concrete		@	2.5	psf per inch	0.0 psf	n
0.5	in	Fire Proofing		@	2	psf per inch	0.0 psf	n
		Diaphragm		@	20.0	psf	0.0 psf	n
3	in	Concrete Slab	(Normal Weight)	@	12.5	psf per inch	0.0 psf	n
4.25	in	Concrete Fill	(Light Weight)	@	9.2	psf per inch	39.0 psf	y
0.5	in	Concrete Overpour	(Light Weight)	@	9.2	psf per inch	0.0 psf	n
18	ga	Bare Metal Deck		@	3.0	psf	3.0 psf	y
2	in	Wood Decking		@	2.5	psf per inch	0.0 psf	n
2	in	Wood Sheathing		@	3.0	psf per inch	0.0 psf	n
0.5	in	Plywood		@	3.2	psf per inch	0.0 psf	n
		Framing		@	20.0	psf	0.0 psf	n
10	ft O.C.	Steel Beams		@	31.0	plf	3.1 psf	y
20	ft O.C.	Steel Girders		@	40.0	plf	2.0 psf	y
2	ft O.C.	Wood Sub-Purlins		@	1.8	plf	0.0 psf	n
8	ft O.C.	Wood Purlins		@	3.0	plf	0.0 psf	n
20	ft O.C.	Wood Girders		@	5.0	plf	0.0 psf	n
8	ft O.C.	Concrete Beams		@	200.0	plf	0.0 psf	n
20	ft O.C.	Concrete Girders		@	300.0	plf	0.0 psf	n
12.0	ft trib. ht.	Typical Columns	(A_{trib} = 400 sf)	@	60.0	plf	1.8 psf	y
		Ceiling		@	5.0	psf	5.0 psf	y
0.5	in	Gypsum Board Ceiling		@	4.4	psf per inch	0.0 psf	n
		Acoustical Fiber Board		@	1.0	psf	0.0 psf	n
		Plaster Ceiling	(On Tile)	@	5.0	psf	0.0 psf	n
		Suspended Metal Lath & Plaster	(Gypsum Plaster)	@	10.0	psf	0.0 psf	n
		Suspended Steel Channel System		@	2.0	psf	0.0 psf	n
		Suspended Wood Furring System		@	2.5	psf	0.0 psf	n
		T-bar Ceiling System		@	3.0	psf	0.0 psf	n
100%	floor area	Interior Partitions	(Above & Below)	@	10.0	psf	10.0 psf	y
		M.E.P.		@	5.0	psf	5.0 psf	y
		Miscellaneous		@	1.1	psf	1.1 psf	y
		Other		@	1.0	psf	0.0 psf	n
		Other		@	1.0	psf	0.0 psf	n
		Other		@	1.0	psf	0.0 psf	n
		Other		@	1.0	psf	0.0 psf	n
		Other		@	1.0	psf	0.0 psf	n

FLR-2 WEIGHT = 86.0 psf

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COLLAPSE PREVENTION
BSE-2E HAZARD LEVEL

WALL TYPE: WALL-P

		Wall Covering		@	4.0	psf	4.0 psf	y
1	in	Exterior Stucco		@	11.4	psf per inch.	0.0 psf	n
1	in	Wood Sheathing		@	3.0	psf per inch	0.0 psf	n
0.5	in	Gypsum Sheathing		@	4.0	psf per inch	0.0 psf	n
0.5	in	Gypsum Wallboard		@	4.4	psf per inch	0.0 psf	n
		Porcelain Enamel Panels		@	5.0	psf	0.0 psf	n
		Metal Lath & Plaster	(Gypsum Plaster)	@	10.0	psf	0.0 psf	n
		Wall Insulation		@	1.0	psf	1.0 psf	y
1	in	Insulation	(Rigid)	@	1.5	psf per inch	0.0 psf	n
1	in	Insulation Boards	(Fiber Board)	@	1.5	psf per inch	0.0 psf	n
0.5	in	Fire Proofing		@	2	psf per inch	0.0 psf	n
		Wall Framing		@	20.0	psf	20.0 psf	y
8	in	Concrete Wall	(Normal Weight)	@	12.5	psf per inch	0.0 psf	n
8	in	CMU Wall w/ Full Grouting	(Normal Weight)	@	83.0	psf	0.0 psf	n
8	in	Solid CMU Wall	(Normal Weight)	@	87.0	psf	0.0 psf	n
4	in	HCB Wall w/ Full Grouting		@	38.0	psf	0.0 psf	n
3.5	in	Solid Clay Brick Wall		@	11.1	psf per inch	0.0 psf	n
0.5	in	Plywood		@	3.2	psf per inch	0.0 psf	n
16	in O.C.	Wood Studs	(2 x 4)	@	1.1	plf	0.0 psf	n
16	in O.C.	Metal Channel Studs		@	2.0	plf	0.0 psf	n
8	ft O.C.	Steel Girts		@	6.0	plf	0.0 psf	n
		Miscellaneous		@	1.0	psf	1.0 psf	y
		Other		@	1.0	psf	0.0 psf	n
		Other		@	1.0	psf	0.0 psf	n
		Other		@	1.0	psf	0.0 psf	n
		Other		@	1.0	psf	0.0 psf	n
		Other		@	1.0	psf	0.0 psf	n

Solid Wall Weight = 26.0 psf
Window & Door Weight = 8.0 psf
% Solid Wall = 100%
WALL-P WEIGHT = 26.0 psf

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COLLAPSE PREVENTION
BSE-2E HAZARD LEVEL

WALL TYPE: WALL-R

		Wall Covering		@	4.0	psf	4.0 psf	y
1	in	Exterior Stucco		@	11.4	psf per inch.	0.0 psf	n
1	in	Wood Sheathing		@	3.0	psf per inch	0.0 psf	n
0.5	in	Gypsum Sheathing		@	4.0	psf per inch	0.0 psf	n
0.5	in	Gypsum Wallboard		@	4.4	psf per inch	0.0 psf	n
		Porcelain Enamel Panels		@	5.0	psf	0.0 psf	n
		Metal Lath & Plaster	(Gypsum Plaster)	@	10.0	psf	0.0 psf	n
		Wall Insulation		@	1.0	psf	1.0 psf	y
1	in	Insulation	(Rigid)	@	1.5	psf per inch	0.0 psf	n
1	in	Insulation Boards	(Fiber Board)	@	1.5	psf per inch	0.0 psf	n
0.5	in	Fire Proofing		@	2	psf per inch	0.0 psf	n
		Wall Framing		@	20.0	psf	20.0 psf	y
8	in	Concrete Wall	(Normal Weight)	@	12.5	psf per inch	0.0 psf	n
8	in	CMU Wall w/ Full Grouting	(Normal Weight)	@	83.0	psf	0.0 psf	n
8	in	Solid CMU Wall	(Normal Weight)	@	87.0	psf	0.0 psf	n
4	in	HCB Wall w/ Full Grouting		@	38.0	psf	0.0 psf	n
3.5	in	Solid Clay Brick Wall		@	11.1	psf per inch	0.0 psf	n
0.5	in	Plywood		@	3.2	psf per inch	0.0 psf	n
16	in O.C.	Wood Studs	(2 x 4)	@	1.1	plf	0.0 psf	n
16	in O.C.	Metal Channel Studs		@	2.0	plf	0.0 psf	n
8	ft O.C.	Steel Girts		@	6.0	plf	0.0 psf	n
		Miscellaneous		@	1.0	psf	1.0 psf	y
		Other		@	1.0	psf	0.0 psf	n
		Other		@	1.0	psf	0.0 psf	n
		Other		@	1.0	psf	0.0 psf	n
		Other		@	1.0	psf	0.0 psf	n
		Other		@	1.0	psf	0.0 psf	n

Solid Wall Weight =	26.0	psf
Window & Door Weight =	8.0	psf
% Solid Wall =	80%	
WALL-R WEIGHT =	**22.4**	**psf**

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Subject:	Weight Take Off	**Job Number:**	B9956006.00	**Date:**	06/28/19
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LINEAR STATIC PROCEDURE
COLLAPSE PREVENTION
BSE-2E HAZARD LEVEL

WALL TYPE: WALL-5

		Wall Covering		@	4.0	psf	4.0 psf	y
1	in	Exterior Stucco		@	11.4	psf per inch.	0.0 psf	n
1	in	Wood Sheathing		@	3.0	psf per inch	0.0 psf	n
0.5	in	Gypsum Sheathing		@	4.0	psf per inch	0.0 psf	n
0.5	in	Gypsum Wallboard		@	4.4	psf per inch	0.0 psf	n
		Porcelain Enamel Panels		@	5.0	psf	0.0 psf	n
		Metal Lath & Plaster	(Gypsum Plaster)	@	10.0	psf	0.0 psf	n
		Wall Insulation		@	1.0	psf	1.0 psf	y
1	in	Insulation	(Rigid)	@	1.5	psf per inch	0.0 psf	n
1	in	Insulation Boards	(Fiber Board)	@	1.5	psf per inch	0.0 psf	n
0.5	in	Fire Proofing		@	2	psf per inch	0.0 psf	n
		Wall Framing		@	20.0	psf	20.0 psf	y
8	in	Concrete Wall	(Normal Weight)	@	12.5	psf per inch	0.0 psf	n
8	in	CMU Wall w/ Full Grouting	(Normal Weight)	@	83.0	psf	0.0 psf	n
8	in	Solid CMU Wall	(Normal Weight)	@	87.0	psf	0.0 psf	n
4	in	HCB Wall w/ Full Grouting		@	38.0	psf	0.0 psf	n
3.5	in	Clay Brick Wall		@	11.1	psf per inch	0.0 psf	n
0.5	in	Plywood		@	3.2	psf per inch	0.0 psf	n
16	in O.C.	Wood Studs	(2 x 4)	@	1.1	plf	0.0 psf	n
16	in O.C.	Metal Channel Studs		@	2.0	plf	0.0 psf	n
8	ft O.C.	Steel Girts		@	6.0	plf	0.0 psf	n
		Miscellaneous		@	1.0	psf	1.0 psf	y
		Other		@	1.0	psf	0.0 psf	n
		Other		@	1.0	psf	0.0 psf	n
		Other		@	1.0	psf	0.0 psf	n
		Other		@	1.0	psf	0.0 psf	n
		Other		@	1.0	psf	0.0 psf	n

Solid Wall Weight =	26.0 psf
Window & Door Weight =	8.0 psf
% Solid Wall =	80%
WALL-5 WEIGHT =	**22.4 psf**

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BSE-2E HAZARD LEVEL

WALL TYPE: WALL-4

		Wall Covering		@	4.0	psf	4.0 psf	y
1	in	Exterior Stucco		@	11.4	psf per inch.	0.0 psf	n
1	in	Wood Sheathing		@	3.0	psf per inch	0.0 psf	n
0.5	in	Gypsum Sheathing		@	4.0	psf per inch	0.0 psf	n
0.5	in	Gypsum Wallboard		@	4.4	psf per inch	0.0 psf	n
		Porcelain Enamel Panels		@	5.0	psf	0.0 psf	n
		Metal Lath & Plaster	(Gypsum Plaster)	@	10.0	psf	0.0 psf	n
		Wall Insulation		@	1.0	psf	1.0 psf	y
1	in	Insulation	(Rigid)	@	1.5	psf per inch	0.0 psf	n
1	in	Insulation Boards	(Fiber Board)	@	1.5	psf per inch	0.0 psf	n
0.5	in	Fire Proofing		@	2	psf per inch	0.0 psf	n
		Wall Framing		@	20.0	psf	20.0 psf	y
8	in	Concrete Wall	(Normal Weight)	@	12.5	psf per inch	0.0 psf	n
8	in	CMU Wall w/ Full Grouting	(Normal Weight)	@	83.0	psf	0.0 psf	n
8	in	Solid CMU Wall	(Normal Weight)	@	87.0	psf	0.0 psf	n
4	in	HCB Wall w/ Full Grouting		@	38.0	psf	0.0 psf	n
3.5	in	Clay Brick Wall		@	11.1	psf per inch	0.0 psf	n
0.5	in	Plywood		@	3.2	psf per inch	0.0 psf	n
16	in O.C.	Wood Studs	(2 x 4)	@	1.1	plf	0.0 psf	n
16	in O.C.	Metal Channel Studs		@	2.0	plf	0.0 psf	n
8	ft O.C.	Steel Girts		@	6.0	plf	0.0 psf	n
		Miscellaneous		@	1.0	psf	1.0 psf	y
		Other		@	1.0	psf	0.0 psf	n
		Other		@	1.0	psf	0.0 psf	n
		Other		@	1.0	psf	0.0 psf	n
		Other		@	1.0	psf	0.0 psf	n
		Other		@	1.0	psf	0.0 psf	n

Solid Wall Weight =	26.0	psf
Window & Door Weight =	8.0	psf
% Solid Wall =	80%	
WALL-4 WEIGHT =	**22.4**	**psf**

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BSE-2E HAZARD LEVEL

WALL TYPE: WALL-3

		Wall Covering		@	4.0	psf	4.0 psf	y
1	in	Exterior Stucco		@	11.4	psf per inch.	0.0 psf	n
1	in	Wood Sheathing		@	3.0	psf per inch	0.0 psf	n
0.5	in	Gypsum Sheathing		@	4.0	psf per inch	0.0 psf	n
0.5	in	Gypsum Wallboard		@	4.4	psf per inch	0.0 psf	n
		Porcelain Enamel Panels		@	5.0	psf	0.0 psf	n
		Metal Lath & Plaster	(Gypsum Plaster)	@	10.0	psf	0.0 psf	n
		Wall Insulation		@	1.0	psf	1.0 psf	y
1	in	Insulation	(Rigid)	@	1.5	psf per inch	0.0 psf	n
1	in	Insulation Boards	(Fiber Board)	@	1.5	psf per inch	0.0 psf	n
0.5	in	Fire Proofing		@	2	psf per inch	0.0 psf	n
		Wall Framing		@	20.0	psf	20.0 psf	y
8	in	Concrete Wall	(Normal Weight)	@	12.5	psf per inch	0.0 psf	n
8	in	CMU Wall w/ Full Grouting	(Normal Weight)	@	83.0	psf	0.0 psf	n
8	in	Solid CMU Wall	(Normal Weight)	@	87.0	psf	0.0 psf	n
4	in	HCB Wall w/ Full Grouting		@	38.0	psf	0.0 psf	n
3.5	in	Clay Brick Wall		@	11.1	psf per inch	0.0 psf	n
0.5	in	Plywood		@	3.2	psf per inch	0.0 psf	n
16	in O.C.	Wood Studs	(2 x 4)	@	1.1	plf	0.0 psf	n
16	in O.C.	Metal Channel Studs		@	2.0	plf	0.0 psf	n
8	ft O.C.	Steel Girts		@	6.0	plf	0.0 psf	n
		Miscellaneous		@	1.0	psf	1.0 psf	y
		Other		@	1.0	psf	0.0 psf	n
		Other		@	1.0	psf	0.0 psf	n
		Other		@	1.0	psf	0.0 psf	n
		Other		@	1.0	psf	0.0 psf	n
		Other		@	1.0	psf	0.0 psf	n

Solid Wall Weight =	26.0	psf
Window & Door Weight =	8.0	psf
% Solid Wall =	80%	
WALL-3 WEIGHT =	**22.4**	**psf**

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Subject:	Weight Take Off	**Job Number:**	B9956006.00	**Date:**	06/28/19
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WEIGHT TAKEOFF

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WALL TYPE: WALL-2

		Wall Covering		@	4.0	psf	4.0 psf	y
1	in	Exterior Stucco		@	11.4	psf per inch.	0.0 psf	n
1	in	Wood Sheathing		@	3.0	psf per inch	0.0 psf	n
0.5	in	Gypsum Sheathing		@	4.0	psf per inch	0.0 psf	n
0.5	in	Gypsum Wallboard		@	4.4	psf per inch	0.0 psf	n
		Porcelain Enamel Panels		@	5.0	psf	0.0 psf	n
		Metal Lath & Plaster	(Gypsum Plaster)	@	10.0	psf	0.0 psf	n
		Wall Insulation		@	1.0	psf	1.0 psf	y
1	in	Insulation	(Rigid)	@	1.5	psf per inch	0.0 psf	n
1	in	Insulation Boards	(Fiber Board)	@	1.5	psf per inch	0.0 psf	n
0.5	in	Fire Proofing		@	2	psf per inch	0.0 psf	n
		Wall Framing		@	20.0	psf	20.0 psf	y
10	in	Concrete Wall	(Normal Weight)	@	12.5	psf per inch	0.0 psf	n
8	in	CMU Wall w/ Full Grouting	(Normal Weight)	@	83.0	psf	0.0 psf	n
8	in	Solid CMU Wall	(Normal Weight)	@	87.0	psf	0.0 psf	n
4	in	HCB Wall w/ Full Grouting		@	38.0	psf	0.0 psf	n
3.5	in	Clay Brick Wall		@	11.1	psf per inch	0.0 psf	n
0.5	in	Plywood		@	3.2	psf per inch	0.0 psf	n
16	in O.C.	Wood Studs	(2 x 4)	@	1.1	plf	0.0 psf	n
16	in O.C.	Metal Channel Studs		@	2.0	plf	0.0 psf	n
8	ft O.C.	Steel Girts		@	6.0	plf	0.0 psf	n
		Miscellaneous		@	1.0	psf	1.0 psf	y
		Other		@	1.0	psf	0.0 psf	n
		Other		@	1.0	psf	0.0 psf	n
		Other		@	1.0	psf	0.0 psf	n
		Other		@	1.0	psf	0.0 psf	n
		Other		@	1.0	psf	0.0 psf	n

Solid Wall Weight =	26.0	psf
Window & Door Weight =	8.0	psf
% Solid Wall =	80%	
WALL-2 WEIGHT =	**22.4**	**psf**

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Subject:	Seismic Mass	**Job Number:**	B9956006.00	**Date:**	06/28/19
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SEISMIC MASS

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ROOF/FLOOR WEIGHT SUMMARY:

Level Type	Weight [psf]
ROOF	33
FLR-5	86
FLR-4	86
FLR-3	86
FLR-2	86

WALL WEIGHT SUMMARY:

Wall Type	Weight [psf]		
	Net	Solid	Openings
WALL-P	26.0	26	8
WALL-R	22.4	26	8
WALL-5	22.4	26	8
WALL-4	22.4	26	8
WALL-3	22.4	26	8
WALL-2	22.4	26	8

SEISMIC MASS SUMMARY:

Level	FLOOR			WALL ABOVE				WALL BELOW				TOTAL
	Level Type	Weight [psf]	Area [sf]	Wall Type	Weight [psf]	Length [ft]	Height [ft]	Wall Type	Weight [psf]	Length [ft]	Height [ft]	WEIGHT [kips]
Roof	ROOF	33	2,960	WALL-P	26.0	0	9.00	WALL-R	22.4	0	5.00	98
5th	FLR-5	86	2,960	WALL-R	22.4	234	5.00	WALL-5	22.4	234	6.00	312
4th	FLR-4	86	2,960	WALL-5	22.4	234	6.00	WALL-4	22.4	234	6.00	317
3rd	FLR-3	86	2,960	WALL-4	22.4	234	6.00	WALL-3	22.4	234	6.00	317
2nd	FLR-2	86	2,960	WALL-3	22.4	234	6.00	WALL-2	22.4	234	5.00	312
											TOTAL	1,357

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Subject:	Seismic Forces	**Job Number:**	B9956006.00	**Date:**	06/28/19
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SEISMIC FORCES

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BSE-2E HAZARD LEVEL

BUILDING TYPE: S2 (Steel Braced Frames with Stiff Diaphragms) [ASCE 41-17, Table 3-1]
SITE CLASS: D (default) #N/A [ASCE 41-17, §2.4.1.6]

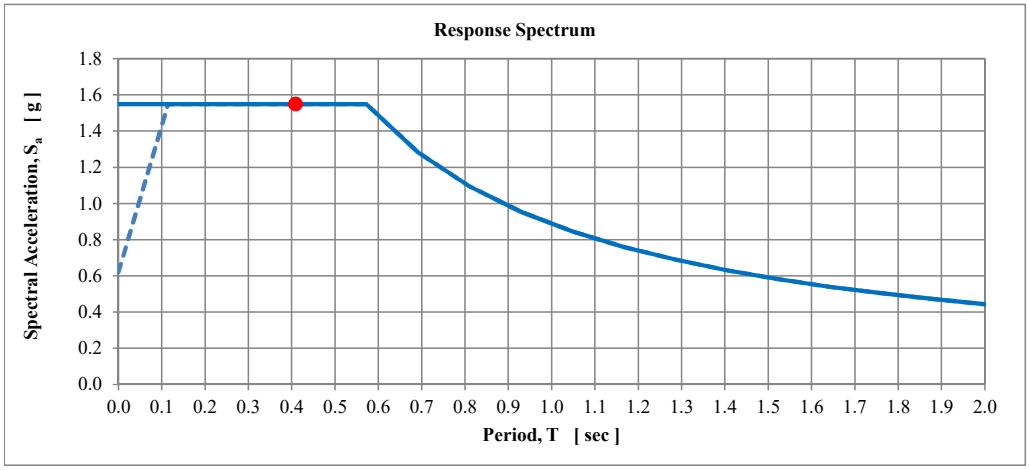
DESIGN SPECTRAL ACCELERATIONS:

S_{XS}	=	1.549 g	(BSE-2E)	Site-Adjusted Design (T = 0.2 sec)	[ASCE 41-17, Eq. 2-1]
S_{X1}	=	0.887 g	(BSE-2E)	Site-Adjusted Design (T = 1.0 sec)	[ASCE 41-17, Eq. 2-2]

BUILDING PERIOD:

h_n	=	56.0 ft	(Base to Roof)	Building Height	[ASCE 41-17, §4.4.2.4]
C_t	=	0.020	(Building Type S2)	Period Coefficient	[ASCE 41-17, §4.4.2.4]
β	=	0.750	(Building Type S2)	Period Exponent	[ASCE 41-17, §4.4.2.4]
T	=	0.409 sec	$= C_t h_n^{\beta}$	Fundamental Period	[ASCE 41-17, Eq. 4-4]

RESPONSE SPECTRUM:



PSEUDO LATERAL FORCE:

n	=	5	($n \geq 4$)	Total Number of Stories	
C	=	1.0	(Building Type S2)	Modification Factor	[ASCE 41-17, Table 4-7]
S_a	=	1.549 g	$= MIN \{ S_{X1} / T , S_{XS} \}$	Spectral Acceleration	[ASCE 41-17, Eq. 4-3]
V	**=**	**1.549 W**	$= C S_a W$	Pseudo Lateral Force	[ASCE 41-17, Eq. 4-1]

VERTICAL DISTRIBUTION OF SEISMIC FORCES:

k = 1.00 ($T \leq 0.5$ sec) Seismic Distribution Exponent [ASCE 41-17, §4.4.2.2]

$F_x = C_{vx} V = [w_x h_x^{k} / \Sigma (w_x h_x^{k})] V$ [ASCE 41-17, Eq. 4-2a]

$V_j = \Sigma F_x$ [ASCE 41-17, Eq. 4-2b]

Level	h_x [ft]	w_x [kips]	$w_x h_x^{k}$	C_{vx}	F_x [kips]	V_j [kips]
Roof	56.0	98	5,470	0.13	282	282
4th	34.0	317	10,794	0.26	557	1,581
3rd	22.0	317	6,984	0.17	360	1,941
2nd	10.0	312	3,122	0.08	161	2,102
TOTAL	-	1,357	40,732	1.00	2,102	-

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BSE-2E HAZARD LEVEL

BUILDING TYPE: C2 (Concrete Shear Walls with Stiff Diaphragms) [ASCE 41-17, Table 3-1]

STEEL REINFORCING RATIO CHECK: [ASCE 41-17, §A.3.2.2.2]

		Horizontal Reinforcing					Vertical Reinforcing				
Wall Type	t_w [in]	$n_{curtains}$ [curtains]	Bar Size No.	Spacing [in]	ρ_h	$\rho_h \geq 0.0020$	$n_{curtains}$ [curtains]	Bar Size No.	Spacing [in]	ρ_v	$\rho_v \geq 0.0012$
WALL-2	10	2	4	10	0.0040	OK	2	4	10	0.0040	OK

AVERAGE SHEAR STRESS CHECK: [ASCE 41-17, §A.3.2.2.1]

f'_c	=	3,000 psi	(ASCE 41 Default)	Concrete Compressive Strength	[ASCE 41-17, Table 4-2]
v_n	=	110 psi	= MAX { 100 psi , 2 $\sqrt{f'_c}$ }	Shear Wall Capacity	[ASCE 41-17, §A.3.2.2.1]
M_s	=	4.5	COLLAPSE PREVENTION	System Modification Factor	[ASCE 41-17, Table 4-8]
$v_{j,\,avg}$	=	(1 / M_s) (V_j / A_w)		Average Shear Wall Stress	[ASCE 41-17, Eq. 4-8]
A_w	=	t_w ($L_{w,\,total}$ - $L_{w,\,openings}$)		Net Wall Area	[ASCE 41-17, §4.4.3.3]

North-South Direction:

Level	V_j [kips]	Wall Type	t_w [in]	$L_{w,\,total}$ [ft]	$L_{w,\,openings}$ [ft]	L_w [ft]	A_w [in^2]	$v_{j,\,avg}$ [psi]	DCR	Quick Check
2nd	2,102	WALL-2	10	160	35	125	15,000	31	0.28	OK

East-West Direction:

Level	V_j [kips]	Wall Type	t_w [in]	$L_{w,\,total}$ [ft]	$L_{w,\,openings}$ [ft]	L_w [ft]	A_w [in^2]	$v_{j,\,avg}$ [psi]	DCR	Quick Check
2nd	2,102	WALL-2	10	74	20	54	6,480	72	0.66	OK

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BSE-2E HAZARD LEVEL

BUILDING TYPE:	S2	(Steel Braced Frames with Stiff Diaphragms)	[ASCE 41-17, Table 3-1]
FRAME TYPE:	CBF	(Concentrically Braced Frame)	
CONFIGURATION:	Inverted V	(Inverted V-Bracing)	
BRACE TYPE:	W	(Wide Flange Braces)	
AXIAL LOAD:	T+C	(Tension and Compression)	
LOAD DIRECTION:	N-S		

FRAME PROPERTIES:

Level	n_f [frames]	n_c [columns]	n_{bays} [bays]	n_{br} [braces]	L_f [ft]	$L_{typical\ bay}$ [ft]	DL [psf]	LL [psf]	A_{trib} [ft^2]	P_D [kips]	P_L [kips]
Roof	2	5	2	4	80.0	20	33	20	190	6	4
5th	2	8	4	8	80.0	20	86	50	190	23	20
4th	2	8	4	8	80.0	20	86	50	190	39	36
3rd	2	8	4	8	80.0	20	86	50	190	55	53
2nd	2	8	4	8	80.0	20	86	50	190	72	69

FRAME MEMBER PROPERTIES: [ASCE 41-17 §4.2.3]

Material Properties:

F_{yc}	=	37 ksi	(ASTM A36 / Structural)	Column Yield Stress	(ASCE 41 Default)	[ASCE 41-17, §4.2.3]
F_{ybr}	=	37 ksi	(ASTM A36 / Structural)	Brace Yield Stress	(ASCE 41 Default)	[ASCE 41-13, Table 4-5]
E	=	29,000 ksi		Modulus of Elasticity		[ASCE 41-17, §4.2.3]

Column Properties:

Level	Section	Bending Axis	L_c [ft]	A_c [in^2]
Roof	W10x33	x	10.0	9.7
5th	W10x33	x	12.0	9.7
4th	W10x45	x	12.0	13.3
3rd	W10x45	x	12.0	13.3
2nd	W10x45	x	10.0	13.3

Brace Properties:

Level	Section	$L_{br,x}$ [ft]	$L_{br,y}$ [ft]	L_{br} [ft]	A_{br} [in^2]	d_{br} / t_{br}	b/t	λ_r	λ_{hd}	Kl/r
Roof	W8x31	10.0	10.0	14.1	9.13	n/a	9.19	15.68	10.68	84.01
5th	W8x31	10.0	12.0	15.6	9.13	n/a	9.19	15.68	10.68	92.80
4th	W8x31	10.0	12.0	15.6	9.13	n/a	9.19	15.68	10.68	92.80
3rd	W8x31	10.0	12.0	15.6	9.13	n/a	9.19	15.68	10.68	92.80
2nd	W8x31	10.0	10.0	14.1	9.13	n/a	9.19	15.68	10.68	84.01

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BSE-2E HAZARD LEVEL

BUILDING TYPE: S2 (Steel Braced Frames with Stiff Diaphragms) [ASCE 41-17, Table 3-1]
LOAD DIRECTION: N-S

COLUMN AXIAL STRESS CHECK: [ASCE 41-17, §A.3.1.3.2]

M_s	=	2.5	COLLAPSE PREVENTION	System Modification Factor	[ASCE 41-17, §4.4.3.6]
F_{yc}	=	37 ksi	(ASTM A36 / Structural)	Column Yield Stress	[ASCE 41-17, §4.2.3]
$P_{n,E} / A_c$	=	11.1 ksi	= 0.30 F_{yc}	Seismic Axial Stress Capacity	[ASCE 41-17, §A.3.1.3.2]
$P_{n,G} / A_c$	=	3.7 ksi	= 0.10 F_{yc}	Gravity Axial Stress Capacity	[ASCE 41-17, §A.3.1.3.2]
$M_{x,ot}$	=	$\Sigma (F_x h_x)$		Global Overturning Moment	[ASCE 41-17, §4.4.3.6]
P_E	=	$(1 / M_s) (M_{x,ot} / n_f) / L_f$		Seismic Axial Load due to Overturning	[ASCE 41-17, §4.4.3.6]
P_G	=	$P_D + P_L$		Unfactored Gravity Load	[ASCE 41-17, §A.3.1.3.2]
P_D	=	$\Sigma (DL A_{trib})$		Gravity Dead Load	[ASCE 41-17, §4.4.3.6]
P_L	=	$\Sigma (LL A_{trib})$		Gravity Live Load	[ASCE 41-17, §4.4.3.6]

Level	Section	A_c [in^2]	h_x [ft]	F_x [kips]	$M_{x,ot}$ [k-ft]	P_E [kips]	$P_E / F_{yc} A_c$	P_G [kips]	$P_G / F_{yc} A_c$	DCR		Quick Check
										Seismic	Gravity	
Roof	W10x33	9.7	56.0	282	2,823	7	0.02	10	0.03	0.07	0.28	OK
5th	W10x33	9.7	46.0	741	15,107	38	0.11	43	0.12	0.35	1.19	OK
4th	W10x45	13.3	34.0	557	34,075	85	0.17	75	0.15	0.58	1.53	OK
3rd	W10x45	13.3	22.0	360	57,369	143	0.29	108	0.22	0.97	2.20	OK
2nd	W10x45	13.3	10.0	161	78,392	196	0.40	141	0.29	1.33	2.86	NO GOOD

BRACE AXIAL STRESS CHECK: [ASCE 41-17, §A.3.3.1.2]

M_s	=	7.0	(Tube, $d_{br} / t_{br} < 90 / \sqrt{F_{yebr}}$)	System Modification Factor (CP)	[ASCE 41-17, Table 4-9]
		3.5	(Tube, $d_{br} / t_{br} > 190 / \sqrt{F_{yebr}}$)	System Modification Factor (CP)	[ASCE 41-17, Table 4-9]
		7.0	(Pipe, $d_{br} / t_{br} < 1500 / F_{yebr}$)	System Modification Factor (CP)	[ASCE 41-17, Table 4-9]
		3.5	(Pipe, $d_{br} / t_{br} > 6000 / F_{yebr}$)	System Modification Factor (CP)	[ASCE 41-17, Table 4-9]
		3.5	(Tension-Only Braces)	System Modification Factor (CP)	[ASCE 41-17, Table 4-9]
		3.5	(Cold-formed steel strap-braced wa	System Modification Factor (CP)	[ASCE 41-17, Table 4-9]
		7.0	(All Other Brace Types)	System Modification Factor (CP)	[ASCE 41-17, Table 4-9]
F_{ybr}	=	37 ksi	(ASTM A36 / Structural)	Brace Yield Stress	[ASCE 41-13, Table 4-5]
F_{yebr}	=	46 ksi	= 1.25 F_{ybr}	Brace Expected Yield Stress	[ASCE 41-17, §4.4.3.4]
f_{nbr}	=	19 ksi	= 0.50 F_{ybr}	Brace Axial Stress Capacity	[ASCE 41-17, §A.3.3.1.2]
$f_{j,avg}$	=	$(1 / M_s) (V_j / (L_{br,x} n_{br})) (L_{br} / A_{br})$		Average Brace Axial Stress	[ASCE 41-17, Eq. 4-9]

Level	V_j [kips]	n_{br} [braces]	$L_{br,x}$ [ft]	L_{br} [ft]	A_{br} [in^2]	d_{br} / t_{br}	M_s	$f_{j,avg}$ [ksi]	DCR	Quick Check
Roof	282	4	10.0	14.1	9.13	n/a	7.00	1.6	0.08	OK
5th	1,024	8	10.0	15.6	9.13	n/a	7.00	3.1	0.17	OK
4th	1,581	8	10.0	15.6	9.13	n/a	7.00	4.8	0.26	OK
3rd	1,941	8	10.0	15.6	9.13	n/a	7.00	5.9	0.32	OK
2nd	2,102	8	10.0	14.1	9.13	n/a	7.00	5.8	0.31	OK

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BSE-2E HAZARD LEVEL

BUILDING TYPE: S2 (Steel Braced Frames with Stiff Diaphragms) [ASCE 41-17, Table 3-1]
LOAD DIRECTION: E-W

FRAME PROPERTIES:

Level	n_f [frames]	n_c [columns]	n_{bays} [bays]	n_{br} [braces]	L_f [ft]	$L_{typical\ bay}$ [ft]	DL [psf]	LL [psf]	A_{trib} [ft^2]	P_D [kips]	P_L [kips]
Roof	2	10	5	5	37.0	13.0	33	20	190	6	4
5th	2	10	5	5	37.0	13.0	86	50	190	23	20
4th	2	10	5	5	37.0	13.0	86	50	190	39	36
3rd	2	10	5	5	37.0	13.0	86	50	190	55	53
2nd	2	10	5	5	37.0	13.0	86	50	190	72	69

FRAME MEMBER PROPERTIES: [ASCE 41-17, §4.2.3]

Material Properties: (ASCE 41 Default)

F_{yc}	=	37 ksi	(ASTM A36 / Structural)	Column Yield Stress [ASCE 41-17, §4.2.3]
F_{ybr}	=	37 ksi	(ASTM A36 / Structural)	Brace Yield Stress [ASCE 41-13, Table 4-5]
E	=	29,000 ksi		Modulus of Elasticity [ASCE 41-17, §4.2.3]

Column Properties:

Level	Section	Bending Axis	L_c [ft]	A_c [in^2]
Roof	W10x33	x	10.0	9.7
5th	W10x33	x	12.0	9.7
4th	W10x45	x	12.0	13.3
3rd	W10x45	x	12.0	13.3
2nd	W10x45	x	10.0	13.3

Brace Properties:

Level	Section	$L_{br,x}$ [ft]	$L_{br,y}$ [ft]	L_{br} [ft]	A_{br} [in^2]	d_{br} / t_{br}	b/t	λ_r	λ_{hd}	Kl/r
Roof	W10x33	13.0	10.0	16.4	9.71	n/a	9.15	15.68	10.68	101.45
5th	W10x33	13.0	12.0	17.7	9.71	n/a	9.15	15.68	10.68	109.43
4th	W10x33	13.0	12.0	17.7	9.71	n/a	9.15	15.68	10.68	109.43
3rd	W10x33	13.0	12.0	17.7	9.71	n/a	9.15	15.68	10.68	109.43
2nd	W10x33	13.0	10.0	16.4	9.71	n/a	9.15	15.68	10.68	101.45

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BUILDING TYPE: S2 (Steel Braced Frames with Stiff Diaphragms) [ASCE 41-17, Table 3-1]
LOAD DIRECTION: E-W

COLUMN AXIAL STRESS CHECK: [ASCE 41-17, §A.3.1.3.2]

M_s	=	2.5	COLLAPSE PREVENTION	System Modification Factor	[ASCE 41-17, §4.4.3.6]
F_{yc}	=	37 ksi	(ASTM A36 / Structural)	Column Yield Stress	[ASCE 41-17, §4.2.3]
$P_{n,E} / A_c$	=	11.1 ksi	= 0.30 F_{yc}	Seismic Axial Stress Capacity	[ASCE 41-17, §A.3.1.3.2]
$P_{n,G} / A_c$	=	3.7 ksi	= 0.10 F_{yc}	Gravity Axial Stress Capacity	[ASCE 41-17, §A.3.1.3.2]
$M_{x,ot}$	=	$\Sigma (F_x h_x)$		Global Overturning Moment	[ASCE 41-17, §4.4.3.6]
P_E	=	$(1 / M_s) (M_{x,ot} / n_f) / L_f$		Seismic Axial Load due to Overturning	[ASCE 41-17, §4.4.3.6]
P_G	=	$P_D + P_L$		Unfactored Gravity Load	[ASCE 41-17, §A.3.1.3.2]
P_D	=	$\Sigma (DL A_{trib})$		Gravity Dead Load	[ASCE 41-17, §4.4.3.6]
P_L	=	$\Sigma (LL A_{trib})$		Gravity Live Load	[ASCE 41-17, §4.4.3.6]

Level	Section	A_c [in^2]	h_x [ft]	F_x [kips]	$M_{x,ot}$ [k-ft]	P_E [kips]	$P_E / F_{yc} A_c$	P_G [kips]	$P_G / F_{yc} A_c$	DCR		Quick Check
										Seismic	Gravity	
Roof	W10x33	9.7	56.0	282	2,823	15	0.04	10	0.03	0.14	0.28	OK
5th	W10x33	9.7	46.0	741	15,107	82	0.23	43	0.12	0.76	1.19	OK
4th	W10x45	13.3	34.0	557	34,075	184	0.37	75	0.15	1.25	1.53	NO GOOD
3rd	W10x45	13.3	22.0	360	57,369	310	0.63	108	0.22	2.10	2.20	NO GOOD
2nd	W10x45	13.3	10.0	161	78,392	424	0.86	141	0.29	2.87	2.86	NO GOOD

BRACE AXIAL STRESS CHECK: [ASCE 41-17, §A.3.3.1.2]

M_s	=	7.0	(Tube, $d_{br} / t_{br} < 90 / \sqrt{F_{yebr}}$)	System Modification Factor (CP)	[ASCE 41-17, Table 4-9]
		3.5	(Tube, $d_{br} / t_{br} > 190 / \sqrt{F_{yebr}}$)	System Modification Factor (CP)	[ASCE 41-17, Table 4-9]
		7.0	(Pipe, $d_{br} / t_{br} < 1500 / F_{yebr}$)	System Modification Factor (CP)	[ASCE 41-17, Table 4-9]
		3.5	(Pipe, $d_{br} / t_{br} > 6000 / F_{yebr}$)	System Modification Factor (CP)	[ASCE 41-17, Table 4-9]
		3.5	(Tension-Only Braces)	System Modification Factor (CP)	[ASCE 41-17, Table 4-9]
		3.5	(Cold-formed steel strap-braced wa	System Modification Factor (CP)	[ASCE 41-17, Table 4-9]
		7.0	(All Other Brace Types)	System Modification Factor (CP)	[ASCE 41-17, Table 4-9]
F_{ybr}	=	37 ksi	(ASTM A36 / Structural)	Brace Yield Stress	[ASCE 41-13, Table 4-5]
F_{yebr}	=	46 ksi	= 1.25 F_{ybr}	Brace Expected Yield Stress	[ASCE 41-17, §4.4.3.4]
f_{nbr}	=	19 ksi	= 0.50 F_{ybr}	Brace Axial Stress Capacity	[ASCE 41-17, §A.3.3.1.2]
$f_{j,avg}$	=	$(1 / M_s) (V_j / (L_{br,x} n_{br})) (L_{br} / A_{br})$		Average Brace Axial Stress	[ASCE 41-17, Eq. 4-9]

Level	V_j [kips]	n_{br} [braces]	$L_{br,x}$ [ft]	L_{br} [ft]	A_{br} [in^2]	d_{br} / t_{br}	M_s	$f_{j,avg}$ [ksi]	DCR	Quick Check
Roof	282	5	13.0	16.4	9.71	n/a	7.00	1.0	0.06	OK
5th	1,024	5	13.0	17.7	9.71	n/a	7.00	4.1	0.22	OK
4th	1,581	5	13.0	17.7	9.71	n/a	7.00	6.3	0.34	OK
3rd	1,941	5	13.0	17.7	9.71	n/a	7.00	7.8	0.42	OK
2nd	2,102	5	13.0	10.0	9.71	n/a	7.00	4.8	0.26	OK

Degenkolb

Subject: Brace Connection Check
Job: UCSC Tier 1 - CAAN#7920.0
Job Number: B959006.00
By: JSW
Checked By:
Date: 06/28/2019
Section:
Page: 1 of 1

Purpose: To check if the W8x31 brace connection can develop the full tensile capacity of the diagonal

Procedure: The calcuation steps are as follows

Step 1: Check the brace net section rupture capacity

Step 2: Check brace to gusset weld

Step 1: Check the brace net section rupture capacity

Per AISC 341-10 the connection must develop the expected tensile yield strength of the brace Per the general notes, wide flange sections are either ASTM A36 and/or ASTM A572 Gr. 50. The expected material strength of each is close after multiplying by Ry per table A3.1

$f_y := 36\ ksi$ $f_u := 58\ ksi$ $A_{W8x31} := 9.13\ in^2$

$R_y := 1.5$ $t_f := 0.435 \cdot in$

$t_w := 0.285 \cdot in$

$f_{ye} := f_y \cdot R_y = 54\ ksi$ $b_f := 8\ in$

$d := 8\ in$

$T_u := f_{ye} \cdot A_{W8x31} = 493.02\ kip$ $l_{weld} := 14\ in$

Original drawings say to slot flange of brace. Based on site visit observations, top and bottom flange are coped to the web on one side of the brace. Take this as the net section area for tensile rupture

$A_n := A_{W8x31} - 2 \cdot t_f \cdot \frac{(b_f - t_w)}{2} = 5.77\ in^2$

$2\ d < l_{weld} = 0$

$2\ d > l_{weld} > 1.5 \cdot d = 1$

$U := 0.87$ Table D3.1 AISC 360-10

$A_e := A_n \cdot U = 5.02\ in^2$

$T_n := f_u \cdot A_e = 291.35\ kip$

Existing building so use a phi of 1

$\phi := 1$

$DCR := \frac{T_u}{\phi \cdot T_n} = 1.69$

Step 2: Check brace to gusset weld

$l_{weld} = 14\ in$ $T_u = 493.02\ kip$

$t_{weld} := 0.5\ in$ $\phi = 1$

$F_{EXX} := 70\ ksi$

Eq 8-1

$R_n := 2 \cdot 0.6 \cdot F_{EXX} \cdot \frac{\sqrt{2}}{2}\ t_{weld} \cdot l_{weld} = 415.78\ kip$ $DCR_{weld} := \frac{T_u}{\phi \cdot R_n} = 1.19$

Degenkolb

Subject: Brace Connection Check
Job: UCSC Tier 1 - CAAN#7920.1
Job Number: B959006.00
By: JSW
Checked By:
Date: 06/28/2019
Section:

Purpose: To check if the W18x35 bream can resist the effect of the combine tensile and compressive brace capacities applied at midspan

Procedure: The calcuation steps are as follows
Step 1: Determine brace capacities
Step 2: Check beam in chevron configuration

Step 1: Determine brace capacities

Per AISC 341-10 the connection must develop the expected tensile yield strength of the brace
Per the general notes, wide flange sections are either ASTM A36 and/or ASTM A572 Gr. 50. The expected material strength of each is close after multiplying by Ry per table A3.1

$f_y := 36\ ksi$ $A_{W8x31} := 9.13\ in^2$
$R_y := 1.5$
$f_u := 58\ ksi$
$E := 29000\ ksi$

Tension
$f_{ye} := f_y \cdot R_y = 54\ ksi$
$T_u := f_{ye} \cdot A_{W8x31} = 493.02\ kip$

Compression
No slender elements from quick check worksheet. Kl/r calculated in quick check worksheet

$Klr := 92.8$

$F_e := \frac{\pi^2 \cdot E}{Klr^2} = 33.24\ ksi$

$\frac{f_y}{F_e} = 1.08$ $\frac{f_y}{F_e} \le 2.25 = 1$

$F_{cr} := \left(0.658^{\frac{f_y}{F_e}}\right) \cdot f_y = 22.88\ ksi$

$P_n := A_{W8x31} \cdot F_{cr} = 208.87\ kip$
$C_u := 0.3 \cdot P_n = 62.66\ kip$ AISC 341-10 F1.4a

Degenkolb

Subject: Brace Connection Check
Job: UCSC Tier 1 - CAAN#7920.1
Job Number: B959006.00
By: JSW
Checked By:
Date: 06/28/2019
Section:

Step 2: Check beam in chevron configuration

$l_{beam} := 20\ ft$

$\theta := \text{acos}\left(\frac{10\ ft}{16\ ft}\right) = 51.32\ deg$

$P := \sin(\theta) \cdot (T_u - C_u) = 335.95\ kip$

$M_u := \frac{P \cdot l_{beam}}{4} = 20156.91\ kip \cdot in$ Pin Pin per connection assumed based on details

$Z_{x\_W18x35} := 66.5\ in^3$

$M_n := f_{ye} \cdot Z_{x\_W18x35} = 3591\ kip \cdot in$

$\phi := 1$

$DCR := \frac{M_u}{\phi \cdot M_n} = 5.61$

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Appendix C
Pictures and Details

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Coped beam flange

Transfer truss in lecture hall

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Foundation crawl space

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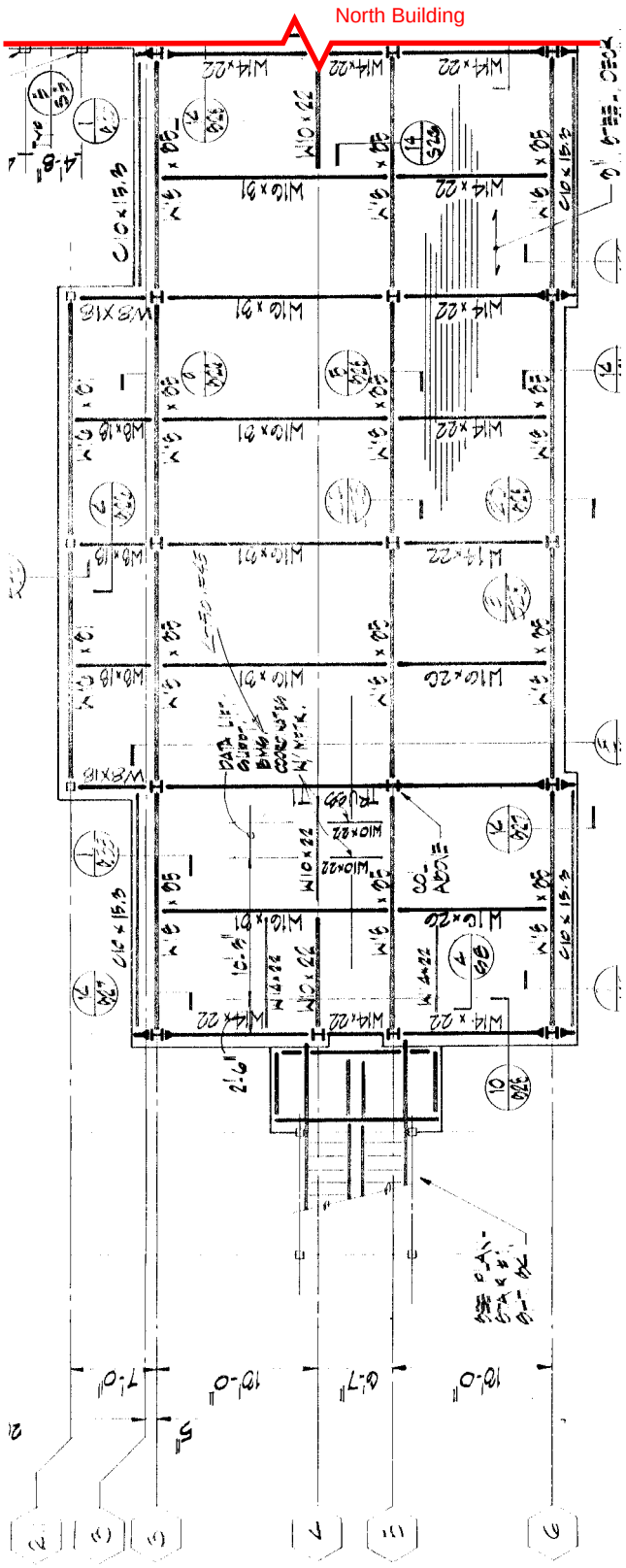

Typical plan - South structure

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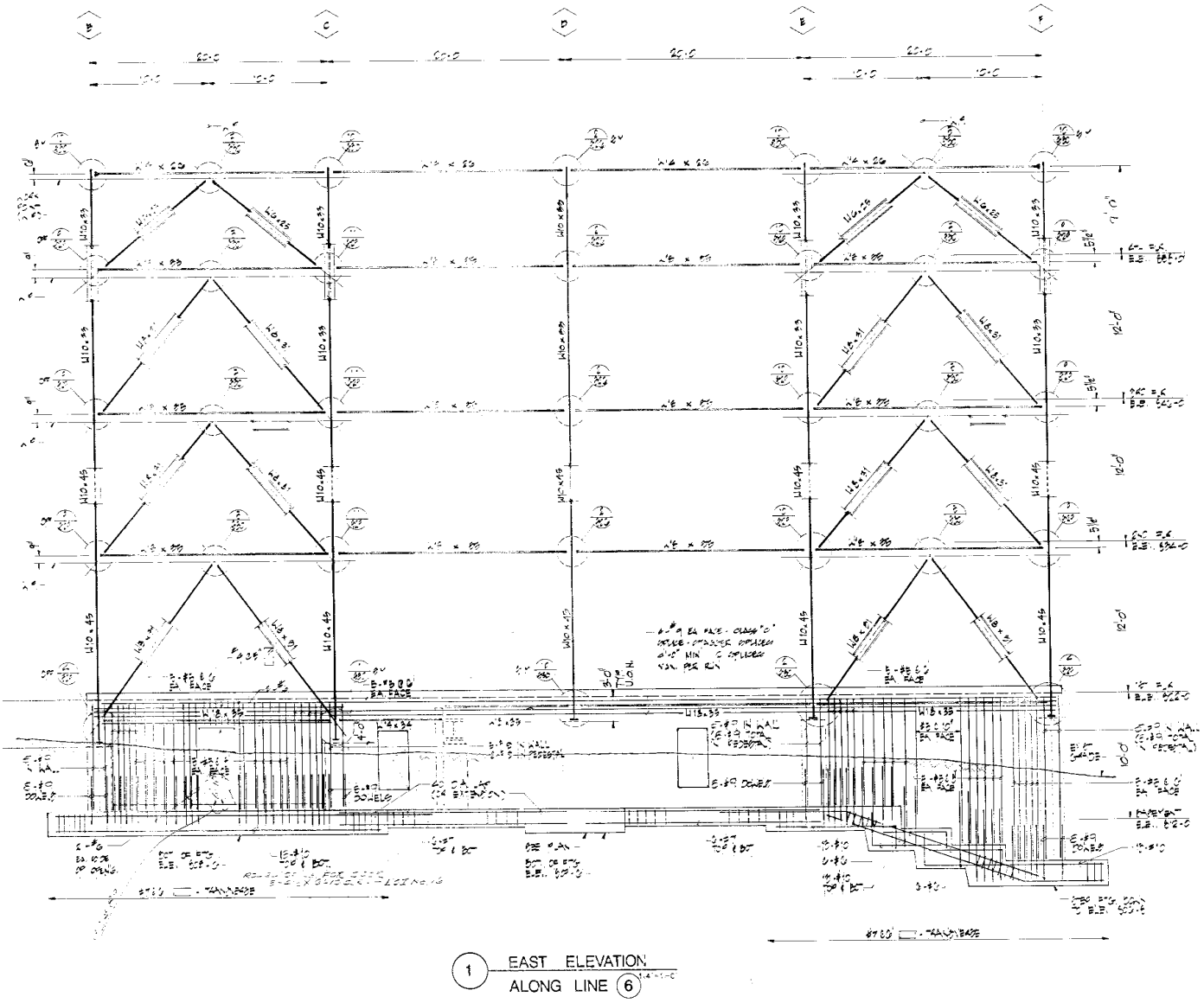

Typical longitudinal elevation

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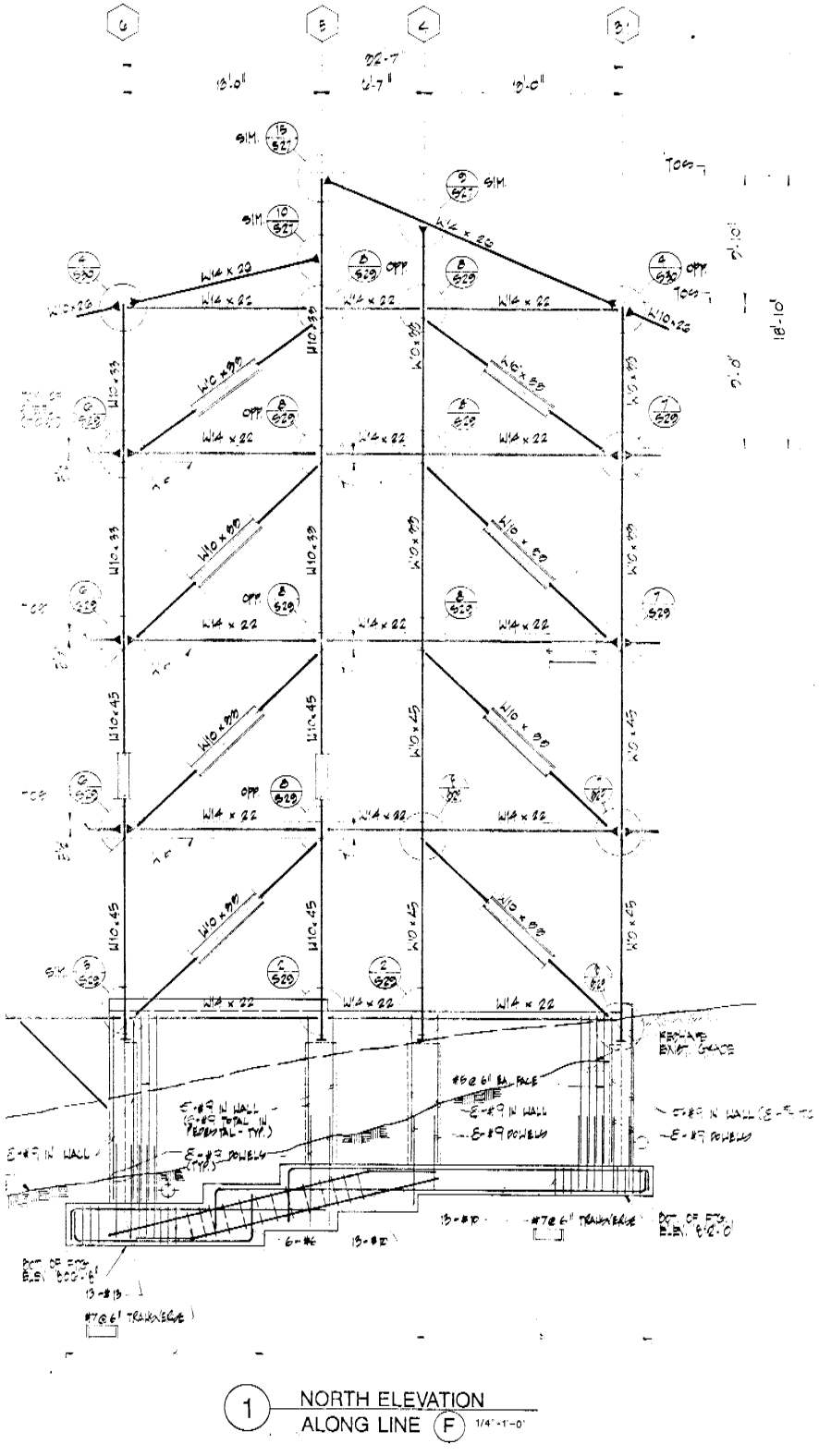

Typical transverse elevation

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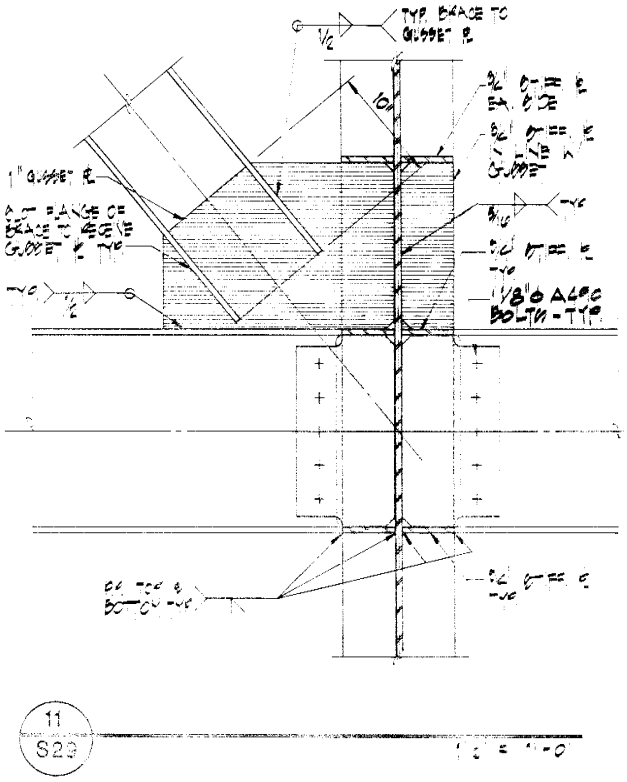

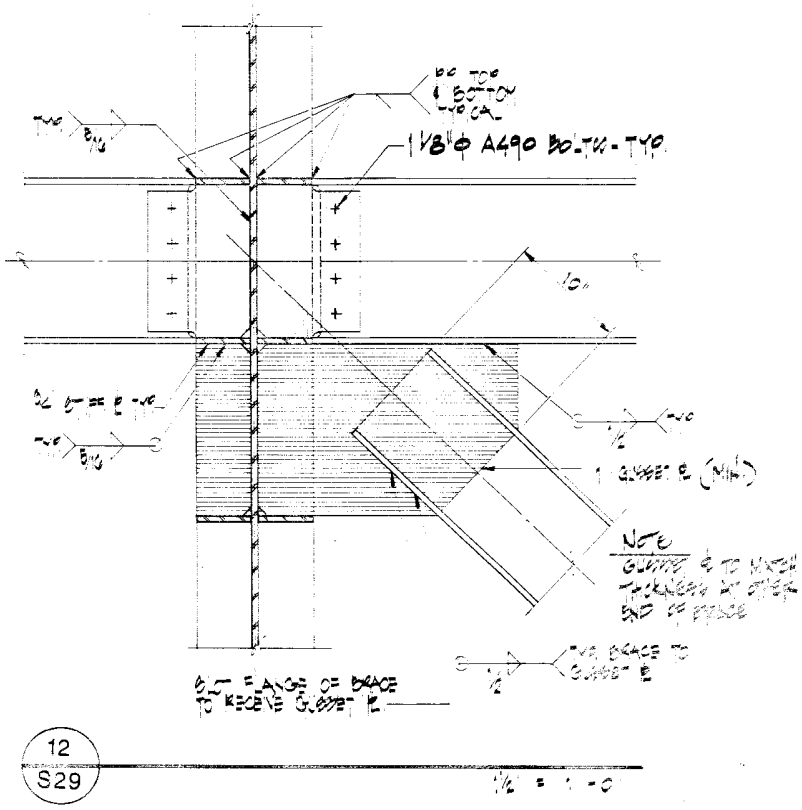

Typical brace connection details