Rating form completed by:

RUTHERFORD + CHEKENE
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Evaluator: CLP/EFA/BL

Date: 07/28/2019

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

DATE: 2019-07-28

UC Santa Cruz Building Seismic Ratings

Crown College Commons

CAAN #7157
630 Crown Road, Santa Cruz, CA 95064
UCSC Campus: Main Campus

Main Entry (Looking Northeast)

Plan

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	Priority B	Priority A=Retrofit ASAP Priority B=Retrofit at next permit application
Ballpark total construction cost to retrofit to IV rating[2]	High ($200-$400/sf)	See recommendations on further evaluation and retrofit.
Is 2018-2019 rating required by UCOP?	Yes	Building was not previously rated.
Further evaluation recommended?	Yes	Tier 2 evaluation needed to clearly identify load path from many different roof areas to foundation. Retrofit may include additional walls and added blocking, straps, clips, and hold downs.

[1] We translate this Tier 1 evaluation to a Seismic Performance Level rating using professional judgment. Non-compliant 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 19 May 2017 *UC Seismic Safety Policy* and Method B of Section 321 of the 2016 *California Building Code*.

[2] Per Section III.A.4.i of the 26 March 2019 *UC Seismic Program Guidebook, Version 1.3*, 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 Ernest J. Kump Associates, "Residential College No. 3, University of California, Santa Cruz," dated variously in 1966, Sheets A1 to A63 (73 sheets). Drawings are for Buildings J, K, L, M & N; relevant sheets are for "Faculty Study Building Unit K."
- Structural drawings by Ernest J. Kump Associates, "Residential College No. 3, University of California, Santa Cruz," dated 24 February 1966, Sheets S1 to S48 (73 sheets). Drawings are for Buildings J, K, L, M & N; relevant sheets are for "Faculty Study Building Unit K."
- Architectural and Structural As-builts, "Crown College Dining Hall Alterations, Phase 1, University of California, Santa Cruz," Sheets A0 to A11 by Leon H. Waller, Architect and Sheets S1 to S3 by Mesiti-Miller Engineering Inc., Structural Engineers, dated 30 May 2000.
- Architectural and Structural As-builts, "Crown College Dining Hall Alterations, Phase 2, University of California, Santa Cruz," Sheets A0 to A5 by Leon H. Waller, Architect and Sheets S1 to S5 by Mesiti-Miller Engineering Inc., Structural Engineers, dated 8 March 2001.
- Architectural and Structural As-builts, "Crown College Dining Hall Alterations, Phase 3, University of California, Santa Cruz," Sheets A0 to A19 by Leon H. Waller, Architect and Sheets S1 to S9 by Mesiti-Miller Engineering Inc., Structural Engineers, dated 27 June 2001.

Additional building information known to exist

None.

Scope for completing this form

Reviewed architectural and structural drawings for the original 1967 construction and for the three phase Dining Hall Alterations in 2000-2001, made brief site visit on 3 June 2019, and carried out ASCE 41-17 Tier 1 evaluation. Drawings for adjacent portions of Merrill College were not available for this review. Note that the as-built roof profile for the Dining Hall is not as shown in the 1966 plans; no revised drawings for the original roof framing and connections to adjacent areas were available for review.

Brief description of structure

The Crown College Commons is one of a cluster of five wood framed buildings that form the core of Crown College. These buildings were originally known as Buildings J, K, L, M and N of Residential College No. 3. The Crown College Commons or Dining Commons Building was Building "L" in the original drawings. The adjacent buildings include the Crown Administration Building ("N"), the Crown Gatehouse ("M"), the Crown Classroom Building ("J"), and the Crown Faculty Wing ("K). The Crown complex was designed in 1966 by architects Ernest J. Kump Associates. The firm logo is also on the structural drawings and a signature for Peter Kump AIA No. 651 appears on both the architectural and structural sheets, so it appears there was no independent structural design professional involved. The construction completion date is unknown, but it is assumed to be 1967. An additional Library Building by the same designer was added to the south of the Classroom Building in about 1968.

Three additional sets of available drawings describe a three-phase Crown College Dining Hall Alteration program in 2000-2001. These drawings all include seismic upgrades, but the scope of the seismic work is not clear. Some of the repairs were done as a result of dry rot or checked wood members. We do not know from the drawings if the seismic work was done in response to a prior poor seismic rating or if the seismic work was triggered due to the extent of other alterations involved. Phase 1 involved seismic work in Banana Joe's (Area #4); Phase 2 involved limited seismic work along the east wall of the Dining Hall (Area #3); and Phase 3 involved seismic work in all areas.

The Dining Commons is a complex one-story wood framed building composed of the central dining room surrounded on four sides by rectangular wings separated by corridors. This results in flat roof areas at the corridors and the kitchen and five different sloping roof sections with Spanish tile roofing. For purposes of this discussion, we have labeled these "Area #1" to "Area #5" on a plan in the following pages. The sloping roof areas are typically exposed heavy glulam framing and long spans. The Fireside Lounge wing (Area #5) on the west includes a tall reinforced concrete chimney and a small mezzanine area in the corridor strip. The Dining Hall (Area #3) in the center is open to the wings to the north (Area #1) and south (Area #4, Banana Joe's), has a solid wall to the west and is roughly half open to the east. Note that the Dining Hall roof was built with clerestory windows in high walls on both the east and

west sides; this is not reflected in the original drawings we reviewed. The kitchen area (Area #2) to the east includes a partial basement that extends out under the parking lot to the north. Note that Area #3 and Area #5 are combined as Area #3 in the accompanying calculations. Two portions of Merrill College were built adjacent to the south and east walls without visible gaps. The gaps to these structures are not indicated on the Crown College drawings, and the Merrill College drawings were not available for this review

Building condition: The building appeared to be well maintained for a structure of this vintage. We did not observe any signs of structural deterioration that would influence the rating, but most of the structural members are covered with architectural finishes. The drawings for the alteration work in 2001-2002 note that some of the work involved replacement or repairs to checked wood members or members with dry rot, so it appears there were past issues with structural deterioration. UCSC facilities staff noted that termite damage was observed and repaired during renovations at the adjacent wood frame Merrill College buildings.

Identification of levels: The original building has one story above grade with a small mezzanine area in the corridor adjacent to the Fireside Lounge and a partial basement at the east side under the kitchen. The original foundation stem walls at the perimeter come up to the level of the 1st-floor slab on grade or framed slab in the kitchen.

Foundation system: The building has continuous strip footings under perimeter stud walls and several interior stud walls. There are no foundation walls in the E-W direction at the north and south sides of the Dining Hall and only short return wall footings on the north side of the south wing and the south side of the north wing. The 8" basement walls and circular concrete columns come up to the underside of the 5-1/2" flat slab in the kitchen area. The remaining areas have a 4" concrete slab-on-grade. The circular concrete columns are supported on individual spread footings.

Structural system for vertical (gravity) load: Most of the roof areas are framed with 2x or 3x lumber that spans to glulam beams that span to wood posts or framed stud walls. The 7"x 35.75" glulam beams along the north and south edges of the Dining Hall roof span 50 feet to 6x8 wood posts. The 9"x 27-5/8" glulam beams in the center of the Dining Hall span 50 feet to 5 ¼" x 9 ¼" glulam posts. The 9" x 13" glulam beams in the kitchen span 10 feet or 30 feet to 6x6 wood posts that rest on concrete columns with spread footings below.

Structural system for lateral forces: While the building consists of five rectangular areas connected by corridors, the load path from the high roof above the Dining Hall is unclear. There is additional uncertainty because the 1966 drawings do not reflect the as-built conditions, so the actual connection details in the original are also unclear. As the building has flat and sloping roof surfaces, we have assumed that loads from each of the surrounding buildings are resisted by shear walls at the margins of these rectangular areas. The Dining Hall rectangle at the center of the complex does not have any shear walls in the E-W direction, so it appears these roof loads need to be dragged to adjacent areas. It appears the three-phase Dining Hall alterations were intended in part to remedy that lack of a clear load path from the high roof, but these drawings need to be scrutinized in detail in a Tier 2 evaluation in order to see if the seismic retrofit is adequate by current standards. The alterations included new narrow shear wall sections, straps, and hold downs, but no foundation work was included so loads in the E-W direction are still dragged to other portions of the structure.

From the original design, lateral forces are typically transferred from the plywood roof diaphragms through blocking at the top of the walls which are sheathed with double sided 3/8" plywood. Plywood roof nailing is specified in the sheet notes on S1 as 8d@6" at margins and 8d@12" intermediate. The original drawings show hold downs at a few locations; other hold downs and straps were added in 2000-2001. Small narrow additional shear walls were added in several locations as part of the upgrade. These original shear walls typically have a 2x4 mud sill with 5/8" x 9" long anchor bolt spaced at 32" on centers. The drawings state that walls are to have 3/8 plywood sheathing with nailing of 8d@4" at edges and 8d@12" at intermediate boundaries. None of the walls are designated as shear walls on the original plans but it appears that all walls were supposed to be sheathed.

Response in the Loma Prieta Earthquake: It is important to note that this building, prior to the seismic renovations, survived the 1989 Loma Prieta Earthquake with ground motions on the order of 0.44g and 0.41g in the two horizontal directions and 0.33g vertical (UCSC Lick Electrical Shop CGS Station 58135). We are not aware of any significant structural damage to this building.

Building code: The building code used for the original design is not listed on either the architectural or structural drawings. Sheet S1 is dated 24 February 1966. As such, the 1964 UBC is assumed to be the building code used. The 2000-2001 renovation drawings also do not have the building code or criteria used for the structural design. Sheet S-1 of the Phase 1 structural drawings is dated 30 May 2000. As such, the 1997 UBC is assumed to be the building code used for detailing. The design criteria for forces is unknown.

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

Identified seismic deficiencies of the building include the following:

- The original building had vertical discontinuities in the E-W direction and lacked a clear load path for E-W loads from the glulam girders at the Dining Hall roof. The original connection details shown in the 1966 drawings may not have been installed as shown, since the as-built roof profile differs from the drawings. A three-phase retrofit in 2000-2001 may have addressed these issues, but the load path remains unclear. A detailed Tier 2 review of the retrofitted building is needed to see if the various narrow wall segments, nailing, straps, and hold downs are adequate to resist the shears and overturning moments from the high roof area. As there were no foundations at the north and south edges of the Dining Hall, these loads are still being dragged into other sections of the building; the adequacy of all the details of this load path should be reviewed.
- The roof diaphragms are discontinuous, and connections between all the adjacent roof areas unclear, particularly since Dining Hall roof was not built as shown in 1966 drawings.
- Two separate wings of Merrill College were built adjacent to the Kitchen area without visible gaps. We have not reviewed the Merrill College drawings and do not know if these buildings rely on the Crown College kitchen for lateral resistance or whether any seismic gaps are present.
- The Tier 1 check for wall shear results in wall shear demands in excess of 1000 plf.
- The wings to the north and south of the Dining Hall are largely open on the north and south sides; the adequacy of the narrow E-W shear walls should be reviewed.
- The reinforced concrete chimney is stiffer than adjoining wood framed elements; as a result, the influence of this concrete element and the connections to the adjacent framing should be reviewed in a more detailed fashion.
- A Tier 2 deficiency-based analysis of the shear walls, transfer of loads from high roofs to walls, and foundation connections is needed to understand the capacity and performance of this lateral force-resisting system.

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	Y	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)	Y	URM wall height-to-thickness ratio	N
Torsion	N	URM parapets or cornices	N
Mass – vertical irregularity	Y	URM chimney	N
Cripple walls	N	Heavy partitions braced by ceilings	N
Wood sills (bolting)	N	Appendages	N
Diaphragm continuity	Y		

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

We observed gas-fired appliances in the kitchen that all appeared to have one anchor bolt in a base plate at each leg. None of the refrigerators, freezers, or storage units appeared anchored. Mechanical equipment and piping in the basement area appeared to be braced and anchored. There are clerestory windows in the high roof area above the Dining Hall and glazing above and around all the entries. We recommend verifying that the glazing consist of tempered glass or the like. This building has what appears to be unrestrained Spanish tiles, including some adjacent to entries and over adjacent areas with foot traffic. We recommend nailing tiles adjacent to stairs and walkways to preclude a life-safety concern.

UCOP nonstructural checklist item	Life safety hazard?	UCOP nonstructural 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	None observed	Unrestrained hazardous materials storage	None observed
Heavy masonry or stone veneer above exit ways and public access areas	None observed	Masonry chimneys	None observed
Unbraced masonry parapets, cornices or other ornamentation above exit ways and public access areas	None observed	Unrestrained natural gas-fueled equipment such as water heaters, boilers, emergency generators, etc.	None observed

Basis of rating

A Seismic Performance Level rating of V is assigned to the structure based on the structural deficiencies identified by the Tier 1 check, including vertical discontinuities in the E-W direction, discontinuities between the roof areas, the lack of a clear load path in the E-W direction for the Dining Hall roof, wall shear stresses in excess of the Tier 1 check level, and potentially inadequate seismic separations between the Commons and adjacent Merrill College buildings.

Recommendations for further evaluation or retrofit

We recommend that the performance of a Tier 2 evaluation to review the lateral force-resisting capacity of the wood shear walls, internal connections, drag struts, hold downs, and connections to the footings with particular attention to a review of the shear and overturning forces from the high roof area above the Dining Hall. If the walls or connections are inadequate, connections could be strengthened, or supplemental lateral resistance could be added. A clear load path should be provided for E-W loads from the high roof area; perhaps including addition of new walls and footings along the north and south edges of the Dining Hall. We assign the building to Priority Category B, as the retrofit of the building should be done when there are any plans for modifying or change of occupancy.

Peer review of rating

This seismic evaluation was discussed in a peer review meeting on 24 July 2019. Reviewers present were Noelle Yuen of Maffei Structural Engineering and Jay Yin of Degenkolb Engineers. Comments from the reviewers have been incorporated into this report. The reviewers agreed with the assigned rating.

Additional building data	Entry	Notes
Latitude	37.000124	
Longitude	-122.054416	
Are there other structures besides this one under the same CAAN#	No	
Number of stories above lowest perimeter grade	1	

[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.

Number of stories (basements) below lowest perimeter grade	1	Partial basement under kitchen
Building occupiable area (OGSF)	19,429	From UCSC facilities database.
Risk Category per 2016 CBC Table 1604.5	II	
Building structural height, h_n	14 ft	Structural height defined per ASCE 7-16 Section 11.2
Coefficient for period, C_t	0.020	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	0.14 sec	Estimated using ASCE 41-17 equation 4-4 and 7-18
Site data		
975-year hazard parameters S_s, S_1	1.289, 0.489	From ATC website
Site class	D	
Site class basis	Geotech[4]	See footnote below
Site parameters F_a, F_v	1.0, 1.811	From ATC website
Ground motion parameters S_{cs}, S_{c1}	1.289, 0.886	From ATC website
S_a at building period	1.289	
Site V_{s30}	900 ft/s	
V_{s30} basis	Estimated	Estimated based on site classification of D.
Liquefaction potential	Low	
Liquefaction assessment basis	County map	See footnote below
Landslide potential	Low	
Landslide assessment basis	County map	See footnote below
Active fault rupture 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: 1967 Code: 1964 UBC	Dates inferred based on design year
Applicable code for partial retrofit	Code: 1997 UBC (Assumed)	Not clear if 2000-2001 alterations intended as full or partial retrofit. No code cited on drawings. No calculations available for review.
Applicable code for full retrofit	None	

[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

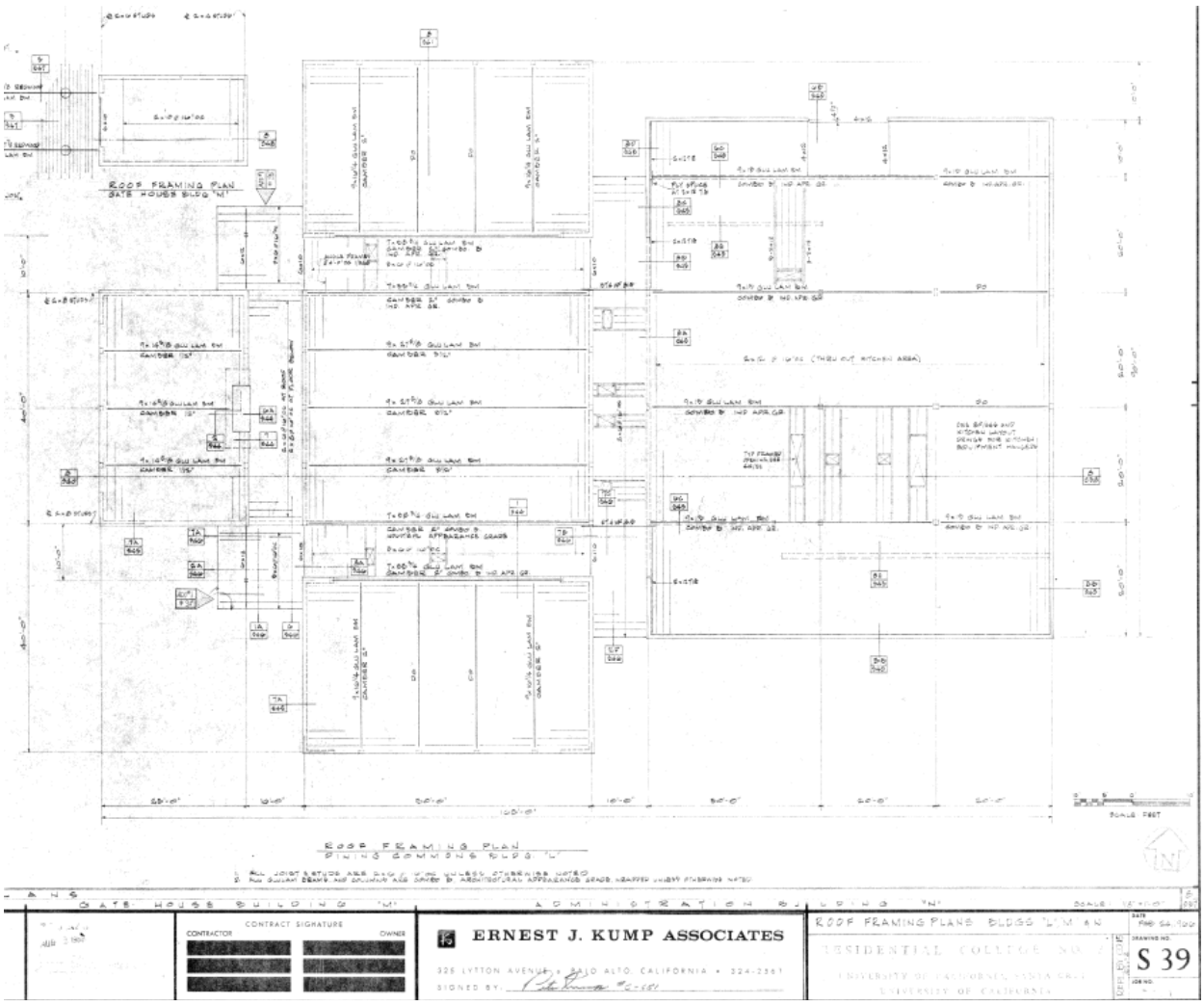
FEMA P-154 data		
Model building type	W2 Wood frame	
FEMA P-154 score	N/A	Not included here because we performed ASCE 41 Tier 1 evaluation.
Previous ratings		
Most recent rating	-	Not evaluated before.
Date of most recent rating	-	
2nd most recent rating	-	
Date of 2nd most recent rating	-	
3rd most recent rating	-	
Date of 3rd most recent rating	-	
Appendices		
ASCE 41 Tier 1 checklist included here?	Yes	Refer to attached checklist file.

Original 1967 Roof Plan (with “Area” designations marked)

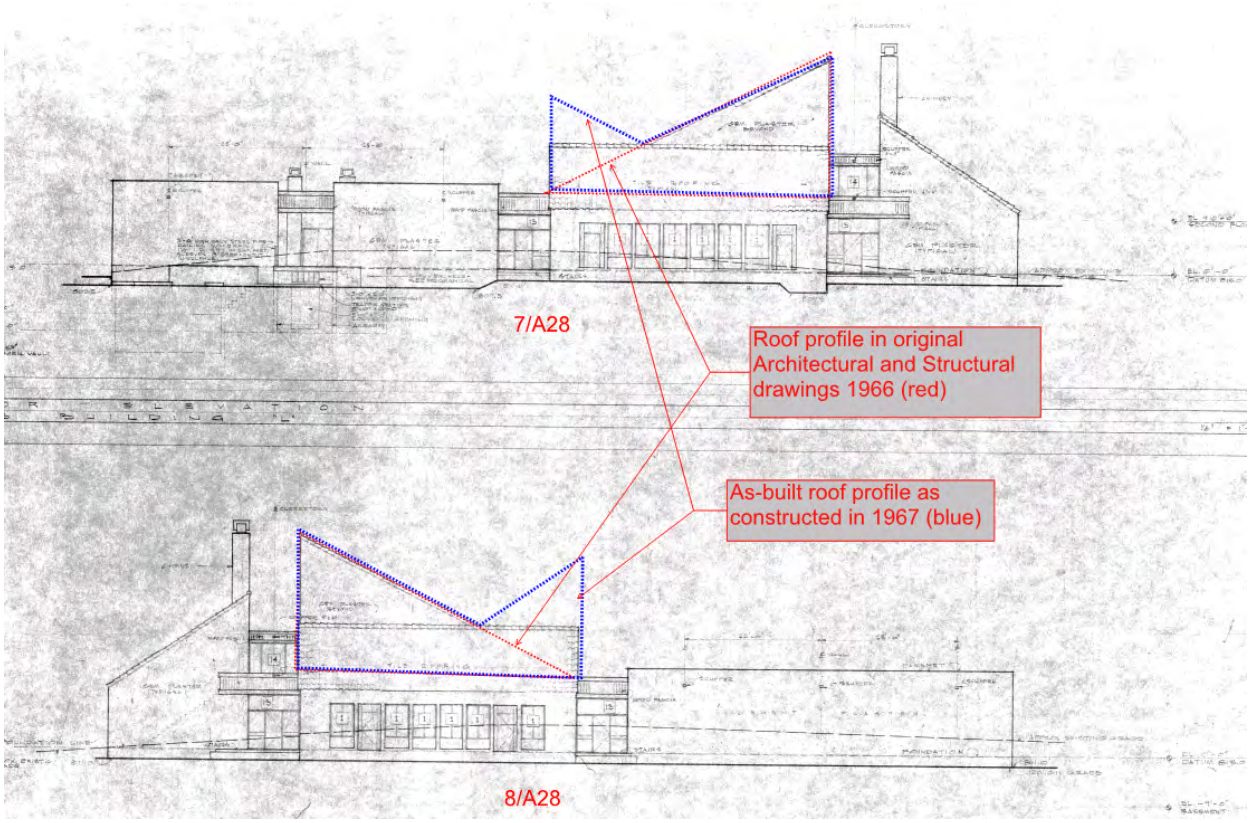
Phase III Shear Wall Retrofit Plan Marked with R+C Understanding of Shear Wall Locations and Retrofit Scope

Original 1967 First Floor Plan (with Locations of Footings Below)

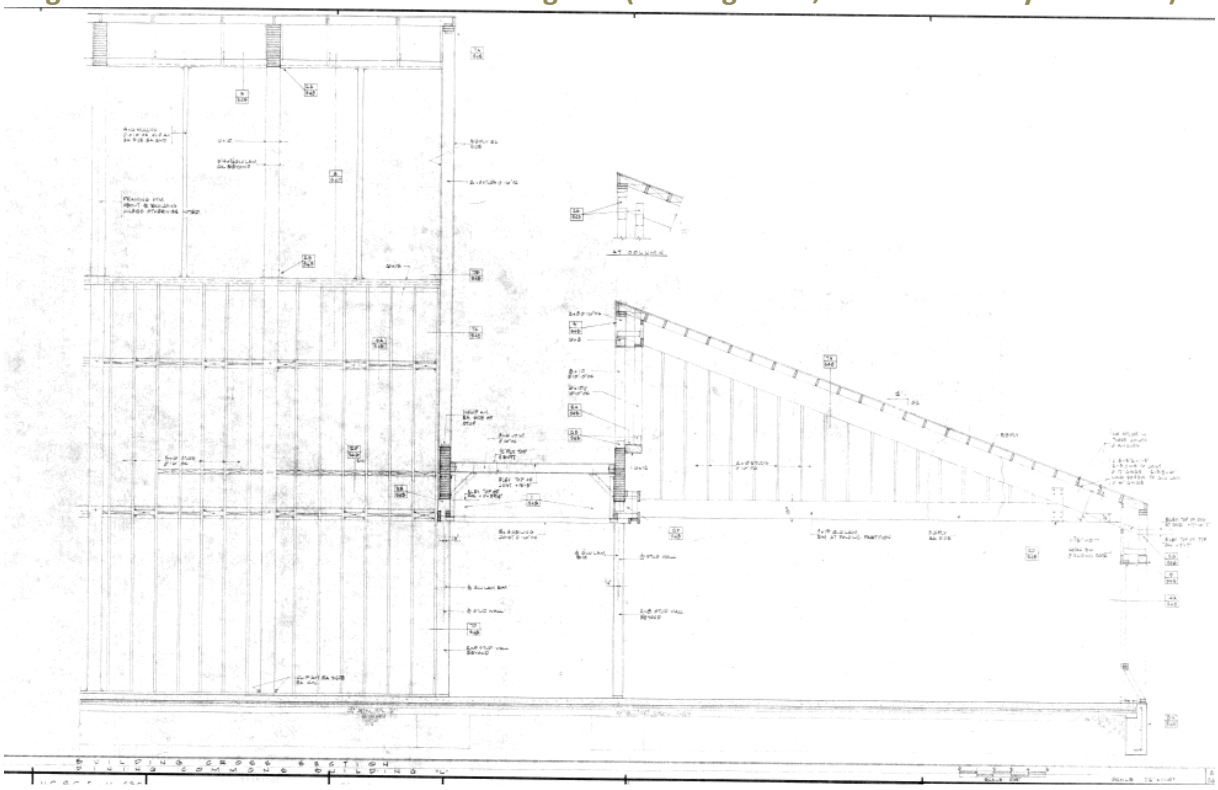
Original 1967 Roof Framing Plan (Not As-Built, See Next Figure)



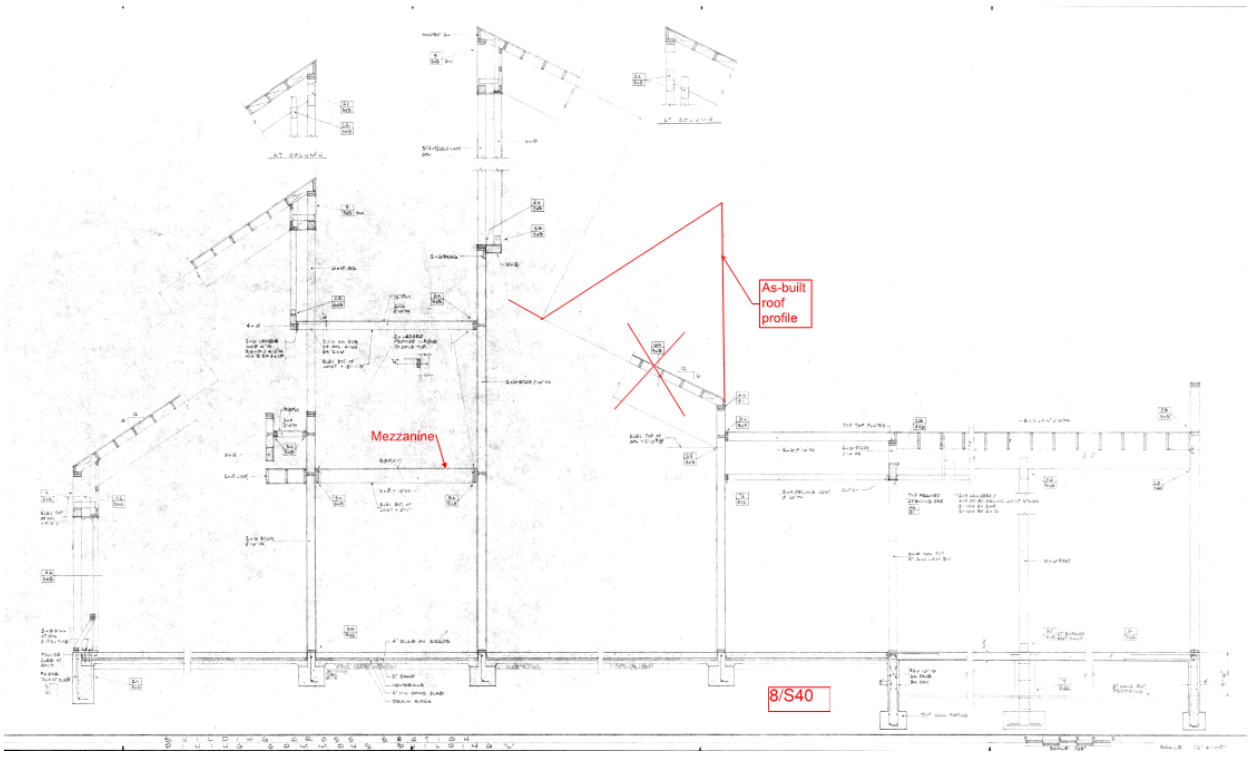
Original 1967 Architectural Elevations Showing Dining Hall Roof Profile (Red) and As-Built Roof Profile (Blue)



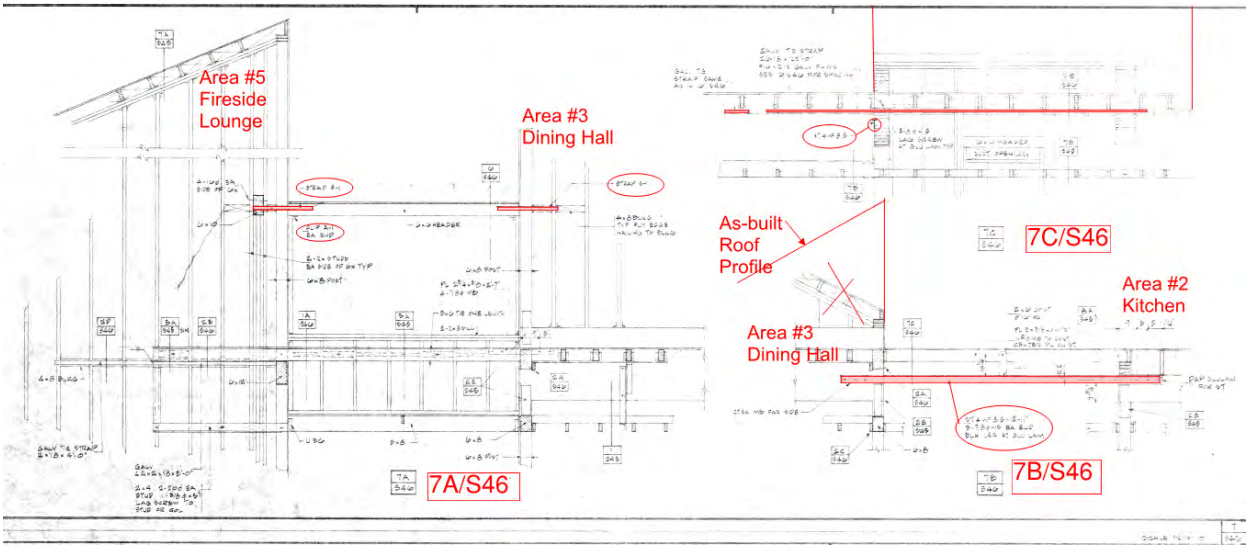
Original 1967 N-S Partial Section at Dining Hall (Looking West, Note Clerestory Windows)



Original 1967 E-W Partial Section (Looking North, Kitchen at Right) with As-Built Roof Profile Marked in Red

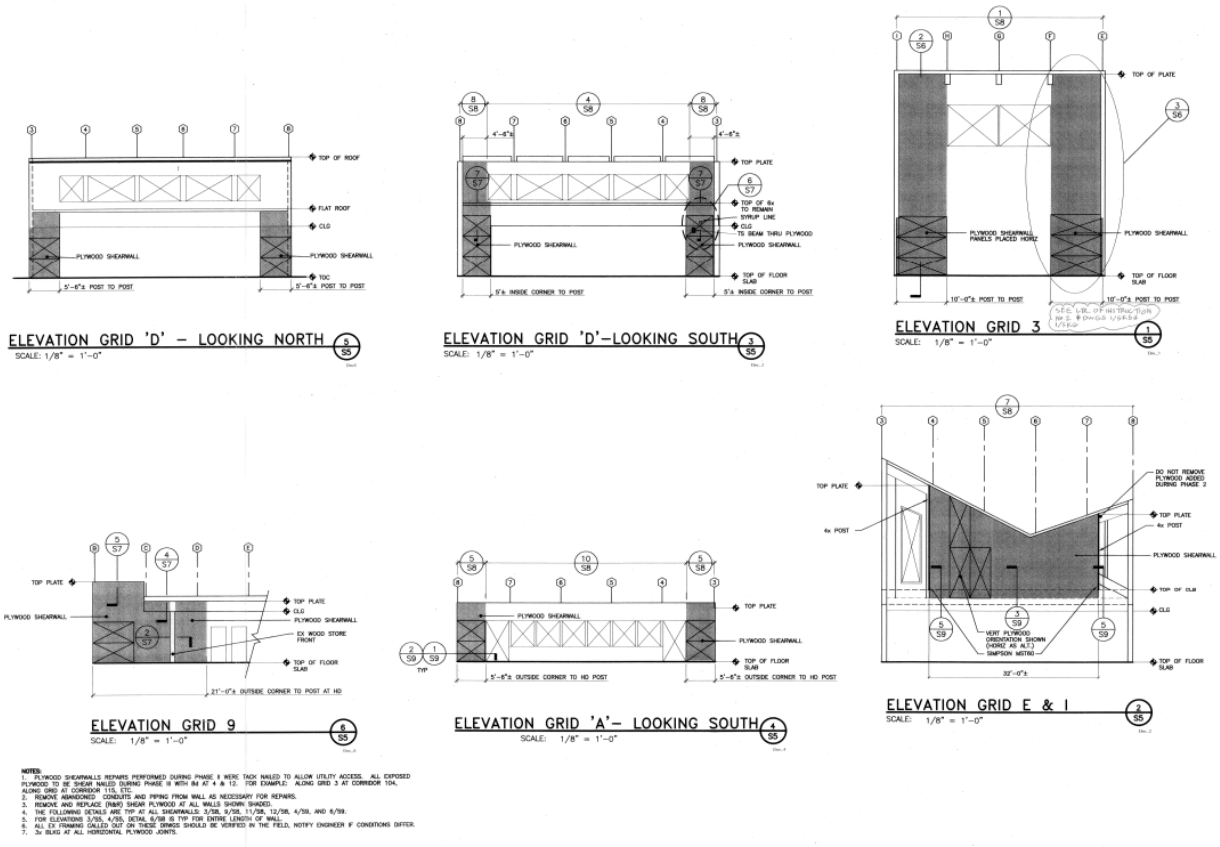


Straps from High Roof in Original 1967 Drawings (As-Built Profile and Straps in Red)



Shear Wall Retrofit Plan Phase III 2001

Shear Wall Elevations from Crown College Dining Hall Alterations, Phase III (Note As-Built Roof Profile Shown in Elevation Grid E &I at Lower Right)



Shear Wall Schedule from Crown College Dining Hall Alterations, Phase III

VERTICAL SHEARWALL SCHEDULE

PER 1997 UBC

ALLOWABLE PLF	SYMBOL	MATERIAL ②	TYPICAL EDGE NAILING T.E.N. ①③	SHEAR TRANSFER		MIN. BLKG SIZE	SILL PLATE	5/8 ø ANCHOR BOLTS ⑥
				SOLE PLATE ③	FRAMING CLIP SPACING			
280	1	3/8" PLYWOOD	8d AT 6" O.C.	16d AT 6" INTO 2x BLK'G OR RIM JST.	A35F OR A35 AT 16" (330 plf)	2X	2X	48" CC (292 plf)
							3X	64" CC (279 plf)
430	2	3/8" PLYWOOD	8d AT 4" O.C. ④	16d AT 4" INTO 2x BLK'G OR RIM JST.	A35F OR A35 AT 12" (440 plf)	3X	2X	16" CC (439 plf)
							3X	40" CC (446 plf)
550	3	3/8" PLYWOOD	8d AT 3" O.C. ④	16d AT 3" INTO 2x BLK'G OR RIM JST.	A35F OR A35 AT 8" (660 plf)	3X	2X	12" CC (585 plf)
							3X	32" CC (558 plf)
730	4	3/8" PLYWOOD	8d AT 2" O.C. ④	16d AT 2" STAGGERED INTO 3x BLKG OR RIM JOIST	A35F OR A35 AT 6" (880 plf)	3X	—	——
							3X	24" CC (744 plf)

① NAILING AT ALL PLYWOOD PANEL EDGES, TOP AND BOTTOM PLATES AND INTO CHORD MEMBERS. ALL PLYWOOD PANEL EDGES SHALL BE BLOCKED. SPACE NAILS AT 12" O.C. ALONG INTERMEDIATE FRAMING MEMBERS.

② APA RATED SHEATHING, STRUCTURAL I

③ ALL NAILS SHALL BE COMMON OR GALVANIZED BOX. NAILS EXPOSED TO THE EXTERIOR SHALL BE GALVANIZED.

④ FRAMING AT ADJOINING PANEL EDGES SHALL BE 3–INCH NOMINAL OR WIDER AND NAILS SHALL BE STAGGERED

⑤ WHERE PLYWOOD IS APPLIED TO BOTH FACES OF A WALL AND NAIL SPACING IS LESS THAN 6" O.C. ON EITHER SIDE, PANEL JOINTS SHALL BE OFFSET TO FALL ON DIFFERENT FRAMING MEMBERS OR FRAMING SHALL BE 3" NOMINAL OR THICKER AND NAILS ON EACH SIDE SHALL BE STAGGERED.

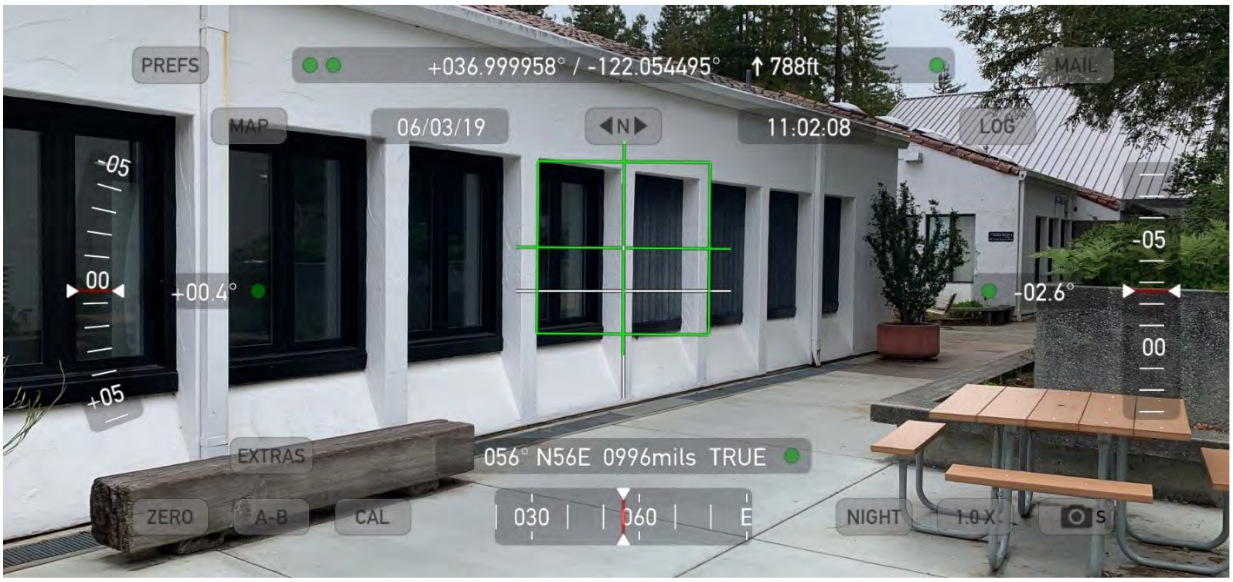
⑥ USE 2"x2"x3/16" PLATE WASHER WITH ANCHOR BOLTS.

APPENDIX A

Additional Photos

Southwest corner of Fireside Lounge including chimney, glazed entry, and peak of roof above Dining Hall (looking northeast)

Partial west elevation at entry and Banana Joe's (looking east)



South elevation at Banana Joe's (looking northeast)

Partial south elevation, Banana Joe's at left, glazed entry and kitchen with flat roof in middle, Merrill College Student Life Wing at right with no visible gap (looking north)

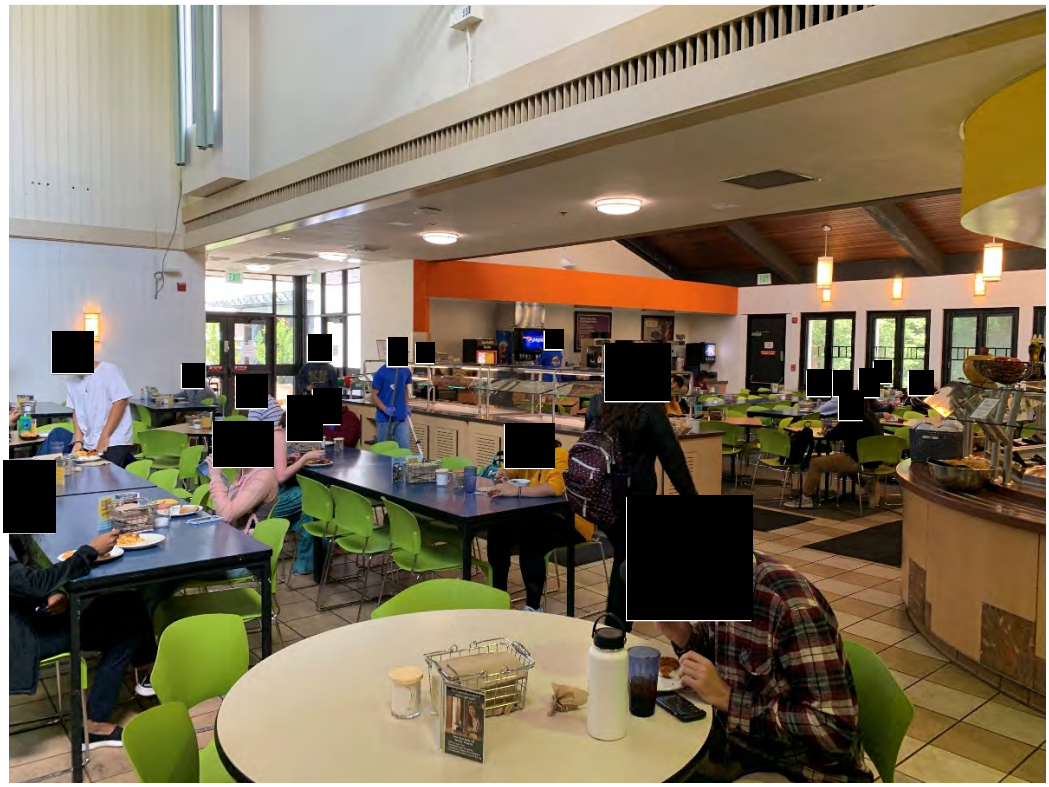
Partial south elevation showing southeast corner at rear of kitchen in center with portions of Merrill College at left and right with no visible gaps (looking north)

Partial north elevation (looking south)

North elevation (looking southeast)

Partial north elevation at Kitchen (looking southeast)

Interior view of glulam beams at high roof in Dining Hall
(looking west, chimney visible through window)



Interior view from Dining Hall (looking northwest)

Glazed interior partition at Banana Joe's (looking south)

Gas-fired stoves anchored in Kitchen

Braced piping in mechanical room at basement level below Kitchen

Base of reinforced concrete chimney in Fireside Lounge

Peak of Dining Hall roof at left, glazed entry and flat roof at center, chimney at Fireside Lounge at right, east wall of Gatehouse at far right (looking south)

APPENDIX B

ASCE 41-17 Tier 1 Checklists (Structural)

UC Campus:	Santa Cruz			Date:	07/28/2019		
Building CAAN:	7157	Auxiliary CAAN:		By Firm:	Rutherford + Chekene		
Building Name:	Crown College Commons			Initials:	CLP, EFA	Checked:	WAL/BL
Building Address:	630 Crown Road, 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:** One-story structure with 5 wings and many different flat and sloped roof planes. Building previously upgraded in stages, but load path for all portions still not clear from brief review of drawings.
☐	☒	☐	☐	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:** One-story structure with 5 wings all connected, so considered it to be one structure. Two buildings of Merrill College abut this Crown Commons on the south and east sides without any visible gaps. Merrill College was built after Crown Commons, but drawings were not available for this review.
☒	☐	☐	☐	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:** Mezzanine storage adjacent to chimney; braced by chimney.

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:** Single story
☐	☐	☒	☐	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:** Single story.
☐	☒	☐	☐	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:** E-W loads from high roof above dining area assumed to be transferred into adjacent wings as no walls below.

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

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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:** Single story
☐	☐	☑	☐	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:** Single story
☐	☐	☑	☐	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:** Flexible diaphragms.

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:** There is no mapped liquefaction on https://gis.santacruzcounty.us/mapgallery/Emergency%20Management/Hazard%20Mitigation/LiquifactionMap2009.pdf
☑	☐	☐	☐	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:** There are no mapped landslides on https://gis.santacruzcounty.us/mapgallery/Emergency%20Management/Hazard%20Mitigation/LandslideMap2009.pdf.
☑	☐	☐	☐	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:** There are no faults at the project site per https://gis.santacruzcounty.us/mapgallery/Emergency%20Management/Hazard%20Mitigation/FaultZoneMap2009.pdf

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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:** Shear wall width B = 30', Building Height (avg) is H = 14' avg, B/H = 2.14 Sa = 1.29g per ATC at BSE-2E 0.6 x Sa = 0.774 B/H > 0.6 Sa
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:** Site Class D assumed. All foundation elements tied together with continuous strip footings.

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Collapse Prevention Structural Checklist For Building Type W2

LOW AND MODERATE SEISMICITY

SEISMIC-FORCE-RESISTING SYSTEM

C	NC	N/A	U	Description
●	○	○	○	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:** .Several wall lines each direction; walls added as part of three phase upgrade program in 2000-2001.
○	●	○	○	SHEAR STRESS CHECK: The shear stress in the shear walls, calculated using the Quick Check procedure of Section 4.4.3.3, is less than the following values: (Commentary: Sec. A.3.2.7.1. Tier 2: Sec. 5.5.3.1.1) Structural panel sheathing: 1,000 lb/ft Diagonal sheathing: 700 lb/ft Straight sheathing: 100 lb/ft All other conditions: 100 lb/ft **Comments:** .Three-phase upgrade program included addition of narrow shear panels. Tier 1 checks show shear in excess of 1000plf, with peak N-S direction demand at 1,668 plf and peak E-W direction demand at 1,856 plf..
○	○	●	○	STUCCO (EXTERIOR PLASTER) SHEAR WALLS: Multi-story buildings do not rely on exterior stucco walls as the primary seismic-force-resisting system. (Commentary: Sec. A.3.2.7.2. Tier 2: Sec. 5.5.3.6.1) **Comments:** Single story but exterior walls are stucco over 3/8 plywood; not relying on stucco.
○	○	●	○	GYPSUM WALLBOARD OR PLASTER SHEAR WALLS: Interior plaster or gypsum wallboard is not used for shear walls on buildings more than one story high with the exception of the uppermost level of a multi-story building. (Commentary: Sec. A.3.2.7.3. Tier 2: Sec. 5.5.3.6.1) **Comments:** Single story
○	●	○	○	NARROW WOOD SHEAR WALLS: Narrow wood shear walls with an aspect ratio greater than 2-to-1 are not used to resist seismic forces. (Commentary: Sec. A.3.2.7.4. Tier 2: Sec. 5.5.3.6.1) **Comments:** Narrow shear panels added as part of upgrade program; they do not meet this Tier 1 check.
○	○	●	○	WALLS CONNECTED THROUGH FLOORS: Shear walls have an interconnection between stories to transfer overturning and shear forces through the floor. (Commentary: Sec. A.3.2.7.5. Tier 2: Sec. 5.5.3.6.2) **Comments:** .Single story.
○	○	●	○	HILLSIDE SITE: For structures that are taller on at least one side by more than one-half story because of a sloping site, all shear walls on the downhill slope have an aspect ratio less than 1-to-1. (Commentary: Sec. A.3.2.7.6. Tier 2: Sec. 5.5.3.6.3) **Comments:** Building has partial basement; but concrete stem walls come up to first floor so say N/A.

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

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C	NC	N/A	U	
●	○	○	○	CRIPPLE WALLS: Cripple walls below first-floor-level shear walls are braced to the foundation with wood structural panels. (Commentary: Sec. A.3.2.7.7. Tier 2: Sec. 5.5.3.6.4) **Comments:** Strip footings and concrete stem walls around each "wing"; no cripple walls.
○	●	○	○	OPENINGS: Walls with openings greater than 80% of the length are braced with wood structural panel shear walls with aspect ratios of not more than 1.5-to-1 or are supported by adjacent construction through positive ties capable of transferring the seismic forces. (Commentary: Sec. A.3.2.7.8. Tier 2: Sec. 5.5.3.6.5) **Comments:** Large E-W openings either side of Dining Hall. Narrow shear panels, straps, hold downs added as part of upgrade but cannot tell if adequate from brief review of upgrade drawings.

CONNECTIONS

				Description
C	NC	N/A	U	
●	○	○	○	WOOD POSTS: There is a positive connection of wood posts to the foundation. (Commentary: Sec. A.5.3.3. Tier 2: Sec. 5.7.3.3) **Comments:** Custom steel connection plates shown at base of all wood posts in original drawings.
●	○	○	○	WOOD SILLS: All wood sills are bolted to the foundation. (Commentary: Sec. A.5.3.4. Tier 2: Sec. 5.7.3.3) **Comments:** 5/8" x9" MB at 32" typical (5A&5B/S42); 2 MB at perimeter columns.
●	○	○	○	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) **Comments:** Heavy glulam beams on wood posts in original. Straps added as part of 2000-2001 upgrade but do not know if adequate from Tier 1 review.

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

CONNECTIONS

				Description
C	NC	N/A	U	
●	○	○	○	WOOD SILL BOLTS: Sill bolts are spaced at 6 ft (1.8 m) or less with acceptable edge and end distance provided for wood and concrete. (Commentary: A.5.3.7. Tier 2: Sec. 5.7.3.3) **Comments**: 5/8" bolts typically at 32"

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

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DIAPHRAGMS

C	NC	N/A	U	Description
☐	☑	☐	☐	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:** Roof diaphragms split between flat portions and five different sloping portions
☐	☑	☐	☐	ROOF CHORD CONTINUITY: All chord elements are continuous, regardless of changes in roof elevation. (Commentary: Sec. A.4.1.3. Tier 2: Sec. 5.6.1.1) **Comments:** Roof diaphragms split between flat portions and five different sloping portions; chords not continuous.
☐	☐	☑	☐	DIAPHRAGM REINFORCEMENT AT OPENINGS: There is reinforcing around all diaphragm openings larger than 50% of the building width in either major plan dimension. (Commentary: Sec. A.4.1.8. Tier 2: Sec. 5.6.1.5) **Comments:** There are no large openings.
☐	☐	☑	☐	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:** Diaphragms have plywood sheathing.
☐	☐	☑	☐	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 have aspect ratios less than or equal to 4-to-1. (Commentary: Sec. A.4.2.3. Tier 2: Sec. 5.6.2) **Comments:** Diaphragms have blocked plywood sheathing.
☐	☐	☑	☐	OTHER DIAPHRAGMS: The 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:** Diaphragms have plywood sheathing.

APPENDIX C

UCOP Seismic Safety Policy Falling Hazards Assessment Summary

UC Campus:	Santa Cruz			Date:	07/28/2019		
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UCOP SEISMIC SAFETY POLICY
Falling Hazard Assessment Summary

	Description
P ☐ N/A ☒	**Heavy ceilings, features or ornamentation above large lecture halls, auditoriums, lobbies, or other areas where large numbers of people congregate (50 ppl or more)** **Comments:** Redwood furring nailed to framing above main dining area.
P ☐ N/A ☒	**Heavy masonry or stone veneer above exit ways or public access areas** **Comments:** No heavy masonry or stone veneer.
P ☐ N/A ☒	**Unbraced masonry parapets, cornices, or other ornamentation above exit ways or public access areas** **Comments:** No unbraced masonry parapets, cornices or ornamentation.
P ☐ N/A ☒	**Unrestrained hazardous material storage** **Comments:** No unrestrained hazardous material storage observed.
P ☐ N/A ☒	**Masonry chimneys** **Comments:** Large reinforced concrete chimney; firebox lined with masonry.
P ☐ N/A ☒	**Unrestrained natural gas-fueled equipment such as water heaters, boilers, emergency generators, etc.** **Comments:** Mechanical room in basement, many gas-fired stoves in kitchen. All gas-fired items we observed were anchored.
P ☒ N/A ☐	**Other:** Glazing around and above all entrances. **Comments:** Recommend replace glazing or provide protective film.
P ☒ N/A ☐	**Other:** Spanish roof tiles with steep slope along many perimeter walls. **Comments:** Do not known if tiles secured with nails or if nails still intact after many years. Check especially adjacent to entrances.
P ☒ N/A ☐	**Other:** Many tall kitchen items such as (refrigerators, freezers, shelving) unanchored and on casters. **Comments:** Unanchored items will roll; may bang into gas lines or gas-fired equipment. Recommend straps to tether or anchor.

Falling Hazards Risk: Low

Note: P= Present, N/A = Not Applicable

APPENDIX D

Quick Check Calculations

Rating form completed by:

RUTHERFORD + CHEKENE
ruthchek.com

Evaluator: CLP/EFA/BL

Date: 07/28/2019

Unit Weights: (by Areas)

Rating form completed by:

RUTHERFORD + CHEKENE
ruthchek.com

Evaluator: CLP/EFA/BL

Date: 07/28/2019

Unit Weights: (by Areas)

Building 7157 Crown College Commons

	Seismic Weight	Dead Load	
Area #2 Flat Roof	**psf**		**Remarks**
flat roofing	2.0	2.0	Flat roof with waterproof
1/2" plywood for flat roof	1.5	1.5	
Rafter and ceiling joists	4.9	4.9	2x12 @ 16" +9*13 glulam at
ceiling	2.0	2.0	typ. gypboard ceiling panels
MEP+misc+lighting	3.0	3.0	flat area
Total psf	13.4	13.4	
flat area	0.0		ft^2
Sloping Tile roofs #1			
Spanish clay tile	19.0	19.0	
5/8" plywood	1.8	1.8	at 36 pcf
membrane	1.0	1.0	
rafters	6.1	6.1	3x6 @ 16"+9*16.25 @10'
MEP+misc+lighting	2.0	2.0	sprinklers, lighting, etc.
ceiling	5.0	5.0	typ. gypboard & redwood ceiling
subtotal on slope	34.9	34.9	scale this by 1.07 to account for slope
partition including shear walls	15.8	0.0	see below
Total weight per unit area	50.6	34.9	psf
Projected area under sloping roof	1500.0		ft^2
Total Seismic weight at roof	79583.6		lbs
	53.06		equivalent psf

Note: Area #3 in these calculations combines Areas #3 and #5 and corridor in between in previous figure.

	Seismic Weight	Dead Load	
Estimate partition/wall weights Area #1	**ft**		**Remarks**
lineal feet exterior stucco walls	110.0	8.0	height avg trib to roof
weight ext walls		21.6	2x8 @ 16 plus two layers 3/8 plywood plus exterior cement plaster plus insulation +misc+ 2 layers 5/8 gyp
		8.0	glazing plus sash etc longitudinal walls only about 25% glazing
		21.6	use heavier value to account for numerous stucco surfaces around windows
lineal feet interior wall	55.0	8.0	height avg trib to roof
		10.5	2x4 @ 16 plus two layers 3/8 plywood plus insulation +misc+ 2 layers 5/8 gyp
Area building		1500.0	ft^2
total ext plus int	165.0		
Weight, roof		23628.0	lbs
Weight per unit area at roof		15.8	psf actual trib to roof

Rating form completed by:

RUTHERFORD + CHEKENE
ruthchek.com
Evaluator: CLP/EFA/BL

Date: 07/28/2019

Story Weights (1967 Area #1, see also below)

Level	Area (ft^2)	Unit Weight (psf)	Seismic Weight (kips)
Typ. Roof	2000	53.06	106.11
	2000		106.11

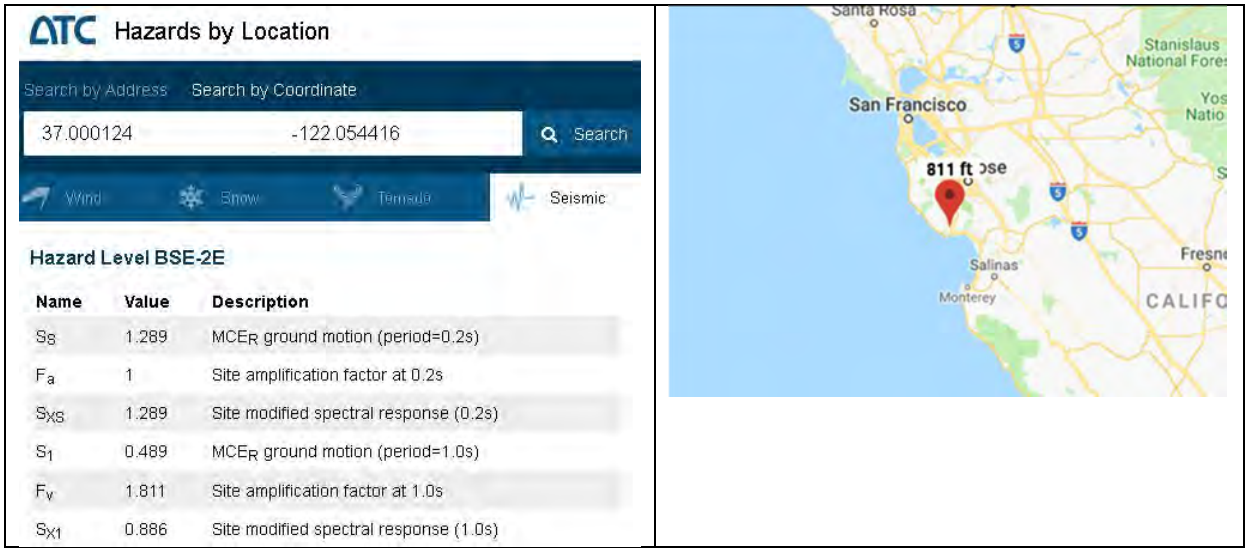
Note:
1- Roof area is projected on horizontal plane; not surface area of roof.

Period

C_t=	0.02
h_n (ft)=	14 avg
B=	0.75

T=	0.14	sec

BSE-2E Response Spectrum



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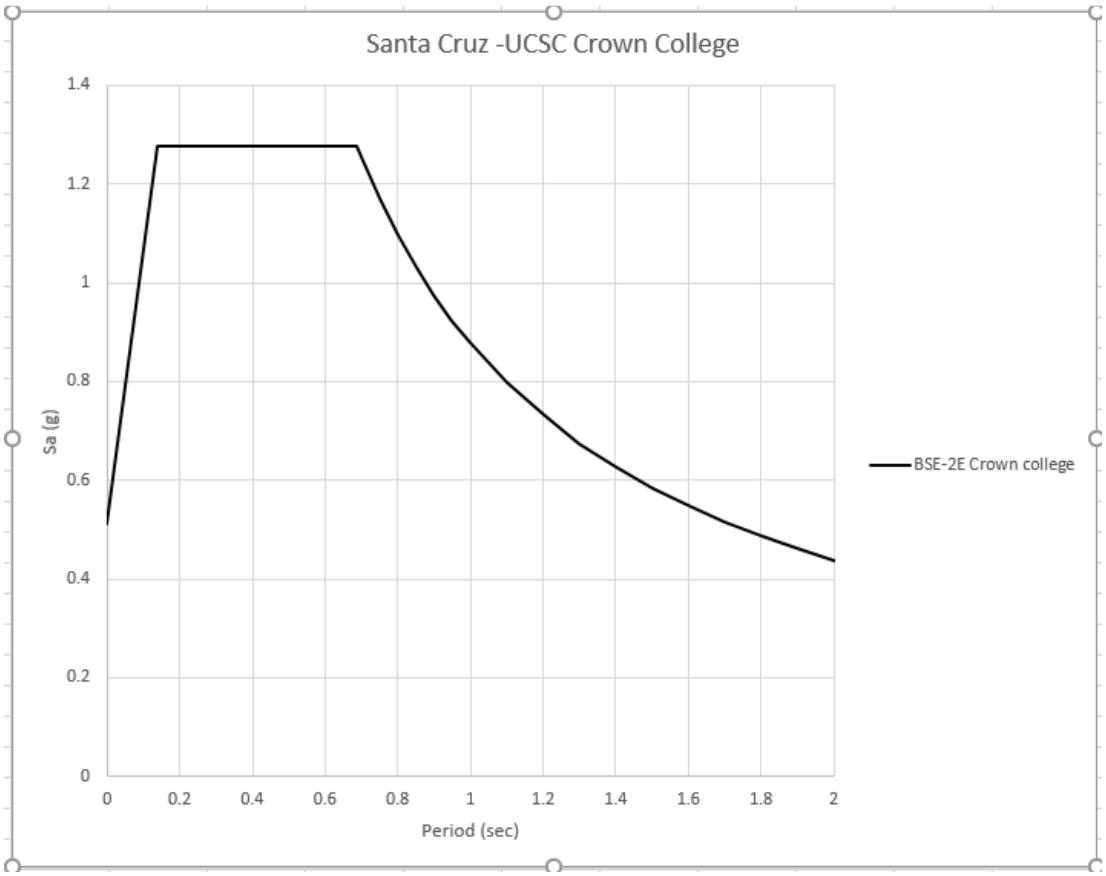
Date: 07/28/2019



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Date: 07/28/2019

Story Shears (Area #1 to #4)

7157 Area #1 only

Sa=	1.29	
W=	106	kips
C=	1.3	Per ASCE 41-17 Table 4-7

Sx1	T	Sxs
0.886	0.14	1.289

V=	178	kips

1.6757

k= 1.00

Per ASCE 41-17 Section 4.4.2.2, K = 1.0 for periods less than 0.5 sec and K = 2.0 for T >2.5 sec. It varies linearly in between 0.5 sec and 2.5 sec period.

Floor Levels	**Story Height**	**Total Height, H**	**Weight, W**	**W x H^k**	**coeff**	**Fx**	**Story Shear, V**
	(ft)	**(ft)**	**(kips)**			**(kips)**	**(kips)**
Roof	14.00	14.00	106.11	1,486	1.00	178	178
				1,486	1	178	

Notes:

1- The base of building is assumed to be at the 1st floor.

2- Use an average for roof height of 14 feet.

3- Modification Factor, C, per ASCE 41-17, Table 4-7.

Average Stress (Area #1 to #4):

	Area 1						
	Shear Walls X dir (ft)	Shear Walls Y dir (ft)	Dim. Lx (ft)	Dim. Ly (ft)	Area (ft^2)	PLF X dir	PLF Ydir
	5	30	50	40	2000	1856	619
	5	30			49.85		
	5				0		
	5				49.85		
total	20	60		seismic weight	99691		
				Seismic force	**167053**		
	Area 3						
	X dir (ft)	Y dir (ft)	Lx (ft)	Ly(ft)	Area (ft^2)	PLF X dir	PLF Ydir
	26	6	85.5	40	3420	649	1668
	28	6			55		
	26	10			0		
	28	20			55		
total	108	42		seismic weight	188100		
				Seismic force	**315199**		
	Area 2						
	X dir (ft)	Y dir (ft)	Lx (ft)	Ly(ft)	Area (ft^2)	PLF X dir	PLF Ydir
	28	90	78	90	7020	963	488
	28	30		roof	13		
	10	30		partitions	15		
	10				28		
total	76	150		seismic weight	196560		
				Seismic force	**329376**		
	Area 4						
	X dir (ft)	Y dir (ft)	Lx (ft)	Ly(ft)	Area (ft^2)	PLF X dir	PLF Ydir
	6	7	50	40	2000	1092	714
	5	7			49.85		
	5	8			0		
	18	30			49.85		
total	34	52		seismic weight	99691		
				Seismic force	**167053**		

Rating form completed by:

RUTHERFORD + CHEKENE
ruthchek.com
Evaluator: CLP/EFA/BL

Date: 07/28/2019

Summary of Average Wall Shear Stress

Ms=	4.5	CP of wood shear wall from Table 4-8

N-S direction			
Level	**Force (kips)**	**length of wall (ft)**	**average shear stress (plf)**
1st Flr Level Area #1	167	60	619
1st Flr Level Area #2	329	150	488
1st Flr Level Area #3	315	42	1668
1st Flr Level Area #4	167	52	714

E-W direction			
Level	**Force (kips)**	**length of wall (ft)**	**average shear stress (plf)**
1st Flr Level Area #1	167	20	1856
1st Flr Level Area #2	329	76	963
1st Flr Level Area #3	315	108	649
1st Flr Level Area #4	167	34	1092

Comments:

1. Tier 1 criteria for wood shear walls is 1000 plf.
2. Typically, loads from each Area were assigned to walls located at the perimeter of that area.
3. For Dining Hall Area #3, this area was combined with Area #5 (but called Area #3) because the Dining Hall does not have any E-W walls. For these calculations, the E-W loads from the Dining Hall roof were assigned to the E-W walls in the Fireside Lounge Area #5 that was combined with Area #3. We made this choice since these are the only walls in line with the Dining Hall roof loads. The original drawings show an ST4 used to drag loads into the kitchen area, but we do not know how any of this was actually built since the roof profile is not as shown and E-W loads delivered to the Kitchen roof would have to be taken by north and south Kitchen walls some distance away.