Rating form completed by:

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Evaluator: CLP/EFA/BL
Date: 06/28/2019

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

DATE: 2019-06-28

UC Santa Cruz Building Seismic Ratings

Crown Classroom Building

CAAN #7155
624 Crown Road, Santa Cruz, CA 95064
UCSC Campus: Main Campus

South Elevation (Looking Northwest)

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	Clearly identify walls with plywood sheathing, connections, and load path to foundation. Retrofit may include additional 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 "Classroom Building J."
- 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 "Classroom Building J."

Additional building information known to exist

Crown College Classroom Building Restroom Renovation Drawings dated 1999; not used for this evaluation.

Scope for completing this form

Reviewed architectural and structural drawings for original construction, made a brief site visit on 3 June 2019, and carried out ASCE 41-17 Tier 1 evaluation.

Brief description of structure

The Crown Classroom Building 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 Classroom Building was Building "J" in the drawings. The adjacent buildings include the Crown Administration Building ("N") to the north, the Crown Gatehouse ("M") to the northeast, the Crown Dining Commons ("L") to the east, and the Crown Faculty Wing ("K") to the southeast. 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.

The building is a two-story wood structure with a small partial basement and contains approximately 6,777 square feet. The building is basically rectangular in plan with a central corridor running the length of the building in the longitudinal direction. There are vertical discontinuities in the wall layout in both directions. There are solid transverse walls on either side of the central corridor although several second story walls do not have corresponding walls at the lower floor. Portions of the second floor are 6 feet wider in the transverse direction than the first floor so the exterior second floor walls are not aligned with the first floor walls. The longitudinal perimeter walls at both levels are penetrated with many window openings. The longitudinal corridor walls have clerestory windows above the flat roof level and door openings along their length below. There is a flat roof portion at a height of 20'-2" above the central corridor, but the corridor walls rise to heights of either 24'-2" or 27'-9" and then slope down towards the top of the perimeter walls at 18'-8". Roof and floor joists are spaced at 16" on center; roof and floor surfaces are a mix of ½" and 5/8" blocked plywood diaphragms. The corridor walls have plywood sheathing and resist longitudinal loading in the center of the building. 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 plans, but it appears that all walls were supposed to be sheathed. Structural details are provided for "corridor wall tiedowns" at door openings at the base of the corridor walls, but no other walls appear to have these tiedown details. An 8" concrete stem wall comes up to the underside of the second floor along a 19 ft section at the north end of the east wall at a location where the grade level is higher.

The Crown Classroom Building is linked by a one-story heavy timber pedestrian bridge at the second floor level to both the Faculty Study Wing and the Library Building that were built at the same time as the Library. A gap between the walkway and the Classroom Building appears on the drawings as 4" minimum but appeared to be approximately 2" where the bridge abuts the Classroom stairway.

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.

Identification of levels: The building has two stories above grade (first floor and second floor) and a very small partial basement at the southeast corner. The basement walls and foundation stem walls at the perimeter come up to the level of the first floor framing, except the section of wall along the east side where the stem wall comes up to the underside of the second floor. Grade around the building site gently slopes down to the south and southwest.

Foundation system: The perimeter and basement walls bear on a continuous 8" thick concrete stem wall on an 18" wide footing. The stem wall typically comes up to the underside of the first floor framing except the location cited above at the north end of the east wall where it comes up to the underside of the second floor framing. The interior bearing walls consist of wood cripple walls with 3/8" plywood sheathing on both sides supported on a shorter 8" stem wall on a 14" wide footing.

Structural system for vertical (gravity) load: All the vertical loads are carried by roof and floor joists that span to wood stud walls except for the roof joists above the extended portions of the second floor where the joists are supported by lintels that span to 4x4 wood posts. The building has one flat roof surface above the central corridor and four separate sloped roof surfaces. 2x6 roof joists span across the flat portion of the roof between the corridor walls with ½" plywood sheathing. The sloped roof surfaces are comprised of 5/8" plywood sheathing spanning between 2x12 wood joists. The sloping roof joists are supported at the top of the corridor walls at one end at a height of either 24'-2" or 27'-9"above the first floor and at the top of the perimeter wall or lintel and posts at a height of 18'-8" above the first floor. The second floor is 10'1" above the first floor, and it has 5/8-inch plywood spanning between a mix of 2x12, 4x12 and 8x12 floor joists, some of which extend 6' beyond the wall below. It appears these were designed to cantilever as the soffit framing below is not detailed to resist vertical loads.

Structural system for lateral forces: Lateral forces in the transverse (E-W) direction are transferred from the plywood roof diaphragms through blocking at the top of the transverse walls which are sheathed with double sided 3/8" plywood. Plywood nailing is specified in the sheet notes on S1 as 8d@6" at margins and 8d@12" intermediate. Some details show additional nailing at eaves or connections. Detail 1/S35 shows nailing and blocking from joists to shear walls; Detail 2/S35 shows the sill plate and anchor bolt conditions at the base of the walls. These typically have a 2x4 mud sill with 5/8" x 9" long anchor bolt spaced at 32" on centers. Not all second story walls have a corresponding wall below; four main transverse walls are wider at the top than the bottom and do not have straps and hold downs to transfer the overturning forces. One intermediate transverse wall does not show a cross wall footing on the foundation plan, so the utility of that wall is unclear. The first-floor connection details shown in Section 8/S35 have cross grain bending in the ledgers at the perimeter walls. Lateral forces in the longitudinal (N-S) direction are transferred from the plywood roof diaphragm through blocking and around clerestory windows to the corridor walls at the center of the building. Corridor walls are detailed per Details 1/S35 and 2/S35 but additionally have tiedowns per detail 3/S35 at each side of ground floor doors. Section 8/S34 shows the corridor walls also have some Simpson A-1 clips at the first to second floor. The load path from the roof of the extended portions is unclear as there does not appear to be a mechanism to transfer loads delivered from the overhanging roof above the 4x4 posts to the walls below.

It is important to note that this building survived the 1989 Loma Prieta Earthquake with ground motions on the order of 0.44g and 0.47g in the two horizontal directions and 0.4g vertical (UCSC Lick Observatory Station on campus). We are not aware of any significant structural damage to this building, thus it would appear that it can resist similar loads again. As the exterior walls all have cement plaster finishes over the plywood, and all walls also have gypsum board fireproofing, it appears the building has more lateral capacity than indicated by this Tier 1 check, so we recommend this be reviewed as part of a Tier 2 evaluation.

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 building has apparent vertical discontinuities in both directions and lacks a clear load path for loads in the longitudinal direction for the cantilevered areas where the second floor is wider than the first and the roof planes do not align.
- Connection details from floors to walls and floors to the foundation stem wall include cross grain bending.

- The transverse walls are wider at the upper floor, and lack straps and hold downs to resist overturning. While drawing notes that walls should have plywood sheathing, the drawings do not clearly show which walls are assumed to resist lateral loads. Not all of the transverse walls extend down to foundation transverse walls.
- It appears the original designer assumed the longitudinal loads could all be resisted by the central corridor walls. There is no clear load path from the outboard edges of the heavy tile roof to the 4x4 posts and down to the walls below.
- There is a potential for pounding between the bridge structure and the stairs at the south end of the building.
- A Tier 2 deficiency-based analysis of the shear walls, transfer of loads to walls, transfer between floors, and foundation connections is needed to understand the capacity and performance of this lateral force-resisting system. Recommend additional field survey to confirm locations of plywood sheathing and foundation cross walls.

Structural deficiency	Affects rating?	Structural deficiency	Affects rating?
Lateral system stress check (wall shear, column shear or flexure, or brace axial as applicable)	N	Openings at shear walls (concrete or masonry)	N
Load path	Y	Liquefaction	N
Adjacent buildings	Y	Slope failure	N
Weak story	Y	Surface fault rupture	N
Soft story	Y	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]

Overhead projectors were present in several classrooms. We recommend verifying that they are properly anchored. This building has what appears to be unrestrained Spanish tiles, including some adjacent to stairs and over adjacent footpaths. We recommend providing positive attachment for tiles (if not currently present) 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 the lack of vertical elements at the perimeter of the second story in the longitudinal

[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.

direction, detailing that will induce cross-grain bending at wall-to-diaphragm ties, and the potential for damage from pounding of the walkway at the second story to the south exit stair.

Recommendations for further evaluation or retrofit

We recommend performance of a Tier 2 evaluation to review the lateral force-resisting capacity of the wood shear walls, internal connections, floor-to-floor connections, and connections to the footings. Since the drawings are not clear regarding the location of plywood, we recommend that the walls be surveyed to identify plywood sheathing (single sided, double sided, or none). If the walls or connections are inadequate, connections could be strengthened, or supplemental lateral resistance could be added. Retrofits might include hold downs and straps between floors at vertical discontinuities. A clear load path should be provided for longitudinal loads at the perimeter. 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. Falling hazards reduction, such as the tile roofs adjacent to exits or footpaths and overhead projectors, should be addressed.

Peer review of rating

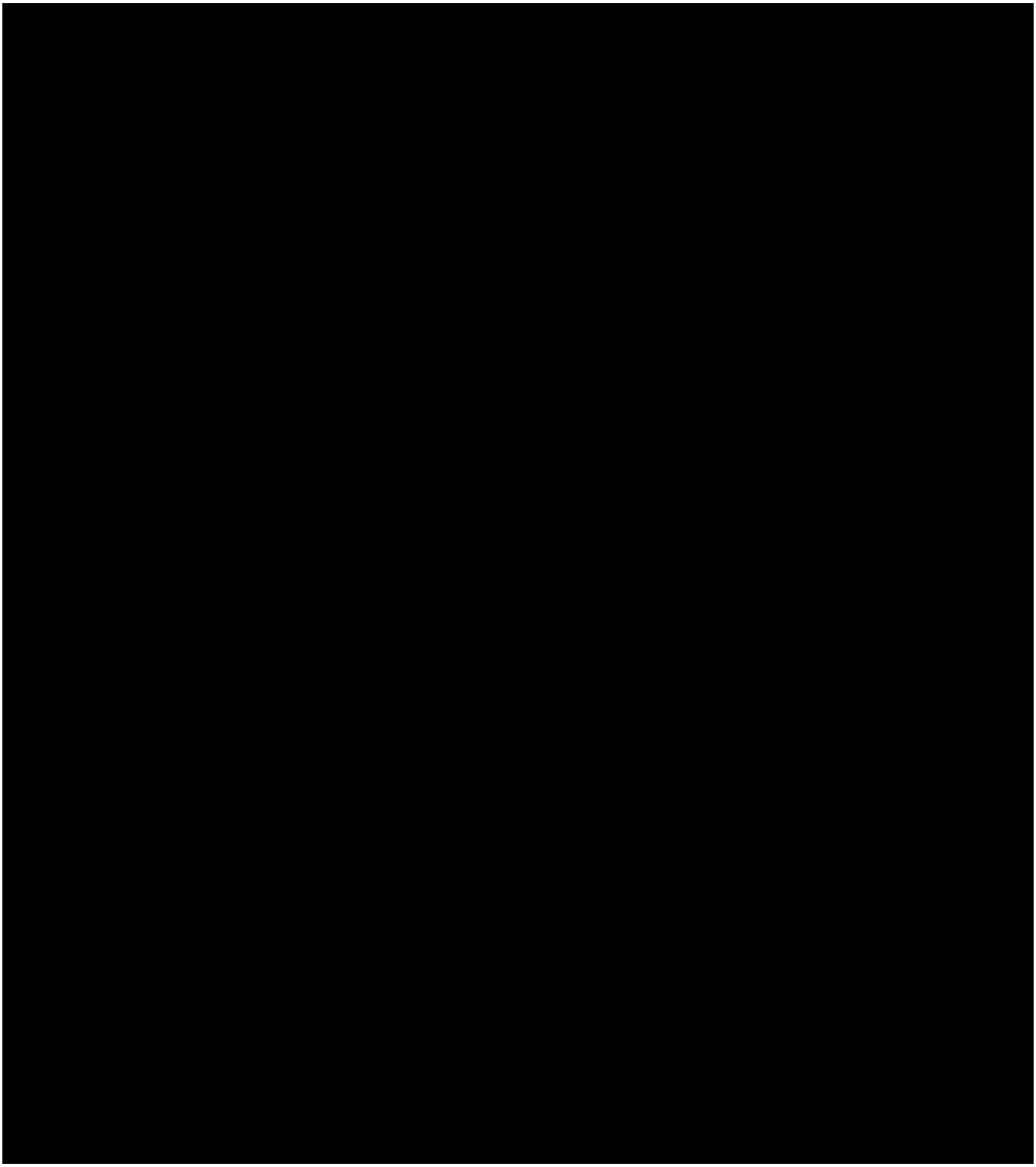
This seismic evaluation was discussed in a peer review meeting on 24 June 2019. Reviewers present were Joe Maffei of Maffei Structural Engineering and Jay Yin of Degenkolb Engineers. Comments from the reviewers have been incorporated into this report. The reviewers agreed with the assigned rating.

Additional building data	Entry	Notes
Latitude	37.000029	
Longitude	-122.054787	
Are there other structures besides this one under the same CAAN#	No	
Number of stories above lowest perimeter grade	2	
Number of stories (basements) below lowest perimeter grade	1	Small partial basement
Building occupiable area (OGSF)	6,777	From UCSC facilities database.
Risk Category per 2016 CBC Table 1604.5	II	
Building structural height, h_n	22 ft	Avg. 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	1.288, 0.489	From OSHPD/SEAOC website
Site class	D	
Site class basis	Geotech[4]	See footnote below

[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

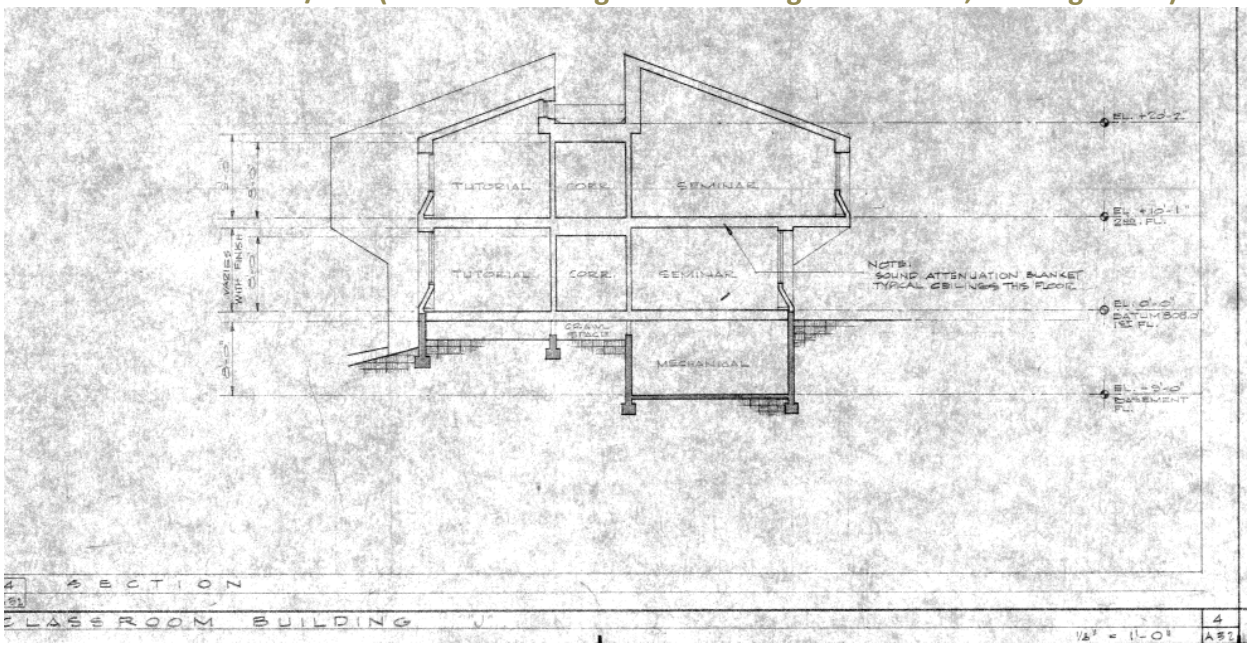
Site parameters F_a, F_v	1.0, 1.811	From OSHPD/SEAOC website
Ground motion parameters S_{cs}, S_{c1}	1.281, 0.886	From OSHPD/SEAOC website
S_a at building period	1.28	
Site V_{s30}	900 ft/s	
V_{s30} basis	Estimated	Estimated based on site classification of D.
Liquefaction potential	Low	
Liquefaction 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	None	No partial retrofit.
Applicable code for full retrofit	None	No full retrofit
FEMA P-154 data		
Model building type north-south	W2 Wood frame	
Model building type east-west	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.

Architectural First Floor Plan A15 Marked with Locations of Assumed 3/8” Plywood Sheathed Stud Walls

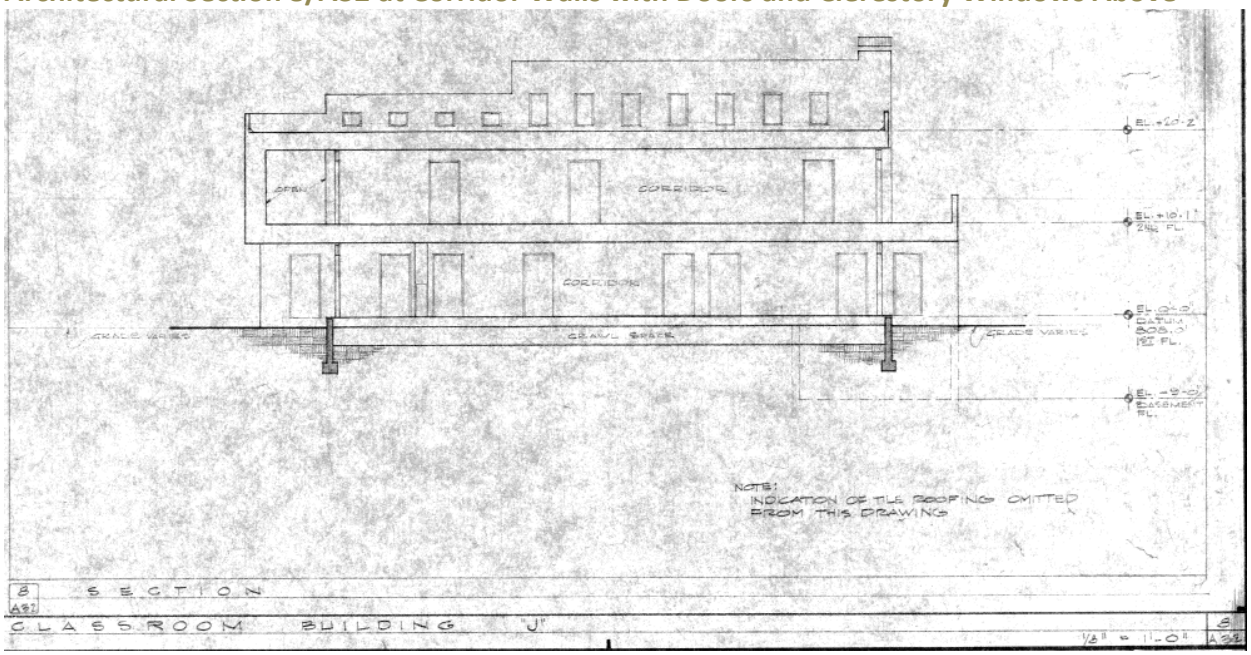


Architectural Second Floor Plan A15 Marked with Locations of Assumed 3/8” Plywood Sheathed Stud Walls

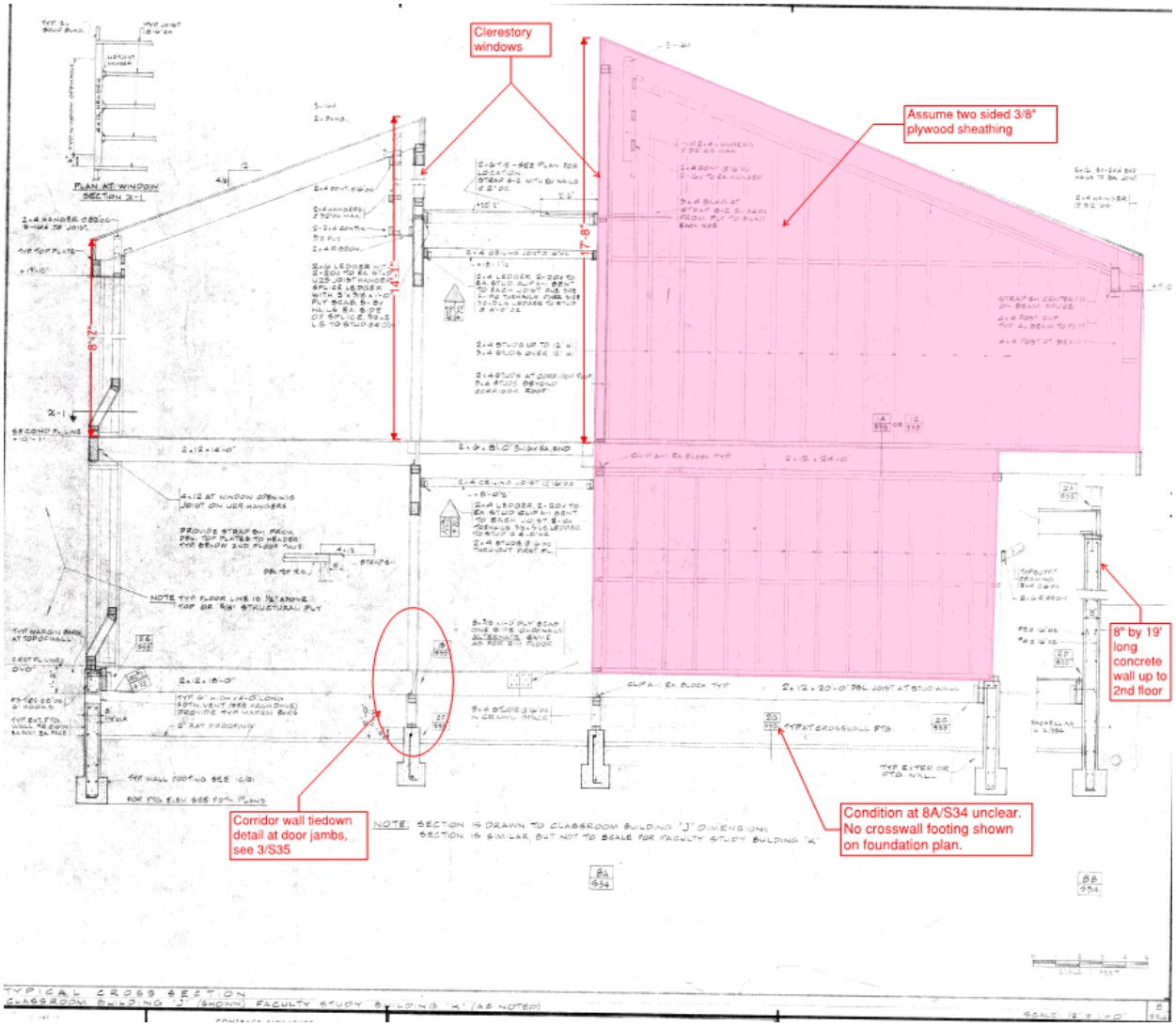
Architectural Section 4/A32 (Shows Overhangs and Differing Roof Planes, Looking North)



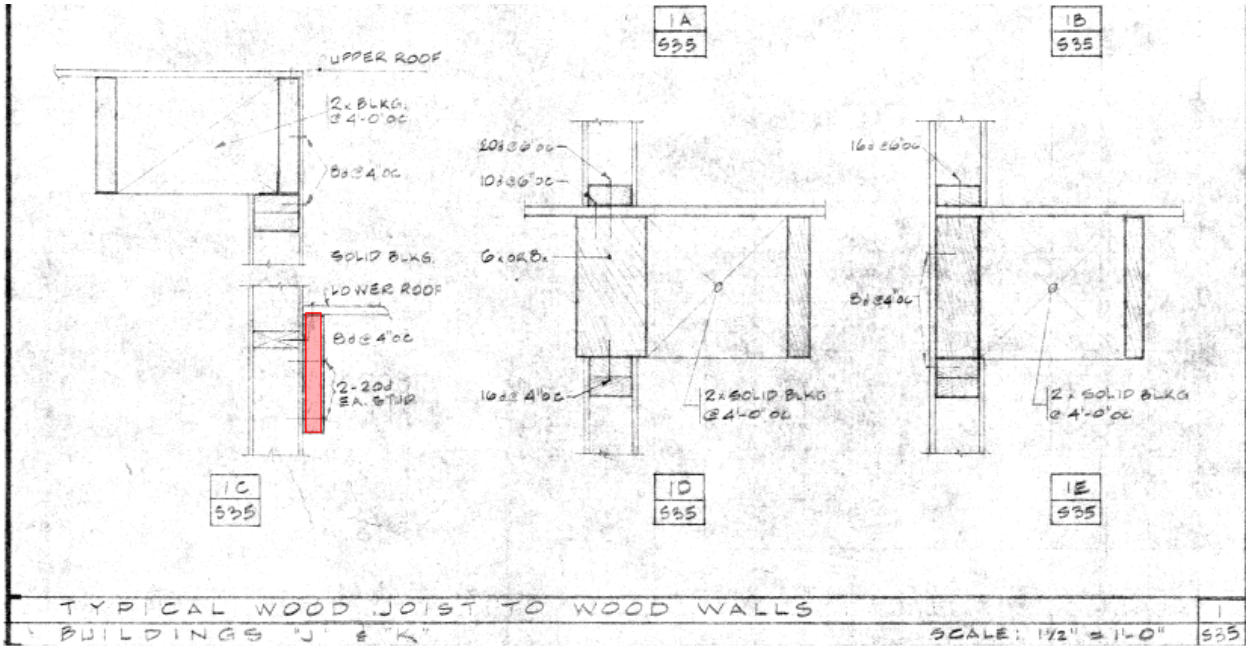
Architectural Section 8/A32 at Corridor Walls with Doors and Clerestory Windows Above

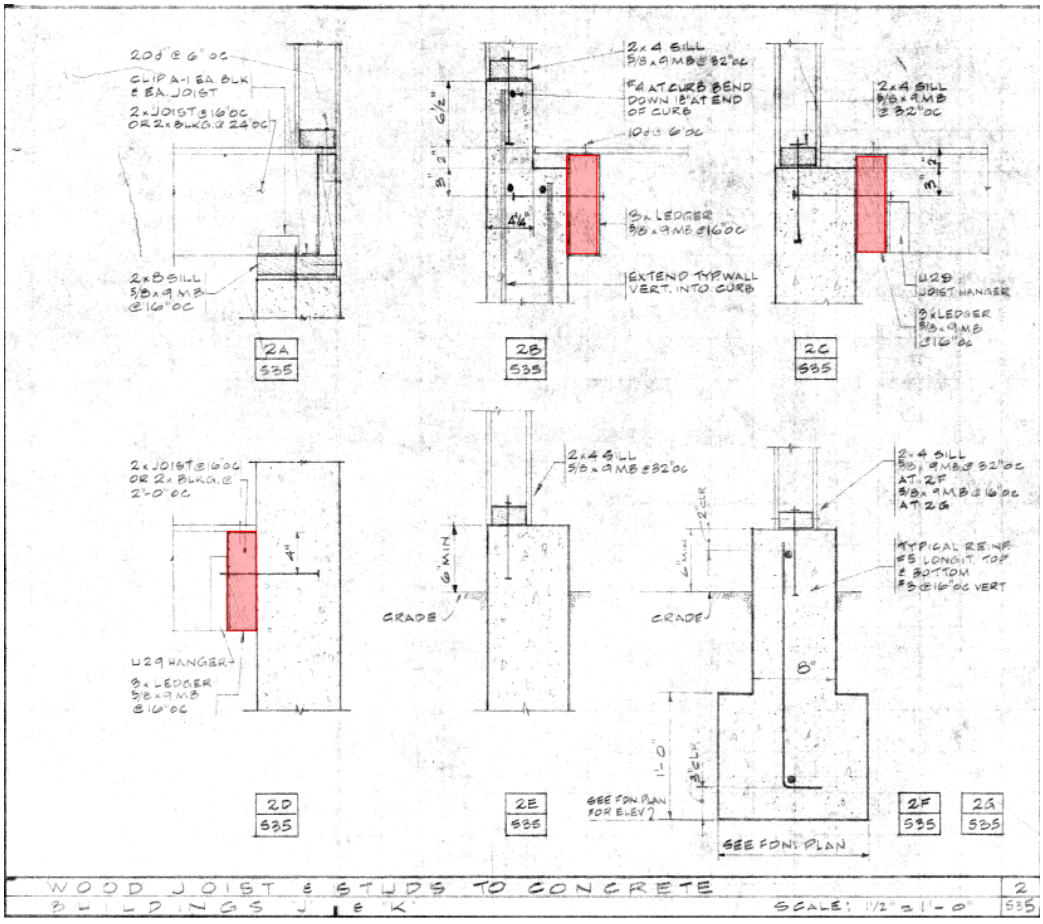


Interior Transverse Structural Building Sections 8A&8B/S34

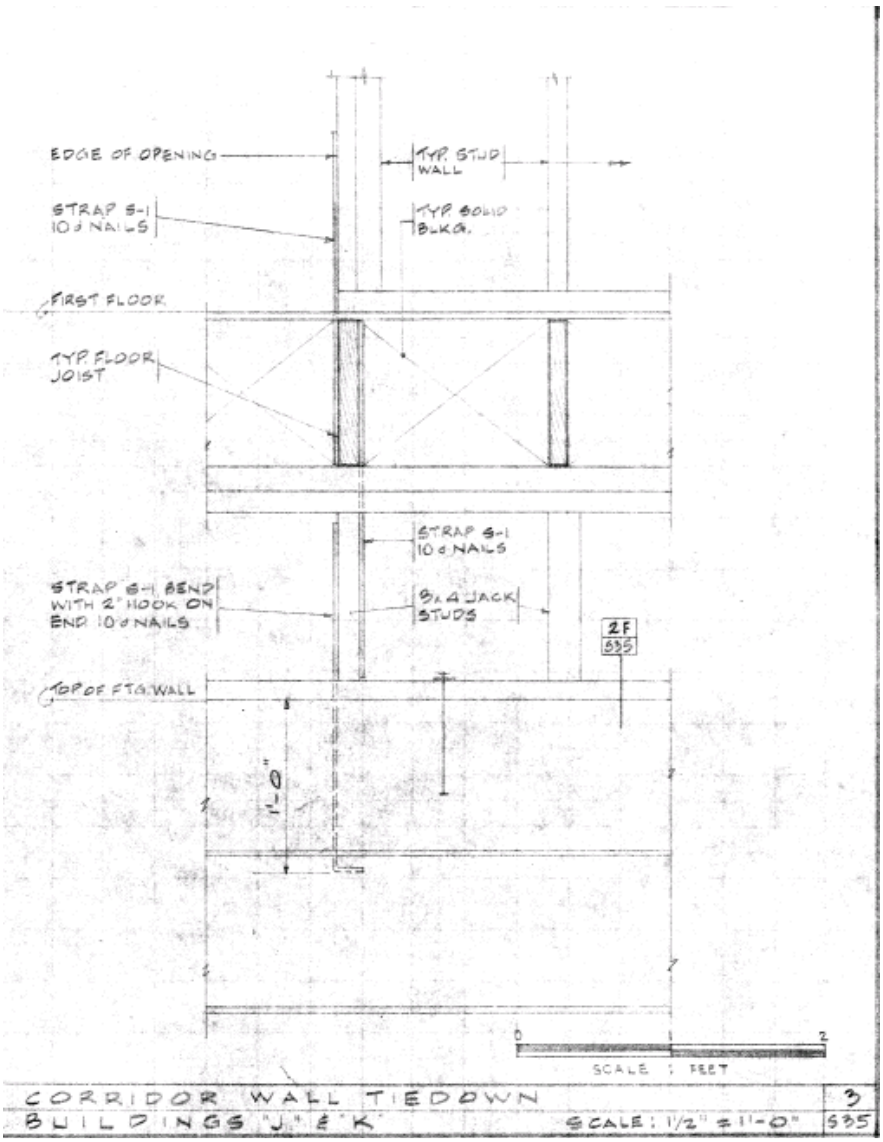


Cross-Grain Bending in Typical Details 1C, 2B, 2C, 2D/S35 at Connections from Corridor Roof to Wall and from Floor to Foundation Stem Walls



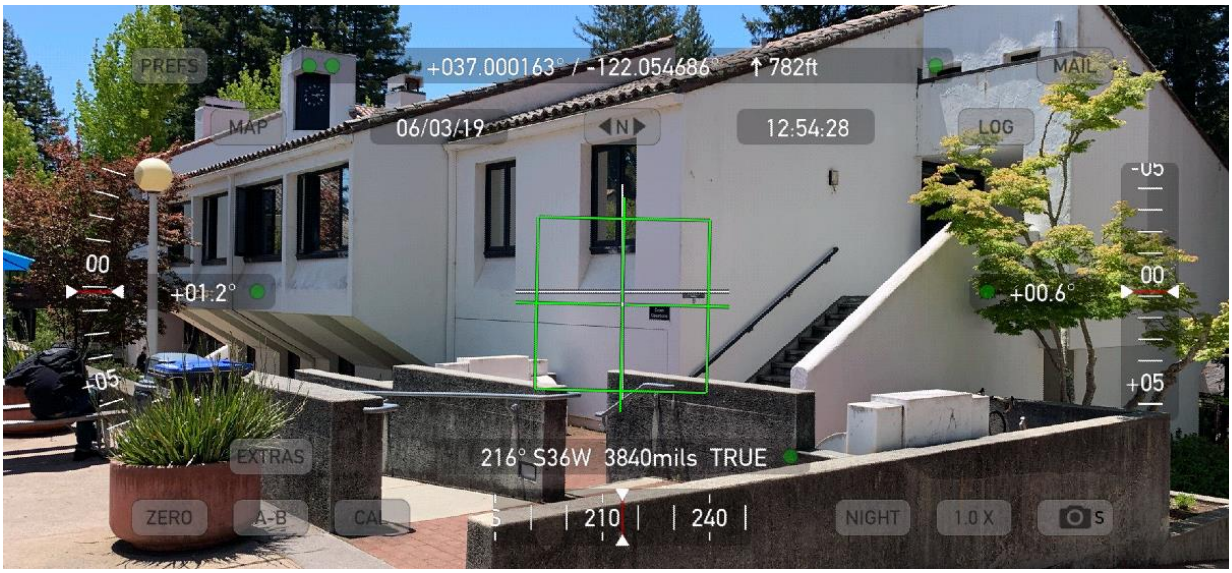


Connection Details at “Corridor Wall Tiedown” (at First Floor Door Jambs Only)



APPENDIX A

Additional Photos



Northeast Corner (Looking Southwest)

East Elevation (Looking South)

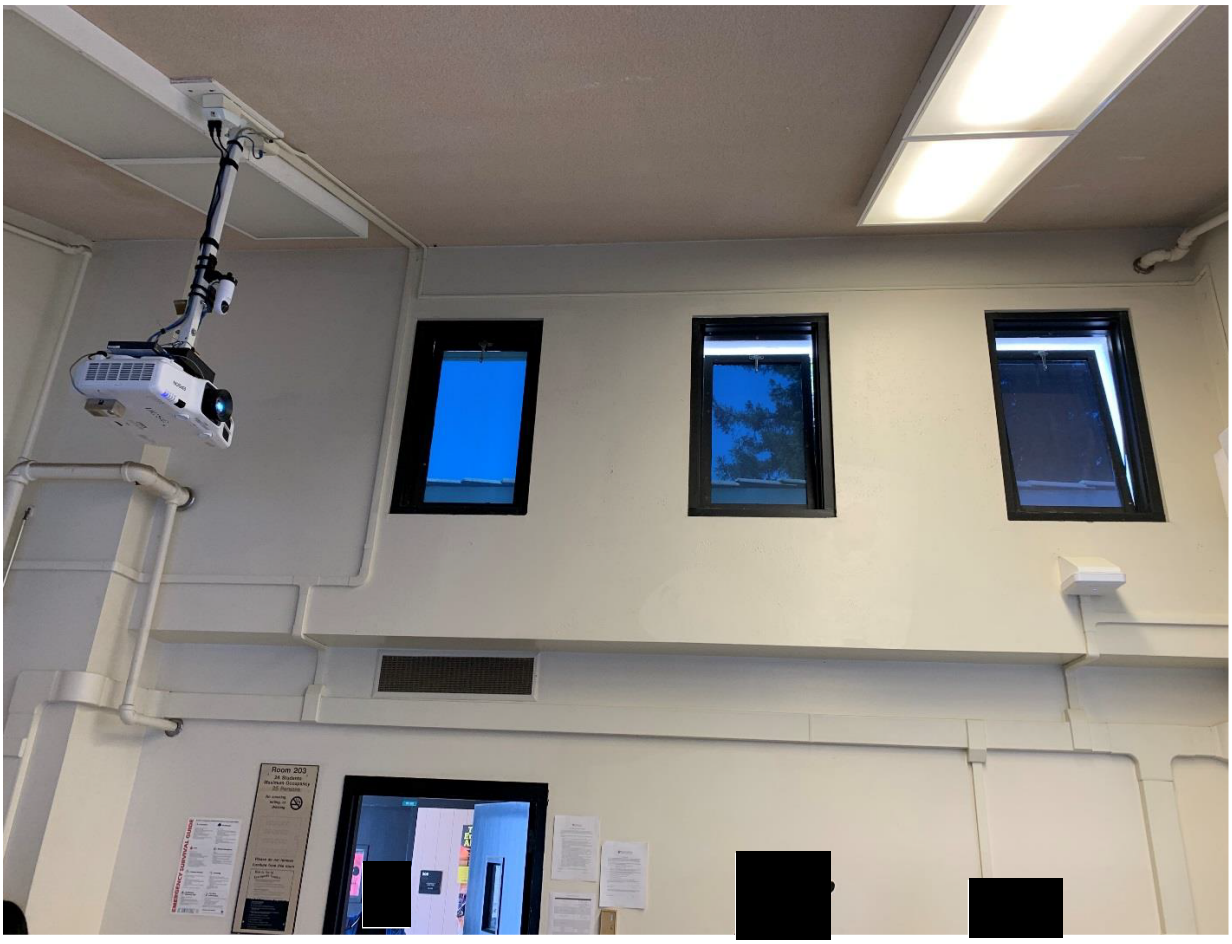
Partial North Elevation (Showing Overhang on West Elevation)

Detail of Overhang at East Elevation (Looking Northwest)

South Elevation (Looking Northwest from Walkway)

Close-up of Walkway Adjacent to South Elevation

4x4 Posts Support Roof Loads at Second Floor (Looking West)



Unsecured Projector, Clerestory Windows in Second Floor Classroom

APPENDIX B

ASCE 41-17 Tier 1 Checklists (Structural)

UC Campus:	Santa Cruz			Date:	06/20/2019		
Building CAAN:	7155	Auxiliary CAAN:		By Firm:	Rutherford + Chekene		
Building Name:	Crown Classroom Building			Initials:	CLP, EFA	Checked:	WAL/BL
Building Address:	624 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:** ½" and 5/8" plywood roof and floor diaphragms deliver loads to wood shear walls supported on strip footings in transverse direction. Transfer of heavy roof loads at projecting perimeter in longitudinal direction is unclear as there are no walls at the perimeter or a lack of connection to the walls near the perimeter due to offsets in the roof planes and no collectors.
○	◉	○	○	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:** There are no adjacent building structures; gaps at 1-story heavy timber walkway are covered with steel checker plate. A Tier 1 gap of 7'*12" *0.015=1.26" is required. Drawings show a 4" gap, but the distance viewed from below in the field is much less.
○	○	◉	○	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:** There are no mezzanine levels. There is a partial basement at the south end of the building supported by concrete stem walls.

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:** More lineal feet of transverse wall at second floor than at first floor.
○	◉	○	○	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:** Transverse direction softer at first relative to second floor.
○	◉	○	○	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:** Longitudinal walls at perimeter do not align from second floor to first.

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

UC Campus:	Santa Cruz			Date:	06/20/2019		
Building CAAN:	7155	Auxiliary CAAN:		By Firm:	Rutherford + Chekene		
Building Name:	Crown Classroom Building			Initials:	CLP, EFA	Checked:	WAL/BL
Building Address:	624 Crown Road, Santa Cruz, CA 95064			Page:	2	of	3

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:** Transverse walls at 2nd 23.33' compared to 17.33' at 1st
◉	○	○	○	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:** Roof mass heavy due to sloping Spanish tile roofs but not more than 50%
◉	○	○	○	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.

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

UC Campus:	Santa Cruz			Date:	06/20/2019		
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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:** Shear wall width B = 17.33', Building Height (avg) is H = 22', B/H = 0.79 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. It is not clear if the slab-on-grade is doweled to the footing.

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

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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:** .There are more than two lines in each direction.
◉	○	○	○	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:** Appears all walls double sided 3/8 ply; maximum shear stress at first floor in transverse direction 782plf and 428 in the longitudinal direction.
◉	○	○	○	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:** 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:** Plywood shear walls are used.
◉	○	○	○	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:** Transverse shear walls ok. Many openings in longitudinal shear walls and individual piers between openings may not meet this aspect ratio.

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C	NC	N/A	U	
○	◉	○	○	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:** Drawings show Simpson clips (A-1) and straps between floors and at base as "corridor wall tiedowns" but no ties or straps for transverse walls where wider at upper floor.
○	○	◉	○	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 and first floor is above grade on the west side, but the grade change is less than half a story, and concrete stem walls come up to first floor, so say "N/A."
◉	○	○	○	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:** Interior cripple walls have doubled sided 3/8" plywood. All perimeter walls connected to concrete stem wall.
○	◉	○	○	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:** Second floor longitudinal walls that project beyond first floor do not have clear load path; windows at upper floor with no shear walls in same plane and no straps to other walls.

CONNECTIONS

C	NC	N/A	U	Description
○	○	◉	○	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:**
◉	○	○	○	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 16" or 32" everywhere.

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C	NC	N/A	U	
◉	○	○	○	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:** Straps at window headers and posts supporting window headers.

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

CONNECTIONS

C	NC	N/A	U	Description
◉	○	○	○	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"

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 diaphragm split between flat portion and two 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 diaphragm split between flat portion and two sloping portions
○	○	◉	○	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:** Diaphragms have plywood sheathing.

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C	NC	N/A	U	
◉	○	○	○	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

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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:** There are no heavy ceilings, features, or ornamentation.
P ☐ N/A ☒	**Heavy masonry or stone veneer above exit ways or public access areas** **Comments:** There is no masonry or stone veneer.
P ☐ N/A ☒	**Unbraced masonry parapets, cornices, or other ornamentation above exit ways or public access areas** **Comments:** There are no masonry parapets, cornices or other ornamentation.
P ☐ N/A ☒	**Unrestrained hazardous material storage** **Comments:**
P ☐ N/A ☒	**Masonry chimneys** **Comments:** There are no masonry chimneys.
P ☐ N/A ☒	**Unrestrained natural gas-fueled equipment such as water heaters, boilers, emergency generators, etc.** **Comments:**
P ☒ N/A ☐	**Other:** Ceiling mounted projectors in middle of several second-floor lecture rooms. **Comments:** Stem mounted to ceiling; one had safety cables. Should install safety cables on all overhead items.
P ☒ N/A ☐	**Other:** Spanish roof tiles with steep slope along all longitudinal walls. Entries in transverse end walls so less of an issue at entries but footpath along rear of building. **Comments:** Do not know if tiles secured with nails or if nails still intact after many years. Check especially adjacent to stairs at ends of building and at footpath along west side.
P ☐ N/A ☐	**Other:** **Comments:**

Falling Hazards Risk: Low

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

APPENDIX D

Quick Check Calculations

Unit Weights:

Building 7155 Crown Classrooms

	Seismic Weight	Dead Load	
Main BLDG Flat Roof	**psf**		**Remarks**
flat roofing	5.5	5.5	3-ply with gravel
1/2" plywood for flat roof	1.5	1.5	
Rafter and ceiling joists	2.8	2.8	2x6@16" plus 2x4@16"
ceiling	2.0	2.0	typ. gypboard ceiling panels
MEP+misc+lighting	3.0	3.0	flat area
Total psf	14.8	14.8	
flat area	560.0		ft^2
Sloping Tile roofs			
Spanish clay tile	19.0	19.0	
5/8" plywood	1.8	1.8	at 36 pcf
membrane	1.0	1.0	
rafters	3.5	3.5	2x12 @ 16" o.c.
MEP+misc+lighting	2.0	2.0	sprinklers, lighting, projectors etc.
ceiling	2.0	2.0	typ. gypboard ceiling panels
subtotal on slope	29.3	29.3	scale this by 1.07 to account for slope
partition including shear walls	16.5	0.0	see below
Total weight per unit area	45.8	29.3	psf
Projected area under sloping roof	2786.3		ft^2
Total Seismic weight at roof	141629.3		lbs
	42.32		equivalent psf

	Seismic Weight	Dead Load	
2nd floor	**psf**		**Remarks**
5/8" plywood	1.8	1.8	at 36 pcf
joists incl cantilevers	4.7	4.7	2x12 @ 16" o.c. (use 2x12 @12 to account for extra 4x12s and 8x12s)
ceiling	2.0	2.0	typ. gypboard ceiling panels
MEP+misc+lighting	3.0	3.0	sprinklers, lighting, radiators, projectors etc.
partition including shear walls	20.8	26.9	see below
Total weight per unit area	32.3	38.4	
Floor area	3346.3		ft^2
Total Seismic weight at 2nd	108093.6		lbs

estimate partition/wall weights	**ft**		**Remarks**
lineal feet exterior stucco walls	233.0	8.0	height avg trib to roof
weight ext walls		20.5	2x4 @ 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
		20.5	use heavier value to account for numerous stucco surfaces around windows
lineal feet interior wall at 2nd floor	202.6	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 at 2nd		3346.3	ft^2
total ext plus int at 2nd floor	435.6		
Weight, roof		55230.4	lbs
Weight per unit area at roof		16.5	psf actual trib to roof
Weight, 2nd		69611.0	lbs
Weight per unit area at 2nd floor		20.8	psf trib to 2nd for 10.083'

Story Weights

Level	Area (ft^2)	Unit Weight (psf)	Seismic Weight (kips)
Typ. Roof	3346	42	142
2nd floor	3346	32	108
1st floor (neglect)	2932	0	0
	6278		250

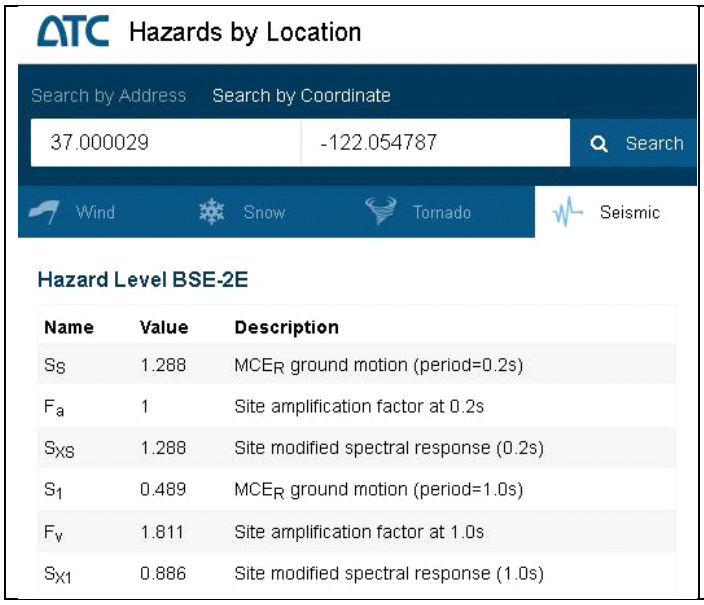
Note:
1- Roof area is projected on horizontal plane; not surface area of roof.

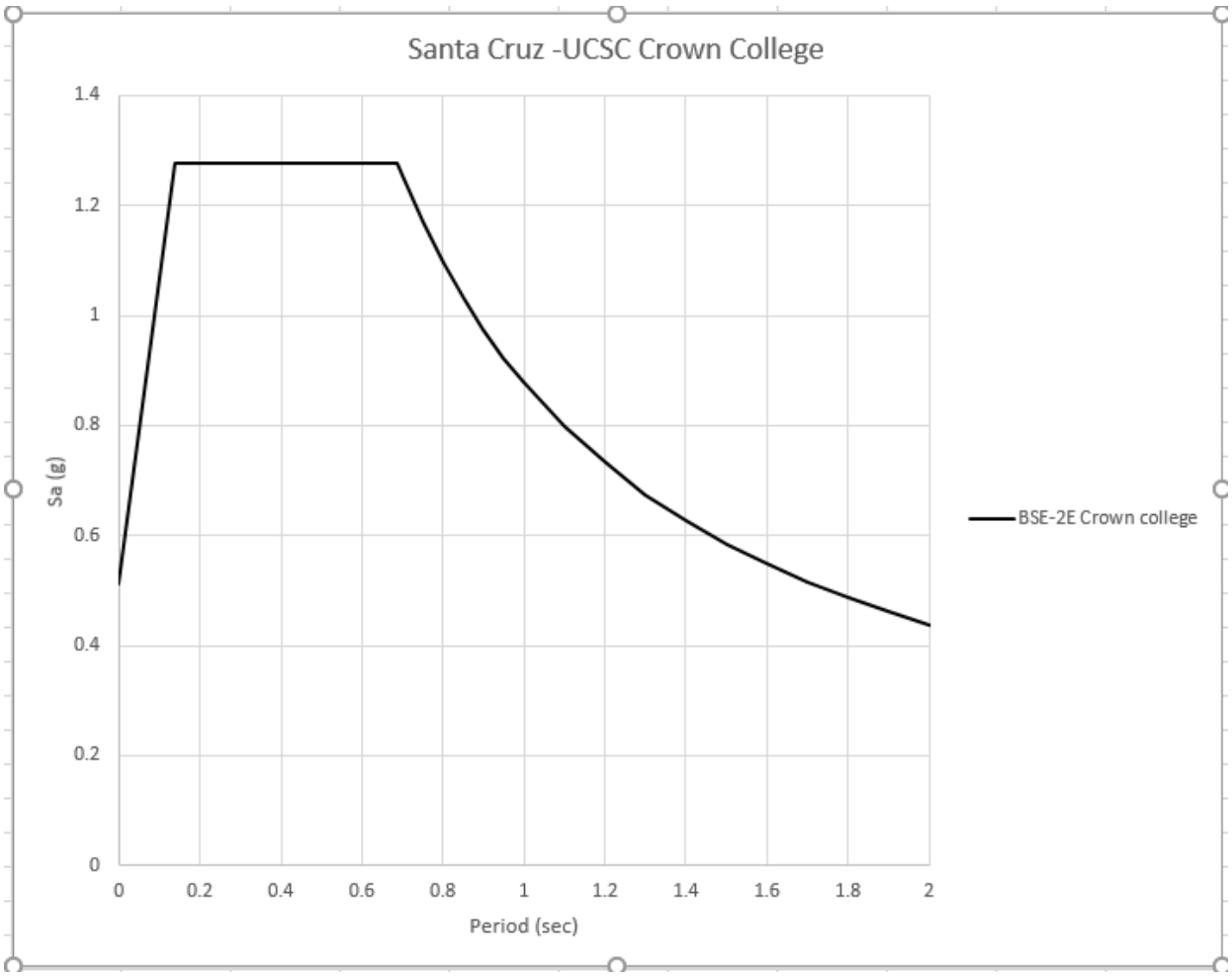
Period

C_t=	0.02
h_n (ft)=	22 avg
B=	0.75

T=	0.20 sec

BSE-2E Response Spectrum




Santa Cruz -UCSC Crown College
Sa (g)
Period (sec)
BSE-2E Crown college
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2

Story Shears

Sa=	1.29			Sx1	T	Sxs	
W=	250	kips		0.886	0.20	1.289	
C=	1.1	Per ASCE 41-17 Table 4-7					
V=	354	kips					
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				

Floor Leve	Story Height (ft)	Total Height, H (ft)	Weight, W (kips)	W x H^k	coeff	Fx (kips)	Story Shear, V (kips)
Roof	12.00	22.08	141.63	3,128	0.74	263	263
2nd Floor	10.08	10.08	108.08	1,090	0.26	91	354
1st Floor			249.71				
				4,217	1	354	

Notes:
1- The base of building is assumed to be at the 1st floor.
Neglect tiny partial basement since concrete stem walls at perimeter come up to first floor.
2- Use an average for roof height of 22 feet.
3- Modification Factor, C, per ASCE 41-17, Table 4-7.

Average Stress:

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

N-S direction (Longitudinal)			
Level	Force (kips)	length of wall (ft)	average shear stress (plf)
2nd Flr Level	263	136	429
1st flr Level	354	184	428

E-W direction (Transverse)			
Level	Force (kips)	length of wall (ft)	average shear stress (plf)
2nd Flr Level	263	175.8	332
1st flr Level	354	100.65	782