RUTHERFORD + CHEKENE
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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 Library Study Building

CAAN #7162
680 Crown Service Road, Santa Cruz, CA 95064
UCSC Campus: Main Campus

Entry Elevation (Looking Southwest)

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 load path at areas with overhanging floors. Check transfer of loads between floors 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, "Additions to Crown College: 1. Library & Faculty Commons, 2. Provost Residence, 3. Preceptors' Apartments, 4. Landscape & Site Development, University of California, Santa Cruz," dated 17 May 1967, Sheets A1-A12 and A22 to A31 (26 sheets).
- Structural drawings by Ernest J. Kump Associates, "Additions to Crown College: 1. Library & Faculty Commons, 2. Provost Residence, 3. Preceptors' Apartments, 4. Landscape & Site Development, University of California, Santa Cruz," dated 19 May 1967, Sheets S1-S07 and S17-S19 (11 sheets).

Additional building information known to exist

Additional miscellaneous drawings with filenames 2300-015.F5, 2300-021.F5, 2300-071, 2326.F5, 2347.F5, 2347-001.F5 related to fireplace, elevator, bridge repair, and ramps. These were not reviewed for this Tier 1 evaluation.

Scope for completing this form

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

Brief description of structure

The Crown Library Study Building was added to a cluster of five wood framed buildings that form the core of Crown College. These five buildings were originally known as Buildings J, K, L, M, and N of Residential College No. 3. The Crown Library Study Building was added a year later. The Crown complex was designed in 1966 by architects Ernest J. Kump Associates, and the Additions for Crown College, including the Library Study, were designed in 1967. 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 1968.

The building is a three-story wood structure with an extended crawl space that supports a patio and extends beyond the footprint above, a small basement beneath the Clock Tower area, and a small Clock Tower above the main roof level. The building contains 7,566 square feet per the UCSC database. The building is irregular in plan and elevation but nearly symmetric in plan about a diagonal axis running at 45 degrees. The building has two stair towers on the north and east sides adjacent to a bridge linking this building to two nearby structures. The site slopes down to the southwest with a large patio above the crawl space on the south and west sides of the building at the first-floor level. The building is predominantly wood framed with 2x6 or 2x10 framed stud walls and plywood diaphragms but includes some steel pipe columns and steel framing sections at long spans at the second and third floor levels. The structural plans indicate that all exterior walls were to receive plywood sheathing with a stucco finish. The sloping roofs have Spanish tiles like the other buildings in the Crown College complex. The north and east sides of the third floor have floor areas that overhang the walls below. The large patio at the third floor is overhanging on the south and west sides and has lightweight concrete fill over plywood. A similar patio at the first-floor level also has lightweight fill but is supported on concrete stem walls that come up to the patio level. The building has tall windows on the south and west sides and at the face of the Clock Tower. The drawings state that all exterior walls are to have 3/8 plywood sheathing with nailing of 8d@4" at edges and 8d@12" at intermediate boundaries; walls at the stair towers were to have nailing of 8d@2". Structural details are provided for "Tiedown Details" but it appears these were only installed on one end of the stair walls; the other walls do not appear to have these tiedown details. An 8" concrete stem wall typically comes up to the underside of the first-floor level.

The Crown Library Study is linked to the Classroom Building and the Faculty Study Building by a one-story heavy timber pedestrian bridge at the second floor level. The bridge is anchored to the Library building along the face of the Clock Tower, the north wall of the east stair tower, and east wall of the north stair tower. Portions of the stair walls are vulnerable to pounding damage where the floors or landing do not align with the bridge deck. Connection details to the stair towers include a ledger connection with cross-grain bending.

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 building rating, but most of the structural members

are covered with architectural finishes. We did however note some areas of the handrails for the adjoining bridge structure that showed signs of dry rot in the top surface.

Identification of levels: The building has three stories above grade (first floor, second floor, and third floor) plus a very small Clock Tower and a very small partial basement area beneath the Clock Tower. Both the first and third floor levels include exterior patio areas. The first floor is a split level with some framing depressed 2'-0" and the patio depressed 2'-3". The site slopes to the southwest, and the first-floor patio lies above a sloping crawl space.

Foundation system: The perimeter and basement walls bear on a continuous 8" or 10" thick concrete stem wall on a 16" wide footing. The downhill walls supporting the first floor patio are tapered to 8" at the top. Basement walls and foundation stem walls at the perimeter come up to the level of the first floor framing, except at the stair towers the walls are somewhat higher and appear to come up to the first landing level. Grade around the building site gently slopes down to the southwest. The interior bearing walls consist of wood cripple walls with 3/8" plywood sheathing on one side supported on a shorter 8" stem wall on a 14" wide footing. Interior wood posts are supported on individual spread footings.

Structural system for vertical (gravity) load: All the vertical loads are carried by roof and floor joists that span to wood stud walls, wood posts, or in one location, a steel pipe column. Joists range in size from 2x to 6x wood members plus several 8WF, 12WF and 14WF steel wide flange sections at the upper floors. Stud walls are typically 2x6 framing but 2x10 studs were used along the south and west sides. The third floor extends out beyond the second floor along all four sides. The patio area extends out beyond the walls below on the south and west sides; the floor framing extends out beyond the walls below at the north and east. Large windows on the south and east are framed by a 4x12 lintel and 4x10 posts. Interior wood posts are typically 6x6. Roof and floor diaphragms are plywood. The adjoining bridge structure has wood joists spanning to glulam beams supported on cantilevered redwood posts.

Structural system for lateral forces: Lateral forces are resisted by plywood shear walls in both the E-W and N-S directions. The building is nearly symmetric about a 45-degree axis and has roughly the same number of walls in each direction. The third floor is heavier than either the roof or second floor due to the large extended floor and patio areas that create vertical irregularities since the walls above do not align with walls below. The drawings state that all perimeter walls are to be sheathed with 3/8" plywood and in addition the cripple walls that align with perimeter walls above are also sheathed. The drawings include some Simpson hardware at the base of posts, some A1 clips for shear transfer, and some tiedowns that we could only locate at one end of each exterior stair wall. The load path from the extended floor and patio areas is unclear as there does not appear to be a mechanism to transfer loads delivered from these areas to the walls below. Details where the first floor or stair landings frame into the foundation walls include cross-grain bending in the ledger. The bridge structure relies on the Library for lateral support, but the connection details include ledgers with cross-grain bending.

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. 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 geometric vertical discontinuities in both directions and lacks a clear load path for loads from the extended floor and patio areas at the third floor to the walls below. Some floors and walls are wider at the third floor than at the second floor and lack straps and hold downs to transfer forces and resist overturning. Only one location indicated a tiedown detail at the lower floor.
- Cross-grain bending is present in wood ledgers where the floor or stair framing connects to the concrete stem walls and where the bridge is anchored to the stair towers.
- Potential for pounding between the bridge structure and the stair towers in between floor or stair landing levels may result in damage to the exit stairs.

- 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. We recommend conducting a field survey to confirm locations of plywood sheathing since not clearly marked on drawings. Review in more detailed locations where cross-grain bending may be present.

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

Building has tall glazing panels above and adjacent to entries at Clock Tower and on south and west sides and also at interior glazed partitions in areas overlooking the open reading rooms at the first floor. We recommend verifying that the glazing consists of tempered glass or the like. 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 discontinuous shear walls, detailing that will induce cross-grain bending at wall-to-diaphragm ties, and the potential for pounding near exit stair locations.

Recommendations for further evaluation or retrofit

We recommend the 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 conducting a field survey to confirm extent of plywood sheathing. We also recommend a review of locations with cross grain bending. If the walls or connections are inadequate, connections could be strengthened, or supplemental lateral resistance could be added. Retrofits might

[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.

include hold downs and straps between floors at vertical discontinuities. A clear load path should be provided for projecting areas at the third floor 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, should be given a higher priority.

Peer review of rating

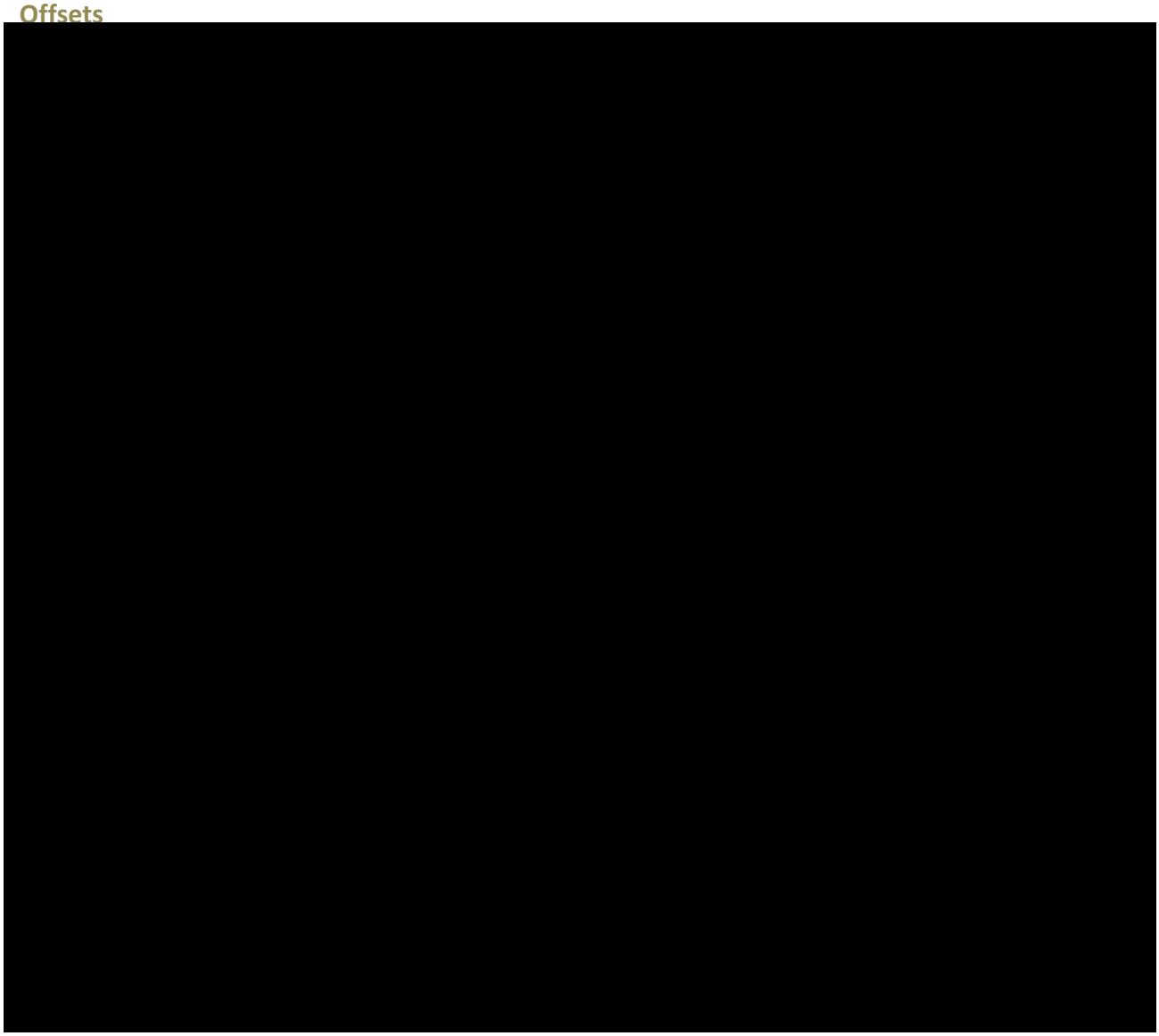
The key issues and expected seismic performance of this building are similar to that for the Crown Classroom Building (CAAN #7155). The peer review of that building, carried out on 24 June 2019, can be applied to this building. Reviewers present were Joe Maffei of Maffei Structural Engineering and Jay Yin of Degenkolb Engineers.

Additional building data	Entry	Notes
Latitude	36.999819	
Longitude	-122.054803	
Are there other structures besides this one under the same CAAN#	No	
Number of stories above lowest perimeter grade	3	
Number of stories (basements) below lowest perimeter grade	1	Small partial basement
Building occupiable area (OGSF)	7,566	From UCSC facilities database.
Risk Category per 2016 CBC Table 1604.5	II	
Building structural height, h_n	37 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	0.30 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
Site parameters F_a, F_v	1.0, 1.811	From OSHPD/SEAOC website
Ground motion parameters S_{cs}, S_{c1}	1.288, 0.885	From OSHPD/SEAOC website
S_a at building period	1.29	
Site V_{s30}	900 ft/s	
V_{s30} basis	Estimated	Estimated based on site classification of D.
Liquefaction potential	Low	

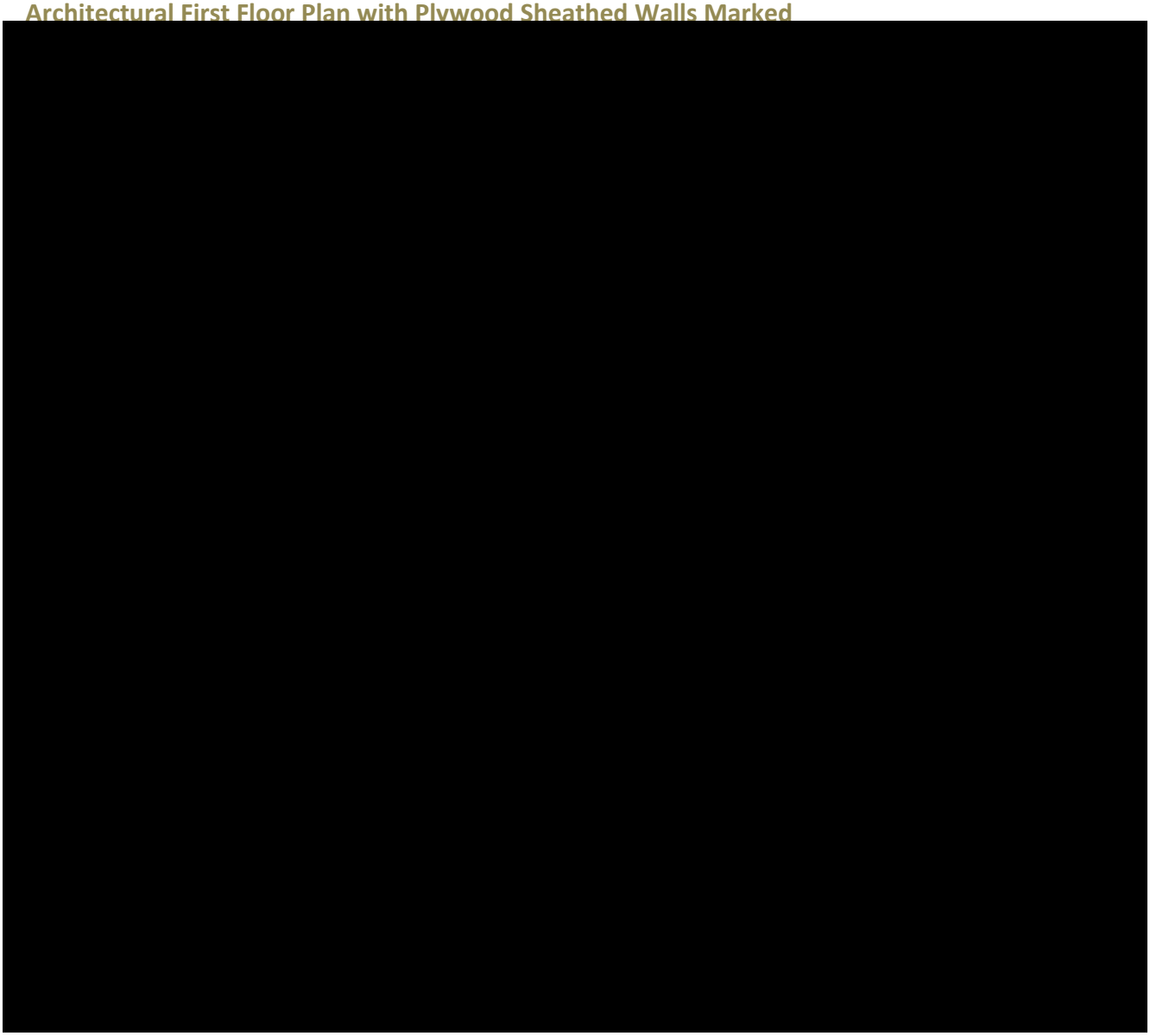
[4] Determination of site class and assessment of geotechnical hazards are based on correspondence with Pacific Crest Geotechnical Engineers and Nolan, Zinn, and Associates Geologists. [*Revised Geology and Geologic Hazards, Santa Cruz Campus, University of California*, Job # 04003-SC 13 May 2005]. Site 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

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.

Structural Floor Plans Used for Area Calculations Showing Changes in Plan Area and Vertical Offsets



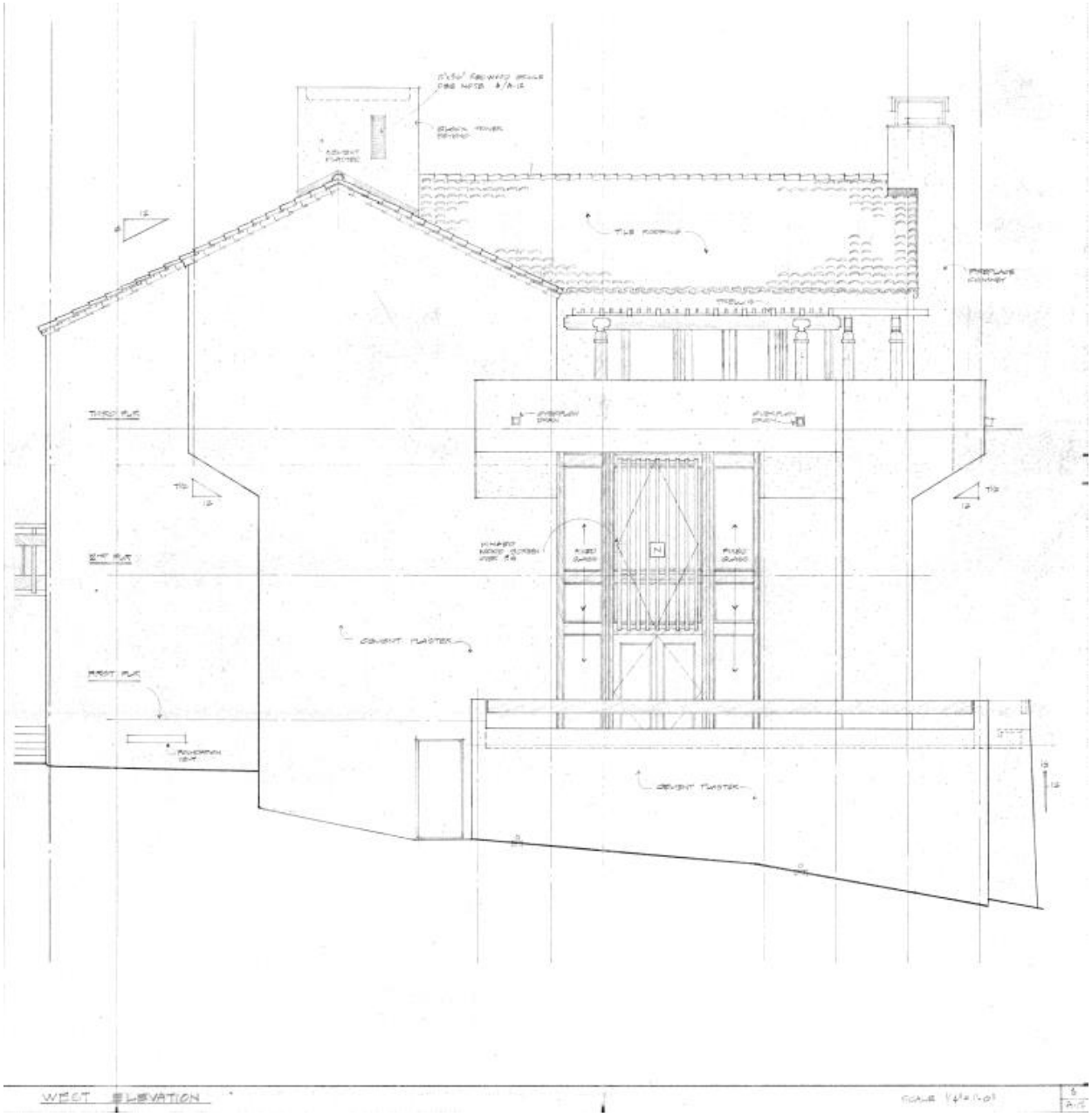
Architectural First Floor Plan with Plywood Sheathed Walls Marked



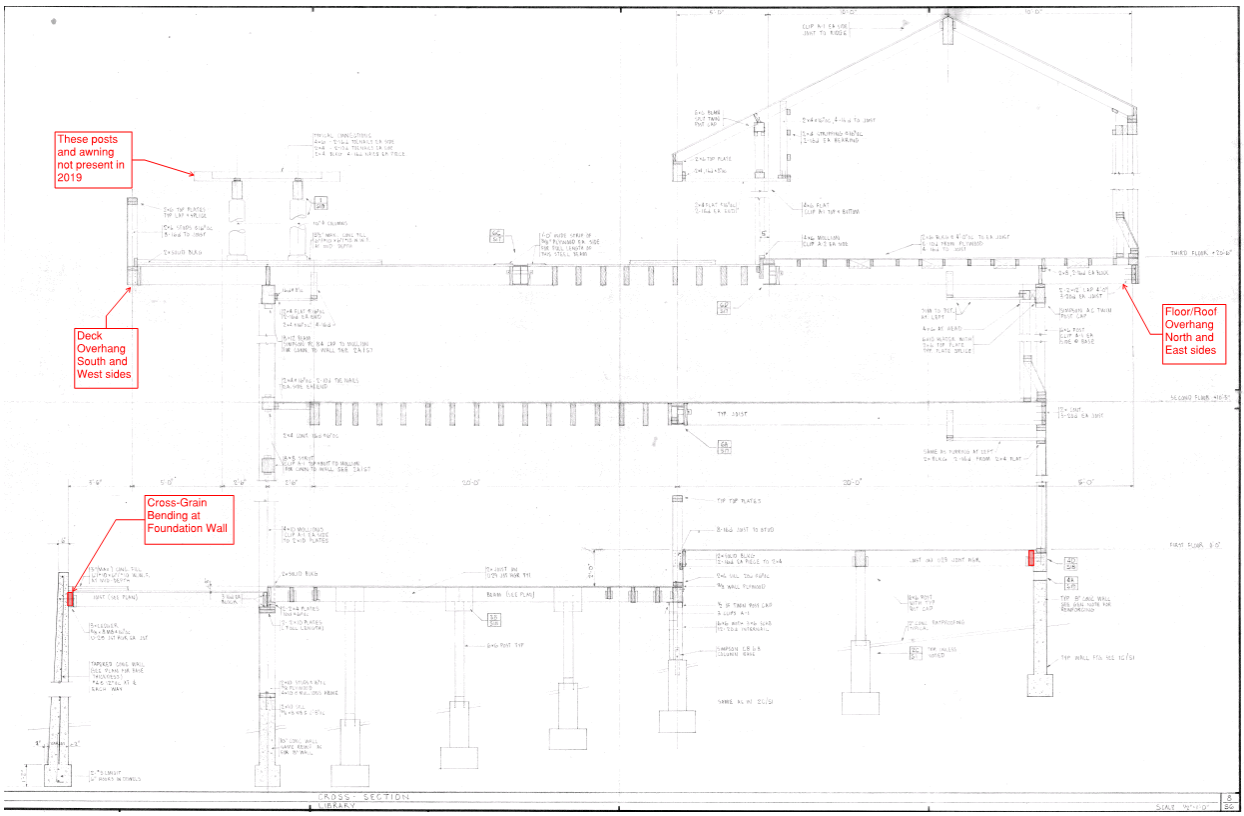
Architectural Second Floor Plan with Plywood Sheathed Walls Marked (Shows Vertical Offsets to Framing Above, Interface at Bridge, Floor Openings)

Architectural Third Floor Plan with Plywood Sheathed Walls Marked

Architectural West Elevation showing Clock Tower, Chimney, Floor and Patio Overhangs, Large 2-story Windows



Interior Transverse (E-W) Building Structural Section 8/S6 (Looking North Showing Overhangs, Vertical Offsets, and Cross-Grain Bending at Connections to Foundation Walls)

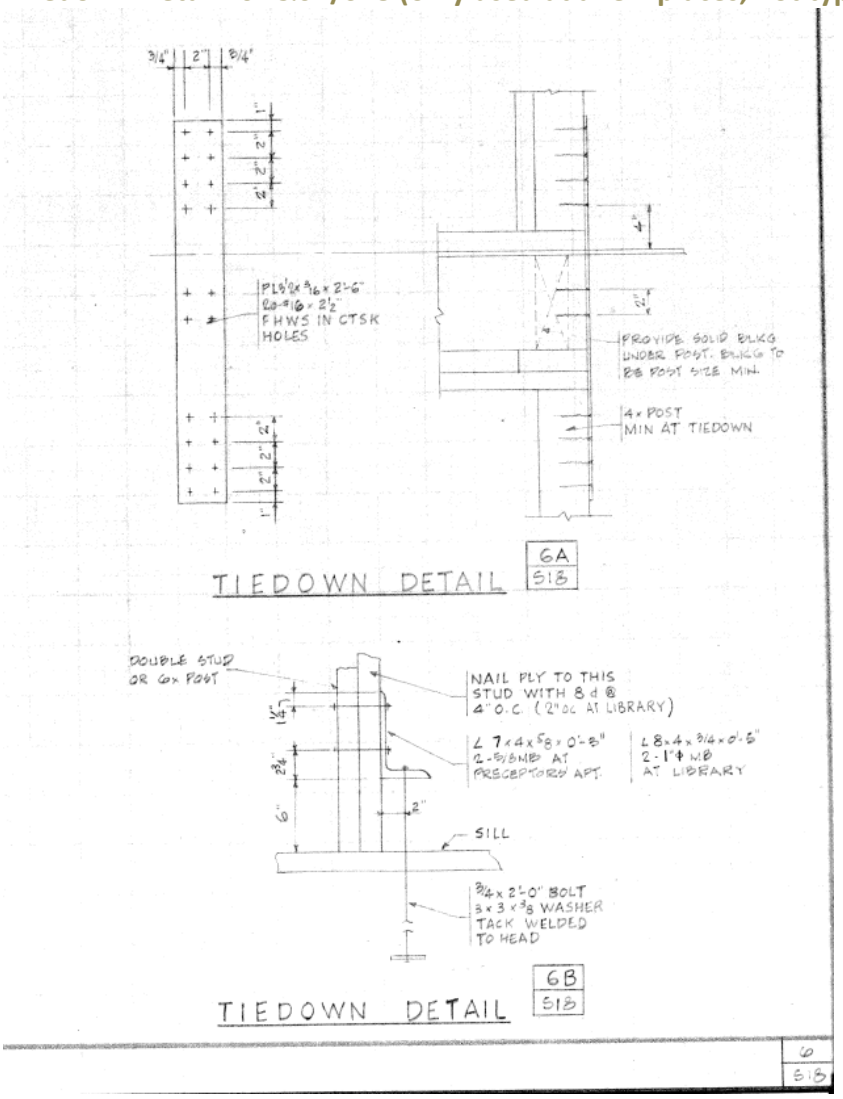


Framing Notes Call for 3/8" Sheathing at all Perimeter Walls

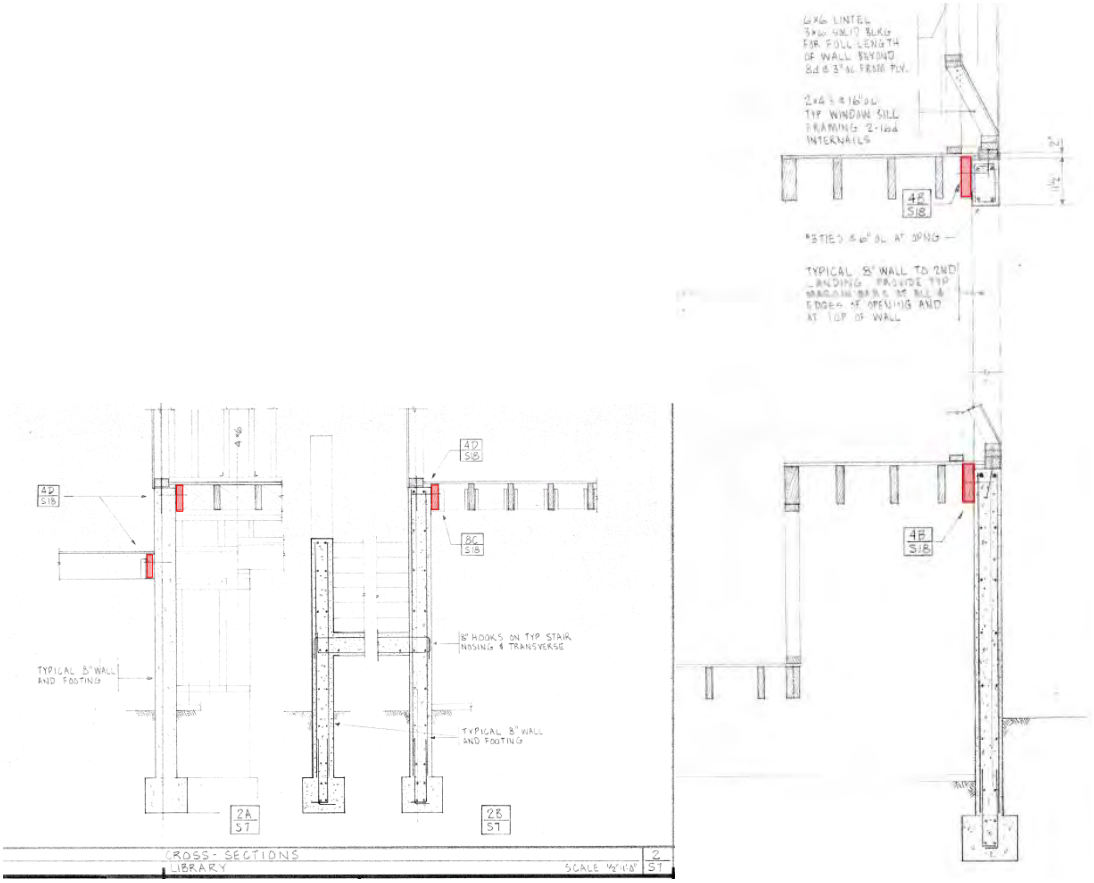
FRAMING NOTES

1. FIRST FLOOR LINE IS AT ELEVATION 0'-0" (808.0') UNLESS OTHERWISE NOTED. TOP OF 5/8" STRUCTURAL FLOOR SHEATHING IS 1/2" BELOW FLOOR LINE.
2. SEE GENERAL NOTES ON SHEET S-1
3. ALL EXTERIOR WALLS ARE SHEATHED WITH 3/8" PLYWOOD
4. ALL STUD WALLS HAVE 2x6 STUDS @16" OC UNLESS NOTED.
5. ALL WOOD POSTS ARE 6x6 UNLESS NOTED

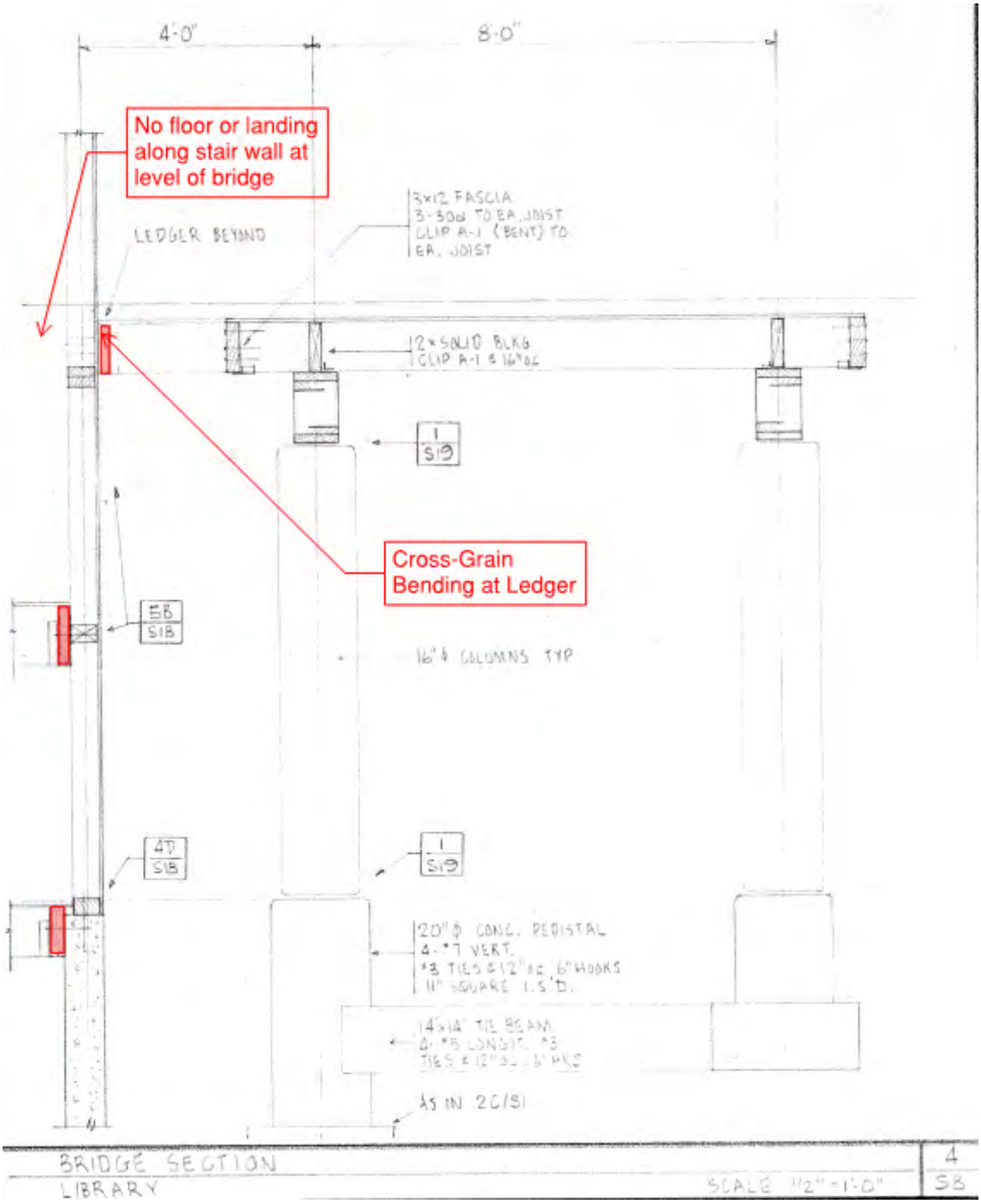
"Tiedown Detail" 6A&6B/S18 (only used at a few places, not typical at all wall ends)



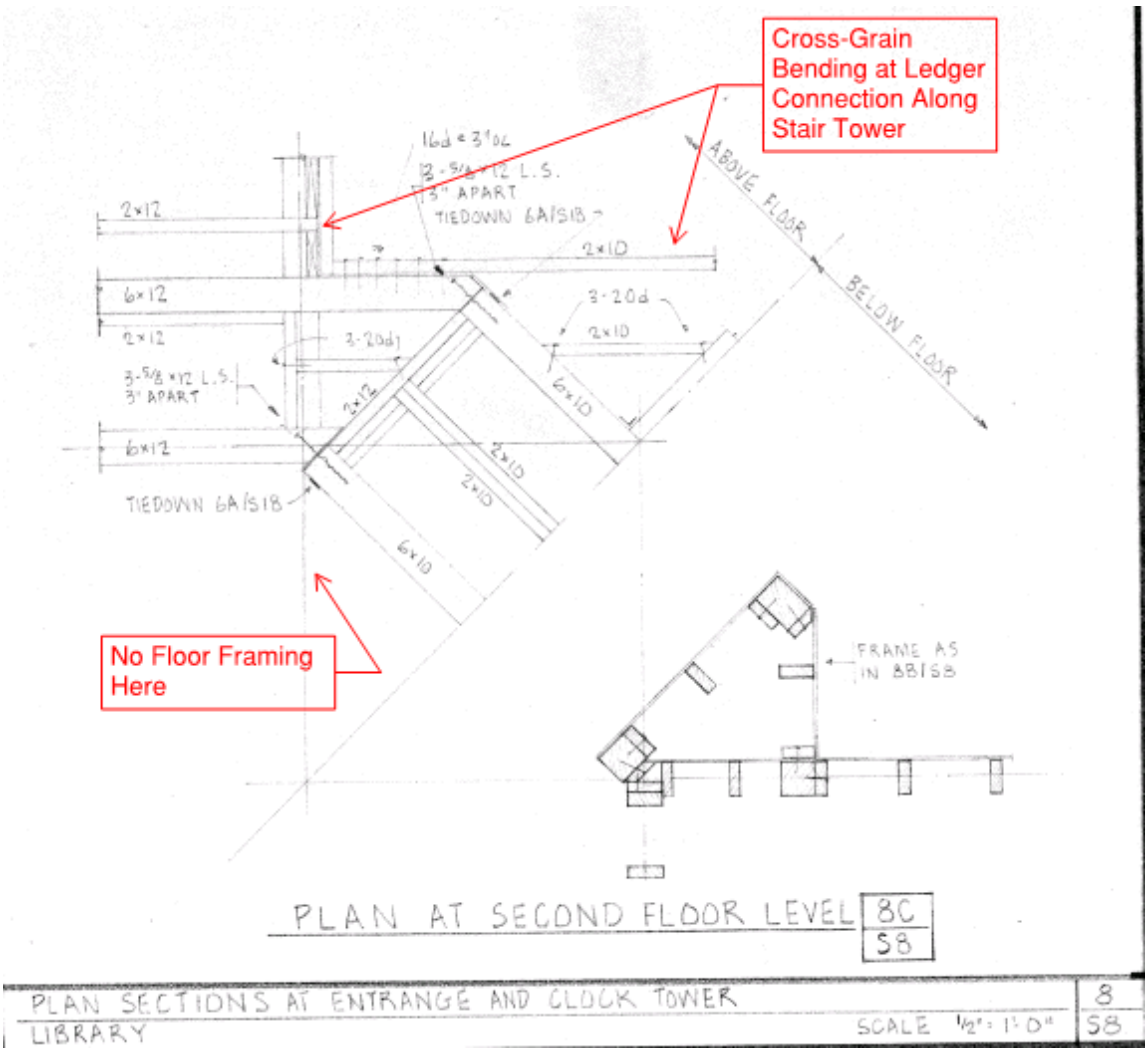
Cross-Grain Bending at Ledger Present in Typical Details 2/S7 and 8/S7



Detail 4/S8 of Adjoining Bridge Structure Anchored to Library and Connecting to Classroom and Faculty Wing at Second Floor Level (No Floor Aligned with Bridge at this Section and Cross-Grain Bending at Connection Details)



Details of Bridge Anchorage to Library Building at Entrance to Clock Tower (Note Floor Opening Adjacent to 6x10)



APPENDIX A

Additional Photos

Library Entry with Clock Tower and Pergola (Looking Southwest)

Southeast Corner (Looking Northwest)

South Elevation with Chimney, Overhanging Floor and Balcony (Looking North)

Southwest Corner with Concrete Perimeter Walls at Base and Third Floor Balcony Overhangs on South and West Elevations (Looking Northeast)

Partial West Elevation at Third Floor from Balcony (Looking East)

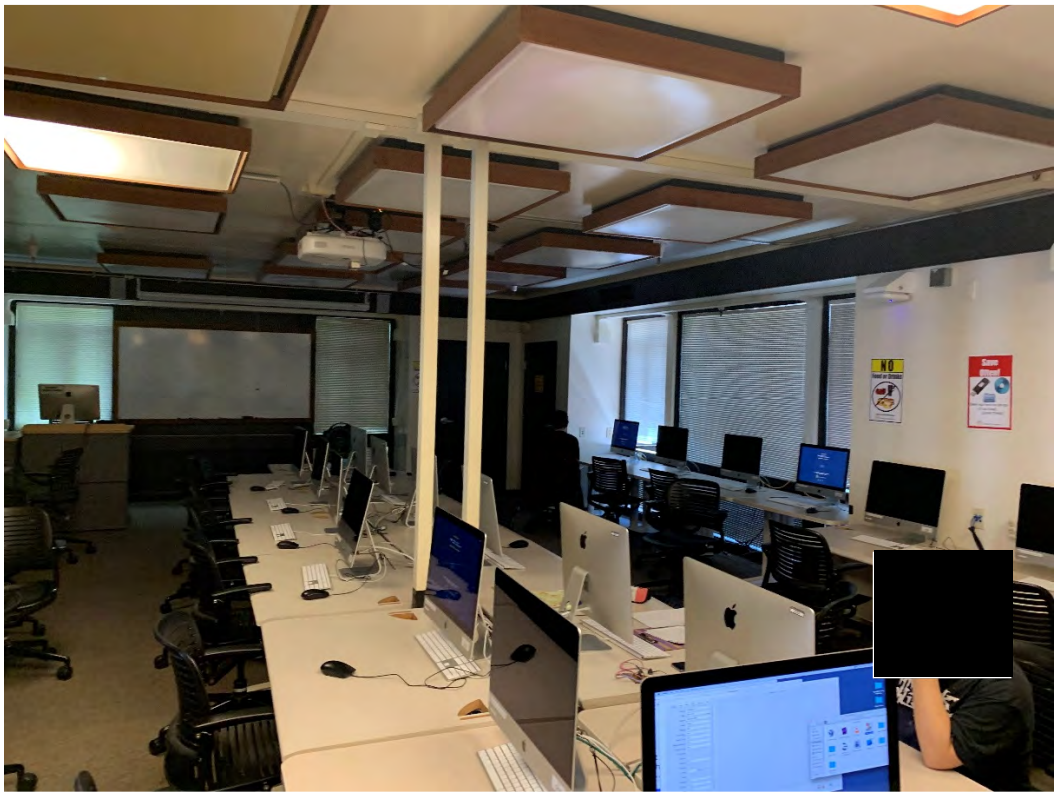
View to Exterior Balcony at Third Floor (Looking Southwest)

Partial East Elevation from Second Floor Walkway (Looking West)

Partial North Elevation from Second Floor Walkway (Looking South)

Partial North Elevation from Second Floor Walkway (Looking Southwest)

Interior View at First Floor Split Level Library (Looking West)



Interior View at Computer Lab at Second Floor

Wood Framed Chimney in Third Floor Lounge (Looking South)

APPENDIX B

ASCE 41-17 Tier 1 Checklists (Structural)

UC Campus:	Santa Cruz			Date:	06/28/2019		
Building CAAN:	7162	Auxiliary CAAN:		By Firm:	Rutherford + Chekene		
Building Name:	Crown Library Study			Initials:	CLP, EFA	Checked:	WAL/BL
Building Address:	680 Crown Service Road, Santa Cruz, CA 95064			Page:	1	of	3

ASCE 41-17
Collapse Prevention Basic Configuration Checklist

LOW SEISMICITY

BUILDING SYSTEMS - *GENERAL*

	Description
C ○ NC ◉ N/A ○ U ○	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 or posts. Transfer of loads at projecting floor and patio areas at 3rd floor at perimeter unclear.
C ○ NC ◉ N/A ○ U ○	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:** The bridge is connected and supported by the Library building, but has inadequate separation at the adjacent buildings and poor connections in portions of the Library.
C ◉ NC ○ N/A ○ U ○	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:** The first floor is split at three levels, but all portions are tied to foundation walls.

BUILDING SYSTEMS - *BUILDING CONFIGURATION*

	Description
C ○ NC ◉ N/A ○ U ○	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 1st and 3rd floor than 2nd floor.
C ○ NC ◉ N/A ○ U ○	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:** Story heights same but few lineal feet of wall at 2nd floor.
C ○ NC ◉ N/A ○ U ○	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:** Walls at 3rd floor perimeter do not align with 2nd floor walls.

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

UC Campus:	Santa Cruz			Date:	06/28/2019		
Building CAAN:	7162	Auxiliary CAAN:		By Firm:	Rutherford + Chekene		
Building Name:	Crown Library Study			Initials:	CLP, EFA	Checked:	WAL/BL
Building Address:	680 Crown Service 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:**
◉	○	○	○	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:** 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:	06/28/2019		
Building CAAN:	7162	Auxiliary CAAN:		By Firm:	Rutherford + Chekene		
Building Name:	Crown Library Study			Initials:	CLP, EFA	Checked:	WAL/BL
Building Address:	680 Crown Service Road, Santa Cruz, CA 95064			Page:	3	of	3

ASCE 41-17
Collapse Prevention Basic Configuration Checklist

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

FOUNDATION CONFIGURATION

C	NC	N/A	U	Description
○	◉	○	○	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 = 25', Building Height (avg) is H = 37', B/H = 0.67 Sa = 1.29g per ATC at BSE-2E 0.6 x Sa = 0.774 B/H< 0.6 Sa
○	○	○	◉	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 are tied together with continuous strip footings. It is unknown if the slab on grade is doweled to the footings.

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ASCE 41-17
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 single sided 3/8 ply; maximum shear stress at 2nd floor is 597plf in the longitudinal (N-S) direction and 582 pf in the transverse (E-W) 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:** Not relying on gypsum wallboard walls.
○	◉	○	○	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:** Includes many narrow piers beside windows with 3'6" or 5'7" that are less than 2-to-1..
○	◉	○	○	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 "tiedown detail" but only find callout at one end of one stair well wall so not typical. .

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UC Campus:	Santa Cruz			Date:	06/28/2019		
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ASCE 41-17
Collapse Prevention Structural Checklist For Building Type W2

C	NC	N/A	U	
○	○	◉	○	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.
◉	○	○	○	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 single 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:**

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:** Simpson hardware at base of posts.
◉	○	○	○	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.
◉	○	○	○	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, hardware connecting WF sections to posts

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ASCE 41-17
Collapse Prevention Structural Checklist For Building Type W2

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 and floor diaphragms continuous except at 1st floor that is supported on concrete stem walls so ok.
○	◉	○	○	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:** Details include some plates and straps at reentrant corners and at transitions, but not known if adequate. Cross grain bending in some roof to wall details.
○	○	◉	○	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:**
○	○	◉	○	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.
◉	○	○	○	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.

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ASCE 41-17
Collapse Prevention Structural Checklist For Building Type W2

C	NC	N/A	U	
○	○	◉	○	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.

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

APPENDIX C

UCOP Seismic Safety Policy Falling Hazards Assessment Summary

UC Campus:	Santa Cruz			Date:	06/28/2019		
Building CAAN:	7162	Auxiliary CAAN:		By Firm:	Rutherford + Chekene		
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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:** Glazing above and adjacent to exits; interior glazing above reading room at first story. **Comments:** Interior glazing had wire glass at one location. Suggest review displacements and consider replacement of film to prevent falling hazard.
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 7162 Crown Library

	Seismic Weight	Dead Load	
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	4.7	4.7	2x12 @ 16" o.c. (use 2x12 @12 to account for extra framing)
MEP+misc+lighting	2.0	2.0	sprinklers, lighting, projectors etc.
ceiling	2.0	2.0	typ. gypboard ceiling panels
subtotal on slope	30.5	30.5	scale this by 1.07 to account for slope
partition including shear walls	27.6	27.6	see below
Total weight per unit area	58.1	58.1	psf
Projected area under sloping roof	1944.0		ft^2
Total Seismic weight at roof	117054.5		lbs
	60.21		equivalent psf

	Seismic Weight	Dead Load	
3rd floor	**psf**		**Remarks**
5/8" plywood	1.8	1.8	at 36 pcf
joists incl steel framing (est)	4.7	4.7	2x12 @ 16" o.c. (use 2x12 @12 to account for extra framing)
ceiling, lightweight fill at patio	5.0	5.0	typ.
MEP+misc+lighting	3.0	3.0	sprinklers, lighting, radiators, etc.
subtotal on floor	14.5	14.5	
partition including shear walls	21.9	21.9	
Total weight per unit area	36.4	36.4	
Floor area	2808.0		ft^2
Total Seismic weight at 3rd	102250.7		lbs
	36.41		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 framing)
ceiling	2.0	2.0	typ. gypboard ceiling panels
MEP+misc+lighting	3.0	3.0	sprinklers, lighting, radiators, projectors etc.
subtotal on floor	11.5	11.5	
partition including shear walls	20.2	20.2	
Total weight per unit area	31.7	31.7	
Floor area	2225.0		ft^2
Total Seismic weight at 2nd	70588.6		lbs
	31.73		equivalent psf

1st floor	Seismic Weight psf	Dead Load	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)
concrete fill	10.0	10.0	
MEP+misc+lighting	3.0	3.0	sprinklers, lighting, radiators, projectors etc.
subtotal on floor	19.5	19.5	
partition including shear walls	20.2	20.2	
Total weight per unit area	39.7	39.7	
Floor area	2894.0		ft^2
Total Seismic weight at 1st	114892.4		lbs
	39.70		equivalent psf

Summary at each Level	weight per level lb	
Roof	117054.5	
3rd floor	102250.7	
2nd floor	70588.6	
1st floor	114892.4	

1st floor

estimate partition/wall weights	ft		Remarks
lineal feet exterior stucco walls	243.4	10.3	height avg trib to floor
weight ext walls		20.0	2x6 @ 16 plus one layer 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
		20.0	use heavier value to account for numerous stucco surfaces around windows
lineal feet interior wall at 1st floor	88.8	10.3	height avg trib to floor
		8.9	2x4 @ 16 plus insulation +misc+ 2 layers 5/8 gyp
Area at 1st		2894.0	ft^2
total ext plus int at 2nd floor	332.3		
Weight, 1st		58459.4	lbs
Weight per unit area at 1st		20.2	psf actual trib
2nd floor			
estimate partition/wall weights	**ft**		**Remarks**
lineal feet exterior stucco walls	194.1	10.3	height avg trib to floor
weight ext walls		20.0	2x6 @ 16 plus one layer 3/8 plywood plus exterior cement plaster plus insulation +misc+ 2 layers 5/8 gyp
		10.0	glazing plus sash etc longitudinal walls only about 25% glazing
		20.0	use heavier value to account for numerous stucco surfaces around windows
lineal feet interior wall at 2nd floor	53.4	10.3	height avg trib to floor
		8.9	2x4 @ 16 plus insulation +misc+ 2 layers 5/8 gyp
Area at 2nd		2225.0	ft^2
total ext plus int at 2nd floor	247.5		
Weight, 2nd		45001.1	lbs
Weight per unit area at 2nd floor		20.2	psf actual trib

3rd floor			
estimate partition/wall weights	**ft**		**Remarks**
lineal feet exterior stucco walls	264.6	10.3	height avg trib to floor
weight ext walls		20.0	2x6 @ 16 plus one layer 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
		20.0	use heavier value to account for numerous stucco surfaces around windows
lineal feet interior wall at 3rd floor	74.7	10.3	height avg trib to floor
		8.9	2x4 @ 16 plus insulation +misc+ 2 layers 5/8 gyp
Area at 3rd		2808.0	ft^2
total ext plus int at 2nd floor	339.3		
Weight, 3rd		61534.7	lbs
Weight per unit area at 3rd		21.9	psf actual trib

roof			
estimate partition/wall weights	**ft**		**Remarks**
lineal feet exterior stucco walls	264.6	9.0	height avg trib to roof
weight ext walls		20.0	2x6 @ 16 plus one layer 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
		20.0	use heavier value to account for numerous stucco surfaces around windows
lineal feet interior wall at 3rd floor	74.7	9.0	height avg trib to roof
		8.9	2x4 @ 16 plus insulation +misc+ 2 layers 5/8 gyp
Area at roof		1944.0	ft^2
total ext plus int at roof	339.3		
Weight, roof		53612.1	lbs
Weight per unit area at roof		27.6	psf actual trib

Rating form completed by:

RUTHERFORD + CHEKENE
ruthchek.com

Evaluator: CLP/EFA/BL

Date: 06/28/2019

Wall Summary Library 7162

	Floor area sf										
roof	1944										
3rd	2808										
2nd	2225										
1st	2894										
	Lx (ft)	LY(ft)			Lx (ft)	LY(ft)			Lx (ft)	LY(ft)	
1st	3.5	15		2nd	3.5	15.5		3rd	3.5	10	
	3.5	15			3.5	14.3			3.5	18	
	25.25	20.5			12	20.33			5.75	11.5	
	2.5	2.2			3	5.66			5.75	3.5	
	10	4			10.5	3			5.5	3.5	
	13.67	4			3	3			3.5	3.4	
	2.5	2.2			13.75	3			3.5	3.5	
	5.5	10			16	10.25			17.67	3.5	
	2.5	6.5			5.25	5.5			5	6.75	
	5.75	3.68			5.25	5.5			3	6.5	
	20.33	3.68			5.5	3.5			5.5	5.5	
	15	5			6	3.5			5	8.75	
	5.5	5.5			6	6			8.83	25.5	
	5.5	5.5			5.5	5.5			5.5	5.5	
	5.5	5.5			5.5	6			5.75	25	
	5.5	5.5			21	6			22	10	
	5.5	5				5.67			10.25	5.67	
	20	5.5							7	3	
		5.5							12	5	
		25							6.25	5.5	
		20							25		
total	157.5	174.76	Lx+Ly	total	125.25	122.21	Lx+Ly	total	169.75	169.57	Lx+Ly
stucco	120.67	122.76	243.43	stucco	98.75	95.3	194.05	stucco	122.17	142.42	264.59
partitions	36.83	52	88.83	partitions	26.5	26.91	53.41	partitions	47.58	27.15	74.73

Story Weights

Level	Seismic Weight (lbs)
Roof	117055
3rd	102251
2nd	70589
1st	114892
total	289894

This goes to the basement walls

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

Period

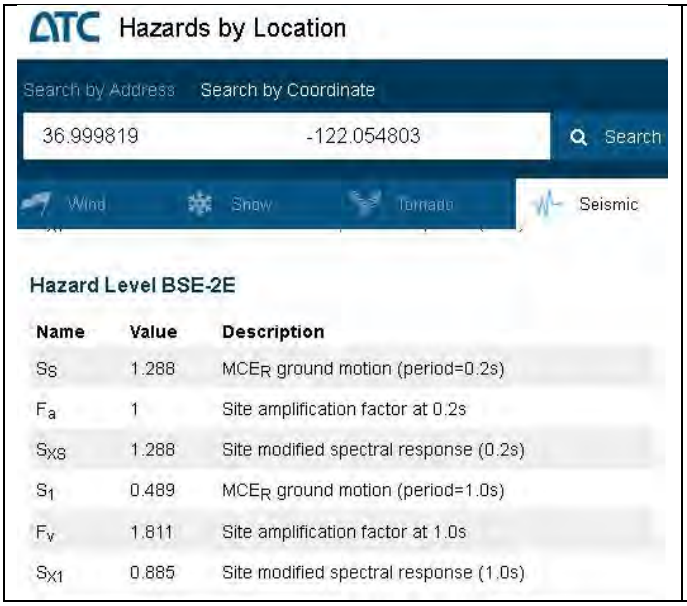
C_t=	0.02
h_n (ft)=	37
B=	0.75

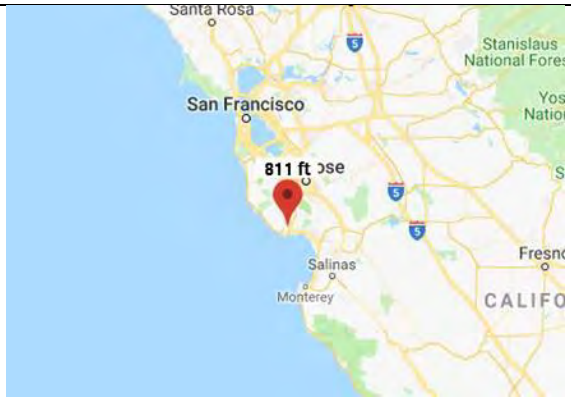
avg

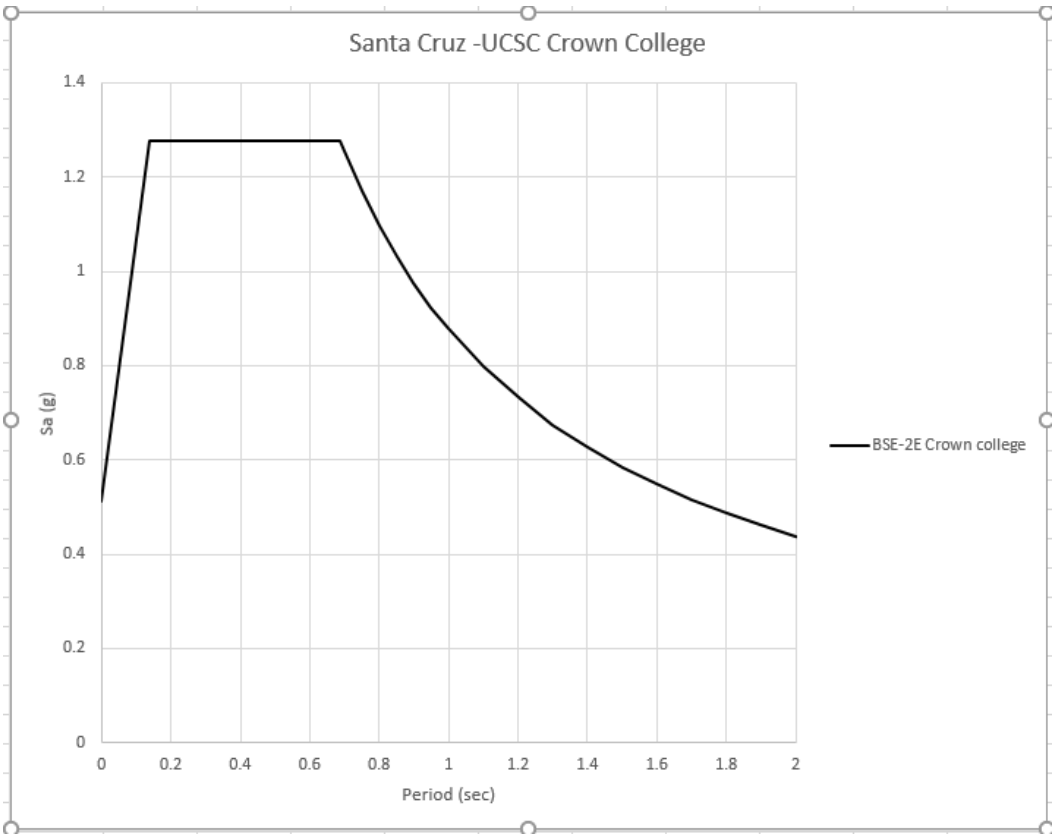
T=	0.30

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

Rating form completed by:

Story Shears

Sa=	1.29			Sx1	T	Sxs	
W=	290	kips		0.886	0.30	1.289	
C=	1.0	Per ASCE 41-17 Table 4-7					
V=	374	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	13.50	37.00	117.05	4,331	0.56	211	211
3rd Floor	10.25	23.50	102.25	2,403	0.31	117	328
2nd Floor	10.25	13.25	70.59	935	0.12	46	374
1st Floor	3.00	3.00	114.89	345	0.04	17	390
				7,669	1	374	

Notes:

1- The base of building is assumed to be at the 1st floor.
Neglect basement since concrete stem walls at perimeter come up to first floor.

2- Use an average for roof height of 37 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) Y dir			
Level	**Force (kips)**	**length of wall (ft)**	**average shear stress (plf)**
3rd Flr Level	211	169.57	277
2nd Flr Level	328	122.21	597
1st flr Level	374	174.76	475

E-W direction (Transverse) X dir			
Level	**Force (kips)**	**length of wall (ft)**	**average shear stress (plf)**
3rd Flr Level	211	169.75	276
2nd Flr Level	328	125.25	582
1st flr Level	374	157.5	527