



Rating form completed by  
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DATE: 2019-06-30

## UC Santa Cruz building seismic ratings Cowell College Academic Building, Cowell College

CAAN #7130

518 Cowell-Stevenson Road, Santa Cruz, CA 95064

UCSC Campus: Main Campus



6/28/19



| Rating summary   | Entry                     | Notes  |
|--|---------------------------|--|
| UC Seismic Performance Level (rating)                                  | V (Poor)                  |  |
| Rating basis   | Tier 1                    | ASCE 41-17 <sup>1</sup>  |
| Date of rating   | 2019                      |  |
| Recommended UC Santa Cruz priority category for retrofit               | Priority A                | Priority A=Retrofit ASAP<br>Priority B=Retrofit at next permit application   |
| Ballpark total construction cost to retrofit to IV rating <sup>2</sup> | Medium (\$50/sf-\$200/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                       | To obtain lower seismic forces at the BSE-2E level for retrofit design. Also, verify diaphragm to wall connections |

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

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

**Building information used in this evaluation**

- Architectural drawings by Wurster, Bernardi and Emmons Architects, "Residential College Number One Unit 'B', University of California, Santa Cruz," as-built drawings dated December 12, 1966
- Structural drawings by Gilbert-Forsberg-Diekman-Schmidt Civil and Structural Engineers, "Residential College Number One, Unit 'B', University of California, Santa Cruz," as-built drawings dated December 12, 1966
- Site visit observations

**Additional building information known to exist**

- None

**Scope for completing this form**

Reviewed structural drawings for original construction and carried out an ASCE 41-17 Tier 1 evaluation. We made a site visit on May 21, 2019. We looked for potentially hazardous nonstructural components during the site visit. No nonstructural hazards were identified.

**Brief description of structure**

The Cowell College Academic Building (CAAN 7130) is one of six buildings that were the Unit "B" cluster of the Residential College No. 1 (now known as Cowell College) at the University of California, Santa Cruz. The Cowell College Academic Building, along with the Cowell College Commons, form what was known as the B3 building of the aforementioned cluster. The Cowell College Academic Building makes up the northwest wing (building) of the B3 building of the Unit "B" cluster. This ASCE 41-17 Tier 1 evaluation assessed the seismic deficiencies within the Cowell College Academic Building (CAAN 7134) and the north wing of Cowell College Commons (CAAN 7134), which has remained intact with the original construction meanwhile the southeastern portion of the Cowell College Commons has been retrofitted twice with the most recent retrofit taking place in 2009. These two buildings, the Cowell College Academic Building and the north wing of the Cowell College Commons, were evaluated together because both buildings are tied together through a shelter (or breezeway) at the second floor with a concrete slab and at the roof with a continuous roof structure.

The Cowell College Academic Building (CAAN 7130) is a two-story structure with a total square footage of about 9,150 sq. ft. The building consists of plywood diaphragms at the second floor and at the pitched roof. The plywood diaphragms span to interior stud walls and perimeter concrete shear walls. The walls are founded on strip footings, which are tied together with a concrete slab-on-grade. There is a staircase near the southeast corner of the building. The Cowell College Academic Building has a wooden trellis connected to its southern concrete shear walls. This wooden trellis is also connected to the Cowell College Classroom Building (CAAN 7132). Refer to the ASCE 41-17 Tier 1 Evaluation report for the Cowell College Classroom Building for the life-safety assessment of the wooden trellis. Additionally, the Cowell College Academic Building is connected at its northwestern side to the Cowell College Faculty Wing (CAAN 7133) with a concrete bridge at the second floor level. Both of the buildings' concrete shear walls and second floor plywood diaphragms are connected to this concrete bridge. Refer to the ASCE 41-17 Tier 1 Evaluation report for the Cowell College Faculty Wing for the life-safety assessment of the concrete bridge.

The north wing of the Cowell College Commons (CAAN 7134) that has not been retrofitted is a two-story structure, very similar to the Cowell College Academic Building (CAAN 7130), but with a smaller square footage of about 5,900 sq. ft. Similarly to the Academic Building, this "building" consists of plywood diaphragms at the second floor and at the pitched roof, which is essentially a continuous roof structure over the Academic Building, the shelter, and this north wing of the Cowell College Commons, as shown in the aerial photo from Google Maps. The plywood diaphragms span to interior stud walls and perimeter concrete shear walls. The walls are founded on strip footings, which are tied together with a concrete slab-on-grade. There is a staircase near the southeast corner of the building. It is important to note that there is no seismic gap or separation between the retrofitted portion of the Cowell College Commons and the unretrofitted north wing.

The shelter (or breezeway) connecting the Cowell College Academic Building and the north wing of the Cowell College Commons is a two-story structure with a square footage of about 2,469 sq. ft. The roof structure for the

shelter is a continuation from both the Academic Building to the west of the shelter and the north wing of the Cowell College Commons to the east of the shelter. The roof of the shelter consists of a plywood diaphragm spanning to wood trusses and rafters spanning to concrete columns and the perimeter concrete shear walls: the western wall of the north wing of the Cowell College Commons and the eastern wall of the Academic Building. The second floor of the shelter consists of a concrete waffle slab spanning to concrete columns and to the previously mentioned concrete shear walls. The concrete columns are founded on spread footings.

Identification of levels: First Floor, Second Floor, and Roof

Foundation system: Shallow foundation of strip and spread footings

Structural system for vertical (gravity) load: For the enclosed buildings: plywood sheathing diaphragm supported on wood framing at the pitched roof and second floor. At the roof, wood trusses span between the perimeter concrete shear walls, and at the second floor, wood joists span between the perimeter concrete shear walls. For the shelter (or breezeway): plywood sheathing diaphragm on wood framing at the pitched roof and a concrete waffle slab (slab with beams in both directions) at the second floor. The roof framing and second floor span to interior concrete columns.

Structural system for lateral forces: Plywood diaphragms at the roof and second floor levels to perimeter 8" thick concrete shear walls. All shear walls founded on strip footings tied together with 6" SOG. It was assumed that the concrete shear walls will resist the combined seismic forces induced by the combined masses of the Academic Building (CAAN 7130), the north wing of the Cowell College Commons (CAAN 7134), and the concrete shelter/breezeway.

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

The building has the following structural deficiencies per Tier 1 Quick checks for the Collapse Prevention performance objective at the BSE-2E seismic event:

1. Vertical mass irregularity may result in higher mode effects when looking into the dynamic response of the building.
2. Large diaphragm openings adjacent to shear walls may result in a reduced diaphragm capacity to transfer seismic loads to shear walls.
3. Discontinuous cross ties may result in cross ties not developing sufficient capacity to transfer out-of-plane wall demands to diaphragm.
4. Unblocked wood diaphragms with spans larger than 40 ft may not have sufficient capacity to resist diaphragm shear demands.
5. Existing out of plane wall anchorage with ledgers in cross grain bending at the second floor is inadequate to transfer diaphragm forces to concrete shear walls. Furthermore, the added seismic weight from the concrete shelter/breezeway and either the Academic Building or the north wing of the Cowell College Commons may lead to the failure of the interior diaphragms at the second floor level. The ledger will likely fail in cross grain bending.
6. The concrete shelter/breezeway should be further investigated to determine if seismic forces are being resisted by the columns. For this evaluation, it was assumed that the shelter only added weight to the overall concrete shear wall with flexible diaphragm system; no seismic resistance by the concrete columns was assumed. Failure of the concrete columns may lead to the collapse of the shelter and will be a falling hazard and life safety issue.

| 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) | Y               |

|                                    |   |  |   |
|------------------------------------|---|--|---|
| Load path                          | N | Liquefaction   | N |
| Adjacent buildings                 | Y | Slope failure  | N |
| Weak story                         | N | Surface fault rupture                                    | N |
| Soft story                         | N | Masonry or concrete wall anchorage at flexible diaphragm | Y |
| Geometry (vertical irregularities) | N | 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   | Y |
| Diaphragm continuity               | Y |  |   |

### Summary of review of non-structural life-safety concerns, including at exit routes.<sup>3</sup>

As discussed in the previous section, the concrete shelter may cause failure of the interior plywood diaphragms at the second floor in one of the enclosed buildings it connects. The shelter/breezeway may also be a falling hazard itself if the concrete columns fail. No other apparent non-structural Life Safety concerns were spotted during site visit.

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

### Discussion of rating

The following non-compliances in the Tier 1 checklist form the basis of rating:

1. Inadequate out of plane anchorage of the perimeter concrete shear walls at the plywood roof and second floor diaphragms.
2. Mass irregularity due to breezeway
3. No seismic gap between retrofitted and nonretrofitted portions of Cowell Commons building (CAAN 7134).
4. Large openings at the plywood (flexible) diaphragms adjacent to the concrete shear walls.
5. Discontinuous ties in the diaphragms, which are spanning more than 40 feet.

### Recommendations for further evaluation or retrofit

Tier 2 analysis is recommended to obtain more refined (lower) seismic forces at the BSE-2E level for retrofit design and to check the breezeway to concrete shear wall connection. Also, a Tier 2 analysis will help determine whether mass and vertical irregularities have any effects on the building response (i.e. are there higher mode effects that

<sup>3</sup> 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 non-structural hazards may occur.

need to be accounted for?). It is recommended to confirm the diaphragm to wall connections are per as-builts prior to evaluating and retrofitting these connections.

The following are possible retrofits to mitigate the identified seismic deficiencies:

1. Installing straps at ledgers to ensure proper shear transfer from the diaphragm to the concrete shear walls.
2. Installing ties or straps at joists to provide continuous ties at diaphragm and to shorten the unblocked diaphragm span and at joists around existing openings to strengthen diaphragm to transfer shear to the concrete walls.
3. Installing epoxied hold downs to strengthen out of plane anchors and to provide tie continuity at the diaphragm.
4. Installing additional plywood sheathing (with blocking and continuous chords) at the bottom face of existing framing (ceiling joists and girders) to strengthen existing diaphragms.
5. Installing blocking to increase diaphragm capacity.
6. Providing a seismic gap between the north wing (unretrofitted portion) of the Cowell College Commons (CAAN 7134) and the retrofitted portion of Cowell College Commons.

#### Peer review of rating

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

| Additional building data   | Entry          | Notes  |
|--|----------------|--|
| Latitude   | 36.997306      |  |
| Longitude  | -122.053472    |  |
| 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       | 0              |  |
| Building occupiable area (OGSF)                                  | 14,012 sq. ft. |  |
| Risk Category per 2016 CBC Table 1604.5                          | II             | Office and residential (dormitory) occupancies.      |
| Building structural height, $h_n$                                | 20.1 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, $\beta$                                  | 0.75           | Estimated using ASCE 41-17 equation 4-4 and 7-18     |
| Estimated fundamental period                                     | 0.19 sec       | Estimated using ASCE 41-17 equation 4-4 and 7-18     |

| Site data  |   |   |
|--|---|---|
| 975 yr hazard parameters $S_s, S_1$                      | 1.287, 0.488  |   |
| Site class   | D   |   |
| Site class basis   | Geotech <sup>4</sup>  | See footnote below  |
| Site parameters $F_a, F_v$                               | 1.2, 1.812  |   |
| Ground motion parameters $S_{cs}, S_{c1}$                | 1.545, 0.885  |   |
| $S_a$ at building period                                 | 1.545   |   |
| 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: 1966<br>Code: 1964 UBC                                 | Code inferred based on design year                                |
| Is this a benchmark building                             | No  |   |
| Is this a retrofit building?                             | No  |   |
| Applicable code for retrofit                             | N/A   |   |
| Model building data                                      |   |   |
| Model building type North-South                          | Concrete,C2a- Concrete Shear Walls (with Flexible Diaphragms) |   |
| Model building type East-West                            | Concrete,C2a- Concrete Shear Walls (with Flexible Diaphragms) |   |
| FEMA P-154 score   | N/A   | Not included here because we performed ASCE 41 Tier 1 evaluation. |
| Previous ratings   |   |   |
| Most recent rating                                       | Unknown   |   |
| Date of most recent rating                               | Unknown   |   |
| 2 <sup>nd</sup> most recent rating                       | -   |   |
| Date of 2 <sup>nd</sup> most recent rating               | -   |   |
| 3 <sup>rd</sup> most recent rating                       | -   |   |
| Date of 3 <sup>rd</sup> most recent rating               | -   |   |

<sup>4</sup> 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>

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**Appendices**

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ASCE 41 Tier 1 checklist included here?

Yes

Refer to attached checklist file in Appendix A.

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University of California, Santa Cruz  
ASCE 41-17 Tier 1 Seismic Evaluation  
7130 - Geisel Library - Cowell College Academic Building

Appendix A  
ASCE 41-17 Checklists



|                   |   |                 |   |           |                     |          |   |
|-------------------|---|-----------------|---|-----------|---------------------|----------|---|
| UC Campus:        | Santa Cruz                                      |                 |   | Date:     | 6/26/19             |          |   |
| Building CAAN:    | 7130  | Auxiliary CAAN: | - | By Firm:  | Degenkolb Engineers |          |   |
| Building Name:    | Cowell College Academic Building                |                 |   | Initials: | PN                  | Checked: |   |
| Building Address: | 518 Cowell-Stevenson Road, Santa Cruz, CA 95064 |                 |   | Page:     | 1                   | of       | 3 |

## ASCE 41-17 Collapse Prevention Basic Configuration Checklist

### LOW SEISMICITY

#### BUILDING SYSTEMS - GENERAL

|   | Description   |
|---|---|
| <b>C NC N/A U</b><br><input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | <b>LOAD PATH:</b> 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)<br><br><b>Comments:</b>  |
| <b>C NC N/A U</b><br><input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | <b>ADJACENT BUILDINGS:</b> 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)<br><br><b>Comments:</b><br>$1.5\%(29.7') \times 12"/ft = 5.35" < 13'-4"$ |
| <b>C NC N/A U</b><br><input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> | <b>MEZZANINES:</b> 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)<br><br><b>Comments:</b>   |

#### BUILDING SYSTEMS - BUILDING CONFIGURATION

|   | Description   |
|---|---|
| <b>C NC N/A U</b><br><input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | <b>WEAK STORY:</b> 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. A.2.2.2. Tier 2: Sec. 5.4.2.1)<br><br><b>Comments:</b>   |
| <b>C NC N/A U</b><br><input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | <b>SOFT STORY:</b> 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)<br><br><b>Comments:</b> |
| <b>C NC N/A U</b><br><input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | <b>VERTICAL IRREGULARITIES:</b> 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)<br><br><b>Comments:</b>  |

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

|                   |   |                 |   |           |                     |          |   |
|-------------------|---|-----------------|---|-----------|---------------------|----------|---|
| UC Campus:        | Santa Cruz                                      |                 |   | Date:     | 6/26/19             |          |   |
| Building CAAN:    | 7130  | Auxiliary CAAN: | - | By Firm:  | Degenkolb Engineers |          |   |
| Building Name:    | Cowell College Academic Building                |                 |   | Initials: | PN                  | Checked: |   |
| Building Address: | 518 Cowell-Stevenson Road, Santa Cruz, CA 95064 |                 |   | Page:     | 2                   | of       | 3 |

## ASCE 41-17 Collapse Prevention Basic Configuration Checklist

|   |  |
|---|--|
| <b>C</b> <b>NC</b> <b>N/A</b> <b>U</b><br><input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> | <p><b>GEOMETRY:</b> 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)</p> <p><b>Comments:</b></p> |
| <b>C</b> <b>NC</b> <b>N/A</b> <b>U</b><br><input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> | <p><b>MASS:</b> 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)</p> <p><b>Comments:</b><br/>(897k-565k)/565k = 59%</p>                            |
| <b>C</b> <b>NC</b> <b>N/A</b> <b>U</b><br><input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> | <p><b>TORSION:</b> 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)</p> <p><b>Comments:</b><br/>Symmetric building.</p>                    |

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

#### GEOLOGIC SITE HAZARD

|   | Description  |
|---|--|
| <b>C</b> <b>NC</b> <b>N/A</b> <b>U</b><br><input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> | <p><b>LIQUEFACTION:</b> 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)</p> <p><b>Comments:</b></p>         |
| <b>C</b> <b>NC</b> <b>N/A</b> <b>U</b><br><input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> | <p><b>SLOPE FAILURE:</b> 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)</p> <p><b>Comments:</b></p> |
| <b>C</b> <b>NC</b> <b>N/A</b> <b>U</b><br><input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> | <p><b>SURFACE FAULT RUPTURE:</b> 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)</p> <p><b>Comments:</b></p>  |

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|                   |   |                 |   |           |                     |          |   |
|-------------------|---|-----------------|---|-----------|---------------------|----------|---|
| UC Campus:        | Santa Cruz                                      |                 |   | Date:     | 6/26/19             |          |   |
| Building CAAN:    | 7130  | Auxiliary CAAN: | - | By Firm:  | Degenkolb Engineers |          |   |
| Building Name:    | Cowell College Academic Building                |                 |   | Initials: | PN                  | Checked: |   |
| Building Address: | 518 Cowell-Stevenson 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

|  | Description  |
|--|--|
| <b>C</b> <b>NC</b> <b>N/A</b> <b>U</b><br><input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | <p><b>OVERTURNING:</b> 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<sub>a</sub>. (Commentary: Sec. A.6.2.1. Tier 2: Sec. 5.4.3.3)</p> <p><b>Comments:</b><br/> <math>38.6'/20.1' = 1.92</math><br/> <math>0.6*1.545 = 0.927 &lt; 1.92</math> (OK)</p> |
| <b>C</b> <b>NC</b> <b>N/A</b> <b>U</b><br><input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | <p><b>TIES BETWEEN FOUNDATION ELEMENTS:</b> 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)</p> <p><b>Comments:</b><br/> Slab on grade tie spread footings together.</p>                       |

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

|                   |   |                 |   |           |                     |          |   |
|-------------------|---|-----------------|---|-----------|---------------------|----------|---|
| UC Campus:        | Santa Cruz                                      |                 |   | Date:     | 6/26/19             |          |   |
| Building CAAN:    | 7130  | Auxiliary CAAN: | - | By Firm:  | Degenkolb Engineers |          |   |
| Building Name:    | Cowell College Academic Building                |                 |   | Initials: | PN                  | Checked: |   |
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## ASCE 41-17 Collapse Prevention Structural Checklist For Building Type C2-C2A

### Low And Moderate Seismicity

#### Seismic-Force-Resisting System

|   | Description   |
|---|---|
| <b>C NC N/A U</b><br><input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | <b>COMPLETE FRAMES:</b> Steel or concrete frames classified as secondary components form a complete vertical-load-carrying system. (Commentary: Sec. A.3.1.6.1. Tier 2: Sec. 5.5.2.5.1)<br><br><b>Comments:</b>   |
| <b>C NC N/A U</b><br><input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | <b>REDUNDANCY:</b> 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)<br><br><b>Comments:</b><br>Two lines of shear walls in both directions in the Cowell College Academic Building (CAAN 7130) and two lines of shear walls in both directions in north wing of the Cowell College Commons (CAAN 7134). |
| <b>C NC N/A U</b><br><input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | <b>SHEAR STRESS CHECK:</b> The shear stress in the concrete shear walls, calculated using the Quick Check procedure of Section 4.4.3.3, is less than the greater of 100 lb/in. <sup>2</sup> (0.69 MPa) or $2\sqrt{f'_c}$ . (Commentary: Sec. A.3.2.2.1. Tier 2: Sec. 5.5.3.1.1)<br><br><b>Comments:</b><br>See quick checks. DCR < 1 (OK)   |
| <b>C NC N/A U</b><br><input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | <b>REINFORCING STEEL:</b> The ratio of reinforcing steel area to gross concrete area is not less than 0.0012 in the vertical direction and 0.0020 in the horizontal direction. (Commentary: Sec. A.3.2.2.2. Tier 2: Sec. 5.5.3.1.3)<br><br><b>Comments:</b><br>See quick checks   |

#### Connections

|   | Description   |
|---|---|
| <b>C NC N/A U</b><br><input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | <b>WALL ANCHORAGE AT FLEXIBLE DIAPHRAGMS:</b> Exterior concrete or masonry walls that are dependent on flexible diaphragms for lateral support are anchored for out-of-plane forces at each diaphragm level with steel anchors, reinforcing dowels, or straps that are developed into the diaphragm. Connections have strength to resist the connection force calculated in the Quick Check procedure of Section 4.4.3.7. (Commentary: Sec. A.5.1.1. Tier 2: Sec. 5.7.1.1)<br><br><b>Comments:</b><br>Although DCR <1 per Quick Checks, the anchorage is inadequate at the second floor diaphragm because the walls are anchored with a wood ledger, which will experience cross grain bending, and there is no development of strength from the wall to the diaphragm via a member joist. Refer to details 11/S13, 25/S13, 29/S13, and 11/S14. |
| <b>C NC N/A U</b><br><input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | <b>TRANSFER TO SHEAR WALLS:</b> Diaphragms are connected for transfer of seismic forces to the shear walls. (Commentary: Sec. A.5.2.1. Tier 2: Sec. 5.7.2)<br><br><b>Comments:</b><br>Yes with ledgers and top/bottom plates and edge/boundary nailing. Per detail 32/S13   |

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

|                   |   |                 |   |           |                     |          |   |
|-------------------|---|-----------------|---|-----------|---------------------|----------|---|
| UC Campus:        | Santa Cruz                                      |                 |   | Date:     | 6/26/19             |          |   |
| Building CAAN:    | 7130  | Auxiliary CAAN: | - | By Firm:  | Degenkolb Engineers |          |   |
| Building Name:    | Cowell College Academic Building                |                 |   | Initials: | PN                  | Checked: |   |
| Building Address: | 518 Cowell-Stevenson Road, Santa Cruz, CA 95064 |                 |   | Page:     | 2                   | of       | 3 |

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

|   |   |
|---|---|
| <b>C</b> <input checked="" type="checkbox"/> <b>NC</b> <input type="checkbox"/> <b>N/A</b> <input type="checkbox"/> <b>U</b> <input type="checkbox"/> | <b>FOUNDATION DOWELS:</b> Wall reinforcement is doweled into the foundation with vertical bars equal in size and spacing to the vertical wall reinforcing directly above the foundation. (Commentary: Sec. A.5.3.5. Tier 2: Sec. 5.7.3.4) |
|   | <b>Comments:</b><br><a href="#">Yes per detail 1/S12</a>  |

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

#### Seismic-Force-Resisting System

|   | Description   |
|---|---|
| <b>C</b> <input type="checkbox"/> <b>NC</b> <input type="checkbox"/> <b>N/A</b> <input checked="" type="checkbox"/> <b>U</b> <input type="checkbox"/> | <b>DEFLECTION COMPATIBILITY:</b> Secondary components have the shear capacity to develop the flexural strength of the components. (Commentary: Sec. A.3.1.6.2. Tier 2: Sec. 5.5.2.5.2)                              |
|   | <b>Comments:</b>  |
| <b>C</b> <input type="checkbox"/> <b>NC</b> <input type="checkbox"/> <b>N/A</b> <input checked="" type="checkbox"/> <b>U</b> <input type="checkbox"/> | <b>FLAT SLABS:</b> Flat slabs or plates not part of the seismic-force-resisting system have continuous bottom steel through the column joints. (Commentary: Sec. A.3.1.6.3. Tier 2: Sec. 5.5.2.5.3)                 |
|   | <b>Comments:</b>  |
| <b>C</b> <input type="checkbox"/> <b>NC</b> <input type="checkbox"/> <b>N/A</b> <input checked="" type="checkbox"/> <b>U</b> <input type="checkbox"/> | <b>COUPLING BEAMS:</b> The ends of both walls to which the coupling beam is attached are supported at each end to resist vertical loads caused by overturning. (Commentary: Sec. A.3.2.2.3. Tier 2: Sec. 5.5.3.2.1) |
|   | <b>Comments:</b><br><a href="#">No coupling beams are present</a>   |

#### Diaphragms (Stiff Or Flexible)

|   | Description   |
|---|---|
| <b>C</b> <input checked="" type="checkbox"/> <b>NC</b> <input type="checkbox"/> <b>N/A</b> <input type="checkbox"/> <b>U</b> <input type="checkbox"/> | <b>DIAPHRAGM CONTINUITY:</b> 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)             |
|   | <b>Comments:</b><br><a href="#">No split level diaphragms</a>   |
| <b>C</b> <input type="checkbox"/> <b>NC</b> <input checked="" type="checkbox"/> <b>N/A</b> <input type="checkbox"/> <b>U</b> <input type="checkbox"/> | <b>OPENINGS AT SHEAR WALLS:</b> Diaphragm openings immediately adjacent to the shear walls are less than 25% of the wall length. (Commentary: Sec. A.4.1.4. Tier 2: Sec. 5.6.1.3) |
|   | <b>Comments:</b><br>$10.5' / 38.58' = 27.2\%$ at 2 <sup>nd</sup> floor ceiling (roof) > 25%   |

|                   |   |                 |   |           |                     |          |   |
|-------------------|---|-----------------|---|-----------|---------------------|----------|---|
| UC Campus:        | Santa Cruz                                      |                 |   | Date:     | 6/26/19             |          |   |
| Building CAAN:    | 7130  | Auxiliary CAAN: | - | By Firm:  | Degenkolb Engineers |          |   |
| Building Name:    | Cowell College Academic Building                |                 |   | Initials: | PN                  | Checked: |   |
| Building Address: | 518 Cowell-Stevenson Road, Santa Cruz, CA 95064 |                 |   | Page:     | 3                   | of       | 3 |

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

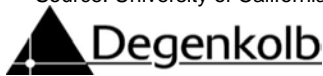
| Flexible Diaphragms                 |                                     |                                     |                          |   |  |  |  |
|-------------------------------------|-------------------------------------|-------------------------------------|--------------------------|---|--|--|--|
|                                     |                                     |                                     |                          | Description   |  |  |  |
| <b>C</b>                            | <b>NC</b>                           | <b>N/A</b>                          | <b>U</b>                 | CROSS TIES: There are continuous cross ties between diaphragm chords. (Commentary: Sec. A.4.1.2. Tier 2: Sec. 5.6.1.2)  |  |  |  |
| <input type="checkbox"/>            | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/> | <b>Comments:</b><br>Cross ties are not continuous.  |  |  |  |
| <b>C</b>                            | <b>NC</b>                           | <b>N/A</b>                          | <b>U</b>                 | 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)  |  |  |  |
| <input type="checkbox"/>            | <input type="checkbox"/>            | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <b>Comments:</b><br>Plywood sheathed diaphragm  |  |  |  |
| <b>C</b>                            | <b>NC</b>                           | <b>N/A</b>                          | <b>U</b>                 | 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)  |  |  |  |
| <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/>            | <input type="checkbox"/> | <b>Comments:</b><br>Plywood sheathed diaphragm  |  |  |  |
| <b>C</b>                            | <b>NC</b>                           | <b>N/A</b>                          | <b>U</b>                 | DIAGONALLY SHEATHED AND UNBLOCKED DIAPHRAGMS: All diagonally sheathed or unblocked wood structural panel diaphragms have horizontal spans less than 40 ft (12.2 m) and aspect ratios less than or equal to 4-to-1. (Commentary: Sec. A.4.2.3. Tier 2: Sec. 5.6.2) |  |  |  |
| <input type="checkbox"/>            | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/> | <b>Comments:</b><br>Aspect ratio = $78' / 39' = 2 < 4$ (OK)<br>$L = 78' > 40'$ (NG)   |  |  |  |
| <b>C</b>                            | <b>NC</b>                           | <b>N/A</b>                          | <b>U</b>                 | OTHER DIAPHRAGMS: Diaphragms do not consist of a system other than wood, metal deck, concrete, or horizontal bracing. (Commentary: Sec. A.4.7.1. Tier 2: Sec. 5.6.5)  |  |  |  |
| <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/>            | <input type="checkbox"/> | <b>Comments:</b>  |  |  |  |
| Connections                         |                                     |                                     |                          |   |  |  |  |
|                                     |                                     |                                     |                          | Description   |  |  |  |
| <b>C</b>                            | <b>NC</b>                           | <b>N/A</b>                          | <b>U</b>                 | UPLIFT AT PILE CAPS: Pile caps have top reinforcement, and piles are anchored to the pile caps. (Commentary: Sec. A.5.3.8. Tier 2: Sec. 5.7.3.5)  |  |  |  |
| <input type="checkbox"/>            | <input type="checkbox"/>            | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <b>Comments:</b><br>Spread and strip footings utilized.   |  |  |  |

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



University of California, Santa Cruz  
ASCE 41-17 Tier 1 Seismic Evaluation  
7130 - Cowell College Academic Building

Appendix B  
Quick Check Calculations



**WEIGHT TAKE-OFF FOR ACADEMIC BUILDING (CAAN 7130)**

|   |                                |                       |
|---|--------------------------------|-----------------------|
| <b>Subject:</b> Global Data                 | <b>Job Number:</b> B9959006.00 | <b>Date:</b> 06/21/19 |
| <b>Job:</b> UCSC Tier 1 Seismic Evaluations | <b>By:</b> PN                  | <b>Section:</b>       |
| CAAN 7130                                   | <b>Checked By:</b>             | <b>Page</b>           |

**GLOBAL DATA**

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

**SITE DATA:**

|                   |              |                                 |   |
|-------------------|--------------|---------------------------------|---|
| Latitude:         | 36.99731 °N  | 518 Cowell-Stevenson Road       | USGS Seismic Design Map Application:  |
| Longitude:        | 122.05347 °W | Santa Cruz, CA 95064            | <a href="http://geohazards.usgs.gov/hazardtool/application.php">http://geohazards.usgs.gov/hazardtool/application.php</a> |
| Site Class:       | D (default)  | ( Stiff Soil )                  | Site Class [ ASCE 41-17, §2.4.1.6 ]   |
| S <sub>s</sub> =  | 1.287 g      | ( USGS ) ( 5% / 50 years )      | USGS Mapped ( T = 0.2 sec ) [ ASCE 41-17, §2.4.1.3 ]  |
| S <sub>1</sub> =  | 0.488 g      | ( USGS ) ( 5% / 50 years )      | USGS Mapped ( T = 1.0 sec ) [ ASCE 41-17, §2.4.1.3 ]  |
| F <sub>a</sub> =  | 1.200        | ( Site Class D )                | Site Coefficient ( T = 0.2 sec ) [ ASCE 7-16, Table 11.4-1 ]  |
| F <sub>v</sub> =  | 1.812        | ( Site Class D )                | Site Coefficient ( T = 1.0 sec ) [ ASCE 7-16, Table 11.4-2 ]  |
| S <sub>XS</sub> = | 1.545 g      | = F <sub>a</sub> S <sub>s</sub> | Site-Adjusted Design ( T = 0.2 sec ) [ ASCE 41-17, Eq. 2-1 ]  |
| S <sub>X1</sub> = | 0.885 g      | = F <sub>v</sub> S <sub>1</sub> | Site-Adjusted Design ( T = 1.0 sec ) [ ASCE 41-17, Eq. 2-2 ]  |

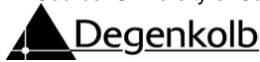
**BUILDING DATA:**

|                    |           |   |                           |
|--------------------|-----------|---|---------------------------|
| Building Type:     | C2A       | ( Concrete Shear Walls with Flexible Diaphragms ) | [ ASCE 41-17, Table 3-1 ] |
| Year Built:        | 1966      |   |                           |
| Number of Stories: | 2 stories | A/A10   |                           |
| Parapet Height:    | 0.00 ft   | B/A10   |                           |
| Roof Height:       | 20.08 ft  | B2/A10  |                           |
| Total Area:        | 9,151 sf  |   |                           |

| Level | Height [ ft ] | Elevation [ ft ] | Length <sub>N-S</sub> [ ft ] | Length <sub>E-W</sub> [ ft ] | Area [ sf ] | Diaphragm Stiffness | Diaphragm Description |
|-------|---------------|------------------|------------------------------|------------------------------|-------------|---------------------|-----------------------|
| Roof  | 8.1           | 20.1             | 39                           | 119                          | 4,575       | Flexible            | Plywood Sheathing     |
| 2nd   | 12.0          | 12.0             | 39                           | 119                          | 4,575       | Flexible            | Plywood Sheathing     |
| 1st   | 0.0           | 0.0              | 39                           | 119                          | 4,575       | -                   | -                     |







**WEIGHT TAKE-OFF FOR ACADEMIC BUILDING (CAAN 7130)**

|   |                                |                       |
|---|--------------------------------|-----------------------|
| <b>Subject:</b> Weight Take Off             | <b>Job Number:</b> B9959006.00 | <b>Date:</b> 06/21/19 |
| <b>Job:</b> UCSC Tier 1 Seismic Evaluations | <b>By:</b> PN                  | <b>Section:</b>       |
|   | <b>Checked By:</b>             | <b>Page:</b>          |

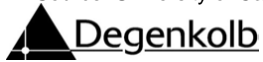
**WEIGHT TAKEOFF**

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

**FLOOR TYPE:** **FLR-2**

|                   |   |   |                   |          |   |
|-------------------|---|---|-------------------|----------|---|
|                   | Flooring  | @ | 15.0 psf          | 0.0 psf  | n |
| 1 in              | Floor Tiles (Linoleum Tile)                     | @ | 4.0 psf per inch  | 4.0 psf  | y |
| 0.75 in           | Wood Flooring (Hardwood)                        | @ | 4.6 psf per inch  | 0.0 psf  | n |
| 2 in              | Wood Blocks                                     | @ | 3.3 psf per inch  | 0.0 psf  | n |
| 2 in              | Asphalt Blocks                                  | @ | 12.0 psf per inch | 0.0 psf  | n |
| 0.75 in           | Mastic  | @ | 12.0 psf per inch | 0.0 psf  | n |
| 1 in              | Cement Finish                                   | @ | 12.0 psf per inch | 0.0 psf  | n |
| 2 in              | Mortar Bed                                      | @ | 12.0 psf per inch | 0.0 psf  | n |
| 2 in              | Floor Fill (Stone Concrete)                     | @ | 12.0 psf per inch | 0.0 psf  | n |
| 0.75 in           | Subflooring                                     | @ | 4.0 psf per inch  | 0.0 psf  | n |
|                   | Marble & Mortar, Stone Concrete                 | @ | 33.0 psf          | 0.0 psf  | n |
|                   | Solid Flat Tile, 1-in Mortar Base               | @ | 23.0 psf          | 0.0 psf  | n |
|                   | Floor Insulation                                | @ | 1.0 psf           | 0.0 psf  | n |
| 1 in              | Insulation (Rigid)                              | @ | 1.5 psf per inch  | 1.5 psf  | y |
| 1 in              | Insulation Boards (Fibrous Glass)               | @ | 1.1 psf per inch  | 0.0 psf  | n |
| 3 in              | Vermiculite Concrete                            | @ | 2.5 psf per inch  | 0.0 psf  | n |
| 0.5 in            | Fire Proofing                                   | @ | 2 psf per inch    | 0.0 psf  | n |
|                   | Diaphragm                                       | @ | 20.0 psf          | 0.0 psf  | n |
| 1.625 in          | Concrete Slab (Normal Weight)                   | @ | 12.5 psf per inch | 0.0 psf  | n |
| 1.63 in           | Concrete Fill (Light Weight)                    | @ | 9.2 psf per inch  | 14.9 psf | y |
| 0.5 in            | Concrete Overpour (Light Weight)                | @ | 9.2 psf per inch  | 0.0 psf  | n |
| 18 ga             | Bare Metal Deck                                 | @ | 3.0 psf           | 0.0 psf  | n |
| 2 in              | Wood Decking                                    | @ | 2.5 psf per inch  | 0.0 psf  | n |
| 2 in              | Wood Sheathing                                  | @ | 3.0 psf per inch  | 0.0 psf  | n |
| 0.625 in          | Plywood   | @ | 3.2 psf per inch  | 2.0 psf  | y |
|                   | Framing   | @ | 20.0 psf          | 0.0 psf  | n |
| 6 ft O.C.         | Steel Beams                                     | @ | 22.0 plf          | 0.0 psf  | n |
| 36 ft O.C.        | Steel Girders                                   | @ | 76.0 plf          | 0.0 psf  | n |
| 2 ft O.C.         | Wood Sub-Purlins                                | @ | 1.8 plf           | 0.0 psf  | n |
| 1.33 ft O.C.      | Wood Purlins                                    | @ | 1.8 plf           | 1.3 psf  | y |
| 8.00 ft O.C.      | Wood Girders                                    | @ | 8.8 plf           | 1.1 psf  | y |
| 8 ft O.C.         | Concrete Beams                                  | @ | 200.0 plf         | 0.0 psf  | n |
| 20 ft O.C.        | Concrete Girders                                | @ | 300.0 plf         | 0.0 psf  | n |
| 10.0 ft trib. ht. | Typical Columns (A <sub>col</sub> = 191 sf)     | @ | 57.1 plf          | 3.0 psf  | y |
|                   | Ceiling   | @ | 5.0 psf           | 5.0 psf  | y |
| 0.5 in            | Gypsum Board Ceiling                            | @ | 4.4 psf per inch  | 0.0 psf  | n |
|                   | Acoustical Fiber Board                          | @ | 1.0 psf           | 0.0 psf  | n |
|                   | Plaster Ceiling (On Tile)                       | @ | 5.0 psf           | 0.0 psf  | n |
|                   | Suspended Metal Lath & Plaster (Gypsum Plaster) | @ | 10.0 psf          | 0.0 psf  | n |
|                   | Suspended Steel Channel System                  | @ | 2.0 psf           | 0.0 psf  | n |
|                   | Suspended Wood Furring System                   | @ | 2.5 psf           | 0.0 psf  | n |
|                   | T-bar Ceiling System                            | @ | 3.0 psf           | 0.0 psf  | n |
| 50% floor area    | Interior Partitions (Above & Below)             | @ | 10.0 psf          | 5.0 psf  | y |
|                   | M.E.P.  | @ | 5.0 psf           | 5.0 psf  | y |
|                   | Miscellaneous                                   | @ | 1.2 psf           | 1.2 psf  | y |
|                   | Other   | @ | 1.0 psf           | 0.0 psf  | n |
|                   | Other   | @ | 1.0 psf           | 0.0 psf  | n |
|                   | Other   | @ | 1.0 psf           | 0.0 psf  | n |
|                   | Other   | @ | 1.0 psf           | 0.0 psf  | n |
|                   | Other   | @ | 1.0 psf           | 0.0 psf  | n |

**FLR-2 WEIGHT = 44.0 psf**



**WEIGHT TAKE-OFF FOR ACADEMIC BUILDING (CAAN 7130)**

|   |                                |                       |
|---|--------------------------------|-----------------------|
| <b>Subject:</b> Weight Take Off             | <b>Job Number:</b> B9959006.00 | <b>Date:</b> 06/21/19 |
| <b>Job:</b> UCSC Tier 1 Seismic Evaluations | <b>By:</b> PN                  | <b>Section:</b>       |
|   | <b>Checked By:</b>             | <b>Page:</b>          |

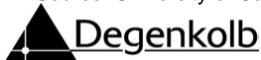
**WEIGHT TAKEOFF**

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

**WALL TYPE:** **WALL-P**

|            |   |   |                    |          |   |
|------------|---|---|--------------------|----------|---|
|            | Wall Covering                             | @ | 4.0 psf            | 4.0 psf  | y |
| 1 in       | Exterior Stucco                           | @ | 11.4 psf per inch. | 11.4 psf | y |
| 1 in       | Wood Sheathing                            | @ | 3.0 psf per inch   | 0.0 psf  | n |
| 0.5 in     | Gypsum Sheathing                          | @ | 4.0 psf per inch   | 0.0 psf  | n |
| 0.5 in     | Gypsum Wallboard                          | @ | 4.4 psf per inch   | 0.0 psf  | n |
|            | Porcelain Enamel Panels                   | @ | 5.0 psf            | 0.0 psf  | n |
|            | Metal Lath & Plaster (Gypsum Plaster)     | @ | 10.0 psf           | 0.0 psf  | n |
|            | Wall Insulation                           | @ | 1.0 psf            | 1.0 psf  | y |
| 1 in       | Insulation (Rigid)                        | @ | 1.5 psf per inch   | 0.0 psf  | n |
| 1 in       | Insulation Boards (Fiber Board)           | @ | 1.5 psf per inch   | 0.0 psf  | n |
| 0.5 in     | Fire Proofing                             | @ | 2 psf per inch     | 0.0 psf  | n |
|            | Wall Framing                              | @ | 20.0 psf           | 20.0 psf | y |
| 8 in       | Concrete Wall (Normal Weight)             | @ | 12.5 psf per inch  | 0.0 psf  | n |
| 8 in       | CMU Wall w/ Full Grouting (Normal Weight) | @ | 83.0 psf           | 0.0 psf  | n |
| 8 in       | Solid CMU Wall (Normal Weight)            | @ | 87.0 psf           | 0.0 psf  | n |
| 4 in       | HCB Wall w/ Full Grouting                 | @ | 38.0 psf           | 0.0 psf  | n |
| 3.5 in     | Solid Clay Brick Wall                     | @ | 11.1 psf per inch  | 0.0 psf  | n |
| 0.5 in     | Plywood                                   | @ | 3.2 psf per inch   | 0.0 psf  | n |
| 16 in O.C. | Wood Studs (2 x 4)                        | @ | 1.1 plf            | 0.0 psf  | n |
| 16 in O.C. | Metal Channel Studs                       | @ | 2.0 plf            | 0.0 psf  | n |
| 8 ft O.C.  | Steel Girts                               | @ | 6.0 plf            | 0.0 psf  | n |
|            | Miscellaneous                             | @ | 1.6 psf            | 1.6 psf  | y |
|            | Other                                     | @ | 1.0 psf            | 0.0 psf  | n |
|            | Other                                     | @ | 1.0 psf            | 0.0 psf  | n |
|            | Other                                     | @ | 1.0 psf            | 0.0 psf  | n |
|            | Other                                     | @ | 1.0 psf            | 0.0 psf  | n |
|            | Other                                     | @ | 1.0 psf            | 0.0 psf  | n |

Solid Wall Weight = 38.0 psf  
 Window & Door Weight = 8.0 psf  
 % Solid Wall = 100%  
**WALL-P WEIGHT = 38.0 psf**



**WEIGHT TAKE-OFF FOR ACADEMIC BUILDING (CAAN 7130)**

|   |                                |                       |
|---|--------------------------------|-----------------------|
| <b>Subject:</b> Weight Take Off             | <b>Job Number:</b> B9959006.00 | <b>Date:</b> 06/21/19 |
| <b>Job:</b> UCSC Tier 1 Seismic Evaluations | <b>By:</b> PN                  | <b>Section:</b>       |
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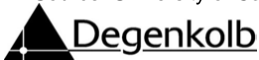
**WEIGHT TAKEOFF**

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

**WALL TYPE:** **WALL-R**

|            |   |   |                    |           |   |
|------------|---|---|--------------------|-----------|---|
|            | Wall Covering                               | @ | 4.0 psf            | 4.0 psf   | y |
| 1 in       | Exterior Stucco                             | @ | 11.4 psf per inch. | 0.0 psf   | n |
| 1 in       | Wood Sheathing                              | @ | 3.0 psf per inch   | 0.0 psf   | n |
| 0.5 in     | Gypsum Sheathing                            | @ | 4.0 psf per inch   | 0.0 psf   | n |
| 0.5 in     | Gypsum Wallboard                            | @ | 4.4 psf per inch   | 0.0 psf   | n |
|            | Porcelain Enamel Panels                     | @ | 5.0 psf            | 0.0 psf   | n |
|            | Metal Lath & Plaster ( Gypsum Plaster )     | @ | 10.0 psf           | 0.0 psf   | n |
|            | Wall Insulation                             | @ | 1.0 psf            | 1.0 psf   | y |
| 1 in       | Insulation ( Rigid )                        | @ | 1.5 psf per inch   | 0.0 psf   | n |
| 1 in       | Insulation Boards ( Fiber Board )           | @ | 1.5 psf per inch   | 0.0 psf   | n |
| 0.5 in     | Fire Proofing                               | @ | 2 psf per inch     | 0.0 psf   | n |
|            | Wall Framing                                | @ | 20.0 psf           | 0.0 psf   | n |
| 8 in       | Concrete Wall ( Normal Weight )             | @ | 12.5 psf per inch  | 100.0 psf | y |
| 8 in       | CMU Wall w/ Full Grouting ( Normal Weight ) | @ | 83.0 psf           | 0.0 psf   | n |
| 8 in       | Solid CMU Wall ( Normal Weight )            | @ | 87.0 psf           | 0.0 psf   | n |
| 4 in       | HCB Wall w/ Full Grouting                   | @ | 38.0 psf           | 0.0 psf   | n |
| 3.5 in     | Solid Clay Brick Wall                       | @ | 11.1 psf per inch  | 0.0 psf   | n |
| 0.5 in     | Plywood                                     | @ | 3.2 psf per inch   | 0.0 psf   | n |
| 16 in O.C. | Wood Studs ( 2 x 4 )                        | @ | 1.1 plf            | 0.0 psf   | n |
| 16 in O.C. | Metal Channel Studs                         | @ | 2.0 plf            | 0.0 psf   | n |
| 8 ft O.C.  | Steel Girts                                 | @ | 6.0 plf            | 0.0 psf   | n |
|            | Miscellaneous                               | @ | 1.0 psf            | 1.0 psf   | y |
|            | Other                                       | @ | 1.0 psf            | 0.0 psf   | n |
|            | Other                                       | @ | 1.0 psf            | 0.0 psf   | n |
|            | Other                                       | @ | 1.0 psf            | 0.0 psf   | n |
|            | Other                                       | @ | 1.0 psf            | 0.0 psf   | n |
|            | Other                                       | @ | 1.0 psf            | 0.0 psf   | n |

Solid Wall Weight = 106.0 psf  
 Window & Door Weight = 8.0 psf  
 % Solid Wall = 70%  
**WALL-R WEIGHT = 76.6 psf**



**WEIGHT TAKE-OFF FOR ACADEMIC BUILDING (CAAN 7130)**

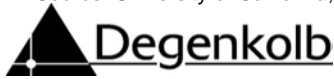
|   |                                |                       |
|---|--------------------------------|-----------------------|
| <b>Subject:</b> Weight Take Off             | <b>Job Number:</b> B9959006.00 | <b>Date:</b> 06/21/19 |
| <b>Job:</b> UCSC Tier 1 Seismic Evaluations | <b>By:</b> PN                  | <b>Section:</b>       |
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**WEIGHT TAKEOFF**  
 ASCE 41-17 SEISMIC EVALUATION & RETROFIT OF EXISTING BUILDINGS  
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 BSE-2E HAZARD LEVEL

**WALL TYPE:** **WALL-2**

|            |   |   |                    |           |   |
|------------|---|---|--------------------|-----------|---|
|            | Wall Covering                             | @ | 4.0 psf            | 4.0 psf   | y |
| 1 in       | Exterior Stucco                           | @ | 11.4 psf per inch. | 0.0 psf   | n |
| 1 in       | Wood Sheathing                            | @ | 3.0 psf per inch   | 0.0 psf   | n |
| 0.5 in     | Gypsum Sheathing                          | @ | 4.0 psf per inch   | 0.0 psf   | n |
| 0.5 in     | Gypsum Wallboard                          | @ | 4.4 psf per inch   | 0.0 psf   | n |
|            | Porcelain Enamel Panels                   | @ | 5.0 psf            | 0.0 psf   | n |
|            | Metal Lath & Plaster (Gypsum Plaster)     | @ | 10.0 psf           | 0.0 psf   | n |
|            | Wall Insulation                           | @ | 1.0 psf            | 1.0 psf   | y |
| 1 in       | Insulation (Rigid)                        | @ | 1.5 psf per inch   | 0.0 psf   | n |
| 1 in       | Insulation Boards (Fiber Board)           | @ | 1.5 psf per inch   | 0.0 psf   | n |
| 0.5 in     | Fire Proofing                             | @ | 2 psf per inch     | 0.0 psf   | n |
|            | Wall Framing                              | @ | 20.0 psf           | 0.0 psf   | n |
| 8 in       | Concrete Wall (Normal Weight)             | @ | 12.5 psf per inch  | 100.0 psf | y |
| 8 in       | CMU Wall w/ Full Grouting (Normal Weight) | @ | 83.0 psf           | 0.0 psf   | n |
| 8 in       | Solid CMU Wall (Normal Weight)            | @ | 87.0 psf           | 0.0 psf   | n |
| 4 in       | HCB Wall w/ Full Grouting                 | @ | 38.0 psf           | 0.0 psf   | n |
| 3.5 in     | Clay Brick Wall                           | @ | 11.1 psf per inch  | 0.0 psf   | n |
| 0.5 in     | Plywood                                   | @ | 3.2 psf per inch   | 0.0 psf   | n |
| 16 in O.C. | Wood Studs (2 x 4)                        | @ | 1.1 plf            | 0.0 psf   | n |
| 16 in O.C. | Metal Channel Studs                       | @ | 2.0 plf            | 0.0 psf   | n |
| 8 ft O.C.  | Steel Girts                               | @ | 6.0 plf            | 0.0 psf   | n |
|            | Miscellaneous                             | @ | 1.0 psf            | 1.0 psf   | y |
|            | Other                                     | @ | 1.0 psf            | 0.0 psf   | n |
|            | Other                                     | @ | 1.0 psf            | 0.0 psf   | n |
|            | Other                                     | @ | 1.0 psf            | 0.0 psf   | n |
|            | Other                                     | @ | 1.0 psf            | 0.0 psf   | n |
|            | Other                                     | @ | 1.0 psf            | 0.0 psf   | n |

Solid Wall Weight = 106.0 psf  
 Window & Door Weight = 8.0 psf  
 % Solid Wall = 70%  
**WALL-2 WEIGHT = 76.6 psf**



**WEIGHT TAKE-OFF FOR ACADEMIC BUILDING (CAAN 7130)**

|   |                                |                       |
|---|--------------------------------|-----------------------|
| <b>Subject:</b> Seismic Mass                | <b>Job Number:</b> B9959006.00 | <b>Date:</b> 06/21/19 |
| <b>Job:</b> UCSC Tier 1 Seismic Evaluations | <b>By:</b> PN                  | <b>Section:</b>       |
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**SEISMIC MASS**

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

**ROOF/FLOOR WEIGHT SUMMARY:**

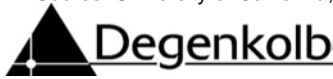
| Level Type | Weight [ psf ] |
|------------|----------------|
| ROOF       | 45             |
| FLR-2      | 44             |

**WALL WEIGHT SUMMARY:**

| Wall Type | Weight [ psf ] |       |          |
|-----------|----------------|-------|----------|
|           | Net            | Solid | Openings |
| WALL-P    | 38.0           | 38    | 8        |
| WALL-R    | 76.6           | 106   | 8        |
| WALL-2    | 76.6           | 106   | 8        |

**SEISMIC MASS SUMMARY:**

| Level | FLOOR      |                |             | WALL ABOVE |                |               |               | WALL BELOW |                |               |               | TOTAL WEIGHT [ kips ] |
|-------|------------|----------------|-------------|------------|----------------|---------------|---------------|------------|----------------|---------------|---------------|-----------------------|
|       | Level Type | Weight [ psf ] | Area [ sf ] | Wall Type  | Weight [ psf ] | Length [ ft ] | Height [ ft ] | Wall Type  | Weight [ psf ] | Length [ ft ] | Height [ ft ] |                       |
| Roof  | ROOF       | 45             | 4,575       | WALL-R     | 76.6           | 0             | 0.00          | WALL-R     | 76.6           | 314           | 4.04          | 303                   |
| 2nd   | FLR-2      | 44             | 4,575       | WALL-2     | 76.6           | 314           | 4.04          | WALL-2     | 76.6           | 314           | 6.00          | 443                   |
|       |            |                |             |            |                |               |               |            |                | <b>TOTAL</b>  |               | <b>746</b>            |



**WEIGHT TAKE-OFF FOR ACADEMIC BUILDING (CAAN 7130)**

|   |                                |                       |
|---|--------------------------------|-----------------------|
| <b>Subject:</b> Seismic Forces              | <b>Job Number:</b> B9959006.00 | <b>Date:</b> 06/21/19 |
| <b>Job:</b> UCSC Tier 1 Seismic Evaluations | <b>By:</b> PN                  | <b>Section:</b>       |
|   | <b>Checked By:</b>             | <b>Page:</b>          |

**SEISMIC FORCES**

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

**BUILDING TYPE:** C2A (Concrete Shear Walls with Flexible Diaphragms) [ ASCE 41-17, Table 3-1 ]  
**SITE CLASS:** D (default) #N/A [ ASCE 41-17, §2.4.1.6 ]

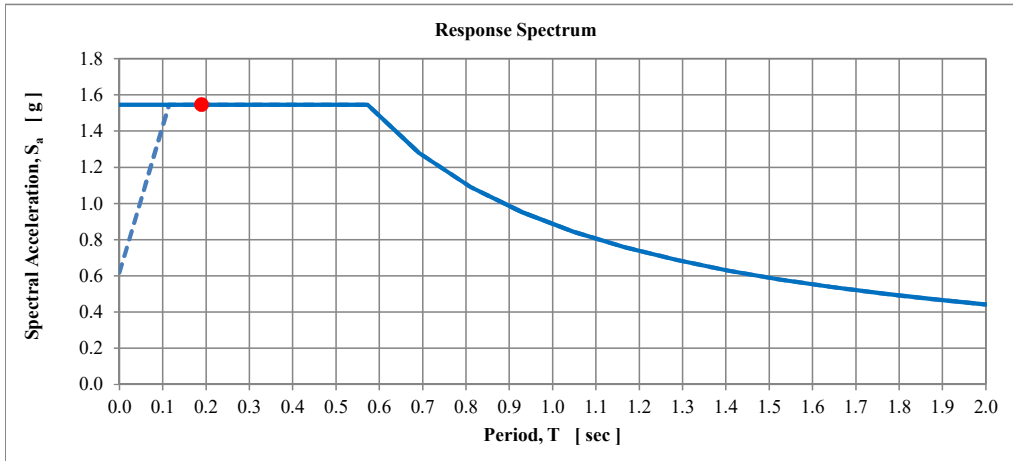
**DESIGN SPECTRAL ACCELERATIONS:**

$S_{XS}$  = 1.545 g (BSE-2E) Site-Adjusted Design ( T = 0.2 sec ) [ ASCE 41-17, Eq. 2-1 ]  
 $S_{X1}$  = 0.885 g (BSE-2E) Site-Adjusted Design ( T = 1.0 sec ) [ ASCE 41-17, Eq. 2-2 ]

**BUILDING PERIOD:**

$h_n$  = 20.1 ft (Base to Roof) Building Height [ ASCE 41-17, §4.4.2.4 ]  
 $C_t$  = 0.020 (Building Type C2A) Period Coefficient [ ASCE 41-17, §4.4.2.4 ]  
 $\beta$  = 0.750 (Building Type C2A) Period Exponent [ ASCE 41-17, §4.4.2.4 ]  
 $T$  = 0.190 sec =  $C_t h_n^\beta$  Fundamental Period [ ASCE 41-17, Eq. 4-4 ]

**RESPONSE SPECTRUM:**



**PSEUDO LATERAL FORCE:**

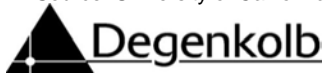
$n$  = 2 (n = 2) Total Number of Stories  
 $C$  = 1.0 (Building Type C2A) Modification Factor [ ASCE 41-17, Table 4-7 ]  
 $S_a$  = 1.545 g = MIN {  $S_{X1} / T$ ,  $S_{XS}$  } Spectral Acceleration [ ASCE 41-17, Eq. 4-3 ]  
 $V$  = **1.545 W** =  $C S_a W$  Pseudo Lateral Force [ ASCE 41-17, Eq. 4-1 ]

**VERTICAL DISTRIBUTION OF SEISMIC FORCES:**

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

| Level        | $h_x$<br>[ ft ] | $w_x$<br>[ kips ] | $w_x h_x^k$   | $C_{vx}$    | $F_x$<br>[ kips ] | $V_j$<br>[ kips ] |
|--------------|-----------------|-------------------|---------------|-------------|-------------------|-------------------|
| Roof         | 20.1            | 303               | 6,089         | 0.53        | 616               | 616               |
| 2nd          | 12.0            | 443               | 5,317         | 0.47        | 537               | 1,153             |
| <b>TOTAL</b> | -               | <b>746</b>        | <b>11,407</b> | <b>1.00</b> | <b>1,153</b>      | -                 |

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



**WEIGHT TAKE-OFF FOR NORTH WING OF COWELL COLLEGE COMMONS (CAAN 7134)**

|   |                                |                       |
|---|--------------------------------|-----------------------|
| <b>Subject:</b> Global Data                 | <b>Job Number:</b> B9959006.00 | <b>Date:</b> 06/21/19 |
| <b>Job:</b> UCSC Tier 1 Seismic Evaluations | <b>By:</b> PN                  | <b>Section:</b>       |
| CAAN 7134 North Wing                        | <b>Checked By:</b>             | <b>Page</b>           |

**GLOBAL DATA**

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

**SITE DATA:**

|                   |              |                                 |   |
|-------------------|--------------|---------------------------------|---|
| Latitude:         | 36.99731 °N  | 520 Cowell-Stevenson Road       | USGS Seismic Design Map Application:  |
| Longitude:        | 122.05347 °W | Santa Cruz, CA 95064            | <a href="http://geohazards.usgs.gov/hazardtool/application.php">http://geohazards.usgs.gov/hazardtool/application.php</a> |
| Site Class:       | D (default)  | ( Stiff Soil )                  | Site Class [ ASCE 41-17, §2.4.1.6 ]   |
| S <sub>s</sub> =  | 1.287 g      | ( USGS ) ( 5% / 50 years )      | USGS Mapped ( T = 0.2 sec ) [ ASCE 41-17, §2.4.1.3 ]  |
| S <sub>1</sub> =  | 0.488 g      | ( USGS ) ( 5% / 50 years )      | USGS Mapped ( T = 1.0 sec ) [ ASCE 41-17, §2.4.1.3 ]  |
| F <sub>a</sub> =  | 1.200        | ( Site Class D )                | Site Coefficient ( T = 0.2 sec ) [ ASCE 7-16, Table 11.4-1 ]  |
| F <sub>v</sub> =  | 1.812        | ( Site Class D )                | Site Coefficient ( T = 1.0 sec ) [ ASCE 7-16, Table 11.4-2 ]  |
| S <sub>XS</sub> = | 1.545 g      | = F <sub>a</sub> S <sub>s</sub> | Site-Adjusted Design ( T = 0.2 sec ) [ ASCE 41-17, Eq. 2-1 ]  |
| S <sub>X1</sub> = | 0.885 g      | = F <sub>v</sub> S <sub>1</sub> | Site-Adjusted Design ( T = 1.0 sec ) [ ASCE 41-17, Eq. 2-2 ]  |

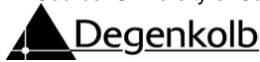
**BUILDING DATA:**

|                    |           |   |                           |
|--------------------|-----------|---|---------------------------|
| Building Type:     | C2A       | ( Concrete Shear Walls with Flexible Diaphragms ) | [ ASCE 41-17, Table 3-1 ] |
| Year Built:        | 1966      |   |                           |
| Number of Stories: | 2 stories | A/A10   |                           |
| Parapet Height:    | 0.00 ft   | B/A10   |                           |
| Roof Height:       | 20.08 ft  | B2/A10  |                           |
| Total Area:        | 5,897 sf  |   |                           |

| Level | Height [ ft ] | Elevation [ ft ] | Length <sub>N-S</sub> [ ft ] | Length <sub>E-W</sub> [ ft ] | Area [ sf ] | Diaphragm Stiffness | Diaphragm Description |
|-------|---------------|------------------|------------------------------|------------------------------|-------------|---------------------|-----------------------|
| Roof  | 8.1           | 20.1             | 39                           | 76                           | 2,948       | Flexible            | Plywood Sheathing     |
| 2nd   | 12.0          | 12.0             | 39                           | 76                           | 2,948       | Flexible            | Plywood Sheathing     |
| 1st   | 0.0           | 0.0              | 39                           | 76                           | 2,948       | -                   | -                     |







**WEIGHT TAKE-OFF FOR NORTH WING OF COWELL COLLEGE COMMONS (CAAN 7134)**

|   |                    |                 |
|---|--------------------|-----------------|
| <b>Subject:</b> Weight Take Off             | <b>By:</b> PN      | <b>Section:</b> |
| <b>Job:</b> UCSC Tier 1 Seismic Evaluations | <b>Checked By:</b> | <b>Page:</b>    |

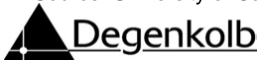
**WEIGHT TAKEOFF**

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

**FLOOR TYPE:** FLR-2

|                   |   |   |                   |          |   |
|-------------------|---|---|-------------------|----------|---|
|                   | Flooring  | @ | 15.0 psf          | 0.0 psf  | n |
| 1 in              | Floor Tiles (Linoleum Tile)                     | @ | 4.0 psf per inch  | 4.0 psf  | y |
| 2 in              | Wood Flooring (Softwood)                        | @ | 3.3 psf per inch  | 0.0 psf  | n |
| 2 in              | Wood Blocks                                     | @ | 3.3 psf per inch  | 0.0 psf  | n |
| 2 in              | Asphalt Blocks                                  | @ | 12.0 psf per inch | 0.0 psf  | n |
| 0.75 in           | Mastic  | @ | 12.0 psf per inch | 0.0 psf  | n |
| 1 in              | Cement Finish                                   | @ | 12.0 psf per inch | 0.0 psf  | n |
| 2 in              | Mortar Bed                                      | @ | 12.0 psf per inch | 0.0 psf  | n |
| 2 in              | Floor Fill (Stone Concrete)                     | @ | 12.0 psf per inch | 0.0 psf  | n |
| 0.75 in           | Subflooring                                     | @ | 4.0 psf per inch  | 0.0 psf  | n |
|                   | Marble & Mortar, Stone Concrete                 | @ | 33.0 psf          | 0.0 psf  | n |
|                   | Solid Flat Tile, 1-in Mortar Base               | @ | 23.0 psf          | 0.0 psf  | n |
|                   | Floor Insulation                                | @ | 1.0 psf           | 0.0 psf  | n |
| 1 in              | Insulation (Rigid)                              | @ | 1.5 psf per inch  | 1.5 psf  | y |
| 1 in              | Insulation Boards (Fibrous Glass)               | @ | 1.1 psf per inch  | 0.0 psf  | n |
| 3 in              | Vermiculite Concrete                            | @ | 2.5 psf per inch  | 0.0 psf  | n |
| 0.5 in            | Fire Proofing                                   | @ | 2 psf per inch    | 0.0 psf  | n |
|                   | Diaphragm                                       | @ | 20.0 psf          | 0.0 psf  | n |
| 1.625 in          | Concrete Slab (Normal Weight)                   | @ | 12.5 psf per inch | 0.0 psf  | n |
| 1.625 in          | Concrete Fill (Light Weight)                    | @ | 9.2 psf per inch  | 14.9 psf | y |
| 0.5 in            | Concrete Overpour (Light Weight)                | @ | 9.2 psf per inch  | 0.0 psf  | n |
| 18 ga             | Bare Metal Deck                                 | @ | 3.0 psf           | 0.0 psf  | n |
| 2 in              | Wood Decking                                    | @ | 2.5 psf per inch  | 0.0 psf  | n |
| 2 in              | Wood Sheathing                                  | @ | 3.0 psf per inch  | 0.0 psf  | n |
| 0.625 in          | Plywood   | @ | 3.2 psf per inch  | 2.0 psf  | y |
|                   | Framing   | @ | 20.0 psf          | 0.0 psf  | n |
| 6 ft O.C.         | Steel Beams                                     | @ | 22.0 plf          | 0.0 psf  | n |
| 36 ft O.C.        | Steel Girders                                   | @ | 76.0 plf          | 0.0 psf  | n |
| 2 ft O.C.         | Wood Sub-Purlins                                | @ | 1.8 plf           | 0.0 psf  | n |
| 1.33 ft O.C.      | Wood Purlins                                    | @ | 1.8 plf           | 1.3 psf  | y |
| 8.00 ft O.C.      | Wood Girders                                    | @ | 8.8 plf           | 1.1 psf  | y |
| 8 ft O.C.         | Concrete Beams                                  | @ | 200.0 plf         | 0.0 psf  | n |
| 20 ft O.C.        | Concrete Girders                                | @ | 300.0 plf         | 0.0 psf  | n |
| 10.0 ft trib. ht. | Concrete Columns (A <sub>col</sub> = 123 sf)    | @ | 57.1 plf          | 4.7 psf  | y |
|                   | Ceiling   | @ | 5.0 psf           | 5.0 psf  | y |
| 0.5 in            | Gypsum Board Ceiling                            | @ | 4.4 psf per inch  | 0.0 psf  | n |
|                   | Acoustical Fiber Board                          | @ | 1.0 psf           | 0.0 psf  | n |
|                   | Plaster Ceiling (On Tile)                       | @ | 5.0 psf           | 0.0 psf  | n |
|                   | Suspended Metal Lath & Plaster (Gypsum Plaster) | @ | 10.0 psf          | 0.0 psf  | n |
|                   | Suspended Steel Channel System                  | @ | 2.0 psf           | 0.0 psf  | n |
|                   | Suspended Wood Furring System                   | @ | 2.5 psf           | 0.0 psf  | n |
|                   | T-bar Ceiling System                            | @ | 3.0 psf           | 0.0 psf  | n |
| 50% floor area    | Interior Partitions (Above & Below)             | @ | 10.0 psf          | 5.0 psf  | y |
|                   | M.E.P.  | @ | 5.0 psf           | 5.0 psf  | y |
|                   | Miscellaneous                                   | @ | 1.5 psf           | 1.5 psf  | y |
|                   | Other   | @ | 1.0 psf           | 0.0 psf  | n |
|                   | Other   | @ | 1.0 psf           | 0.0 psf  | n |
|                   | Other   | @ | 1.0 psf           | 0.0 psf  | n |
|                   | Other   | @ | 1.0 psf           | 0.0 psf  | n |
|                   | Other   | @ | 1.0 psf           | 0.0 psf  | n |

**FLR-2 WEIGHT = 46.0 psf**



**WEIGHT TAKE-OFF FOR NORTH WING OF COWELL COLLEGE COMMONS (CAAN 7134)**

|   |                    |                 |
|---|--------------------|-----------------|
| <b>Subject:</b> Weight Take Off             | <b>By:</b> PN      | <b>Section:</b> |
| <b>Job:</b> UCSC Tier 1 Seismic Evaluations | <b>Checked By:</b> | <b>Page:</b>    |

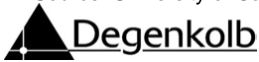
**WEIGHT TAKEOFF**

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

**WALL TYPE:** WALL-P

|            |   |   |                    |          |   |
|------------|---|---|--------------------|----------|---|
|            | Wall Covering                             | @ | 4.0 psf            | 4.0 psf  | y |
| 1 in       | Exterior Stucco                           | @ | 11.4 psf per inch. | 11.4 psf | y |
| 1 in       | Wood Sheathing                            | @ | 3.0 psf per inch   | 0.0 psf  | n |
| 0.5 in     | Gypsum Sheathing                          | @ | 4.0 psf per inch   | 0.0 psf  | n |
| 0.5 in     | Gypsum Wallboard                          | @ | 4.4 psf per inch   | 0.0 psf  | n |
|            | Porcelain Enamel Panels                   | @ | 5.0 psf            | 0.0 psf  | n |
|            | Metal Lath & Plaster (Gypsum Plaster)     | @ | 10.0 psf           | 0.0 psf  | n |
|            | Wall Insulation                           | @ | 1.0 psf            | 1.0 psf  | y |
| 1 in       | Insulation (Rigid)                        | @ | 1.5 psf per inch   | 0.0 psf  | n |
| 1 in       | Insulation Boards (Fiber Board)           | @ | 1.5 psf per inch   | 0.0 psf  | n |
| 0.5 in     | Fire Proofing                             | @ | 2 psf per inch     | 0.0 psf  | n |
|            | Wall Framing                              | @ | 20.0 psf           | 20.0 psf | y |
| 8 in       | Concrete Wall (Normal Weight)             | @ | 12.5 psf per inch  | 0.0 psf  | n |
| 8 in       | CMU Wall w/ Full Grouting (Normal Weight) | @ | 83.0 psf           | 0.0 psf  | n |
| 8 in       | Solid CMU Wall (Normal Weight)            | @ | 87.0 psf           | 0.0 psf  | n |
| 4 in       | HCB Wall w/ Full Grouting                 | @ | 38.0 psf           | 0.0 psf  | n |
| 3.5 in     | Solid Clay Brick Wall                     | @ | 11.1 psf per inch  | 0.0 psf  | n |
| 0.5 in     | Plywood                                   | @ | 3.2 psf per inch   | 0.0 psf  | n |
| 16 in O.C. | Wood Studs (2 x 4)                        | @ | 1.1 plf            | 0.0 psf  | n |
| 16 in O.C. | Metal Channel Studs                       | @ | 2.0 plf            | 0.0 psf  | n |
| 8 ft O.C.  | Steel Girts                               | @ | 6.0 plf            | 0.0 psf  | n |
|            | Miscellaneous                             | @ | 1.6 psf            | 1.6 psf  | y |
|            | Other                                     | @ | 1.0 psf            | 0.0 psf  | n |
|            | Other                                     | @ | 1.0 psf            | 0.0 psf  | n |
|            | Other                                     | @ | 1.0 psf            | 0.0 psf  | n |
|            | Other                                     | @ | 1.0 psf            | 0.0 psf  | n |
|            | Other                                     | @ | 1.0 psf            | 0.0 psf  | n |

Solid Wall Weight = 38.0 psf  
 Window & Door Weight = 8.0 psf  
 % Solid Wall = 100%  
**WALL-P WEIGHT = 38.0 psf**



**WEIGHT TAKE-OFF FOR NORTH WING OF COWELL COLLEGE COMMONS (CAAN 7134)**

|   |                    |                 |
|---|--------------------|-----------------|
| <b>Subject:</b> Weight Take Off             | <b>By:</b> PN      | <b>Section:</b> |
| <b>Job:</b> UCSC Tier 1 Seismic Evaluations | <b>Checked By:</b> | <b>Page:</b>    |

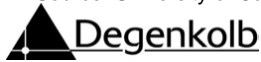
**WEIGHT TAKEOFF**

ASCE 41-17 SEISMIC EVALUATION & RETROFIT OF EXISTING BUILDINGS  
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 BSE-2E HAZARD LEVEL

**WALL TYPE: WALL-R**

|            |   |   |                    |           |   |
|------------|---|---|--------------------|-----------|---|
|            | Wall Covering                             | @ | 4.0 psf            | 4.0 psf   | y |
| 1 in       | Exterior Stucco                           | @ | 11.4 psf per inch. | 0.0 psf   | n |
| 1 in       | Wood Sheathing                            | @ | 3.0 psf per inch   | 0.0 psf   | n |
| 0.5 in     | Gypsum Sheathing                          | @ | 4.0 psf per inch   | 0.0 psf   | n |
| 0.5 in     | Gypsum Wallboard                          | @ | 4.4 psf per inch   | 0.0 psf   | n |
|            | Porcelain Enamel Panels                   | @ | 5.0 psf            | 0.0 psf   | n |
|            | Metal Lath & Plaster (Gypsum Plaster)     | @ | 10.0 psf           | 0.0 psf   | n |
|            | Wall Insulation                           | @ | 1.0 psf            | 1.0 psf   | y |
| 1 in       | Insulation (Rigid)                        | @ | 1.5 psf per inch   | 0.0 psf   | n |
| 1 in       | Insulation Boards (Fiber Board)           | @ | 1.5 psf per inch   | 0.0 psf   | n |
| 0.5 in     | Fire Proofing                             | @ | 2 psf per inch     | 0.0 psf   | n |
|            | Wall Framing                              | @ | 20.0 psf           | 0.0 psf   | n |
| 8 in       | Concrete Wall (Normal Weight)             | @ | 12.5 psf per inch  | 100.0 psf | y |
| 8 in       | CMU Wall w/ Full Grouting (Normal Weight) | @ | 83.0 psf           | 0.0 psf   | n |
| 8 in       | Solid CMU Wall (Normal Weight)            | @ | 87.0 psf           | 0.0 psf   | n |
| 4 in       | HCB Wall w/ Full Grouting                 | @ | 38.0 psf           | 0.0 psf   | n |
| 3.5 in     | Solid Clay Brick Wall                     | @ | 11.1 psf per inch  | 0.0 psf   | n |
| 0.5 in     | Plywood                                   | @ | 3.2 psf per inch   | 0.0 psf   | n |
| 16 in O.C. | Wood Studs (2 x 4)                        | @ | 1.1 plf            | 0.0 psf   | n |
| 16 in O.C. | Metal Channel Studs                       | @ | 2.0 plf            | 0.0 psf   | n |
| 8 ft O.C.  | Steel Girts                               | @ | 6.0 plf            | 0.0 psf   | n |
|            | Miscellaneous                             | @ | 1.0 psf            | 1.0 psf   | y |
|            | Other                                     | @ | 1.0 psf            | 0.0 psf   | n |
|            | Other                                     | @ | 1.0 psf            | 0.0 psf   | n |
|            | Other                                     | @ | 1.0 psf            | 0.0 psf   | n |
|            | Other                                     | @ | 1.0 psf            | 0.0 psf   | n |
|            | Other                                     | @ | 1.0 psf            | 0.0 psf   | n |

Solid Wall Weight = 106.0 psf  
 Window & Door Weight = 8.0 psf  
 % Solid Wall = 70%  
**WALL-R WEIGHT = 76.6 psf**



**WEIGHT TAKE-OFF FOR NORTH WING OF COWELL COLLEGE COMMONS (CAAN 7134)**

|   |                    |                 |
|---|--------------------|-----------------|
| <b>Subject:</b> Weight Take Off             | <b>By:</b> PN      | <b>Section:</b> |
| <b>Job:</b> UCSC Tier 1 Seismic Evaluations | <b>Checked By:</b> | <b>Page:</b>    |

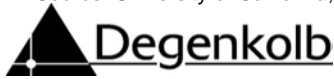
**WEIGHT TAKEOFF**

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

**WALL TYPE:** WALL-2

|            |   |   |                    |           |   |
|------------|---|---|--------------------|-----------|---|
|            | Wall Covering                             | @ | 4.0 psf            | 4.0 psf   | y |
| 1 in       | Exterior Stucco                           | @ | 11.4 psf per inch. | 0.0 psf   | n |
| 1 in       | Wood Sheathing                            | @ | 3.0 psf per inch   | 0.0 psf   | n |
| 0.5 in     | Gypsum Sheathing                          | @ | 4.0 psf per inch   | 0.0 psf   | n |
| 0.5 in     | Gypsum Wallboard                          | @ | 4.4 psf per inch   | 0.0 psf   | n |
|            | Porcelain Enamel Panels                   | @ | 5.0 psf            | 0.0 psf   | n |
|            | Metal Lath & Plaster (Gypsum Plaster)     | @ | 10.0 psf           | 0.0 psf   | n |
|            | Wall Insulation                           | @ | 1.0 psf            | 1.0 psf   | y |
| 1 in       | Insulation (Rigid)                        | @ | 1.5 psf per inch   | 0.0 psf   | n |
| 1 in       | Insulation Boards (Fiber Board)           | @ | 1.5 psf per inch   | 0.0 psf   | n |
| 0.5 in     | Fire Proofing                             | @ | 2 psf per inch     | 0.0 psf   | n |
|            | Wall Framing                              | @ | 20.0 psf           | 0.0 psf   | n |
| 8 in       | Concrete Wall (Normal Weight)             | @ | 12.5 psf per inch  | 100.0 psf | y |
| 8 in       | CMU Wall w/ Full Grouting (Normal Weight) | @ | 83.0 psf           | 0.0 psf   | n |
| 8 in       | Solid CMU Wall (Normal Weight)            | @ | 87.0 psf           | 0.0 psf   | n |
| 4 in       | HCB Wall w/ Full Grouting                 | @ | 38.0 psf           | 0.0 psf   | n |
| 3.5 in     | Clay Brick Wall                           | @ | 11.1 psf per inch  | 0.0 psf   | n |
| 0.5 in     | Plywood                                   | @ | 3.2 psf per inch   | 0.0 psf   | n |
| 16 in O.C. | Wood Studs (2 x 4)                        | @ | 1.1 plf            | 0.0 psf   | n |
| 16 in O.C. | Metal Channel Studs                       | @ | 2.0 plf            | 0.0 psf   | n |
| 8 ft O.C.  | Steel Girts                               | @ | 6.0 plf            | 0.0 psf   | n |
|            | Miscellaneous                             | @ | 1.0 psf            | 1.0 psf   | y |
|            | Other                                     | @ | 1.0 psf            | 0.0 psf   | n |
|            | Other                                     | @ | 1.0 psf            | 0.0 psf   | n |
|            | Other                                     | @ | 1.0 psf            | 0.0 psf   | n |
|            | Other                                     | @ | 1.0 psf            | 0.0 psf   | n |
|            | Other                                     | @ | 1.0 psf            | 0.0 psf   | n |

Solid Wall Weight = 106.0 psf  
 Window & Door Weight = 8.0 psf  
 % Solid Wall = 70%  
**WALL-2 WEIGHT = 76.6 psf**



**WEIGHT TAKE-OFF FOR NORTH WING OF COWELL COLLEGE COMMONS (CAAN 7134)**

|   |                                |                       |
|---|--------------------------------|-----------------------|
| <b>Subject:</b> Seismic Mass                | <b>Job Number:</b> B9959006.00 | <b>Date:</b> 06/21/19 |
| <b>Job:</b> UCSC Tier 1 Seismic Evaluations | <b>By:</b> PN                  | <b>Section:</b>       |
|   | <b>Checked By:</b>             | <b>Page:</b>          |

**SEISMIC MASS**

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 COLLAPSE PREVENTION  
 BSE-2E HAZARD LEVEL

**ROOF/FLOOR WEIGHT SUMMARY:**

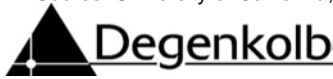
| Level Type | Weight [ psf ] |
|------------|----------------|
| ROOF       | 45             |
| FLR-2      | 46             |

**WALL WEIGHT SUMMARY:**

| Wall Type | Weight [ psf ] |       |          |
|-----------|----------------|-------|----------|
|           | Net            | Solid | Openings |
| WALL-R    | 76.6           | 106   | 8        |
| WALL-2    | 76.6           | 106   | 8        |

**SEISMIC MASS SUMMARY:**

| Level | FLOOR      |                |             | WALL ABOVE |                |               |               | WALL BELOW |                |               |               | TOTAL WEIGHT [ kips ] |
|-------|------------|----------------|-------------|------------|----------------|---------------|---------------|------------|----------------|---------------|---------------|-----------------------|
|       | Level Type | Weight [ psf ] | Area [ sf ] | Wall Type  | Weight [ psf ] | Length [ ft ] | Height [ ft ] | Wall Type  | Weight [ psf ] | Length [ ft ] | Height [ ft ] |                       |
| Roof  | ROOF       | 45             | 2,948       | WALL-R     | 76.6           | 0             | 0.00          | WALL-R     | 76.6           | 230           | 4.04          | 204                   |
| 2nd   | FLR-2      | 46             | 2,948       | WALL-2     | 76.6           | 230           | 4.04          | WALL-2     | 76.6           | 230           | 6.00          | 313                   |
|       |            |                |             |            |                |               |               |            |                | <b>TOTAL</b>  |               | <b>516</b>            |



**WEIGHT TAKE-OFF FOR NORTH WING OF COWELL COLLEGE COMMONS (CAAN 7134)**

|   |                                |                       |
|---|--------------------------------|-----------------------|
| <b>Subject:</b> Seismic Forces              | <b>Job Number:</b> B9959006.00 | <b>Date:</b> 06/21/19 |
| <b>Job:</b> UCSC Tier 1 Seismic Evaluations | <b>By:</b> PN                  | <b>Section:</b>       |
|   | <b>Checked By:</b>             | <b>Page:</b>          |

**SEISMIC FORCES**

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 BSE-2E HAZARD LEVEL

**BUILDING TYPE:** C2A (Concrete Shear Walls with Flexible Diaphragms) [ ASCE 41-17, Table 3-1 ]  
**SITE CLASS:** D (default) #N/A [ ASCE 41-17, §2.4.1.6 ]

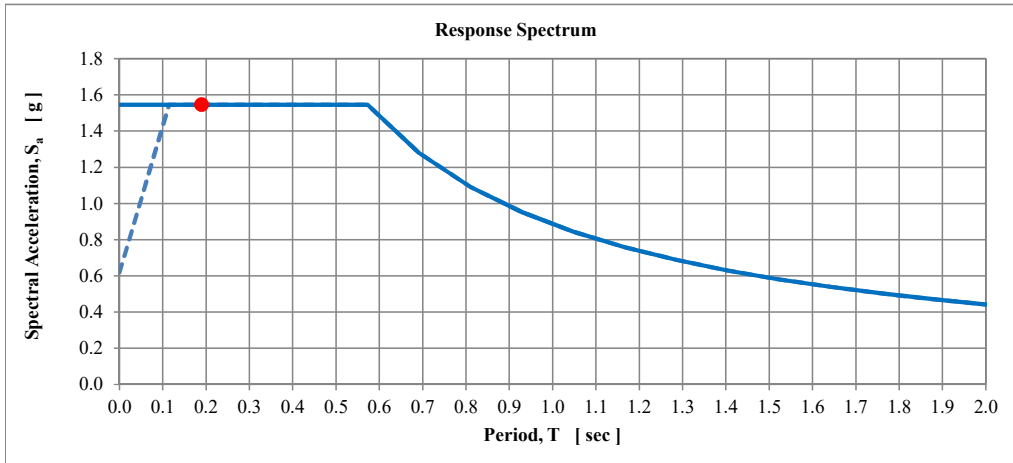
**DESIGN SPECTRAL ACCELERATIONS:**

$S_{XS}$  = 1.545 g (BSE-2E) Site-Adjusted Design ( T = 0.2 sec ) [ ASCE 41-17, Eq. 2-1 ]  
 $S_{X1}$  = 0.885 g (BSE-2E) Site-Adjusted Design ( T = 1.0 sec ) [ ASCE 41-17, Eq. 2-2 ]

**BUILDING PERIOD:**

$h_n$  = 20.1 ft (Base to Roof) Building Height [ ASCE 41-17, §4.4.2.4 ]  
 $C_t$  = 0.020 (Building Type C2A) Period Coefficient [ ASCE 41-17, §4.4.2.4 ]  
 $\beta$  = 0.750 (Building Type C2A) Period Exponent [ ASCE 41-17, §4.4.2.4 ]  
 $T$  = 0.190 sec =  $C_t h_n^\beta$  Fundamental Period [ ASCE 41-17, Eq. 4-4 ]

**RESPONSE SPECTRUM:**



**PSEUDO LATERAL FORCE:**

$n$  = 2 ( n = 2 ) Total Number of Stories  
 $C$  = 1.0 ( Building Type C2A ) Modification Factor [ ASCE 41-17, Table 4-7 ]  
 $S_a$  = 1.545 g = MIN {  $S_{X1} / T$ ,  $S_{XS}$  } Spectral Acceleration [ ASCE 41-17, Eq. 4-3 ]  
 $V$  = **1.545 W** =  $C S_a W$  Pseudo Lateral Force [ ASCE 41-17, Eq. 4-1 ]

**VERTICAL DISTRIBUTION OF SEISMIC FORCES:**

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

| Level        | $h_x$<br>[ ft ] | $w_x$<br>[ kips ] | $w_x h_x^k$  | $C_{vx}$    | $F_x$<br>[ kips ] | $V_j$<br>[ kips ] |
|--------------|-----------------|-------------------|--------------|-------------|-------------------|-------------------|
| Roof         | 20.1            | 204               | 4,095        | 0.52        | 416               | 416               |
| 2nd          | 12.0            | 313               | 3,750        | 0.48        | 381               | 798               |
| <b>TOTAL</b> | -               | <b>516</b>        | <b>7,845</b> | <b>1.00</b> | <b>798</b>        | -                 |

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



|  |                                |                       |
|--|--------------------------------|-----------------------|
| <b>Subject:</b> Global Data                    | <b>Job Number:</b> B9959006.00 | <b>Date:</b> 06/24/19 |
| <b>Job:</b> UCSC Tier 1 Seismic Evaluations    | <b>By:</b> PN                  | <b>Section:</b>       |
| CAAN 7130 - Concrete Shelter Between Buildings | <b>Checked By:</b>             | <b>Page</b>           |

**GLOBAL DATA**

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

**SITE DATA:**

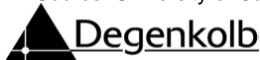
|                 |              |                                 |   |
|-----------------|--------------|---------------------------------|---|
| Latitude:       | 36.99735 °N  | 520 Cowell-Stevenson Road       | USGS Seismic Design Map Application:  |
| Longitude:      | 122.05344 °W | Santa Cruz, CA 95064            | <a href="http://geohazards.usgs.gov/hazardtool/application.php">http://geohazards.usgs.gov/hazardtool/application.php</a> |
| Site Class:     | D (default)  | ( Stiff Soil )                  | Site Class [ ASCE 41-17, §2.4.1.6 ]   |
| S <sub>s</sub>  | = 1.287 g    | ( USGS ) ( 5% / 50 years )      | USGS Mapped ( T = 0.2 sec ) [ ASCE 41-17, §2.4.1.3 ]  |
| S <sub>1</sub>  | = 0.488 g    | ( USGS ) ( 5% / 50 years )      | USGS Mapped ( T = 1.0 sec ) [ ASCE 41-17, §2.4.1.3 ]  |
| F <sub>a</sub>  | = 1.200      | ( Site Class D )                | Site Coefficient ( T = 0.2 sec ) [ ASCE 7-16, Table 11.4-1 ]  |
| F <sub>v</sub>  | = 1.812      | ( Site Class D )                | Site Coefficient ( T = 1.0 sec ) [ ASCE 7-16, Table 11.4-2 ]  |
| S <sub>XS</sub> | = 1.545 g    | = F <sub>a</sub> S <sub>s</sub> | Site-Adjusted Design ( T = 0.2 sec ) [ ASCE 41-17, Eq. 2-1 ]  |
| S <sub>X1</sub> | = 0.885 g    | = F <sub>v</sub> S <sub>1</sub> | Site-Adjusted Design ( T = 1.0 sec ) [ ASCE 41-17, Eq. 2-2 ]  |

**BUILDING DATA:**

|                    |           |   |                           |
|--------------------|-----------|---|---------------------------|
| Building Type:     | C2A       | ( Concrete Shear Walls with Flexible Diaphragms ) | [ ASCE 41-17, Table 3-1 ] |
| Year Built:        | 1966      |   |                           |
| Number of Stories: | 2 stories | A/A10   |                           |
| Parapet Height:    | 0.00 ft   | B/A10   |                           |
| Roof Height:       | 20.08 ft  | B2/A10  |                           |
| Total Area:        | 2,526 sf  |   |                           |

| Level | Height<br>[ ft ] | Elevation<br>[ ft ] | Length <sub>N-S</sub><br>[ ft ] | Length <sub>E-W</sub><br>[ ft ] | Area<br>[ sf ] | Diaphragm<br>Stiffness | Diaphragm<br>Description |
|-------|------------------|---------------------|---------------------------------|---------------------------------|----------------|------------------------|--------------------------|
| Roof  | 8.1              | 20.1                | 40                              | 38                              | 1,389          | Flexible               | Plywood Sheathing        |
| 2nd   | 12.0             | 12.0                | 40                              | 38                              | 1,059          | Rigid                  | Concrete Slab            |
| 1st   | 0.0              | 0.0                 | 39                              | 38                              | 1,466          | -                      | -                        |





## WEIGHT TAKE-OFF FOR SHELTER (BREEZEWAY)

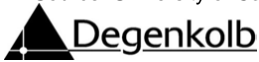
|   |                                |                       |
|---|--------------------------------|-----------------------|
| <b>Subject:</b> Weight Take Off             | <b>Job Number:</b> B9959006.00 | <b>Date:</b> 06/24/19 |
| <b>Job:</b> UCSC Tier 1 Seismic Evaluations | <b>By:</b> PN                  | <b>Section:</b>       |
|   | <b>Checked By:</b>             | <b>Page:</b>          |

**WEIGHT TAKEOFF**

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 BSE-2E HAZARD LEVEL

| ROOF TYPE:        | ROOF  |   |                   |  |          |   |
|-------------------|---|---|-------------------|--|----------|---|
|                   | Roofing / Re-roofing                            | @ | 5.0 psf           |  | 0.0 psf  | n |
| 0.5 in            | Rock Ballast (Gravel)                           | @ | 8.0 psf per inch  |  | 0.0 psf  | n |
| 3 ply             | Ready Roofing                                   | @ | 0.3 psf per ply   |  | 0.0 psf  | n |
| 5 ply             | Felt Roofing                                    | @ | 0.5 psf per ply   |  | 0.0 psf  | n |
| 0.25 in           | Slate   | @ | 40.0 psf per inch |  | 0.0 psf  | n |
|                   | Shingles (Asphalt)                              | @ | 2.0 psf           |  | 0.0 psf  | n |
|                   | Copper or Tin                                   | @ | 1.0 psf           |  | 0.0 psf  | n |
|                   | Corrugated Asbestos-Cement                      | @ | 4.0 psf           |  | 0.0 psf  | n |
|                   | Waterproofing Membranes (Smooth Bituminous)     | @ | 1.5 psf           |  | 0.0 psf  | n |
|                   | Cement Tiles                                    | @ | 16.0 psf          |  | 0.0 psf  | n |
|                   | Clay Tiles (Roman)                              | @ | 12.0 psf          |  | 12.0 psf | y |
|                   | Mortar Bed for Clay Tiles                       | @ | 10.0 psf          |  | 10.0 psf | y |
|                   | Roof Insulation                                 | @ | 1.0 psf           |  | 0.0 psf  | n |
| 1 in              | Insulation (Rigid)                              | @ | 1.5 psf per inch  |  | 0.0 psf  | n |
| 1 in              | Insulation Boards (Fibrous Glass)               | @ | 1.1 psf per inch  |  | 0.0 psf  | n |
| 3 in              | Vermiculite Concrete                            | @ | 2.5 psf per inch  |  | 0.0 psf  | n |
| 0.5 in            | Fire Proofing                                   | @ | 2.0 psf per inch  |  | 0.0 psf  | n |
|                   | Diaphragm - core planks                         | @ | 35.0 psf          |  | 0.0 psf  | n |
| 2.5 in            | Concrete Slab (Normal Weight)                   | @ | 12.5 psf per inch |  | 0.0 psf  | n |
| 4.75 in           | Concrete Fill (Light Weight)                    | @ | 9.2 psf per inch  |  | 0.0 psf  | n |
| 0.5 in            | Concrete Overpour (Light Weight)                | @ | 9.2 psf per inch  |  | 0.0 psf  | n |
| 18 ga             | Bare Metal Deck                                 | @ | 3.0 psf           |  | 0.0 psf  | n |
| 2 in              | Wood Decking                                    | @ | 2.5 psf per inch  |  | 5.0 psf  | y |
| 2 in              | Wood Sheathing                                  | @ | 3.0 psf per inch  |  | 0.0 psf  | n |
| 0.375 in          | Plywood   | @ | 3.2 psf per inch  |  | 1.2 psf  | y |
|                   | Framing   | @ | 20.0 psf          |  | 0.0 psf  | n |
| 6 ft O.C.         | Steel Beams                                     | @ | 22.0 plf          |  | 0.0 psf  | n |
| 36 ft O.C.        | Steel Girders                                   | @ | 76.0 plf          |  | 0.0 psf  | n |
| 2 ft O.C.         | Wood Sub-Purlins                                | @ | 1.8 plf           |  | 0.0 psf  | n |
| 3.00 ft O.C.      | Wood Purlins                                    | @ | 8.9 plf           |  | 3.0 psf  | y |
| 10 ft O.C.        | Wood Girders                                    | @ | 22.3 plf          |  | 2.2 psf  | y |
| 12.75 ft O.C.     | Concrete Beams                                  | @ | 800.0 plf         |  | 0.0 psf  | n |
| 20 ft O.C.        | Concrete Girders                                | @ | 300.0 plf         |  | 0.0 psf  | n |
| 4.04 ft trib. ht. | Typical Columns (A <sub>col</sub> = 174 sf)     | @ | 204.2 plf         |  | 4.8 psf  | y |
|                   | Ceiling   | @ | 5.0 psf           |  | 0.0 psf  | n |
| 0.5 in            | Gypsum Board Ceiling                            | @ | 4.4 psf per inch  |  | 0.0 psf  | n |
|                   | Acoustical Fiber Board                          | @ | 1.0 psf           |  | 0.0 psf  | n |
|                   | Plaster Ceiling (On Tile)                       | @ | 5.0 psf           |  | 0.0 psf  | n |
|                   | Suspended Metal Lath & Plaster (Gypsum Plaster) | @ | 10.0 psf          |  | 0.0 psf  | n |
|                   | Suspended Steel Channel System                  | @ | 2.0 psf           |  | 0.0 psf  | n |
|                   | Suspended Wood Furring System                   | @ | 2.5 psf           |  | 0.0 psf  | n |
|                   | T-bar Ceiling System                            | @ | 3.0 psf           |  | 0.0 psf  | n |
| 20% floor area    | Interior Partitions (Below)                     | @ | 5.0 psf           |  | 0.0 psf  | n |
|                   | M.E.P.  | @ | 2.0 psf           |  | 2.0 psf  | y |
|                   | Miscellaneous                                   | @ | 1.8 psf           |  | 1.8 psf  | y |
|                   | Percast Fascia (4sqft)                          | @ | 47.1 psf          |  | 0.0 psf  | n |
|                   | Other   | @ | 1.0 psf           |  | 0.0 psf  | n |
|                   | Other   | @ | 1.0 psf           |  | 0.0 psf  | n |
|                   | Other   | @ | 1.0 psf           |  | 0.0 psf  | n |
|                   | Other   | @ | 1.0 psf           |  | 0.0 psf  | n |
|                   | Other   | @ | 1.0 psf           |  | 0.0 psf  | n |

**ROOF WEIGHT = 42.0 psf**



## WEIGHT TAKE-OFF FOR SHELTER (BREEZEWAY)

|   |                                |                       |
|---|--------------------------------|-----------------------|
| <b>Subject:</b> Weight Take Off             | <b>Job Number:</b> B9959006.00 | <b>Date:</b> 06/24/19 |
| <b>Job:</b> UCSC Tier 1 Seismic Evaluations | <b>By:</b> PN                  | <b>Section:</b>       |
|   | <b>Checked By:</b>             | <b>Page:</b>          |

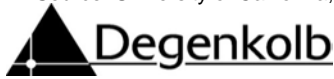
**WEIGHT TAKEOFF**

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

**FLOOR TYPE:** FLR-2

|                   |   |   |                   |          |   |
|-------------------|---|---|-------------------|----------|---|
|                   | Flooring  | @ | 15.0 psf          | 0.0 psf  | n |
| 0.5 in            | Floor Tiles (Linoleum Tile)                     | @ | 4.0 psf per inch  | 0.0 psf  | n |
| 2 in              | Wood Flooring (Softwood)                        | @ | 3.3 psf per inch  | 0.0 psf  | n |
| 2 in              | Wood Blocks                                     | @ | 3.3 psf per inch  | 0.0 psf  | n |
| 2 in              | Asphalt Blocks                                  | @ | 12.0 psf per inch | 0.0 psf  | n |
| 0.75 in           | Mastic  | @ | 12.0 psf per inch | 0.0 psf  | n |
| 1 in              | Cement Finish                                   | @ | 12.0 psf per inch | 0.0 psf  | n |
| 2 in              | Mortar Bed                                      | @ | 12.0 psf per inch | 0.0 psf  | n |
| 2 in              | Floor Fill (Stone Concrete)                     | @ | 12.0 psf per inch | 0.0 psf  | n |
| 0.75 in           | Subflooring                                     | @ | 4.0 psf per inch  | 0.0 psf  | n |
|                   | Marble & Mortar, Stone Concrete                 | @ | 33.0 psf          | 0.0 psf  | n |
|                   | Solid Flat Tile, 1-in Mortar Base               | @ | 23.0 psf          | 0.0 psf  | n |
|                   | Floor Insulation                                | @ | 1.0 psf           | 0.0 psf  | n |
| 1 in              | Insulation (Rigid)                              | @ | 1.5 psf per inch  | 0.0 psf  | n |
| 1 in              | Insulation Boards (Fibrous Glass)               | @ | 1.1 psf per inch  | 0.0 psf  | n |
| 3 in              | Vermiculite Concrete                            | @ | 2.5 psf per inch  | 0.0 psf  | n |
| 0.5 in            | Fire Proofing                                   | @ | 2 psf per inch    | 0.0 psf  | n |
|                   | Diaphragm                                       | @ | 20.0 psf          | 0.0 psf  | n |
| 4 in              | Concrete Slab (Normal Weight)                   | @ | 12.5 psf per inch | 50.0 psf | y |
| 1.625 in          | Concrete Fill (Light Weight)                    | @ | 9.2 psf per inch  | 0.0 psf  | n |
| 0.5 in            | Concrete Overpour (Light Weight)                | @ | 9.2 psf per inch  | 0.0 psf  | n |
| 18 ga             | Bare Metal Deck                                 | @ | 3.0 psf           | 0.0 psf  | n |
| 2 in              | Wood Decking                                    | @ | 2.5 psf per inch  | 0.0 psf  | n |
| 2 in              | Wood Sheathing                                  | @ | 3.0 psf per inch  | 0.0 psf  | n |
| 0.625 in          | Plywood   | @ | 3.2 psf per inch  | 0.0 psf  | n |
|                   | Framing   | @ | 20.0 psf          | 0.0 psf  | n |
| 6 ft O.C.         | Steel Beams                                     | @ | 22.0 plf          | 0.0 psf  | n |
| 36 ft O.C.        | Steel Girders                                   | @ | 76.0 plf          | 0.0 psf  | n |
| 2 ft O.C.         | Wood Sub-Purlins                                | @ | 1.8 plf           | 0.0 psf  | n |
| 3.00 ft O.C.      | Wood Purlins                                    | @ | 4.4 plf           | 0.0 psf  | n |
| 10.00 ft O.C.     | Wood Girders                                    | @ | 5.0 plf           | 0.0 psf  | n |
| 7.5 ft O.C.       | Concrete Beams                                  | @ | 325.0 plf         | 0.0 psf  | n |
| 3.276 ft O.C.     | Concrete Girders                                | @ | 208.3 plf         | 63.6 psf | y |
| 10.0 ft trib. ht. | Typical Columns (A <sub>col</sub> = 132 sf)     | @ | 204.2 plf         | 15.5 psf | y |
|                   | Ceiling   | @ | 5.0 psf           | 0.0 psf  | n |
| 0.5 in            | Gypsum Board Ceiling                            | @ | 4.4 psf per inch  | 0.0 psf  | n |
|                   | Acoustical Fiber Board                          | @ | 1.0 psf           | 0.0 psf  | n |
|                   | Plaster Ceiling (On Tile)                       | @ | 5.0 psf           | 0.0 psf  | n |
|                   | Suspended Metal Lath & Plaster (Gypsum Plaster) | @ | 10.0 psf          | 0.0 psf  | n |
|                   | Suspended Steel Channel System                  | @ | 2.0 psf           | 0.0 psf  | n |
|                   | Suspended Wood Furring System                   | @ | 2.5 psf           | 0.0 psf  | n |
|                   | T-bar Ceiling System                            | @ | 3.0 psf           | 0.0 psf  | n |
| 0% floor area     | Interior Partitions (Above & Below)             | @ | 10.0 psf          | 0.0 psf  | n |
|                   | M.E.P.  | @ | 2.0 psf           | 2.0 psf  | y |
|                   | Miscellaneous                                   | @ | 1.9 psf           | 1.9 psf  | y |
|                   | Other   | @ | 1.0 psf           | 0.0 psf  | n |
|                   | Other   | @ | 1.0 psf           | 0.0 psf  | n |
|                   | Other   | @ | 1.0 psf           | 0.0 psf  | n |
|                   | Other   | @ | 1.0 psf           | 0.0 psf  | n |
|                   | Other   | @ | 1.0 psf           | 0.0 psf  | n |

**FLR-2 WEIGHT = 133.0 psf**



**WEIGHT TAKE-OFF FOR SHELTER (BREEZEWAY)**

|   |                                |                       |
|---|--------------------------------|-----------------------|
| <b>Subject:</b> Seismic Mass                | <b>Job Number:</b> B9959006.00 | <b>Date:</b> 06/24/19 |
| <b>Job:</b> UCSC Tier 1 Seismic Evaluations | <b>By:</b> PN                  | <b>Section:</b>       |
|   | <b>Checked By:</b>             | <b>Page:</b>          |

**SEISMIC MASS**

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

**ROOF/FLOOR WEIGHT SUMMARY:**

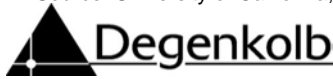
| Level Type | Weight [ psf ] |
|------------|----------------|
| ROOF       | 42             |
| FLR-2      | 133            |

**WALL WEIGHT SUMMARY:**

| Wall Type | Weight [ psf ] |       |          |
|-----------|----------------|-------|----------|
|           | Net            | Solid | Openings |
| WALL-R    | 0              | 0     | 8        |
| WALL-2    | 0              | 0     | 8        |

**SEISMIC MASS SUMMARY:**

| Level | FLOOR      |                |             | WALL ABOVE |                |               |               | WALL BELOW |                |               |               | TOTAL WEIGHT [ kips ] |
|-------|------------|----------------|-------------|------------|----------------|---------------|---------------|------------|----------------|---------------|---------------|-----------------------|
|       | Level Type | Weight [ psf ] | Area [ sf ] | Wall Type  | Weight [ psf ] | Length [ ft ] | Height [ ft ] | Wall Type  | Weight [ psf ] | Length [ ft ] | Height [ ft ] |                       |
| Roof  | ROOF       | 42             | 1,389       | WALL-R     | 0.0            | 0             | 0.00          | WALL-R     | 0.0            | 157           | 4.04          | 58                    |
| 2nd   | FLR-2      | 133            | 1,059       | WALL-2     | 0.0            | 157           | 4.04          | WALL-2     | 0.0            | 156           | 6.00          | 141                   |
|       |            |                |             |            |                |               |               |            |                | <b>TOTAL</b>  |               | <b>199</b>            |



**WEIGHT TAKE-OFF FOR SHELTER (BREEZEWAY)**

|   |                                |                       |
|---|--------------------------------|-----------------------|
| <b>Subject:</b> Seismic Forces              | <b>Job Number:</b> B9959006.00 | <b>Date:</b> 06/24/19 |
| <b>Job:</b> UCSC Tier 1 Seismic Evaluations | <b>By:</b> PN                  | <b>Section:</b>       |
|   | <b>Checked By:</b>             | <b>Page:</b>          |

**SEISMIC FORCES**

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

**BUILDING TYPE:** C2A (Concrete Shear Walls with Flexible Diaphragms) [ ASCE 41-17, Table 3-1 ]  
**SITE CLASS:** D (default) #N/A [ ASCE 41-17, §2.4.1.6 ]

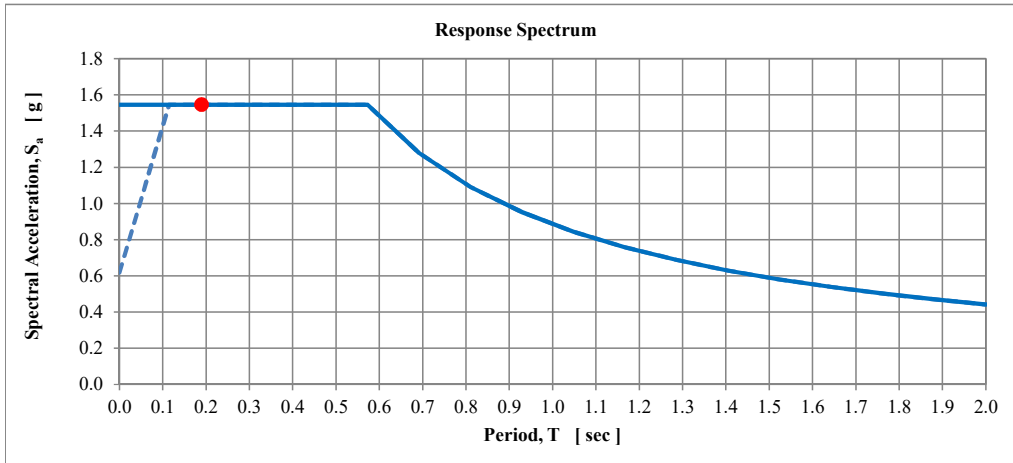
**DESIGN SPECTRAL ACCELERATIONS:**

$S_{XS}$  = 1.545 g (BSE-2E) Site-Adjusted Design ( T = 0.2 sec ) [ ASCE 41-17, Eq. 2-1 ]  
 $S_{X1}$  = 0.885 g (BSE-2E) Site-Adjusted Design ( T = 1.0 sec ) [ ASCE 41-17, Eq. 2-2 ]

**BUILDING PERIOD:**

$h_n$  = 20.1 ft (Base to Roof) Building Height [ ASCE 41-17, §4.4.2.4 ]  
 $C_t$  = 0.020 (Building Type C2A) Period Coefficient [ ASCE 41-17, §4.4.2.4 ]  
 $\beta$  = 0.750 (Building Type C2A) Period Exponent [ ASCE 41-17, §4.4.2.4 ]  
 $T$  = 0.190 sec =  $C_t h_n^\beta$  Fundamental Period [ ASCE 41-17, Eq. 4-4 ]

**RESPONSE SPECTRUM:**



**PSEUDO LATERAL FORCE:**

$n$  = 2 ( n = 2 ) Total Number of Stories  
 $C$  = 1.0 ( Building Type C2A ) Modification Factor [ ASCE 41-17, Table 4-7 ]  
 $S_a$  = 1.545 g = MIN {  $S_{X1} / T$ ,  $S_{XS}$  } Spectral Acceleration [ ASCE 41-17, Eq. 4-3 ]  
 $V$  = **1.545 W** =  $C S_a W$  Pseudo Lateral Force [ ASCE 41-17, Eq. 4-1 ]

**VERTICAL DISTRIBUTION OF SEISMIC FORCES:**

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

| Level        | $h_x$<br>[ ft ] | $w_x$<br>[ kips ] | $w_x h_x^k$  | $C_{vx}$    | $F_x$<br>[ kips ] | $V_j$<br>[ kips ] |
|--------------|-----------------|-------------------|--------------|-------------|-------------------|-------------------|
| Roof         | 20.1            | 58                | 1,171        | 0.41        | 126               | 126               |
| 2nd          | 12.0            | 141               | 1,691        | 0.59        | 182               | 308               |
| <b>TOTAL</b> | -               | <b>199</b>        | <b>2,862</b> | <b>1.00</b> | <b>308</b>        | -                 |

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



|   |                                |                       |
|---|--------------------------------|-----------------------|
| <b>Subject:</b> Seismic Mass                | <b>Job Number:</b> B9959006.00 | <b>Date:</b> 06/27/19 |
| <b>Job:</b> UCSC Tier 1 Seismic Evaluations | <b>By:</b> PN                  | <b>Section:</b>       |
| CAAN 7130                                   | <b>Checked By:</b>             | <b>Page</b>           |

**SEISMIC MASS**

ASCE 41-17 SEISMIC EVALUATION &amp; RETROFIT OF EXISTING BUILDINGS

CHAPTER 4 - TIER 1 EVALUATION

LINEAR STATIC PROCEDURE

COLLAPSE PREVENTION

BSE-2E HAZARD LEVEL

**ROOF/FLOOR WEIGHT SUMMARY:**

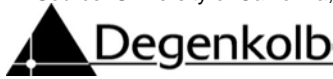
|            | 7130           | 7134 NW        | Shelter        |
|------------|----------------|----------------|----------------|
| Level Type | Weight [ psf ] | Weight [ psf ] | Weight [ psf ] |
| ROOF       | 45             | 45             | 42             |
| FLR-2      | 42             | 46             | 133            |

**WALL WEIGHT SUMMARY:**

| Wall Type | Weight [ psf ] |       |          |
|-----------|----------------|-------|----------|
|           | Net            | Solid | Openings |
| WALL-R    | 76.6           | 106   | 8        |
| WALL-2    | 76.6           | 106   | 8        |

**SEISMIC MASS SUMMARY:**

| Level | CAAN 7130 [kips] | CAAN 7134 N. Wing [kips] | Concrete Shelter [kips] | TOTAL WEIGHT [kips] |
|-------|------------------|--------------------------|-------------------------|---------------------|
| Roof  | 303              | 204                      | 58                      | 565                 |
| 2nd   | 443              | 313                      | 141                     | 897                 |
|       |                  |                          | <b>TOTAL</b>            | <b>1,462</b>        |



## COMBINED MASS SEISMIC CHECK

|   |                                |                       |
|---|--------------------------------|-----------------------|
| <b>Subject:</b> Seismic Forces              | <b>Job Number:</b> B9959006.00 | <b>Date:</b> 06/27/19 |
| <b>Job:</b> UCSC Tier 1 Seismic Evaluations | <b>By:</b> PN                  | <b>Section:</b>       |
| CAAN 7130                                   | <b>Checked By:</b>             | <b>Page:</b>          |

**SEISMIC FORCES**

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

**BUILDING TYPE:** C2A (Concrete Shear Walls with Flexible Diaphragms) [ ASCE 41-17, Table 3-1 ]  
**SITE CLASS:** D (default) #N/A [ ASCE 41-17, §2.4.1.6 ]

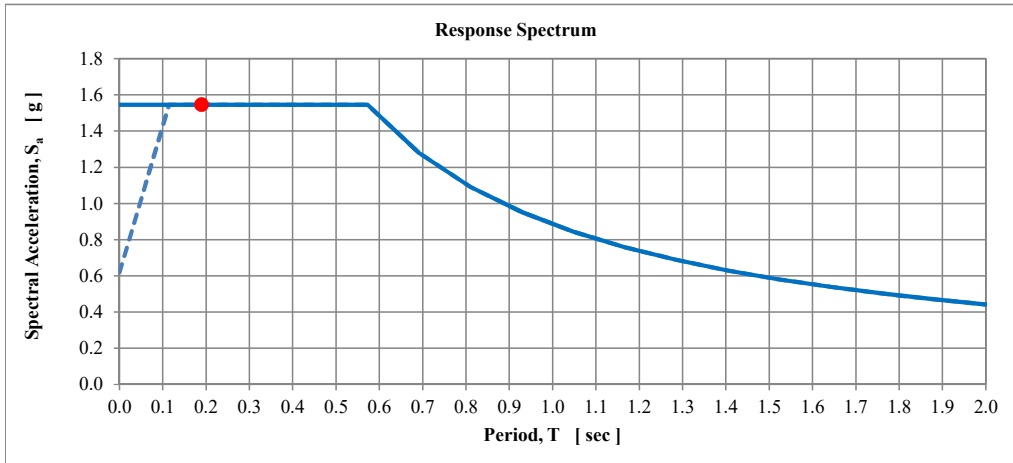
**DESIGN SPECTRAL ACCELERATIONS:**

$S_{XS}$  = 1.545 g (BSE-2E) Site-Adjusted Design ( T = 0.2 sec ) [ ASCE 41-17, Eq. 2-1 ]  
 $S_{X1}$  = 0.885 g (BSE-2E) Site-Adjusted Design ( T = 1.0 sec ) [ ASCE 41-17, Eq. 2-2 ]

**BUILDING PERIOD:**

$h_n$  = 20.1 ft (Base to Roof) Building Height [ ASCE 41-17, §4.4.2.4 ]  
 $C_t$  = 0.020 (Building Type C2A) Period Coefficient [ ASCE 41-17, §4.4.2.4 ]  
 $\beta$  = 0.750 (Building Type C2A) Period Exponent [ ASCE 41-17, §4.4.2.4 ]  
 $T$  = 0.190 sec =  $C_t h_n^\beta$  Fundamental Period [ ASCE 41-17, Eq. 4-4 ]

**RESPONSE SPECTRUM:**



**PSEUDO LATERAL FORCE:**

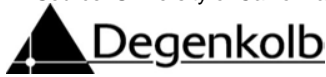
$n$  = 2 ( n = 2 ) Total Number of Stories  
 $C$  = 1.0 ( Building Type C2A ) Modification Factor [ ASCE 41-17, Table 4-7 ]  
 $S_a$  = 1.545 g = MIN {  $S_{X1} / T$ ,  $S_{XS}$  } Spectral Acceleration [ ASCE 41-17, Eq. 4-3 ]  
 $V$  = **1.545 W** =  $C S_a W$  Pseudo Lateral Force [ ASCE 41-17, Eq. 4-1 ]

**VERTICAL DISTRIBUTION OF SEISMIC FORCES:**

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

| Level        | $h_x$<br>[ ft ] | $w_x$<br>[ kips ] | $w_x h_x^k$ | $C_{vx}$ | $F_x$<br>[ kips ] | $V_j$<br>[ kips ] |
|--------------|-----------------|-------------------|-------------|----------|-------------------|-------------------|
| Roof         | 20.1            | 565               | 11,347      | 0.51     | 1,159             | 1,159             |
| 2nd          | 12.0            | 897               | 10,764      | 0.49     | 1,100             | 2,259             |
| <b>TOTAL</b> | -               | 1,462             | 22,111      | 1.00     | 2,259             | -                 |

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



## COMBINED MASS SEISMIC CHECK

|   |                                |                       |
|---|--------------------------------|-----------------------|
| <b>Subject:</b> Quick Checks                | <b>Job Number:</b> B9959006.00 | <b>Date:</b> 06/27/19 |
| <b>Job:</b> UCSC Tier 1 Seismic Evaluations | <b>By:</b> PN                  | <b>Section:</b>       |
| CAAN 7130                                   | <b>Checked By:</b>             | <b>Page</b>           |

**QUICK CHECKS**

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

**BUILDING TYPE:** C2A ( Concrete Shear Walls with Flexible Diaphragms ) [ ASCE 41-17, Table 3-1 ]

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

| Wall Type | t <sub>w</sub><br>[ in ] | Horizontal Reinforcing                |                 |                   |                |                         | Vertical Reinforcing                  |                 |                   |                |                         |
|-----------|--------------------------|---------------------------------------|-----------------|-------------------|----------------|-------------------------|---------------------------------------|-----------------|-------------------|----------------|-------------------------|
|           |                          | n <sub>curtains</sub><br>[ curtains ] | Bar Size<br>No. | Spacing<br>[ in ] | ρ <sub>h</sub> | ρ <sub>h</sub> ≥ 0.0020 | n <sub>curtains</sub><br>[ curtains ] | Bar Size<br>No. | Spacing<br>[ in ] | ρ <sub>v</sub> | ρ <sub>v</sub> ≥ 0.0012 |
| WALL-R    | 8                        | 2                                     | 4               | 18                | 0.0028         | OK                      | 2                                     | 4               | 18                | 0.0028         | OK                      |
| WALL-2    | 8                        | 2                                     | 4               | 18                | 0.0028         | OK                      | 2                                     | 4               | 18                | 0.0028         | OK                      |

**AVERAGE SHEAR STRESS CHECK:**

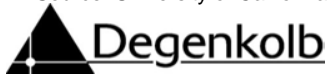
|                     |   |   |                               |                            |
|---------------------|---|---|-------------------------------|----------------------------|
| f' <sub>c</sub>     | = 3,000 psi   | ( Specified )                           | Concrete Compressive Strength | [ ASCE 41-17, §4.2.3 ]     |
| v <sub>n</sub>      | = 110 psi   | = MAX { 100 psi , 2 √ f' <sub>c</sub> } | Shear Wall Capacity           | [ ASCE 41-17, §A.3.2.2.1 ] |
| M <sub>s</sub>      | = 4.5   | COLLAPSE PREVENTION                     | System Modification Factor    | [ ASCE 41-17, Table 4-8 ]  |
| v <sub>j, avg</sub> | = ( 1 / M <sub>s</sub> ) ( V <sub>j</sub> / A <sub>w</sub> )          |   | Average Shear Wall Stress     | [ ASCE 41-17, Eq. 4-8 ]    |
| A <sub>w</sub>      | = t <sub>w</sub> ( L <sub>w, total</sub> - L <sub>w, openings</sub> ) |   | Net Wall Area                 | [ ASCE 41-17, §4.4.3.3 ]   |

**North-South Direction:**

| Level | V <sub>j</sub><br>[ kips ] | Wall Type | t <sub>w</sub><br>[ in ] | L <sub>w, total</sub><br>[ ft ] | L <sub>w, openings</sub><br>[ ft ] | L <sub>w</sub><br>[ ft ] | A <sub>w</sub><br>[ in <sup>2</sup> ] | v <sub>j, avg</sub><br>[ psi ] | DCR  | Quick Check |
|-------|----------------------------|-----------|--------------------------|---------------------------------|------------------------------------|--------------------------|---------------------------------------|--------------------------------|------|-------------|
| Roof  | 1,159                      | WALL-R    | 8                        | 154                             | 36                                 | 118                      | 11,360                                | 23                             | 0.21 | OK          |
| 2nd   | 2,259                      | WALL-2    | 8                        | 154                             | 36                                 | 118                      | 11,360                                | 44                             | 0.40 | OK          |

**East-West Direction:**

| Level | V <sub>j</sub><br>[ kips ] | Wall Type | t <sub>w</sub><br>[ in ] | L <sub>w, total</sub><br>[ ft ] | L <sub>w, openings</sub><br>[ ft ] | L <sub>w</sub><br>[ ft ] | A <sub>w</sub><br>[ in <sup>2</sup> ] | v <sub>j, avg</sub><br>[ psi ] | DCR  | Quick Check |
|-------|----------------------------|-----------|--------------------------|---------------------------------|------------------------------------|--------------------------|---------------------------------------|--------------------------------|------|-------------|
| Roof  | 1,159                      | WALL-R    | 8                        | 390                             | 144                                | 246                      | 23,616                                | 11                             | 0.10 | OK          |
| 2nd   | 2,259                      | WALL-2    | 8                        | 390                             | 144                                | 246                      | 23,616                                | 21                             | 0.19 | OK          |



## COMBINED MASS SEISMIC CHECK

|   |                                |                       |
|---|--------------------------------|-----------------------|
| <b>Subject:</b> Quick Checks                | <b>Job Number:</b> B9959006.00 | <b>Date:</b> 06/27/19 |
| <b>Job:</b> UCSC Tier 1 Seismic Evaluations | <b>By:</b> PN                  | <b>Section:</b>       |
| CAAN 7130                                   | <b>Checked By:</b>             | <b>Page</b>           |

**QUICK CHECKS**

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

**BUILDING TYPE:** C2A ( Concrete Shear Walls with Flexible Diaphragms ) [ ASCE 41-17, Table 3-1 ]

**OUT-OF-PLANE WALL ANCHORAGE CHECK:** [ ASCE 41-17, §A.5.1.1 ]

$\Psi$  = 1.0 COLLAPSE PREVENTION Out-of-Plane Wall Anchorage Coefficient [ ASCE 41-17, §4.4.3.7 ]  
 $S_{XS}$  = 1.545 g ( BSE-2E ) Design Spectral Acceleration ( T = 0.2 sec ) [ ASCE 41-17, §2.4.1.1 ]  
 $T_c$  =  $\Psi S_{XS} w_p A_p$  Out-of-Plane Wall Anchorage Force [ ASCE 41-17, Eq. 4-12 ]  
 $w_p A_p$  =  $( w_{w,above} h_{w,above} + w_{w,below} h_{w,below} ) S_{anchor}$  Tributary Mass to Anchorage [ ASCE 41-17, §4.4.3.7 ]

**North-South Direction:**

| Level | WALL ABOVE |                |               | WALL BELOW |                |               | OUT-OF-PLANE ANCHORAGE |                  |              |                 |      |             |
|-------|------------|----------------|---------------|------------|----------------|---------------|------------------------|------------------|--------------|-----------------|------|-------------|
|       | Wall Type  | Weight [ psf ] | Height [ ft ] | Wall Type  | Weight [ psf ] | Height [ ft ] | $S_{anchor}$ [ ft ]    | $w_p A_p$ [ lb ] | $T_c$ [ lb ] | $T_{cn}$ [ lb ] | DCR  | Quick Check |
| Roof  | WALL-P     | 38             | 0.00          | WALL-R     | 106            | 4.04          | 4.00                   | 1,714            | 2,647        | 7,555           | 0.35 | OK          |
| 2nd   | WALL-R     | 106            | 4.04          | WALL-2     | 106            | 6.00          | 2.67                   | 2,838            | 4,385        | 5,521           | 0.79 | OK          |

**East-West Direction:**

| Level | WALL ABOVE |                |               | WALL BELOW |                |               | OUT-OF-PLANE ANCHORAGE |                  |              |                 |      |             |
|-------|------------|----------------|---------------|------------|----------------|---------------|------------------------|------------------|--------------|-----------------|------|-------------|
|       | Wall Type  | Weight [ psf ] | Height [ ft ] | Wall Type  | Weight [ psf ] | Height [ ft ] | $S_{anchor}$ [ ft ]    | $w_p A_p$ [ lb ] | $T_c$ [ lb ] | $T_{cn}$ [ lb ] | DCR  | Quick Check |
| Roof  | WALL-P     | 38             | 0.00          | WALL-R     | 106            | 4.04          | 4.00                   | 1,714            | 2,647        | 7,555           | 0.35 | OK          |
| 2nd   | WALL-R     | 106            | 4.04          | WALL-2     | 106            | 6.00          | 2.67                   | 2,838            | 4,385        | 5,521           | 0.79 | OK          |





|                                      |                                |                       |
|--------------------------------------|--------------------------------|-----------------------|
| <b>Subject:</b> SEISMIC DESIGN LOADS | <b>Job Number:</b> B9959006.00 | <b>Date:</b> 06/27/19 |
| <b>Job:</b> UCSC ASCE 41-17 Tier 1   | <b>By:</b> PN                  | <b>Section:</b>       |
| <b>Model:</b> CAAN 7130              | <b>Checked By:</b>             | <b>Page</b> of        |

**SEISMIC DESIGN LOADS**

ASCE 41-13 SEISMIC EVALUATION AND RETROFIT OF EXISTING BUILDINGS  
 COLLAPSE PREVENTION PERFORMANCE LEVEL  
 BSE-2E SEISMIC HAZARD

**BUILDING TYPE:** C2A (Concrete Shear Walls with Flexible Diaphragms) [ ASCE 41-13, Table 3-1 ]  
**SITE CLASS:** D (Stiff Soil) [ ASCE 41-13, §2.4.1.6.1 ]

**SPECTRAL ACCELERATIONS:**

|                 |   |         |                         |                                |                          |
|-----------------|---|---------|-------------------------|--------------------------------|--------------------------|
| S <sub>s</sub>  | = | 1.287 g | ( USGS Hazard App )     | 5% / 50 Years ( T = 0.2-sec )  | [ ASCE 41-13, §2.4.1.4 ] |
| S <sub>1</sub>  | = | 0.488 g | ( USGS Hazard App )     | 5% / 50 Years ( T = 1.0-sec )  | [ ASCE 41-13, §2.4.1.4 ] |
| S <sub>Xs</sub> | = | 1.545 g | Site Specific from SAGE | Default Design ( T = 0.2-sec ) | [ ASCE 41-13, §2.4.1.4 ] |
| S <sub>X1</sub> | = | 0.885 g | Site Specific from SAGE | Default Design ( T = 1.0-sec ) | [ ASCE 41-13, §2.4.1.4 ] |

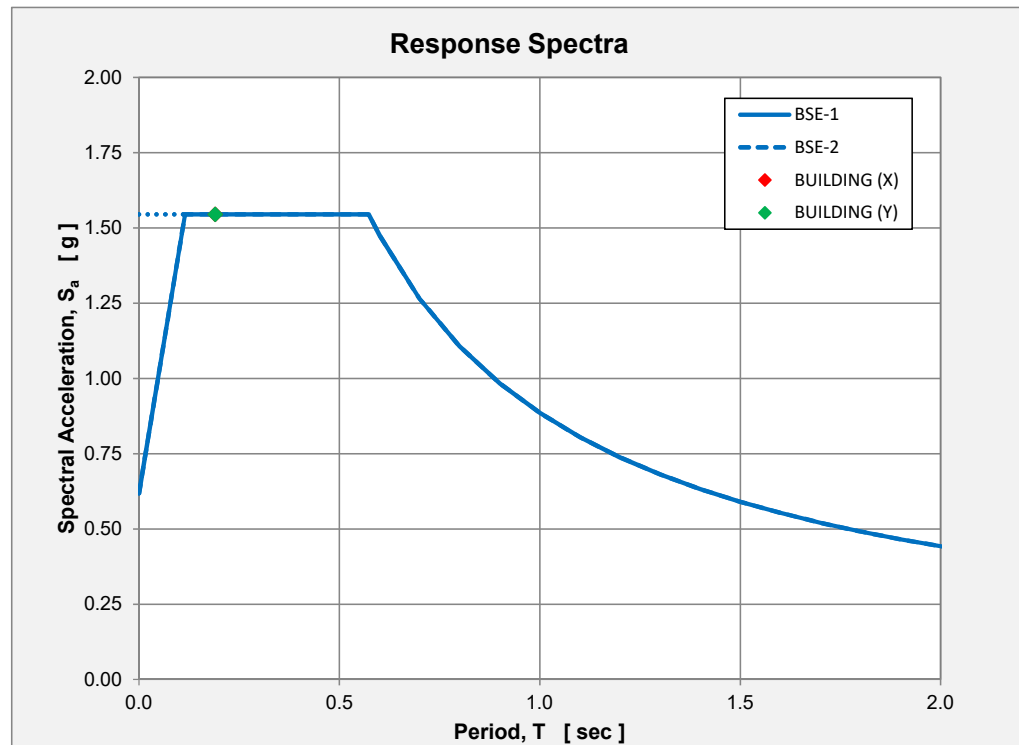
**BUILDING PERIOD:**

|                |   |          |  |                    |                            |
|----------------|---|----------|--|--------------------|----------------------------|
| h <sub>n</sub> | = | 20.1 ft  | ( Base to Roof Level )                       | Building Height    | [ ASCE 41-13, §7.4.1.2.2 ] |
| C <sub>t</sub> | = | 0.02     | ( Building Type C2A )                        | Period Coefficient | [ ASCE 41-13, §7.4.1.2.2 ] |
| β              | = | 0.75     | ( Building Type C2A )                        | Period Exponent    | [ ASCE 41-13, §7.4.1.2.2 ] |
| T <sub>a</sub> | = | 0.19 sec | = C <sub>t</sub> h <sub>n</sub> <sup>β</sup> | Approximate Period | [ ASCE 41-13, Eq. 7-18 ]   |
| T <sub>X</sub> | = | 0.19 sec | = C <sub>t</sub> h <sub>n</sub> <sup>β</sup> | Model Period (X)   |                            |
| T <sub>Y</sub> | = | 0.19 sec | = C <sub>t</sub> h <sub>n</sub> <sup>β</sup> | Model Period (Y)   |                            |
| T              | = | 0.19 sec | = MIN { T <sub>X</sub> , T <sub>Y</sub> }    | Fundamental Period |                            |

**RESPONSE SPECTRUM:**

|                  |   |          |   |   |                            |
|------------------|---|----------|---|---|----------------------------|
| β                | = | 0.05     | ( 5% Damping )  | Effective Viscous Damping Ratio           | [ ASCE 41-13, §2.4.1.7.1 ] |
| B <sub>1</sub>   | = | 1.00     | = 4 / [ 5.6 - ln ( 100 β ) ]  | Damping Adjustment Factor                 | [ ASCE 41-13, Eq. 2-11 ]   |
| T <sub>O</sub>   | = | 0.11 sec | = 0.2 T <sub>s</sub>  | Constant S <sub>a</sub> Transition Period | [ ASCE 41-13, Eq. 2-10 ]   |
| T <sub>S</sub>   | = | 0.57 sec | = S <sub>X1</sub> / S <sub>Xs</sub>   | Constant S <sub>a</sub> Transition Period | [ ASCE 41-13, Eq. 2-9 ]    |
| S <sub>a,X</sub> | = | 1.545 g  | = MIN { S <sub>X1</sub> / T <sub>X</sub> , S <sub>Xs</sub> } / B <sub>1</sub> | Spectral Acceleration                     | [ ASCE 41-13, Eq. 2-6 ]    |
| S <sub>a,Y</sub> | = | 1.545 g  | = MIN { S <sub>X1</sub> / T <sub>Y</sub> , S <sub>Xs</sub> } / B <sub>1</sub> | Spectral Acceleration                     | [ ASCE 41-13, Eq. 2-6 ]    |

| BSE-2 SPECTRUM |  |
|----------------|--|
| T [ sec ]      | S <sub>a</sub> [ g ]                       |
| 0.00           | 0.618                                      |
| 0.11           | 1.545 ( T <sub>O</sub> , S <sub>Xs</sub> ) |
| 0.57           | 1.545 ( T <sub>S</sub> , S <sub>Xs</sub> ) |
| 0.60           | 1.475                                      |
| 0.70           | 1.264                                      |
| 0.80           | 1.106                                      |
| 0.90           | 0.983                                      |
| 1.00           | 0.885                                      |
| 1.10           | 0.805                                      |
| 1.20           | 0.738                                      |
| 1.30           | 0.681                                      |
| 1.40           | 0.632                                      |
| 1.50           | 0.590                                      |
| 1.60           | 0.553                                      |
| 1.70           | 0.521                                      |
| 1.80           | 0.492                                      |
| 1.90           | 0.466                                      |
| 2.00           | 0.443                                      |
| 2.10           | 0.421                                      |
| 2.20           | 0.402                                      |
| 2.30           | 0.385                                      |





|                 |                        |                    |             |                 |           |
|-----------------|------------------------|--------------------|-------------|-----------------|-----------|
| <b>Subject:</b> | SEISMIC DESIGN LOADS   | <b>Job Number:</b> | B9959006.00 | <b>Date:</b>    | 06/27/19  |
| <b>Job:</b>     | UCSC ASCE 41-17 Tier 1 | <b>By:</b>         | PN          | <b>Section:</b> |           |
| <b>Model:</b>   | CAAN 7130              | <b>Checked By:</b> |             | <b>Page</b>     | <b>of</b> |

### SEISMIC DESIGN LOADS

ASCE 41-13 SEISMIC EVALUATION AND RETROFIT OF EXISTING BUILDINGS  
 COLLAPSE PREVENTION PERFORMANCE LEVEL  
 BSE-2E SEISMIC HAZARD

#### PSEUDO LATERAL FORCE:

|                  |   |         |  |  |                            |
|------------------|---|---------|--|--|----------------------------|
| $n$              | = | 2       | ( $n \leq 2$ )                                 | Total Number of Stories                    | [ ASCE 41-13, §7.4.1.3.1 ] |
| $DCR_{max}$      | = | 1.50    | ( Wall Shear )                                 | Max Primary Component DCR                  | [ ASCE 41-13, §7.4.1.3.1 ] |
| $\mu_{strength}$ | = | 1.00    | $= DCR_{max} C_m / 1.5 \geq 1.0$               | Required Elastic-to-Yield Strength Ratio   | [ ASCE 41-13, Eq. C7-3 ]   |
| $a$              | = | 60      | ( Site Class D )                               | Site Class Factor                          | [ ASCE 41-13, §7.4.1.3.1 ] |
| $C_1$            | = | 1.000   | $= 1 + (\mu_{strength} - 1) / (a T^2)$         | Inelastic Displacement Factor              | [ ASCE 41-13, Eq. 7-22 ]   |
| $C_2$            | = | 1.000   | $= 1 + [(\mu_{strength} - 1) / T]^2 / 800$     | Cyclic Degradation Factor                  | [ ASCE 41-13, Eq. 7-23 ]   |
| Alt $C_1 C_2$    | = | 1.100   | ( $m_{max} = DCR_{max}$ )                      | Alternate $C_1 C_2$ Value                  | [ ASCE 41-13, Table 7-3 ]  |
| $C_1 C_2$        | = | 1.000   | $= \text{MIN}\{C_1 C_2, \text{Alt } C_1 C_2\}$ | $C_1 C_2$ Value Used for Analysis          | [ ASCE 41-13, §7.4.1.3.1 ] |
| $C_m$            | = | 1.000   | ( Building Type C2A )                          | Effective Mass Factor                      | [ ASCE 41-13, Table 7-4 ]  |
| $S_{a,X}$        | = | 1.545 g | $= \text{MIN}\{S_{X1}/T_X, S_{XS}\} / B_1$     | Spectral Acceleration                      | [ ASCE 41-13, Eq. 2-6 ]    |
| $S_{a,Y}$        | = | 1.545 g | $= \text{MIN}\{S_{X1}/T_Y, S_{XS}\} / B_1$     | Spectral Acceleration                      | [ ASCE 41-13, Eq. 2-6 ]    |
| $V_X$            | = | 1.545 W | $= C_1 C_2 C_m S_{a,X} W$                      | Pseudo Lateral Force                       | [ ASCE 41-13, Eq. 7-21 ]   |
| $V_Y$            | = | 1.545 W | $= C_1 C_2 C_m S_{a,Y} W$                      | Pseudo Lateral Force                       | [ ASCE 41-13, Eq. 7-21 ]   |
| $V_X / C_1 C_2$  | = | 1.545 W | $= C_m S_{a,X} W$                              | Pseudo Lateral Force Excluding $C_1 C_2^*$ | [ ASCE 41-13, Eq. 7-21 ]   |
| $V_Y / C_1 C_2$  | = | 1.545 W | $= C_m S_{a,Y} W$                              | Pseudo Lateral Force Excluding $C_1 C_2^*$ | [ ASCE 41-13, Eq. 7-21 ]   |

#### VERTICAL DISTRIBUTION OF SEISMIC FORCES:

|                 |   |          |                              |  |                            |
|-----------------|---|----------|------------------------------|--|----------------------------|
| $k_X$           | = | 1.00     | ( $T \leq 0.5 \text{ sec}$ ) | Seismic Distribution Exponent              | [ ASCE 41-13, §7.4.1.3.2 ] |
| $k_Y$           | = | 1.00     | ( $T \leq 0.5 \text{ sec}$ ) | Seismic Distribution Exponent              | [ ASCE 41-13, §7.4.1.3.2 ] |
| $V_X / C_1 C_2$ | = | 783 kips | $= C_m S_{a,X} W$            | Pseudo Lateral Force Excluding $C_1 C_2^*$ | [ ASCE 41-13, Eq. 7-21 ]   |
| $V_Y / C_1 C_2$ | = | 783 kips | $= C_m S_{a,Y} W$            | Pseudo Lateral Force Excluding $C_1 C_2^*$ | [ ASCE 41-13, Eq. 7-21 ]   |

Table 3.1: LSP BSE-2E Vertical Distribution of Seismic Forces

| Level<br>x | $h_x$<br>[ ft ] | $w_x$<br>[ kips ] | X           |          |                   |                   | Y           |          |                   |                   |
|------------|-----------------|-------------------|-------------|----------|-------------------|-------------------|-------------|----------|-------------------|-------------------|
|            |                 |                   | $w_x h_x^k$ | $C_{vx}$ | $F_x$<br>[ kips ] | $\frac{F_x}{w_x}$ | $w_x h_x^k$ | $C_{vy}$ | $F_x$<br>[ kips ] | $\frac{F_x}{w_x}$ |
| ROOF       | 20.1            | 235               | 4,721       | 0.59     | 463               | 1.971             | 4,721       | 0.59     | 463               | 1.971             |
| FLOOR2     | 12.0            | 272               | 3,262       | 0.41     | 320               | 1.177             | 3,262       | 0.41     | 320               | 1.177             |
| BASE       | 0.0             | 0                 | 0           | 0.00     | 0                 | -                 | 0           | 0.00     | 0                 | -                 |
| SUM        |                 | 507               | 8.E+03      | 1.00     | 783               | -                 | 8.E+03      | 1.00     | 783               | -                 |

Table 3.2: LSP BSE-2E Diaphragm Forces

| Level<br>x | $\Sigma w_x$<br>[ kips ] | $\Sigma F_x$<br>[ kips ] | $\frac{\Sigma F_x}{\Sigma w_x}$ | X              |                      |                      | Y                        |                                 |                |                      |                      |
|------------|--------------------------|--------------------------|---------------------------------|----------------|----------------------|----------------------|--------------------------|---------------------------------|----------------|----------------------|----------------------|
|            |                          |                          |                                 | $w_{px} / w_x$ | $w_{px}$<br>[ kips ] | $F_{px}$<br>[ kips ] | $\Sigma F_x$<br>[ kips ] | $\frac{\Sigma F_x}{\Sigma w_x}$ | $w_{px} / w_x$ | $w_{px}$<br>[ kips ] | $F_{px}$<br>[ kips ] |
| ROOF       | 235                      | 463                      | 1.971                           | 1.00           | 235                  | 463                  | 463                      | 1.971                           | 1.00           | 235                  | 463                  |
| FLOOR2     | 507                      | 783                      | 1.545                           | 1.00           | 272                  | 420                  | 783                      | 1.545                           | 1.00           | 272                  | 420                  |
| BASE       | -                        | -                        | -                               | 0.00           | 0                    | 0                    | -                        | -                               | 0.00           | 0                    | 0                    |



### Degenkolb Engineers

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|                 |  |                    |             |                 |          |
|-----------------|--|--------------------|-------------|-----------------|----------|
| <b>Subject:</b> | Check Reinforcement at Shelter Concrete Slab | <b>Job Number:</b> | B9959006.00 | <b>Date:</b>    | 06/27/19 |
| <b>Job:</b>     | UC Santa Cruz Tier 1 Eval                    | <b>By:</b>         | PN          | <b>Section:</b> |          |
|                 | CAAN 7130                                    | <b>Checked By:</b> |             |                 |          |

Check Existing Reinforcement at Shelter Concrete Slab to transfer diaphragm forces from CAAN 7130 to concrete shelter. CAAN 7130 has a larger footprint and more mass than the North Wing of CAAN 7134 so it governs this check.

Diaphragm Forces at CAAN 7130 - see "Seismic Forces" (per Eqn 7-26, ASCE 41-17):

|           | $\Sigma W_x$<br>[ kips ] | $\Sigma F_x$<br>[ kips ] | $F_{px}$<br>[ kips ] |
|-----------|--------------------------|--------------------------|----------------------|
| Roof      | 235                      | 463                      | 463                  |
| 2nd Floor | 272                      | 320                      | 420                  |
| Total     | 507                      | 783                      |                      |

$$\begin{aligned}
 W_{slab} &= 38.6 \text{ ft} \\
 W_{bld} &= 38.6 \text{ ft} \\
 T_{slab} &= 420 \text{ kips} = F_{px} \text{ at 2nd floor} \times (W_{slab} / W_{bld})
 \end{aligned}$$

Demands:

$$\begin{aligned}
 C1C2 &= 1.0 \\
 J &= 1.5 \text{ = smallest m-factor for concrete shear wall at CP} \\
 T_{slab} &= 7 \text{ kip / ft} = T_{slab} / W_{bld} / (C1C2 * J)
 \end{aligned}$$

Capacity (Per detail 4/S13):

$$\begin{aligned}
 \text{Bar Size: } & \#4 \\
 db &= 0.5 \text{ in} \\
 A_s &= 0.2 \text{ in}^2 \\
 \text{Spacing} &= 12 \text{ in} \\
 F_y &= 40 \text{ ksi} \\
 f_c &= 3000 \text{ psi} \\
 T_{prov} &= 7.2 \text{ kip/ft} = 0.9 * A_s * F_y / \text{spacing}
 \end{aligned}$$

Development Lengths : Use ACI 318-14

$$\begin{aligned}
 \psi_t &= 1 \text{ 25.4.2.4} \\
 \psi_e &= 1 \text{ 25.4.2.4} \\
 \lambda &= 1 \text{ 25.4.2.4} \\
 \text{cover} &= 1 \text{ in}
 \end{aligned}$$

1) Lap Splice: per ACI 318-14, Section 25.5.2

$$\begin{aligned}
 T_{prov} / T_{slab} &: 0.99 < 2 \\
 L_{st} &= \max(1.3 * L_d, 12 \text{ in})
 \end{aligned}$$

Calculate  $L_d$ : per ACI 318-14, Section 25.4.2

$$\begin{aligned}
 \text{clear spacing} &= 11.5 \text{ in} = \text{Spacing} - db \\
 2 * db &= 1 \text{ in} < \text{clear spacing} \\
 \text{cover} &= 1 \text{ in} \\
 db &= 0.5 \text{ in} < \text{cover}
 \end{aligned}$$

$$\begin{aligned}
 L_d &= (f_y * \psi_t * \psi_e) / (25 * \lambda * \sqrt{f_c}) * db \\
 L_d &= 29.21 * db \\
 L_d &= 14.61 \text{ in} \\
 L_{st} &= 18.99 \text{ in} \\
 L_{st, prov} &= 20 \text{ in} > L_{st} \rightarrow \text{reduce capacity by } L_{st, prov} / L_{st}
 \end{aligned}$$



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|                 |   |                    |             |                 |          |
|-----------------|---|--------------------|-------------|-----------------|----------|
| <b>Subject:</b> | Check Reinforcement at Shelter Concrete | <b>Job Number:</b> | B9959006.00 | <b>Date:</b>    | 06/27/19 |
| <b>Job:</b>     | UC Santa Cruz Tier 1 Eval               | <b>By:</b>         | PN          | <b>Section:</b> |          |
|                 | CAAN 7130                               | <b>Checked By:</b> |             |                 |          |

2) Standard Hooks in Tension per ACI 318-14, Section 25.4.3.1

|                 |     |          |
|-----------------|-----|----------|
| $\psi_e =$      | 1   | 25.4.3.2 |
| $\lambda =$     | 1   | 25.4.3.2 |
| side cover =    | 12  | in       |
| bar ext cover = | 12  | in       |
| $\psi_c =$      | 0.7 | 25.4.3.2 |
| $\psi_r =$      | 1   | 25.4.3.2 |

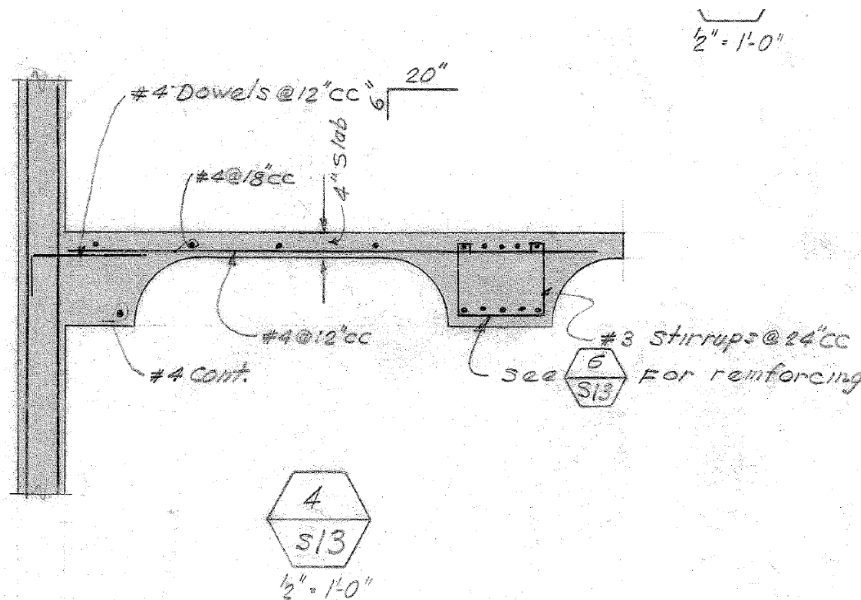
Ldh = max of the following:

|        |   |
|--------|---|
| inches | Criteria  |
| 5.11   | $(f_y \psi_e \psi_c \psi_r) / (50 \lambda \sqrt{f_c}) * db$ |
| 4      | 8 * db  |
| 6      | 6 in  |

Ldh = 6.00 in  
 Ldh, prov = 6 in = Ldh --> hooked bar capacity is developed

**\*\*Modified Capacity:**

$T_{prov\_red} = 7.2 \text{ kip / ft} = Lst_{prov} / Lst * T_{prov}$   
 $DCR = T_{slab} / W_{slab} / T_{prov\_red}$   
**DCR = 101% < 1.5, forces can be refined**




**Profis Anchor 2.7.5**
[www.hilti.us](http://www.hilti.us)

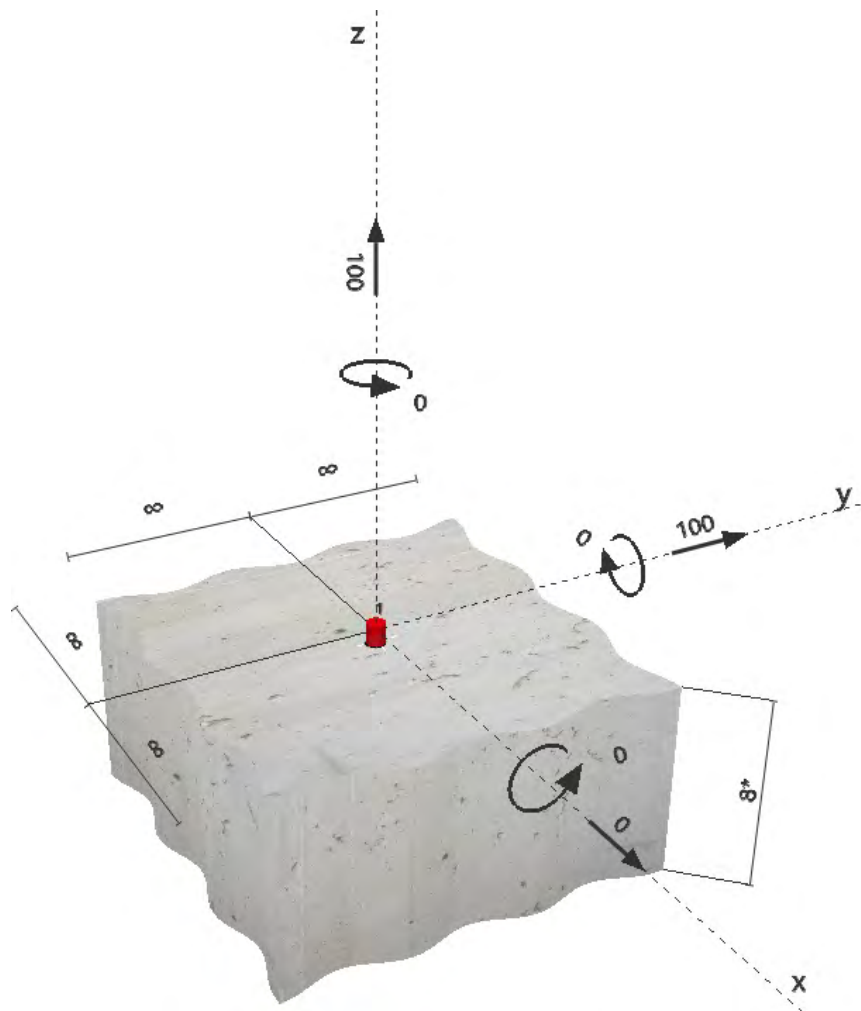
 Company:  
 Specifier:  
 Address:  
 Phone | Fax:  
 E-Mail:

 Page:  
 Project:  
 Sub-Project | Pos. No.:  
 Date:

 1  
  
 5/24/2019

**Specifier's comments:**
**1 Input data**

|   |   |
|---|---|
| <b>Anchor type and diameter:</b>          | <b>Hex Head ASTM F 1554 GR. 36 3/4</b>  |
| Effective embedment depth:                | $h_{ef} = 4.000$ in.  |
| Material:                                 | ASTM F 1554   |
| Proof:                                    | Design method ACI 318-14 / CIP  |
| Stand-off installation:                   | - (Recommended plate thickness: not calculated)   |
| Profile:                                  | no profile  |
| <b>Base material:</b>                     | <b>cracked concrete, 3000, <math>f_c' = 3000</math> psi; <math>h = 8.000</math> in.</b> |
| Reinforcement:                            | tension: condition B, shear: condition B;<br>edge reinforcement: none or < No. 4 bar    |
| <b>Seismic loads (cat. C, D, E, or F)</b> | <b>Tension load: yes (17.2.3.4.3 (d))</b><br><b>Shear load: yes (17.2.3.5.3 (c))</b>    |


**Geometry [in.] & Loading [lb, in.lb]**




## Profis Anchor 2.7.5

www.hilti.us

Company:  
 Specifier:  
 Address:  
 Phone | Fax: |  
 E-Mail:

Page: 2  
 Project:  
 Sub-Project | Pos. No.:  
 Date: 5/24/2019

## 2 Load case/Resulting anchor forces

Load case: Design loads

### Anchor reactions [lb]

Tension force: (+Tension, -Compression)

| Anchor | Tension force | Shear force | Shear force x | Shear force y |
|--------|---------------|-------------|---------------|---------------|
| 1      | 100           | 100         | 0             | 100           |

max. concrete compressive strain: - [%]  
 max. concrete compressive stress: - [psi]  
 resulting tension force in (x/y)=(0.000/0.000): 0 [lb]  
 resulting compression force in (x/y)=(0.000/0.000): 0 [lb]

## 3 Tension load

|  | Load $N_{ua}$ [lb] | Capacity $\phi N_n$ [lb] | Utilization $\beta_N = N_{ua}/\phi N_n$ | Status |
|--|--------------------|--------------------------|---|--------|
| Steel Strength*                          | 100                | 14529                    | 1                                       | OK     |
| Pullout Strength*                        | 100                | 8240                     | 2                                       | OK     |
| Concrete Breakout Strength**             | 100                | 5521                     | 2                                       | OK     |
| Concrete Side-Face Blowout, direction ** | N/A                | N/A                      | N/A                                     | N/A    |

\* anchor having the highest loading \*\*anchor group (anchors in tension)

### 3.1 Steel Strength

$$N_{sa} = A_{se,N} f_{uta} \quad \text{ACI 318-14 Eq. (17.4.1.2)}$$

$$\phi N_{sa} \quad N_{ua} \quad \text{ACI 318-14 Table 17.3.1.1}$$

#### Variables

| $A_{se,N}$ [in. <sup>2</sup> ] | $f_{uta}$ [psi] |
|--------------------------------|-----------------|
| 0.33                           | 58000           |

#### Calculations

| $N_{sa}$ [lb] |
|---------------|
| 19372         |

#### Results

| $N_{sa}$ [lb] | $\phi_{steel}$ | $\phi N_{sa}$ [lb] | $N_{ua}$ [lb] |
|---------------|----------------|--------------------|---------------|
| 19372         | 0.750          | 14529              | 100           |

### 3.2 Pullout Strength

$$N_{pN} = \psi_{c,p} N_p \quad \text{ACI 318-14 Eq. (17.4.3.1)}$$

$$N_p = 8 A_{brg} f'_c \quad \text{ACI 318-14 Eq. (17.4.3.4)}$$

$$\phi N_{pN} \quad N_{ua} \quad \text{ACI 318-14 Table 17.3.1.1}$$

#### Variables

| $\psi_{c,p}$ | $A_{brg}$ [in. <sup>2</sup> ] | $\lambda_a$ | $f'_c$ [psi] |
|--------------|-------------------------------|-------------|--------------|
| 1.000        | 0.65                          | 1.000       | 3000         |

#### Calculations

| $N_p$ [lb] |
|------------|
| 15696      |

#### Results

| $N_{pn}$ [lb] | $\phi_{concrete}$ | $\phi_{seismic}$ | $\phi_{nonductile}$ | $\phi N_{pn}$ [lb] | $N_{ua}$ [lb] |
|---------------|-------------------|------------------|---------------------|--------------------|---------------|
| 15696         | 0.700             | 0.750            | 1.000               | 8240               | 100           |



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## 3.3 Concrete Breakout Strength

$$N_{cb} = \left( \frac{A_{Nc}}{A_{Nc0}} \right) \psi_{ed,N} \psi_{c,N} \psi_{cp,N} N_b \quad \text{ACI 318-14 Eq. (17.4.2.1a)}$$

$$\phi N_{cb} N_{ua} \quad \text{ACI 318-14 Table 17.3.1.1}$$

$A_{Nc}$  see ACI 318-14, Section 17.4.2.1, Fig. R 17.4.2.1(b)

$$A_{Nc0} = 9 h_{ef}^2 \quad \text{ACI 318-14 Eq. (17.4.2.1c)}$$

$$\psi_{ec,N} = \left( \frac{1}{1 + \frac{2 e_N}{3 h_{ef}}} \right) 1.0 \quad \text{ACI 318-14 Eq. (17.4.2.4)}$$

$$\psi_{ed,N} = 0.7 + 0.3 \left( \frac{c_{a,min}}{1.5 h_{ef}} \right) 1.0 \quad \text{ACI 318-14 Eq. (17.4.2.5b)}$$

$$\psi_{cp,N} = \text{MAX} \left( \frac{c_{a,min}}{c_{ac}}, \frac{1.5 h_{ef}}{c_{ac}} \right) 1.0 \quad \text{ACI 318-14 Eq. (17.4.2.7b)}$$

$$N_b = k_c \lambda_a f_c h_{ef}^{1.5} \quad \text{ACI 318-14 Eq. (17.4.2.2a)}$$

## Variables

| $h_{ef}$ [in.] | $e_{c1,N}$ [in.] | $e_{c2,N}$ [in.] | $c_{a,min}$ [in.] | $\psi_{c,N}$ |
|----------------|------------------|------------------|-------------------|--------------|
| 4.000          | 0.000            | 0.000            |                   | 1.000        |

| $c_{ac}$ [in.] | $k_c$ | $\lambda_a$ | $f_c$ [psi] |
|----------------|-------|-------------|-------------|
| -              | 24    | 1.000       | 3000        |

## Calculations

| $A_{Nc}$ [in. <sup>2</sup> ] | $A_{Nc0}$ [in. <sup>2</sup> ] | $\psi_{ec1,N}$ | $\psi_{ec2,N}$ | $\psi_{ed,N}$ | $\psi_{cp,N}$ | $N_b$ [lb] |
|------------------------------|-------------------------------|----------------|----------------|---------------|---------------|------------|
| 144.00                       | 144.00                        | 1.000          | 1.000          | 1.000         | 1.000         | 10516      |

## Results

| $N_{cb}$ [lb] | $\phi_{concrete}$ | $\phi_{seismic}$ | $\phi_{nonductile}$ | $\phi N_{cb}$ [lb] | $N_{ua}$ [lb] |
|---------------|-------------------|------------------|---------------------|--------------------|---------------|
| 10516         | 0.700             | 0.750            | 1.000               | 5521               | 100           |



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## 4 Shear load

|                                       | Load $V_{ua}$ [lb] | Capacity $\phi V_n$ [lb] | Utilization $\beta_v = V_{ua}/\phi V_n$ | Status |
|---------------------------------------|--------------------|--------------------------|---|--------|
| Steel Strength*                       | 100                | 7555                     | 2                                       | OK     |
| Steel failure (with lever arm)*       | N/A                | N/A                      | N/A                                     | N/A    |
| Pryout Strength**                     | 100                | 14723                    | 1                                       | OK     |
| Concrete edge failure in direction ** | N/A                | N/A                      | N/A                                     | N/A    |

\* anchor having the highest loading \*\*anchor group (relevant anchors)

## 4.1 Steel Strength

$$V_{sa} = 0.6 A_{se,V} f_{uta} \quad \text{ACI 318-14 Eq. (17.5.1.2b)}$$

$$\phi V_{steel} = V_{sa} \quad \text{ACI 318-14 Table 17.3.1.1}$$

## Variables

|                                |                 |
|--------------------------------|-----------------|
| $A_{se,V}$ [in. <sup>2</sup> ] | $f_{uta}$ [psi] |
| 0.33                           | 58000           |

## Calculations

|               |
|---------------|
| $V_{sa}$ [lb] |
| 11623         |

## Results

|               |                |                    |               |
|---------------|----------------|--------------------|---------------|
| $V_{sa}$ [lb] | $\phi_{steel}$ | $\phi V_{sa}$ [lb] | $V_{ua}$ [lb] |
| 11623         | 0.650          | 7555               | 100           |

## 4.2 Pryout Strength

$$V_{cp} = k_{cp} \left[ \left( \frac{A_{Nc}}{A_{Nc0}} \right) \psi_{ed,N} \psi_{c,N} \psi_{cp,N} N_b \right] \quad \text{ACI 318-14 Eq. (17.5.3.1a)}$$

$$\phi V_{cp} = V_{ua} \quad \text{ACI 318-14 Table 17.3.1.1}$$

$$A_{Nc} \text{ see ACI 318-14, Section 17.4.2.1, Fig. R 17.4.2.1(b)}$$

$$A_{Nc0} = 9 h_{ef}^2 \quad \text{ACI 318-14 Eq. (17.4.2.1c)}$$

$$\psi_{ec,N} = \left( \frac{1}{1 + \frac{2 e_N}{3 h_{ef}}} \right) 1.0 \quad \text{ACI 318-14 Eq. (17.4.2.4)}$$

$$\psi_{ed,N} = 0.7 + 0.3 \left( \frac{c_{a,min}}{1.5 h_{ef}} \right) 1.0 \quad \text{ACI 318-14 Eq. (17.4.2.5b)}$$

$$\psi_{cp,N} = \text{MAX} \left( \frac{c_{a,min}}{c_{ac}}, \frac{1.5 h_{ef}}{c_{ac}} \right) 1.0 \quad \text{ACI 318-14 Eq. (17.4.2.7b)}$$

$$N_b = k_c \lambda_a f_c h_{ef}^{1.5} \quad \text{ACI 318-14 Eq. (17.4.2.2a)}$$

## Variables

|          |                |                  |                  |                   |
|----------|----------------|------------------|------------------|-------------------|
| $k_{cp}$ | $h_{ef}$ [in.] | $e_{c1,N}$ [in.] | $e_{c2,N}$ [in.] | $c_{a,min}$ [in.] |
| 2        | 4.000          | 0.000            | 0.000            |                   |

|              |                |       |             |             |
|--------------|----------------|-------|-------------|-------------|
| $\psi_{c,N}$ | $c_{ac}$ [in.] | $k_c$ | $\lambda_a$ | $f_c$ [psi] |
| 1.000        | -              | 24    | 1.000       | 3000        |

## Calculations

|                              |                               |                |                |               |               |            |
|------------------------------|-------------------------------|----------------|----------------|---------------|---------------|------------|
| $A_{Nc}$ [in. <sup>2</sup> ] | $A_{Nc0}$ [in. <sup>2</sup> ] | $\psi_{ec1,N}$ | $\psi_{ec2,N}$ | $\psi_{ed,N}$ | $\psi_{cp,N}$ | $N_b$ [lb] |
| 144.00                       | 144.00                        | 1.000          | 1.000          | 1.000         | 1.000         | 10516      |

## Results

|               |                   |                  |                     |                    |               |
|---------------|-------------------|------------------|---------------------|--------------------|---------------|
| $V_{cp}$ [lb] | $\phi_{concrete}$ | $\phi_{seismic}$ | $\phi_{nonductile}$ | $\phi V_{cp}$ [lb] | $V_{ua}$ [lb] |
| 21033         | 0.700             | 1.000            | 1.000               | 14723              | 100           |




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**5 Combined tension and shear loads**

| $\beta_N$ | $\beta_V$ | $\zeta$ | Utilization $\beta_{N,V}$ [%] | Status |
|-----------|-----------|---------|-------------------------------|--------|
| 0.018     | 0.013     | 5/3     | 1                             | OK     |

$$\beta_{NV} = \beta_N^{\zeta} + \beta_V^{\zeta} \leq 1$$

**6 Warnings**

- The anchor design methods in PROFIS Anchor require rigid anchor plates per current regulations (ETAG 001/Annex C, EOTA TR029, etc.). This means load re-distribution on the anchors due to elastic deformations of the anchor plate are not considered - the anchor plate is assumed to be sufficiently stiff, in order not to be deformed when subjected to the design loading. PROFIS Anchor calculates the minimum required anchor plate thickness with FEM to limit the stress of the anchor plate based on the assumptions explained above. The proof if the rigid base plate assumption is valid is not carried out by PROFIS Anchor. Input data and results must be checked for agreement with the existing conditions and for plausibility!
- Condition A applies when supplementary reinforcement is used. The  $\zeta$  factor is increased for non-steel Design Strengths except Pullout Strength and Pryout strength. Condition B applies when supplementary reinforcement is not used and for Pullout Strength and Pryout Strength. Refer to your local standard.
- Checking the transfer of loads into the base material and the shear resistance are required in accordance with ACI 318 or the relevant standard!
- An anchor design approach for structures assigned to Seismic Design Category C, D, E or F is given in ACI 318-14, Chapter 17, Section 17.2.3.4.3 (a) that requires the governing design strength of an anchor or group of anchors be limited by ductile steel failure. If this is NOT the case, the connection design (tension) shall satisfy the provisions of Section 17.2.3.4.3 (b), Section 17.2.3.4.3 (c), or Section 17.2.3.4.3 (d). The connection design (shear) shall satisfy the provisions of Section 17.2.3.5.3 (a), Section 17.2.3.5.3 (b), or Section 17.2.3.5.3 (c).
- Section 17.2.3.4.3 (b) / Section 17.2.3.5.3 (a) require the attachment the anchors are connecting to the structure be designed to undergo ductile yielding at a load level corresponding to anchor forces no greater than the controlling design strength. Section 17.2.3.4.3 (c) / Section 17.2.3.5.3 (b) waive the ductility requirements and require the anchors to be designed for the maximum tension / shear that can be transmitted to the anchors by a non-yielding attachment. Section 17.2.3.4.3 (d) / Section 17.2.3.5.3 (c) waive the ductility requirements and require the design strength of the anchors to equal or exceed the maximum tension / shear obtained from design load combinations that include E, with E increased by  $\omega_0$ .

**Fastening meets the design criteria!**


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## 7 Installation data

Anchor plate, steel: -  
 Profile: -  
 Hole diameter in the fixture: -  
 Plate thickness (input): -  
 Recommended plate thickness: -  
 Drilling method: -  
 Cleaning: No cleaning of the drilled hole is required

Anchor type and diameter: Hex Head ASTM F 1554 GR. 36 3/4  
 Installation torque: -  
 Hole diameter in the base material: - in.  
 Hole depth in the base material: 4.000 in.  
 Minimum thickness of the base material: 5.000 in.

### Coordinates Anchor in.

| Anchor | x     | y     | C-x | C+x | C-y | C+y |
|--------|-------|-------|-----|-----|-----|-----|
| 1      | 0.000 | 0.000 | -   | -   | -   | -   |

## 8 Remarks; Your Cooperation Duties

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# UC Santa Cruz Tier 1

Latitude, Longitude: 36.99752620, -122.05373821



|                                       |                                  |
|---------------------------------------|----------------------------------|
| <b>Date</b>                           | 6/4/2019, 9:11:34 AM             |
| <b>Design Code Reference Document</b> | ASCE41-17                        |
| <b>Custom Probability</b>             |                                  |
| <b>Site Class</b>                     | D - Default (See Section 11.4.3) |

| Type            | Description                             | Value  |
|-----------------|---|--------|
| Hazard Level    |   | BSE-2N |
| S <sub>s</sub>  | spectral response (0.2 s)               | 1.638  |
| S <sub>1</sub>  | spectral response (1.0 s)               | 0.629  |
| S <sub>XS</sub> | site-modified spectral response (0.2 s) | 1.965  |
| S <sub>X1</sub> | site-modified spectral response (1.0 s) | 1.069  |
| F <sub>a</sub>  | site amplification factor (0.2 s)       | 1.2    |
| F <sub>v</sub>  | site amplification factor (1.0 s)       | 1.7    |
| ssuh            | max direction uniform hazard (0.2 s)    | 1.758  |
| crs             | coefficient of risk (0.2 s)             | 0.932  |
| ssrt            | risk-targeted hazard (0.2 s)            | 1.638  |
| ssd             | deterministic hazard (0.2 s)            | 3.026  |
| s1uh            | max direction uniform hazard (1.0 s)    | 0.69   |
| cr1             | coefficient of risk (1.0 s)             | 0.912  |
| s1rt            | risk-targeted hazard (1.0 s)            | 0.629  |
| s1d             | deterministic hazard (1.0 s)            | 1.032  |

| Type            | Description                             | Value  |
|-----------------|---|--------|
| Hazard Level    |   | BSE-1N |
| S <sub>XS</sub> | site-modified spectral response (0.2 s) | 1.31   |
| S <sub>X1</sub> | site-modified spectral response (1.0 s) | 0.713  |

| Type         | Description                             | Value  |
|--------------|---|--------|
| Hazard Level |   | BSE-2E |
| $S_S$        | spectral response (0.2 s)               | 1.287  |
| $S_1$        | spectral response (1.0 s)               | 0.488  |
| $S_{XS}$     | site-modified spectral response (0.2 s) | 1.545  |
| $S_{X1}$     | site-modified spectral response (1.0 s) | 0.885  |
| $f_a$        | site amplification factor (0.2 s)       | 1.2    |
| $f_v$        | site amplification factor (1.0 s)       | 1.812  |

| Type         | Description                             | Value  |
|--------------|---|--------|
| Hazard Level |   | BSE-1E |
| $S_S$        | spectral response (0.2 s)               | 0.696  |
| $S_1$        | spectral response (1.0 s)               | 0.245  |
| $S_{XS}$     | site-modified spectral response (0.2 s) | 0.865  |
| $S_{X1}$     | site-modified spectral response (1.0 s) | 0.517  |
| $F_a$        | site amplification factor (0.2 s)       | 1.243  |
| $F_v$        | site amplification factor (1.0 s)       | 2.11   |

| Type         | Description                              | Value        |
|--------------|--|--------------|
| Hazard Level |  | T-Sub-L Data |
| T-Sub-L      | Long-period transition period in seconds | 12           |

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7130 - Cowell College Academic Building

Appendix C  
Photos and Details



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Figure 1 - View from the south with CAAN 7130 (Academic Building) on the left



Figure 2 - Door/wall between retrofitted and unretrofitted portion of CAAN 7134 (Cowell College Commons)





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Figure 3 - View of shelter/breezeway from the north side



Figure 4 - View of shelter/breezeway to the Academic Building (CAAN 7130)



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7130 - Cowell College Academic Building

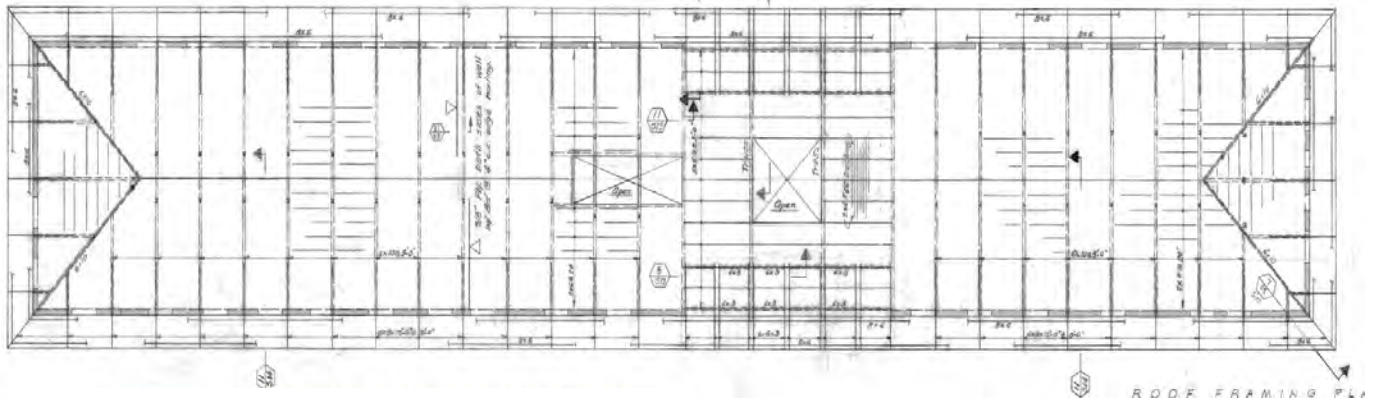


Figure 5 - Roof Framing Plan

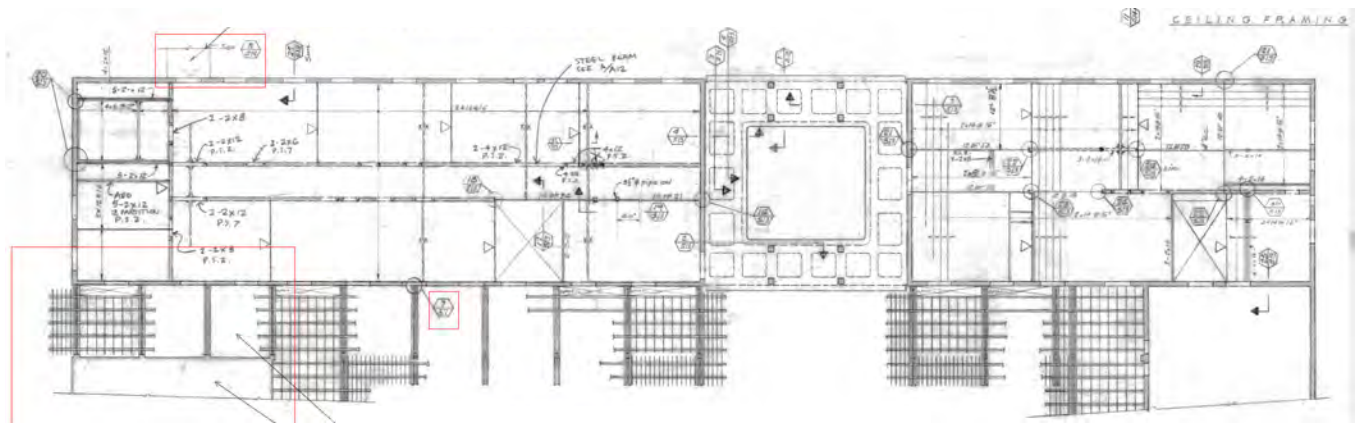


Figure 6 - Second Floor Framing Plan

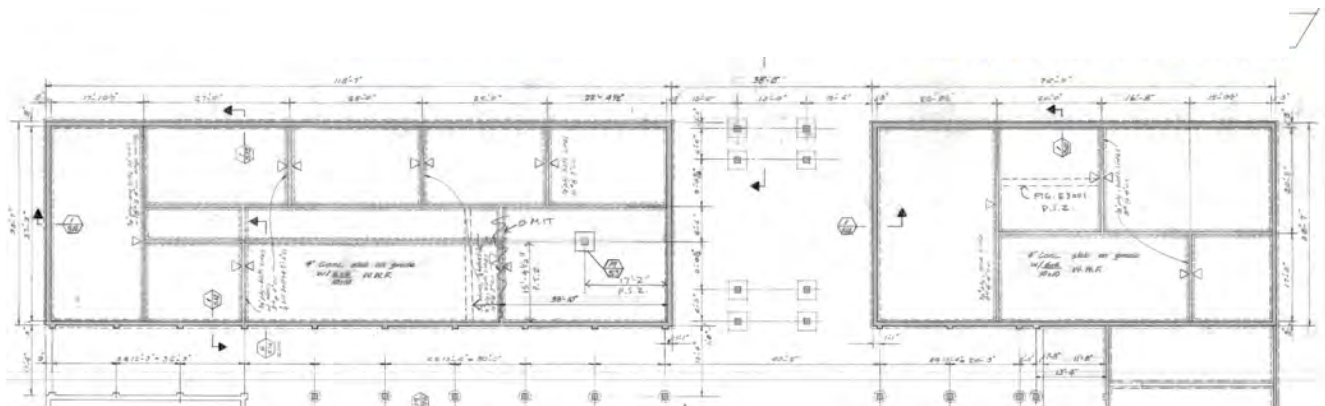


Figure 7 - Foundation Plan







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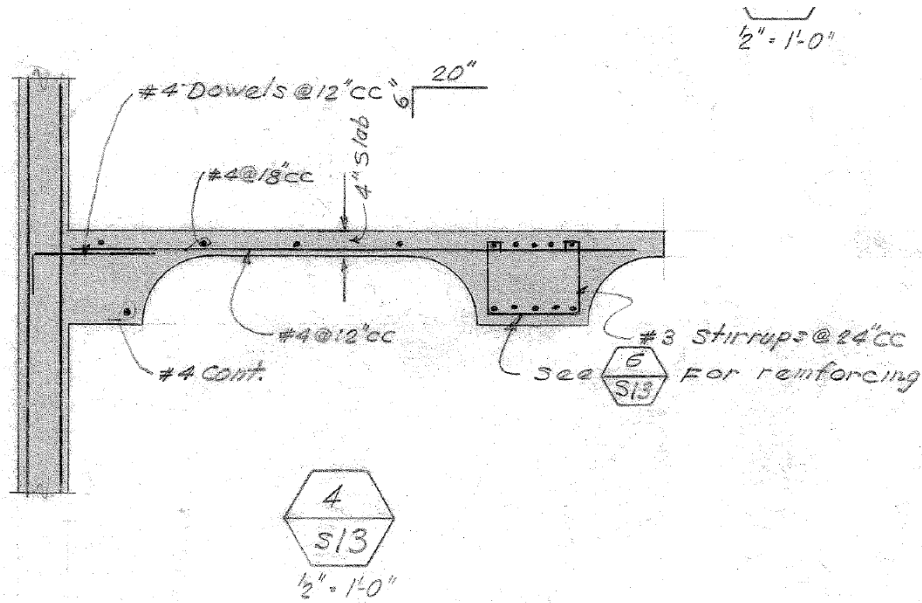


Figure 10 - Shelter/Breezeway to Concrete Wall Connection Detail 4/S13

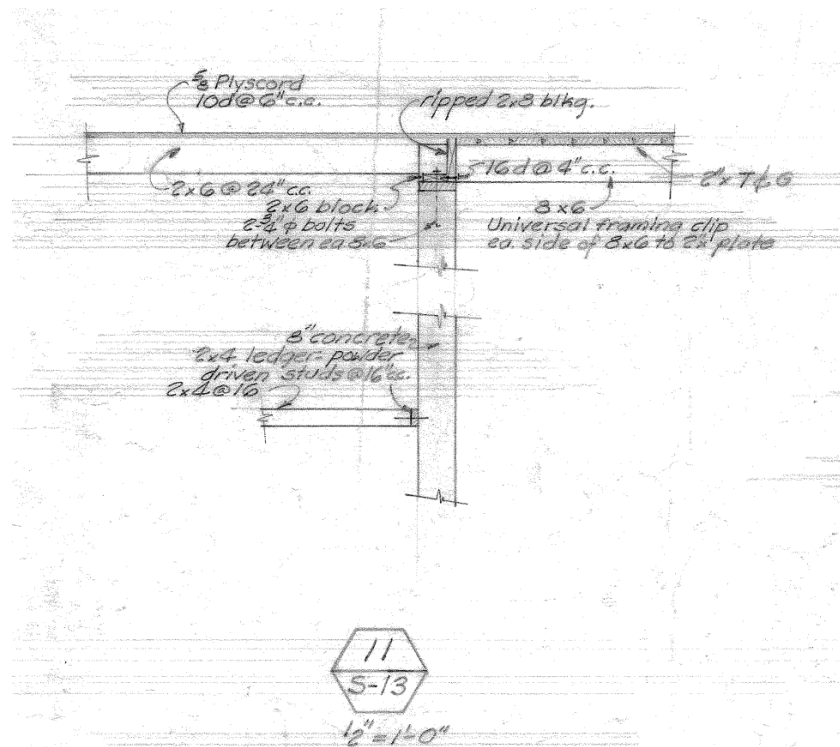


Figure 11 - Second Floor Diaphragm to Concrete Wall Detail 11/S13



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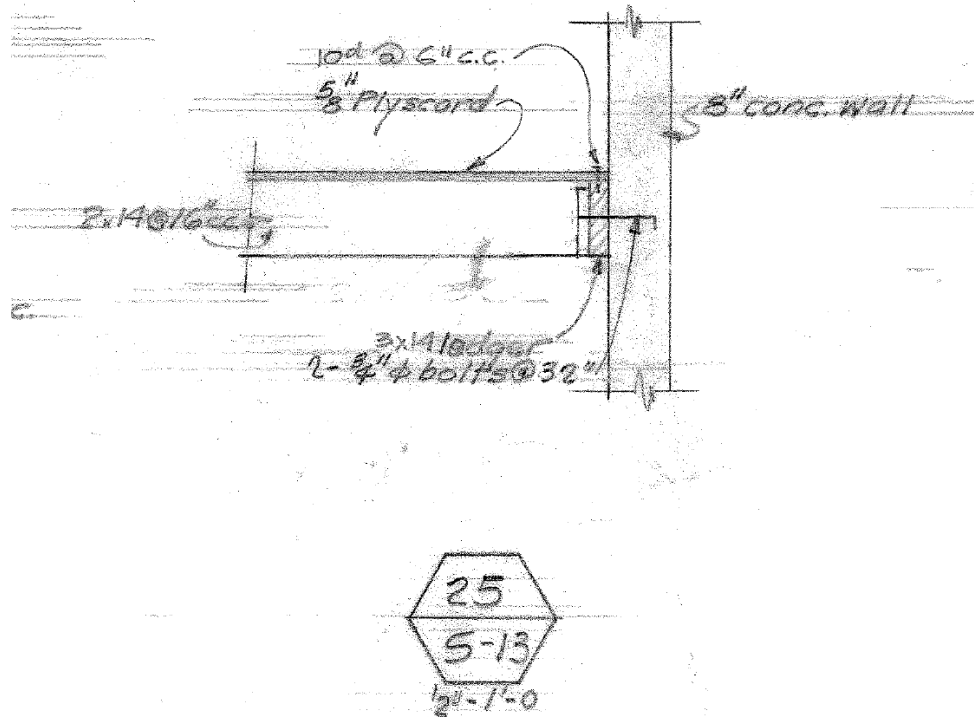


Figure 12 - Second Floor Diaphragm to Concrete Wall Detail 25/S13

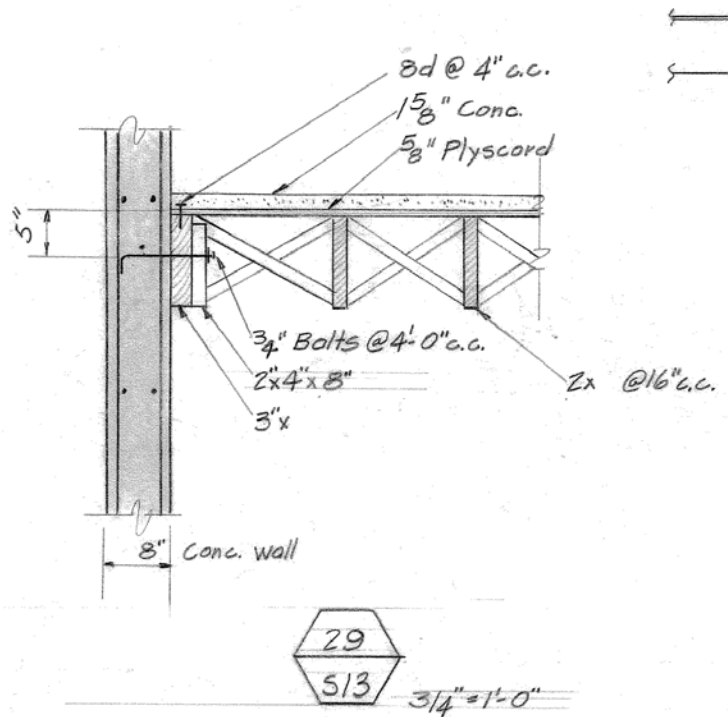


Figure 13 - Second Floor Diaphragm to Concrete Wall Detail 29/S13 (Joists Parallel to Concrete Shear Wall)



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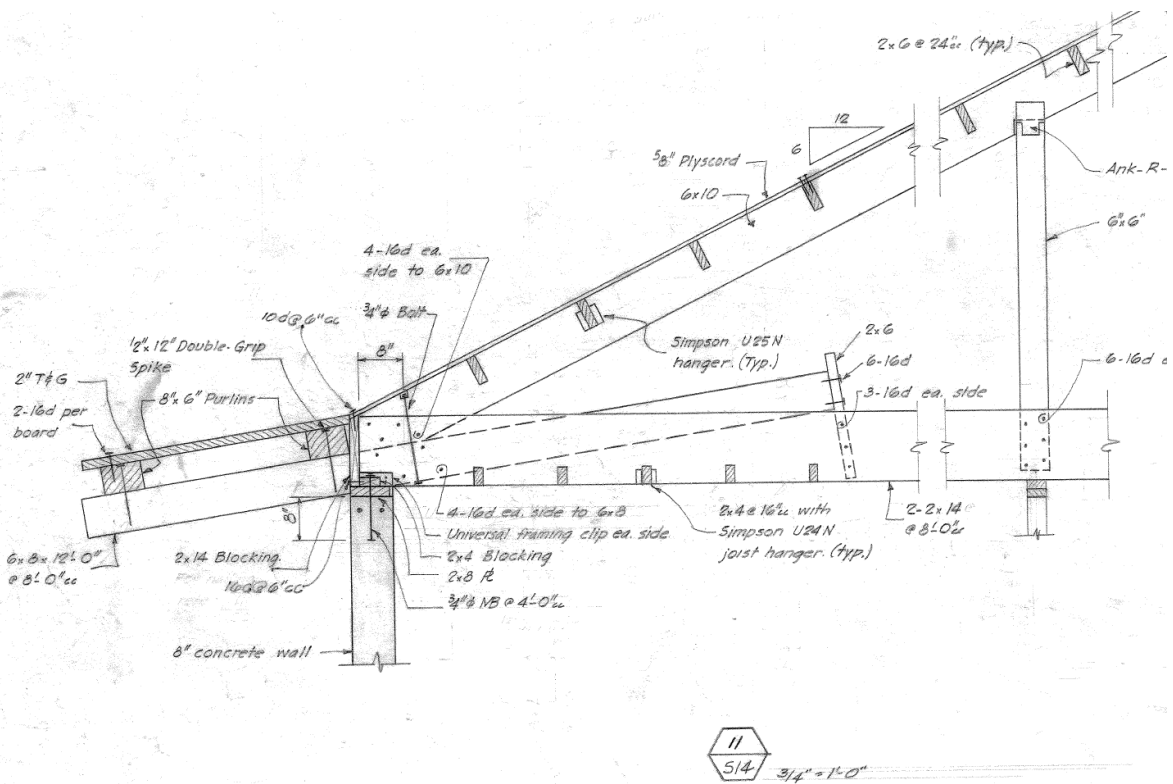


Figure 14 - Typical Roof Truss Section Detail 11/S14