

**ASCE 41-17 Tier 1 Seismic Evaluation**

Building Name: Tang Center, West Wing

CAAN ID: 1286

Auxiliary Building ID: 1286.1

Address: 2222 Bancroft Way, Berkeley, CA

Site location coordinates: Latitude 37.8675 Longitudinal -122.2643



Aerial Photo

North Exterior Elevation

**UCOP SEISMIC PERFORMANCE LEVEL (OR "RATING") BASED ON TIER 1 EVALUATION FINDINGS: IV****BUILDING DATA**

ASCE 41-17 Model Building Type (Governing Building Type bolded for Seismic Risk Model when multiple types exist):

- Longitudinal Direction: **S1a Steel Moment Frame** on top of C2 Concrete shear wall system
- Transverse Direction: **S1a Steel Moment Frame** on top of C2 Concrete shear wall system

Square Footage: 11,600 ft<sup>2</sup> out of 79,509 ft<sup>2</sup> total

Building Length: 58'

Building Width: 58'

Building Height: 39'

Story Height: 13' (1<sup>st</sup>-Roof)Number of stories *above* grade: 3Number of basement stories *below* grade: 0

Year of Original Construction and Code Year: 1993, 1989 CBC (1988 UCB)

Year of Later Constuction and Code Year:

**COST RANGE TO RETROFIT (if applicable): N/A**

## BUILDING DESCRIPTION

### General

The Tang Center was constructed in 1992. The complete building is T shaped in plan covering a footprint of approximately 252' in the North-South direction and 170' in the East West direction. The West Wing is generally square in plan, spanning approximately 57' in the North-South and East-West direction. The West Wing is located to the West of the main portion of the Tang Center. This structure is three stories, each 13' tall with no basement level. There is a seismic joint separating the Main Building from the West Wing in the stem of the tee. The West Wing portion has a building area of 9,000 square feet and houses various office space.

### Structural System

The gravity load structural system consists of light weight concrete filled metal deck on wide flange steel beam and column framing. The first floor is a reinforced, 5" slab on grade. The lateral system consists of 12" concrete shear walls in both longitudinal and transverse directions up to the second floor with two bays of Welded Unreinforced Flange (WUF) moment frame lines offset from the perimeter on each side approximately 9' that extends from the foundation to the roof. The moment frame is the main lateral force resisting system of the third story. The concrete filled metal decks serve as horizontal diaphragms and the concrete shear walls and steel columns as vertical elements. The walls and columns are founded on spread footings and tied together with grade beams below the slab on grade.

### Building Condition

Good

**Date of Site Visit:** 03/28/2019, Ray Pugliesi & Torrey Bolden, Degenkolb Engineers

Limitations of walk-through: none

## SITE INFORMATION

Site Class (A-F): C Basis: Geologic Hazards and Site Classification, Geomatrix Plate 2

Site Specific Ground Motion Study? Yes, 2015 Update to the Site-Specific Seismic Hazard Analyses and Development of Seismic Design Ground Motions

**BSE-1N Spectral Accelerations:** Basis: 2015 Site Specific Report Table 5 for 36-75 ft Soil

$S_{DS}$ : 2.40g  $S_{D1}$ : 0.71g

**BSE-2E Spectral Accelerations:** Basis: 2015 Site Specific Report Table 6 for 36-75 ft Soil

$S_{XS}$ : 3.15g  $S_{X1}$ : 1.05g

Level of Seismicity: High

Performance Level: Collapse Prevention Structural Performance

Geologic Hazards:

Fault Rupture No Basis: Earthquake Zones of Required Investigation- Oakland West Quadrangle <https://maps.conservation.ca.gov/cgs/informationwarehouse/regulatorymaps/>

Liquefaction No Basis: Earthquake Zones of Required Investigation- Oakland West Quadrangle <https://maps.conservation.ca.gov/cgs/informationwarehouse/regulatorymaps/>

Landslide No Basis: Earthquake Zones of Required Investigation- Oakland West Quadrangle <https://maps.conservation.ca.gov/cgs/informationwarehouse/regulatorymaps/>

**PREVIOUS RATINGS SUMMARY**

1. Good – 1997 Preliminary Seismic Evaluation (SAFER), Forell Elsesser Engineers, Inc.

**DOCUMENTATION**

Architectural Drawings: “UC Berkeley, University Health Service Building”, Anshen + Allen, 6/18/1991, A0.1-2, A1.1-3, A2.1-4, A3.1-4, A3.10, A4.1A-1D, A4.2A-2D, A4.3A-3D, A5.0, A5.1, A5.3-6, A6.1A-1D, A6.2A-2D, A6.3A-3D, A7.1-3, A8.1, A8.3-5, A8.10-12, A8.20-21, A8.30, A8.40, A9.1-6, A9.10-14

Structural Drawings: “UC Berkeley, University Health Service Building”, Forell Elsesser Engineers, Inc., 6/18/1991, S0.1, S2.1-4, S3.1-2, S5.1-6, S7.1-8

Seismic Evaluations: “1997 Preliminary Seismic Evaluation (SAFER)”, Forell Elsesser Engineers, Inc., 08/26/1997, FEMA-178 Structural Checklist

Geotechnical Reports: N/A

Other Documents: N/A

**CONSTRUCTION DATA**

|                                 |   |             |                 |
|---------------------------------|---|-------------|-----------------|
| Gravity Load Structural System: | Concrete on metal deck with wide flange steel framing   |             |                 |
| Exterior Transverse Walls:      | Cement plaster / glass façade   | Opening(s)? | Yes             |
| Exterior Longitudinal Walls:    | Cement plaster / glass façade   | Opening(s)? | Yes             |
| Roof Materials/Framing:         | 3” 18 ga Metal Deck with 2 ½” Lightweight Concrete Fill   |             |                 |
| Intermediate Floors/Framing:    | 3” 18 ga Metal Deck with 3 ¼” Lightweight Concrete Fill   |             |                 |
| Ground Floor:                   | 5” Concrete Slab on Grade   |             |                 |
| Columns:                        | Wide Flange and Tube Steel  | Foundation: | Spread footings |
| General Condition of Structure: | Good  |             |                 |
| Evidence of Settling?:          | No  |             |                 |
| Special Features & Comments:    | Seismic joint between the Main Building and the West Wing.<br>West Wing concrete walls stop at the 3 <sup>rd</sup> floor. |             |                 |
|                                 |   |             |                 |
|                                 |   |             |                 |

**LATERAL-FORCE-RESISTING SYSTEM**

|  | Longitudinal                                   | Transverse                                     |
|--|--|--|
| <b>ASCE 41-17 Building Type:</b>               | S1a Steel Moment Frame and C2 Concrete SW      | S1a Steel Moment Frame and C2 Concrete SW      |
| Diaphragms:                                    | Metal Deck with Conc. Top.                     | Metal Deck with Conc. Top.                     |
| Vertical Elements:                             | Concrete Shear Wall, Wide Flange Steel Columns | Concrete Shear Wall, Wide Flange Steel Columns |
| Connections:                                   | Shear studs to SW, WUF                         | Shear studs to SW, WUF                         |
| Details:                                       | Ex. 36/S5.6, S7.1 (MF Conn.)                   | Ex. 36/S5.6, S7.1 (MF Conn.)                   |
| Estimated Fundamental Period, T (sec):         | 0.312  | 0.312  |
| BSE-2E Spectral Acceleration, S <sub>a</sub> : | 3.15g  | 3.15g  |

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|  |                             |                             |
|--|-----------------------------|-----------------------------|
| Modification Factor, C:                      | <u>1.1 (C2 – Table 4-7)</u> | <u>1.1 (C2 – Table 4-7)</u> |
| Building Weight, W (kips):                   | <u>1,062</u>                | <u>1,062</u>                |
| Seismic Base Shear, V (kips):                | <u>3,678</u>                | <u>3,678</u>                |
| System Modification Factor, M <sub>s</sub> : | <u>4.5 CP @ BSE-2E</u>      | <u>4.5 CP @ BSE-2E</u>      |

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**Significant Structural Deficiencies, Potentially Affecting *Seismic Performance Level* Designation:**

- Lateral System Stress Check (wall shear, column shear or flexure, or brace axial as applicable)
- Load Path
- Adjacent Buildings
- Weak Story
- Soft Story
- Geometry (vertical irregularities)
- Torsion
- Mass – Vertical Irregularity
- Cripple Walls
- Wood Sills (bolting)
- Diaphragm Continuity
- Openings at Shear Walls (concrete or masonry)
- Liquefaction
- Slope Failure
- Surface Fault Rupture
- Masonry or Concrete Wall Anchorage at Flexible Diaphragm
- URM wall height to thickness ratio
- URM Parapets or Cornices
- URM Chimney
- Heavy Partitions Braced by Ceilings
- Appendages

## **OVERALL SEISMIC DEFICIENCIES & EXPECTED SEISMIC PERFORMANCE**

The below items have been identified as non-compliant:

1. *Moment Connections:* The moment connections specified in the drawings are welded unreinforced flange (WUF) connections with a bolted shear tab. These connections are typical of the Pre-Northridge period, and have been identified to perform poorly under higher cyclic demands. The expected flexural demands of these moment frame beams are low and this is not expected to affect the seismic performance of the structure.
2. *Overtuning:* The structures aspect ratio is causing the structure to not pass the quick check procedure for overturning at this force level. This is not expected to significantly affect the seismic performance of the structure because the structure is on good soil and has a well tied together foundation.

The above deficiencies are not expected to significantly affect the structural performance, and as a result the structure has been assigned an SPL rating of IV.

No non-structural deficiencies have been identified for this structure.

## **Appendices**

- A. Additional Photos
- B. ASCE 41-17 Tier 1 Checklists (Structural)
- C. UCOP Seismic Safety Policy Falling Hazards Assessment Summary
- D. Quick Check Calculations

**APPENDIX A**  
**Additional Photos**



*Figure 1 Seismic joint at roof between main structure and west wing*



*Figure 2 Seismic joint from the interior of the structure*



**APPENDIX B**  
**ASCE 41-17 Tier 1 Checklist (Structural)**

|                   |                                |                 |        |           |                     |          |   |
|-------------------|--------------------------------|-----------------|--------|-----------|---------------------|----------|---|
| UC Campus:        | Berkeley                       |                 |        | Date:     | 3/26/2019           |          |   |
| Building CAAN:    | 1286                           | Auxiliary CAAN: | 1286.1 | By Firm:  | Degenkolb Engineers |          |   |
| Building Name:    | Tang Center, West Wing         |                 |        | Initials: | TAB                 | Checked: |   |
| Building Address: | 2222 Bancroft Way, Berkeley CA |                 |        | Page:     | 1                   | of       | 3 |

## ASCE 41-17 Collapse Prevention Basic Configuration Checklist

### LOW SEISMICITY

#### BUILDING SYSTEMS - GENERAL

|                                     |                          |                          |                          | Description   |
|-------------------------------------|--------------------------|--------------------------|--------------------------|---|
| <b>C</b>                            | <b>NC</b>                | <b>N/A</b>               | <b>U</b>                 | LOAD PATH: The structure contains a complete, well-defined load path, including structural elements and connections, that serves to transfer the inertial forces associated with the mass of all elements of the building to the foundation. (Commentary: Sec. A.2.1.1. Tier 2: Sec. 5.4.1.1)   |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <b>Comments:</b>  |
| <b>C</b>                            | <b>NC</b>                | <b>N/A</b>               | <b>U</b>                 | ADJACENT BUILDINGS: The clear distance between the building being evaluated and any adjacent building is greater than 0.25% of the height of the shorter building in low seismicity, 0.5% in moderate seismicity, and 1.5% in high seismicity. (Commentary: Sec. A.2.1.2. Tier 2: Sec. 5.4.1.2) |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <b>Comments:</b><br>7" seismic gap at the roof is adequate.   |
| <b>C</b>                            | <b>NC</b>                | <b>N/A</b>               | <b>U</b>                 | MEZZANINES: Interior mezzanine levels are braced independently from the main structure or are anchored to the seismic-force-resisting elements of the main structure. (Commentary: Sec. A.2.1.3. Tier 2: Sec. 5.4.1.3)  |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <b>Comments:</b>  |

#### BUILDING SYSTEMS - BUILDING CONFIGURATION

|                                     |                          |                          |                          | Description  |
|-------------------------------------|--------------------------|--------------------------|--------------------------|--|
| <b>C</b>                            | <b>NC</b>                | <b>N/A</b>               | <b>U</b>                 | WEAK STORY: The sum of the shear strengths of the seismic-force-resisting system in any story in each direction is not less than 80% of the strength in the adjacent story above. (Commentary: Sec. A.2.2.2. Tier 2: Sec. 5.4.2.1)   |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <b>Comments:</b>   |
| <b>C</b>                            | <b>NC</b>                | <b>N/A</b>               | <b>U</b>                 | SOFT STORY: The stiffness of the seismic-force-resisting system in any story is not less than 70% of the seismic-force-resisting system stiffness in an adjacent story above or less than 80% of the average seismic-force-resisting system stiffness of the three stories above. (Commentary: Sec. A.2.2.3. Tier 2: Sec. 5.4.2.2) |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <b>Comments:</b>   |
| <b>C</b>                            | <b>NC</b>                | <b>N/A</b>               | <b>U</b>                 | VERTICAL IRREGULARITIES: All vertical elements in the seismic-force-resisting system are continuous to the foundation. (Commentary: Sec. A.2.2.4. Tier 2: Sec. 5.4.2.3)  |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <b>Comments:</b>   |

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

|                   |                                |                 |        |           |                     |          |   |
|-------------------|--------------------------------|-----------------|--------|-----------|---------------------|----------|---|
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## ASCE 41-17 Collapse Prevention Basic Configuration Checklist

|   |   |
|---|---|
| <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>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) |
| <b>Comments:</b>  |   |
| <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>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)   |
| <b>Comments:</b>  |   |
| <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>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)  |
| <b>Comments:</b>  |   |

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

#### GEOLOGIC SITE HAZARD

|   | 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>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)         |
| <b>Comments:</b>  |   |
| <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>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) |
| <b>Comments:</b>  |   |
| <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>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)  |
| <b>Comments:</b>  |   |

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|                   |                                |                 |        |           |                     |          |   |
|-------------------|--------------------------------|-----------------|--------|-----------|---------------------|----------|---|
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## ASCE 41-17 Collapse Prevention Basic Configuration Checklist

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

#### FOUNDATION CONFIGURATION

|   | Description  |
|---|--|
| <b>C</b> <b>NC</b> <b>N/A</b> <b>U</b><br><input checked="" type="checkbox"/> <input checked="" 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 <math>0.6S_a</math>. (Commentary: Sec. A.6.2.1. Tier 2: Sec. 5.4.3.3)</p> <p><b>Comments:</b><br/> <math>60/39 = 1.538</math><br/> <math>0.6 * 3.15 = 1.89</math></p>  |
| <b>C</b> <b>NC</b> <b>N/A</b> <b>U</b><br><input checked="" type="checkbox"/> <input checked="" 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/> Local grade beams tie together the lateral force elements and slab on grade ties together isolated gravity footings</p> |

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

|                   |                                |                 |        |           |                     |          |   |
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| Building Name:    | Tang Center, West Wing         |                 |        | Initials: | TAB                 | 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</b>                            | <b>NC</b>                | <b>N/A</b>               | <b>U</b>                 | <p>COMPLETE FRAMES: Steel or concrete frames classified as secondary components form a complete vertical-load-carrying system. (Commentary: Sec. A.3.1.6.1. Tier 2: Sec. 5.5.2.5.1)</p> <p><b>Comments:</b><br/>Complete steel gravity framing.</p>  |  |  |  |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <p>REDUNDANCY: The number of lines of shear walls in each principal direction is greater than or equal to 2. (Commentary: Sec. A.3.2.1.1. Tier 2: Sec. 5.5.1.1)</p> <p><b>Comments:</b><br/>Two lines of shear walls in both directions</p>  |  |  |  |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <p>SHEAR STRESS CHECK: The shear stress in the concrete shear walls, calculated using the Quick Check procedure of Section 4.4.3.3, is less than the greater of 100 lb/in.<sup>2</sup> (0.69 MPa) or <math>2\sqrt{f'_c}</math>. (Commentary: Sec. A.3.2.2.1. Tier 2: Sec. 5.5.3.1.1)</p> <p><b>Comments:</b><br/>See quick checks</p>  |  |  |  |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <p>REINFORCING STEEL: The ratio of reinforcing steel area to gross concrete area is not less than 0.0012 in the vertical direction and 0.0020 in the horizontal direction. (Commentary: Sec. A.3.2.2.2. Tier 2: Sec. 5.5.3.1.3)</p> <p><b>Comments:</b><br/>See quick checks</p>   |  |  |  |
| Connections                         |                          |                          |                          |  |  |  |  |
|                                     |                          |                          |                          | Description  |  |  |  |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <p>WALL ANCHORAGE AT FLEXIBLE DIAPHRAGMS: Exterior concrete or masonry walls that are dependent on flexible diaphragms for lateral support are anchored for out-of-plane forces at each diaphragm level with steel anchors, reinforcing dowels, or straps that are developed into the diaphragm. Connections have strength to resist the connection force calculated in the Quick Check procedure of Section 4.4.3.7. (Commentary: Sec. A.5.1.1. Tier 2: Sec. 5.7.1.1)</p> <p><b>Comments:</b></p> |  |  |  |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <p>TRANSFER TO SHEAR WALLS: Diaphragms are connected for transfer of seismic forces to the shear walls. (Commentary: Sec. A.5.2.1. Tier 2: Sec. 5.7.2)</p> <p><b>Comments:</b><br/>Shear studs are provided at beams adjacent to shear walls.</p>  |  |  |  |

|                   |                                |                 |        |           |                     |          |
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| Building CAAN:    | 1286                           | Auxiliary CAAN: | 1286.1 | By Firm:  | Degenkolb Engineers |          |
| Building Name:    | Tang Center, West Wing         |                 |        | Initials: | TAB                 | Checked: |
| Building Address: | 2222 Bancroft Way, Berkeley CA |                 |        | 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>  |

### 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 checked="" type="checkbox"/> <b>NC</b> <input type="checkbox"/> <b>N/A</b> <input 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><br>Steel columns have adequate shear capacity for flexural mechanism demands |
| <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><br>  |
| <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>No coupling beams are present   |

| Diaphragms (Stiff Or Flexible)  |   | 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>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>No split level diaphragms |
| <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>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>                          |

|                   |                                |                 |        |           |                     |          |   |
|-------------------|--------------------------------|-----------------|--------|-----------|---------------------|----------|---|
| UC Campus:        | Berkeley                       |                 |        | Date:     | 3/26/2019           |          |   |
| Building CAAN:    | 1286                           | Auxiliary CAAN: | 1286.1 | By Firm:  | Degenkolb Engineers |          |   |
| Building Name:    | Tang Center, West Wing         |                 |        | Initials: | TAB                 | Checked: |   |
| Building Address: | 2222 Bancroft Way, Berkeley CA |                 |        | 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 checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <b>Comments:</b>  |  |  |  |
| <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 checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <b>Comments:</b>  |  |  |  |
| <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 checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <b>Comments:</b>  |  |  |  |
| <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 checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <b>Comments:</b>  |  |  |  |
| <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 checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <b>Comments:</b>  |  |  |  |
| <b>Connections</b>                  |                                     |                          |                          |   |  |  |  |
|                                     |                                     |                          |                          | 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 checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <b>Comments:</b>  |  |  |  |
|                                     |                                     |                          |                          | Spread and strip footings utilized  |  |  |  |

|                   |                                |                 |        |           |                     |          |   |
|-------------------|--------------------------------|-----------------|--------|-----------|---------------------|----------|---|
| UC Campus:        | Berkeley                       |                 |        | Date:     | 3/26/2019           |          |   |
| Building CAAN:    | 1286                           | Auxiliary CAAN: | 1286.1 | By Firm:  | Degenkolb Engineers |          |   |
| Building Name:    | Tang Center, West Wing         |                 |        | Initials: | TAB                 | Checked: |   |
| Building Address: | 2222 Bancroft Way, Berkeley CA |                 |        | Page:     | 1                   | of       | 4 |

## ASCE 41-17 Collapse Prevention Structural Checklist For Building Type S1-S1A

| LOW SEISMICITY                      |                          |                          |                          |  |  |  |  |
|-------------------------------------|--------------------------|--------------------------|--------------------------|--|--|--|--|
| SEISMIC-FORCE-RESISTING SYSTEM      |                          |                          |                          |  |  |  |  |
|                                     |                          |                          |                          | Description  |  |  |  |
| <b>C</b>                            | <b>NC</b>                | <b>N/A</b>               | <b>U</b>                 | REDUNDANCY: The number of lines of moment frames in each principal direction is greater than or equal to 2. (Commentary: Sec. A.3.1.1.1. Tier 2: Sec. 5.5.1.1)   |  |  |  |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <b>Comments:</b><br>Two frame lines of two bays in each direction  |  |  |  |
| <b>C</b>                            | <b>NC</b>                | <b>N/A</b>               | <b>U</b>                 | DRIFT CHECK: The drift ratio of the steel moment frames, calculated using the Quick Check procedure of Section 4.4.3.1, is less than 0.030. (Commentary: Sec. A.3.1.3.1. Tier 2: Sec. 5.5.2.1.2)   |  |  |  |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <b>Comments:</b><br>Moment frame portion only drifts 0.017.  |  |  |  |
| <b>C</b>                            | <b>NC</b>                | <b>N/A</b>               | <b>U</b>                 | COLUMN AXIAL STRESS CHECK: The axial stress caused by gravity loads in columns subjected to overturning forces is less than $0.10F_y$ . Alternatively, the axial stress caused by overturning forces alone, calculated using the Quick Check procedure of Section 4.4.3.6, is less than $0.30F_y$ . (Commentary: Sec. A.3.1.3.2. Tier 2: Sec. 5.5.2.1.3) |  |  |  |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <b>Comments:</b><br>The column axial stress from gravity is less than $0.10 F_y$ .   |  |  |  |
| <b>C</b>                            | <b>NC</b>                | <b>N/A</b>               | <b>U</b>                 | FLEXURAL STRESS CHECK: The average flexural stress in the moment frame columns and beams, calculated using the Quick Check procedure of Section 4.4.3.9, is less than $F_y$ . Columns need not be checked if the strong column-weak beam checklist item is compliant. (Commentary: Sec. A.3.1.3.3. Tier 2: Sec. 5.5.2.1.2)                               |  |  |  |
| <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>                 | TRANSFER TO STEEL FRAMES: Diaphragms are connected for transfer of seismic forces to the steel frames. (Commentary: Sec. A.5.2.2. Tier 2: Sec. 5.7.2)  |  |  |  |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <b>Comments:</b><br>Composite steel beams at roof diaphragm  |  |  |  |
| <b>C</b>                            | <b>NC</b>                | <b>N/A</b>               | <b>U</b>                 | STEEL COLUMNS: The columns in seismic-force-resisting frames are anchored to the building foundation. (Commentary: Sec. A.5.3.1. Tier 2: Sec. 5.7.3.1)   |  |  |  |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <b>Comments:</b>   |  |  |  |

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



|                   |                                |                 |        |           |                     |          |   |
|-------------------|--------------------------------|-----------------|--------|-----------|---------------------|----------|---|
| UC Campus:        | Berkeley                       |                 |        | Date:     | 3/26/2019           |          |   |
| Building CAAN:    | 1286                           | Auxiliary CAAN: | 1286.1 | By Firm:  | Degenkolb Engineers |          |   |
| Building Name:    | Tang Center, West Wing         |                 |        | Initials: | TAB                 | Checked: |   |
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**ASCE 41-17**  
**Collapse Prevention Structural Checklist For Building Type S1-S1A**

**MODERATE SEISMICITY (COMPLETE THE FOLLOWING ITEMS IN ADDITION TO THE ITEMS FOR LOW 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"/> | <p>REDUNDANCY: The number of bays of moment frames in each line is greater than or equal to 2. (Commentary: Sec. A.3.1.1.1. Tier 2: Sec. 5.5.1.1)</p> <p><b>Comments:</b><br/> Two frame lines of two bays in each direction</p>  |
| <b>C NC N/A U</b><br><input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> | <p>INTERFERING WALLS: All concrete and masonry infill walls placed in moment frames are isolated from structural elements. (Commentary: Sec. A.3.1.2.1. Tier 2: Sec. 5.5.2.1.1)</p> <p><b>Comments:</b><br/> No infill walls</p>  |
| <b>C NC N/A U</b><br><input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | <p>MOMENT-RESISTING CONNECTIONS: All moment connections can develop the strength of the adjoining members based on the specified minimum yield stress of steel. (Commentary: Sec. A.3.1.3.4. Tier 2: Sec. 5.5.2.2.1).</p> <p><b>Comments:</b><br/> Moment frame connections are Pre-Northridge welded unreinforced flange connections. These connections are non-compliant.</p> |

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

**SEISMIC-FORCE-RESISTING SYSTEM**

|   | Description  |
|---|--|
| <b>C NC N/A U</b><br><input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | <p>MOMENT-RESISTING CONNECTIONS: All moment connections are able to develop the strength of the adjoining members or panel zones based on 110% of the expected yield stress of the steel in accordance with AISC 341, Section A3.2. (Commentary: Sec. A.3.1.3.4. Tier 2: Sec. 5.5.2.2.1)</p> <p><b>Comments:</b><br/> Moment frame connections are Pre-Northridge welded unreinforced flange connections. These connections are non-compliant.</p> |
| <b>C NC N/A U</b><br><input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | <p>PANEL ZONES: All panel zones have the shear capacity to resist the shear demand required to develop 0.8 times the sum of the flexural strengths of the girders framing in at the face of the column. (Commentary: Sec. A.3.1.3.5. Tier 2: Sec. 5.5.2.2.2)</p> <p><b>Comments:</b><br/> Panel zones increases the strength of the panel zone beyond the 80% demand from adjacent beams.</p>  |

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

|                   |                                |                 |        |           |                     |          |
|-------------------|--------------------------------|-----------------|--------|-----------|---------------------|----------|
| UC Campus:        | Berkeley                       |                 | Date:  | 3/26/2019 |                     |          |
| Building CAAN:    | 1286                           | Auxiliary CAAN: | 1286.1 | By Firm:  | Degenkolb Engineers |          |
| Building Name:    | Tang Center, West Wing         |                 |        | Initials: | TAB                 | Checked: |
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## ASCE 41-17 Collapse Prevention Structural Checklist For Building Type S1-S1A

|  |   |
|--|---|
| <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>COLUMN SPLICES:</b> All column splice details located in moment-resisting frames include connection of both flanges and the web. (Commentary: Sec. A.3.1.3.6. Tier 2: Sec. 5.5.2.2.3)</p> <p><b>Comments:</b><br/>No column splices in moment frame beams.</p>  |
| <b>C</b> <b>NC</b> <b>N/A</b> <b>U</b><br><input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>            | <p><b>STRONG COLUMN—WEAK BEAM:</b> The percentage of strong column—weak beam joints in each story of each line of moment frames is greater than 50%. (Commentary: Sec. A.3.1.3.7. Tier 2: Sec. 5.5.2.1.5)</p> <p><b>Comments:</b><br/>One story moment frame. Moment frames do not have to satisfy SCWB checks at the roof level.</p> |
| <b>C</b> <b>NC</b> <b>N/A</b> <b>U</b><br><input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>            | <p><b>COMPACT MEMBERS:</b> All frame elements meet section requirements in accordance with AISC 341, Table D1.1, for moderately ductile members. (Commentary: Sec. A.3.1.3.8. Tier 2: Sec. 5.5.2.2.4)</p> <p><b>Comments:</b></p>   |
| <b>DIAPHRAGMS (STIFF OR FLEXIBLE)</b>  |   |
|  | <b>Description</b>  |
| <b>C</b> <b>NC</b> <b>N/A</b> <b>U</b><br><input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>            | <p><b>OPENINGS AT FRAMES:</b> Diaphragm openings immediately adjacent to the moment frames extend less than 25% of the total frame length. (Commentary: Sec. A.4.1.5. Tier 2: Sec. 5.6.1.3)</p> <p><b>Comments:</b></p>   |
| <b>FLEXIBLE DIAPHRAGMS</b>   |   |
|  | <b>Description</b>  |
| <b>C</b> <b>NC</b> <b>N/A</b> <b>U</b><br><input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>            | <p><b>CROSS TIES:</b> There are continuous cross ties between diaphragm chords. (Commentary: Sec. A.4.1.2. Tier 2: Sec. 5.6.1.2)</p> <p><b>Comments:</b></p>  |
| <b>C</b> <b>NC</b> <b>N/A</b> <b>U</b><br><input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>            | <p><b>STRAIGHT SHEATHING:</b> 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)</p> <p><b>Comments:</b></p>  |
| <b>C</b> <b>NC</b> <b>N/A</b> <b>U</b><br><input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>            | <p><b>SPANS:</b> 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)</p> <p><b>Comments:</b></p>  |

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

|                   |                                |                 |        |           |                     |          |
|-------------------|--------------------------------|-----------------|--------|-----------|---------------------|----------|
| UC Campus:        | Berkeley                       |                 | Date:  | 3/26/2019 |                     |          |
| Building CAAN:    | 1286                           | Auxiliary CAAN: | 1286.1 | By Firm:  | Degenkolb Engineers |          |
| Building Name:    | Tang Center, West Wing         |                 |        | Initials: | TAB                 | Checked: |
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**ASCE 41-17**  
**Collapse Prevention Structural Checklist For Building Type S1-S1A**

|   |  |
|---|--|
| <b>C</b> <b>NC</b> <b>N/A</b> <b>U</b><br><input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | <b>DIAGONALLY SHEATHED AND UNBLOCKED DIAPHRAGMS:</b> 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)<br><br><b>Comments:</b> |
| <b>C</b> <b>NC</b> <b>N/A</b> <b>U</b><br><input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | <b>OTHER DIAPHRAGMS:</b> 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)<br><br><b>Comments:</b>  |

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

**APPENDIX C**  
**UCOP Seismic Safety Policy Falling Hazards Assessment Summary**

|                   |                                 |                 |        |           |                     |          |
|-------------------|---------------------------------|-----------------|--------|-----------|---------------------|----------|
| UC Campus:        | Berkeley                        |                 | Date:  | 2/14/2019 |                     |          |
| Building CAAN:    | 1286                            | Auxiliary CAAN: | 1286.1 | By Firm:  | Degenkolb Engineers |          |
| Building Name:    | Tang Center, West Wing          |                 |        | Initials: | TAB                 | Checked: |
| Building Address: | 2222 Bancroft Way, Berkeley, CA |                 |        | Page:     | 1                   | of 1     |

## UCOP SEISMIC SAFETY POLICY Falling Hazard Assessment Summary

|                               |  | Description  |
|-------------------------------|--|--|
| P<br><input type="checkbox"/> | N/A<br><input checked="" type="checkbox"/> | Heavy ceilings, features or ornamentation above large lecture halls, auditoriums, lobbies, or other areas where large numbers of people congregate (50 ppl or more)<br><br>Comments: |
| P<br><input type="checkbox"/> | N/A<br><input checked="" type="checkbox"/> | Heavy masonry or stone veneer above exit ways or public access areas<br><br>Comments:  |
| P<br><input type="checkbox"/> | N/A<br><input checked="" type="checkbox"/> | Unbraced masonry parapets, cornices, or other ornamentation above exit ways or public access areas<br><br>Comments:  |
| P<br><input type="checkbox"/> | N/A<br><input checked="" type="checkbox"/> | Unrestrained hazardous material storage<br><br>Comments:   |
| P<br><input type="checkbox"/> | N/A<br><input checked="" type="checkbox"/> | Masonry chimneys<br><br>Comments:  |
| P<br><input type="checkbox"/> | N/A<br><input checked="" type="checkbox"/> | Unrestrained natural gas-fueled equipment such as water heaters, boilers, emergency generators, etc.<br><br>Comments:  |
| P<br><input type="checkbox"/> | N/A<br><input type="checkbox"/>            | Other:<br><br>Comments:  |
| P<br><input type="checkbox"/> | N/A<br><input type="checkbox"/>            | Other:<br><br>Comments:  |
| P<br><input type="checkbox"/> | N/A<br><input type="checkbox"/>            | Other:<br><br>Comments:  |

Falling Hazard Risk: Low

**APPENDIX D**  
**ASCE 41-17 Quick Check Calculations**



|                                    |                                |                       |
|------------------------------------|--------------------------------|-----------------------|
| <b>Subject:</b> Weight Take Off    | <b>Job Number:</b> B8114004.00 | <b>Date:</b> 5/1/2019 |
| <b>Job:</b> Tang Center, West Wing | <b>By:</b> TAB                 | <b>Section:</b>       |
|                                    | <b>Checked By:</b>             | <b>Page/of:</b>       |

| Superimposed Floor DL    |             |
|--------------------------|-------------|
| Material                 | Area Weight |
| Ceiling                  | 3           |
| Flooring                 | 3           |
| Partions                 | 10          |
| MEP                      | 5           |
| Misc                     | 2           |
| Floor Framing (BM & Col) | 8           |
| <b>Σ</b>                 | <b>31</b>   |

| Superimposed Roof DL |             |
|----------------------|-------------|
| Material             | Area Weight |
| Ceiling              | 3           |
| Roofing              | 11          |
| Partions             | 5           |
| MEP                  | 10          |
| Misc                 | 3           |
| Floor Framing        | 8           |
| <b>Σ</b>             | <b>40</b>   |

**First Floor**

Atotal = 3000 ft<sup>2</sup>

| Item                  | Area            | Length | Height | Area Weight                | Weight     |            |
|-----------------------|-----------------|--------|--------|----------------------------|------------|------------|
|                       | ft <sup>2</sup> | ft     | ft     | psf                        | lbf        |            |
| 3 1/4" LWC on 3" Deck | 3000            |        |        | 46.5                       | 139500     |            |
| Superimposed Floor DL | 3000            |        |        | 31                         | 93000      |            |
| 12" Wall, Below       |                 | 152    | 6.50   | 150.0                      | 148200     |            |
| 12" Wall, Above       |                 | 90     | 6.50   | 150.0                      | 87750      |            |
|                       |                 |        |        | <b>Σ W<sub>floor</sub></b> | <b>468</b> | <b>kip</b> |



**Degenkolb Engineers**

375 Beale St. Ste. 500  
San Francisco, CA 94105

|                                    |                                |                       |
|------------------------------------|--------------------------------|-----------------------|
| <b>Subject:</b> Weight Take Off    | <b>Job Number:</b> B8114004.00 | <b>Date:</b> 5/1/2019 |
| <b>Job:</b> Tang Center, West Wing | <b>By:</b> TAB                 | <b>Section:</b>       |
|                                    | <b>Checked By:</b>             | <b>Page/of:</b>       |

Second Floor

Atotal = 3000 ft<sup>2</sup>

| Item                  | Area            | Length | Height | Area Weight                | Weight     |            |
|-----------------------|-----------------|--------|--------|----------------------------|------------|------------|
|                       | ft <sup>2</sup> | ft     | ft     | psf                        | lbf        |            |
| 3 1/4" LWC on 3" Deck | 3000            |        |        | 46.5                       | 139500     |            |
| Superimposed Floor DL | 3000            |        |        | 31                         | 93000      |            |
| 12" Wall, Below       |                 | 90     | 6.50   | 150.0                      | 87750      |            |
| 8" Wall, Above        |                 | 36     | 13.00  | 100.0                      | 46800      |            |
|                       |                 |        |        | <b>Σ W<sub>floor</sub></b> | <b>367</b> | <b>kip</b> |

Roof

Atotal = 3000 ft<sup>2</sup>

Aconc 1600

| Item                          | Area            | Length | Height | Area Weight                | Weight     |            |
|-------------------------------|-----------------|--------|--------|----------------------------|------------|------------|
|                               | ft <sup>2</sup> | ft     | ft     | psf                        | lbf        |            |
| 2 1/2" LWC on 3" Deck         | 1600            |        |        | 40                         | 64000      |            |
| Metal Deck with Non-struct To | 1400            |        |        | 30                         | 42000      |            |
| Superimposed Roof DL          | 3000            |        |        | 40                         | 120000     |            |
|                               |                 |        |        | <b>Σ W<sub>floor</sub></b> | <b>226</b> | <b>kip</b> |



## ASCE 41-17 Linear Static Base Shear & Vertical Force Distribution Tier 1 Shear Wall Demands

### INPUT DATA

C: Modification factor (Table 4-7) = 1.1 3 Conc. SW  
 S<sub>1</sub>: Spectral Response Acceleration @ 1 sec. = 1.05 (Site Specific)  
 S<sub>s</sub>: Short Period Response Acceleration = 3.15 (Site Specific)  
 SC: Soil Class = B (A through F), 1.6.1.4.1

| Table 1-5:     | S <sub>1</sub> ≤ 0.1 | S <sub>1</sub> = 0.2 | S <sub>1</sub> = 0.3 | S <sub>1</sub> = 0.4 | S <sub>1</sub> ≥ 0.5 |
|----------------|----------------------|----------------------|----------------------|----------------------|----------------------|
| Soil Class B   | 1.0                  | 1.0                  | 1.0                  | 1.0                  | 1.0                  |
| F <sub>v</sub> | -                    | -                    | -                    | -                    | 1.00                 |

F<sub>v</sub>: Site Coefficient for S<sub>1</sub> = 1.00 (Table 11.4-1)

| Table 1-4:     | S <sub>s</sub> ≤ 0.25 | S <sub>s</sub> = 0.50 | S <sub>s</sub> = 0.75 | S <sub>s</sub> = 1.00 | S <sub>s</sub> ≥ 1.25 |
|----------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| Soil Class B   | 1.0                   | 1.0                   | 1.0                   | 1.0                   | 1.0                   |
| F <sub>a</sub> | -                     | -                     | -                     | -                     | 1.00                  |

F<sub>a</sub>: Site Coefficient for S<sub>s</sub> = 1.00 (Table 11.4-2)  
 S<sub>X1</sub>: Spectral Response Acceleration @ 1 sec. = 1.05 Table 6, UCB Site Specific  
 S<sub>Xs</sub>: Short Period Acceleration = F<sub>a</sub>\*S<sub>s</sub> = 3.15 Table 6, UCB Site Specific  
 β: Building System Exponent = 0.75 (4.4.2.4)  
 C<sub>t</sub>: Building System Coefficient = 0.02 (4.4.2.4)  
 W: Total Building Weight = 1062 kips  
 hn: Total Building Height = 39.0 feet  
 n: Number of Stories = 3  
 S<sub>M1</sub>: Spectral Response Acceleration @ 1 sec. = 1.07 (2-2)  
 S<sub>M<sub>s</sub></sub>: Short Period Acceleration = F<sub>a</sub>\*S<sub>s</sub> = 3.60 (2-1)  
 S<sub>d1</sub>: Design spectral acceleration, 1 s = 0.71  
 S<sub>ds</sub>: Design spectral acceleration, short = 2.40

### CALCULATE BASE SHEAR FOR BSE-2 (MCE)

T: Fundamental Period of Vibration = C<sub>t</sub> \* h<sup>β</sup> = 0.312 sec. (4-4)  
 S<sub>a</sub>: Spectral Acceleration at Building Period = 3.15 (4-3)  
 V: Pseudo Seismic Force = 3678 kips (4-1)

| Story  | w    | h  | w x h   | C <sub>x</sub> | F <sub>x</sub> | V <sub>x</sub> |
|--------|------|----|---------|----------------|----------------|----------------|
| Third  | 226  | 39 | 8814    | 0.36           | 1326           | 1326           |
| Second | 367  | 26 | 9543    | 0.39           | 1436           | 2762           |
| First  | 468  | 13 | 6090    | 0.25           | 916            | 3678           |
| Σ      | 1062 |    | Σ 24447 |                | Σ 3678         |                |

**Ms = 4.5** TBL 4-8, Collapse Prevention

|                     |      |     |
|---------------------|------|-----|
| $f_c =$             | 5000 | psi |
| $f_{ce} =$          | 7500 | psi |
| $2 \sqrt{f_c} =$    | 141  | psi |
| $2 \sqrt{f_{ce}} =$ | 173  | psi |

TBL 10-2 Default Lower Bound Value

**East West**

| Story  | Thickness | $A_w$           | V    | $\sigma_v$ |
|--------|-----------|-----------------|------|------------|
|        | 12        | in <sup>2</sup> | kip  | psi        |
| Third  | -         | -               | -    | -          |
| Second | 36        | 5184            | 2762 | 118        |
| First  | 39        | 5616            | 3678 | 146        |

Moment Frame @ Roof

**North South**

| Story  | Thickness | $A_w$           | V    | $\sigma_v$ |
|--------|-----------|-----------------|------|------------|
|        | 12        | in <sup>2</sup> | kip  | psi        |
| Third  | -         | -               | -    | -          |
| Second | 54        | 7776            | 2762 | 79         |
| First  | 54        | 7776            | 3678 | 105        |

Moment Frame @ Roof



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**Subject:** Wall Steel Reinforcement Ratio

**Job Number:** B8114004

**Date:** 5/1/2019

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**Job:** Tang Center, West Wing

**By:** TAB

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**Checked By:**

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## Concrete Walls

### 12" Wall

Vertical: #4 @ 12" oc EF

t<sub>wall</sub> = 12 in

A<sub>bar</sub> = 0.4 in<sup>2</sup>

spacing = 12 in

rho = 0.0028 OK > 0.0012 vertical minimum ratio

Horizontal #4 @ 12" oc EF

t<sub>wall</sub> = 12 in

A<sub>bar</sub> = 0.4 in<sup>2</sup>

spacing = 12 in

rho = 0.0028 OK > 0.002 horizontal minimum ratio



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|   |                             |                       |
|---|-----------------------------|-----------------------|
| <b>Subject:</b> Column Deflection Compatability | <b>Job Number:</b> B8114004 | <b>Date:</b> 5/1/2019 |
| <b>Job:</b> Tang Center, West Wing              | <b>By:</b> TAB              |                       |
| <b>Checked By:</b>                              |                             |                       |

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### Column D/8 W8x58

#### Material Properties

$$f_y = 60 \text{ ksi}$$

$$f_{ye} = 75 \text{ ksi}$$

#### Section Moment Capacity

Using Expected Material Properties

$$f_{ye} = 75 \text{ ksi}$$

$$Z_x = 59.8 \text{ in}^3$$

$$M_{\max} = 373.75 \text{ k-ft} \quad @ 291 \text{ k Axially}$$

$$l = 13 \text{ ft}$$

|                             |
|-----------------------------|
| $V_{ls} = 57.5 \text{ kip}$ |
|-----------------------------|

#### Shear Capacity

$$t_w = 0.51 \text{ in}$$

$$d = 8.75 \text{ in}$$

$$A_v = 4.4625 \text{ ksi}$$

|                           |
|---------------------------|
| $V_n = 200.8 \text{ kip}$ |
|---------------------------|

**ASCE 41-17 Linear Static Base Shear & Vertical Force Distribution Tier 1**

**Moment Frame Demands**

**INPUT DATA**

C: Modification factor (Table 4-7) = 1 3 Story MF  
 S<sub>1</sub>: Spectral Response Acceleration @ 1 sec. = 1.05 (Site Specific)  
 S<sub>s</sub>: Short Period Response Acceleration = 3.15 (Site Specific)  
 SC: Soil Class = B (A through F), 1.6.1.4.1

| Table 1-5:     | S <sub>1</sub> <= 0.1 | S <sub>1</sub> = 0.2 | S <sub>1</sub> = 0.3 | S <sub>1</sub> = 0.4 | S <sub>1</sub> >= 0.5 |
|----------------|-----------------------|----------------------|----------------------|----------------------|-----------------------|
| Soil Class B   | 1.0                   | 1.0                  | 1.0                  | 1.0                  | 1.0                   |
| F <sub>v</sub> | -                     | -                    | -                    | -                    | 1.00                  |

F<sub>v</sub>: Site Coefficient for S<sub>1</sub> = 1.00 (Table 11.4-1)

| Table 1-4:     | S <sub>s</sub> <= 0.25 | S <sub>s</sub> = 0.50 | S <sub>s</sub> = 0.75 | S <sub>s</sub> = 1.00 | S <sub>s</sub> >= 1.25 |
|----------------|------------------------|-----------------------|-----------------------|-----------------------|------------------------|
| Soil Class B   | 1.0                    | 1.0                   | 1.0                   | 1.0                   | 1.0                    |
| F <sub>a</sub> | -                      | -                     | -                     | -                     | 1.00                   |

F<sub>a</sub>: Site Coefficient for S<sub>s</sub> = 1.00 (Table 11.4-2)  
 S<sub>X1</sub>: Spectral Response Acceleration @ 1 sec. = 1.05 Table 6, UCB Site Specific  
 S<sub>Xs</sub>: Short Period Acceleration = F<sub>a</sub>\*S<sub>s</sub> = 3.15 Table 6, UCB Site Specific  
 β: Building System Exponent = 0.8 (4.4.2.4)  
 C<sub>t</sub>: Building System Coefficient = 0.035 (4.4.2.4)  
 W: Total Building Weight = 1062 kips  
 hn: Total Building Height = 39.0 feet  
 n: Number of Stories = 3  
 S<sub>M1</sub>: Spectral Response Acceleration @ 1 sec. = 1.07 (2-2)  
 S<sub>Ms</sub>: Short Period Acceleration = F<sub>a</sub>\*S<sub>s</sub> = 3.60 (2-1)  
 S<sub>d1</sub>: Design spectral acceleration, 1 s = 0.71  
 S<sub>ds</sub>: Design spectral acceleration, short = 2.40

**CALCULATE BASE SHEAR FOR BSE-2 (MCE)**

T: Fundamental Period of Vibration = C<sub>t</sub> \* h<sup>β</sup> = 0.656 sec. (4-4)  
 S<sub>a</sub>: Spectral Acceleration at Building Period = 1.60 (4-3)  
 V: Pseudo Seismic Force = 1699 kips (4-1)

| Story  | w    | h  | w x h   | C <sub>x</sub> | F <sub>x</sub> | V <sub>x</sub> |
|--------|------|----|---------|----------------|----------------|----------------|
| Third  | 226  | 39 | 8814    | 0.36           | 613            | 613            |
| Second | 367  | 26 | 9543    | 0.39           | 663            | 1276           |
| First  | 468  | 13 | 6090    | 0.25           | 423            | 1699           |
| Σ      | 1062 |    | Σ 24447 |                | Σ 1699         |                |



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|                                    |                             |                       |
|------------------------------------|-----------------------------|-----------------------|
| <b>Subject:</b> MF Drift Check     | <b>Job Number:</b> B8114004 | <b>Date:</b> 3/6/2019 |
| <b>Job:</b> Tang Center, West Wing | <b>By:</b> TAB              |                       |
| <b>Checked By:</b>                 |                             |                       |

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**Roof Drift**

**S4 Demands**

|                    |       |     |                |
|--------------------|-------|-----|----------------|
| lb =               | 984   | in4 | W18x60         |
| L =                | 288   | in  |                |
| lc =               | 1810  | in4 | W14x145        |
| h =                | 156   | in  |                |
| E =                | 29000 | ksi |                |
| V =                | 613   |     | MF Story Force |
| N <sub>col</sub> = | 6     |     |                |
| V <sub>Col</sub> = | 102.1 |     |                |
| kb =               | 3.42  |     |                |
| kc =               | 11.60 |     |                |

**story drift ratio**

**D<sub>r</sub> = 0.017** < 0.030 Drift req



|                                     |                             |                       |
|-------------------------------------|-----------------------------|-----------------------|
| <b>Subject:</b> Column Axial Stress | <b>Job Number:</b> B8114004 | <b>Date:</b> 5/1/2019 |
| <b>Job:</b> Tang Center, West Wing  | <b>By:</b> TAB              |                       |
| <b>Checked By:</b>                  |                             |                       |

Material Properties

$f_y = 36$  ksi  
 $f_{ye} = -$  ksi

**East-West Direction**

Tributary Area

| Roof Framing                   |             |            | Wall Trib |        |     |
|--------------------------------|-------------|------------|-----------|--------|-----|
| w =                            | 20          | ft         | w =       | 20.66  | ft  |
| d =                            | 14.5        | ft         | h =       | 37.125 | ft  |
| DL =                           | 76.5        | psf        | Wall DL = | 17     | psf |
| Roof LL =                      | 70          | psf        | W =       | 13.0   | kip |
| $W_{Floor,DL}$ =               | 22.2        | kip        |           |        |     |
| $W_{Roof,DL}$ =                | 20.3        | kip        |           |        |     |
| $W_{LL}$ =                     | 11.6        | kip        |           |        |     |
| WFloor=                        | 50.17       |            |           |        |     |
| Wroof =                        | 20.3        |            |           |        |     |
| <b><math>W_{grav}</math> =</b> | <b>70.5</b> | <b>kip</b> |           |        |     |

Column Axial Stress Due to Gravity

| Property           | W14x145     |
|--------------------|-------------|
| Ag in <sup>2</sup> | 42.7        |
| Fy x Ag            | 1537.2      |
| Pg / Py            | <b>0.05</b> |

< 0.1 Gravity Req



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**Subject:** Compactness Check      **Job Number:** B8114004      **Date:** 3/6/2019  
**Job:** Tang Center, West Wing      **By:** TAB  
**Checked By:**

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E = 29000 ksi  
fy = 36 ksi

| Frame Members | b/t | h/t <sub>w</sub> | Flange $\lambda_{md}$ | Web $\lambda_{md}$ | Flange | Web |
|---------------|-----|------------------|-----------------------|--------------------|--------|-----|
| W18x60        | 5.4 | 38.7             | 10.79                 | 42.29              | C      | C   |
| W14x145       | 7.1 | 16.8             | 10.79                 | 42.29              | C      | C   |





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**Subject:** [Flexural Stress - 4.4.3.9](#)      **Job Number:** [B8114004](#)      **Date:** [5/1/2019](#)  
**Job:** [Tang Center, West Wing](#)      **By:** [TAB](#)  
**Checked By:**

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Ms = 9 Collapse Prevention system modification factor  
nc = 6 frame columns  
nf = 2 frames  
h = 156 in  
Zcol = 706.4 in<sup>3</sup>      \*Weak Axis  
Zbm = 492 in<sup>3</sup>  
  
Vj = 613 kips roof story  
  
fj-avg = 16.2 ksi



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|   |                             |                       |
|---|-----------------------------|-----------------------|
| <b>Subject:</b> Flexural Stress - 4.4.3.9 | <b>Job Number:</b> B8114004 | <b>Date:</b> 5/1/2019 |
| <b>Job:</b> Tang Center, West Wing        | <b>By:</b> TAB              |                       |
| <b>Checked By:</b>                        |                             |                       |

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|           |        |                 |
|-----------|--------|-----------------|
| W18x60    |        |                 |
| Zbm =     | 123    | in <sup>3</sup> |
| Fye =     | 37.8   | ksi             |
| Mx_bm =   | 9298.8 | k-in            |
| db =      | 18.2   | in              |
| Vpz =     | 510.9  | kip             |
| 0.8 Vpz = | 408.7  | kip             |

---

|         |       |     |
|---------|-------|-----|
| W14x145 |       |     |
| dc =    | 14.8  | in  |
| tw =    | 0.55  | in  |
| tpl =   | 2.5   | in  |
| Fye =   | 37.8  | ksi |
| Vy =    | 938.5 | kip |
|         |       |     |
| DCR =   | 0.436 |     |