ASCE 41-17 Tier 1 Seismic Evaluation

Building Name: Recreational Sports Facility, Lobby
CAAN ID: 1365
Auxiliary Building ID: 1365.2
Address: Core Campus, Berkeley, CA 94720
Site location coordinates: Latitude 37.8686  Longitudinal -122.2623

UCOP SEISMIC PERFORMANCE LEVEL (OR “RATING”) BASED ON TIER 1 EVALUATION FINDINGS: V

BUILDING DATA
ASCE 41-17 Model Building Type (Governing Building Type bolded for Seismic Risk Model when multiple types exist):
   a. Longitudinal Direction: S1: Steel MF w/ Stiff Diaphragms
   b. Transverse Direction: S1: Steel MF w/ Stiff Diaphragms

*Concrete SW Parking Garage Basement Calculations Included in Appendices*

Square Footage: 4830 ft² (+ 2340 ft² – Parking SF, ratio of superstructure SF/ total superstructure SF) out of 191,703 ft² total
Building Length: 38’-4”
Building Width: 39’-8”
Building Height: 38’
Story Height: 13’-2” (1st), 12’ (2nd), 13’-10” (3rd)
Number of stories above grade: 3
Number of basement stories below grade: 1

Year of Original Construction and Code Year: 1984, 1979 UBC
Year of Later Construction and Code Year: 2007 (Wall Cladding Repair), 2001 CBC (Assumed)
COST RANGE TO RETROFIT (if applicable): High: over $200 per sf and less than $400 per sf

BUILDING DESCRIPTION

General
This building finished construction in 1984 and is situated on a level site. The structure referenced as, "Lobby", is part of the RSF complex. The RSF has two buildings that are separated with an expansion joint in the parking garage level creating an East and West building. These buildings have separate superstructures separated by seismic joints above grade. The Handball Superstructure is part of the East Building at the RSF complex. This superstructure has three stories for a total height of 38’ above the parking garage. The building is rectangular in shape with a floor plan of about 38'-4” in the NS direction and 39'-8” in the EW direction. The building area is approximately 4,830 square feet and houses miscellaneous office space at the upper story and the main entrance to the recreational facility at the ground level.

Structural System
The gravity structural system consists of composite metal deck with LWC fill at the 2nd and 3rd story with intermediate steel open web joists framing to steel beams. The roof is comprised of sheet metal deck with the same framing type. The first floor is a reinforced concrete slab supported by concrete cast-in-place (CIP) beams framing to concrete walls that make up the parking garage level below. The steel beams frame into steel columns that are supported by concrete transfer beams at the first level. The lateral system consists of a steel moment frame system utilizing Pre-Northridge WUF moment connections. The steel moment frame is supported by concrete CIP transfer beams. The transfer beams span to shear walls in the basement level that are supported on pile foundations.

Building Condition
Good, no signs of deterioration found on limited site walk.

Date of Site Visit: 02/15/2019, 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
Sos: 2.40 Sds: 0.71
BSE-2E Spectral Accelerations: Basis: 2015 Site Specific Report Table 6 for 36-75 ft Soil
Sxs: 3.15 Sxs1: 1.05
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

DOCUMENTATION
Architectural Drawings: “University of California, Berkley Intramural Sports Facility”, ELS Design Group, 06/29/1982, A0.0-A9.7 (Sub Consultant DWG’s Included)

CONSTRUCTION DATA
Gravity Load Structural System: Metal deck on steel joists framing into steel WF beams on steel WF columns
Exterior Transverse Walls: Stud wall w/ plaster finish  Opening(s)?  Yes
Exterior Longitudinal Walls: Stud wall w/ plaster finish  Opening(s)?  Yes
Roof Materials/Framing: 1 ½” Metal Deck
Intermediate Floors/Framing: 1 ½” Composite Metal Deck w/ 3 ½” LWC Fill
Ground Floor: 5” suspended slab
Columns: W14x90 Steel Columns  Foundation: Pile Foundation
General Condition of Structure: Good
Evidence of Settling?: No
Special Features & Comments: Pre-Northridge moment connections. Moment Frame systems is discontinuous on transfer concrete beams.

LATERAL-FORCE-RESISTING SYSTEM

<table>
<thead>
<tr>
<th>Longitudinal</th>
<th>Transverse</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASCE 41-17 Building Type: S1: Steel MF w/ Stiff Diaphragms</td>
<td>S1: Steel MF w/ Stiff Diaphragms</td>
</tr>
<tr>
<td>Diaphragms: Metal Deck with Conc. Top.</td>
<td>Metal Deck with Conc. Top.</td>
</tr>
<tr>
<td>Vertical Elements:</td>
<td>Metal Deck at Roof</td>
</tr>
<tr>
<td>----------------------------</td>
<td>--------------------</td>
</tr>
<tr>
<td>Connections:</td>
<td>W14x90</td>
</tr>
<tr>
<td>Details:</td>
<td>WUF MC</td>
</tr>
<tr>
<td>Estimated Fundamental Period, T (sec):</td>
<td>0.643</td>
</tr>
<tr>
<td>BSE-2E Spectral Acceleration, $S_a$:</td>
<td>1.63g</td>
</tr>
<tr>
<td>Modification Factor, C:</td>
<td>1.1 (S4 – Table 4-7)</td>
</tr>
<tr>
<td>Building Weight, W (kips):</td>
<td>327</td>
</tr>
<tr>
<td>Seismic Base Shear, V (kips):</td>
<td>588</td>
</tr>
<tr>
<td>System Modification Factor, M:</td>
<td>7.5 – Limited Safety</td>
</tr>
</tbody>
</table>

**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. **Drift Check**: The moment frame is flexible in the East-West direction due to all of the columns being framed in the weak axis. This increased flexibility is resulting in a 3.2% inter-story drift at the first floor per the quick check procedure. This drift demand indicates the potential for significant structural damage due to large rotation demands at joints and non-structural damage to components framed full story height.

2. **Moment Resisting Connections**: The moment connection utilized is a Pre-Northridge, Welded Unreinforced Flange (WUF) connection. This connection type is non-compliant and requires a more detailed analysis.

3. **Compact Members**: All the moment frame beam types except one have non-compact webs. This deficiency can lead to premature local buckling and generally poor inelastic behavior. A more detailed analysis is required to determine the members’ adequacy.

4. **Vertical Irregularities**: The moment frame is not continuous to the foundation of the structure. The lobby columns land on concrete transfer beams that span between parking level walls. These transfer beams would likely see larger forces than the original design had intended. This could result in the formation of a shear or flexural mechanism in the transfer beam.

5. **Adjacent Buildings**: Seismic joints between the adjacent structures are inadequate for the expected displacements. The levels of the adjacent Gym Building are misaligned, which can result in increased structural and non-structural damage relative to an aligned level pounding scenario.

As a result of these deficiencies, the structure has been assigned a SPL V rating. A more detailed Tier 2 or Tier 3 analysis will provide a better understanding of the force distribution and ductility demands to better evaluate the importance of the current identified deficiencies.

No non-structural deficiencies are identified for this building.
Seismic Retrofit Concept Sketches/Description (only if above-listed rating is V or greater):

*Potential Retrofit Scheme:* Strengthen the moment connection to provide improved performance. Potential retrofit connection configurations are described in FEMA 351, chapter 6. In addition to connection strengthening, beam bracing, and column stiffening may be necessary pending a more detailed analysis.
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

Typical Moment Frame Connection
APPENDIX B
ASCE 41-17 Tier 1 Checklist (Structural)
# ASCE 41-17 Collapse Prevention Basic Configuration Checklist

**BUILDING SYSTEMS - GENERAL**

<table>
<thead>
<tr>
<th>Description</th>
<th>C</th>
<th>NC</th>
<th>N/A</th>
<th>U</th>
</tr>
</thead>
<tbody>
<tr>
<td>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)</td>
<td>C</td>
<td>NC</td>
<td>N/A</td>
<td>U</td>
</tr>
</tbody>
</table>

**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)

**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)

**BUILDING SYSTEMS - BUILDING CONFIGURATION**

<table>
<thead>
<tr>
<th>Description</th>
<th>C</th>
<th>NC</th>
<th>N/A</th>
<th>U</th>
</tr>
</thead>
<tbody>
<tr>
<td>WEAK STORY: The sum of the shear strengths of the seismic-force-resisting system in any story in each direction is not less than 80% of the strength in the adjacent story above. (Commentary: Sec. A2.2.2. Tier 2: Sec. 5.4.2.1)</td>
<td>C</td>
<td>NC</td>
<td>N/A</td>
<td>U</td>
</tr>
</tbody>
</table>

| 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) | C | NC | N/A | U |

| VERTICAL IRREGULARITIES: All vertical elements in the seismic-force-resisting system are continuous to the foundation. (Commentary: Sec. A.2.2.4. Tier 2: Sec. 5.4.2.3) | C | NC | N/A | U |

**Note:**  
C = Compliant  
NC = Noncompliant  
N/A = Not Applicable  
U = Unknown
### ASCE 41-17
Collapse Prevention Basic Configuration Checklist

<table>
<thead>
<tr>
<th>C</th>
<th>NC</th>
<th>N/A</th>
<th>U</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>C</td>
<td>N/A</td>
<td>U</td>
<td>GEOMETRY: There are no changes in the net horizontal dimension of the seismic-force-resisting system of more than 30% in a story relative to adjacent stories, excluding one-story penthouses and mezzanines. (Commentary: Sec. A.2.2.5, Tier 2: Sec. 5.4.2.4)</td>
</tr>
<tr>
<td>C</td>
<td>C</td>
<td>N/A</td>
<td>U</td>
<td>Comments: The change in the lateral force system from the superstructure to the basement level changes by &gt;50% in the both directions</td>
</tr>
<tr>
<td>C</td>
<td>C</td>
<td>N/A</td>
<td>U</td>
<td>MASS: There is no change in effective mass of more than 50% from one story to the next. Light roofs, penthouses, and mezzanines need not be considered. (Commentary: Sec. A.2.2.6, Tier 2: Sec. 5.4.2.5)</td>
</tr>
<tr>
<td>C</td>
<td>C</td>
<td>N/A</td>
<td>U</td>
<td>Comments: Superstructure first story relative to parking garage ground level is greater than 50% difference.</td>
</tr>
<tr>
<td>C</td>
<td>C</td>
<td>N/A</td>
<td>U</td>
<td>TORSION: The estimated distance between the story center of mass and the story center of rigidity is less than 20% of the building width in either plan dimension. (Commentary: Sec. A.2.2.7, Tier 2: Sec. 5.4.2.6)</td>
</tr>
<tr>
<td>C</td>
<td>C</td>
<td>N/A</td>
<td>U</td>
<td>Comments:</td>
</tr>
</tbody>
</table>

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

#### GEOLOGIC SITE HAZARD

<table>
<thead>
<tr>
<th>C</th>
<th>NC</th>
<th>N/A</th>
<th>U</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>C</td>
<td>N/A</td>
<td>U</td>
<td>LIQUEFACTION: Liquefaction-susceptible, saturated, loose granular soils that could jeopardize the building's seismic performance do not exist in the foundation soils at depths within 50 ft (15.2m) under the building. (Commentary: Sec. A.6.1.1, Tier 2: 5.4.3.1)</td>
</tr>
<tr>
<td>C</td>
<td>C</td>
<td>N/A</td>
<td>U</td>
<td>Comments:</td>
</tr>
<tr>
<td>C</td>
<td>C</td>
<td>N/A</td>
<td>U</td>
<td>SLOPE FAILURE: The building site is located away from potential earthquake-induced slope failures or rockfalls so that it is unaffected by such failures or is capable of accommodating any predicted movements without failure. (Commentary: Sec. A.6.1.2, Tier 2: 5.4.3.1)</td>
</tr>
<tr>
<td>C</td>
<td>C</td>
<td>N/A</td>
<td>U</td>
<td>Comments:</td>
</tr>
<tr>
<td>C</td>
<td>C</td>
<td>N/A</td>
<td>U</td>
<td>SURFACE FAULT RUPTURE: Surface fault rupture and surface displacement at the building site are not anticipated. (Commentary: Sec. A.6.1.3, Tier 2: 5.4.3.1)</td>
</tr>
<tr>
<td>C</td>
<td>C</td>
<td>N/A</td>
<td>U</td>
<td>Comments:</td>
</tr>
</tbody>
</table>

**Note:**  C = Compliant  NC = Noncompliant  N/A = Not Applicable  U = Unknown
### ASCE 41-17
Collapse Prevention Basic Configuration Checklist

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

<table>
<thead>
<tr>
<th>Foundation Configuration</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>OVERTURNING:</strong></td>
<td>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 0.6S₀. (Commentary: Sec. A.6.2.1. Tier 2: Sec. 5.4.3.3)</td>
</tr>
<tr>
<td><strong>TIES BETWEEN FOUNDATION ELEMENTS:</strong></td>
<td>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)</td>
</tr>
</tbody>
</table>

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

### SEISMIC-FORCE-RESISTING SYSTEM

<table>
<thead>
<tr>
<th>Description</th>
<th>C</th>
<th>NC</th>
<th>N/A</th>
<th>U</th>
</tr>
</thead>
<tbody>
<tr>
<td>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)</td>
<td>C</td>
<td>NC</td>
<td>N/A</td>
<td>U</td>
</tr>
<tr>
<td>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)</td>
<td>C</td>
<td>NC</td>
<td>N/A</td>
<td>U</td>
</tr>
<tr>
<td>COLUMN AXIAL STRESS CHECK: The axial stress caused by gravity loads in columns subjected to overturning forces is less than 0.10Fy. Alternatively, the axial stress caused by overturning forces alone, calculated using the Quick Check procedure of Section 4.4.3.6, is less than 0.30Fy. (Commentary: Sec. A.3.1.3.2. Tier 2: Sec. 5.5.2.1.3)</td>
<td>C</td>
<td>NC</td>
<td>N/A</td>
<td>U</td>
</tr>
<tr>
<td>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 Fy. 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)</td>
<td>C</td>
<td>NC</td>
<td>N/A</td>
<td>U</td>
</tr>
</tbody>
</table>

### CONNECTIONS

<table>
<thead>
<tr>
<th>Description</th>
<th>C</th>
<th>NC</th>
<th>N/A</th>
<th>U</th>
</tr>
</thead>
<tbody>
<tr>
<td>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)</td>
<td>C</td>
<td>NC</td>
<td>N/A</td>
<td>U</td>
</tr>
<tr>
<td>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)</td>
<td>C</td>
<td>NC</td>
<td>N/A</td>
<td>U</td>
</tr>
</tbody>
</table>

Note: C = Compliant  NC = Noncompliant  N/A = Not Applicable  U = Unknown
### MODERATE SEISMICITY (COMPLETE THE FOLLOWING ITEMS IN ADDITION TO THE ITEMS FOR LOW SEISMICITY)

#### SEISMIC-FORCE-RESISTING SYSTEM

<table>
<thead>
<tr>
<th>Description</th>
<th>C</th>
<th>NC</th>
<th>N/A</th>
<th>U</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>REDUNDANCY:</strong> 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)</td>
<td>C</td>
<td>C</td>
<td>N/A</td>
<td>C</td>
</tr>
<tr>
<td><strong>INTERFERING WALLS:</strong> 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)</td>
<td>C</td>
<td>C</td>
<td>N/A</td>
<td>C</td>
</tr>
<tr>
<td><strong>MOMENT-RESISTING CONNECTIONS:</strong> 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).</td>
<td>C</td>
<td>C</td>
<td>N/A</td>
<td>C</td>
</tr>
</tbody>
</table>

#### Comments:
- Redundancy: The number of bays of moment frames in each line is greater than or equal to 2.
- Interfering walls are isolated from structural elements.
- Moment connections are able to develop the strength of the adjoining members.

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

#### SEISMIC-FORCE-RESISTING SYSTEM

<table>
<thead>
<tr>
<th>Description</th>
<th>C</th>
<th>NC</th>
<th>N/A</th>
<th>U</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MOMENT-RESISTING CONNECTIONS:</strong> 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)</td>
<td>C</td>
<td>C</td>
<td>N/A</td>
<td>C</td>
</tr>
<tr>
<td><strong>PANEL ZONES:</strong> 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)</td>
<td>C</td>
<td>C</td>
<td>N/A</td>
<td>C</td>
</tr>
</tbody>
</table>

#### Comments:
- Moment connections are able to develop the strength of the adjoining members.
- Doubler plates provided to strengthen panel zones.

**Note:**
- **C** = Compliant
- **NC** = Noncompliant
- **N/A** = Not Applicable
- **U** = Unknown
### Collapse Prevention Structural Checklist For Building Type S1-S1A

**UC Campus:** Berkeley  
**Building CAAN:** 1365  
**Auxiliary CAAN:** 1365.2  
**By Firm:** Degenkolb Engineers  
**Building Name:** Recreational Sports Facility, Lobby  
**Building Address:** 2301 Bancroft Way, Berkeley, CA  
**Date:** 2/12/2019  
**Checked:** 2/12/2019

#### COLUMN SPLICES:
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)

**Comments:**
No column splices

#### STRONG COLUMN—WEAK BEAM:
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. 5.5.2.2.5)

**Comments:**

#### COMPACT MEMBERS:
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)

**Comments:**
All except 1 beam type does not meet to moderate ductility requirements for web compactness.

### DIAPHRAGMS (STIFF OR FLEXIBLE)

#### OPENINGS AT FRAMES:
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)

**Comments:**

### FLEXIBLE DIAPHRAGMS

#### CROSS TIES:
There are continuous cross ties between diaphragm chords. (Commentary: Sec. A.4.1.2. Tier 2: Sec. 5.6.1.2)

**Comments:**

#### STRAIGHT SHEATHING:
All straight-sheathed diaphragms have aspect ratios less than 2-to-1 in the direction being considered. (Commentary: Sec. A.4.2.1. Tier 2: Sec. 5.6.2)

**Comments:**

#### SPANS:
All wood diaphragms with spans greater than 24 ft (7.3 m) consist of wood structural panels or diagonal sheathing. (Commentary: Sec. A.4.2.2. Tier 2: Sec. 5.6.2)

**Comments:**

---

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

Page 15
### ASCE 41-17
Collapse Prevention Structural Checklist For Building Type S1-S1A

<table>
<thead>
<tr>
<th>C</th>
<th>NC</th>
<th>N/A</th>
<th>U</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NC</td>
<td>C</td>
<td>C</td>
<td><strong>DIAGONALLY SHEATHED AND UNBLOCKED DIAPHRAGMS:</strong> 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)</td>
</tr>
<tr>
<td></td>
<td>NC</td>
<td>N/A</td>
<td>C</td>
<td><strong>OTHER DIAPHRAGMS:</strong> 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)</td>
</tr>
<tr>
<td>C</td>
<td>NC</td>
<td>N/A</td>
<td>U</td>
<td>Comments</td>
</tr>
</tbody>
</table>

**Note:**  
C = Compliant  
NC = Noncompliant  
N/A = Not Applicable  
U = Unknown
Low And Moderate Seismicity

Seismic-Force-Resisting System

<table>
<thead>
<tr>
<th>Description</th>
<th>C</th>
<th>NC</th>
<th>N/A</th>
<th>U</th>
</tr>
</thead>
<tbody>
<tr>
<td>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)</td>
<td>C</td>
<td>NC</td>
<td>N/A</td>
<td>U</td>
</tr>
<tr>
<td>Comments: Concrete walls support lateral systems above and ground floor slab. No continuous concrete column detailing to the foundation.</td>
<td>C</td>
<td>NC</td>
<td>N/A</td>
<td>U</td>
</tr>
<tr>
<td>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)</td>
<td>C</td>
<td>NC</td>
<td>N/A</td>
<td>U</td>
</tr>
<tr>
<td>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.² (0.69 MPa) or 2√f̅c. (Commentary: Sec. A.3.2.2.1. Tier 2: Sec. 5.5.3.1.1)</td>
<td>C</td>
<td>NC</td>
<td>N/A</td>
<td>U</td>
</tr>
<tr>
<td>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)</td>
<td>C</td>
<td>NC</td>
<td>N/A</td>
<td>U</td>
</tr>
</tbody>
</table>

Connections

<table>
<thead>
<tr>
<th>Description</th>
<th>C</th>
<th>NC</th>
<th>N/A</th>
<th>U</th>
</tr>
</thead>
<tbody>
<tr>
<td>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)</td>
<td>C</td>
<td>NC</td>
<td>N/A</td>
<td>U</td>
</tr>
<tr>
<td>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)</td>
<td>C</td>
<td>NC</td>
<td>N/A</td>
<td>U</td>
</tr>
</tbody>
</table>

Note: C = Compliant  NC = Noncompliant  N/A = Not Applicable  U = Unknown
<table>
<thead>
<tr>
<th>C</th>
<th>NC</th>
<th>N/A</th>
<th>U</th>
<th>FOUNDATION DOWELS: 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) Comments:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>Diaphragms (Stiff Or Flexible)</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>Description</strong></td>
</tr>
<tr>
<td>C</td>
<td>NC</td>
<td>N/A</td>
<td>U</td>
<td><strong>DIAPHRAGM CONTINUITY:</strong> The diaphragms are not composed of split-level floors and do not have expansion joints. (Commentary: Sec. A.4.1.1. Tier 2: Sec. 5.6.1.1) Comments:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>OPENINGS AT SHEAR WALLS:</strong> 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) Comments:</td>
</tr>
</tbody>
</table>

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

- **Seismic-Force-Resisting System**
  - **Description**
  - **Comments:**
    - DEFLECTION COMPATIBILITY: 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)
    - Bearing wall system in basement utilized in the basement.
    - Comments:
    - FLAT SLABS: 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)
    - Comments:
    - COUPLING BEAMS: 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)
    - Comments:
APPENDIX C
UCOP Seismic Safety Policy Falling Hazards Assessment Summary
<table>
<thead>
<tr>
<th>Description</th>
<th>P</th>
<th>N/A</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heavy ceilings, features or ornamentation above large lecture halls, auditoriums, lobbies, or other areas where large numbers of people congregate (50 ppl or more)</td>
<td>☒</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Comments:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heavy masonry or stone veneer above exit ways or public access areas</td>
<td>☒</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Comments:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unbraced masonry parapets, cornices, or other ornamentation above exit ways or public access areas</td>
<td>☒</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Comments:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unrestrained hazardous material storage</td>
<td>☒</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Comments:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Masonry chimneys</td>
<td>☒</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Comments:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unrestrained natural gas-fueled equipment such as water heaters, boilers, emergency generators, etc.</td>
<td>☒</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Comments:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other:</td>
<td>☒</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Comments:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other:</td>
<td>☒</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Comments:</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Falling Hazard Risk: Low

Note: P = Present, N/A = Not Applicable
APPENDIX D
ASCE 41-17 Quick Check Calculations
### Roofing

<table>
<thead>
<tr>
<th>Material</th>
<th>Area Weight</th>
<th>Weight</th>
<th>Assume Density</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.5&quot; 16 GA Metal Deck</td>
<td>4</td>
<td>4</td>
<td>75 pcf</td>
</tr>
<tr>
<td>2 1/2&quot; LWC Fill</td>
<td>19</td>
<td>19</td>
<td></td>
</tr>
<tr>
<td>4 ply felt and gravel</td>
<td>5.5</td>
<td>5.5</td>
<td></td>
</tr>
<tr>
<td>H-Joists</td>
<td>3</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td><strong>Σ</strong></td>
<td><strong>32</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Interior Level Office

<table>
<thead>
<tr>
<th>Material</th>
<th>Area Weight</th>
<th>Weight</th>
<th>Assume Density</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.5&quot; 20 GA Metal Deck</td>
<td>2</td>
<td>2</td>
<td>110 pcf</td>
</tr>
<tr>
<td>2 1/4&quot; Cellular Conc. Fill</td>
<td>39</td>
<td>39</td>
<td></td>
</tr>
<tr>
<td>Flooring</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Misc Mep</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>H-Joists</td>
<td>3</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td><strong>Σ</strong></td>
<td><strong>49</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Exterior Partition

<table>
<thead>
<tr>
<th>Material</th>
<th>Area Weight</th>
<th>Weight</th>
<th>Assume Density</th>
</tr>
</thead>
<tbody>
<tr>
<td>6&quot; Struct Studs</td>
<td>1.5</td>
<td>1.5</td>
<td></td>
</tr>
<tr>
<td>1&quot; Rigid Insulation</td>
<td>1.5</td>
<td>1.5</td>
<td></td>
</tr>
<tr>
<td>Batt Insulation</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>7/8&quot; Cem Plaster</td>
<td>11</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>1/2&quot; Gyp</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td><strong>Σ</strong></td>
<td><strong>17</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Floor Geometry

- L = 39.66 ft
- D = 38.33 ft
- Area = 1601 ft²

### Roof

<table>
<thead>
<tr>
<th>Item</th>
<th>Total</th>
<th>Area</th>
<th>Length</th>
<th>Height</th>
<th>Area Weight</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>#</td>
<td>#</td>
<td>#</td>
<td>#</td>
<td>#</td>
<td>#</td>
<td>#</td>
</tr>
<tr>
<td>Roofing</td>
<td>1601</td>
<td>1601</td>
<td>32</td>
<td>5</td>
<td>51245</td>
<td>72</td>
</tr>
<tr>
<td>Interior Partition</td>
<td>1601</td>
<td>1601</td>
<td>5</td>
<td>8</td>
<td>8007</td>
<td>128</td>
</tr>
<tr>
<td>Exterior Wall</td>
<td>117</td>
<td>117</td>
<td>6.63</td>
<td>17</td>
<td>13177</td>
<td>128</td>
</tr>
<tr>
<td>**Σ **W&lt;sub&gt;floor&lt;/sub&gt;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>72</strong></td>
<td><strong>128</strong></td>
</tr>
</tbody>
</table>

### Second Floor

<table>
<thead>
<tr>
<th>Item</th>
<th>Total</th>
<th>Area</th>
<th>Length</th>
<th>Height</th>
<th>Area Weight</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>#</td>
<td>#</td>
<td>#</td>
<td>#</td>
<td>#</td>
<td>#</td>
<td>#</td>
</tr>
<tr>
<td>Interior Office Floor</td>
<td>1601</td>
<td>1601</td>
<td>49</td>
<td>17</td>
<td>78469</td>
<td>127</td>
</tr>
<tr>
<td>Interior Partition</td>
<td>1601</td>
<td>1601</td>
<td>15</td>
<td>24</td>
<td>24021</td>
<td>127</td>
</tr>
<tr>
<td>Exterior Wall</td>
<td>117</td>
<td>117</td>
<td>12.63</td>
<td>17</td>
<td>25111</td>
<td>127</td>
</tr>
<tr>
<td>**Σ W&lt;sub&gt;floor&lt;/sub&gt;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>128</strong></td>
<td><strong>127</strong></td>
</tr>
</tbody>
</table>

### First Floor

<table>
<thead>
<tr>
<th>Item</th>
<th>Total</th>
<th>Area</th>
<th>Length</th>
<th>Height</th>
<th>Area Weight</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>#</td>
<td>#</td>
<td>#</td>
<td>#</td>
<td>#</td>
<td>#</td>
<td>#</td>
</tr>
<tr>
<td>Interior Office Floor</td>
<td>1601</td>
<td>1601</td>
<td>49</td>
<td>17</td>
<td>78469</td>
<td>327</td>
</tr>
<tr>
<td>Interior Partition</td>
<td>1601</td>
<td>1601</td>
<td>15</td>
<td>24</td>
<td>24021</td>
<td>327</td>
</tr>
<tr>
<td>Exterior Wall</td>
<td>117</td>
<td>117</td>
<td>12.46</td>
<td>17</td>
<td>24780</td>
<td>327</td>
</tr>
<tr>
<td>**Σ **W&lt;sub&gt;floor&lt;/sub&gt;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>327</strong></td>
<td><strong>327</strong></td>
</tr>
</tbody>
</table>
ASCE 41-17 Linear Static Base Shear
Tier 1

INPUT DATA

C: Modification factor (Table 4-7) = 1.1
S1: Spectral Response Acceleration @ 1 sec. = 1.03
Ss: Short Period Response Acceleration = 2.47
SC: Soil Class = D

<table>
<thead>
<tr>
<th>Soil Class</th>
<th>S1 &lt;= 0.1</th>
<th>S1 = 0.2</th>
<th>S1 = 0.3</th>
<th>S1 = 0.4</th>
<th>S1 = 0.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>D</td>
<td>2.4</td>
<td>2.0</td>
<td>1.8</td>
<td>1.6</td>
<td>1.5</td>
</tr>
</tbody>
</table>

Fv: Site Coefficient for S1 = 1.50

<table>
<thead>
<tr>
<th>Soil Class</th>
<th>Ss &lt;= 0.25</th>
<th>Ss = 0.50</th>
<th>Ss = 0.75</th>
<th>Ss = 1.00</th>
<th>Ss = 1.25</th>
</tr>
</thead>
<tbody>
<tr>
<td>D</td>
<td>1.6</td>
<td>1.4</td>
<td>1.2</td>
<td>1.1</td>
<td>1.0</td>
</tr>
</tbody>
</table>

Fa: Site Coefficient for Ss = 1.00

CALCULATE BASE SHEAR FOR BSE-2 (MCE)

T: Fundamental Period of Vibration = Ct * hb = 0.643 sec. (4-4)
Ss: Spectral Acceleration at Building Period = 1.63 (4-3)
V: Pseudo Seismic Force = 588 kips (4-1)
Subject: MF Drift Check 4.4.3.1
Job Number: B8114004
Date: 7/11/2019
Job: RSF Lobby
By: TAB
Checked By:

North-South

\[ \begin{align*}
I_b &= 609 \text{ in}^4 \\
L &= 230 \text{ in} \\
I_c &= 999 \text{ in}^4 \\
h &= 151.5 \text{ in} \\
E &= 29000 \text{ ksi} \\
V &= 588 \text{ kips} \\
N_{col} &= 9 \text{ columns} \\
V_{col} &= 65 \text{ kips} \\
kb &= 2.65 \\
kc &= 6.59 \\
\end{align*} \]

\text{story drift ratio}

\[ \text{Dr} = 0.015 < 0.03 \text{ Drift req} \]

East-West

\[ \begin{align*}
I_b &= 338 \text{ in}^4 \\
L &= 239.5 \text{ in} \\
I_c &= 362 \text{ in}^4 \\
h &= 151.5 \text{ in} \\
E &= 29000 \text{ ksi} \\
V &= 588 \text{ kips} \\
N_{col} &= 9 \text{ columns} \\
V_{col} &= 65 \text{ kips} \\
kb &= 1.41 \\
kc &= 2.39 \\
\end{align*} \]

\text{story drift ratio}

\[ \text{Dr} = 0.032 < 0.03 \text{ Drift req} \]
Material Properties

\[ f_y = 36 \text{ ksi} \]
\[ f_{ye} = - \text{ ksi} \]

**East-West Direction**

Tributary Area

Column B/1.3

\[ w_{trib} = 19.8 \text{ ft} \]
\[ h_{trib} = 19.2 \text{ ft} \]
\[ A_{trib} = 380 \text{ ft}^2 \]

<table>
<thead>
<tr>
<th></th>
<th>DL</th>
<th>LL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roof</td>
<td>32.0</td>
<td>20 psf</td>
</tr>
<tr>
<td>2nd</td>
<td>49.0</td>
<td>50 psf</td>
</tr>
<tr>
<td>first</td>
<td>49.0</td>
<td>50 psf</td>
</tr>
</tbody>
</table>

\[ W_{\text{grav}} = 49.4 \text{ kip} \]
\[ W_{\text{factored}} = 66.9 \text{ kip} \]

Column Axial Stress Due to Gravity

<table>
<thead>
<tr>
<th>Property</th>
<th>W14x90</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ag in²</td>
<td>26.5</td>
</tr>
<tr>
<td>Fy x Ag</td>
<td>954</td>
</tr>
<tr>
<td>Pg / Py</td>
<td><strong>0.05</strong></td>
</tr>
</tbody>
</table>
Ms = 9 Collapse Prevention system modification factor
nc = 9 frame columns
nf = 6 frames
h = 180 in
Z1col = 75.6
Zcol = 680.4 in³ *Weak Axis
Zbm = 589.2 in³

W16x31 W16x26
54  44.2
6  6
324  265.2

Σ 589.2
Using middle column, O9 at second floor
Beams - W21x44 and W16x31
Column - W14x90

\[ Ze_{beam} = 149.4 \text{ in}^3 \]
\[ t_{web,col} = 1.69 \text{ in} \quad 5/8'' \text{ Doubler Plate EA Face} \]
\[ d_{col} = 14 \text{ in} \]
\[ f_{y\text{-spec}} = 36 \text{ ksi} \]
\[ d_{beam} = 20.7 \text{ in} \]
\[ M_{pu\text{-total}} = 5378.4 \text{ kip-in} \]
\[ 0.8*M_{pu} = 4302.72 \text{ kip-in} \]
\[ V_{web} = 208 \text{ kip} \]
\[ v_{web} = 9 \text{ ksi} \]
\[ 0.6f_{y} = 21.6 \text{ ksi} \]
Using middle column, B/1.3 at second floor
W16x31 and W16x26
W14x90 column, weak axis

**East-West**

fy-spec = 36 ksi

\[ Z_{beam\_L} = \text{54 in}^3 \]
\[ Z_{beam\_R} = \text{44.2 in}^3 \]
\[ \Sigma M_{pb} = \text{3535.2 kip-in} \]

\[ Z_{col\_T} = \text{75.6 in}^3 \]
\[ Z_{col\_B} = \text{75.6 in}^3 \]
\[ \Sigma M_{pc} = \text{5443.2 kip-in} \]

\[ \frac{\Sigma M_{pc}}{\Sigma M_{pb}} = 1.54 \]

**North-South**

fy-spec = 36 ksi

\[ Z_{beam\_L} = \text{95.4 in}^3 \]
\[ Z_{beam\_R} = \text{54 in}^3 \]
\[ \Sigma M_{pb} = \text{5378.4 kip-in} \]

\[ Z_{col\_T} = \text{157 in}^3 \]
\[ Z_{col\_B} = \text{157 in}^3 \]
\[ \Sigma M_{pc} = \text{11304 kip-in} \]

\[ \frac{\Sigma M_{pc}}{\Sigma M_{pb}} = 2.10 \]
E = 29000 ksi
fy = 36 ksi

AISC 341, TBL D1.1 Criteria

<table>
<thead>
<tr>
<th>Frame Members</th>
<th>b/t</th>
<th>h/tw</th>
<th>Flange $\lambda_{nd}$</th>
<th>Web $\lambda_{nd}$</th>
<th>Flange</th>
<th>Web</th>
</tr>
</thead>
<tbody>
<tr>
<td>W14x90</td>
<td>10.2</td>
<td>25.9</td>
<td>10.79</td>
<td>42.29</td>
<td>C</td>
<td>C</td>
</tr>
<tr>
<td>W16x31</td>
<td>6.28</td>
<td>51.6</td>
<td>10.79</td>
<td>42.29</td>
<td>C</td>
<td>NC</td>
</tr>
<tr>
<td>W16x26</td>
<td>7.97</td>
<td>56.8</td>
<td>10.79</td>
<td>42.29</td>
<td>C</td>
<td>NC</td>
</tr>
<tr>
<td>W21x44</td>
<td>7.22</td>
<td>53.6</td>
<td>10.79</td>
<td>42.29</td>
<td>C</td>
<td>NC</td>
</tr>
<tr>
<td>W14x22</td>
<td>7.46</td>
<td>53.3</td>
<td>10.79</td>
<td>42.29</td>
<td>C</td>
<td>NC</td>
</tr>
<tr>
<td>W14x38</td>
<td>6.57</td>
<td>39.6</td>
<td>10.79</td>
<td>42.29</td>
<td>C</td>
<td>C</td>
</tr>
</tbody>
</table>
### Weight Take Off

**Job:** RSF - Parking  
**By:** TAB  
**Section:** Roofing  
**Date:** 7/11/2019

#### Tee "T1" Slab Weight

**Material** | **Area Weight**  
--- | ---  
1.5" 16 GA Metal Deck | 4  
4 ply felt and gravel | 5.5  
R-11 Insulation | 2.25  
**Σ:** 12

**Section** | **Area [ft²]**  
--- | ---  
Plange | 4.17  
Plange Taper | 1.36  
Web | 2  
**Σ:** 83 psf

#### Exterior Partition

**Material** | **Area Weight**  
--- | ---  
6" Struct Studs | 1.5  
1" Rigid Insulation | 1.5  
Batt Insulation | 1  
7/8" Cem Plaster | 11  
1/2" Gyp | 2  
**Σ:** 17

#### Gym Floor

**Material** | **Area Weight**  
--- | ---  
T1 PC/PT | 83  
Batt Insulation | 0.5  
Wood Plat. | 1.5  
**Σ:** 85

#### Roofing

- **L:** 228.66 ft  
- **D:** 147.5 ft  
- **Area:** 33727 ft²

**Item** | **Total Area** | **Length** | **Height** | **Area Weight** | **Weight**  
--- | --- | --- | --- | --- | ---  
Roofing | 33727 | | | 12 | 404728  
50% PV Allowance | 33727 | | | 7.5 | 252955  
Exterior Partition Wall | 753 | 10.3 | | 17 | 131210  
**Σ W_floors:** 789 kip

#### First Brace Level

**Item** | **Total Area** | **Length** | **Height** | **Area Weight** | **Weight**  
--- | --- | --- | --- | --- | ---  
Exterior Partition Wall | 524 | 18.6 | | 17 | 165355  
**Σ W_floors:** 165 kip

**Σ W_total:** 954 kip
### 2nd Floor

<table>
<thead>
<tr>
<th>Item</th>
<th>Total</th>
<th>Area</th>
<th>Length</th>
<th>Height</th>
<th>Area Weight</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>#</td>
<td>ft²</td>
<td>ft</td>
<td>ft</td>
<td>psf</td>
<td>lb</td>
</tr>
<tr>
<td>Slab Area</td>
<td>33727</td>
<td>33727</td>
<td>85</td>
<td>2866825</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4” LWC Topping</td>
<td></td>
<td></td>
<td>37</td>
<td>1236670</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exterior Partition Wall</td>
<td></td>
<td></td>
<td>524</td>
<td>8.3</td>
<td>17</td>
<td>74048</td>
</tr>
<tr>
<td>Exterior Partition Wall</td>
<td></td>
<td></td>
<td>228.66</td>
<td>8.3</td>
<td>10</td>
<td>19007</td>
</tr>
<tr>
<td>12” Conc Wall, 75% Open</td>
<td></td>
<td></td>
<td>939.57</td>
<td>12.5</td>
<td>112.5</td>
<td>1321270</td>
</tr>
</tbody>
</table>

Σ $W_{floor}$ = 5518 kip

### 1st Floor

<table>
<thead>
<tr>
<th>Item</th>
<th>Total</th>
<th>Area</th>
<th>Length</th>
<th>Height</th>
<th>Area Weight</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>#</td>
<td>ft²</td>
<td>ft</td>
<td>ft</td>
<td>psf</td>
<td>lb</td>
</tr>
<tr>
<td>12” Conc Wall, 75% Open</td>
<td></td>
<td>939.57</td>
<td>12.5</td>
<td>112.5</td>
<td>1321270</td>
<td></td>
</tr>
<tr>
<td>Slab Area</td>
<td>50125</td>
<td></td>
<td>119</td>
<td>5988545</td>
<td></td>
<td>7310</td>
</tr>
</tbody>
</table>

SuperStructure Weight = 6472 kip

### BSMT

<table>
<thead>
<tr>
<th>Item</th>
<th>Total</th>
<th>Area</th>
<th>Length</th>
<th>Height</th>
<th>Area Weight</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>#</td>
<td>ft²</td>
<td>ft</td>
<td>ft</td>
<td>psf</td>
<td>lb</td>
</tr>
<tr>
<td>12” Conc Wall, 80% Open</td>
<td></td>
<td>1520</td>
<td>6.5</td>
<td>127.5</td>
<td>1259700</td>
<td>1260</td>
</tr>
</tbody>
</table>

Total Weight = 15042 kip

- Lobby Weight = 327 kip
- Handball Weight = 1902 kip

Seismic Weight Garage = 17271 kip
ASCE 41-17 Linear Static Base Shear & Vertical Force Distribution
Tier 1

INPUT DATA

C: Modification factor (Table 4-7) = 1.1 2 Conc. SW w/ BF above
S\text{s}_1: Spectral Response Acceleration @ 1 sec. = 1.03 (from MCE maps or Site Specific)
S\text{s}_2: Short Period Response Acceleration = 2.47 (from MCE maps or Site Specific)
SC: Soil Class = D (A through F), 1.6.1.4.1

<table>
<thead>
<tr>
<th>Table 1-5:</th>
<th>S_1 &lt;=</th>
<th>S_1 =</th>
<th>S_1 =</th>
<th>S_1 =</th>
<th>S_1 =</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soil Class</td>
<td>D</td>
<td>0.1</td>
<td>0.2</td>
<td>0.3</td>
<td>0.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.4</td>
<td>2.0</td>
<td>1.8</td>
<td>1.6</td>
</tr>
<tr>
<td>F_v</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1.50</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

F_v: Site Coefficient for S_1 = 1.50 (Table 11.4-1)

<table>
<thead>
<tr>
<th>Table 1-4:</th>
<th>S_s &lt;=</th>
<th>S_s =</th>
<th>S_s =</th>
<th>S_s =</th>
<th>S_s =</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soil Class</td>
<td>D</td>
<td>0.25</td>
<td>0.50</td>
<td>0.75</td>
<td>1.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.6</td>
<td>1.4</td>
<td>1.2</td>
<td>1.1</td>
</tr>
<tr>
<td>F_a</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

F_a: Site Coefficient for S_s = 1.00 (Table 11.4-2)

S\text{M}_1: Spectral Response Acceleration @ 1 sec. = 1.05 Table 6, UCB Site Specific
S\text{M}_2: Short Period Acceleration = F_a*S_s = 3.15 Table 6, UCB Site Specific
β: Building System Exponent = 0.75 (4.4.2.4)
C_t: Building System Coefficient = 0.02 (4.4.2.4)
W: Total Building Weight = 17271 kips
h_n: Total Building Height = 52.3 feet *shortest structure
n: Number of Stories = 3
S\text{M}_1: Spectral Response Acceleration @ 1 sec. = 1.07 (2-2)
S\text{M}_2: Short Period Acceleration = F_a*S_s = 3.60 (2-1)
S_d1: Design spectral acceleration, 1 s = 0.71
S_d2: Design spectral acceleration, short = 2.40

CALCULATE BASE SHEAR FOR BSE-2 (MCE)

T: Fundamental Period of Vibration = C_t * h_n^β = 0.389 sec. (4-4)
S_a: Spectral Acceleration at Building Period = 2.70 (4-3)
V: Pseudo Seismic Force = 51321 kips (4-1)
Considering All Possible Wall

**East West**

\[
\begin{align*}
L_{12w} &= 812 \text{ ft} \\
L_{24w} &= 66 \text{ ft} \\
t_{wall} &= 12 \text{ in} \\
M_s &= 4.5 \text{ for Conc. SW, Limited Safety} \\
A_w &= 135936 \text{ in}^2 \\
V_{\text{base}} &= 51321 \text{ kip} \\
v_j-\text{avg} &= 84 \text{ psi}
\end{align*}
\]

**North-South Loading**

\[
\begin{align*}
L_{6w} &= 70.66 \text{ ft} \\
L_{12w} &= 782.75 \text{ ft} \\
t_{wall} &= 12 \text{ in} \\
t_{wall} &= 6 \text{ in} \\
M_s &= 4.5 \text{ for Conc. SW, Limited Safety} \\
A_w &= 117804 \text{ in}^2 \\
V_{\text{base}} &= 51321 \text{ kip} \\
v_j-\text{avg} &= 97 \text{ psi}
\end{align*}
\]
Concrete Walls

**Typical 12" Wall**

Vertical: #4 at 12" o.c., each way, both faces
- \( t_{wall} = 12 \text{ in} \)
- \( A_{bar} = 0.2 \text{ in}^2 \)
- \( s_{pacing} = 12 \text{ in} \)
- \( \rho = 0.0028 \text{ OK} > 0.0012 \text{ vertical minimum ratio} \)

Horiztonal #4 at 12" o.c., each way, both faces
- \( t_{wall} = 12 \text{ in} \)
- \( A_{bar} = 0.2 \text{ in}^2 \)
- \( s_{pacing} = 12 \text{ in} \)
- \( \rho = 0.0028 \text{ OK} > 0.002 \text{ horizontal minimum ratio} \)

**Typical 6" Wall**

Vertical: #3 at 12" o.c., each way, both faces
- \( t_{wall} = 6 \text{ in} \)
- \( A_{bar} = 0.11 \text{ in}^2 \)
- \( s_{pacing} = 12 \text{ in} \)
- \( \rho = 0.0015 \text{ OK} > 0.0012 \text{ vertical minimum ratio} \)

Vertical: #4 at 12" o.c., each way, both faces
- \( t_{wall} = 6 \text{ in} \)
- \( A_{bar} = 0.2 \text{ in}^2 \)
- \( s_{pacing} = 12 \text{ in} \)
- \( \rho = 0.0028 \text{ OK} > 0.002 \text{ horizontal minimum ratio} \)