Rating form completed by: Simpson Gumpertz & Heger, SGH.COM
LZ, CAO, KDP, KSM

*Text in green is to be part of UCSF building database and may be part of UCOP database.*

Date: 2020-11-03

**UCSF Building Seismic Ratings**

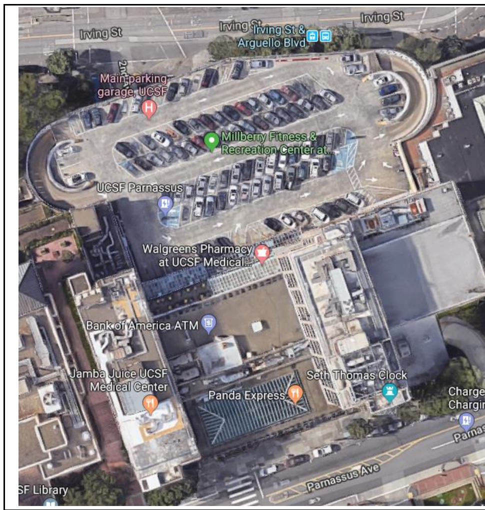
***Millberry Garage, Parnassus Avenue***

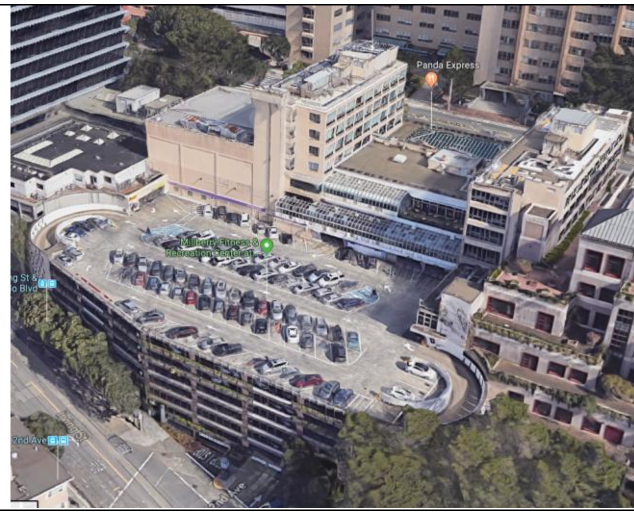
CAAN# *2212.1*

*500 Parnassus Avenue, San Francisco, CA 94131*

UCSF Campus Site: *Parnassus*

REGISTERED PROFESSIONAL ENGINEER
KEVIN S. MOORE
No. 4528
STRUCTURAL
STATE OF CALIFORNIA
11/03/2020




| Rating summary | Entry | Notes |
|---|---|---|
| UC Seismic Performance Level (rating) | V | Findings based on a drawing review and ASCE 41-17 Tier 1 & 3 evaluation[1] |
| Rating basis | Tier 1 & 3 | ASCE 41-17 |
| Date of rating | 2020 | |
| Recommended UCSF priority category for retrofit | Priority B | Priority A=Retrofit ASAP<br>Priority B=Retrofit at next permit application for modification |
| Ballpark total project cost to retrofit to IV rating | Very High (> $400/sf) | See recommendations on further evaluation and retrofit |
| Is 2018-2019 rating required by UCOP? | Yes | Building previously rated IV but does not have a fully documented quantifiable review |
| Further evaluation recommended? | Yes | Additional analysis to determine size and scope of required retrofit |

[1] The evaluations at UCSF translate the Tier 1 & 3 evaluation to a Seismic Performance Level rating using professional judgment discussed among the Seismic Review Committee. Non-compliant items in the Tier 1 & 3 evaluation do not automatically put a building into a particular rating category, but such items are evaluated along with the combination of building features and potential deficiencies, focused on the potential for collapse or serious damage to the gravity supporting structure that may threaten occupant safety.

**Building information used in this evaluation**

- "Combined Structure – Unit No. 1 (Quarter of nurses, interns, and resident staff; student union, including physical education and recreation facilities; and parking garage)" structural drawings, Milton T. Pflueger (Architect) and Huber & Knapik (Civil Engineers), dated 14 July 1955.
- "Combined Structure – Unit No. 2" structural drawings, Milton T. Pflueger (Architect) and Huber & Knapik (Civil Engineers), dated 21 May 1958.
- *Performance of UCSF Buildings During the October 17, 1989 Loma Prieta Earthquake*, Impell Corporation, dated 17 November 1989.

**Scope for completing this form**

Reviewed original structural construction drawings and performed an ASCE 41-17 Tier 1 & Tier 3 evaluation. Made a brief site visit of building exterior and walked through parking garage levels. Did not observe nonstructural life-safety hazards within or outside of the building.

**Brief description of structure**

The building comprises about half of the 400,000 sq ft Millberry combined structure. The structure was constructed in phases described as Units No. 1, 2, and 3 in the original structural drawings.

- Units No. 1 and No. 3 encompass the student union building located south of the Garage. The main building is five stories (Level C to Level 2). A tower on the west side of the building extends up three additional stories while the tower on the east side extends up four additional stories. The top two levels of the east tower (Level 5 and Roof) were constructed as the later Unit No. 3. The remainder of the Union building was included in the original Unit No. 1 construction.
- Unit No. 2 is the seven-story (Level H to Level A) parking garage with circular ramps located on the east and west ends.

The focus of this report is the Millberry Garage building (Unit No. 2). The garage was designed in 1958 and constructed shortly thereafter.

There is no joint between the Garage and Union buildings. The Garage's slab reinforcing was welded to existing dowels extended from the Union's slabs at Levels A and B. Additionally, during the Garage's construction, a shared retaining wall was constructed from Level E to Level C and keyed into the existing Union's caisson foundations.

<u>Identification of Levels:</u> The building is sited on a severe slope. The levels are identified in the structural drawings as follows:

- Level H: EL. 307.52 ft – aligned with grade at Irving Street along the north side of the building
- Level G: EL. 316.58 ft
- Level F: EL. 325.23 ft
- Level E: EL. 334.08 ft
- Level D: EL. 342.94 ft
- Level C: EL. 351.79 ft
- Level B: EL. 360.65 ft
- Level A: EL. 369.50 ft

The Garage Levels C through A are roughly aligned with the adjacent Union Levels C through A.

Grade at the north side of the structure along Irving Street is at approximately EL. 307 ft, roughly aligned with the Garage Level H. Grade at the south side of the structure along Parnassus Avenue is at approximately EL. 393 ft, roughly aligned with the Union Level 1, two stories above the top of the garage.

Foundation System: The parking garage foundations comprise reinforced concrete spread footings below columns and reinforced concrete strip footings below walls. The southernmost columns along Line P are founded on belled caissons.

Structural System for Vertical (Gravity) Load: The parking garage floor framing comprises a 12 in. deep two-way flat slab with drop panels, supported by reinforced concrete columns spaced such that bay sizes are 34 ft x 32 ft. The slab drop panels are 20 ft x 20 ft in plan tapering from 24 in. thick at the columns to 12 in. thick at their perimeter. The drop panels are typically unreinforced. Typical interior columns are cylindrical with diameters ranging from 24 in. to 36 in. with spiral confinement steel surrounding the vertical steel reinforcement. Spiral reinforcement ranges from 3/8 in. dia. to 1/2 in. dia. with a pitch ranging between 2 in. and 3-1/4 in. The lower story columns have two concentric spiral cores around an inner and outer ring of vertical reinforcing creating double confined cores. Columns located along the north building elevation are rectangular with #4 hoops and #3 cross-ties engaging all vertical bars. Hooks and ties are detailed with both 135-degree or 180-degree hooks. Hoop and tie spacing is identified as 3 in. at the top and bottom 14 in. of the columns with the balance of hoops and ties spaced at 12 in. o.c. The garage has two helical ramps comprising an 8 in. thick reinforced concrete slab driveway, located at each end of the building. These helical ramps are supported by curved concrete walls on each side of the ramp slab. The interior ramp wall is a 16 in. solid wall; the exterior wall is a 16 in. punched wall with regularly-spaced openings.

Structural System for Lateral Loads: The garage does not have a clearly defined lateral load-resisting system as walls, columns, beams and slabs all significantly contribute to the building's lateral load resistance. The reinforced beams (at the north perimeter), reinforced flat slab (at the interior) and columns will resist load through frame action. Reinforced concrete retaining walls at the south side of the building and the curved ramp walls at the east and west ends provide much of the structure's stiffness. However, the efficacy of the wall system is limited by the strength of the diaphragms.

**Brief description of supplemental analysis model**

A linear response spectrum analysis model was developed in accordance with ASCE 41-17 procedures to determine the anticipated building response when subject to seismic loads. The model includes an increased seismic demand associated with the retained soil south of the building in the form of an earth pressure seismic increment. This model was used to identify potential areas of overstress under the BSE-R hazard with a Life Safety performance objective and under the BSE-C hazard with a Collapse Prevention performance objective. Concrete shear walls, beam-column moment frames, and slab-column moment frames were all considered as primary lateral force-resisting components.

**Brief description of seismic deficiencies and expected seismic performance**

Seismic deficiencies that affect the building performance include:

- Garage concrete column axial stresses, caused by overturning forces alone, exceed 0.3 f'c.
- Garage moment frames comprise flat slab frames. The drop panels in the concrete slabs are not adequately reinforced, thereby adding no increase to the flexural capacity of the slab.

- Garage flat slab and spandrel beam bottom steel is not continuous through the joint, but is lapped within the column diameter dimension. This lap length is insufficient for full reinforcing development, resulting in limited positive flexural capacity and force-controlled brittle failures.
- Garage column bar splices are insufficient for full development of reinforcing.
- Rectangular column stirrups are spaced too far apart through the column length to develop the probable column flexural strength.
- Beam column joints, at spandrel beams, do not have ties within the joint.
- The steep grade results in a flexible frame on the north side relative to the southern walls, causing a torsional response in the E-W direction.
- Exterior ramp walls are connected to the main floor diaphragm via short segments of thin ramp slabs, limiting the force that can be transferred to the walls.
- Horizontal wall segments in the punched ramp walls lack sufficient reinforcing to couple the vertical piers.

The large number of items listed above may collectively affect the seismic performance of the building such that local failures may occur collectively, negatively affecting the global building performance. The shared wall at the south edge of the parking garage will likely not influence the behavior, response or potential damage to the Millberry Union building located above the garage.

| **Structural deficiency** | **Affects rating?** | **Structural deficiency** | **Affects rating?** |
|---|---|---|---|
| Lateral system stress check (wall shear, column shear or flexure, or brace axial as applicable) | **Y** | Openings at shear walls (concrete or masonry) | **Y** |
| Load path | **Y** | Liquefaction | N |
| Adjacent buildings | N | Slope failure | N |
| Weak story | N | Surface fault rupture | N |
| Soft story | N | Masonry or concrete wall anchorage at flexible diaphragm | N |
| Geometry (vertical irregularities) | N | URM wall height-to-thickness ratio | N |
| Torsion | **Y** | URM parapets or cornices | N |
| Mass – vertical irregularity | N | URM chimney | N |
| Cripple walls | N | Heavy partitions braced by ceilings | N |
| Wood sills (bolting) | N | Appendages | N |
| Diaphragm continuity | N | | |

**Summary of review of nonstructural life-safety concerns, including at exit routes.**

A detailed assessment of nonstructural systems has not been performed. No life-safety concerns were observed during the site walk.

| UCOP non-structural checklist item | Life safety hazard? | UCOP non-structural checklist item | Life safety hazard? |
|---|---|---|---|
| Heavy ceilings, feature or ornamentation above large lecture halls, auditoriums, lobbies or other areas where large numbers of people congregate | None observed | Unrestrained hazardous materials storage | None observed |
| Heavy masonry or stone veneer above exit ways and public access areas | None observed | Masonry chimneys | None observed |
| Unbraced masonry parapets, cornices or other ornamentation above exit ways and public access areas | None observed | Unrestrained natural gas-fueled equipment such as water heaters, boilers, emergency generators, etc. | None observed |

### Basis of seismic performance level rating

The building's Seismic Performance Level rating of V can be attributed to the structural deficiencies identified above. The influence of the Millberry Union building, when subjected to seismic shaking, may also have an effect on the seismic response and potential for damage in a major earthquake.

### Recommendations for further evaluation or retrofit:

We recommend that the University perform a more detailed seismic evaluation to determine the size and scope of the retrofit required to achieve a Seismic Performance Level IV. Applicable retrofit measures may include adding strength to slabs and columns via fiber-reinforced polymer. The addition of concrete walls or other similarly stiff elements is likely required to reduce stress on existing elements and balance the building's torsional response.

### Peer review comments on rating

The structural members of the UCSF Seismic Review Committee (SRC) reviewed the evaluation on 8 January 2020 and agree with the rating of V.

| Additional building data | Entry | Notes |
|---|---|---|
| Latitude | 37.76365° | |
| Longitude | -122.45855° | |
| Are there other structures besides this one under the same CAAN# | No | |
| Number of stories above lowest perimeter grade | 7 | Top of garage is 7 levels above grade at north side of building, 2 levels below grade at south side of building |
| Number of stories (basements) below lowest perimeter grade | 0 | Garage at base of slope |
| Building occupiable area (OGSF) | 240,000 | Estimated from drawings |
| Risk Category per 2016 CBC 1604.5 | II | |
| Building structural height, $h_n$ | 62 ft | As defined per ASCE 7-16 Section 11.2 |
| Coefficient for period, $C_t$ | 0.02 | ASCE 41-17 equation 4-4 and 7-18 |
| Coefficient for period, ? | 0.9 | ASCE 41-17 equation 4-4 and 7-18 |
| Estimated fundamental period | 0.74 sec | ASCE 41-17 equation 4-4 and 7-18 |
| **Site data** | | |
| 975 yr hazard parameters $S_s$, $S_1$ | 1.543, 0.608 | https://hazards.atcouncil.org/ |

| Additional building data | Entry | Notes |
|---|---|---|
| Site class | D | UCSF Group 2 Buildings, Geotechnical Characteristics and Geohazards, Egan (2019) |
| Site class basis | Estimated | UCSF Group 2 Buildings, Geotechnical Characteristics and Geohazards, Egan (2019) |
| Site parameters $F_a$, $F_v$ | 1.0, 1.7 | https://hazards.atcouncil.org/ describes *null for $F_v$ (estimated) |
| Ground motion parameters $S_{cs}$, $S_{c1}$ | 1.543, 1.034 | UCSF Group 2 Buildings, Geotechnical Characteristics and Geohazards, Egan (2019) |
| $S_a$ at building period | 1.54 | Calculated |
| Site $V_{s30}$ | 305 m/s | UCSF Group 2 Buildings, Geotechnical Characteristics and Geohazards, Egan (2019) |
| $V_{s30}$ basis | Estimated | UCSF Group 2 Buildings, Geotechnical Characteristics and Geohazards, Egan (2019) |
| Liquefaction potential | No | UCSF Group 2 Buildings, Geotechnical Characteristics and Geohazards, Egan (2019) |
| Liquefaction assessment basis | Estimated | UCSF Group 2 Buildings, Geotechnical Characteristics and Geohazards, Egan (2019) |
| Landslide potential | No | UCSF Group 2 Buildings, Geotechnical Characteristics and Geohazards, Egan (2019) |
| Landslide assessment basis | Sloping Site | Rutherford + Chekene Study, 2006 |
| Active fault-rupture hazard identified at site? | No | UCSF Group 2 Buildings, Geotechnical Characteristics and Geohazards, Egan (2019) |
| Site-specific ground motion study? | No | |
| **Applicable code** | | |
| Applicable code or approx. date of original construction | Unit No. 2 Drawings Dated 1958 | |
| Applicable code for partial retrofit | None | No partial retrofit known |
| Applicable code for full retrofit | None | No full retrofit known |
| **Model building data** | | |
| Model building type North-South | C1 & C2 Conc. | |
| Model building type East-West | C1 & C2 Conc. | |
| FEMA P-154 score | N/A | Not included here because we performed ASCE 41 Tier 1 evaluation. |
| **Previous ratings** | | |
| Most recent rating | IV | In spreadsheet. Basis for rating is unknown |
| Date of most recent rating | - | Rating date is unknown |
| 2nd most recent rating | - | |
| Date of 2nd most recent rating | - | |

| Additional building data | Entry | Notes |
| --- | --- | --- |
| **Appendices** | | |
| ASCE 41 Tier 1 checklist included here? | Yes | Refer to attached checklist file |

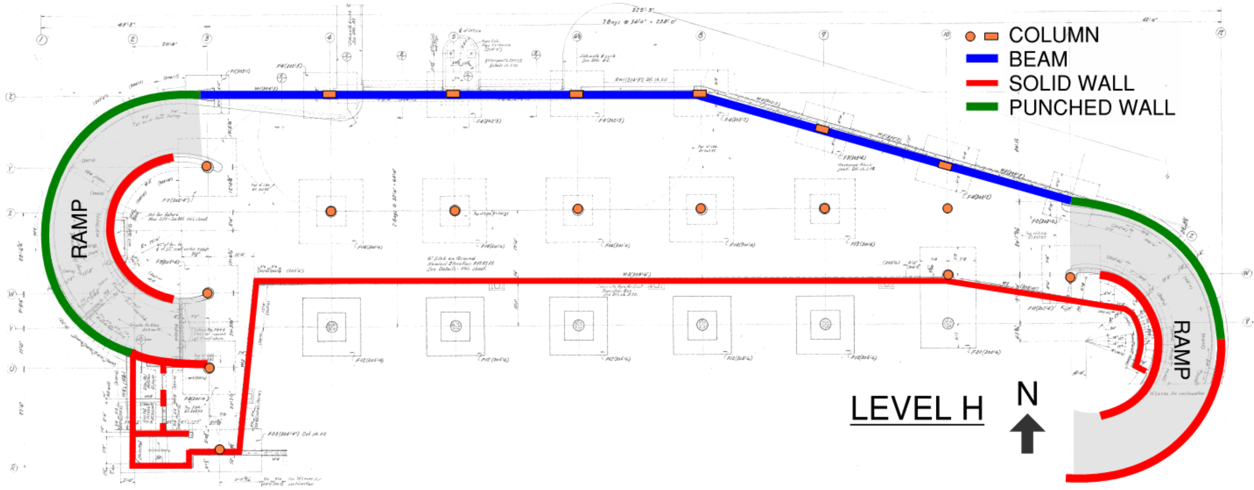
UCSF

SIMPSON GUMPERTZ & HEGER

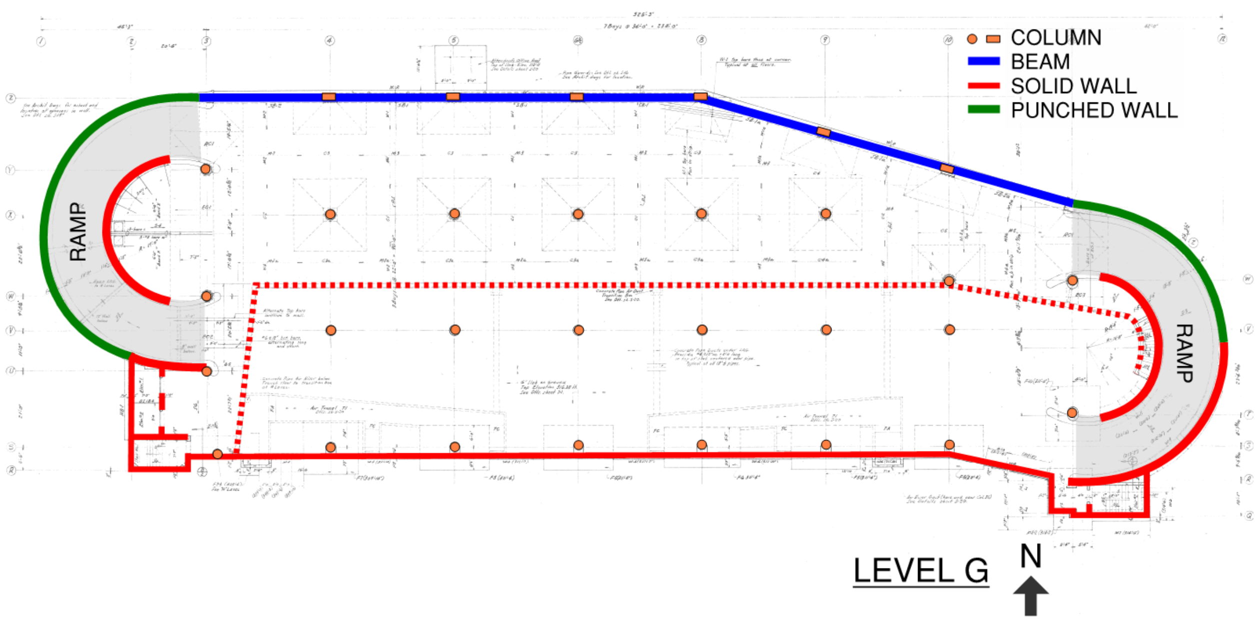
Engineering of Structures and Building Enclosures

# Appendix A

Drawing Images




Garage Plans



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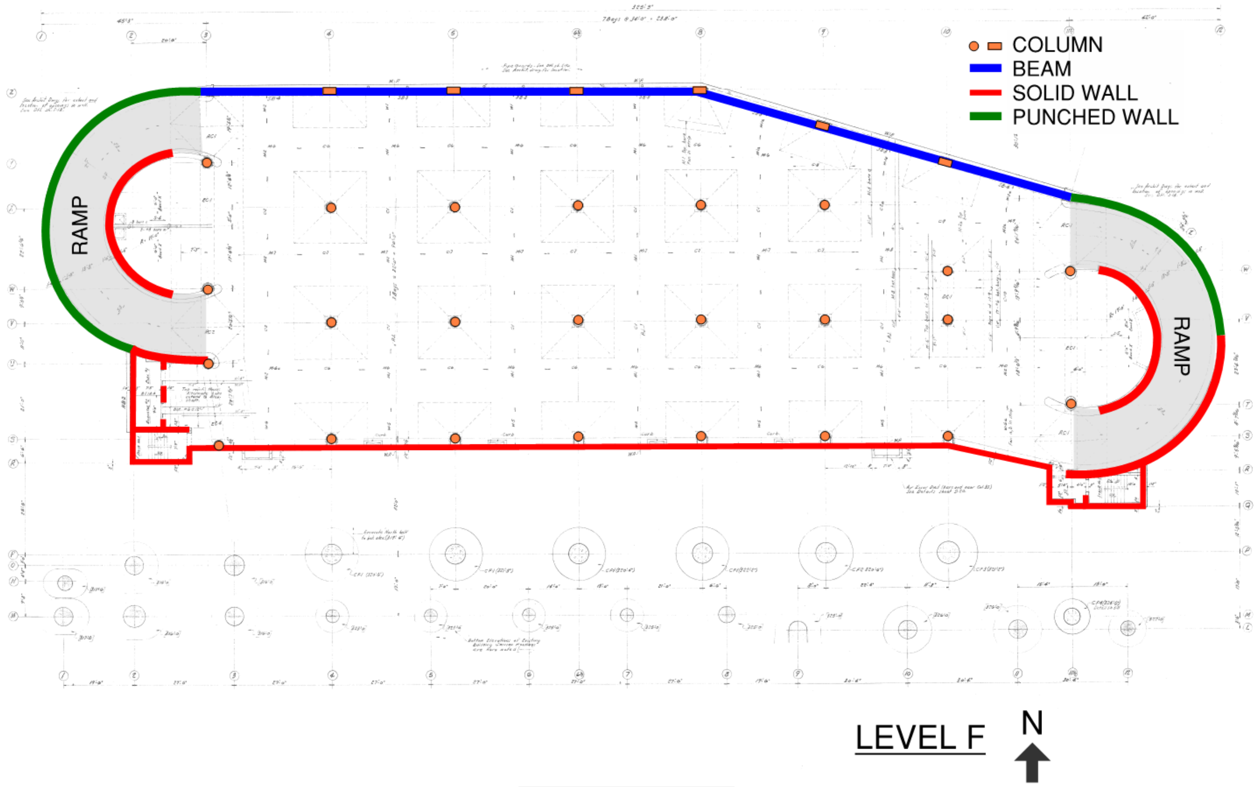
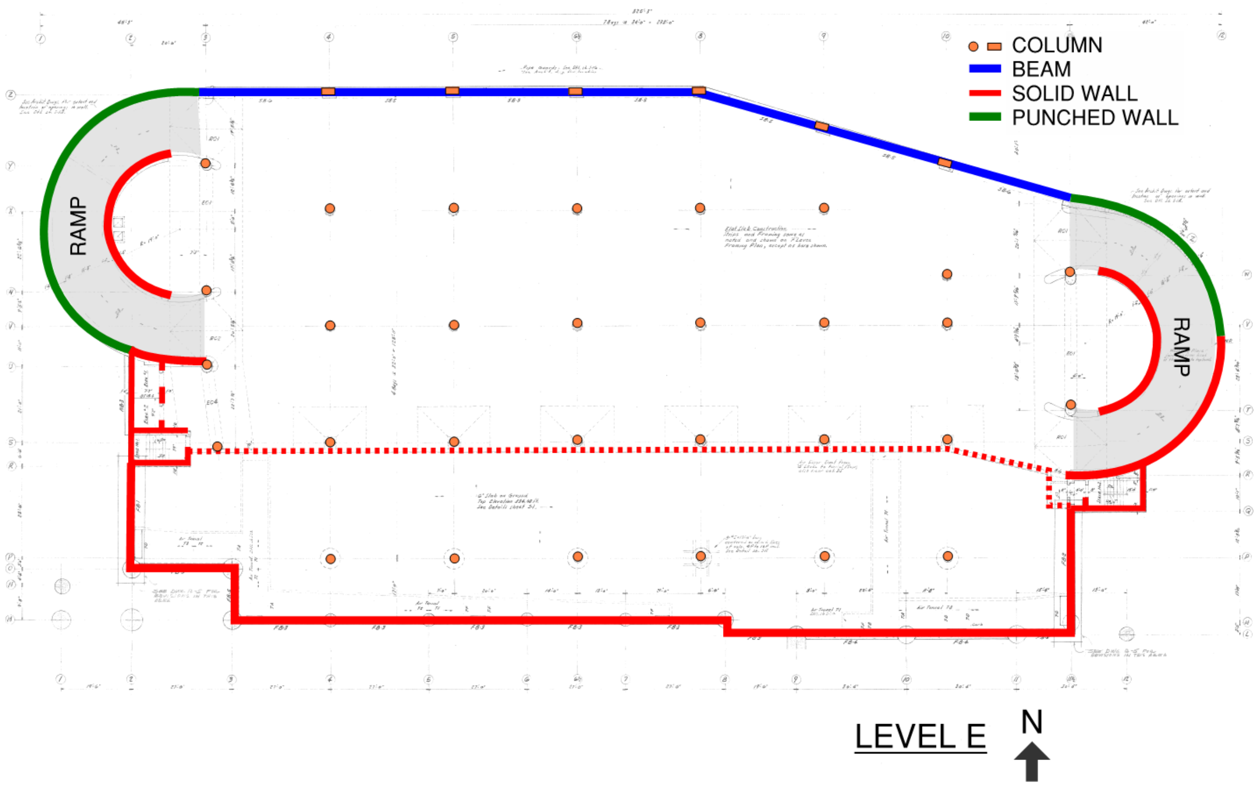
Engineering of Structures and Building Enclosures




Garage Plans



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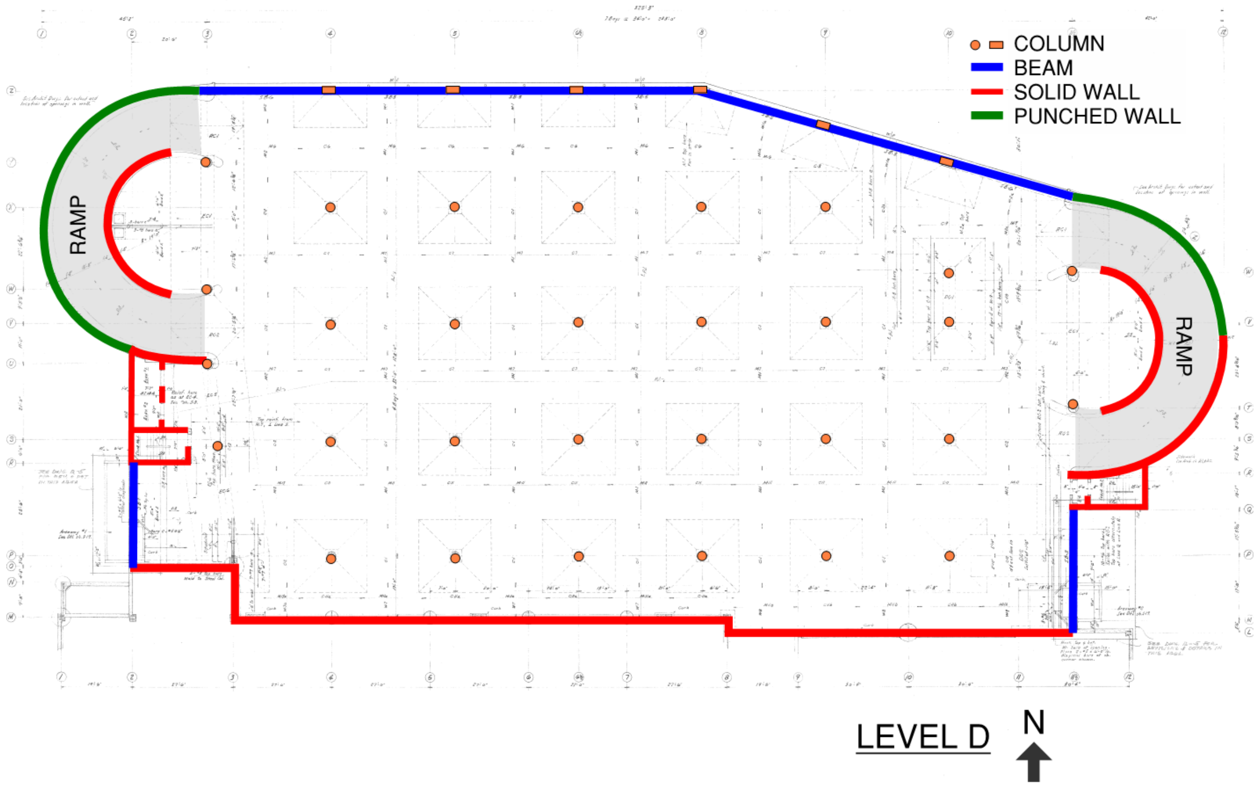
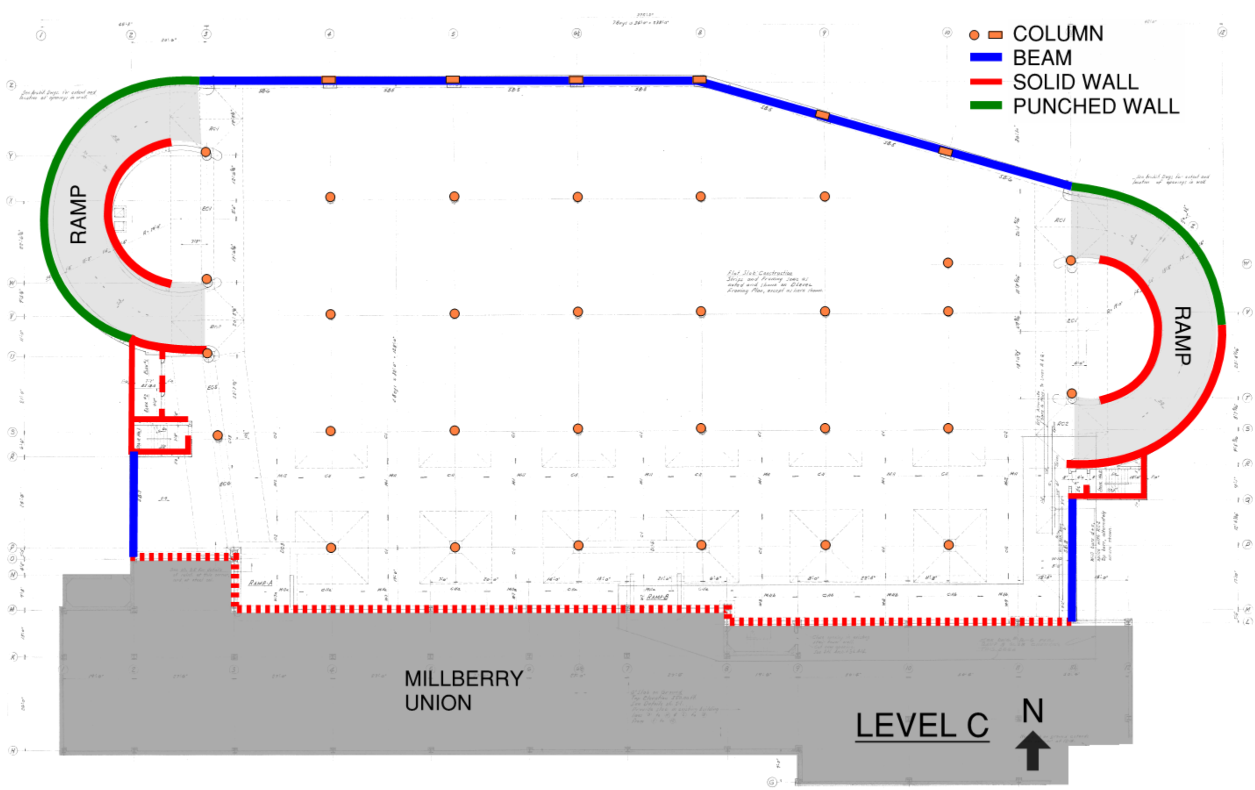



Garage Plans



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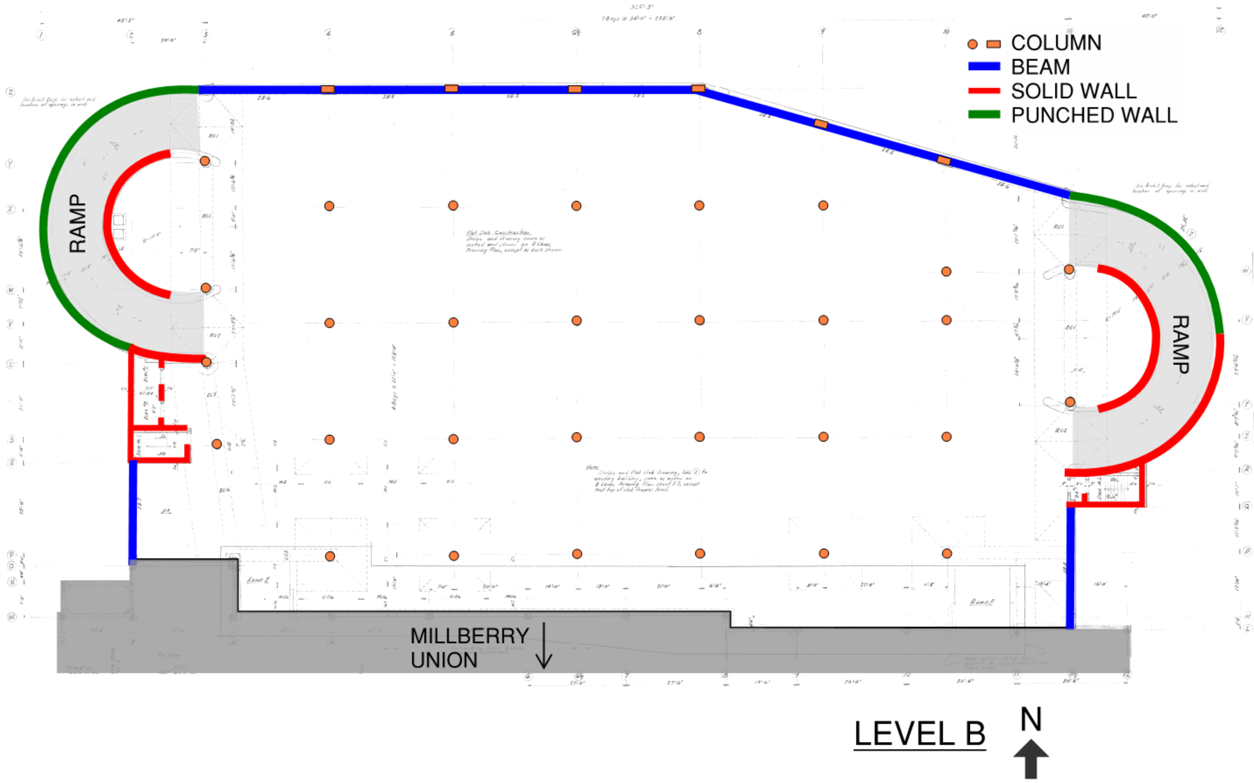
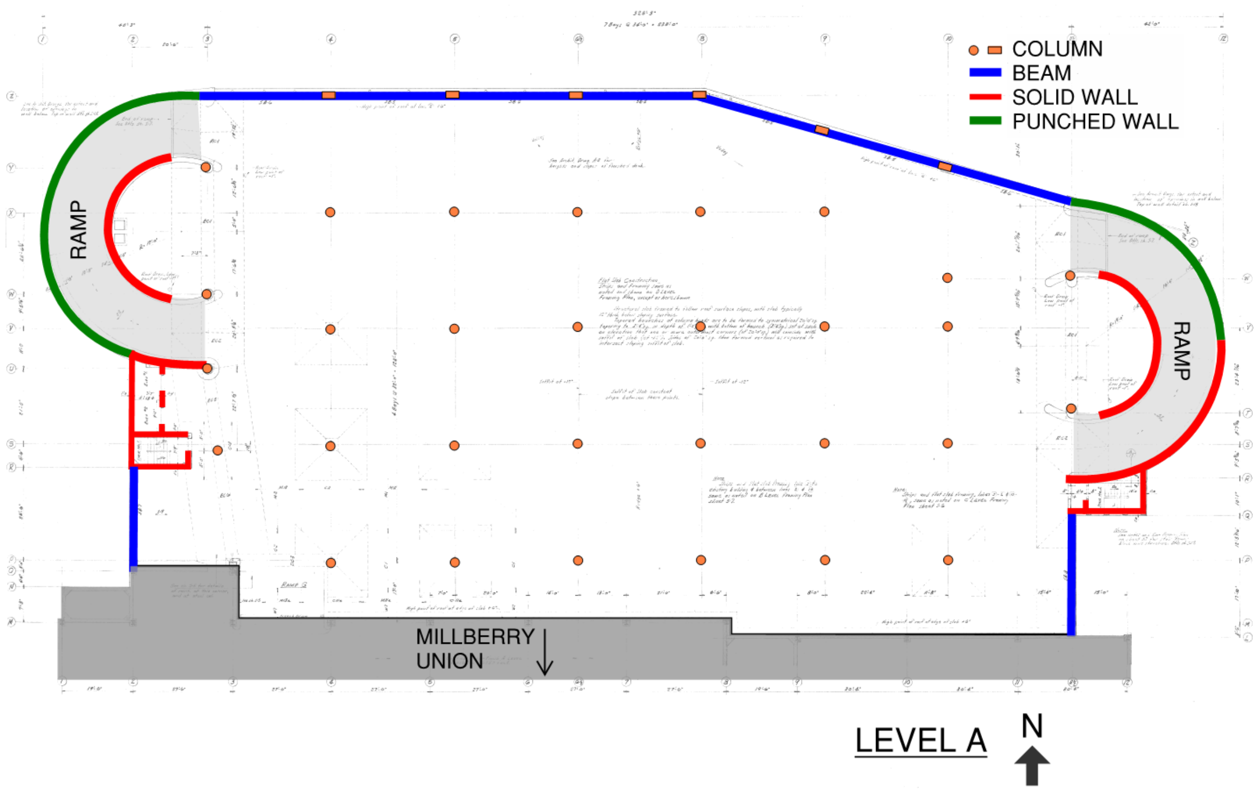
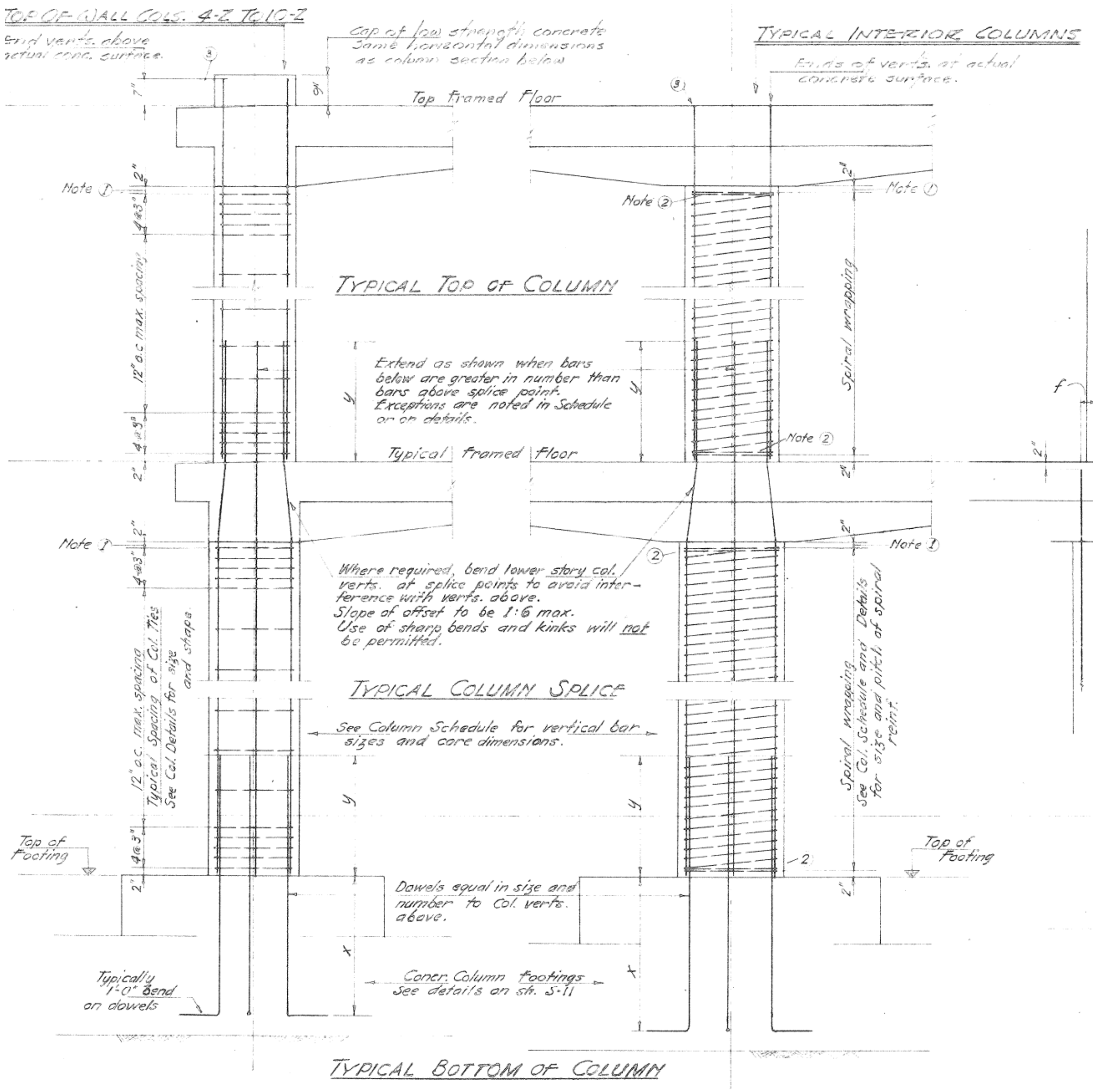



Garage Plans






TIED COLUMNS — SPIRALLY REINF. COLUMNS

TYPICAL COLUMN DETAILS

NOTES:

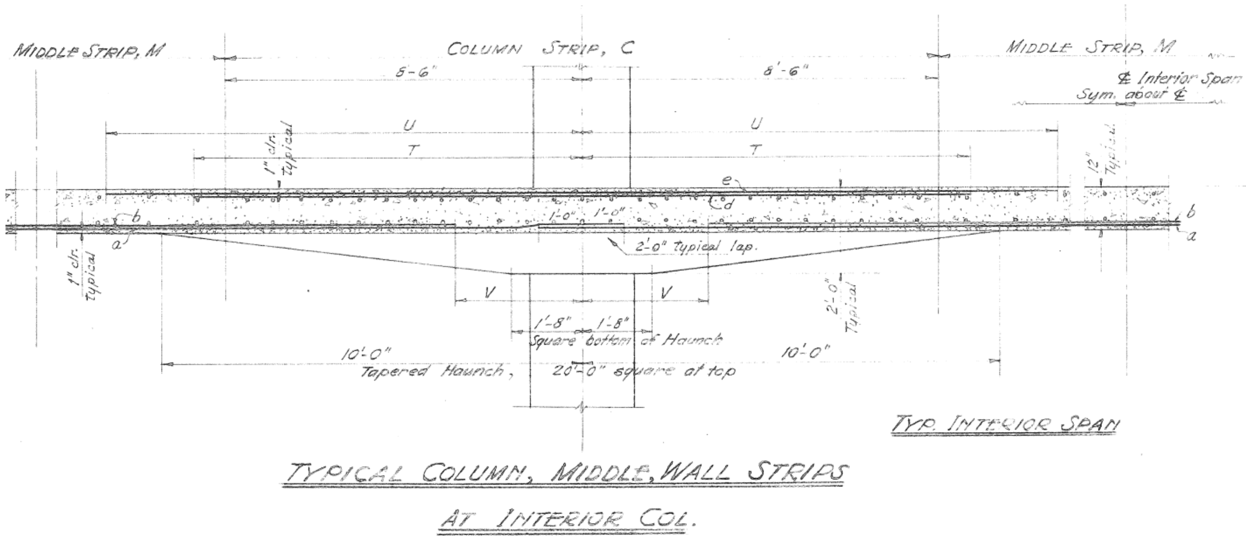
① – 2" typically below beam, tapered haunch at column top, continuous haunch, or slab soffit; i.e. deepest member framing into column.

② – Typical at ea. end of spiral wrapping – Two complete turns, with end of spiral hooking around col. vert.

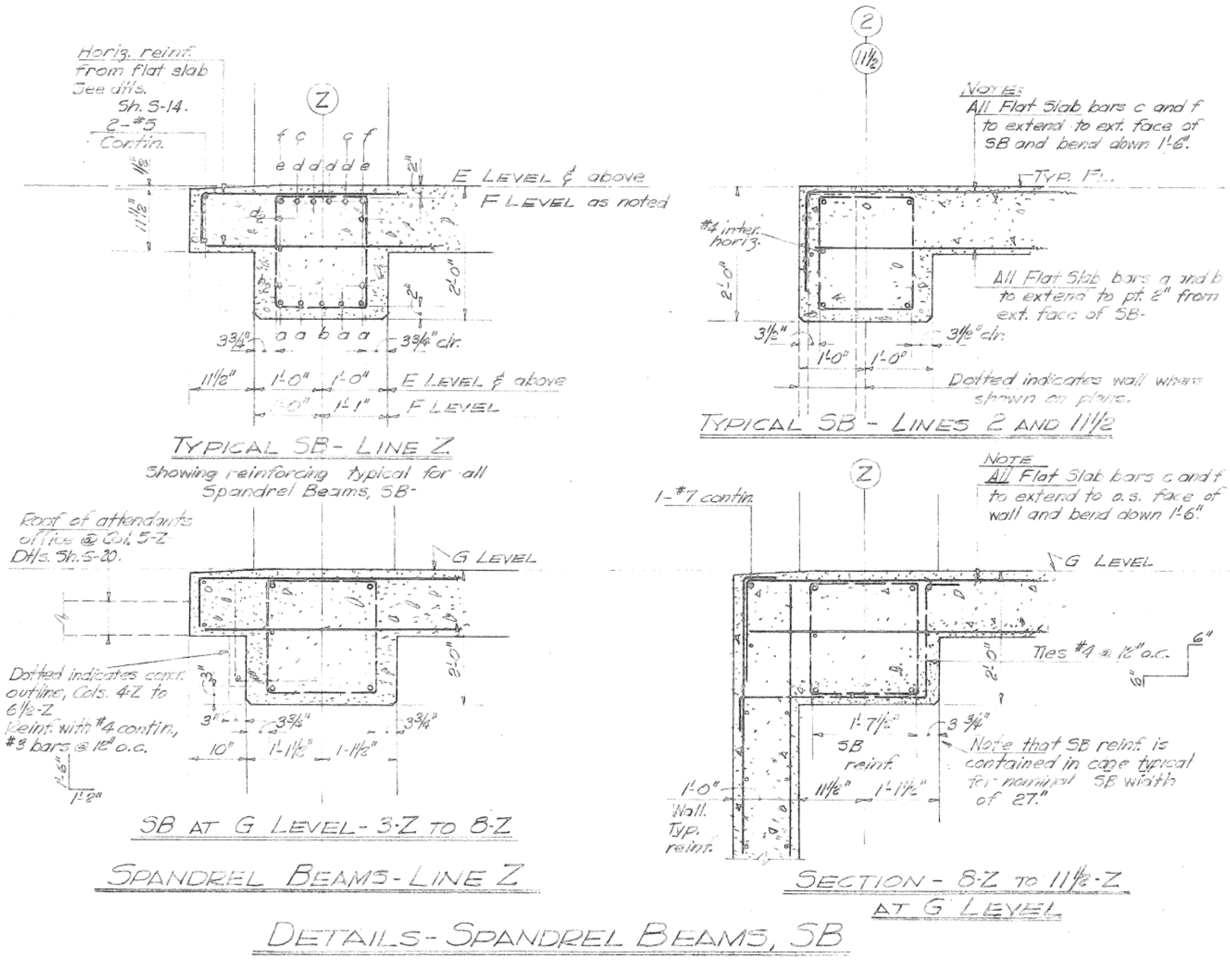
X = Dowel extension – a. Typically – to bottom of spread footing, ending in 1'-0" bend. See details.
b. At Caisson Footings – Straight dowels, no bends, extending 20 dia. or 3'-0" min. below top of footing.

y = Typical Splice lap – 20 dia. or 3'-0" min. unless otherwise indicated on details.

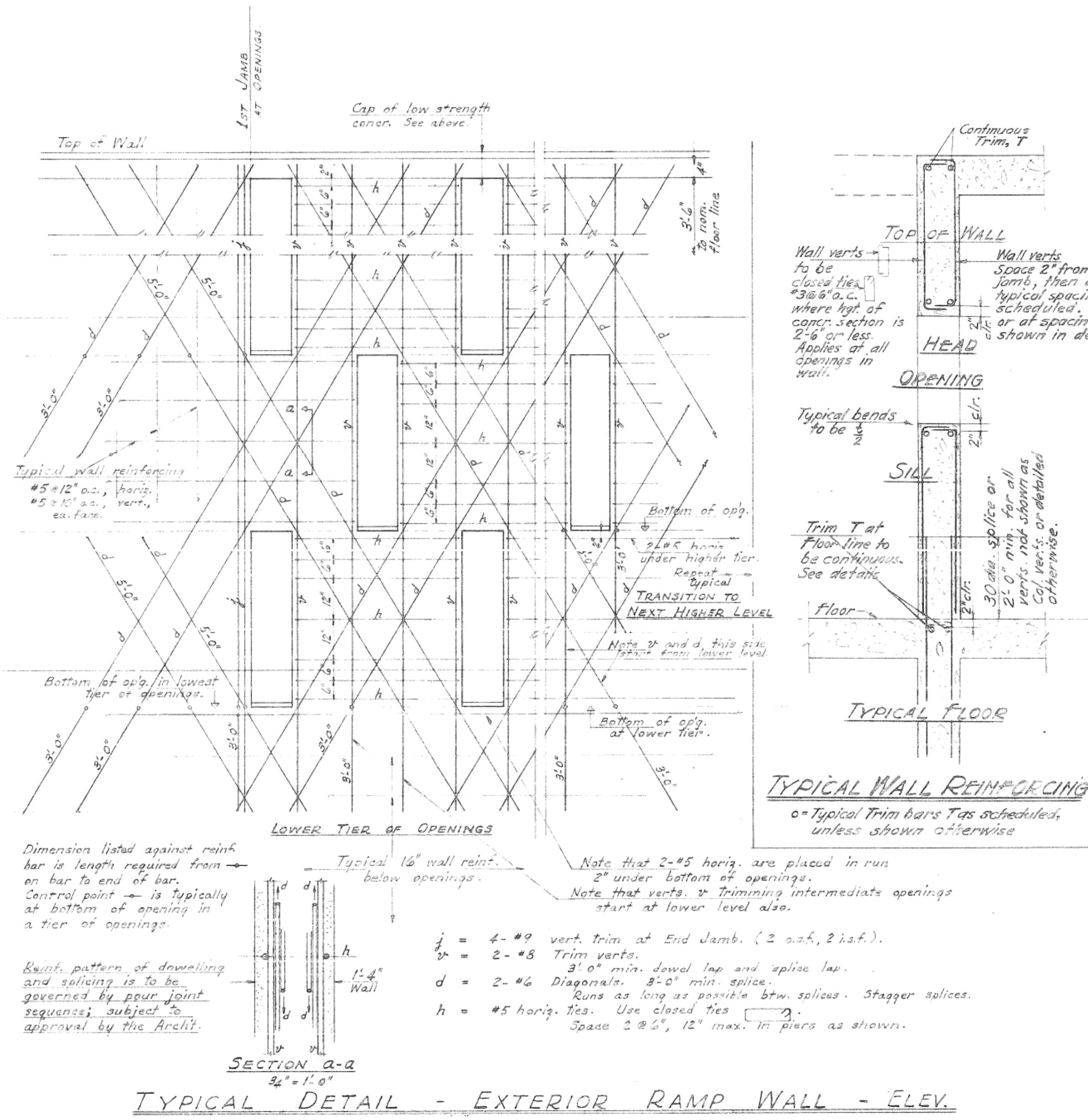
③ – Ends of verticals cut square. Grind to horiz. surface to permit future welded extensions.




Slab-Column Detail




Frame Beam Details




Punched Exterior Ramp Wall Elevation

# Appendix B

Checklists

| | | | | | | |
|---|---|---|---|---|---|---|
| UC Campus: | **San Francisco** | | Date: | **06/12/2020** | | |
| Building CAAN: | **2212.1** | Auxiliary CAAN: | By Firm: | **Simpson Gumpertz & Heger** | | |
| Building Name: | **Millberry Garage** | | Initials: | ***MP/LZ*** | Checked: | ***KDP*** |
| Building Address: | *500 Parnassus Ave, San Francisco, CA 94143* | | Page: | **1** | of | **3** |

# ASCE 41-17
# Collapse Prevention Basic Configuration Checklist

## LOW SEISMICITY

### BUILDING SYSTEMS - *GENERAL*

| | Description |
|---|---|
| **C** ◉ **NC** ○ **N/A** ○ **U** ○ | LOAD PATH: The structure contains a complete, well-defined load path, including structural elements and connections, that serves to transfer the inertial forces associated with the mass of all elements of the building to the foundation. (Commentary: Sec. A.2.1.1. Tier 2: Sec. 5.4.1.1)<br><br>**Comments: Diaphragm and frames are flat-slabs and columns are anchored into foundation.** |
| **C** ○ **NC** ◉ **N/A** ○ **U** ○ | ADJACENT BUILDINGS: The clear distance between the building being evaluated and any adjacent building is greater than 0.25% of the height of the shorter building in low seismicity, 0.5% in moderate seismicity, and 1.5% in high seismicity. (Commentary: Sec. A.2.1.2. Tier 2: Sec. 5.4.1.2)<br><br>**Comments: Garage building is tied to the adjacent Union building along Grids M and O with slab dowels (at Levels A & B) and a shared retaining wall (spanning between Level C to E).** |
| **C** ○ **NC** ○ **N/A** ◉ **U** ○ | MEZZANINES: Interior mezzanine levels are braced independently from the main structure or are anchored to the seismic-force-resisting elements of the main structure. (Commentary: Sec. A.2.1.3. Tier 2: Sec. 5.4.1.3)<br><br>**Comments:** |

### BUILDING SYSTEMS - *BUILDING CONFIGURATION*

| | Description |
|---|---|
| **C** ◉ **NC** ○ **N/A** ○ **U** ○ | WEAK STORY: The sum of the shear strengths of the seismic-force-resisting system in any story in each direction is not less than 80% of the strength in the adjacent story above. (Commentary: Sec. A2.2.2. Tier 2: Sec. 5.4.2.1)<br><br>**Comments: Shear strengths between stories are similar** |
| **C** ◉ **NC** ○ **N/A** ○ **U** ○ | SOFT STORY: The stiffness of the seismic-force-resisting system in any story is not less than 70% of the seismic-force-resisting system stiffness in an adjacent story above or less than 80% of the average seismic-force-resisting system stiffness of the three stories above. (Commentary: Sec. A.2.2.3. Tier 2: Sec. 5.4.2.2)<br><br>**Comments: Shear stiffnesses between stories are similar** |
| **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)<br><br>**Comments: Frames and walls are continuous to the foundation** |

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

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| UC Campus: | San Francisco | | | Date: | 06/12/2020 | | |
| Building CAAN: | 2212.1 | Auxiliary CAAN: | | By Firm: | Simpson Gumpertz & Heger | | |
| Building Name: | Millberry Garage | | | Initials: | MP/LZ | Checked: | KDP |
| Building Address: | *500 Parnassus Ave, San Francisco, CA 94143* | | | Page: | 2 | of | 3 |

# ASCE 41-17
# Collapse Prevention Basic Configuration Checklist

| C NC N/A U | |
|---|---|
| NC | 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)<br><br>**Comments: One or two bays are added at each grade step** |
| NC | 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)<br><br>**Comments: One or two bays are added at each grade step** |
| NC | 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)<br><br>**Comments: North frame is more flexible than south frames and retaining walls at the grade steps** |

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

### GEOLOGIC SITE HAZARD

| C NC N/A U | Description |
|---|---|
| C | 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)<br><br>**Comments: Liquefaction potential is negligible per Egan (2019).** |
| C | 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)<br><br>**Comments: Slope failure is unlikely per Egan (2019).** |
| C | 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)<br><br>**Comments: Faults are adequately distant and do not pose a risk at this site per Egan (2019).** |

**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)

## FOUNDATION CONFIGURATION

| C NC N/A U | Description |
|---|---|
| C ○ NC ◉ N/A ○ U ○ | OVERTURNING: The ratio of the least horizontal dimension of the seismic-force-resisting system at the foundation level to the building height (base/height) is greater than $0.6S_a$. (Commentary: Sec. A.6.2.1. Tier 2: Sec. 5.4.3.3)<br><br>**Comments: The calculation shows noncompliance for this building; further analysis is required to assess the contribution from the retained soil and the interaction of foundation and influence from overburden** |
| C ○ NC ◉ N/A ○ U ○ | TIES BETWEEN FOUNDATION ELEMENTS: The foundation has ties adequate to resist seismic forces where footings, piles, and piers are not restrained by beams, slabs, or soils classified as Site Class A, B, or C. (Commentary: Sec. A.6.2.2. Tier 2: Sec. 5.4.3.4)<br><br>**Comments: Interior footings are not tied together by beams or directly by the slab** |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| UC Campus: | **UCSF - Parnassus** | | | Date: | **06/12/2020** | | |
| Building CAAN: | **2212.1** | Auxiliary CAAN: | | By Firm: | **Simpson Gumpertz & Heger** | | |
| Building Name: | **Millberry Garage** | | | Initials: | ***LZ/MP*** | Checked: | ***KDP*** |
| Building Address: | *500 Parnassus Ave, San Francisco, CA 94143* | | | Page: | **1** | of | **4** |

# ASCE 41-17
# Collapse Prevention Structural Checklist For Building Type C1

## Low Seismicity

### Seismic-Force-Resisting System

| | Description |
|---|---|
| **C NC N/A U**<br>◉ ○ ○ ○ | 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)<br><br>**Comments: Every line in the building in each direction is a slab-column or beam-column moment frame.** |
| **C NC N/A U**<br>○ ◉ ○ ○ | COLUMN AXIAL STRESS CHECK: The axial stress caused by unfactored gravity loads in columns subjected to overturning forces because of seismic demands is less than $0.20f'_c$. Alternatively, the axial stress caused by overturning forces alone, calculated using the Quick Check procedure of Section 4.4.3.6, is less than $0.30f'_c$. (Commentary: Sec. A.3.1.4.2. Tier 2: Sec. 5.5.2.1.3)<br><br>**Comments: Axial stress caused by overturning alone exceeds 0.3f'c. (2.1 ksi compared to an acceptable 1.5 ksi.)** |

### Connections

| | Description |
|---|---|
| **C NC N/A U**<br>◉ ○ ○ ○ | CONCRETE COLUMNS: All concrete columns are doweled into the foundation with a minimum of four bars. (Commentary: Sec. A.5.3.2. Tier 2: Sec. 5.7.3.1)<br><br>**Comments: Dowels equal in number and size to column verticals provided.** |

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

### Seismic-Force-Resisting System

| | Description |
|---|---|
| **C NC N/A U**<br>◉ ○ ○ ○ | 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)<br><br>**Comments: Except at the base where there are two bays in the short direction before they increase with increasing grade, there are 3 to 5 bays in the short direction and at least 7 bays in the long direction.** |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| UC Campus: | **UCSF - Parnassus** | | | Date: | **06/12/2020** | | |
| Building CAAN: | **2212.1** | Auxiliary CAAN: | | By Firm: | **Simpson Gumpertz & Heger** | | |
| Building Name: | **Millberry Garage** | | | Initials: | ***LZ/MP*** | Checked: | ***KDP*** |
| Building Address: | *500 Parnassus Ave, San Francisco, CA 94143* | | | Page: | **2** | of | **4** |

# ASCE 41-17
# Collapse Prevention Structural Checklist For Building Type C1

| | |
|---|---|
| **C** ◉ **NC** ○ **N/A** ○ **U** ○ | 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)<br><br>**Comments: No interfering walls. Retaining walls occur at the south and will participate in the lateral resistance.** |
| **C** ◉ **NC** ○ **N/A** ○ **U** ○ | COLUMN SHEAR STRESS CHECK: The shear stress in the concrete columns, calculated using the Quick Check procedure of Section 4.4.3.2, is less than the greater of 100 lb/in.$^2$ (0.69 MPa) or $2\sqrt{f'c}$. (Commentary: Sec. A.3.1.4.1. Tier 2: Sec. 5.5.2.1.4)<br><br>**Comments: Shear stress is 4.0 ksi compared to an acceptable 4.5 ksi.** |
| **C** ○ **NC** ◉ **N/A** ○ **U** ○ | FLAT SLAB FRAMES: The seismic-force-resisting system is not a frame consisting of columns and a flat slab or plate without beams. (Commentary: Sec. A.3.1.4.3. Tier 2: Sec. 5.5.2.3.1)<br><br>**Comments: The main seismic force-resisting system is flat-slab moment frames.** |

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

## Seismic-Force-Resisting System

| | **Description** |
|---|---|
| **C** ○ **NC** ○ **N/A** ◉ **U** ○ | PRESTRESSED FRAME ELEMENTS: The seismic-force-resisting frames do not include any prestressed or post-tensioned elements where the average prestress exceeds the lesser of 700 lb/in.$^2$ (4.83 MPa) or $f'_c/6$ at potential hinge locations. The average prestress is calculated in accordance with the Quick Check procedure of Section 4.4.3.8. (Commentary: Sec. A.3.1.4.4. Tier 2: Sec. 5.5.2.3.2)<br><br>**Comments: There are no prestressed structural elements.** |
| **C** ◉ **NC** ○ **N/A** ○ **U** ○ | CAPTIVE COLUMNS: There are no columns at a level with height/depth ratios less than 50% of the nominal height/depth ratio of the typical columns at that level. (Commentary: Sec. A.3.1.4.5. Tier 2: Sec. 5.5.2.3.3)<br><br>**Comments: Columns span the full story heights uninterrupted.** |
| **C** ○ **NC** ◉ **N/A** ○ **U** ○ | NO SHEAR FAILURES: The shear capacity of frame members is able to develop the moment capacity at the ends of the members. (Commentary: Sec. A.3.1.4.6. Tier 2: Sec. 5.5.2.3.4)<br><br>**Comments: Beams and rectangular columns do not have adequate shear reinforcing to develop moment capacity.** |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| UC Campus: | UCSF - Parnassus | | | Date: | 06/12/2020 | | |
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| Building Name: | **Millberry Garage** | | | Initials: | *LZ/MP* | Checked: | *KDP* |
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# ASCE 41-17
# Collapse Prevention Structural Checklist For Building Type C1

| C | NC | N/A | U | Item |
|---|---|---|---|---|
| ● | ○ | ○ | ○ | STRONG COLUMN—WEAK BEAM: The sum of the moment capacity of the columns is 20% greater than that of the beams at frame joints. (Commentary: Sec. A.3.1.4.7. Tier 2: Sec. 5.5.2.1.5)<br>**Comments: Compliant at the spandrel beams and flat slab frames.** |
| ○ | ○ | ○ | ○ | BEAM BARS: At least two longitudinal top and two longitudinal bottom bars extend continuously throughout the length of each frame beam. At least 25% of the longitudinal bars provided at the joints for either positive or negative moment are continuous throughout the length of the members. (Commentary: A.3.1.4.8. Tier 2: Sec. 5.5.2.3.5)<br>**Comments: Spandrel beams and flat slab fail these requirements.** |
| ○ | ● | ○ | ○ | COLUMN-BAR SPLICES: All column-bar lap splice lengths are greater than $35d_b$ and are enclosed by ties spaced at or less than $8d_b$. Alternatively, column bars are spliced with mechanical couplers with a capacity of at least 1.25 times the nominal yield strength of the spliced bar. (Commentary: Sec. A.3.1.4.9. Tier 2: Sec. 5.5.2.3.6)<br>**Comments: Column bar splices are 20db or 36” min.** |
| ○ | ● | ○ | ○ | BEAM-BAR SPLICES: The lap splices or mechanical couplers for longitudinal beam reinforcing are not located within $l_b/4$ of the joints and are not located in the vicinity of potential plastic hinge locations. (Commentary: Sec. A.3.1.4.10. Tier 2: Sec. 5.5.2.3.6)<br>**Comments: Spandrel beam and flat slab bottom steel is lapped within the column.** |
| ○ | ● | ○ | ○ | COLUMN-TIE SPACING: Frame columns have ties spaced at or less than $d/4$ throughout their length and at or less than $8d_b$ at all potential plastic hinge locations. (Commentary: Sec. A.3.1.4.11. Tier 2: Sec. 5.5.2.3.7)<br>**Comments: Circular columns are compliant and utilize spirals with 2 or 3 inch pitch. Perimeter rectangular columns have ties spaced at 12” throughout, typically larger than d/4, and closer spacing provided at ends (4 ties @ 3”) does not extend far enough to encompass the potential hinge region.** |
| ○ | ● | ○ | ○ | STIRRUP SPACING: All beams have stirrups spaced at or less than $d/2$ throughout their length. At potential plastic hinge locations, stirrups are spaced at or less than the minimum of $8d_b$ or $d/4$. (Commentary: Sec. A.3.1.4.12. Tier 2: Sec. 5.5.2.3.7)<br>**Comments: Spandrel beam have a typical d=21”. Stirrups are spaced at 12”, larger than d/2, throughout with 4 to 6 stirrups at 6” spacing at the ends, larger than d/4.** |
| ○ | ● | ○ | ○ | JOINT TRANSVERSE REINFORCING: Beam–column joints have ties spaced at or less than $8d_b$. (Commentary: Sec. A.3.1.4.13. Tier 2: Sec. 5.5.2.3.8)<br>**Comments: No reinforcement in the joints.** |

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

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| UC Campus: | **UCSF - Parnassus** | | | Date: | **06/12/2020** | | |
| Building CAAN: | **2212.1** | Auxiliary CAAN: | | By Firm: | **Simpson Gumpertz & Heger** | | |
| Building Name: | **Millberry Garage** | | | Initials: | ***LZ/MP*** | Checked: | ***KDP*** |
| Building Address: | *500 Parnassus Ave, San Francisco, CA 94143* | | | Page: | **4** | of | **4** |

# ASCE 41-17
# Collapse Prevention Structural Checklist For Building Type C1

| | |
|---|---|
| **C NC N/A U**<br>N/A selected | 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)<br><br>**Comments: All columns are assumed to participate in frame action.** |
| **C NC N/A U**<br>N/A selected | 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)<br><br>**Comments: All flat slabs are assumed to participate in frame action (continuous bottom steel does not occur at any location).** |

## Diaphragms

| | Description |
|---|---|
| **C NC N/A U**<br>C selected | DIAPHRAGM CONTINUITY: The diaphragms are not composed of split-level floors and do not have expansion joints. (Commentary: Sec. A.4.1.1. Tier 2: Sec. 5.6.1.1)<br><br>**Comments: Concrete floor diaphragms continuous throughout floors.** |

## Connections

| | Description |
|---|---|
| **C NC N/A U**<br>N/A selected | 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)<br><br>**Comments: Foundations are spread footings and belled caissons. This building does not have piles or pile caps.** |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| UC Campus: | UCSF - Parnassus | | | Date: | 06/12/2020 | | |
| Building CAAN: | 2212.1 | Auxiliary CAAN: | | By Firm: | Simpson Gumpertz & Heger | | |
| Building Name: | Millberry Garage | | | Initials: | *LZ* | Checked: | *KDP* |
| Building Address: | 500 Parnassus Avenue, San Francisco, CA 94133 | | | Page: | 1 | of | 3 |

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

## Low and Moderate Seismicity

## Seismic-Force-Resisting System

| C NC N/A U | Description |
|---|---|
| N/A | 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)<br>**Comments: All frames are assumed to participate in frame action.** |
| C | 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)<br>**Comments: Four curved ramped walls exist at each level. Slab-column frames are assumed to participate providing additional lines of resistance.** |
| C | 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 $2\sqrt{f'_c}$. (Commentary: Sec. A.3.2.2.1. Tier 2: Sec. 5.5.3.1.1)<br>**Comments: Compliant at ramp walls (0.4 ksi compared to an acceptable 3.5 ksi).** |
| C | 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)<br>**Comments: Wall steel exceeds minimum ratios, 0.0025 minimum is provided in both directions.** |

## Connections

| C NC N/A U | Description |
|---|---|
| N/A | 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)<br>**Comments: No flexible diaphragms are present.** |
| C | 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)<br>**Comments: Exterior ramp walls are not adequately connected to the main diaphragm, limited by ramp connection.** |
| C | 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)<br>**Comments: Wall steel is doweled into the foundation.** |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| UC Campus: | **UCSF - Parnassus** | | | Date: | **06/12/2020** | | |
| Building CAAN: | **2212.1** | Auxiliary CAAN: | | By Firm: | **Simpson Gumpertz & Heger** | | |
| Building Name: | **Millberry Garage** | | | Initials: | ***LZ*** | Checked: | ***KDP*** |
| Building Address: | **500 Parnassus Avenue, San Francisco, CA 94133** | | | Page: | **2** | of | **3** |

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

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

### Seismic-Force-Resisting System

| | Description |
|---|---|
| **C NC N/A U**<br>○ ○ ◉ ○ | 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)<br>**Comments: All slabs, beams, and columns are assumed to participate in frame action.** |
| **C NC N/A U**<br>○ ○ ◉ ○ | 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)<br>**Comments: Flat slabs are assumed to participate in frame action.** |
| **C NC N/A U**<br>○ ○ ◉ ○ | 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)<br>**Comments: No coupling beams in the building.** |

### Diaphragms (Stiff or Flexible)

| | Description |
|---|---|
| **C NC N/A U**<br>◉ ○ ○ ○ | DIAPHRAGM CONTINUITY: The diaphragms are not composed of split-level floors and do not have expansion joints. (Commentary: Sec. A.4.1.1. Tier 2: Sec. 5.6.1.1)<br>**Comments: Diaphragms are generally continuous, without joints.** |
| **C NC N/A U**<br>○ ◉ ○ ○ | OPENINGS AT SHEAR WALLS: 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)<br>**Comments: Exterior ramp walls are connected to the main diaphragm only by the ramp. No significant openings occur next to perimeter walls.** |

### Flexible Diaphragms

| | Description |
|---|---|
| **C NC N/A U**<br>○ ○ ◉ ○ | CROSS TIES: There are continuous cross ties between diaphragm chords. (Commentary: Sec. A.4.1.2. Tier 2: Sec. 5.6.1.2)<br>**Comments: Not applicable to this building.** |

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

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| UC Campus: | UCSF - Parnassus | | | Date: | 06/12/2020 | | |
| Building CAAN: | 2212.1 | Auxiliary CAAN: | | By Firm: | Simpson Gumpertz & Heger | | |
| Building Name: | Millberry Garage | | | Initials: | *LZ* | Checked: | *KDP* |
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# ASCE 41-17
# Collapse Prevention Structural Checklist For Building Type C2-C2A

| | |
|---|---|
| **C** ○ **NC** ○ **N/A** ● **U** ○ | 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)<br><br>**Comments: Not applicable to this building.** |
| **C** ○ **NC** ○ **N/A** ● **U** ○ | SPANS: All wood diaphragms with spans greater than 24 ft (7.3 m) consist of wood structural panels or diagonal sheathing. (Commentary: Sec. A.4.2.2. Tier 2: Sec. 5.6.2)<br><br>**Comments: Not applicable to this building.** |
| **C** ○ **NC** ○ **N/A** ● **U** ○ | DIAGONALLY SHEATHED AND UNBLOCKED DIAPHRAGMS: All diagonally sheathed or unblocked wood structural panel diaphragms have horizontal spans less than 40 ft (12.2 m) and aspect ratios less than or equal to 4-to-1. (Commentary: Sec. A.4.2.3. Tier 2: Sec. 5.6.2)<br><br>**Comments: Not applicable to this building.** |
| **C** ● **NC** ○ **N/A** ○ **U** ○ | 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)<br><br>**Comments: Diaphragms are all reinforced concrete.** |

## Connections

| | **Description** |
|---|---|
| **C** ○ **NC** ○ **N/A** ● **U** ○ | 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)<br><br>**Comments: Foundations are spread footings and belled caissons. This building does not have piles or pile caps.** |

UCSF

SIMPSON GUMPERTZ & HEGER
Engineering of Structures and Building Enclosures

# Appendix C

Tier 1 Calculations

**SIMPSON GUMPERTZ & HEGER**
Engineering of Structures
and Building Enclosures

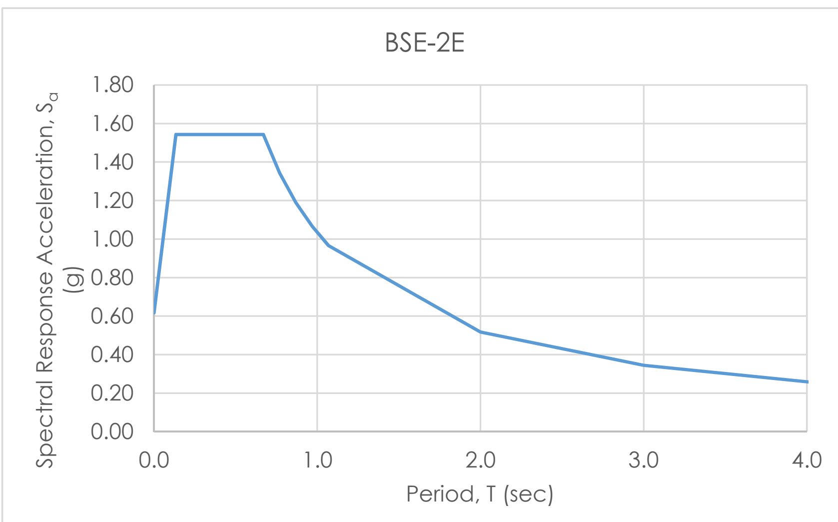
CLIENT UCSF
SUBJECT Milberry Garage Tier 1 - Quick Checks: BSE-C Hazard

SHEET NO.
PROJECT NO. 197042.00
DATE 12/30/2019
BY MP/LZ
CHECKED BY KDP

## Hazard Level BSE-C (BSE-2E)

| | | |
|---|---|---|
| $MCE_R$ ground motion (period=0.2s) | $S_S$ | 1.543 g |
| $MCE_R$ ground motion (period=1.0s) | $S_1$ | 0.608 g |
| Site amplification factor at 0.2s | $F_a$ | 1.0 |
| Site amplification factor at 1.0s | $F_v$ | 1.7 |
| Site modified spectral response (0.2s) | $S_{XS}$ | 1.543 g |
| Site modified spectral response (1.0s) | $S_{X1}$ | 1.034 g |
| Long-period transition period (s) | $T_L$ | 12 sec |
| | $T_0$ | 0.134 sec |
| | $T_S$ | 0.670 sec |

| T | $S_a$ |
|---|---|
| sec | g |
| 0.0 | 0.617 |
| 0.134 | 1.543 |
| 0.670 | 1.543 |
| 0.67 | 1.543 |
| 0.77 | 1.342 |
| 0.87 | 1.188 |
| 0.97 | 1.066 |
| 1.1 | 0.966 |
| 2.0 | 0.517 |
| 3.0 | 0.345 |
| 4.0 | 0.258 |
| 6.0 | 0.172 |
| 8.0 | 0.129 |
| 10.0 | 0.103 |
| 12.0 | 0.086 |




## Approximate Period of Structure

System // Flat slab

| | |
|---|---|
| $h_n$ | 61.98 ft |
| $\beta$ | 0.75 |
| $C_t$ | 0.020 |

| | |
|---|---|
| T | 0.442 sec |
| $S_a$ | 1.543 g |

SIMPSON GUMPERTZ & HEGER

Engineering of Structures
and Building Enclosures

CLIENT UCSF

SUBJECT Millberry Garage Tier 1 - Quick Checks: Flat Loads

SHEET NO.

PROJECT NO. 197042.00-UCSF

DATE 07 October 2019

BY LZ

CHECKED

## Typical Garage — Level G - Level A

| Material | Self-Weight (psf) | SDL (psf) | Gravity (psf) | Seismic (psf) | Remarks |
|---|---|---|---|---|---|
| 12" Concrete Slab | 150.0 | - | 150.0 | 150.0 | |
| Tapered Drop Panels | 22.0 | - | 22.0 | 22.0 | *Distributed over average 32'x24' bay* |
| MEP/Sprinkler/Miscellaneous | - | 5.0 | 5.0 | 5.0 | |
| *Sum of Dead Loads* | **172.0** | **5.0** | **177.0** | **177.0** | |
| *Sum of Live Loads* | **-** | **-** | **40.0** | **-** | |
| *Sum of Dead Plus Live Loads* | **-** | **-** | **217.0** | **177.0** | |

## Typical Ramp — Level G - Level A

| Material | Self-Weight (psf) | SDL (psf) | Gravity (psf) | Seismic (psf) | Remarks |
|---|---|---|---|---|---|
| 8" Concrete Slab | 100.0 | - | 100.0 | 100.0 | |
| MEP/Sprinkler/Miscellaneous | - | 2.0 | 2.0 | 2.0 | |
| *Sum of Dead Loads* | **100.0** | **2.0** | **102.0** | **102.0** | |
| *Sum of Live Loads* | **-** | **-** | **40.0** | **-** | |
| *Sum of Dead Plus Live Loads* | **-** | **-** | **142.0** | **102.0** | |

## Union Lobby — Level 0

| Material | Self-Weight (psf) | SDL (psf) | Gravity (psf) | Seismic (psf) | Remarks |
|---|---|---|---|---|---|
| 30" Concrete Slab | 375.0 | - | 375.0 | 375.0 | |
| Ceiling | - | 5.0 | 5.0 | 5.0 | |
| Floor Finish | - | 25.0 | 25.0 | 25.0 | |
| Partitions | - | 0.0 | 0.0 | 10.0 | |
| MEP/Sprinkler/Miscellaneous | - | 5.0 | 5.0 | 5.0 | |
| *Sum of Dead Loads* | **375.0** | **35.0** | **410.0** | **420.0** | |
| *Sum of Live Loads* | **-** | **-** | **100.0** | **-** | |
| *Sum of Dead Plus Live Loads* | **-** | **-** | **510.0** | **420.0** | |

SIMPSON GUMPERTZ & HEGER

Engineering of Structures
and Building Enclosures

CLIENT UCSF

SUBJECT Millberry Garage Tier 1 - Quick Checks: Flat Loads

SHEET NO.

PROJECT NO. 197042.00-UCSF

DATE 07 October 2019

BY LZ

CHECKED

## Penthouse Floor — PH Floor

| Material | Self-Weight (psf) | SDL (psf) | Gravity (psf) | Seismic (psf) | Remarks |
|---|---|---|---|---|---|
| 5" Concrete Slab | 62.5 | - | 62.5 | 62.5 | *Decked area is similar in weight* |
| Ceiling | - | 5.0 | 5.0 | 5.0 | |
| Roofing/Insulation | - | 10.0 | 10.0 | 10.0 | |
| Roof Ducts | - | 5.0 | 5.0 | 10.0 | |
| MEP/Sprinkler/Miscellaneous | - | 5.0 | 5.0 | 5.0 | |
| *Sum of Dead Loads* | **62.5** | **25.0** | **87.5** | **92.5** | |
| *Sum of Live Loads* | **-** | **-** | **20.0** | **-** | |
| *Sum of Dead Plus Live Loads* | **-** | **-** | **107.5** | **92.5** | |

## Machinery Deck — Mach Floor

| Material | Self-Weight (psf) | SDL (psf) | Gravity (psf) | Seismic (psf) | Remarks |
|---|---|---|---|---|---|
| 4" Concrete Slab | 50.0 | - | 50.0 | 50.0 | |
| Ceiling | - | 5.0 | 5.0 | 5.0 | |
| MEP/Sprinkler/Miscellaneous | - | 5.0 | 5.0 | 5.0 | |
| *Sum of Dead Loads* | **50.0** | **10.0** | **60.0** | **60.0** | |
| *Sum of Live Loads* | **-** | **-** | **50.0** | **-** | |
| *Sum of Dead Plus Live Loads* | **-** | **-** | **110.0** | **60.0** | |

## Penthouse Roof — PH Roof

| Material | Self-Weight (psf) | SDL (psf) | Gravity (psf) | Seismic (psf) | Remarks |
|---|---|---|---|---|---|
| 3" Concrete Slab | 37.5 | - | 37.5 | 37.5 | |
| 4"x13" Joists @ 34" | 15.0 | - | 15.0 | 15.0 | |
| Ceiling | - | 5.0 | 5.0 | 5.0 | |
| Roofing/Insulation | - | 10.0 | 10.0 | 10.0 | |
| MEP/Sprinkler/Miscellaneous | - | 5.0 | 5.0 | 5.0 | |
| *Sum of Dead Loads* | **52.5** | **20.0** | **72.5** | **72.5** | |
| *Sum of Live Loads* | **-** | **-** | **20.0** | **-** | |
| *Sum of Dead Plus Live Loads* | **-** | **-** | **92.5** | **72.5** | |

SIMPSON GUMPERTZ & HEGER
Engineering of Structures
and Building Enclosures

CLIENT UCSF
SUBJECT Millberry Garage Tier 1 - Quick Checks: Seismic Mass

SHEET NO.
PROJECT NO. 197042.00-UCSF
DATE 22 Oct 2019
BY LZ
CHECKED BY KDP

| | Mass Type | Area (sf) | Length (ft) | Load (psf) | Load (plf) | Mass (kips) |
|---|---|---|---|---|---|---|
| **Penthouse Roof** | Roof Area | 360 | | 73 | | 26 |
| h = 8.58' | 8" Concrete Wall Below | | 78 | | 429 | 33 |
| | | | | | Σ = | **60** |
| **Machinery Deck** | Typical Area | 275 | | 60 | | 17 |
| h = 5.50' | 8" Concrete Wall Above | | 78 | | 429 | 33 |
| | 8" Concrete Wall Below | | 58 | | 275 | 16 |
| | 12" Concrete Wall Below | | 53 | | 413 | 22 |
| | 16" Concrete Wall Below | | 10 | | 550 | 6 |
| | | | | | Σ = | **93** |
| **Penthouse Floor** | Penthouse Area | 330 | | 93 | | 31 |
| h = 10.75' | Roof Area | 730 | | 93 | | 68 |
| | Metal Stair | 25 | | 30 | | 1 |
| | 8" Concrete Wall Above | | 58 | | 275 | 16 |
| | 12" Concrete Wall Above | | 53 | | 413 | 22 |
| | 16" Concrete Wall Above | | 10 | | 550 | 6 |
| | 12" Concrete Wall Below | | 94 | | 806 | 76 |
| | 16" Concrete Wall Below | | 17 | | 1075 | 18 |
| | | | | | Σ = | **236** |
| **Ground Floor** | Lobby Area | 1,065 | | 420 | | 447 |
| h = 10.50' | Concrete Stair | 115 | | 125 | | 14 |
| | 12" Concrete Wall Above | | 94 | | 806 | 76 |
| | 16" Concrete Wall Above | | 17 | | 1,075 | 18 |
| | 12" Concrete Wall Below | | 94 | | 788 | 74 |
| | 16" Concrete Wall Below | | 22 | | 1050 | 23 |
| | Circular Columns Below (26" Dia Typ) | | | | | 3 |
| | | | | | Σ = | **656** |
| **Level A** | Garage Area | 37,020 | | 177 | | 6553 |
| h = 8.85' | Ramp Area | 2,975 | | 102 | | 303 |
| | Concrete Stair | 245 | | 125 | | 31 |
| | 12" Concrete Wall Above | | 94 | | 788 | 74 |
| | 16" Concrete Wall Above | | 22 | | 1,050 | 23 |
| | 16" Ramp Wall Parapet | | 370 | | 700 | 259 |
| | Circular Columns Above (26" Dia Typ) | | | | | 3 |
| | 8" Concrete Wall Below | | 27 | | 443 | 12 |
| | 12" Concrete Wall Below | | 115 | | 664 | 76 |
| | 16" Concrete Wall Below | | 174 | | 885 | 154 |
| | 16" Punched Ramp Wall Below (19% open) | | 196 | | 719 | 141 |
| | Circular Columns Below (24" Dia Typ) | | | | | 74 |
| | Rectangular Columns Below (24"x48" Typ) | | | | | 63 |
| | Beams Below (24"x24" Typ) | | 300 | | 300 | 90 |
| | | | | | Σ = | **7,857** |

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| BY | LZ |
| CHECKED BY | KDP |

CLIENT UCSF

SUBJECT Millberry Garage Tier 1 - Quick Checks: Seismic Mass

| | Mass Type | Area (sf) | Length (ft) | Load (psf) | Load (plf) | Mass (kips) |
|---|---|---|---|---|---|---|
| **Level B** | Garage Area | 37,020 | | 177 | | 6553 |
| h = 8.85' | Ramp Area | 2,975 | | 102 | | 303 |
| | Concrete Stair | 245 | | 125 | | 31 |
| | 8" Concrete Wall Above | | 27 | | 443 | 12 |
| | 12" Concrete Wall Above | | 115 | | 664 | 76 |
| | 16" Concrete Wall Above | | 174 | | 885 | 154 |
| | 16" Punched Ramp Wall Above (19% open) | | 196 | | 719 | 141 |
| | Circular Columns Above (24" Dia Typ) | | | | | 74 |
| | Rectangular Columns Above (24"x48" Typ) | | | | | 63 |
| | 8" Concrete Wall Below | | 27 | | 443 | 12 |
| | 12" Concrete Wall Below | | 115 | | 664 | 76 |
| | 16" Concrete Wall Below | | 174 | | 885 | 154 |
| | 16" Punched Ramp Wall Below (19% open) | | 196 | | 719 | 141 |
| | Circular Columns Below (26" Dia Typ) | | | | | 73 |
| | Rectangular Columns Below (24"x48" Typ) | | | | | 53 |
| | Beams Below (24"x24" Typ) | | 300 | | 300 | 90 |
| | | | | | Σ = | **8,007** |
| **Level C** | Garage Area | 37,020 | | 177 | | 6553 |
| h = 8.85' | Ramp Area | 2,975 | | 102 | | 303 |
| | Concrete Stair | 245 | | 125 | | 31 |
| | 8" Concrete Wall Above | | 27 | | 443 | 12 |
| | 12" Concrete Wall Above | | 115 | | 664 | 76 |
| | 16" Concrete Wall Above | | 174 | | 885 | 154 |
| | 16" Punched Ramp Wall Above (19% open) | | 196 | | 719 | 141 |
| | Circular Columns Above (26" Dia Typ) | | | | | 73 |
| | Rectangular Columns Above (24"x48" Typ) | | | | | 53 |
| | 8" Concrete Wall Below | | 27 | | 443 | 12 |
| | 12" Concrete Wall Below | | 411 | | 664 | 273 |
| | 16" Concrete Wall Below | | 174 | | 885 | 154 |
| | 16" Punched Ramp Wall Below (19% open) | | 196 | | 719 | 141 |
| | Circular Columns Below (28" Dia Typ) | | | | | 85 |
| | Rectangular Columns Below (24"x48" Typ) | | | | | 53 |
| | Beams Below (24"x24" Typ) | | 300 | | 300 | 90 |
| | | | | | Σ = | **8,205** |
| **Level D** | Garage Area | 37,020 | | 177 | | 6553 |
| h = 8.85' | Ramp Area | 2,975 | | 102 | | 303 |
| | Concrete Stair | 245 | | 125 | | 31 |
| | 8" Concrete Wall Above | | 27 | | 443 | 12 |
| | 12" Concrete Wall Above | | 411 | | 664 | 273 |
| | 16" Concrete Wall Above | | 174 | | 885 | 154 |
| | 16" Punched Ramp Wall Above (19% open) | | 196 | | 719 | 141 |
| | Circular Columns Above (28" Dia Typ) | | | | | 85 |
| | Rectangular Columns Above (24"x48" Typ) | | | | | 53 |
| | 8" Concrete Wall Below | | 27 | | 443 | 12 |
| | 12" Concrete Wall Below | | 411 | | 664 | 273 |
| | 16" Concrete Wall Below | | 174 | | 885 | 154 |
| | 16" Punched Ramp Wall Below (19% open) | | 196 | | 719 | 141 |
| | Circular Columns Below (30" Dia Typ) | | | | | 98 |
| | Rectangular Columns Below (24"x48" Typ) | | | | | 53 |
| | Beams Below (24"x24" Typ) | | 300 | | 300 | 90 |
| | | | | | Σ = | **8,426** |

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| CLIENT | UCSF |
| SUBJECT | Millberry Garage Tier 1 - Quick Checks: Seismic Mass |
| SHEET NO. | |
| PROJECT NO. | 197042.00-UCSF |
| DATE | 22 Oct 2019 |
| BY | LZ |
| CHECKED BY | KDP |

| | Mass Type | Area (sf) | Length (ft) | Load (psf) | Load (plf) | Mass (kips) |
|---|---|---|---|---|---|---|
| **Level E** | Garage Area | 25,550 | | 177 | | 4522 |
| h = 8.85' | Ramp Area | 2,975 | | 102 | | 303 |
| | Concrete Stair | 245 | | 125 | | 31 |
| | 8" Concrete Wall Above | | 27 | | 443 | 12 |
| | 12" Concrete Wall Above | | 411 | | 664 | 273 |
| | 16" Concrete Wall Above | | 174 | | 885 | 154 |
| | 16" Punched Ramp Wall Above (19% open) | | 196 | | 719 | 141 |
| | Circular Columns Above (30" Dia Typ) | | | | | 98 |
| | Rectangular Columns Above (24"x48" Typ) | | | | | 53 |
| | 8" Concrete Wall Below | | 27 | | 443 | 12 |
| | 14" Concrete Wall Below | | 352 | | 775 | 272 |
| | 16" Concrete Wall Below | | 174 | | 885 | 154 |
| | 16" Punched Ramp Wall Below (19% open) | | 196 | | 719 | 141 |
| | Circular Columns Below (32" Dia Typ) | | | | | 89 |
| | Rectangular Columns Below (24"x48" Typ) | | | | | 43 |
| | Beams Below (24"x24" Typ) | | 242 | | 300 | 73 |
| | | | | | Σ = | **6,371** |
| **Level F** | Garage Area | 25,550 | | 177 | | 4522 |
| h = 8.85' | Ramp Area | 2,975 | | 102 | | 303 |
| | Concrete Stair | 245 | | 125 | | 31 |
| | 8" Concrete Wall Above | | 27 | | 443 | 12 |
| | 14" Concrete Wall Above | | 352 | | 775 | 272 |
| | 16" Concrete Wall Above | | 174 | | 885 | 154 |
| | 16" Punched Ramp Wall Above (19% open) | | 196 | | 719 | 141 |
| | Circular Columns Above (32" Dia Typ) | | | | | 89 |
| | Rectangular Columns Above (24"x48" Typ) | | | | | 43 |
| | 8" Concrete Wall Below | | 27 | | 443 | 12 |
| | 14" Concrete Wall Below | | 352 | | 775 | 272 |
| | 16" Concrete Wall Below | | 174 | | 885 | 154 |
| | 16" Punched Ramp Wall Below (19% open) | | 196 | | 719 | 141 |
| | Circular Columns Below (34" Dia Typ) | | | | | 100 |
| | Rectangular Columns Below (25"x48" Typ) | | | | | 44 |
| | Beams Below (25"x24" Typ) | | 242 | | 313 | 76 |
| | | | | | Σ = | **6,367** |
| **Level G** | Garage Area | 14,000 | | 177 | | 2478 |
| h = 8.85' | Ramp Area | 1,560 | | 102 | | 159 |
| | Concrete Stair | 115 | | 125 | | 14 |
| | 8" Concrete Wall Above | | 27 | | 443 | 12 |
| | 14" Concrete Wall Above | | 352 | | 775 | 272 |
| | 16" Concrete Wall Above | | 174 | | 885 | 154 |
| | 16" Punched Ramp Wall Above (19% open) | | 196 | | 719 | 141 |
| | Circular Columns Above (34" Dia Typ) | | | | | 100 |
| | Rectangular Columns Above (25"x48" Typ) | | | | | 44 |
| | 12" Concrete Wall Below | | 395 | | 664 | 262 |
| | 14" Concrete Wall Below | | 107 | | 775 | 83 |
| | 16" Concrete Wall Below | | 174 | | 885 | 154 |
| | 16" Punched Ramp Wall Below (19% open) | | 196 | | 719 | 141 |
| | Circular Columns Below (36" Dia Typ) | | | | | 52 |
| | Rectangular Columns Below (27"x48" Typ) | | | | | 60 |
| | Beams Below (27"x24" Typ) | | 242 | | 338 | 82 |
| | | | | | Σ = | **4,209** |
| **Base** | | | | | | |
| | | | | | Calculated Total Σ = | **50,485** |

| | [kip] | [ft] | [ft] | [kip-ft] | | [kip] | [kip] |
|---|---|---|---|---|---|---|---|
| **Floor** | **$W_i$** | **$h_i$** | **$(h_i)^k$** | **$W_i(h_i)^k$** | **$C_{vi}$** | **$F_i$** | **$V_i$** |
| | | | | | | | |
| A + PH* | 8901 | 62.0 | 55.0 | 489254 | 0.279 | 21717 | 21717 |
| B | 8007 | 53.1 | 47.3 | 378933 | 0.216 | 16820 | 38537 |
| C | 8205 | 44.3 | 39.6 | 325294 | 0.185 | 14439 | 52976 |
| D | 8426 | 35.4 | 31.9 | 268983 | 0.153 | 11940 | 64916 |
| E | 6371 | 26.6 | 24.1 | 153817 | 0.088 | 6828 | 71743 |
| F | 6367 | 17.7 | 16.3 | 103701 | 0.059 | 4603 | 76347 |
| G | 4209 | 8.9 | 8.3 | 34971 | 0.020 | 1552 | 77899 |
| | 50485 | | | 1754954 | 1.00 | 77899 | |

| | | |
|---|---|---|
| T | 0.442 | sec |
| k | 0.97 | |
| | | |
| W | 50485 | kip |
| C | 1.0 | [Modification factor, buildings 4 stories or greater] |
| $S_a$ | 1.543 | g |
| V | 77899 | kip |

* Masses at penthouse floors lumped to Level A

| | |
|---|---|
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| | PROJECT NO. 197042.00 |
| | DATE 06/21/2019 |
| CLIENT UCSF | BY MP/LZ |
| SUBJECT Milberry Garage Tier 1 - Quick Checks: Column Axial Stress | CHECKED BY KDP |

**Column Axial Stress Check**

**E-W direction**

axial stress check in column 4X at level H

| | | | | |
|---|---|---|---|---|
| Compressive strength of the concrete in columns | f'c | = | 5 | ksi |
| Pseudo seismic force | V | = | 77899 | kip |
| Total number of frames in E-W direction | nf | = | 4 | |
| System modification factor | Ms | = | 2.5 | (for collapse prevention) |
| Base to roof height | hn | = | 61.98 | ft |
| Length of frame | L | = | 153 | ft |
| Area of the column at base | Acol | = | 7.07 | ft2 |

Axials tress due to overturning force

pot = (1/Ms)(2/3)(V*hn/Lnf)(1/Acol)

297.77 ksf

pot = 2.07 ksi

limiting axial stress in column epr checklist C1

0.3f'c = 1.5 ksi < 2.07 ksi

NG

**N-S direction**

axial stress check in column 4X at level H

| | | | | |
|---|---|---|---|---|
| Compressive strength of the concrete in columns | f'c | = | 5 | ksi |
| Pseudo seismic force | V | = | 77899 | kip |
| Total number of frames in N-S direction | nf | = | 8 | |
| System modification factor | Ms | = | 2.5 | (for collapse prevention) |
| Base to roof height | hn | = | 61.98 | ft |
| Length of frame | L | = | 96 | ft |
| Area of the column at base | Acol | = | 7.07 | ft2 |

Axials tress due to overturning force

pot = (1/Ms)(2/3)(V*hn/Lnf)(1/Acol)

237.29 ksf

pot = 1.65 ksi

limiting axial stress in column epr checklist C1

0.3f'c = 1.5 ksi < 1.65 ksi

NG

## Column Shear Stress Check

**E-W direction**

shear stress check in column 4X at level H

| | | | | |
|---|---|---|---|---|
| Compressive strength of the concrete in columns | f'c | = | 5 | ksi |
| Story shear | Vj | = | 77899 | kip |
| Total number of frames in E-W direction | nf | = | 4 | |
| Total number of columns | nc | = | 24 | |
| System modification factor | Ms | = | 2 | (for collapse prevention) |
| Summation of the area of all columns | Ac | = | 89.33 | ft2 |

Shear stress

vj_avg = (1/Ms)(nc/(nc-nf))(Vj/Acol)
523.25 ksf
vj_avg = 3.63 ksi

limiting shear stress in column per checklist C1

100psi = 0.1 ksi
2sqrt(f'c) = 4.47 ksi

max(100psi,2sqrt(f'c)) = 4.47 ksi > 3.63 ksi
OK

**N-S direction**

shear stress check in column 4X at level H

| | | | | |
|---|---|---|---|---|
| Compressive strength of the concrete in columns | f'c | = | 5 | ksi |
| Story shear | Vj | = | 77899 | kip |
| Total number of frames in N-S direction | nf | = | 8 | |
| Total number of columns | nc | = | 32 | |
| System modification factor | Ms | = | 2 | (for collapse prevention) |
| Summation of the area of all columns | Ac | = | 89.33 | ft2 |

Shear stress

vj_avg = (1/Ms)(nc/(nc-nf))(Vj/Acol)
581.39 ksf
vj_avg = 4.04 ksi

limiting shear stress in column per checklist C1

100psi = 0.1 ksi
2sqrt(f'c) = 4.47 ksi

max(100psi,2sqrt(f'c)) = 4.47 ksi > 4.04 ksi
OK

**Wall Shear Stress Check**

**E-W direction**
shear stress check in ramp walls

| | | | | |
|---|---|---|---|---|
| Compressive strength of the concrete in walls | f'c | = | 3 | ksi |
| Story shear | Vj | = | 77899 | kip |
| Total approx. length in E-W direction | lw | = | 250.5 | ft |
| Thickness of walls | tw | = | 1.33 | ft |
| System modification factor | Ms | = | 4.5 | (for collapse prevention) |
| Summation of the area of walls | Aw | = | 334.00 | ft2 |

Shear stress

| | | | | | | |
|---|---|---|---|---|---|---|
| vj_avg | = | (1/Ms)(Vj/Aw) | | | | |
| | | 51.83 | ksf | | | |
| vj_avg | = | 0.36 | ksi | | | |

limiting shear stress in column per checklist C2

| | | | | | | |
|---|---|---|---|---|---|---|
| 100psi | = | 0.1 | ksi | | | |
| 2sqrt(f'c) | = | 3.46 | ksi | | | |
| max(100psi,2sqrt(f'c)) | = | 3.46 | ksi | > | 0.36 | ksi |
| | | | | OK | | |

**N-S direction**
shear stress check in ramp walls

| | | | | |
|---|---|---|---|---|
| Compressive strength of the concrete in walls | f'c | = | 3 | ksi |
| Story shear | Vj | = | 77899 | kip |
| Total approx. length in E-W direction | lw | = | 228 | ft |
| Thickness of walls | tw | = | 1.33 | ft |
| System modification factor | Ms | = | 4.5 | (for collapse prevention) |
| Summation of the area of walls | Aw | = | 304.00 | ft2 |

Shear stress

| | | | | | | |
|---|---|---|---|---|---|---|
| vj_avg | = | (1/Ms)(Vj/Aw) | | | | |
| | | 56.94 | ksf | | | |
| vj_avg | = | 0.40 | ksi | | | |

limiting shear stress in column per checklist C2

| | | | | | | |
|---|---|---|---|---|---|---|
| 100psi | = | 0.1 | ksi | | | |
| 2sqrt(f'c) | = | 3.46 | ksi | | | |
| max(100psi,2sqrt(f'c)) | = | 3.46 | ksi | > | 0.40 | ksi |
| | | | | OK | | |

**Typical Wall Reinforcing Ratio Check**

| Wall | Horizontal Reinforcing | | | | Vertical Reinforcing | | | |
|---|---|---|---|---|---|---|---|---|
| Thickness | Curtains | Size | Spacing | Ratio | Curtains | Size | Spacing | Ratio |
| 6 | 1 | #4 | 12 | 0.0028 | 1 | #4 | 12 | 0.0028 |
| 8 | 2 | #4 | 18 | 0.0028 | 2 | #4 | 18 | 0.0028 |
| 10 | 2 | #4 | 16 | 0.0025 | 2 | #4 | 16 | 0.0025 |
| 12 | 2 | #4 | 12 | 0.0028 | 2 | #4 | 12 | 0.0028 |
| 14 | 2 | #5 | 15 | 0.0030 | 2 | #5 | 12 | 0.0037 |
| 16 | 2 | #5 | 12 | 0.0032 | 2 | #5 | 10 | 0.0039 |