University of California, McLaughlin Hall
Berkeley, CA

Building Assessment
Report

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I. INTRODUCTION

A. GENERAL

McLaughlin Hall is located on the University of California Berkeley campus. It was built in 1931 and consists of a basement and four levels of classrooms and offices. This report assumes the building is not classified as a high-rise structure.

This report is comprised of four parts under each of the disciplines. The first part is a description of the existing system and provides a basic assessment of the building's current HVAC, plumbing, fire protection, and electrical. The second part describes the impact of the seismic upgrades on the above systems. The third part provides recommendations of upgrades to existing systems that may increase their current usability. The fourth part provides recommendations for upgrades to modernize the systems.

The report is based on a review of available building drawings and a walk through of the building by Flack + Kurtz engineers, as well as limited conversations with building occupants. No input from the building's zone engineers or maintenance personnel was available. The walk through was limited to the observation of visible equipment only. Equipment was not tested or operated for functionality, nor were hidden areas exposed or inspected.
II. HEATING, VENTILATING, AND AIR CONDITIONING

A. EXISTING CONDITIONS

1. Heating System

The heating source for the building is the campus steam system. A pressure reducing station at the building entrance reduces the steam pressure for use by equipment. Pipe risers located at perimeter columns supply steam to steam radiators located on the Ground through Third Levels. The Basement Level is served by a steam heating coil.

There are two steam to hot water heat exchangers located in the Basement Level which convert steam to heating hot water. The heating hot water is then piped to a heating hot water coil that serves Hess Hall.

Condensate from the radiators and the steam coil drains into a flash vessel and then a condensate receiver located in the basement. Pumps discharge the condensate back to the campus system.

The steam radiators are from the original construction. Various shut-off valves, steam traps, pressure relief valves, pumps, and other piping trim has been replaced in equipment rooms in the Basement Level over the years. Many of the original automatic pneumatic control valves for the radiators on the Ground through Third Levels have been replace with manual hand adjusted valves.

2. Space Conditioning Systems

A main exhaust air fan and operable windows provide ventilation for the Ground through Third Levels. The Basement Level is served by a supply air fan located in the Basement.

The building’s main exhaust air fan is located in the penthouse. Exhaust ductwork is routed down a riser and then above corridor ceilings on the Ground through Third Levels. Exhaust registers are located in the rooms on each side of the corridor. A second dedicated exhaust fan is located in the penthouse that serves the building’s toilet rooms.

A chilled water system provides cooling to a computer workroom in the building. A packaged air cooled chiller and chilled water pumps are located on the roof. Chilled water is piped to a fan coil unit located in the computer room.
The exhaust fans and perimeter steam radiators are from the original construction, however they appear to be in fair condition. The chilled water system is a more recent addition and it seems be in good condition.

A supply air fan that serves Hess Hall is located in the Basement Level of McLaughlin Hall. Connecting ductwork is routed through the Basement of McLaughlin Hall and through the north side of the building to Hess Hall.

3. Control System

The majority of building controls are pneumatic. Two air compressors and a refrigerated air dryer in the Basement Level mechanical room provide compressed air to the system. Both compressors and the refrigerated air dryer appear relatively new and in good condition.

Original pneumatic thermostats are located on perimeter columns on the Ground through Third Levels, however they appear to have been disconnected from the pneumatic control system. Many of the original pneumatic control valves on the steam radiators have been replaced by manual hand adjusted knobs.

The complete working condition of the existing pneumatic control system including distribution piping has not been determined.

B. COLLATERAL IMPACT FROM SEISMIC STRENGTHENING

The subheadings below reference the seismic upgrade scheme. Refer to the seismic portion of the report for further information.

1. Basement & Ground Floor Shear Walls

The shear walls will affect existing ductwork, piping, and equipment. The ductwork and piping will need to be removed to allow construction of the shear walls then re-installed through new wall penetrations. The major elements impacted by the work are approximately as follows:
Basement Shear wall at column line 3:

- (1) 24x24 duct and 24x24 grille
- (1) 4" high pressure steam (HPS) pipes and (1) 2" condensate return pipe
- (2) 2" low pressure steam (LPS) pipes and (2) 1" condensate return pipes
- (2) air compressors with approximately 30 gallon compressed air tanks require temporary relocation for construction
- (1) wall mounted pneumatics air dryer
- (6) misc. wall mounted equipment switches

Basement Shear wall at column line 7:

- (1) 52x36 supply air duct (to Hess Hall)
- (2) 4" LPS pipes and (2) 2" LPS return condensate pipes
- 3" LPS pipe and (1) 1"LPS return pipe
- (2) 4" LPS pipes and (2) 2" return pipes (Hess Hall heat exchanger room)
- (2) ¼" pneumatic lines
- (1) new access door to heat exchangers (HX-16&17) will be required
- (1) new access door to basement area east of shear wall will be required

Ground Level Shear wall at column line 17:

- Should not affect the building’s HVAC system.
2. **Steel Brace Frames and Concrete Moment Frame:**

The concrete moment frames will mostly affect the perimeter radiant heat system. The corridor exhaust ductwork should remain unaffected. Piping and equipment will need to be removed to allow construction of the brace beams and frames and then re-installed as required. The major existing mechanical components impacted by the framework are approximately as follows:

**Ground Level/through Level 3:**

Steel frame at column lines B&P from column lines 2-7
- (40) existing radiators will need to be demolished and
- (40) new radiators of equivalent capacity and dimensioned to fit between concrete moment frames to replace demolished radiators.
- (12) 2-1/2” LPS risers and (12) ¾” return condensate risers routed from basement up to Level 3 will need to be relocated/replaced.

3. **East Concrete Moment Frames:**

**Ground Level/through Level 3:**

- (12) radiators will need to be relocated/replaced
- (3) 2-1/2” LPS risers and (3) ¾” return risers routed from basement up to Level 3 will need to be relocated/replaced.

4. **Penthouse Support**

Strengthening the beam connections below the penthouse should not affect the building’s HVAC system.

Construction of a new reinforced concrete walkway on the roof will require the temporary disconnection/relocation of chilled water supply and return piping serving building supplemental cooling systems.

**C. MODERNIZATION**

1. **Heating System**

The existing system configuration appears adequate for the building’s needs, although many of the existing steam radiators and steam pipe risers will be demolished to facilitate the construction of
the new seismic reinforcement. The equipment is nearing the end of its useful service life. Replacement of equipment and controls upgrade should be considered.

2. Exhaust Systems

The exhaust system used in conjunction with operable windows should provide adequate comfort levels for much of the year. This system can be retained since the majority of building usage does not mandate mechanical cooling and seismic upgrades do not appear to conflict with existing ductwork.

The toilet exhaust system appears adequate for the building’s needs.

3. Control System

Control upgrades should be considered for radiators, exhaust fans, and other major equipment. DDC control would allow optimization of system operation and increased monitoring to identify maintenance needs. The existing pneumatic zone control may be adequate for individual room control, however the overall condition of the pneumatic system is not known and replacement of control valves, thermostats, and control air piping may be required.
III. PLUMBING/FIRE PROTECTION

A. EXISTING CONDITIONS

1. Domestic Water System

The 4" domestic water service enters the building in the basement level electrical room and then branches off to serve the Fire Protection standpipe and domestic water system. A steam fired heat exchanger without storage tank supplies the hot water, and a recirculating pump serves the hot water re-circulation system.

2. Sanitary Waste and Vent System

The sanitary waste and vent system serves toilet groups and floor drains throughout the building. All waste drains by gravity to the campus mains. No deficiencies were identified.

The toilet room layouts vary due to renovations over the years. The building’s original design had a men’s toilet room on ground level which has been divided in two toilet rooms to serve men and women. All toilet rooms have been upgraded to meet ADA requirements and water closets utilize 3.5 gallons per flush.

3. Fire Protection Systems

The building’s fire protection water branches off from the 4” domestic cold water service inside the building.

Class II wet type standpipes with 1-1/2” hoses are provided in the corridor at the middle of the building on each floor. The hoses are in good condition.

B. COLLATERAL IMPACT FROM SEISMIC STRENGTHENING

The subheadings below reference the seismic upgrade scheme. Refer to the seismic portion of the report for further information.

1. Basement & Ground Floor Shear Walls

The shear walls will affect existing plumbing piping. Piping will need to be removed to allow construction of the shear wall then re-installed through new wall penetrations. The major pipe runs affected by the work are approximately as follows:
Basement Shear wall at column line 3:

- (1) 3” subsurface drain, (1) 3” storm drain leader, (1) ¾” hose bib
- (1) 4” cold water main, (1) 6” storm drain and (1) 1” cold water.

Basement Shear wall at column line 7:

- (1) 5” sanitary, (2) 4” storm drain, (2) 4” cold water (1) 3” fire water, and (1) 3/4” hot water return.

2. Steel Brace Frames and Concrete Moment Frame

The new steel columns at column lines P/3, 4, 5, 6, 7 and B/6, total six (6) locations, are located adjacent to the plumbing pipe risers. The proposed beam will impact piping services in existing shafts and existing stand pipe connectors. The piping will need to be removed to allow construction of the column and steel brace frame, then re-installed through new wall penetrations.

3. East Concrete Moment Frames

Should have minor impacts on the building’s piping systems.

4. Penthouse Support

Strengthening beam connections in the penthouse should have minor impacts on the building’s piping systems.

C. RENEWAL

1. Domestic Water System

The equipment and piping appears to be in good condition and no deficiencies were noted. The domestic water heat exchanger is from the original construction and nearing the end of its useful service life. Replacement with a double wall heat exchanger should be considered.

2. Sanitary Waste and Vent System

The system appears serviceable and no modifications are required.

3. Fire Protection System

The system appears serviceable and no modifications are required.
D. MODERNIZATION

1. Domestic Water System
   The addition of a hot water storage tank and utilization of 1.6 gallons per flush for water closets should be considered.

2. Waste and Vent System
   The piping appears serviceable and no modernization requirements were identified. New plumbing fixtures added for any future additions or remodeling will be required to meet the State of California's new low flow requirements.

3. Fire Protection System
   Provision of sprinklers throughout the building should be considered.
IV. **ELECTRICAL**

A. **EXISTING CONDITIONS**

1. **Electric Service**
   
   The building is served from the campus primary voltage distribution system, which runs underground in concrete encased duct banks. A 12KV primary load interrupter switch is located on the basement level of the building. There is one (1) 300KVA 12KV delta primary, 208Y/120V Wye Secondary transformer which feeds one (1) 3000A 208/120V switchboard. The 208V switchboard feeds the chiller and motor control centers for miscellaneous mechanical and plumbing equipment on the 1st level. The switchboard was upgraded in March 1974. There is no standby generator for the building.

2. **Power Distribution**
   
   Electric service to the building is provided through two (2) 120/208V panelboards, which provide power for the office and classroom receptacles and lighting on each floor. There is an electrical closet on every floor (Ground level through 3rd level), and panelboards are located in the electrical closets. In addition there are some panelboards provided in other areas, such as the Transformer room and the equipment in the crawl space of the building, which serve local circuits.

3. **Power for Mechanical Equipment**

   The mechanical equipment in the building is served through 208V, 3-phase 3 wire motor control centers. Motor control center MCCCA is located in the Transformer Room.

4. **Lighting**

   Lighting throughout the building utilizes T12 fluorescent lamp fixtures with magnetic ballasts. Lighting in the corridors consists of two (2) lamp ceiling mounted strips and in the classrooms of either two (2) or four (4) lamps ceiling mounted fixtures. All the fixtures are controlled by toggle switches only. There are also bare incandescent lamps installed in the basement mechanical room and the equipment room in the crawl space. There are exit signs and battery back for emergency lights. The existing lighting control system does not meet the requirements of the current Title 24 Energy Code.
5. **Receptacle Branch Circuits**

Existing receptacle circuits are provided from the panelboards in the electrical closet on every floor. Circuits are mainly routed in the ceiling space.

6. **Fire Alarm System**

The fire alarm system was upgraded in 1999 with a Cerberus Pyrotronics system. Fire alarm pull stations and strobes are located next to stairwell doors and at all exits to the building. A fire alarm control panel is located in the Transformer Room at the basement level. A fire alarm remote annunciator is located on the West Side of the entrance. Smoke detectors are located in both stairwells, within 30'-35' of each other in the corridors, and in the Penthouse. The system appears in compliance with current standards.

**B. COLLATERAL IMPACT FROM SEISMIC STRENGTHENING**

The subheadings below reference the seismic upgrade scheme. Refer to the seismic portion of the report for further information.

1. **Basement & Ground Floor Shear Walls:**

The new shear walls will affect existing conduits and equipment. The conduits and the equipment will need to be relocated or removed to allow construction of the shear wall then re-installed through new wall penetrations. The major elements impacted by the work are approximately as follows:

**Basement Shear wall at column line 3:**

The work required to create a shear wall at this location will affect major pieces of electrical distribution equipment including the main electrical service.

- (1) 12KV primary load interrupter switch.
- (1) 300KVA 12KV Delta Primary; 208Y/120V Wye Secondary Transformer.
- (8) 4” Conduits
- (3) Recessed Panels
- (6) Misc. wall mounted equipment switches.
- (2) Convenience duplex receptacles.
• (1) Telecom Backboard
• (2) 1" Telecom Conduits

Basement Shear wall at column line 7:
• (6) ½" Conduits.
• (1) 100A Electrical Panel: 240V, 3 phase, 3 wire.

Ground Level Shear wall at column line 17:
• Should have little impact on the electrical system.

2. **Brace Beams and Concrete Moment Frame:**
The brace beams should have minor impact on the electrical systems. The power connection to the mechanical equipment will need to be relocated. (See Mechanical description for specific mechanical equipment).

2. **East Concrete Moment Frames:**
Should have little impact on the electrical system.

4. **Penthouse Support:**
Strengthening the beam connections in the penthouse should have minor impact on the electrical systems. The power connections to the mechanical equipment will need to be relocated. (See Mechanical description for specific mechanical equipment).

C. **RENEWAL**

1. **Electric Service**
The existing electric service was upgraded in March 1974 and seems to be in good working condition and serviceable.

2. **Power Distribution**
The power distribution system is in good working condition and serviceable.

3. **Power for Mechanical Equipment**
The motor control centers seem to be in good working condition and serviceable.
4. **Lighting**

A complete lighting retrofit is recommended to incorporate a standard type light fixture (with T8 or T5 fluorescent lamps) and energy saving electronic ballasts.

5. **Receptacle Branch Circuits**

The building’s receptacles are still usable. No renewal is required.

6. **Fire Alarm System**

There should be more strobes added in the corridors to meet code requirements. In addition, smoke detectors should be added in the Transformer Room, all equipment rooms and in front of each electrical closet. Additional audible devices should be added on each floor.

D. **MODERNIZATION**

1. **Electric Service**

No modernization requirements were identified.

2. **Power Distribution**

No modernization requirements were identified.

3. **Power for Mechanical Equipment**

No modernization requirements were identified.

4. **Lighting**

Automatic shut off controls, such as motion sensors, should be installed in individual offices. The existing lighting should be replaced with more efficient ballasts and T8 or T5 lamps. The existing building should have programmable lighting relay cabinets installed, which offer more flexibility in shutting off lights and saving energy. In addition, a complete lighting retrofit is recommended to incorporate a standard light fixture and electronic ballasts.

5. **Receptacle Branch Circuits**

No modernization requirements were identified.

6. **Fire Alarm System**

No modernization requirements were identified.
REFERENCES


APPENDIX A

SAFER ASSESSMENT

1. McLaughlin Hall
2. O'Brien Hall
BUILDING DESCRIPTION

(Note: This building description is based only on the cursory review of drawings described below and of the McLaughlin Hall, Seismic Improvement Study, University of California, Berkeley, by Fleming Corporation and Structural Design Engineers, dated October 19, 1990.)

General
McLaughlin Hall is an approximately 46,200 square foot, three story plus full basement and attic, laboratory, office and classroom facility. The building is rectangular in plan, measuring approximately 67' wide by 106' long; roof is generally gabled. A 47' by 47' penthouse at the southeast corner extends approximately 21' above the attic level. Surrounding grade slopes from northeast to southwest. The Engineering/Hesse Courtyard Building is immediately to the North. Typical story height is approximately 15'; overall building height is approximately 65'. The building exterior is highly articulated with moldings, fenestration and entryway columns.

Construction
McLaughlin Hall is primarily constructed of a complete steel frame encased in concrete with unreinforced masonry and cast-in-place reinforced concrete walls. The gravity load carrying system primarily consists of concrete roof and floor slabs spanning to steel secondary beams supported by steel roof trusses and floor girders. Roof and floor systems are supported by steel H columns founded on interior and exterior spread footings. The lateral force resisting system consists the rigid concrete roof and floor diaphragms spanning to a cast-in-place reinforced concrete pier/wall system along the North Wall and a unreinforced masonry pier/wall system on the remaining sides. The penthouse roof is supported by concrete beam and column framing, enclosed with concrete piers and unreinforced masonry infill.

Building Condition  Fair, noticeable interior wall cracking.

Year Built  Circa 1931.

Design Code  1927 UBC (Assumed).

Building Type  (FEMA-178: #6,#7; FEMA-273: S4,S5) Steel Frame with Concrete and Infill Masonry Shear Walls.

DOCUMENTATION

Architectural Drawings:  George W. Kelham, Architect
(No drawings made available.)

Structural Drawings:  H. J. Brunnier, Structural Engineer, August 1, 1930.
Engineering Building, Sheets S1- S14.
SUMMARY OF DEFICIENCIES

(Note: The following deficiencies are outlined in the referenced report by Fleming Corporation and Structural Design Engineers, dated October 19, 1990, with which this evaluation concurs.)

By brief inspection of available drawings, and a cursory review of the aforementioned report, it appears that the lateral force resisting system of McLaughlin Hall is fundamentally flawed. Brittle, under strength unreinforced masonry and stone veneer will most likely be unable to resist in and out of plane forces and will separate and fall. The essentially complete steel frame (with semi-rigid bolted connections) will provide some measure of lateral stability and prevent floor collapse. Where the roof is not supported by a complete steel frame (at the penthouse roof) the surrounding unreinforced masonry wall is solid and well confined inside concrete framing members. Other primary deficiencies include:

- Anchorage of stone veneer to unreinforced masonry and of masonry walls to floors is unknown. No methods of attachment are shown on the drawings; based on the date of construction and building type, little to no attachment can be assumed. A large amount of falling hazards from out-of-plane wall and parapet failure is expected (especially at the heavily ornamented entrance).

- Once the masonry walls degrade, the concrete wall/piers along the North face may promote building torsion. The concrete wall/piers are also found have insufficient shear and flexural strength.

- Numerous interior partitions are constructed of hollow clay tile. While these walls may provide added initial lateral strength, they are expected to experience substantial in-plane shear cracking and out-of-plane failure.

- The roof is composed of unanchored terra cotta tiles. These tiles are expected to dislodge during appreciable ground shaking and present a moderate falling hazard.
**PREDICTED SEISMIC RESPONSE AND DAMAGE TO EXISTING BUILDING**

<table>
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<tr>
<th>Earthquake</th>
<th>Chance of Exceedance (%/No. of Years)</th>
<th>Vision 2000 Performance Damage Index</th>
<th>UCB Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Occasional</td>
<td>50/50</td>
<td>4</td>
<td>N.A.</td>
</tr>
</tbody>
</table>

*Description of Performance:*
Moderate structural and non-structural damage. Moderate to high amounts of unreinforced masonry and interior partition cracking. Some exterior architectural components may fall. Life safety generally protected; building operations disrupted.

| Rare         | 10/50                                 | 3                                   | POOR       |

*Description of Performance:*
Severe structural and non-structural damage. Extensive unreinforced masonry and stone veneer failure. Interior hollow clay tile partition collapse. Exterior architectural elements will fall. Appreciable life hazards presented; however, structural collapse prevented by complete steel gravity frame.

| Very Rare    | 10/100                                | 3                                   | N.A.       |

*Description of Performance:*
Similar to Rare event predicted performance. Especially severe structural and non-structural damage. Global unreinforced masonry and stone veneer failure. Interior hollow clay tile partition collapse. Exterior architectural elements will fall. Extremely high life hazards presented; however, structural collapse prevented by complete steel gravity frame.
RETROFIT CONCEPT & PLAN

Retrofit Description

(Note: The following general retrofit solutions were presented in the referenced report by Fleming Corporation and Structural Design Engineers, dated October 19, 1990, with which this evaluation concurs.)

- Introduce vertical elements to provide lateral strength and stiffness along the entire building perimeter (steel bracing or concrete shear walls, etc.).
- Improve anchorage between unreinforced masonry and concrete floor and between stone veneer and unreinforced masonry backing. Strengthen exterior architectural ornamentation anchorage. Introduce out-of-plane bracing.
- Replace (or brace and reinforce) interior hollow clay tile partitions.
- Anchor terra cotta roof tiles.
1997 PRELIMINARY SEISMIC EVALUATION
University of California Berkeley
Project No. 7R1164
O'Brien Hall

BUILDING DESCRIPTION

General
O'Brien Hall is a reinforced concrete (R/C) structure designed in 1956 and presumably built in 1958 or so. The main portion of the building is a 4 story structure with a regular rectangular plan measuring 155 feet by 55 feet. At the south end a glass-enclosed link structure connects the building with McLaughlin Hall. This link structure is 3 stories tall.

Construction
The typical floor structure is a 14 inch two-way R/C flat slab without drop panels. The slab is supported by 24 inch square R/C columns. The perimeter walls are 14 and 16 inch thick R/C punched shear walls. The west wall abuts Hesse Hall and the west wall therefore contains large passageways to Hesse Hall at the first floor level.

The link structure is a bolted steel moment frame in the east-west direction, and is rigidly bolted to O'Brien Hall to restrain it in the north-south direction. The floors of the Link Building are constructed of 4.5" deep x 18 gage metal deck with a 2.5" topping of regular weight concrete.

Building Condition
The structure appears to be in good condition.

Year Built
1958

Design Code
1955 UBC (assumed)

Building Type
Type 9: Concrete Shear Wall

DOCUMENTATION

Architectural Drawings: Mitchell Van Bourg, September 28, 1956, Sheets 2-8, 10, 12-17, 20-29, 31
GM Associates, July 1, 1981, Alteration sheets 1,2

Structural Drawings: H.J. Brunnier, September 28, 1956, Sheets S1-S20
H.J. Brunnier, June 8, 1971 for elevator addition, Sheet S1

Walk Through to Observe Building Condition: A walk-through was performed on 7/22/97.
SUMMARY OF DEFICIENCIES

- Link structure is laterally weak in both directions and is dynamically incompatible with O'Brien Hall.
# Predicted Seismic Response and Damage to Existing Building

<table>
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<tr>
<th>Earthquake</th>
<th>Chance of Exceedance (%/No. of years)</th>
<th>Vision 2000 Performance</th>
<th>UCB Rating</th>
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<td>Occasional</td>
<td>50/50</td>
<td>Operational (8)</td>
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<tr>
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<td>[Link Structure - Life-Safe (5)]</td>
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**Description of Performance:**
Minor cracking at spandrel panels and around wall openings, and near openings in floor slabs. Probable damage to connection with link structure.

<table>
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<tr>
<th>Rare</th>
<th>10/50</th>
<th>Life Safe (6)</th>
<th>Good</th>
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<td>[Link Structure - Near Collapse (3)]</td>
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**Description of Performance:**
Cracking and spalling at spandrel beams and around wall openings, and near openings in floor slabs. General cracking of walls. Pronounced damage to north and south end wall spandrels and near openings. Failure of connection with link structure. Pounding damage expected. Link structure east-west lateral drift expected to be high. Window wall supports and/or windows may fail. Link may suffer permanent lateral set. Possible failure of bolted connections at moment-resisting joints.

<table>
<thead>
<tr>
<th>Very Rare</th>
<th>10/100</th>
<th>Life Safe (5)</th>
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<td></td>
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<td>[Link Structure - Collapse (2)]</td>
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**Description of Performance:**
Failure of spandrel beams and severe cracking of walls. Severe cracking of slabs near openings, and particularly at 2nd floor near lab space opening. Collapse of link structure.
APPENDIX B

PREVIOUS SEISMIC STRENGTHENING STUDY
(by Fleming Corporation)
McLAUGHLIN HALL

SEISMIC IMPROVEMENT STUDY

- Need elevations
- Sewer? 150
- Can grand motions update to 6V 1112 61P

UNIVERSITY OF CALIFORNIA, BERKELEY

OCTOBER 19, 1990
ACKNOWLEDGMENTS

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<td>A. DETAILED COST ESTIMATE</td>
<td>45 - 48</td>
</tr>
<tr>
<td>STRUCTURAL CALCULATIONS - (SEE SEPARATE ATTACHMENT)</td>
<td></td>
</tr>
</tbody>
</table>
ADDENDUM TO McLAUGHLIN HALL
SEISMIC IMPROVEMENT STUDY

Under Executive Summary Scheme 2A, page 2, add the following to the first paragraph last two sentences:

"New continuous steel framing would connect to the columns and brace the exterior walls. Horizontal saw cuts would be made through the entire 10-inch thickness of concrete wall, 13-inch thickness of masonry wall grout and 7-inch thickness of granite wall grout for a 350-foot length just below the roof level and below the 4th floor level. This will prevent lateral forces from overstressing the masonry and causing their collapse. The saw cuts will then be caulked and sealed with flexible moisture resistant materials."

"Bracing would also be placed on three walls along the length of each saw cut as well as on three walls where the box frame ends."

Add the following to the last paragraph of Scheme 2A, to read as follows:

"The estimated construction cost for the described work is $3,697,996, which adds $100,000 for saw cutting; waterproofing, expansion joint covers. It is anticipated that it would take eleven (11) months to complete the construction work, during which period the building should be vacated."

On page number 3 of the Executive Summary, add the following:

"Passive energy dissipating isolation systems may prove effective at McLaughlin Hall, however, investigation of such systems were beyond the scope of the work for this report and were not evaluated in detail."

On page number 11 entitled Structural Seismic Strengthening Schemes, under Scheme 2A, add the following to the second to last paragraph:

"Horizontal saw cuts will be made in the masonry and concrete, just below the roof level and below the third floor level, to protect the masonry walls against over-stress.

On page 13, in the second paragraph, delete the following statement:

"Two floors can be vacated at a time, so that one can act as a noise buffer for the other two floors."

Add the following statement:

"McLaughlin Hall should be vacated during the construction period."
EXECUTIVE SUMMARY

McLaughlin Hall, a four-story building with a basement and a penthouse constructed in 1931, is a steel framed building. It has a total area of 46,200 square feet.

The building is constructed of steel with concrete columns, girders, beams and steel roof trusses. The East, West, and South walls are unreinforced brick with stone facing and the North wall is reinforced concrete. A number of windows on the four facades bring light and ventilation to the interior of the building, but provide literally no seismic support. In fact, the size and number of windows at the exterior walls limit any possible provision of shear walls unless they are replaced or infilled with a solid material, such as concrete or provided with a supplemental wall adjacent to them. The roof is composed of terra cotta roof tiles which are unanchored.

The interior is constructed basically of the following materials:

<table>
<thead>
<tr>
<th>Item</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>Floors</td>
<td>Concrete with a finish of battleship linoleum or tile or a concrete hardener.</td>
</tr>
<tr>
<td>Walls</td>
<td>Hollow clay tile with an acoustical plaster finish.</td>
</tr>
<tr>
<td>Ceilings</td>
<td>Suspended plaster ceiling.</td>
</tr>
</tbody>
</table>

There are variations in the finish from room to room depending on the use of the space. Such variations include carpeting in some offices, the presence of different trim and wainscot materials, and fixtures/furnishings.

Fleming Corporation was commissioned for this particular seismic report in order to update previous studies completed in 1975 and performed by Frank E. McClure and David T. Messinger, Consulting Engineers, as well as the report completed in November 1979 by H.J. Degenkolb & Associates, Engineers. The initial report by McClure and Messinger gave the building a "Poor" rating in seismic resistance.

The rating "Poor", according to University policy, states that "seismic performance rating would apply to buildings and other structures whose performance during a major seismic disturbance is anticipated to result in significant structural and non-structural damage and/or falling hazards that would represent appreciable life hazards."

The Degenkolb report supported the findings of McClure and Messinger. Degenkolb also listed the deficiencies of the building which were basically inadequate lateral bracing to withstand seismic force requirements of Title 24.

This report utilizes the information found in the two previous seismic reports, the 1973 Uniform Building Code required base shear value, the 1986 Uniform Building Code for all other design aspects as well as the University Policy on Seismic Safety to investigate McLaughlin Hall to confirm the seismic rating. Preliminary analysis of four strengthening schemes were used to improve the seismic performance rating. Further analyses were completed on two schemes and finally a detailed analysis was completed for one scheme.

This study and report support and confirm the seismic performance rating of "Poor." Our findings
determined the building to be structurally deficient that could result in structural and non-structural damage, which would endanger life safety.

The schemes completed in our overall analysis are as follows:

**Scheme 1A** consists of installation of braced steel frames down the center of the building on one side of the corridor and at three (3) others perpendicular to the center spline dividing the building into six sections. These new braced frames would be supported by existing columns connected by W6 X 25 wall bracing.

This particular scheme does not affect the exterior facade of the building, since all the frames are located on the interior of the building. On the other hand, this scheme makes the interior space less flexible because of the creation of four (4) permanent walls on each floor. Although this scheme contains approximately 45 tons of structural steel, it causes little disruption or replacement mechanically and electrically. The overall construction will cause a great deal of disruption to the occupants.

**Scheme 1B** consists of installation of concrete shear walls located in the same areas as Scheme 1A. This particular scheme is similar to Scheme 1A in almost all areas, except that it is even less flexible and its overall added weight created by the concrete mass. Whereas the braced frame scheme would allow more flexibility of allowing more openings, the openings are limited in the concrete shear walls. The core area would have to be redesigned to accommodate new openings and placement of electrical panels.

**Scheme 2A** consists of basically a box braced frame with braced steel frames on the interior side of the exterior walls connecting to two other braced frames at third points of the building forming the box. A braced frame is also located at the east end of the building. The braced frame would be supported by new columns placed adjacent to the inside face of the exterior walls. New concrete footings would support these columns. New continuous steel framing would connect to the columns and brace the exterior wall. Bracing would also be placed on three walls where the box braced frame ends. This bracing would be in the form of steel columns.

The location of the brace framed at the exterior wall is somewhat flexible but should allow enough space away from the existing fenestration so window coverings can be installed to assist in keeping the facade uniform. Although the installation of this scheme will affect the exterior facade, it can be kept to a minimum. One of the reasons for opting to place the brace frame on inside face of the exterior wall was to preserve the existing facade.

Visibility through the existing windows will be impaired but does not cause any existing window relocation.

This particular scheme causes less disruption to the occupants than Scheme 1A. It utilizes 158 tons of structural steel which can be erected much faster than concrete and steel is more flexible in terms of adjusting it to job conditions. This scheme can be completed in phases and will cause less demolition of the existing structure. It should be noted that for each scheme we recommend removal of all hollow clay tile walls and replacement with metal studs. If removal of the hollow tile is acceptable, there will be significant disruption throughout the building.

The estimated construction cost for the described work is $3,597,996.

**Scheme 2B** is composed of concrete shear walls located in the same areas as Scheme 2A. The obvious problem with this scheme is the conflict at the exterior wall and windows. The use of this scheme would require closing some of the window opening at the exterior walls. This scheme was not investigated any further for this particular reason.
Fleming Corporation

The team considered base isolation very early as an alternate. Basically it requires isolating the building from the seismic ground motion and maintains vertical support. However, McLaughlin Hall is located too close to an earthquake fault, so design guidelines do not recommend a base isolation system for a building with such close proximity to a fault.

Each scheme has its pros and cons and two of them clearly deviate from the initial studies by McClure and Messinger and Degenkolb.

Scheme 2A was chosen as the best overall solution. It located a box braced frame within the building and braced frames at east end of the building.
INTRODUCTION

This is a seismic report for McLaughlin Hall, which presents an analysis and development schemes for strengthening the building. McLaughlin is located on the University of California, Berkeley Campus, just off Hearst Avenue. See Figure 1.0 for exact location of the building.

Our overall task for this report included seismic investigations and analysis to develop a scheme to determine mitigating design criteria for strengthening the building to resist forces of an earthquake. Preliminary analysis of four schemes were initially developed, however, only one scheme was completely developed to improve the ratings given first by McClure and Messinger, and later by H.J. Degenkolb Associates. The preliminary analysis of each scheme consisted of minimizing disruption of the building occupants, as well as what the associative cost would be if any one scheme was developed in detail.

H.J. Degenkolb Associates' seismic report in 1979 suggested the following for strengthening the building:

- Installing two reinforced concrete shear walls from the foundation to the roof level.
- Strengthening and anchoring the brick walls.
- Replacing hollow clay tile partitions.
- Anchoring the terra cotta roof tile.
- Reinforcing the front entrance to eliminate falling hazards.

This particular study took into account each of these solutions. The use of concrete shear walls for strengthening the building was considered, but a braced frame scheme was chosen as the solution for strengthening the building. Since the building is basically a steel frame building, development of a detailed braced frame solution is sufficient to provide an acceptable strengthening scheme and cost estimate for construction. The other four recommendations by Degenkolb were considered viable and needed solutions to completely make the structure safe for the public.

The following team was assembled to complete this scope of work:

- Fleming Corporation, Architects, Engineers and Planners
- Structural Design Engineers, Consulting Structural Engineers

McLaughlin Hall has been given a "Poor" rating, which means a major earthquake will result in significant structural and non-structural damage. The report supports that finding and recommends corrections for deficiencies in seismic resistance for the frame and falling hazards.
MISSION STATEMENT

PURPOSE OF REPORT

This seismic report for McLaughlin Hall was commissioned to update previous studies and analysis by McClure/Messinger and H.J. Degenkolb. This report is also intended to be detailed enough to act as guide to carry out the needed work on the building. Since the 1989 October 17th earthquake, which caused extensive damage throughout the Bay Area, it is recommended that corrective measures be instituted to the building with all due haste.

CONSIDERATIONS FOR DESIGN

McLaughlin Hall, although not officially a historical landmark building, its unique character deserves special consideration for preserving the facade. It is to preserve this unique design that consideration was made for final structural strengthening recommendations.

Our mission for final design solution consisted of maintaining the existing exterior facade and, if any work is required on the exterior, it would be necessary to replace it to match the existing condition. Such requirements exist for historically significant structures and this particular building is certainly one that should be considered as one.
BUILDING DESCRIPTION

McLaughlin Hall was designed by George W. Kelham, Architect, and H.J. Brunnier, Structural Engineer, in 1931. The building character is typical of buildings designed for the U.C. Berkeley Campus during this period. Although not officially a historical landmark building, its unique character deserves special consideration for preserving the façade. The natural stone wall facing and blend of fenestrations is positioned to provide not only light but a very unique rhythm. The main entry is accentuated with columns, moldings and fenestrations with complimenting trim to match the columns at the entry.

McLaughlin Hall contains 46,200 square feet. Its overall dimensions are 67 feet 4 inches wide by 106 feet 6 inches in length and 78 feet 7 inches in height at the west end, and 86 feet at the east end entry. These dimensions form a four story building with a basement. Refer to photos 1, 2, 3 and 4.

The existing structure is a steel frame encased in concrete and unreinforced masonry walls as well as reinforced walls. The floor construction is reinforced concrete with structural steel beams and girders encased in concrete. The stair is primarily steel with reinforced concrete. The roof is composed of a number of different materials. The roof frame is primarily structural steel and the roof structure is primarily reinforced concrete. The roofing material is a composition of mineral surface on some portions of the building, but has terra cotta tile located at the sloped portions of the roof.

The interior construction mainly consists of unreinforced hollow clay tile. The columns are structural steel encased in concrete and foundations are reinforced concrete spread footings. The interior finishes consist of linoleum and exposed concrete at the floors, plaster wall finishes over hollow clay tile and metal lath and plaster as well as acoustical tile for the ceilings.

The interior of the building shows signs of wear in various areas. There are noticeable cracks at the interior walls. These cracks may be the result of the October 17, 1989 earthquake and on the other hand, it has been reported that cracks existed before then. They do not indicate any immediate danger. Many of the interior walls are hollow clay tile covered with a heavy coat of plaster.

STRUCTURAL

The lateral load resistance of the existing building is provided by the concrete and masonry wall piers at the perimeter of the building, and by the secondary strength of the steel frame. Previous studies by Frank E. McClure and David T. Messinger, Consulting Engineers, and H.J. Degenkolb Associates, Engineers, have determined that the building has inadequate lateral resistance to withstand the seismic force requirements of Title 24. The reports also identified falling hazards due to the terra cotta roof tile, the stone and masonry walls, and the ornamentation at the east entry.

MECHANICAL

The existing mechanical heating system utilizes high pressure steam from an outdoor underground system reduced to low pressure for heating. Heating system consists of radiators at the perimeter of the building on each floor.

Ventilation air is introduced by fans located in the penthouse ducted to supply ducts in the corridor ceilings. Air is supplied into rooms from corridor ducts. Areas in the basement and on the third floor have local ventilation systems. Toilets are exhausted to outdoors.
FIRE PROTECTION

A fire main serves hose racks located in the corridor on each floor.

PLUMBING

Hot water heater (steam fired) is located in the basement. Toilets are located in the northeast section of the building on each floor, except the second floor. Plumbing services are connected to water closets, urinals, lavs, roof drains, floor drains, sinks and drinking fountains.

ELECTRICAL

The existing electrical system generally consists of fluorescent light fixtures, toggle type wall switches and duplex receptacles. All of the electrical equipment is wired to various branch panels which are placed at strategic locations throughout the building.
BUILDING EVALUATION METHODOLOGY

The procedures used for producing the report consisted of utilization of the University seismic safety policy and previous reports, structural calculations, drawings, and building inventory to investigate as-built conditions. This study does not include materials testing, therefore all materials strength information was taken from the drawings.

There were no available soils report for this building, but the soils report for the adjacent Earth Sciences building was used to evaluate the allowable bearing capacities. Structural calculations were produced through computer modeling to formulate the strengthening solutions.

The drawings available for review included the following:

A. Architectural Floor Plan
   Architectural Elevations
   Architectural Sections
   Architectural Finish Schedules
   Architectural Details

B. Structural Floor Plan
   Structural Sections
   Structural Details

C. Mechanical and Electrical and Plumbing Plans

The onsite survey and inventory was completed to determine the condition and compare it to the drawings. Photographs were taken and investigation of material wall location and wear and tear on the building.

After review of the existing drawings and initial design of the strengthening schemes, follow-up site visits were completed to obtain detail information to refine our initial solutions. For example, upon selecting a scheme to further develop into detail, we were able to concentrate on how the new strengthening scheme would affect mechanical ducts or electrical light fixtures. Our study does not include documenting every item mechanical, electrical, or architectural that would be in conflict with any new structural recommendations, but does address these areas in general covering the majority of work anticipated for this level of study.
EVALUATION RESULTS

Our findings in this study are in agreement with the findings of the previous reports prepared by Frank E. McClure and David L. Messinger, Consulting Engineers, and H.J. Degenkolb & Associates, Engineers. The building's seismic lateral force resisting system is insufficient to meet the University seismic safety policy, and several falling hazards exist.

Some of the deficiencies are as follows:

1. The relatively stiff but brittle exterior walls of unreinforced masonry and stone veneer provide the primary resistance to lateral loads along the south, west and east sides of the building. These walls do not have sufficient in-plane shear or flexural strength, and the excessive height to thickness ratio makes them very vulnerable to out-of-plane failure. Also, the connection of these walls to the floors is unknown.

2. The anchorage of the stone veneer to the unreinforced masonry walls at the south, east, and west exterior walls is not specifically known since testing and destructive investigation were not in the scope of this study. It is assumed that the connection is inadequate, especially considering the deficiencies of the masonry walls. This poses a moderate to severe falling hazard around the perimeter of the building.

3. The cast in place concrete walls at the north side of the building have insufficient in-place shear and flexural strength. In addition, since the strength of the north wall is greater than that of the south wall, this could create a significant torsional problem after the masonry walls fail.

4. The interior partition walls constructed of hollow clay tile are unbraced against out-of-plane seismic loads. They are also deficient for in-place shear, which would be the result of significant lateral displacement of the building frame.

5. The bolted beam-to-column connections create a semi-rigid frame which is capable of resisting some lateral load after the more rigid elements in the building have failed. However, the non-ductile concrete encasement and bolted connections have insufficient strength.

6. The terra cotta roof tiles are not anchored and as such create a slight to severe falling hazard around the perimeter of the building.

7. The parapet at the roof of the penthouse is of unreinforced masonry and stone veneer. It extends nearly five feet above the roof and is unbraced, creating a slight to severe falling hazard.

8. The connections of the stone columns and ornamentation at the east entry are unknown, but are assumed to be inadequate. The concrete structure supporting the stone ornamentation is adequate to laterally brace these elements, but the concrete structure appears to be vertically supported by the stone columns. This poses a severe falling hazard at the entry.
MODIFICATIONS TO MECHANICAL

1. Where ducts interfere with new structural bracing, ducts will have to be removed and replaced with new ducts in a different location.

2. Where new walls are being added, existing ventilation may have to be modified and/or rebalanced.

3. Where steam piping risers and steam radiators interfere with new structural bracing, pipes and radiators will have to be relocated.

MODIFICATIONS TO FIRE PROTECTION

1. Where pipes and hoseracks interfere with new structural bracing, pipes and hoseracks will have to be relocated.

MODIFICATIONS TO PLUMBING

1. Where new wall is being added in toilet rooms, plumbing fixtures and associated pipes will have to be removed and replaced with new ones in a location to match location of new walls.

2. Where pipes and plumbing fixtures interfere with new structural bracing, pipes and fixtures will have to be removed and replaced with new ones in location to meet code requirements.

MODIFICATIONS TO ELECTRICAL

Modify the existing electrical system as necessitated by the removal of existing partitions, the installation of new partitions and the installation of new cross bracing.

In affected areas, remove existing light fixtures and install new fixtures in a manner to meet code requirements.

Also, in affected areas, remove existing duplex receptacles from walls being removed and provide new receptacles at new walls. New duplex receptacles shall be 20 ampere, grounding type. Color of new receptacles shall match that of the existing.

All new or relocated items of electrical work shall be connected with new boxes, conduit or panduit with wiring sized in accordance with the national electrical code. Existing circuits in the effected areas shall be utilized.

No revisions are contemplated for the existing branch panels.
STRUCTURAL SEISMIC STRENGTHENING SCHEMES

We have studied four schemes which would strengthen the McLaughlin Hall building to the lateral strength level required by the 1973 Edition of the Uniform Building Code. All four schemes were developed to a conceptual design level and were presented to the University. Further design was completed on schemes 1A and 2A for cost comparison, and the University then selected Scheme 2A to be developed for cost estimation.

The four schemes are as follows:

**Scheme 1A** - New steel bracing installed within the existing steel frame, thereby incorporating the existing columns and girders into the new braced frames. One braced frame would be created in the East-West direction along the center of the building, at line D. Three braced frames would be created in the North-South direction, one each of line 3, line 7, and line 10. See figures 1A-1 through 1A-7. These braced frames would extend from the roof down to the foundation. Only a few of the existing columns would need to be reinforced, and all of the beam to column connections would be reinforced where a new brace is introduced. The foundation would also require reinforcing.

In this scheme, the exterior brick and stone walls would be braced by the addition of a steel framework next to the walls. This steel framework would be doweled into the unreinforced masonry and stone, and would span vertically from floor to floor, transferring the seismic loads from the walls directly into the floor framing.

In the interior, all of the hollow clay tile partition walls would be replaced with metal stud walls, extending from floor to floor. At the roof, the terra cotta tiles would be removed and replaced with properly anchored tile.

**Scheme 1B** - New concrete shear walls at the same locations as the braced frames of Scheme 1A. These shear walls would extend from the roof down to the foundation. This scheme adds considerable weight to the building, and results in very limited flexibility in the interior.

The exterior brick and stone walls would be braced in the same manner as Scheme 1A, and the interior partitions and the roof tile would be treated in the same manner as Scheme 1A.

**Scheme 2A** - Steel braced frames in each direction. In the East-West direction, new braced frames would be installed just inside the North and South exterior walls, with new columns, beams, and braces. The new columns are connected to the existing columns and girders at each level. The new bracing members are also inside of the exterior wall. Some usable floor space is lost next to the wall and windows, but this scheme allows for much more flexibility in the center of the building.

In the North-South direction, three braced frames are added, one each at lines 1, 5 and 10. See drawings 2A-1 through 2A-9. At lines 5 and 10, the existing columns at the center of the building, line D, are used, while at the North and South ends these frames share the new columns of the East West braced frames. The braced frame at line 1 would use new columns, beams, and braces, and would be located approximately three feet inside the existing column line 1. All of the frames extend from the roof down to the foundation, which would require strengthening.

The exterior stone and brick walls would be braced in the same manner as Scheme 1A, except that the steel framework would be tied to the new braced frame columns where they occur.

The interior partition walls and the roof tile would be treated in the same manner as Scheme 1A.
Scheme 2B - New concrete shear walls at the same location as the braced frames of Scheme 2A. At the North and South exterior walls, the length of the existing wall piers is not sufficient for five story shear walls, so the windows would have to be partially infilled. Also, the North-South shear walls would considerably limit flexibility in the interior. This scheme was not pursued any further for these reasons.
CONCLUSIONS AND RECOMMENDATIONS

Although each scheme for strengthening the building was not completely developed in detail, each of the two braced frame schemes have advantages and disadvantages. Whereas the two concrete shear wall schemes both have real substantial disadvantages in terms of being the most disruptive, Scheme 2B is probably the most problematic scheme, since it would interfere with the fenestration. Both braced frames cause virtually no adverse effect on the building’s exterior facade. Scheme 1A would cause the most disruption of the two braced frame, since its has members spanning down the center of the building from East to West. To limit the change in appearance of the facade on Scheme 2A, it is recommended that window coverings, such as mini-blinds be used to help create uniformity at the exterior facade.

Fabrication of structural members for either of the brace frame solutions can take place off site and assembled on site to minimize disruption in the building. Phasing of the construction is possible. The brace frame can be installed at exterior walls first. This construction should probably start in the basement, building the footings and foundations and then building the frame assembly. The construction can then continue from floor to floor. Two floors can be vacated at a time so that one can act as a noise buffer for the other two floors. Hollow clay tile walls should be removed in a separate phase and completed when the building is totally vacated on at least two floors.

Scheme 2A was selected because it causes the least disruption to the building. It also serves multiple purposes, since it allows not only bracing the structure as a whole, but also helps to simplify bracing the exterior granite and stone.
### LIST OF DRAWINGS

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<td>2A-18</td>
<td>Section @ Penthouse Roof Parapet</td>
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</table>
GENERAL NOTE
WHERE BRACED FRAME IS SHOWN ALIGNING W/EXISTING WALLS, THOSE WILL NEED TO DEMOLISHED & REBUILT AS A STUD WALL.

NEED A NEW STUD WALL IN THIS LOCATION.

BRACED FRAME WILL HAVE TO BE COORDINATED W/EXIST. DUCTS & MCH. EQ.

McLAUGHLIN HALL
BASEMENT FLOOR PLAN

SCHEMES
1A: BRACED FRAME
1B: GONC. SHEAR WALLS

LEGEND
HCT: HOLLOW CLAY TILE
---: BRACED FRAME

NEED: A NEW STUD WALL RM. 3

GRAPHIC SCALE
0 4 8 16 32
LEGEND
HCT: HOLLOW CLAY TILE
--- : BRACED FRAME

NEED TO REMOVE EXIST. WALL & BUIL NEW WALL TO ENCLOSE BRACED FRAME.

INT. SPACE AT 107E & 107D ARE REDUCED APPROXIMATELY BY 1/4 AND WILL NEED REPLACING.

McLAUGHLIN HALL
FIRST FLOOR PLAN

SCHEMES
1A: BRACED FRAME
1B: CONG. SHEAR WALL

DWG #1A-2
-17-
This wall needs to be demolished and will have to build new to enclose braced frame. Space in RM 210 is reduced.


McLAUGHLIN HALL
SECOND FLOOR PLAN

Schemes
1A: BRACED FRAME
1B: CONJ. SHEAR WALL

LEGEND
HCT: HOLLOW CLAY TILE
---: BRACED FRAME
WILL NEED A NEW STUD WALL IN RM. 312

312

HCT

315

315A

HCT

STAFF
WOMEN

317

317A

316A

316

318

319

320

321

302

301

306

308

308F

308E

WILL NEED A NEW STUD WALL IN RM. 308F & 316A. BOTH ROOMS WILL POTENTIALLY LOOSE SPACE.

THE WALL IN 308 COULD BE DESIGNED W/OPENINGS TO KEEP THE SPACE AS OPEN AS POSSIBLE.

McLAUGHLIN HAL
THIRD FLOOR PLAN

SCHEMES

1A: BRACED FRAME
1B: CONC. SHEAR WALL

GRAPHIC SCALE

0 4 8 16 32

DWG #1A-4
WILL NEED TWO NEW WALLS IN RM. 412 & RM. 411.
SINCE 412 IS THE LIBRARY THE STACK IN THAT AREA WILL HAVE TO BE RELOCATED

WILL NEED A NEW WALL IN RM. 407

McLAUGHLIN HALL
FOURTH FLOOR PLAN

LEGEND
HCT: HOLLOW
CLAY TILE
# BRACED FRAME

Dwg #1A-5
-20-
FRAME ELEVATION
AT LINE 7

EXISTING BM. TYP.

EXISTING BM. TYP.

EXISTING BM. TYP.

EXISTING BM. TYP.

EXISTING BM. TYP.

EXISTING BM. TYP.

EXISTING BM. TYP.

EXISTING BM. TYP.

FRAME ELEVATION
AT LINE 7

DWG #1A-6
-21-
WILL NEED A NEW STUD WALL IN RM. 1
2 RM. 3.

GENERAL NOTE
1. BRACED FRAMES LOCATED AROUND THE PERIMETER WALLS SHALL BE ENCASED WITH METAL STUDS & GYP. BOARD.

WILL HAVE TO CORRECT BRACE FRAME W/ MECHANICAL DUCTS & PIPES IN THIS AREA. NEED ACCURATE LOCATION OF ALL EXISTING MCH. ITEMS.

McLAUGHLIN HALL
BASEMENT FLOOR PLAN

SHEMES
2A: BRACED FRAME
2B: CONC. SHEAR WALLS

DWG #2A-1
-23-
LEGEND
HGT: HOLLOW
CLAY TILE

WILL NEED TO EITHER FURR EXIST. WALLS TO ENCLOSE THIS BRACE FRAME OR DEMOLISH EXIST. ADJACENT TO THIS FRAME & BUILD A NEW STUD WALL TO ENCLOSE BRACE FRAME.

WILL NEED A NEW STUD WALL IN 114

WILL NEED TO FURR OUT THIS EXIST. PLUMBING WALL, REMOVE & REPLACE EXIST. PLUMBING FIXTURES.

McLAUGHLIN HALL
FIRST FLOOR PLAN

SCHEMES
2A: BRACED FRAME
2B: CONC. SHEAR WALLS
WILL HAVE TO REMOVE ALL HOT WALLS & BUILD NEW MET. STUD WALLS AT BRACE FRAME

THE BRACE FRAME STRUCTURE WILL DIVIDE RM. 201 IN HALF.
WILL NEED A NEW STUD WALL IN RM. 412 & ADJACENT RM. 411

WILL NEED TO EITHER FURR OUT THIS WALL OR MOVE ADJACENT WALL.

IVILL NEED TO RELOCATE PLUMBING WALL & FIXTURES TO ACCOMODATE THE NEW STUD WALL FOR BRACE FRAME.

McLAUGHLIN HALL  
FOURTH FLOOR PLAN

LEGEND  
HCT: HOLLOW CLAY TILE

SHEMES
2A: BRACED FRAME  
2B: CONC. SHEAR WALLS

DWG #2A-5
-27-
FRAME ELEVATION
AT LINE E

DWG # 2A-11
EXISTING STONE VENEER

(C) GRADE

(E) COLUMN

(E) (H) COLUMNS

(H) STEEL BRACES NOT SHOWN, SEE ELEVATION

BASEMENT

(E) (N) 16" CONC. WALL

(E) CONC. PEDESTAL & COLUMN

(E) BOTH & BEDROCK

SECTION AT SOUTH HALL BASEMENT

DWC # 9A-14
HEX STEEL BRACES NOT SHOWN, SEE ELEVATION.
H0 x 25 HALL BRACING, CONT. BETWEEN NEW COLUMNS.
FY 3/4" O THREADLESS RODS 24" O.C. TO (E) MASONRY, EPOXY EMBED. 3" INTO (E) GRANITE VENEER, 1ST FLOOR.

NEW STEEL BM.
EXISTING GIRDER BEYOND.

NEW STEEL COL. BEYOND SEE ELEVATION.

SECTION AT SOUTH HALL 2ND FLR.

DWG # 2A-15
-37-
SECTION AT SOUTH HALL 4TH FLR.
DBL. 2 4x4x1 1/2 EA. (E) CONC. BEAM ALONG EAST & WEST HALLS, AND 2 6x3 1/2" O.C. ALONG NORTH & SOUTH HALLS.

7 (E) STONE & MASONRY PARAPET.

6x6x1 1/2 CONT. H/3 1/4" Ø THREADED ROD ANCHORS @ 24" O.C.

(E) CONC. BEAMS @ 7'-0" ± O.C.

4x6 1/2x1'-0" H/4 - 1/2" Ø HEDGE ANCHORS.

AT PENTHOUSE ROOF PARAPET BRACING DETAIL
APPENDIX C

HISTORIC BUILDING REPORT
(by Siegel & Strain)
UNIVERSITY OF CALIFORNIA
BERKELEY

SUMMARY

FIELD OBSERVATIONS

OF

McLAUGHLIN HALL

FEBRUARY 12, 2000

DRAFT
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Report Preparation

Field Observations January 2001 by
Burton Peek Edwards and Mary Hardy of
Siegel & Strain Architects
TRANSMITTAL

DATE: 2/20/01
TO: David Duncan
FROM: Burton Peek Edwards
RE: McLaughlin Hall

ENCLOSED:
(1) Summary of Field Observations of McLaughlin Hall (2/12/01)

REMARKS:

David,

Pending your decision on who should receive this report; I wanted you to at least have a look at it.

This is the standard for the first round or "draft" reports we intend to provide to inform your consultants.

Please call me if you have any questions and when you know how many copies we should make available and to whom we should send them.

SIGNED:

Burton Peek Edwards
The following is a summary of initial observations by Siegel & Strain Architects (S&S) during field investigations for the preparation of an Historic Structures Report (HSR) covering McLaughlin Hall (historic name - Engineering Building, architect - George Kelham, 1931). These observations are subject to revision as work progresses on the final HSR.

I. Site

The building was planned as the western most structure of a larger engineering complex. Site work remaining from that scheme is limited to the brick entry patio at the eastern façade (main entry) and the stairway leading down from that patio to the Glade facing Doe Library. Both the patio and the stairway are Very Significant. It is also worth noting that the main entry (East façade) aligns with the peak on the West façade of the entry court of the Hearst Memorial Mining Building. Site furnishings are later additions and are considered Non Contributing. Some eucalyptus trees and landscape features may be historic in nature - S&S will be consulting with the University's landscape architect to confirm.

II. Exterior

The East, South and West facades are all clad with cut granite. These were intended to be the formal facades facing into the campus. The North façade has details in board formed concrete similar to those on the granite facades, but is more "utilitarian" as it faces away from the central campus and into other engineering buildings. The North East corner of this façade was left blank in anticipation of future expansion.

**East Façade:** The entry façade is Very Significant. The cut granite face blocks, entablature, decorative medallion, cornice, corinthian columns and engaged corner pilasters are all of equal importance. Also of note is the incised inscription "Engineering" which corresponds with the original name of the building. The steel industrial sash window system is also of equal importance. The steps, plinth and brick/concrete patio are also important (see Site above). The entry door itself has been altered and is Non Contributing.

**South Façade:** Similar to the East Façade; all the same elements are considered Very Significant. Some alterations have been made at the basement level to provide access to room 3 - this is considered Non Contributing.
West Façade: Similar to the East Façade; all the same elements are considered Very Significant. This includes the stairway (approx. six risers) and abutting walls. The entry door at the basement level has been altered and is considered Non Contributing. There are three openings on either side of the entrance - some have louvers, some have windows. The openings are considered significant - not the window/louver elements themselves.

North Façade: This façade is detailed in concrete instead of granite with the exception of engaged corner pilasters at the East and West ends. The concrete façade is considered Significant and the granite portions Very Significant. Some windows at the second floor have been covered over - on the inside. The exterior, however, remains intact with the exception of reflective film placed on the glass. The windows and door at the first floor level have been compromised by a later addition which has rendered the door non functional. They are considered Significant. The glazed breezeway connection to O’Brien is considered Non Contributing.

Roof: The building has a red clay barrel tile roofing system. The tile roof is considered Very Significant. There is a flat roof deck at the fifth floor level. It is surrounded by a three foot tall parapet in which are located vents for the attic. The roof is covered with a composition roofing material. The flat roof deck is considered Contributing. The equipment located on this roof is Non Contributing. There is also a flat roof at the tower (@ the sixth floor level). It also has a composition roof. There is a large horizontal opening to air handling units located below. This flat roof is considered Contributing; the equipment located there is Non Contributing.

III. Interior

The interior is, in general, in good original condition. The two stairways, referred to as East and West, are believed to be prefabricated steel stair systems with poured in place concrete treads and are Very Significant. The "battleship" linoleum floor covering is Very Significant where it still exists. The double loaded corridor arrangement with wooden doors and transoms above is considered Very Significant where it is still intact. Further description on a floor by floor basis follows.

Basement: Both the stairways are considered Very Significant. S&S was unable to gain access to any mechanical equipment rooms at this level - these rooms are considered Contributing pending direct observation. See attached Floor Plans for additional information.
First Floor: The stairways are Very Significant. The corridor is Significant - kept only from being Very Significant by the fact that the original floor covering has been altered. The rooms on the North side of the building have been altered and are Non Contributing. The offices (rooms 110-115) on the South side of the building are for the most part in original condition (including hallway doors/transoms) and are Very Significant. They represent the best preserved series of rooms in McLaughlin. See attached Floor Plans for additional information.

Second Floor: The stairways are Very Significant as is the radiator at the West stairwell. The corridor (flooring) has been altered and borders Very Significant / Significant. The rooms on the North side have been altered and are Non Contributing. Room 210 on the South side may be an original classroom; if so, it will be considered Very Significant. The office suite (rooms 215, 215A) are substantially intact and may contain original lighting fixtures. These rooms are Very Significant. The Entry Lobby has travertine floors and walls and is Very Significant with the exception of the exterior doors which are later additions. See attached Floor Plans for additional information.

Third Floor: The stairways are Very Significant as is the radiator at the West stairwell. The majority of offices and classrooms on this floor have been altered and are less than Significant. The exception is the suite of offices (rooms 315, 315a, 316 and 316a) which contain their original finishes and partitions. This suite is Significant. The women's room may also be Significant - original condition and the only women's facilities in the original plan. See attached Floor Plans for additional information.

Fourth Floor: The stairways are Very Significant. The West stair has been altered by the insertion of a door separating it from the corridor - this door is Non Contributing. The original stairwell is intact including marble stalls and wainscoting; it is Very Significant. Other spaces have mostly been altered and are considered Contributing. The exception is the steel stair (room 417) leading up to the fifth floor storage area. It is Significant. Also of note is the electrical equipment closet at the top of the East stair because it provides access to view the attic above. See attached Floor Plans for additional information.

Fifth Floor: Room 501 is Contributing. It is of interest because of the air handling equipment there and the ability to clearly see the structural system of the building in general (concrete floors, brick infill @ exterior and hollow clay tile partition walls @ interior) and the structural system of the tower in particular (more board formed concrete). There is a small door on the western wall of room 501 which provides access to the attic space above the fourth floor. The view of the roof / structural system is important. The roof at the fifth and the sixth floors (roof) have been described in "Exterior." See attached Floor Plans for additional information.
IV. Conclusions (preliminary)

The three primary elevations (East, South and West) are Very Significant and should not be altered. The North elevation, while Significant, might be able to accommodate some change. Relevant to this is the fact that most of the interior spaces on the North side of the central corridor have been altered. Alterations required for seismic retrofit might be located in this area. If re-roofing is done; existing clay tiles should be removed, stored and reinstalled. The interior stairways (East and West) are Very Significant and should not be altered. The interior corridor system with wooden doors and glass transoms should not be altered and, where possible, be restored. Final recommendations will be forthcoming with the full HSR
McLaughlin Hall

Historic Name: Engineering
Architect: George Kelham (1931)

East Elevation
McLaughlin Hall

Historic Name: Engineering

Architect: George Kelham (1931)

DRAFT

West Stair (Detail)
McLaughlin Hall

Historic Name: Engineering
Architect: George Kelham (1931)

Elevations
University of California, McLaughlin Hall
Berkeley, CA

Building Assessment
Report

Prepared for:
Rutherford & Chekene
427 Thirteenth Street
Oakland, CA  94612

Prepared by
Flack+Kurtz Inc.
343 Sansome Street, Suite 450
San Francisco, California 94104

March 15, 2001
I. **HEATING, VENTILATING, AND AIR CONDITIONING**

A. **COLLATERAL IMPACT FROM SEISMIC STRENGTHENING**

The subheadings below reference the seismic upgrade scheme. Refer to the seismic portion of the report for further information.

1. **Basement & Ground Floor Shear Walls**

   The shear walls will affect existing ductwork, piping, and equipment. The ductwork and piping will need to be removed to allow construction of the shear wall then re-installed through new wall penetrations. The major elements impacted by the work are approximately as follows:

   **Basement:**

   Shear wall @ column line 3

   - (1) 24x24 duct and 24x24 grille
   - (1) 4” high pressure steam (HPS) pipes and (1) 2” condensate return pipe
   - (2) 2” low pressure steam (LPS) pipes and (2) 1” condensate return pipes
   - (2) air compressors with approximately 30 gallon compressed air tanks require temporary relocation for construction
   - (1) wall mounted pneumatics air dryer
   - (6) misc. wall mounted equipment switches

   Shear wall @ column line 7

   - (1) 52x36 supply air duct (to Hess Hall)
   - (2) 4” LPS pipes and (2) 2” LPS return condensate pipes
   - 3” LPS pipe and (1) 1”LPS return pipe
   - (2) 4” HPS pipes and (2) 2” return pipes (Hess Hall heat exchanger room)
   - (2) ¼” pneumatic lines
• (1) new access door to heat exchangers (HX-16&17) will be required

• (1) new access door to basement area east of shear wall will be required

Ground Level:

Shear wall @ column line 17
• Should not affect the building’s HVAC system.

2. Steel Brace Frames and Concrete Moment Frame

The concrete moment frames will mostly affect the perimeter radiant heat system. The corridor exhaust ductwork should remain unaffected. Piping and equipment will need to be removed to allow construction of the brace beams and frames and then re-installed as required. The major existing mechanical components impacted by the frame work are approximately as follows:

Ground Level/through Level 3:

Concrete frame @ column lines B&P from column lines 2-7
• (40) existing radiators will need to be demolished and
• (40) new radiators of equivalent capacity and dimensioned to fit between concrete moment frames to replace demolished radiators.
• (12) 2-1/2” LPS risers and (12) 3/4” return condensate risers routed from basement up to Level 3 will need to be relocated/replaced.

3. East Concrete Moment Frame

Ground Level/through Level 3:

• (12) radiators will need to be relocated/replaced
• (3) 2-1/2” LPS risers and (3) ¾” return risers routed from basement up to Level 3 will need to be relocated/replaced.

4. Penthouse Support

Strengthening the beam connections below the penthouse should not affect the building’s HVAC system. Construction of new reinforced concrete walkway on roof will require the temporary disconnection/relocation of chilled water
supply and return piping serving building supplemental cooling systems.
II. PLUMBING/FIRE PROTECTION

A. COLLATERAL IMPACT FROM SEISMIC STRENGTHENING

The subheadings below reference the seismic upgrade scheme. Refer to the seismic portion of the report for further information.

1. Basement & Ground Floor Shear Walls

The shear walls will affect existing plumbing piping. Piping will need to be removed to allow construction of the shear wall then reinstalled through new wall penetrations. The major pipe runs affected by the work are approximately as follows:

**Basement:**

Shear wall @ column line 3

- (1) 3” subsurface drain, (1) 3” storm drain leader, (1) ¾” hose bib
- (1) 4” cold water main, (1) 6” storm drain and (1) 1” cold water.

Shear wall @ column line 7

- (1) 5” sanitary, (2) 4” storm drain, (2) 4” cold water (1) 3” fire water, and (1) 3/4” hot water return.

2. Steel Brace Frames and Concrete Moment Frame

The steel columns @ column line P/3, 4, 5, 6, 7 and B/6, total six (6) locations are located adjacent to the plumbing pipe risers. The proposed beam will impact piping services in exiting shafts and existing stand pipe connectors. The piping will need to be removed to allow construction of the column and steel brace frame, then reinstalled through new wall penetrations.

3. East Concrete Moment Frame

Should have minor impacts on the building’s piping systems.

4. Penthouse Support

Strengthening beam connections in the penthouse should have minor impacts on the building’s piping systems.
III. **ELECTRICAL**

A. **COLLATERAL IMPACT FROM SEISMIC STRENGTHENING**

The subheadings below reference the seismic upgrade scheme. Refer to the seismic portion of the report for further information.

1. **Basement & Ground Floor Shear Walls**

The shear walls will affect existing conduits and equipment. The conduits and the equipment will need to be relocated or removed to allow construction of the shear wall then re-installed through new wall penetrations. The major elements impacted by the work are approximately as follows:

**Basement:**
Shear wall @ column line 3
The work required to create a shear wall at this location will affect major pieces of electrical distribution equipment including the main electrical service.

- (1) 12KV primary load interrupter switch.
- (1) 300KVA 12KV Delta Primary; 208Y/120V Wye Secondary Transformer.
- (8) 4” Conduits
- (3) Recessed Panels
- (6) Misc. wall mounted equipment switches.
- (2) Convenience duplex receptacles.
- (1) Telecom Backboard
- (2) 1” Telecom Conduits

**Shear wall @ column line 7**

- (6) ½” Conduits.
- (1) 100A Electrical Panel: 240V, 3 phase, 3 wire.

**Ground Level:**

Shear wall @ column line 17
- Should have little impact on the electrical system.
2. **Brace Beams and Concrete Moment Frame**
   The brace beams should have minor impact on the electrical systems. The power connection to the mechanical equipment needs to be relocated (See Mechanical description for specific mechanical equipment).

3. **East Concrete Moment Frame**
   Shall have little impact on the electrical system.

4. **Penthouse Support**
   Strengthening the beam connections in the penthouse should have minor impact on the electrical systems. The power connection to the mechanical equipment needs to be relocated (See Mechanical description for specific mechanical equipment).
Rutherford & Chekene, Consulting Engineers
Oakland, CA Phone 510-740-3200
McLaughlin Hall, UC Berkeley
Conceptual Seismic Retrofit Scheme
March 23, 2001 Sheet 2
Rutherford & Chekene, Consulting Engineers
Oakland, CA Phone 510-740-3200
McLaughlin Hall, UC Berkeley
Conceptual Seismic Retrofit Scheme
March 23, 2001
To: Robert Bluhm, UC Capital Projects
    Michael Mohrman, R & S
    Bret Roberts, NBBJ
    Michael Morehead, Flack + Kurtz
From: Bill Holmes
Date: March 9, 2001
Project: McLaughlin Hall Seismic Evaluation
Subject: Preliminary Scheme

We have confirmed the rating to be POOR. Enclosed is a preliminary scheme that shows the extent of work, but not much detail. There are several issues that need to be resolved:

1. Use of diagonal steel braces on the north and south elevations: The south, east and west elevations are considered significant and the decision process to decide if such a scheme is acceptable is unclear to me. The alternative would be to shotcrete the inside face of pier and spandrels to approximately the same extent as the brace system. Both systems would probably disrupt the finishes and plumbing on the inside face of the wall to the same extent. In addition, the offices on the ground level on the south side are in their original configuration and are considered significant. The braces (or concrete) could probably be moved to the bays at the east and west end to accommodate these offices, but at the cost of losing symmetry (seismically, detailing, construction, etc.) with the north side.

2. Many of the interior walls are of clay tile. The 1990 report included replacing them all with steel stud. This obviously would be difficult while saving any of the finishes. Alternates include application of epoxy and fibermesh on one side (away from historic finishes) to form a minimum system to hold them together, or installation of vertical strongbacks. We have noted fibermesh on this scheme. In our opinion, these walls form a significant risk only at the stairwells. Pending further consideration, the solution may be to only provide stability at these locations. Unfortunately, the stairwells are also historically significant, so treatment on the stair side might be problematic.

3. Securing the exterior cladding: The 1990 study included an extensive steel bracing system on the east, west and south walls. I have shown dowels at 2’ oc to tie the inside brick and outside granite together and create a structurally thicker wall (no details of these walls are currently available). We will have to study this more to determine if this thicker wall, coupled with the existing steel columns and beams, will form adequate out-of-plane support for these walls.

4. The geometry involved in getting the main lateral force systems in is complex because of the inconsistent surface of the inside face of exterior walls, and the need to tie through existing steel beams. This complexity should be studied to determine if a steel or concrete system is more economical, as well as for making the final cost estimate.

We are intending to make available a more complete scheme, as well as preliminary Architectural and MEP impact statements, by Friday, March 16. We will be contacting each of you to try to resolve the issues outlined above. We will attempt to have a draft report completed by March 23.