UCLA TFT **Structural Narrative**

Macgowan Hall and Melnitz Hall 10/4/2011 Excerpt from Clive Wilkenson Theatre, Film and Television Master Plan Study)

Introduction

This section presents the results of a seismic reevaluation performed on Macgowan Hall and Melnitz Hall, which are a part of the UCLA School of Theater, Film and Television as well as a discussion of structural system recommendations for the new construction and alterations to the existing buildings. It is proposed to demolish the existing East Melnitz Building; consequently, this building is not discussed in the structural narrative.

Macgowan Hall and Melnitz Hall have been evaluated in prior seismic studies, but these were of limited scope or addressed a specific aspect of the buildings (e.g., the ceilings in the Bridges and Freud Theaters).[1,2,3] Except for the ceiling in the Bridges Theater, these earlier studies rated the buildings as "Fair" in accordance with the then-current University of California Seismic Policy. The ceiling in the Bridges Theater was rated "Poor."

The seismic evaluation was conducted in accordance with the general requirements in ASCE 31[4] and Chapter 34 of the *2010 California Building Code.*

Macgowan Hall

Macgowan Hall (Theater Arts Unit 1) was constructed based on drawings prepared by Charles Luckman Associates, architects, and Hillman & Nowell, structural engineers, dated August 1, 1960. The existing building consists of three sections, although they are not structurally separate: the Office Building (Lines A through E) and Theater and Dressing Room Building (Lines E though V') and the Construction Building (Lines J through V north of the Theater Building).

The Office Building is a three-story structure with a typical floor-to-floor height of 10'-8". The Second Floor only covers part of the Office Building footprint to allow for two-story spaces east of Line B. the Third Floor also covers only a portion of the building footprint. Foundations consist of a combination of spread footings and belled caissons. Generally, foundations bear approximately 10 feet below the First Floor. The vertical load carrying system consists of reinforced brick masonry bearing walls, reinforced concrete bearing walls and concrete columns supporting reinforced concrete floor and roof slabs. Lateral loads are resisted using the brick and concrete walls and the concrete floor and roof diaphragms. The shear walls on the north and south limits of the building, Lines 1 and 10, respectively, are nearly solid. The west wall along Line A is pierced by many regularly spaced openings, but the remaining wall piers represent a significant amount of concrete wall.

The Theater and Dressing Room Building (Theater Building) is a one-story structure with mezzanines, catwalk and gridiron framing and a partial basement. The overall height of the building varies due to the different uses. Except at the theaters, the roof is approximately 18 feet. The theater roof heights vary from approximately 30 feet over the seating areas to approximately 50 to 80 feet over the stage houses. The mezzanine is 14 feet above the First Floor. Foundations consist of a combination of spread footings and belled caissons. Generally, foundations bear approximately 10 feet below the First Floor or Basement. The vertical load carrying system consists of reinforced brick masonry bearing walls, reinforced concrete bearing walls and concrete columns. The theater roofs are constructed of steel beams, tapered steel girders or steel trusses supporting a concrete slab. The mezzanine, catwalks and gridiron framing are constructed of steel columns, steel beams and a concrete floor slab or grating. Lateral loads are resisted using the brick and concrete walls and the concrete floor and roof diaphragms. Except for door openings,

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[1] Englekirk & Sabol, Inc., 1998 Preliminary Seismic Evaluation, MacGowan Hall (Freud Theater) Ceiling, December 1998.
[2] Englekirk & Sabol, Inc., 1998 Preliminary Seismic Evaluation, Melnitz (Bridges) Theater Ceiling, December 1998.
[3] Campus Seismic Study, 2000.
[4] American Society of Civil Engineers/Structural Engineering Institute (ASCE/SEI), Seismic Evaluation of Existing Buildings (ASCE/SEI 31-03).

the shear walls are generally continuous.

The Construction Building is a one-story structure with a mezzanine between Lines K and N and a partial basement east of Line U. The overall height of the building is approximately 32 feet and the mezzanine is 14 feet above the First Floor. Foundations consist of a combination of spread footings and belled caissons. Generally, foundations bear approximately 10 feet below the First Floor. The vertical load carrying system consists of reinforced brick masonry bearing walls, reinforced concrete bearing walls and concrete columns. The roof is constructed of steel beams and steel trusses supporting a concrete slab. The mezzanine is constructed of steel columns, steel beams and a concrete floor slab. Lateral loads are resisted using the brick and concrete walls and the concrete floor and roof diaphragms.

Melnitz Hall

Melnitz Hall (Theater Arts Unit 2) was constructed based on drawings prepared by Charles Luckman Associates, architects, and Erkel/Greenfield, structural engineers, dated December 10, 1965.

Melnitz Hall is a two-story structure, although the existing studios and Bridges Theater are two-story spaces. As a result, the Second Floor only covers part of the building footprint, generally to the north of Line E. There is also a partial basement beneath the Bridges Theater and the two-story section of the building. Foundations consist of drilled, cast-in-place concrete piles. Pile lengths vary due to applied loads but generally range from 20 to 35 feet long. Since the floor slabs-on-grade in the studios are separated from the walls for acoustical purposes, tie beams between the piles are used to provide lateral support. The vertical load carrying system consists of reinforced brick masonry bearing walls, reinforced concrete bearing walls and concrete and steel columns supporting steel beams and concrete floor and roof slabs. Tapered steel girders span over the Bridges Theater, studios and a portion of the north part of the building. Lateral loads are resisted using the brick and concrete walls and the concrete floor and roof diaphragms. Between the studios, there are double concrete walls for acoustical purposes, although the walls are tied together at the roof.

Seismic Ratings

Based upon a review of the buildings using ASCE 31, Macgowan Hall and Melnitz Hall qualify for a Seismic Rating of IV using the current UC Seismic Policy rating system, except as noted below. This is equivalent to the prior ratings of “Fair.”

Both buildings have complex geometries with respect to building footprint and building elevation. These geometries complicate seismic load paths and dynamic response. For example, the Office Building of Macgowan Hall contains a combination of one-and two-story spaces and is connected to the adjacent Theater Building through a relatively small section of common slab. The Theater Building of Macgowan Hall roof levels vary significantly because of the need for taller spaces over the stage house. The studios in Melnitz Hall introduce two-story high spaces into a large section of the building.

Generally speaking, the seismic detailing in both buildings is typical of reinforced concrete and masonry structures constructed in the 1960s.Column ties, for example, are widely spaced (e.g., typically at 12 in. on center) and are closed with 90-degree hooks. Concrete and masonry shear walls are relatively lightly reinforced without significant confinement at the boundary elements. Lap splices between the foundations and the walls or within the concrete or masonry elements are short by current standards.

Balanced against the complex building geometries and detailing deficiencies is an abundance of generally well-distributed concrete and masonry shear walls. The nature of the buildings’ use as theater, studio and craft space results in generally continuous walls, except for a limited number of doors and windows in the office sections. As a result, the seismic demands on a majority of the shear walls are relatively modest. On balance, the low demand on most of the shear walls is the basis for confirming the general seismic rating of IV for Macgowan Hall and Melnitz Hall, except as noted below.

Following the partial collapse of the plaster ceiling in the Freud Theater during the 1994 Northridge Earthquake, the ceiling was more securely attached to the supporting roof structure. It is for this reason that that ceiling of the Freud Theater was rated “Fair.” The Bridges Theater ceiling was rated “Poor” due to the lack of a reliable seismic connection as a part of the sound and vibration control system. It is not known whether repairs similar to those performed at the Freud Theater were performed to the ceiling in the Bridges Theater. It is for this reason the ceiling of the Bridges Theater retains a rating of “Poor,” which is equivalent to a Seismic Rating of V in using the current UC Seismic Policy rating system.

Recommended Seismic Upgrade Work

Although the buildings, as a whole, qualify for a Seismic Rating of IV, we recommend the following seismic upgrade work as a part of the proposed project:

1. **Bridges Theater Ceiling:** The connections supporting the Bridges Theater ceiling should be examined to determine whether post-Northridge Earthquake upgrades were performed to address deficiencies identified in the 1998 seismic evaluation. If upgraded connections have not been performed, it is recommended that these be undertaken as a part of the proposed project. The recommended upgrade may utilize a supplemental anchorage system that provides some slack to preserve the acoustical properties of the existing ceiling but would become active should the primary anchorage fail. For estimating purposes, we recommend that these supplemental anchors be installed with a tributary area of 12 SF and would consist of aircraft cable looped around the existing ceiling framing and anchored to the existing concrete roof structure with post installed anchors. The cable should be left slack with approximately an inch of play and may be isolated from the ceiling framing using flexible foam insulation similar to that used to insulate hot water piping. An allowance should be provided to allow for access to the ceiling space. Alternatively, the ceiling can be reconstructed.

2. **Anchorage of Long-Span Structure to Walls**: Given the level of investment proposed in the existing buildings, it is recommended that an allowance be included to improve the anchorage of the long-span framing (e.g., beams and trusses) to the existing walls. Generally, this work consists of providing additional steel plates and angles at the existing support points for the framing. This work is recommended in the Little Theater, Freud Theater, Bridges Theater, Scene Shop, Dance Studio, Digital Studio of the Future (Black Box Theater), and Small Theater/Classroom Sound Stages 1 through 3, TV Studio 1 and Library of Alexandria (Rehearsal Space). For estimating purposes, we recommend that it be assumed that these supplemental anchors occur at 10 ft. on center along the two longest walls of the space.

3. **Other Upgrade Work:** Where existing structure is to be altered to accommodate new programming, seismic upgrade work will be required to maintain the seismic rating. For example, this would apply to changes related to the Café and Mash-Up, the interconnection adjacent to the Bridges Theater Lobby, the addition of the new floors in Melnitz Hall (i.e., the new Third and Fourth Floors), expanded Third Floor in the Office Building. The extent of the upgrade work would depend upon the final configuration of the alterations, but for budgeting purposes it is recommended that an allowance be included to replace existing walls and foundations in-kind and upgrade the shear walls in the areas impacted.

from one floor to the next of the new buildings. In addition, SMF systems utilizing deep columns have proven to be cost-effective compared to braced systems in similar buildings.

The height of the screening facility in the south building would have to be considered in developing final recommendations for seismically bracing this building. Braced frame systems may be feasible in this area, particularly since the common wall between Macgowan Hall and the south addition may provide an opportunity to introduce braced frames.

For the purposes of developing a structural budget, the recommended structural steel unit weight for the buildings is estimated to be on the order of 20 to 23 pounds per square foot for elevated structure due to tall spaces in both the north and south additions and the relatively small floor plates.

As an alternative to the structural steel system, a cast-in-place concrete system or a precast concrete system could be used to resist gravity and seismic loads. Concrete systems often result in a thinner structural envelope, better vibration control, and may provide better acoustical separation from one floor to another. Concrete schemes will result in increased building mass and increased foundation loads and generally allow for less architectural flexibility unless a beam and slab system is used, which is expected to be relatively more expensive than a flat slab concrete slab. It is for these reasons that a concrete structural system is not currently recommended.

New construction within the existing buildings is recommended to consist of structural steel to reduce the additional weight of the added floor area. This will be important when evaluating the existing foundations, particularly in Melnitz Hall due to the addition of significant new floor area. A similar situation occurs in the Office Building of Macgowan Hall where a new floor is proposed. It is likely that the added floor area in Melnitz Hall will trigger a required seismic analysis per Chapter 34; this is less likely in Macgowan Hall since the added floor area is relatively modest. Although there is a significant amount of shear wall in Melnitz Hall, an allowance for additional shear walls and foundations in the area of the new floor space should be included in the construction budget. An appropriate premium for adding foundations within a building supported on drilled piles should be included.