CONSULTING
ENGINEERS

TRABUE, HANSEN & HINSHAW, Inc.

1901 Pennsylvania Drive
Columbia, MO 65202

February 23, 2014

Mr. Larry Hubbard
Director of Campus Facilities
Plan, Design & Construction
E111 General Services Building
Columbia, MO 65211

Re: University Village Apartments Partial Walkway Collapse
Structural Engineering Evaluation

***THHinc** #pending*

Mr. Hubbard,

The purpose of this correspondence is to describe the observed conditions at the University Village apartment complex located at 601 S. Providence Rd., and to provide recommendations for any temporary shoring that may be required.

Around 5:45 am on February 22, 2014 ***THHinc*** responded to your request for emergency structural engineering assistance related to an incident involving a structure collapse. Representing ***THHinc*** onsite were Kris L. Bezenek, PE, T. Patrick Earney, PE, Thomas A. Trabue, PE and Thomas P. Wells, PE. Upon arrival our team performed a visual observation of the partial walkway collapse at building 707 and subsequently each of the other buildings in the University Village apartment complex. Additionally, the condition of several other buildings maintained by Residential Life was evaluated as well.

A portion of the building 707 walkway at the east end had collapsed and was found to be resting, upside down on the walkway below. It is believed that the failure originated near the exterior channel support framing which then resulted in the loss of structural support for the elevated concrete walkway. See the attached sketch SK1 that represents the assumed failure mode & geometry of the incident.

Once the assumed cause was identified ***THHinc*** developed a shoring system that would provide temporary support for the remaining portions of the walkway. The purpose of this framing was to prevent additional damage and to allow for escorted, short-term access into the dwelling units so that personal belongings could be retrieved. Reference sketch SK2. The interior of a second story unit was observed and, although no related damaged was noted, it was recommended that this building should not be occupied in its current condition.

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Once the evaluation of building 707 was complete the attention turned to the remaining structures in the complex. The exterior of each of the remaining thirteen (13) buildings was observed for potential eminent structural problems with specific attention paid to the elevated walkway framing. During the observation the only noted items of concern were related to the walkway support framing. Each of the buildings was assigned to one of three categories depending on the conditions observed: Immediate, Necessary and Suggested.

Immediate – Buildings 602, 604 & 709

In general the load-carrying capacity of at least portions of the walkway framing observed in this category was very questionable. Some areas of complete section loss of the steel and concrete deck were found and, unless remedial action is taken, a catastrophic collapse could be imminent. The wood shoring represented on sketch SK2 was installed immediately to allow for the continued occupation of the dwelling units. Additionally, the channel lateral bracing shown on SK2 is recommended to be installed relatively soon (i.e. within 6-weeks) to help prevent additional lateral and torsional movement of the exterior channel and supported guardrail.

Necessary – Buildings 605, 701 & 706

In general the load-carrying capacity of at least portions of the walkway framing observed in this category was very questionable. The wood shoring represented on sketch SK2 was recommended to be installed as soon as possible to allow for the continued occupation of the dwelling units. Additionally, the channel lateral bracing shown on SK2 is recommended to be installed relatively soon (i.e. within 6-weeks) to help prevent additional lateral and torsional movement of the exterior channel and supported guardrail.

Suggested – Buildings 601, 603, 704, 705 & 708

Although the walkway framing of buildings 601 and 603 was found to be somewhat deteriorated, sufficient section remained so that a catastrophic failure in the relatively near future (i.e. 1-year) is not likely.

The walkway framing for buildings 704, 705 and 708 was observed to be in very poor condition and would otherwise have been classified in the immediate category. However, these buildings have been taken out of service and are not currently occupied by the general public. Some of the rooms are being used to store various materials and, if the Owner wishes to continue this activity and allow access even if only by staff, then the temporary wood shoring should be installed. Otherwise, in order to protect the welfare of the general public, the front portions of the buildings (in the vicinity of the elevated walkways) should be roped off to prevent unintended access.

In any case, if excess twist or sweep of the exterior walkway channel is observed, the lateral brace detail should be installed.

In addition to the University Village complex, the Owner asked that all of the buildings maintained by Residential Life be visually evaluated as well. The Owner's representatives onsite were consulted and it was determined that, in general, buildings that had been constructed or completely renovated within the past 10-years could be excluded from those requiring immediate attention. Although most all of the Residential Life buildings were evaluated by at least a "windshield observation" the following were specifically targeted for a more complete exterior evaluation.

With respect to conditions that may result in a public safety concern, no instances of items requiring immediate attention were observed. Some general maintenance items were noted as described below:

University Heights

The University Heights complex consists of four (4) buildings of the same geometry and construction type. In each building the center stair structure consists of concrete stair supported on a central column. The landing and upper deck are hollow-core sections with concrete topping. No structural support issues or failure noted, and no need for auxiliary support. There are maintenance issues that should be addressed: rail sections are not attached at wall and rail impact has caused cracking in outer stair landing surface. Vertical posts are also undersized. Cracks on hollow core sides should be grouted and sealed to protect steel. Some exposed bar ends on stair landings.

Manor Hall

Manor Hall is an 8-story apartment building. Only observed items were related to loose stone window lintels. Each lintel should be evaluated and, if any are found to be loose, they should be re-grouted in place.

Tara Apartments

The Tara Apartments are wood frame buildings with rear decks extending from floor framing as cantilevered structures. No distress was found but isolated areas where noted where the end connection is irregular. Front deck joists are supported by the building framing on the inner ends and by column and beam assemblies on outer ends. One unit evidently had some separation issues, and an all-thread tie with turnbuckle was placed to prevent outward movement. No current problems observed and no need for remedial action.

Hatch / Bingham / Schurz

No observed exterior structural concerns.

Defoe-Graham / Hawthorne

No observed exterior structural concerns.

Gillett / Rollins / Hudson

No observed exterior structural concerns.

Johnston / Wolpers

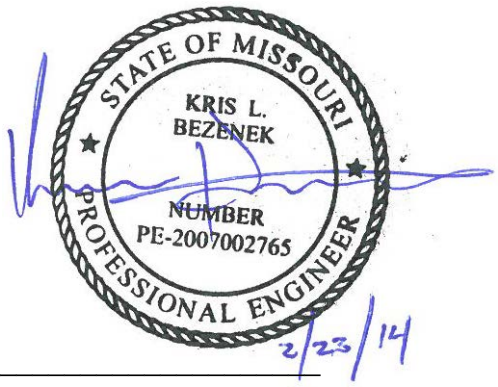
No observed exterior structural concerns – currently under renovation.

Jones / Laws / Lathrop

The three (3) residence halls have central decks at their stair core areas. These are inset and supported on full spanning beams at their outer edges. They have wooden substructure and drains that carry water away to internal piping. No observable structural defects noted.

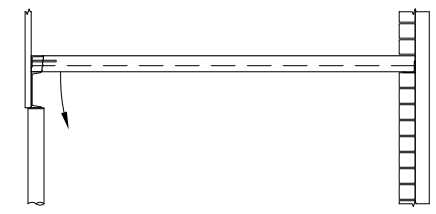
Please feel free to let us know if anything additional is required.

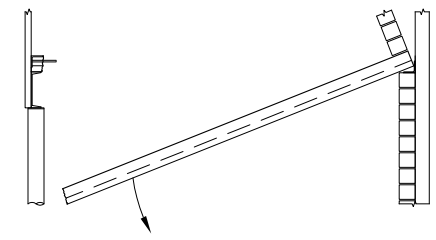
Sincerely,

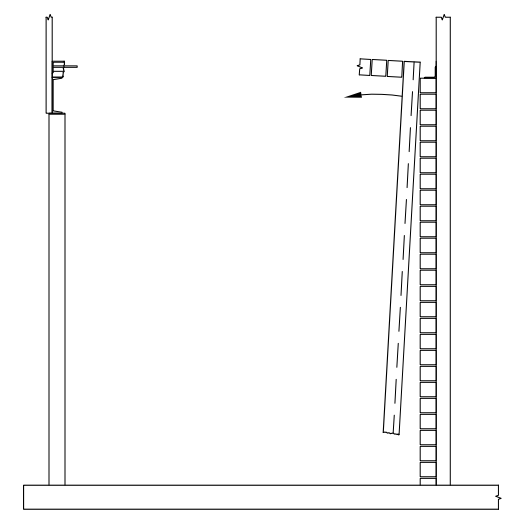


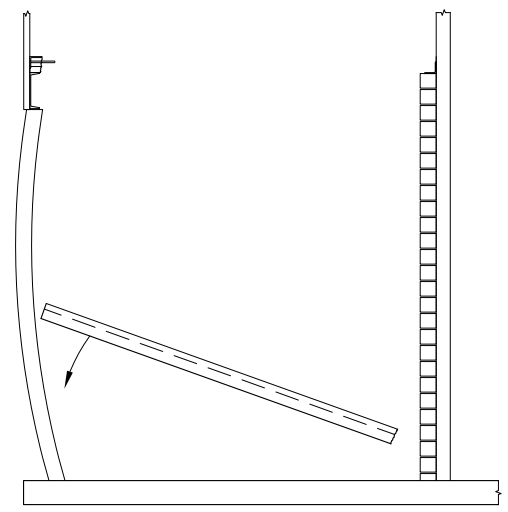

Kris L. Bezenek, PE, MLSE
Structural Team Leader / Principal

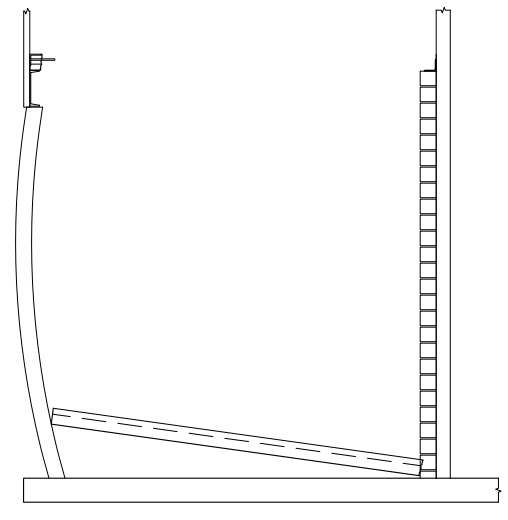
Attached: SK1 – Sketch of Walkway Failure Mode
SK2 – Required Temporary Shoring











1 SK1 Assumed Schematic Walkway Failure Mode

1/4" = 1'-0"

STATE OF MISSOURI
KRIS L. BEZENEK
NUMBER PE-2007002765
PROFESSIONAL ENGINEER
2/23/14

*University of Missouri*

*University Village Walkway Collapse*
*Columbia, Missouri*

Assumed Walkway Failure Mode

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Client Proj # pending
THHinc Proj # pending
Engineer: KLB
Designer: ---
Drafter: ---
Plotted: 2/22/2014

DWG. SK1
SHT. 1 OF 1

Revisions

| No. | Date | Description | Initials |
|---|---|---|---|
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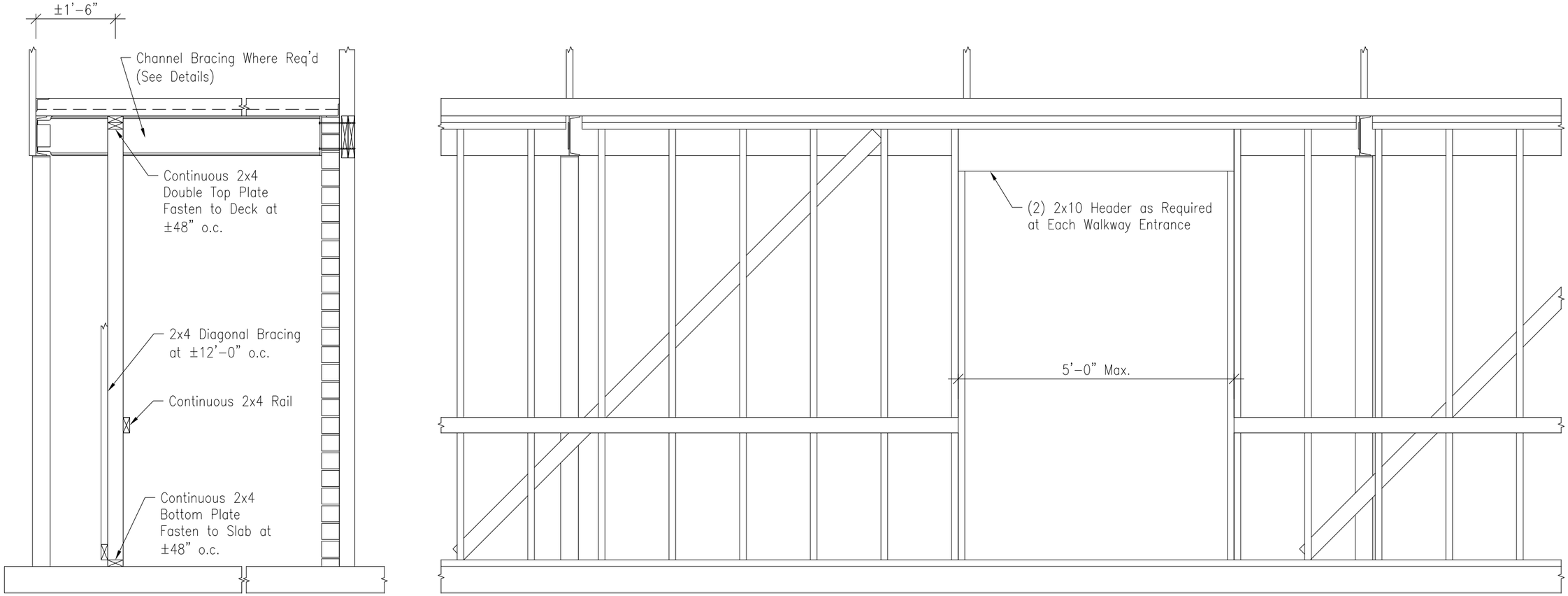
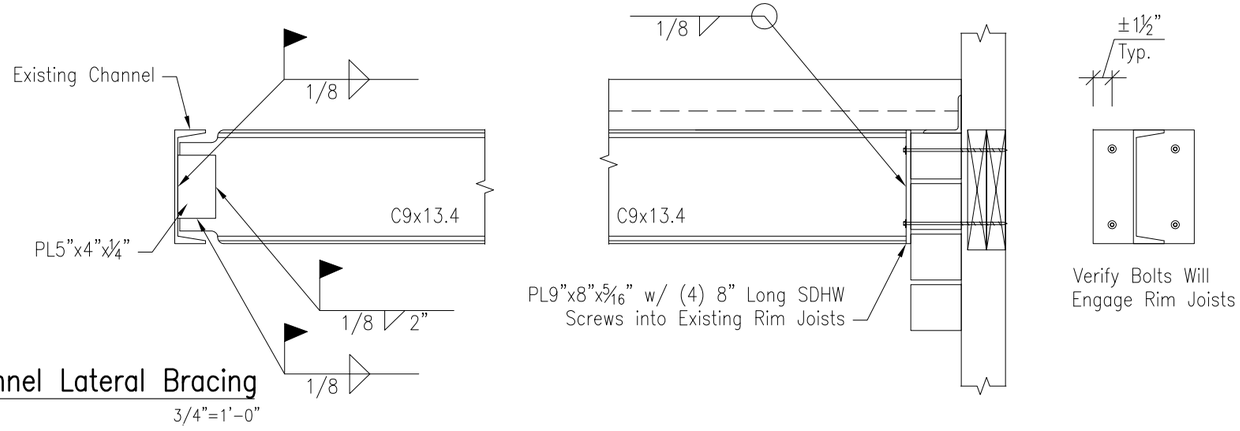



## 1 SK2 Temporary Shoring

1/2" = 1'-0"




## 2 SK2 Channel Lateral Bracing

3/4"=1'-0"

Channel bracing required at locations where temporary shoring is intended to allow for normal occupancy and will remain in place for an extended period of time. This specific requirement applies to Buildings 602, 604, 605, 701, 706 & 709 ONLY. Install channel bracing at or near existing columns and notch through temporary wood-framed shoring. Additional braces may be necessary between the columns to control excessive twist or sweep of the existing channels.


| Revisions | | | |
|---|---|---|---|
| No. | Date | Description | Initials |

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University of Missouri
University Village Walkway Collapse
Columbia, Missouri

Temporary Walkway Shoring

| | |
|---|---|
| Client Proj # | pending |
| THHinc Proj # | pending |
| Engineer: | KLB |
| Designer: | --- |
| Drafter: | --- |
| Plotted: | 2/22/2014 |

DWG. SK2

SHT. 1 OF 1