A Summary of Reconnaissance of the Clinton, MO Elks Lodge Building Collapse on June 26, 2006

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Content submitted to and published by:
International Journal of Web Services Research
July 2006

U.S. Department of Commerce
Carlos Gutierrez, Secretary

National Institute of Standards and Technology
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NIST National Institute of Standards and Technology • U.S. Department of Commerce

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The Event

- A three-story unreinforced brick building in Clinton, MO. collapsed on June 26, 2006 causing one fatality. The building was built in the 1880s.
- Two NIST structural engineers visited the collapse site on June 29, 2006.
- The NIST engineers inspected the collapsed building. They met with the city mayor, the city administrator, and a building official of Clinton to obtain relevant building information and available records. They were informed by the building official that drawings of the collapsed building are not available as the building was constructed in the 1880s.
- The NIST engineers also obtained general information regarding the occupancy, the history of the building, and the collapse from Clinton emergency responders, structural engineers retained by the insurance companies that underwrote policies for the Elks Lodge building and an adjacent pharmacy building, as well as eye witnesses and a survivor who was on the second floor of the building at the time of collapse. This individual owned the store on the first floor of the collapsed building.
- According to information from Clinton city officials and emergency responders, there were about 50 people on the second floor for a dinner function of the Elks Lodge at the time of the collapse.

The following summarizes the NIST reconnaissance:

The Building

- The NIST engineers made photographic documentation of the collapsed and adjacent buildings, and took measurements of structural members and overall structural layout of the building to the extent possible. The engineers also obtained photographs from the structural engineers retained by two insurance companies after the floor and roof debris had been removed. (See attached photographs.)
- Information on the structural system of the Elks Lodge building was determined based on examination of the framing system of the first and second floors and the basement of the pharmacy building immediately to the west (which was built at about the same time as the collapsed building). The building has a floor plan of about 40 ft wide (in the east-west direction) x 120 ft deep (in the north-south direction). The upper two stories were occupied by the Clinton Elks Lodge. The first floor was occupied by the Cummings Men's Wear store (see photograph 1). The floors were comprised of wood planks supported on wood joists. On the second and third floors, these wood joists were supported on the 13-in brick bearing wall at one end, and on wood beams spanning between cast iron columns at the other end. The cast iron columns were located at mid point between the bearing walls located at the two sides of the building, which were about 40 ft

apart. The columns were spaced along the length of the building (the north-south direction) at about 18 feet on center (o.c.). The third story was an open floor, i.e., there was no cast iron column between the two brick bearing walls on the third floor, and the roof joists spanned between the two brick bearing walls. The brick bearing walls were common walls shared by the adjacent buildings, thus the floor and roof joists of the adjacent buildings were also supported by the common wall.

The Collapse

- The east wall of the Elks Lodge building remained mostly intact at the time of collapse, whereas the west wall collapsed totally causing all three floors and the roof of the building to collapse. Because the west wall was a common wall, the collapse of the west wall also caused extensive damage and partial collapse to the adjacent building (Kreisler Drug Pharmacy).
- During the reconnaissance, it was noted that the lime-based mortar of the west wall had signs of extensive deterioration (crumbled easily by rubbing between two fingers and did not appear to have any cohesive strength).
- Photographs taken after removal of the floor debris showed that (1) a large portion of the west wall had disintegrated into individual loose bricks (see photograph 2), (2) many bricks either cracked or broke into smaller pieces, and (3) the lower portion of the west brick wall was wet due to exposure to moisture which would have caused deterioration of the lime-based mortar joints (see photographs 3 and 4). These observations indicate that the west wall was not acting as a single-wall unit at the time of collapse. Rather, it was likely that the deterioration of the mortar joints led to the floor joist loads being carried by individual bricks that were in direct contact with the floor joists. This possibly led to failure of individual bricks (which cracked and broke into smaller pieces) and of the entire west wall progressively. The failure of the west wall resulted in loss of the support for the floors, which ultimately led to the collapse of the entire Elks Lodge building.
- The owner of Cummings Men's Wear store who was on the second floor toward the rear of the building (north end) at the time of collapse had heard a loud sound emanating from the west wall, and observed the collapse of the second floor initiating at the west wall. This corroborates the failure of the west wall as the likely initiating factor that led to the collapse of the Elks Lodge building.

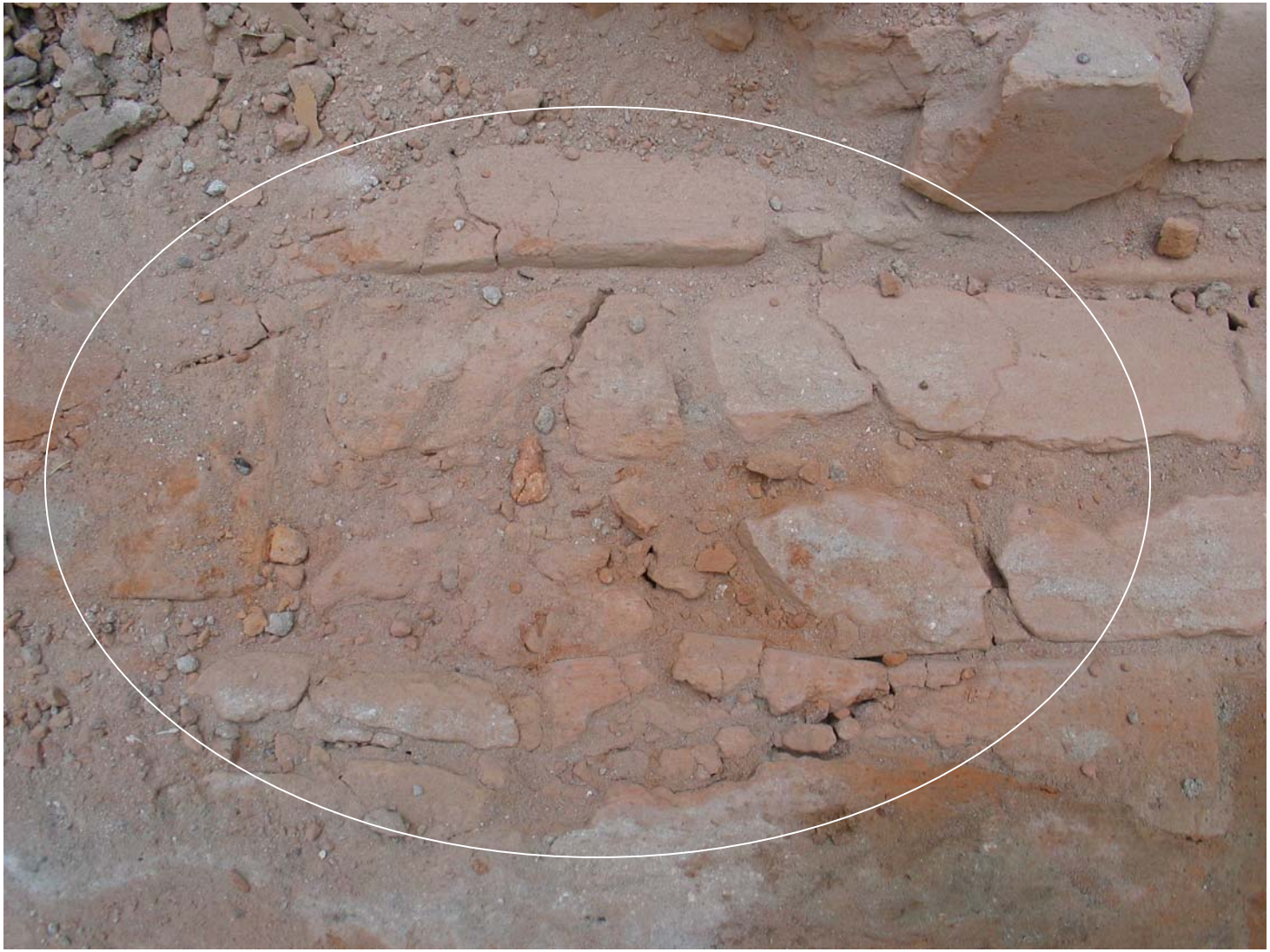
The Conclusion:

Based on the evidence and our engineering judgment, this failure is unique to this particular building, which is over 100 years old. Based on visual and photographic evidence, it was likely that moisture led to significant deterioration of the lime-based mortar joints. This likely led to the loss of the bearing capacity of the west wall resulting in the collapse of the Elks Lodge building. As such, and given the age and type of construction of the building, no further structural investigation is warranted. Our independently determined findings are consistent with those of engineers for the two insurance companies.

Photograph 1. Front of the Elks Lodge building immediately after the collapse (Photo courtesy of Robert Easton, Director, Henry County Emergency Management Agency, Clinton, MO.)

Photograph 2. Remnants of the west wall showing individual bricks, broken and pulverized (Note: no wall segments remained. Photo courtesy of Tim Gardner, Executive General Adjuster, Regional Manager, NHI General Adjusters)

Photograph 3. Base of the west wall with signs of wetness and cracks (Photo courtesy of Tim Gardner, Executive General Adjuster, Regional Manager, NHI General Adjusters)



Photograph 4. Close up view of the base of the west wall showing cracked and wet bricks (Photo courtesy of Tim Gardner, Executive General Adjuster, Regional Manager, NHI General Adjusters)