NGA Glazing Executives Forum

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Atlanta, GA
glassbuild.com

Lessons Learned: Risk Management Case Studies

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Smith Cashion & Orr, PLC

Understanding Standard of Care

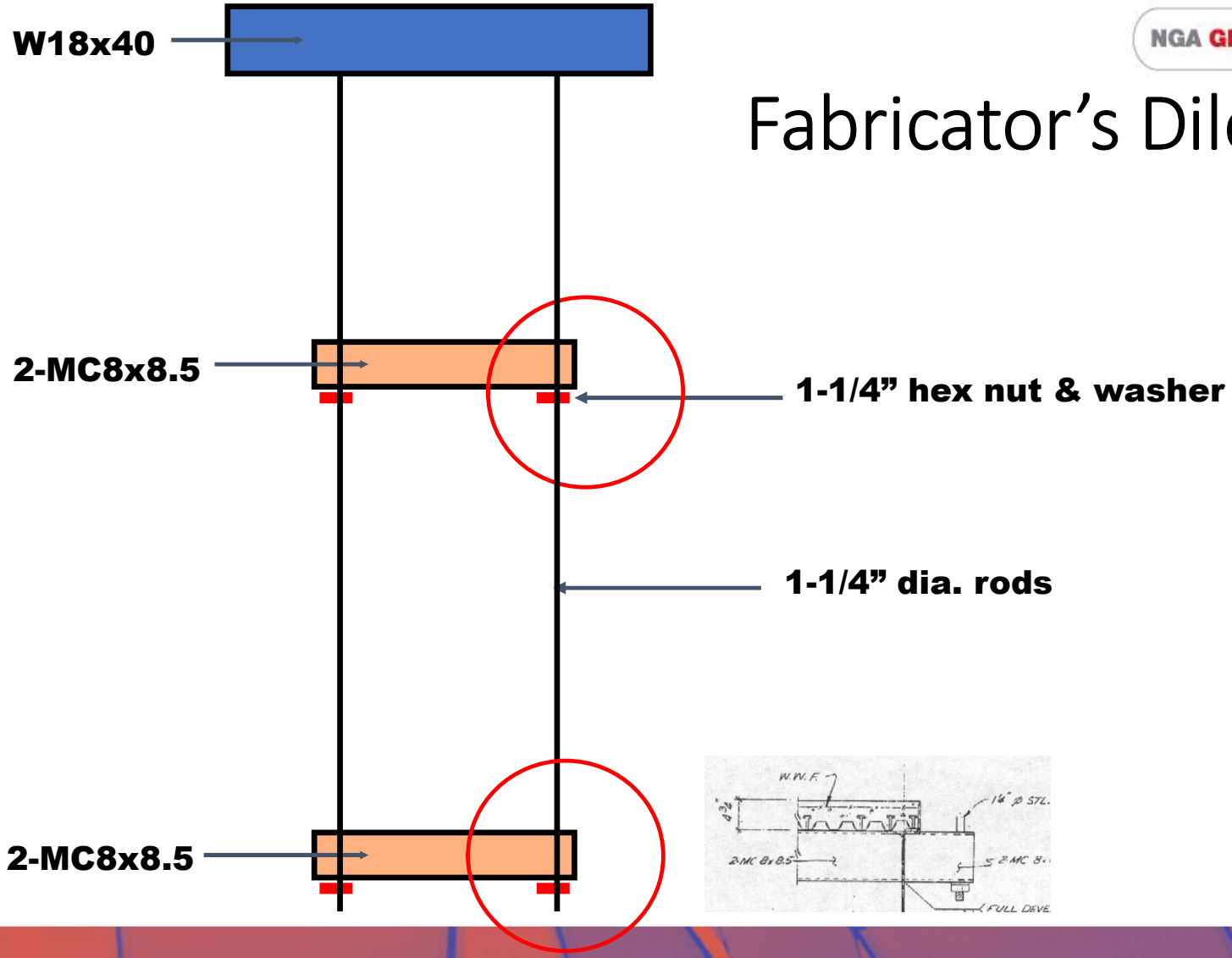
- Standard of professional care – one will be judged according to the standard of care required by their profession

  - **"one who undertakes to render services in the practice of a profession or trade is required to exercise the skill and knowledge normally possessed by members of that profession or trade in good standing in similar communities."**
    - Martin v. Barge Waggoner, 894 S.W.2d 750, 751 (1991)

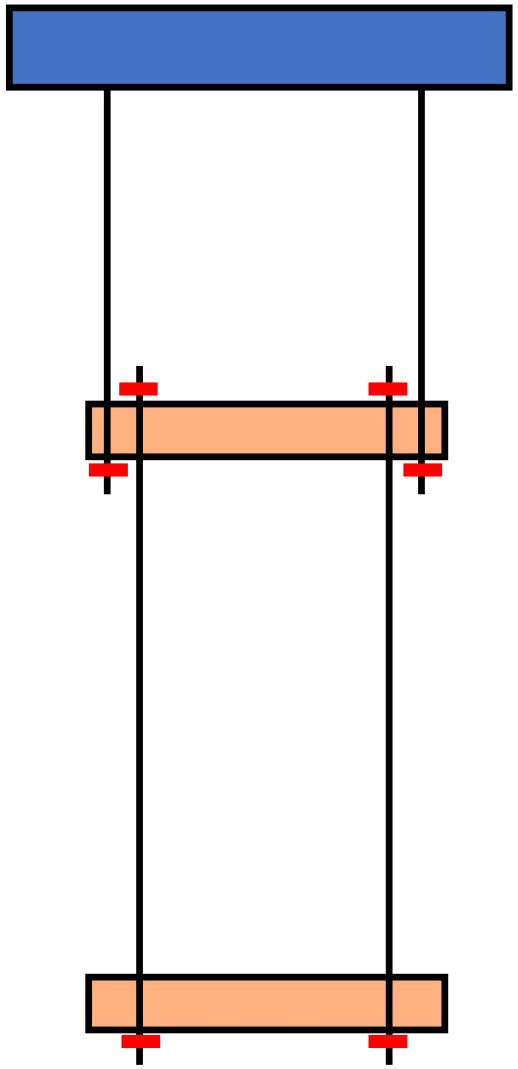
Hyatt Skywalk Collapse (July 17, 1981)

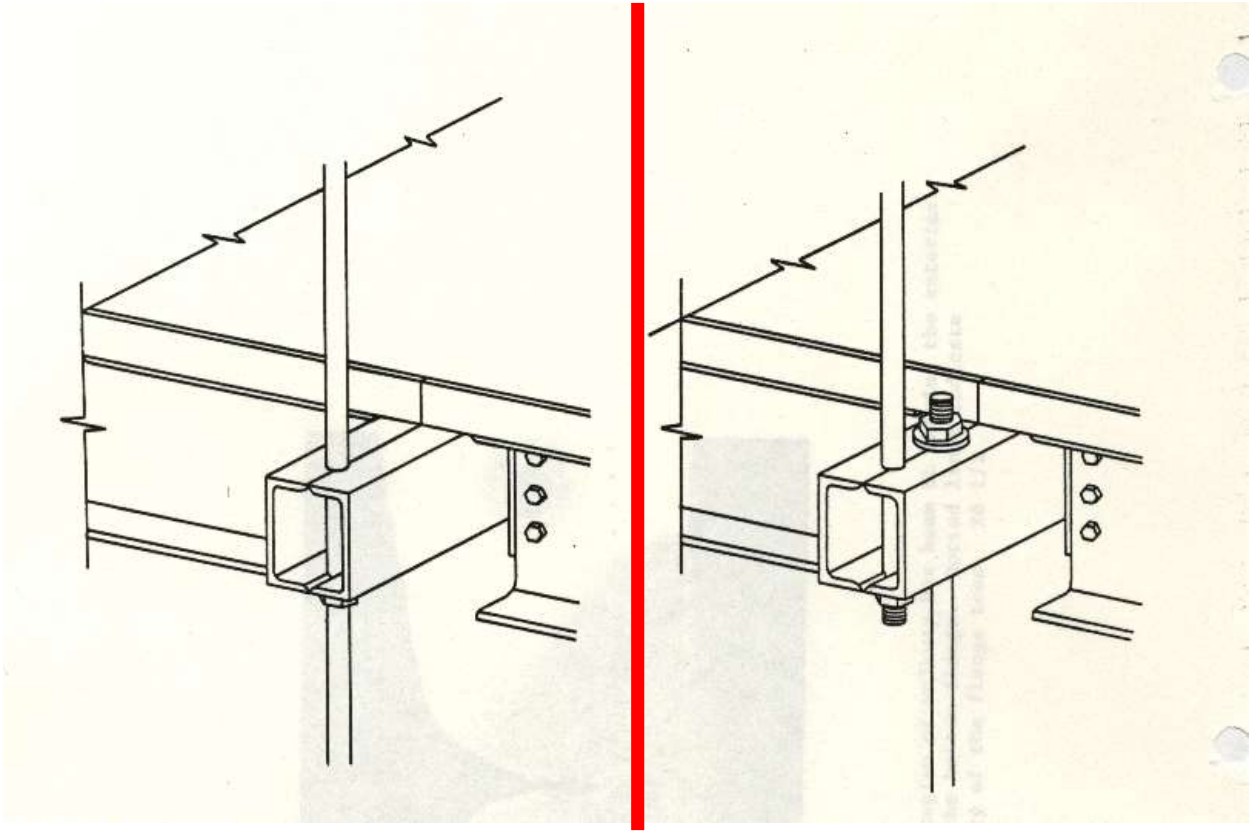
Bill Quatman, General Counsel, Burns & McDonnell Engineering Co., Inc.

Fabricator's Dilemma



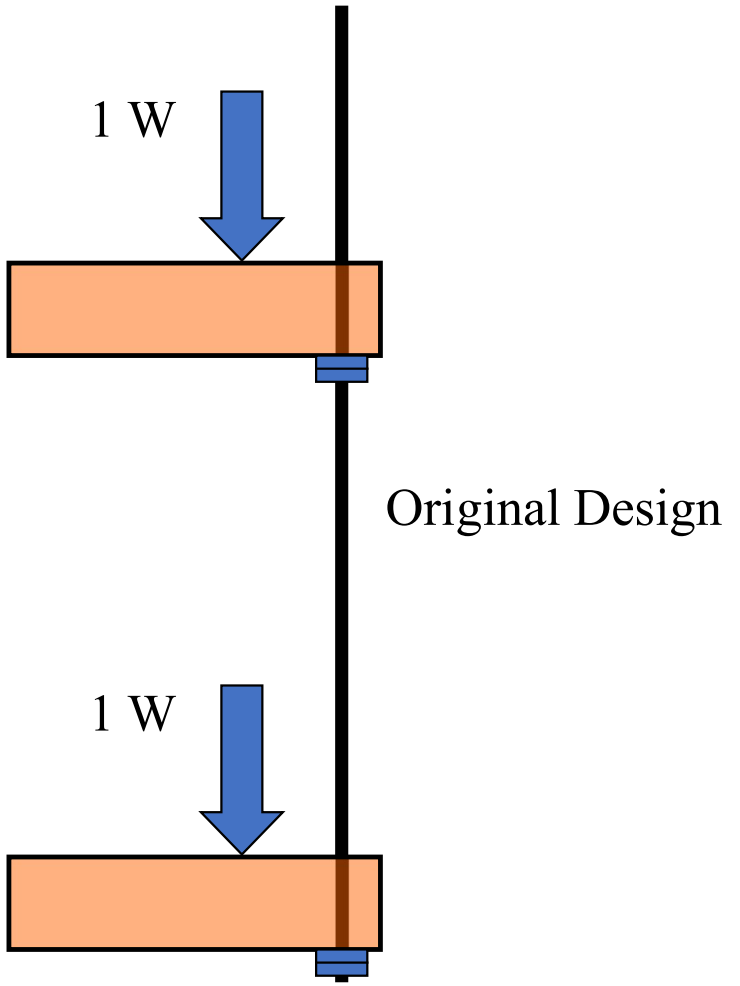
Dan Duncan's Solution



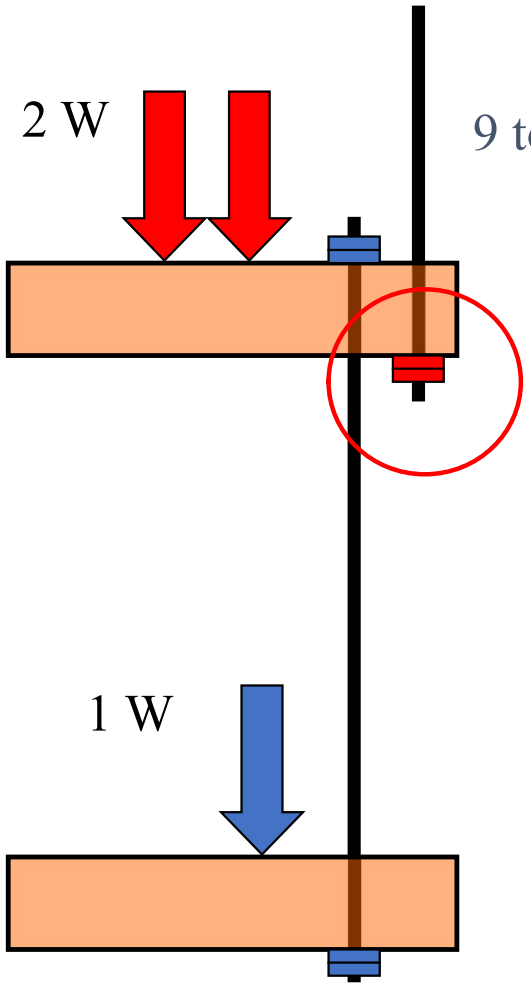


Original Single-Rod Design Concept

Revised Two-Rod Connection Design



Original Design



Revised Design

fire. Staub added.

85 die when walkways fall at hotel

By ROBERT MACY
Associated Press Writer

KANSAS CITY, Mo (AP) — Rescue teams gingerly moved crumpled steel beams early today and freed 10 people trapped under two "sky bridges" that crashed onto a crowded dance floor at the Hyatt Regency Hotel, killing 85 and injuring more than 140, police said.

"At this point, it looks as if no one else in there is alive," said Jerry Jette, an administrative assistant to Mayor Richard Berkley.

Police spokesman Sgt. Jim Treece set the official death toll at 85.

Jette said that 142 people were injured in the collapse and were taken to area hospitals where three later died. Sixty-two people required hospitalization.

Rescue workers used cranes, torches and saws into the early-morning hours to cut through the tons of metal and concrete and reach those

Courtesy Kansas City Star

ENR News
The McGraw-Hill Construction Weekly
November 21, 1985

Hyatt engineers found 'guilty' of negligence

The two St. Louis structural engineers who designed the Hyatt Regency hotel walkways showed "conscious indifference" to their professional duties, a Missouri judge ruled last week. They should be punished for the 1981 collapse in Kansas City that claimed 114 lives, he said.

The two engineers, Jack D. Gillum and Daniel M. Duncan, as well as their firm, GCE International, Inc., abdicated their responsibility to review shop drawings of the critical steel-to-steel connections that failed, said James B. Deutsch, a Missouri administrative law judge. The decision comes 14 months after the conclusion of a 26-day hearing into allegations of gross negligence and misconduct (ENR 9/27/84 p. 10). The charges were leveled in 1984 by the Missouri Board for Architects, Professional Engineers and Land Surveyors. The engineers could lose their licenses to practice in the state.

The board is expected to schedule a disciplinary hearing before the end of the year. It will determine, based on the judge's findings, whether to reprimand the engineers, suspend them from practice or permanently revoke their licenses. Revocation in Missouri could lead to revocation in other states.

Patrick McLarney, an attorney for the licensing board, says the finding "is a personal tragedy for Dan Duncan and Jack Gillum. But it will do a lot toward straightening out confusion in the industry."

In a written statement issued hours after the report was made public, Gillum and Duncan said, "We are shocked and dismayed by the findings. We continue to believe we have always conformed to the highest standards of professional conduct.

"The decision appears to be telling design and construction professionals . . . that the structural engineer is responsible for each and every item of design, fabrication and construction even though the structural engineer does not design all items nor is he on the job site with authority to control the quality of construction."

Gillum: Shocked and dismayed by the findings.

Duncan: Firm "spot-checked" shop drawings.

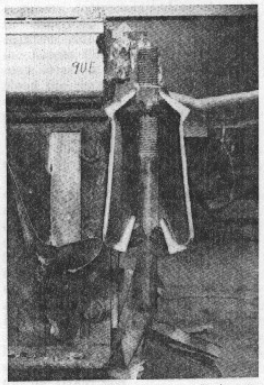
Blame. The ruling is the only declaration of blame for the Hyatt tragedy that has been or is likely to be made. All but two lawsuits, of the hundreds filed by victims and others, have now been settled out of court. No civil court jury was ever asked to consider evidence on the cause of the collapse. In 1983, a grand jury in Kansas City cited a lack of evidence in declining to issue indictments for criminal negligence.

In his 442-page ruling, Judge Deutsch, however, said he found evidence of deliberate fraud on the part of the engineers.

In 1979, while the hotel was still under construction, a section of the atrium roof collapsed. At that time, the engineers were asked to undertake a complete design review of all structural elements in the atrium lobby where the walkways were located. The judge said evidence showed that some structural elements were checked, but the complete review pledged by the engineers was not done.

Gillum's "later conduct in misrepresenting that he had in fact done such a complete design review when he had not was worse than unacceptable and

Walkway collapse in 1981 killed 114 persons.



Connection through box beam was inadequate.

"Duncan's failure to even look at or analyze the connections shown on the Shop Drawing 30, constitutes gross negligence . . . and demonstrates a conscious indifference to his professional duties."

Court OKs pulling of Hyatt engineers' licenses

By Rick Alm
staff writer

A St. Louis judge has refused to block action by state officials that strips the professional licenses from the two engineers who designed the Kansas City Hyatt Regency hotel and its sky walks.

The decision Tuesday by Circuit Judge Jack L. Koehr permits the Missouri Board for Architects, Professional Engineers and Land Surveyors to act immediately on its Jan. 22 decision to revoke the licenses of engineers Jack D. Gillum and Daniel M. Duncan, both of St. Louis, while their appeal is pending.

Lawyers for the engineers could not be reached for comment on whether they will appeal the order.

Following a lengthy hearing in 1984 and 14 months of deliberation, a state administrative law judge and the licensing panel determined that the engineers had been "grossly negligent" in their design work. The 1981 collapse of the sky walks, since blamed on a design flaw, killed 114 persons.

In February the engineers appealed the board's revocation decision. In it they challenged the law judge's findings on several constitutional grounds, including vagueness of the civil charges against them, which Judge Koehr rejected, said John Murphy, a Kansas City lawyer hired to represent the state board.

"They (the engineers) had argued there was no threat against public safety" if they were allowed to continue to practice during the appeal, Mr. Murphy said today after learning of Judge Koehr's decision.

"I argued that the public interest was a broader concern than just that of public safety," Mr. Murphy said. "The public interest is to see that the engineers are disciplined. We're coming up on the five-year anniversary of this, and that's long enough."

In January, after the board's decision was announced, the engineers voluntarily stopped performing any engineering duties at their firm.

Mr. Murphy said several other elements of the engineers' appeal that questions the law judge's factual findings still must be heard by Judge Koehr.

The Missouri board's revocation decision is expected to trigger reciprocal revocations in about 30 other states where the engineers are licensed.

I-35W Bridge Collapse (August 1, 2007)

I-35W Background

- Opened in 1967
- August 1, 2007
  - Being resurfaced by Progressive Contractors, Inc. (PCI)
  - Collapsed at 6:05 p.m. during rush hour
    - 13 killed
    - 145 injured

What did they know before the I-35W collapse?

Table 5. Condition ratings, sufficiency ratings, and status for I-35W bridge, 1983–2007.

Year[A]	Deck condition rating	Superstructure condition rating	Substructure condition rating	Sufficiency rating	Status
1983	6	7	6	80.1	Not deficient
1984	6	7	6	80.1	Not deficient
1985	6	7	6	80.1	Not deficient
1986	6	7	6	79.6	Not deficient
1987	6	7	6	79.8	Not deficient
1988	6	7	6	79.8	Not deficient
1989	6	8[B]	6	75.5	Not deficient
1990	6	7	6	75.5	Not deficient
1991	6	4	6	46.5	Structurally deficient
1992	6	4	6	46.5	Structurally deficient
1993	6	4	6	46.5	Structurally deficient
1994	6	4	6	46.5	Structurally deficient
1995	6	4	6	46.5	Structurally deficient
1996	6	4	6	49	Structurally deficient
1997	6	4	6	49	Structurally deficient
1998	6	4	6	49	Structurally deficient
1999	N/A	N/A	N/A	76	Not deficient[C]
2000	5	4	6	48	Structurally deficient
2001	5	4	6	48	Structurally deficient
2002	5	4	6	50	Structurally deficient
2003	5	4	6	50	Structurally deficient
2004	5	4	6	50	Structurally deficient
2005	5	4	6	50	Structurally deficient
2006	5	4	6	50	Structurally deficient
2007	5	4	6	50	Structurally deficient

[A]Although data exist from as early as 1979, these data were originally maintained in file formats that did not allow for simple conversion into current definitions. Starting with 1983, the FHWA was able to provide data it believed were accurate and consistent with current record-keeping.

[B]Mn/DOT officials attributed this apparent improvement in rating from the previous year to an error in the data file submitted to the FHWA.

[C]According to Mn/DOT, the bridge inspection reporting software that was being used at the time (BrInfo) did not submit the correct 1999 inspection data to the FHWA, and the FHWA system used default values to calculate the sufficiency rating and status. In 2000, Mn/DOT began using the Pontis system to format and submit the data.

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Classified as
"Structurally Deficient"
since 1991

MnDOT Condition Rating

- Received a superstructure condition rating of **"Poor"**
- Poor Condition means –
  - "Superstructure has ***advanced deterioration***"
  - "Members may be ***significantly bent*** or misaligned"
  - "***Connection failure may be imminent***"
  - "Bearings may be severely restricted"

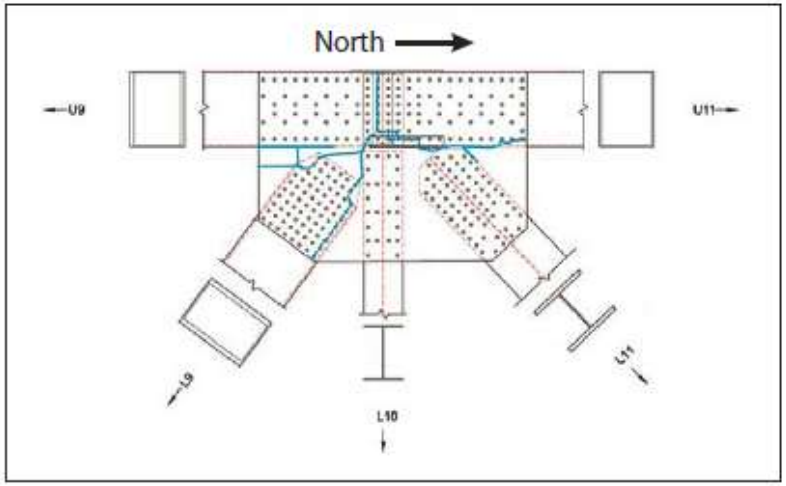
U10W looking north

U10E looking north

U10'E looking south

U10'W looking south

The ill-fated, warped U10 gusset plate on the I35W bridge. June 12, 2003.



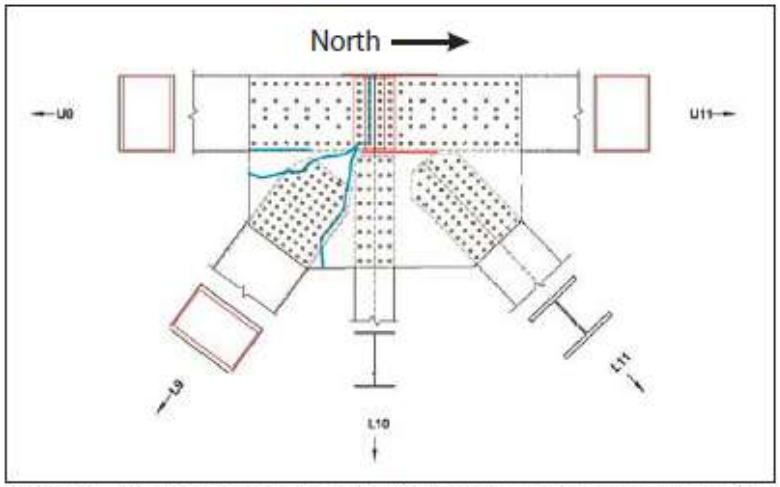
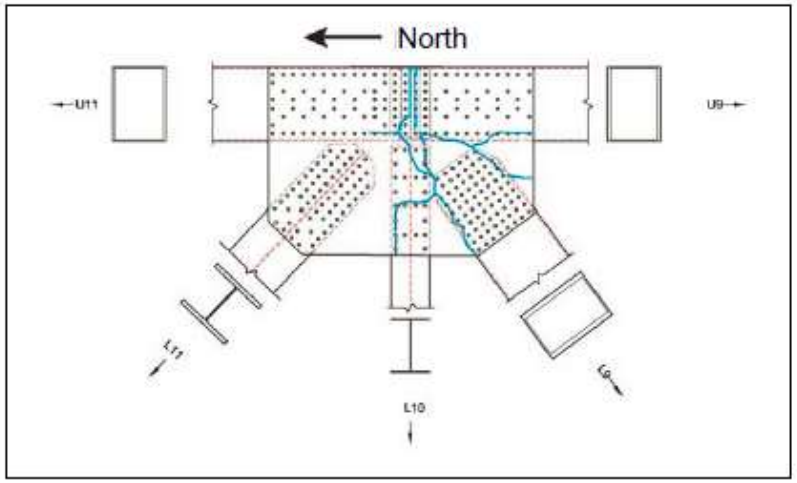


Figure 20A. Inside (east) gusset plate at U10W (top) and outside (east) gusset plate at U10E (bottom), showing similar fracture patterns in blue.



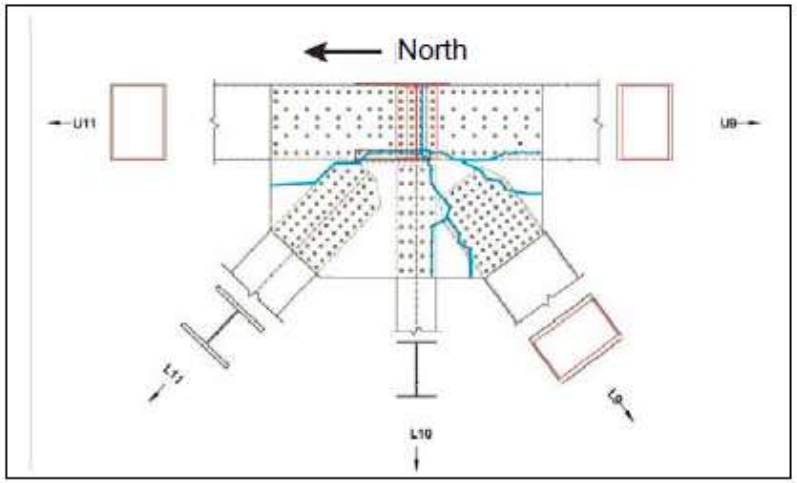


Figure 20B. Outside (west) gusset plate at U10W (top) and inside (west) gusset plate at U10E (bottom), showing similar fracture patterns in blue.

What They Knew

- Photos from 1999 & 2003 showed bowing
- MnDOT engineer had observed the gusset plate bowing after 1997
  - Concluded it was result of “fit-up” issue during original construction
- Discovery of fatigue cracking in structural members common after 1998
- Concerned enough to commission fatigue studies in 1999 and then 2003
- Started planning a retrofit project in July 2006
- **Failed August 1, 2007**

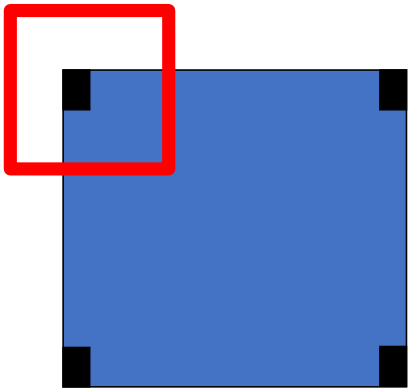
The Citicorp Center was completed in 1977 at a cost of $175 million

At the time of its completion, the Citicorp Center was the seventh tallest building in the world.

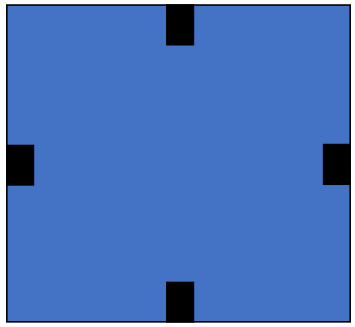
The Design Challenge

How do you build a 59-story skyscraper over a Church with minimal interference?

Innovative Column Layout



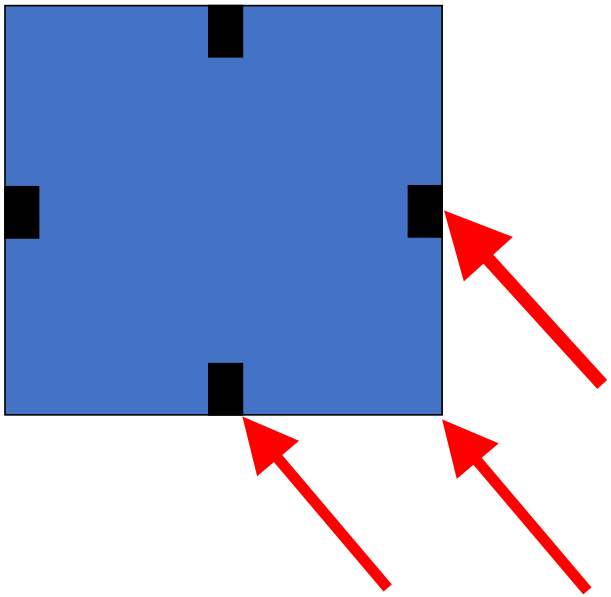
Conventional column layout



Innovative column layout

The Design

- Massive columns were believed to be located in the strongest position to resist quartering winds
  - Quartering winds flow across two sides at once thereby increasing the forces on both sides



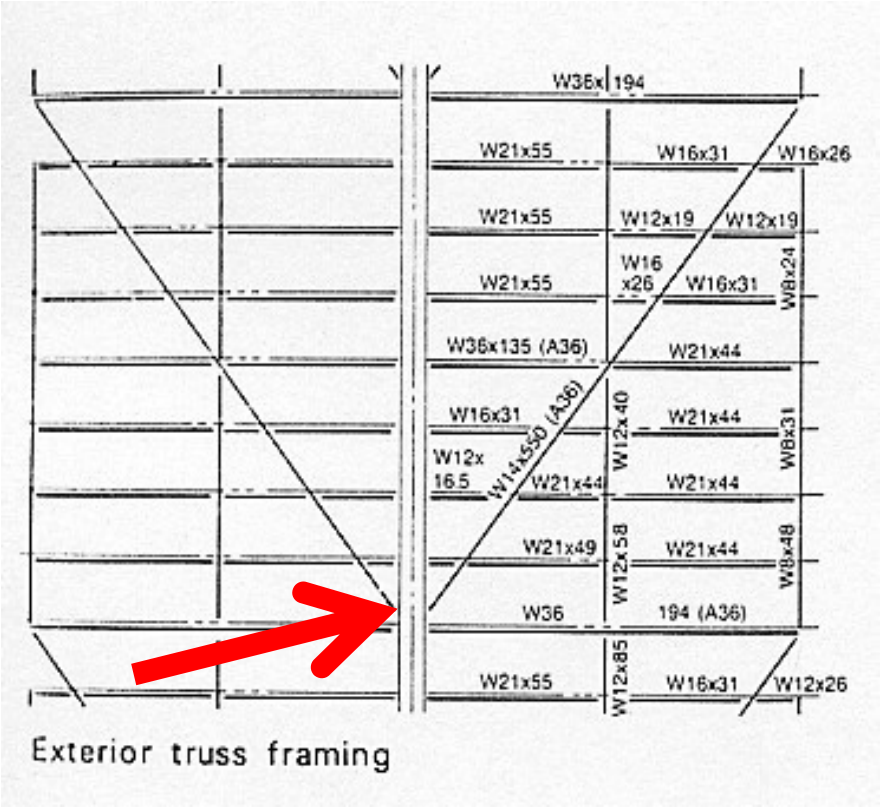
Unusual wind bracing system designed to counteract wind forces.

The Design

Consisted of diagonal steel girders arrayed like giant chevrons every eight floors

The Design

The original wind bracing design called for high strength full penetration ***welded connections***



Exterior truss framing

The Design Change

- Remember – All wind bracing connections were full penetration welds

- Value engineering meeting
  - Bethlehem Steel suggested bolted connections

- Why?
  - Full penetration welded connections are time consuming and overkill
  - Bolted connections are cheaper and faster

The Design Change

- On August 1, 1974, the structural engineer (LeMessurier) accepted Bethlehem's design change proposal

- All wind braces were bolted together instead of welded

The Discovery

- After construction completed, engineers decided to re-check design.
  - In four of the eight chevron braces on each tier, a quartering wind actually ***increased the strain in the members by 40%***
- Normally not a concern with high strength welded connections, but . . .

The Discovery

- New calculations revealed that the 40% increase in connection tension produced by the quartering winds became a ***160% increase*** on the building's bolts as a result of the design assumption.

Further Analysis

- Calculated that the weakest joint was on the 30th floor.
- Failure of the joint at the 30th floor would cause ***catastrophic failure*** of the entire building

Further Analysis

- Calculated that the ***sixteen-year storm*** (a storm statistically occurring once every sixteen years) would generate winds strong enough to rip the weakest joint apart (if the tuned mass damper was not working).

What did LeMessurier Do?

- Quickly concluded that disclosure and repair plan was the only answer notwithstanding the risk of:
  - professional disgrace
  - public humiliation
  - protracted litigation
  - possible bankruptcy

The Repair

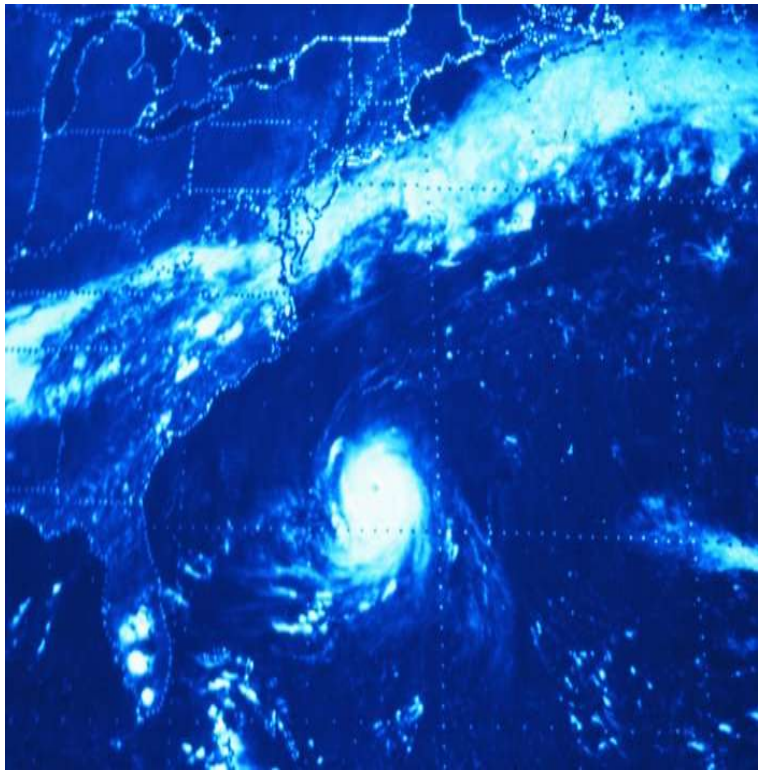
- Over 200 diagonal girder joints had to be repaired – but how?

The Repair

- Priority joint repair plan formulated
  - LeMessurier constantly calculated which joints were most critical for repair
  - The joint repairs were then ordered based upon the increase in building strength that could be accomplished with each joint repair
  - 24 hour-a-day stress/strain, mass damper and weather monitoring

The Repair

Repair work was in full swing when news came on September 1, 1978, that hurricane Ella was headed for New York.



Most Effective Risk Evaluation Strategies
(According to Owners, GCs and Trade Contractors)

Dodge Data & Analytics, 2017

Most Effective Risk Mitigation Strategies
(According to all Respondents)

Dodge Data & Analytics, 2017

Best Practice Checklist

- Establish experienced project team to monitor project activities on a regular basis
- Seek peer review when needed and document events that could generate claims
- Disclose risk concerns and ask for direction

Best Practice Checklist

- Document decisions made or direction provided
- Immediately evaluate and respond to criticism or inaccurate information
- Document, Document & Document
  - Keep records of conversations
  - Document site conditions
  - Take photographs

The Game Changing Photo

Questions?

Breakout Session Room B311
11:30 am – 12:00 pm

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