Hyatt Regency Walkway Collapse

Author(s)

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Description

A summary of the Hyatt Walkway collapse that includes discussion questions.

Body

ENGINEERING ETHICS

Negligence And The Professional "Debate" Over Responsibility For Design Instructor's Guide - Introduction To The Case

On July 17, 1981, the Hyatt Regency Hotel in Kansas City, Missouri, held a videotaped tea-dance party in their atrium lobby. With many party-goers standing and dancing on the suspended walkways, connections supporting the ceiling rods that held up the second and fourth-floor walkways across the atrium failed, and both walkways collapsed onto the crowded first-floor atrium below. The fourth-floor walkway collapsed onto the second-floor walkway, while the off set third-floor walkway remained intact. As the United States' most devastating structural failure, in terms of loss of life and injuries, the Kansas City Hyatt Regency walkways collapse left 114 dead and in excess of 200 injured. In addition, millions of dollars in costs resulted from the co**l** apse, and thousands of lives were adversely affected.

The hotel had only been in operation for approximately one year at the time of the walkways co**l** apse, and the ensuing investigation of the accident revealed some unsettling facts:

During January and February, 1979, the design of the hanger rod connections was changed in a series of events and disputed communications between the fabricator (Havens Steel Company) and the engineering design team (G.C.E. International, Inc., a professional engineering firm). The fabricator changed the design from a one-rod to a two-rod system to simplify the assembly task, doubling the load on the connector, which ultimately resulted in the walkways collapse.(1)

The fabricator, in sworn testimony before the administrative judicial hearings after the accident, claimed that his company (Havens) telephoned the engineering firm (G.C.E.) for change approval. G.C.E. denied ever receiving such a call from Havens.(2)

On October 14, 1979 (more than one year before the walkways collapsed), while the hotel was **still** under construction, more than 2700 square feet of the atrium roof collapsed because one of the roof connections at the north end of the atrium failed.(3) In testimony, G.C.E. stated that on three separate occasions they requested on-site project representation during the construction phase; however, these requests were not acted on by the owner (Crown Center Redevelopment Corporation), due to additional costs of providing on-site inspection.(4)

Even as originally designed, the walkways were barely capable of holding up the expected load, and would have failed to meet the requirements of the Kansas City Building Code.(5)

Due to evidence supplied at the Hearings, a number of principals involved lost their engineering licenses, a number of firms went bankrupt, and many expensive legal suits were settled out of court. The case serves as an excellent example of the importance of meeting professional responsibilities, and what the consequences are for professionals who fail to meet those responsibilities. This case is particularly serviceable for use in structural design, statics and materials classes, although it is also useful as a general overview of consequences for professional actions. The Hyatt Regency Walkways Collapse provides a vivid example of the importance of accuracy and detail in engineering design and shop drawings (particularly regarding revisions), and the costly consequences of negligence in this realm.

For purposes of this case study, we assume that the disputed telephone call **was** made by the fabrication firm and that the engineering firm **did** give verbal approval for the fatal design change. Students are, however, encouraged to view the case reversing these assumptions.

Guidelines For Presentation

1. Read student handout for a detailed description of the case.

2. At the class preceding case discussion, distribute student handouts: The Kansas City Hyatt Regency Walkways Collapse, which includes literature on negligence and the professional "debate" over responsibility for design, and an annotated bibliography. Have students come to the follow-up discussion class prepared to address the Kansas City Hyatt Regency Walkways Collapse in light of the ethical issues raised in the student handout.

3. Show Hyatt Regency Walkways Collapse segment of the "To Engineer is Human," video. Discuss with students the five overheads:

    1. The Hyatt Regency Walkways Collapse Cast of Characters

    2. Hanger Rod Details Original Design and As Built

    3. Chronology of the Hyatt Regency Walkways Collapse (four pages)

    4. ASME Code of Ethics of Engineers; and

    5. IEEE Code of Ethics. Ask students some of the following questions:

        - Who is ultimately responsible for the fatal design flaw? Why?

        - Does the disputed telephone call matter to the outcome of the case? Why or why not?

- What is the responsibility of a licensed professional engineer who fixes his/her seal to fabrication drawings?

- In terms of meeting building codes, what are the responsibilities of the engineer? The fabricator? The owner?

- What measures can professional societies take to ensure that catastrophes such as the Hyatt Regency Walkways Collapse do not occur?

- Do you agree with the findings that the principal engineers involved should have been subject to discipline for gross negligence in the practice of engineering? Should they have lost their licenses, temporarily or permanently?

- Was it fair that G.C.E., as a company, was held liable for gross negligence and engineering incompetence? Why or why not?

4. End the discussion with Overhead 6), Hyatt Regency Walkways Collapse: Ethical Issues of the Case. Discuss the ethical questions raised by the case: what are the professional responsibilities of the engineers, fabricators, and hotel contractors? How can professionals protect themselves, and the public, from the gross negligence of an incompetent few? What are the implications of this case in terms of state-by-state licensing procedures?

For a detailed discussion on these issues, see essay #5, "Negligence, Risk, and the Professional Debate Over the Responsibility for Design," appended at the end of the cases in the report. In addition, essays #1 through #4 appended at the end of the case listings in this report will have relevant background information for the instructor preparing to lead classroom discussion. Their titles are, respectively: "Ethics and Professionalism in Engineering: Why the Interest in Engineering Ethics?;" "Basic Concepts and Methods in Ethics;" "Moral Concepts and Theories," and "Engineering Design: Literature on Social Responsibility Versus Legal Liability."

Case Notes

1. Missouri Board for Architects, Professional Engineers and Land Surveyors vs. Daniel M. Duncan, Jack.
2. D. Gillum and G.C.E. International, Inc., before the Administrative Hearing Commission, State of Missouri, Case No. AR840239, Statement of the Case, Findings of Fact, Conclusions of Law and Decision rendered by Judge James B. Deutsch, November 14, 1985, pp. 54-63. Case No. AR840239 hereinafter referred to as **Administrative Hearing Commission**.
3. Administrative Hearing Commission, pp. 63-66.
4. Administrative Hearing Commission, p. 384.
5. Administrative Hearing Commission, pp. 12-13.
6. Administrative Hearing Commission, pp. 423-425.

Copy of Administrative Hearing Commission: pdf version Word version Note that both of these were scanned from every poor copy of the document. Sorry, but you get what you paid for.

The Hyatt Regency Walkways Collapse Cast Of Characters

In 1976, as owner, Crown Center Redevelopment Corporation - commenced a project to design and build a Hyatt Regency Hotel in Kansas City, Missouri, and on April 4, 1978, Crown entered into a standard contract with G.C.E. International, Inc. Professional Consulting Firm of Structural Engineers (1980 formerly called Jack D. Gillum & Associates, Ltd. changed name to G.C.E. May 5, 1983)

Principals

Jack D. Gillum P.E., structural engineering state licensed since February 26, 1968.

Daniel M. Duncan P.E., structural engineering state licensed since February 27, 1979 PBNDML Architects, Planners, Inc. Architect.

G.C.E. agreed to provide, "all structural engineering services for a 750-room hotel projected located at 2345 McGee Street, Kansas City, Missouri."

On or about December 19, 1978, Eldridge Construction Company, the general contractor on the Hyatt project, entered into a subcontract with **Havens Steel Company** Professional Fabricator who agreed to fabricate and erect the atrium steel

for the Hyatt project.

Chronology Of The Hyatt Regency Walkways Collapse

Early 1976: Crown Center Redevelopment Corporation (owner) commences project to design and build a Hyatt Regency Hotel in Kansas City, Missouri.

July 1976: Gillum-Colaco, Inc. (G.C.E. International, Inc., 1983), a Texas corporation, selected as the consulting structural engineer for the Hyatt project.

July 1976: Hyatt project in schematic design development.

Summer 1977: G.C.E. assisted owner and architect (PBNDML Architects, Planners, Inc.) with developing various plans for hotel project, and decided on basic design.

Late 1977: Bid set of structural drawings and specifications.

Early 1978: Project prepared, using standard Kansas City, Missouri, Building Codes.

April 4, 1978: Actual contract entered into by G.C.E. and the architect, PBNDML Architects, Planners, Inc.

G.C.E. agreed to provide "all structural engineering services for a 750-room hotel project located at 2345 McGee Street, Kansas City, Missouri."

Spring 1978: Construction on hotel begins.

August 28, 1978: Specifications on project issued for construction, based on the American Institute of Steel Construction (AISC) standards used by fabricators.

December 1978: Eldridge Construction Company, general contractor on the Hyatt project, enters into subcontract with Havens Steel Company. Havens agrees to fabricate and erect the atrium steel for the Hyatt project.

January 1979: Events and communications between G.C.E. and Havens.

February 1979: Havens makes design change from a single to a double hanger rod box beam connection for use at the fourth floor walkways. Telephone calls disputed; however, because of alleged communications between engineer and fabricator, Shop Drawing 30 and Erection Drawing E3 are changed.

February 1979: G.C.E. receives 42 shop drawings (including Shop Drawing 30 and Erection Drawing E-3) on February 16, and returns them to Havens stamped with engineering review stamp approval on February 26.

October 14, 1979: Part of the atrium roof collapses while the hotel is under construction. Inspection team called in, whose contract dealt primarily with the investigation of the cause of the roof collapse and created no obligation to check any engineering or design work beyond the scope of their investigation and contract.

October 16, 1979: Owner retains an independent engineering firm, Seiden-Page, to investigate the cause of the atrium roof collapse.

October 20, 1979: Gillum writes owner, stating he is undertaking both an atrium collapse investigation as well as a thorough design check of all the members comprising the atrium roof.

October: Reports and meetings from engineer to clients.

November 1979: Owner/architect assures clients of overall safety of the entire atrium.

July 1980: Construction of hotel complete, and the Kansas City Hyatt Regency Hotel opens for business.

July 17, 1981: Connections supporting the rods from the ceiling that held up the 2nd and 4th floor walkways across the atrium of the Hyatt Regency Hotel col apse, killing 114 and injuring in excess of 200 others.

February 3, 1984: Missouri Board of Architects, Professional Engineers and Land Surveyors files complaint against Daniel M. Duncan, Jack D. Gillum and G.C.E. International Inc., charging gross negligence, incompetence, misconduct and unprofessional conduct in the practice of engineering in connection with their performance of engineering services in the design and construction of the Hyatt Regency Hotel in Kansas City, Missouri.

November, 1984: Duncan, Gillum, and G.C.E. International, Inc. found guilty of gross negligence, misconduct and unprofessional conduct in the practice of engineering. Subsequently, Duncan and Gillum lost their licenses to practice engineering in the State of Missouri, and G.C.E. had its certificate of authority as an engineering firm revoked. American Society of Civil Engineering (ASCE) adopts report that states

structural engineers have full responsibility for design projects. Duncan and Gillum now practicing engineers in states other than Missouri.

ASME Code Of Ethics Of Engineers The Fundamental Principles

Engineers uphold and advance the integrity, honor, and dignity of the Engineering profession by:

I. Using their knowledge and skill for the enhancement of human welfare;

II. being honest and impartial, and serving with fidelity the public, their employers and clients; and

III. striving to increase the competence and prestige of the engineering profession.

The Fundamental Canons

1. Engineers shall hold paramount the safety, health and welfare of the public in the performance of their professional duties.

2. Engineers shall perform services only in areas of their competence.

3. Engineers shall continue their professional development throughout their careers and shall provide opportunities for the professional development of those engineers under their supervision.

4. Engineers shall act in professional matters for each employer or client as faithful agents or trustees, and shall avoid conflicts of interest.

5. Engineers shall build their professional reputation on the merit of their services and shall not compete unfairly with others.

6. Engineers shall associate only with reputable persons or organizations.

7. Engineers shall issue public statements only in an objective and truthful manner.

IEEE Code Of Ethics (Revised October 1990)

We, the members of the IEEE, in recognition of the importance of our technologies in affecting the quality of life throughout the world, and in accepting a personal obligation to our profession, its members and the communities we serve, do hereby commit ourselves to the highest ethical and professional conduct and agree:

1. to accept responsibility in making engineering decisions consistent with the safety, health, and welfare of the public, and to disclose promptly factors that might endanger the public or the environment;

2. to avoid real or perceived conflicts of interest whenever possible, and to disclose them to affected parties when they do exist;

3. to be honest and realistic in stating claims or estimates based on available data;

4. to reject bribery in all its forms;

5. to improve the understanding of technology, its appropriate application, and potential consequences;

6. to maintain and improve our technical competence and to undertake technological tasks for others only if qualified by training or experience, or after full disclosure of pertinent limitations;

7. to seek, accept, and offer honest criticism of technical work, to acknowledge and correct errors, and to credit properly the contributions of others;

8. to treat fairly all persons regardless of such factors as race, religion, gender, disability, age, or national origin;

9. to avoid injuring others, their property, reputation, or employment by false or malicious action;

10. to assist colleagues and coworkers in their professional development and to support them in following this code of ethics.

Hyatt Regency Walkways Collapse: Ethical Issues Of The Case

1. Who is ultimately responsible for checking the safety of final designs as depicted in shop drawings?

2. In terms of meeting building codes, what are the responsibilities of the engineer? The fabricator? The owner?

3. What measures can professional societies take to ensure catastrophes like the Hyatt Regency Walkways Collapse do not occur?

Synopsis

On July 17, 1981, the Hyatt Regency Hotel in Kansas City, Missouri, held a videotaped tea-dance party in their atrium lobby. With many party-goers standing and dancing on the suspended walkways, connections supporting the ceiling rods that held up the second and fourth-floor walkways across the atrium failed, and both walkways collapsed onto the crowded first-floor atrium below. The fourth-floor walkway collapsed onto the second-floor walkway, while the off set third-floor walkway remained intact. As the United States' most devastating structural failure, in terms of loss of life and injuries, the Kansas City Hyatt Regency walkways co**l** apse

left 114 dead and in excess of 200 injured. In addition, millions of dollars in costs resulted from the co**l** apse, and thousands of lives were adversely affected.

The hotel had only been in operation for approximately one year at the time of the walkways co**l** apse, and the ensuing investigation of the accident revealed some unsettling facts.

First, during January and February, 1979, over a year before the collapse, the design of the walkway hanger rod connections was changed in a series of events and communications (or disputed miscommunications) between the fabricator (Havens Steel Company) and the engineering design team (G.C.E. International, Inc., a professional engineering firm). The fabricator changed the design from a one-rod to a two-rod system to simplify the assembly task, doubling the load on the connector, which ultimately resulted in the walkways collapse.(1)

Second, the fabricator, in sworn testimony before the administrative judicial hearings after the accident, claimed that his company (Havens) telephoned the engineering firm (G.C.E.) for change approval. G.C.E. denied ever receiving such a call from Havens.(2)

Third, on October 14, 1979, while the hotel was still under construction, more than 2700 square feet of the atrium roof collapsed because one of the roof connections at the north end of the atrium failed.(3) In testimony, G.C.E. stated that on three separate occasions they requested on-site project representation to check all fabrication during the construction phase; however, these requests were not acted on by the owner (Crown Center Redevelopment Corporation), due to additional costs of providing on-site inspection.(4)

Fourth, even as originally designed, the walkways were barely capable of holding up the expected load, and would have failed to meet the requirements of the Kansas City Building Code.(5)

Individuals Involved In The Hyatt Regency Case Several key players are involved in the case:

In 1976, as owner, **Crown Center Redevelopment Corporation** commenced a project to design and build a Hyatt Regency Hotel in Kansas City, Missouri, and on April 4, 1978 entered into a standard contract with G.C.E. International,

Inc. Professional Consulting Firm of Structural Engineers (1980 formerly cal ed Jack D. Gil um & Associates, Ltd. changed name to G.C.E. May 5, 1983) Principals Jack D. Gillum P.E., structural engineering state licensed since February 26, 1968 Daniel M. Duncan P.E., structural engineering state licensed since February 27, 1979 and PBNDML Architects, Planners, Inc. Architect. G.C.E. agreed to provide, "all structural engineering services for a 750-room hotel projected located at 2345 McGee Street, Kansas City, Missouri. On or about December 19, 1978, Eldridge Construction Company, the general contractor on the Hyatt project, entered into a subcontract with Havens Steel Company fabricator who agreed to fabricate and erect the atrium steel for the Hyatt project.

Structural Failure During the Atrium Tea Dance

In 1976, Crown Center Redevelopment Corporation initiated a project for designing and building a Hyatt Regency Hotel in Kansas City Missouri. In July of 1976, Gillum-Colaco, Inc., a Texas corporation, was selected as the consulting structural engineer for the project. A schematic design development phase for the project was undertaken from July 1976 through the summer of 1977. During that time, Jack D. Gillum (the supervisor of the professional engineering activities of Gillum-Colaco, Inc.) and Daniel M. Duncan (working under the direct supervision of Gillum, the engineer responsible for the actual structural engineering work on the Hyatt project) assisted Crown Center Redevelopment Corporation (the owner) and PBNDML Architects, Planners, Inc. (the architect on the project) in developing plans for the hotel project and deciding on its basic design. A bid set of structural drawings and specifications for the project were prepared in late 1977 and early 1978, and construction began on the hotel in the spring of 1978. The specifications on the project were issued for construction on August 28, 1978.(6)

On April 4, 1978, the actual written contract was entered into by Gillum-Colaco, Inc. and PBNDML Architects, Planners, Inc. The contract was standard in nature, and Gillum-Colaco, Inc. agreed to provide all the structural engineering services for the Hyatt Regency project. The firm Gillum-Colaco, Inc. did not actually perform the structural engineering services on the project; instead, they subcontracted the responsibility for performing all of the structural engineering services for the Hyatt Regency Hotel project to their subsidiary firm, Jack D. Gillum & Associates, Ltd. (hereinafter referenced as G.C.E.).(7) According to the specifications for the project, no work could start until the shop drawings for the work had been approved by the

structural engineer.(8)

Three teams, with particular roles to play in the construction system employed in building the Hyatt Regency Hotel, were contracted for the project: PBNDML and G.C.E. made up the "design team," and were authorized to control the entire project on behalf of the owner; Eldridge Construction Co., as the "construction team," was responsible for general contracting; and the "inspection team," made up of two inspecting agencies (H&R Inspection and General Testing), a quality control official, a construction manager, and an investigating engineer (Seiden and Page).

On December 19, 1978, Eldridge Construction Company, as general contractor, entered into a subcontract with Havens Steel Company, who agreed to fabricate and erect the atrium steel for the Hyatt project.

G.C.E. was responsible for preparing structural engineering drawings for the Hyatt project: three walkways spanning the atrium area of the hotel. Wide flange beams with 16-inch depths (W16x26) were used along either side of the walkway and hung from a box beam (made from two MC8x8.5 rectangular channels, welded toe-to-toe). A clip angle welded to the top of the box beam connected these beams by bolts to the W section. This joint carried virtually no moment, and therefore was modeled as a hinge. One end of the walkway was welded to a fixed plate and would be a fixed support, but for simplicity, it could be modeled as a hinge. This only makes a difference on the hanger rod nearest this support (it would carry less load than the others and would not govern design). The other end of the walkway support was a sliding bearing modeled by a roller. The original design for the hanger rod connection to the fourth floor walkway was a continuous rod through both walkway box beams (Figure 1 below).

Events and disputed communications between G.C.E. engineers and Havens resulted in a design change from a single to a double hanger rod box beam connection for use at the fourth floor walkways. The fabricator requested this change to avoid threading the entire rod. They made the change, and the contract's Shop Drawing 30 and Erection Drawing E-3 were changed (Figure 2 shows the hanger rod as built).

On February 16, 1979, G.C.E. received 42 shop drawings (including the revised Shop Drawing 30 and Erection Drawing E-3). On February 26, 1979, G.C.E. returned the drawings to Havens, stamped with Gi**l** um's engineering review seal, authorizing construction. The fabricator (Havens) built the walkways in compliance with the

directions contained in the structural drawings, as interpreted by the shop drawings, with regard to these hangers. In addition, Havens followed the American Institute of Steel Construction (AISC) guidelines and standards for the actual design of steel-to-steel connections by steel fabricators.

As a precedent for the Hyatt case, the **Guide to Investigation of Structural Failure**'s Section 4.5, "Failure Causes Classified by Connection Type," states that:

Overall **collapses** resulting from connection failures have occurred only in structures with few or no redundancies. Where low strength connections have been repeated, the failure of one has lead to failure of neighboring connections and a progressive co**l** apse has occurred. The primary causes of connection failures are:

1. improper design due to lack of consideration of all forces acting on a connection, especia**l** y those associated with volume changes
2. Improper design utilizing abrupt section changes resulting in stress concentrations.
3. Insufficient provisions for rotation and movement.
4. Improper preparation of mating surfaces and installation of connections.
5. Degradation of materials in a connection.
6. Lack of consideration of large residual stresses resulting from manufacture or fabrication.

Figure 1. Hangar-rod/box-beam assembly as origina**l** y designed. (See Figures) Note that the nut only carries the load of the floor above it.

Figure 2. Schematic of original versus changed design. Note that now the upper nut at the far left carries only the load of the floor above it whereas the nut at the far right carries the load of both floors. (See Figures)

On October 14, 1979, part of the atrium roof collapsed while the hotel was under construction. As a result, the owner called in the inspection team. The inspection team's contract dealt primarily with the investigation of the cause of the roof collapse and created no obligation to check any engineering or design work beyond the scope of their investigation and contract. In addition to the inspection team, the owner retained, on October 16, 1979, an independent engineering firm, Seiden-Page, to investigate the cause of the atrium roof co**l** apse. On October 20, 1979, G.C.E.'s Gillum wrote the owner, stating that he was undertaking both an atrium collapse investigation as well as a thorough design check of all the members

comprising the atrium roof. G.C.E. promised to check **all** steel connections in the structures, not just those found in the roof.

From October-November, 1979, various reports were sent from G.C.E. to the owner and architect, assuring the overall safety of the entire atrium. In addition to the reports, meetings were held between the owner, architect and G.C.E.

In July of 1980, the construction was complete, and the Kansas City Hyatt Regency Hotel was opened for business.

Just one year later, on July 17, 1981, the box beams resting on the supporting rod nuts and washers were deformed, so that the box beam resting on the nuts and washers on the rods could no longer hold up the load. The box beams (and walkways) separated from the ceiling rods and the fourth and second floor walkways across the atrium of the Hyatt Regency Hotel collapsed, killing 114 and injuring in excess of 200 others.

One investigation report gave the following summary:

The Hyatt Regency consists of three main sections: a 40-story tower section, a function block, and a connecting atrium. The atrium is a large open area, approximately 117 ft (36 m) by 145 ft (44 m) in plan and 50 ft (15 m) high. Three suspended walkways spanned the atrium at the second, third and fourth floor levels [see Figure 3 on following page]. These walkways connected the tower section and the function block. The third floor walkway was independently suspended from the atrium roof trusses while the second floor walkway was suspended from the fourth floor walkway, which in turn was suspended from the roof framing.

In the collapse, the second and fourth floor walkways fell to the atrium first floor with the fourth floor walkway coming to rest on top of the second. Most of those killed ed or injured were either on the atrium first floor level or on the second floor walkway. The third floor walkway was not involved in the collapse.

Figure 3. Schematic Layout of Walkways as Viewed from the South (See Figures)

Figure 4. Schematic representation of hangar-rod/box-beam assembly as actually built. Note that the two top hangars to the fourth floor no longer continue through that floor to the second floor. (See Figures)

Following the accident investigations, on February 3, 1984, the Missouri Board of Architects, Professional Engineers and Land Surveyors filed a complaint against Daniel M. Duncan, Jack D. Gillum, and G.C.E. International, Inc., charging gross negligence, incompetence, misconduct and unprofessional conduct in the practice of engineering in connection with their performance of engineering services in the design and construction of the Hyatt Regency Hotel. The NBS report noted that:

The hanger rod detail actually used in the construction of the second and fourth floor walkways is a departure from the detail shown on the contract drawings. In the original arrangement, each hanger rod was to be continuous from the second floor walkway to the hanger rod bracket attached to the atrium roof framing. The design load to be transferred to each hanger rod at the second floor walkway would have been 20.3 kips (90 kN). An essentially identical load would have been transferred to each hanger rod at the fourth floor walkway. Thus the design load acting on the upper portion of a continuous hanger rod would have been twice that acting on the lower portion, but the required design load for the box beam hanger rod connections would have been the same for both walkways (20.3 kips (90 kN)).(11)

The hanger rod configuration actually used consisted of two hanger rods: the fourth floor to ceiling hanger rod segment as originally detailed on the second to fourth floor segment which was off set 4 in. (102 mm) inward along the axis of the box beam. With this modification the design load to be transferred by each second floor box beam-hanger rod connection was unchanged, as were the loads in the upper and lower hanger rod segments.

However, the load to be transferred from the fourth floor box beam to the upper hanger rod under this arrangement was essentia**l** y doubled, thus compounding an already critical condition. The design load for a fourth floor box beam-hanger rod connection would be 40.7 kips (181 kN) for this configuration. ...

Had this change in hanger rod detail not been made, the ultimate capacity of the box beam-hanger rod connection still would have been far short of that expected of a connection designed in accordance with the Kansas City Building Code, which is based on the AISC Specification. In terms of ultimate load capacity of the connection, the minimum value should have been 1.67 times 20.3, or 33.9 kips (151 kN). Based on test results the mean ultimate capacity of a single-rod connection is approximately 20.5 kips (91 kN), depending on the weld area. Thus the ultimate capacity actually available using the original connection detail would have been

approximately 60% of that expected of a connection designed in accordance with AISC Specifications.(12)

During the 26-week administrative law trial that ensued, G.C.E. representatives denied ever receiving the call about the design change. Yet, Gillum affixed his seal of approval to the revised engineering design drawings.

Results of the hearing concluded that G.C.E., in preparation of their structural detail drawings, "depicting the box beam hanger rod connection for the Hyatt atrium walkways, failed to conform to acceptable engineering practice. [This is based] upon evidence of a number of mistakes, errors, omissions and inadequacies contained on this section detail itself and of [G.C.E.'s] alleged failure to conform to the accepted custom and practice of engineering for proper communication of the engineer's design intent."(13) Evidence showed that neither due care during the design phase, nor appropriate investigations following the atrium roof collapse were undertaken by G.C.E. In addition, G.C.E. was found responsible for the change from a one-rod to a two-rod system. Further, it was found that even if Havens failed to review the shop drawings or to specifically note the box beam hanger rod connections, the engineers were still responsible for the final check. Evidence showed that G.C.E. engineers did not "spot check" the connection or the atrium roof collapse, and that they placed too much reliance on Havens.

Due to evidence supplied at the Hearings, a number of principals involved lost their engineering licenses, a number of firms went bankrupt, and many expensive legal suits were settled out of court. In November, 1984, Duncan, Gillum, and G.C.E. International, Inc. were found guilty of gross negligence, misconduct and unprofessional conduct in the practice of engineering. Subsequently, Duncan and Gillum lost their licenses to practice engineering in the State of Missouri (and later, Texas), and G.C.E. had its certificate of authority as an engineering firm revoked.

As a result of the Hyatt Regency Walkways Collapse, the American Society of Civil Engineering (ASCE) adopted a report that states structural engineers have full responsibility for design projects.

Both Duncan and Gillum are now practicing engineers in states other than Missouri and Texas.

The responsibility for and obligation to design steel-to-steel connections in construction lies at the heart of the Hyatt Regency Hotel project controversy. To

understand the issues of negligence and the engineer's design responsibility, we must examine some key elements associated with professional obligations to protect the public. This will be discussed in class from three perspectives: the implicit social contract between engineers and society; the issue of public risk and informed consent; and negligence and codes of ethics of professional societies.

Ethical Issues Of The Case - Points For Discussion

This case centers on the question of who is responsible for a design failure. As an ethical issue,

- Who is ultimately responsible for checking the safety of final designs as depicted in shop drawings?

When we take the implicit social contract between engineers and society, the issue of public risk and informed consent, and codes of ethics of professional societies into account, it seems clear that the engineer must assume this responsibility when any change in design involving public safety carries a licensed engineer's seal. Yet,

- In terms of meeting building codes, what are the responsibilities of the engineer? The fabricator? The owner?

If we assume the engineer in the Hyatt case received the fabricator's telephone call requesting a verbal approval of the design change for simplifying assembly, what would make him approve such an untenable change? Some

- possible reasons include:
- saving time; saving money;
- avoiding a call for re-analysis, thereby raising the issue of a request to recheck all connector designs following the previous year's atrium roof collapse;
- following his immediate supervisor's orders;
- looking good professionally by simplifying the design; misunderstanding the consequences of his actions; or any combination of the above.

These reasons do not, however, fall within acceptable standards of engineering professional conduct. Instead, they pave the way for legitimate charges of negligence, incompetence, misconduct and unprofessional conduct in the practice of engineering. When the engineer's actions are compared to professional responsibilities cited in the engineering codes of ethics, an abrogation of

professional responsibilities by the engineer in charge is clearly demonstrated. But what of the owner, or the fabricator?

What if the call was not made? While responsibility rests with the fabricator for violating building codes, would the engineers involved in the case be off the hook? Why or why not?

The Hyatt Regency walkways collapse has resulted in a nationwide reexamination of building codes. In addition, professional codes on structural construction management practices are changing in significant ways.(14) Finally, what is your assessment of this case, based on the following questions:

- What measures can professional societies take to ensure catastrophes like the Hyatt Regency Walkways Collapse do not occur?
- Should Gillum and Duncan be allowed to practice engineering in other states? Why or why not? What is the engineering society's responsibility in this realm?

Annotated Bibliography

Davis, Michael, "Thinking Like An Engineer: The Place of a Code of Ethics in the Practice of a Profession," **Philosophy & Public Affairs**, Vol. 20, No. 2, Spring 1991, pp. 150-167. (see also, "Explaining Wrongdoing," **Journal of Social Philosophy**, Vol. 20, Numbers 1&2, Spring/Fall 1989, pp. 74-90.

In these lucid essays, Davis argues that "a code of professional ethics is central to advising individual engineers how to conduct themselves, to judging their conduct, and ultimately to understanding engineering as a profession." Using the now infamous Challenger disaster as his model, Davis discusses both the evolution of engineering ethics as well as why engineers should obey their professional codes of ethics, from both a pragmatic and ethica**l** y-responsible point of view. Essential reading for any graduating engineering student.

Engineering News Report

Throughout the hearings, **Engineering News Report**, published by the National Society of Professional Engineers (NSPE), kept vigilant watch over the case. Of particular interest are their following articles:

- "Hyatt Walkway Design Switched," July 30, 1981. "Hyatt Hearing Traces Design Change," July 26, 1984.
- "Difference of Opinion: Hyatt Structural Engineer Gi**l** um Disputes NBS Collapse Report," September 6, 1984.
- "Weld Aided Collapse, Witness Says," September 13, 1984. "Judge Bars Hyatt Tests," September 20, 1984.
- "Hyatt Engineers Found Guilty of Negligence," November 21, 1985. "Hyatt Ruling Rocks Engineers," November 28, 1985. "Construction Rescuers Sue," August 7, 1986.

Glickman, Theodore S., and Michael Gough (eds.), **Readings in Risk**, Washington, D.C.: Resources for the Future, 1990.

This is an excellent collection of essays on managing technology-induced risk. As a starting-off point, of particular worth to the engineers are the essays: "Probing the Question of Technology-Induced Risk" and "Choosing and Managing Technology-Induced Risk," by M. Granger Morgan; "Defining Risk," by Baruch Fischhoff, Stephen R. Watson, and Chris Hope; "Risk Analysis: Understanding 'How Safe is Safe Enough?'," by Stephen L. Derby and Ralph L. Keeney; "Social Benefit Versus Technological Risk," by Chauncey Starr; and "The Application of Probabilistic Risk Assessment Techniques to Energy Technologies," by Norman C. Rasmussen.

Gibble, Kenneth (ed.), **Management Lessons from Engineering Failures**, Proceedings of a symposium sponsored by the Engineering Management Division of the American Society of Civil Engineers in conjunction with the ASCE Convention in Boston, October 28, 1986, New York: American Society of Civil Engineers, 1986.

This short work examines a variety of engineering failures, including those involving individual planning, and project failures. In particular see Irvin M. Fogel's essay, "Avoiding 'Failures' Caused by Lack of Management," and Gerald W. Farquhar's "Lessons to be Learned in the Management of Change Orders in Shop Drawings," both excellent illustrations for use with the Hyatt case.

Hall, John C., "Acts and Omissions," **The Philosophical Quarterly**, Vol. 39, No. 157, October 1989, pp. 399-408.

This article is a discussion of the legal and ethical ramifications of professional choices and activities, both active and passive.

"Hyatt Notebook: Parts I and II," **Kansas City**, October 1984 and November 1984.

These are two articles written by a Kansas City television reporter for the local magazine, **Kansas City**, detailing highlights from the 26-week Hyatt Regency Walkways Collapse hearings.

Janney, Jack R. (ed.), **Guide to Investigation of Structural Failures**, prepared for the American Society of Civil Engineers' Research Council on Performance of Structures, sponsored by the Federal Highway Administration, U.S. Department of Transportation, Contract No. DOTFH118843, 1979.

This short volume gives an excel**l** ent overview of structural failure investigation procedures, and discusses failure causes by project type, structural type, and material, connection and foundation type. In addition, discussions on field operations, project management, and data analysis and reports are offered. Of particular interest to those studying the Hyatt case are sections 4.5-4.7, "Failure Causes Classified by Connection Type," and "Steel to Steel Connections."

Martin, Mike W. and Roland Schinzinger, **Ethics in Engineering** (2nd ed.), New York: McGraw-Hill Book Company, 1989.

An excellent text-book treatment of ethical issues in engineering. Of particular interest to this case is Part Two, "The Experimental Nature of Engineering," and Part Three, "Engineers, Management and Organizations."

McK Norrie, Kenneth, "Reasonable: The Keystone of Negligence," **Journal of Medical Ethics**, Vol. 13, No. 2, June 1987, pp. 92-94.

This article is a brief discussion of legal liability for professional actions. "The more knowledge, skill and experience a person has, the higher standard the law subjects that person to" (p. 92).

PDF version: Missouri Board for Architects, Professional Engineers and Land Surveyors vs. Daniel M. Duncan, Jack D. Gi**l** um and G.C.E. International, Inc., before the Administrative Hearing Commission, State of Missouri, Case No. AR840239, Statement of the Case, Findings of Fact, Conclusions of Law and Decision rendered by Judge James B. Deutsch, November 14, 1985, 442 pp. Note this is a BIG file - 20 Mb!

Word version: Missouri Board for Architects, Professional Engineers and Land Surveyors vs. Daniel M. Duncan, Jack D. Gillum and G.C.E. International, Inc., before the Administrative Hearing Commission, State of Missouri, Case No. AR840239, Statement of the Case, Findings of Fact, Conclusions of Law and Decision rendered by Judge James B. Deutsch, November 14, 1985, 442 pp. This has been changed to Word format, without any checking. Many errors are found when the scanner attempted to transcribe the pdf file to Word, but no one has found the time to correct the conversion

This volume contains the findings, conclusions of law and the final decision of the Hyatt Regency Walkways Collapse case, as rendered by Judge James B. Deutsch. The volume contains both the findings of the case and an excel ent general discussion of responsibilities of the professional engineer.

Pfrang, Edward O. and Richard Marshall, "Collapse of the Kansas City Hyatt Regency Walkways," **Civil Engineering-ASCE**, July 1982, pp. 65-68.

Official findings of the failure investigation conducted by the National Bureau of Standards, U.S. Department of Commerce. Among its conclusions was this: "Even if the now-notorious design shift in the hanger rod details had not been made, the entire design of all three walkways, including the one which did not collapse, was a significant violation of the Kansas City Building Code."

Notes

The Kansas City Hyatt Regency Walkways Collapse.

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