The Fatal Engineering Flaw Behind the Deadliest Building Collapse in U.S. History

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By Andrew Zaleski
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Mark Williams remembers his ankles resting beside his head. He was lying facedown on the floor of a hotel lobby, with his left ankle next to his right ear and his right ankle next to his left ear. For Williams, an avid outdoorsman and hunter, it was an improbable occurrence—one made possible due to the mangled mishmash of concrete and steel that had crashed down on top of him, trapping him while tearing both his legs out of their sockets.

Even so, Williams, now in his 70s, is one of the lucky ones: He survived the Hyatt Regency Hotel tragedy of 1981, an engineering calamity that injured more than 200 people and killed 114 others.

The evening of July 17, 1981, was a lovely, if humid, summer Friday in Kansas City, Missouri. For about 1,500 people, that meant only one thing: a night of drinks, dinner, and dancing at the Hyatt Regency. The building was owned by Crown Center Redevelopment Corporation, the real estate arm of Hallmark, the greeting card conglomerate based in Kansas City.

The walkways collapsed onto the lobby of the Hyatt Regency hotel during a Friday night tea dance.
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After the $50 million hotel opened in 1980, it became known for its weekly tea dances. There was live music and a dance contest, but for many people the main attraction was the conviviality—a chance to unwind with friends and family at the end of a long workweek.

That’s what drew the 34-year-old Williams there on this particular night.

The tea dances were held in the lobby, a grand five-story atrium. Above the crowd were three 120-foot-long skywalks, each weighing 36 tons, that connected the hotel’s north and south ends. Made of concrete, steel, and glass, these walkways were designed to look as if they were floating, and their elevation gave partygoers an excellent vantage point from which to take photos or watch the crowd down below.

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While the third-floor skywalk hung by itself on the east side of the lobby, the second- and fourth-floor skywalks hung in a stacked pair on the lobby’s west side, with a system of hanger rods suspending the upper walkway 30 feet above the lower one. These rods extended from the framing of the atrium roof to box beams beneath the fourth-floor skywalk, holding that walkway up. Meanwhile, the second-floor skywalk hung from the fourth-floor skywalk thanks to a separate set of hanger rods that extended from the box beams of the upper walkway to the box beams beneath the lower walkway.

Just after 7 p.m., Williams was standing in line at the bar with a few dozen other people, directly under the second-floor skywalk, waiting to order a drink. The band was just getting going again; at 7:04, it launched into a rendition of Duke Ellington’s “Satin Doll.” One minute later, an audible cracking noise—“like a big tree limb cracking,” as Dalton Grant, who was 11 years old at the time, recalled in a local TV interview—crashed through the cacophony of conversation and big-band music.

The area where the second- and fourth-floor walkways had been, one hanging directly above the other. The third-floor walkway, still intact, hangs on the right.
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Breaking through the supports that anchored it to the ceiling, the fourth-floor walkway plummeted 30 feet and slammed into the second-floor walkway, which then collapsed and fell to the floor.

Crushed beneath the weight of the debris, Williams still recalls what he was thinking at the time. “I didn’t feel any pain,” he said in an interview published in May. “Adrenaline is a magical drug.” At 4:30 a.m. on Saturday, after being pinned for nine and a half hours, Williams was pulled from the wreckage. He was the final person rescued.

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In the wake of the event, two experts on the Hyatt project became the first engineers to ever lose their professional licenses for what an administrative law judge deemed “gross negligence.” The Hallmark company paid out $140 million in settlements and judgments; the largest settlement, $12 million, went to Sally Firestone, who had been standing on the second-floor skywalk. She lost the use of her arms and legs and is now in a wheelchair.

Firefighters rescue people from under a collapsed walkway.
BettmannGetty Images

Forty years later, the failure of the skywalks at the Hyatt Regency Hotel is still, in the words of federal investigators, “the most devastating structural collapse” in U.S. history. (The June 2021 condo collapse in Surfside, Florida, killed 98 people.) The disaster went on to be studied in engineering classrooms and at conferences. The causes and effects of the failure, as well as the preventive measures that could have stopped it from happening at all, create a disturbing case study of negligence and thoughtlessness that still informs engineering and construction practices in the U.S. today.

And yet to the creators of those skywalks, the warning signs of a catastrophe were there all along, inexplicably ignored until it was too late. Jack Gillum, the main structural engineer on the Hyatt project, spent his remaining years warning engineers how to avoid disaster. “Engineering societies need to talk about failures. That’s how we learn,” Gillum said 20 years after the Hyatt Regency calamity.

In early 1976, as soon as Crown Center Development Corp. began its preliminary planning for Kansas City's newest hotel, a huge emphasis was placed on the impressiveness of the building's interior. In those days, the Hyatt chain wanted to wow people with spectacular features as soon as they entered the doors.

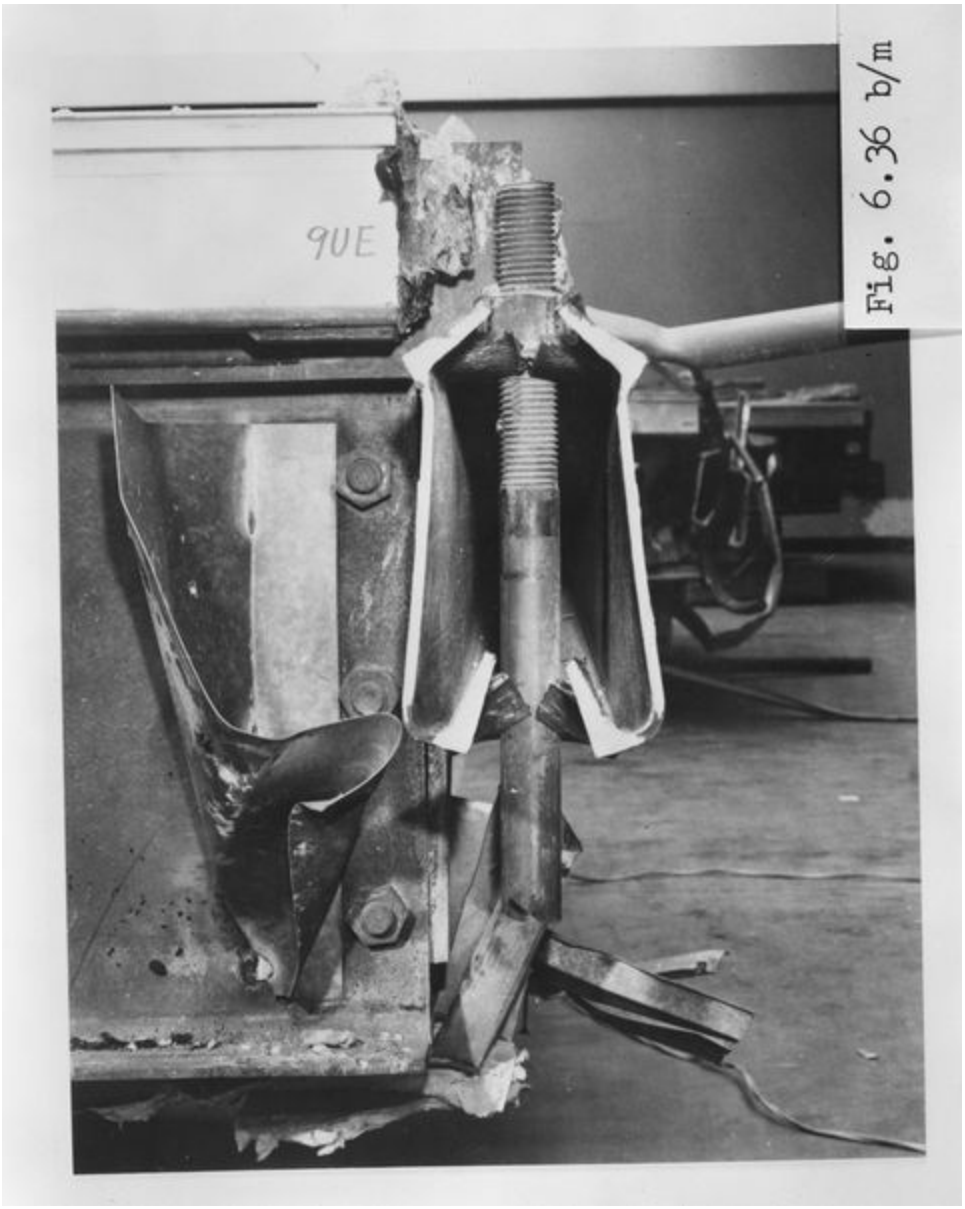
It was known as the "Jesus Christ factor," says Rick Serrano, a former newspaper reporter who shared in a Pulitzer Prize at the *Kansas City Times* for the paper's coverage of the skywalk collapse. (Serrano has written a book, due out in September, that recounts the entirety of the disaster and its aftermath.)

Wreckage of the walkways in the hotel lobby.
AP Photo/Pete Leabo

"The Hyatt Corporation wanted you to walk into the hotel, look around the lobby, and say, 'Jesus Christ, this is beautiful,'" he says. "So they were pushing the architects for big designs and to think outside the box, and they came up with these skywalks."

Gillum and his firm were brought in that same year to handle all the structural engineering services. A respected veteran engineer, Gillum assigned Daniel Duncan, one of his best project engineers, to the project. Working with the architects, the team helped develop various plans and decide on the basic design of several features, including the elevated walkways.

Going for the Jesus Christ factor, the architects envisioned a support system using long rods —as opposed to supports underneath—in order to make the skywalks look like they were floating in air. The original version of the plan called for both the fourth-floor and second-floor skywalks to be supported by single, continuous rods suspended from the atrium ceiling and running through box beams on the underside of each walkway. Each box beam, three to a skywalk, was actually hollow, nothing more than a pair of 8-inch steel channels with the flanges welded toe to toe. (Write the letter “C” on a piece of paper. Now write a backward “C” next to it. That’s toe to toe.) To actually hold the walkways in place, the rods would be threaded at the top and bottom to receive a nut and a washer below each set of beams.



A front view of a beam section from one of the collapsed walkways.
Department of Commerce. National Bureau of Standards/National Archives

As these design plans were coming together, the Hyatt Regency was already being built. The hotel was a fast-track construction project. According to Randall Bernhardt, a structural engineer in St. Louis and a member of the board of governors for the Structural Engineering Institute at the American Society of Civil Engineers, when projects are fast-tracked, mistakes can easily happen.

“Everything is in a hurry,” he says. “The contractor wants to get things underway and constructed. So the engineers were designing in a hurry … There was a sense of speed and urgency that could tempt people to be a little careless in the design.”

A subcontractor, Havens Steel Company, was hired to fabricate the steel rods, but the plan hit a snag. Threading a 45-foot-long rod was impractical. Doing so would make the rods flimsy and potentially unsafe. On the construction site, it became clear that such a design would be unworkable. In early 1979, almost a year into the construction, Havens Steel sketched a revised plan: Instead of using long, continuous rods linking both walkways to the atrium ceiling, they could use two sets of shorter, offset rods bolted above and below the welds of the box beams on both walkways. In other words, the second-floor skywalk would no longer connect to the ceiling; it would anchor itself only to the fourth-floor skywalk hanging 30 feet above it.

Duncan provisionally agreed to the change over the phone. The drawings, however, had the stamps of the contractor, the architects, and Gillum’s firm on them, meaning they all gave their approval. Rearranging the hanger rods effectively transferred all the tonnage of the second-floor skywalk to the fourth-floor skywalk. That, in turn, doubled the load on the lower nuts of the box beams of the fourth-floor walkway—which now supported the weight of two skywalks.

On the night of the collapse, one of the nuts on the middle box beam on the underside of the fourth-floor walkway finally pulled through the weld of the steel flanges. The load on the rod was so heavy that the nut made the walls of the channel cave in.

> From the day of construction, they had only minimal capacity to resist their own weight.

According to an investigative report filed a year after the collapse, the National Bureau of Standards attributed the engineering failure to that decision to replace those continuous hanger rods. “With this change,” the investigators wrote, “the ultimate capacity of the walkways was so significantly reduced that, from the day of construction, they had only minimal capacity to resist their own weight.”

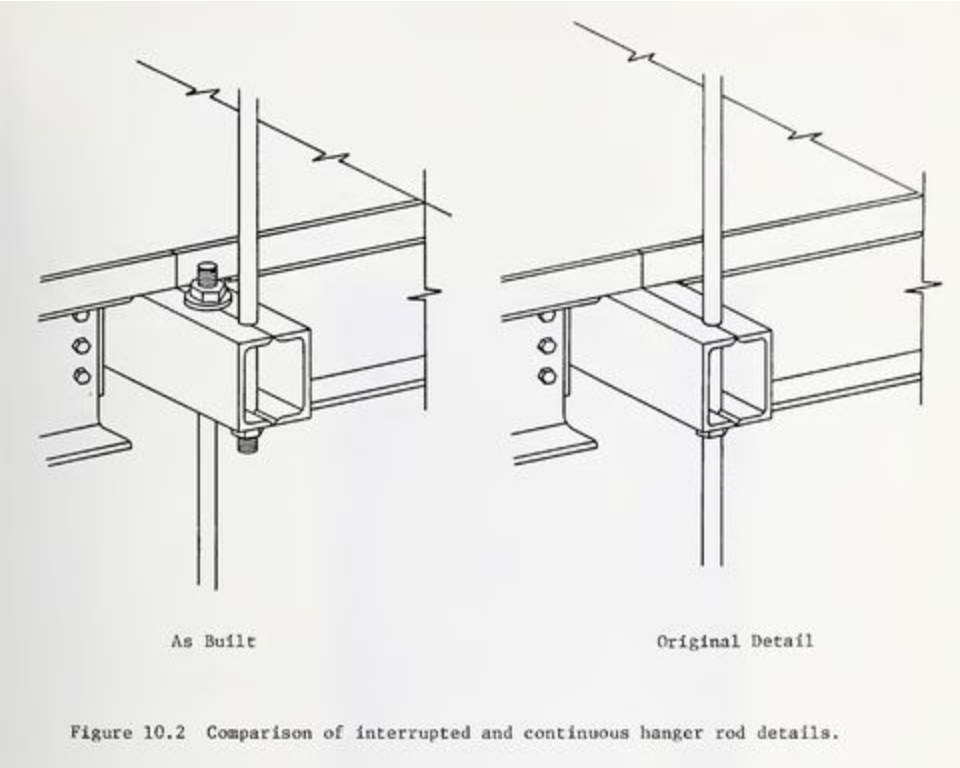


Figure 10.2 Comparison of interrupted and continuous hanger rod details.

A diagram from the investigation report into the collapse shows the original design of the hanger rods versus how they were built.
Marshall, R. D.; Pfrang, E. O.; Leyendecker, E. V.; Woodward, K. A.;Reprinted courtesy of the National Institute of Standards and Technology, U.S. Department of Commerce. Not copyrightable in the United States.

Put another way: The fourth-floor skywalk was supporting too much weight *as built*. It didn't even matter that on the night of July 17, a few dozen people were spread out on the second- and fourth-floor skywalks. The upper walkway was bound to fail, and its collapse was just a matter of time.

One of the first doctors who arrived at the scene after the skywalks fell likened it to a war. It was bedlam and chaos combined, he said, with "a lot of screaming." Severed body parts were strewn about. What later became known as "geographic triage" went into effect, as anyone who was injured but could still walk was ordered out of the hotel. Crews with jackhammers tried to extricate people from under broken concrete. Those who were fatally injured were told they wouldn't make it. One bartender died right there on the lobby floor, as a surgeon was amputating his leg in an attempt to free him from the rubble.

As the Hyatt Regency Hotel was being built, there were chances for people to slow down and double-check their work. One glaring opportunity came in October 1979, eight months after the change was made to the hanger rods, when 2,700 square feet of the atrium roof collapsed: Subfreezing temperatures caused bearing plates to split and concrete to spoil. Workers rebuilt the roof and inspectors checked out the reconstruction, but no one examined

the connections of the skywalks. On this point, the city's inspectors share some blame: According to Serrano, many inspections throughout the hotel's construction, if they took place at all, were just minutes long.

What's more, even the original design of the skywalks was in violation of the Kansas City Building Code's minimum load requirements. Built as envisioned, the connection on the fourth-floor walkway where the box beams met the hanger rods could safely support about a 20,000-pound load—far short of the city's minimum of 33,000 pounds. The new design could support a maximum load of only about 10,300 pounds. Each walkway weighed 64,000 pounds.

AP Photo

"I have not seen very many designs over my 40 years where rods like this were used to support a walkway," says Bernhardt. "In fact, I've never, ever seen another one like this."

The fact that no one spotted problems with the skywalk connections came down to buck-passing, and no single team took overall responsibility. When the new support system for the skywalks was designed, the engineers and architects indicated that it was the job of the steel fabricators to check the strength of the new setup. Meanwhile, the fabricator assumed it was up to the engineers on site to check the strength of the rods running through the box beams.

Ultimately the blame was placed on Gillum and Duncan. In the course of its own investigation, the Missouri Board of Architects, Professional Engineers and Land Surveyors discovered that the faulty hanger rod connection was indeed a topic of concern during the construction phase. Duncan was asked about the design change six separate times, and he reiterated every time that replacing the single rod with the two offset rods wouldn't jeopardize walkway safety. In court testimony, Gillum and Duncan maintained that it was the job of the fabricator to determine if the steel connections would hold. Investigators concluded that as the structural engineers on the project, it was their responsibility to ensure the stability of the connections. In 1985, an administrative law judge found them guilty of gross negligence; in 1986, the Missouri licensing board revoked their licenses to practice engineering in the state.

The Hyatt Regency disaster led to wholesale changes in the engineering world in the decades that followed. The American Society of Civil Engineers adopted a policy stating that on a construction site, the structural engineer is responsible for reviewing drawings and design changes.

"They finally determined that the engineer is the ultimate man responsible for the structural integrity, not the fabricators and not the architectural engineer," Serrano says.

Mandatory peer reviews by outside engineering firms also became a standard practice in some cities and states where particularly complicated structural design or architecture is under consideration. Usually another firm comes in and reviews the designs and the calculations to lessen the risk of errors. Had that been in place for the construction of the Hyatt Regency, two more underlying errors in the design of the skywalk might have been caught: The rods were only 1.25 inches in diameter; they should have been at least 1.75 inches. And the box beams should have been I-beams (beams with I-shaped cross sections) to offer better load support.

In addition, the few building codes in place when the Hyatt Regency was built have been replaced, for the most part, by Chapter 17 of the International Building Code, according to Bernhardt. It's now stipulated that special inspections should be required for certain kinds of designs. In the context of the Hyatt Regency, that would've involved a structural engineering inspector on site who reported to the structural engineering team but observed the testing or construction of critical structural components of the skywalks: the welds, the connections on the rods, maybe even measuring the torque on some of the bolts that received nuts and washers.

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Perhaps the biggest change of all is one of perception. Industry groups these days recognize that matters of structural integrity rest with a project’s “engineer of record”—the person whose seal of approval ends up on the plans. During his retirement, Gillum, who died in 2012, spoke at professional conferences about the mistakes made in the years and days leading up to July 17, 1981. The overall message each time, though, was the same: The buck stops with the structural engineer. Of what went wrong at the Hyatt, he told one audience in 2001: “Any first-year engineering student could figure it out.”

“This is a tragedy I think about 365 days a year,” Gillum said. “I think about it anytime I walk into a public building.”

As for Mark Williams, when he was first pulled from the wreckage, doctors were sure he would die in the hospital. When he didn’t die, he was told he’d never walk again. His most serious and lingering injury was the loss of the use of his left foot. In a recent interview with a local TV station reporting on the 40-year mark since the tragedy, he said he measures time differently these days. In Kansas City, there’s only B.H. and A.H.: Before Hyatt, when the skywalks were still afloat, and After Hyatt, when they came crashing down to earth.