

Hyatt Regency: the human price of failure



Sean Brady tells the stories of some of the survivors, rescuers and engineers involved in the Hyatt Regency walkway collapse.

Collapse

Mark Williams walked up to the bar in the Hyatt Regency hotel in Kansas City to buy a scotch and water¹. It was 7:05 pm on 17 July 1981. A ‘tea dance’ was in full swing in the hotel lobby, an impressive, four-storey architectural space, with a number of walkways suspended from the lobby roof. One walkway spanned the lobby at the third-floor level, while a pair of walkways spanned it at the second- and fourth-floor levels – one suspended directly above the other. There were 1500 to 2000 people at the tea dance, with a number of them standing on the walkways watching the dancing below.

At the same time, Cyndi Paulson, working as a hostess in the hotel’s Terrace Restaurant overlooking the lobby, took a moment to look out of the hotel window, past the fourth-floor walkway, to check the time on a bank clock across the street¹. Suddenly, she watched in disbelief as the fourth- and second-floor walkways began to fall.

Mark Williams knew something was wrong when he heard a loud crack above the sound of the music and the revellers. He thought about moving, but it was too late. When the walkways struck the crowded lobby floor, a cloud of dust billowed up towards Paulson. As she watched, she realised her father was in the hotel.

Forty-two blocks south, Dr Joseph Waeckerle, an emergency physician and former director of Kansas City’s emergency medical system, had just finished running 11 flights of stairs at the Baptist Medical Center as part of his training for the rugby season. He was returning to the emergency room when he got a phone call from dispatchers: “We need you at the Hyatt”¹. It took him 12 minutes to reach the hotel, and he immediately started

Figure 1
Deformed as-built connection



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treating the people who’d made it outside. Then a paramedic took Waeckerle by the arm and told him that the disaster was inside, adding, “You need to get inside”¹. Waeckerle entered the lobby. He later described it as “like a war”².

Cause of failure

At 7:45 pm that same evening, Jack Gillum, a structural engineer, returned home with his wife to find their telephone ringing³. It was Herb Duncan, one of the principals at the architecture firm responsible for the Hyatt. Duncan said, “There has been a collapse at the Hyatt”³. Gillum was shocked: his firm had been the engineers on the project, with Gillum himself being the Engineer of Record, ultimately responsible for the structure. Duncan went on to explain that one of the walkways had collapsed and that “several may have been killed and many injured”³. Chillingly, Duncan asked Gillum the weight of the individual walkway units. Rescue workers needed to determine the lifting equipment necessary to get to the victims.

Despite his shock, Gillum gave the architect the information. Then he contacted his project engineer on the Hyatt, as well as two other key principals at the firm. He also managed to charter a plane to take them to Kansas City. They arrived at the Hyatt at around 11:15 pm that night to find utter devastation. As there was little they could do to aid the rescue, they set about trying to investigate what caused

the collapse. They quickly discovered that the rods, bolts and washers that supported the fourth-floor skywalk were largely undamaged and still hanging from the lobby ceiling. Inspection of the failed walkways confirmed the cause of failure: the two channels that transferred the walkway loading into the steel rods had deformed, allowing the rods’ nuts and washers to pull through the connection (Figure 1). At about 3 am that morning they got to their hotel, and Gillum did some quick calculations, discovering that the as-built connection was “grossly inadequate”. He tried to get some sleep but was “numb with despair and grief”³.

Over time Gillum’s view would be confirmed, with a paper by Moncarz and Taylor on the failure summarising that “the collapse occurred because of the doubling of the load on the connection resulting from ill-considered change of an ill-defined structural detail”⁴. So what was this change? The as-built connection consisted of two steel rods, the upper rod connecting the fourth-floor walkway to the lobby roof, and the lower rod supporting the second-floor walkway below (Figure 2). The original connection detail, however, consisted of only one rod, with a nut and washer transferring the walkway loading into the steel rod (Fig. 2)⁵.

The change resulted in a doubling of the load on the fourth-floor walkway connection, with Henry Petroski comparing the mechanics of the change to that of two men gripping

a rope hung from the ceiling⁶. The original detail is akin to two men hanging from a rope, one above the other. Neither man will fall as long as their grip is sufficient to support their own individual weight. However, the as-built connection is analogous to cutting the rope just below the upper man and tying it to his leg. The upper man is now carrying his own weight, plus the weight of the man below, with his grip being required to carry the additional load. If the upper man's grip was not up to the task, then both men would fall, which is what happened to the walkways.

As the investigation progressed it was discovered that the original and as-built connections **were not actually designed**³. Somehow, a critical connection had managed to make its way through the entire design and construction process without being checked by a structural engineer. The reason for this oversight, as with many of the structural failures we explore, was due to human factors. The original connection was sketched by Gillum's firm, with its design to be undertaken by the fabricator, which was common practice at the time. The fabricator, however, phoned and suggested that the original detail was impractical – for example, the rod would have to be threaded from the second- to the fourth-floor level so that the fourth-floor washer and nut could be wound up into place. The fabricator suggested using two rods, as per the as-built detail. While still on the call, the engineer's project manager did some quick calculations and confirmed that the change was acceptable, but then asked the fabricator to submit the change application through the formal channels for approval. The fabricator failed to do so, and drew the as-built detail⁵.

The fabricator then won an unrelated major project, and in order to free up capacity to deliver it, they subcontracted the remaining work to produce the shop drawings for the walkways. As the drawings included the partially completed as-built connection of the walkways, the subcontractor simply assumed it had been designed. The drawings were finalised, and the issue was not picked up by the designer. The detail was fabricated and installed.

Warning signs that could have raised the alarm were missed. The connections' channels began to deform under self-weight alone soon after installation³. While the owner's inspector noticed the deformations and reported them, the report was not followed up. A workman also noticed the deformations while installing plasterboard on the walkways, but thought nothing of it. And once the plasterboard had been installed,

the connection was hidden and any further opportunities to identify the deformations were lost.

Rescue

All this would take months to unravel, but the grim task the emergency services faced on the night of 17 July would stay with them for years afterwards. What Dr Waeckerle encountered when he entered the lobby was confronting in the extreme: "There was a lot of screaming. Power lines had broken and were swinging above the lobby, arching electricity. A waterline had ruptured and there were several inches of water on the floor"². Severed body parts floated in the water.

Waeckerle took control of the rescue effort, directing those able to walk to leave the hotel, and he began triaging the survivors. He soon realised that there were many more people requiring attention than there were resources to do so. Those fatally wounded were told they were going to die and given pain medication, there was not enough time to free them. This task greatly troubled some of the rescue workers. Waeckerle remembers having "to do that for one lady whose family was right in my face, screaming for me to do something. I remember every single time I did it. To this day I pray I did the best I could for each person"².

Among the debris walked Cyndi Paulson, searching for her father and comforting victims as she went. She got outside and was met by her mother. Her mother told her that her father was still alive – he had left the hotel just before the collapse. Paulson could not believe it. Then she sent her mother home and stayed to help with the rescue.

Over 63t of walkway had collapsed into the lobby, with bodies – dead and alive – entwined

together beneath it⁷. In some cases, rescuers were forced to dismember the dead to get to the living, with some people requiring amputation to free them. A number of rescue workers found the work too traumatic and had to leave. Waeckerle spoke to one man, telling him his legs would have to be amputated. The man refused. Waeckerle returned some time later and found the man deteriorating and now agreeing to amputation. Waeckerle summoned a surgeon, who freed the man with a chainsaw. The man died shortly afterwards¹.

Throughout the rescue efforts, Mark Williams lay beneath the rubble, trapped in an 18in. high pocket. Both his legs had been dislocated from his pelvis, with his left leg twisted over his torso, his left foot at his right ear. Two people were trapped near him, slowly dying. Water from the ruptured pipe overhead was flowing through the rubble around him and he feared he would drown before rescue.

Most of the victims were removed in the first hour by rescue workers using forklifts, pneumatic drills and concrete-cutting saws. Some took longer to free – seven hours after the collapse rescuers pulled a man, woman and child out of the rubble. By 3 am two Belger cranes arrived, smashing through the front windows of the hotel to protrude above the fallen walkways. They began lifting the slabs and looking beneath them. Eventually, a rescuer heard Mark Williams shouting. They used pneumatic drills to break through the slab above him, almost stabbing him in the process. He was freed at 4:30 am, the last to be freed alive. Later, when rescuers lifted the final slab of concrete, they discovered 31 bodies beneath it.

In all, the collapse resulted in 114 fatalities

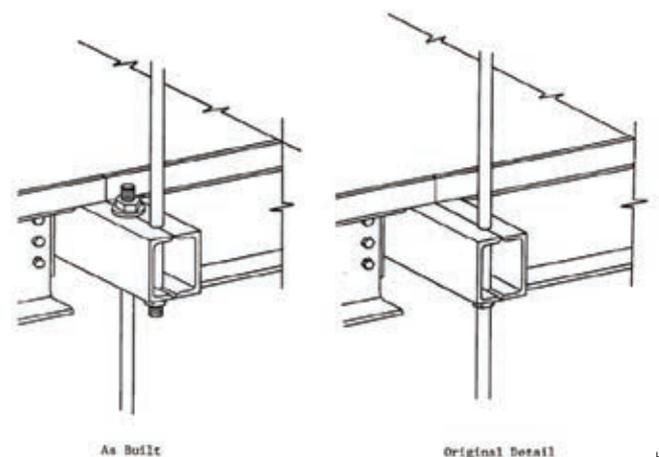


Figure 2
As-built and original detail

– 111 people died in the lobby and a further three succumbed to their injuries after being freed. More than 200 people were injured and it took the emergency rooms of 17 hospitals to treat them¹.

Aftermath

The legal battles that ensued were immense. At one stage, the claims under review totalled \$3bn⁵. A single class action settled for \$143M. The 72 rescue workers sued for the trauma they suffered during the rescue effort. Their claim was for \$150M but they settled the case for \$500 000.

Gillum and his project engineer were convicted of gross negligence, misconduct and unprofessional conduct in the practice of engineering, and had their professional licences revoked in many states. No criminal charges were filed because of lack of evidence. But rather than retreat from the public eye, Gillum has on many occasions spoken publically about the collapse, his role in it, and the human factors that led to failure. His objective has been to “scare the daylights” out of engineers about what can go wrong⁸. He presented a paper on the collapse at the American Society of Civil

Engineers Second Forensic Congress in 2000. On finishing, he received a standing ovation from the audience.

Gillum closed his paper with a heartfelt expression of regret and a reminder to the profession of the importance of discussing such failures:

“There is hardly a day that goes by that I don’t think about the Hyatt collapse, the lives that were lost or marred forever, the relatives that lost their loved ones, and the effect it has had on Kansas City, the construction industry, and everyone connected with the project.

“My hope is that we, as a profession, can and will continue to learn, practice, disseminate, change, and adopt procedures and policies that will prevent a tragedy like this from occurring again.”³

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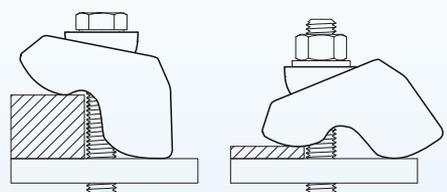


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