

Mentions of the designers and relevant causation issues:

Part 1: 8:27

Did some design flaw doom the building? 6:50

Part 2: 3:15

Something must have gone wrong at the beginning. 3:10

Part 3: 8:59

Engineering principles involved in the design are well known. 1:00

Turns out the project's problems began as soon as construction started. 4:00

Once construction started the owners decided they wanted a shopping mall instead of an office. 4:15

When the builder's refused to this demand, the owner fired them. 4:20

Owner hired its own construction company to proceed, and its own construction company saw no problem with the new plan. 4:30

The new builder removed dividing walls 4:40

The new builder cut a shaft to install escalators 4:45

The new builder changed the size and shape of the support columns 4:50

Reduced columns size from 31" to 23"

Near escalators, reduced col size even more

Part 4: 8:38

Owners permit for 4 floors but built 5 stories 0:30

Owners added a 5th floor without increasing support column 0:40

Owners leased 5th floor for restaurants with heavy equipment and floor loads when building opened 0:55

The owners placed 3 AC units on the roof 7:20

Builders failed to compensate for the added roof weight 7:50

Part 5: 9:06

Warning signs were everywhere 2:50

Owner calls in building inspector 3:25

Owner is convinced trouble is confined to the roof and do not evacuate 3:45

Drop panels not strong enough 7:20

Floor to wall connection did not include "L" shaped rebar 9:00

Part 6: 7:12

One final mistake pushed building over the edge

Owners decide to move the AC roof units and to save money, pushed them instead of getting a crane to lift them 0:55

Owner's bribed 12 government officials to get their building built 5:00

The Guardian said, "More than 500 people died in the Sampoong Department Store – not because of a gas explosion or a North Korean bomb (two early suspicions) – but because of [sheer negligence in construction and maintenance](https://www.theguardian.com/cities/2015/may/27/seoul-sampoong-department-store-disaster-history-cities-50-buildings) of a building not yet six years old.¹

¹ <https://www.theguardian.com/cities/2015/may/27/seoul-sampoong-department-store-disaster-history-cities-50-buildings>

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The Tampa Bay Times wrote that Shoddy construction plagues Korea. This article ended with the following passage.

In Korea, people's sense of responsibility toward work has been lacking since the old days, especially in the construction industry," said Seo Sang Kyo, a Korean professor.

The tremendous gap between the safety records at home and abroad reflects sharp differences in the environments in which South Korean firms operate, construction experts say.

Overseas, Korean firms must adhere to highly sophisticated standards of quality control and accountability _ systems almost entirely lacking at home.

Sampoong hired Woosung Construction both to lay the foundation in 1987 and serve as project supervisor, a common arrangement that critics say invites abuse.

Authorities charge that Sampoong officials blatantly violated the law by building well beyond the approved blueprint. They improperly added an entire fifth floor and added twice as much floor space as allowed in a recent expansion, authorities charged.

Officials also charge that Sampoong used substandard steel reinforcing rods that were thinner than required by law. And the apparent softness of the concrete exposed by the disaster has drawn fire.

Quality of domestic projects is also compromised by what analysts here say is rampant bribery. Kickbacks rumored at 10 percent to 15 percent of the project cost are used to win contracts, avoid inspections and deviate from approved building plans, according to analysts.²

Interesting Engineering 'dot' com reported on this collapse in a 2021 article named "**Death and Calamity: The Sampoong Department Store Collapse Explained**" wrote in part,

The investigation into the tragedy revealed that, in addition to the not well thought out fifth floor addition, the badly placed air conditioning units, and reducing the diameter and number of support columns, the collapse was a perfect storm of terrible engineering. Had the developers stuck to the original plans, the structure would have been twice as strong as it needed to be. Given all of the errors, it was amazing that the structure had had stood for 6 years.

Truth and Consequences:

Two members of the Sampoong group [received prison sentences](#) as a consequence of their negligence — Lee Joon and his son Lee Han-Sang (whose wife was among those trapped in the rubble). Various city officials were also incarcerated for accepting bribes to overlook the building's architectural flaws.

If you could say anything good came of this tragedy, it would probably be, with good reason, South Korean's demand for justice and accountability. After discovering the concrete used for the building was also substandard, and that every possible corner appeared to have been cut, Korean safety standards were revised. New inspections revealed that [hundreds of other buildings](#) in Seoul were also on the verge of collapsing. Only one building out of fifty was considered safe, one out of seven needed rebuilding from the ground up, and four out of five required major renovations.³

² <https://www.tampabay.com/archive/1995/07/01/shoddy-construction-plagues-korea/>

³ <https://interestingengineering.com/death-and-calamity-sampoong-department-store-collapse-explained>

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The Great Disasters website also ran a feature on this failure entitled The Sampoong Department Store Collapse. They wrote in part,

The building had not originally been planned as a five-floor department store, but as a four-floor apartment building. The Sampoong Group had decided to make changes after construction had begun. Their original builders, Woosung Construction, had objected to the changes, and had been dismissed. An in-house building company had completed the work.

Because of regulations that restricted the number of trading floors a department store could have, the fifth floor was initially intended to be a rollerskate rink. However, again, changes were made by the Sampoong Group, and instead the fifth floor was given over to restaurants. This may not seem particularly important, but it was actually very significant.

In a traditional Korean restaurant, customers sit on the floor – and to ensure their comfort, they use underfloor heating. This requires pipes to be run throughout the floor, and as a result the concrete of that floor needs to be thicker. Restaurants also come with a lot of heavy kitchen equipment. The net result was that the fifth floor was now three times heavier than originally planned.

Flat slab construction means that each floor is a concrete slab, supported by a number of columns which distribute the weight evenly. Any changes to that weight must, therefore, be reflected in changes to the columns; a heavier building needs stronger columns.

The columns were originally supposed to be 80cm in diameter, with 16 reinforcing rods running through them. When Professor Chung looked at the drawings, he discovered that, far from having been made stronger, they had been reduced to 60cm in diameter, and had only eight rods.

When Professor Chung calculated the effect that this reduction would have, he found that it reduced the building's strength by nearly half. However, buildings are usually designed with a large safety margin, so it should still have been strong enough.

Except that there were further problems with the columns, noted by structural engineer Lee Moon-Gon.

“The connection area between the column and the slab is very critical because the columns directly distribute the load... We eventually found that some columns were missing the drop panels between the slab and the column, and the drop panel is essential in a flat slab structure.”

The spacing between the columns also caused some concern; if they had been closer together, they would each have borne less load, but instead they had been spaced widely to create as much retail space as possible.

Then, another factor was discovered; one which was supposed to have made the building safer. Fire shields had been installed around the escalators; in the event of a fire, these shields would drop to ensure that the flames and smoke could not spread to adjacent floors. Unfortunately, installing these shields had meant cutting into the columns around the escalators, reducing the support they provided by as much as 25 percent.

While all these factors combined to put the building on the verge of collapse, there was one more mystery for the investigators to solve – why had it happened then?

As Professor Chung put it,

“There always exists a critical point. If you go beyond that point, the building collapses.

It can take a long time for a building to reach the critical point before it collapses. But then sometimes you just need a drop of water, one drop of water, and the destruction starts.”

They still needed to identify that one drop of water, the final factor which had actually triggered the collapse.

Several members of the store's management had been arrested and questioning one of them led to the answer.

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The facilities manager, Mr Lee, told the investigation team that there had been significant issues earlier on the day of the collapse. That morning, he had been called to one of the fifth floor restaurants because there were cracks around one of the columns. These were not small cracks, either – they were described as being the size of a man’s fist. In other parts of the fifth floor, the floor was visibly buckled, and just before midday some of the kitchen staff reported hearing cracking sounds from the ceiling.

The building’s management brought a structural engineer in that afternoon. He had taken pictures of the cracks and bulges. According to some sources, he told senior staff that the building was sound; others say that he advised them to evacuate the building, but was ignored. Those senior staff members did, of course, leave the building themselves.

This information allowed the investigators to pinpoint the column which had precipitated the collapse, and from there they were able to discover how and why.

Two years earlier, following noise complaints from neighbours, three large air conditioning units on the roof had been moved. Although they were very heavy, they were not lifted using cranes. Instead, they were placed on rollers and dragged across the roof. Noticeable cracks were left behind, but nothing was done about them.

The investigators concluded that the air conditioning had been dragged directly over column 5E – the one which had been cracked on the morning of the collapse – and this had fatally weakened it. Over the next two years, every time the air conditioning was turned on, vibrations were sent through the roof and the columns, gradually widening the cracks.

Management were aware that the air conditioning was causing vibrations; this was why it had been switched off that day, but it was too late. Column 5E was no longer able to bear the load. Finally, it gave way. Its share of the load was transferred to the other columns, which in turn gave way, and the entire structure failed. The roof fell down onto the fifth floor, and successively every other floor collapsed, too.

Once the first column failed, it took only about twenty seconds for the entire building to pancake downwards. However, the collapse of the Sampoong Department Store had effectively begun more than five years earlier – it began before the store ever opened.

As a result of the investigation’s findings, criminal charges were brought against several members of the Sampoong Group’s senior management.

Chairman Lee Joon was charged with criminal negligence and was given a prison sentence of ten and a half years. On appeal this was reduced to seven and a half years. He died in 2003, shortly after his release.

His son, the store’s president Lee Han-Sang, was also convicted and sentenced to seven years for accidental homicide and corruption.

However, responsibility for the collapse went beyond the store itself, which had passed regular inspections right up until the collapse.

Hwang Chul-Min, former chief of the Seocho ward where the store was located, was sentenced to ten years after being found guilty of accepting a bribe of twelve million won. Other officials received sentences of between eight and eighteen months. In total, 25 people received either prison sentences or were fined.

This level of corruption raised concerns about other buildings in Seoul. If one company could get away with shoddy construction through bribery, what had stopped others doing the same?

The shocking answer was, nothing at all. A thorough inspection of Seoul’s skyscrapers revealed that only one in fifty could be called safe. Four out of five needed major repairs, and one in seven had to be rebuilt. ... Jeong Gwan-Jin, a lawyer who lost three daughters in the collapse, said, “People should do their best at their jobs. This accident happened because they didn’t.”⁴

⁴ <http://www.greatdisasters.co.uk/the-sampoong-department-store-collapse/>

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