

he phenomenal city of San Francisco, famous for the Golden Gate Bridge and Alcatraz Tower, is a bustling city of Northern California which houses the spectacle - Transamerica Pyramid. Though, it no longer houses the headquarter of the Transamerica Corporation, the building has retained its association by being depicted in the company logo.

A 48-storey, modernist architectural skyscraper, boasts to be the soaring 2<sup>nd</sup> tallest building in whole of San Francisco which was constructed 51 years ago! With a height of 260 m, the building houses multiple retail and office spaces.

Basis estimation by seismologists, there is a 72% probability of a magnitude 6.7 or greater earthquake in San Francisco's Bay Area in the near future. Earthquake hazard is spread throughout San Francisco Bay Area. There is a 3 out of 4 chances of the Bay Area to be struck by disastrous earthquakes in the next 30 years. U.S. Geological Survey names the prime 'Earth Movers' as the San Andreas Fault, the Calaveras Fault and the Hayward Fault.

Damages from a Hayward Fault rupture alone could shake one million homes with 77,000 to 152,000 households displaced. It is not just the Earth's shaking that could lead to billions in damages

and lead to tens of thousands of Bay Area residents becoming homeless. When earthquakes occur in San Fransisco, they cause liquefaction of soil and pose a high risk to neighbouring areas as well.

Such catastrophic geological situations can only be mitigated and not completely avoided. This is where earthquake resilient buildings such as the Transamerica Pyramid play a significant role in safeguarding lives, infrastructure and economy when faced with such catastrophes. The Transamerica Pyramid successfully withstood the 1989 Loma Prieta earthquake of magnitude 7.1 which struck the Santa Cruz Mountains Basis estimation by seismologists, there is a 72% probability of a magnitude 6.7 or greater earthquake in San Francisco's Bay Area in the near future.



During the quake, the top story swayed over 12 inches from side to side. Yet the building was undamaged and no one was seriously injured.

The success of this building goes to Architects - William Pereira & Harry D. Som, Structural Engineer - Walter Hensolt and Engineering Firm - Chin & Hensolt.

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## Structural System & Seismic Design

The Transamerica Pyramid in San Francisco was built with the possibility of future devastating shocks in mind. The building's concrete and steel foundations are designed to move with any earthquakes and reach as far as 15.8 m deep. This base allows for stability and the absorption of shock waves.

The building's seismic defences include a four-storey steel and concrete base rising from a 2.7 m thick foundation, and two sets of internal framework. To construct this advanced building, the team first excavated the site and undertook a lengthy continuous concrete pour to build its foundation.

From there, they established the skyscraper's main structural support; the fourstorey steel and concrete truss webbing that wraps around the base of the building and extends approximately 15.5 m below ground.

Rising from this formidable foundation, the building's exterior framework is reinforced with additional interior frames that rise to the 17<sup>th</sup> and 45<sup>th</sup> floors providing resistance to torsional movements. As the skyscraper began to take its place on the skyline, its two distinctive "wings" steadily emerged from the 29<sup>th</sup> floor.

Providing both form and function, these extrusions actually help to make the building's height economically feasible. With its pyramid design creating a floor-plate that reduces in area with increase in height,



these fins carry elevators, stairways and services to the top of the structure while keeping them out of the lettable floor space. Clad in white precast quartz window frames, the pyramid was topped with a 65 m illuminated spire and capped with a beacon known as the "crown jewel".

Possibly, the most visually recognizable seismic safety feature of tall buildings is the truss. The Transamerica Pyramid in San Francisco is famous for its architecture: a wide base that narrows as it goes up increases the building's stability. A network of diagonal trusses at its base supports the building against both horizontal and vertical forces.

## **Specs and Facts**

- The building's façade is covered in crushed quartz, giving the building its light color.
- The four-storey base contains 12,000 m<sup>3</sup> of concrete and over 480 km of steel rebar.
- The building's foundation is 2.7 m thick, the result of a 3-day, 24-hour continuous concrete pour.
- Only two of the building's 18 elevators reach the top floor.
- The building is on the site that was the temporary home of A.P. Giannini's Bank of Italy after the 1906 San Francisco earthquake destroyed its office. Giannini founded Transamerica in 1928 as a holding company for his financial empire. Bank of Italy later became Bank of America.
- The aluminum cap is indirectly illuminated from within to balance the appearance at night.
- The two wings increase interior space at the upper levels. One extension is the top of elevator shafts while the other is a smoke evacuation tower for fire-fighting.
- A glass pyramid cap sits at the top and encloses a red aircraft warning light and the brighter seasonal beacon.
- Because of the shape of the building, the majority of the windows can pivot 360 degrees so they can be washed from the inside.
- The spire is actually hollow and lined with a 30.5 m steel stairway at a 60 degree angle, followed by two steel ladders.
- Construction began in 1969 and the first tenants moved in during the summer of 1972.

## REFERENCES

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