

TRANSAMERICA PYRAMID DESIGN

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Figure 1. Transamerica Pyramid. Photo courtesy of the USGS.

Introduction

The Transamerica Pyramid is San Francisco's tallest building. The Pyramid has 49 stories and a 212 foot spire. The height from the apex to the ground is 845 feet. The base width is 175 feet. The unique structural feature of this tapered building is the truss system above the first floor, as shown in Figures 2 and 3.

Note that that photos in Figures 2 and 3 are courtesy of the Earthquake Engineering Research Center, University of California, Berkeley.



Figure 2. Truss System at Base of the Transamerica Building

The truss system supports both vertical and horizontal loading. The building is carefully engineered to take large horizontal base shear forces. Note that the nearby San Andreas and Hayward Faults are sources of major earthquakes.



Figure 3. Horizontal X-bracing

The overhead X-bracing resists torsional movement of the building about its vertical axis.

In addition to the exterior frames, four interior frames in each direction extend up to the 17th floor and two interior frames in each direction continue to the 45 floor.

The building is constructed of steel and reinforced concrete.

Loma Prieta Earthquake

The Transamerica Pyramid successfully withstood the Loma Prieta earthquake as reported in Reference 2:

The 1989 Loma Prieta earthquake of magnitude 7.1 struck the Santa Cruz Mountains in California. Sixty miles away, in downtown San Francisco, the 49 story Transamerica building shook for over a minute. 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.

Modal Natural Frequencies

The natural frequencies of the Transamerica Pyramid are given in Table 1. These frequencies were obtained by measurement as documented in Reference 2.

Table 1. Transamerica Pyramid Natural Frequencies			
Mode	East-West (Hz)	North-South (Hz)	Torsion (Hz)
1	0.330	0.337	0.447
2	0.616	0.630	0.814
3	0.843	0.880	1.06
4	1.10	1.11	1.27
5	1.50	1.52	-
6	1.72	1.73	-

The first mode shape is shown in Figure 4.

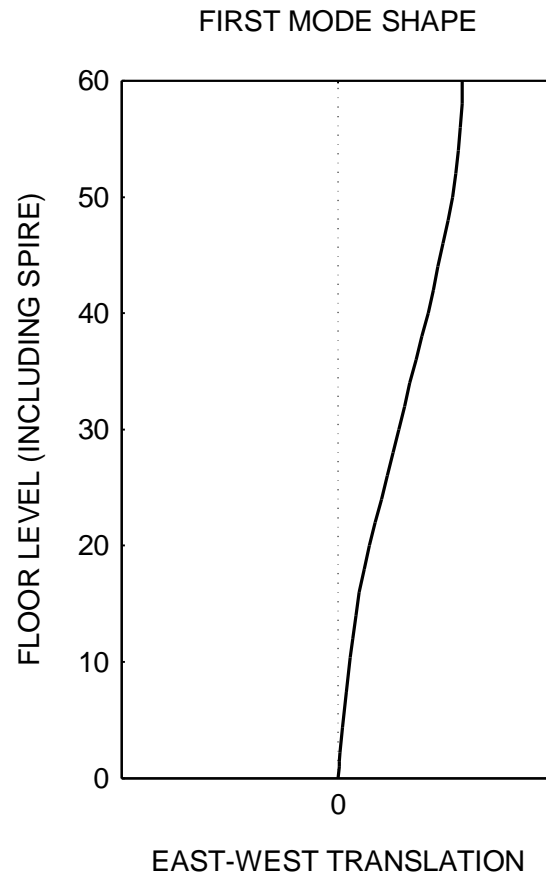


Figure 4.

References

1. Western States Seismic Policy Council Earthquake Quarterly - Spring 1998
2. The Recorder, Vol. II - Issue 1, Kinometrics, Inc.