EXAMPLE 5

Three-Story, Three-Dimensional Braced Frame - Dynamic Response Spectrum Analysis

Problem Description

This is an L-shaped building structure with four identical braced frames. All members (columns and braces) carry only axial loads.

The structure is subject to the El Centro 1940 N-S component seismic response spectrum in the X-direction. The structural damping is 5 percent. The structure is modeled by appropriately placing four identical planar frames. Each frame is modeled using three column lines. Kip-inch-second units are used.

Geometry, Properties and Loading

The modulus of elasticity is taken as 29500 ksi and the typical member axial area as 6 in^2. A story mass of 1.242 kip-sec^2/in and a mass moment of inertia of 174,907.4 kip-sec^2-in are used.

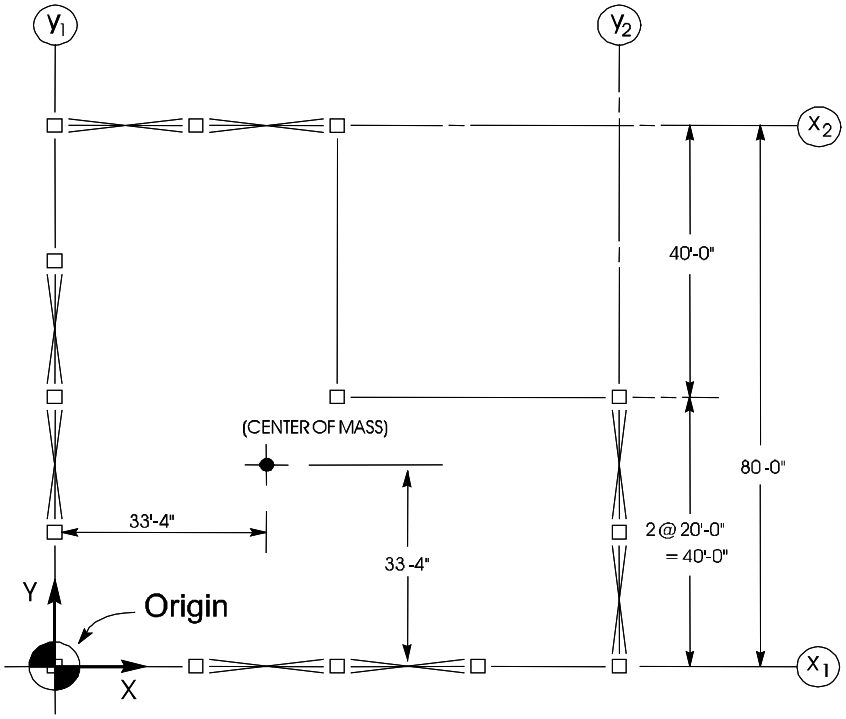
The geometry of the structure and a typical frame are shown in Figure 5-1.

Technical Features of ETABS Tested

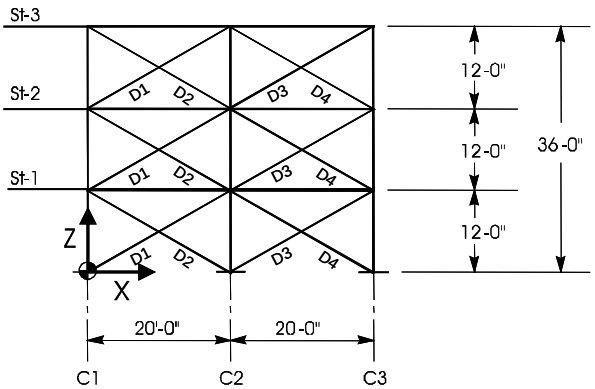
- Three-dimensional structure analysis using planar frames
- Brace (diagonal) and column members with no bending stiffness
- Dynamic response spectrum analysis

Results Comparison

This example has been solved in Wilson and Habibullah (1992) and Peterson (1981). A comparison of ETABS results for natural periods and key member forces for one frame with these references is given in Table 5-1.



Plan



Typical Frame Elevation

Figure 5-1 Three-Story, Three-Dimensional Braced Frame Building

Table 5-1 Comparison of Results

Quantity	ETABS	Wilson and Habibullah	Peterson
Period, Mode 1	0.32686	0.32689	0.32689
Period, Mode 2	0.32061	0.32064	0.32064
Axial Force Column C1, Story 1	279.39	279.47	279.48
Axial Force Brace D1, Story 1	194.44	194.51	194.50
Axial Force Brace D3, Story 1	120.49	120.53	120.52

Computer File

The input data file is Example 05.EDB. This file is provided as part of the ETABS installation.

Conclusions

The results comparison reflects acceptable agreement between the ETABS results and reference data.