

EXAMPLE 6

Nine-Story, Ten-Bay Plane Frame - Eigenvalue Analysis

Problem Description

An eigenvalue analysis is completed.

Geometry, Properties and Loads

The frame is modeled with eleven column lines and ten bays. Kip-ft-second units are used. A modulus of elasticity of 432,000 ksf is used. A typical member axial area of 3ft^2 and moment of inertia of 1ft^4 are used. A mass of $3\text{kip}\cdot\text{sec}^2/\text{ft}/\text{ft}$ of member length is converted to story mass using tributary lengths and used for the analysis.

This is a nine-story, ten-bay plane frame, as shown in Figure 6-1.

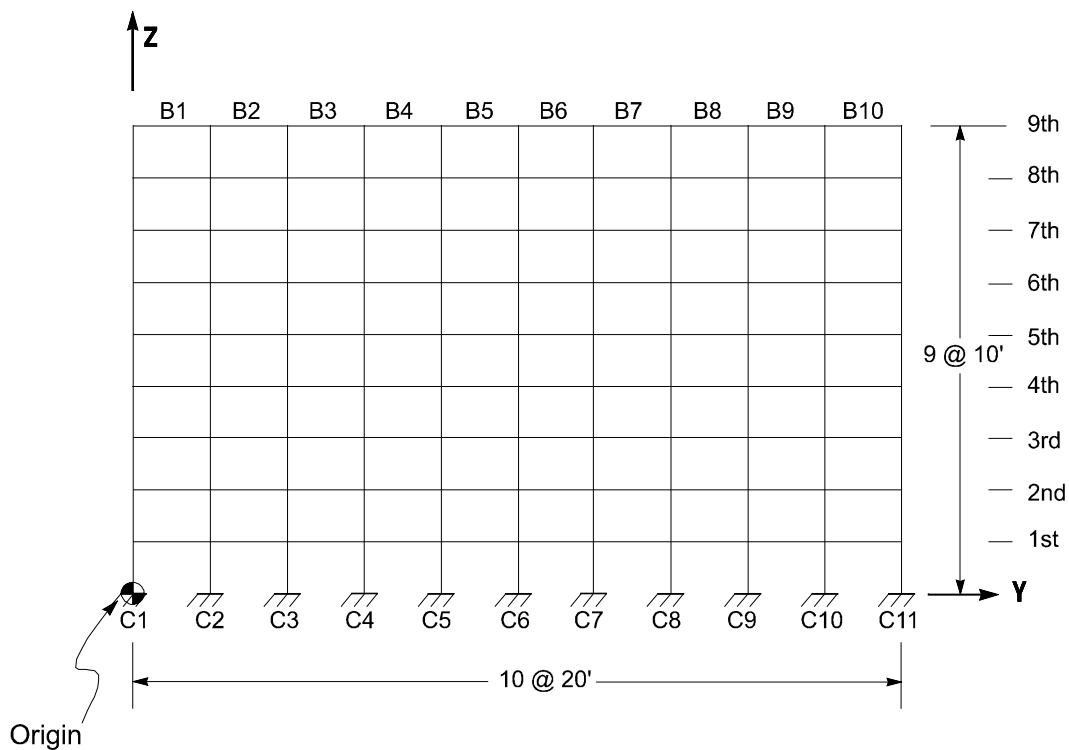


Figure 6-1 Nine-Story, Ten-Bay Plane Frame

Technical Features of ETABS Tested

- Two-dimensional frame analysis
- Eigenvalue analysis

Results Comparison

This example is also analyzed in Wilson and Habibullah (1992) and Bathe and Wilson (1972). There are two differences between the ETABS analysis and the analyses of the references. The models of the references assign vertical and horizontal mass degrees of freedom to each joint in the structure. However, the ETABS model only assigns horizontal masses and additionally, only one horizontal mass is assigned for all the joints associated with any one floor level.

The eigenvalues obtained from ETABS are compared in Table 6-1 with results from Wilson and Habibullah (1992) and Bathe and Wilson (1972).

Table 6-1 Comparison of Results for Eigenvalues

Quantity	ETABS	Wilson and Habibullah	Bathe and Wilson
1	0.58964	0.58954	0.58954
2	5.53195	5.52696	5.52695
3	16.5962	16.5879	16.5878

Computer File

The input data filename for this example is Example 06.EDB. This file is provided as part of the ETABS installation.

Conclusions

Considering the differences in modeling enumerated herein, the results comparison between ETABS and the references is acceptable.