

## EXAMPLE 1

### Plane Frame with Beam Span Loads - Static Gravity Load Analysis

#### Problem Description

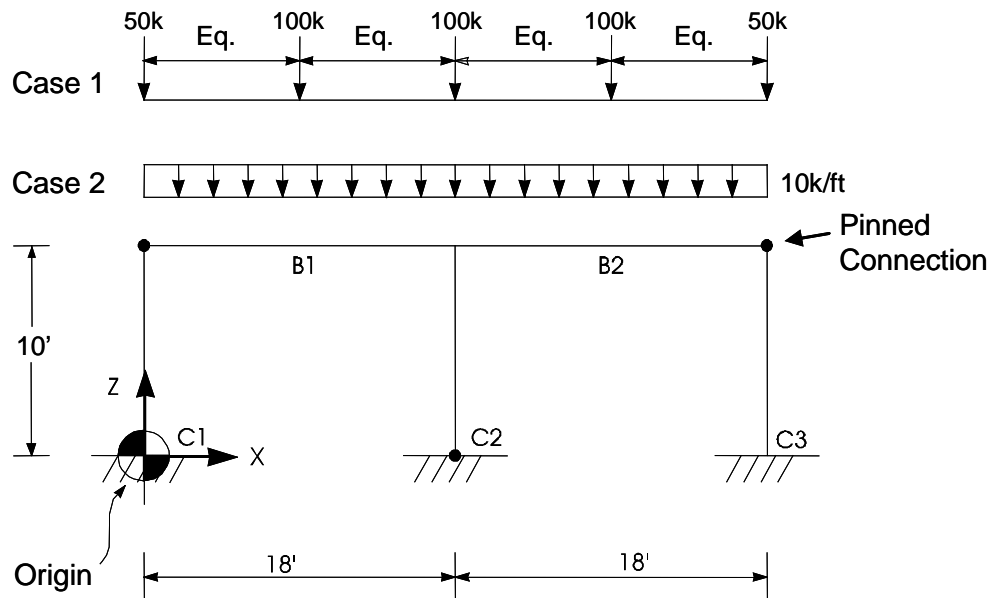
This is a one-story, two-dimensional frame subjected to vertical static loading.

To be able to compare ETABS results with theoretical results using prismatic members and elementary beam theory, rigid joint offsets on columns and beams are not modeled, and axial and shear deformations are neglected. Thus, the automatic property generation feature of ETABS is not used; instead, the axial area and moment of inertia for each member are explicitly input.

#### Geometry, Properties and Loading

The frame is a three-column line, two-bay system. Kip-inch-second units are used. The modulus of elasticity is 3000 ksi. All columns are 12"x24"; all beams are 12"x30".

The frame geometry and loading patterns are shown in Figure 1-1.



*Figure 1-1 Plane Frame with Beam Span Loads*

## Technical Features of ETABS Tested

- Two-dimensional frame analysis
- Vertical beam span loading
- No rigid joint offsets on beams and columns
- Column pinned end connections

## Results Comparison

The theoretical results for bending moments and shear forces on beams B1 and B2 are easily obtained from tabulated values for propped cantilevers (American Institute of Steel Construction 1989). These values for beam B1 are compared with ETABS results in Table 1-1.

**Table 1-1 Comparison of Results for Beam B1 – Case 1**

Quantity	Location	Load Case I (Concentrated Load)	
		ETABS	Theoretical
Bending Moments	End I	0.00	0.00
	¼ Point	1,687.50	1,687.50
	½ point	3,375.00	3,375.00
	¾ point	-337.50	-337.50
	End J	-4,050.00	-4,050.00
Shear Forces	End I	-31.25	-31.25
	¼ Point	-31.25	-31.25
	½ point	68.75	68.75
	¾ point	68.75	68.75
	End J	68.75	68.75

**Table 1-1 Comparison of Results for Beam B1 – Case II**

Quantity	Location	Load Case II (Uniformly Distributed Load)	
		ETABS	Theoretical
Bending Moments	End I	0.00	0.00
	¼ Point	2,430.00	2,430.00
	½ point	2,430.00	2,430.00
	¾ point	0.00	0.00

**Table 1-1 Comparison of Results for Beam B1 – Case II**

Quantity	Location	Load Case II (Uniformly Distributed Load)	
		ETABS	Theoretical
Shear Forces	End J	-4,860.00	-4,860.00
	End I	-67.50	-67.50
	¼ Point	-22.50	-22.50
	½ point	22.50	22.50
	¾ point	67.50	67.50
	End J	112.50	112.50

## Computer File

The input data file for this example is Example 01.EDB. This file is provided as part of the ETABS installation.

## Conclusion

The comparison of results shows an exact match between the ETABS results and the theoretical data.