Panel zone and rigid offset

ETABS provides for the modeling of **panel zones and rigid offsets**. To demonstrate, the steel-frame system, shown below, is subjected to a 10-kip lateral load along its top level. Panel-zone and rigid-offset conditions are modified for comparison.

Model 1: Rigid zone factor = 0, No panel zone

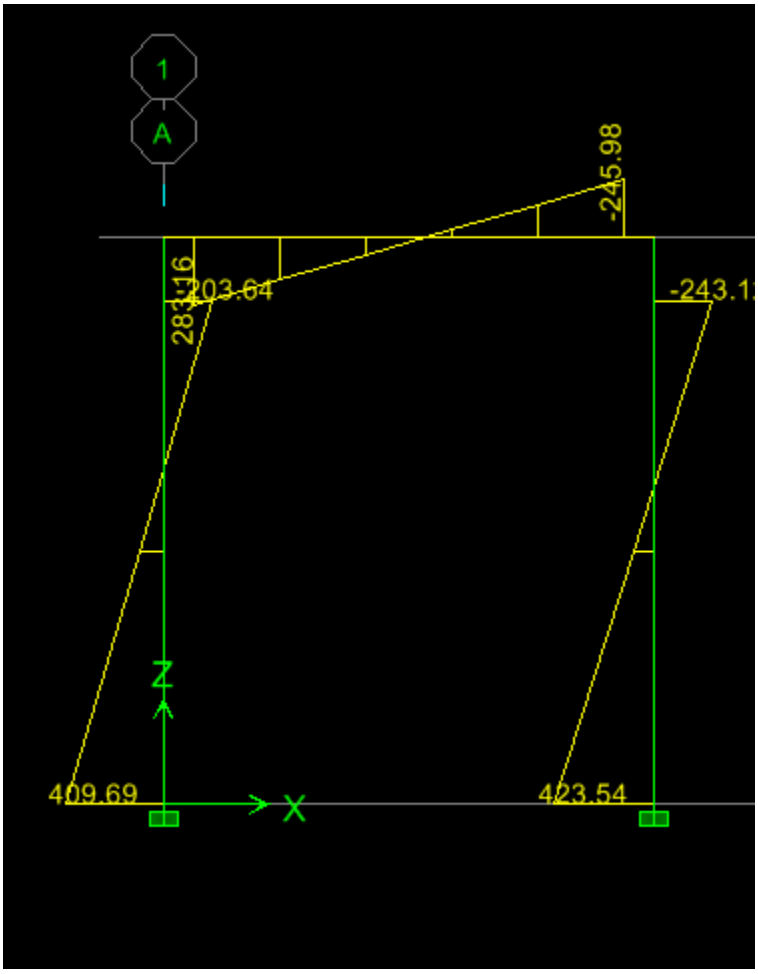

Figure 1 - Model 1

Maximum deflection: $_x$ = 0.133in

Model 1 is the most simple in that it utilizes neither panel zones nor rigid offsets. Model 1 deflections are the largest (most conservative) and moments are the smallest (least conservative).

Model 2: Rigid zone factor = 1.0, No panel zone

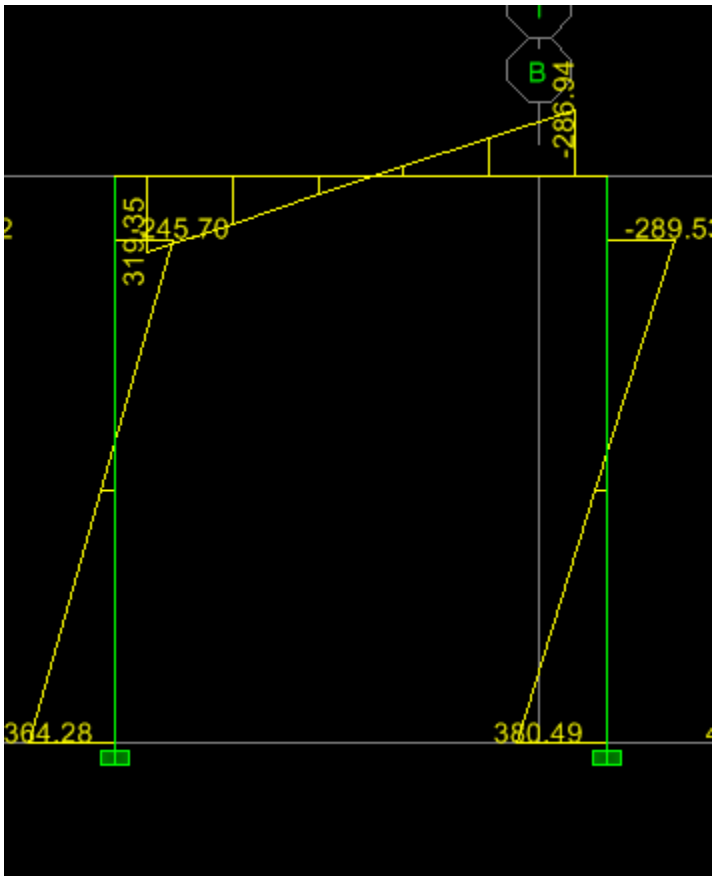

Figure 2 - Model 2

Maximum deflection: $_x$ = 0.104in

Model 2 implements fully rigid offsets at beam and columns. This technique is not recommended because the smallest and least conservative deflections result. Further, moment values are the highest and most conservative.

Model 3: Rigid zone factor = 0, Panel zone from column

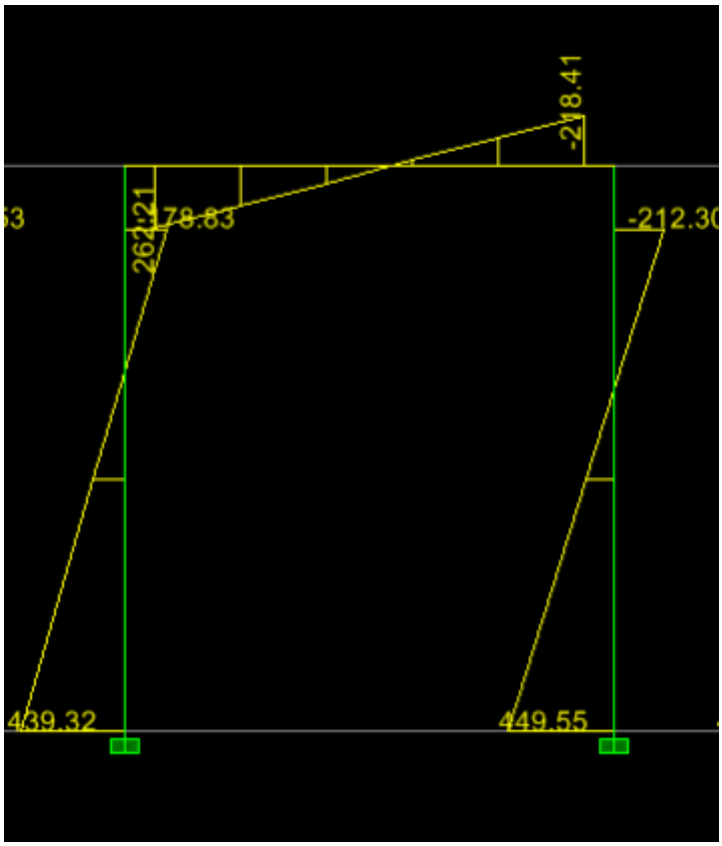

Figure 3 - Model 3

Maximum deflection: $_x$ = 0.152in

Rigid zones are not specified for Model 3, though panel zones are introduced according to column properties. Flexibility is duplicated at joint locations, causing unrealistically large deflections. This technique is also not recommended because moment values are unconservative.

Model 4: Rigid zone factor 1.0, Panel zone from column

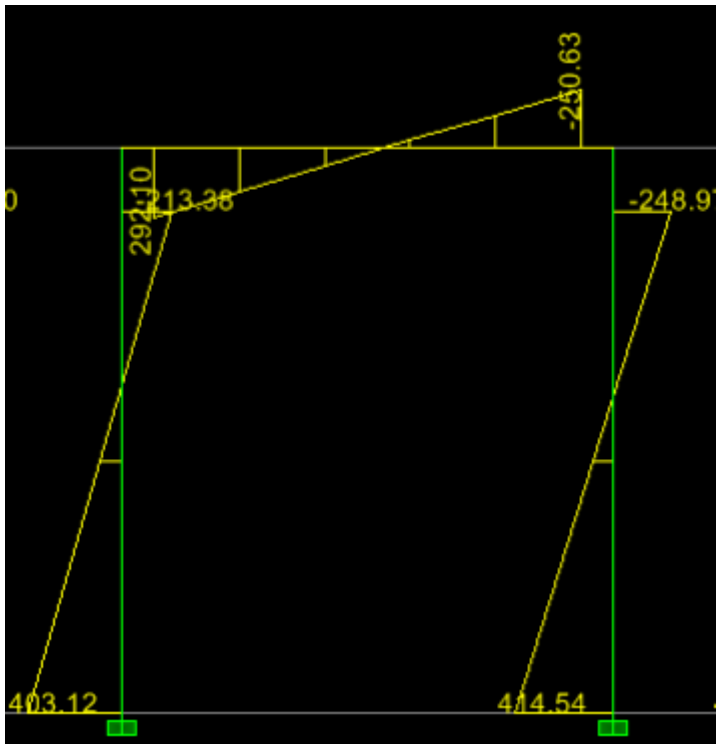

Figure 4 - Model 4

Maximum deflection: $_x$ = 0.128in

Model 4 utilizes both features by modeling fully rigid offsets at beam & columns while explicit panel zone assignments are based on column properties. Here, flexibility at joint locations is correct and accurate. We recommend using this approach because it is the most realistic, as indicated by response, in which deflection and moment are within the extreme bounds.

Notes

- If the user-defined rigid-offset lengths option for Model 1 were set to (0,0), rather than default settings based on connectivity, results would be identical except that moment values would be reported at the end of members, and not at the face of columns and beams.
- Concrete frames should never use a fully rigid zone. A value of 0.5 is recommended for concrete frames, where 50% of the actual offset is considered rigid.
- Rigidity only affects bending about the 3-axis, and not axial and torsional properties.

Attachments

- Panel zone and rigid offset model (zipped EDB file)