

# Align solid and hollow sections

Test Problem	
Name:	Align solid and hollow sections with different center-of-gravity locations
Description:	Model relative positive position for frame sections which have identical outlines, but different center-of-gravity locations due to one section being hollow.
Program:	SAP2000
Version:	14.2.0
Model ID:	na

The internal forces and capacities of a beam are calculated with respect to the cross-section center of gravity. This test problem studies the modeling of a rectangular and continuous beam which is solid along the left segment and hollow along the right. This void is located along the bottom of the element.

Default insertion-point settings locate each segment such that the center of gravity aligns with the element chord. As shown in the image at the top of Figures 1-4, this results in misalignment between each segment because the center of gravity is higher for the hollow section. This may be corrected through either of the following methods:

1. Draw element chords to account for the difference in center-of-gravity location, as shown in the middle image of each figure.
2. Use a bottom-center [insertion point](#) to draw the two segments along the same line as shown in the bottom image of each figure.

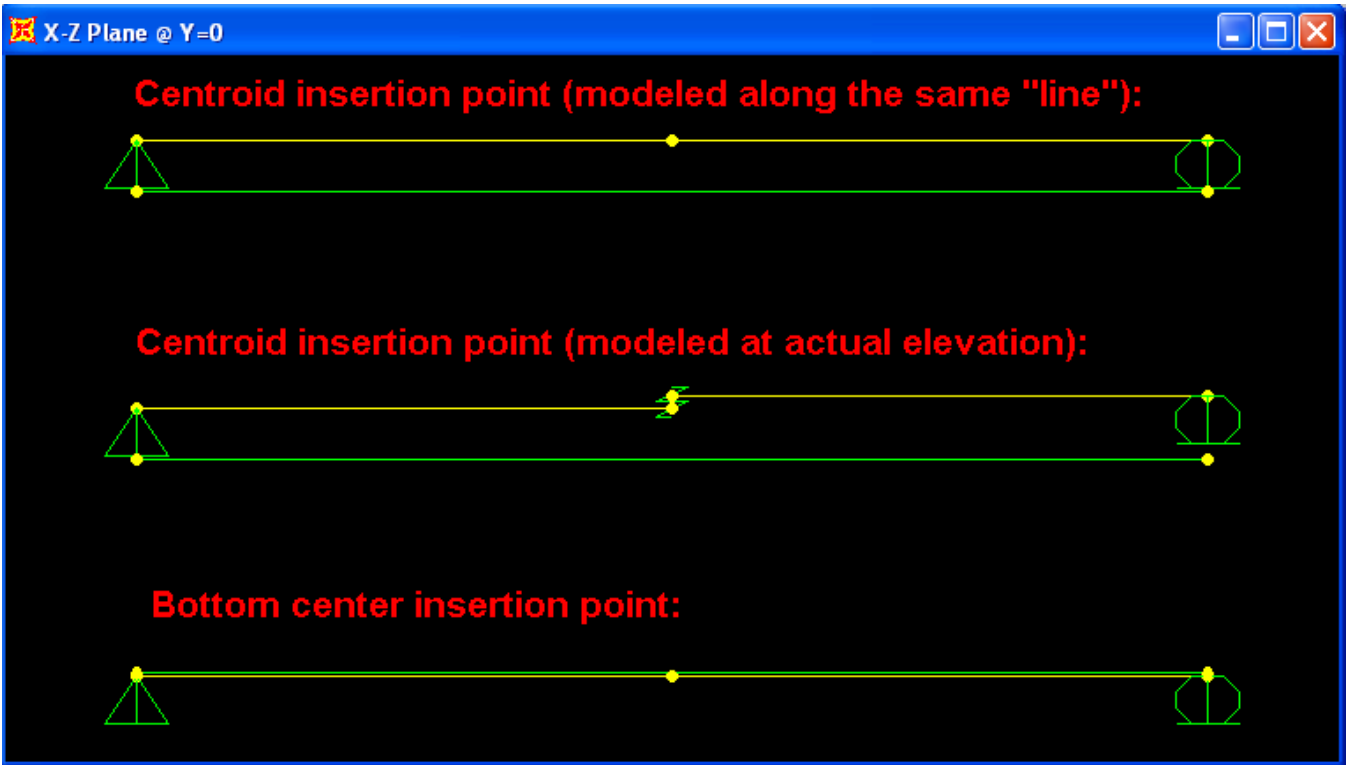


Figure 1 - Modeling approaches

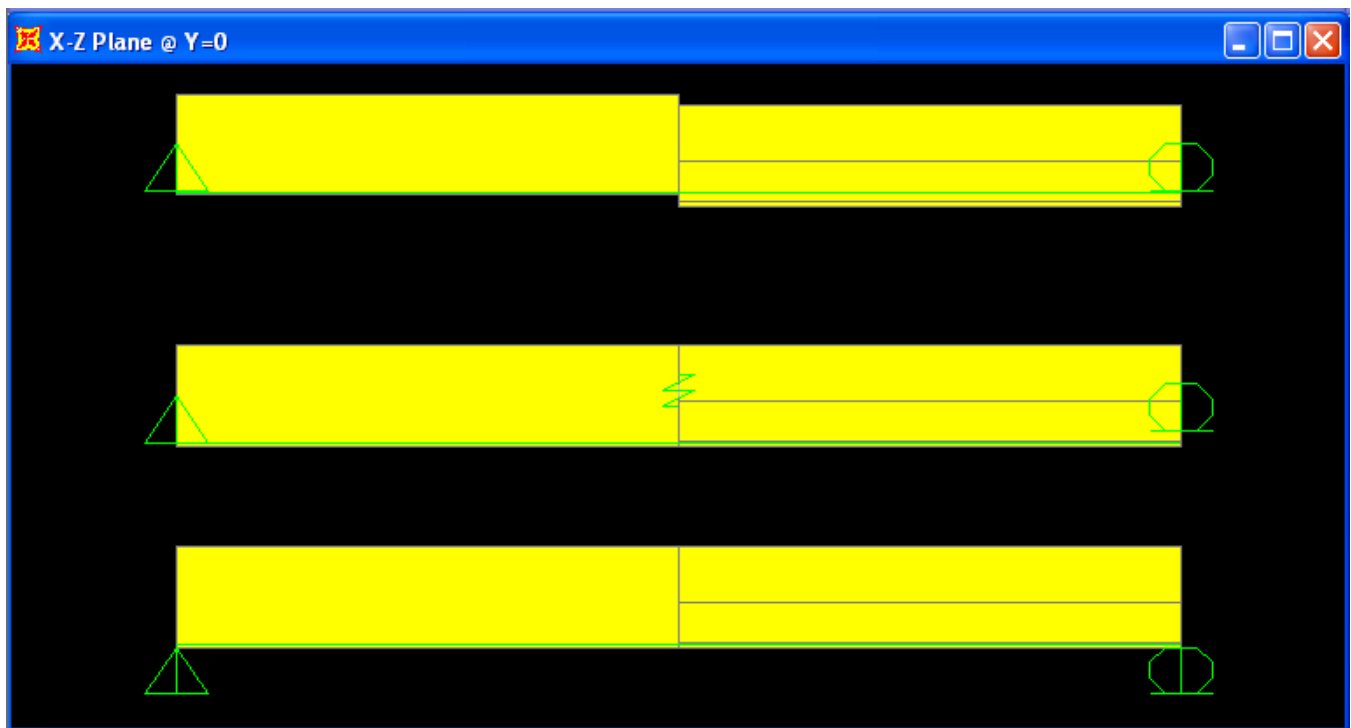


Figure 2 - Corresponding depth profile

To demonstrate how each of these conditions affects response, a straight tendon is modeled below each beam. Tendon deflection and internal moment (relative to cross-section centroid) is presented. Results are correctly reported only for the second and third case, where the solid and hollow sections properly align.

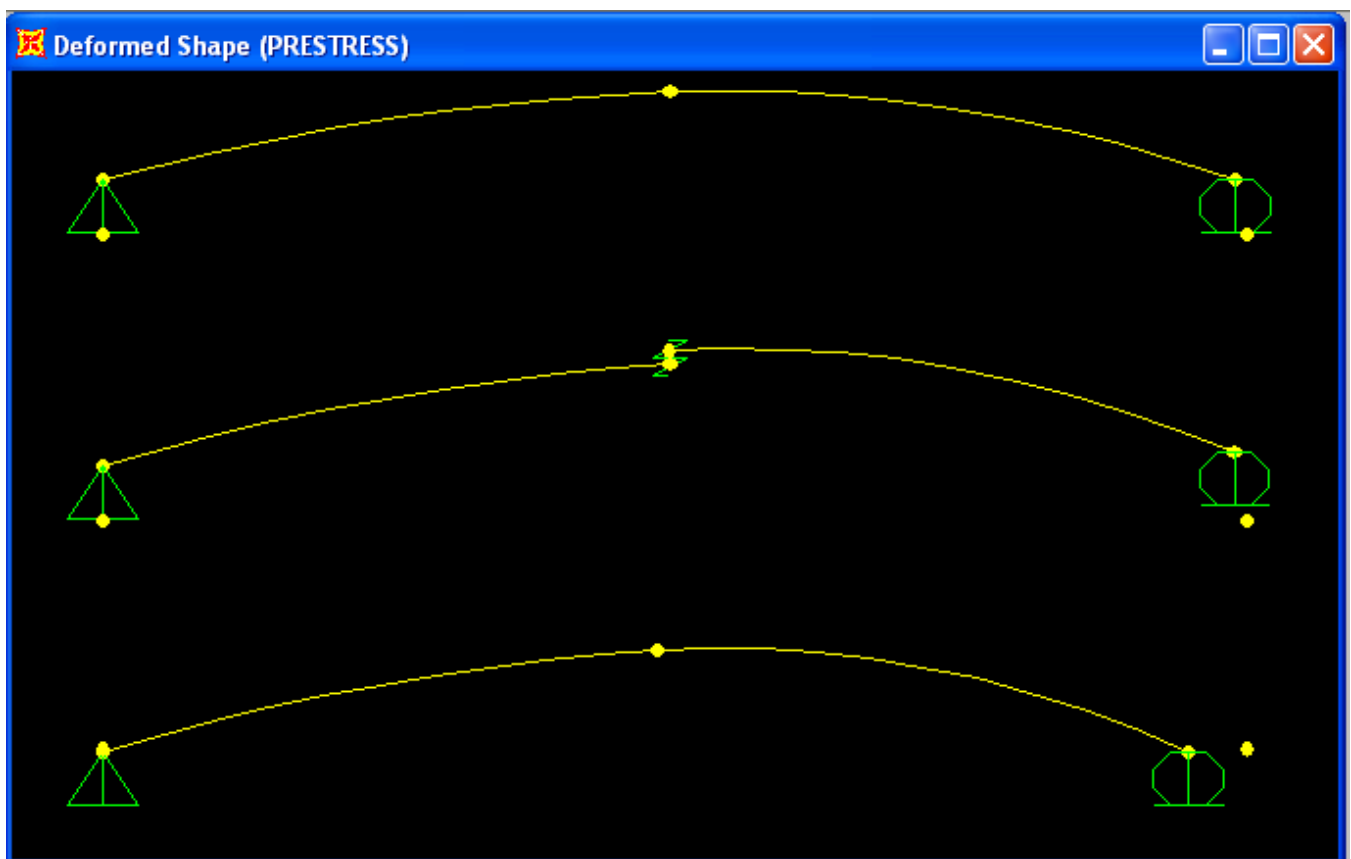


Figure 3 - Displacement

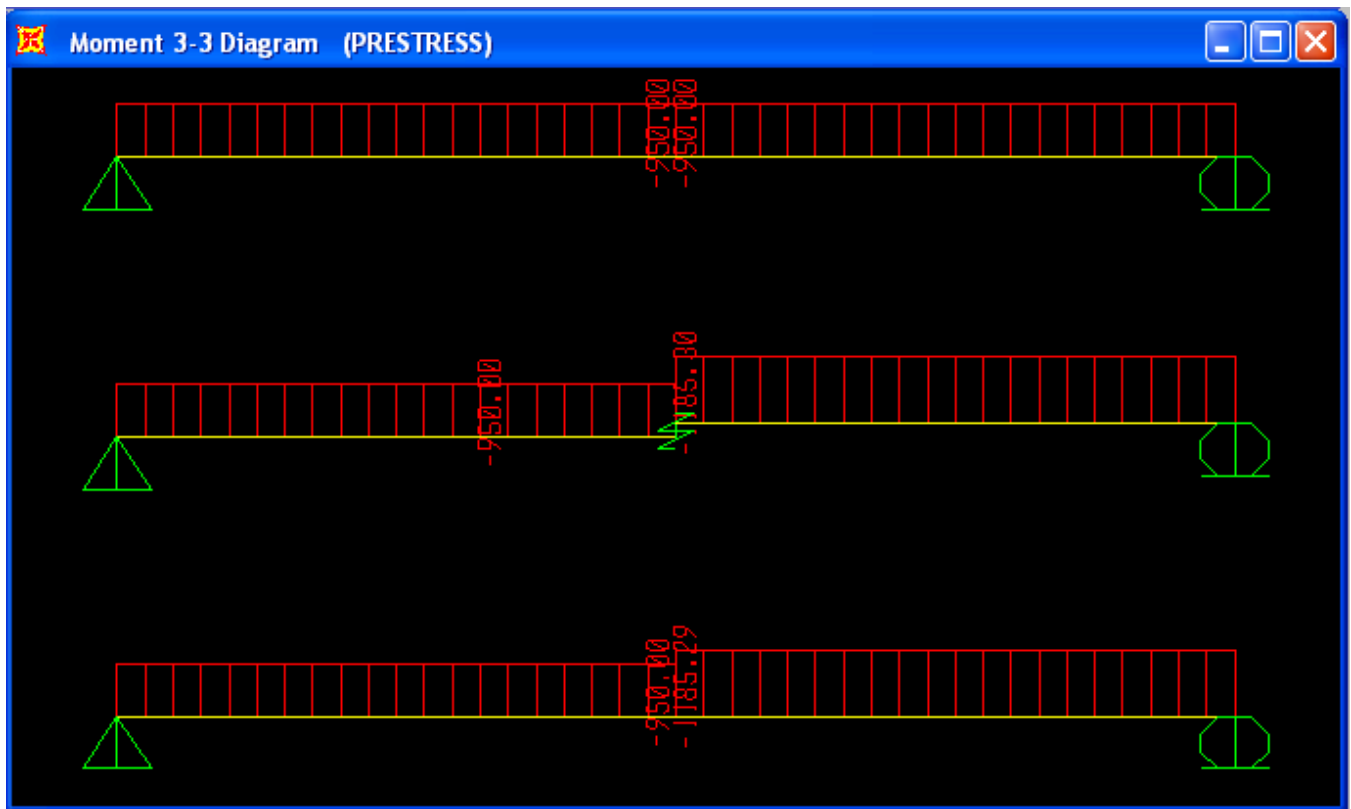


Figure 4 - Moment

## Attachments

- [SAP2000 V14.2.0 model](#) (zipped SDB file)