

Transform stiffness

Transform stiffness involves an important distinction in which the line that represents the position of a **frame** object may be different from the line that represents the object centroid and its physical attributes. When the **insertion point** is at the centroid, these lines coincide. In this case, the Do not Transform Stiffness for Offsets from Centroid option generates identical results regardless of whether or not it is selected. In all other cases, these lines are different, and some notable points include:

- **Default settings.** The default settings leave the Do not Transform Stiffness for Offsets from Centroid option unchecked. This *does* transform stiffness to account for the offset from the line drawn to represent that object in the model.
- **Transformation.** By selecting the Do not Transform Stiffness for Offsets from Centroid option, the centroid of the frame object is located along the line drawn to represent that object in the model.

It may be best to implement the default setting by leaving the Do not Transform Stiffness for Offsets from Centroid option unchecked, since this coordinates stiffness with the actual physical location of the frame object.

Transform-stiffness example

Figure 1 illustrates an example in which a **frame** object is modeled using a top-center **insertion point**. As seen in the first image, the object is actually located entirely beneath the line which represents its location in the model. By following the default setting, stiffness is automatically transformed to account for the offset location of the object centroid. This is shown in the second image, in which the analytical line extends downward to align with the centroid. Selecting the Do not Transform Stiffness for Offsets from Centroid option has the effect shown in the third image. Here, the default transformation is not made, and the analytical model aligns object attributes with the projection of the insertion point (top center), though the object is actually entirely beneath this line. Different stiffness properties will result.

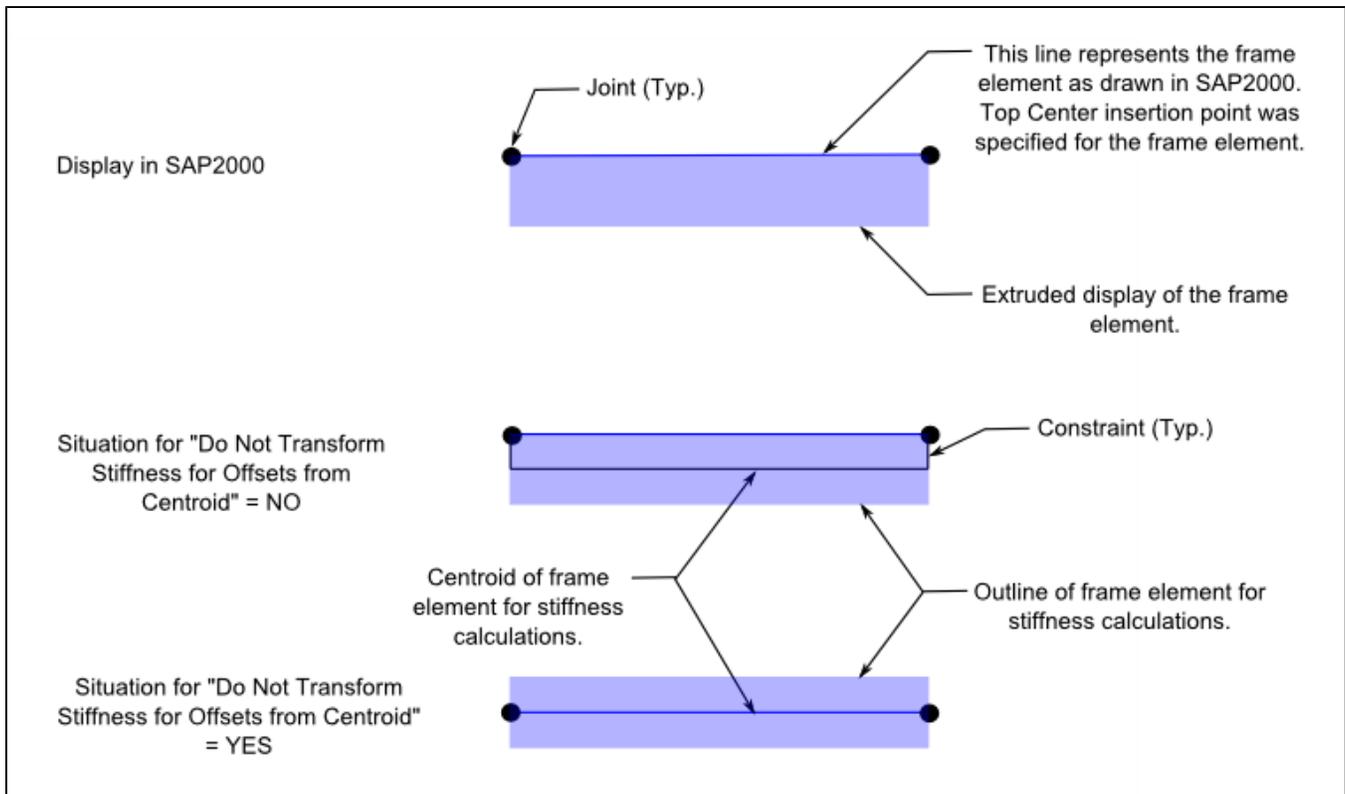


Figure 1 - Stiffness Transformation Test Model

Bridge application

An instance in which this topic may be relevant is the modeling of a bridge superstructure. A line may be drawn to represent the location of a composite bridge deck. In relation to this line, girders may be specified with a top-center insertion point such that they are positioned below the line, which will then align with the plane of their top flanges. Then the deck may be specified with a bottom-center insertion point such that it is above the line, which will then align with its bottom surface. This would then form the basis of a composite bridge deck section.

Additional diagrams and a discussion on how insertion point affects horizontal reaction may be found in the [Effect of insertion point on beam reactions](#) test problem.

See Also

- [SAP2000 Verification Problem 1-011](#)
- [Effect of insertion point on beam reactions](#) test problem