

# Body vs. equal constraint

Test Problem	
Name:	Body vs. equal constraint
Description:	Comparison between body-constraint and equal-constraint application to a simply supported beam.
Program:	SAP2000
Version:	11.0.8
Model ID:	na

This test problem demonstrates the difference between [body constraints](#) and [equal constraints](#), as applied to a simply supported beam model. The primary difference between these constraint types is that DOF are [coupled](#) when a body constraint is applied. This causes the constrained [joints](#) to translate and rotate as a rigid body.

## Modeling

A simply supported beam is modeled once with body constraints joining the beam to its supports, then again with equal constraints. Geometric configuration is shown in Figure 1:

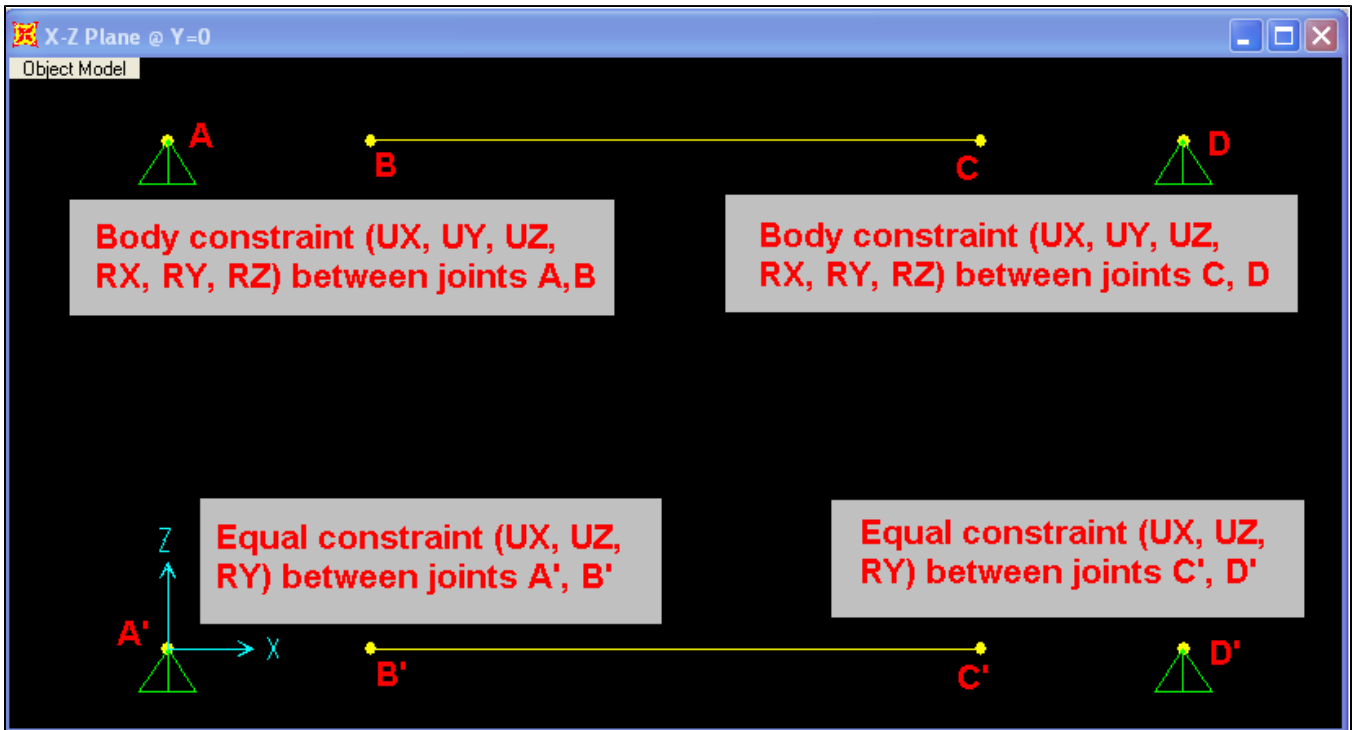


Figure 1 - Structural configuration

## Analysis

Once each system is subjected to a uniform distributed load, analysis generates the results shown in Figures 2-4:

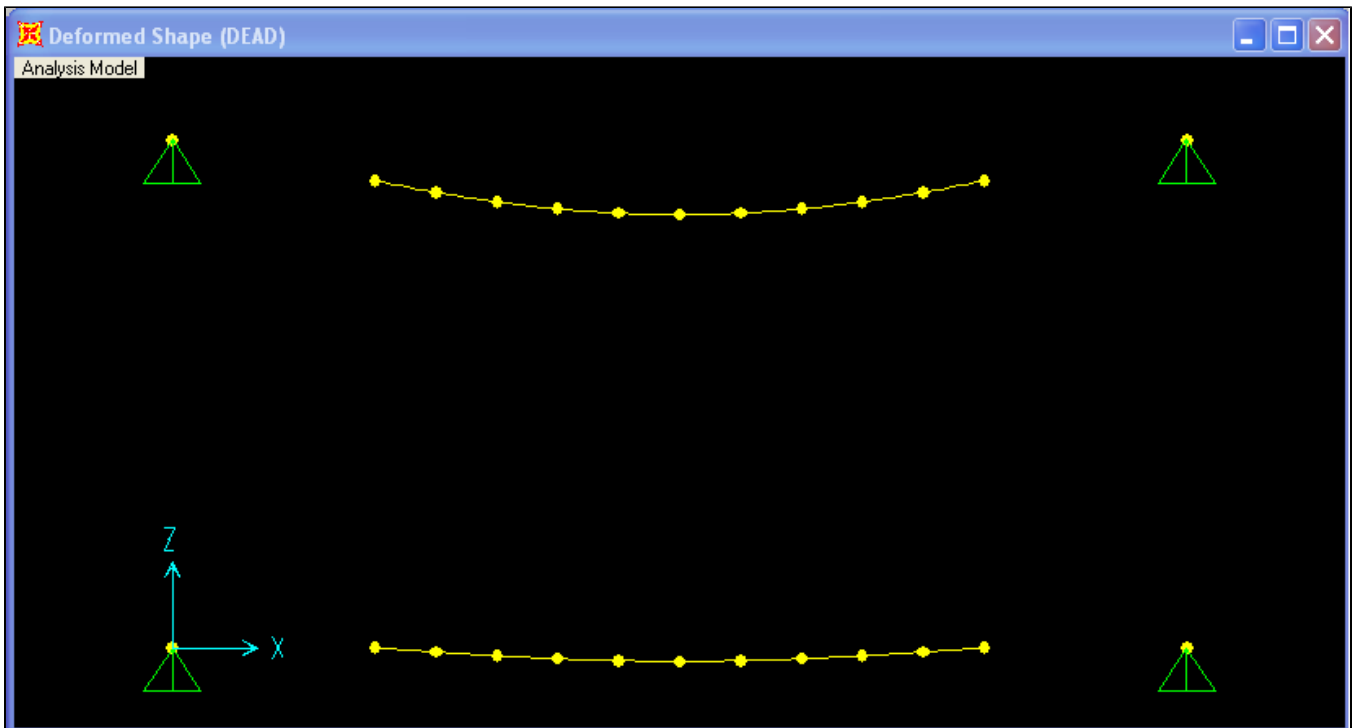


Figure 2 - Deflected configuration

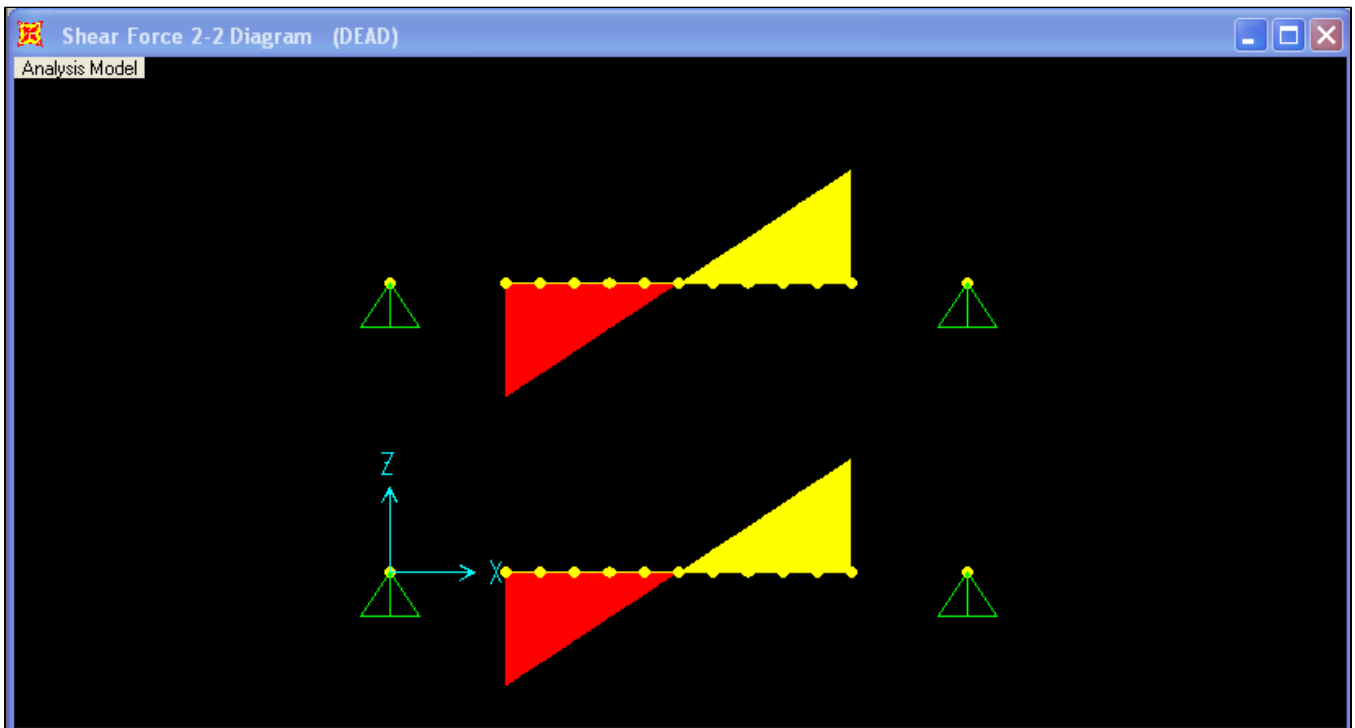


Figure 3 - Shear response

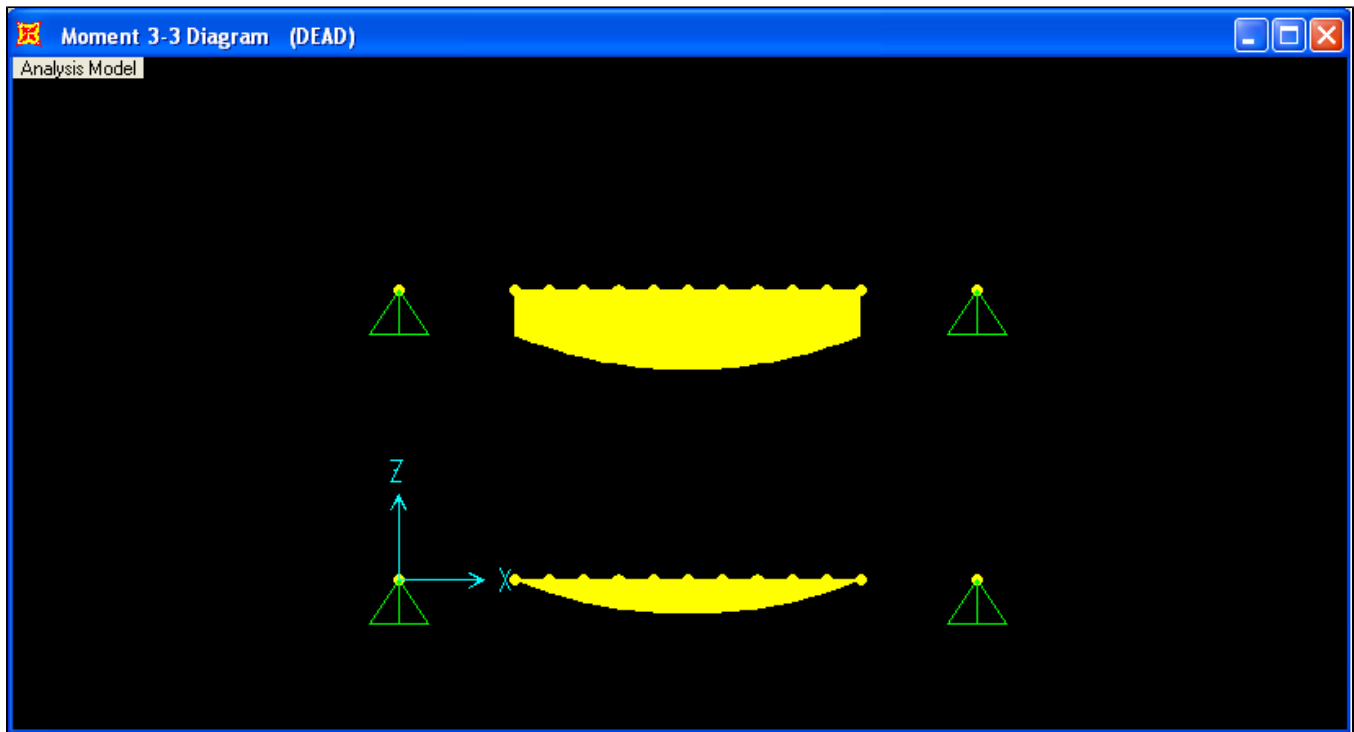


Figure 4 - Moment response

## Commentary

Conclusions may be drawn as follows:

- From the deflected shape of the first beam, it is evident that the support and the coincident-beam joints rotate as a rigid body, allowing the beam to effectively span between the actual supports.
- As seen in the deflected shape of the second beam, beam end-joints do not deflect downward. This is because the equal constraint, applied to the UZ direction, constrains joint displacement with that of the support, which is zero. This produces a stiffer system in that the beam effectively spans between its end joints, and not the support joints.

## Attachments

- [SAP2000 V11.0.8 model](#) (zipped SDB file)