Comparison of Gravity Loaded Concrete Frame Models in spBeam and spFrame under Sidesway

spBeam Program can be utilized for one-way multi-story two-dimensional Concrete Frames by modeling each story at a time as separate frames. Models for a typical story may consist of slab beam elements and columns above and below. In the analytical model, an equivalent column concept is utilized and the horizontal translational degree of freedom at the story level is restrained as shown in Figure 1 below.

Figure 1 – Analytical Model for a Typical Story of a Multi-Story Frame in spBeam Program

The horizontal translational restraint assumption in spBeam has to be verified in a typical single and multi-story concrete frames subjected to unsymmetrical vertical loading configurations, support stiffness variations, boundary conditions at far ends of columns. If it is deemed that such conditions introduce horizontal sidesway, then spFrame Program must be utilized to perform such analysis by modeling the two-dimensional frame as a unit for the entire height of the building in order to properly and correctly account for the effect of sidesway on the magnitude of internal forces.

A single-story, single span frame subjected to vertical loading that consists of a beam and two supporting columns of different size (see Figure 1) is analyzed for illustration with both spBeam (sidesway restrained as assumed) and spFrame (sidesway permitted). The Table below displays the difference in beam moments based on the assumption of sidesway being restrained (spBeam) or permitted (spFrame):

Program Name	Negative Moment @ Left Support	Positive Moment @ Mid-Span of Beam	Negative Moment @ Right Support	Total Moment	Axial Force on Beam	spFrame Deflected Shape
spBeam *Sidesway Restrained*	-613	6095	-2594	7699	0	
spFrame *Sidesway Permitted*	-930	6460	-1590	7720	514	

In these conditions, spBeam cannot be utilized and spFrame results would be more reliable for design purposes.