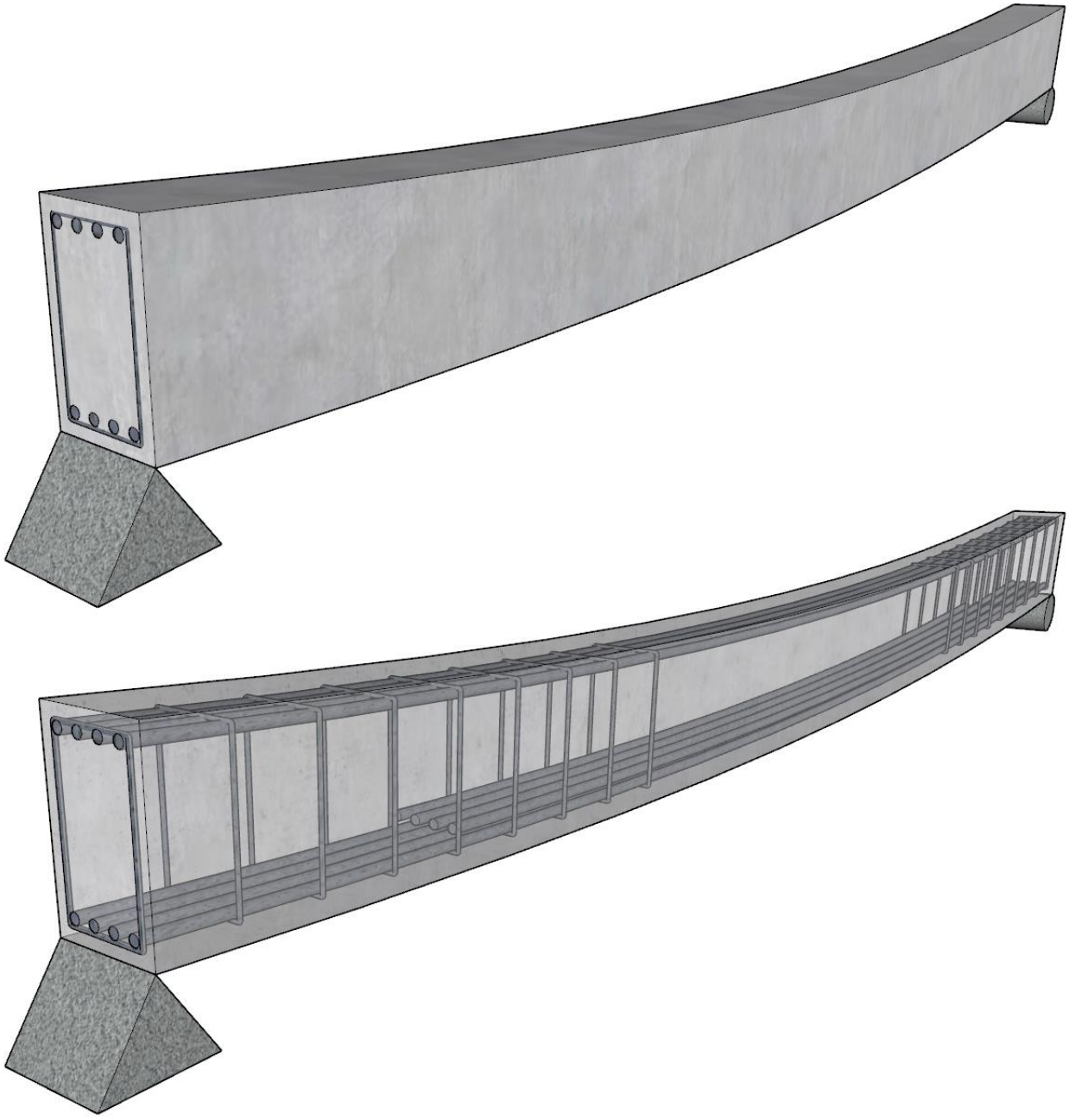
spSlab/spBeam Reinforcing Bar Arrangement Impact on Deflections



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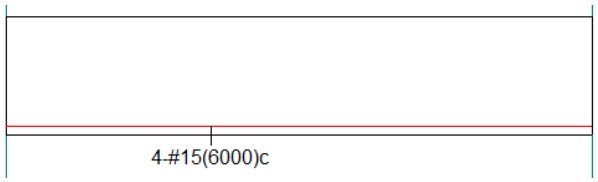
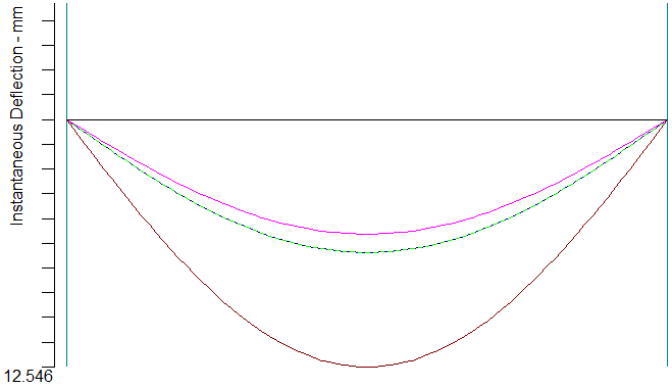
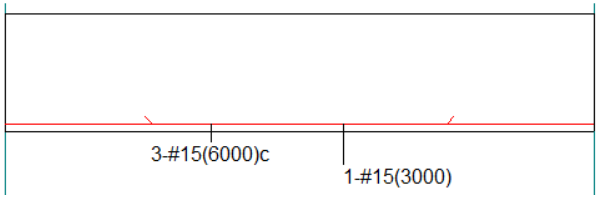
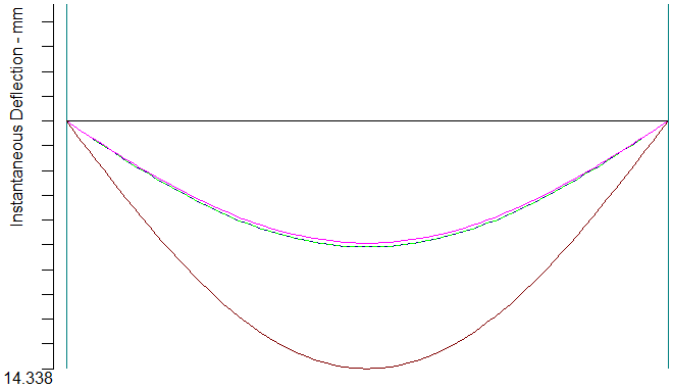
The solve options in spSlab/spBeam offer users the flexibility to customize design options, punching shear options, and deflection calculations options. However, it is crucial to exercise sound engineering judgment and remain aware of how these options are implemented within the software to ensure the most accurate representation of the physical model and its conversion to an analytical model. It is also important to understand the consequences of each solve option and how it impacts the analysis and design results.

This technical article investigates the implications of activating the compression reinforcement solve option in spSlab/spBeam, with a particular focus on how it influences bar arrangement and its subsequent impact on deflection calculations. By shedding light on this aspect, engineers and designers can gain valuable insights to make informed decisions for optimal structural analysis and design outcomes.

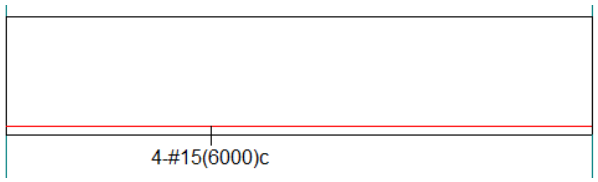
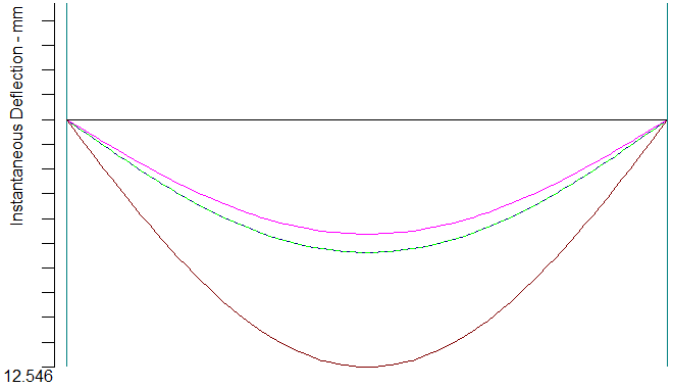
References

- spSlab/spBeam Engineering Software Program Manual v5.50, STRUCTUREPOINT, 2015
- "Doubly Reinforced Concrete Beam Design (ACI 318-14)" Design Example, STRUCTUREPOINT, 2020
- "Doubly Reinforced Concrete Beam Design (CSA A23.3-14)" Design Example, STRUCTUREPOINT, 2021
- Contact Support@StructurePoint.org to obtain supplementary materials (spBeam models: A1, A2, B1, and B2)

Condition A: Compression Reinforcement option **IS NOT** checked to be considered.

Reinforcing Bar Arrangement	Deflection Notes
All bottom reinforcement **IS** "Bottom Continuous" Type. Bottom reinforcement **DOES NOT** contain "Bottom Discontinuous" Type.	**Model A1:** Program considers "Bottom Continuous" Type (4 - #15) in the calculation of cracked moment of inertia, I_{cr}. No "Bottom Discontinuous" Type.
	
Bottom reinforcement **DOES** contain **BOTH** "Bottom Continuous" **AND** "Bottom Discontinuous" Types.	**Model A2:** When Compression Reinforcement option **IS NOT** checked, Program considers "Bottom Continuous" Type (3 - #15) in the calculation of cracked moment of inertia, I_{cr}. However, "Bottom Discontinuous" Type (1 - #15) **IS NOT** considered in I_{cr} calculation. As a result, deflection (14.338 mm) in Model A2 is greater than deflection in Model A1 (12.546 mm).
	

Condition B: Compression Reinforcement option **IS** checked to be considered.

Reinforcing Bar Arrangement	Deflection Notes
All bottom reinforcement **IS** "Bottom Continuous" Type. Bottom reinforcement **DOES NOT** contain "Bottom Discontinuous" Type.	**Model B1:** Program considers "Bottom Continuous" Type (4 - #15) in the calculation of cracked moment of inertia, I_{cr}. No "Bottom Discontinuous" Type.
	
Bottom reinforcement **DOES** contain **BOTH** "Bottom Continuous" **AND** "Bottom Discontinuous" Types.	**Model B2:** When Compression Reinforcement option **IS** checked, Program considers **BOTH** "Bottom Continuous" Type (3 - #15) **AND** "Bottom Discontinuous" Type (1 - #15) in the calculation of cracked moment of inertia, I_{cr} as **BOTH ARE** considered in Compression Reinforcement algorithm. As a result, deflection in Model B2 (12.546 mm) equals to deflection in Model B1.