Numerical Study on Pretensioned Bridge Girder Using Thermal Strain Technique

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Abstract : The transfer of prestress force from prestressing strands to the surrounding concrete is dependent on the bond between the two materials. It is essential to understand the actual bond stress distribution along the transfer length to determine the transfer zone in pre-tensioned concrete. A 3-D nonlinear finite element model has been developed to simulate the transfer of prestress force from steel to concrete in pre-tensioned bridge girders through thermal strain technique using commercially available package ABAQUS. Full-scale bridge girder has been analyzed with thermal strain approach where the damage plasticity constitutive model has been used to model concrete. Parameters such as concrete strain, effective prestress, upward camber and longitudinal stress have been compared with analytical results. The discrepancy between numerical and analytical values was within 20%. The paper also presents a convergence study on mesh density and aspect ratio of the elements to perform the finite element study.

Keywords : aspect ratio, bridge girder, centre of gravity of strand, mesh density, finite element model, pretensioned bridge girder

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