

# Full Height Rectangular Opening Castellated Steel Beam Partially Encased in Reinforced Mortar

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The application of steel profiles encased in reinforced concrete beams is not optimum if the top and bottom flanges are not in the outermost position and if the height of the profile is limited. This paper discusses analyses and test results of castellated steel beams which are partially encased in reinforced mortar to maximize the effectiveness of the used steel profile. The castellated beam was made from IWF 150x75x5x7 profile where the web was cut in a rectangular pattern to create castellated beams with full height rectangular opening. Using this opening pattern the total height of the profile can be increased by almost double from 150 mm to 277 mm, with the rectangular opening size of 130 mm x 263 mm. Only both sides of the web were encased with reinforced mortar so that the top and bottom flanges were kept in the outermost position and by maintaining the flange width as the beam width. Two type of beams were made in this research namely a beam with shear dominant type and a beam with flexural dominant type. The calculated original profile beam yield load capacity is 186 kN for the shear dominant type and is 46.34 kN for the flexural dominant type. The application of reinforced mortar at both sides of the castellated beams web can give larger load capacity to become 582 kN for the shear dominant type beam and 181 kN for the flexural dominant type beam. Brittle failure mechanism happened in the shear dominant type beam due to diagonal crushing in the mortar and then followed by Vierendeel mechanism. Meanwhile quite ductile failure mechanism happened in the flexural dominant type beam due to mortar crushing around the top flange compressive area and then followed by lateral buckling. Therefore, careful design shall be carried out for the application of this system.

Key words: beam, castellated, encased, flexural, shear, Vierendeel mechanism

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