

## **ABSTRACT**

### **FLEXURAL BEHAVIOR OF REINFORCED CONCRETE BEAMS WITH OPENINGS IN THE MIDDLE OF SHEAR SPAN**

**By**

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In a high rise building, utilities and pipelines network is usually placed above ceiling below the floor beams. With this channel pass through transverse holes in the floor beams will eliminate a significant amount of unused space, so resulting in a compact building design and economical. However, making an openings in the beam will give effect to the flexural behavior of beams. This research was conducted to determine the flexural behavior of reinforced concrete beams which are openings in the shear span with and without reinforcement bars around the openings, compared with solid beam.

This study used 3 specimens of beam, namely a solid beam (BU), a beam with openings that uses reinforcement bars (BB I) and one beam with openings without reinforcement bars (BB II) with sample size 150 mm x 270 mm x 3000 mm. Web openings is made horizontally and vertically symmetrical and located in the middle of shear span. Dimensions of the openings is 270 mm long and 90 mm high. Testing was conducted on a simply supported with the imposition of a third-point loading, which is done in stages.

The results show that BB II had decreased stiffness and its capacity is reduced 1.83% compared to BU, while the BB I had a little increase in stiffness and its capacity rises 9.23% against BU. Fracture patterns that occur in all beams is bending crack. The phenomenon of increased stiffness and load capacity on the BB I was due to additional reinforcement bars which resulted tension and modulus of elasticity of the beam increased, while decreasing stiffness in the BB II was due the moment of inertia of the beam around the openings decreased.

Key words : reinforced concrete beam, flexural behavior, openings, third-point loading, stiffness, loading capacity.