

# **Capacity of rectangular steel beams and their connections to carry loads through catenary action**

**Kyung-Jae Shin<sup>1</sup>, Hee-Du Lee<sup>1</sup>, †Swoo-Heon Lee<sup>1</sup>, So-Yeong Kim, and \*Young-Joo Lee**

<sup>1</sup>School of Architectural Engineering, Kyungpook National University, Korea.

\*Presenting author: lee068@naver.com

†Corresponding author: finksnow@knu.ac.kr

## **Abstract**

This study describes the flexural capacities of rectangular steel beams and the load carrying capacities through catenary action of moment connection at both ends. The material of beam specimens was the SPSR400 having a nominal yield strength of 245 MPa and a tensile strength of 400 MPa, and the beam specimens were subjected to three-point bending. The moment connection at both ends consisted of three angles (one was installed on bottom flange and two were on web sides) and three anchor bolts.

To determine the catenary action, one beam specimen with simply supported condition and two with rotationally semi-rigid connection with different horizontal reaction strength applied by anchor bolts were prepared and tested under single-point load. The embedded lengths of anchor bolts in moment connection beams were selected as 50 mm and 80 mm. First peak loads of three beams reached when first plastic hinge occurs around the loading point (or mid-span) but three first-peak loads and corresponding deflections were not significantly different. After a first peak load on the load-deflection curve, the load decreased in both of a simply supported beam and a beam with 50 mm embedded anchor length. On the other hands, a beam with 80 mm embedded anchor length sought supplemental resistance through formation of catenary configuration. With increased vertical deflection, the both angle connections yielded and the axial tension forces developed in the beam. The axial tension in the beam increased until the test terminated with concrete cone failure near anchor bolts. The loading tests present the catenary action after large deflection at loading point on the beam can increase the second peak load-carrying capacity.

**Keywords:** Rectangular Hollow Section, Catenary Action, Connection, Moment Resistance.