

# EXPERIMENTAL INVESTIGATION OF HOLLOW CORE COMPOSITE BEAM BY USING STEEL TUBES

D.Vimal<sup>1</sup>, M.Arunmozhi<sup>2</sup>, R.Kishorekumar<sup>3</sup>, S.Prasanth<sup>4</sup>, S.Subash<sup>4</sup>  
Department of Civil Engineering

Vel Tech High Tech Dr.Rangarajan Dr.Sakunthala Engineering College, Chennai

Email: [vimal.danny@gmail.com](mailto:vimal.danny@gmail.com)

## ABSTRACT

In this work, an attempt is made to study the hollow core composite beam (HCCB) using steel sheet tubes. To determine the compressive strength, Flexural Strength of Hollow core Rectangular Composite Beam. Compare the Compressive Strength of the Rectangular Composite Beam with Standard Conventional Beam. To study the behaviour experimentally, six beams were cast for a size of 150 x 250 x 1200mm with conventional and HCCB profiles of same cross sectional area. The thickness of cold formed steel sheet used to fabricate the HCCB profile was 2mm. M25 grade concrete was used to cast the beams.

After 28 days curing, the beams were tested on the 100 ton capacity loading frame which is placed over strong floor. The beams were tested for pure bending. The load-deflection graph and deflection profile are plotted for all the beams. From these plots, it is found that the HCCB beams behaved in a ductile manner which is the need of the hour in quake prone zone. From the experimental results, it was observed that in HCCB beam using profile the ultimate deflection is 1.3 mm for 2mm thickness, and the ultimate load of resistance is 40.325kN. The conventional beam gave 2.17 times lesser the strength of that of rectangular hollow steel tube beam. It was found that the increase in percentage of ultimate load of resistance for HCCB beams when compared to conventional beam.

Keywords: Concrete, HCCB beam, Steel tube.

## I. INTRODUCTION

The world at the end of the 20th century that has just been left behind was very different to the world that its people inherited at the beginning of that century. The latter half of the last century saw unprecedented technological changes and innovations in science and engineering in the field of communications, medicine, transportation and information technology, and in the wide range and use of materials. Concrete filled with steel tubes have world wide application including columns, platforms which support offshore structures, storage tank roofs, piers of bridges and piles [1]. There is no doubt that

these dramatic changes to the scientific, engineering and industrial face of the world have brought about great social benefits in terms of wealth, good living and leisure, at least to those living in the industrialized nations of the world. We have responsibility to reduce the effect of the application of concrete materials to environmental impact. According to the natural behaviour of the concrete, it is strong in compression and weak in tension [2]. But this process of the evolution of the industrial and information technology era has also, however, been followed, particularly during the last four to five decades, by unprecedented social changes, unpredictable upheavals in world economy, uncompromising social attitudes, and unacceptable pollution and damage to our natural environment

## II. MATERIAL AND METHODS

Steel pipes are long, hollow tubes that are used for a variety of purposes. They are produced by two distinct methods which result in either a welded or seamless pipe. In both methods, raw steel is first cast into a more workable starting form. It is then made into a pipe by stretching the steel out into a seamless tube or forcing the edges together and sealing them with a weld. The first method for producing steel pipe was introduced in the early 1800s, and they have steadily evolved into the modern processes we use today. Each year, millions of tons of steel pipe are produced. Its versatility makes it the most often used product produced by the steel industry.

Steel pipes are found in a variety of places. Since they are strong, they are used underground for transporting water and gas throughout cities and towns. They are also employed in construction to protect electrical wires. While steel pipes are strong, they can also be lightweight. This makes them perfect for use in bicycle frame manufacture. Other places they find utility is in automobiles, refrigeration units, heating and plumbing systems, flagpoles, street lamps, and medicine.

The beams has been casted using slabs of size 150mm by 250mm, 1200mm in length and cured for 28 days. Totally 6 beams has been casted under three Hollow steel tube beam Rectangular section and another three are Conventional beam

### III. RESULT AND DISCUSSION

Flexural strength test is carried out to determine the deflection and ultimate load carrying capacity of beam from which the behaviour of beam can be observed. Here the concrete beam is tested under equally spaced two-point loading using 100 tonne loading frame machine. The crack pattern and behavior of concrete beam is observed while conducting the test and the test results for various combination of beam.

The deflections of all six beams are tested until. This test is performed by using two-point load and deflection is noted in deflect meter. The deflection is noted until the initial cracked. The deflection table is listed below

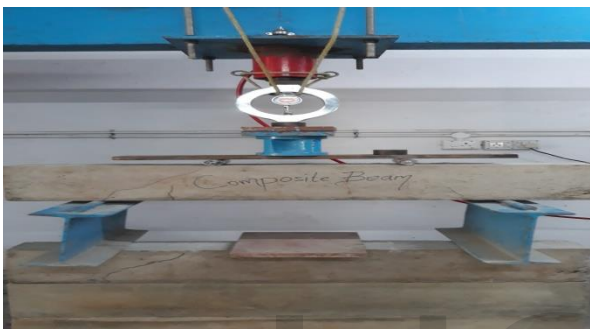


Fig 1. Loading setup of HCCB beams

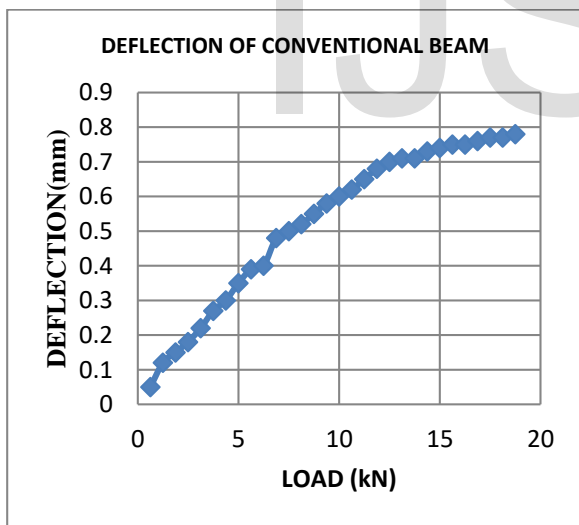


Fig 2. Load Vs deflection graph for conventional beam

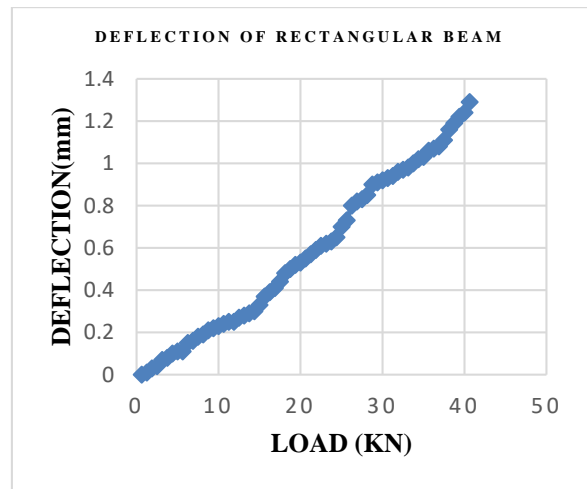


Fig 3. Load Vs deflection graph for HCCB beam

The deflection was studied along the length of the beam using deflectometer under the point load i.e., the deflectometer is placed at the mid of the beam. Graphs are drawn for the deflection of beam along its length and shown in the figures.

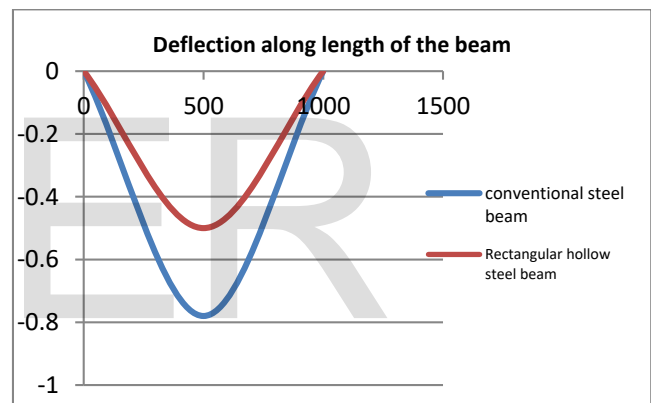


Fig 4. Deflection profile along the length of the beam

### IV. CONCLUSIONS

Six numbers of HCCB beams profiles were tested under two point loading condition. From the observation following conclusions were drawn,

- ❖ At about 40% of the ultimate load, the hair line cracks are appeared.
- ❖ The failure of HCCB beams was due to flexure.
- ❖ The conventional beam gave 2.17 times lesser the strength of that of rectangular hollow steel tube beam and weighted 0.06 times greater than the rectangular hollow steel tube beam
- ❖ There is no sudden failure of beams and the failure is gradual due to yielding of steel.

### V. REFERENCES

- [1]. Shaik Heena, Syed Rizwan, A.B.S. Dadapeer," A Detailed Experimental Study on The Flexural Behaviour of Concrete Filled Steel Tube Beams", Shaik Heena et al. Int. J. S. Res. Sci. Technol. November-December-2018 PP 196-203
- [2]. Dhinesh.N.P, Satheesh.V.S,"Flexural Behaviour of Hollow Square Beam," International Journal of Scientific Engineering and Applied Science – Vol-3, PP 236-242
- [3]. V.Aparna, D.Vivek, Kancharla Neelima and B.Karthikeyan,"Experimental investigations on steel-concrete composite columns for varying parameters," IOP Conf. Series: Earth and Environmental Science 80 (2017), PP 1-9
- [4] Andrej Mudrov, Antanas Šapalas, Gintas Šaučiuvėnas," Experimental study of CFST column to steel beam bolted connection with curved end-plates"
- [5]. Jothimani.B, Umarani.C," Experimental investigation on concrete filled steel tubular column to foundation connections subjected to combined axial and lateral cyclic loading" Latin American Journal of Solids and Structures, 2019, PP 1-20
- [6]. Audronis Kazimieras kvedaras, Gintas sauciuvenas, Arunas komka, Algirdas juozapaitis, "Design of circular composite beams with a different concrete core considering the effect of concrete in tension", Journal of Civil Engineering and Management, 2016, PP 118–123
- [7]. Alireza bahrami, Wan hamidon wan badaruzzaman, Siti aminah osman,"Investigation Of Concrete-Filled Steel Composite (CFSC) Stub Columns With Bar Stiffeners", Journal of Civil Engineering and Management, 2013, PP: 433-446
- [8]. Shaik Heena, Syed Rizwan, A.B.S. Dadapeer, "A detailed experimental study on the flexural behaviour of concrete filled steel tube beams", International Journal of Scientific Research in Science and Technology November-December-2018, PP: 196-203
- [9]. J.Thivya, R. Malathy, D Tensing, "Experimental investigation of confined steel concrete composite beam under bending", International Journal of Advanced Engineering Technology Vol.VII/Issue-I, Jan.-March, 2016, PP: 716-720
- [10]. Nasser H. Tuma, Mustafa R. Aziz, "Flexural Performance of Composite Ultra-High-Performance Concrete-Encased Steel Hollow Beams" Civil Engineering Journal Vol. 5, No. 6, June, 2019, PP: 1289-1304