# Experimental Study On Cold Formed Steel Beams Using Shear Connectors

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***Abstract-*** *Cold formed steel sections are widely used in many areas especially in commercial and residential buildings. In this paper, the flexural strength of cold formed steel beams is investigated experimentally. To transfer horizontal shear between cold formed steel and concrete, shear connectors are provided. Two beams with shear connectors and two beams without shear connectors were casted and tested under two point loading. The flexural strength of the beam had noted. The experimental results have shown that, the load carrying capacity of beams with shear connectors carries more load when compared to beams without shear connectors.*

***Keywords***- cold formed steel, flexural strength, shear connectors, two point loading.

## I. INTRODUCTION

Cold formed steel evolved as a building material in the 1930's and reached large scale usage only after the Second World War. In comparison with conventional steel construction, where standard hot- rolled shapes are used, the cold-formed steel structures are relatively new development. Cold formed steel is also specified as light gauge steel.

Cold formed steel sections are cold- formed in rolls by rolling the material in cold condition or by bending the steel sheets or strips in press brakes, cold rolling being used for mass production while press brakes are used for economical production of small quantities of special shapes. These are used extensively in structures subjected to light or moderate loads or for the members of short span length. For such structures the use of hot- rolled shapes is often uneconomical and the stresses developed in the smallest available shape may be very low. Earlier, use of light gauge steel was limited to building construction only but now it finds application in trucks and trailer bodies, rail coaches, etc., Light gauge members are connected by spot welds or by screws, rivets, bolts, etc.

## II. PREVIOUS STUDIES

**Joanna et al (2014)** presented the flexural behaviour of cold formed steel beams with diagonal stiffener and found that cold formed steel section with concrete has resulted in increased resistance to lateral torsional buckling. **Alex et al (2016)** conducted the experimental study on flexural behaviour of cold formed steel section and found that the load carrying capacity of cold formed built-up steel section without lip was 16% higher. **Arivalagan et al (2017)** studied the experimental analysis of cold formed steel members subjected to tension load and found that the presence of lip increases the load carrying capacity of single angles by 21% and increases by 24% for double angles. **Sudharsan et al (2018)** carried out an experimental and numerical investigation of Cold-Formed Steel Composite Beams with Shear Connectors and found that beams with channel shear connectors carries more load than the beam with T type shear connectors. **Kamal et al (2018)** conducted the experimental investigation of cold formed steel section with triangular web section and found that the corrugation is ineffective in pure bending zone and effective in shear zone.

## III. EXPERIMENTALINVESTIGATION

In this paper, a total of four cold formed beams with and without shear connectors were casted and experimentally tested under two point loading for flexural behaviour. The specimens are fabricated by locally available cold formed steel sheets. The cold formed steel sheet of 1.6mm thickness is used. The yield strength of CFS steel used is 250Mpa.

**Table 1: Beam Designation**

| No | Beam Designation | Explanation |
|---|---|---|
| 01. | BSC | Beam with shear connectors |
| 02. | BWSC | Beam without shear connectors |

### 1. TEST SETUP:

The testing was done in a loading frame machine of 50TN capacity. Two beams were fabricated without shear connector and two beams were welded with shear connectors was used. The views of the cold formed steel beams with shear connectors and without shear connectors are shown in Fig 1 and 2. Cross sectional dimensions of beams are

200mmX100mm. The length of cold formed steel beam is 1000mm.

**Figure 1. Beam with shear connectors (BSC)**

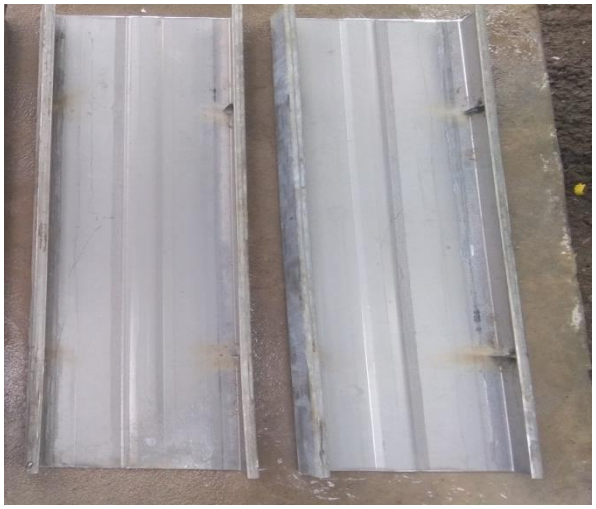


**Figure 1. Beam with shear connectors (BSC)**

## 2. Materials used and Mix Proportion

### A. Concrete

OPC of 43 grades as per Indian Standard was used. Fine aggregate passing through 4.75mm sieve was used. Coarse aggregate passing through 20mm sieve and retaining on 4.75mm sieve was used. The tests on fine and coarse aggregate were conducted to determine specific gravity.

**Table 2- Material Characterization**

| Test | Results |
|---|---|
| Specific Gravity of cement | 3.2 |
| Specific Gravity of F.A | 2.54 |
| Specific Gravity of C.A | 2.7 |

**Table 3- Mix Proportion in kg/m³**

| Cement | Fine Aggregate | Coarse Aggregate | Water |
|---|---|---|---|
| 518.42 | 586.36 | 1161.76 | 192 |

### B. Cold Formed Steel:

Cold Formed steel is manufactured, fabricated by processing the steel at room temperature. Cold formed steel sheets are light weight and widely used in many areas. Cold formed steel sheet of 1.6mm thickness was used.

### C. Shear Connectors:

To avoid slip of concrete particles and to transfer longitudinal shear connectors were used.

## 3. Casting of Beams:

After finishing of fabrication, the cold formed steel beams were casted and curing was done for 28 days using M25 grade of concrete.

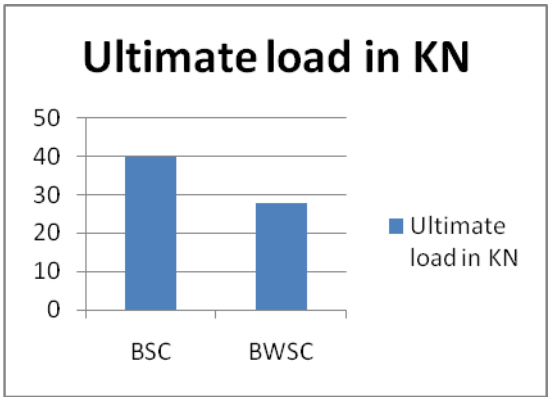
**Figure 3- Casted Beams**

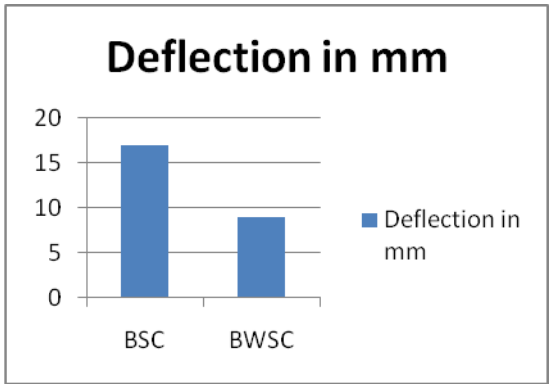
## IV. TESTING

A beam was fixed in loading frame of 50TN capacity. Two roller supports were provided. Two point loads was applied transversely at distance of L/3 from the both supports. The initial failure and ultimate load of beams were noted and observed.

## V. TEST RESULTS

| Beam Specification | Ultimate load in KN | Deflection in mm |
|---|---|---|
| BSC | 35 | 17 |
| BWSC | 22 | 9 |




## VI. CONCLUSION

In this investigation, the flexural behaviour of cold formed steel beams with and without shear connectors were tested and the results were recorded.

From the tested results, the following conclusions are shown.

Cold formed steel beams with shear connectors have high flexural strength when compared to cold formed steel beams without shear connectors.

The flexural strength of beam without shear connectors (BWSC) was 35kn and the ultimate deflection was 17mm. The flexural strength of beam with shear connectors (BSC) was 22kn and the ultimate deflection was 9mm.

The ultimate load carrying capacity of BSC beam was 20-25% higher than that of BWSC beams. The deflection of BSC beam was 10-15% lesser than that of BWSC beams.

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