Analytical & Experimental comparison on steel composite deck

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Abstract— A composite slab with profiled steel decking has proved over the years to be one of the simpler, faster, lighter, and economical constructions in steel-framed building systems. Comparative study of flexural strength of steel-concrete composite slab is made. This paper presents the testing of cold formed steel – concrete composite slab. Full scale bending test with UDL is conducted. Flexural capacity and vertical shear capacity is then analyzed using Euro code- IV. Experimental results are compared with analytical values. The result shows good agreement between analytical and experiment result.

I. INTRODUCTION

During the last two decades, research towards the development of effective flooring systems has resulted in a system based on the composite action of a concrete slab and a cold-formed steel deck. This deck serves both purposes of providing the formwork for the concrete slab and acting as the tensile reinforcement for the composite slab system. To achieve the desirable composite action, shearing forces have to be transferred between the concrete slab and the steel deck. This is usually accomplished by the mechanical interlocking devices rolled into the surface of the steel deck such as embossments and indentations.

II. DESCRIPTION OF TEST SPECIMEN

A full scale composite slab is made of trapezoidal shape steel cold formed steel deck is built and tested in this study. The specimen was constructed in single span. For casting of slab, M25 mix design of concrete used as per IS 456:2000.After casting of concrete, the specimen was cure by spraying water for 28 days. When specimen was ready to be tested, the side and end forms were removed. The geometry of slab is as per following

III. PROFILED STEEL DECKING PROPERTIES

1 Length of slab = 1500 mm
2 Width of slab = 700 mm
3 Over all thickness of slab = 110 mm
4 Thickness of concrete = 59 mm

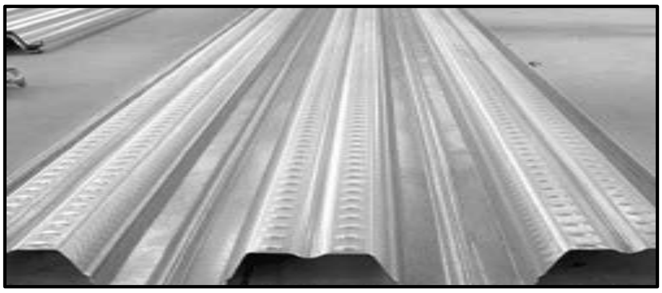

Fig. 1: Decking sheet with embossment

Fig. 2: Test setup

5 Diameter of bar = 8 mm
6 Spacing of reinforcement in both direction = 175 mm
7 The thickness of galvanized steel profile = 0.8 mm
8 Grade of concrete = M25
9 Yield strength of profiled galvanized steel sheeting fyp = 250 N/mm2
10 Characteristic strength of concrete fck = 25 N/mm2

The view of arrangement for the simply supported composite slab configuration with an effective span (L) of 1.3 m subjected uniformly distributed load is shown in Figure. 2. Figure 2 shows the complete experimental setup. Loading is applied by a single hydraulic jack system mounted on structural spreader beams section beneath the structural load beams and load is measured with the help of proving ring at the point of application. Uniform loading is applied.

Fig. 3: Arrangement of Dial gauge

IV. CALCULATION OF FLEXURAL STRENGTH

Full shear connection, the compressive force Ncf in concrete is equal to steel yield force Npa.

$$Ncf = Npa = \frac{Ap\ fyp}{ap}$$

$$Ncf = \frac{1051.43 X\ 0.25}{1.25}$$

Fig.4 Arrangement of loading cell

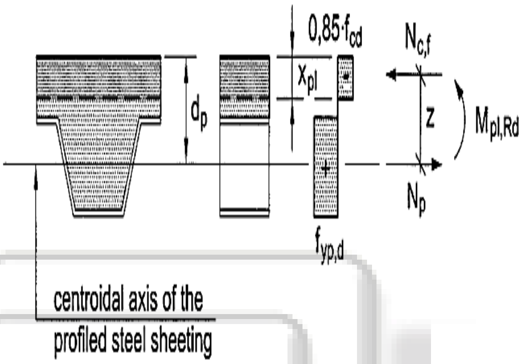

Fig. 5: Stress distribution for sagging bending if the neural axis is above the

Steel sheeting

= 210.29kN /m

$$X = \frac{Ncf}{b\,(0.85fck / 1.5)}$$

$$X = \frac{210.29 \times 1000}{1000 \times 0.85 \times 25/1.5}$$

$X = 14.84$ mm

If $x \leq hc$

Mp.rd = Ncf (dp - 0.5 x)

Mp.rd = 210.29 x (0.0845 - 0.5 x 0.0148)

= 16.21 kNm

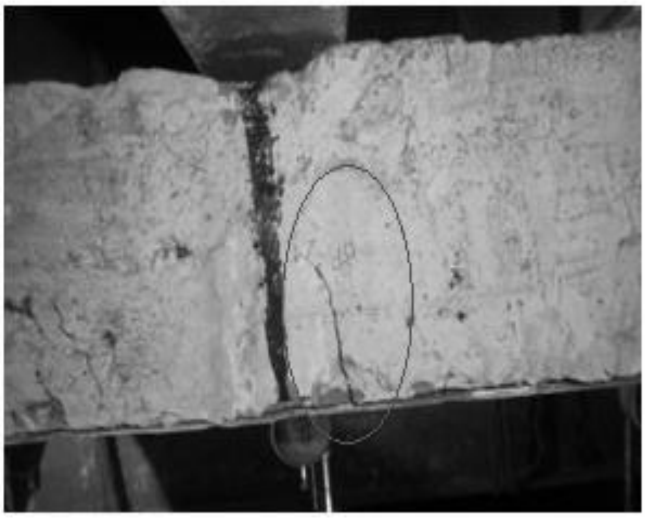

Fig.6 Crack at mid-point

V. VERTICAL SHEAR

Vv,Rd = (bo/b) x dp x τRd x kv (1.2+40ρ) per unit width

Kv = (1.6-dp) ≥ 1 with dp in m

= (1.6 - 0.0845)

= 1.515 m ≥ 1

$$\rho = \frac{Ap\,(bo)}{bo \times dp} < 0.02$$

$$= \frac{120}{117 \times 84.5}$$

= 0.0121 < 0.02

Vv,Rd = (bo/b) x dp x τRd x kv (1.2+40ρ) per unit width

$$VvRd = \frac{117 \times 84.5 \times 0.12 \times 1.515 \times (1.2 + 40 \times 0.0121)}{134}$$

= 22.58kN

Sr. No	Title	Vertical Shear kN	Moment Capacity kN.m	Load at first crack (kN)
1	Euro Code	22.58	16.21	-
2	Sample CS-1A	27.37	18.14	70.92kN
2	Sample CS-1B	26.15	17.67	78.25KN

TABLE 2:

VI. CONCLUSION

The result good agreement between analysis and experiment result. The results are within 18.51 % difference in the average of sample CS1A and CS1B.

REFERENCE

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