

# Experimental Investigation on Composite Slab using Cold Formed Steel Sheet in Light Weight Concrete

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## ABSTRACT

Composite slab construction is emerging technique for flooring system. Concrete is a member that works well in compression and steel is a member that works extremely well in tension. By joining the two materials strength can be exploited to results in a highly efficient way. So the project is to increase the strength of the slabs by using steel sheeting as flexural member and concreting is done over the steel sheets. Experimental verification of load carrying capacity of composite slab is conducted. The steel decking of composite slab is made of cold formed profile sheeting which serves as the permanent form work and tensile reinforcement. The project concentrates on finding the flexural strength of the composite slab. The three geometric profile shapes of steel decking are trapezoidal, rectangular and hololib. Concrete used for composite slabs are reinforced cement concrete, foam concrete and fiber reinforced concrete.

**KEYWORDS:** HOLORIB. CONCRETE, STEEL SHEETING, TENSILE REINFORCEMENT

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## 1. INTRODUCTION

Composite construction is the term used for structures composed of two or more different materials. Generally in Structural Engineering, the composite materials may be combinations of concrete & steel, concrete & timber, timber & plastic, timber & steel, plastic & steel etc. Composite construction integrates the structural properties of the two materials to produce stiffer, stronger and lighter members from the efficient connection between the two materials. The shear-bond connection between the two materials is a very important factor in ensuring that they act as one unit.

Cold-formed shapes can be used for entire buildings and for complete roof, floor and wall systems. They can also be used as individual framing members such as studs, joists and truss members. In Buildings they are constructed as Other commercial buildings, Industrial buildings and warehouses, Leisure buildings, Stadia, Hospitals, Schools, Cinemas, Housing; both individual houses and residential buildings, Refurbishment projects.

The grade of carbon steel and high strength low alloy steel used for cold-formed steel product. These are characterized by two main properties such as the yield point and the tensile strength. The yield point of the steels commonly used for cold-forming ranges from 230 to 380 MPa and may be higher.

1. To determine the maximum load carrying capacity of the composite section experimentally under static two Line Loading.
2. To compare the results theoretically with the obtained experimental results.

## 2. MATERIAL USED

- Cement
- Fine aggregate
- Course aggregate
- Lightweight expanded clay aggregate
- Water
- Foaming agent
- Cold formed sheet

## 2.1. MATERIAL TEST RESULTS

S.No	Property	Experimental Value	Limiting value
1	Specific gravity of cement	3.17	Approximate 3.15
2	Standard consistency of cement	32%	Approximate 33%
3	Initial setting time of cement	95 min	IS 12269-1987 not < 30min clause 5.3
4	Final setting time of cement	345 min	IS 12269-1987 not > 600min clause 5.3
5	Average Compressive strength test of cement mortar cube 28days	58.3 N/mm <sup>2</sup>	Not < 53 N/mm <sup>2</sup> as per IS 12269-1987
6	Specific gravity of F.A	2.68	Approximate 2.6-2.7
7	Sieve analysis of F.A	FM=2.75	Medium sand 2.6-2.9
8	Water absorption test on F.A	0.917%	< 2%
9	Specific gravity test for C.A	2.67	Approximate C.A 2.7
10	Specific gravity test for LECA	0.44	-
11	Water absorption test for C.A	1.11%	< 5%
13	Sieve analysis of C.A	FM=7.27	6.6 – 8.0
14	Impact test of C.A	7.29%	not > 45% for concrete other than wearing surface per IS 283-1970
15	Tensile strength on steel	481N/mm <sup>2</sup>	not < 415 N/mm <sup>2</sup> for 415 grade steel as per IS

Table 2.1 Material test results

## 3. CASTING OF CONCRETE

The hardened properties of concrete such as concrete cube compressive strength and split tension strength tests are conducted as per Indian standard. The six concrete cube and cylinder specimens are casted for tests conducted at 7 and 28 days. 2 numbers of composite slabs are also casted and subjected to cyclic loading. The concrete after workability tests was used for casting test specimens. For casting cube specimen cube moulds of size 150x150x150 and for cylinder 150mm dia. and 300mm high cylindrical moulds are used. The inner surface was thoroughly cleaned and a thin layer of grease was coated. The concrete was filled and compacted in three layers with standard tamping bar and. After the top layer was compacted, the surface of the concrete was finished in level with top of the mould using a trowel.



Figure 3.1 Casting of cube and cylinder specimens.

## 3.1. CASTING OF BEAMS

### 3.1.1. CONCRETING OF BEAMS:

The profiled steel sheets are shuttered properly and the oil is coated at the inner side of the shuttering. After oiling, the concrete is poured over the profiled steel sheet to a thickness of 100mm. The concrete is well compacted while concreting. The Conventional M20 concrete and the LECA concrete is used for the mix. The minimum reinforcement is

used as weld mesh of 1mm diameter is provided as top reinforcement to take care of thermal and shrinkage cracks.

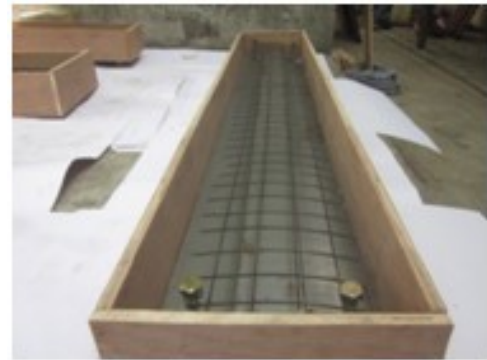


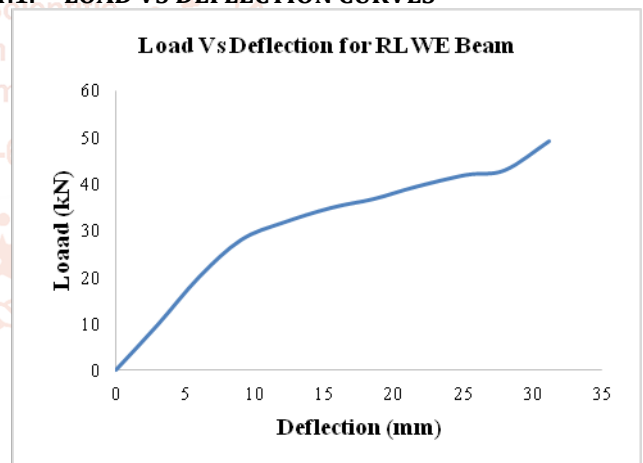
Figure 3.2: Minimum reinforcement and concreting

## 4. TEST RESULTS

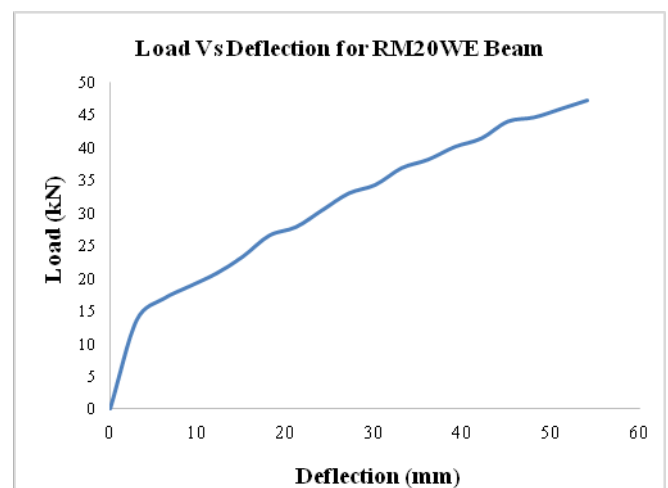
S. No	Name of the specimen	Max Load kN	Max Deflection mm
1	RLWE	49.29	31.2
2	RM20WE	47.231	54
3	RM20WOE	58.88	69.5
4	TLWE	32.997	39.
5	TM20WE	46.584	69
6	TM20WOE	36.879	57
7	RELWE	45	65
8	REM20WE	35	31.9
9	REM20WOE	35	25.25

Table 4.1: Test results

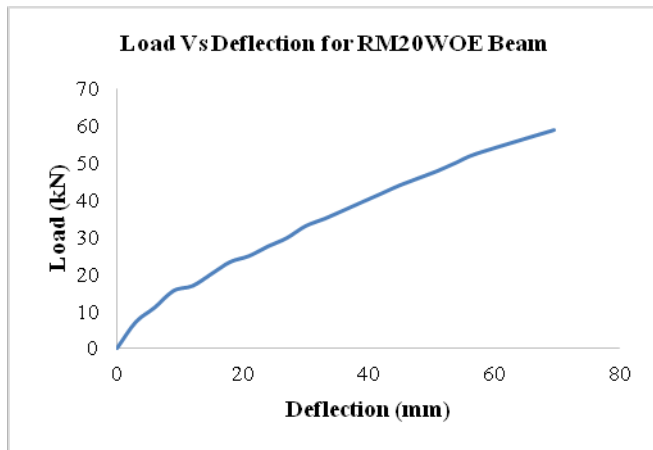
### 4.1. LOAD VS DEFLECTION CURVES



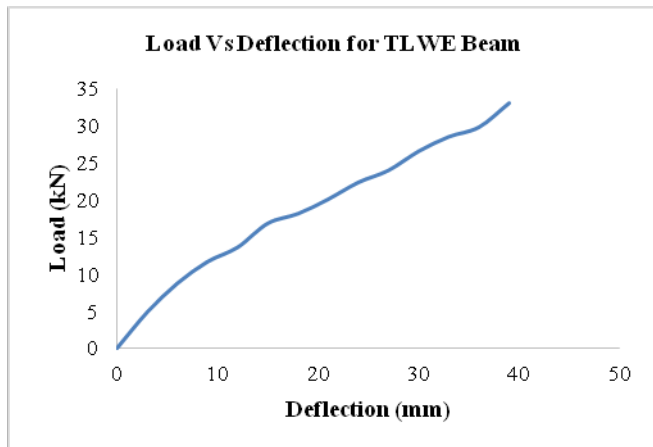
Graph 4.1: Load Vs Deflection for RLWE Beam



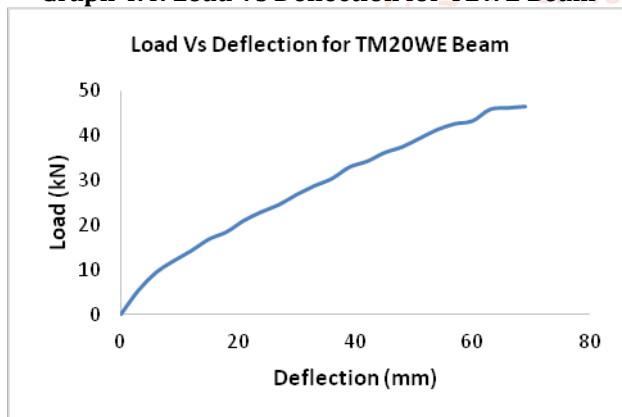
Graph 4.2: Load Vs Deflection for RM20WE Beam



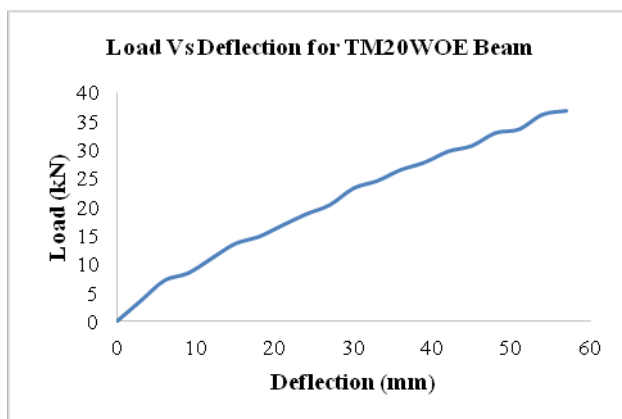
Graph 4.3: Load Vs Deflection for RM20WOE Beam



Graph 4.4: Load Vs Deflection for TLWE Beam



Graph 4.5: Load Vs Deflection for TM20WE Beam



Graph 4.6: Load Vs Deflection for TM20WOE Beam

## 5. CONCLUSIONS

From the Test results it is clear that the composite slab element with Rectangular profile without Embossment has a higher load carrying capacity. Among the Three composite slab elements of the M20 with embossments the Rectangular profiled slab element had the higher value for the ultimate load whereas the Re-entrant profiled slab element was found to have the lower value of the Ultimate load capacity.

Among the three composite slab element of the M20 grade concrete without embossment the Rectangular slab element with Shear connectors was found to have the higher ultimate load capacity while The Re-entrant profiled composite slab element was having lower Ultimate load capacity.

The Light weight concrete with LECA reduced the dead weight of the slab element by 15% on partial replacement. The LECA concrete almost had the same strength as that of the M20 grade concrete. Among the three composite slabs with Light weight aggregates the rectangular profiled slab element was found to have higher ultimate load capacity whereas the trapezoidal profiled decking was found to have low ultimate load capacity.

If the same procedure is followed for both the full scale and elemental testing, comparable results are produced for full size specimens. The data obtained from the elemental analysis can be applied for the current design specifications. It is also noted that the strain in concrete is equal to half the strain in steel.

## REFERENCES

- [1] Design recommendations for steel deck floor slab, M. L. Porter, C. E. Ekberg (1980)
- [2] Experimental study on shear-bond behaviour of composite slab according to Euro code 4.
- [3] Shear-Bond failures in composite slabs - A detailed experimental study(2011), Shiming Chen, XiaoYu Shi, ZiahoQiu, Steel and composite structures, Vol II, No.3, 233-250.
- [4] Experimental study on composite slabs to determine the shear-bond characteristics (m-k) values of the embossed profiled sheet, V. Marimuthu, Journal of constructional steel research-ELSEVIER 63 (2007), 791-803.
- [5] Analysis of deflection of composite slabs with profiled sheeting up to the ultimate moment, G. Marciukaitis, B. Jonaitis, J. Valivonis, Journal of constructional steel research 62 (2006) 820-830.