International Journal of Trend in Research and Development, Volume 7(3), ISSN: 2394-9333
www.ijtrd.com

Behavioural Study on Flitched Beams

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Abstract: The sandwich deep beam are used to reduce the self-weight, deflection and shear by inclusion of thermocol and weld mesh. The outcome of recent research undertaken on concrete deep beams with and without reinforcement In this project study with experimental studies which have been conducted to understand the various modes of failure that could occur due to possible combination of shear and bending moment acting at a given section. The main obstacle to the shear problem is the large number of parameters involved Reinforced concrete deep beams are used as load distributing structural elements such as transfer girders, pile caps, foundation walls, and offshore structures. The shear strength evaluation of reinforced concrete beams has been the subject of several studies devoted to determine the influence of the main parameters. Due to the small value of span-depth ratio, the strength of deep beams usually controlled by shear strength rather than flexural strength, if normal amounts of longitudinal reinforcement are used. Shear force presents in beams at sections where there are a change in bending moment along the span, it is equal to the rate of change of bending moment. Apart from highlighting the experimental set-up, typical crack patterns, failure modes, and load-deflection behaviour are also reported.

Keywords: *Self Weight, Deep Beam, Thermocol, Bending Moment*

I. INTRODUCTION

The behaviour of RC deep beams is complex. The assumption of **"plane sections remain plane in bending**" is not applicable in deep beams. The important characteristic of the deep beam is its high shear strength due to internal arch action, which thrusts the load directly on to the end support through concrete struts. As per ACI code (ACI 318), the beams are classified as deep beams when their shear span-to depth ratio is less than or equal to two. If the quantity of flexural reinforcement is high without shear reinforcement, such deep beams fail in shear

In larger size deep beams, the crack propagates fast causing sudden failure

A beam shall be deemed to be a deep beam when the ratio of effective span to overall depth, is less than

1) 2.0 for a simply supported beam; and
2) 2.5 for a continuous beam

WELD-MESH:

High quality steel mesh, formed from electrically welded, smooth steel wire. ARC Weldmesh has a huge number of applications across many industries

Working with Weld-mesh

- Weld-mesh can be cut, bent, wired together and welded.
- Sheets can be cut to size or made to order to meet your needs
- All Weld-mesh products are manufactured to a high quality standard in facilities with ISO 9001 accreditation. Cut and straightened wire products are also available in a variety of sizes, material and surface finishes.

Objectives of Project

To carry out experimental investigations to use weld mesh and thermocol of RC deep beams to reduce the concrete area and to determine the flexure strength of the deep beam and compare the self-weight and ultimate and shear strength of the beam

- First Crack load
- Flexural strength
- Shear strength
- Ultimate Load
- Deflections

Scope of the project

This project relates the replacement of reinforcement by weld-mesh and thermocol. And it can be used to reduce the concrete area of deep beam an alternate for reinforcement in Rc deep beams by reduce the self weight of the Rc deep beam and to increase the shear resistance of the deep beam.

Specimen Details

Testing was carried out on 12 beams, Beams were simply supported on constant effective span of 1200 mm. 12 numbers of beams were tested under two point concentrated symmetrical loads. All the beams were having constant overall span and width of 400 mm and 150 mm respectively. There were four series of beams

II. MATERIAL PROPERTIES

Cement

The cement used in the study is ordinary Portland cement of 53 grades supplied from Ultra Tech cement factory. It is tested for physical properties as per IS 12269: 2013 standard. The preliminary test results of the cement

Fine aggregate

Locally available river sand conforming to Grading zone II of IS 383 –1970 was used in the study. Used as a filler. It accounts 60-80% of volume & 70-80 % of weight of concrete and defines concrete dimensional stability.

Coarse aggregate

Locally available crushed blue granite stones conforming to graded aggregate of nominal size 20 mm as per IS 383 – 1970 is used. Properties of aggregates have large impact on the strength, durability, workability and economy of concrete.

Specimen Details

Nine specimens (Deep Beams) were cast and tested up to failure divided into three groups (G1 to G3) to investigate the effects of three variables on shear strength of deep beams which are:

- Conventional deep beam
- Weld mesh and thermo-coal without reinforcement
- Weld mesh and thrmo-coal with reinforcement

Specimen Preparation

All the beams were rectangular in cross-section with 150mm width. The overall depths of the three beams were; 400mm respectively. The shear spanto- depth ratio was 0.75. The effective span-to-depth ratio was 1.5. The overall length (L) of the beam was 70mm respectively. The effective cover to the reinforcement was 50mm with a clear cover of 25mm in all the beams. The horizontal shear reinforcement was 0.2 and 0.3%, distributed uniformly over the total depth (UN) and uniformly distributed over 0.3d (CN).

III. EXPERIMENTAL INVESTIGATION

Purpose of Mix design:

Design of concrete mixes involves determination of the proportions of the given constituents namely cement, water, coarse and fine aggregates, fly ash. Polypropylene and admixture Workability is specified as the important property of concrete in the fresh state and compressive strength and durability are important properties of hardened concrete. Hence the mix design is generally carried out for a particular compressive strength of concrete with adequate workability so that the fresh concrete can be properly placed and compacted to achieve the required durability .In special situations concrete can be designed for flexural strength for any other specific property of concrete.

IV. TEST RESULTS

TRAIL1:

Compressive strength for fresh concrete for 7 day

S.No	load Kg	Compressive strength (N/mm^2)
1	71000	30.95
2	77000	33.57
3	76000	33.17

TRAIL2:

Compressive strength for fresh concrete for 28 days

S.No	load Kg	Compressive strength (N/mm^2)
1	73000	31.82
2	77000	33.57
3	78000	34.00

CYLINDER

TRAIL 1:

Split tensile strength of cylinder for 7 day

S.No	load Kg	Split tensile stress (N/mm^2)
1	34500	2.39
2	32500	2.25
3	34000	2.34

TRAIL 2:

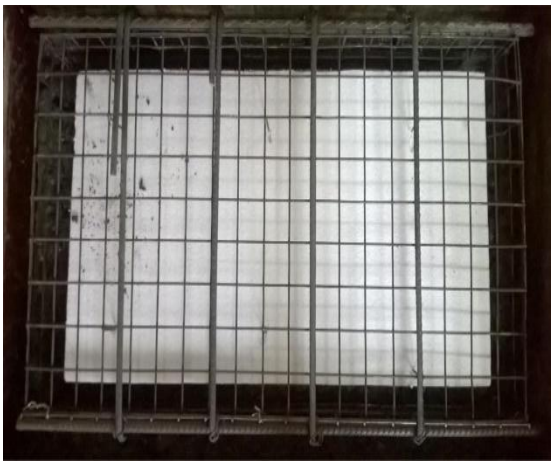
Split tensile strength of cylinder for 28 day

S.No	load Kg	Split tensile stress (N/mm^2)
1	34000	2.40
2	35500	2.34
3	36500	2.53

Casting of beam:

Casting of beam for thermocal with weldmesh

Weld mesh thermocol with r\f



Test results of beam: Load vs deflection for weldmesh with thermocol concrete deep beam

LOAD	DEFLECTION
0	0.0
0.4	0.1
0.8	0.2
1.2	0.3
1.6	0.4
2	0.5
2.4	0.6
2.8	0.7
3.2	0,8
3.6	0.9
4	1.0
4.4	1.1

Load vs deflection curve for weldmesh and thermocol with reinforced concrete deep beam

LOAD	DEFLECTION
0	0.0
0.4	0.1
0.8	0.2
1.2	0.3
1.6	0.4
2	0.5
2.4	0.6
2.8	0.7
3.2	0,8
3.6	0.9
4	1.0
4.4	1.1

CONCLUSION

The idea of light weight concrete deep beams and weld mesh and thermocol added concrete deep beams were proposed the main conclusions were,

- The failure of deep beams is by the diagonal strut failure.
- Comparing to normal concrete deep beams light weight concrete deep beams show poor behaviour in deflection, cracking and the design became non conservative.
- Addition weld mesh and thermocol of too lightweight concrete deep beams improves its performance in cracking and deflection

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