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FLEXURAL BEHAVIOUR OF RC BEAM WITH WELDED MESS AS SHEAR REINFORCEMENT

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ABSTRACT

An alternative reinforcement system, Welded mesh is planned to achieve the purpose of stirrups in Reinforced Concrete Beams. Welded Wire Mesh Built-up Method, comprises of galvanize welded wire mesh and vinyl glazed welded wire mesh making process. Welded mesh excludes some of the detailing problems linked in conventional rebar in the Reinforced Concrete. Usage of welded wire mesh results in stress-free and quicker assembly, and better budget and superiority control. In this present experimental work on the behavior of Rectangular concrete beams with Shear reinforcement by Welded mesh was carried out. One Control beam with conventional reinforcement with five other beams with vary welded mesh were cast and tested under two point loading. The results were used to study the flexural behavior. It is obtained that the beam with continuous weld mesh and longitudinal bar given the maximum load carrying capacity.

KEYWORDS: Welded wire mess, Shear reinforcement, Crack width, Stirrups.

INTRODUCTION

This paper presents Flexural behaviour of beam under two point loading with Welded mesh as shear reinforcement. This kind of welded mesh wire is formed from stainless steel that has extraordinary strength and reliability. This corrosion resistance meshed wire is long lasting . Because of its economy, ease, and faster of construction as well as better quality control, Welded mesh has been widely used in buildings that Weld mesh can be a good substitute for the conventional reinforcement and yielded excellent results both in strength and ductility. This is because of a little is known about the structural behaviour of RC Beams confined by Weld mesh as Shear reinforcement.A total of 6 Beam specimens to made in this study. Five of the specimens with weld mesh at various longitudinal section as transverse reinforcement, while the other specimen is with conventional reinforcement.The parameters are to be investigated in this research included the spacing and grid configuration of Weld mesh reinforcement, and the distribution of longitudinal reinforcement.It is well known that confined concrete behaves differently from unconfined concrete due to the effect of lateral pressure. Tests of reinforced concrete beams indicate that the strength and ductility of concrete are improved not only by longitudinal reinforcement, but also shear reinforcement.

WELDED WIRE MESS MATERIALS AND METHODS

Advantages of the Welded Wire Mesh

a. Higher Characteristic Design Strength
b. Better Bonding Behaviour
c. Better and Economic Crack Fighting with Tinny Wires and Nearer Spacing
d. Savings of Labour, Time and Binding Wire
e. Flexibility of Handling and Placing

Application of Welded Wire Mesh

Structural Slabs & Walls

Welded wire mess instead of stirrups makes the reinforcement for domestic and Official Buildings most speedy and sophisticated. In addition to this., there is quit savings of steel of nearly 30%.

Roads / Pavements

Huge Floor area labs on ground, roadways, airfields, airstrips, aprons etc to attain crack-free linkages

Precast Members

Precast components that are squeaky and problematic to reinforce such as curved arch flat elements,

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Hyperbolic Paraboloid Shells, folded plate roof girders, fins, thin pardis or chajja drops.

EXPERIMENTAL INVESTIGATION

The experimental investigation is conducted as detailed below. All the materials tests were conducted in the laboratory as per relevant Indian Standard codes. Basic tests were conducted on fine aggregate, coarse aggregate, and cement to check their suitability for concrete making. The study aims to investigate the strength related properties of concrete of M20 grade. The proportions of ingredients of the control concrete of grade M20 had to be determined by mix design as per IS code. The cubes are cast as per the M20 grade of concrete. Totally six cube specimens, six cylinders and six beam specimens to made in this study. Five of the beams with weld mesh at various longitudinal section as transverse reinforcement, while the other specimen is with conventional reinforcement. The parameters are to be investigated in this research included the spacing and grid configuration of Weld mesh reinforcement, and the distribution of longitudinal reinforcement. Six beam specimens of size 100mm x 200mm x 2200mm were cast, cured and subjected under two- point loading to study their flexural behaviour and other salient parameters.

Materials

Cement

The cement used in this experimental investigation was 53 grade OPC manufactured by Chettinad cements.

Fine aggregate

The sand used for experimental program was locally procured and conforming to zone II. The sand was primarily sieved over 4.75 mm size sieve to take out any units bigger than 4.75 mm. The fine aggregates were tested as per Indian Standard Specification IS: 383-1970.

Coarse aggregate

Locally available coarse aggregates were used in this work. Aggregates passing through 20mm sieve and retained on 16mm sieve were sieved and tested as per Indian Standard Specifications IS: 383-1970.

Water

The tap water available in the campus was tested for its suitability. Necessary properties such as pH value, chloride content, total hardness and total dissolved solids were evaluated.

Welded Mesh

Our range of welded mesh, highest in class and manufactured with compatible to IS: 1566-1982 with lengthy and cross wire space altering from 20 mm to 150 mm and diameter ranges from 2mm to 6mm.. The connections are firmly welded and has the capability to tolerate the shear stress up to 210 N\mm2 on the orientation area of the wire.

Tables:

Table 1. Physical properties of cement

PROPERTY	VALUE
Specific Gravity	3.05
Standard consistency	32%
Setting time	
(i) Initial setting time	50 minutes
(ii) Final setting time	217 minutes
Fineness	2.5%

Tables 2. Chemical composition of cement

COMPONENT	%
Sio2	21.8
Al2O3	4.8
Fe2O3	3.8
CaO	63.3
SO3	2.2
MgO3	0.9
P2O5	<0.04
Loss of ignition	2
Insoluble residue	0.4

Table 3. Physical properties of Fine Aggregate

PROPERTY	VALUE
Specific gravity	2.45
Fineness modulus	2.515
Bulk density	1.65 kg/m^3
Type of sand	Medium sand (zone 2)
Total water absorption	1.0%

Table 4. Physical properties of Coarse Aggregate

PROPERTY	VALUE
Specific gravity	2.62
Density	1567 kg/m^3
Fineness modulus	7.42
Impact value	22.12% < 45%
Crushing value	24.44% < 45%
Total water absorption	0.6%

Table 5. Properties of Water

PROPERTY	VALUE
pH value	8.2
Chloride content	112.5 mg/l
Totol hardness	105 mg/l

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Total dissolved solids	105 mg/l

Table 6. Concrete mix design proportion (M25 grade)

UNIT	WATER	CEMENT	FA	CA
Kg/m^3	192	383	639	1115
Ratio	0.5	1	1.8	2.97

RESULTS AND DISCUSSION

Compressive strength

Compression test has been carried out on concrete cubes with standards confirming to IS 516-1999. All the samples were tested in a 1000KN capacity universal testing machine. After 28 days of curing, the cubes were permitted to turn into dry condition before testing. Plane surfaces of the specimen were between platens of compression testing machine and subjective to loading. The compressive strength of the concrete cubes are given in Table

Table 7. Compressive strength of cubes (M25 grade)

S.NO	TYPE	7 DAYS STRENGTH	28 DAYS STRENGTH
1	SP1	17.21 N/mm^2	26.18 N/mm^2
2	SP1	16.82 N/mm^2	25.80 N/mm^2

Tests for beams

All beams were tested in reaction type loading frame of capacity 500 KN. The span of the beams kept as 2000 mm with simply supported end condition and was tested under two point loading applied at one third span points through a stiff beam. Deflections of the beams were measured by three LVDTs at midspan, one third span and one fourth span.

Load Deflection Behaviour

Load Vs deflection plot has been drawn for all test specimens from the experimental data. The behaviour of test specimens is compared the plots. The first crack and failure load were recorded along with corresponding displacements and strains

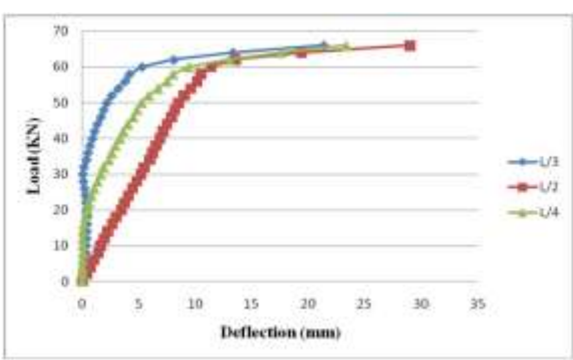

Fig.1 Load Vs Deflection Curve for Specimen SP 1

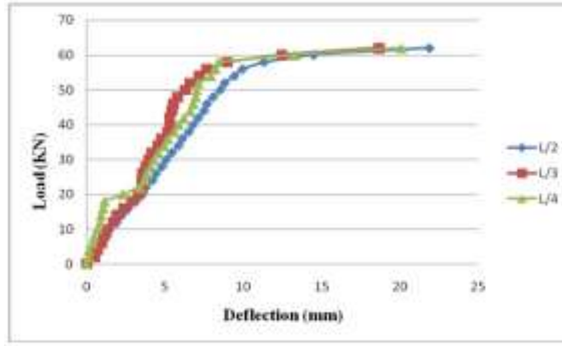

Fig.2 Load Vs Deflection Curve for Specimen SP 2

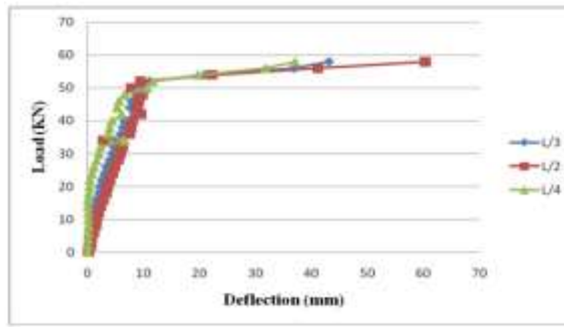

Fig.3 Load Vs Deflection Curve for Specimen SP 3

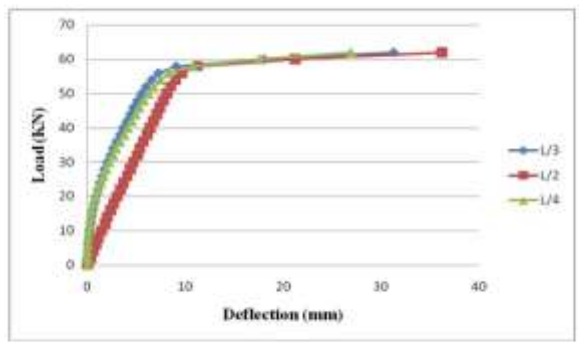

Fig.4 Load Vs Deflection Curve for Specimen SP 4

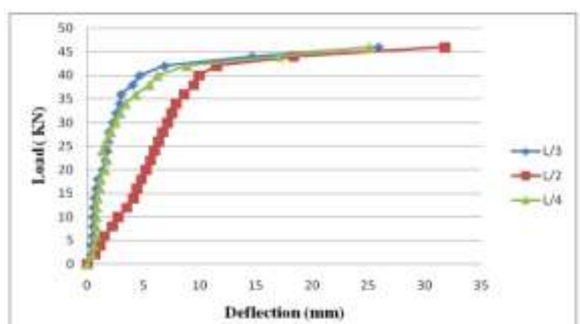

Fig.5 Load Vs Deflection Curve for Specimen SP 5

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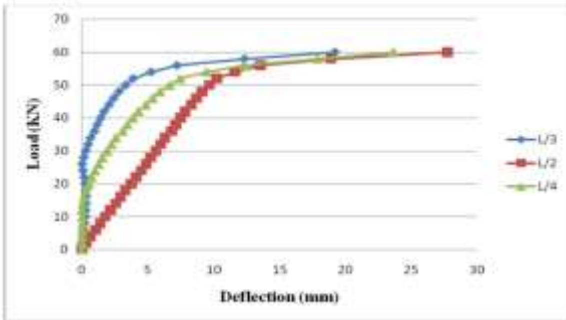

Fig.6 Load Vs Deflection Curve for Specimen SP 6

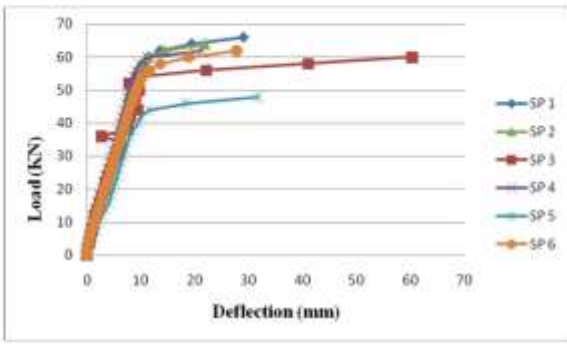

Fig.7 Load Vs Deflection Curve at L/2 for Specimen SP 1 to SP 6

It is clearly seen from Table 4.1, that SP 1 specimen has the highest load carrying capacity among the group. The beam specimen SP 5 performed in a poor manner with low load carrying capacity. The remaining beams can be grouped under the same class as their load carrying capacity or ultimate load is nearly same. Hence for better flexural performance fully weld mesh stirrups throughout the beam span can be suggested.

Shear failure of beams

The nominal shear is less than designed shear strength of concrete beam, the minimum shear reinforcement shall be provided. The nominal shear is exceeds designed shear strength of concrete beam, the shear reinforcement shall be provided. The effect of shear stress is greatest in web of the beam and is maximum at the neutral axis and decrease to zero at the extreme edges. Shear forces tend to cause diagonal cracks radiating from the top and at 45˚ to the plane of the beam. These are steeper where bending moment prevail and are more inclined where the shear are largest. In this experimental work the specimens are behaving like same manner in the shear failure mode. Cracks due to shear are widest in the region of the neutral axis and become thinner towards the upper and the lower of the beam. Figure 4.11 indicates typical shear failure mode of failed beams

Modes of failure

Fig.8 Modes of Failure.

- All Reinforced cocnrete beams failed in flexure zone.
- After the first crack load, the reinforcement started yielding and more number of cracks have formed in the flexure zone and extended towards the point loads with increment in loads.
- At the ultimate load, the failure of all concrete beam with welded mesh occurred with crushing of concrete in compression zone.
- In the Specimens SP 3 and SP 5 more number of cracks formed in flexure zone. This is due to the absence of shear reinforcement in the flexure zone at the mid span.
- Specimens SP 2 and SP 5 having less number of cracks formed in flexure zone. It indicates that the combination of weld mesh shear reinforcement with conventional stirrups provide mariginally high strength and cracking reistance.

CONCLUSION

1. The flexural strength of beam increases nominally and remains unaffected compared to that of control specimen for the fully welded mesh shear reinforcement provided throughout the length of the specimen.
2. Even though Shear Reinforcement was replaced with welded mesh there is no appreciable change in flexural load carrying capacity.
3. The load carrying capacity reduces in the case of specimen provided with very small volume of welded mesh shear reinforcement at the supports only.
4. In the mode of failure, the conventional RCC Beam specimen and welded mesh specimen are similar.

5. When the shear stirrups are completely replaced with welded mesh, when the welded mesh distribute throughout the span, behaviour of beam is better than other beam
6. Out of the six specimens tested the specimens with the provision of fully welded mesh of grid configuration 50.8 x 50.8 mm exhibits better performance.
7. Since there is reduction in cost, the use if welded mesh is found to be an suitable alternative to conventional shear stirrups.

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