# FLEXURAL BEHAVIOUR OF WELDED MESH REINFORCED CONCRETE SLAB

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**Abstract**

**In this experimental study the conventional RC slabs are compared with the replaced welded mesh slabs to develop a high strength concrete by testing the mechanical properties and strength variations between the conventional and welded mesh slabs. The slabs are studied for their flexural behaviour and impact behaviour of welded mesh slabs with high strength concrete matrix. In first phase of my study, the materials are collected and the preliminary test were conducted for finding their properties as per Indian standards. The mix design was carried out for M30 grade concrete and Fe415 steel were used for beam design. The specimens such as cube of size 100x100x100 mm, cylinder of size 100 mm diameter and 200 mm height and prism of size 100x100x500 mm were cast and the specimens were tested for finding compressive strength, split tensile strength and flexural strength respectively. The average compressive strength of cube was obtained at 28th day as 32.6 N/mm2. The average split tensile strength for cylinder was obtained as 4.21 N/mm2. The average modulus of rupture of prism was obtained as 5.2 N/mm2. Six Slabs of each size 1200x500x80 mm were casted and in second phase of study, the test will be carried out for finding the ultimate load carrying capacity, deflection and ductility. The cracking pattern will also be studied.**

## Introduction

Welded wire fabric, with characteristic yield strength of 500 MPa, is commonly used by the Australian building industry in reinforced concrete slabs. Such steel has recently been classified in the steel reinforcement standard AS/NZS4671-2001 as Class L (low ductility). Reinforcement is classified as Class L if the minimum specified lower characteristic uniform elongation is at least 0.015 and the ratio of yield stress to ultimate tensile strength exceeds 1.03. A reinforced concrete flexural element reinforced with welded wire fabric invariably fails by fracture of the tensile reinforcement and the conventional understanding of ductile under-reinforced flexural failure is not valid. At the ultimate moment, fracture of the tensile steel may occur well before the concrete in the compression zone becomes overstressed, certainly well before the extreme compressive fiber strain reaches 0.003. This can be readily shown using a simple cross-sectional analysis, assuming plane sections remain plane and enforcing the requirements of equilibrium and compatibility. It is important to verify the theoretical predictions with experimental results, as the catastrophic failure mode resulting from fracture of the tensile steel has direct consequences on ductility, warning of failure, moment redistribution in indeterminate structures and the validity of many of the routine approximations and simplifications made in the analysis and design of reinforced concrete structures

## 1. Methodology

1.1 General

The methodology is the systematic and theoretical analysis of the methods applied to a field study, or the theoretical analysis of the body of methods and principles associated with a branch of knowledge. This chapter briefly explains the methodology adopted in this experimental work. Fig 3.1 shows the flow chart of methodology.

1.2 Phase I Methodology

In the first phase, 10 journals are collected and studied thoroughly. After the collection of

required information, the preliminary tests are carried out. Using the obtained material properties, the mix is designed for M30 grade concrete. The cubes, cylinder and prism beam is casted for the conventional test for M30 grade concrete. The RC conventional slabs and welded mesh slab are casted.

1.3 Phase II Methodology

The casted RC and welded mesh slab are tested for the study of flexural behavior.

## 2. Scheme of work

The Fig. 1 shows the flow diagram representing the methodology adopted for this work.

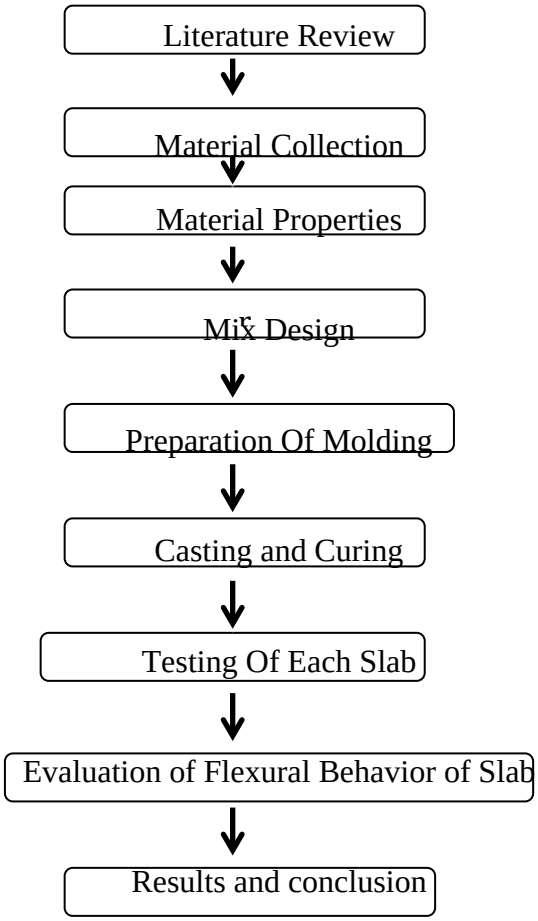



**Fig.1. Flow Diagram Representing the Methodology**

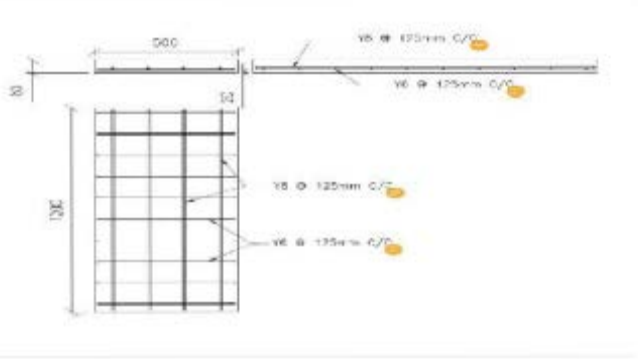
### 2.1 Summery of literature

- Slab size of 1200 x 500 x 80 mm is used.
- M30 grade of concrete was used.
- HYSD 8mm&6mm diameter bars are used.
- Welded mesh using 25mm*25mm 3mm diameter.

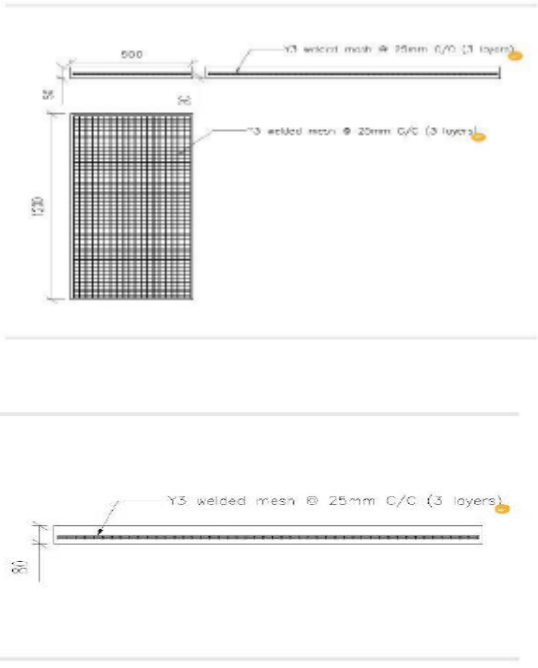
### 2.2 Materials used

- Cement
- Fine Aggregate
- Coarse Aggregate
  - 40% 12mm sieve
  - 60% 20mm sieve
- Water

## 3. Reinforcement detail of conventional slab



### 3.1Reinforcement detail of welded mesh slab




### 3.3 Casting of slab

Size = 1200 x 500 x 80 mm
Mix ratio M30 grade = 1: 1.5: 2.6
W/C = 0.45
Volume = 1.2 x 0.5x 0.08
= 0.048 $m^3$
Mass = volume x density
= 0.048 x 2400
= 115.2kg + 20% of wastage
= 138.24 kg
Cement = 138.24 / 5.55 = 25.13 kg
Fine aggregate = 37.70kg (25.13 x 1.5)
Coarse aggregate = 65.34 kg (25.13 x 2.6)
Water = 11.30 litres (25.13 x 0.45)


**Conventional slab** **Welded mesh slab**

### 3.4 Load Frame Fabrication

### 3.5 Load point marked on slab and yet to be tested

## 4. Experimental work

### 4.1 Materials

Portland pozzolona cement (PPC) – 53 grade was used in this investigation with specific gravity of 3.1 and fineness of 6%. The fine aggregate was locally procured and sieved through 4.75mm sieve which was confirming to zone II with specific gravity of 2.6. The locally available coarse aggregate was purchased and 60% of 20mm aggregates and 40% of 12mm aggregates were used with specific gravity of 2.84 and water absorption of 2.8%. The tap water available in the college campus was taken. The HYSD bars of 8mm diameter were used for main reinforcement and 6mm diameter mild steel bars were used for. The welded mesh are using 25mm*25mm spacing and 3mm diameter welded mesh are using.

### 4.2 Characterization of Materials

M30 mix of 1:1.5:2.6 concrete of ratio were used and the preliminary tests like compressive strength, split tensile and flexural strength were done

| TESTS | AVERAGE (N/MM2) |
|---|---|
| Compressive strength of cubes | 34.6 |
| Split tensile strength of cylinders | 5.21 |
| Flexural strength of prism | 4.2 |

### 4.3 Preparation of Samples

Six slabs are casted for to find a flexural behavior of size 1200*500*80mm are used. In which 3slabs are Conventional slab and other 3 slabs are fully replaced with welded mesh are used.

### 4.4 Test Setup and Loading Procedure

All the slabs were simply supported over a span of 1050mm and the performance under static and cyclic loading has been observed under four-point bending. The load was measured using proving ring of 250 KN and 50 KN capacities and applied through hydraulic jack of 50 tons capacity. One dial gauges were used to measure the mid span deflections and at loading points. Strain gauge is provided at the mid of the top and bottom of the slabs for strain readings. Number of cracks, crack spacing and crack propagation were taken for each 5 KN interval of loads. The test setup was shown in Fig.1 and the slabs with specifications are given employed for the data collection.

**Fig.1 Test setup**

| slabs | SPECIFICATIONS |
|---|---|
| S1,S2 | Static load for conventional slab |
| S3 | Cyclic load for conventional slab |
| S4,S5 | Static load for welded mesh slab |
| S6 | Cyclic load for welded mesh slab |

## 5. RESULTS AND DISCUSSIONS

### 5.1 STATIC LOAD

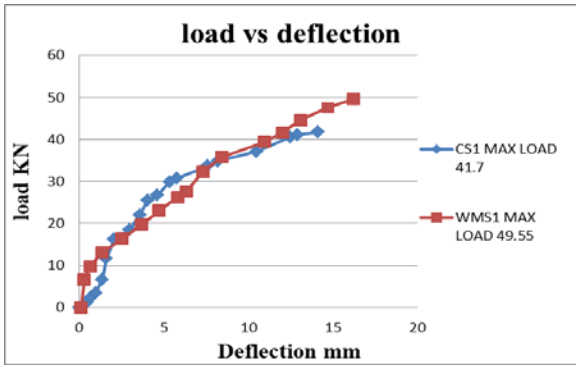
#### 5.1.1. FAILURE MODES FOR CONVENTIONAL SLAB

- Conventional slab C1, C2 is a pure flexure come compression failure.
- Two continuous crack having 0.5mm width travel up to the top of the slab.
- Other cracks are having minimum crack width.

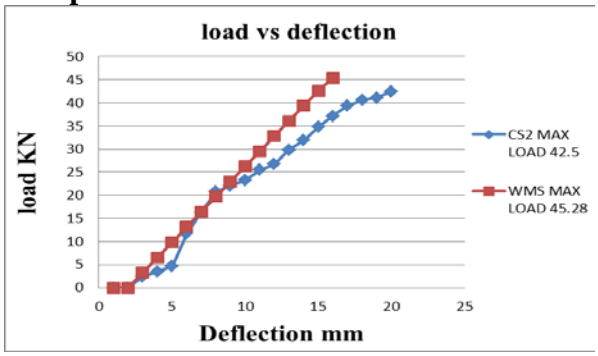
#### 5.1.2. FAILURE MODES FOR WELDED MESH SLAB

- Welded mesh slab WM1,WM2 is a pure flexural come compression
- Width of crack is larger at the mid-span of the slab.
- Cracks are developed at the shear span also.

#### 5.1.3. COMPARISION CONVENTIONAL SLAB AND WELDED MESH SLAB



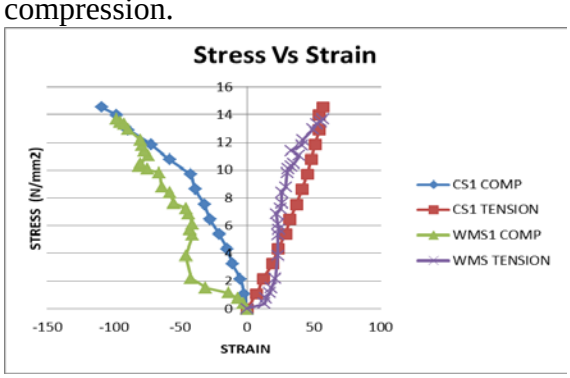

**Comparison of CS 1 & WMS 1**



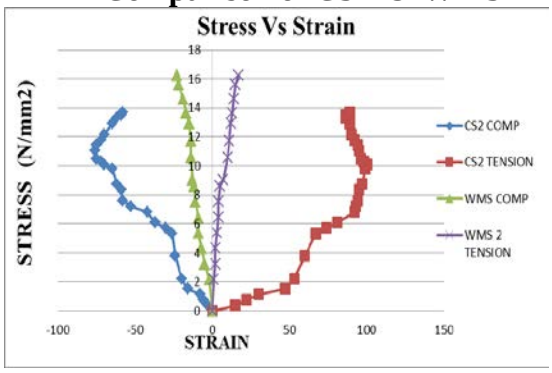

**Comparison of CS 2 & WMS 2**

#### 5.1.4 STRESS AND STRAIN BEHAVIOUR

The relationship between stress and strain of Slab were compared with the stress-strain of CS1, WMS1 and CS2, WMS2 The strain on the concrete were obtained from the strain gauge attached to the mid of the bottom surface for tension and mid of the top surface for compression.




**Comparison of CS 1 & WMS 1**




**Comparison of CS 1 & WMS 1**

### 5.2 CYCLIC LOAD

#### 5.2.1 FAILURE MODES

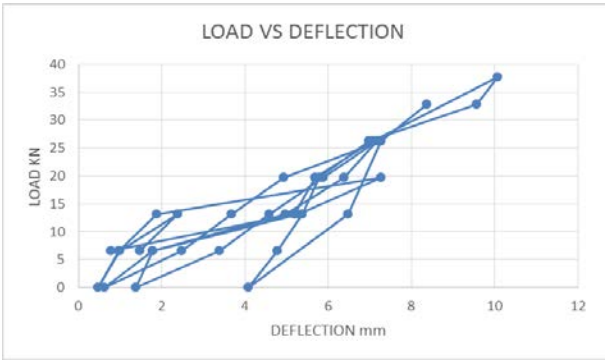
#### 5.1.1. FAILURE MODES FOR CONVENTIONAL SLAB

- Pure flexural crack is occurred.
- Four continuous crack width equal spacing occurred at bottom of the constant bending moment zone.
- Failure crack width is about 4-6mm.
- Crack propagation reached up to top of the slab at failure.

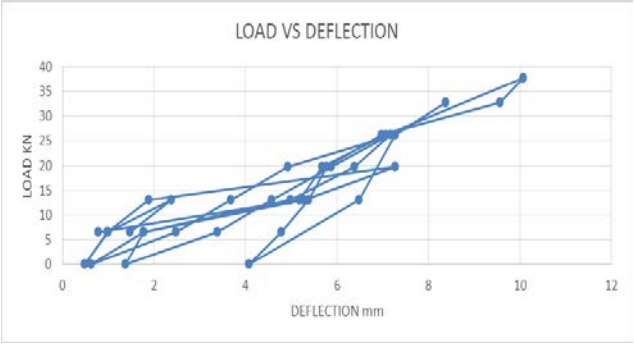
#### 5.1.2. FAILURE MODES FOR WELDED MESH SLAB

- The failure crack width 4-5mm.
- Pure flexural crack is occurred.

- The crack propagation reach up to depth of slab




**CYCLIC LOAD FOR CONVENSIONAL SLAB**




**CYCLIC LOAD FOR WELDED MESH SLAB**

## 6. CONCLUSION

The experimental results shows that the different between the flexural behavior of both convention and welded mesh slabs are observation will explained Two continuous crack having 0.5mm width travel up to the top of the slab. Other cracks are having minimum crack width Mode of failure is flexural come compression.

Width of crack is larger at the mid-span of the slab. Cracks are developed at the shear span also. Pure flexural crack is occurred. Four continuous crack width equal spacing occurred at bottom of the constant bending moment zone. Failure crack width is about 4-6mm.Crack propagation reached up to top of the slab at failure.

The strength of welded mesh slab is much greater than the conventional slab. It also arrests the crack width less than 0.5mm. The strength is calculated by using static load and in cyclic load its help to compare the each and every slabs.

## References

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