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Comparative Study of Conventional, Lattice, Triangular Shape Shear Reinforcement in Concrete Beam By Experimentally and Analyatically.

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ABSTRACT: The main objective of experimental analysis is to study the various possible shapes of shear reinforcement. Study the effect of the shape of stirrups provided in the beam. The experimental and analytical investigation focused on the various types of shear reinforcement in the reinforced concrete beams. Conventional RCC beam, latticed RCC beam and triangular RCC beam. These three types of shear reinforcement are studied thoroughly; Beam strength as well as beam deflection are the main parameters in the project that was considered in this study.

Shear failure in reinforced concrete beams is one of the most unwanted modes of failure. This type of failure mode of beam made it essential to explore more effective ways to design these beams for shear.it is observed in the reinforced concrete beams that failure due to shear is more dangerous that the failure due to bending. The diagonal cracks that developed due to over shear forces in beam are wider as compared to the flexural cracks. The economy, durability, serviceability and safety of shear reinforcement in reinforced concrete beams led to the study of other alternatives. Lattice reinforcement and triangular reinforcement are a new type of shear reinforcement. Lattice reinforcement is welded bar and triangular reinforcement is bind bar with the help of binding cable.

In this project, an experimental study of the conventional reinforced concrete beam, latticed reinforced concrete beam and triangular reinforced concrete beam have been studied. Several numbers of both types of the beam were analyzed by experimental work and analytical work and deflection is measured by applying concentrated load applied at the center of the beam surface. The analysis was done for the simply supported condition. Experimental analysis is carried out in lab and analytical analysis is carried out in Ansys software and results were compared in terms of strength and deflection.

Keywords: Beam, shear, reinforcement,lattice, triangular, conventional.

I. INTRODUCTION

Building is the structure made of the assembling or casting of different component such as slab, beam, column, foundation etc. beam is the main structural component in the building. The main function of the beam is to support the super structure and transfer the load to the column. Being the most important structural member the study and research is carried out on this component. Generally the beam which is constructed is in square shape. And the stirrups provide to tie the main reinforcement are in square shape.

The concept of providing triangular reinforcement over the square shape is slating side of triangular shape can distribute and transfer properly. In this experiment shear reinforcement is tie to main reinforcement with the help of welding and binding. So experiment is carried to check weather bearing capacity of the beam affect or not. How much deflection occurs in the beam after application of the load is clarified.

In this project, an experimental study of the square shape stirrups reinforced concrete beam and triangular and lattice shape stirrups reinforced concrete beams have been studied. Three numbers of each types of the beam were analysed by experimentally at the laboratory under the observation of the technical person and deflection is measured by applying concentrated load (point load) applied at the center of the beam surface. Analytical analysis is carried out with the help of Ansys software. The analysis was done for the simply supported condition. Experimental analysis is carried out and results were

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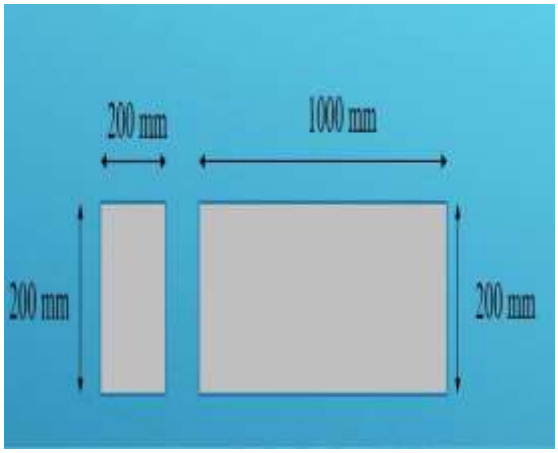
compared in terms of strength and deflection with analytical analysis.

II. EXPERIMENTAL PROGRAM

The test was carried out on the structural laboratory in constrovision engineering consultant's pvt.ltd. On UTM. A universal testing machine (UTM), also known as a universal tester, materials testing machine or materials test frame, the specimen is placed in the machine one by one and simply supported condition is maintained. Geometric centre of the surface of the beam was calculated manually and then marked on the surface of the beam. With the help of bar point load condition of the test setup is maintained. Load is applied gradually by the UTM machine.as the load increases the deflection on the beam is recorded by the machine. Which was useful to draw load verses deflection graph and to study the graph of each specimen. The loading capacity of machine is 1000kN.

2.1 SPECIMENS

Mainly specimen were categorized into three group beam1, beam2 and beam3. Beam 1is for square shape stirrups reinforcement in beam. And another is beam2 and beam3 for lattice shaped stirrup beam and triangular shaped stirrup beam. Mainly sizes of beam described with the help of diagram.



(**Fig No. 1** Geometry of the beam)

2.2 GRADE OF CONCRETE

Grade of concrete is defined as the minimum strength the concrete must possess after 28 days of construction with proper completion of curing period with proper quality control. Grade of concrete is written as M and the number followed by the unit N/mm2

Sr.No	Name of beam	Abbreviation	Grade of concrete	Clear cover (mm)	Steel used (Kg)
1	Square shape stirrups reinforced beam	C1	25	25	3.875
2		C2	25	25	
3		C3	25	25	
4	Lattice reinforced concrete beam	L1	25	25	3.875
5		L2	25	25	
6		L3	25	25	
7	Lattice reinforced concrete beam	T1	25	25	3.875
8		T2	25	25	
9		T3	25	25	

(Table No. 1 general information of the specimen.)

2.3 MATERIAL PROPERTIES

All beam specimens tested in this study were constructed with concrete casts at rosewood society. The Material were used for concreting was cement, sand, aggregate, water. Mould were made with the help of the labour as per the dimension required. Square stirrups, lattice and triangular were tied to main reinforcement.

(Fig No. 2 Lattice reinforcement)

(Fig No. 2 square shape stirrups reinforcement)

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(Fig No. 2 triangular shape stirrups reinforcement)

The beam were casted at the rosewood park society. The grade of concrete 25. And steel used of the Fe 500. Concrete were mix with the help of concrete mixer. Compaction was carried with the help of tamping rod travel. Curing was done by gunny bags for 28 days. After curing period of the beam, beam were tested.

(Fig No. 3 curing of concrete beam)

Material	Ratio (1:1:2)	Volume (Required)	Density	Weight (Required)
Sand	1:4	0.064 m3	1602 kg/m3	102.528 kg
Cement	1:4	0.064m3	1440 kg/m3	92.16Kg
Aggregate	2:4	0.129 m3	1680 kg/m3	216Kg

(Table No. 2 Quantity of material required)

2.3 TEST SETUP

Beam were tested on UTM machine. Beam was simply supported at both end. Point Load was applied to carry out experimental analysis. A 1000 KN compression testing machine was used to conduct the compressive tests on all of the beam specimens. The data of load and displacement were recorded simultaneously from the beginning of the tests until the failure of the column specimens was reached.

(Fig No. 4 Experimental setup of concrete beam)

RESULTS

Sr. No	Name of beam	Abbreviation	Peak load(KN)	Average peak load	Deflection (mm)	Average deflection (mm)
1	Square shape stirrups beam	C1	122	109.66	20.18	19.16
2		C2	102		19.13	
3		C3	105		18.18	
4	Lattice reinforced concrete beam	L1	75.33	84.02	29.38	30.39
5		L2	78.50		30.14	
6		L3	98.25		31.36	
7	Triangular reinforced concrete beam	T1	93.33	88.64	14.17	14.02
8		T2	97.25		12.19	
9		T3	75.33		15.71	

(Table No.3 load and deflection of the tested sample.)

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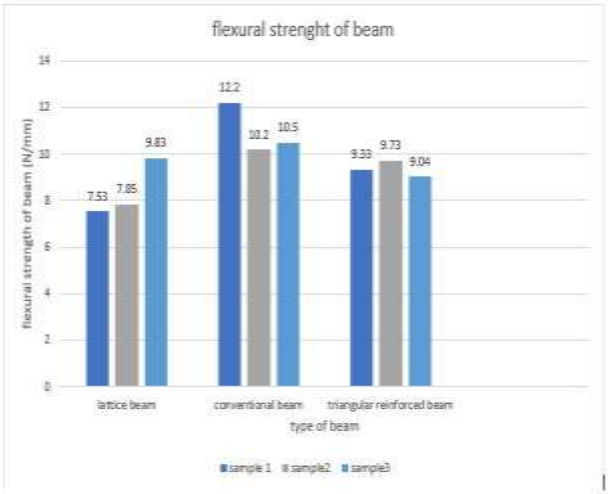


(Fig No. 5 Graphical representation of strength of beam (Self-made)

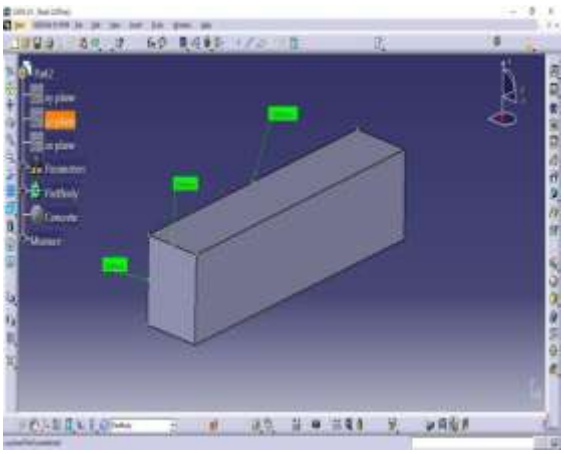
III. SOFTWARE ANALYSIS

Analytical work consist of two part first one is geometry design and second one is analysis.

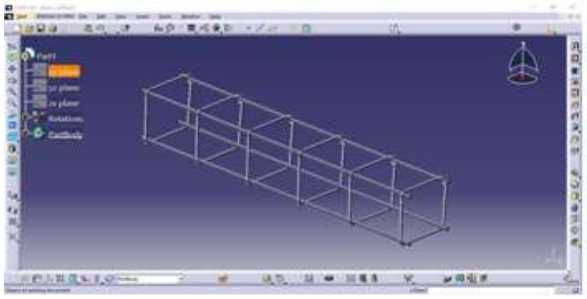
1. Part design- structure consist of two part. One is of concrete and another is of steel. Both geometry was created according to dimension.

Analysis system consist of three main stages.

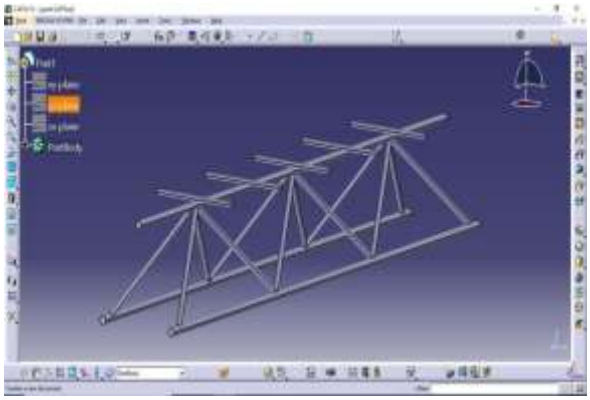
1. Pre-processing
2. Processing
3. Post processing



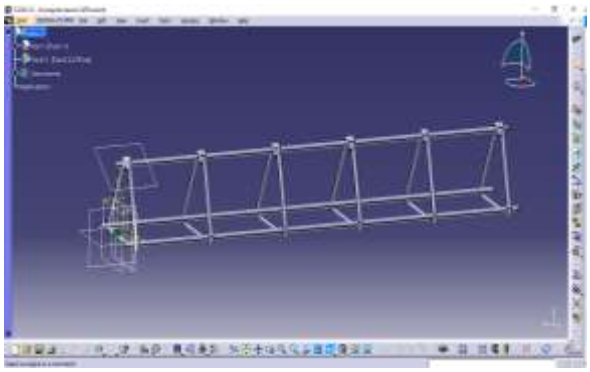
(Figure 6 Concrete beam)



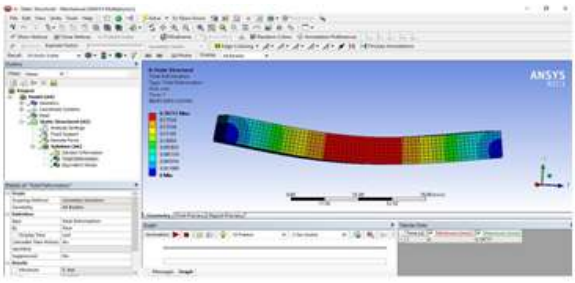
(Figure 7 Conventional beam)



(Figure 8 Lattice beam)



(Figure 9 Triangular beam)



(Figure 10 solution for the RCC beam)

RESULTS

After analytical analysis of lattice reinforced beam and conventional reinforced concrete beam

Sr.No	Name of beam	Abbreviation	Maximum load(KN)	Maximum Deflection (mm)
1	conventional reinforced concrete beam	C	120	0.12
2	Lattice reinforced concrete beam	L	120	0.11
3	Triangular reinforced concrete beam	T	120	0.11

(Table 4 After analytical analysis of lattice reinforced beam and conventional reinforced concrete beam)

IV. CONCLUSIONS

Load bearing capacity of square shape stirrups reinforced concrete beam is 20 % more than the lattice reinforced concrete beam and triangular reinforced concrete beam as the physical properties of the beam kept constant. Deflection of square shape stirrups reinforced concrete beam is 20% less than the latticed reinforced and triangular reinforced concrete beam.

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