



AN EXPERIMENTAL STUDY ON REINFORCED CONCRETE BEAM USING TRIANGULAR SHEAR REINFORCEMENT

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ABSTRACT

In recent trend the research on beams goes tremendously. The ultimate aim of the project is to alternating the stirrups form in the members. This will reducing the volume of shear reinforcement steel and may be improve the load carrying capacity of the member. Six beams have been casted and the difference is only in the stirrups shape and spacing. The stirrups of triangular shape are used on the beam. Two type of spacing (gradually increasing spacing towards the center of the span and equal spacing) is provided. The beams measured 1200 mm long were tested. And the deflection will be evaluated then it is compared with the conventional beam.

KEY WORD: Stirrups shape, Triangular stirrups, Shear reinforcement, Deflection.

I. Introduction

Reinforced concrete is widely accepted material for the rapid urbanization. It is extensively used in the construction industry all over the world. The use of reinforced concrete has increased due to its noticeable advantages like high modulus of elasticity, chemical resistance, freeze thaw resistance and low creep, shrinkage and permeability. Besides these advantages, there is various mode of failure exist in reinforced concrete structure. Among of them the more predominant failure in the concrete beams and other structural component is shear failure which give no pre attention to his user. Various researchers has been done the experiments on beams without web reinforcement and found the following factors influenced the shear behavior of beams. The various factors are

- ❖ Shear span to effective depth ratio

- ❖ Longitudinal steel ratio (ρ)
- ❖ Aggregate type
- ❖ Strength of concrete
- ❖ Type of Loading
- ❖ Support conditions

One of the main objectives of the design of reinforced concrete beams is safety. Sudden failure due to shear low strength is not desirable mode of failure. The reinforced concrete beams are designed primarily for flexural strength and shear strength. Beams are structural members used to carry loads primarily by internal moments and shears. In the design of a reinforced concrete member, flexure is usually considered first, leading to the size of the section and the arrangement of reinforcement to provide the necessary resistance for moments. For safety reasons, limits are placed on the amounts of flexural reinforcement to ensure ductile type of failure.



In RC structures, provision of minimum shear reinforcement is mandated when the factored shear force exceeds one-half the design shear strength of concrete. The intension of providing minimum shear reinforcement in RC elements by the codes of practice is

- ❖ To prevent sudden brittle failure as soon as reaching the first diagonal cracking load
- ❖ To control widening of cracks at service loads and
- ❖ To impart adequate ductility before failure.

The purpose of shear reinforcement is to prevent failure in shear, and to increase beam ductility and subsequently the likelihood of sudden failure will be reduced. Normally, the inclined shear cracks start at the middle height of the beam near support at approximately 45° and extend toward the compression zone. In practice, shear reinforcement is provided in three forms; stirrups, inclined bent-up bars and combination system of stirrups and bent-up bars. In building construction, stirrups are most commonly used as shear reinforcement, for their simplicity in fabrication and installation. Normally, spacing between stirrups is reduced to resist high shear stress. Congestion near the support of RC beams due to the presence of the closely spaced stirrups increase the cost and time required for installation. . [5] discussed about amplifier power relation, impedance , T π and

microstripline matching networks.

The objective of this project is to alternating the stirrups form in shear reinforcement. To compare the results with Conventional reinforced concrete beam. The aim of the project is Effective use of

shear reinforcement in the beam and also reduce the shear reinforcement steel.

II. Materials Used

The materials usually used in the concrete mix are cement, fine aggregate (River Sand), coarse aggregate. The materials used in this project for concrete mix are,

A. Cement

The cement used in this experimental study is 53 grade Ordinary Portland Cement. All properties of cement are tested by referring IS 12269-1987 specification of 53 grade Ordinary Portland Cement. The properties of cement are given in table 1.



Fig 1: Cement

Table 1: Properties of Cement

SI.NO	PROPERTY	VALUE
1	Specific gravity	3.15
2	Initial setting time	35 min
3	Standard consistency	31%

B. Fine Aggregate (River Sand)

Good quality natural river sand is readily available in many areas and may be easily obtained and processed. Generally fines are classified based on size, i.e.;

below 4.75mm is regarded as fine aggregate.



Fig 2: River Sand

Table 2: Properties of River Sand

Sl.NO	PROPERTY	VALUE
1	Specific gravity	2.4
2	Fineness modulus	2.3
3	Water absorption	1.04 %
4	Moisture content	2 %
5	Zone	II

C. Coarse Aggregate

Coarse aggregate of nominal size of 20mm is chosen and tests to determine the different physical properties as per IS 383-1970. Test results conform to the IS 383 (PART III) recommendations.



Fig 3: Coarse Aggregate

Table 3: Properties of Coarse Aggregate

Sl.NO	PROPERTY	VALUE
1	Specific gravity	2.63
2	Fineness modulus	7.5
3	Water absorption	0.32 %

III. REINFORCEMENT DETAILS

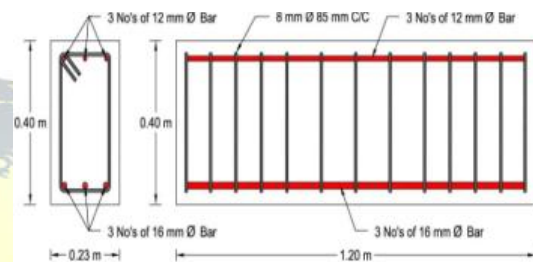


Fig 4: Reinforcement Details for Conventional Beam

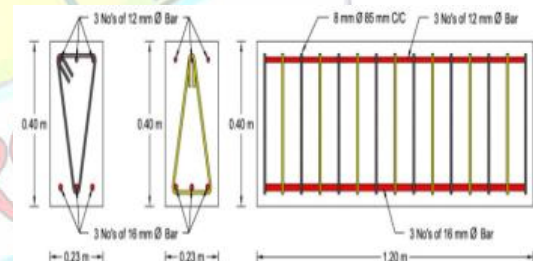


Fig 5: Triangular shear reinforcement detail with equal spacing

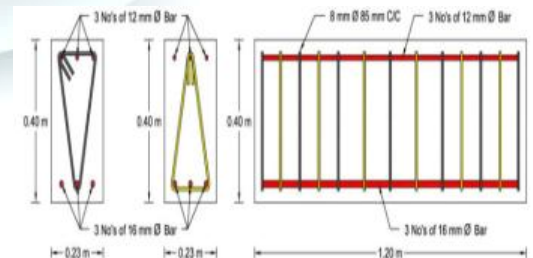


Fig 6: Triangular shear reinforcement details with gradually increasing spacing towards the center of the span



IV TEST ON BEAMS

The beam are subjected to two point loading conditions and the deflection is measured at the centre of the beam.

TESTING OF FLEXURAL STRENGTH

Flexural strength of a concrete is a measure of its ability to resist bending. Flexural strength can be expressed in terms of 'modulus of rupture'.

Flexural strength test was carried out using a simple beam with two-point loading method at 28 days of curing age, with the loading frame.



Fig 7 Flexure Test on Beam

A) FLEXURAL TEST

To determine the flexure strength of the beam of size 1200mmx230mmx400mm were cast and cured for 28 days in tap water. After the specimens are dried in open air they are subjected to flexure testing under digital universal testing machine by using dialguages.

Conventional beam is given by the notation "N". The beam with triangular shape of stirrups with equal spacing is given by the notation "E" and gradually increasing spacing towards the center of the span is given by the notation "C".

Table 4 comparison of Initial crack & Ultimate load on Specimens

	SPECIMEN	INITIAL CRACK (KN)	ULTIMATE LOAD (KN)
1	N	48.4	232.4
2	E1	49.5	234.4
3	E2	47.6	235.9
4	C1	53.4	249.8
5	C2	51.4	248.1
6	C3	54.8	241.7

V. RESULTS AND DISCUSSION

The result obtained from the above elaborative experiments are discussed in this chapter. The results of flexutal strength have discussed.

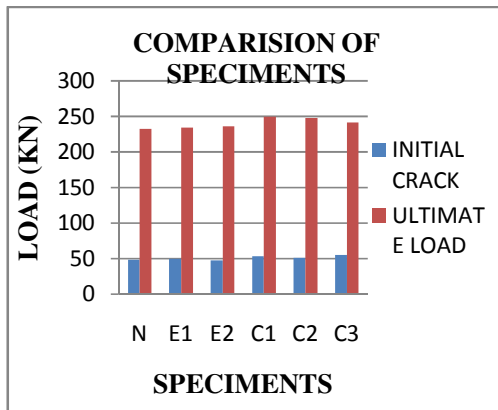


Chart 1 Comparison of Initial crack & Ultimate load on Specimens

VI. CONCLUSION

Based on the experimental investigations carried out the following conclusions are made:-

- ✓ Compare to normal shear reinforcement, steel requirement is reduces to 12.71% in Triangular shear reinforcement.
- ✓ The Triangular shear reinforcement can be used as a shear reinforcement for beam
- ✓ It was found that load carrying capacity is increasing in the triangular shear reinforcement beams comparing to conventional beam.
- ✓ The loads are attained maximum value in triangular shear reinforcement of gradually increasing spacing towards the center of the span when comparing with the triangular shear reinforcement with equal spacing beam and conventional beam.

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