Investigative Study on Warren form Trussed Beam

Vivek Narayanan
Dept. of civil engineering
Sree Buddha College of Engineering
Pathanamthitta India

Aiswarya S
Dept. of civil engineering
Sree Buddha College of Engineering
Pathanamthitta India

Abstract— **Hybrid steel–trussed concrete beams (HSTCBs) are typically constituted by a steel truss embedded in a concrete core. The truss is usually made up of a steel plate or a precast concrete slab, which represents the bottom chord, a system of ribbed or smooth steel bars welded to form the diagonals of the truss, with some single or coupled rebars constituting the upper chord. This paper focussed on the development of a new structural beam element using warren truss as reinforcement that should be a substitution for conventional concrete beam The design and numerical analysis is conducted using FEM (ANSYS).**

*Keywords— **Hybrid steel trussed beams, rebar, ANYSIS, FEM***

I. INTRODUCTION.

Hybrid steel–trussed concrete beams (HSTCBs) are typically constituted by a steel truss embedded in a concrete core. The truss is usually made up of a steel plate or a precast concrete slab, which represents the bottom chord, a system of ribbed or smooth steel bars welded to form the diagonals of the truss, with some single or coupled rebars constituting the upper chord. Among the large variety of beams currently produced, in the present paper HSTCBs with a bottom steel plate, inclined tensile and compressed web bars, coupled upper rebars, and a space cross section are considered (Fig. 1.1). Such beams represent a structural solution for light industrialization; their main advantages are higher construction speed with minimum site labour, the possibility of covering wide spans with low depths, and economic benefits.

Furthermore, they are frequently introduced in seismic-framed structures. HSTCBs are typically subjected to two different operative phases, indicated in Fig. 1.1, named Phase I, in which the beam, placed in situ, is subjected to a load condition mainly due to its own weight and the weight of the wet concrete and Phase II, ruled by the mechanical response of the composite beam made up of the steel truss encased in the hardened concrete. With particular regard to HSTCBs in Phase II, many topics have been investigated, first of all the mechanism of stress transfer between the bottom plate and the block of concrete passing through the web reinforcement members with constant, linear, and parabolic height or width variations are commonly used. Different approaches have been developed for the analysis of prismatic member.
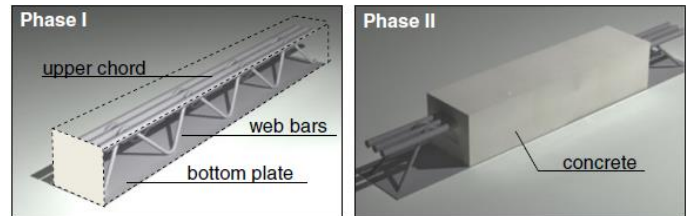

Fig. 1.1 Scheme Of HSTCB Typology

II . OBJECTIVES

- To develop a new structural beam element using warren truss as reinforcement that should be a substitution for conventional concrete beam.
- To perform static structural analysis on warren form trussed beam using FEA (ANSYS).

III. METHODOLOGY

Methodology employed is static structural method of FEA analysis.

I.   Modelling of Beam
    Here the study is carried out for the behavior and development of warren form trussed beam which should be a substitution for conventional concrete beam with cross section of beam is 1500x300x250mmThe modeling of buildings was created in ANSYS software.

II.   Truss Details
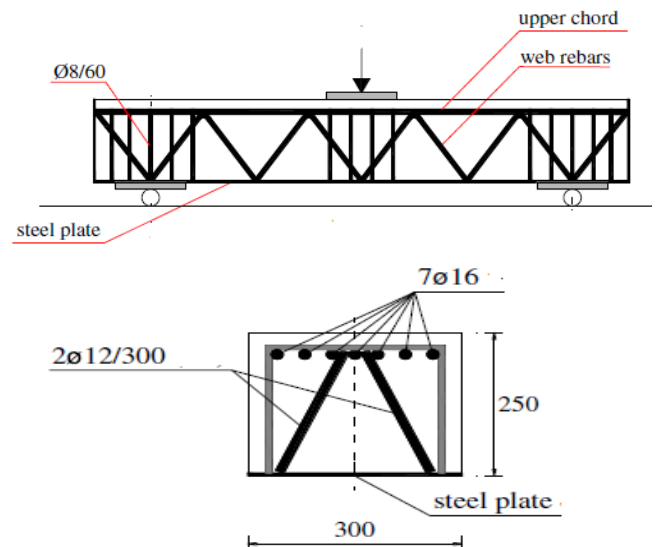   The detail of trussed beam is shown in Fig:2

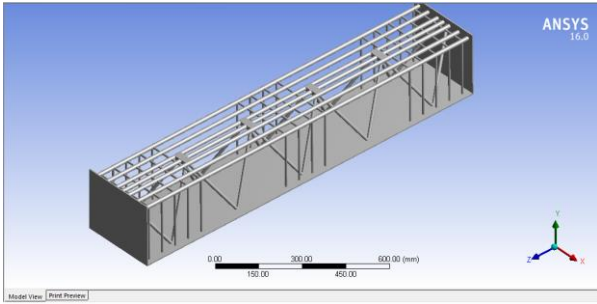Fig:2 Detail of Reinforcement In Trussed Beam

Special Issue - 2018

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
ETCEA - 2K18 Conference Proceedings

Fig.3 Reinforcement Detail of Warren Form Trussed Beam
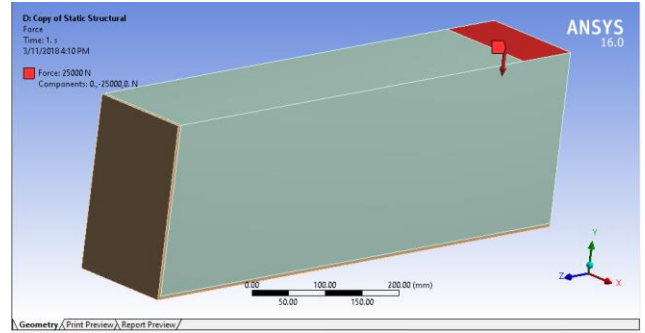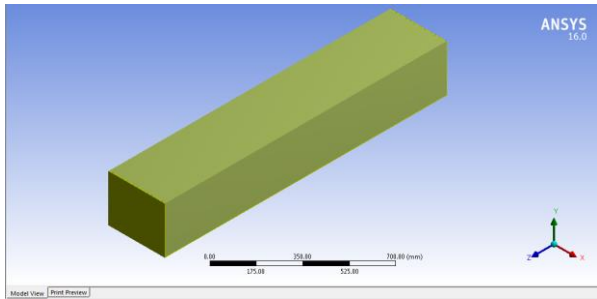

Fig.4 Warren Form Trussed Beam

For simplicity of analysis the modelled beam is assigned to symmetry in two direction

Fig.5 Symmetry Assigned Reinforced Beam

Fig.6 Symmetry Assigned Concrete Trussed Beam

III. Analysis of Trussed Beam

Three point bending test is done to study on the load vs displacement of warren form trussed beam. For the an initial load of 30kN is applied and increased up to 500kN and its corresponding deformation, stress and load vs displacement value were analyzed.

Fig:7 Loading Diagram

IV. RESULTS

Static structural analysis is done on the warren form trussed beam and the following results are evaluated.

Fig:8 Deformation In The Concrete Trussed Beam
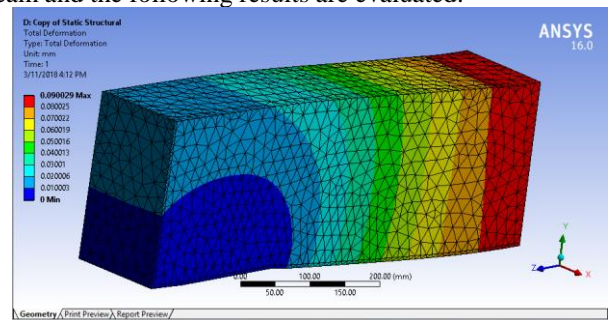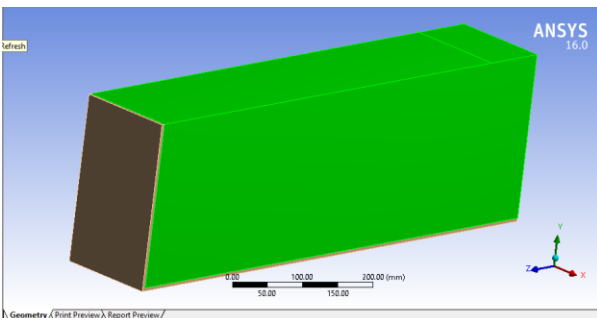

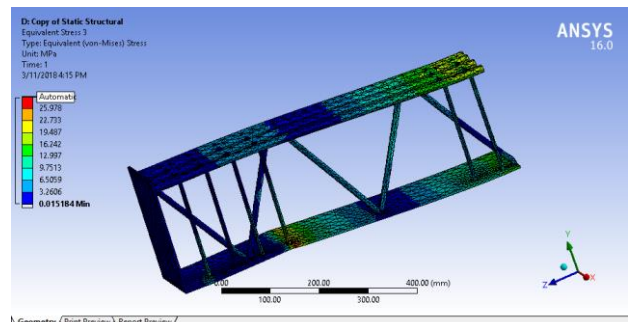
Fig:9 Deformation In The Reinforcement of Trussed Beam

Fig:Equevalent Stress In Reinforcement of Trussed Beam

Special Issue - 2018

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
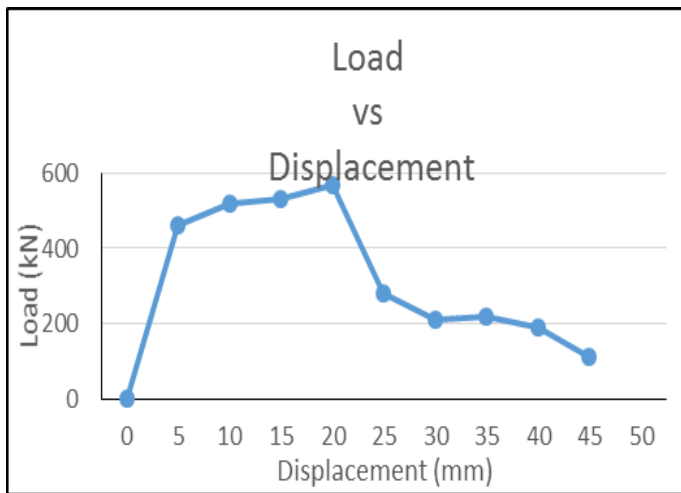**ETCEA - 2K18 Conference Proceedings**

Chart 1: Load vs Displacement Curve In Warren Form Trussed Beam

VI. CONCLUSIONS

Analytical study has been conducted to understand the behavior of warren form truss reinforcement in beam. ANSYS software is used to model and analysis. From the above result the deformation, stress distribution and load vs displacement curve gives evidence that trussed concrete beam has better performance than the ordinary reinforced concrete beam.

ACKNOWLEDGMENT

REFERENCES

[1] **Leone S. Procedimenti di calcolo** per travi REP (''Method of calculus of REP beams''). *Associazione Produttori travi REP* (''REP Beams Producers Association''), Milan, March 1972.

[2] **Papia M. Indagine teorica e** sperimentale sui fenomeni di instabilità flessotorsionale nelle travi REP (theoretical and experimental investigation on the flexural-torsional buckling phenomena of the REP beams). *Science of Constructions Institute Acts, University of Palermo; 1977.*

[3] **Puhali R, Smotlack I. Relazione sulle** prove di push-out atte a determinare le leggi di carico-scorrimento delle travi in sistema composto REP (Report on the push-out tests fit for the determination of load-slip laws of REP composite truss beams). *Science of Constructions Institute Acts, University of Trieste; 1980.*

[4] **Giordano G, Spadea G. Stato Ultimo** in flessione di travi in cemento armato con doppia armatura tipo REP: ricerca sperimentale (Flexural ultimate state of reinforced concrete beams with double reinforcement REP type: experimental research). *Report no. 65, Structural Department of University of Calabria; 1983.*

[5] **Giordano G, Ombres L, Spadea G. Modellazione teorica** e controllo sperimentale del comportamento a rottura di travi inflesse di tipo REP (Theoretical modelling and experimental verification of the collapse behavior of REP type bended beams). *L'Industria Italiana del Cemento; 1987. p. 617.*

[6] **Mullett DL.** Composite floor systems. UK: The Steel Construction Institute, Blackwell Science; 1998.

[7] **Naccarato PA**. ''Low floor-to-floor heights'', Modern steel construction. American Institute of Steel Construction; 2000.

[8] **Khuntia M, Goel SC**. Experimental study of FRC-encased steel joist composite beams. *J Struct Eng ASCE 1999;125(5):495–501.***Nursiah chairunnisaa et.al(2014),** "Various Existing Methods of Coupling Beams and a New Alternative Hybrid Method", 2nd international conference on sustainable civil engineering structures and construction Materials, procedia engineering 95(2014),139-149.

[9] **Khuntia M, Goel SC**. Analytical study of FRC-encased steel joist composite beams. J Struct Eng, ASCE 1999;125(5):503–9.

[10] **Di Marco R. Sperimentazione su travi** continue REP con traliccio tipo TR (Experimental tests on hyperstatic REP beams with TR truss type). *Internal Report University IUAV of Venice; 2004.*