Parametric study of composite slab using ANSYS

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***Abstract*— The work presented is concerned with the behaviour of concrete composite slabs .In this study investigation the behaviour of composite slab using ANSYS14.0 software. In this paper, analysis of different composite slab modal prepared in ANSYS Workbench. And modal in ANSYS is based on finite element method. ANSYS software is introduced together with it's proprietary elements, material models and contact. And analysed for given loading and support condition and results are summarized.**

***Keywords*— Composite slab, Perfobond shear connector, RCC slab, Deflection, ANSYS software**

I. INTRODUCTION

Composite construction is the term used for structures composed of two or more different materials. In composite integrates the structural properties of the two materials to produce stiffer, stronger and lighter members form the efficient connection between the two materials. The shear-bond connection between the two materials is a very important factors in ensuring they act as one unit. In Composite slab bending moment caused by a static load is mainly resisted by the compressive force in the concrete and tensile force in the steel.

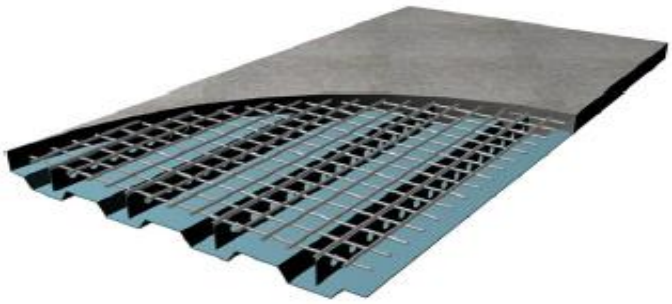

Fig. 1 Composite slab

In composite construction, uses steel in form of profiled steel sheeting. The steel sheeting is considered as an external main reinforcement for the composite member. Numerous types of profiled decking are used in composite slabs. The different types of profiled sheet present in different shapes, depth, width and mechanical connection between steel sheeting and concrete. Profiled steel sheeting divided into two broad categories: open through profiles and re-entrant profiles. In composite slab perfobond rib shear connector is effectively used.

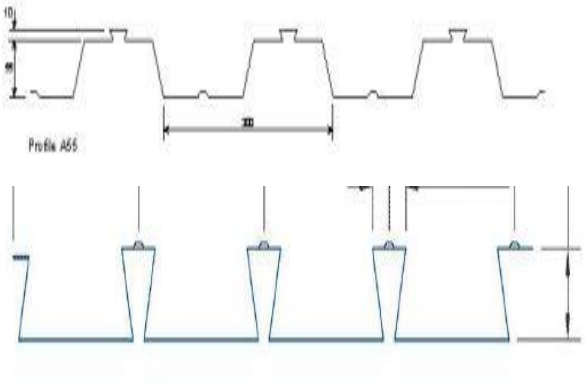

Fig. 2 Open through and re-entrant profile sheet

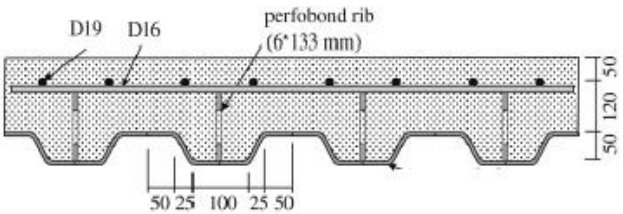

Fig. 3 Cross-section of composite slab

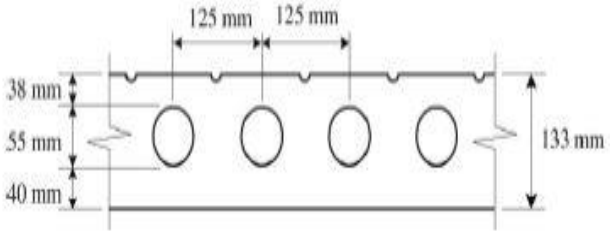

Fig. 4 Perfobond shear connector

II. ANSYS-FINITE ELEMENT ANALYSIS SOFTWARE

A complete finite element analysis involves three stages:

- Pre-Processing
- Finite Element Solver
- Post-Processing

And for the ANSYS Finite Element system, it consists of two parts to perform a full analysis:

1. ANSYS Modeler is a fully interactive pre- and post-processing graphical user interface.
2. ANSYS Solver performs the finite Element Analysis.

The pre-processing stage involves creating a model of the structure. A model is a graphical representation, consisting of two major parts which are geometry and assigned attributes. In ANSYS attributes types included mesh, geometry, materials, supports and loading. Stiffness method will be solved and produces a result file with the required data.

III.MODELING OF COMPOSITE SLAB IN ANSYS

In modeling four types of profiles steel sheet is taken and prepared a model. Composite slab size 1500mm x 850mm is considered. And profiled sheet thickness is 1mm and 2mm. perfobond shear connector thickness 6mm and height 133mm.Applying loading on composite slab is 500KN, 700KN.

Load applying on composite slab at L/4(shear span) of the span. The structure is subjected to two concentrated load P applied vertically downward on upper surface of composite slab. Support condition like two side of slab are fixed. The material properties like grade of concrete M25, grade of steel Fe 415 and grade of steel plate Fe250. Longitudinal reinforcement is 19mm and Transverse reinforcement is 16mm.

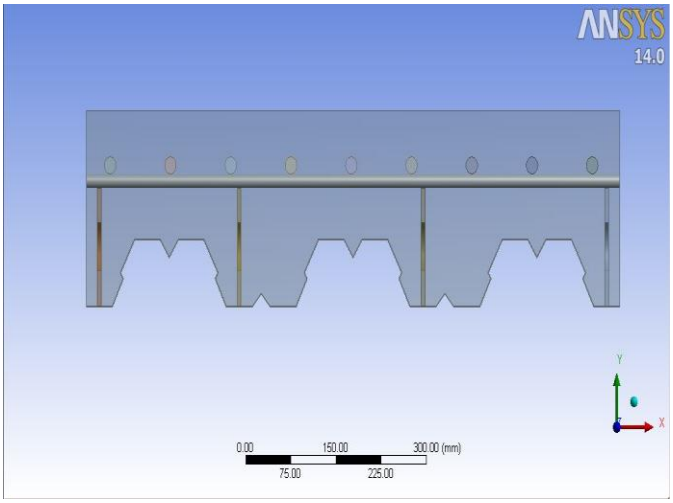

Fig. 6 Cross-section of W-Type profile sheet

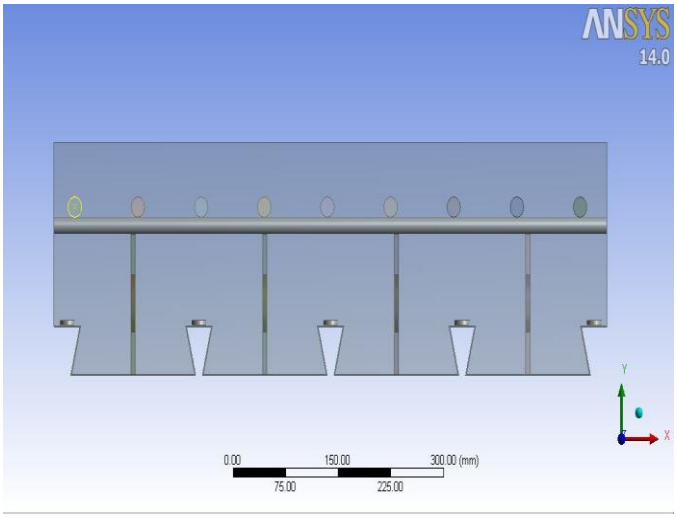

Fig. 7 Cross-section of Holorib profile sheet

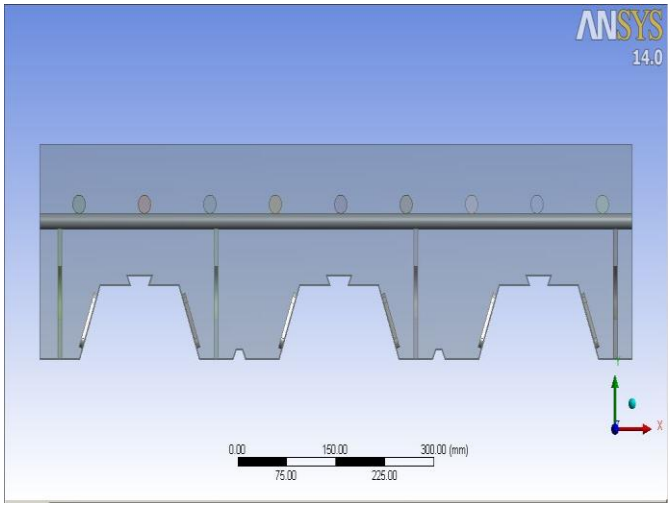

Fig. 5 Cross-section of 3D-Deck profile sheet

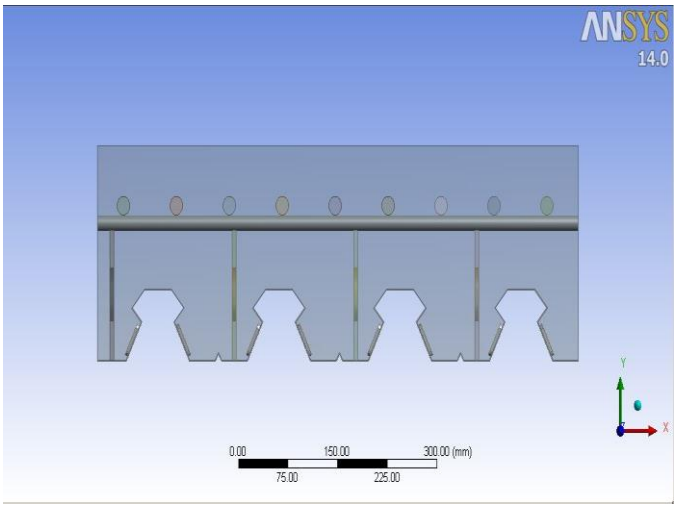

Fig. 8 Cross-section of Cofrastra 70 profile sheet

IV. MODELING OF RCC SLAB IN ANSYS

RCC slab dimension is 1500mm x 850mm.Applying load on RCC slab at L/4(shear span) of the span. Load applying on RCC slab is 500KN and 700KN. Support condition like two side are fixed. Longitudinal reinforcement is 19mm and Transverse reinforcement is 16mm. The material properties like grade of concrete M25, grade of steel Fe 415.

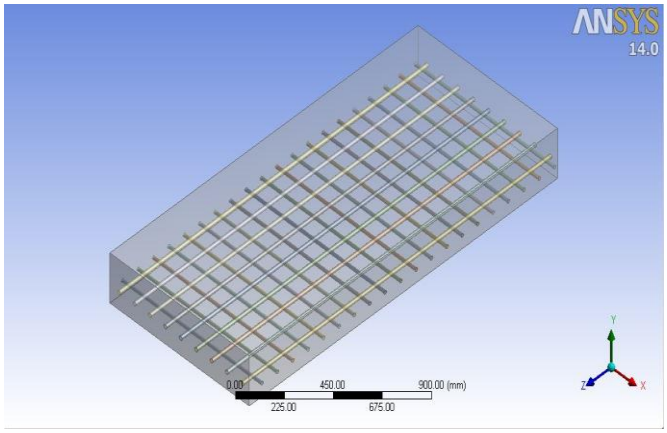

Fig. 9 RCC slab

VI. RESULT AND DISCUSSION

In results, different types of profile sheet of Composite slab is analysed with different parameter like i.e. Maximum Principle Stress, Minimum Principle Stress, and Deflection.

Table 1 Analysis of Composite slab (1500mm)

Profile sheet	**Load (kN)**	**Thickness Of plate**	**Deflection Of composite Slab(mm)**	**Max. stress (N/mm2)**	**Min. stress (N/mm2)**
3D-Deck Profile sheet	500	1	0.25	62.58	-82.85
		2	0.22	54.00	-63.17
	700	1	0.38	81.29	-130.17
		2	0.36	75.60	-88.44
W-Type profile sheet	500	1	0.29	70.55	-116.86
		2	0.27	61.57	-100.15
	700	1	0.42	86.72	-177.83
		2	0.39	80.73	-136.2
Holorib profile sheet	500	1	0.23	62.08	-55.80
		2	0.19	58.64	-46.93
	700	1	0.33	80.92	-78.129
		2	0.29	75.55	-68.83
Cofrastra 70 Profile sheet	500	1	0.26	59.68	-80.43
		2	0.22	55.59	-57.76
	700	1	0.34	79.58	-107.25
		2	0.30	74.124	-82.52

Table 2 Analysis results of RCC slab (1500mm)

Specimen	**Load (kN)**	**Deflection Δ (mm)**	**Max. stress (N/mm2)**	**Min. stress (N/mm2)**
RCC slab	500	0.80	108.42	-168.26
	700	1.16	139.39	-216.34

VII. CONCLUSION

The models of composite slabs are analyzed in ANSYS 14.0 software for all the loading condition and values of Maximum Principal Stress, Minimum Principal Stress and Deflection are found. In composite slab increase thicknesses of profiled steel sheet then decrease the deflection and stress. Maximum stress in profile steel sheet at Centre and Minimum stress in profile steel sheet at edge.

Different types of profile sheet are taken and analyzing the stress and deflection it's indicate that the stresses and deflection can be reduced compare to RCC slab.

Stress and deflection is reduced in open through profile like 3D-Deck profile sheet with embossments compare to W-Type profile sheet without embossments.

In Re-entrant profile sheets like Holorib & Cofrastra 70 profile sheet stress and deflection is reduced compare to the open through profile sheet.

Conclusion from this research study is that increasing the thickness of profiled steel sheet, Stresses and deflection can easily be reduced compare to RCC slab.

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