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A Parametric Study Of Composite Panels Made Of Light Steel Skins And Light Weight Concrete Under Different Loading Conditions

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Abstract – *This paper addresses the structural performance of sandwich panels, a type of thin steel skins filled with lightweight concrete. Experimental tests and numerical simulations were performed on integrated panels subjected to various loading conditions such as concentric and eccentric compressive loads, flexural loads and thermal pressure at high humidity. The result show that skin buckling is a measure of the load bearing capacity of this structural component. Based on the contact buckling theory, practical formals have been developed for segment capacity prediction of integrated panels. Related parameters are identified through finite component analysis using ANSYS design optimization module.*

Key Words: **Composite Sandwich panels, Lightweight concrete, eccentric loads, Thermal stress, FEM analysis**

1. INTRODUCTION

Sandwich panels are composites consisting of two thin laminates shells and a lightweight (e.g., honeycomb) thick core structure. It is widely used in the field of civil engineering. The most commonly used type of sandwich composite member is a double skinned panel consisting of outer steel sheets with a core material, lightweight concrete as shown in the figure 1. Lightweight concrete can be applied in a number of ways, reducing the self weight of structures with small cross sections. One of the common applications is an important material in the structure of a typical sandwich. Sandwich structures can incorporate different types of cores and leather materials to create the optimal design for a specific performance purpose. Due to the main structures, such mixtures are separated by hardness. Despite the thickness of the core, sandwich composites are lightweight and relatively highly flexible. These compounds have a spatial structure, which affects the good thermal insulator properties. Sandwich panels are used in aeronautics, road vehicles, ships, and civil engineering ability to adjust the mechanical properties of a particular application

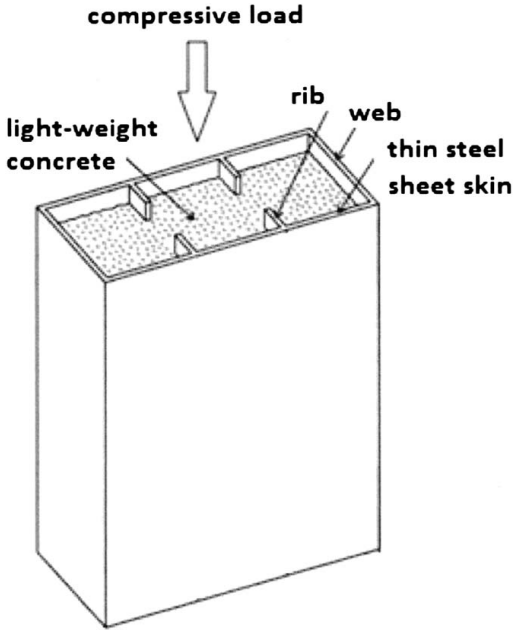

Fig-1:Sandwich panel systems with thin steel skins and lightweight concrete

1.1 Objectives

- To study the behavior of Composite Panels Made of Lightly Profiled Steel Sheeting and Lightweight Concrete.
- To study the concentric and eccentric compressive loading condition.

1.2 Scope

The scope of the study is limited below,

- Lightweight sandwich composite panel have the potential to completely transform the way bridges, rail, walls, Aircrafts.
- Sandwich constructions are very important in case of transport means mainly in ship-building and railway branches.

2. CONCENTRIC AND ECCENTRIC COMPRESSION LOAD

Model 1-a shown in fig 2 has the specimen columns with 2 ribs,3 ribs and 4 ribs with dimensions mentioned above was modeled and subjected to concentric and eccentric

compression loads.

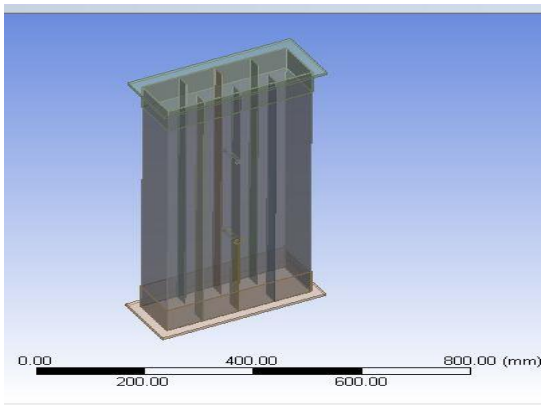

Fig-2: Geometrical model for 3 ribs

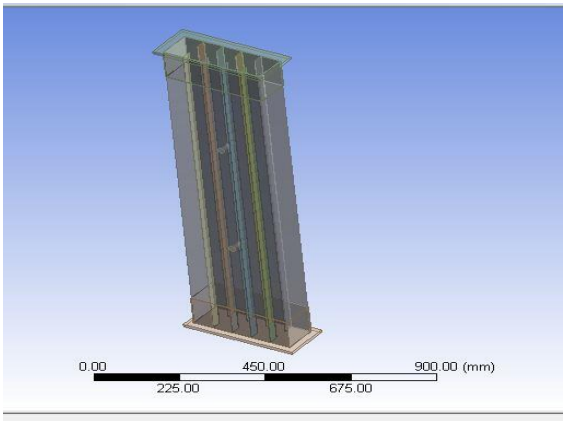

Fig-3: Geometrical model for 4 RIB

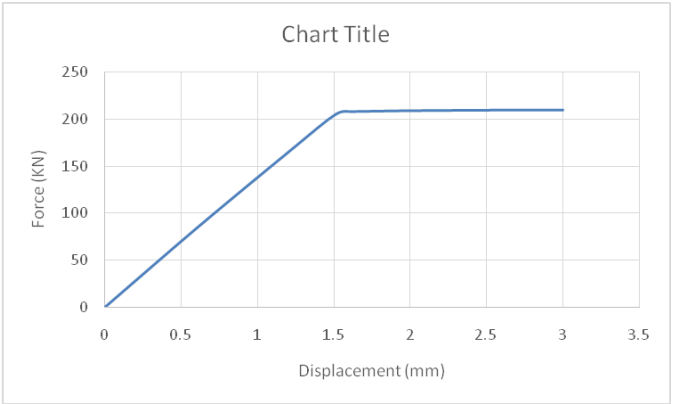

Chart-1 Comparison load-displacement curves – concentric loads (2 RIB)

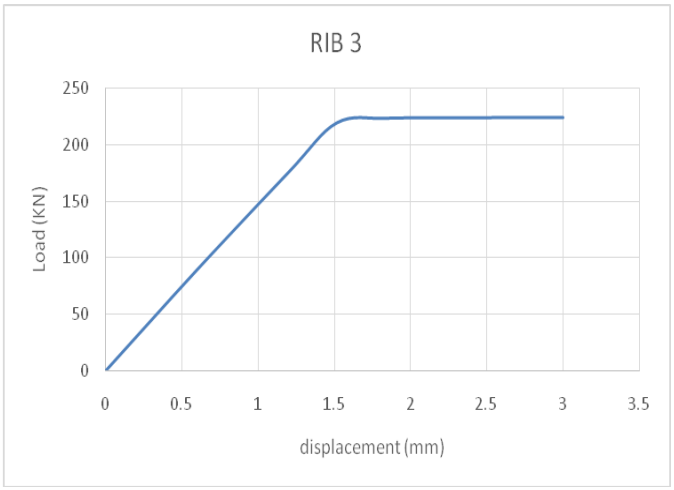

Chart-2 Comparison load-displacement curves – concentric loads (3 RIB)

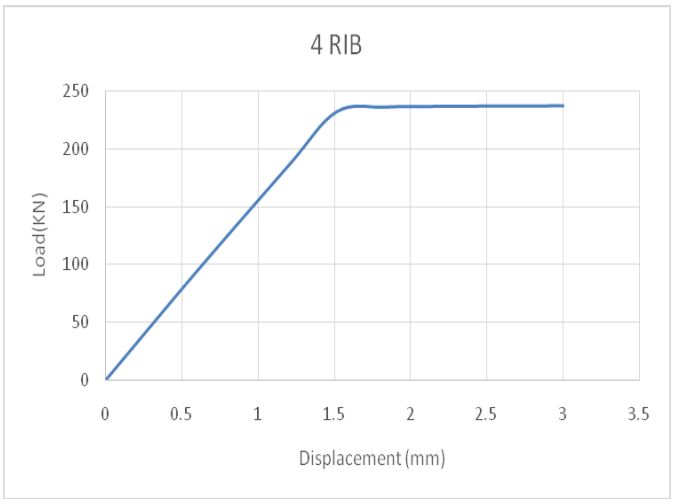

Chart-3 Comparison load-displacement curves – concentric loads (4 RIB)

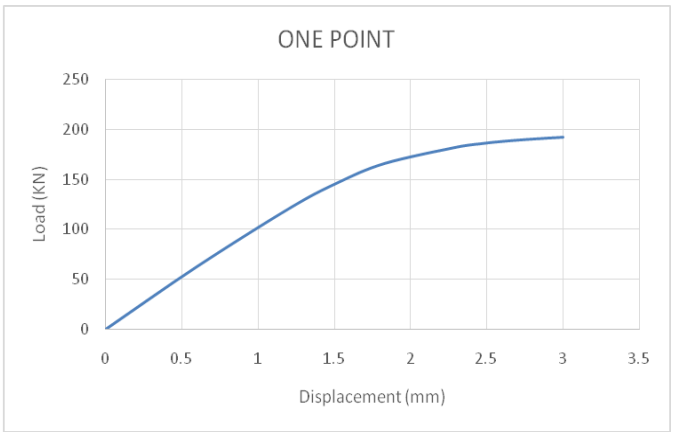

Chart-4 Comparison load-displacement curves –Eccentric loads (1 POINT)

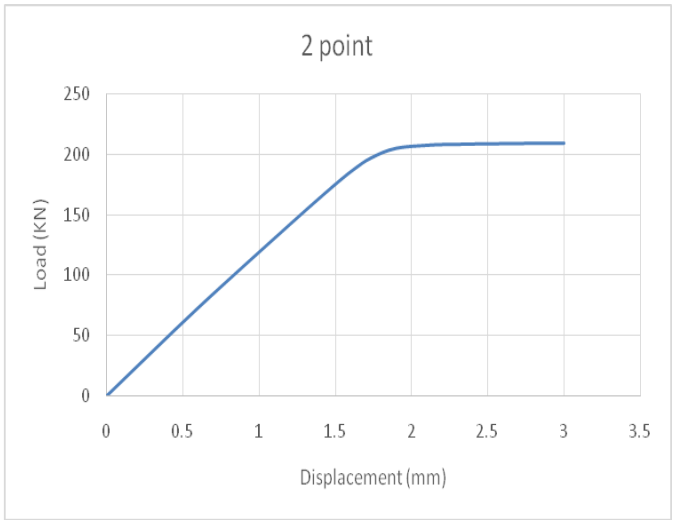

Chart-5 Comparison load-displacement curves –Eccentric loads (2 POINT)

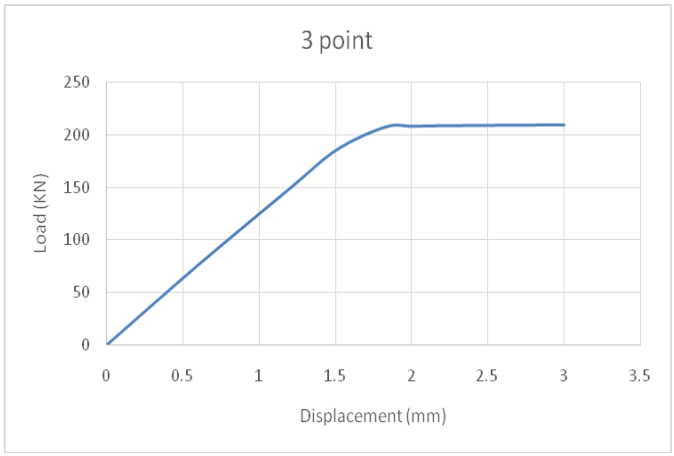

Chart-6 Comparison load-displacement curves – concentric loads (3 POINT)

3. COMPARISON OF COMPOSITE PANELS MADE OF LIGHT SS AND LC OF CONCENTRIC AND ECCENTRIC LOADS

Table - 1: Force comparison concentric loads

Type	2 RIBS	3 RIBS	4 RIBS
Max Stress	317.7	323.12	306.56
Total Deformations	3.0021	3.002	3.002

From the table it shows that the 3 ribs takes more stress.

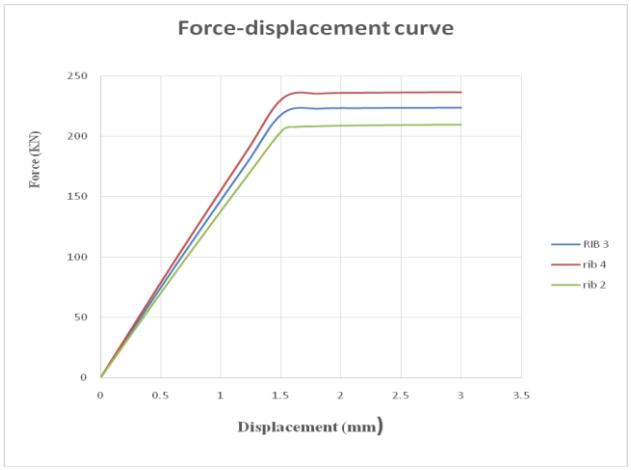

Chart- 7: Comparison load-displacement curves – concentric loads

Comparison of Force-displacement curves of the models in objective 1 is shown in chart. It shows that the 3 ribs takes more stress as compares to other types.

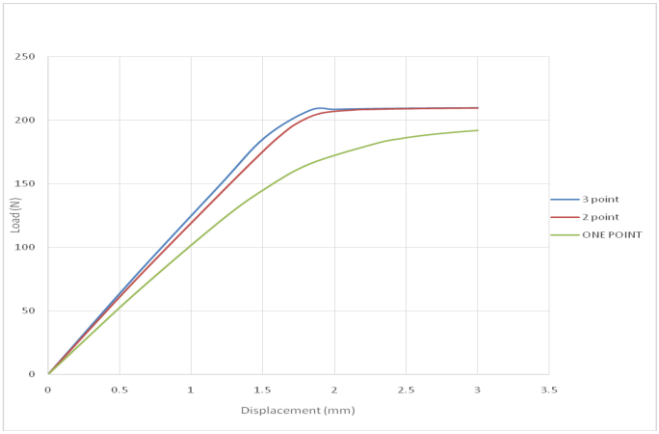

Chart- 8: Comparison load-displacement curves-eccentric loads.

Table -2: Force comparison eccentric loads

Type	1 point	2 point	3 point
Maximum Stress	323.71	306	309.34
Total Deformations	3.031	3.0128	3.0104

Comparison of Force-displacement curves of the models in objective 1 is shown in chart.Comparing With Point Loads Area Loading Capacity Is High And More Suitable. Because One Point Shows Deflection And 2 Point And 3 Point Are Almost Similar Load Carrying Capacity Is high.

4. CONCLUSIONS

The different type of analysis are carried out by composite panels made of light SS and LC. It is widely used in the field of aircrafts and rails. it is evidently clear that this type of composite panel made of light SS and LC can be used in aircrafts walls. The load carrying capacity increases in the model 4ribs and it provides maximum load vale at 2.37E+02. Also it is 27 percentage greater than 2 ribs and 14 percentage greater than 3 ribs model. Stress distribution indicates large deflection (8.36MPa)between 2 ribs and 3 ribs model. Comparison of eccentric compression loads analyses between 2 point loading is more suitable in the given model light SS and LC because the load carrying capacity is higher and the stress distribution is comparatively very low in the applied loading condition. Based on the analysis conducted eccentric compression loading condition is more suitable in this types of composite panels made of light SS and LC .

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