Behavior of reinforced mud sandwich panel under flexure loading

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***Abstract*— Reinforced sandwich panels are used as a walls, slabs and floors in construction of buildings. Majorly Wythe's of these panels are made of concrete. This research focus on using stabilized mud as Wythe's for Reinforced sandwich panels. Load-midpoint deformation was determine under flexure loading. Three Reinforced mud sandwich panels were casted having core of EPS and Wythe's were made of stabilized mud. Results shows that greater deformation was observed before failure of panel. Hence the panel depict ductile behavior. Ultimate load was observed to be 10270N, 7640N and 10270N for panel 1, 2 and 3 respectively.**

Keywords— Reinforced mud sandwich panels, Flexure loading, Ductile.

I. INTRODUCTION

Sandwich panels consist of a core, surrounded by Wythe's. EPS is majorly used as a core material in structural sandwich panels that enhances the thermal and sound insulation of the panel. Wythe's are generally reinforced by welding wire mesh. Wires are also connected inclined across the depth with meshes [1]. These panels have high strength to weight ratio [2]. Sandwich panels are used in many industries like aerospace and automotive. It is also used in construction industry as a slab, floors and walls [3]. Many researches have done in order to determine the mechanical properties of sandwich panel.

Gara *et al.*(2012) studied the flexure behavior of precast concrete sandwich panels. Panels of different core thickness were made. He observed that the panels with greater core thickness shows more strength [4]. Benayoune *et al.*(2008) used conventional rebars as mesh (reinforcement) and shear connectors. Results shows that the panel behavior was similar as in the case of RCC slab and composite action was achieved [5]. Effect of different types of loading on flexure behavior of precast sandwich panel was determined by Joseph *et al.*(2016). Panels were subjected to two different types of loading, punching and fourth point bending. Flexure failure was observed in punching load and panel behavior was similar to that of RC slab. While the panel subjected to fourth point loading shows brittle behavior, and was due to failure of concrete [6]. Kumar and Suman (2013) studied the insulation materials for walls and roofs and their effect on indoor temperature under composite climate. He carried out experiments to determine thermal conductivity of various materials having different thickness. Results shows that the Elastospray having 50mm thick with conventional roof and walls satisfies the Energy Conservation Building Code. While that of 70mm thick EPS with conventional roof and walls satisfies the ECBC. Further he made two rooms, one with burnt clay walls and RCC slab having 50 mm thick thermal insulation outside and the other one without insulation. Inside room temperature was observed with data loggers. Results show that the temperature difference was 4.8°C and 9°C during winter and summer season's respectively [7].

From the literature it was concluded that no work was done on sandwich panels having wythes of mud. In this research Reinforced Mud Sandwich panels were casted and its load-midpoint deformation under third point loading was determined.

II. MATERIALS AND METHODS:

A. Materials:

EPS panel is used as core materials, while steel wires of 2mm diameter are used for reinforcement and shear connectors. Stabilized mud having 10% cement and 1% straw by weight of soil is used as a wythe material.

B. *Casting of Specimens*

Three Reinforced mud sandwich panels were casted having dimensions, length x width x thickness 3352mm x 1219mm x 203mm respectively. While the thickness comprises of 101 mm core (EPS) and 50.8 mm thick each wythe. Panels were tested on the 28th day after casting. Panels after casting are shown in fig. 1.

C. *Test Procedure:*

Third point loading mechanism was applied for testing of panels. Linear Displacement Sensors were installed at midpoint of the panel to determine the midpoint deformation. Load was increased gradually and with respect to the load, midpoint deformation was determined with the help of data logger. Loading assembly is shown in fig. 2.

Figure 1: Panels after casting

Figure 2: Loading assembly

III. RESULTS AND DISCUSSION

Load-midpoint deformation of all the three panels are shown in fig. 3, 4 & 5. It was observed that the ultimate load of panel 1, 2 and 3 was 10270N, 7640N and 10270 respectively. While the deformation was 106mm, 103mm and 108mm for panel 1, 2 and 3 respectively. Panel 2 results were not good as compare to the panel 1 and 3 because of some major cracks in the Wythe due to construction joints before testing. Failure of panel was due to the cracking of EPS and lower Wythe at the mid area of panel.

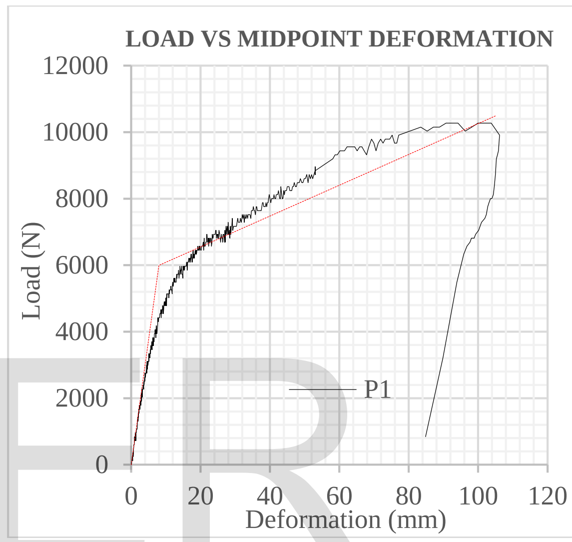

Figure 3: Load- Midpoint Deformation Curve of Panel 1

Figure 4: Load- Midpoint Deformation Curve of Panel 2

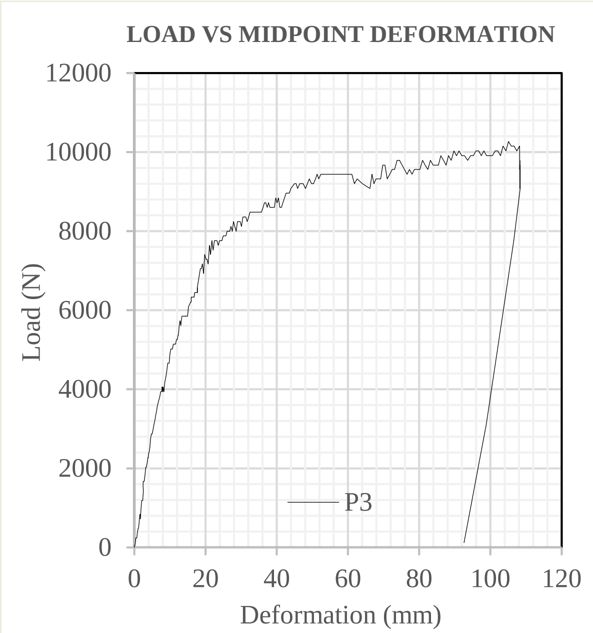

Figure 5: Load- Midpoint Deformation Curve of Panel 3

Comparison of Load-midpoint deformation of panel 1, 2 and 3 is shown in fig. 6. Panel 1 and 3 results are approximately similar, while panel 2 shows some deviation with respect to 1 and 3.

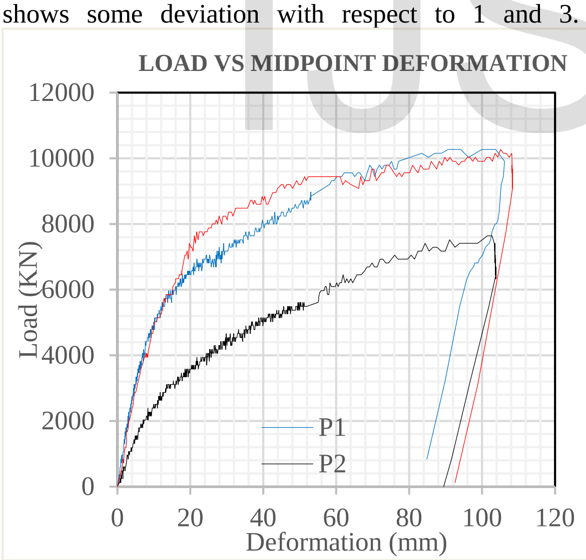

Figure 6: Comparison of Load- Midpoint Deformation Curve of Panel 1, 2

IV. Conclusion

- Greater deformation can be seen prior to failure.
- No collapse was observed after failure of panel.
- Stabilized mud can be used as a wythes in Reinforced Sandwich panels.
- Economically and environment friendly materials as compare to concrete.

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