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An Exclusive Sandwiched Structural Panel with a Shear Layer in the Mid of the Double Corrugate Layered Core

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Structural sandwich panels with core of Advanced Composites Laminates Honeycombs/PU-foams are extensively used in aero-space applications and these are also fabricated for use now in some civil engineering applications. An all Advanced Composites Foot Over Bridge (FOB) system, designed and developed earlier for pedestrian traffic is one such application [1] that may be cited here as an example. During development stage of this FoB, the profile of its decks then spurred out was a single corrugate sheet core sandwiched between two Glass Fibre Reinforced Plastics (GFRP) flat laminates. Once fabricated and successfully used, these decks did prove suitable on their assembly, to form other structues such as erecting temporary shelters. Corrugate sheet core profile sandwiched panels have also been tried using the construction materials but in any conventional method of construction as existed, posed certain difficulties in achieving the required core profile without any bonding within the sandwiched slabs and hence its use remained only abandoned. The required monolithic construction becomes now as eased out with demonstration on dispensing of suitable materials through 3D Printers. An study was conducted which included first, the fabrication of a 3D printer in-house (already patented [2]) and then make use of them as well. On functional operation, more complex sandwich core profiles have then been 3D-printed out and thus produced the number of panels hard-ware. Initially, number of these sandwich panels in single corrugated sheet core monolithically were printed out, which were subjected to load test in an experimental set up [3] and their structural behavior studied analytically, correlated and were also reported earlier by the Author as in the literature [4]. It was observed from the 3D printed hardware that the presence of any corrugate core in any sandwich core profile although provides continuous support to the loaded face sheets of the sandwich panels in their longitudinal direction, in their transversal direction however, this corrugate core still remains supporting the face sheets at periodic intervals only. Therefore it is felt that adoption of such core profile creates a vast difference in the available shear resistance between the longitudinal and transverse directions on flexural bending of any of such sandwich panel under application of, for example, uniformly distributed load. To over come this and also attempting to achive the required more depths further so as to exhibit the stronger sandwiched decks with better structural and mechanical behavior, more complex core configuration such as that of dual corrugate sheets core with a flat mid plane was felt to be a better sandwich core profile and therefore panels of different geometries were created in a good numbers, as shown in figures 1, a few of those circular and figure 2(a&b) shows a few of rectangular/square panels. Such an exclusive profile has been an outcome that turned out merely on stacking of two separately 3D printed units of single monolithic corrugated sheet core so developed earlier as briefed above and on initially bonded them together but maintaining here, a certain different orientation in the two corrugate layers. For any required sequential understanding of the structural behavior of any such complex core profile sandwich decks with special emphasis to study analytically, the effect in variation of such corrugation orientations in each distinct tire of the core, some fruitful findings obtained and those were reported elsewhere. It has been ob-served here that a flat layer which eventually get created monolithically in the middle, in addition to eliminating any bonding process in these sandwich panels development, it has been found also to offer, much more effective bending resistance by these sandwich panels when subjected to any loads over them.

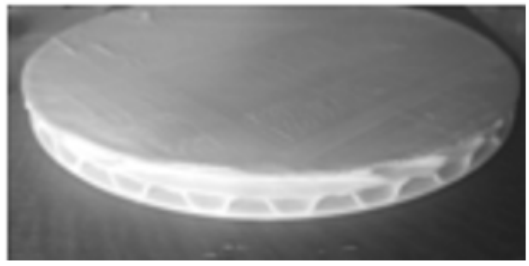
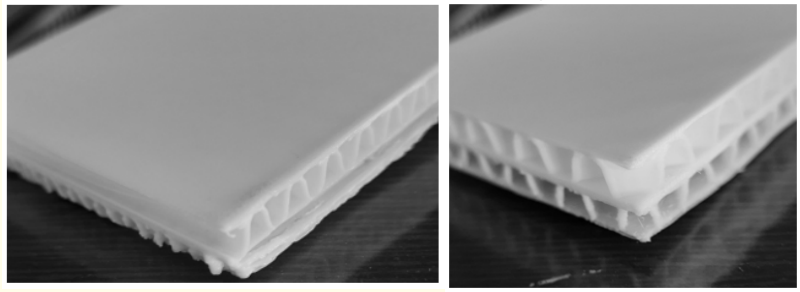


Figure 1: Circular panel in exclusive sandwich core profile.



(a) 0 -90 stack dual corrugate profile. (b) 45 -45 stack dual corrugate profile.

Figure 2: Circular panel in exclusive sandwich core profile.

Conclusion

This improved structural behavior may be understood here as addendum to all such efforts made and were published earlier, since this unique dual corrugate sheet core profile sandwiched structural decks, monolithically has now been printed out from a 3D Printer with ease at site itself. Such exclusive monolithic sandwich decks of dual corrugate with mid shear layer core profile being the optimal choice that can now easily be developed for use in any civil engineering future applications.

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