

Hybrid Materials for Bonnet of a Car to Reduce Weight and to Improve Pedestrian Safety



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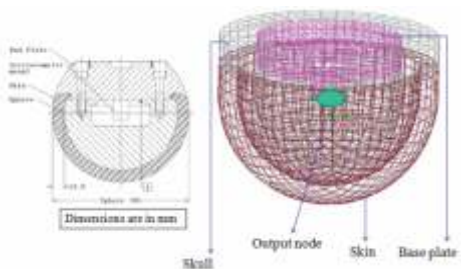
Keywords: Pedestrian Safety, Head Injury Criteria, Bonnet Panel, Hybrid Materials, Hybrid Construction

Abstract:

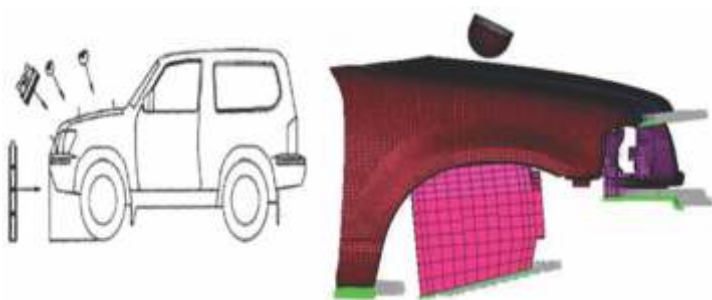
With ever increasing accidents, head on collisions of pedestrians with vehicle have increased. In this, pedestrians are severely affected due to the head impact on the bonnet of the vehicle. Thus, in order to save life of a pedestrian, the vehicles should be pedestrian friendly. Weight reduction in a vehicle is another important area of concern. Hence, this project was envisaged by taking into consideration of pedestrian safety as well as weight reduction for bonnet. This was realized by alternate design of bonnet through combination of materials.

The density and Young's modulus of plastic materials are less when compared to steel and aluminium. Advances in plastic technology have lead to the usage of plastics for outer panel of a bonnet. In the current work, the bonnet was designed in such a way that plastic and steel form for outer and inner panel of bonnet respectively, leading to a hybrid material construction. Head impact analysis was carried out with the validated adult headform model to evaluate HIC as per EEVC WG17 norms. The headform was validated by impact and drop test with resultant acceleration of 390 g and 237 g respectively, which satisfies the given norms of EEVC WG17. This proves that the headform can be used to evaluate HIC.

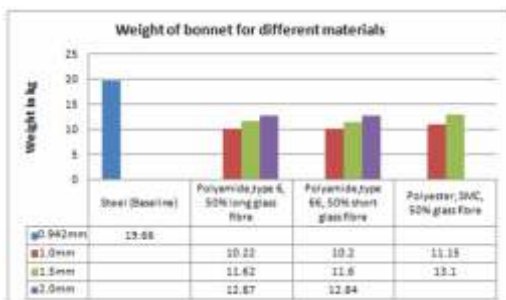
Based on structural analysis of bonnet for local, global and torsional stiffness and two criteria such as local stiffness must be lower, and global and torsional stiffness must be on par with baseline, material for outer panel of bonnet was finalised as Polyester (SMC) with 50% short glass fibre. With the usage of polyester (SMC) for outer panel and steel for inner panel of bonnet, HIC value came down to 106 from 248. This reduces the severity of the injury for the pedestrians. Weight of the bonnet was found to reduce to 11.15 kg from 19.66 kg.



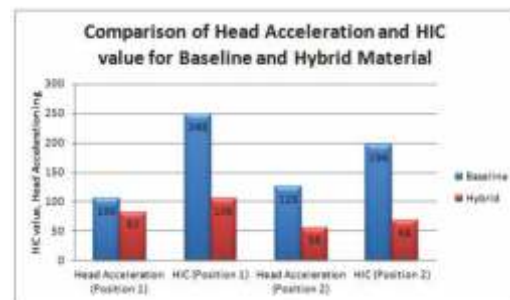
Validation of FEM of headform with the experimental headform



Pedestrian head impact test on bonnet as per EEVC WG17 norms



Comparison of weight of bonnet for different materials



Comparison of head acceleration and HIC value of pedestrian for baseline and hybrid material