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Analysis of Bumper Beam in Frontal collision

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ABSTRACT: Aluminium Honeycomb sandwich panel is structure which has very sleight to weight ratio. Its main application in past observed in aerospace ,marine and high end automobile sector This structure can effectively used to eliminate one major drawback in Indian passenger car which is Pedestrian damage .By reference of test conducted by Euro NCAP we are having data the major passenger car which is day today part of life have fail in safety measure of European countries.

KEYWORDS: Sandwich structure, , Impact Analysis**.**

I. INTRODUCTION

Honeycomb sandwich structure basically consist of a core, which is basically sandwiched between the two face sheet upper and lower face sheet.. In this structure we have option to select material for upper face sheet ,lower face sheet and for core material{1} .This structures property depend upon the geometry of the core such as cell shape ,which is basic unit of core, height of core, thickness of foil from which cell is prepared. Face sheet thickness also major contribute in properties. We can obtain desired effect by changing any one parameter.{2} For pedestrian damage we have to focus on front side bumper of car .In Indian low cost car the material used for bumper is steel .Bumper is part which come most in deformation zone, so crashworthiness of bumper should increase.

The objective of this work is to identify, the best material for bumper reinforcement which will ensure passenger safety, with high strength to weight ratio through static impact analysis .Using different engineering material like aluminium honeycomb sandwich and fly ash aluminium.

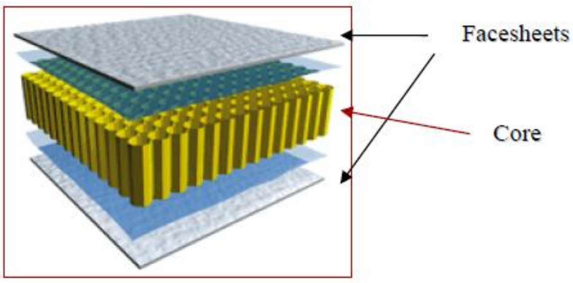

Fig no.1 Honeycomb sandwich structure

II LITERATURE REVIEW

First three paper in reference focuses on honeycomb structure Hexel is big bull in composite market and large shre in honeycomb manufacturing. Paper no second focuses about hoe material properties of honeycomb by different theories can be calculated. Third paper is mot important as describes honeycomb equivalent plate theory. the three layer structure can be converted in to one layer and treated as isotropic. Author v.Kleisner and R.Zerik in his paper (4) Analyses the car bumper reinforcement made of composite(EHKF420-UD24K-400).In methodology section they described RCAR test..The test vehicle speed is 15km/he within 1 meter distance from the barrier. The barrier offset of the vehicle is40%.in paper no. (.5) brief description regarding FMVSS215 is mentioned. It also shows that speed for

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low velocity impact is 5 Km/hr. In paper no.6 design and manufacturing of car bumper is by hand layup method is described .material used is glass fibre reinforced polymer Charpy impact test is used to validate the result for energy absorption capacity of material. by studying paper no.7 we know just addition hexagonal honeycomb structure made cardboard increases energy absorption capacity by 260%.in paper no .8 we can see comparison of composite GMT(Glass material Thermoplastics) and steel .They suggest to used GMT as backbone behind steel as energy absorber.

III.METHODOLOGY

The 3D model of bumper reinforcement is made in creo.2 After this the same model is imported in to ANSYS workbench for impact analysis and total deformation is observed. We are applied here condition for impact is low velocity condition which 8 km/hr(2.2m/s) {5} and mass 1000 kg. In100% frontal impact force component is perpendicular to the bumper beam. This test is conducted to check pedestrian safety purpose .Now by using Newtons second law, we calculated force value which is 22000 N .This point force applied centrally on Bumper beam.The Fixed support Applied at the end portion which is attached to the chassis in real condition. This condition is according to NCAP..

IV MATERIAL SELECTION

Three types of material is selected for bumper mainly following specification:

Table No.1 Material properties

Material Name	Young's Modulus	Density
Steel	207 Gpa	7800 kg/m3
Fly Ash Aluminum (FAA)	70 Gpa	2611 kg/m3

As Aluminium honeycomb sandwich is anisotropic material having different properties in different crystal direction. We assumed it as orthotropic and applied The equivalent plate theory and make it as homogenous plate having only one young's modulus .As these are assumption for fast analysis results are approximate and should be verified by practical impact test.{3}

Table No.2 Material properties of Aluminium honeycomb sandwich structure

Parameter	Real sandwich panel	Equivalent Homogenous Plate
Total Thickness	20mm	33mm
Young's Modulus	Three different values in x,y,z direction	4253 kg/m^2
Density Of Face-sheet	2700 kg/m3	210 kg/m^3
Density Of Core	83 kg/m3	

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V RESULT AND DISCUSSION

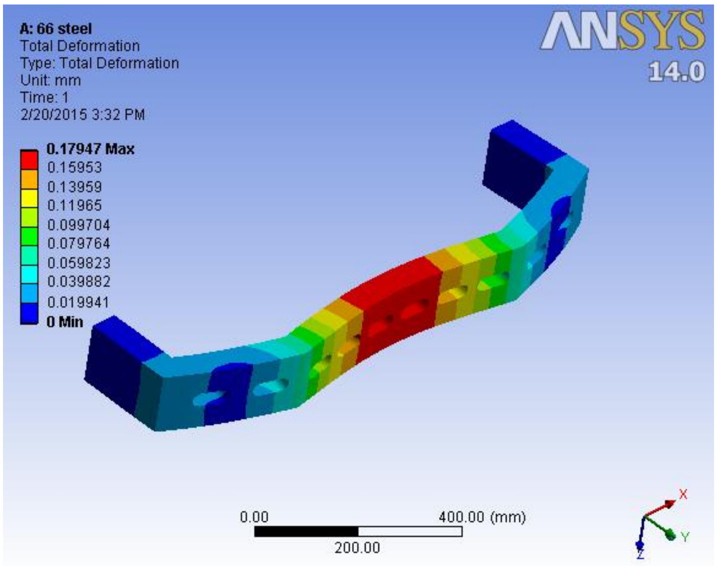

Fig.no.2 Deformation of steel bumper Reinforcement

Figure No. 2 shows the deformation value for steel bumper beam which is we have considered as solid but in real practice it is hollow bumper beam. Maximum deformation we can observe is 0.17 mm .here we have provided end support as well as central support.

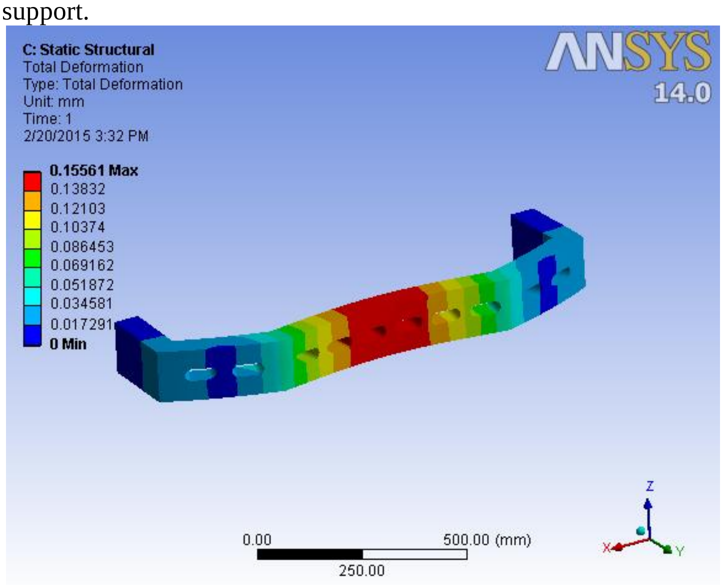

Fig.no.3 .Deformation of AHCS bumper Reinforcement

Figure No. 3 shows the deformation value for Aluminium Honeycomb sandwich composite bumper beam which is we have considered as isotopic solid material but in real practice it is anisotropic layered material. Maximum deformation we can observe is 0.15 mm .Here we have provided end support as well as central support.

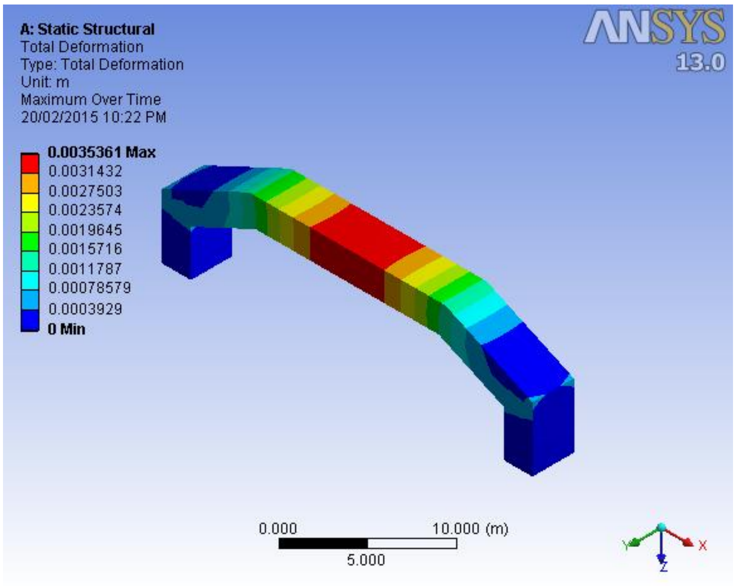

Fig.no.4.Deformation of FAA bumper Reinforcement

Figure No. 4 shows the deformation value for Fly Ash Aluminium bumper beam l Maximum deformation we can observe is 3.5 mm .Here we have provided end support as well as central support

Table no.2 Material Deformation After Impact

Material Name	Steel	Fly Ash Aluminium	Aluminium honeycomb sandwich structure
Deformation (mm)	0.17	3.5	0.15561

By observing above result we can predict that we can replace steel by other two material .By seeing space required for other accessories behind reinforcement ,we can increase thickness of bumper reinforcement.

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