REVIEW PAPER ON SANDWICH PANEL FOR AUTOMOTIVE BUMPER

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ABSTRACT

The main function of bumper beam is to absorb the kinetic energy which is generated due to the low speed impact. Due to the accidents and fatalities, it is estimated that India is using 3% of its GDP. So safety has become one of the most important criteria for vehicle designing. As per the new regulations for low speed and high speed pedestrian impact, the complexity level for designing bumper system has increased. It is important to design a new bumper in a flexible manner to reduce the passenger and occupant injury and stay intact in low speed impact besides being stiff enough to dissipate the kinetic energy in high speed impact.

The aim of the paper is to study the role of the reinforcement beam, different energy absorber and its benefit for absorbing the impact energy generated during accidents. The result of the paper is to help designer and researcher in performing functional analysis of the bumper beam determinant variables.

Keywords: Bumper beam, Energy absorber, Impact energy, Pedestrian impact, Regulations.

I.INTRODUCTION

More than 2,70,000 pedestrian lose their life each year. Despite the magnitude of the problem, most attempts at reducing pedestrian deaths had historically focused solely on education and traffic regulations. Automotive industry is one of the fastest growing sectors in India. Safety has become one of the most important critical of the vehicle designing with more than one death and injuries every minute. Unfortunately India has been reporting highest number of road fatalities in the world. Bumpers were at just rigid metal bars. But as development is happening in vehicle crash protection in current design practice. Bumper structure on modern automobile made up of steel, aluminum, composite materials and plastics.

II.LITERATURE SURVEY

Yi-Ming Jen et al. [1] determined the bending fatigue strength of aluminium honeycomb sandwich beam by varying the thickness of face sheet and found that no apparent relationship exists between the face sheet thickness and the fatigue life of specimen.

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Wenhao Mu et al. [2] analyzed frontal bumper system of car for pedestrian protection and low speed impact. The optimization design of bumper for low speed impact and lower leg impact was carried out and the optimal values of design variables were obtained.

Rikard Fredriksson et al. [3] studied the levels of injury severity of pedestrian in car accidents at different speeds. They concluded that the most commonly injured body region was leg. At higher speed head and chest were dominating body region.

A Masoumi et al. [4] investigated Head Injury Criteria (HIC) value by new developed finite element model by changing the car bonnet material as steel, aluminium and composite at eight different locations. Aluminium has the lowest HIC value and highest displacement than steel.

Mary et al. [5] constructed the bumper beam energy absorber with two different sized cell layers to absorb more energy and introduced reinforcing material between these layers to increase the strength of the energy absorber. Also examined extrusion process for manufacturing open cell network.

Ramesh S Sharma et al. [6] has done Quasi-static test and Impact test on the hexagonal honeycomb cell by varying its height and keeping all other dimensions constant. Variation in height of the honeycomb structure doesn’t show any significant change in energy absorbing capacity of it. Top face absorbs more energy than the core.

M Giglio et al. [7] has studied an experimental-numerical methodology for the investigation of three point bending test (TPBT) on sandwich panel made with thin aluminium skin and Nomex honeycomb core. Numerical FE reference results are in good accordance with the experimental results.

Xiong Zhang et al. [8] studied the crush strength of aluminium honeycomb, experimentally and numerically by varying the cell numbers and central angles. Honeycomb with different central angles has no significant difference in crush strength but has great influence in crush strength due to different number of cells.

Praveen Kumar A. et al. [9] has done analysis on front bumper beam of TATA 207 by using different materials like steel, carbon fiber, foam and honeycomb structure using ansys. The result is that the honeycomb structure absorbs more energy and ensures pedestrian safety.

C Ramesh Kannan et al. [10] studied different shapes for the crush can and cuboid seems to be suitable and suggested that the aluminium is the best material for crush can. The honeycomb structure crush can absorb more energy than the plain crush can.

Amey Gongle et al. [11] has done analysis of hexagonal honeycomb structure made up from aluminium alloy by using ansys by varying cell size and keeping sheet thickness and core height constant. Natural frequency of honeycomb structure is increases with increase in cell size.

S A Abdul Sukkur et al. [12] performed static analysis to obtain the response of the hexagonal honeycomb sandwich made up of copper core and stainless steel panel faces by varying three different loads for three different core heights. It is found that the gradient of the deflection curve is high for lower core height and stress is low for higher core height.

Pandey Alok S et al. [13] studied the car bumper with different materials such as steel, carbon fiber reinforced polymer (CFRP), aluminium honeycomb sandwich panel and metal foam. They found that the aluminium honeycomb have high energy absorbing capacity and low cost and weight. It is best suited for car bumpers.

Dr. S. Srinivasa Rao et al. [14] has done the analysis on bumper beam made from steel by using ansys 15.0 at low speed. Thickness of bumper beam is varied during analysis and concluded that the as thickness increases, stress and deflection in bumper beam is decreases but weight and rigidity also increases. The S2 glass epoxy is proposed that could replace the steel based on strength and weight criteria.

R Hedayati et al. [15] studied the mechanical properties of octagonal honeycomb structure made up from polylactic acid (PLA) by using analytical, numerical and experimental approaches. All the results are compared with honeycomb structures having square, triangular, hexagonal, mixed, diamond and kamoge unit cell shapes.

V Siva Kumar et al. [16] has done impact analysis of a car bumper made up from different materials with different loads using ansys 14.5. In metals, stainless steel is suitable materials and in plastic thermoplastic olefin is better material for car bumper.

Arun Basil Jecob et al. [17] performed individual crash test analysis of car bumper made up of steel honeycomb structure and aluminium foam using LS-Dyna. Both the materials structure shows the better impact absorption capacity than current steel bumper of the car.

P Satya Lakshmi et al. [18] analyzed an automobile bumper using ansys 15.0 with steel, composite steel and honeycomb hybrid structure. It is observed that the honeycomb hybrid structure bumper has less deformation compared to other two materials.

Amit Chege et al. [19] examined the energy absorption capacity of car bumper by using different materials such as foam, honeycomb, double cylinder model, double cylinder model filled with foam and double half cylinder model. The results show that the two double half cylinder has the better energy absorption than others.

A Al Antali et al. [20] has developed light weight honeycomb core containing embedded carbon fiber reinforced plastic (CFRP) tubes. They investigated the energy absorbing characteristic by conducting tests on this.

G Tiwari et al. [21] carried out an experimental and numerical simulation on aluminium honeycomb structure by varying cell wall thickness and node length, keeping the cell size constant to determine the axial compression behavior. Experiments were conducted on compressive testing machine and numerical simulations were performed on LS-Dyna.

Guangyong Sun et al. [22] performed three point bending (TPB) and In panel compression (IPC) tests on aluminium honeycomb sandwich panel with four different parameters such as thickness of face sheet, hexagonal cell size, foil thickness and height of honeycomb core to investigate crushing and energy absorbing behavior.

Ines Ivanez et al. [23] performed the experimental compressive tests and numerical model to determine the crush behavior and the energy absorption capability of an aluminium honeycomb core by varying the cell size, cell wall thickness and material properties. Conclusion is that the energy absorption capacity increases with increase in cell wall thickness and energy absorption capacity decreases with increase in cell size.

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