DESIGN AND EXPERIMENTAL ANALYSIS ON CAR BUMPER WITH COMPOSITE MATERIALS

Gandla Pradeep[1], P. Chandra kumar[2]

[1]M.Tech student, Department of Mechanical Engineering, Vidya Jyothi Institute of Technology, Hyderabad, TS.
[2] Assistant Professor, Department of Mechanical Engineering, Vidya Jyothi Institute of Technology, Hyderabad, TS.

Abstract:- *The main criteria of the project is to minimize the cost & increase the strength of the bumper by using composite materials. Design should be under attention of safety of the passenger meanwhile with low weight. In point of safety, efficiency & emission gas regulation are very important in recent years that enforce the manufacturer to reduce the weight of passenger cars. For the design & analysis of a bumper chosen with composite material of Carbon fibre & Jute fibre with low cost and good strength. Study done by using software solid works & Ansys. Tests done on bumper is Tensile strength and Impact analysis.*

Keywords: Carbon Fibre, Bumper, Solid Works, Ansys, Jute Fibre.

1. INTRODUCTION

In this current situation most of the automobile accident was occurring day today life. In recent survey also resolved that accident were occurs because of rash driving and safeties of automobiles. However, the survey show that ten thousand dead& million wounded each year. Hence, safety of vehicles are major requirement to avoid accidents. In point of automobiles safety important parameters are air bags, belts & body of the automobile. Bumper beams aretone of the vital part in passenger vehicles. For that part we essential to have important design & manufacturing take care of good control behavior. The Automotive bumper is one of the key parts of traveler autos.

Bumpers are intended to anticipate or to diminish physical harm of the front or backsides of traveler vehicles in crash condition. It secures the sub systems, fuel line, out gas flow system and cooling cushion or radiator. Distinctive nations have comparable execution and gauges for guards. In the worldwide security controls initially created as European gauges & now embraced by generally nations. The utility of car bumpers has changed extensively finished the previous seventy years. A not long after execution is accomplished by a blend of cautious plan, material choice to achieve a specific feeling of adjust firmness, quality and vitality ingestion. Unbending nature and Energy assimilation are the essential criteria.

Firmness is vital on the grounds that vehicle plan thought restrains the volume for the bumper expect to twist under load and Energy ingestion is critical in light of the fact that bumper must point of confinement the amount of the effect constrain transmitted to the encompassing rails and vehicle frame. Vehicles bumper plays an essential role in absorbing impact energy. In automobiles, a bumper is usually a metal which was fixed front & rear ends of the automobiles to withstand the impact load at the time of accidents which is safety for car body and major parts of the vehicles. Bumper is mainly used to protect the trunk, fuel, grill, cooling & heating systems along with this front lights, indicating lights & headlamps.

When designing the bumper of the vehicle mainly focused on to reduce the passenger, occupant injury & stay intact in low-speed impact besides being stiff enough to dissipate the kinetic energy in highspeed impact. The bumper beam is a key structure for absorbing the energy of collisions. Since, bumper is an energy absorbing system for a certain impact strength at the requirement for such, this exploration examinations the parameters that specifically influences affect attributes and proposes easily achievable changes coming about because of impact modeling on bumpers.

A traveler vehicle is displayed and tried for the test. With the presentation of car security enactment, crashworthiness and wellbeing ought to be considered as preconditions in light-weight design of bumper beam. There were four fundamental vital parameters being examined in the test displaying in the initial step for metallic material. Firstly, the material i.e., how the type off material can affect the impact specifications and what kind of materials can be used as replacement in order to lower part weights. By considering all the requirement carbon fiber is used as a composite material in this research.
To summarize, the objective of this research was to develop & propose a replaced composite bumper, which could satisfy following requirements:

a. Easy to manufacture a required shape. This was consummate by removing strengthening ribs of bumper.

b. Being reasonable by consuming low-cost composite materials.

c. Attaining reduced weight related to the metal bumpers.

d. Attaining improved or similar impact behavior related to the current metallic structure.

Table 1. Characteristics and Applications of Carbon Fibers

1	Physical strength, specific toughness, light weight	Aerospace, road and marine transport, sporting goods
2	High dimensional stability, low coefficient of thermal expansion, and low abrasion	Missiles, aircraft brakes, aerospace antenna and support structure, large telescopes, optical benches, waveguides for stable high-frequency (GHz) precision measurement frames
3	Good vibration damping, strength, and toughness	Audio equipment, loudspeakers for Hi-fi equipment, pickup arms, robot arms
4	Electrical conductivity	Automobile hoods, novel tooling, casings and bases for electronic equipment's, EMI and RF shielding, brushes
5	Biological inertness and x-ray permeability	Medical applications in prostheses, surgery and x-ray equipment, implants, tendon/ligament repair
6	Fatigue resistance, self-lubrication, high damping	Textile machinery, genera engineering
7	Chemical inertness, high corrosion resistance	Chemical industry; nuclear field; valves, seals, and pump components in process plants
8	Electromagnetic properties	Large generator retaining rings, radiological equipment

1.1. Impact mechanics

It is significant in the study of influences to distinguish between the two altered types of effects that occur, elastic & plastic impacts. In a elastic effect an immaterial amount of energy is lost among the two affecting bodies, for instance, the impact of two billiard balls. A plastic effect includes a lot of energy disseminated in the collision. An effect between two vehicles/between one vehicle & an rigid body, where the vehicles fold on affect, is a case of an elastoplastic effect. The impacting wonder between an impactor & the front guard in a low-speed full crash could be extremely confused, since transient and nonlinear examinations are included. Be that as it may, in outlining the front guard, car producers demand that the guard framework ought not have any material crash or disappointment. Along these lines, up to that point, the total energy is moderated all through the effect span.

2. LITERATURE SURVEY

The examination is done by considering the previous experiments done by the analysts in the field of determination of material in the car guard affect investigation. Analysts concentrated on the mechanical properties of a half breed glass epoxy composite for usage in a traveler auto guard shaft. A crossover material, which is manufactured by adjusted SMC strategy present a decent mechanical properties cause by connected strain to yield a solid security between the half breed fortified fibers[1].

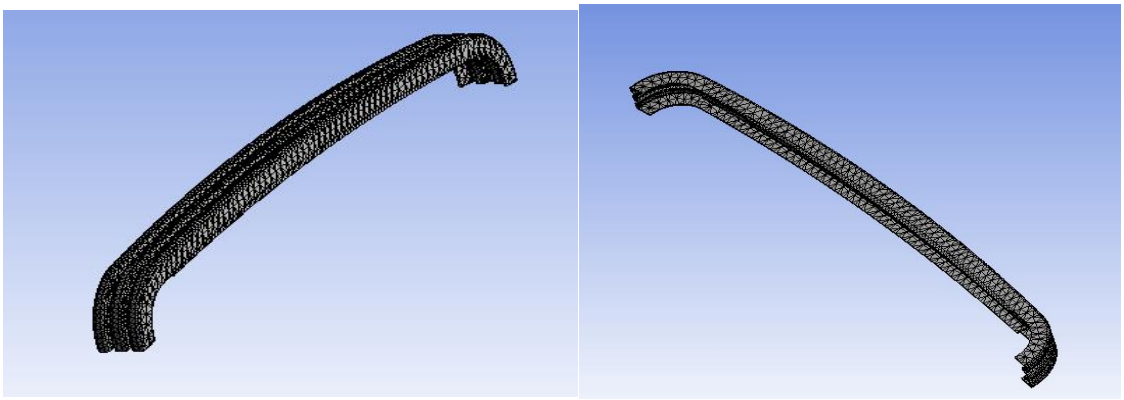
The design parameter for the production such as rib thickness, cross section, fixing method & the strength play a main role [2]. The researchers had studied on the influence behavior of vehicle-vehicle' impact test & 'vehicle to barrier test in order to govern whether vehicle-to-'barrier tests can serve as substitutes for vehicle-to-vehicle tests in accident rebuilding [3].

The explores have been done on the examination to build up a numerical expository model of collinear low-speed packed in accidents, the model regards the auto body as inflexible structure and the guard pillar as a deformable structure appended to the vehicle. The model is additionally used to look at that how the auxiliary qualities of the vehicles' guards and the end speed influence the accident beat and to show a strategy to gauge the most extreme seriousness of a low-speed crash that has just happened [4].

3. RESULT & DISCUSSIONS

Table 2. Results and Discussions

S.No	MATERIAL	DEFORMATION	EQUIVALENT STRESS
1	CARBON FIBRE & JUTE FIBRE	0.33 mm	4.12 MPa
2	ALLOY STEEL	0.38 mm	14.3 MPa
3	ALLOY ALUMINUM	1.08 mm	16.4 MPa



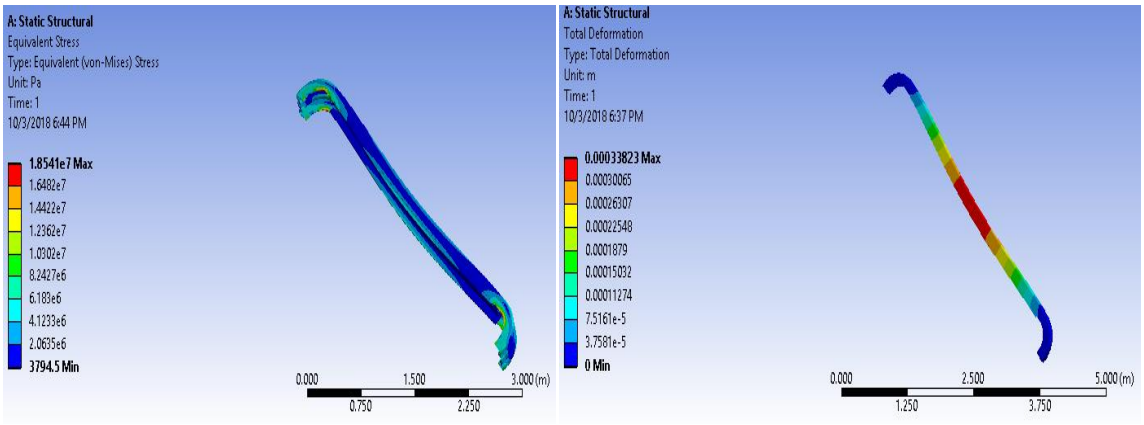


Fig.1. Diagram of composite material with stress & deformation

Based on the load applied on the bumper made by composite material i.e carbon fibre & jute fibre the equivalent stress values & deformations are calculated. Deformation was 0.33mm and equivalent stress as 4.12 MPa.

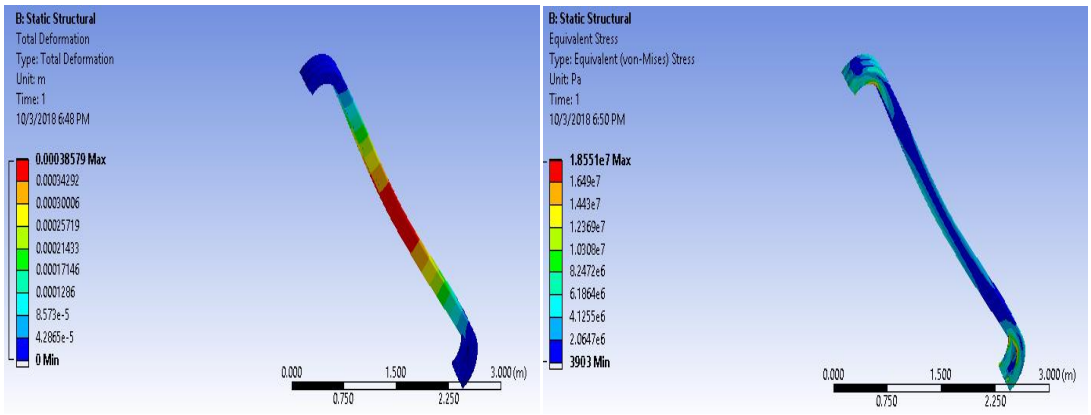


Fig.2. Diagram of alloy steel with stress & deformation

Based on the load applied on the bumper made by alloy steel the equivalent stress values & deformations are calculated. Deformation was 0.38mm and equivalent stress as 14.3 MPa .

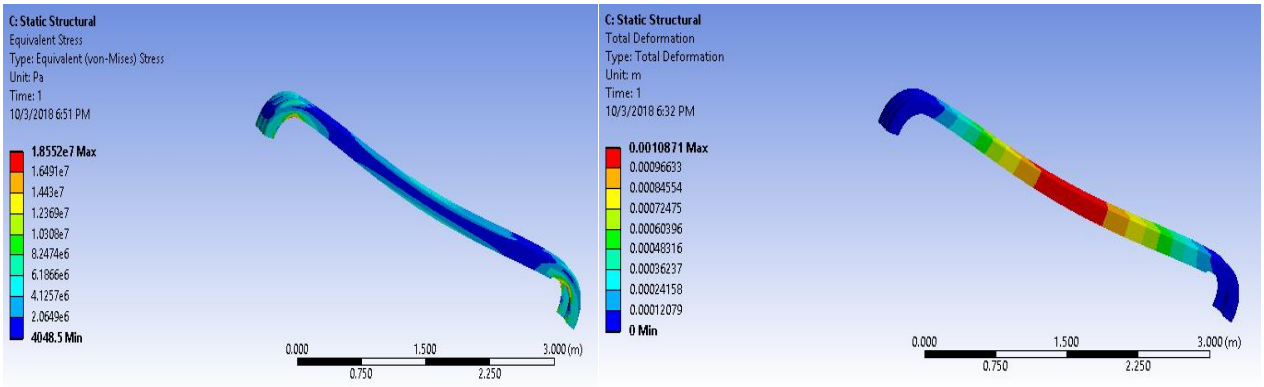


Fig.3. Diagram of alloy aluminum with stress & deformation

Based on the load applied on the bumper made by alloy aluminum the equivalent stress values & deformations are calculated. Deformation was 1.08mm and equivalent stress as 16.4 MPa.

4. Conclusion

By comparing three dissimilar materials for car bumper such as composite material (carbon fibre and jute fibre), alloy steel and alloy aluminum the deformation was very less in composite material and even equivalent stress values are less compared to other different materials

5. References

[1] M.M. Davoodia,*, S.M. Sapuan a, D. Ahmad b , Aidy Ali a, A. Khalina b, Mehdi Jonoobi," Mechanical properties of hybrid kenaf/glass reinforced epoxy composite for passenger car bumper beam", material design 31 (2010) 4927-4932.

[2]. M.M. Davoodia,b, S.M. Sapuan b, A. Aidy c, N.A. Abu Osman a, A.A. Oshkour a, W.A.B. Wan Abas," Development process of new bumper beam for passenger car", Materials and Design 40 (2012) 304–313.

[3]. Bradley E. Heinrichs, Jonathan M. Lawrence, Boyd D. Allin, James J. Bowler, Craig C. Wilkinson, Kurt W. Ising and David J. King MacInnis Engineering Associates," Low-Speed Impact Testing of Pickup Truck Bumpers". SAE Paper 2001-01-0893.

[4]. W. R. Scott, C. Bain, S. J. Manoogian, J. M. Cormier and J. R. Funk Biodynamic Research Corporation," Simulation Model for Low-Speed Bumper-toBumper Crashes", SAE Paper 2010-01-051.