

# ANALYSIS OF GLASS/BASALT FIBER COMPOSITE FOR CAR BUMPER

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## Abstract

Bumper is an important part which is used as protection for passengers from front and rear collision. The intend of this study was to investigate the structure and material employed for car bumper in one of the car manufacturers. In this study, the most important variables like material, structures, shapes, and impact conditions are studied for analysis of the bumper beam in order to improve the crashworthiness during collision. The simulation of a bumper is characterized by impact modelling using CATIA, impact analysis is done by ANSYS according to the speed that is 13.3 m sec<sup>-1</sup> (48 km hr<sup>-1</sup>) given to analyse the results. In this research, analysis is done for speed according to regulations and by changing the speeds. Simulation using Finite Element Analysis software, which is ANSYS, was conducted. We have fabricated and analyzed the car bumper, implementing the material properties of E-glass/Basalt epoxy and, we made comparison with the material properties of steel, aluminium, carbon fibre, plastic through plotting graph.

**Keywords:** Car bumper, E-Glass fibre, Basalt fibre, Epoxy resin.

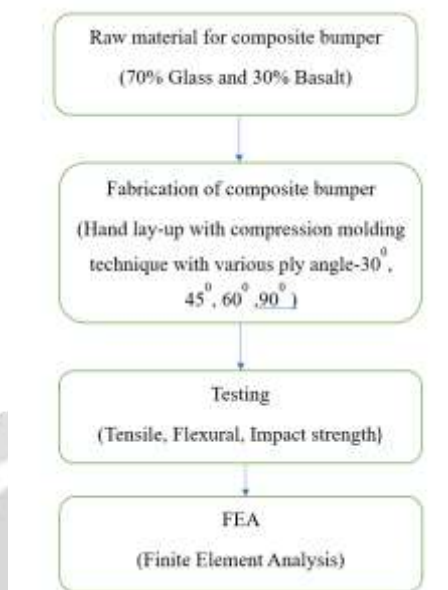
## 1. INTRODUCTION

A bumper is a shield made of steel, Aluminum, rubber, or plastic that is mounted on the front and rear of a passenger car. In a low speed collision, the bumper system is designed to absorb the shock of the impact to prevent or reduce damage to the car's body and other important components. In existing bumper, the weight is more. In the present trends the weight reduction has been the focus of automobile manufacturers. Less fuel consumption, less weight, effective utilization of natural resources is focus of automobile manufacturers in the present scenario. The above can be achieved by introducing better design concept, better material, and effective manufacturing process. Steel is a common material used in the construction of car bumpers because it has good load carrying capacity and is relatively inexpensive. Steel is relatively heavy compared to other materials, and this can affect the overall weight and fuel efficiency of the vehicle. Hence, composites with better mechanical properties have been used as an replacement for steel. In the present work, the steel bumper used in passenger vehicles is replaced with a composite bumper made of glass/basalt composites. The objective was to compare the stress, weight, and cost savings.

### 1.1 Advantages of composite bumper

1. One of the most advantageous reasons for considering their use over steel is their reduced weight.
2. Absorb more collision energy.
3. Excellent corrosion resistance.
4. High impact strength.
5. Light in weight.

## 2.METHODOLOGY



## 3.MATERIALS

- \* Fabric : 70% Glass and 30% Basalt
- \* Fabric type : Plain woven fabric
- \* Fabric GSM : 400GSM
- \*Resin : Epoxy resins

## 4.FABRICATION F BUMPER

In the hand lay-up process the thickness of the composite part is built up by applying a series of fibre glass layers and liquid resin layers. A roller is used to squeeze out the excess resin and create uniform distribution of the resin throughout the surfaces. By the squeezing action of the roller, homogeneous fibre wetting is obtained, the part is then cured at room temperature for about one week and once solidified it is removed from mould. The cost making one composite bumper (glass/basalt) is around Rs.1200.

## 5.DESIGN OF COMPOSITE BUMPER

For designing the composite bumper an already existing ambassador steel bumper is used as mould. Dimensions are assumed as same as that of steel bumper for fabrication.

## 6.OBSERVATION

Charpy test specimen

DESCRIPTION	COMPOSITE (GLASS/BASALT) BUMPER	COMPOSITE (BASALT) BUMPER	STEEL BUMPER
Cross sectional area, A (mm <sup>2</sup> )	40	40	40
Impact value, I (J)	270	294	163
Impact energy = I/A (J/mm <sup>2</sup> )	6.80	7.35	4.07

Experimental Result

Impact value for basalt composite bumper is 294J and glass/basalt composite bumper is 270 J is higher than steel bumper value of 163J for same cross-sectional area. Thus, impact energy is higher for composite bumper (basalt) 7.35 j/mm<sup>2</sup> and composite bumper(glass/basalt) 6.80 j/mm<sup>2</sup> than steel bumper which is 4.07 j/mm<sup>2</sup>.

### 6.1 Comparison of results

DESCRIPTION	STEEL	COMPOSITE (BASALT) BUMPER	COMPOSITE (GLASS/BASALT) BUMPER	PERCENTAGE OF REDUCTION
Weight (Kg)	13	4.3	4.3	66.92%
Cost (Rs)	3600	1800	1200	33.33%
Impact strength (J/mm <sup>2</sup> )	3.25	7.35	6.80	–
Max stress(N/mm <sup>2</sup> )	73.32	80.41	75	–

## 7.CONCLUSION

Design, fabrication and testing of steel and composite bumper (using glass/basalt fiber material) are completed, and composite bumper is analyzed and compared with steel bumper. It is proved that fuel economy of the vehicle is improved as the composite bumper weighs less when compared with steel bumper. Cost of composite bumper is Rs.1200/- which is 66.67% less than steel bumper. Impact strength of composite bumper is 6.80 J/mm<sup>2</sup> where steel bumper is 3.25 J/mm<sup>2</sup>. Factor of safety for composite bumper is increased by 64%. From the study, it is concluded that fiber reinforced plastic material is a suitable material for manufacturing the bumper.

## 8.SCOPE OF FUTURE WORK

By changing design and dimension of bumper, further analysis carried out in ANSYS for increasing the impact strength. Crash test can be done practically using the bumper inserted in the car for testing the performance. Type of composite material will be further compared to find out the best material for the bumper

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