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## **Design Improvement in Bumper Using FE Analysis-A review**

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### **ABSTRACT**

Automotive bumper system is one of the important systems in automobile which helps to protect the vehicle during impacts. The main purpose of bumper is to absorb impact during collision. The focus of this work is material selection for Bumper by performing analysis. In point of safety, efficiency & emission gas regulation are very important at the time design of bumper. Bumper is connected to chassis so there is no any linkage to drop that impact. So design a new bumper which is minimizing the impact on vehicle with some modification. Saving the impact energy to reduces the damages of the vehicle and passenger

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Keywords: Bumper, Impact, Material, crashworthiness design, Passenger Safety.

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### **1. INTRODUCTION**

Bumper system is one of the important systems in automobile. Bumper systems are designed to prevent or reduce the impact in collision condition. A design of car bumper provides safety for passengers. Automotive bumper plays a very important role in minimizing impact and save passenger life. The aim of this work is to design bumper.

Design a bumper on following basis:

- Performance related parameters of automobile bumper.
- Deformation and Energy absorption capability of bumper material.
- Shape/ Size/ Thickness (Geometry) of the bumper.

First, analyzed existing design and based on observations, design a new bumper which satisfy all parameter.

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### **2. LITERATURE REVIEW**

Hosseinzadeh RM and et.al [1] In this paper, bumper beam made of glass mat thermoplastic is studied and characterized by impact modeling .Three main design factors are considered while design i.e. shape, material and impact conditions and the results are compared with metals like steel and aluminum.

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Javad Marzbanrad. et al [2] in this paper they studied the material, thickness, shape and impact condition for design and analysis of a bumper beam to improve the crashworthiness design in impact. Beside the role of safety, fuel efficiency and emission gas regulations are being more important factor considered by manufacturer. Bumper beam made of aluminum, glass mat thermoplastic and high-strength sheet molding compound is studied by impact modeling to determine the deflection, impact force, stress distribution and energy-absorption. The mentioned characteristics are compared to find best choice of material, shape and thickness. SMC bumper beam minimize deflection, impact force and stress.

Marzbanrad JM et.al [3] in this paper they studied front bumper beam made of aluminum, GMT and high-strength SMC. The mentioned characteristics are compared to every different material. To search out most suitable option of fabric, form and thickness while design.

Gandla Pradeep et al [4] in this paper they studied by comparing three materials for car bumper such as composite material, alloy steel and alloy aluminum. And the deformation less in composite material and equivalent stress values are less compared to other different materials.

Butler et al. [5] in this paper they studied the components linked to crash safety it absorb energy and energy absorbing capability. And specific component is a combination of its geometry and material properties. The material which is selected should have high yield strength and relatively high elongation to fracture. And these properties of steel increased in use.

B Karthik [6] in this paper they studied the designed mechanism is used to convert the impact stresses to spring potential energy. Spring with the stiffness required to manage the impact and the arms that join shock absorber and the bumper and the small link which pivots between the two arms at both the sides. To increase the bumper efficiency and passenger safety used spring as point of safety.

Alen john,nidhi [7]in this paper they studied materials used for these bumper analysis are Aluminum B390 alloy, Chromium coated mild steel and carbon composite. At the time analysis, the composite material shows the highest stress value, lowest deformation and the lowest strain value as compared to other two materials. From the analysis carbon composite has the maximum stress value, highest strength to weight ratio and low deformation.

Anderson et al [8] has discussed that it's necessary to use new techniques like use of energy absorber and materials. Components linked to crash safety should transmit or absorb energy as possible as. The energy absorbing capability of a material is a combination of geometry and material properties of that component.

Pradeep Kumar Uddandapu [9] in this paper review material used is ABS plastic and PEI. The aim of this study is to analyze the structure and material. In this research analysis is done for different speed in this analysis. The density of ABS and PEI are but steel therefore the general overall weight of car bumper is reduced. Stress values are less for ABS compared to other two materials.

Sachin Manoj, kumar Jain [10] they discussed shape, material, design and analysis of bumper to improve its performance. Virtual analysis better than impact test and it provides a great platform to carry out simulation of the model in real conditions. The most important factor of material selection at the time design is done keeping in mind engineering design and its feasibility.

B.A. Bohra , Prof. D.B. Pawar [11] in this paper describes impact analysis is carrying on varying speed according to regulations. The aim of that research is improvement in the design of bumper and gives the economical solution for the bumper material and design by improving the safety increasing aspects. ABS is best bumper material as compared to other and modified bumper design is best as compare to existing bumper design.

### 3. Summary Of Literature Review

Table 1- Summary of Literature Review

Sr No	Author	Year	Title	Finding
1	Hosseinzadeh RM, Shokrieh M,	2005	Study of composite bumper beams subjected to low velocity impacts	In this paper, a front bumper beam made of GMT is studied and characterized by impact modeling
2	Javad Marzbanrad	2008	Design and analysis of an automotive bumper beam in low-speed frontal crashes	SMC bumper beam can minimize the bumper beam deflection, impact force and stress distribution and also maximize the elastic strain energy.
3	JM Marzbanrad, M, Alijanpour, and MS Kiasat	2009	Design and analysis of automotive bumper beam in low speed frontal crash.	Three materials analyzed for deformation, strain and stress and from that search out most suitable fabric.
4	Gandla Pradeep	2018	Design And Experimental Analysis On Car Bumper With Composite Materials	Deformation, Equivalent stress are less in composite material as compared to alloy steel and aluminum alloy
5	Butler M, Wycech J, Parfitt J, and Tan E	2002	Using Terocore Brand Structural Foam to improve Bumper Beam Design	Deformation and stresses are increases with increasing in speed and stress values for Polypropylene were less as compared to Poly-Vinyl-Chloride and Polyurethane.
6	B.karthik	2015	Design and analysis of spring shock absorbing bumper to release impact stresses in automobiles	Design a spring to improve passenger safety and also fulfill design requirement.
7	Alen john,nidhi	2014	Modeling and Analysis of an Automotive Bumper	Composite shows the highest stress value, lowest deformation and the lowest strain value.
8	Andersonet	2002	The Applicability of Stainless Steel for Crash Absorbing Components	Necessary to use new techniques such as use of energy absorber materials and energy absorbing capability is a combination of geometry and material properties.
9	Pradeep Kumar Uddandapu	2013	Impact Analysis on Car Bumper	At the time analysis density of ABS plastic and PEI are less than steel and stress values are less for ABS plastic.
10	Mr. Sachin Manoj kumar Jain	2018	Impact Analysis of Automotive Bumper	Virtual analysis better than impact test and it provides simulation of model in real conditions
11	Mr. B.A. Bohra , D.B. Pawar	2015	Comparative Analysis of Frontal Car Bumper during Impact	ABS plastic is best bumper material and modified bumper design is best as compare to existing bumper design.

### 4. FINDING OF LITERATURE REVIEW

The above mentioned literature can be alleging in the following way:-

- a. There are some studies about the work associated with improvement within the design of frontbumper consistent with safety of coach.
- b. Present studies have not identified the effect of shape, size and or material at the time analysis.
- d. The safety of the passenger needs to be increased and his literature does not address the impact analysis of the passenger cars considering the shape, material and size.

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## 5. STATEMENT OF THE PROBLEM

Design Improvement in Front Bumper of a vehicle using Impact Analysis .

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## 6. SCOPE OF THE WORK

The study will focus on existing design performance, advantage and limitations of the bumper and its design. Based on observations design improvements will be necessary in terms of shape, size and or material. New designed bumper design is getting to be tested using FEM software for impact loads as per international standards.

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## 7. OBJECTIVE OF THE WORK

The following are the objectives:

1. To study existing front bumper design.
2. To carry out impact analysis using ANSYS on existing bumper.
3. To carry out design improvements in the existing model of the bumper.
4. To perform impact analysis for the modified bumper by using ANSYS.
5. To validate the FE results of the modified bumper against the existing bumper.

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## 8. CONCLUSION

From the above literature it can be concluded that the bumper is an important part of an automobile vehicle from the safety point of view. Thus the analysis of bumper will help to increase the security of passengers and new size and shape also can be considered to exchange the prevailing one. This different type of structure absorbs different kinetic energy during impact. Study comparisons of those structures in terms of energy absorption are often study.

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