

Modeling & Impact Analysis of a Car Bumper with Different Loads on Different Materials

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ABSTRACT: Here the main objective is doing impact analysis on Car Bumper with different impact load on different materials in this the safety and minimum conditions are the most important criteria. This project involves in modeling and analysis of a car bumper by using advanced Modeling software NX8.5 and Analysis was done by ANSYS 14.5 with different loads on different materials and the results will be tabulated

KEYWORDS: Bumper, impact, modelling, Ansys.

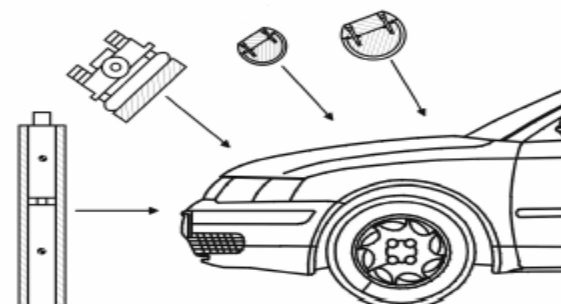
I. INTRODUCTION

BUMPER:

In automobiles, a bumper is usually a metal bar or beam, attached to the vehicle's front-most and rear-most ends, designed to absorb impact in a collision. Regulations for automobile bumpers have been implemented to allow the car to sustain a low-speed impact without damage to the vehicle's safety systems. Automotive bumper system is one of the key systems in passenger cars. Bumper systems are designed to prevent or reduce physical damage to the front or rear ends of passenger motor vehicles in collision condition. They protect the hood, trunk, grill, fuel, exhaust and cooling system as well as safety related equipment such as parking lights, headlamps and taillights, etc.

HEIGHT MISMATCHES

Even when bumpers cannot protect against moderate or high speed collisions, their height from the roadway surface is important in engaging other protective systems such as energy-absorbing crush zones and airbags. Major height mismatches can cause highly lethal under ride collisions, in which a smaller vehicle, such as a passenger sedan, slides under a larger vehicle, such as a tractor-trailer. The platform bed of a typical tractor trailer is at the head height of seated adults in a typical passenger car, and can cause severe head trauma in even a moderate speed collision. In addition, modest mismatches between SUV bumper heights and passenger car side door protection have allowed serious injuries at relatively low speeds.



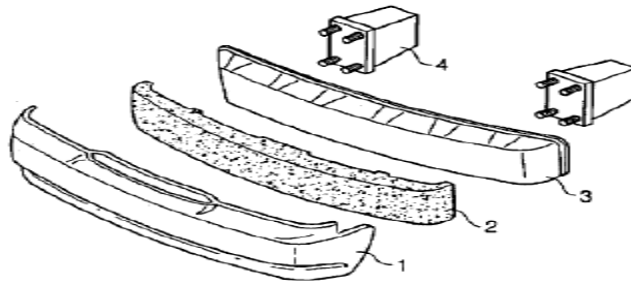
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II. RELATED WORK

A bumper is a car shield made of steel, aluminum, rubber, or plastic that is mounted on the front and rear of a passenger car. When a low speed collision occurs, the bumper system absorbs the shock to prevent or reduce damage to the car. Some bumpers use energy absorbers or brackets and others are made with a foam cushioning material. The car bumper is designed to prevent or reduce physical damage to the front and rear ends of passenger motor vehicles. Generally, a bumper is attached to either end of a vehicle to absorb impact in a collision, thereby protecting passenger. As shown in Fig2.1, a conventional bumper system comprises a bumper cover 1 defining an outer appearance of the bumper system, an energy absorber 2 formed of an elastic material such as a polypropylene foam body or an urethane foam body to absorb energy, an impact beam 3 for supporting the energy absorber 2, and a stay 4 for connecting the impact beam 3 to a vehicle body.



III. DESIGN

BUMPER SYSTEMS

Bumper systems, Metal face bar system, Plastic fascia and reinforcing beam system, Plastic fascia, reinforcing beam and energy absorption system

BUMPER COMPONENTS

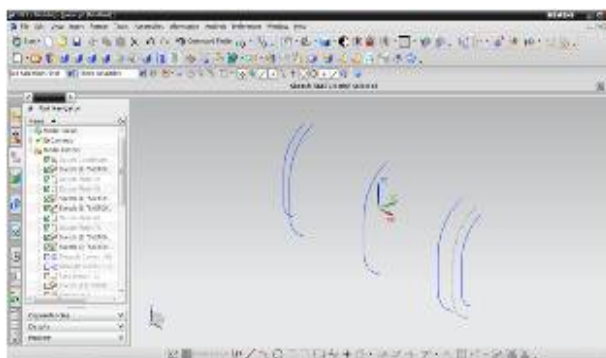
Fascia, Energy absorbers, Face bar, reinforcing beam,

TYPES OF BUMPER BEAMS

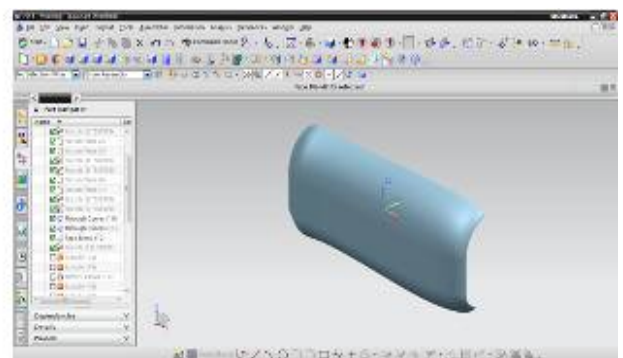
Steel Reinforcing Beams, Steel Face bars, Plastic Reinforcing Beams, Aluminum Reinforcing Beams,

BUMPER MATERIALS

Steel Materials, Aluminum Alloy, Plastic Materials (a) polypropylene (b) polyurethane



Sketch for Bumper

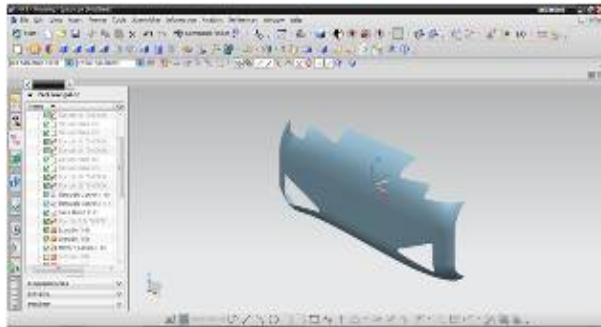


Material adding with through curves tool

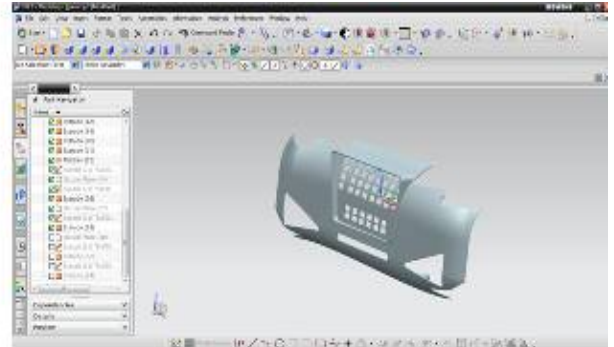
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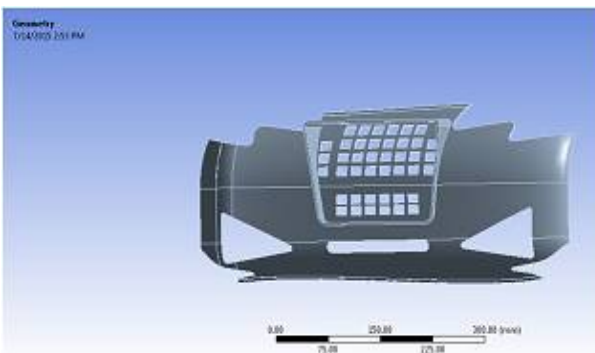
Bumper component with Fog Lamp Holders



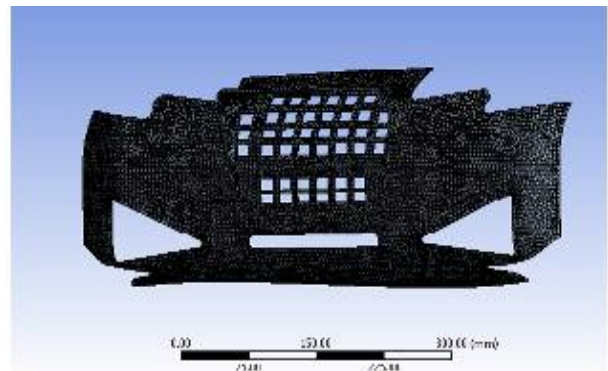
Final Bumper

IV. ANSYS

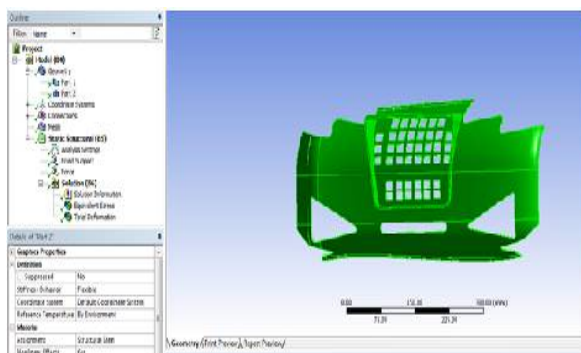
Steps in Ansys: Pre-processor phase – Material Properties – Meshing – Solution Phase – Displacement – Force – Pressure - Static analysis- Post processor – Result- Graphs



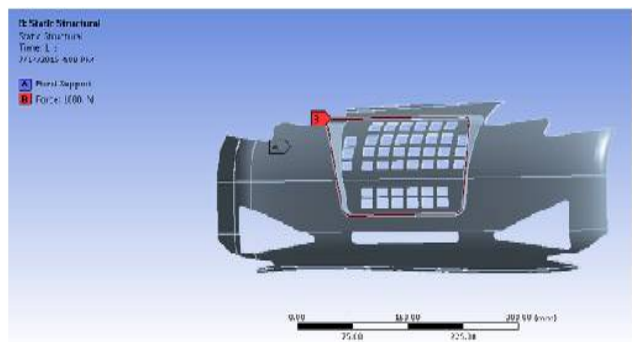
Geometry of Bumper



Mesh



Structural Steel

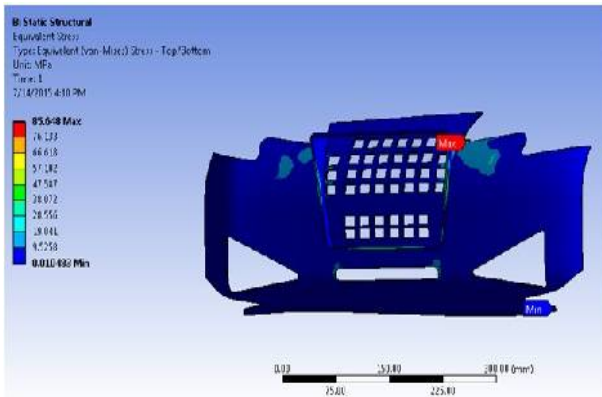


Force at 1000N

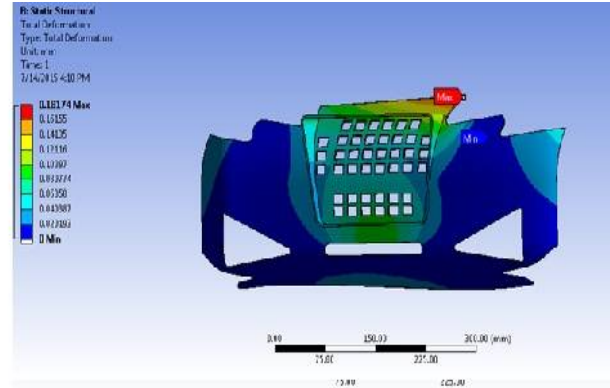
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Equivalent Stress at Force 1000N for Structural Steel



Total Deformation at Force 1000N for Structural Steel

Note: The Material Properties like Steel, Stainless steel, Titanium Alloy, Polypropylene, Thermoplastic olefin and the loads 1000N, 2000N has done in ANSYS same as above process by comparing the results finally gave one conclusion which is suitable

V. RESULT

From Static - Structural Analysis:

Bumper component undergoes for loading conditions;

Force at 1000N and 2000N

And the corresponding Stress and total Deformations were tabulated in the below table for each material.

STRUCTURAL STEEL

STRUCTURAL STEEL			
S.NO	LOAD In N	STRESS In N/mm ²	TD In mm
1	1000	85.648	0.1817
2	2000	171.3	0.3634

Table: Structural Steel

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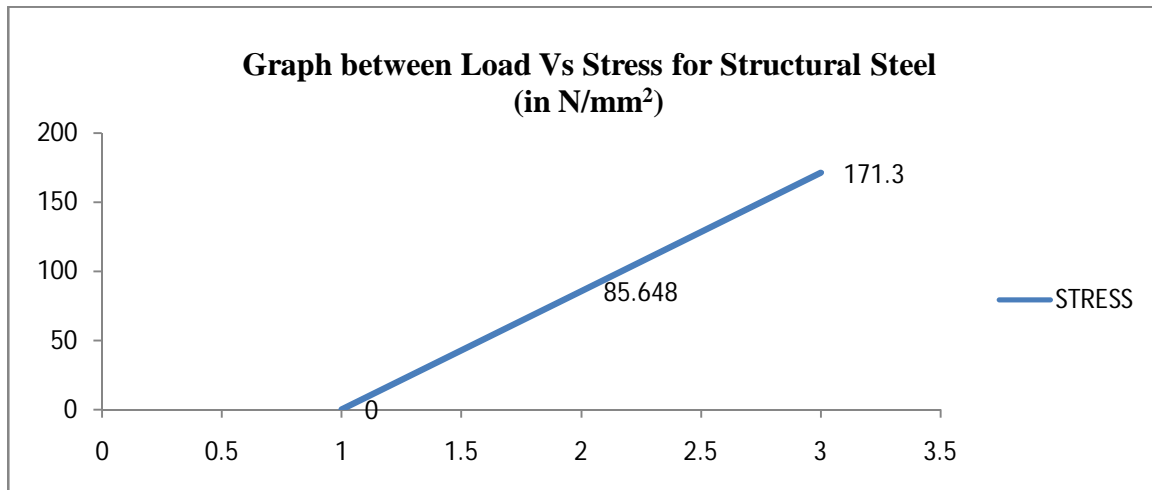


Fig: Load Vs Stress for Structural Steel

VI. CONCLUSION

Metals:

By comparing the results among these three materials, the Equivalent Stress is less for Stainless Steel at 1000N & 2000N. And if we consider the Total deformation, Structural Steel is better than Stainless Steel, but we have to look for life of the components. So, Stainless Steel is the suggested material among these to get the maximum life.

Plastics:

In these days we are using most of Plastics than metals for automobile parts. If we really want to select plastics instead of metals, TPO is the better one than Poly Propylene.

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