Impact Analysis on Honey Comb Structured Go-Kart Bumper Using Ansys R19.1

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ABSTRACT: ***Automotive bumper plays very important role in absorbing impact and shocks. This paper deals with the parameters of automotive front bumper such as shape and impact condition have been studied to improve the crashworthiness and passenger's safety. The simulation and analysis of bumper done beneath standard-velocity impact as per the standards of Federal motor vehicle safety (FMVSS No. 581) and Insurance Institute for Highway Safety (IIHS). The strength of the bumper elastic mode is investigated and premeditated with energy absorption and impact force in most deflection state of affairs. Similar bumper fabricated from Resinasepoxi material with honeycomb like structure are simulated to determine the distortion forces, impact force, stress diversities and distribution and energy-engrossment behaviour, these attributes are compared with each other to find best fit on safety parameters. The results show that bumper with internal honeycomb like structure can minimize the bumper distortion forces, impact force, stress diversion and distribution, energy-engrossment behaviour, maximize the elastic strain energy. In addition, the effect on passenger's compartment in the impact behaviour is also examined.***

KEYWORDS: ***Bumper, Design, automotive, go-kart, analysis, impact, safety, Honey comb.***

I. INTRODUCTION:

Road crash are happening every day. Nevertheless, we must consider the statistics – Nearly 1.3 million people die in road crashes each year, on average 3,287 deaths a day[1]. These numbers urge for the necessity to develop the safety of automobiles during accidents. Automotive vehicle's bumper major role in safety records in passenger cars. Automotive vehicle Bumper is designed to reduce physical damage at the front and other ends of the motor vehicles especially cars in collision condition. They defend the passengers by objecting the impact and that they additionally shield trunk, hood, fuel, grill, exhaust and cooling system moreover as safety connected instrumentality like headlamps, parking lights, and taillights, etc. [2]. Every country has their own various performance standards for bumpers and their deigning. Under the International safety regulations originally evolved as European standards and now adopted by many countries all over the world, a car's safety systems still operate normally after a straighten pendulum or moving-barricade impact of 4.02 Kmph (2.5 mph) to the front and the rear, and to the front and rear end region of 2.57 Kmph (1.6 mph) at 445mm above the ground with the vehicle loaded or unpacked.

Revised Manuscript Received on April 07, 2019.

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We took (FMSS: Federal Motor Vehicle Safety Standards (FMVSS No. 581) and Insurance Institute for Highway Safety (IIHS)) standards [3]. Theseregulations are accepted by automotive research association of India, so it is used for our analysis.

II. ADVANTAGES OF HAVING BUMPER:

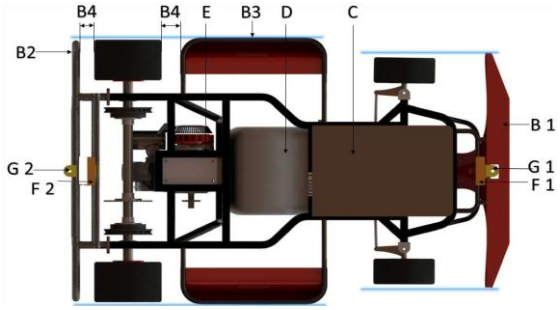
A Bumper is horizontal structure fixed or integrated with the front end and at the back end of an automobile, to absorb impact during collision and to stabilize the vehicle byprotecting passenger compartment and body.

(**Fig.1**): GB 101 Front bumper Vitara Brazza (source: goldsun.in/gb101).

They defend the passengers by objecting the impact and that they additionally defend trunk, hood, fuel, grill, exhaust and cooling system additionally as safety connected instrumentation like headlamps, parking lights, and taillights, etc.

III. GO-KART BUMPER:

Bumpers are mandatory for all the sides of the Kart. It should be very strong so that during collision it should not allow the impact to driver seat compartment. It should not be less than outer most point of tires as shown in figure (Fig. 2) with blue line. Minimum height of bumper of rear and left-right side is 5inches from the lower base of chassis/frame. There is no restriction in type of pipe for manufacturing bumper, but it must be of metal and rigidly attached with chassis. Bumper covering/bumper body works can be of glass fiber or plastic but must be rigidly attached.



(**Fig.2**): Demonstrate view of Go-kart.

B1- Front bumper;B2- Rear bumper ;B3- Side bumper ; B4- Gap between tire and bumper must be at least 3 inches on either side ; C- Leg compartment; D- Seat compartment ;E- Engine compartment ; F1- Front jack point ;F2- Rear jack point ;G1- Front Hitch point ;G2-Rear Hitch point.

(Fig.3): Animated view of Bumpers of a go kart.

For design of bumper we have considered ISIE standard parameters which is combinedly accepted by ISIE, FMSCI.

IV. DESIGN:

We have used ANSYS R19.1 software to design for dynamic analyse of impact. Which is a software used for ultimate discovery of results,

(Fig.4): Official ANSYS R19.1 logo.

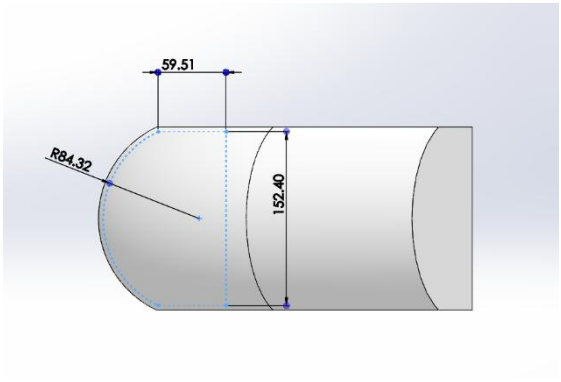
ANSYS 2019 R1 delivers the speed, gracefulness and accessibility that engineers — in the slightest degree levels of experience — can leverage to develop and deliver next-generation merchandise. With bigger simple use and new functionalities throughout the ANSYS software system portfolio, this latest unharness permits additional engineers to harness the ability of ANSYS' Pervasive Engineering Simulation solutions

CASES:

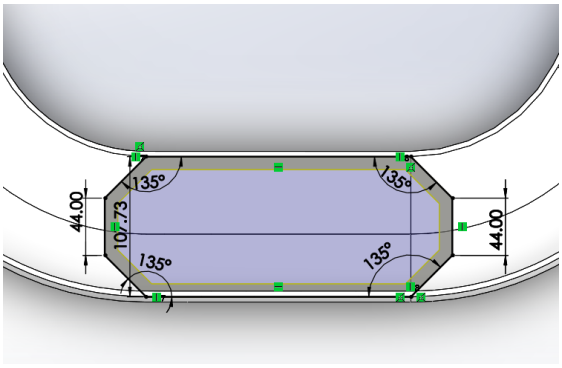
1) D-shape cross sectional hallow bumper.
2) D-shape cross sectional hallow bumper with honey comb structure inserted internally (Fig.6).

V. DIMENTIONS:

We have taken standard dimensions suggested in FMVSS NO. 581 and IIHS as mentioned in Fig.5 and Fig.6



(Fig.5): Bumper cross section and dimensions in mm.



(Fig.6): Sectional view of honey comb structure inserted inside the bumper.

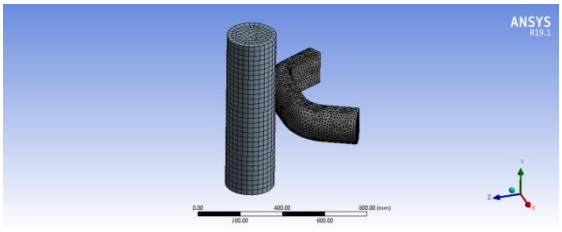
MATERIAL:RESINAS EPOXI.

BOUNDARIES:

3) Rigid body condition (wall).
4) Movability or velocity conditions(kart)
5) Fixed body condition.

ANSYS MESHING:

ANSYS Meshing is the command used to mesh the component so that the system will analyse the component in finest element method. It constructs the most appropriate mesh for accurate, well organized Multiphysics solutions. A mesh well enhances the respective of component and generate appropriate metaphysical for all parts in a model. The power of parallel processing is automatically used to minimise the time you must wait for mesh generation as shown in Fig.7.



(Fig.7): under meshing command.

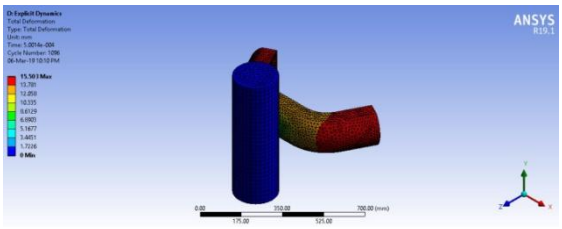
Creating the most suitable mesh is the foundation to engineering analysis &simulations. ANSYS Meshing is intellectually known of the type of solutions were used in the model and has the utmost criteria to develop the best suited mesh. The Meshing tool is automatically integrated with every solver within the ANSYS Workbench territory. The Meshing tool chooses the most suitable options based on the analysis and design type and the geometry of the model.

VI. RESULTS:

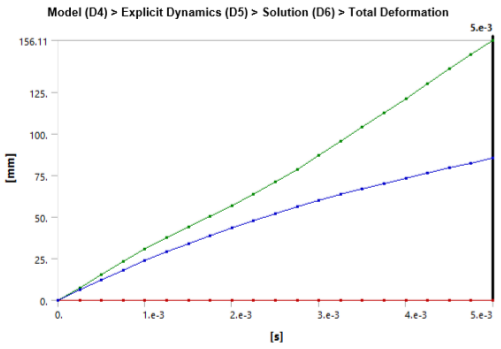
1) Total deformation.
2) Eqivalent stress.
3) Eqivalent elastic strain.

TOTAL DEFORMATION:

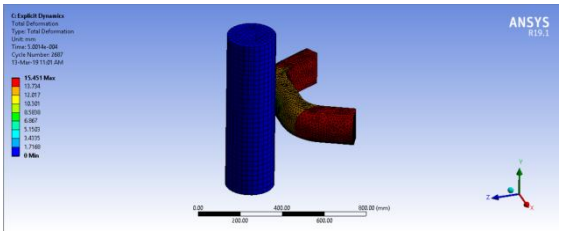
we generated the result of a distortion proses for both the cases (with honey comb structure and without honey comb structure).



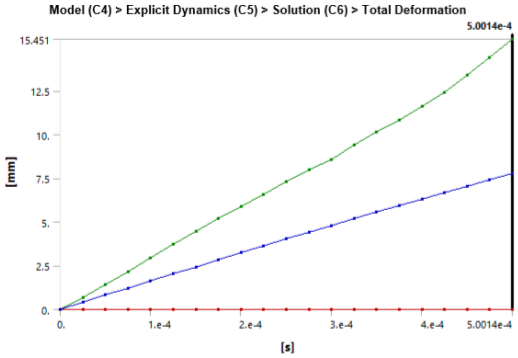
(Fig.8): Total Deformation without honey comb structure.



(Fig.9): Plot of Total Deformation without honey comb structure.



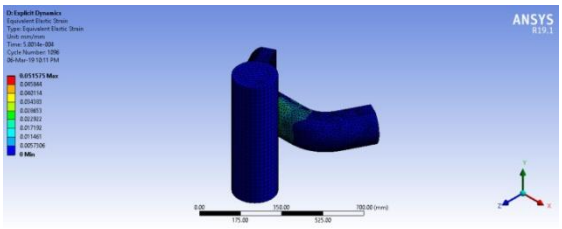
(Fig.10): Total Deformation with honey comb structure.



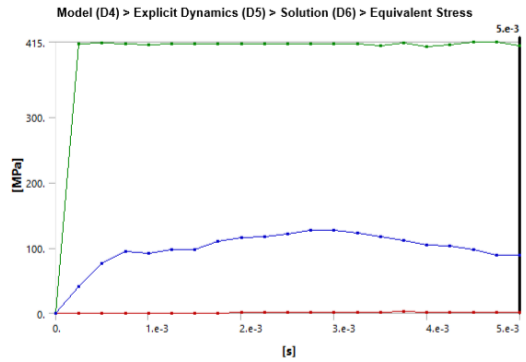
(Fig.11): Plot of Total Deformation with honey comb structure.

EQIVALENT STRESS:

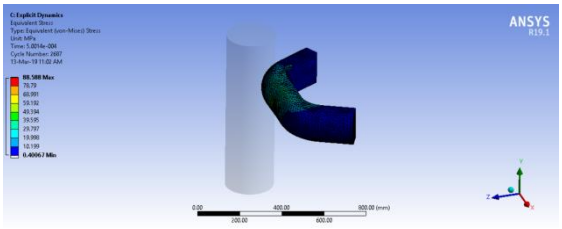
we generated the result of a Equivalent Stress for both the cases (with honey comb structure and without honey comb structure).



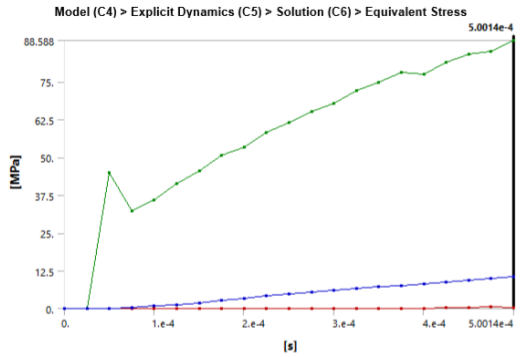
(Fig.12): Equivalent Stress without honey comb structure.



(Fig.13): Plot of Equivalent Stress without honey comb structure.



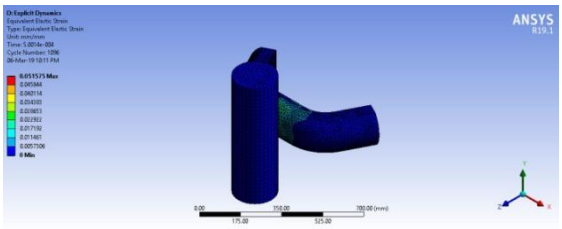
(Fig.14): Equivalent Stress with honey comb structure.



(Fig.15): Plot of Equivalent Stress with honey comb structure.

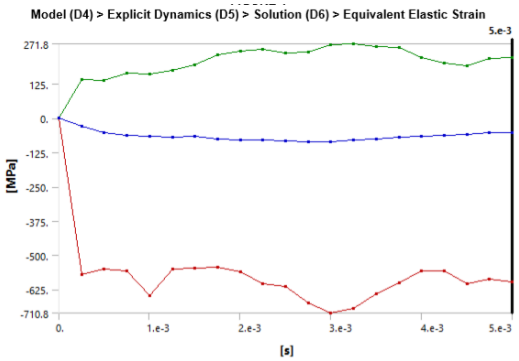
VII. EQIVALENT ELASTIC STRAIN:

we generated the result of a Equivalent elastic strain for both the cases (with honey comb structure and without honey comb structure).

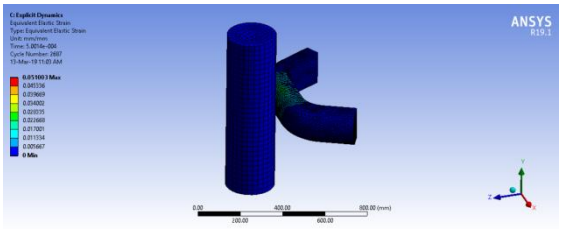


(Fig.16): Equivalent elastic strain without honey comb structure.

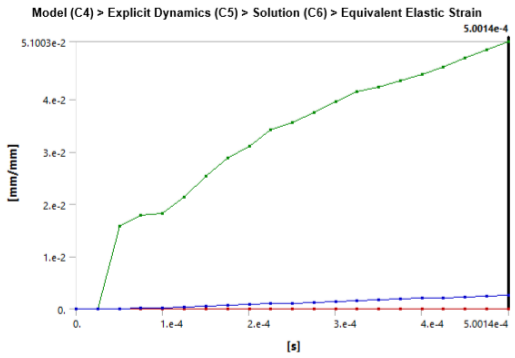
Internal strain with in the bumper have be analysed and plotted the results obtained.



(Fig.17): Plot of Equivalent elastic strain without honey comb structure.



(Fig.18): Equivalent elastic strain with honey comb structure.



(Fig.18): Plot of Equivalent elastic strain with honey comb structure.

VIII. CONCLUSION:

The parameters of automotive front bumper such as shape and impact condition have been studied to improve the crashworthiness and passenger's safety. The simulation and analysis of bumper done beneath standard-velocity impact as per the standards of Federal motor vehicle safety (FMVSS No. 581) and Insurance Institute for Highway Safety (IIHS).The strength of the bumper elastic mode is investigated and premeditated with energy absorption and impact force in most deflection state of affairs. Similar bumper fabricated from Resinasepoxi material with honeycomb like structure are simulated to determine the distortion forces, impact force, stress diversities and distribution and energy-engrossment behaviour, these attributes are compared with each other to find best fit on safety parameters. The results show that bumper with internal honeycomb like structure can minimize the bumper distortion forces, impact force, stress diversion and distribution, energy-engrossment behaviour, maximize the elastic strain energy. In addition, the effect on passenger's compartment in the impact behaviour is also examined which indicated that bumpers having honey comb like structure internally have better standards regard safety.

FURTHER INVESTIGATION:

This paper helps in developing new ideas in designing internal structured bumpers for the safety of passenger compartment. Using deferent materials considering all the design parameters same design can be analysed and best suitable material can be suggested.

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