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IMPACT ANALYSIS OF BUMPER AND FASCIA OF HEAVY LOAD CARRIED VEHICLE

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Abstract:- ***As long as Bumper and Fascia parts of vehicles are looking well and stylish. The safety, reliability, and comfort of vehicle analyze by design software technologies. This paper work explains the part of the energy transfer and uniform stress distribution and high stress concentration areas upon impact. We are utilizing tools as solid works for modeling, hyper mesh to mesh, ls-dyna for analysis. The actual ideas, system of procedures are displayed under. Finally we found results of stress concentration areas and energy analysis of crash box with aluminum foam upon impact and design is modified accordingly. By using this work we found that high stress effecting areas of fascia and bumper upon collision. We know front part of deformation under different loading conditions of impact. To minimize the damages of vehicle and form uniform deformation upon impact.***

Keywords: Design calculations, simulation, crash box and hyper mesh

Introduction:-

In front of vehicle Fascia and bumper parts are played major role. If there is an occurrence of accident ,it absorb energy and safety to vehicle. This is authorized by means of the formability of bumper and strong retention amid an effect. The accident ability of the fascia and bumper ought to likewise meet overall direction with respect to the well being of traveler this paper portrays the non-linear static recreation hardly performed on a truck front bumper and Fascia. In this section show a clear preface of truck front bumper and Fascia, high stress concentration point and uniform stress deformation. Crash boxes absorb the energy transferred after fascia, energy absorbers and bumper beam shown in figure.1.

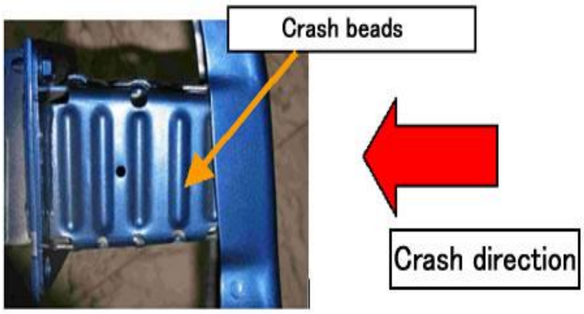

Figure.1.Crash box.

2. Development of Design and its approach:-

The bumper should be a very strong, to design solid necessities to be met by the bumper and Fascia. On impact Fascia easily damaged so bumper will come in contact with the high impact loading conditions.

We are taking a fascia and bumper of a heavy vehicle. Using a material is A286 iron base super alloy. The design of fascia and bumper emerge the hyper mesh [14] and meshed bumper and fascia assembly shown in figure 2.

The following points are important for design of fascia and bumper assembly:

- To clearly separate requirements from the means of achievements.
- Compare high-level goals and decisions, thus involving designer to understand, how to selection of manufacturing solutions impacts the achievement.
- To accurately communicate the decomposition of requirements and strategic objectives.
- As a designing effective parts on specific commercial enterprises.
- Research to take up a reasonable capability of design. Careful observation of the major portion of energy during a collision.
- Crash box located in between chassis frame and the bumper beam.

After Mesh of bumper and fascia simulate by using hyper view. The simulation of bumper and fascia results as shown in figure. By this results to know the stress deformation and different colors indicates the different portion of stress. The design of crash box with aluminum foam pre-processing in hyper mesh as shown in figure.

A-286 **stainless** steel (**UNS S66286**) is a precipitation hardening alloy that combines high strength and good corrosion resistance at temperatures up to 704 degree censies. The super alloy A-286 is an iron-based high temperature and high strength.

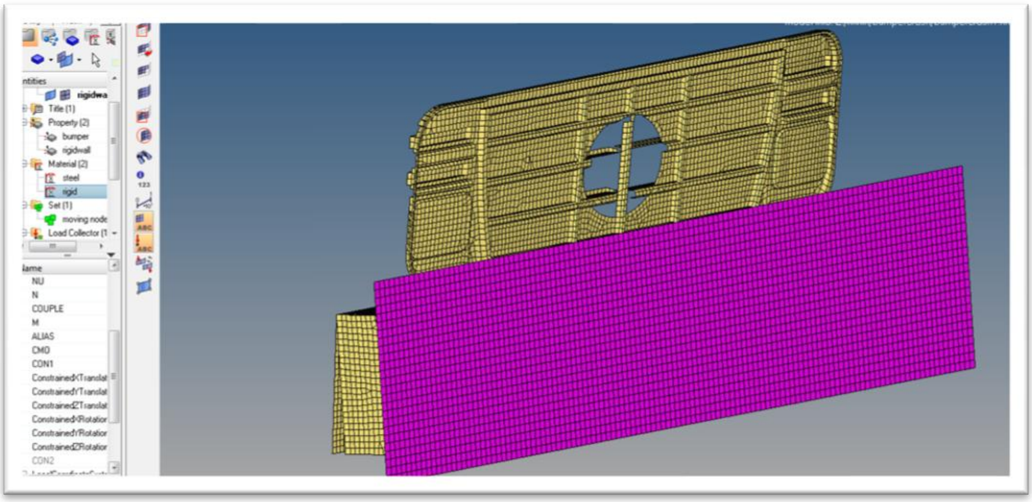

Figure no.2. Meshed bumper and fascia assembly.

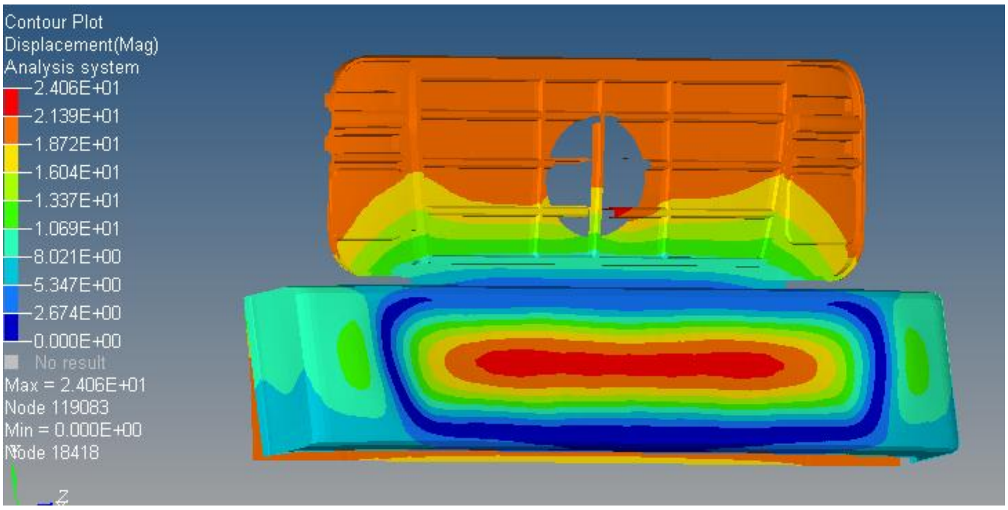

Figure no.3. Finalsimulation results of bumper fascia assembly in hyper view.

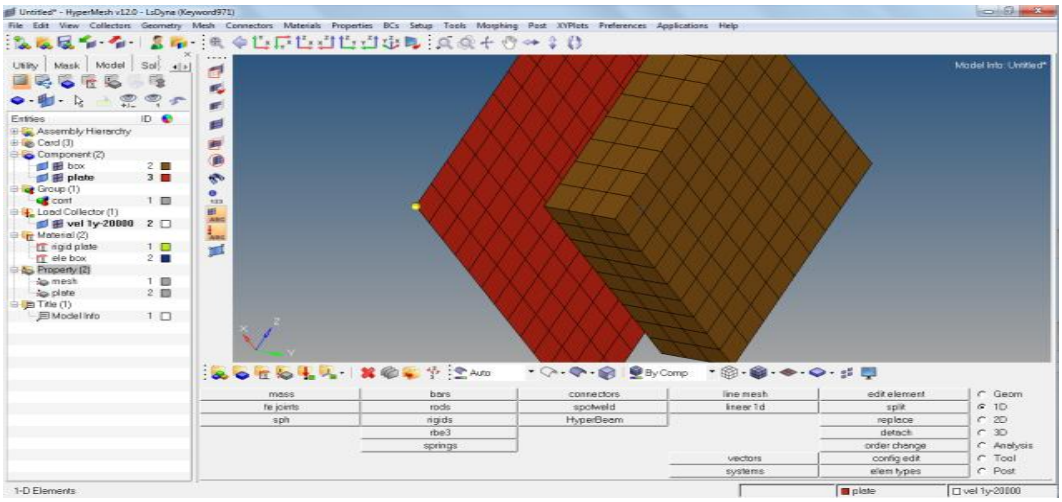

Figure.4.Mesh of crashbox with al foam

3. Material properties table:-

Table no. 1. Fascia and Bumper assembly properties

Bumper fascia assembly	**Properties**
Material	**A286 IRON BASE SUPER ALLOY**
Model type	**Linear Elastic Isotropic**
Yield strength	**5.05e+006 N/m^2**
Tensile strength	**5.6e+008 N/m^2**
Compressive strength	**4.35e+008 N/m2**
Elastic modulus	**7.3e+010 N/m^2**
Poisson's ratio	**0.34**
Mass density	**2815 kg/m^3**
Shear modulus	**2.68e+010 N/m^2**
Thermal expansion coefficient	**2.4e-006 /Kelvin**

Table no.2.Fascia and bumper mesh properties

Mesh type	**Shell Mesh**
Mesh Used	**Curvature based mesh**
Maximum element size	**28 mm**
Minimum element size	**4.5 mm**
Total Elements	**201473**
Total Nodes	**4015422**
Mesh Quality	**High**

4. Resultsand Discussion:

At 30 mm/ms is approximately 60 km/hr, the maximum displacement in bumper and fascia assembly is 24mm in the middle region(fig.3) and is safe for operation. Total kinetic energy is decreased to 0 km/hr at 1.6 milliseconds and same increase in internal energy.

After impact occurs, the vehicle spring back from the barrier. During this period, vehicle is experience continues acceleration in the same direction. This phenomenon is expressed more formally through the application of Newton's second law of motion,

$$F=ma \ldots\ldots\ldots 4.1$$

Where F is force,m is mass,a is acceleration.

Where acceleration can be represented by the change in velocity with respect to time,

$$a = (Vf – Vo)/\Delta t \ldots\ldots\ldots\ldots 4.2$$

Vo is initial velocity and Vf is the final velocity .

Substituting eq.4.1 the Newton's second law yields:

$$F = m\{(Vf – Vo)/\Delta t \} \ldots\ldots\ldots\ldots\ldots 4.3$$

From this equation, it is clear that as the time of the collision decreases.

As comparison kinetic energy v/s time of crash box with and without aluminumfoam as shown in figure.5.

As comparison reaction force v/s time of crash box for with and without aluminum foam as shown in figure.6.

Table.2.Comparison of reaction force of empty crash box and Aluminum foam filled crash box

Profile	Initial reaction force	Units
Empty crash box	183	KN
Aluminum foam crash box	243	KN

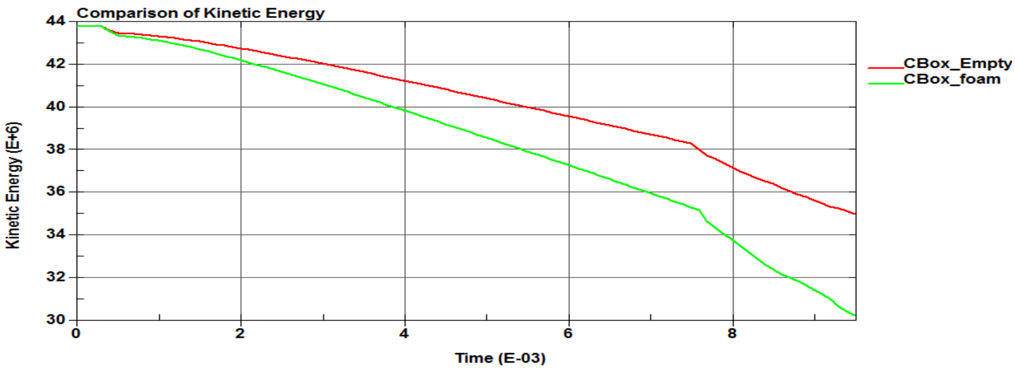

Figure.5. Comparison of kinetic energy

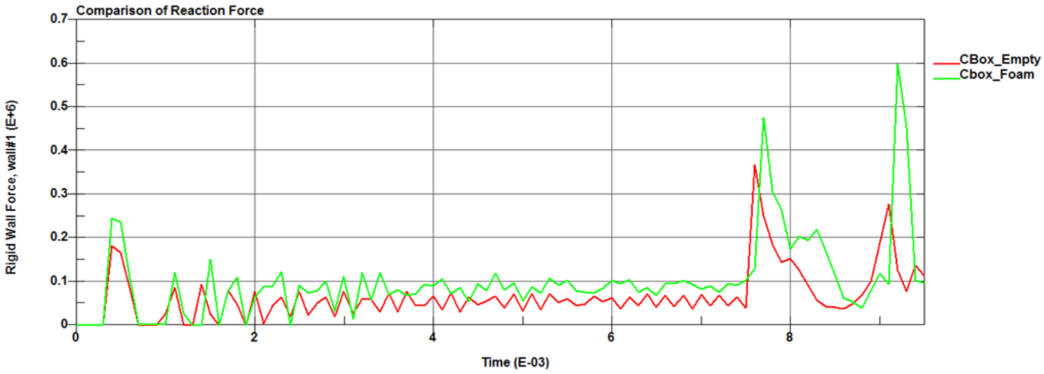

Figure.6.comparison of reaction force.

In this graph, red line are indicated empty crash box and green line indicated crash box with aluminium foam.

5. Conclusion:

- Impact analysis is done for different components and is safe for operation.
- The 60 km/hr speed of heavy vehicle hit a rigid wall,total kinetic energy reduces to 0 km/hr in 1.6 millisecond and increase internal energy.
- Conclusion of crash box with aluminium foam is safe for operation.

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