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Structural Analysis on Cross Car Beam by Varying Materials

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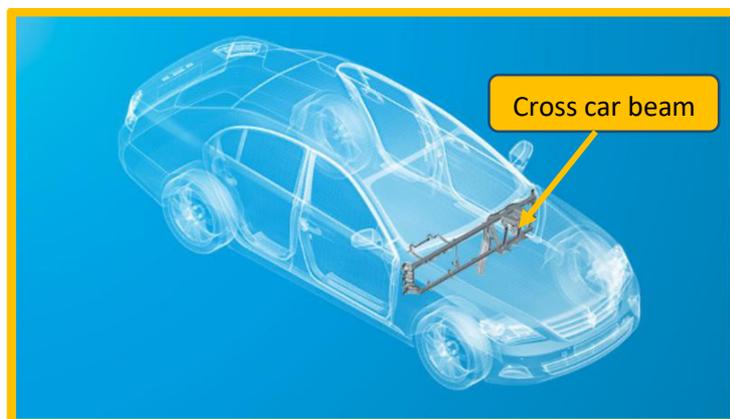
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ABSTRACT: In the present study we have taken Cross car beam (CCB) for the consideration whereas it was the rigid metal body or structure component that helps for the entire fixation of the instrumental panel and front dash board. It acts as the main column whereas the entire front system is mounted on it. Theccb is hinged or attached at the sides of it to the main structure that is body in white. The design of the ccb doesn't change from internal combustion engine to electric but there may be slight change for the fixations mountings compared to EV with Ic engine vehicles because of more switches and knots engines. According to the resource the weight of the cross car beam weight up to 20 to30 percent of the weight of the metal panel inside the car. The cross car beam is the backbone of the metal panel. From a structural point of view, the ends are mounted on the body walls and firewall, and there needs to be adequate support for the structure of the steering column for both the safety and comfort of the driver.in this project we have taken Cross car beam is created in the model in Catia V5 that was saved in STP file and later analysis was carried out on wheel hub with five different materials at two different rpms. And later it was taken into simulation to know the deformations and stress values in this present project strength materials, design of machine members, and finite element analysis was taken into consideration.

KEYWORDS: Cross car beam, structural analysis, CATIA v5, FEM

I.INTRODUCTION

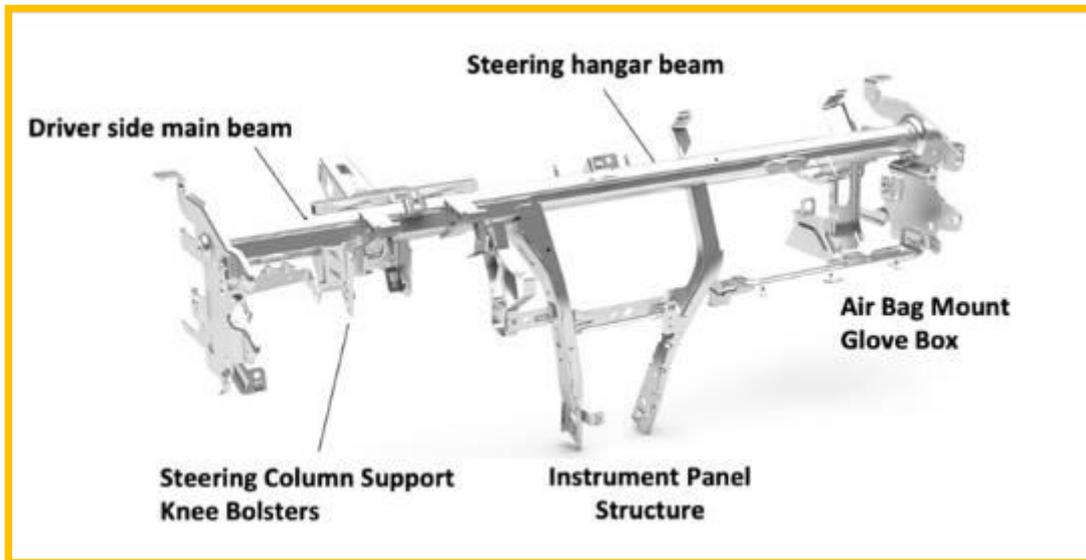
Cross-vehicle beams are complex parts, which contribute significantly to the stability and safety of all vehicles used. As a single cross inside the car they ensure that, in the event of a side hold the steering wheel, airbags, and the entire dashboard. Depending on the model, we can produce this important component in steel or aluminium.



There are many ways and materials to produce cross-vehicle beams. The base is a metal structure made of tube and plate. These are the lowest cost and the highest durability option, yet they are also the most difficult and costly to assemble. As traffic light grows in importance, other ways to make cross car beams grow in popularity. Another is the manufacture of aluminum extrusions. Another option for many items is using a mix of items. The third component is magnesium die casting which is very low, yet also very low in potency which can adversely affect NVH metrics, i.e.



vibration. Also, die castings require significant equipment investment, which is often a barrier to the system, and especially to low-volume EV systems



Design with Extrusions

Cross beams are less than twisted loads on the roads, so it is advantageous to use bare structures that naturally provide torsional strength. Aluminium extrusions have a clear advantage over weight-bearing designs because they are compact, easy to obtain, and easy to make.

II. MATERIAL AND MANUFACTURING PROCESSES

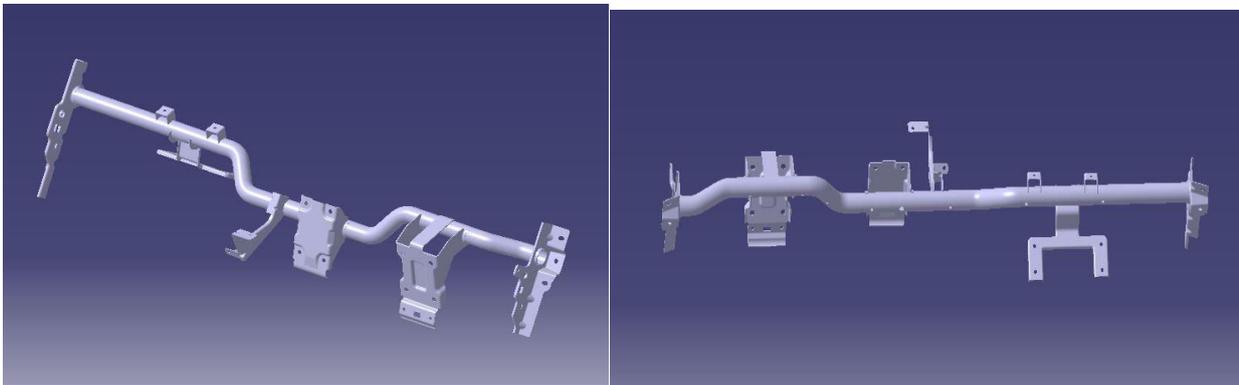
The Selection of material was the major task in order to get the accurate result with the best output. The Cadillac CTS system optimized the magnesium design by extrusions and cut 36% by weight. 6000 series alloys are standard, i.e. 6063 easy to remove, as well as solid 6061 and 6005A if required locally. Alloy preferences vary in product and production performance, and the example is that 6005A is sometimes preferred over 6061 or 6082 in a large tube because there is a slight distortion due to the quenching levels, as well as the welding, which also reduces the composite tolerance. Since it was structural component the strength to weight ratio must be taken into consideration as per the weight point of view from past mild steel is used for various rigid structures and structural steel was mainly encouraged for the bodies where there will undergo the huge load factor and supporting capacity of bearing loads on the structure. Whereas coming to Aluminium Alloy is combination of two or more materials but the aluminium Composition is of higher rate it has the higher loading capacity and coming to the weight point of view aluminium alloy is very light in weight compared to the two materials which we have taken for the study.

Material	Density in kgm-3	Poisson Ratio	Young’s modulus	Shear modulus	Bulk Modulus
Structural Steel	7850	0.3	2.e+11	7.6923e+10	1.6667e+11
Mild Steel	7856	0.31	2.1e+10	7.8367e+10	1.75e+005
Aluminium Alloy	2170	0.33	7.1e+10	2.669e+10	6.96e+10

Table 1 shows the materials properties

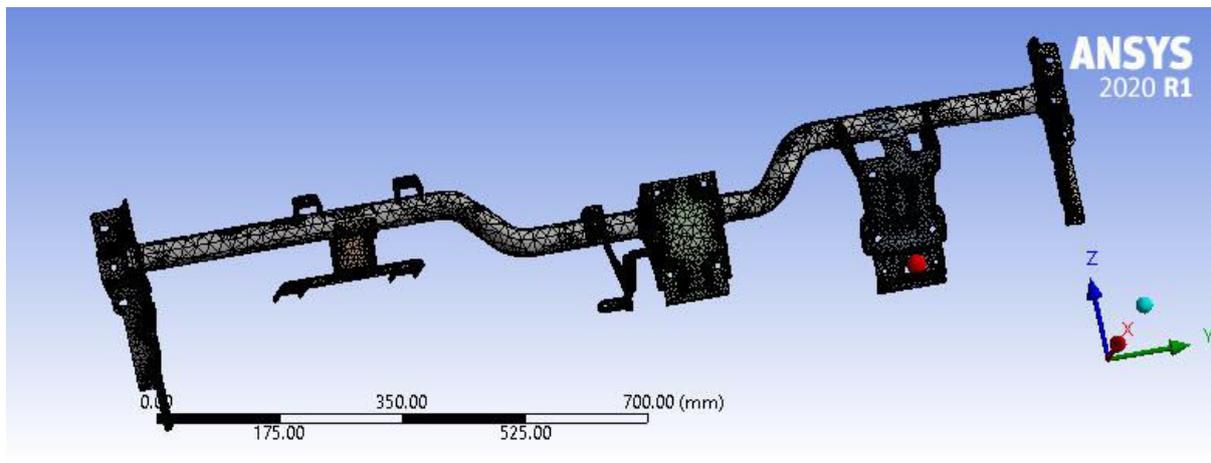
III. MODELLING AND ANALYSIS PROCEDURE

The modelling of the cross car beam was carried out in catia v5r21 Computer-assisted design programs are powerful tools for mechanical design and geometry of products and materials. There are many good reasons to use the CAD program to fund construction work The software allows the human user to transform the hardware configuration into a powerful design and production system. Procedure as follows Open the catia software and click on the start <Mechanical Design <design section. Identify the part of the feature that can be easily identified. Enter a single point point that acts as a reference point. Then create an axis system with location reference.: Select the body and axis needed to click the drawing to create the drawing.: Introduce the body as a large body to function as a large body and other activities will be done with the body as needed. Example: Remove, slot, handle etc. Click the profile command to draw the first drawing make sure the drawing should be tied and closed. The bound drawing is in green and the drawing analysis command is used to check if the drawing is open or closed. Get out of the drawing job bench. Build a drawing into a solid model of the required size Using the pad command from the drawing feature based on the drawing. Save the file in STP format that can easily open in A



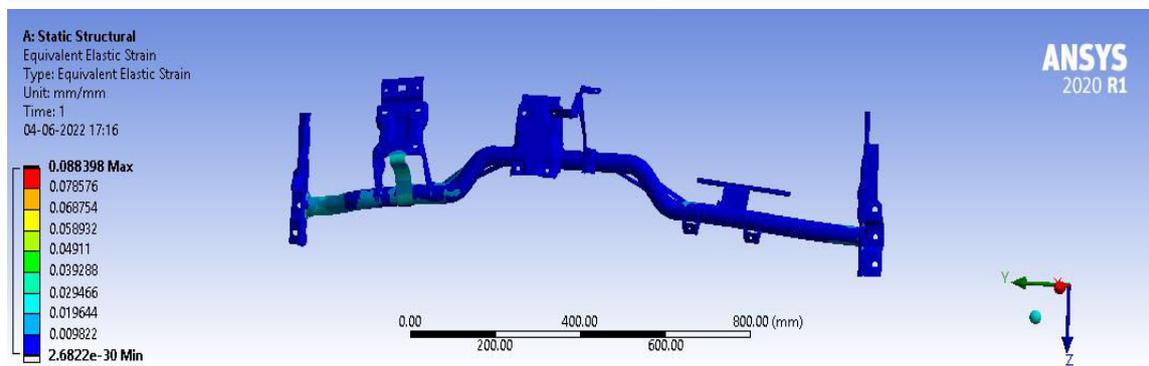
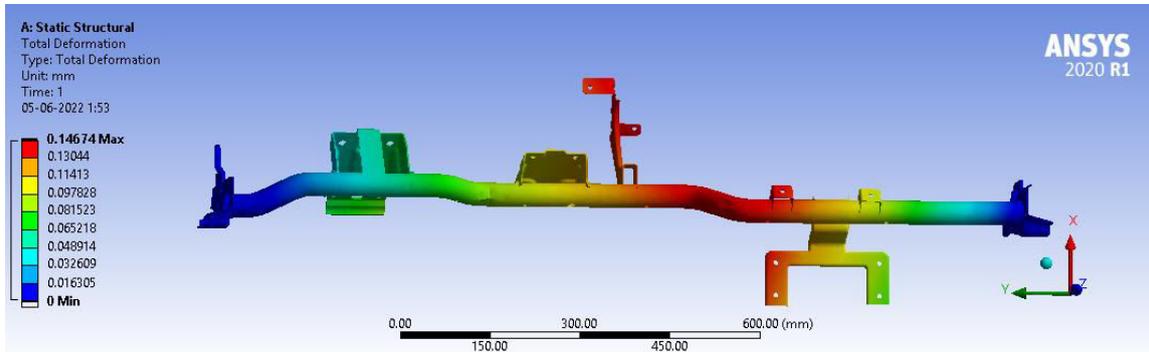
Mesh Presentation:

Meshing is an internal process of Ansys pre processing whereas it was a process of segregation of component into a small elements. there are different types of meshing such as mechanical, non mechanical linear and explicit dynamics and also depends on sizing of element that can be selected as per the requirement A good mesh generation provides the fine good quality of result. Meshing is a process of making irregular shape of the elements to a fine volume .

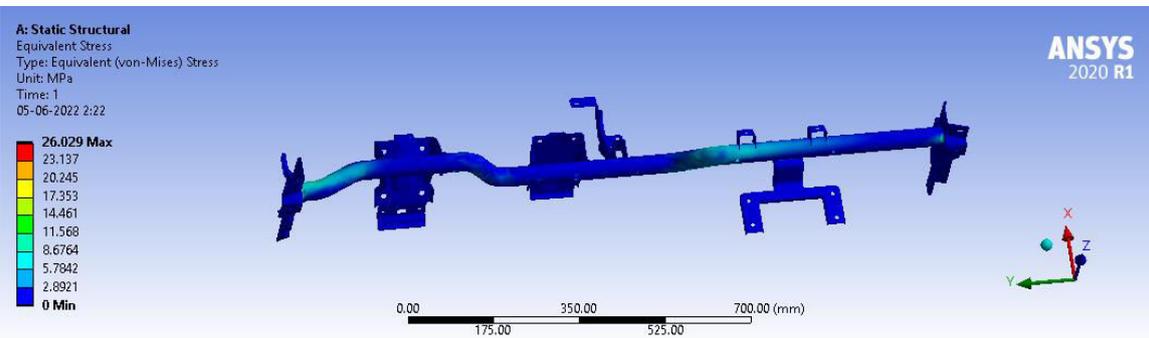
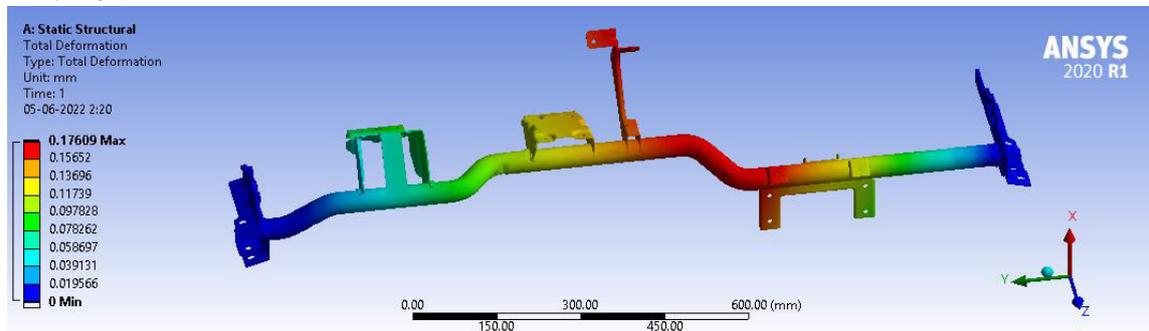


V. EXPERIMENTAL RESULTS

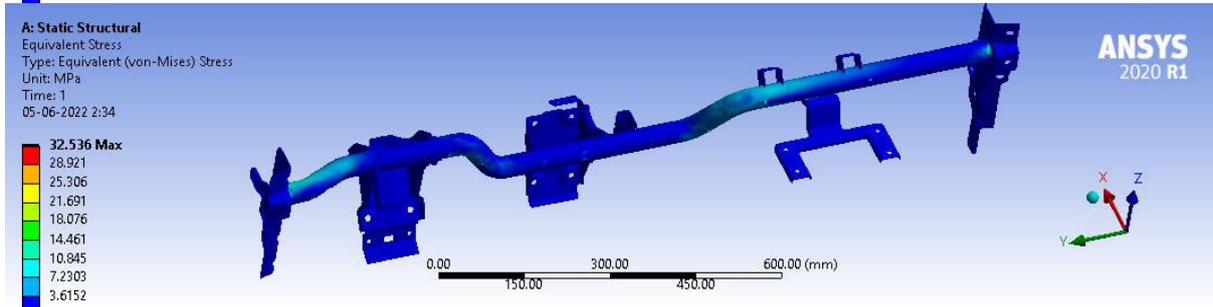
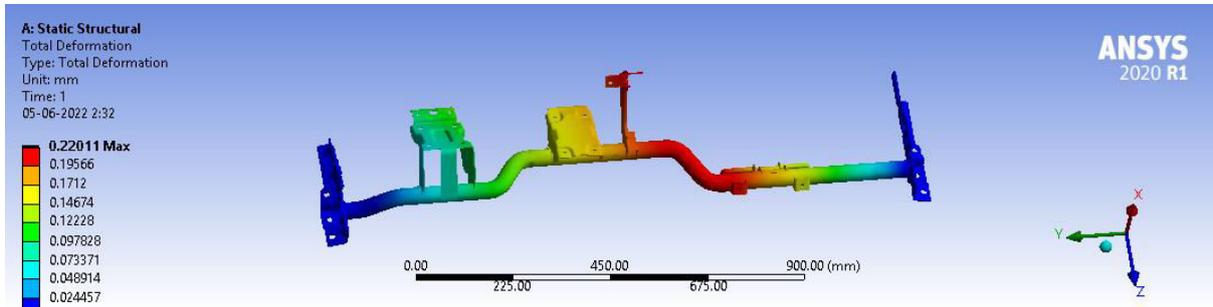
The experiment was carried out at 3 different applied force i.e 100N, 120N, and 150N and three different materials. At 100N With structural steel



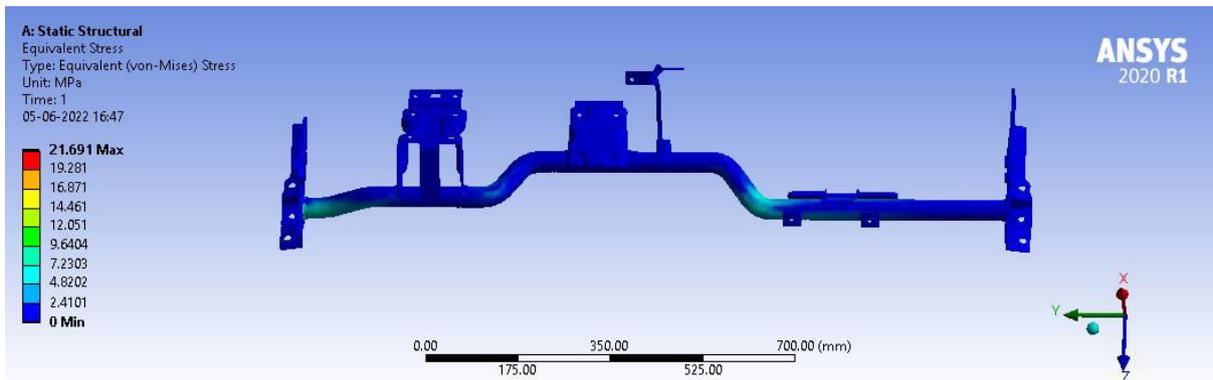
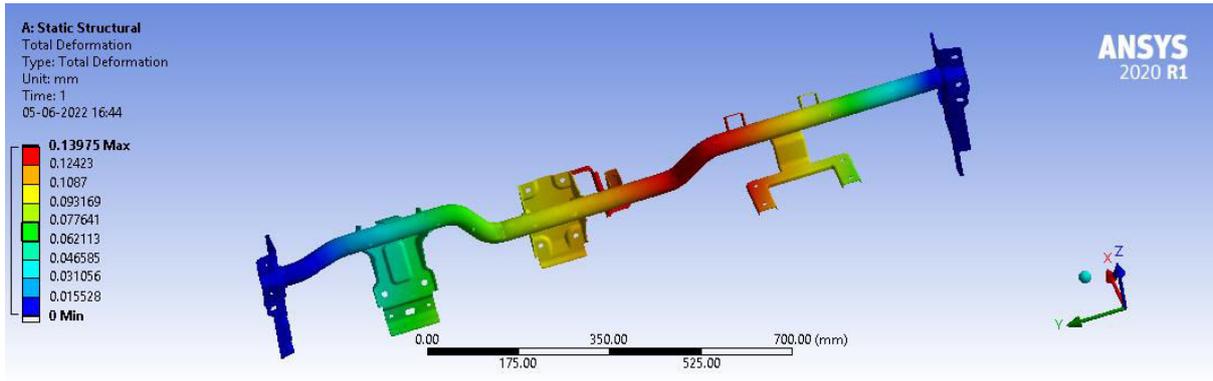
At 120N



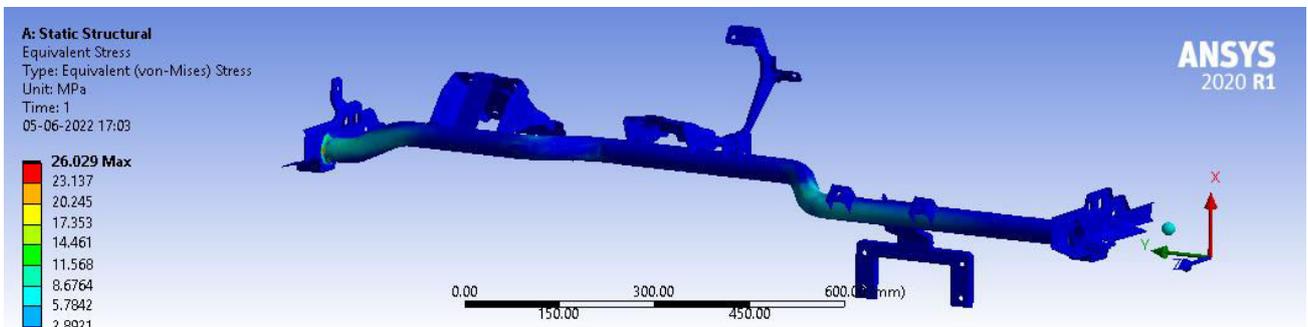
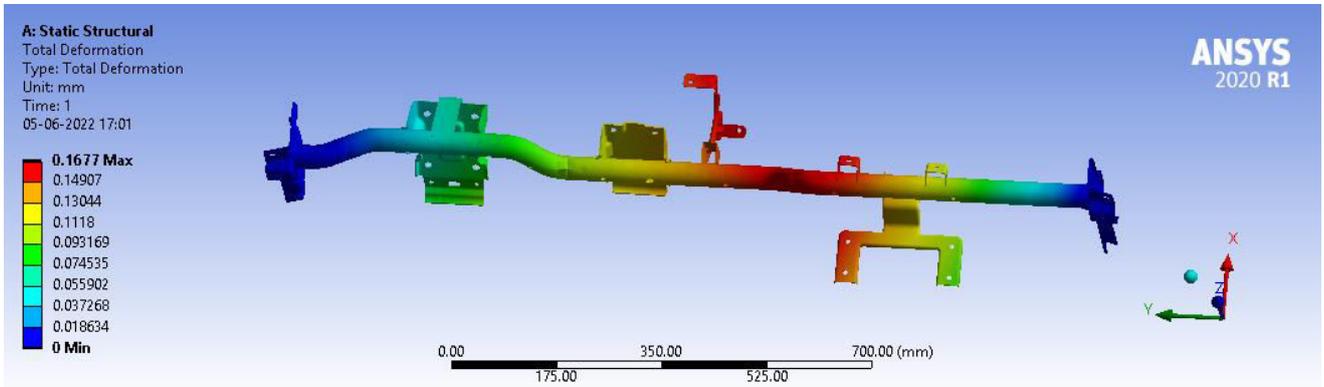
At 150N



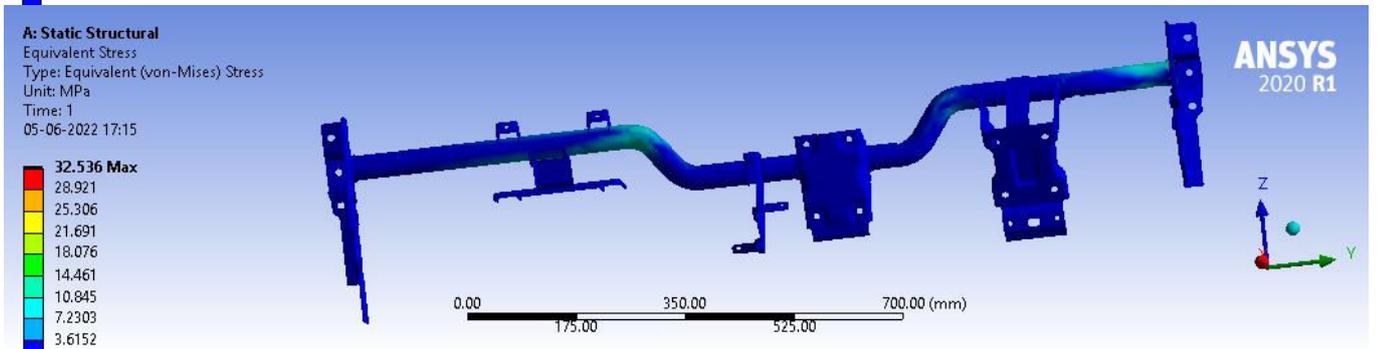
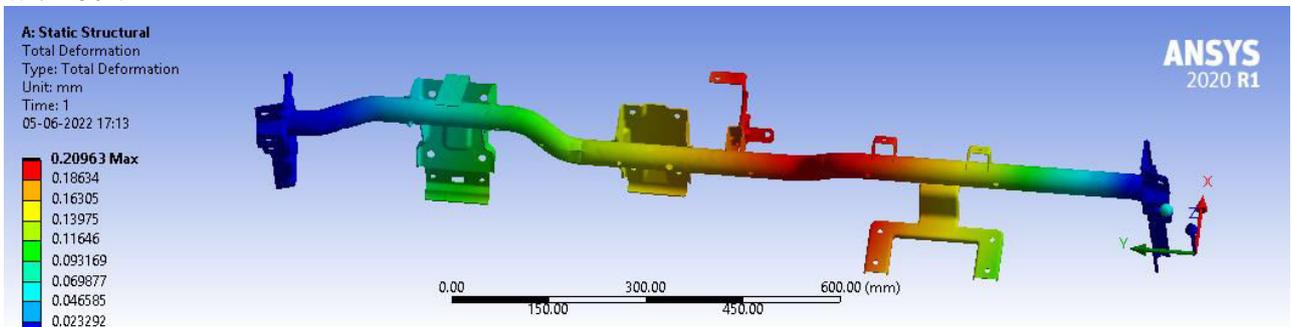
With Mild Steel At 100N



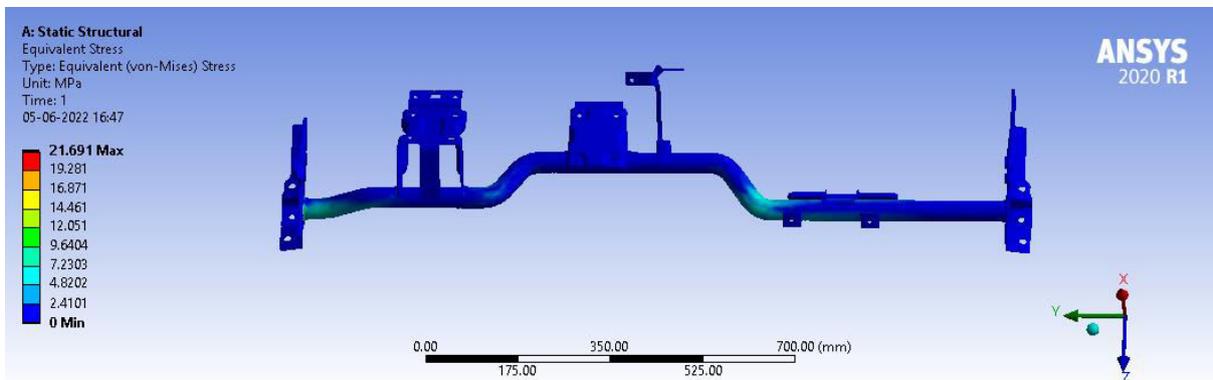
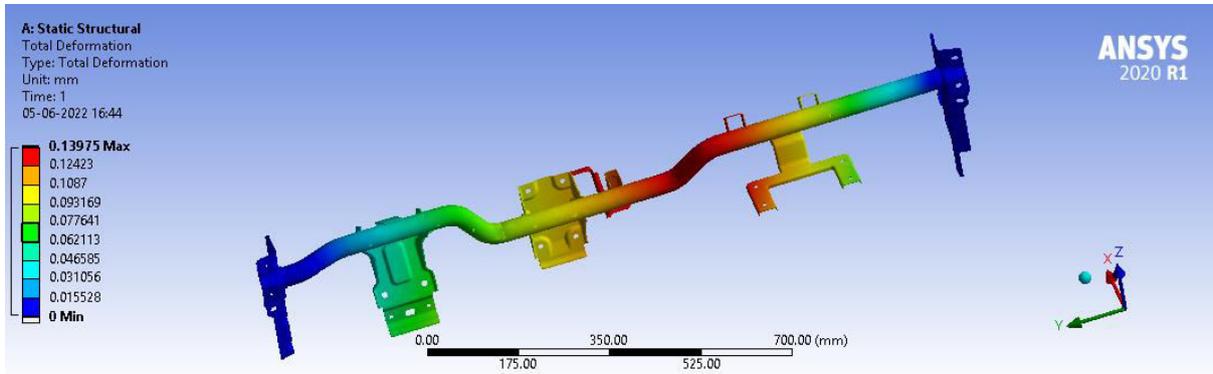
With 120N



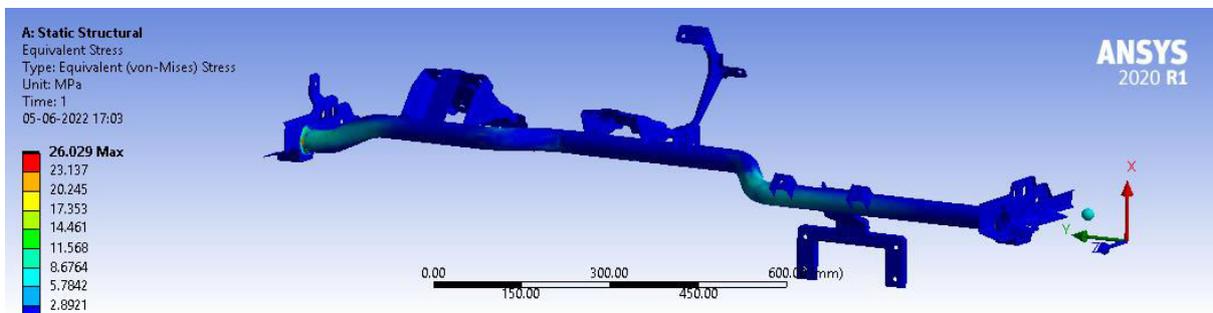
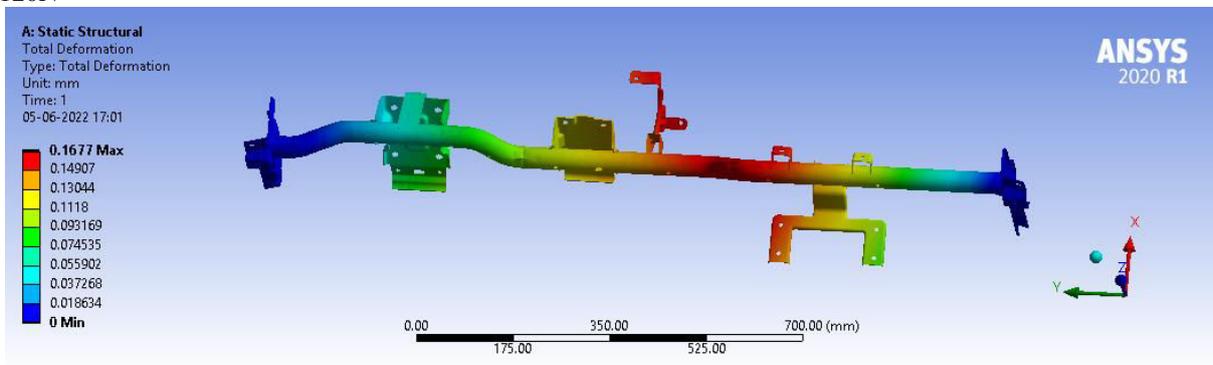
With 150N



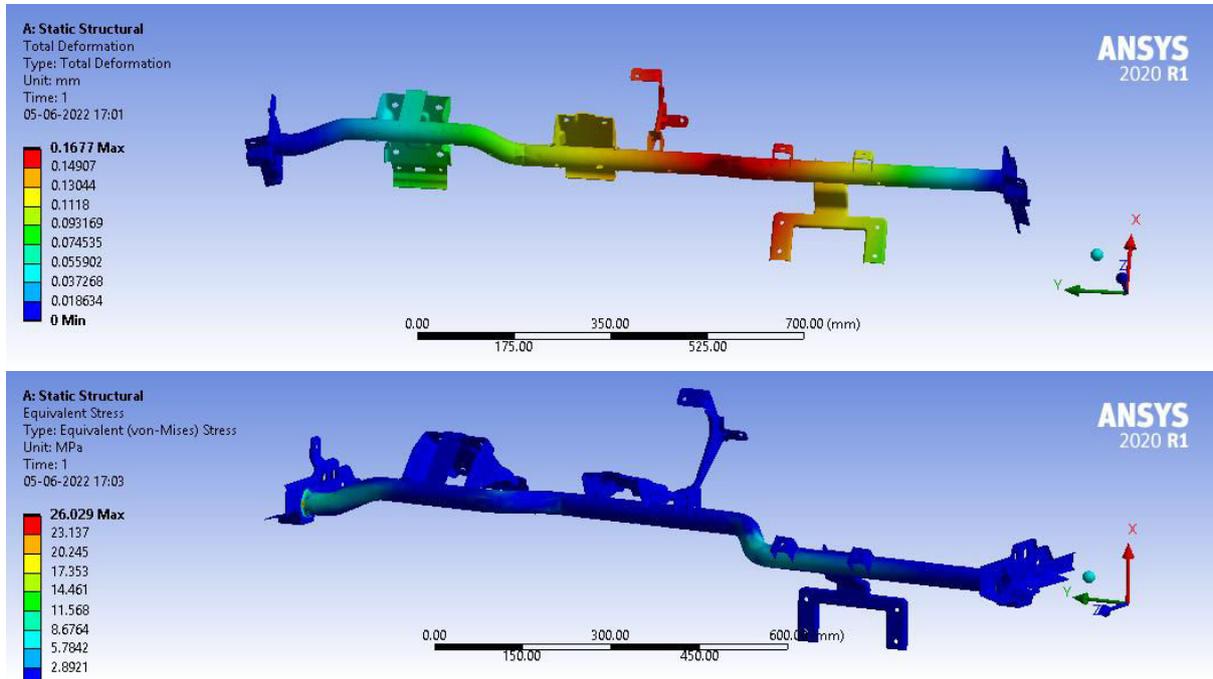
With Aluminium Alloy at 100N



At 120N



At 150N



VI. CONCLUSION

The Analysis is carried out with three different materials at 3 applied forces that is 100,120,150 with Mild Steel, Structural steel and Aluminium Alloy the deformation was mainly observed the edge cross section at one side less with the mild steel and next aluminium alloy later with the Structural steel the ccb(cross car beam) which i have designed was the reference passenger car that was basically made of mild steel and now we have taken two more materials for the analysis consideration with three different found the strain was observed that was suitable for the application of load factor on the ccb. And observed stress was observed less with a aluminum alloy minimal difference of the selected 3 materials with the strength to weight ratio all the three materials are safer to use for the designed model.

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