Design of Helmet and Fracture Analysis to Identify the Crack Formation

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Abstract - In this paper the standard helmet for two wheeler vehicle is designed and the drop test has been conducted at different velocities of dropping to find the crack formation and to determine the reasons for the crack formation . The helmet designed and analyzed in a way to evaluate the equivalent stresses , deformation on helmet in real time conditions. Helmet 3d model is created in CATIA V5 R19 and the drop test analysis done in ANSYS (explict dynamics).

Keywords : Helmet , Drop test , Fracture

I. INTRODUCTION

Helmet has been used to avoid damaging of the skull which protect you from death during vehicle accidents . In an accident the impact mostly occur on head and it may leads to the death. As in an understanding way by wearing helmet heads are also injured in this way of consideration the optimized angle of view for a naked eye is 120 degrees and while wearing helmet the angle of view may reduce due to some obstructions

A helmet is a form of protective gear worn on the head to protect it from Injuries. Ceremonial or symbolic helmets (e.g., English policeman's helmet) without protective function are sometimes used. The oldest known use of helmets was by Assyrian soldiers in 900BC, who wore thick leather or bronze helmets to protect the head from blunt object and sword blows and arrow strikes in combat. Soldiers still wear helmets, now often made from lightweight plastic materials.

In civilian life, helmets are used for recreational activities and sports (e.g., jockeys in horse racing, American football, ice hockey, cricket, and rock climbing); dangerous work activities (e.g., construction, mining, riot police); and transportation. (e.g., Motorcycle helmets and bicycle helmets). Since the 1990s, most helmets are made from resin or plastic, which may be reinforced with fibers such as aramids.

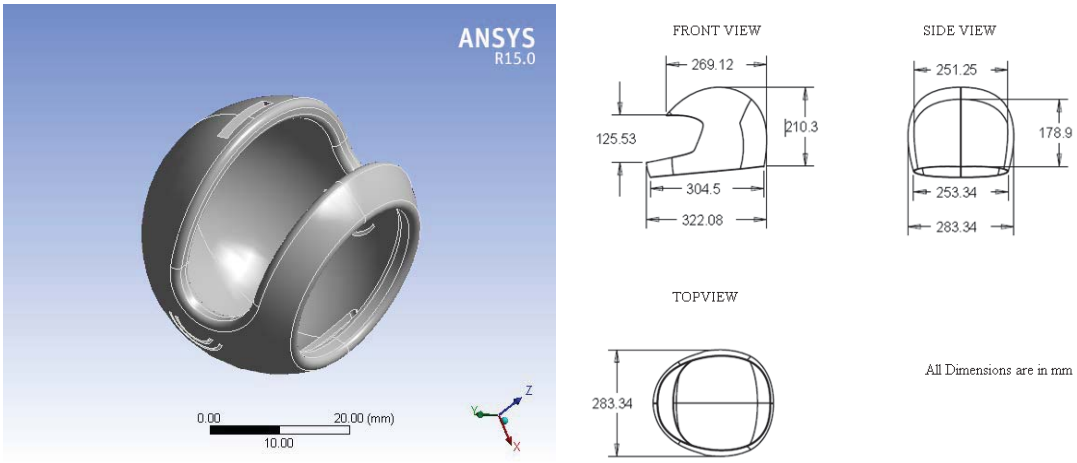
II. EXPERIMENTATION

PVC is a terpolymer made by polymerizing styrene and acrylonitrile in the presence ofpolybutadiene. The proportions can vary from 15 to 35% acrylonitrile, 5 to 30% butadiene and 40 to 60% styrene. The result is a long chain of poly butadiene criss-crossed with shorter chains of poly(styrene-co-acrylonitrile). The nitrile groups from neighboring chains, being polar, attract each other and bind the chains together, making PVC stronger than pure polystyrene. The styrene gives the plastic a shiny, impervious surface. The butadiene, a rubbery substance, provides resilience even at low temperatures. For the majority of applications, PVC can be used between −20 and 80 °C (−4 and 176 °F) as its mechanical properties vary with temperature.

The properties are created by rubber toughening, where fine particles of elastomer are distributed throughout the rigid matrix.

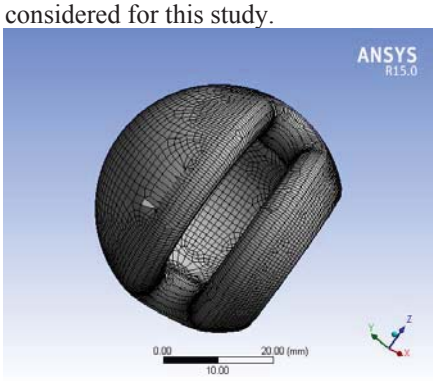
III. DESIGN OF HELMET

Helmet angle of view in the front part is modified to some extent without reducing the safety factor without damaging the skull or part of head. The changed helmet design is 3d modeled in catia by different steps and procedure and the model looks like as follows.



a) Design of helmet modified dimensions

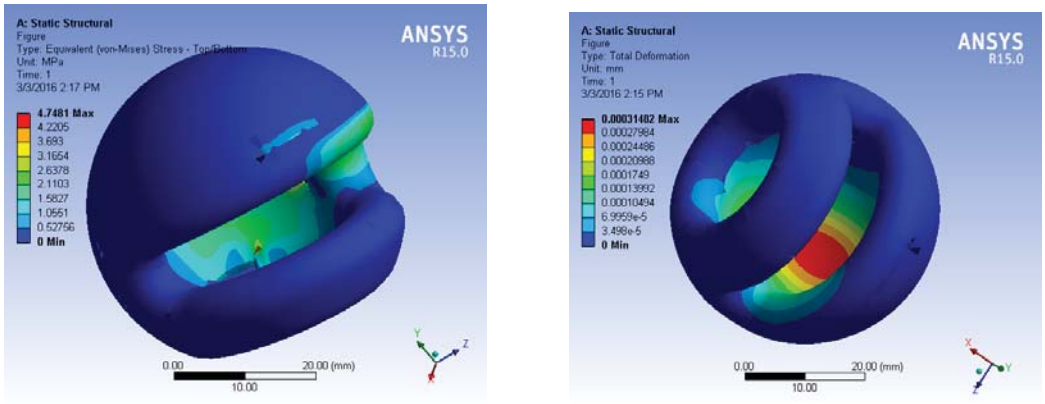
The 3D model of helmet is converting to the ".stp "file and imported to ANSYS for analysis.before the analysis we need to consider and calculate the force and velocity acting on helmet when drop test has done.
The maximum permissible limit of 19.5 kn (as per BIS standard) impact load is applied for this analysis. The Following are the different conditions considered for this study.



b) Fracture mesh applied to helmet

IV. RESULTS AND DISCUSSION

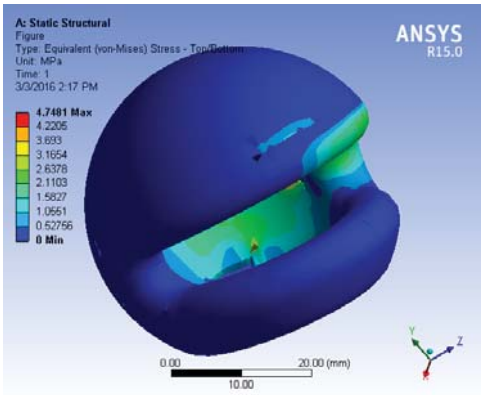
During drop test analysis donae at different velocity changes and the constant load values to determine the equivalent stresses that is von-misses stresses and deformation in the helmet during the conditions applied on it .



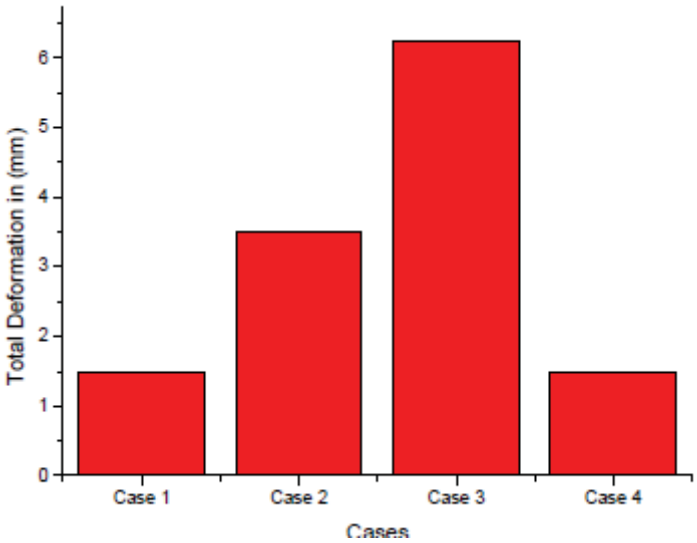
c) Equivalent stresses and deformation of helmet in case1

V. CONCLUSION

The crack formation takes place at the vent holes placed in the helmet . The suface crack is forming when the helmet hit the ground at different conditions.



In the above figure we can observe there is a vent hole placed on the helmet and the crack is forming at the initial stage of impact of helmet to the ground.
the below mentioned are the different velocity of droping test of case values and the research is going to modify the helmet .



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