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Finite Element Analysis of seat Belt Frame Assembly

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Abstract - A seat belt is a safety device designed to secure the occupant of a vehicle against harmful movement that may result during a collision or a sudden stop. A seat belt functions to reduce the likelihood of death or serious injury in a traffic collision by reducing the force of secondary impacts with interior strike hazards, by keeping occupants positioned correctly for maximum effectiveness of the airbag and by preventing occupants being ejected from the vehicle in a crash or if the vehicle rolls over. In this project the main aim is to consider an appropriate seat belt frame assembly using modeling software. An attempt is made to research the seat belt frame assembly for total deformation and von misses strain the using a finite element analysis. Also consider for various parametric analysis is carried out for seat belt frame assembly by different loads and thickness. Here in this project five different case studies have been made varying the thickness from 8mm to 4mm and varying load from 63.5N to 350N.As the thickness of the plate decreases the von misses stress goes on increasing. The failure of the plate takes place at 7mm thickness at 350N.The latch plate works under safe conditions for all the thickness up to 250N.To withstand a load of 350N the plate should made up of 8mm thick. The deformations for all the loads and thickness are negligible. Hence the favorable thickness for the latch plate is 8mm which kind withstand all kinds of loads.

***Key Words;* seat belt frame assembly; Computer Aided Design; finite element analysis**

1. INTRODUCTION

Seat belt is very commonly used in vehicle,because it reduces the injuries and harmful effects when vechile suddenly stops. Now a days automobile companies gives more preference to its safety purpose. so many companies are giving the chance of safety and to build the customer oriented desings in seat belt over. A 2-point belt were by jack in nineteen ninetieth. Two point belts attaches the two end points of seat belts [1]. A lap belt could be a strap that goes over the waist. This was the foremost unremarkably Putin kind of belt before legislation requiring 3-point belts, and is primarily installed in older cars and aircrafts [1]. A "sash" or shoulder harness can be a strap that goes diagonally to the lap belt tongue, or it should have a tongue and buckle utterly become independent from those of the lap belt. over the vehicle occupant's outboard shoulder and is buckled inboard of his or her lap. The shoulder harness ought to connect shoulder harnesses of this separate or partial-separate type have been put in along side lap belts within the outboard front seating positions of the many motors [1]. It is similar to lap and sash belts type and y-shape arranging.The three point belts divide out of the energy of the running body upon the chest and shoulders. The first volvo company introduced in the year of ninteen fiftynine [1].Belt – in – Seat (BIS) these types of belts are commonly used in automotive and it is connected between the shoulders and seat. These belts were first used in range rover car [1].4, 5 and 6 point This type are usually seen in child proctection seats and other vechile. The lap portion is attached to a belt between the legs and shoulder belts, making all the five points joined to the seat.To develop a seat belt frame assembly using modeling software.To conduct FEM analysis by given material properties of ck55 steel. To determine deformation and von misses stress in different thickness for different load condition. To evaluates results obtained by FEA analysis and tabulated.

2. METHODOLOGY

First step is to gather the dimensions info of a safety belt buckle assembly from the consumers or market place, those vital info gathering from the existing belt frame like length, breadth. Using these dimension to select the appropriate material. After collecting the data, generating the model using software. After collecting of all details CAD geometry is generated using solid edge software. Using solid edge software the geometry is exported in the form of neutral file. Meshing the components to find out the following element quality. After discretization, boundary and loading conditions are carried out on the form and the assessment is performed for these loading conditions together with breaking, bumping, turning. In this analysis 5 cases are considered to analyze the seat buckle frame assembly i.e. Case1: 8 mm Thickness latch plate – Loading conditions are 63.5 N, 100 N, 200N, 250N, and 350N.

Case 2: 7 mm Thickness latch plate – Loading conditions are 63.5 N, 100 N, 200N, 250N, 300N and 350N.

Case 3: 6 mm Thickness latch plate – Loading conditions are 63.5 N, 100 N, 200N, 250N, 300N and 350N.

Case 4: 5 mm Thickness latch plate – Loading conditions are 63.5 N, 100 N, 200N, 250N, 300N and 350N.

Case 5: 4 mm Thickness latch plate – Loading conditions are 63.5 N, 100 N, 200N, 250N, 300N and 350N.

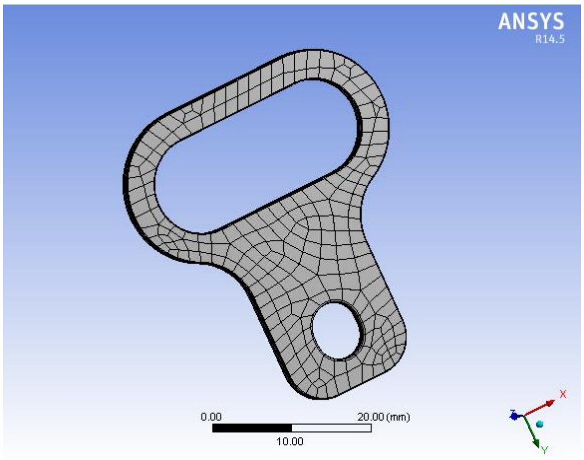

Fig No 1 Latch plate

Latch Plate material properties The analyzed latch plate is made of steel grade CK55 (corresponding to OLC 55 X, STAS 880), whose material properties are given in EN10083-1:2002: for t ≤ 8mm, Remin =550 MPa, Rm = 800-950 MPa, Amin = 12%, Zmin = 30%

3. Result and discussion

In the present analysis for 5 cases Total Deformation and Von Misses Stress tabulated and then comparison is made how the deformation and stresses are varying.

For 8 mm thickness latch plate and for 63.5 N and 100 N load the total deformation and stress is as shown below.

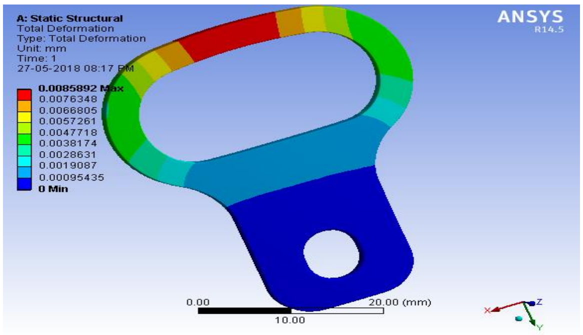

Fig No 2 Total deformation for case 1 and for load 63.5N

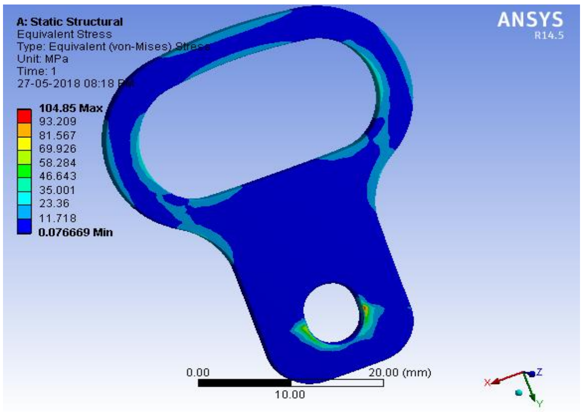

Fig No 3 von mises stress for case 1 and for load 63.5N

In Fig 2 and 3 indicates the outcomes of Von Misses Stress and Total Deformation developed in frame assembly. The max Von Misses Stress is 104.85 and max deformation is 0.0085892 for a load of 63.5N

Table -1: Total deformation for all the cases

Thickness	63.5N	100N	200N	250N	350N
8 mm	0.0085	0.0135	0.027	0.033	0.0473
7 mm	0.0094	0.0148	0.028	0.035	0.0487
6 mm	0.0108	0.0162	0.029	0.036	0.05
5 mm	0.0122	0.0173	0.031	0.037	0.0514
4 mm	0.0132	0.0189	0.0325	0.039	0.0527

Table 2: Von Misses Stress for all the cases

Thickness	63.5N	100N	200N	250N	350N
8 mm	104.8	165.1	330.1	412.3	577.12
7 mm	115.6	181.6	346.7	429.3	594.4
6 mm	132.1	198.1	363.3	445.8	610.9
5 mm	148.6	2146	379.8	462.3	627.0
4 mm	161.8	231.1	396.3	478.5	643.9

4. Conclusion

This paper has looked into the determination of the total deformation and von misses stress under the static loading conditions. The ultimate strength of the plate is 550MPA steel grade CK55.Here in this project five different case studies have been made varying the thickness from 8mm to 4mm and varying load from 63.5N to 350N.As the thickness of the plate decreases the von misses' stress goes on increasing. The failure of the plate takes place at 7mm thickness at 350N.The latch plate works under safe conditions for all the thickness up to 250N.To withstand a load of 350N the plate should made up of 8mm thick.The deformations for all the loads and thickness are negligible. Hence the favorable thickness for the latch plate is 8mm which kind withstand all kinds of loads.

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