MODELLING AND FEM ANALYSIS OF BUS PASSENGER SEAT

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Abstract - ***In Maharashtra most of people uses MSRTC (Maharashtra state road transportation co-operation) bus for daily travelling. The varies parameter such as road condition, vibration forces, suddenly break applied due to not good condition of road are responsible for failure of seat joint. Another reason is overloading of passenger weight. In MSRTC there are 15500 buses in which ordinary bus are 14022 and other are city buses, Semi comfortable buses, mini, deluxe, air conditional buses. Ordinary buses having the facility of 2x2 seat arrangement. Ordinary buses face failure of seat joint. Current design of passenger seat joint undergoes failure due above specified reasons which leads to financial losses to workshop. The major problem i.e. joint failure of seat and reasons which are responsible for this failure are discuss in this paper. The analysis of this joint leads to suggest dimensional changes in L-joint which reduces the stresses to greater extent. To achieve the results analysis different boundary conditions like Impact loading, Vibration and static loading were discuss in this paper.***

Key Words: *Bus passenger seat frame joint, Pro-E, FEA, Equivalent & shear stress.*

1. INTRODUCTION

The Maharashtra State Road Transport Corporation abbreviated as (MSRTC, or simply ST), it is the state run bus service of Maharashtra, India with [16,000] buses which ferry [7] million passengers' daily on [17,000] routes. It is the third largest bus service provider in India and serves routes to towns and cities within Maharashtra and adjoining states. Apart from locations within the state of Maharashtra, the MSRTC service also covers destinations in neighboring states. It is one of the largest fleet owners in India. It also offers a facility for online booking of tickets for all [17,000] routes a large number of passengers every day use public transport buses in Maharashtra not only in the cities but also in rural areas. Hence, buses are a popular mode of travelling in Maharashtra. MSRTC provide this transport facility and this corporation uses mainly TATA [2515] bus Parivartan: Parivartan in Marathi means 'change'. This is the changed face of the ordinary red bus service. A successful attempt by MSRTC to offer comfortable service to masses. The buses consist of a 2x2 seating arrangement and offer better comfort. These are slowly replacing the ordinary buses from the fleet and are also responsible for 'change' (Parivartan) in urban people's mindsets about the ordinary ST bus services. The fare structure of Parivartan buses is same as that of the ordinary buses.

In Maharashtra most of the MSRTC buses travelling in rural area. The road condition of rural area is not good due this bus facing suddenly Jerk, impact load during the suddenly applied break due to improper seat frame design. The failure of seat frame joint at most of the last three rows of seat Tata motors provided only Engines with chassis body of the bus and the remaining Assembly work of bus body is constructed at MSRTC workshop level. Many time three passengers seated on the one seat than existing design is not strong to sustain load and causes the breakage of seat frame joint. This project work on the seat frame joint.

2. Reason for selecting project?

Maharashtra State Road Transport Cooperation (MSRTC) Passenger Buss has cause failure of passenger seat frame and supporting joint as shown in Fig: 3.1 & 3.2 This failure occurs with a few months from date of manufacturing of buss and due to this passenger causes accident & this is one of major problem facing to MSRTC workshop supervisor due to improper design or material selection of seat frame.

Fig -1: Existing seat frame.

Fig -2: Existing seat frame joint.

3. Forces Acting On Bus Seat

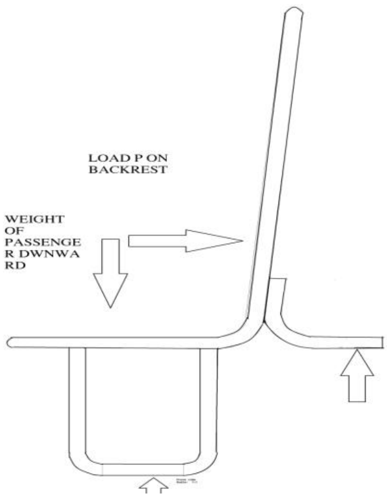

Fig -3: Forces acting on seat.

4. Impact loading Analysis for Existing seat joint

Table -1 Finite Element Method calculations for Existing design of L–shape joint

No of passenger	Wt. of each passenger.	Load due to suddenly breaking	Tensile stress	Shear stress	Remark
03		971.4	222.6	114.9	Unsafe
02		645.9	148	76.4	Safe
01	55	322.9	74.01	38.1	Safe
03		1145	262.4	135	Unsafe
02		763.3	174.9	90.2	Unsafe
01	65	381.6	87.46	45.1	Safe
03		1321.2	302.8	156.	Unsafe
02		880.8	201.8	104	Unsafe
01	75	440.4	100.9	52.1	Safe

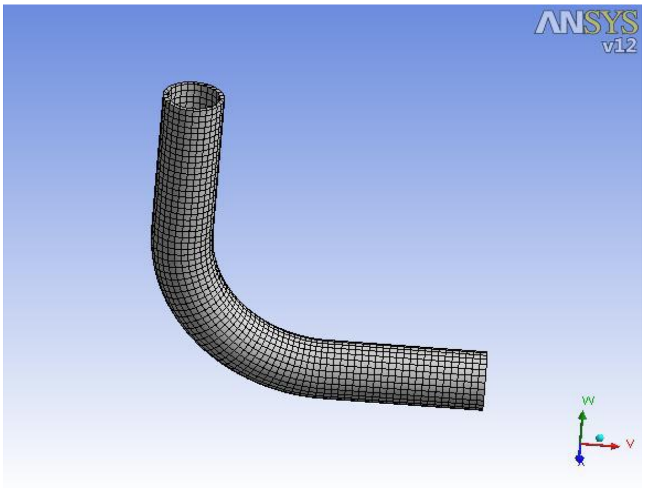

Fig -3 Seat joint Model with Meshing

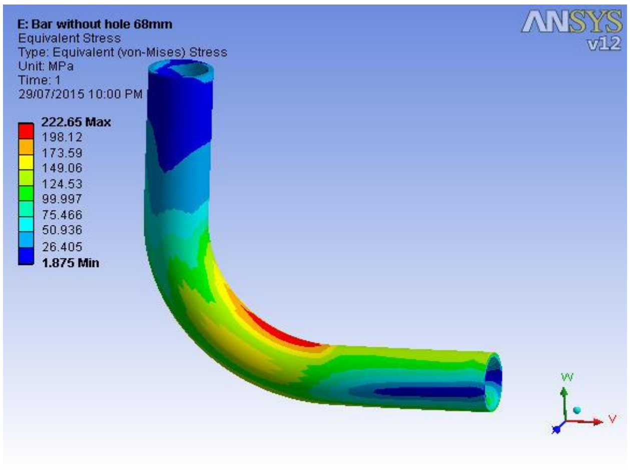

Fig -4 Equivalent Stress Distribution for existing joint.

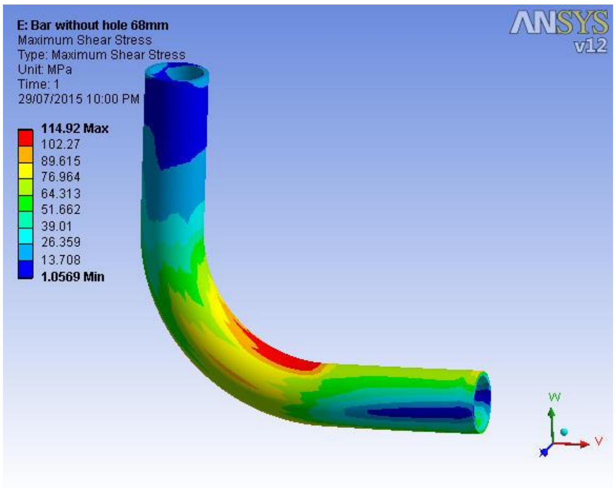

Fig -5 Shear Stress Distribution for existing joint

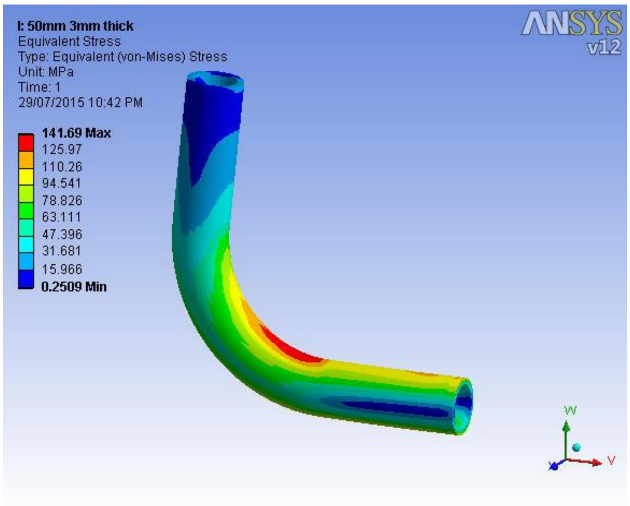

Fig -6 Equivalent Stress Distribution for Modified joint.

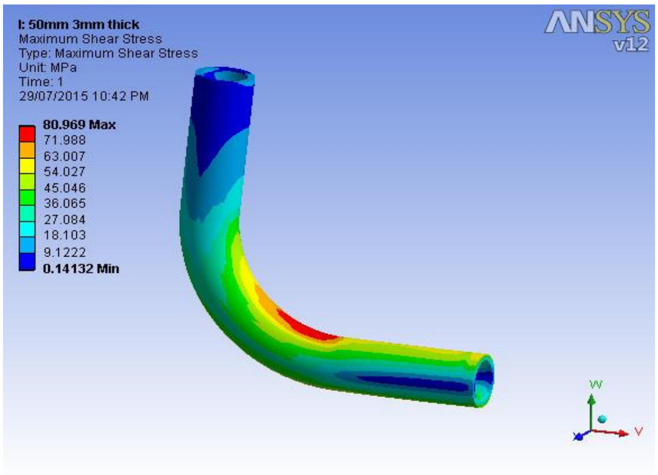

Fig -7 Shear Stress Distribution for Modified joint.

Table -2 Finite Element Method calculation of Modified design

No of passenger	Wt. of each passenger.	Load due to suddenly breaking	Tensile stress	Shear stress	Remark
03	55	971.4	141.6	80.9	Safe
02		645.9	94.21	53.8	Safe
01		322.9	47.09	26.9	Safe
03	65	**1145**	167	95.4	Nearer to
02		763.3	111.3	63.6	Safe
01		381.6	55.65	31.8	Safe
03	75	1321.2	192.7	110	Unsafe
02		880.8	128.4	73.4	Safe
01		440.4	64.23	34.7	Safe

5. Dynamic loading for spring mass system at front portion of bus.

Table -3 FEA Calculation for Existing Joint & modified joint at Frontal Spring Mass System.

			Existing joint			Modified joint		
No of passenger	Wt. of each passenger.	Load due to	Tensile stress	Shear stress	Remark	Tensile stress	Shear stress	Remark
02	55	829	190	98	US	149	85	S
01		608	139	7	S	117	67	S
02	65	901	206	106	US	161	92	S
01		648	148	76	S	123	70	S
02	75	990	227	117	US	172	98	S
01		688	144	74	S	129	73	S

6. Dynamic Loading for Spring Mass System at Rear Portion of Bus.

Table -4 FEA Calculation for Existing Joint & modified joint at Rear Spring Mass System.

			Existing joint			Modified joint		
No of passenger	Wt. of each passenger.	Load due to	Tensile stress	Shear stress	Remark	Tensile stress	Shear stress	Remark
02	55	1025	235	121	US	149	85	S
01		804	184	95	US	117	67	S
02	65	1105	253	130	US	161	92	S
01		844	193	99	US	123	70	S
02	75	1186	271	140	US	172	98	S
01		884	202	104	US	129	73	S

7 CONCLUSIONS

After studying the analysis of existing joint and making modification in the existing joint following results are obtained .If following changes are implemented in the existing design stresses on the joint can be reduce and life of the joint can be increase to considerable amount.

7.1 Case-1: When applying the impact load due to suddenly applied Breaking force:

From the Table -1 the existing seat joint is applied for **763.3N load** the tensile stress is **174.95 Mpa** & shear stress is **90.299 Mpa** which exceed permissible stress of existing material which is mild steel whose ultimate strength is **147 Mpa** and after modified joint applied as shown in Table -2 **it** is found that modified joint has load bearing capacity of 1145N**.**

7.2 Case-2: when the vibration force applied at the Front portion of Bus:

From the Table -3 the existing joint fails at **648.64 N &** modified joint sustain up to load **990N** applied by vibration force at Front portion of Bus hence the failure of joint at first rows of seat frame joint is less occurs.

7.3 Case-3: when the vibration forces applying at the Rear Portion of Bus:

From the Table -4 found that existing joint fail at loads of **804N** & the modified joint sustain at **1186 N.** hence the existing seat joint mostly fail at last rows o seat frame joint as we say in problem identification.

From the above cases found that the Existing joint is fail at **763N** and modified joint is sustain load up to **1145N** then the modified joint is **66.6%** stronger than Existing joint.

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