Redesigning of Chassis Frame for (Three Wheeler) Vikram 750 D

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Abstract— In this paper an effort is made to review the current design of chassis frame used in vikram 750 d1 for manufacturing ease as well as more stable with respect to dynamic and static loading. In this paper current design compared with two proposed design by application of dynamic and static loading condition. 2 Proposed design analysis has been done with the help of solid works modelling software by application of real time load analysis. With the application of external load, members yield strength3 has been analyzed with respect to external load.

Key words: Chassis Frame, Three Wheeler

I. INTRODUCTION

Vikram 750 D is the load carrier three wheeler vehicle manufactured by scooters India limited company, Lucknow. This work involve static and dynamic analysis on various design of chassis frame of Vikram 750 D.Currently reinforcement type section is been used for frame analysis, which involve lots of manufacturing process. Therefore tow more design has been proposed to replace existing design with the help of static and dynamic analysis under same conditions.

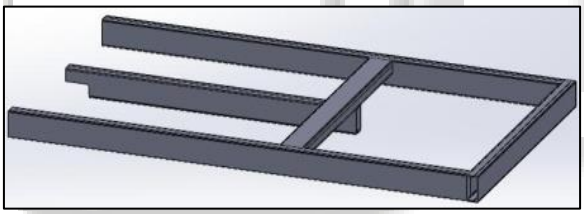


Fig. 1: Reinforcement Design of Frame

II. MANUFACTURING OF CHASSIS FRAME ACCORDING TO THE EXISTING DESIGN

A. *Parts of Chassis Frame*

Chassis frame has following members

- Long member
- Reinforcement of long member
- Cross member
- Reinforcement cross member
- Rear member
- Reinforcement rear member
- Middle member
- Reinforcement of middle member

B. *Sequence of Operations*

a) Long Member
- Shearing[4]
- Forming[5]

b) Reinforcement of Long Member
- Shearing
- Forming

c) Cross Member
- Shearing
- Forming

d) Reinforcement of Cross Member
- Shearing
- Forming

e) Rear Member
- Shearing
- Forming

f) Reinforcement of Rear Member
- Shearing
- Forming

g) Middle Member
- Shearing
- Notching
- Forming

h) Reinforcement of Middle Member
- Shearing
- Notching
- Forming

III. ANALYSIS OF VARIOUS DESIGNS

A. *Method of Analysis*

Now in this project various proposed designs are subjected to the load of engine 703 Newton. This is the approximate load exerted on the engine mounting under working condition & then by using the solid works software, stress& displacements developed on the various points of engine mounting are calculated according to the theory of von mises. The engine mounting bracket is being manufactured by using hot rolled steel having following properties.

Elastic modulus	2e+011	N/m^2
Poisson's ratio	.29	
Shear modulus	8e+010	N/m^2
Density	7870	Kg/m^3
Tensile strength	325	MPa
Yield strength	180	MPa

Table 1: Properties of Hot Rolled Steel[7]

Various designs given in previous sections are checked by simulation tool of solid works with respect to above properties & then the best design is selected and cost estimation of that design is performed among the following.

IV. PROPOSED DESIGNS & ANALYSIS

Following proposed designs are checked by simulation tool of solid works under the working condition of engine load (703 Newton) &then the results of stresses & displacements developed at various points are compared with respect to properties of hot rolled steel given in table 3.1. Proposed designs are as follows.

1) Design with thickened channel 3mm
2) Design with L channel through out
3) Design of single component with flange of 3mm

4) Design of single component without flange & cut inside 6mm.
5) Design with square bar through out

The best design is selected from the above & cost estimation of that design is performed, which is then compared with the cost of the existing design of engine mounting.

The solid works simulation tool during analysis puts the load of 703 Newton on the model of the various designs and then the software after simulation gives the value of stresses & displacements developed at various points of bracket. The same procedure is repeated for all other proposed designs and the results are observed

V. ANALYSIS OF EXISTING DESIGN

Following picture shows the existing design which is being used by scooters India as of now. Here the component is fine meshed for the fine & accurate results.

This the current variants of chassis frame. After providing proper fixture apply the load and select frame material cold rolled bar. After applying load frame structure will look like that.

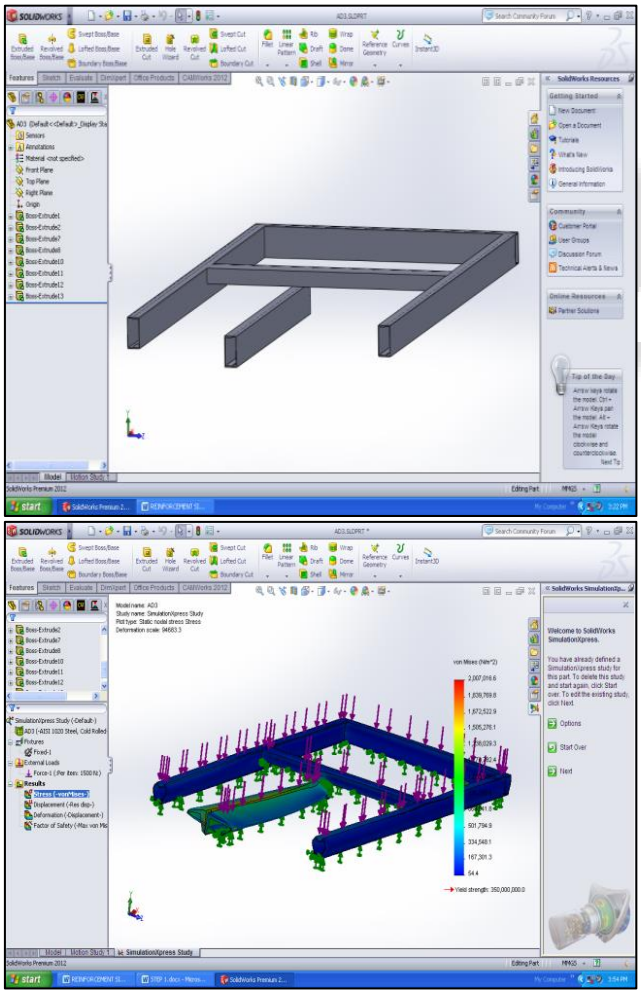


Fig. 2 & 3: Analysis on Existing Design (Reinforcement Section)

Here URES is calculated by the software according to plot displacement components of resonant mode shapes:\
UX = Displacement in the X-direction
UY = Displacement in the Y-direction
UZ = Displacement in the Z-direction
URES = Resultant displacement (does not use the reference geometry)
Mode shapes illustrate the profile of the mode only (i.e., the displacement of nodes relative to each other). The displacement values are calculated based on various normalization procedures. The software normalizes each mode.

A. Analysis of Design with Uniformly Decreasing Section Working Condition

a. This is first variant of frame, uniform decreasing section. After providing proper fixture apply the load and select frame material cold rolled bar. After applying load frame structure will look like that

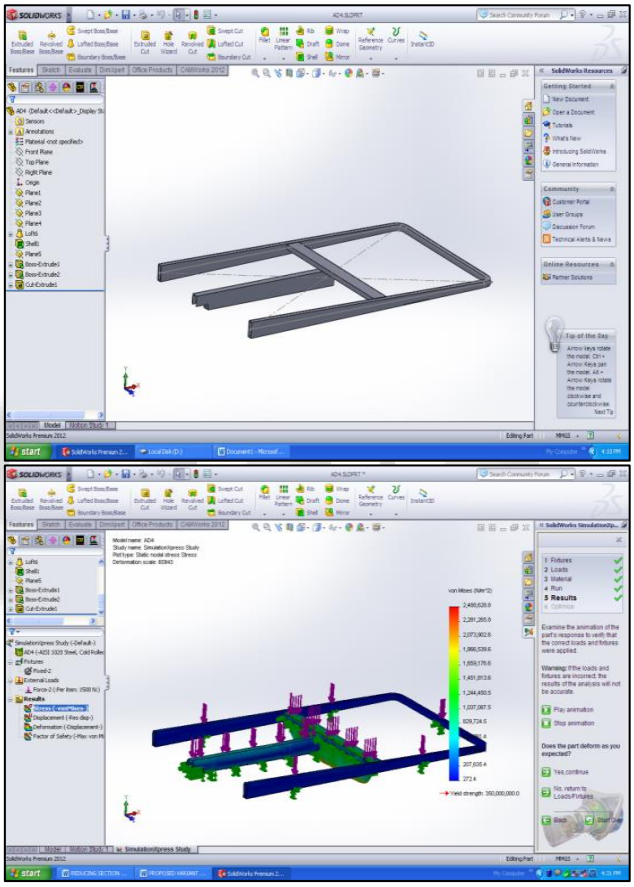
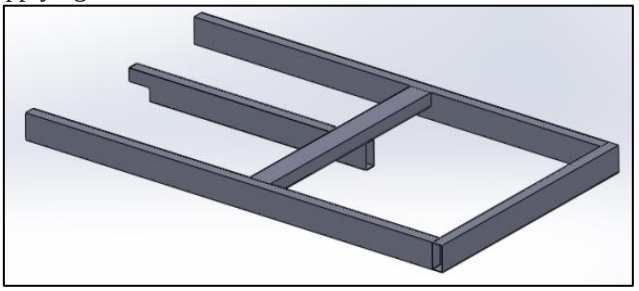


Fig. 4 & 5: Analysis on First Variant Design (Reinforcement Section)

B. Analysis of Design with Rectangular Section

This is second variant. After providing proper fixture apply the load and select frame material cold rolled bar. After applying load frame structure will look like that



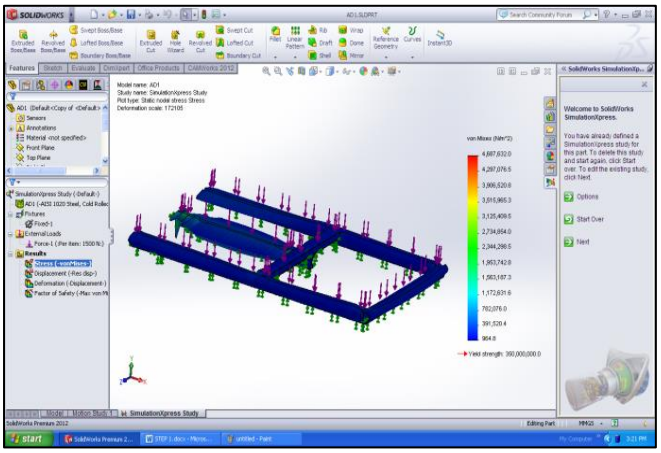


Fig. 6&7: Analysis on Second Variant Design with Rectangular Section

VI. FINDINGS, RESULTS, DISCUSSION & CONCLUSION

Comparative Results (For All Designs under Working Conditions) –

SN	Name of design of Engine mounting Bracket.	Max. Stress in N/m^2 developed on any point of bracket
1	Existing design reinforcement	2,007,016.6
2	Design with ERW pipe 3mm	4,687,649.0
3	Design with uniformly reducing section.	2,488826.8

Table 2: Comparison of All Design

From the above table it is clear that the two designs which can replace the existing design are Design with ERW pipe 3 mm and Design with uniformly reducing section. throughout as under working condition the maximum stress developed in them are less than then maximum stress developed in the existing design, but the project suggests that the best design among these two is, Design with ERW pipe 3mm.

The cost estimation of the selected design i.e. designs with square bar throughout is done and will be compared with the cost estimation of the existing design.

A. Assembly Cost of the Rectangular Pipe

S.NO.		Cost	Qty	Total cost
1	Long Member	481.00	2	962.00
2	Cross Member	275.80	2	551.60
3	Middle Member	286.03	1	286.03
		Net cost		1799.63

Table 3: Assembly Cost

- Mig Welding Cost: 5 joints of 25 cm = 125 cm
- 125 cm x 0.40 = 50 Rs.
- Total cost of the chassis frame 1799.63 + 50.00 = 1849.63 Rs.
- Now the total difference after cost comparison is 2142.32 – 1849.63 = 292.69 Rs.
- Annual requirement of the chassis frame is 75 vehicles x 300 working days = 22500
- Now annual saving would be 22500 x 292.69 = 6585525 Rs.
- The amount of saving is remarkable.

B. Result

- So from above table it is clear that the proposed design (Design with square bar throughout).
- Now the total difference after cost comparison is 2142.32 – 1849.63 = 292.69 Rs.
- Annual requirement of the chassis frame is 75 vehicles x 300 working days = 22500
- Now annual saving would be 22500 x 292.69 = 6585525 Rs.
- The amount of saving is remarkable

C. Conclusion of the Paper

Paper conclude that the present chassis frame of the three wheeler Vikram should be replaced with the new proposed design in which the U channel should be completely eliminated and be replaced by the square bar throughout, because this design is not only less stressed under loading but also cost effective as compared to the existing design moreover its manufacturability is also better and less time taking after looking into the essential parameters of design.

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