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"DESIGN & STATIC ANALYSIS OF MANUAL PALLET TRUCK USING FEM METHOD BY ANSYS SOFTWARE"

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ABSTRACT

In this paper, study has been carried out on the manufacturing process and functional activities of Manual operated pallet truck and came across with the various problems and handling in the current system. After thorough studies, careful static analysis and reviews of the various manufacturing systems and technologies. Manual Pallet Truck are robust in construction and are smooth in operations. Manual Pallet Truck are able to work efficiently for pallets on high rack, smooth control of precise lifting and lowering. By this project man power effort and time can reduce. We design and analyze of carriage fork. Our aim is design and develops a model of Manual Pallet Truck .This system has a significant importance in the equipment and material handling. 2 D and 3D modeling has done by CATIA software and simulation has done by ANSYS software.

Key Words: *Manual Pallet Truck , manufacturing, pallet, lifting, static analysis, ANSYS.*

I. INTRODUCTION

Material handling (MH) involves "short-distance movement that usually takes place within the confines of a building such as a plant or a warehouse and between a building and a transportation agency."[1]It can be used to create "time and place utility" through the handling, storage, and control of material, as distinct from manufacturing (i.e., fabrication and assembly operations), which creates "form utility" by changing the shape, form, and makeup of material. It is often said that MH only adds to the cost of a product, it does not add to the value of a product. Although MH does not provide a product with form utility, the time and place utility provided by MH can add real value to a product, i.e., the value of a product can increase after MH has taken place; for example:

The value (to the customer) added by the overnight delivery of a package (e.g., Federal Express) is greater than or equal to the additional cost of the service as compared to regular mail service—otherwise regular mail would have been used.

The value added by having parts stored next to a bottleneck machine is the savings associated with the increase in machine utilization minus the cost of storing the parts at the machine.

Electric Pallet Stacker is a thin, highly-versatile lift that compliments nearly any primarily indoor application. Balanced similar to a traditional forklift and without base legs, the Counter-Balanced Electric Stacker can fit into tight

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spaces. Extremely durable and budget friendly, the Toyota Counter-Balanced Stacker can help increase both your uptime and your bottom line.

Fig.1. Stacker

II. STACKER SPECIFICATIONS

Dimensions	Unit	Value
Capacity	Kg	1000
Max fork height	mm	90
Min fork height	mm	35
Lifting height	mm	55
Weight of unit	Kg	25

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III. PROPERTIES OF MATERIALS USED FOR MANUAL PALLET TRUCK

Table 3.1 Structure Steel Mechanical properties

Material Field Variable	Value	Units
Density	7750	Kg/m^3
Young's modulus	1.93E+05	Mpa
Poisson Ratio	0.31	
Shear modulus	76664	Mpa
Bulk Modulus	1.6937E+05	Mpa
Tensile Yield Strength	207	Mpa
Compressive Yield Strength	207	Mpa
Tensile Ultimate Strength	586	Mpa

Table 3.2 Aluminium Alloy Mechanical properties

Material Field Variable	Value	Units
Density	2770	Kg/m^3
Young's modulus	7.1E+10	Mpa
Poisson Ratio	0.33	
Shear modulus	2.6692E+04	MPa
Bulk Modulus	6.9608E+04	MPa
Tensile Yield Strength	280	Mpa
Compressive Yield Strength	280	Mpa
Tensile Ultimate Strength	310	Mpa

Table 3.3 Cast Iron Alloy Mechanical properties

Material Field Variable	Value	Units
Density	7200	Kg/m^3
Young's modulus	1.11E+05	Mpa
Poisson Ratio	0.28	
Shear modulus	42969	Mpa
Bulk Modulus	83333	Mpa
Tensile Yield Strength	240	Mpa
Tensile Ultimate Strength	820	Mpa

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Table 3.4 Carbon Fiber Mechanical properties

Material Field Variable	Value	Units
Density	1490	Kg/m^3
Young's modulus X Direction	125000	Mpa
Young's modulus Y Direction	8600	Mpa
Young's modulus Z Direction	8600	Mpa
Poisson Ratio XY	0.27	
Poisson Ratio YZ	0.4	
Poisson Ratio ZX	0.27	Mpa
Shear modulus XY	4700	Mpa
Shear modulus YZ	3100	Mpa
Shear modulus XZ	4700	Mpa

IV. MODELING & SIMULATIONS

The full form of CATIA is Computer Aided Three-dimensional Interactive. CATIA V5 is a powerful software package yet has a relatively short learning curve. One of the reasons for the short learning curve is that it is fully Windows compatible and the processes are consistent across the workbenches, toolbars and tools.

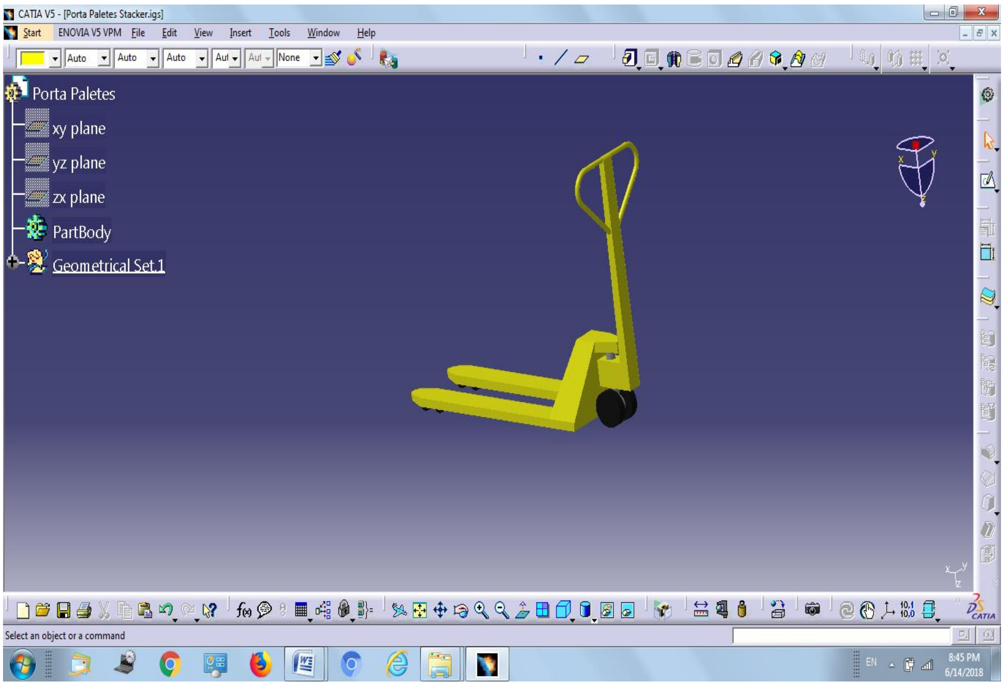

Fig.4.1 CATIA Model of stacker

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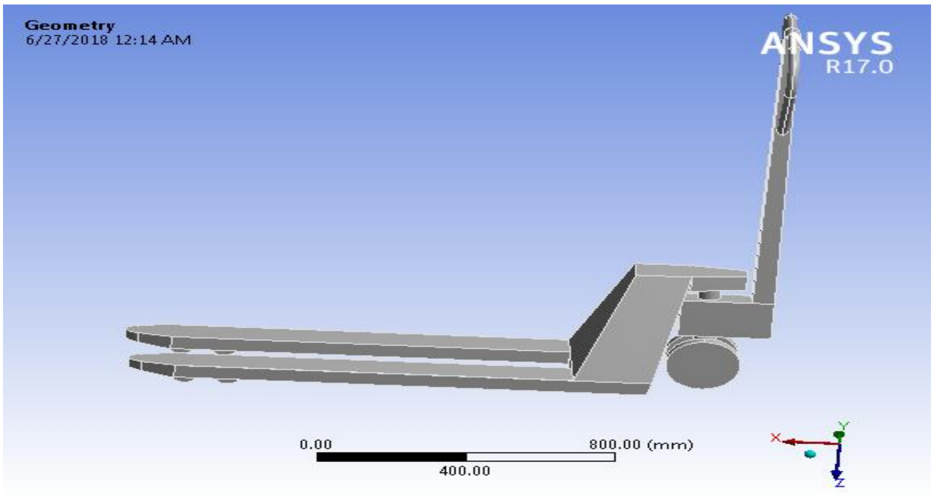

Fig.4.2 Import Geometry in ANSYS

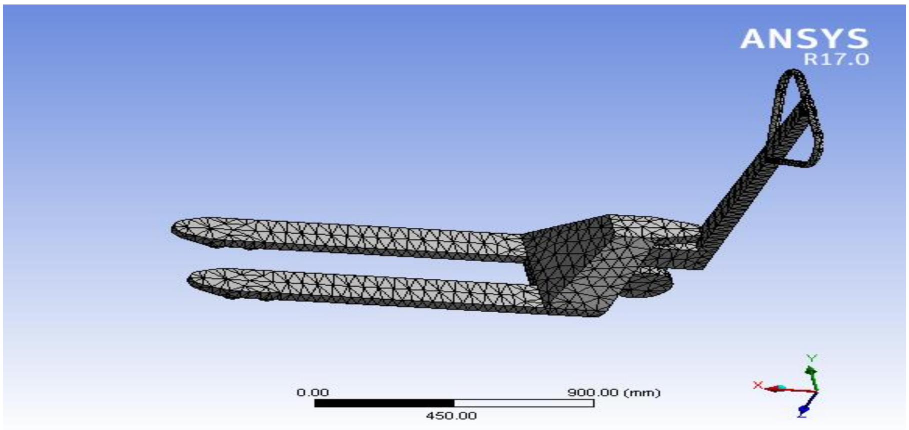

Fig.4.3 Geometry Meshing

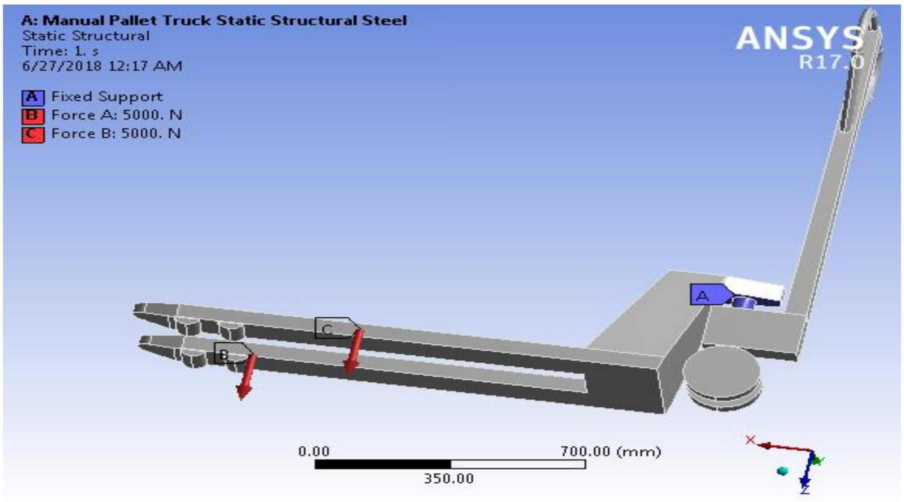

Fig.4.4 Boundary conditions (Structural Steel)

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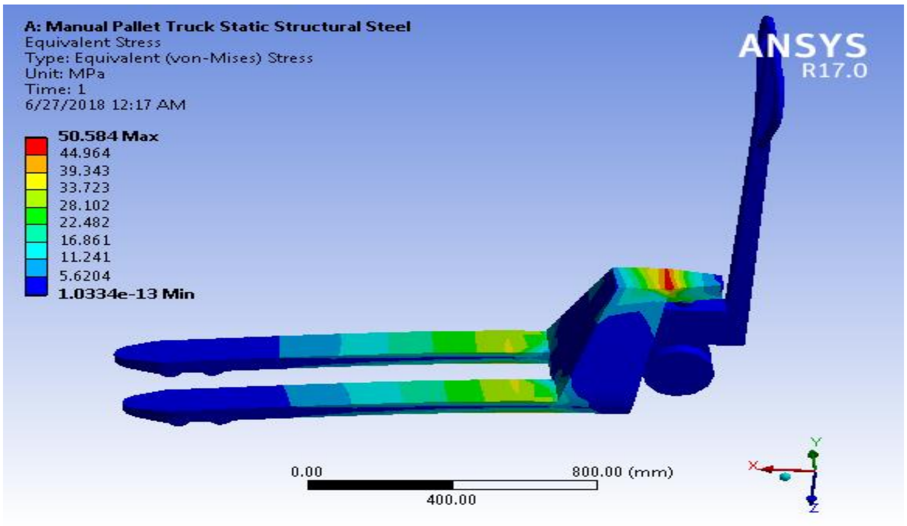

Fig.4.5 Equivalent Stress (Structural Steel)

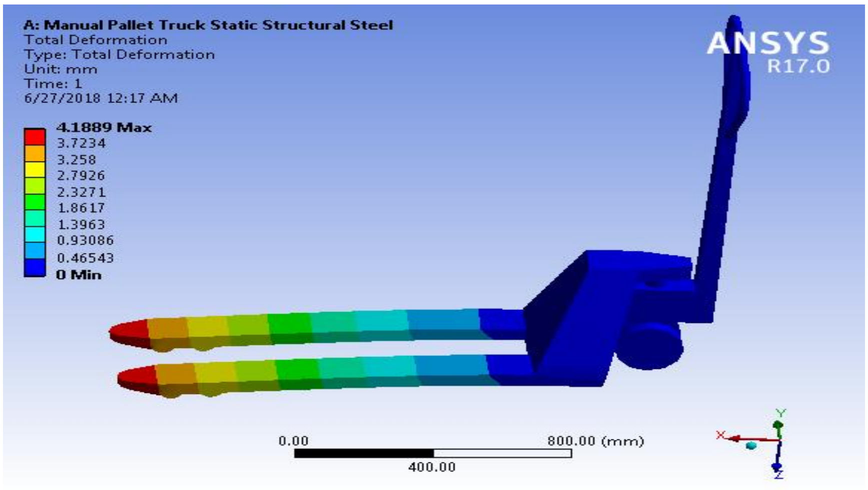

Fig.4.6 Total Deformation (Structural Steel)

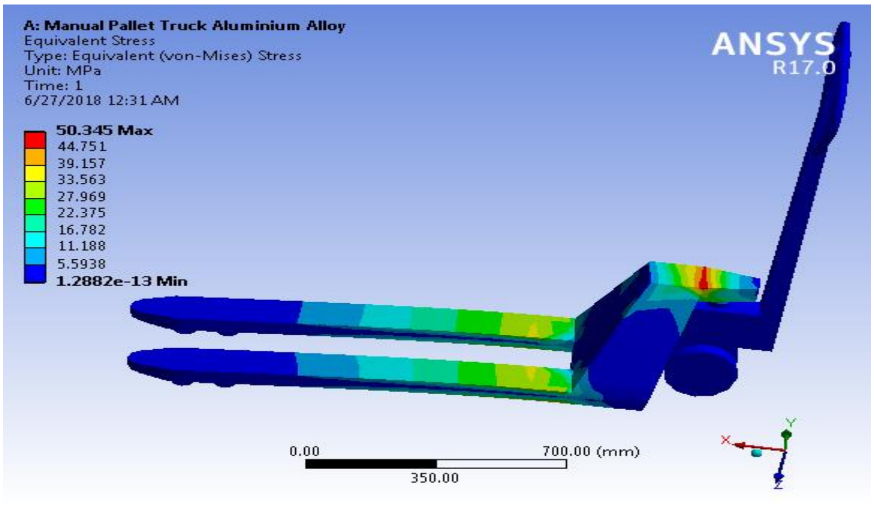

Fig.4.7 Equivalent Stress (Aluminium Alloy)

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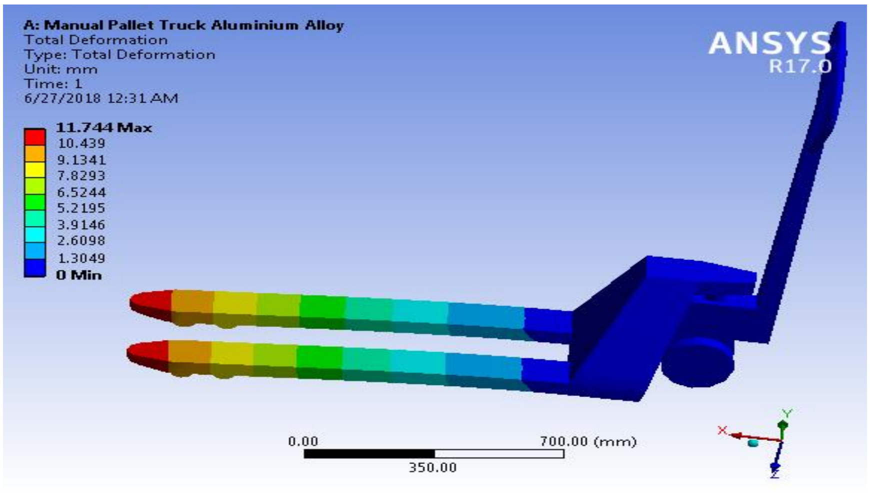

Fig.4.8 Deformations (Aluminium Alloy)

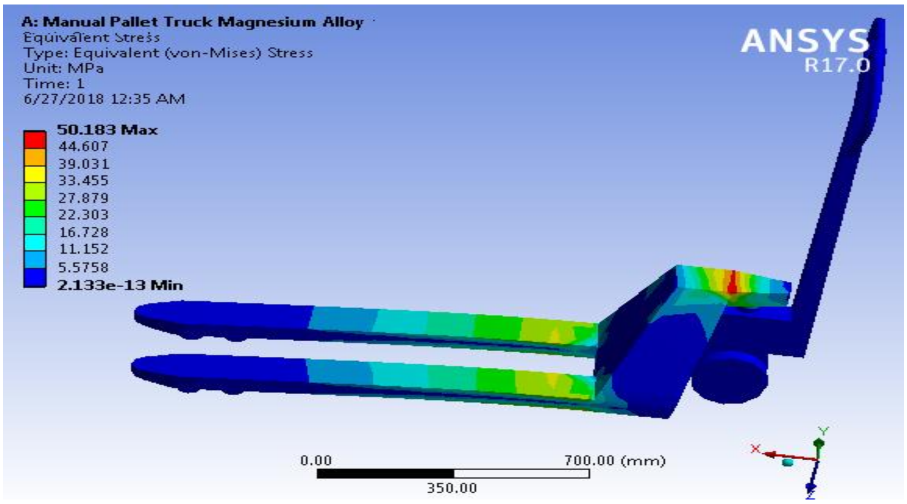

Fig.4.9 Equivalent stress (Magnesium Alloy)

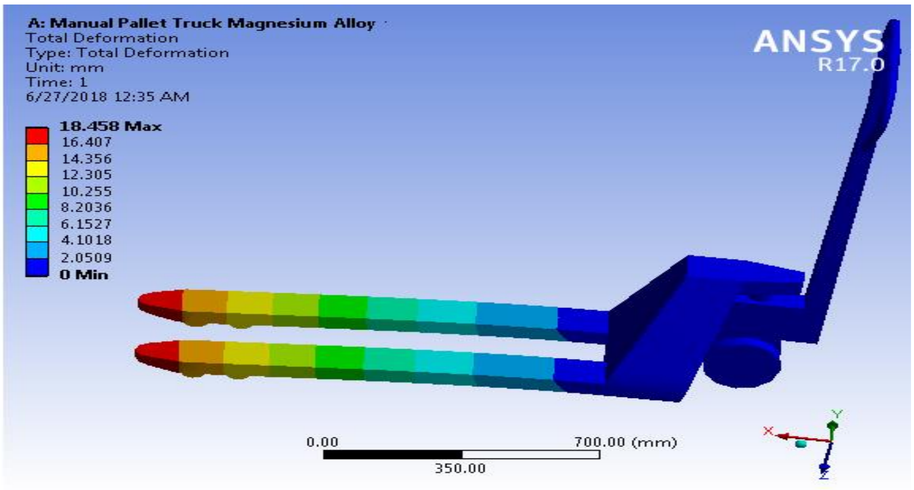

Fig.4.10 Equivalent Stress (Magnesium Alloy)

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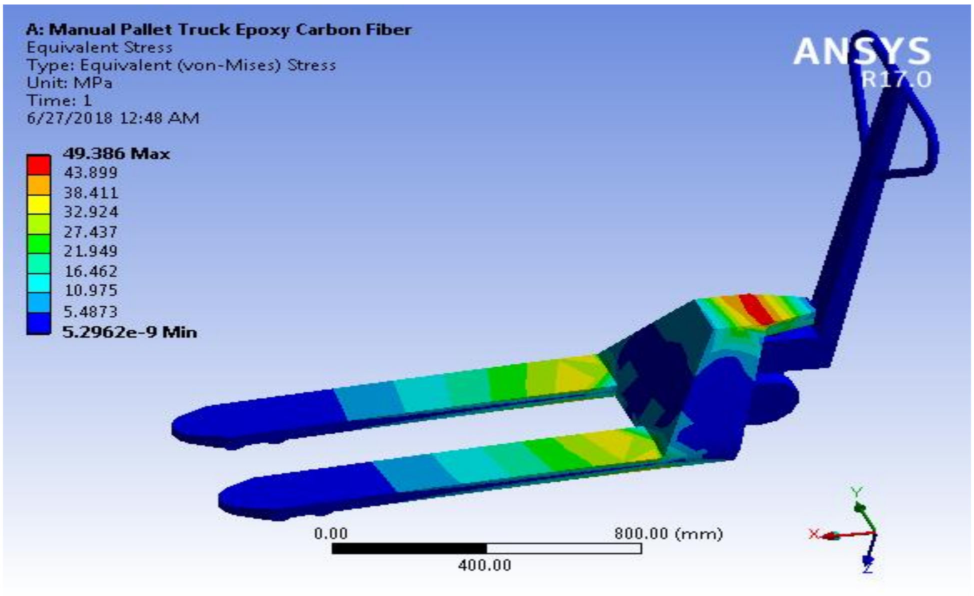

Fig.4.11 Equivalent Stress (Epoxy Carbon UD)

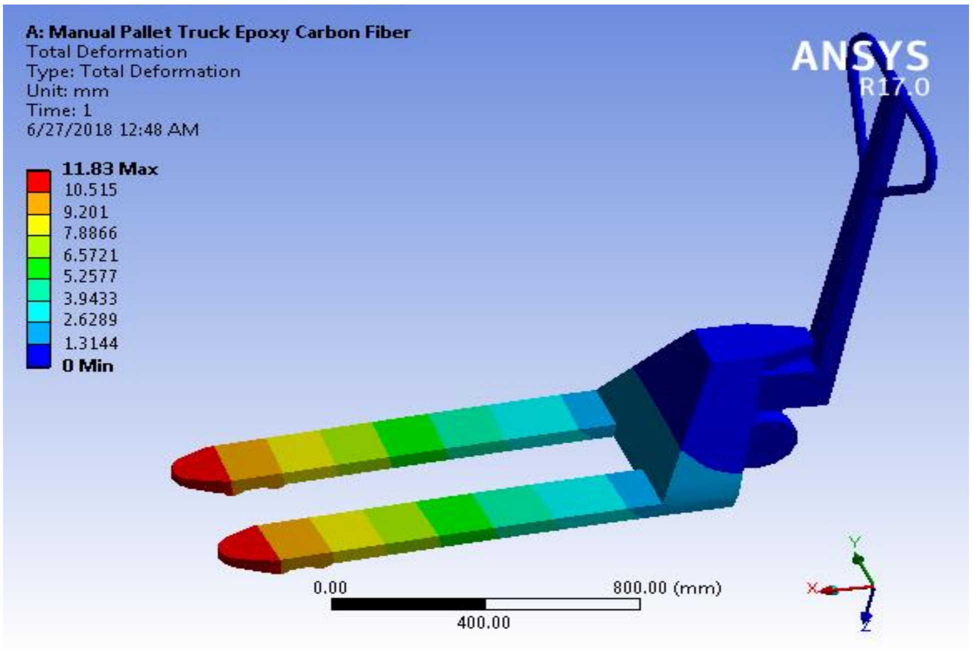

Fig.4.12 Deformation (Epoxy Carbon UD)

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V. Result & Discussion

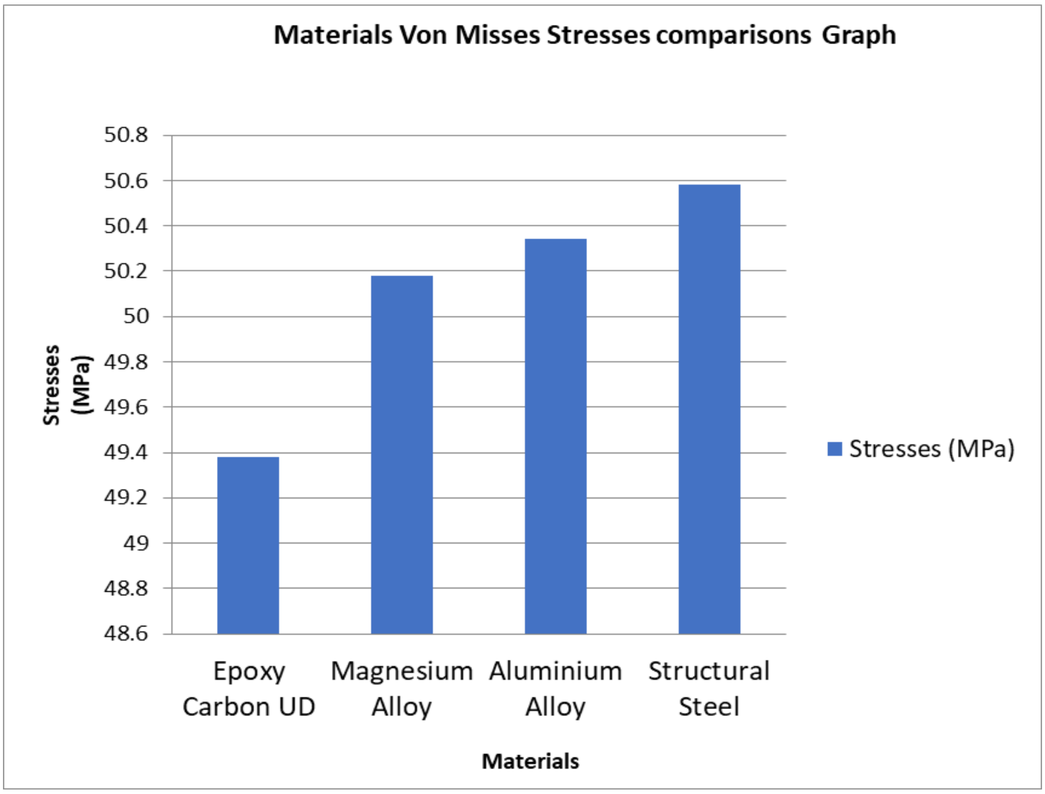

Fig.5.1 Stress comparison with different materials

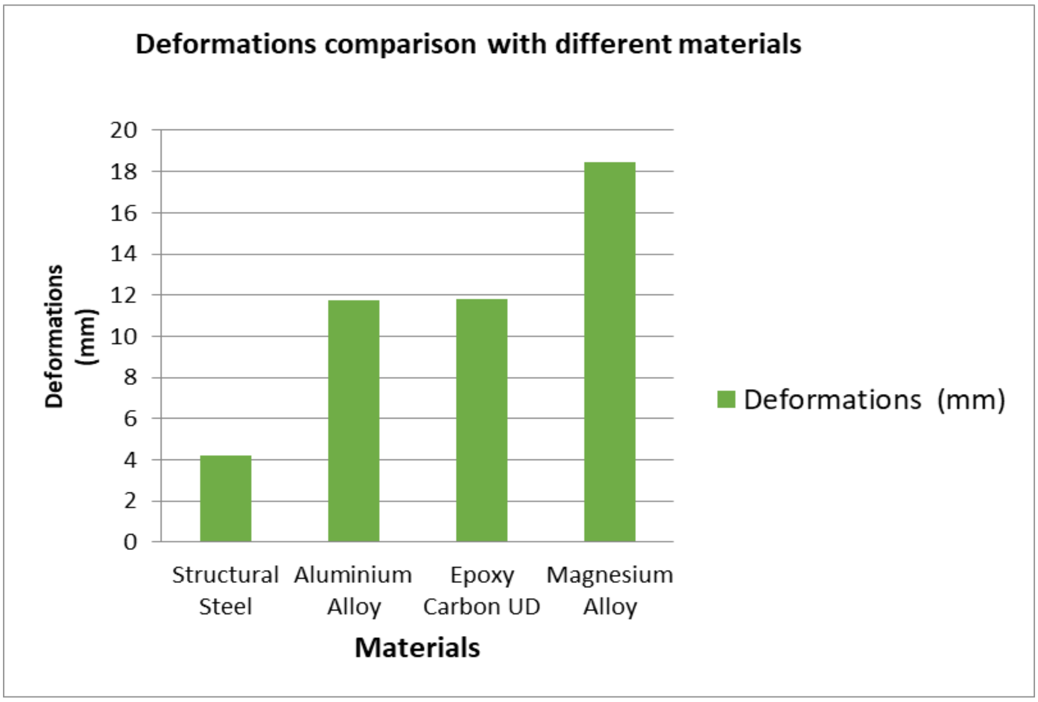

Fig.5.2 Deformations comparison with different materials

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Manual Pallet Truck are robust in construction and are smooth in operations. Manual Pallet Truck are able to work efficiently. Smooth control of precise lifting and lowering. By this project man power effort can be reduce and time of work can reduce. And we designed and analyzed of carriage fork with different load. This system has a significant importance on the equipment and material handling system considering the aspects of noise and vibration. The objective of this work is to present an improved methodology, based on numerical and experimental analysis; to evaluate the life of the manual pallet truck system. It can be improving the industrial work. and also improve the material handling equipment system. In the last several years' material handling has become a new, complex, and rapidly evolving science. For moving material in and out of warehouse many types of equipment and system are in use, depending on the type of products and volume to be handled. The equipment issued, in loading and unloading operations, for movement of goods over short distances. The handling of material in warehouse is restricted to unitized forms, which require smaller size equipment. However, for bulk handling of material at logistics nodes such as fully automatic stacker can be used for the appropriate need of improved industry In this work we find value of vonmisses stresses Structural Steel, Aluminium Alloy, Magnesium Alloy and Epoxy Carbon UD are respectively 50.58 MPa, 50.34 MPa, 50.18 MPa and 49.38MPa. And total deformation for these materials likes Structural Steel, Aluminium Alloy, Magnesium Alloy and Epoxy Carbon UD are respectively 4.188 mm, 11.74mm, 18.45mm, and 11.83 mm.

Here we can see that we have used four different materials in all materials we will be selected composite material to other than because it is light weight and heavy duty its deformation and stresses range are considerable under 1000 kg loading condition.

VI. Conclusion

In this projects we can see that we have used four different materials in all materials we will be selected composite material to other than because it is light weight and heavy duty its deformation and stresses range are considerable under 1000 kg loading condition and its very light weight compare to other than materials here we have optimize the unit weight of Pallet Truck 30% and its simple in construction ,convenient lifting operating system and special design is available according to customers' requirements.

. VII. Future scope

For further research work can be extended by using different materials and in future we can do work on stacker machine with composite materials and optimize weight, cost parameter.

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