

Design of Chassis for Automated Road Cleaning Vehicle

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Abstract - In general, the chassis is the base frame of an automotive, motorcycle, carriage, or significant vehicle. The chassis could be a frame sort of a skeleton within which numerous elements of the vehicle installed. There are several factors that need to be take into account while designing any chassis like, material choice, strength, stiffness and weight. the most important criteria for the development of chassis for electrical vehicles is rigidity, strength and price elimination. so as to fulfill the performance needed by this automotive market for electric vehicles, the body of electrical vehicles should be light-weight, sturdy and long-lasting. The chassis of the vehicle carries a substantial quantity of weight. Hence, the chassis is taken into account mutually of the foremost important elements of the any vehicle as it holds all the components and elements along.

Key Words: Chassis, Automated Vehicle, Mild Steel, Stresses, Torsional rigidity, Cost effective.

1.INTRODUCTION:

Chassis acts as a backbone for any vehicle. A chassis frame should be sturdy enough to resist all the static, dynamic, torsional and bending stresses engaged on it. Today's automotive trade could have to face some of the biggest technical challenges in its history. Seeing today's status, combustion engines doesn't have immense scope in future thanks to various reasons like increase in fuel insufficiency and inflation in fuel costs and one among the key drawbacks is increase in pollution. Electrical vehicles are solution to a number of the key issues like global warming the world is facing nowadays. The chassis is one among the foremost vital components of any vehicle as a result of it is a foundation for the body and alternative elements. Extreme stress, extreme deflection, and equal stress are all vital parameters to think about while coming up with an ideal chassis. The accomplishment of lightweight and stiff automotive structures typically plays a vital role in maximizing the potency of the electrical automotive. This work aims to design the chassis of automated road cleaning vehicle.

1.1 Parameters of Chassis:

- Supports Vehicle weight/load.
- Should withstand stresses due to road condition.
- Should withstand pressure due to breaking and acceleration.

- Ample space for mounting.
- Capability to steer vehicle.
- Must provide adequate clearance between engine compartment and uneven road surfaces.

1.2 Important Aspects of materials required to Build Chassis:

Important Aspects

- Yield strength
- Durability
- Hardness of material
- Applicable weight
- Cost of material

1.3 Functions of Chassis:

- To support the body weight and loads engaged on vehicle.
- To support the accessories of vehicle.
- To sustain all types of stresses.
- To integrate the various components of the vehicle.

1.3 Literature Survey:

Vijayan SN, et.al. [1] in this research they carried out the study of the Stress Distribution test and Deformation test for Chassis. Steel Chassis is stronger And has superior strength to withstand high load and induced low deformation and stress distribution as compared to S-Glass Epoxy composites material. A. Yasar, et.al. [2] during this analysis aim was to design a chassis for an electrical vehicle and main purpose of the design was to get a rigid and light-weight chassis. numerous chassis varieties with totally different geometries are considered of and eighteen units of chassis are designed with the help of computer aided design (CAD) software. V. Patel, et.al. [3] illustrates and offers analysis of Weight Modification With help of software. We can simply Optimize the load Of Chassis By using FEA(Finite Element Analysis) beneath FEM software (Finite Element Method) which is better and Safe. S. Kumar, et.al. [4] during this analysis some parameters of chassis square are analysed. From the results calculated within the paper it is can be said that stress is localized at certain points. Stress concentration is minimised

by adding a thick plate at the joint of side bar and a supporting member providing additional strength. K. Maideo, et.al. [5] illustrates design and analysis of chassis frame using graphene, carbon fibre and metal alloy as composite. Material selection for chassis frame plays a vital role in order to maintain the structural integrity and safety of the vehicle. With static structural analysis we tend to verify minimum, maximum and average deformation together with equivalent stresses. H.H. Rathod, et.al. [6] describes the properties of various alternate materials like carbon fibre, Aluminium alloy, Titanium and compares it with conventional mild steel. The analysis also aims to predict life of a chassis there is need to analyse the bottom material for the load variation and impacting static also as in dynamic. R.Y. Garud, et.al. [7] during this analysis they dispensed the optimization carried on the chassis, it can be concluded that eight millimetres thick Advanced High Strength Steel chassis shows higher result as compared to original five millimetres thick steel chassis. Also, for weight reduction purpose, amendment in geometrical topology was carried by dynamic Box section to T section for cross members. Z. Yang, et.al. [8] illustrates totally different applications of chassis dynamometer for vehicle emission in four aspects that are emission testing of various types of vehicles, evaluation of emission management technology, testing vehicle emission of various types of fuel, and assessing the influence of the driving style on vehicle emission and fuel consumption. The chassis dynamometer is efficient for the testing of vehicle emission. S. Chittaliya, et.al. [9] during this analysis they carried out analysing of front impact, rear impact, side impact, front torsional, rear torsional, vertical bending, lateral bending static structural analyses in ANSYS. Also observe that the chassis is safe, sturdy and durable. Design has high torsional rigidity. The stress evaluated throughout all the analysis was within the permissible limit. A. Sharma, et.al. [10] this research primary aims to analyse & build (design) light-weight chassis for significant vehicles. It compares properties of gray cast iron, AISI 4130 alloy steel and ASTM A710 steel grade A. AISI 4130 steel alloy shows higher performance than all of the opposite metal alloys or materials. it's less deformation, it's sturdy, light-weight and strong.

2. Problem Statement:

The main function of a chassis isn't solely to take care of the structural integrity but to conjointly give safety to the occupants of a vehicle just in case of a collision thus choice of material is extremely crucial. A chassis frame should be sturdy enough to resist all the static, dynamic, torsional and bending stresses engaged on it. the value needed for producing the chassis conjointly plays a serious role. Modern technology uses materials like graphene, Carbon Fiber for coming up with of chassis that ends up in high making cost. Historically, the foremost used material for producing chassis frame has been steel. Steel has some good properties; it has low-cost and is readily available.

3. Aim and Objectives:

- To use Mild Steel (M.S) as material for manufacturing of Chassis.
- To use mild steel as material for manufacturing of Chassis which makes it cost effective.
- To design a chassis for Automated Vehicle.
- To design a chassis frame that should consist of simple and vigorous structure.

4. Methodology:

A chassis serves as the basic foundation which provides strength to the body and on that all the components of a machine rest. Mass or weight reduction is a vital issue in automotive industry. Chassis could be a distinguished structure for a body, that takes the masses throughout serious accidents, costly recalls; chassis too has an excellent impact on product image. The chassis is taken into account as the most important part of the any vehicle because it holds all the components and elements along. the most important function of a chassis isn't solely to take care of the structural integrity but to provide safety to the occupants of a vehicle just in case of a collision thus choice of material is very much crucial. The design of chassis frame should sustain all kinds of stresses acting on it. The material suitable for developing Chassis is Mild Steel.

The Fig. 1 illustrates Design of Chassis.

The Table 1 illustrates dimensions of chassis.

4.1 Design of Chassis:

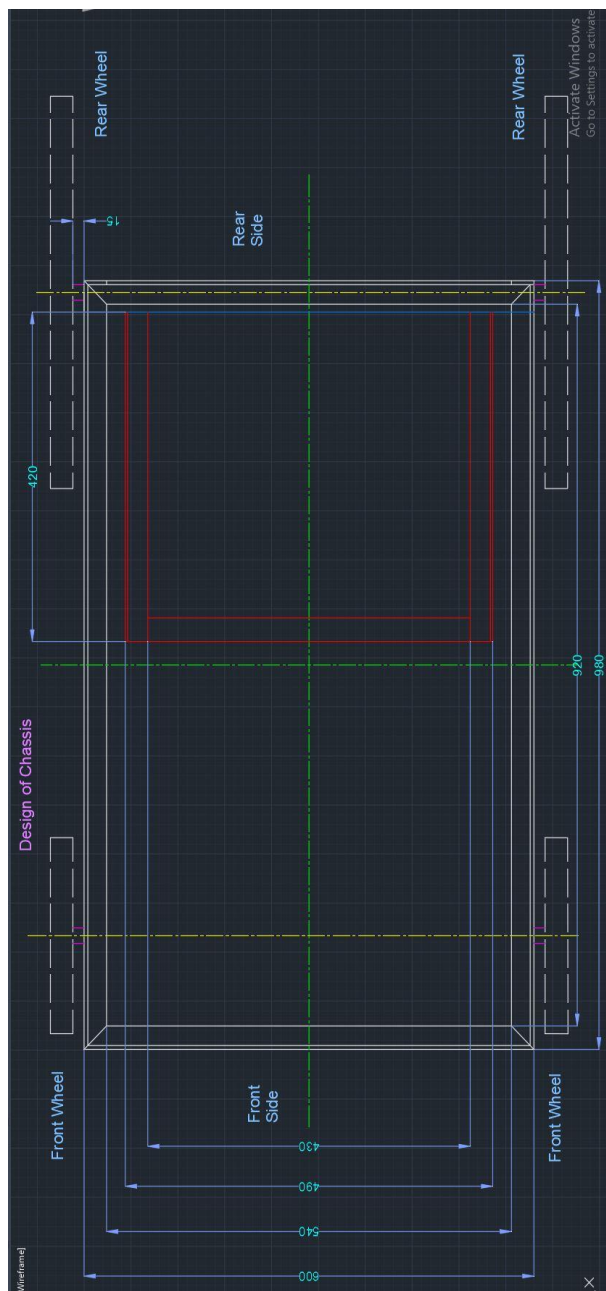


Fig 1. Design of Chassis

4.2 Dimensions of Chassis:

Attributes	Dimensions
Length of Chassis	980 mm
Width of Chassis	600 mm
Material for construction	M.S Angle 30x30x3 mm

Distance between wheels	630 mm
Collection tank support frame size	490x420 mm
Material of construction for collection tank support frame	M.S angle 25x25x3 mm

Table 1. Dimension of Chassis

4.3 Materials Available for Building Chassis:

The materials that play a major role in production of chassis involve Mild Steel, Aluminium, and Carbon fibre. Table 2. illustrates the comparison between different important aspects of following materials for chassis.

Materials	Mild Steel	Aluminium	Carbon Fibre
Yield Strength	Low yield strength	More yield strength	Excels in all parameters.
Ultimate tensile Strength	Low ultimate tensile strength	More ultimate tensile strength	
Hardness of material	Hardness is more	Less hard material	
Weight	Slightly heavier	Lighter than steel	
Cost of material	Low cost	Cost is more	Cost is very high

Table 2. Comparison between properties of metals

The Carbon Fibre excels in all parameters on comparison with Mild Steel and Aluminium. But the cost of Carbon Fibre is very high.

4.4 Cost of Materials:

The cost of material is an important factor that must be studied before selection of material. Table 3. illustrates cost of materials that can be used for producing chassis.

Materials	Cost of material per kg
Mild Steel	INR 110
Aluminium	INR 225
Carbon fibre	INR 1700

Table 3. Cost of materials

5. Expected Outcomes:

- From the gathered information, it is clear that chassis could be a distinguished structure for a body, that takes the loads throughout serious accidents. A chassis is the essential foundation which provides strength to the body and on that all the components of a machine rest.
- A chassis frame should be sturdy enough to resist all the static, dynamic, torsional and bending stresses acting on it.
- The utilization of mild steel for manufacturing chassis makes it cost effective, also mild steel is readily available out there.

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