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Automotive Chassis: The Back Bone of the Vehicle

Margaret H. Brandon[1], Jill Bradshaw[2]
Associate Professor[1], Assistant Professor[2]
Department of Mechanical Engineering
Georgia Institute of Technology
Corresponding Authors' email id: *jill_99bradshaw@gmail.com*

Abstract

Vehicle Chassis is the main support structure of the vehicle which is also known as 'Frame'. It bears all the stresses on the vehicle in both static and dynamic conditions. In a vehicle, it is analogous to the skeleton in living organisms. Every vehicle whether it is a two-wheeler or a car or a truck has a chassis-frame. However, its form obviously varies with the vehicle type. In this article we will discuss the main functions of chassis with its different types and applications followed by conclusion

Keywords: *Automotive chassis, Vehicle, Chassis-frame, Radiator,*

INTRODUCTION

Automotive chassis is a skeletal frame on which various mechanical parts like engine, tires, axle assemblies, brakes, steering etc. are bolted. At the time of manufacturing, the body of a vehicle is flexibly molded according to the structure of chassis. Automobile chassis is usually made of light sheet metal or composite plastics. A vehicle frame, also known as its chassis, is the main supporting structure of a motor vehicle, to which all other components are attached, comparable to the skeleton of an organism.

The origin of the word Chassis lies in the French language and was initially used to denote the frame parts or basic structure of the vehicle. Until the 1930s virtually every car had a structural frame, separate from its body. This construction design is known as body-on-frame. Over time, nearly all passenger cars have migrated to unibody construction, meaning their chassis and bodywork has been integrated into one another. Nearly all trucks, buses, and most pickups continue to use a separate frame as their chassis.

In most passenger cars through the middle of the 20th century, a pressed-steel frame—the vehicle's chassis—formed a skeleton on which the engine, wheels, axle assemblies, transmission, steering mechanism, brakes, and suspension members were mounted. The body was flexibly bolted to the chassis during a manufacturing process typically referred to process is used today for heavy-duty vehicles, such as trucks, which benefit from having a strong central frame, subjected to the forces involved in such activities as carrying freight, including the absorption of the movements of the engine and axle that is allowed by the combination of body and frame.

In modern passenger-car designs, the chassis frame and the body are combined into a single structural element. In this arrangement, called unit-body (or unibody) construction, the steel body shell is reinforced with braces that make it rigid enough to resist the forces that are applied to it. Separate frames or partial "stub" frames have been used for some cars to achieve better noise-isolation characteristics. The heavier-gauge steel present in modern component designs also tends to absorb energy during impacts and limit intrusion in accidents.

See Figure: 1 Chassis of an automobile generally consists of the following components suitably mounted on it

- Engine and the Radiator
- Transmission system (clutch, gear box, propeller shaft etc.)
- Suspension system
- Road Wheels
- Steering System
- Brakes
- Fuel Tank

FUNCTIONS

The Chassis has the following functions. It

1) Supports or bears the load of the vehicle body
2) Provide the space and mounting location for various aggregates of vehicle
3) Supports the weight of various systems of the vehicle such as engine, transmission etc.
4) Supports a load of passengers as well as the luggage
5) Withstands the stresses arising due to bad road condition
6) Withstands stresses during braking and acceleration of the vehicle

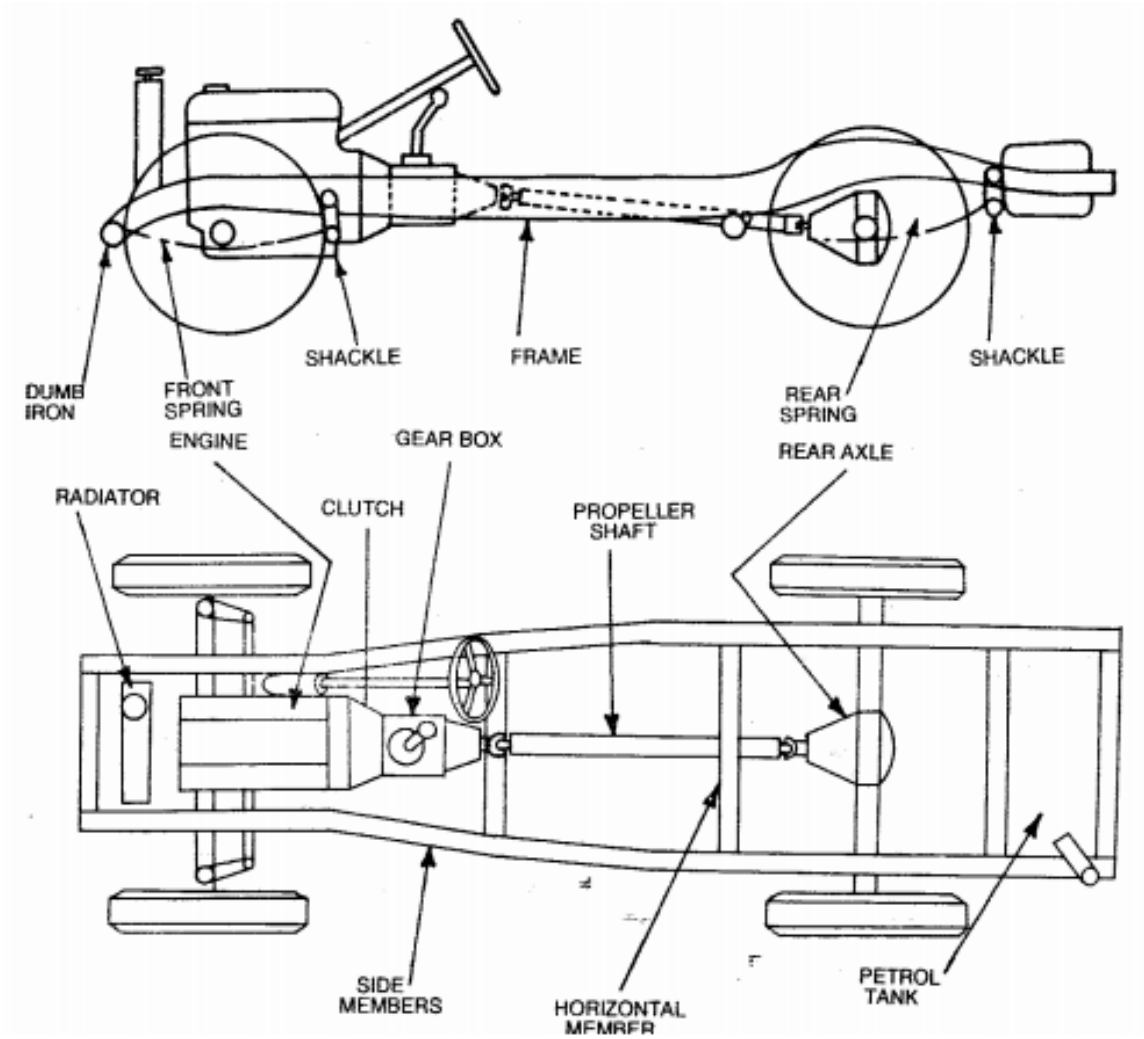

Figure 1: Layout of a Chassis and its main components

TYPES OF CHASSIS FRAMES

There are three types of frames

1. Conventional frame
2. Integral frame
3. Semi-integral frame

1. Conventional frame: It has two long side members and 5 to 6 cross members joined together with the help of rivets and bolts. The frame sections are used generally.

Figure 2: Conventional Chassis

In this type of chassis the body is made as a separate unit and then joined with ladder frame. It supports all the systems in a vehicle such as the Engine, Transmission system, Steering system, Suspension system.

Advantage

- Higher load capacity and strength.

Disadvantage

- The body tends to vibrate easily and the overall vehicle handling and refinement is lower.

These are generally used in truck, bus and in SUV cars and bigger vehicles.

a. Channel Section - Good resistance to bending

b. **Tabular Section -** Good resistance to Torsion

c. **Box Section -** Good resistance to both bending and Torsion

2. Integral Frame or Frameless or Non Conventional Chassis: This frame is used now a day in most of the cars. There is no frame and all the assembly units are attached to the body. All the functions of the frame carried out by the body itself. Here the body shell and underbody are welded into single unit. The underbody is made of floor plates and channel and box sections welded into single unit. This assembly replaces the frame. Due to elimination of long frame it is cheaper and due to less weight most economical also. Only disadvantage is repairing is difficult.

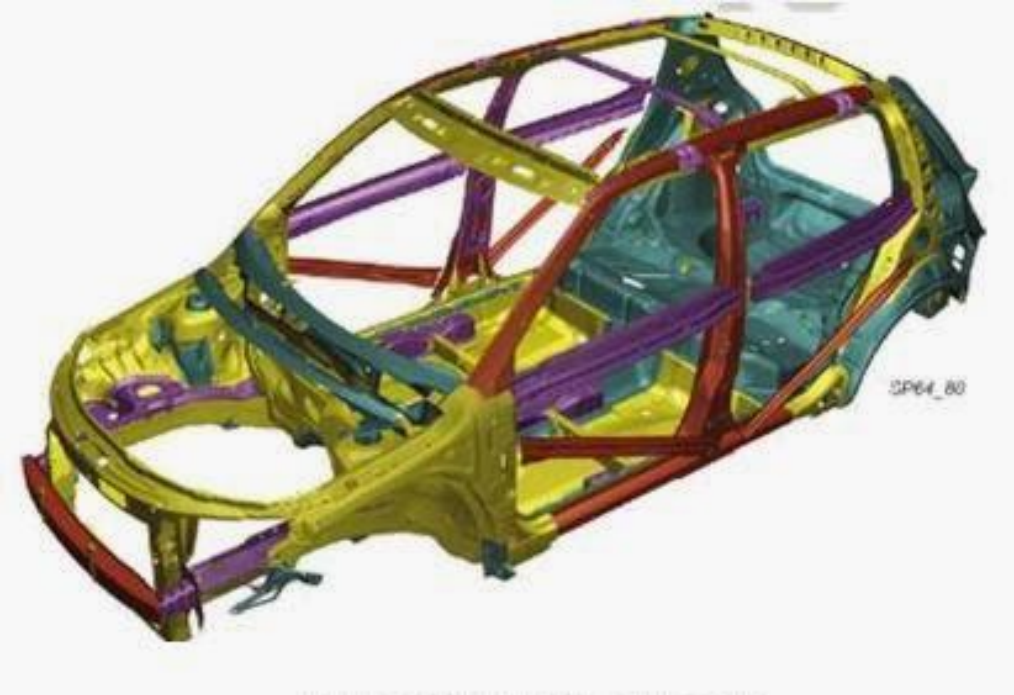

Figure 3: Integral Frame or Non Conventional Chassis

In this type of chassis the ladder frame is absent and the body itself acts as the frame. It supports all the systems in a vehicle such as the Engine, Transmission system, Steering system, Suspension system.

Advantage

- Less rattles and squeaks are developed.
- Handling is better due to the higher body rigidity and weight.
- Due to elimination of long frame it is cheaper and due to less weight most economical also.

Disadvantage

- The load carrying capacity is lower.
- It is not safe in accidental condition.
- Repairing is difficult

These types of chassis are generally used mostly in hatchback and sedan cars.

3. Semi - Integral Frame: In some vehicles half frame is fixed in the front end on which engine gear box and front suspension is mounted. In this case the rubber mountings used in conventional frame between frame and suspension are replaced by more stiff mountings. Because of this some of the vehicle load is shared by the frame also.

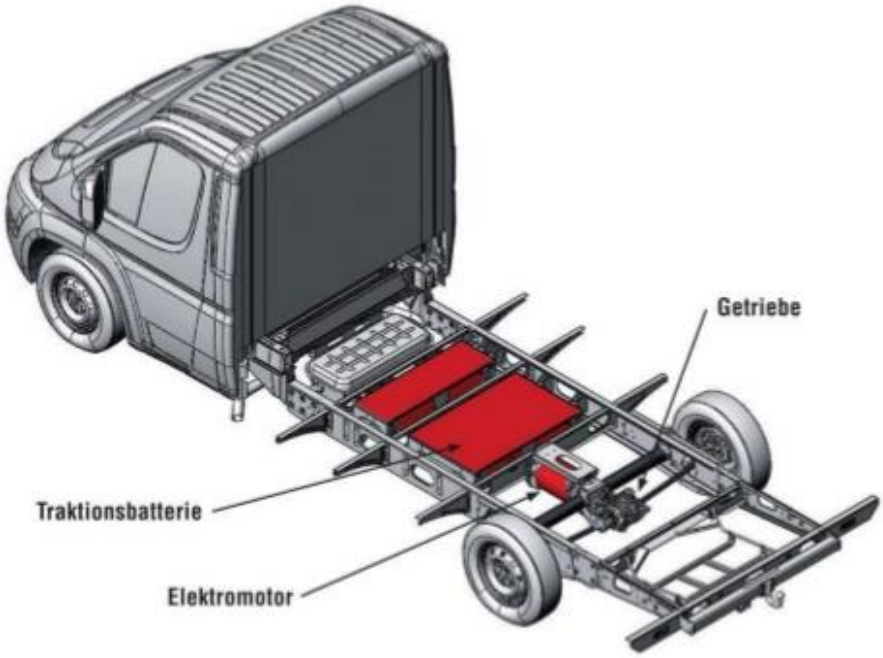

Figure 4: Semi-Integral Frame

This type of frame is heavier in construction. It has the advantage when the vehicle is met with accident the front frame can be taken easily to replace the damaged chassis frame.

Advantages

- When the vehicle is met with accident the front frame can be taken easily to replace the damaged chassis frame.
- Vehicle load is shared by the frame.

Disadvantages

- Heavier in construction

This type of frame is used in FIAT cars and some of the European and American cars.

CONCLUSION

A vehicle without body is known as chassis. It is the backbone of vehicle on which total load of vehicle is applied. Many of vehicles properties are strictly connected with the chassis or frame. Dynamic properties and static or geometric parameters of the vehicle depends on chassis or frames. It provides strength needed for supporting vehicular components and payload placed upon it. Automobile chassis helps keep an automobile rigid, stiff and unbending and

thus ensures low levels of noise, vibrations and harshness throughout the automobile.

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