4.0 **Chassis Frame and Body**

Chassis otherwise called chassis frame is the primary supporting unit of several vehicle components such as engine, transmission system, etc as shown in Figure 4.1. It provides a rigid structural foundation for the vehicle body, and solid anchorage for the suspension system. It can be referred to as the back-bone of a vehicle.

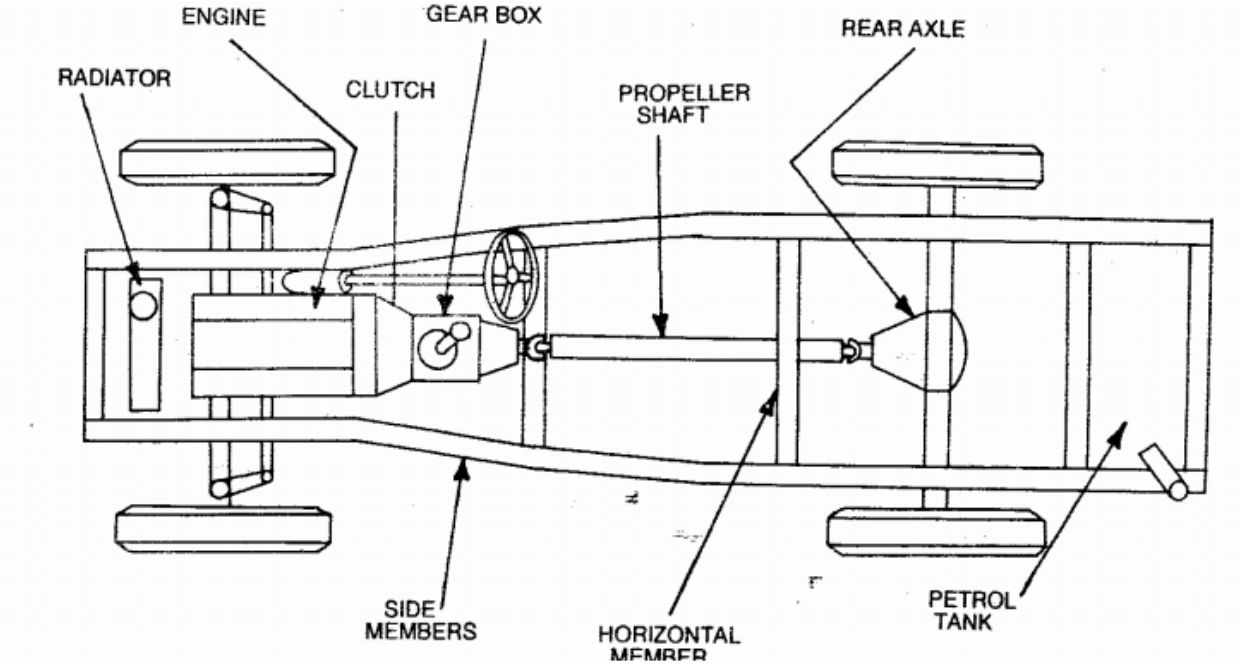

Figure 4.1: Layout of Chassis and its main Components

4.1 Main components of vehicle chassis

1. Frame: it is made up of two members called side members which are joined together by cross members.

2. Engine: provides the source of power

3. Clutch: It connects and disconnects the power from the engine fly wheel to the transmission system.

4. Gear Box

5. Propeller Shaft

4.2 Functions of Chassis Frame

1. Supports passengers load, goods and body of the vehicle.

2. It also support vehicle components such as engine, gear box etc.

3. It helps to withstand the forces caused due to the sudden braking or acceleration.

4. It also helps to withstand the stresses caused due to the bad road condition.

5. It assists to stabilize the vehicle while cornering.

4.3 Types of Chassis Frames

1. Conventional frame: This is constructed as a separate unit from the vehicle body. The frame may be constructed with steel. The structural members are usually of the following:

a. Channel Section - Good resistance to bending

b. Tubular Section – Good resistance to torsion

c. Box Section - Good resistance to both bending and torsion

2. Integral Frame: This is the type of frame used in modern cars. In this type of chassis, the frame and body are built as a unit. The various body sections are used as structural strength members to help support and stiffen the entire unit. Due to elimination of long frame it is cheaper and due to less weight most economical. The only disadvantage is that it is difficult to repair.

3. Semi - Integral Frame: In some vehicles half frame is fixed in the front end on which engine gear box and front suspension are mounted. In a situation when the vehicle is met with accident, the front frame if damaged can easily replace. This type of frame is used in some of the European and American cars.

4.4 Requirements of automotive bodies

1. The body should be light.

2. It should have minimum number of components.

3. It should provide sufficient space for passengers and luggage.

4. It should withstand vibrations while in motion.

5. It should be attractive in shape and colour.

6. It should provide good vision and ventilation.

5.0 Steering System

Steering system helps to provide the directional change in the movement of an automobile and maintain in a position as per the driver's decision without much strain.

5.1 Requirements of steering system

1. It must keep the wheel at all times in rolling motion without rubbing on the road.

2. It must light and stable.

3. It should be able to absorb the road shocks.

4. It must be easy to operate with less maintenance.

5. It should have self-centering action to some extent.

5.2 Functions of Steering System:

1. It helps in swinging the wheels to the left or right.

2. It helps in turning the vehicle at the will of the driver.

3. It provides directional stability.

4. It is used to minimize the tyre wear and tear.

5. It helps in achieving self-centering efforts.

5.3 Main Components of Steering System

The main components include steering wheel, steering column or shaft, steering Gear, etc as shown in Figure 5.1.

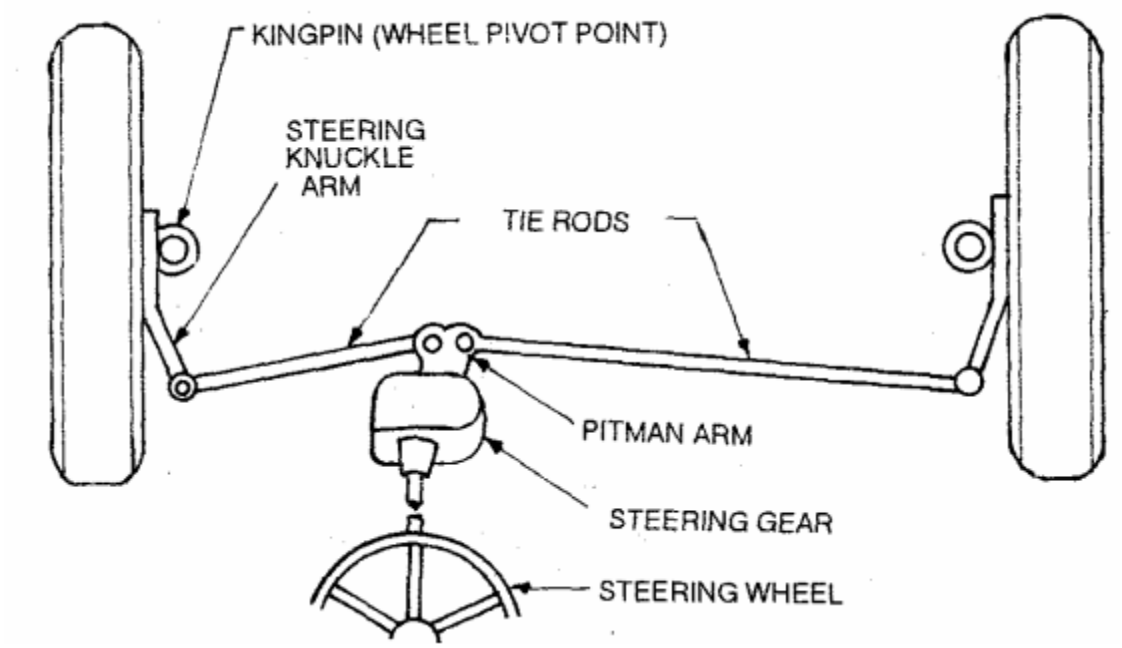

Figure 2.2: Components of steering system.

Steering gears

The steering gears are machine element used to:

1. Converts the rotary motion of the steering wheel into the angular turning of the front wheels.

2. Multiplies driver's efforts and gives mechanical advantage.

Steering Linkages: These are connection of various links between the steering gear box and the front wheels. The motion of the pitman arm and steering gear box is transferred to the steering knuckles of the front wheels through the steering linkages. The swinging movement of the pitman arm from one side to the other gives angular movement to the front wheel through the steering linkages.

Slip Angle: It is the angle between direction of the motion of the vehicle and the center plane of the tyre. It ranges from 8º to 10º.

Under steer: It is a condition in which the front slip angle is greater than that of rear and the vehicle tends to steer in the direction of centre path. This provides greater driving stability, especially when there is a side wind.

Over Steer: It is a condition in which the rear slip angle is greater than that of front slip angle and the vehicle tends to move away from the direction of center path. This is important when the vehicle is moving on the road having many bends or curves.

Turning Radius: It is the radius of the circle on which the front wheels move when turned to their extreme outer position. This radius ranges from 5 to 7.5 m for buses and trucks.

5.4 Wheel Alignment: It is referred to as the positioning of the front wheels and steering mechanism so as to give the vehicle directional stability, reduce tyre wear.

5.4.1 Factors influencing the wheel alignment

1. Balance of wheels (Static and Dynamic)
2. Inflation of tyre.
3. Brake adjustments.
4. Steering Linkages.
5. Suspension System
6. Steering Geometry

Steering Geometry: It refers to the angular relationship between the front wheels and parts attached to it and car frame. The steering Geometry includes Caster angle, Camber angle, etc.

Caster Angle: This is the angle between backward or forward tilting of the king pin from the vertical axis at the top. This is about 2^{o} to 4^{o}. The backward tilt is called as positive caster. The forward tilt is called negative caster.

Camber Angle: The angle between wheel axis to the vertical line at the top is called camber angle. It is approximately ½º to 2º.

King-pin inclination: It is the angle between vertical line to the king pin axis. The inclination tends to keep wheels straight ahead and make the wheels to get return to the straight position after completion of a turn. The inclination is normally kept 7º to 8º.

Toe-in: It is the amount in minimum at the front part of the wheel points inwards approximately 3 to5 mm. It prevents side slipping excessive tyre wear, proper rolling of front wheels and steering stability.

Toe-out: It is the difference in angles between two front wheels and vehicle frame during turning. It is used to prevent dragging of tyre during turn.

5.5 Steering defects and their Causes/remedies:

1. Wheel wobble: The oscillation of the front wheels at low speeds is called wheel wobble.

Causes	Remedies
a. Incorrect dynamic balancing of wheels.	Correct the wheel balance.
b. Uneven tyre pressure.	Check the tyre pressure.
c. The camber may be incorrect or uneven.	Adjust suitably.
d. The ball joints may be worn out.	Replace with a new one.
e. Excessive caster.	Adjust.
f. Steering gear or wheel bearing may be loosen.	Adjust or replace.
g. Tyre may wear unevenly.	Replace.

2. High Speed shimmy: The oscillation of the front wheels at high speed is called high speed shimmy.

a. Wheel Rim may be buckled - Straighten or replace

b. Front wheel bearing may loose or worn out - Tighten or Replace

c. Faulty shock Absorber - Replace

d. Incorrect toe-in - Adjust

3. Excessive backlash in steering:

a. Steering gear base may be loose -Tighten

b. Drop arm may be loose on splines - Replace

c. Front wheel stub axle bearing loose or worn out - Tighten or Replace

d. Loose steering Linkages - Tighten Properly

4. Steering Wander: The moving of Vehicle slightly in one side is known as wandering

a. Tyre pressure in two sides is not equal - Check and correct

b. Steering knuckle bearing tight - Adjust

c. Badly worn tyre - Replace

d. Incorrect Toe-in - Correct it.

5. Hard Steering: When the effort required for steering is more it is called hard steering.

a. Low tyre pressure - Correct pressure

b. Excessive caster - Adjust

c. Steering gear too tight - Adjust

d. Incorrect wheel Alignment - Adjust