1.3 VECHICLE CHARACTERISTICS

The various vehicular characteristics affecting road the road design may be classified into two types.

1. Static characteristics

2. Dynamic characteristics

- **Static characteristics**

Static characteristics of vehicle includes the vehicle dimensions, weight, axle configuration, turning radius and turning path.

- **Vehicle Dimensions**

The vehicular dimensions which can affect the road and traffic design are mainly: **width, height, length, rear overhang, and ground clearance**. The width of vehicle affects the **width of lanes, shoulders and parking facility**.

The capacity of the road will also decrease if the width exceeds the design values. The **height of the vehicle affects** the clearance height of structures like over- bridges, under-bridges and electric and other service lines and also placing of signsand signals.

Another important factor is the **length of the vehicle** which **affects** the extra width of pavement, minimum turning radius, safe overtaking distance, capacity andthe parking facility.

The **rear overhang** control is mainly important when the vehicle takes aright/left turn from a stationary point.

The ground clearance of vehicle comes into picture while designing ramps and property access and as bottoming out on a crest can stop a vehicle from moving under its own pulling power.

1. Weight, axle configuration etc.

The weight of the vehicle is a **major consideration during the design of pavements both flexible and rigid.**

The **weight of the vehicle** is transferred to the **pavement** through the axles andso the **design** parameters are fixed on the basis of the number of axles.

The power to weight ratio is a measure of the ease with which a vehicle can move. It determines the operating efficiency of vehicles on the road.

The ratio is more important for heavy vehicles. The power to weight ratio is the major criteria which determines the length to which a positive gradient can be permitted taking into consideration the case of heavy vehicles.

2. Turning radius and turning path

The minimum turning radius is dependent on the design and class of the vehicle. The effective width of the vehicle is increased on a turning. This also important at an intersection, roundabout, terminals, and parking areas. acceleration and braking characteristics, Power Performance and some aspects ofvehicle body design.

1. Speed

The vehicle speed affects, **(i)** sight distances **(ii)** super elevation, length of transition curve and limiting radius on horizontal curves **(iii)** length of transition curves on vertical valley curves and humps **(iv)** width of pavement shoulders on straight and on horizontal curves **(v)** design gradient **(vi)** capacity of traffic lane **(vii)** design and control measures on intersections.

2. Acceleration Characteristics

The acceleration capacity of vehicle is dependent on its mass, the resistance to motion and available power. In general, the acceleration rates are highest at low speeds, decreases as speed increases.

Heavier vehicles have lower rates of acceleration than passenger cars. The difference in acceleration rates becomes significant in mixed traffic streams. Forexample, heavy vehicles like trucks will delay all passengers at an intersection.

Again, the gaps formed can be occupied by other smaller vehicles only if they are given the opportunity to pass. The presence of upgrades make the problem more severe.

3. Braking performance

As far as highway safety is concerned, the braking performance and deceleration characteristics of vehicles are of prime importance. The time and distance taken to stop

the vehicle is very important as far as the design of various traffic facilities are concerned.

Trucks are forced to decelerate on grades because their power is not sufficient to maintain their desired speed. As trucks slow down on grades, long gaps will be formed in the traffic stream which cannot be efficiently killed by normal passing maneuvers.

The factors on which the braking distance **depends are the type of the road and its condition, the type and condition of tire and type of the braking system.**

The main characteristics of a traffic system influenced by braking and 4deceleration performance are: (i) sight distance (ii) clearance and change in interval (iii) sign placement

Safe stopping sight distance: The minimum stopping sight distance includes both the reaction time and the distance covered in stopping. Thus, the driver shouldsee the obstruction in time to react to the situation and stop the vehicle.

Clearance and change interval: The Clearance and change intervals are again related to safe stopping distance. All vehicles at a distance further away than one stopping sight distance from the signal when the Yellow is flashed is assumed to be able to stop safely.

Sign placement: The placement of signs again depends upon the stopping sight distance and reaction time of drivers. The driver should see the sign board from a distance at least equal to or greater than the stopping sight distance.

3. Power performance of vehicles

Knowledge of the power performance of a vehicle is necessary to determine the vehicle running costs and the geometric design elements like grades.

The power developed by the engineer (P_p) should be sufficient to overcome all resistance to motion at the desired speed and to acceleration at any desired rate to the desired speed. The forces have to be overcome for this purpose:

1. Rolling resistance(P_f)
2. Air resistance(P_a)
3. Grade resistance(Pi)

4. Inertia forces during acceleration and deceleration(P_j)

5. Transmission losses

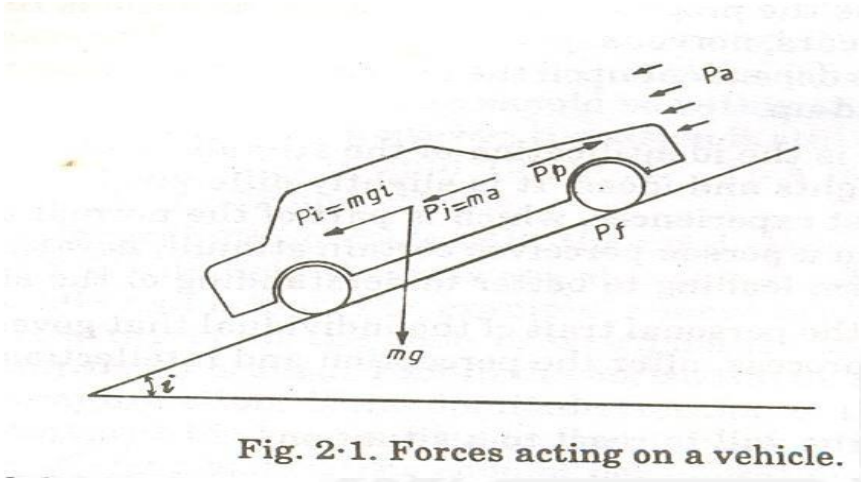

Fig. 2·1. Forces acting on a vehicle.

1.3.1 TRAFFIC CHARACTERISTICS

Traffic engineering covers a broad range of engineering applications with a focus on the safety of the public, the efficient use of transportation resources, and the mobility of people and goods.

Traffic engineering involves a variety of engineering and management skills, including design, operation, and system optimization. In order to address the above requirement, the traffic engineer must first understand the traffic flow behaviour and characteristics by extensive collection of traffic flow data and analysis. Based on this analysis, traffic flow is controlled so that the transport infrastructure is used optimally as well as with good service quality.

❖ In short, the role of traffic engineer is to protect the environment while providing mobility, to preserve scarce resources while assuring economic activity, and to assure safety and security to people and vehicles, through both acceptable practices and high-tech communications is difficult to categorize them into separate well defined disciplines because of the significant overlap, it may be worth the effort to highlight the importance given by thetransportation community.

They can be enumerated as below:

1. **Public transportation**: Public transportation or mass transportation deals with study of the transportation system that meets the travel need of several people by sharing a vehicle. Generally this focuses on the urban travel by bus and rail transit. The major topics include characteristics of various modes; planning, management and operations; and policies for promoting public transportation.

2. **Financial and economic analysis:** Transportation facilities require large capital investments. Therefore it is imperative that whoever invests money should get the returns. When government invests in transportation, its objective is not often monetary returns; but social benefits. The economic analysis of transportation project tries to quantify the economic benefit which includes saving in travel time, fuel consumption, etc. This will help the planner in evaluating various projects and to optimally allocate funds. On the contrary, private sector investments require monetary projects from the projects. Financial evaluation tries to quantify the return from a project.

Environmental impact assessment: The depletion of fossil fuels and the degradation of the environment has been a severe concern of the planners in the past few decades. Transportation; in spite of its benefits to the society is a major contributor to the above concern. The environmental impact assessment attempts in quantifying the environmental impacts and tries to evolve strategies for the mitigation and reduction of the impact due to both construction and operation. The primary impacts are fuel consumption, air pollution, and noise pollution.

4. **Accident analysis and reduction:** One of the silent killers of humanity is transportation. Several statistics evaluates that more people are killed due to transportation than great wars and natural disasters. This discipline of transportation looks at the causes of accidents, from the perspective of human, road, and vehicle and formulate plans for the reduction.
5. **Intelligent transport system:** With advent to computers, communication, and vehicle technology, it is possible in these days to operate transportation system much

effectively with significant reduction in the adverse impacts of transportation. Intelligent transportation system orders better mobility, efficiency, and safety with the help of the state-of-the-art-technology.

The study of traffic engineering may be divided into six major sections:

1. Traffic characteristics
2. Traffic surveys and analysis
3. Traffic operation control and regulations
4. Planning and analysis
5. Geometric design
6. Traffic management

5E'S OF TRAFFIC ENGINNERING:

1. Engineering
2. Enforcement
3. Education
4. Economics
5. Environmental