



RGPVNOTES.IN

Program : **B.E**

Subject Name: **Traffic Engineering**

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Semester: **8th**



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Unit –I

Traffic Characteristics: (i) Road user's characteristics - general human characteristics, physical, mental and emotional factors, factors affecting reaction time, PIEV theory. (ii) Vehicular characteristics: Characteristics affecting road design-width, height, length and other dimensions. Weight, power, speed and braking capacity of a vehicle.

ROAD USER CHARACTERISTICS

Human beings performing different roles in the traffic are most important elements of the traffic and so we have to study their characteristics and behavior. Various roles of human are such as driver, pedestrians, cyclists etc. The physical, mental and emotional characteristics of human beings affect their ability to operate motor vehicle safely or to service as a pedestrian. Hence it is important for a traffic engineer to study the characteristics and limitations of the road users.

The various factors which affect road user characteristics may broadly be classified under four heads:

- Physical
- Mental
- Psychological
- Environmental

Physical characteristics: The permanent physical characteristics of the driver are vision, hearing, strength and the general reaction to the traffic situations.

Vision includes the acuity of vision, peripheral vision and eye movement; glare vision, glare recovery and depth judgment. Field of accurate, clear vision is about a 3 degrees cone however the vision is fairly satisfactory up to 10 degrees in general and 20 degrees in horizontal plane. In vertical plane the vision may be limited to 2/3 of that in horizontal plane. Hearing is helpful for drivers but of more important for the pedestrians and cyclists. Strength is not an important factor in general; lack of strength may make parking maneuvers difficult, particularly for heavy vehicles.

Mental Characteristics: Knowledge, skill, intelligence, experience and literacy can affect the road user characteristics. Knowledge of vehicle characteristics, traffic behavior, driving practice, rules of roads and psychology of road users will be quite useful for safe traffic operations.

Psychological factors: this effect reaction to traffic situations of road users to a great extent. Attentiveness, anger, fear, anxiety, phobias, superstition, and impatience may affect the traffic performance to great extent.

Environment factors: The various environmental conditions affecting the behavior of road user are traffic stream characteristics, facilities to the traffic, atmospheric conditions and locality. The traffic stream may consist of mixed traffic or heavy traffic whereas facilities to overtake to the faster vehicles may be limited. The behavior of the driver varies from one traffic stream to another.

PIEV

PIEV is the amount of time it takes a driver to react to a hazard. PIEV mean PIEV time - perception, intellection, emotion and volition. Before we can stop an automobile, four specific areas of activity need to happen:

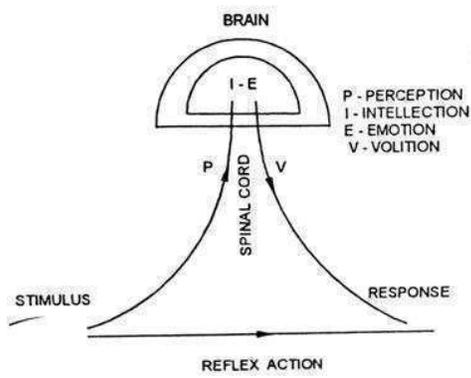
PIEV Theory Splits the Reaction Time of Driver into 4 Components....!

Perception: Time Required To Perceive an Object or Situation. This is Function of Eyes, Ears

Intellection: Time Required For Understanding The Situation. This is Function of Brain

Emotion: Based on Our Emotions at the time (Fear, Anger etc.) We Reach The Decision Weather We Want To Stop or Not. This is Function of Brain

Volition: Once The Decision of Stopping Has Been Finalized, Time Required For Moving the Foot From the Gas to the Brake Pedal. This is Function of Hands or Legs



Perception 2) Intellection 3) Emotion 4) Violation 1) Perception time: is time required for the sensations received by the eyes or ears of the driver to be transmitted to the brain through the nervous system & spinal cord or it is the time required to perceive an object or situation. 2) Intellection time : is the time require for the driver to understand the situation it is also the time required for comparing the different thoughts. 3) Emotion time: is the time elapsed during emotional sensational and other mental disturbance such as fear, anger or any other emotional feeling superstition etc 4) Volition time: is the time taken by the driver for the final action such as brake application.

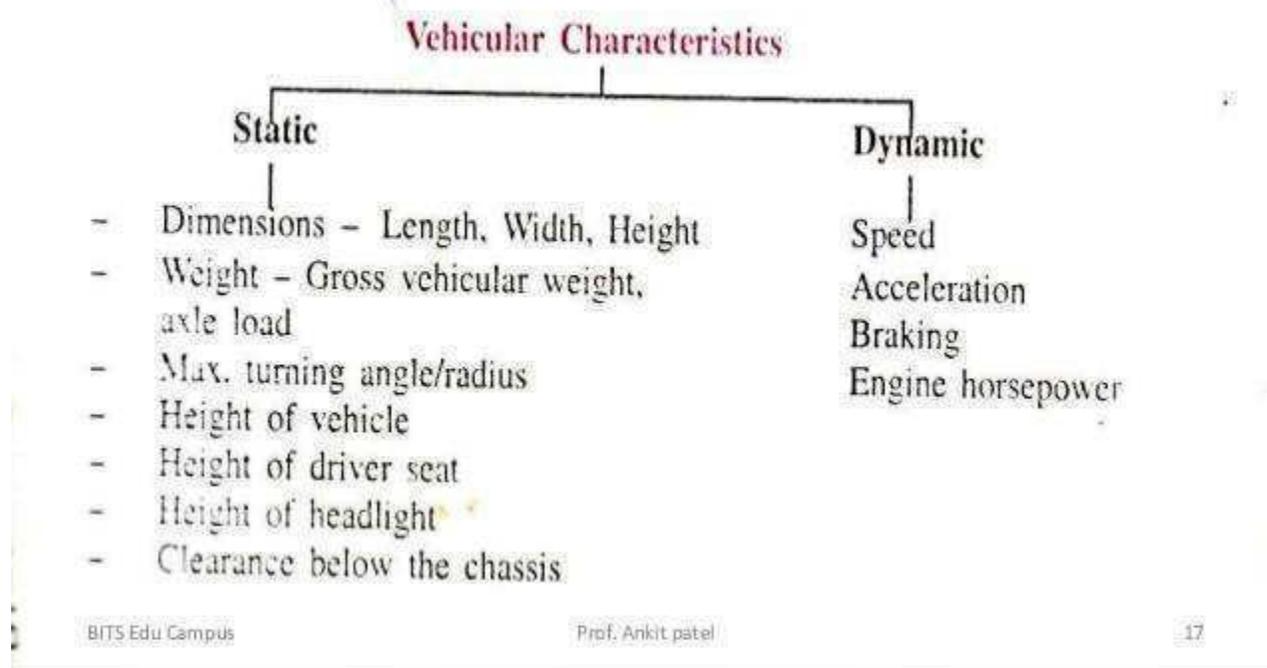
VEHICULAR CHARACTERISTICS--

Static characteristics- Static characteristics of vehicles affecting road design are the dimensions, weights and maximum turning angle. The height of vehicle affects the clearance of the overhead structure.

Dynamic Characteristics- Dynamic characteristics of vehicles affecting road design are speed, acceleration and braking characteristics. The speed and acceleration depends upon the power of engine and resistance to be overcome and are important in all geometric design elements.

Vehicular Characteristics

(B) Vehicular Characteristics :



CHARACTERISTICS AFFECTING ROAD DESIGN - FACTORS AFFECTING PAVEMENT DESIGN

There are so many factors which influencing the pavement design. The factors may be of loading, environment, materials used etc. Which are as follows.

- Wheel load
- Axle configuration
- Contact pressure
- Vehicle speed
- Repetition of loads
- Subgrade type
- Temperature
- Precipitation

Wheel Load Influence on Pavements:-Wheel load on pavement is an important factor to determine the pavement thickness to be adopted. By providing adequate thickness, the load coming from wheels doesn't affect the Subgrade soil. The wheel load is acts at particular point on pavement and cause deformations. If the vehicle contains dual wheels on one side of axle, then convert it into equivalent single wheel load. Dual wheeled axle vehicles control the contact pressure within the limits.

Tire Contact Pressure on Pavement:-When the vehicle is moving on pavement, a pressure developed between the tire and pavement. If the tire is low pressure tire, then contact pressure will be greater than tire pressure. If it is high pressure tire, then contact pressure will be less than tire pressure. The original Shape of contact area is generally elliptical. But to ease the calculations circular shape is considered.

Vehicle Speed:-If the vehicle is moving at creep speed then also damage occurs to the pavement. If vehicle speed is gradually increased then it will cause smaller strains in the pavement.

Repetition of Loads:-Constructed pavement is used by several vehicles in its design life. The wheel loads are repeated all the time due to this some deformation occurs on the pavement. Total deformation is the sum of all wheel loads acting on it. So, in the design of pavement frequency of load is also considered. For the design of pavement, single axle with dual wheels carrying 80Kn load is considered as standard axle.

Sub grade Type:-To construct pavement sub grade soil need to be tested. Various test like CBR, Tri axial etc. will helps to determine the quality of Subgrade. From this we can adopt the required thickness to the pavement. If sub grade soil is poor then the pavement should damage easily.

Temperature Effects on Pavements Design:-Temperature is the important environmental factor to be considered in the design of pavement. In case of asphalt roads, temperature affects the resilient modulus of surface course. In very hot condition asphalt layers lose their stiffness. At low temperature, asphalt layers become brittle and cracks are formed.

Precipitation: - Moisture variations or precipitation from rain affects the depth of groundwater table. Good drainage facilities should be provided for good strength and support. The ground water table should be at least below 1m from the pavement surface.

Many factors such as number of vehicles, speed, climatic conditions and other factors affect are to be considered for the design of pavement. In this article we will discuss about the factors influencing pavement design.

Pavements are engineered structures which are used as roads, runways, parking areas, etc. Ground or surface transportation is the most widely used transportation in the world. So, construction of pavements should be done as it is strong and durable for their design life.

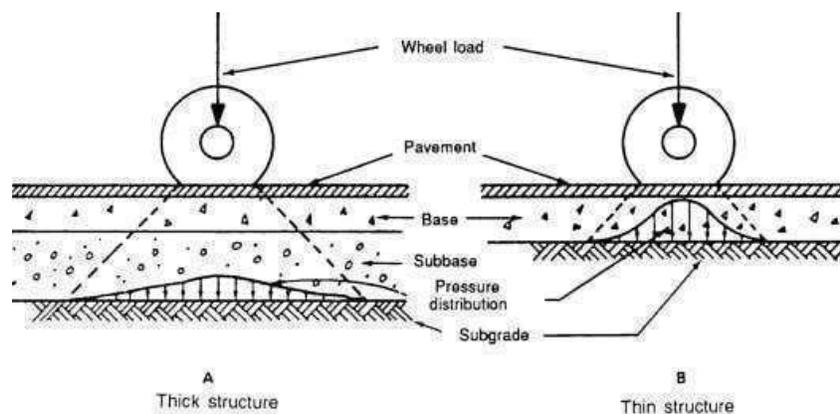
Factors Affecting Pavement Design

There are so many factors which influencing the pavement design. The factors may be of loading, environment, materials used etc. Which are as follows?

1. Wheel load
2. Axle configuration
3. Contact pressure
4. Vehicle speed
5. Repetition of loads
6. Subgrade type
7. Temperature
8. Precipitation

1. Wheel Load Influence on Pavements

Wheel load on pavement is an important factor to determine the pavement thickness to be adopted. By providing adequate thickness, the load coming from wheels doesn't affect the subgrade soil. The wheel load is acts at particular point on pavement and cause deformations. If the vehicle contains dual wheels on one side of axle, then convert it into equivalent single wheel load. Dual wheeled axle vehicles control the contact pressure within the limits.



3. Tire Contact Pressure on Pavement

When the vehicle is moving on pavement, a pressure developed between the tire and pavement. If the tire is low pressure tire, then contact pressure will be greater than tire pressure. If it is high pressure tire, then contact pressure will be less than tire pressure. The original Shape of contact area is generally elliptical. But to ease the calculations circular shape is considered.



4. Vehicle Speed

If the vehicle is moving at creep speed then also damage occurs to the pavement. If vehicle speed is gradually increased then it will cause smaller strains in the pavement.

5. Repetition of Loads

Constructed pavement is used by several vehicles in its design life. The wheel loads are repeated all the time due to this some deformation occurs on the pavement. Total deformation is the sum of all wheel loads acting on it. So, in the design of pavement frequency of load is also considered. For the design of pavement, single axle with dual wheels carrying 80 Kn load is considered as standard axle.

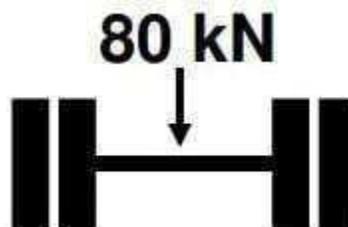


Fig 5: Axle Load on Pavement

6. Subgrade Type

To construct pavement sub grade soil need to be tested. Various test like CBR, Tri axial etc. will helps to determine the quality of subgrade. From this we can adopt the required thickness to the pavement. If subgrade soil is poor then the pavement should damage easily.



7. Temperature Effects on Pavements Design

Temperature is the important environmental factor to be considered in the design of pavement. In case of asphalt roads, temperature affects the resilient modulus of surface course. In very hot condition asphalt layers lose their stiffness. At low temperature, asphalt layers become brittle and cracks are formed.



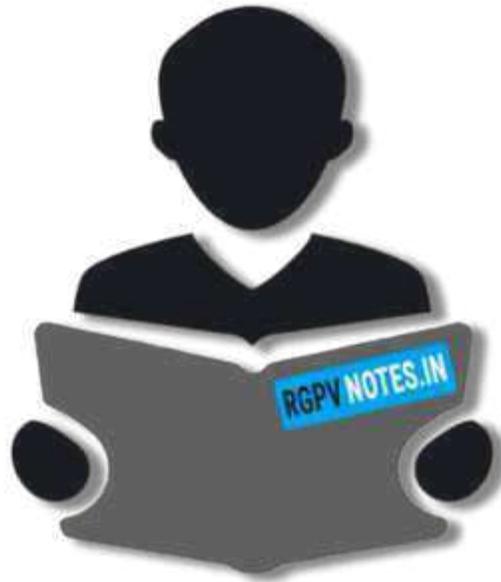
In case of rigid pavement, temperature stresses are developed. Curling of concrete is also possible due to variation of temperature in top and bottom layers of pavement.

8. Precipitation



Fig 8: Effect of Rain on Pavement Design

Moisture variations or precipitation from rain affects the depth of groundwater table. Good drainage facilities should be provided for good strength and support. The ground water table should be at least below 1m from the pavement surface.



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