

Question No:-1 (A)

⇒ Railways :-

1. Railways are steel tracks laid on the ground, over which the train move.
2. Railways transportation is very advantageous for both passengers and goods particularly for long distances.
3. Railway transportation is dependant on road transport since they serve as a feeder system.
4. Comparitively to road transport, railway transport is much safer due to minimum crash rate.
5. Trains can move at much higher speeds than the pneumatic tires vehicles.
6. Energy required to drag a unit load through unit distance by the railway is $\frac{1}{4}$ to $\frac{1}{5}$.

⇒ Highways :-

1. It provides services to one and all.
2. Other modes are dependant on it.

3. Door to door service is provided by (2) highway transportation.
4. It is a flexible transportation mode since it provides with reference, time, traveling speed, direction etc.
5. It is cheaper compared to other modes of transportation.



Question No:- 2

Preliminary analysis of data:-

- ⇒ Preliminary data are the data generated from small-scale research projects to evaluate the feasibility, prior to conducting full research studies.
- ⇒ This analysis of data helps in indicating that whether we should exclude a specific site from further consideration.
- ⇒ The data to be collected includes;
1. Engineering:
 - ↳ topography
 - ↳ geology
 - ↳ climate
 - ↳ traffic volumes.

2. Social & demographic:-

↳ land use

↳ zoning patterns .

(3)

3. Environmental:-

↳ historical sites

↳ archaeological sites

↳ wildlife

↳ air, noise, water pollution.

4. Economic:-

↳ Construction cost

↳ Agricultural, commercial
& industrial activities.

⇒ If it comes to our attention that there is a certain archaeological site located along the route on which construction has to take place, then we will immediately exclude that area from further consideration.

⇒ Economic Evaluation:-

This evaluation is conducted to determine as to what will be the future effects if we invest the resources in a construction project.

⇒ Factors include:-

↳ Road user cost

↳ Construction cost

↳ Maintenance cost

↳ Road user benefit

↳ Road user dis-benefit.

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⇒ Environmental Evaluation:-

This evaluation is conducted to study as to what will be the environmental effects of the project.

- The starting of a construction project creates a noise, air & water pollution.
- It also causes a lot of disturbance to the residents living nearby.
- It affects the gas pipe lines causing many problems in winter.
- It can badly affect the plants & animals living nearby.
- Due to the starting of these projects, the equilibrium established in the environment is disturbed.



Question No:- 3

Vehicle Performance:-

The most critical parameters which are included in determining highway design are ✓ acceleration rates
✓ deceleration rates.

The performance of road vehicles form (5)
the basis for roadways design guidelines
such as;

- ↳ length of acceleration - deceleration rates
- ↳ maximum grades
- ↳ stopping sight distances
- ↳ setting speed limits.
- ↳ passing sight distances.
- ↳ timing of signalized intersections.
- ↳ Turnout bays for buses.
- ↳ Free way ramps.

⇒ The main reason we study vehicle performance in highway design is to be able to accommodate a large variety of vehicle types on roads.



Question No:- 4

Directional Distribution:-

We can define it as the percentage of heavier volume over the total highway volume.

Importance:-

⇒ It helps in converting daily traffic to directional peak hour traffic.

▷ The construction & design of highway should always contribute towards serving the peak-hour traffic volume in peak direction flow.

▷ Highways are designed in different ways. Some highways have more than 2 lanes where a passenger encounters important intersections, therefore it is important to have knowledge regarding the hourly traffic volume for each travel direction.

▷ We observe 80% of total traffic but typically ~~only 55-70%~~ one direction contributes by 55-70% in total traffic.

Example:-

- ▷ A rural highway/road with a design volume of 4,000 veh/hr for both directions combined
- ▷ If we equally split the directional distribution we get 2000 vph in one direction.
- ▷ If 80% of DHV is in one direction, at least 3 lanes in each direction would be needed for 3,200 vph.

$$DDHV = A ADT \times K(\text{Peak hr}) \times D(\text{Peak dir-flow})$$



Question No: 5

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Classification Of Pavement Distress :-

◇ Fracture :- Occurs in the form of:-

- ↳ cracking
- ↳ breaking
- ↳ due to loading
- ↳ fatigue
- ↳ thermal changes.

◇ Disintegration :- Occurs in the form of:

- ↳ stripping
- ↳ raveling
- ↳ removal of paving materials.

It occurs due to the reasons involving;

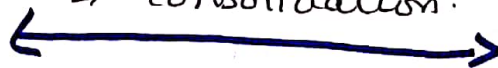
- ↳ binder aging
- ↳ traffic abrasion
- ↳ chemical reactivity.

◇ Distortion :- Occurs in the form of

- ↳ deformation.

It occurs due to the reasons involving;

- ↳ excessive loading.
- ↳ subgrade issues
- ↳ consolidation.

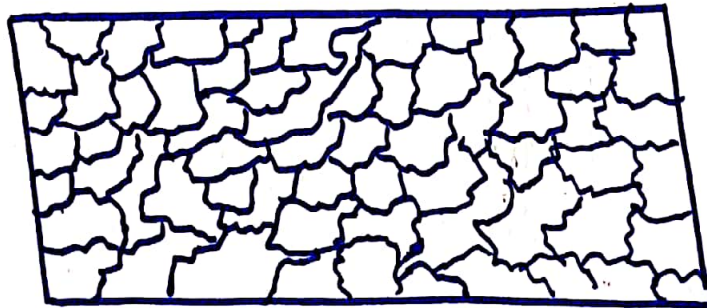


Question No:-6

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Alligator Cracking :-

- ↳ Combination of fatigue & block cracking causes alligator cracking.
- ↳ Series of interconnected cracks.
- ↳ It is a common type of distress in asphalt pavements.
- ↳ The pattern usually begins with longitudinal cracks.
- ↳ Pattern looks like reptile scales, mostly seen on alligator or crocodile's back



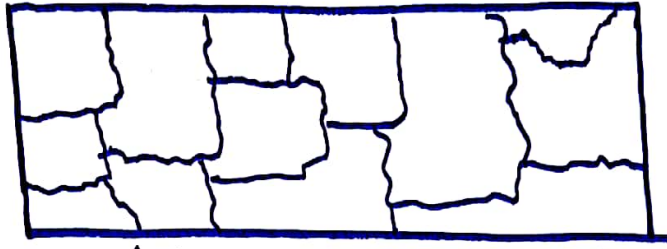
"Alligator cracking"

Block Crackings:-

- ↳ These cracks appear in the form of blocks.
- ↳ These rectangular pieces or blocks can range in size from approximately 0.1m^2 to 10m^2 .

L> Causes of block cracking :- Shrinkage in asphalt.

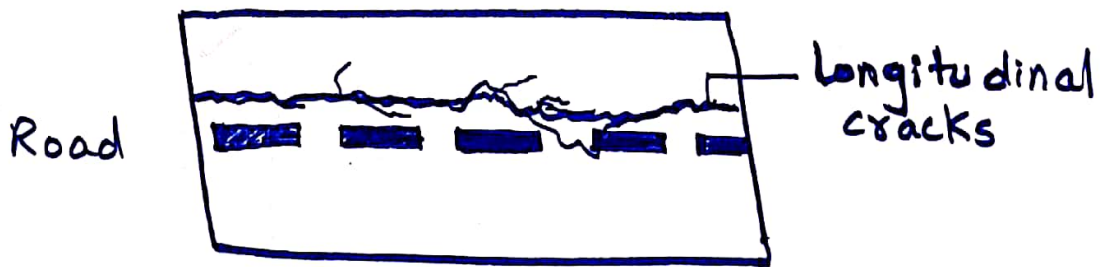
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'Block cracking'

Longitudinal Cracking :-

- L> It occurs parallel to the pavement centerline
- L> Caused due to shrinkage in asphalt layer and poorly constructed joint.
- L> Cracks occur in the concrete due to thermal expansion & contraction..



Transverse Cracking :-

- L> These are unconnected cracks running across the pavement, perpendicular to direction of road.
- L> Occurs due to asphaltic layer shrinkage or due to reflection from existing crack.
- L> They are not load related.
- L> We can fix the cracks by replacing the cracked pavement layer with an overlay.

