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Q No : 1

Means of Transport :

Five Mode of Transportation

A :- Road Transport
B :- Railway Transpost
C :- Air Transpost
D :- Waterways Transpost
E :- Pipelines Transpost

(A) Road Transport :

→ Advantages

1. Less Capital outlay
2. Door To Door Service
3. Service in Rural Areas
4. Flexible Service
5. Suitable for Short Distance
6. Lesses Risk of Damage in Transit
7. Saving in Packing Cost
8. Rapid Speed
9. Less Cost
10. Private Owned Vehicles
11. Feeder to other Modes of Transpost

→ Disadvantages

1. Seasonal Nature
2. Accidents and Breakdowns
3. Unsuitable for Long Distance and Bulky Traffic
4. Slow Speed
5. Lack of Organisation

* Under Revision

(B) Railway Transport:

Advantages:

1. Dependable
2. Better Organised
3. High Speed over Long Distances
4. Suitable for Bulky and Heavy Goods
5. Cheaper Transport
6. Safety
7. Larger Capacity
8. public welfare
9. Administrative facilities of Government
10. Employment Opportunities

Disadvantages :

1. Huge Capital Outlay
2. Lack of Flexibility
3. Lack of Door to Door Service
4. Booking Formalities
5. Centralised Administration
6. No Rural Service

© Air Transport :

Advantages :

1. High Speed
2. Comfortable and Quick Service
3. No Investment in Construction of Track
4. No physical Barriers
5. Easy Access
6. Emergency Services
7. Quick Clearence
8. National Defence
9. Space Explosation

Disadvantages:

1. Very Costly
2. Small Carrying Capacity
3. Uncertain and Unreliable
4. Breakdown And Accidents
5. Large Investment
6. Specialised Skill
7. Unsuitable For Cheap and Bulky Goods
8. Legal Restrictions

D:- Waterways
E: Pipelines.

QNO: 02

Ans:

Reference Material are:

Design procedure Like AASHTO and ASTM design proceduse, Legal Load Limits Like for Pakistan Specified by "FHWA" and "NHA"

Design Consideration:

The most appropriate Location, aligment, and Shape of a highway are Selected dusing the design Stage. Pavement performance, Traffic Roadbed Soil. Materials of Construction, Enviroment Drainage Reliability of Soad

Data to be extracted:

Average daily traffic Calculation to find Design ESAL, Material property in the Form of MR, Drainage Characteristics of the area from the mentioned data Layers Thickness will be Calculated.

The Structural Number (SN) Represents the overall Structural Requirement needed to Sustain the design traffic Loadings.

It is an abstract number that expresses the Structural Strength of a pavement required for given Combinations of Soil Support (MR), total traffic expressed in ESALs, terminal Serviceability and environment.

$$M_R = C\left(\frac{0.24P}{d^{2.32}}\right)$$

$$SN = a_1D_1 + a_2D_2M_2 + a_3D_3M_3$$

→ a_1, a_2, a_3 = Structural-Layer Coefficient of the wearing Surface base and Sub-base Layers respectively,

→ D_1, D_2, D_3 = Thickness of the wearing Surface, base and Sub-base Layers in inches, respectively, and

→ M_2, M_3 = drainage Coefficients for the base and Sub-base respectively.

Q NO: 03 : Vehicle Performance in highway Design :

Ans: Roadway Design is governed by Two main Factors:

Vehicle Capabilities :

A :- acceleration / deceleration

B :- Braking , C :- Cornering

Human Capabilities :

A : Perception/Reaction times

B: Eyesight (peripheral range , height above roadway)

⟶ performance of road vehicles forms the basis for roadway design guidelines such as: Length of acceleration/deceleration Lanes, maximum grades , Stopping - Sight distances , passing - Sight distances , setting speed Limits , timings of Signalized intersections.

⟶ Studying vehicle performance Serves Two important purpose ① provides insight into roadway design and traffic Opertionsand the Comproises that are necessary to accomodate the wide variety of vehicles that use roadways.

(2) It forms a basis on which to assess the impact of advancing vehicle techologies on existing roadway design - guidelines

Note Highway pavements, grades Curves and wind and traffic flow rates affect the fuel Consumption and air Contaminat of highway or a network of highways.

Q NO: 04 :-

Directional Distribution in design of Highways:

Ans: The directional distribution, also known as the "D" factor, is an important traffic parameter that is frequently used for design and operational performance analysis.

→ In the basic principles of traffic engineering a 'D' factor is selected as the ratio between the major direction hourly traffic volume to the total traffic volume of both directions during the design hour.

→ The Highway Capacity Manual (TRB 2010) defines the 'D' factor as "the proportion of traffic moving in the peak direction of travel on a given roadway during the peak hours"

The manual Suggest That The 'D' Factoris highly dependent on The highway types.

Traditionaly, The D Factor has been used For operational Capacity and Level of Service (Los) analysis, especially For two-Lane highways. The directional design hour volume (DDHV) is The one way volume in The predominant direction of travel in The design hour, expressed as a percentage of the two-way DHV.

For Rural and Suburban Roads, The directional distribution factor (D) Ranges from 55 to 80 percent.

QNO: 5 :

Classification of Surface Distress Mode:

Distress is a Condition of The pavement Structure That Reduces Serviceability or Leads to a Reduction in Service life. OR

Distress is a Condition of The pavement Structure That Reduces Serviceability or Leads to a Reduction in Service life.

Surface Distress Modes:

Surface distress modes can be broadly classified into the following three groups:

Fracture: This could be in the form of cracking or spalling (breaking generally due to excessive loading, fatigue, thermal changes.

Distortion: This is in the form of deformation which can result from such things as excessive loading densification, consolidation or subgrade issues.

Disintegration: This is in the form of stripping or raveling or removal of paving materials which can result from such things as loss of bonding chemical reactivity, traffic abrasion, aggregate degradation or binder aging.

Note:-

Structural failure is a fracture or distortion that may or may not cause an immediate reduction in serviceability but leads to a future loss of serviceability.

QNO : 06

Ans: (i) **ALLigator Cracking** : Alligator Cracking may be Considered a Combination of fatigue and block Cracking. It is a Series of interconnected Cracks of various Stages of development. Alligator Cracking develops into a many-sided pattern that resembles Chicken wire or alligator Skin It Can occur anywhere in the Road Lane. Alligator Cracking must have a quantifiable area.

Severity Levels are as under

Low: An area of Cracks with no or very Few Interconnecting Cracks and the Cracks are not Spalled. Cracks are <= 0.25 in (6mm) in mean width. May be Sealed Cracks with Sealant in good condition.

Medium: An area of Interconnected Cracks That form a Complete pattern. Cracks may be Slightly Spalled. Cracks are > 0.25 in. (6mm) and <= 0.75 in. (19mm).

High: An area of interconnected Cracks forming a Complete pattern Cracks are moderately or Several Spalled. Cracks are > 0.75 in (19mm) or any Crack with a mean width <= 0.75 in (19mm).

(ii) **Block Cracking**: A pattern of Cracks that divides the pavement into approximately Rectangular pieces. Rectangular blocks Range in Size from approximately 0.1 m2 to 10 m2

Severity Levels are as under

Low: Cracks with a mean width ≤ 6 millimeter (mm); or Sealed Cracks with Sealant material in good Condition

Moderate: Cracks with a mean width >6 millimeter and ≤ 19 mm; or any Crack with a mean width ≤ 19 mm and adjacent Low Severity Random Cracking.

High: Cracks with a mean width > 19 mm or any Crack with a mean width ≤ 19 mm and adjacent moderate to high Severity Random Cracking

(iii) **Longitudinal Cracking**: Cracks predominantly parrallel to pavement Centerline. Location within the Lane (wheel path versus non-wheel path) is Significant.

Severity Levels: are as under

Low: A Crack with a mean width ≤ 6mm; or a Sealed Crack with Sealant material in good Condition and with a width That Cannot be determined

Moderate: Any Crack with a mean width >6mm and ≤ 19mm; or any Cracks with a mean width ≤ 19mm and adjacent Low Severity Random Cracking

High: Any Crack with a mean width >19mm; or any Crack with a mean width ≤ 19mm and adjacent moderate to high Severity Random Cracking.

(iv) Transverse Cracking: Cracks that are predominantly perpendicular to pavement Centerline.

Severity Levels: are as under

Low: An unsealed Cracks with a mean width ≤ 6mm; or a Sealed Cracks with Sealant material in good Condition and width That Cannot be determined.

Moderate: Any Crack with a mean width >6mm and ≤19mm; or any Crack with a mean width ≤19mm and adjacent Low Severity Random Cracking.

High: Any Crack with a mean width >19mm; or any Crack with a mean width ≤19mm and adjacent moderate to high Severity Random Cracking.