ID : 7847

Section : B

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Subject : Highway and Traffic Engineering

Teacher Name :- Dr. Nadeem sir

Question No # 01

keeping in view different modes of Transportation compare railways with Highways.

Answer No # 01

Mode of Transportation :

↳ Transport modes are the means by which Passengers and freight achieve access and mobility between origin and destination. They fall into of three basic categories depending over what median is used to travel upon.

1) Land (road, rail and Pipelines)
2) Water (shipping)
3) Air (Aircrafts)

↳ Highways :-
car, Bus, Track, non-motorized etc.

↳ Railways :-
Passenger and Good (freight trains)

↳ Airways.

Aircraft, Helicopter & Hot-air ballon.

↳ Waterways.

Ships, boat, submarine etc.

↳ Continuous Flow systems.

Pipelines, belts, elevator, ropeway ... etc

Railways:

- The transportation along the railway track could be advantages by railways between the station both for the passengers and goods. Particularly for long distances.
- It depends upon the road transport i.e road could serve as a feeder system.
- Energy required to drag a unit load through unit distance by the railways is only 1/4 to 1/5 of that required by road.
- Safety (minimum crash rate if handled carefully else sever crach can occur).

Highways:

- It gives the maximum service to one and all
- It gives maximum flexibility for travel with refrences to route choice, direction, time and traveling speed.

- It provide door to door service.
- Other modes are depend on it.
- It required small investment for the government.
- Motor vehicles are chaper than other carries like rail engines.
- It saves the time for short distance
- High degree of accident due to flexibility of movement.

Question No # 02

You are a Transportion engineer. You have been tasked to conduct office study as a Preliminary step for design of new highway. what refrences material you will study and what data you will extract.

Answer No # 02

The following steps should by

- office study of existing information.
- Reconnaissance Survey
- Preliminary location survey
- final location survey.

Office study of existing information :-

Data Examination (office study) : The first phase in any highway location study is the examination of all avaiable data of the area in which the road is to be constructed.

This phase is usually carried out prior to any field or photogrammetic investigation

Data sources: (National/Provincial departments. transportation. agriculture. geology, hydrology. and mining)

- Existing engineering reports.
- Maps.
- Aerial Photographs.
- charts.

⇒ The type and amount of data collected and examined depend on the type of highway being considered.

Area characteristic covered in data collection:

- Engineering including topography. geology. climate and traffic volumes.
- Social and demographic. including land uses and zoning patterns.
- Environmental, including type of wildlife; location of recreational historic and archeologist sites and the possibles effect of air, noise, and water Pollution.
- Economic, including unit costs for construction and the trend of agricultural, commercial, and industrial activities.

Preliminary analysis of the data.

- will indicate whether any of the specific sites should be excluded from further consideration because of one or more of the above characteristics.
- For examples. if it is found that a site of historic and archeological importance is located with in an area being considered for possible route location. it may be immediat decided that any route that traverses that site should be excluded from further consideration.
- At the completion of this phase of the study of the engineer will be able to select general areas through which the highway can traverse.

Reconnaissance Survey:

↳ The object of this phase of the study is to identify several feasible routes. each within a band of a limited width of a few hundred feet.

↳ Rural Road. there is often little information available on maps or photographs and therefore aerial photography is widely used to obtain the required information.

↳ Feasible routs are identified by a stereoscopic examination of the aeiral photographs. taking into consideration factor such as:

- Terrain and soil conditions.
- Serviceability of route to industrial and Population areas.
- crossing of other transportation facilities. such as rivers, railroads and highway.
- Direction of route.
- control points between the two endpoints are determined for each feasible route.

Preliminary location survey:

- During this phase of the study. the position of the feasible route are set as closely as feasible possible by

1) Establishing add the control points
2) Determining preliminary vertical and horizontal alignments for each

- Preliminary alignments are used to evaluate the economic and environmental feasibility of the alternative route

Economic Evaluation: Economic evaluation of each alternative route is carried out to determine the future effect of investing the resources necessary to construct the highway.

- Factors considered in economic evaluation.
  - Road user costs.
  - construction costs.
  - Maintenance costs.
  - Road user benefits.
  - Road used dis-benefits. such as adverse impacts due to dislocation of families, businesses and so forth.

Environmental Evaluation:-

- Highway construction at any location - significant impact on surroundings.
- A highway - an integral part of the local environment
- Environment includes Plants, animal, and human communities and encompasses social, physical, natural and man-made variables
- These variables are interrelated in a manner that maintains equilibrium and sustains the lifestyle of the different communities.
- The construction of a highway at a given location may result in significant changes in one or more variables, which in turn may offset the equilibrium and result in significant adverse effect on the environment.

Final Location Survey

↳ The final location survey is a detailed layout of the selected route

↳ The horizontal and vertical alignments are determined. and the positions of structures and drainage channels are located.

↳ The method used is to set out the points of intersections of the straight portion of the highway and fit a suitable horizontal curve between these.

↳ Best alignment is obtained using a trial-and-error process (designer's opinion) ~~opinion~~) considering both engineering and aesthetic factor.

Question No # 03

what is the Importance of vehicles Performance in highway design?

Answer No # 03

The vehicle performance in highway design is very important because of following Points.

1) Adequate Passing and slopping Sight distance
2) Maximum grades.
3) Acceleration and deceleration
4) Timing of signalized intersection.
5) Braking characteristic also effect vehicle Performance.
6) climbing or Passing lane.
7) Freeway Jamps.
8) setting Speed limit.

Question No # 04

Write short note on Directional distribution in a design of highways.

Answer No # 04

Directional Distribution.

↳ Highways must be designed to adequately serve the Peak-hour traffic volume in the Peak direction of flow.

↳ Total hourly traffic in both direction is used to design two lane roads.

↳ In the design of the highways with more than two lanes and on two-lane road where important intersections are encountered or where additional lanes are to be provided later, knowledge of the hourly traffic volume for each direction of travel is essential. Directional traffic is used for multilane roads and streets.

↳ Typically, one directional contributes by 55-70% in total traffic. although occasionally 80% is observed.

↳ For example. consider a rural road with a design volume of 4000 vehicles Per hour (vph) for both directions of travel combined.

↳ If during the design hour, the directional distribution is equally split or 2000 vph is one direction, two lanes in each direction may be adequate

↳ If 80 percent of the DHV is in one direction. at least three lanes in each direction would be needed for the 3200 vph.

↳ Directional Distribution. Directional Design Hourly volumes DDHV - ADTs are converted to a Peak-hour volume in a peak direction of flow.

$$DDHV = AADT * K(\text{Peak hr}) * D(\text{Peak dir - flow})$$

* K = Proportional of daily traffic occur in Peak hr.
* D = Proportional of Peak hr traffic travel in Peak Dir.

Question No # 05

Explain broad classification of surface distress modes:

Answer No # 05

Surface Distress :-

surface distress is "Any indication of poor or unfavorable pavement performance or signs of impending failure; any unsatisfactor performance of a pavement short of failure "Highway Research Board 1970"

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

1) Fracture :

This could be in the form of cracking (in flexible and rigid pavements) or spalling resulting from such thing as excessive loading, fatigue, thermal changes, moisture damage, slippage or contraction.

2) Distortion :-

This is in the form of deformation (e.g rutting corrugation and shoving) which can result from such

such thing are excessive loading, creep, densification, consolidation, swedding or frost action.

Dicintegration :-

This is in the form of stripping, vaveding or spadding which can result from such things as loss of bonding. chemicad reactivity, traffic abrasion. aggregate degradation. Poor consolidation / compaction or binder aging.

Question No # 06

Explain Alligator cracking, block cracking. Jongitudinal cracking and Transverse cracking.

Answer # 06

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.
- Occurs in areas subjected to repeated traffic loading.
- chicken-wire cracking: Spider web cracking. map cracking. etc.
- Indicative of Fatigue Failure of Pavement due to repeated traffic loads.

Block Cracking :-

- A pattern of cracks that divides the Pavement into approximately rectangular Pieces, with sides generally longer than one foot.
- ~~Rect~~ Rectangular block range in size from approximately 0.1 m^2 to 10 m^2
- Possible cause : Shrinkage of asphalt.

Longitudinal Cracking :-

Cracks Predominantly Paralled to Pavement centerline. location with in the lane (wheel Path versus non-wheel Path) is significant.

. Possible causes :

Expansion and contraction of Pavement material, roadbed settlement, Poorly constructed Paving joints.

causes :-

. subcoil settlement.

cures

. Joint sealing.
. Full Depth replacement.
. subsurface stabilization.

- Transverse Cracking :-
- cracking across the centerline, not due to reflection cracking.

Possible cause :-

Expansion and contraction of Pavement material, road bed settlement, Poorly construct Paving Joint.

causes:

- Slab longer then required.
- Excessive thermal stresses.

Cures:

- Crack sealing.
- Full - depth rigid repair.
- Dowel bar retrofit.