UNIT I

HIGHWAY PLANNING & ALIGNMENT

Significance of highway planning

Transportation contributes to the economic, industrial, social & cultural development of any country. It is vital for the economic development of any region since every commodity produced whether it is food, clothing, industrial Products or medicines need Transport @ all stages from Production to distribution. The adequancy of transportation system of a country indicates it's Economic & social development.

Mode of Transportation

i) Roadways
ii) Railways
iii) waterways
iv) Airways

* The transportation by air is fastest among the 4 modes. It also provide more comfort apart from saving time.

* Transportation by water is slowest. It need min energy to haul unit load through min distance. It is possible b/w ports on searoute or along the rivers or canals where inland Transportation facilities are available.

* Road Transport can provide door to door service only by road Transport. This mode has also the max. Flexibility for travel with reference to route, direction, time & speed of Travel.

Scope of highway Engg.

The road pavements are generally constructed on small

embankments, slightly above the general ground level wherever possible. In order to avoid the difficult drainage & maintenance problems

Scope of Highway Engg.

Phases

- Development Planning & location → Historical background, Basis for planning, Master plan, Engg surveys & highway alignment.
- Design, geometrics & structures → Road design, Rigid & Flexible pavements, Design Factors, thickness design, overlay design, Design of drainage system.
- Traffic performance & its control → Traffic study analysis, Need for new & road links Traffic regulation control, Intersection design, their control with signs.

Details

Necessity of Highway Planning:

1) To plan a road network for efficient & safe traffic operation, but @ min. cost. The cost of construction, maintenance & renewal of pavement layers & the vehicle operation cost are to be given due to consideration.

2) To arrive @ the road system and the length of different categories of roads which could provide max. utility & could be constructed within the available resources during the plan period under consideration

3) To fix up datewise priorities for development of road link based on utility as the main criteria for phasing the road development programme.

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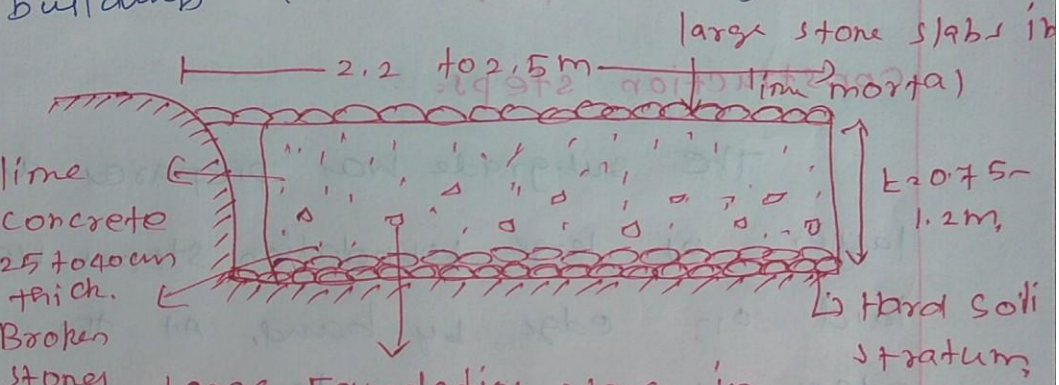
Historical development of road construction.

Roman roads:

During the period which many roads were built of stone blocks of considerable thickness, The appian way was built in 312 B.C extend over 580 km which illustrate the road building techniques used by Romans

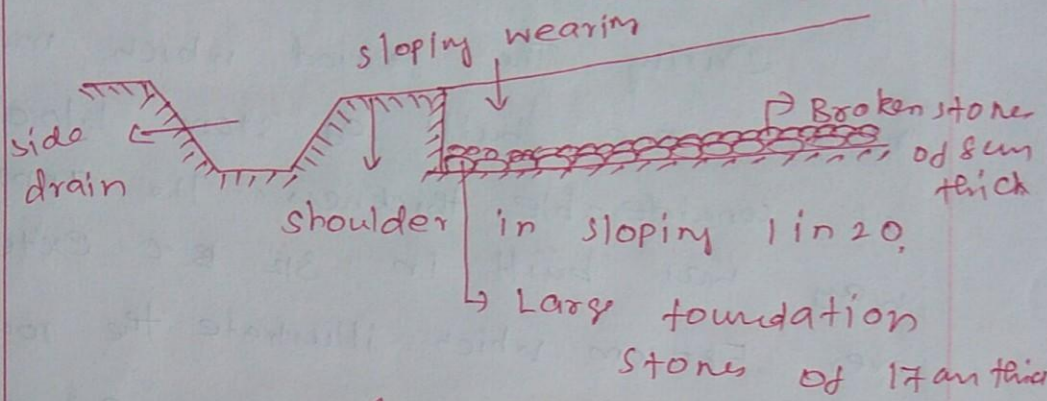


They were built straight regardless of straightness

They were built after the soft soil was removed and hard stratum was reached.

Tresaguet construction

The thickness of construction may in the order of 30cm.



c/s.

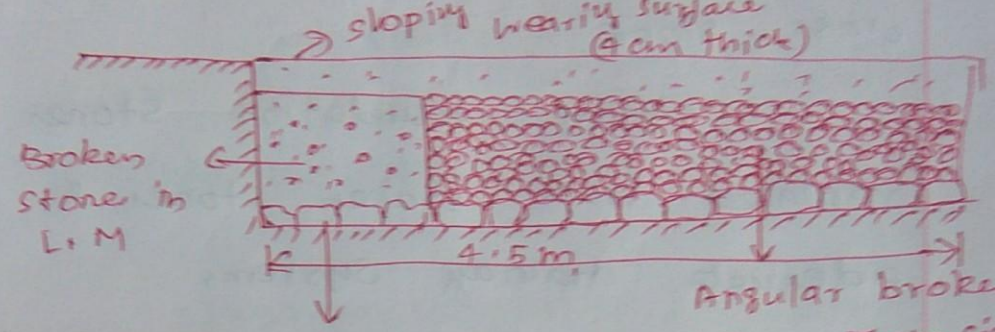
Construction steps:

The subgrade was prepared and a layer of large foundation stones were laid on edge by hand. At the two edges of pavements, large stones were embedded edge wise to serve as submerged kerb stones.

corners are filled with smaller stones. They were thickness of 8cm.

Telford construction;

In this, heavy foundation stones used above the soil subgrade inorder to keep the road foundation firm.



* A level subgrade was prepared to design width of about 9m.
* Large Foundation stones of th 17 to 22 cm were laid with hand & with their largest face down so as to be laid in stable position
* The interstices are filled with smaller stone.
* The central portion was covered with 2 layers of angular section

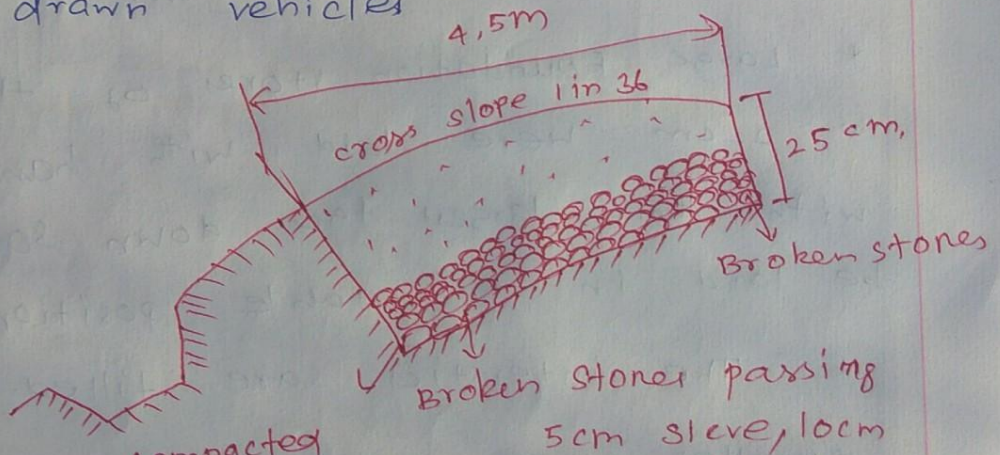
Macadam construction:

The importance of subgrade drainage and compaction was realized subgrades were prepared with suff. cross slope

Heavy foundation stones were replaced with broken stones & with adequate drainage systems,

The thickness of 25 cm,

The size of broken stones based on the stability under animal drawn vehicles



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History of road development in India:

Ancient period.

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Mughal period

↓

British period

↓

Jayakar committee.

↓

IRC

↓

CRRI.

Recommendations of Jayakar committee.

1) The road development in the country should be considered as a national interest as this has become beyond the capacity of State govt s and local bodies

classification of highway.

Based on

1) weather
2) Type of carriage way
3) Traffic volume
4) Load
5) Location

i) weather

a) All weather roads
b) Fair weather roads

All weather roads -

Negotiable during all weather except @ major river crossings where interruption to traffic is permissible upto a certain extent.

Fair weather roads -

Traffic may be interrupted during the monsoon season @ causeways where streams may be overflow

Fair weather roads:

Traffic may be interrupted during the monsoon season @ causeways where streams may be over.

ii) carriageway

a) Paved roads:

If they are provided with a hard pavement course which should be atleast a water bound macadam layer.

b) Unpaved roads;

If they are not provided with a hard pavement course of atleast a WBM layer. This earth roads may be called uppared roads

iii) Based on pavement surfacing

a) Surface Roads;

Provided with a block topped bituminous or cement concrete surfacing.

b) Unsurfaced roads:

Not provided with cement concrete surfacing

iv) Traffic Volume:

a) heavy
b) Medium
c) Light traffic

} Based on vehicles per day.

v) Load Transport or Tonnage:

class I
class II
:
etc

class A
class B
:
etc.,

} Tonnes per day.

vi) Location and function

a) National highways:

connecting major ports, foreign highways; capitals of states, large industrials, tourist centres.

NH 1 - Delhi - Ambala - Amristar
NH 3 - Bombay - Agra
NH 49 - Madurai - Rameshwaram

b) State highways:

connecting national highways of adjacent state, districts & Important cities within the state.

c) Major District Roads:

Roads within district servicing areas of production & Markets and connecting those with each other or with main highways of district

d) other District Roads:

It serves rural areas of production with market centre, taluk & main roads

(f) Village Roads;

connecting villages or groups of villages with each other to the nearest road of a higher category.

Urban roads;

i) Arterial roads - streets primarily for through traffic or continuous route

ii) Sub arterial roads - same as i), but they have lower level of Traffic mobility than above roads.

iii) collector streets - Provide access to arterial streets they collect & distribute traffic from & to local streets.

Highway alignment:

The position or the layout of the central line of highway on the ground is called alignment

Hzl Alignment:

Includes the st. path, the hzl deviations & curves.

Vtl Alignment:

changes in gradient & vtl curves are covered under alignment

Requirements

i) short: It is desirable to have a short alignment b/w two stations

ii) Easy: It is easy to construct & maintain the road with min. problems Easy for vehicles & easy gradients

iii) Safe; It should be safe enough for construction, Maintanance.

iv) Economical,

The total cost including initial cost, Maintenance cost & vehicle operation cost is lowest

Utility of road;

↳ utility value unit length of road.

Factors controlling alignment.

a) obligatory points.

b) Traffic

c) Design

d) Economics

e) consideration

In hill roads

stability

Drainage

Geo. standards

Resisting length

Engineering Surveys

Stages:

a) Map study
b) Reconnaisance
c) Preliminary survey
d) Final location & detailed survey

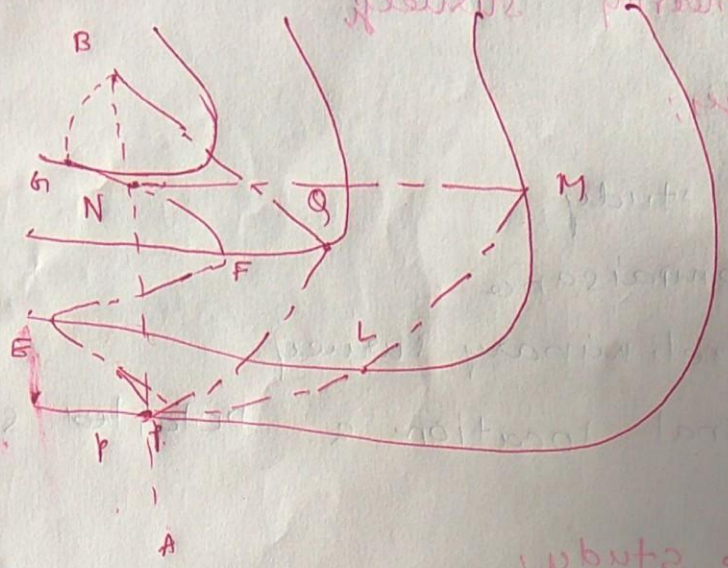
Map study:

a) Alignment avoiding valleys, ponds or lakes

b) When the road has to cross a row of hills possibility of crossing through mountain pass

c) Approx. location of bridge site for crossing rivers, avoid bend of river, if any

d) When a road is to connect b/w 2 stations one of the top & other on foot of hill.



AB - Shortest route

APQB - Steeper gradient

APLMNB - Flatter "

APEFGB - Flatter Gradient

2) Reconnaisance Survey:

1) Valleys, Ponds, lakes, marshy lands, ridge, hills along the route which are not available.

2) Approx. values of gradient

iii) No of drainage system, Max. Flood level & natural ground water level

iv) soil type along routes

v) Sources of construction material.

iii) Preliminary survey:

1) To survey alternate alignments proposed after the reconnaisance & collect all physical information & details of topography

2) compare different proposals

3) To estimate qty. of earthwork materials, cost of alternate proposals

Methods:

A) conventional approach

2) Modern ~~Road~~ Rapid approach

Procedure for conventional methods

1. primary Traverse
2. Topographical Features
3. Levelling work
4. Drainage studies
5. soil survey
6. Material survey
7. Traffic survey
8. Determination of final centre line