Highway engineering

Lecture - ①
15/04/19

① Introduction
② Geometric design
③ Traffic engineering
④ Pavement Design
⑤ Highway Material and construction

① Introduction:

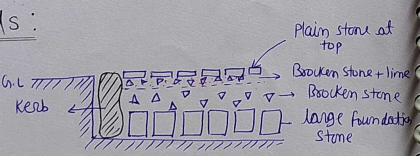
① Highway – special type of road design to allow high speed of vehicle.

② It is generally constructed over embankment due to certain advantage like ⓐ Modified drainage ⓑ Safety from (HFL) (highest flood level) ⓒ No lateral entry of Public and animals.

② Express highway / express ways – it is special type of highway which is design to connect define origin and define destination to organise the traffic in generalised way. eg: (Yamuna ~~highway~~ expressway) (Mumbai to pune) express highway.

Development of Roads:

① Roman Roads:

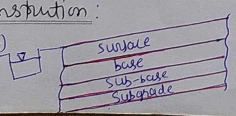


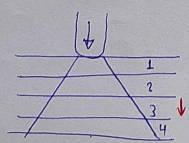
Drawback

① No drainage system
② No cross slope (camber)
③ Large foundation stone at bottom

④ Mecadam construction:

(Modern construction)
[Mecadam + CBR]





⇒ (John macadam was the first person who suggested that large foundation stones are not require to the placed at bottom) (1 in 36) slope for subgrade

⇒ Highway Planning in india: 1927 (NOV) goverment appointed a road development commitee headed by M.R. Jayker

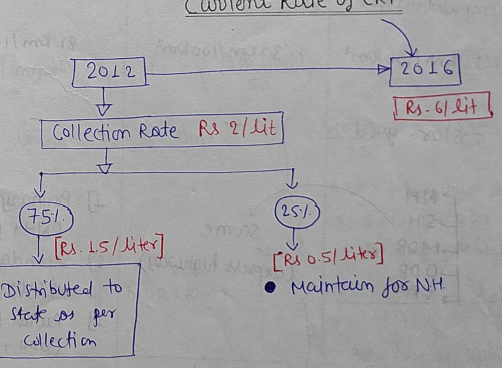
- Recommandation of M.R. Jayker commitee

① Road development should be considered as national interest.
Result: Fund participation

- 2nd Recommandation – an extra charge should be pay for road development and maintanance (for Petrol and diesal)

[1929 CRF (established)]
↓
[Central road fund]

Current Rate of CRF



- A semitechnical body should be established for design and specification

Result: IRC (Indian Road Congress)

established: 1934

Correct chronological order
① creation of central road fund (1929)
② Indian road congress (1934)
③ National highway act
④ Highway research board (1950)

[1 > 2 > 3 > 4]

Research and development organisation should be established for road development

CRRI (Central Road Research Institute)

Established: [1950]

④ Jayker commitee gave more stess for long term planning

Result: Various 20 year road plan.

	1st 20yr Plan	2nd 20 yr Plan	3rd 20 yr Plan
Name	Nagpur	Bombay	Lucknow
Duration	1943-1963 (completed in 1961)	[1961-1981]	[1981-2001]
Road density	16 Km/100 Km²	32 Km/100 Km²	82 Km/100 Km²
Puttern	Star-grid	—	—
classification	NH, SH, MDR, ODR, VR	Same (express highway)	1] Primary Roads (NH+EH) 2] Secondary Roads (SH+MDR) 3] Rural Roads (ODR+VR)

Road length as per 3rd 20yr Plan-

① Total length area-(Km) = max { 4.74 × NO. of towns and villages ; Area × Road density }

② Length of NH(Km) = $\left[\frac{\text{Area (Km}^2\text{)}}{50}\right]$

③ Length of S.H(Km) = max { $\left(\frac{\text{Area (Km}^2\text{)}}{25}\right)$; 62.5 × NO. of town − length of N.H. }

④ Length of MDR (Km) = max { $\frac{\text{Area (Km}^2\text{)}}{12.5}$; 90 × NO. of towns }

W.B. question-(41) Area = 13400 Km²

NO. of towns = 12

(As per lucknow Plan)

① Total Road length (Km) = max { 4.74 × (12) = 56.88 Km ; $\frac{13400 \times 82}{100}$ = 10988 Km }

② Length of NH = $\left(\frac{\text{Area (Km}^2\text{)}}{50}\right) = \frac{13400}{50}$ = 268 Km

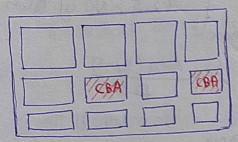
③ length of S.H(Km) = max { $\frac{\text{Area (Km}^2\text{)}}{25} = \frac{13400}{25}$ = 536 Km ; 62.5 × (NO. of town) − length of NH ; 62.5 × (12) − 268 ; 750 − 268 = 482 Km }

④ Length of MDR (Km) = max { $\frac{\text{Area (Km}^2\text{)}}{12.5} = \frac{13400}{12.5}$ = 1072 ; 90 × (NO. of towns) = 90 × 12 = 1080 Km }

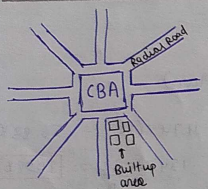
- Primary Roads = (N.H + E.H) = 268 Km
- Secondary Roads = (S.H + MDR) = 536 + 1080 = 1616 Km
- Rural Road; (ODR + V.R) = total Road length − (Primary + Secondary) = 10988 − (268 + 1616) = 9104 Km

- Road Pattern:

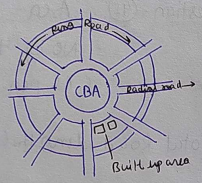
(a) (Rectangular and block Pattern)



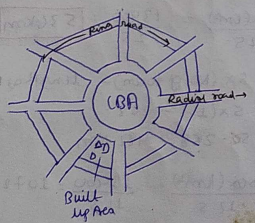
(b) (Star and block Pattern)



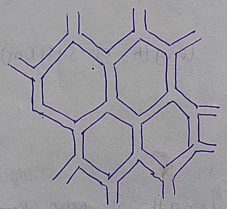
(c) Star and circular



(d) Star and grid



(e) Hexagonal Patterns



- Engineering survey for Highway Alignment:

Before Highway alignment is finalized engineering survey are to be carried out in following stage

Stage

① Map study:- various alignment are drawn on map (contours and topographical) Passing mini. no. of obstacle and max. utilization area

② Reconnaissance survey → It is done by visiting the site location to identify the feature which are not available on map feasibility is also checked during this survey

③ Preliminary survey → chain survey → compass survey → Plan table ← levelling etc are done along with (a) traffic study (b) drainage study (c) Material location survery (soil investigation) and Highway alignment is finalised.

④ Detailed survey → Planning → designing → material estimation → cost estimation etc are done and DPR (Detaile Project Report) is prepared.

Max. saturation system / utility factor: this system is used to choose the best alignment among various option it depend upon population & Production (Agriculture and industry)

Rule's to decide utility factor -

stage ① Provide utility factor of 0.5 to lowest population range and increase it by multiplying with 2 for next population range [for. exam] 0.5, 1, 2, 4 etc

stage ② Provide utility factor to (1) aggriculture and to industry it should be taken as per (weightage) if not given consider (10)