IES MASTER

Civil Engineering

Toppers Handwritten Notes

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- Theory
- Explanation
- Derivation
- Example
- Shortcuts
- Previous Years Question With Solution

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Highway Engineering

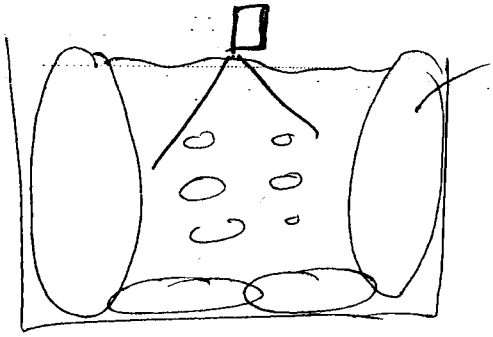
GATE → 2 – 3 marks

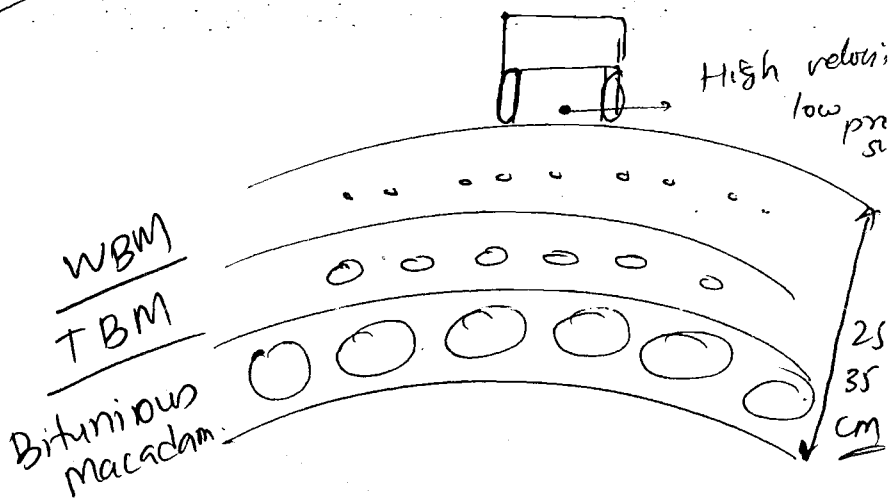
ESE obj → 4 – 6 Ques.

Conventional → 30 – 40 Marks.

Content

INTRODUCTION





The Nagpur Plan (1943 - 63) : (2041)

- In the nagpur plan, roads were devided into four classes.——
  1. National highway
  2. Provincial and state Highway.
  3. District Road.
  4. Village Roads.
- They recommended the construction of star & grid pattern of roads throught the country.
- Road density of 16 km per 100 km^2
- The nagpur plan laid down the following formulae for the different classes, considering the geographi agricultural and population condition.

(i) length of National & ~~Border~~ Provincial Highway & Major district road (in miles).

$$= \frac{A}{5} + \frac{B}{20} + N + 5T + D - R$$

where,

A = Agricultural area in province in ~~km~~ mile^2

B = Non agricultural area in ~~km~~ mile^2

N = no of town and villeges having a population of 2000 – 5000

T = Number of town and villeges having a population of over 5000

D = An allowance for agricutural and industrial development (about 15%).

R = Railway milage in the area under consideration.

(ii) Length of other district & village Roads (in miles)

$$= \frac{V}{5} + \frac{Q}{2} + R + 2S + D.$$

where Q = no of villages with population 501 – 1000

R = No of villages with population 1001 – 2000

S = No of villages with population 2001 – 5000

D = An allowance for agriculture and industrial development during the next 20 years.

V =

The Bombay plan (1961-81) (20 yr)

- The total road length targeted to construct was about 10 lakhs km which will give a road density of 32 km per 100 km^2 [40% of the length would be surfaced]
- The construction of 1600 km expressway was also included in the plan.

The Lucknow Plan (1981-2001) (20 yr)

- Road should be classified for india as follows:
  - (a) Primary system.
    - (i) Expressway.
    - (ii) National highway.
  - (b) Secondary system:
    - (i) State highway.
    - (ii) Major District Road (MDR)
  - (c) Tertiary system (Rural Roads).
    - (i) Other district Road
    - (ii) Village Road.
- Road length for the year 2001 should be 27,000,00 km giving a density of 82 km / ~~km²~~ 100 k
- Expressway should be constructed on major traffic corridor to provide speedy travel.

- National highway should form a square grid of 100 km x 100 km.

- following formula give the length of various classes of roads as per the above guidelines :—

① Length of NH (in km) = $\frac{\text{Area (km}^2\text{)}}{50}$

② Length of SH (in km) = $\frac{\text{Area (km}^2\text{)}}{25}$

or

Length of SH (in km) = 62.5 x No. of town with population above 5000 $- \frac{\text{Area (km}^2\text{)}}{50}$

③ Length of MDR (in km) = $\frac{\text{Area (km}^2\text{)}}{12.5}$

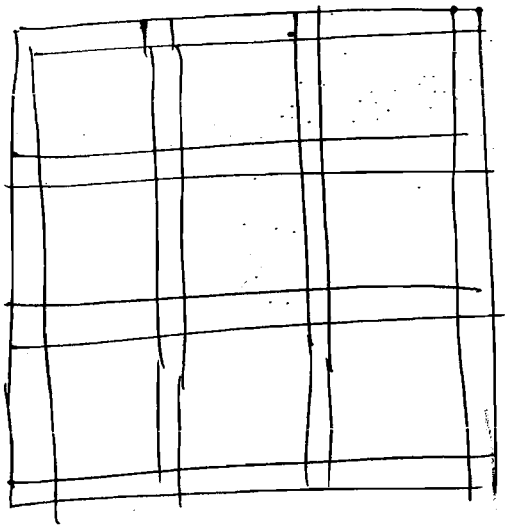
or

④ length (in km) = 90 x No. of towns with population above 5000.

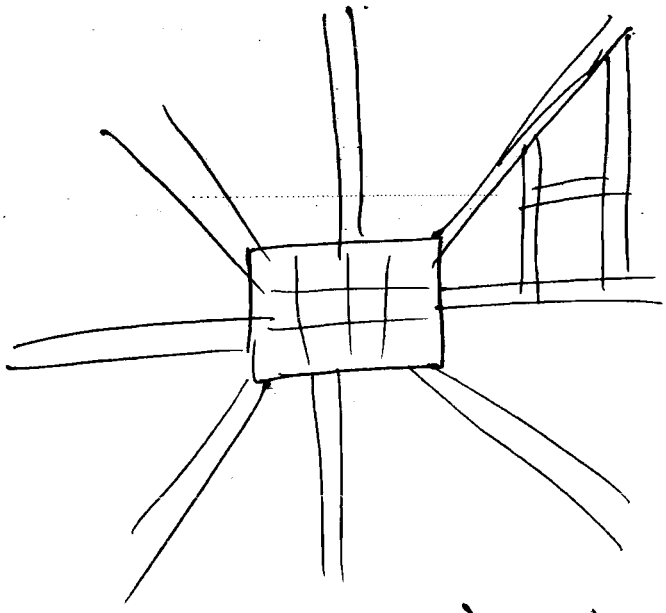
⑤ Total Road length (km) = 4.74 x No. of villages & town

⑥ Rural road length (km) ⇒ Total road length − other catogery road length.

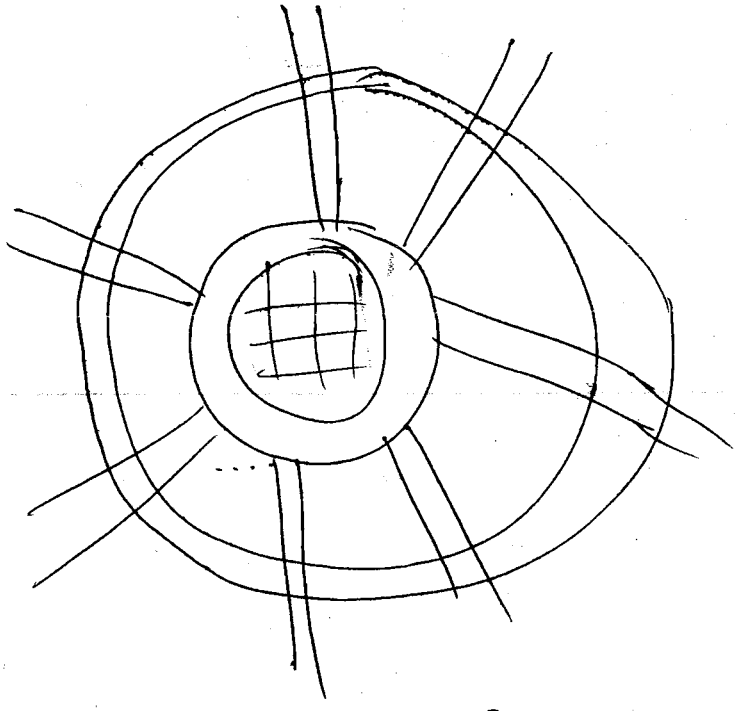
Road Pattern



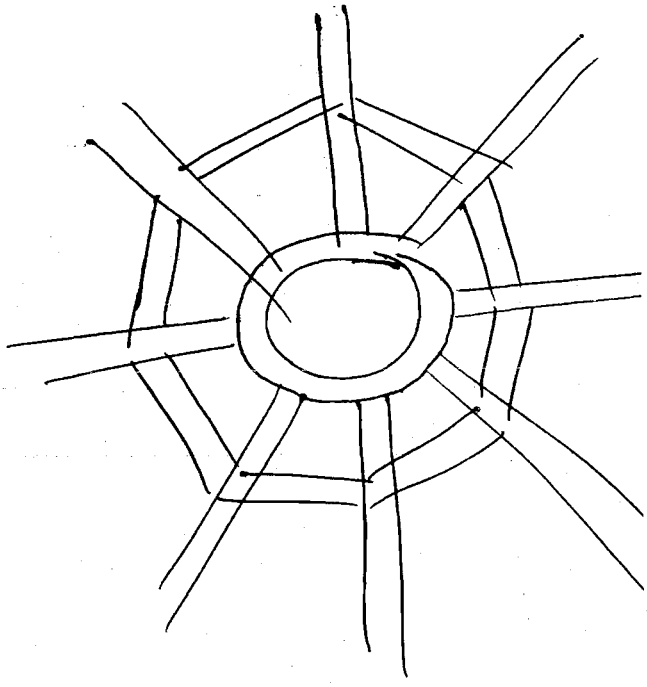
Rectangular & Block pattern.



(Radial or star) and Block pattern.



Radial or star & Circular pattern.



Radial or star & Grid pattern.

- The rectangular & the block pattern has been adopted in the city roads of chandigarh.

- Radial and circular pattern is the road network of Connaught place in new delhi.

- The nagpur road plan formulae were prepared assuming star & grid pattern.

Maxᴹ Utility Road :

Utility units :

if population : $< 2000 \rightarrow 0.25$

$2000 - 5000 \rightarrow 0.5$

$5000 - 10000 \rightarrow 1$

$> 10,000 \rightarrow 2.5$

} Utility units.

Example :

Road	length (km)	No. of town with population < 2000	$2000 - 5000$	$5000 - 10000$
A	20	8	6	1
B	18	19	8	4
C	12	7	5	2

Soln: Utility of Road :

$A \rightarrow 8 \times 0.25 + 6 \times 0.5 + 1 \times 1 = 6$

$B \rightarrow 19 \times 0.25 + 8 \times 0.5 + 4 \times 1 = 12.75$

$C \rightarrow 7 \times 0.25 + 5 \times 0.5 + 2 \times 1 = 6.25.$

Priority of road is decided on basis of utility / km.

- Hence, Utility / km

$A \rightarrow \frac{6}{20} = 0.3$

$B \rightarrow 12.75 / 18 = 0.708$

$C \rightarrow 6.25 / 12 = 0.52$

} $\Rightarrow$ Hence preference $B \rightarrow C \rightarrow A$.