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Internal Assessment Test 1 –November 2022

| Sub: | HIGHWAY ENGINEERING | | | | | Sub Code: | 18CV56 | Branch: | CIVIL |
|---|---|---|---|---|---|---|---|---|---|
| Date: | 07.11.2022 | Duration: | 90 min's | Max marks: | 50 | Sem / sec: | 5/A | | OBE |

**Answer all questions. Assume any missing data suitably.**

| | | MARKS | CO | RBT |
|---|---|---|---|---|
| 1. | . Explain the role of transportation in the development of the country.? Explain briefly the salient features of nagpur twenty year road development plan. | [10] | CO1 | L2 |
| 2. | Explain briefly the following: (i) Jayakar Committee (ii) Indian Road Congress (IRC) (iii) Central Road Fund (CRF) | [10] | CO1 | L1 |
| 3. | Briefly explain how MAP study is helpful in the alignment of new highway? What are the basic requirements of an ideal highway alignment? List and explain briefly | [10] | CO2 | L2 |
| 4. | Explain road patterns with neat diagrams? Explain Classification of roads as per third road development plan | [10] | CO2 | L2 |
| 5. | There are five proposals of road plans for a backward district. The details are given below.Justify with reasons which proposal is best assuming, Utility units of 0.5, 1, 2, 4 and 8 for five population ranges and 1.0 and 5 per 1000t of agricultural and industrial products served. | [10] | CO1 | L3 |

| Road link | Length, Km | No: of villages served with population range | | | | | Productivity served in 1000 tonnes | | |
|---|---|---|---|---|---|---|---|---|---|
| | | <2000 | 2001-5000 | 5001-10000 | 10001-20000 | >20000 | Agricultural | Raw material | |
| P | 500 | 100 | 150 | 40 | 20 | 3 | 150 | 20 | |
| Q | 600 | 100 | 250 | 68 | 28 | 3 | 220 | 25 | |
| R | 700 | 270 | 350 | 82 | 36 | 4 | 300 | 35 | |
| S | 800 | 280 | 410 | 91 | 41 | 4 | 400 | 42 | |
| T | 900 | 290 | 430 | 96 | 44 | 4 | 430 | 45 | |

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**1. Explain the role of transportation in the development of the country.? Explain briefly the salient features of nagpur twenty year road development plan.?**

**Ans:**

- Transportation is a non separable part of any society. It exhibits a very close relation to the style of life, the range and location of activities and the goods and services which will be available for consumption. Advances in transportation has made possible changes in the way of living and the way in which societies are organized and therefore have a great influence in the development of civilizations
- Transport extends the range of sources of supply of goods to be consumed in an area, making it possible for user to get resources at cheap price and high quality
- The use of more efficient systems of supply results in an increase in the total amount of goods available for consumption.
- Since the supply of goods is no longer dependent on the type of mode, items can be supplied by some alternative resources if usual source cannot supply what is needed.
- Transportation has always played an important role in influencing the formation of urban societies. Although other facilities like availability of food and water, played a major role, the contribution of transportation can be seen clearly from the formation, size and pattern, and the development of societies, especially urban centers.
- Growth of urban centers:- When the cities grow beyond normal walking distance, then transportation technology plays a role in the formation of the city. For example, many cities in the plains developed as a circular city with radial routes, where as the cities beside a river developed linearly. The development of automobiles, and other factors like increase in personal income, and construction of paved road network, the settlements were transformed into urban centers of intense travel activity.
- Growth of transportation has a very unfortunate impact on the society in terms of accidents. Increased variation in the speeds and vehicle density resulted in a high exposure to accidents. Accidents result in loss of life and permanent disability, injury, and damage to property.
- Transportation is responsible for the development of civilizations from very old times by meeting travel requirement of people and transport requirement of goods. Such movement has changed the way people live and travel. In developed and developing nations, a large fraction of people travel daily for work, shopping and social reasons. But transport also consumes a lot of resources like time, fuel, materials and land.

## Nagpur road plan (or) First 20-year road plan: -.

The conference of civil engineer held at Nagpur in 1943 finalized the first twenty yearroad development plan for India called Nagpur plan the period 1943-63.

The road network in the country was classified into five categories:

♣ National highway
♣ State highway
♣ Major district road
♣ Other district road
♣ Village road

## Salient Features of Nagpur Road Plan:

1) The responsibility of construction and maintenance of national highways was assigned to thecentral government.

2) It was a 20-year plan intended for the period 1943-63 aiming to provide for about two-lakh km of surfaced roads and remaining unsurfaced roads.

3) The formulae were based on star and grid pattern of road network. But the existing irregular pattern of roads and obligatory points not fitting in the geometric pattern were to be given due consideration.

4) The second category roads are meant to provide internal road system linking small villages with first category roads.

5) An allowance for agricultural and industrial development during the next 20 years was estimated as 15 percent and this allowance was to be provided while calculating the road length for both the categories of roads.

**2. Explain briefly the following: (i) Jayakar Committee (ii) Indian Road Congress (IRC) (iii) Central Road Fund (CRF)?**

**Ans:**

**(i) Jayakar Committee:**

The first World war period and that immediately following it found a rapid growth in motor transport. So need for better roads became a necessity. For that, the Government of India appointed a committee called Road development Committee with Mr. M.R. Jayakar as the chairman. This committee came to be known as Jayakar committee. In 1927 Jayakar committee for Indian road development was appointed. The major recommendations and the resulting implementations were:

- Committee found that the road development of the country has become beyond the capacity of local governments and suggested that Central government should take the proper charge considering it as a matter of national interest.
- They gave more stress on long term planning programme, for a period of 20 years(hence called twenty year plan) that is to formulate plans and implement those plans within the next 20 years.
- One of the recommendations was the holding of periodic road conferences to discuss about road construction and development. This paved the way for the establishment of a semi-official technical body called Indian Road Congress (IRC) in 1934.
- The committee suggested imposition of additional taxation on motor transport which includes duty on motor spirit, vehicle taxation, license fees for vehicles plying for hire. This led to the introduction of a development fund called Central road fund in 1929. This fund was intended for road development
- A dedicated research organization should be constituted to carry out research and development work. This resulted in the formation of Central Road Research Institute (CRRI) in 1950.

**(ii) Indian Road Congress**

- IRC was formed in the year 1934.
- The main objectives are: (a) to provide forum for regular pooling of experience and ideas on all matters that effect the planning, construction and maintenance of roads in India, and (b) to recommend standard specifications to provide a platform for the expression of professional opinion on matters relating to road engineering.
- It publishes journals, research publications, standard codes, specifications, guidelines and other special publications on various aspects of highway engineering.
- Provides a platform for expression of professional opinion on matters relating to roads and road transport.
- Played an important role in the formation of three road development programs in India.
- It works in close collaboration with Roads Wing of the Ministry of Transport

**iii) Central Road Fund (CRF)?**

Central Road Fund Scheme was constituted on 1 March 1929

. • The consumers of petrol were charged an extra levy of 2.64 paisa per litre of petrol for the development of the State Roads.

• From this 20% of annual revenue is to be retain as a central revenue for research and experimental work expenses etc.

- Balance 80% is allowed by central govt. to various states based on actual petrol consumption or revenue collected.
- Distribution of 100% cess on petrol asfollows: o 57.5% for NH o 30% for SH o 12.5% for safety works on rail-Road crossing o 50% cess on diesel for Rural Road development
- The accounts of the CRF are maintained by the Accountant General of CentralRevenues.
- The control of the expenditure is exercised by the Roads Wings of Ministry ofTransport.

**3.Briefly explain how MAP study is helpful in the alignment of new highway? What are the basic requirements of an ideal highway alignment? List and explainbriefly**

**Ans:**

Map study is done to suggest the likely routes of roads. In India topographic maps are available from the survey of India. The probable alignment can be located on the map from the following details available on the map:

- Alignment avoiding valleys, ponds or lakes
- When the road has to cross a row of hills, possibility crossing through a mountain pass.
- Approximate location of bridge site for crossing rivers, avoiding bend of the river.
- When a road is to be connected between two stations one on the top and the other on the foot of the hill then alternate routes can be suggested keeping in view the permissible alignment.
- Suppose the scale of the contour map is known, and then the contour intervals it is possible to decide the length of road required between two consecutive contours keeping the gradient within allowable limits.

**Requirements of a Highway alignment**

There are some basic requirements of the highway alignment in the plain and hill roads which must be fulfilled. In general, the basic requirements are:

(1) Short: The alignment must be the shortest of the various alternatives available. The shortest path between any two points is a straight line but the topography of the area or other factors may necessitate it do divert and take some other route, but as far as possible it should be kept minimum.

(2) Easy: Alignment should be such that the road must be easy to construct and easy to maintain or repair. If curves are of large radius and the gradient is gentle it would be easy to construct the road, rather than opposite.

(3) Safe: Safety is again the basic requirement of the highway alignment and special care must be taken to align the road in such a way that it must have the safe or minimum Sight distances and Radius of the curves, means the geometrical design features like Sight Distance, Radius of the curves and the gradient of the road must be given special attention.

(4) Economical: Road alignment must be designed to have the initial cost of construction, maintenance cost and the vehicle operation cost to a minimum. Also the locally available materials should be checked before and it may decrease the over all cost. There must be a balance in the cutting and filling on the alignment of the road

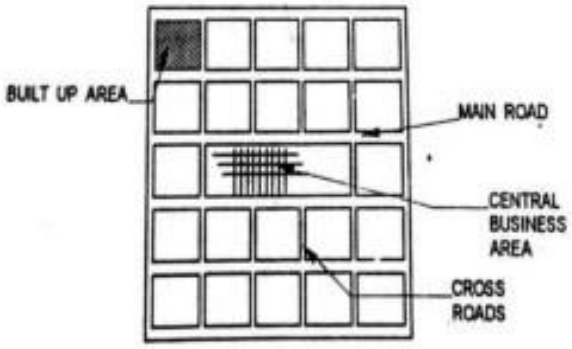
**4.Explain road patterns with neat diagrams? Explain Classification of roads as per third road development plan**

**Ans:**

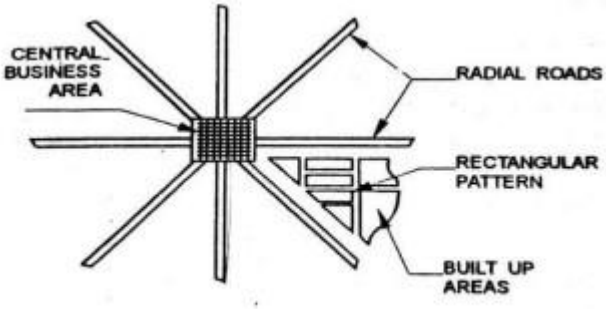
Road network can be laid in various patterns. These patterns in which the road network is laid could be

1) **Rectangular or Block pattern:** In this pattern, the whole area is divided into rectangular blocks of plots,

with streets intersecting at right angles. The main road which passes through the center of the area should be sufficiently wide and other branch roads may be comparatively narrow. The main road is provided a direct approach to outside the city. Eg:- Chandigarh has rectangular pattern

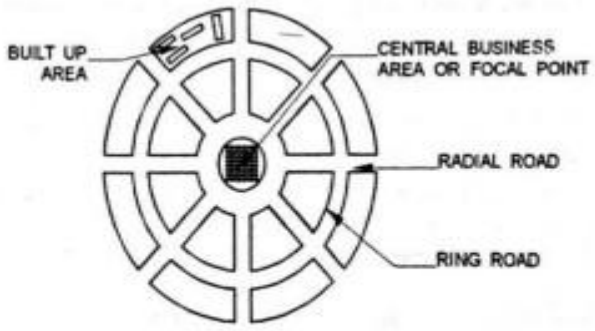



**2.Radial or Star and block Pattern:** In this pattern, the entire area is divided into a network of roads radiating from the business outwardly. In between radiating main roads, the built-up area may be planned with rectangular block.



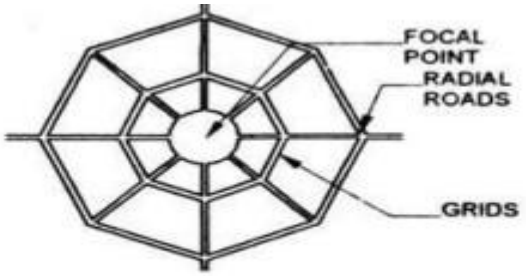

**(c) Radial or star and block pattern**

3) **Radial or Star and Circular Pattern**: In this system, the main radial roads radiating from central business area are connected together with concentric roads. In these areas, boundary by adjacent radial roads and corresponding circular roads, the built-up area is planned with a curved block system.




**(d) Radial or star and circular pattern**

4) **Radial or Star and Grid Pattern** : Change in direction, and because street patterns are the most enduring physical element of any layout, it could potentially contribute to systematic site planning and, consequently, deserves a closer look. Though the network is entirely interconnected, north-south movement becomes circuitous, indirect, and inconvenient, making driving an unlikely choice and vividly illustrating that interconnectedness by itself is insufficient to facilitate movement. Eg: The Nagpur road plan formulae were prepared on the assumption of Grid pattern




(c) Radial or star and grid pattern

5) **Hexagonal Pattern** :In this pattern, the entire area is provided with a network of roads formatting hexagonal figures. At each corner of the hexagon, three roads meet the built-up area boundary by the sides of the hexagons is further divided in suitable sizes.

(b) Hexagonal pattern

6) **Minimum Travel Pattern** :In this road pattern, city is contented by sector center, suburban center and neighborhood center by the road which required minimum to connect the city center

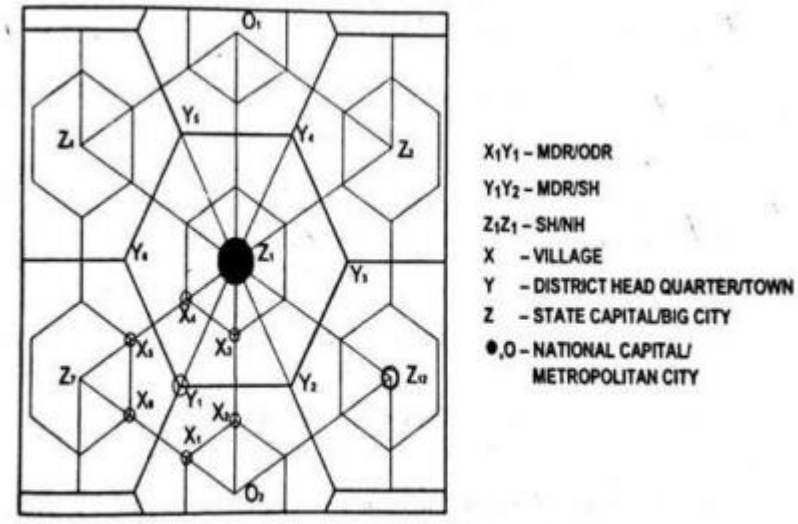



Fig. 2.3 Concept of star and grid pattern

## Classification of roads as per third road development plan

1. Primary system

   The primary system consists of two categories of highways, i.e

   . • Expressways – These are separate class of highways with superior facilities and design standards. It

is the highest class of roads in the Indian road network. They are mostly six or eight lane controlled access highways where the entrance is controlled by the use of slip roads. India has approximately 1,324 km of expressways. National Expressways Authority of India operating under the Ministry of Road Transportation and Highways will be in charge of the construction and maintenance of expressways.

- National Highways (NH) – It is one of the important categories of primary roadsystem classification

2. The secondary system – The secondary system consists of two categories of roads.

   These are:

   - State Highways (SH)
   - Major District Road (MDR)

3. Tertiary system or rural roads –

   The tertiary system are rural roads and these consists of two categories of roads.

   These are:

   - Other District Roads (ODR)
   - Village Roads ( VR)

**5.There are five proposals of road plans for a backward district. The details are given below.Justify with reasons which proposal is best assuming, Utility units of 0.5, 1, 2, 4 and8 for five population ranges and 1.0 and 5 per 1000t of agricultural and industrial products served.**

| Road link | Length, Km | No: of villages served with population range | | | | | Productivity served in 1000 tonnes | | |
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Ans:

P ⇒ Population

$(100 \times 0.5) + (150 \times 1) + (40 \times 2) + (20 \times 4) + (3 \times 8)$

⇒ $50 + 150 + 80 + 80 + 24 \Rightarrow 384$

Production = $(150 \times 1) + (20 \times 5)$

= $150 + 100 = 250$

Utility per unit length = $\frac{384 + 250}{500} = 1.964$

Q = population = 572

production = 345

Utility / unit length = 1.52

R ⇒ population = 825 ; production = 475

utility / unit length = 1.85

S ⇒ population = 928 ; production = 610

Utility / unit length = 1.92.

T ⇒ population = 975 production = 655

Utility / unit length = 1.81.

Proposals of priority of Roads server ⇒ S, R, T, Q & P.