

## 4.2 Classification of Roads:-

The roads are classified on the following basis:

- 1) According to traffic
- 2) According to transported tonnage
- 3) According to importance
- 4) According to location & function.

1) According to traffic:-

Based on traffic volume, the roads are classified as:

St. No. Sr. No. i) Types of roads based on vehicles per day

1.	Very heavy traffic roads	Above 600
2.	Heavy traffic roads	251 to 600
3.	Medium traffic roads	70 to 250
4.	Light traffic roads	Below 70

(90M) short traffic weight  
(900) short metric weight

1 tonne = 1000 kg

2) According to tonnage:-

Based on the total tonnage per day, the roads are classified as:

St. No. Sr. No. i) Types of roads based on Vehicles per day

1.	Very heavy traffic roads	Above 1524
2.	Heavy traffic roads	1017 to 1524
3.	Medium traffic roads	508 to 1017
4.	Light traffic roads	Below 508

### 3) According to importance:-

According to their importance of holy places, stations of strategic importance, roads are classified as:

- Class I roads
- Class II roads
- Class III roads

### 4) According to location & function:-

Classification based on location & functions is defined clearly therefore it is more acceptable for a country.

The Nagpur road plan classified the road in India based on location & functions into following categories:

- Expressways
- National Highways (NH)
- State Highways (SH)
- Major District Roads (MDR)
- Other district Roads (ODR)
- Village Roads (VR)

#### 1) Expressways :-

- These are special category of roads constructed for uninterrupted transport, i.e. roads without puncture.
- Speed limit on such highways is above 60 km/hr & they are usually constructed in heavy traffic areas.
- They have advantages like reduction of travel time & less fuel consumption.
- e.g. - Pune-Mumbai expressway.

- 2) National Highways (NH) :-
- ⇒ National highways are the main highway running through the length & breadth of the country; joining major parts, capital of states, large industrial & tourist centers, foreign highways & including roads required for strategic movements for the defense of the country etc.
  - ⇒ All the national highways are assigned with the respective numbers.

⇒ e.g. - Amritsar - Ambala - Delhi road ⇒ NH 1  
⇒ E. of Delhi - Agra - Kanpur - Calcutta road ⇒ NH 2  
⇒ Agra - Mumbai road ⇒ NH 3  
⇒ Madurai - Rameshwaram ⇒ NH 49.

⇒ There are about 215 national highways in India.

⇒ National highways should have at least two lanes in traffic & should have high class surface finishing together with adequate structural strength.

- 3) State Highways (SH) :-

⇒ The highways linking up with the national highways of adjacent states, district headquarters & important cities with the states are known as State Highways (SH).

⇒ The geometric design specifications & design speed for NH & SH are different.

⇒ These highways serve as arterial routes to & fro from district road within the state.

⇒ The responsibility of construction & maintenance of these roads lies with state government. However, the central government gives grant for development.

⇒ Dhule - Aurangabad ⇒ SH 22.  
Jalgaon - Dhule ⇒ SH 6.

#### 4) Major District Roads (MDR) :-

- These are the broader connecting important towns, areas of production & market places, with each other or with the main highway of a district.
- The responsibility of construction & maintenance of these roads lies with District Authorities. However, the state government gives grant for development of these roads.

#### 5) Other District Roads (ODR) :-

- These are roads connecting a particular town to a town or a village with some other roads.

These are the roads serving rural areas of production providing them with outlet to market centers, taluk headquarters, block development headquarters, railway stations, etc.

- This has lower design specification than MDR.

#### 6) Village Roads (VR) :-

- The roads connecting villages or group of villages with each other or with the nearest road of higher category are known as village roads.
- These roads are very important from the rural area development point of view.

There are more than 2,25,000 km long village roads

in the state of Maharashtra.

Important : In many states like Bihar, Jharkhand, West Bengal, etc., there are no village roads.

These are the roads serving farmlands.

#### 4.3 Classification of Roads based on Materials:-

Types of roads based on materials are :-

- (1) Earth roads. In it earth, horse or goat dung are used.
- (2) Water bound Macadam roads (WBM)
- (3) Bituminous roads or tarmac roads with coarse aggregate.
- (4) Cement concrete roads have strength with help of cement.

(1) Earth roads :-

→ These are kuchha roads in which earth is the main constituent of road & probably provided in village area.

→ They are constructed from the local available soil near the site or nearby by utilising soil & sand from field & mixing it with help of cart or bullock.

(2) Water Bound Macadam roads (WBM) :-

→ It consists of broken pieces of stones of size varying from 25 mm to 75 mm that are laid in three layers on prepared subgrade.

→ The bigger sized pieces of stones are laid in the bottom course.

→ This type of road is also usually provided in village area.

→ Now-a-days, WBM is the compact base for the bituminous road & concrete road.

→ Water bound macadam road is named after a Scottish Engineer John Macadam.

→ WBM is a better quality road than the ordinary earth road.

Fine sand & red earth mix

Thick surface of broken stones of 50 mm size

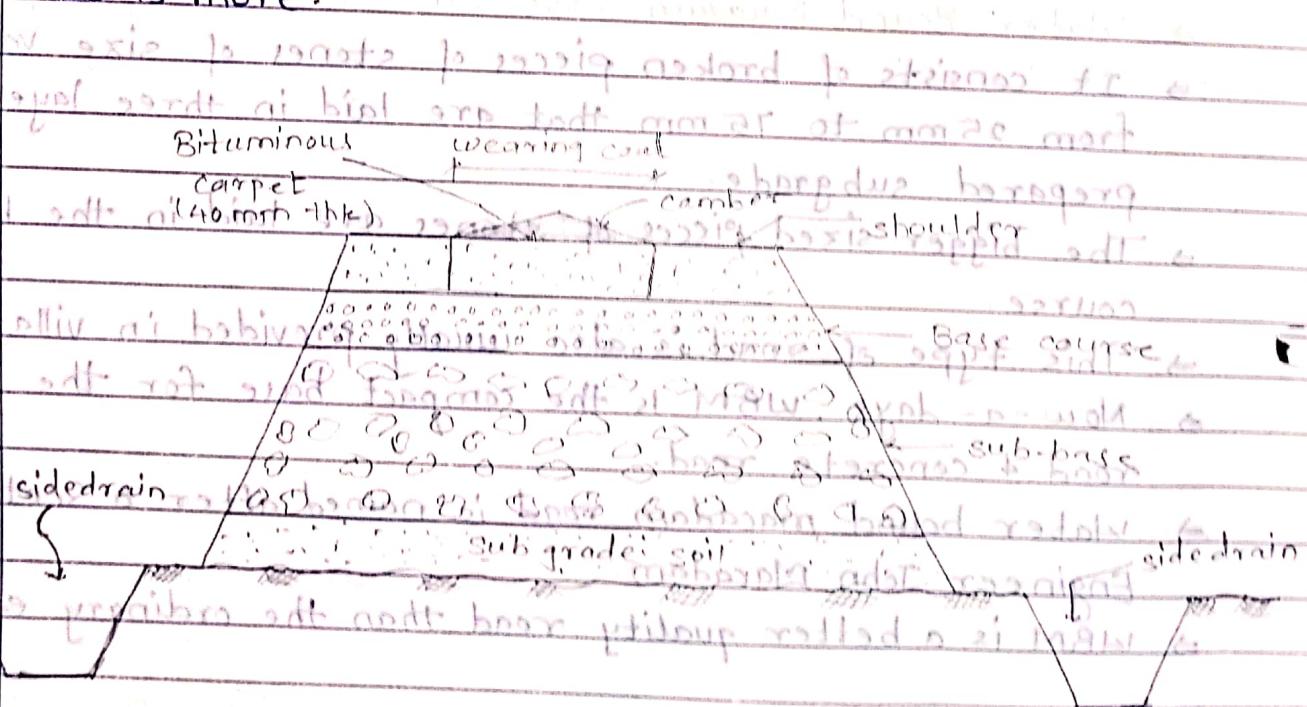


10 mm thick broken stone layer passing 3.75 mm sieve

10 mm thick broken stone layer passing 5 mm sieve

level.

- 3) Bituminous roads or tar roads :-
- It is the structure of a flexible pavement.
  - In such type of road, first of all, water bound macadam surface is prepared & then smaller chips of stones, size varying from 16 mm to 20 mm with bitumen are laid, in the thickness varying from 30 mm to 40 mm. Bitumen acts as binder.
  - This type of road gives a smooth wearing course for layer at the top of the road.
  - Life span of bituminous road is short & durability is less as compared to the concrete road.
  - There is a possibility of developing the corrugations due to heavy traffic. Its repairing is easy but maintenance cost is more.



Camber - slight convex curve given to a surface

#### 4) Cement Concrete road:-

- ⇒ It is the structure of rigid pavement.
- ⇒ It consists of a rigid wearing surface on the top resting on the sub-base then with base course & then sub-base to compacted sub grade as shown in fig.
- ⇒ Life span of concrete road is long & its durability is also more as compared to bituminous road.
- ⇒ There is no possibility of developing the corrugations due to rigid pavement.
- ⇒ Its repair work is difficult due to rigidity of concrete.

Its maintenance cost is quite low.

Cross section of the cement concrete road is as shown in figure.

From bottom to top, the layers are:

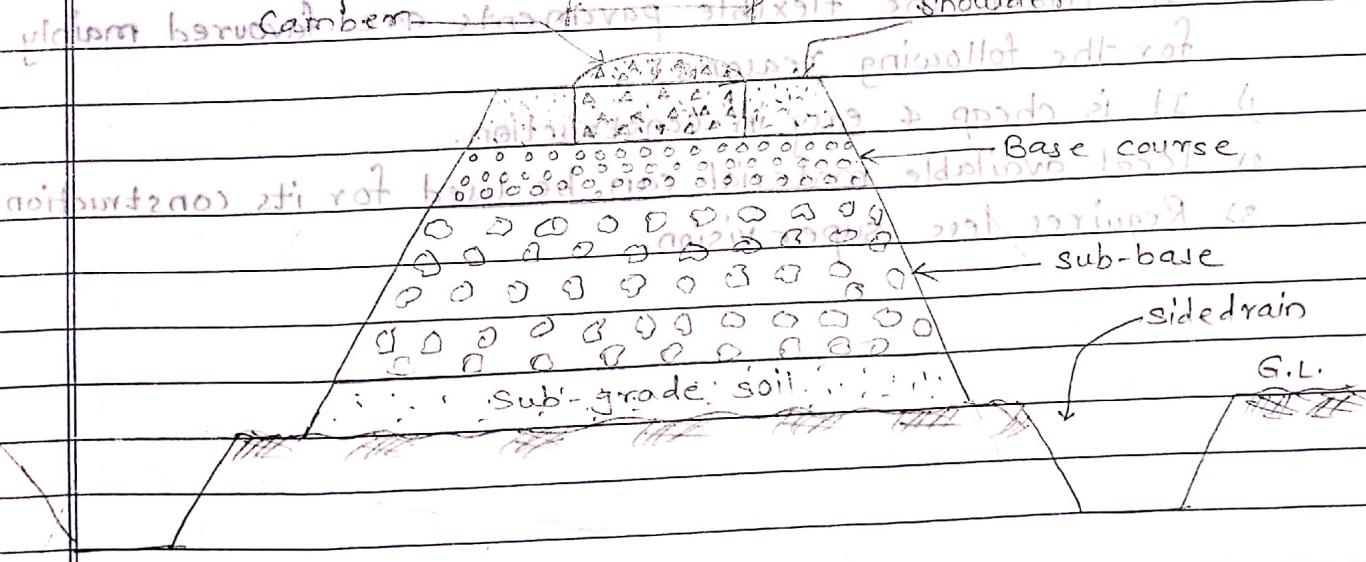
Concrete slab  
(150 mm thick)

Base course

Sub-base

Sidedrain

G.L.



Pavement - hard surface of road

#### 4.4. Types of Pavements:-

Following are two basic types of road pavement:

1) Flexible Pavement (Institutional)

2) Rigid Pavement (Institutional)

pit in roads in shape due to

flexible  $\Leftrightarrow$  able to bent  
Rigid  $\Leftrightarrow$  unable to

more movement of hammer in same

flexible pavements work by utilizing soil itself.

$\Rightarrow$  The road pavement which can change their shape to some extent without rupture are known as flexible pavement.

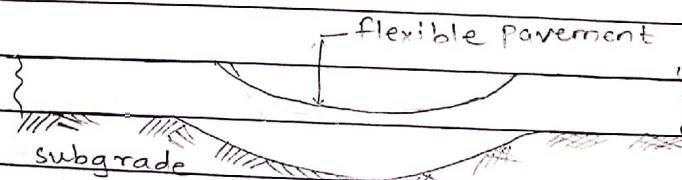
breaking

and still it does not break

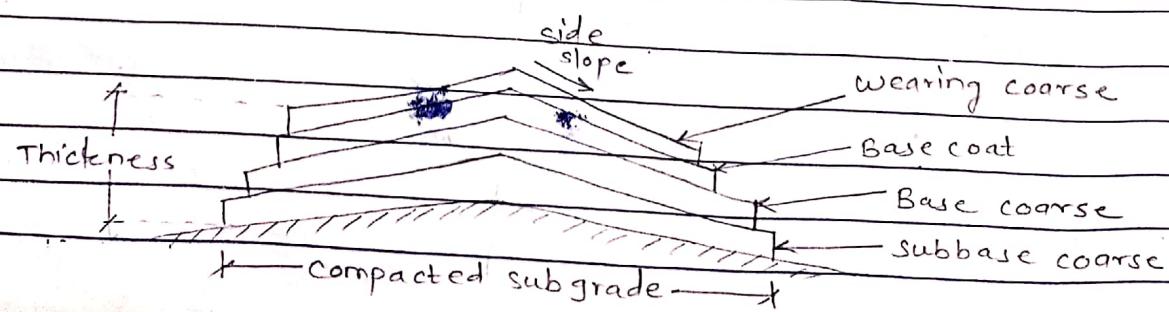
The common examples of flexible pavements are all bituminous pavements, gravel pavements, water bound macadam pavements, etc.

$\Rightarrow$  In India, the flexible pavements are favoured mainly for the following reasons:

- 1) It is cheap & easy in construction.
- 2) Local available material can be used for its construction.
- 3) Requires less supervision.



A flexible Pavement depicting depression due to settlement of subgrade

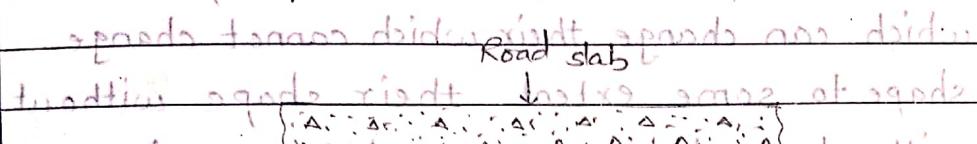


2) Rigid Pavement :-

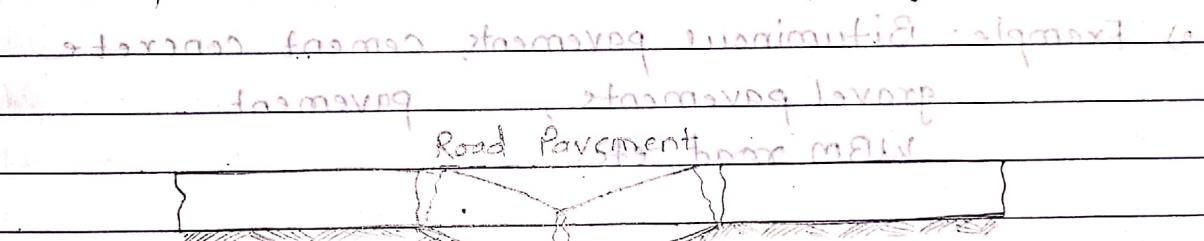
→ The road pavements which cannot change their shape without rupture are known as rigid pavements.

⇒ Common example of rigid pavement is cement concrete pavement.

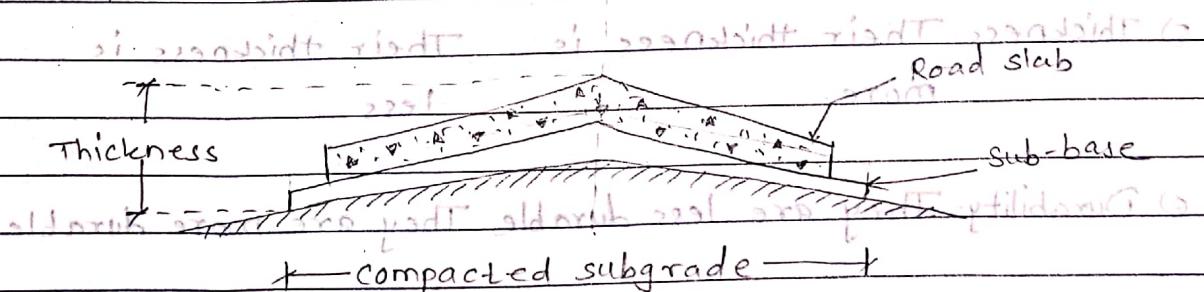
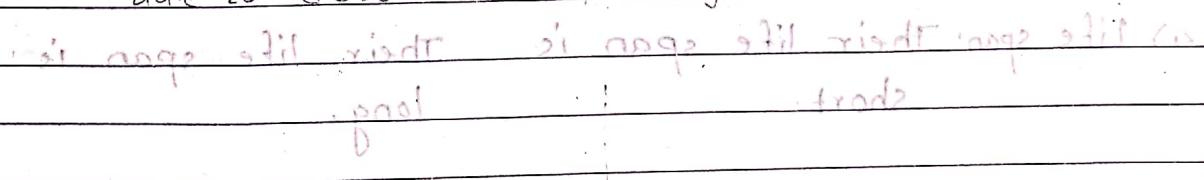
⇒ Their life span is long & initial cost is high.



(a) A rigid pavement acting as a beam over depression due to settlement of subgrade



(b) Failure of rigid pavement in case of depression due to settlement of subgrade



corrugations - shaped into alternate ridges & grooves.

## 4.5 Difference bet<sup>n</sup>: flexible Pavements & Rigid Pavements

(May 2010, 6 marks) Class discuss advantages and disadvantages of the following:  
a) telephone b) fax c) e-mail

Classification of Pavements

Start from	Flexible Pavements	Rigid Pavements
1) Defn:	The road pavements which can change their shape to some extent without rupture are known as flexible pavements.	The road pavements which cannot change their shape without rupture are known as rigid pavements.
2) Example:	Bituminous pavements, cement concrete gravel pavements, ICBM road, etc.	pavement.
3) Initial cost:	Their initial cost is low.	Their initial cost is high.
4) Life span:	Their life span is short.	Their life span is long.
5) Thickness:	Their thickness is more.	Their thickness is less.
6) Durability:	They are less durable.	They are more durable.
7) Repair work:	Their repair work is easy.	Their repair work is difficult.
8) Corrugations:	They develop corrugations.	They do not develop corrugations.
9)	moderate skill & less supervision is required.	High degree of skill & more supervision is required.

#### 4.6 Necessity of Roads:-

The roads serve the following purposes:

- ⇒ Quick & easy transportation of men, material, food grains, vegetables & other goods from one place to another.
- ⇒ Roads develop the area quickly.
- ⇒ Roadways are the only means of transport in isolated locations of country where other means of transport cannot be used.

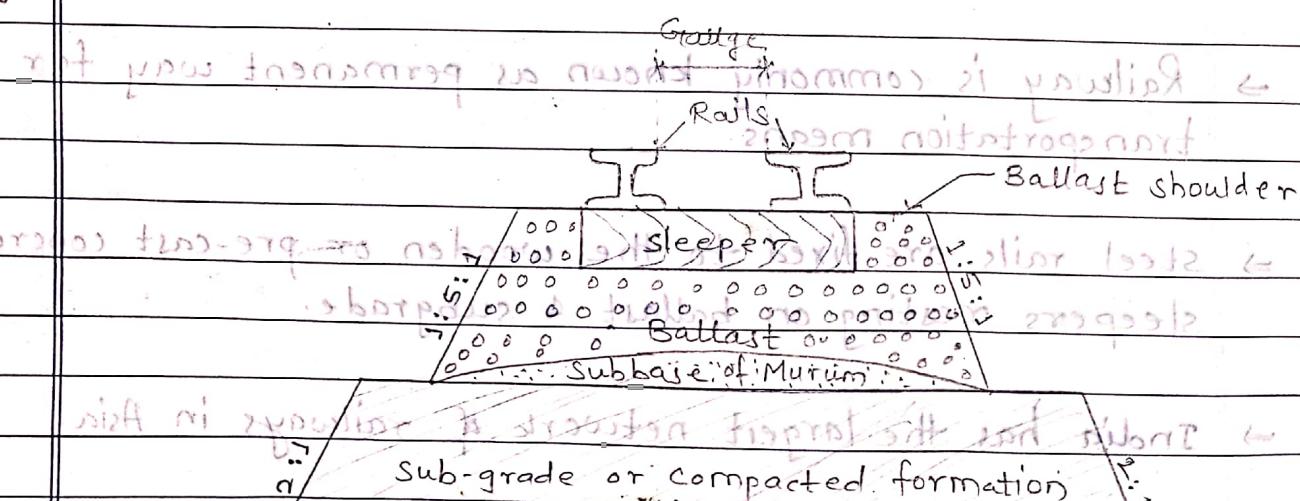
#### 4.7 Railways:-

- ⇒ Railways or railway transport is now a days, the life line of the nation & more essential for mass transportation of men & materials for long distances.
- ⇒ The part upon which the railway actually moves consists of steel rails, wooden or pre-cast concrete sleepers, ballast (crushed stones & metals) & subgrade (i.e. compacted soil underneath the ballast).
- ⇒ Railway is commonly known as permanent way for transportation means.
- ⇒ Steel rails are fixed to the wooden or pre-cast concrete sleepers resting on ballast & subgrade.
- ⇒ India has the largest network of railways in Asia.
- ⇒ The metro-railway at kolkata is another advanced development in the Indian railways. The greatest advantage of such metro railway is that it does not interfere with other traffic in metropolitan cities.

→ Indian railways are divided into nine zones for convenience of operation & maintenance as follows:

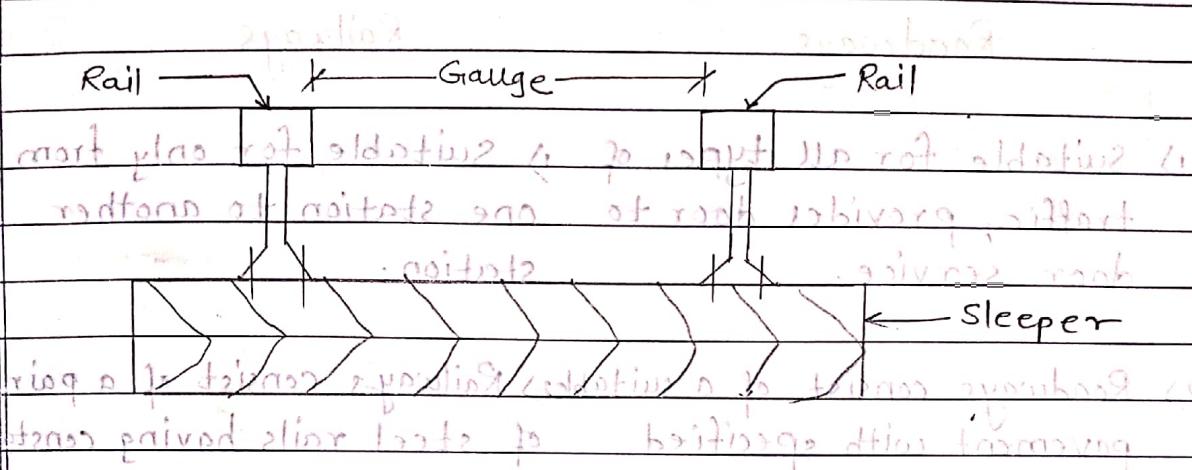
- 1) Central railways
- 2) Eastern railways
- 3) Western railways
- 4) North-eastern railways
- 5) Southern railways
- 6) South central railways
- 7) South-eastern railways
- 8) North-eastern railways
- 9) North-East frontier zone

→ A typical cross-section of a permanent way for transportation means, showing details of rails, sleepers, sub-grade soil & gauge is shown in figure below.



## 4.8 Gauges :-

(May 2010, May 2012, 416 marks)



- The rails run parallel to each other & maintain constant distance between them throughout.

utis A clear distance between inner faces of rail is called as gauge of track. cm

→ There are three gauges used in Indian railways as follows:

Sr No. It is Gauge limit b) Clear distance bet<sup>n</sup> Example.

- |    |              |         |                                    |
|----|--------------|---------|------------------------------------|
| 1. | Narrow gauge | 0.765 m | -illy / Remote areas<br>Tarsiling. |
| 2. | Meter gauge  | 1.000 m | Kolkata city                       |
| 3. | Broad gauge  | 1.676 m | Sangli - Kolhapur<br>Sangli - Nira |

- In India, broad gauge is now a days commonly used in railway track & narrow or meter gauge is rarely found in some of the regions.

level.

4.9 Comparison bet": Roadways & Railways :-

(May 2009, Dec. 2010, Dec. 2011, May 2012, 6 marks)

Roadways	Railways
1) Suitable for all types of traffic; provides door to door service.	1) suitable for only from one station to another station.
2) Roadways consist of a suitable pavement with specified width.	2) Railways consist of a pair of steel rails having constant gauge throughout the track.
3) Load carrying capacity is less than railways.	3) Load carrying capacity is more than roadways.
4) Suitable for any distance.	4) Suitable for long distance.
5) Suitable for steeper gradients.	5) Limitations on the steeper gradients.
6) Maintenance cost is less.	6) Maintenance cost is more.
7) No special turning devices or provisions are constructed.	7) special turning devices or provisions in the form of points & crossings are made.