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SECTION:	A
SUBJECT:	TRANSPORTATION - 1
SEMESTER EXAM	SUMMER - FINAL 2020 (ONLINE)
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## QUESTION: 01

**Given Data:-**

60000 vehicles monthly (30 days)

Peak flow rate of 550 vehicles @ 15 min

**Required:**

(1) No. of vehicles moving per lane per hour in each direction = ?

(2) Peak hour factor PHF = ?

**Solution:**

60000 vehicles moving in 30 days.

So finding vehicles per day =  $\frac{60000}{30} = 2000$  /day

Now per hour:-

So  $\frac{2000}{24} = 83.3 \approx 84$  veh/hr.

Now considering three lanes in each direction so total six lanes for both directions.

So Now

$\frac{84}{6} = 14$  vehicles.

Hence 14 vehicles are moving per lane per hour in each direction.

Now Finding PHF:

$$\text{PHF} = \frac{\text{hourly volume}}{4 \times \text{max. 15 min vol with in hour}}$$

$$= \frac{14}{4 \times 550}$$

$$\text{PHF} = 0.00636$$

Ans.



QUESTION: 02

Given Table

Vehicle	Distance (meters)	Travel time (min)	Speed km/h
1	1400	1.31	64.122
2	1400	1.51	55.629
3	1200	1.11	64.865
4	1500	0.90	100.00
5	1600	1.12	85.714
6	1800	1.52	71.053
7	1200	1.45	49.655
8	950	0.90	65.33
9	1175	1.33	53.008
10	1200	1.13	63.717
11	1300	1.30	60.00
12	1400	1.20	70.00
13	1800	1.24	87.097
14	1700	1.11	91.892
15	1800	1.00	108.00
16	2100	1.12	112.50
17	1200	0.87	82.759
18	1700	1.40	72.857
19	1600	1.21	79.339
20	1700	0.55	185.455

## Unit Conversion

veh	Distance (km)	Time Travel (hr)	Speed (km/hr)
1	1.400	0.02183	64.122
2	1.400	0.025167	55.629
3	1.200	0.018500	64.865
4	1.500	0.01500	100.00
5	1.600	0.018667	85.714
6	1.800	0.025333	71.053
7	1.200	0.024167	49.655
8	0.950	0.01500	63.333
9	1.175	0.0022167	53.008
10	1.200	0.018833	63.717
11	1.300	0.021667	60.000
12	1.400	0.20000	70.00
13	1.800	0.020667	87.097
14	1.700	0.0185	91.892
15	1.800	0.016667	108.00
16	2.100	0.018667	112.500
17	1.200	0.014500	82.759
18	1.700	0.02333	72.857
19	1.600	0.0201667	79.339
20	1.700	0.0091667	185.455
Total	29.575	0.572168	1620.995
Avg	= 1.47625	= 0.028608	$\frac{1620.995}{20}$ $= 81.0497$

Finding TMS:-

As we know by formula:

$$TMS = \frac{\sum_i^n (x/t_i)}{n}$$

putting values

$$= \frac{1620.995}{0.572168}$$

20

$$= \frac{2833.07525}{20}$$

20

$$TMS = 141.6537 \text{ km/hr.}$$

Finding SMS:

we know by formula

$$SMS = \frac{x}{\frac{\sum t_i}{n}} = \frac{xn}{\sum t_i}$$

putting values

$$SMS = \frac{20 \times 1.47625}{0.572168}$$

$$SMS = 51.6019 \text{ km/h.}$$

## QUESTION: 03

Railway Engineering: Branch of civil engineering that deals with planning, design, construction, operation of railway tracks for safe and sound movement of trains is called railway engineering.

→ Primary objectives of railway engineering are

- (i) Safety
- (ii) Efficiency.

→ The first railway in world was opened to traffic on 27<sup>th</sup> Sept, 1825.

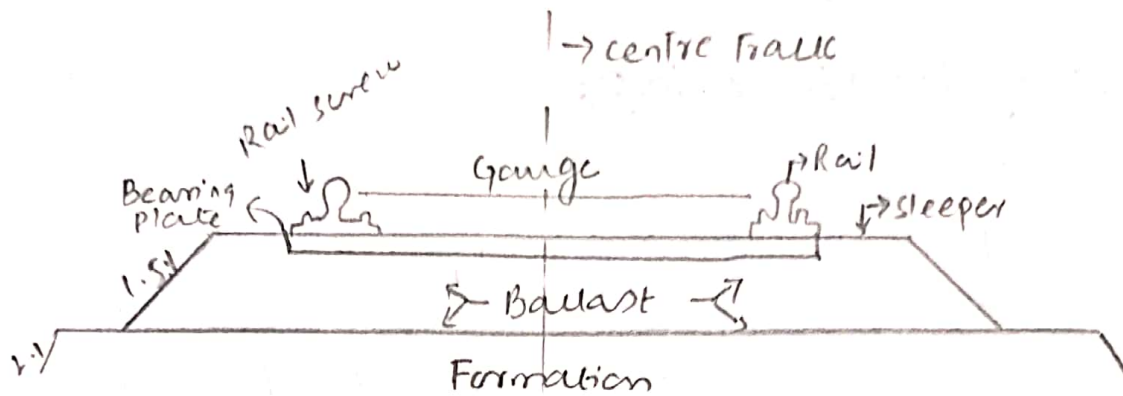
### Components of Railway Track:

#### Railway Track:

An engineered structure consisting of two metal guiding rails on which vehicles are self propelled or pulled by locomotive is called railway track.

Components of railway track include

- (i) Rails
- (ii) Ballast
- (iii) Sleepers
- (iv) Fastenings.



Cross-section of Railway Track

Rails: They are laid in two parallel lines to provide continuous and level surface for movement of train.

→ It has inverted T or I shaped cross section

→ Made up of high carbon steel to withstand stress.

Function:

→ It provides continuous and level surface

→ pathway provided is very smooth and has very little friction

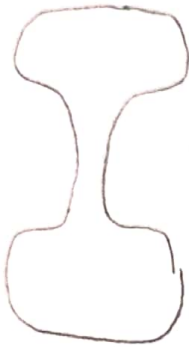
→ Rail serve as lateral guide for wheels.

→ Bears the stress developed due to vertical load

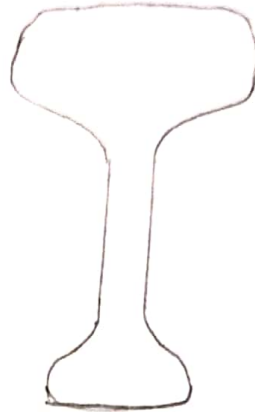


Types: Rails can be divided into following three types

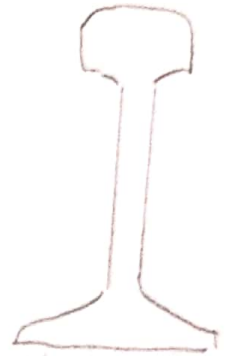
- (1) Double headed rails
- (2) Bull headed rails
- (3) Flat footed rails



Double headed rail



Bull headed rail



Flat Bottom rail

Railway Track Gauge: Defined as minimum distance b/w two rails. or distance b/w inner side of two parallel rails that make up single railway line.

Loading Gauge: It defines max. height and width for railway vehicles and their loads to ensure safe passage through bridge, tunnel etc

Construction Gauge: It is determined by adding necessary clearance to loading gauge so vehicle can move safely at prescribed speed without infringement

## 2 BALLAST:

It's layer of broken stones, gravel or granular material placed and packed, below and around sleepers for distribution of load from sleepers to formation.

- It provides drainage, lateral and longitudinal stability to track
- It holds sleepers in position during passage of train.

Types: Types of Ballast Include.

(i) Sand Ballast.

It has good drainage prop and its cheap. Good packing material. Disadvantages include excessive wear is caused and Blows off easily.

(ii) Marum Ballast:-

Advantages include: cheap and prevent water from percolating  
Disadvantages: very soft & turns into dust, quality of track is average

(iii) Coal ash or cinder

Advantages:- Easy availability, cheap and good drainage

Disadvantages: soft and easily pulverized harmful for steel slipper.

#### (iv) Broken Stone Ballast :-

Advantages: → hard and durable  
→ Good drainage properties

Disadvantages: → Difficult in procurement  
→ Initial cost is high.

Requirements of Good Ballast include:  
It should be

- hard
- tough
- cubical with sharp edges
- non-porous and absorb water
- resist abrasion.
- cheap and economical

#### Railway Station ::

It's place on railway line where traffic is booked and dealt with and where trains are given authority to proceed forward.

Railway station are classified as

- (1) Flag station
- (2) Block station

Rail Yard :: Consists of system of tracks laid down to deal with passenger as well as good traffic handled by railway,

### 3 SLEEPERS:

Transverse ties that are used and laid to support the rails are called sleepers.

- Functions:
- (1) Transfer load from rail to ballast.
  - (2) prevent longitudinal movement of rail
  - (3) hold rails in correct gauge and alignment
  - (4) Give firm and even support

### Types:

Sleepers have following types:

#### (1) Wooden sleepers:

Advantage:

- economical and easy to build
- can be used with or without Ballast

Disadvantage - Development of cracks, wear and decay

- high maintenance cost.

#### (2) Steel sleepers.

Advantage:

- long life
- Free from decay

Disadvantage:

- liable to corrode

- Unsuitable for track circuiting area

#### (3) Cast Iron Sleeper:

Advantage:

- less corrosion
- less probability of cracking

Disadvantages:

- Gauge maintenance is difficult

- provide less lateral stability

(4) Concrete Slippers :-Advantage :-

- maintain better gauge
- have long life span

Disadvantage :-

- heavy weight
- Difficult to be manufactured.

(4) FASTENINGS :-

Track fittings and fastening are used for fixing rails together and fixing them to sleepers.

Their main purpose is to hold rail in proper position in order to ensure the smooth running of trains.

Rails are fixed to wooden sleeper using following type of fastenings,

1) Spikes

(2) Screws and Bearing plates

The spikes include

Spike

- Dog Spikes
- Round spikes
- Fang Bolts
- Screw spikes

Bearing plates include

Bearing plate

- Mild steel coated bearing plate
- Flat MS Bearing plate
- Cast iron antileep bearing plate

## Creeps of Rails::

It is defined as longitudinal movement of rails with respect to sleeper in track is called creep of rail.

### Causes::

It includes

- (1) Badly maintained rail joints.
- (2) Improper securing of rail to sleepers
- (3) Bad quality sleepers
- (4) Overloading on rails.

The most serious effect is that it causes buckling of tracks/rail.

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## QUESTION: 04

Airport Engineering: Airport engineering refers to planning, design and construction of terminals, runway and navigation aid to provide safe movement for passenger and freight services.

It provide facility where passengers from ground transportation connect to air transportation.

Airfield: Area where air craft can land and take off, which is equipped with navigational aid, markings and terminal facilities.

Aerodromes: Area on land or water intended to be used either wholly or in part for arrival, departure and surface movement of air craft

Components of airport: Airport has

following components

- (1) Runway
- (2) Taxiway
- (3) Apron
- (4) Terminal Building
- (5) Control Tower
- (6) Hanger
- (7) Parking.

1. Runway :- It's a paved land strip on which take off and landing operation of aircraft takes place. It's on levelled position and there's no obstruction on it.

→ Special markings are made to differ it from normal roads. esp. lightening helps in safe landing.

→ Factors affecting runway construction are

- (1) Direction of runway should be in direction of wind
- (2) Cross-winds might occur so second runway should also be laid.
- (3) Bitumen or concrete can be used. Bitumen is economical but concrete has long life span.
- (4) No. of runway of airport depends upon traffic. If traffic is greater than 30 movements per hour then another runway required.
- (5) Width of runway depend on max size of aircraft utilizing it.



(2) Taxiway: It is a path that connects each end of runway with terminal area, apron or hanger etc.

→ In modern airports, it is laid at an angle of 30 degree to runway so that it can be used by aircraft to change from one runway to other runway easily.

→ Asphalt or concrete is used for construction

3. Apron: It is basically a parking place for aircrafts. It is also used for loading and unloading of aircrafts.

→ It is usually paved and located in front of terminal building

→ The size of area required for construction of apron depends upon number of aircrafts and characteristics of aircrafts.

→ proper drainage facility is necessary

→ sufficient clearance must be provided for aircrafts to bypass each other

- (4) Terminal Building: It's place where airport administration facilities are located. The pre-journey and post journey checking of passengers takes place
- Cafe and lounges are there for waiting passengers. Ticket counters, luggage check in or transfer security checks and customs are basic of all airport terminals.
  - large airports can have more than one terminals.

- (5) Control Tower: It's a place where air-craft under a particular zone are controlled whether in air or on land. It is done through radar and information carried through radio.

- (6) → All aircraft in that zone are controlled that inform pilots about their airport fix-applic, landing routes, visibility etc. Based on this information pilot decides and attempts safe landing.
- It's like nervous system of airport.

(6) Hanger: Place where repair and service of aircraft is done. It is connected to runway through taxiway.  
 ⇒ When repair of aircraft needed it moves to hanger.  
 → It is constructed using steel trusses and frames. Large area should be provided for hanger for comfortable movement of aircraft.

(7) Parking: It provides place for parking vehicles of airport staff or passenger which is outside terminal building or sometimes underground.

(8) Runway Markings: Runway markings are provided with different purposes like

(i) Runway centre line Marking  
 → For guidance, identify centre of road.  
 → painted white in colour

(ii) Runway edge strip:  
 → white lines denoting edges of road  
 → consists of 2 strips one along each side

(iii) Touch down or landing zone marking:  
 → thin white strip, indicating touch zone for landing.  
 → comprise pair of rectangular markings

(iv) Threshold marking:  
 → helps to identify beginning and end of runway  
 → consists of pattern of longitudinal strips placed symmetrically around centreline

(1) Runway Numbering

Airport Lightings: They are

- (1) Approach lighting
  - (2) Runway lighting
  - (3) Threshold lighting
  - (4) Taxiway lighting
  - (5) Boundary lighting
  - (6) Lighting of wind direction indicator
  - (7) Apron, hanger lighting
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