Question bank for LDC examination

General Feature

1. Steep gradients which need extra engine for hauling is known as
a) Pusher gradient*
b) Rulling Gradient
c) Reasonable gradient
d) Momentum gradient

2. Rising gradient followed by a falling gradient is known as
a) Rulling gradient
b) **Momentum gradient***
c) Pusher graient
d) Aangular gradient

3. The safety in Railway in India is looked after by
a) Ministry of Railways
b) Commission of Railway Safety*
c) Railway Board
d) Headquarter Office

4. Longest platform of the world on BG is
a) At Sonepur station*
b) At Sasaram station
c) At Allahabad station
d) At Kharagpur station

5. The ruling gradient is 1 in 200 on a section of the BG track. If the track is laid in that place at a curve of 5 degrees then the allowable ruling gradient on the curve will be
a) 1 in 16.7
b) 1 and 400
c) 1 in 240
d) 1 in 333*

6. The number of stations on Indian Railways is
a) 6000 approximately
b) 7070 approximately*
c) 8000 proximately
d) 9000 approximately

7. Longest tunnel on Indian Railway is
a) Kharbude tunnel on Konkan Railway*
b) Near Lonavala between Monkey hill and Khandala station
c) Kalka Shimla
d) Darjeeling hill Railway

8. Longest Railway Bridge on Indian Railway is

1. Sone Bridge at Dehri on Sone*

2. Yamuna Bridge at Kalpi

3. Ganga Bridge near Patna

4. Pamban Bridge

9. Longest passenger train on Indian Railway is

1. Prayagraj Express*

2. Kalka Mail

3. Himsagar express

4. Lucknow mail

10. Railway station at the highest altitude on Indian Railway is

1. Ghum station in Darjeeling Himalayan Railway*

2. Shimla station on Kalka Shimla railway line

3. Mount Abu and Abu Road Mount Road station

4. Joginder Nagar on Pathankot jogindernagar section

Track and track gauges

1.Track Structure for private siding with operating speed of 80 to 100 kmph is same as the track structure as specified for

a) Group B route

b) Group A route

c) Group D route*

d)Group C route

2. Track structure for private siding with operating speed 50 to 80 kmph is the same as track structure as specified for

a)Group A route

b) Group B route

c) Group D route

d)Group E route*

3. Indicate which of the statement is incorrect with regard to coning of Wheels

a)coning of wheels help the vehicle to negotiate a curve smoothly

b) It helps in smooth riding

c) It increases wear and Tear of wheel flanges*

d)it enables the outer wheel of vehicle to take a longer distance

e) it restricts the swaying of vehicles

4. Tilting of rails is done at a slope of
a. 1 in 30
b. 1 in 25
c. 1 in 20*
d. 1 in 15

5. Clear perpendicular distance between inner faces of two rails is
a. Gauge of track*
b. Inner gauge
c. Wheel base
d. Wheel gauge

6. The ratio of wheel diameter to gauge is about
a. 0. 40
b. 0.55
c. 0. 75*
d. 0. 90

7. The train runs faster on BG than on MG rail because its speed is directly proportional to
a) Weight of the train*
b) Gauge width
c)Policy of Railway Board
d) Length of the train

8. The ratio of maximum cant e and gauge G in India is about
a)1 / 100
b) 1 / 50
c)1 /10*
d) 1 / 25

9. "Composite sleeper index" is employed to determine
a) sleeper density requirement
b) number of fixtures required for a particular type of sleeper
c) durability of sleeper
d) mechanical strength of wooden sleepers and thereby gives its suitability as to be used as li sleepers.*

10. The maximum permissible speed recommended for Indian Railways for 1 in 8 and half crossing is
a)16 kmph*
b) 20 kmph
c)24 kmph
d) 32 kmph

11.What is the weight per meter length of 52 kg Rail?
a. 54.14 kg
b. 50.25 kg
c. 51.89 kg*
d. 53.85 kg

12.What is the height of 60 kg rail section?
a. 180 mm
b. 172 mm*
c. 185 mm
d. 165 mm

13.In M+7 sleeper density, how many sleepers are there in a km Track.
a. 1660 nos
b. 1540 nos.*
c. 1310 nos.
d. 1440 nos.

14.What is the assessed GMT service life of 60 kg 90 UTS rail?
a. 650 GMT
b. 600 GMT
c. 800 GMT*
d. 500 GMT

15.What is the assessed GMT service life of 52 kg 90 UTS rail.
a. 650 GMT
b. 600 GMT
c. 525 GMT*
d. 500 GMT

16.What is the full form UTS of rails
a. Ultimate technical Strength
b. Ultimate tensile Strength*
c. Upper Top surface
d. None of above

17.What is the width of Head of 52 kg Rail section
a. 70 mm
b. 75 mm
c. 67 mm*
d. 60 mm

18.What is the full form of GMT
a. Gross Million Tonnes*
b. Gross minimum thickness
c. Gross Maximum thickness

d. None of above

19.In Indian Railway how many Gauges of Track has been adopted
a. 1
b. 3*
c. 2
d. 4

20.What is the Highest speed of train in Indian Railway
a. 140 KMPH
b. 120 kmph
c. 160 kmph*
d. 130 kmph

21.How many divisions in Northern Railway
a. 5*
b. 4
c. 6
d. 3

22.What do you mean by BG
a. Big Gauge
b. Broad Gauge*
c. Buffer gauge
d. None of above

23.What do you mean by RDSO
a. Research & Development Standard organisation*
b. Railway Development & Standard organisation
c. Regional Development & Standard organisation
d. None of above

24.Where is the Head Quarter of Northern Railway
a. New Delhi*
b. Lucknow
c. Mumbai
d. Calcutta

25.What is the highest post in Railway
a. General Manager
b. Chief Engineer
c. Chairman Railway Board*
d. Divisional Railway Manager

26.What is the standard distance between lines in Broad Gauge
a. 1670 mm

b. 1676 mm*
c. 1665 mm
d. 1680 mm

27.What do you mean by LWR
a. Long welded Rail*
b. Long weld able Rail
c. Linear welded rail
d. None of above.

28.On the basis of temperature how many zones are in Indian railway
a. 2
b. 6
c. 4*
d. 7

29.What is the minimum distance centre to centre of straight tracks for new works/alterations to existing works.
a. 4265 mm.
b.3660 mm.
c.**5300 mm.***
d 4365 mm.

30.What is the full form of OMS used for track recording
a. Outer most Surface
b. Oscillation Monitoring system*
c. Only measuring system
d. Official measurement system

31.What is the frequency of track recording of the sections having speed more than 110 kmph to 130 kmph
a. 4 Months
b. 2 Months
c. 6 Months
d. 3 Months*

32.What is the full form of PQRS used for Track renewal works.
a. Plasser quick Relaying system*
b. Please quick return services
c. Poor Quality renewal system
d. None of above

33.Minimum radius of curve on Broad gauge
a. 175 meter*
b. 215 meter
c. 146 meter
d. 200 meter

34.Minimum check rail clearance at Level crossing
a. 45 mm
b. 51 mm*
c. 50 mm
d. 57 mm

35.Maximum height above rail level of high passenger Platform
a. 860 mm
b. 900 mm
c. 840 mm&*
d. 875 mm

36.Minimum clearance between toe of Open switch and stock rail for new works
a. 115 mm*
b. 120 mm
c. 95 mm
d. 110 mm

37.What is the formula of TGI for track recording
a. UI+4TI+6GI+AI/10
b. 2UI+TI+GI+6AI/10*
c. 3UI+TI+2GI+5AI/10
d. 2UI+2tI+2GI+4AI/10

38.What is the limit of Unevenness of A category of track
a. 0 to 10 mm
b. 0 to 5 mm
c. 0 to 6 mm*
d. 0 to 8 mm

39.What is the difference between rail flange of 60 kg & 52 rail section
a. 20 mm
b. 18 mm
c. 14 mm*
d. 16 mm

40. what is the value of long chord for measuring unevenness in track recording

a. 3.6 meter
b. 9.6 meter*
c. 7.2 meter
d. 4.8 meter

41. Frequency of TTM tamping on PSC sleepers track
a. 2 years or 100 GMT which ever is earlier*

b. 2 years or 150 GMT which ever is earlier
c. 1.5 years or 200 GMT which ever is earlier
d. 2 years or 175 GMT which ever is earlier

42. How many sleepers are there in Fan shaped 1 in 12 turnout
a. 85 sleepers
b. 96 sleepers*
c. 90 sleepers
d. 100 sleepers

43.Minimum wing rail clearance opposing nose of crossing on Fan shaped turnout
a. 45 mm
b. 40 mm
c. 41 mm*
d. 44 mm

44.Overall length of fan shaped 1 in 12 Turnout
a. 39975 mm*
b. 41004 mm
c. 28613 mm
d. None of above

45.What is the full form of TGI
a. Track Geometry Index*
b. Track general Index
c. Track gravity Index
d. None of above

46.Permissible speed of Turnout with 1 in 12 curved switches
a. 40 kmph*
b. 25 kmph
c. 15 kmph
d. 20 kmph

47.Permissible speed of Turnout with 1 in 8.5 curved switches
a. 40 kmph
b. 25 kmph*
c. 15 kmph
d. 20 kmph

48.How many green flags are with Patroller during Hot weather patrolling.
a. 02
b. 03
c. 01
d. None of above*

49.Lowest level of staff/supervisor competent for TTM tamping operation in LWR/CWR.

a. Gang Mate
b. PWS
c. PWI*
d. Keyman.

50.Lowest level of staff/supervisor competent for Lifting/Lowering of track in LWR/CWR.

a. Keyman.
b. Gangmate.
c. PWI.
d. PWS.*

51.Lowest level of staff/supervisor competent for packing or renewal of single isolated sleeper not requiring lifting or slewing of track in LWR/CWR.

a. PWI
b. Keyman
c. Gangmate*
d. PWS

52.Lowest level of staff/supervisor competent of Renewal of fastenings not requiring lifting in LWR/CWR.

a. PWS
b. Gangmate
c. Keyman*
d. Gangman

53.Lowest level of staff/supervisor competent for Renewal/recoupment of fastenings requiring lifting in LWR/CWR.

a. PWS
b. Gangmate*
c. Keyman
d. Gangman

54.Lowest level of staff/supervisor competent for Screening of ballast other than deep screening in LWR/CWR.

a. PWS
b. Keyman
c. Gangmate*
d. Gangman

55.Lowest level of staff/supervisor competent for Organising Hot weather patrolling during summer months in LWR/CWR.

a. Gangmate
b. PWI*
c. Keyman
d. PWS

31. Lowest level of staff/supervisor competent for all operations regarding distressing in LWR/CWR.
    a. PWI*
    b. PWS
    c. Gangmate
    d. Keyman

56.Lowest level of staff/supervisor competent for passing of first train after buckling in LWR/CWR.
    a. PWI*
    b. PWS
    c. Gangmate
    d. Keyman

57.How many zones are in Indian railway
    a. 8
    b. 10
    c. 16*
    d. 12

58.In LWR What is the range of Destressing temperature in 52 kg and heavier section
a.* Mean rail temp+5 ^{0}C to Mean rail temp+10 ^{0}C
b. Mean rail temp+5 ^{0}C to Mean rail temp+15 ^{0}C
c. Mean rail temp to Mean rail temp+10 ^{0}C
d. Mean rail temp+2 ^{0}C to Mean rail temp+10 ^{0}C

59.What is full form of SPURT car
a. Self propelled ultrasonic rail testing car*
b. Self pulled united rail testing car
c. Self pumped universal testing car
d. None of above

60.What do you mean by 60 kg rail
a. Weight of rail in 1 meter*
b. Area of rail of 1 meter
c. Weight of rail in 1 feet
d. Volume of rail in 1 meter

61.Points & Crossing is laid at a cant of
a. 1 in 20
b. 1 in 10
c. 1 in 15
d. NIL*

62.Minimum permissible vertical wear on nose of a 52 kg CMS crossing on Rajdhani route is

i) 6mm
ii) 8mm*
iii) 10mm
iv) 12 mm

63.Normal life of detonators is

e. 5 years
f. 10 years
g. 7 years *
h. 6 years.

64.Maximum distance apart of trolley refuges on bridges with main spans of 100metre or more is

i. 50 mtr
j. 100 mtr
k. 200 mtr
l. a refuge over each pair*

65.Permissible creep in track is

m. 50 mm
n. 100 mm
o. 125 mm
p. 150 mm.*

66. Maximum distance covered in a day by a Patrolman should not normally exceed

q. 2 km.
r. 5 km.
s. 10 km.
t.* 20 km .

67.Curve inspection shall be carried out by Sectional PWI

a. Once in three months
b. Once in six months
c. Once in four months*
d. None of above

68.An accident has taken place at out station and main line is blocked and relief train is to be turned out without medical car. The hooter shall be:

a. 3 long
b. 4 long*
c. 4 long, 1 short
d. 3 long, and 1 short

69.Minimum speed restriction to be imposed for Track renewal is:-

(a) Stop dead & 10 Kmph
(b) 10 Kmph

(c) 15 Kmph
(d) 20 Kmph*

70.Service life in terms of total GMT carried for 52 kg. 90 UTS rail is:-
(a) 425 GMT
(b) 475 GMT
(c) 525 GMT*
(d) 545 GMT

71.Minimum rail section recommended for section having traffic more than 20 GMT is
(a) 90 UTS
(b) 52 Kg.
(c) 60 Kg.*
(d) None of the above.

72.Lubrication of ERC and inserts in corrosion prone areas and platform line is done:-
(a) Once in a month.
(b) Once in a fortnight.
(c) Once in a week.
(d) Once in a year.*

73.Vertical wear permissible for 60kg/90UTS. rails is:-
(a) 23 mm.
(b) 10 mm.
(c) 13 mm.*
(d) 15 mm.

74. Permissible wear of web & foot of rail due to corrosion is:-
(a) 15 mm.
(b) 1.5 mm.*
(c) 0.5 mm.
(d) 2.5 mm.

75.Minimum depth of ballast cushion below the bottom of sleeper at the rail seat on BG group A route should be :-
(a) 350 mm.
(b) 250 mm.
(c) 300 mm.*
(d) 325 mm.

76.Sleeper density for group 'A' route with traffic density more than 20 GMT is:-
(a) 1560 sleepers/ Km.
(b)* 1660 sleepers/ Km.
(c) 1540 sleepers/ Km.
(d) 1340 sleepers/ Km.

77.Track structure for CC+8 t+ 2 t loaded trains is:-

(a) 52 Kg 90 UTS;PSC 1540 sleepers/ Km.; 250 mm ballast.
(b) 60 Kg 90 UTS;PSC 1660 sleepers/ Km.; 300 mm ballast.*
(c) 52 Kg 72 UTS;PSC 1540 sleepers/ Km.; 300 mm ballast.
(d) 90 R;PSC 1340 sleepers/ Km.; 250 mm ballast.

78.Deep screening of entire track must be done at least:-

(a) Once in a quarter.
(b) Once in a year.
(c) Once in 5 years.
(d) Once in 10 years.*

79.Service life of Glued insulated rail joint of 60 Kg rail is:-

(a) 300 GMT.
(b) 200 GMT.*
(c) 400 GMT.
(d) 150 GMT.

80.Service life of improved SEJ of 60 Kg rail is:-

(a) 400 GMT.
(b) 300 GMT.
(c) 200 GMT.*
(d) 150 GMT.

81.Service life of CMS crossing (52 Kg rail) is:-

(a) 400 GMT.
(b) 300 GMT.
(c) 200 GMT.
(d) 150 GMT.*

82.D&G charges for works estimates of CTR(P) is:-

(a) 2.25%.
(b) 1.8%.*
(c) 1.35%.
(d) 1.62%.

83. What is speed restriction on deep screening site done by BCM and tamped by machine followed with DGS?

(a) 20
(b) 30
(c) 40*
(d) 10

(Accidents, Derailments & Disaster Management,)

(1) ACD means

(a) Anti collision Devise*

(b) Accidents causing death

(c) Accidents causing derailment

(d) None of the above

(2) Duration of short hooter is……..

(a) 5 seconds*

(b) 10 seconds

(c) 15 seconds

(d) 20 seconds

(3) For taking track measurement at accident site stations shall be marked at …….. Apart.

(a) 1 m

(b) 2m

(c) 3m*

(d) 5m

(4) Flat tyre causes maximum damage at a speed of

(a) 90 to 100 kmph

(b) 25 to 30 kmph*

(c) 10 to 15 kmph

(d) 15 to 20 kmph

(5) As per IRCA rules, the rejection limits for wheel flange thickness is -

(a) 38mm

(b) 25.4mm

(**c) 16mm***

(d) 20 mm

(6) Where Enquiries are ordered by DRM the enquiry report should be submitted to DRM within

(a) 5 days

(b) 7 days*

(c) 10 days

(d) 12 days

(7) In a semi permanent (BG) diversion the gradient should not be steeper then

(a) 1 in 75

(b) 1 in 125

(c) 1 in 100 *

(d) 1 in 150

(8) An accident will be termed as serious accident when the loss of Railway property is more then

(a) 3 lacs

(b) 10 lacs
(c) 25lacs*
(d) 15 lacs

(9) *Collision as per new classification is classified as
(a) A class*
(b) B class
(C) C class
(d) none of these

(10) Number of hooters to be sounded, when the accident takes place is Loco shed or in traffic

(a) One long hooter
(b) Two long hooters
(c) Two long & one short
(d) none to these

(11) Number of hooters to be sounded, when accident takes place out station, but main line is clear:

(a) 02 long
(b) 03 long*
(c) 03 long 01 short*
(d) none of these

(12) Duration of lone Hooter is:

(a) 20 seconds
(b) 25 seconds
(c) 30 seconds*
(d) 50 seconds

(13) "Accident Drill" is organized by:

(a) Engg. Officers
(b) Operating Officers
(c) Engg. & operating officers *
(d) none of these

(14) When flange contact of wheel leads tread contact. Then it is known as:

(a) Zero angularity
(B) Negative angularity
(c) Positive angularity*
(d) none of these

(15) The condition will be called as thin flange, when the flange thickness becomes less the:

(a) 10mm
(b) 12mm
(c) 16mm*
(d) 15mm

(16) Min. sleeper density in case of semi permanent diversion-

(a) (m + 2)
(b) (m + 3)*
(c) (m + 4)
(d) (m + 7)

(17) As per new classification of railway accident, floods breaches & land slides' is classified in the following class

(a) Class J
(b) Class K
(c) Class Q
(d) Class R*

(17) Diplorry can be worked:

(a) In block*
(B) without block
(c) With look put caution
(d) None of these

(18) Min. authority to be Incharge of lorry.

(a) Keyman
(b) Mate
(c) PWS*
(d) none of these

(19) UCC is abbreviated for

(a) Uncontrolled cement concrete
(b) Unified Control Command
(c) Unified Command Centre*
(d) none of them

(20) In a semi permanent (BG) diversion the gradient should not be steeper then
(a) 1 in 75

(b) 1 in 125
(c) 1 in 100*
(d) 1 in 150

(Schedule of Dimensions)

(1) The minimum centre to centre distance of a B.G. track in mid-section is …….. mm
(a) 4200
(b) **4265***
(C) 4350
(d) 4000

(2) Any deviations from the Schedule of dimensions will require prior sanction of …….
(a) Zonal Rly
(b) Rly Board*
(c) CRS
(d) All of them

(3) The maximum gradient in station yards should be ……. Unless special safely devices are adopted and/or special rules enforced.
(a) 1 in 400*
(B) 1 in 500
(c) 1 in 1000
(D) 1 In 600

(4) The recommended maximum gradient in the year for B.G is-
(a) 1 in 1000
(b) 1 in 1200*
(c) 1 in 1500
(d) 1 in 1800

(5)For B.G. the minimum radius of a curve is ……
(a) 150m
(b) 175*
(c) 200m

(d) 225m

(6) Check rails should normally be provided where the radius is ……. M or less in B.G.
(a) 150m
(b) 200m
(c) 208m*
(d) 225m

(7) On B.G. maximum clearances of check rails at a level crossing are
(a) 51mm
(b) 57mm*
(c) 65mm
(d) 54mm

(8) Minimum depth of space for wheel flange form rail level in B.G. is …… mm
(A) 35
(B) 38*
(C) 42
(D) 45

(9) The minimum horizontal distances form centre of track to face of passenger platform coping for B.G. is ……. Mm
(A) 1650 MM.
(B) 1670 MM*
(C)1676 MM
(D) 1685 MM

(10) What is maximum height above rail level for low-level passenger platform for BG?
(a) 300mm
(b) 455mm*
(c) 525mm
(d) 550mm

(11) Maximum curvature permitted on B.G. is
(a) 8 degree
(b) 10 degree*
(c) 12 degree
(d) 16 degree

(12) The minimum track centres in B.G. double line is
(a) 4500 mm
(b) 4750 mm
(c) 5000 mm
(d) 5300 mm*

(13) Maximum height of rolling stock on BG should be

(a) 2745mm
(b) 3250mm
(c) 3450mm
(d) 4140mm*

(14) Maximum width of rolling stock on BG should be
(a) 4745mm
(b) 3250mm*
(c) 3450mm
(d) 4140mm

(15) The gradient of a platform is generally
(a) 1 in 1000
(b) 1 in 750
(c) 1 in 500*
(d) 1 in 250

(16) Maximum clearance of check rails at level crossing for B.G. should be

(a) 48mm
(b) 57mm*
(c) 51mm
(d) 44mm

(17) Height gauges should be located at a minimum distance of….. from gate post.

(a) 5 m
(b) 7.5m
(**c) 8m***
(d)10m

(18) O.D.C. Stands for

(a) On direct current
(b) Over dimensioned consignment*
(c) None of them
(d) Operating & gate

(19) In case of 'A' Class ODC escort is……..

(a) Necessary
(**b) not necessary***
(c) does not matter
(d) on direct current

(20) For A class ODC, the gross clearance over maximum moving dimension of B.G is

(a) 150mm
(b) 175mm
(c) 225 mm*
(d) (d) 250mm

(21) For A Class, the gross clearance of over maximum moving dimension for BG is

(a) 100mm
(b) 125mm
(c) 150mm*
(d) 175mm

(22) Check rails should normally be provided where the radius is …. M or less in B.G.
(a) 150m
(b) 200m
(**c) 218m***
(d) 240m

(23) On B.G. maximum clearances of check rails at a level crossing are

(a) 51 mm
(b) 57mm*
(c) 65mm
(d) 70mm

(24) The maximum height above rail level for B.G. goods platform is ……. Mm

(a) 1000mm
(b) 1050mm
(c) 1065mm*
(d) 1075mm

(25) Minimum clearance of check rails for B.G. at level crossing should be

(a) 48mm
(b) 57mm
(c) 51mm*
(d) 44mm

1. Specific yield of well is
a) Discharge per unit time
b) Yield of well per metre of drawdown*
c) Velocity of water per unit time
d)None of the above

2.While taking sample of water from well, sample is collected
a)About 2 metre above the bottom of wel
b) About 1 metre above the bottom of well *
c)About 1 metres below the bottom of well
d) none of the above

3. While collecting sample of water from tap the
a) Mouth of tap is heated for 5 minutes*
b) Mouth of tap is heated for 10 minutes
c)Mouth of tap is not heated
d)none of the above

4. Demand of water for passengers on railway station is
a)10 litres per passenger
b)15 litres per passenger
c) 20 litres for passenger
d) 25 litres per passenger*

5. Peak hour demand of water is taken as ---------- times the average daily demand
a)1.5
b)1.9
c)2.25*
d)2.75

6. The spacing of tube wells should generally be more than ----------from the circle of influence
a)10 metre
b)50 metre
c)100 metre*
d) 500 metre

7. The capacity of highest storage tank with efficient standby pump should be higher of the following figures
a)1/4 the maximum water consumption in 24 hours
b)1/3 the normal water consumption in 24 hours
c)1/4 the normal water consumption in 24 hours.
d) a or b*
e) b or c
f) a of c

8. With regard to standard of quality of drinking water as laid down by Indian Railway , the requirement (desirable) limit of total dissolved solids should not be more than---------- mg/l
a)200
b) 300
c) 400
d) 500*

9. Chandigarh is a city which has roads generally parallel or perpendicular to each other. The ideal water supply system in such a city should be
a. Dead and system
b. Grid Iron system*
c. Ring system
d. Any of them
10. Give the most matching option out of list one and list to with regard to pipe appurtenances of fittings

Llist I type of fitting)	List -II(Function of the fitting)
A) Sluice Valves or gate Valves	1. We are provided to stop and regulate the flow of water in course of ordinary and emergency operations
B) Scour Valve	2. These are automatic cut off valves. when pressure of water exceeds specific limit the wall operates automatically and saves a particular section of pipe before bursting takes place
C) Air Valve	3. These are located at dead end and the lowest points or depressions in the water mains. Hence are operated to remove sand or silt deposited in the water pipe
D) Relief Valve	4. Whenever there are distinct high points in the gradient of the pipeline. They are installed to permit expulsion of air

Matching option

	A	B	C	D
(a)	1	2	3	4
(b)	**1**	**3**	**4**	**2***
(c)	2	4	1	3
(d)	4	3	2	1

11. From distribution main of 40 mm size , number of service pipe of 15 mm size can be taken off are---------
a) 3
b) 6
c) 10
d) 12*

12. From the distribution main of 40 mm size, number of service pipe of 20 mm size can be taken off are -------
a)3
B) 6*
c) 10

d) 12

13. From distribution main of 50 mm size, number of service pipes of 15 mm size can be taken off are ------
a) 6
b)10
c) 12
e):20*

14. PH value of drinking water as per wh0 standards should lie between
a)5 and 5.5
b)6 and 7
c) 7 and 7.5
d)7 and 8.5*

12. The amount of residual chlorine after a period of contact 10 to 20 minutes is
a. 0.1 to 0.2 ppm.*
b. 0.2 to 0.3 ppm.
c. 0.3 to 0.4 ppm
d. 0.4 to 0.5ppm
13. A rural water supply serves a population of 10, 000 at the rate of 50 litres per capita per day . For the chlorine dose of 2 PPM the required amount of bleaching powder with 20% available chlorine will be
a. 0.5 kg
b. 5 kg *
c. 10 kg
d. 15 kg
14. The main drawback of centrifugal pump is
a)necessity of priming
b) discharge from pump varies with the load of water
c) For high heads efficiency is low up to 50%
d) the suction lift is limited to 6 metre
e) all of the above*

15.Aeration Of water is done to remove
a) Odour*
b) Colour
c) Bacterias
d) Hardness
e) Turbidity

16. Requirement of water for platform washing is
a)5 litre per square metre per day *
b)10 litre per square meter per day
c) 15 litre per square metre per day
d)20 litre per square metre per day

17. Requirement of water for apron washing

a. 5 litre per square metre per day

b. 10 litre per square metre per day *

c. 15 litre per square metre per day

d. 20 litre per square metre per day

18. The pumping system should be capable of supplying the normal quantity of water required in 24 hours in

a)12 hours or less

b) 16 hours or less

c) 20 hours or less*

d) 8 hours or less

19. Water connection given to contractor for construction work can be discontinued by giving a notice of

a)3 days*

b) 2 days

c)7 days

d) no notice is required

BRIDGE

1. Initial inspection for PSC girders / Welded girder bridges as per IRBM 1998

a) **Within one year of installation***

b) Once in 3 years

d) Once in 2 years

d) Once in 5 years

2. Periodical inspection of Welded girders

a) Once in 3 years

b) **Once in 3 years***

c) Once in 2 years

d) Once in 5 years

3. Periodical inspection of PSC & Composite girders

a) Once in 3 years
b) **Once in 5 years ***
c) Once in 2 years
d) Once in 5 years

4. The date of painting of steel work should be painted in white on the out side of the left girder
a) of the 1st span only
b) **first span only but on all spans for Imp. Bridges***
c) of the all spans
d) None of the above

5. Camber in steel triangulated girder is provided to compensate for deflection
a) **Under live load and dead load***
b) Under live load
c) Under dead load
d) None of the above

6. The length of the snap head rivet shank is, when L = length of the rivet,
G = length of grip in mm; D = Dia of rivet in mm
a) **L =G +1.5 D + 1mm for every 4 mm of grip or part thereof** *
b) b) L =G +0.5 D + 1mm
c) L =G +0.5 D
d) None of the above

7. The length of the countersunk head rivet shank is, when L = length of the rivet,
G = length of grip in mm; D = Dia of rivet in mm
a) **L =G +0.5 D + 1mm for every 4 mm of grip or part thereof** *
b) b) L =G +0.5 D + 1mm
c) L =G +0.5 D
d) None of the above

8.A bridge is generally specified as "Br. No. 180 (5x9.10m G) at km 345/5-6".
a) Effective Span
b) Width of bridge
c) Clear Span*
d) Overall length of bridge

9. The strength of a bridge is termed as MBG loading of 1987. MBG refers to
a) Model Broad Gauge
b) Modified Budget Grant

c) Model Budget grant
d) **Modified Broad Gauge***

10.In a temporary signaling arrangements for a bridge work in BG section, caution board shall be placed in advance of ……. m from start of the bridge/ work spot.
a) 30 m
b) **1200 m***
c) 677 m
d) 1000 m

11. Free Board is the level difference between Formation Level and …….
a) Rail Level
b) **HFL***
c) Bed Level
d) Danger Level

12. Minimum Free Board required in a bridge is
a) **1 m***
b) 1.20 m
c) 600 mm
d) 300 mm

13. Vertical Clearance (VC) in water way bridges is the level difference between
a) HFL and Formation level
b) Bed level and bottom of superstructure
c) **HFL and bottom of superstructure***
d) Rail level and Formation level

14. Depth of construction in a girder bridge means the depth from
a) RL to HFL
b) **RL to top of bed block ***
c) RL to bottom of bed block
d) RL to Bed level

15. Skew of a bridge is the angle between
a) C.L. of water course to C.L. of track
b) C.L. of water course to C.L. of pier
c) **C.L. of water course/road to normal (perpendicular) of C.L. of track***
d) C.L. of abutment to C.L. of pier

16. Angle of crossing of a bridge is the angle between

a) **C.L. of water course/road to C.L. of track***
b) C.L. of water course to C.L. of pier
c) C.L. of water course to normal (perpendicular) of C.L. of track
d) C.L. of abutment to C.L. of pier

17. In a single span bridge, the clear span is the distance between
a) Centres of Abutments
b) **Inner faces of Abutments***
c) Outer faces of Abutments
d) Width of Abutment

18. Sub structure of a bridge does not include
a) Abutment
b) **Girder/Slab***
c) Piers
d) Wing and Return walls

19. Super structure of a bridge includes
a) **Girder/Slab***
b) Abutment
c) Piers
d) Bed block

20. Bearings are provided in bridges to transfer the load to

a) Super structure
b) Track
c) Embankment
d) **Sub structure***

21. Wing walls and return walls are provided to retain
a) **earth on approaches**
b) ballast
c) track on approaches
d) none

22. In a temporary signaling arrangements for a bridge work in BG section, speed board shall be placed in advance of 30 m from the
a) C.L. of the bridge
b) Termination Board
c) **Start of the bridge/work spot***
d) Caution Board

23. In shallow type girders, the rail level shall be
    a) **25mm above the top flange of girder***
    b) near the bottom of the girder
    c) near the middle of the girder
    d) below the girder

24. The load transferred from rails to bottom flanges is in
    a) deck type girder
    b) **through type girder***
    c) semi-through type girder
    d) plate girder

25. The load transferred from rails to web of girders is in
    a) deck type girder
    b) through type girder
    c) **semi-through type girder***
    d) plate girder

26. The medium to transfer loads from superstructure to substructure is called
    a) Abutment
    b) Bed block
    c) **Bearing**
    d) Pier

27. Temporary staging for casting PSC Box Girder for a ROB over the Railway span shall be removed
    a) after hardening of concrete
    b) before hardening of concrete
    c) during concreting
    d) **after stressing the cables**.*

28. The horizontal clearance of edge of foot over bridge structure from face of platform is
    a) 6525 mm
    b) **3660 mm***
    c) 5330 mm
    d) 5300 mm

29. The vertical clearance of bottom most foot over bridge structure above rail level is
    a) **6525 mm***

b) 3660 mm
c) 5330 mm
d) 6250 mm

30. The minimum vertical clearance of foot over bridge gangway is
a) 2100 mm
b) 3660 mm
c) 6525 mm
d) **2710** mm

31. The horizontal clearance between guard rail and running rail in BG track is
a) 25 mm
b) **250 ± 50 mm***
c) 75 mm
d) 200 ± 50 mm

32. The level of guard rail in bridges shall not be lower than that of running rail by more than
a) **25 mm***
b) 55 mm
c) 75 mm
d) 65 mm

33. The guard rail is provided in bridges to
a) prevent derailment in bridges
b) prevent falling of vehicles during derailment*
c) have good riding
d) guide the wheels

34. Steel channel sleepers are provided in bridges with superstructure of
a) PSC slab
b) PSC girder
c) **Steel girder***
d) RCC Box

35.Minimum earth cushion required over RCC Box is
a) 300 mm
b) 600 mm
c) **0***
d) 1000 mm

36.The minimum vertical clearance above R.L. to bottom of ROB near the yard shall be

a) **6525 mm***
b) 5870 mm
c) 2360 mm
d) 6250 mm

37. The minimum vertical clearance in RUB in rural area shall be
a) 5870 mm
b) 6525 mm
c) **5000 mm***
d) 5500 mm

38. The minimum vertical clearance in RUB in urban area shall be
a) 5870 mm
b) 6525 mm
c) 5000 mm
d) **5500 mm***

39. The embankment width in approach of the bridge shall be
a) 5870 mm
b) 6525 mm
c) **6850 mm***
d) 6000 mm

40. The height gauge need to be provided in
a) ROB
b) **RUB***
c) FOB
d) Fly Over

41. The CRS sanction is required in the ROB project for construction of
a) Approach spans
b) Laying road
c) **Railway spans**
d) none

42. The temporary girders are generally required for the bridge works
a) **on traffic condition***
b) under mega block
c) in cut and open method
d) in new route

43. The diameter of hole for 20 dia rivet shall be
    a) 23 mm
    b) 18 mm
    c) **21.5 mm***
    d) 22 mm

44. IS code for Steel structures is
    a) IS 236
    b) IS 226
    c) IS 456
    d) **IS 800***

45. Pipe culvert is a/an
    a) major bridge
    b) **minor bridge***
    c) unimportant bridge
    d) important bridge

46. One of the following works does not require CRS sanction
    a) Regirdering/ Rebuilding
    b) Erection of new FOB
    c) **Erection of platform shelter***
    d) Pipe line crossing

47. Facia boards of platform shelters shall have a minimum horizontal clearance of ……. from C.L. of track at a minimum height of 4.61m above RL.
    a) 2360 mm
    b) 3660 mm
    c) 3000 mm
    d) **1600 mm***

48. At FOBs in electrified section the electrocution by live OHE wires is prevented by providing
    a) smoke gaurds
    b) Roofing
    c) Bottom lateral bracings
    d) **protective screens***

49. One of the following is a shallow foundation
    a) Pile foundation
    b) **Raft foundation***

c) Under reamed pile foundation
d) Well foundation

50. Minimum vertical clearance (VC) for a slab/ girder bridges with discharge of 0-30 cumecs is
    a) 300 mm
    b) 1500 mm
    c) 1800 mm
    d) **600 mm***

51. Maximum vertical clearance (VC) for a slab/ girder bridges with discharge above 3000 cumecs is
    a) 300 mm
    b) 1500 mm
    c) **1800 mm***
    d) 600 mm

52. For end bearing piles, the minimum spacing of piles of diameter 'd' shall be
    a) 3d
    b) 2d
    c) **2.5d***
    d) 5d

53.

54. Weep holes are provided in
    a) piers
    b) trestle piers
    c) foundation
    d) **abutments***

55. The pressure on soil worked out shall be …… the SBC of the soil.
    a) more than
    b) equal to
    c) not equal to
    d) **less than***

56. …….. soil has the least SBC of the soil.
    a) Hard moorum
    b) Stiff clay
    c) **Black cotton soil***
    d) Soft rock

57. The minimum edge distance for rivets of diameter 'd' in steel plates shall be
    a) 2 x d

b) 3 x d
c) **1.5 x d***
d) 2.5 x d

58. The minimum pitch of rivets of diameter ‘d’ in steel plates shall be
a) 2 x d
b) 3 x d
c) 1.75 x d
d) **2.5 x d***

58) Rail Cluster, as temporary arrangement can be used upto a span of
a) **3.66m***
b) 6.1m
c) 12.2m
d) 18.3 m

59) Speed restriction required for using CC cribs as temporary arrangement is
a) **20 kmph***
b) 40 kmph
c) 35 kmph
d) 30 kmph

60) The minimum cushion specified over an arch bridge is --
a) 0.5m
b) 0.9m
c) **1.0m***
d) 1.2 m

61) In case of water crossing danger level in bridges
a) speed restriction be imposed
b) traffic be suspended till water recedes
c) **traffic be suspended till a responsible person inspects the site and declares it safe for running traffic***
d) bridge watchman is to be posted

62) From fatigue considerations, bridges are designed for --
a) 2 million cycles
b) 1 million cycle
c) **10 million cycles***
d) 3 million cycles

63) Structural steel for railway loading above 0°C temperature conforms to --

a) IS 2062 grade A
b) **IS 2062 grade B***
c) IS 2062 grade C
d) None of the above

64) Bearings for plate girders are --
a) roller bearing
b) sliding bearings
c) **centralised articulated bearings***
d) None of the above

65) Bentonite is used in pile driving --
a) to facilitate pile driving
b) to enable proper pile concreting
c) **to stabilize the bore hole walls***
d) None of the above

66) In a routine pile load test the test load is --
a) 1.25 times the design load
b) **1.5 times the design load***
c) 1.75 times the design load
d) 2 times the design load

67) In the eight digit code given in the rating system the first digit is called --
a) URN
b) **ORN***
c) CRN
d) None of the above

68) An important bridge is one which has total waterway of equal to or more than
a) **1000 sq.metres.***
b) 800 sq. metres
c) 500 sq. metres
d) 300 sq. metres

69) Well foundation may be of the following type
a) circular
b) D type
c) Double D type
d) **Any of the above***

70) Maximum tilt specified during sinking of well foundation is
   a) 1 in 10
   b) 1 in 50
   c) **1 in 100***
   d) 1 in 150

71) Foundation and substructure of the bridge should be inspected by SE/P.Way/Works
   a) Once a year any time
   b) **Once a year before monsoon***
   c) Once a year after monsoon
   d) Once in 3 months

72) For a major bridge, the URN would comprise of
   a) single digit
   b)**eight digits***
   c) six digits
   d) four digits

73) Speed restrictions is suggested for distressed bridges on Group I
   a) **upto maximum of 15 kmph***
   b) 25 kmph
   c) 50 kmph
   d) 60 kmph

74) Speed restrictions is suggested for distressed bridges on Group II
   a) upto maximum of 15 kmph
   b) **25 kmph to 50 kmph***
   c) 75 kmph
   d) 60 kmph

75) Settlement of foundations or Tilted piers and abutments will be considered as distressed bridge as
   a) **Group I***
   b) Group II
   c) Both of the above
   d) None of the above

76) Cracks in return walls/ wing walls or Slight tilting/ bulging of abutments are the signs of distressed bridge under
   a) Group I
   b) **Group II***

c) Both of the above
d) None of the above

77) In arch bridges, Cracks/ lean/ bulge in parapet walls, Bulging or separation of spandrel from arch barrel, are the signs of distressed bridge under
a) Group I
b) **Group II***
c) Both of the above
d) None of the above

78) Special inspection of distressed bridges shall be carried out by Asst. Engineer is
a) Once in three months
b) **Once in two months***
c) Once in a month
d) Once in six months

79) Special inspection of distressed bridges Group II shall be carried out by Inspector (Concerned) is
a) **Once in three months***
b) Once in two months
c) Once in a month
d) Once in six months

80) Temporary arrangements for rebuilding of Railway bridges can be executed by providing
a) Temporary girder
b) Temporary diversion
c) **Any of the above***
d) None of the above

81) Callendar Hamilton spans are normally available maximum up to
a) 60 ft.
b) 100 ft.
c) 150 ft.
d) **200 ft.***

82) In areas where there is no severe corrosion Finishing coat will be
a) Two coats of aluminium paint to IS : 2339
b) One coat of zinc chromate priming to IS : 104
c) **Two cover coats of red oxide paint to IS :123***

d) One coat of zinc chrome - red oxide priming to IS : 2074

83) In areas where there is severe corrosion Finishing coat will be
a) **Two coats of aluminium paint to IS : 2339***
b) One coat of zinc chromate priming to IS : 104
e) Two cover coats of red oxide paint to IS :123
f) One coat of zinc chrome - red oxide priming to IS : 2074

84) Entire steel work of girder bridge should be painted at regular interval; known as
a) patch painting
b) **periodical through painting***
c) Any of the above
d) None of the above

85) When as small area of girder bridge should be painted when requiring immediate painting; known as
a) **patch painting***
b) periodical through painting
c) Any of the above
d) None of the above

86) Elcometer is used to measure the ……..
a) cross level
b) Gauge
c) **Thickness of paint***
d) All the above

87) Repairing by cement pressure grouting can be adopted in case of
a) Honey comb concrete
b) Hollow masonry, Dormant cracks
c) Deep leached mortar joints
d) **all the above***

88) Cement pressure grouting is suitable for
a) Very fine crack
b) weathered concrete
c) Active crack where cause of crack is known and remedial action has been taken*
d) Crushed masonry

89) Epoxy pressure grouting is suitable for
a) wide and deep crack
b) fine and deep crack
c) **fine but not very deep crack***

d) None of the above

90) In cement pressure grouting, pressure is kept as
a) **2 to 4 kg./sqcm.***
b) 3 to 6 kg./sqcm.
c) 3 to 10 kg./sqcm.
d) 3.5 to 7 kg./sqcm.

91) In Epoxy pressure grouting, pressure is kept as
a) 2 to 4 kg./sqcm.
b) 3 to 6 kg./sqcm.
c) 3 to 10 kg./sqcm.
d) **3.5 to 7 kg./sqcm.***

92) In cement pressure grouting, water cement ratio is kept as
a) **0.4 to 0.5***
b) 0.3 to 0.4
c) 0.25 to 0.35
d) 0.35 to 0.5

93) In guniting/ shotcreting , water cement ratio is kept as
a) 0.4 to 0.5
b) 0.3 to 0.4
c) 0.25 to 0.35
d) **0.35 to 0.5***

94) In cement pressure grouting holes should be drilled at spacing in both direction at
a) 150 – 500 mm
b) 450 mm
c) **500 – 750 mm***
d) 1000 mm

95) In cement pressure grouting G.I pipes of diameter …… and ……length, should be fixed in drilled holes
a) **12 to 20 mm, 200 mm***
b) 12 to 20 mm, 300 mm
c) 12 to 25 mm, 500 mm
d) 20 to 25 mm, 300 mm

96) Paint is the mixture of …….
   a) **Binder, Pigment & Solvent***
   b) Binder & Pigment
   c) Binder & Solvent
   d) None of the above

97) CC Crib stands for
   a) Cement concrete
   b) Criss crossing
   c) **Christ church***
   d) None of the above

98) While painting with red oxide paint, a little quantity of ……..shall be added to the paint while doing the first coat to distinguish it from the second coat
   a) little blue paint
   b) **lamp black***
   c) red paint
   d) green paint

99) While painting with Aluminium paint, a little quantity of ……..shall be added to the paint while doing the first coat to distinguish it from the second coat
   a) **little blue paint***
   b) lamp black
   c) red paint
   d) green paint

100) Shelf life of Paint Red Oxide Ready mixed (IS : 123)
   a) 4 month
   b) **1 year***
   c) 6 month
   d) None of the above

101) Shelf life of Paint aluminium when paste and oil are mixed
   a) **Oneday***
   b) 1 year
   c) 6 month
   d) None of the above

102) The maximum time lag between surface preparation and the application of primer coat shall not exceed
   a) 12 hours
   b) **24 hours***

c) 48 hours
d) 36 hours

103) The maximum time lag between the primer coat and the Ist finishing coat shall not exceed

a) 3 days
b) **7 days***
c) 4 days
d) 12 days

104) For railway bridges with spans in excess of 30.5m, generally provided with

a) deck type girders
b) **open web through girders***
c) semi through girders
d) shallow type girders

105) Mostly long span rail-cum road bridges are provided with

a) rocker & roller bearings
b) **segmental roller with oil bath***
c) Sliding bearings
d) centralised bearings

106) The advantages of electrometric bearings are

a) Permits movement of the structure in all directions
b) Serves as a shock absorber due to anti-vibration properties of elestomeric
c) better dispersion of longitudinal forces to the approaches
d) **All of the above***

107) Length of guard rails to be bent so as to be brought together at the middle of the track.(L2)

a) 3200 mm
b) **4875 mm***
c) 3655 mm
d) None of the above

108) The size of bridge timber required for the standard spans up to 18.3 m

a) **250 x 150mm***.
b) 250 x 180mm.
c) 250 x 240mm
d) 250 x 200mm

109) Rail joints should be avoided within ……of a bridge abutment.
a) 6 m
b) **3 m***
c) 4 m
d) 10 m

110) In case of LWR track, full ballast section as specified in LWR Manual should be provided up to …….. from the bridge abutment.
a) 200 m
b) 50 m
c) 300 m
d) **100 m***

111) Clear distance between consecutive sleepers not to exceed on bridges in BG is
a) **450 mm***
b) 600 mm
c) 510 mm
d) 500 mm

113) In Girder and Slab Bridges Danger level should be marked below bottom of girders/slabs for water way is > 6.10 < 12.2 m
a) 300 mm
b) 600 mm
c) **450 mm***
d) 500 mm

114) In Girder and Slab Bridges Danger level should be marked below bottom of girders/slabs for water way is > 12.20 < 30.5 m
a) 300 mm
b) **600 mm***
c) 500 mm
d) 450 mm

115) For Box Culverts Danger level is to be taken as
a) at the top of slab
b)one third height below bottom of slab
c) **at the bottom of slab***
d) None of the above

116) The danger level should be marked with a bright red band …… wide centrally over a white band …… wide for a length of……

a) **5 cm, 10 cm, 60 cms***
b) 10 cm, 20 cm, 60 cm
c) 15 cm, 30 mm, 60 cm
d) None of the above

117) Renewal of slack rivets should be taken up in steel girder bridges:
a) All rivets which are hand loose or which have lost 50% of their head by corrosion.
b) All hammer loose rivets where corrosion has set in between the head and the plate.
c) In end stiffeners when the percentage of hammer loose rivets is >30%
d) All the above*

118) In flange splices when the number of hammer and hand loose rivets is 30% or more of the total rivets on any side of the splice location,
a) Need no be renewed
b) wait for 100% loose rivets
c) **all the rivets should be renewed.***
d) None of the above

119) Corrosion in Steel girder bridges may be prevented by :
a) Protective coatings by painting
b) Metallising
c) Use of epoxy based paints
d) **All the above***

120) Surface preparation for Metallising the abrasives used for final cleaning is
a) Chilled iron grit G.24, as defined in BS : 2451
b) Washed salt free angular silica sand of mesh size 12 to 30 with a minimum of 40% retained on a 20 mesh
c) **either (a) or (b) ***
d) d) neither (a) or (b)

121) Minimum length of steel channel sleeper in BG
a) 2500mm
b) **2440mm***
c) 2400mm
d) 2600mm

122) Length of bridge timber in BG
a) outer to outer of girder plus 305mm

b) 2440mm
c) whichever is more in a) & b)*
d) whichever is less in a) & b)

123) Periodicity of Under water inspection
a) Once in a year
b) Once in two years*
c) Whenever high flood occurs
d) Along with detailed inspection of SE/Br

128) Definition of major bridge
a) Single span of 12m & above
b) Total linear water way more than 18m
c) Both a) & b)*
d) None of the above

124) Definition of minor bridge
e) Single span less than 12m
f) Total linear water way less than 18m
g) Both a) & b)*
h) None of the above

125) Permitted wind velocity for running of trains on the bridge
a) 72 km/h*
b) 58 km/h
c) 64 km/h
d) No limits

126) Periodicity of recording of camber in PSC girders
a) Once in a year*
b) Once in two years
c) Once in three years
d) During the detailed inspection of SE/Br.

127) Weight of steel crib 75x75x10mm angles
a) 200kg
b) 187.2kg*
c) 210kg
d) 185kg

128) Conventional method of camber recording
a) Piano wire with counter weight*
b) By using leveling instrument
c) Offset method
d) None of the above

129) Flood level gauge to be marked in

a) All important bridges*
b) All major bridges
c) All minor & major bridges
d) All bridges

130) Velocity of water can be measured by

a) Anemo meter
b) Elco meter
c) Current meter*
d) Thermo meter

131) Flood level gauge to be marked

a) commencing from bed level to top
b) commencing from bottom of girder towards bed level*
c) commencing from Rail level
d) commencing from Danger level

132) Shallow type girder can be used in

a) ROBs
b) RUBs*
c) FOBs
d) None of the above

133) Under slung girders can be used in

a) Plain section
b) Ghat section*
c) Aquaduct
d) Viaduct

134) Spacing of Trolley refuges

a) Every 100m
b) If span is more than 100m, on each pier
c) Ballasted deck bridges – every 50m
d) All the above*

135) Testing of welds by

a) Dye penetrant test
b) Magnetic particle inspection
c) Radiographic inspection
d) All the above*

136) Rebound hammer is used for

a) To find the strength of concrete*

b) To form rivet heads
c) To break the concrete structures
d) None of the above

137) Ultrasonic Pulse Velocity test is meant for

a) Identifying the integrity of concrete*
b) Finding the strength of concrete
c) To know the crack in steel structure
d) To know the flaw in rail

138) The clear distance between consecutive sleepers laid over unballasted bridge on BG should not exceed

a)300mm
b)400mm
c)450mm*
d)550mm

139) The total number of bridges on I.R.is about

a)1 Lac
b)1**.25 Lacs***
c)1.50 Lacs
d)2 Lacs

140) Which para of Engineering code deals with cost sharing of ROB/RUBs

a) 1716
b) 1814
c) **1816***
d) 1819

141) What is the carriageway of two lane ROB on National Highway

a)10.00m
b)8.5
c)**9.50***
d)10.50

142) The depth of 19.81 mlong service girder is about……

a)1.67 m
b)**1.16 m***
c)0.95 m
d)1.52 m

143) BGML loading stands for

a)Broad gauge mineral loading
b) Broad gauge modified loading
c)**Broad gauge mainline loading***
d) None of above

144) MBG loading stands for
a)MineralBroad gauge loading
b**) Modified Broad gauge loading***
c)MediumBroad gauge loading
d) None of above

145) RBG loading stands for
a)**Revised Broad gauge loading**
b) Rolling Broad gauge loading
c)Railway Broad gauge loading
d) None of above

146) BGML loading caters for maaaaximum axle load of…….tonnes for locomotive with trailing load of……tonnes/metre.
a)**22.9,7.67***
b)22.5,7.67
c)25,7.67
d)None of above

147 RBG loading caters for maaaaximum axle load of…….tones for locomotive with trailing loadof…… tonnes/metre of track with maximum axle load of…….tonnes for wagons
a)22.9,7.67,25
b)**22.5,7.67,22.9***
c)25,7.67,22.9,
d)None of above

148) Piano wire is used for measuring the-
a) Distortion
b)Camber in PSC girder
c)**Both a & b***
d)None of above

149) When the railway crosses a deep vally without perinial water,it is called…….
a)**Aqueduct ***
b)Cause way
c)Via-duct
d)River crossing

150) What is the clear distance between two consecutive bridge Timbers or Girder bridge?

(a) 450 mm

(b) 510 mm*

(c) 500 mm

(d) 520 mm

151) What is the clear distance between two consecutive steel channel sleepers on Girder bridges?

(a) 450 mm*

(b) 510 mm

(c) 500 mm

(d) 460 mm

152) For painting, the unit of rate is per

a) Sqm

b) cum

c) 10sqm *

d) 10cum

153) When proposed depth of construction of a bridge is more than the existing depth of construction in a bridge work, the existing rail level requires

a) Lowering

b) **Lifting***

c) Slewing

d) None

154) Which cement should not be used for bridge slabs ro RCC frames

a) OPC

b) Portland Pozzolana cement *

c) Portland furnace slag cement

d) Rapid hardening cement

155) Standard bag of cement in …… kg

a) 52 kg

b) 30.5kg

c) 10.7kg

d) 50 kg*

156) The concrete under water minimum grade of cement recommended by IS code

a) M 10

b) M 15
c) M 20*
d) M 25

157) What is DPC?
a) Damp proof course *
b) weathering course
c) Treatment the foundation
d) Treatment over the roof

158) Elastomeric bearings are made of natural or synthetic rubber of shore hardness of approximately.
a) 30 to 40
b) **50 to 70***
c) 40 to 50
d) 60 to 70

159 Investigation for important bridges may be carried out in which stage
a) Technical feasibility study (reconnaissance survey)
b) Techno-economic feasibility study (preliminary engineering survey)
c) Detailed survey and project report stage (final location survey)
d) All the above *

160) At locations where access to the new bridge construction is available by rail, the launching of girders upto 18.3 m which method is ideal.
a) slew in slew out method b) gantry method
c) **Launching of girders with the help of a BFR***:
d) Pantoon method

161) The normal procedure for promotion should be by ……..Qualified men will be entitled to promotion by seniority within their own groups.
a) **Trade test*** b) Interview
c) Recommendation d) Random selection

162) Payment to bridge staff on the section will be made by the pay clerk in the presence of
a) SSE/SE/JE/ P.Way b) **SSE/SE/JE/ Br.***
c) SSE/SE/JE/ Works d) Office clerk

163) If the SSE/SE/JE/ Br. working in the section is not readily available, another SSE/SE/JE may be authorised by …….. to witness payment on the section.

a) DEN
b) SSE/SE/JE/
c) **AEN (Bridges)***
d) Office clerk

164) The Indian Railways Way and Works Manual was first published in the year 1954.

a) 1956
b) 1999
c) **1954***
d) 1998

165) Indian Railway Bridge manual established in

a) **1998***
b) 1999
c) 1989
d) 1954

166) While finalizing the IRBM, which of the following have been taken into account.

a) Indian RailwaysGeneral Rules 1976
b) Indian Railways Code for Engineering Department 1993
c) Bridge Rules and Substructure
d) **All the above***

167) A bridge having super structure with "Single or duplicate girders with cross sleepers on top flanges" is classified as

a) RSJ girder bridge
b) Cross Girder
c) **Deck plate girder***
d) Open web girder

Fill up the blanks with suitable words.

1. Super structure including bearings of all steel Girder of span 12.20m and above is to be inspected by …**SE./Br**.…once in 5 years
2. A bridge foundation having less then 2M depth below bed level in case of arch bridges and 1.2M depth below bed level in case of other bridges is termed as …**Shallow foundation**..
3. Paint Zinc chromate primer confirms to IS …**104**….
4. Paint Zinc chromate Red oxide primer confirms to IS …**2074**….

5. Paint Red Oxide confirms to IS …**123**….
6. Paint Aluminium confirms to IS …**2339**….
7. Abbreviation of DFT ……**Dry Film Thickness**……
8. Metallising is the process of spraying of …**Zinc**.. or ..**Aluminium**.. on the surface prepared girder.
9. Greasing of bearings of Steel girder bridges is done once in -…**Three**.. years.
10. Abbreviation of PTFE is……**Poly Tetra Fluoro Ethylene** …
11. Trolley refuges are provided at every …**100** m on long bridges
12. Girders which are overstressed and kept under observation are to be inspected once in …**a**… year by SE/Br.
13. Abbreviation of NRS …**Numerical Rating System**…
14. Abbreviation of CRN …**Conditional Rating Number**…
15. Abbreviation of ORN …**Overall Rating Number**
16. Abbreviation of URN … **Unique Rating Number**
17. Abbreviation of RUB …**Road Under Bridge**…
18. Abbreviation of ROB … **Road Over Bridge**
19. Abbreviation of FOB … **Foot Over Bridge**
20. Abbreviation of HFL …**High Flood Level**…
21. Stock indent form No is … **S1313**…….
22. Disposal of Unserviceable materials is under Form No. **S.1539…**
23. Abbreviation of RL-BF is …**Depth from rail level to bottom of foundation**
24. Abbreviation WL is **Well Foundation**
25. Abbreviation of ON is …..**Open Foundation**
26. Abbreviation of CCN is …**Cement Concrete** …
27. Abbreviation of BF is ……**Bottom of Foundation**……
28. Abbreviation of TF is ……**Top of Foundation**
29. Abbreviation of S is ……**Sand**……
30. Abbreviation of C is ……**Clay**……
31. Abbreviation of BC is ……**Black cotton soil**……..
32. PSC is the abbreviation of….**Prestressed Concrete**…..
33. The minimum thickness of Metallising is **115 micron**
34. The average thickness of Metallising is **150micron**
35. The weight of rivet testing hammer is **110 gm**
36. The URN of minor bridge shall be represented by its **ORN**

37. The abutment the weep holes should be provided **one metre** horizontal and **one metre** in vertical in a staggered manner
38. Painting during night and early morning avoided because of **dew**
39. In important bridge the total linear waterway is **300 m or the total water way is 1000 sq.m**.
40. In case of underwater independency diver will be employed in depth beyond **10 m** should be medically checked
41. Normally centre to centre spacing of pile should not be more than **4d** where d is the dia of pile shaft
42. Renewal of loose rivet shall be taken up in end bearing stiffener when the % of hammer loose rivet is **30%**
43. In case of distressed bridge category II, ADEN shall inspect the bridge **once in 6 months**
44. Greasing of bearing shall be done with **grease graphite**
45. In case of bridge is distressed category I then special restriction of **15 kmph** shall be imposed
46. The form number used for preparation of indent of stock item is **S1313**
47. The form used for preparation of Indent on non – stock item is **S 1302**
48. In case of transfer of material from one custodian to another through is **ST 47** challan
49. The wind velocity is measured using **Anemometer**
50. As per GCC Engineer shall mean **DEN / XEN**

State whether true of false

1. Phosphor Bronze bearing need not be greased. **True**
2. Primer coat protects the steel from weather. **False**
3. Clear span is more than the effective span **False**
4. Danger level is always above HFL **False**
5. Acetelyne gas cylinders are always kept vertical **True**
6. A speed restriction of 15 kmph can be imposed in a Neutral section **False**
7. A bridge of single span of 12.1 m is called a minor bridge **False**
8. Camber is measured at the ends of a girder **False**
9. Temporary girders are used for normal sectional speed. **False**
10. 4 SWG electrode is thicker than 6 SWG electrodes. **True**
11. Red lead paint is not poisonous. **False**
12. Wire rope pulleys are interchangeable with manilla rope pulleys. **False**

13. Portal bracing of a through girder is deeper than sway bracing. **True**
14. Numerical ledger shows the name of staff in numerical order. **False**
15. Hemispherical Tanks having inner ties **False**
16. Water tanks are to be painted inside once in 5 years. **False**
17. In case of Tremie concreting for 20 mm size of aggregate the tremie pipe should not be less than 200 mm. **True**
18. The dry film thickness of paint shall be measured by anemometer **False**
19. The ord. MS Rivet testing hammer can be used for testing metalised girders. **False**
20. The distance between center to center of bearing is effective span of a girder bridge. **True**
21. Guard rail should be provided on all major and minor girder bridges. **True**
22. A bridge foundation having less then 1.2M depth below bed level is termed as shallow foundation. **True**
23. When cracks are active but cause of cracking has been determined and remedial action has been taken cement pressure grouting is used. **True**
24. Shelf life of Paint Red Oxide Ready mixed (IS : 123) is 4 month. **False**
25. IRBM consists of 14 chapters **True**

Multiple choice Questions on Level crossings

TVU is abbreviated for
a) Track vulnerable unit
b) Train vehicle unit *
c) Total vehicle unit
d) Traffic variation unit

2. Indication post for detonator should be provided at a distance of ---------meter and --------- meter for BG level crossing
a) 400 meters in 800 meters

b) 500 meters and 1200 meters
c) 600 meters and 1200 meter *
d)600 meters and 1000 meters

3. For protection of level crossing gate in an emergency on BG double line the Gateman should place one detonator at one place and 3 detonators at a subsequent place at a distance of ------- a) and------- meters respectively
b) 400 meters in 800 meters
c) 500 meters and 1000 meters
d**) 600 meters and 1200 meters***
e) 800 meters in 1500 meters

4. Periodical Census of traffic at unmanned level Crossings should be done once in
a) Once in 6 years
b) Every year
c) Once in 3 years*
d) Once in 5 years

5. Level Crossing beyond the outermost stop signals is called
a) Engineering Gate*
b) Traffic Gate
c) Engineering and Signal Gate
d) Signal Gate

6. On an unmanned level crossing stop board should be provided at a distance of --------- from the centre of nearest track
a) 5 meters *
b) 6 meters
c) 3 meters
d) 7.5 meters

7. Speed breaker has to be provided on road approaches of level crossing at maximum feasible distance within Railway boundary but not exceeding
a) 10 meters
b) 15 meters
c) 20 meters*
d) 200 meters

8. The rail joint should be located at ---------- from the end of level crossing
a) 2 meters
b) 3 meters *
c) 5 meters
d)6 meters

9. The frequency of census at a level crossing having TVU between 75000 to 1 lakh will be once

a) In 2 years
b) In 3 years*
c) In 4 years
d) Every year

10. For Skew level crossings the angle of crossing should not be less than
a) 60 degree
b) 45 degree
c) 30 degree
d) 15 degree

11. Minimum distance of gate post from centre line of nearest track on BG is
a) 2 meters
b) 3 meters*
c) 4 meters
d) 5 meters

12. Minimum distance of duty hut from centre line of nearest track on BG is
a) 2 meters
b) 3 meters
c) 4 meters
d) 6 meters*

12. Level crossing is classified on the basis of
a) Class of road
b) TVU*
c) Volume of road traffic
d) Volume of rail traffic

13. The Assistant Divisional Engineer should inspect the equipment at every manned level crossing on the subdivision once in
a) 2 months
b) 3 months
c) 4 months
d) 6 months*

14. On Broad gauge tracks whistle indicator shall be provided at a distance of ---------- from level crossing along the track
a) 400 meters
b) 600 meters*
c) 350 meters
d) 500 meters

15. On Broad Gauge tracks Banner flag at a level crossing shall be provided at a distance of---------- from ends of check rail before opening the gate for road traffic.

a) 5 meters*
b) 3 meters
c) 6 meters
d) 30 meters

16. Fish plated joint shall be avoided in check raisl and on the running rails within--------- from the end of level crossing
a) 3 meters*
b) 5 meters
c) 10 meters
d) 12 meters

17. Stop boards on either side of approaches of all unmanned level crossings shall be provided at ----------from the centre line of nearest track.
a) 3meters
b) 5 meters*
c) 6 meters
d) 10 meters

18. Speed breaker of approved design shall be provided on either side of level crossing at ------ within Railway boundary
a) 5 meters
b) 15 meters
c) 20 meters*
d0 30 meters

19. Minimum length of check rail for square crossing shall be -------- more than the width of gate a) 1 meters
b) 2 meters*
c) 3 meters
d) 5 meters

20. The minimum and maximum clearances of check rails at all BG level crossings shall be
a) 51 to 57 mm*
b) 44 to 48 mm
c) 41 to 45 mm
d) 55 to 70 mm

21. In case of Shot Welded Rails the fish plated joint should be avoided on Level Crossings within a distance of --------- from end of level crossing
a) 3 meters
b) 4 meters
c) 5 meters
d) 6 meters*

22. There should not be any combination joint on level crossing proper and its approaches up to
a) 15 meters
b) 30 meters
c) 40 meters
d) 50 meters*

23. The Height Gauge for a level crossing should be located at least --------- from the gate post a) 3 meters
b) 5 meters
c) 8 meters*
d) 10 meters

24. Traffic census at a level crossing shall be done by
a) A team of SSE/ P Way and SSE/ Works
b) A team of SSE/ P Way and Traffic inspector
c) A team of SSE/ P Way and Signal Inspector
d) A multidisciplinary team of SSE/ P Way, Signal Inspector and Traffic Inspector*.

25. Frequency of overhauling for a level crossing with PRC sleepers shall be-
a) Every year
c) Every 2 years*
c) Every 3 years
d) Every 5 years

26. A level crossing qualifies for construction of Road Over Bridge/ Under Bridge on Cost sharing basis with State Government when the Train Vehicle Unit is more than
a) 50,000
b) 1, 00,000*
c) 3, 00,000
d) 5, 00,000

27. On Indian Railways a new level crossing can be provided with the approval of
a) Chief engineer
b) General Manager
c) Commissioner of Railway Safety
d) None of the above*

28. In LWR track on BG
a) Level crossing should be separated by providing SEJs
b) Level crossing cannot be provided in LWR.
c) Level crossing should not fall within the breathing length of LWR*
d) Level crossing should be laid with rail free fastenings.

29. In case of a curved track on electrified, double line, BG section
a) Duty hut cannot be provided for a level crossing.

b) Duty hut should be on the inside of the curve.
c) Duty hut should be on the outside of the curve.*
d) Duty hut can be provided on any side of the curve.

30. Minimum depth of space for wheel flange from the rail level on BG track is
a) 44 mm
b) 48 mm
c) 38 mm
d) 51mm

Soil mechanics

1. Which of the statements with regard to formation is correct

(1) One of the Functions of the formation is to facilitate drainage
(2) Width of bank for double railway line is 12.155 meters
(3) Width of cutting for double railway track is 11.750 meters
(4) Centre to centre of formation for double line is 4.725 meters
(5) Width of formation is different for concrete sleeper track and other than concrete sleeper track

a) 2, 3, 5
b) 3, 4, 5*
c) 2, 3, 4
d) 2, 4, 5

2. Centre to Centre spacing of formation for double railway line for Broad Gauge is
a) 1676 mm
b) 4725 mm
c) 4265mm
d) 5300 mm*

3. Earthwork in embankment for railway with manual compaction should be done in layers not exceeding----------
a) 15 centimeter
b) 20 centimeters
c) 25 centimeters
d) 30 centimeters*

4. To provide inverted filter to improve the bearing capacity of soil the liquid limit of blanketing material should not be greater than
a) 5
b) 20
c) 27
d) 35*

5. To provide inverted filter to improve the hearing capacity of soil the plasticity index of blanketing material should not be greater than
a) 15*
b) 20
c) 27
d) 35

6. The bottom of side drains should be below the formation level by at least----------
a) 45 cm
b)30 cm*
c) 15 cm
d) 60 cm

7. Cross slope of the formation to have good drainage of Ballast section is
a) 1 in 40*
b) 1 in 50
c) 1 in 30
d) 1 in 20

8. The side slope of formation in embankment is
a) 2 : 1*
b) 1: 1
c) 1:5
d) 1:3

9. The side slope of formation in embankment /cutting depends on
a) Shearing strength of soil and its angle of repose*
b) Angle of repose
c) Bearing capacity of the soil
d) Optimum moisture content of the soil

10. The recommended width of Double line cutting formation for B G is
a) 10210 mm
b) 10 975 mm
c) 11555 mm*
d) 10 820 mm

11. The recommended width of Single line formation cutting for BG excluding drain is
a) 6250 mm*
b) 6850mm
c) 54 90mm
d) 6100mm

12. In case of compaction of soil by sheep foot roller maximum thickness of layer should not exceed buy more than ---------- centimeter of length of their teeth
a) 5 centimeter*

b) 4 centimeter
c) 3 centimeter
d) 2 centimeter

13. The catch water drains are provided in the
a) Formation in the embankment
b) Formation in cutting*
c) Zero fills formation
d) Steep gradient

14. Cross sectional area of catch water drain should not be more than
a) 0 .75 square meter*
b) 0. 90 square meter
c) 0. 80 square meter
d). 50 square meter

15. Density of each compacted layer should be ascertained by taking soil samples on either side of Central Line at
a) 5 meter interval
b) 10 meter interval*
c) 12 meter interval
d) 15 meter internal

16. For laying a Railway track the prepared surface ready to receive the ballast is called
a) Sub ballast
b) Formation*
c) Blanket
d) Cushion

17. The height of formation depends upon the
a) Ground contours and the gradient adopted*
b) Ground contour only
c) Gradient adopted only
d) Rainfall intensity over the year

18. The dry density of soil is
a) Always greater than the saturated density
b) Weight of soil solids per unit of total volume prior to drying*
c) Total weight of soil solids per unit of its total volume
d) Total weight of soil mass per unit of its total volume

19. The ratio of volume of water present in a given soil sample to the total volume of voids in it is known as
a) Percentage of air voids
b) Degree of saturation *
c) Void ratio

d) Porosity

20. The ratio of volume of air voids to the volume of voids is known as
a) Percentage of air voids
b) Porosity
c) Degree of saturation
d) Air content*

21. At the liquid limit
a) The soil just begins to crumble when rolled into a thread
b) The shearing strength against flowing is negligible
c) The shearing strength against flowing is a small but definite*
d) The soil will not get fully saturated

22. The property of soil which allows it to be deformed rapidly, without rupture, without elastic rebound and without volume change is known as
a) Porosity
b) Plasticity*
c) Stiffness
d) Plastic limit

23. The minimum water content in soil at which the soil just begins to crumble when rolled into threads 3 mm in diameter is known as
a) Plastic limit
b) Liquid limit
c) Consistency limit
d) Shrinkage limit

24. The minimum water content at which a reduction in water content will not cause a decrease in the volume of a soil mass is known as
a) Plastic limit
b) Shrinkage limit*
c) Liquid limit
d) Consistency limit

25. The numerical difference between the liquid limit and plastic limit of a soil is known as
a) Liquidity index
b) Plasticity index *
c) Shrinkage index
d) Consistency index

26. In India soils are classified by
a) MIT classification
b) Unified soil classification system*

c) International classification system
d) Particle size classification

27. The consistency index of soil is
a) (Natural water content - liquid limit) / plasticity index
b) (Natural water content - liquid limit)/ liquidity index
c) (Liquid limit - natural water content)/ consistency index
d) (Liquid limit - natural water content)/plasticity index*

28. The property of a soil due to which water percolates through it is known as
a) Porosity
b) Permeability*
c) Moisture content
d) Capillarity

29. Permeability of soil varies
a) Inversely as square of grain size
b) Inversely as grain size
c) Directly as grain size
d) Square of grain size*

30. Quicksand is
a) Moist sand containing a small percentage of clay
b) Is a condition which generally occurs in coarse sands
c) Is a condition in which cohesive properties of soil increase rapidly
d) **Is a condition in which a cohesion less soil loses its strength because of upward flow of water***

31. Piping in a soil mass is
a) **Erosion of subsoil by the high velocities of flow of water through it when such velocities exceed a certain limit***
b) Caused due to very low exit gradient
c) Due to continuous passage of water through a series of well connected pores
d) Due to loss of the strength of cohesion less soil because of upward flow of of water

32. The maximum dry density to which a soil may be compacted to depends upon
a) Soil water content *
b) The process of compaction
c) The voids ratio
d) Is independent of the type of soil

33. A saturated clay is to be tested for shearing strength. Which test should be recommended?

a) Direct shear test
b) Triaxial shear test
c) Vane shear test
d) Unconfined compression*

34. A temporary enclosure in a river or Lake built around a working area for the purpose of excluding water during construction is known
a) Caisson
b) Augur
c) Cofferdam *
d) Sheet pile wall

35. The maximum pressure which the soil can carry safely without the risk of shear failure is called
a) Safe bearing capacity
b) Ultimate bearing capacity*
c) Allowable bearing capacity
d) Shear bearing capacity

36. Black cotton soils are
a**) Heavy clay soils varying from clay to Loam, with clay content of 40 to 50% formed by decomposition of rocks by long continued weathering***
b) Compacted and laminated clays
c) Soils containing carbon of coal underneath
d) Dark brown earthy materials formed due to partial or complete decomposition of vegetable matter

37. The high density of soil placed in a fill is desired in order to
a) Increase its shear resistance*
b) Reduce its shear resistance
c) Promote future settlements
d) Decrease percolation through the fill.

38. Plasticity index represents the range of water content between
a) Liquid and plastic limit *
b) Plastic limit and semi solid limit
c) Semisolid Limit and liquid limit
d) Liquid limit and solid limit.

39. For yard drainage Pucca drains should be designed for the velocity of
a) 0 05 to 1 meter per second
b) 1 to 1.5 meter per second
c) 1.5 to 2 meter per second
d) 2 to 2.5 meter per second

40. Formation prepared by depositing Soil over the existing ground level is known as
a) Formation in cutting
b) Formation in embankment
c) Zero fills formation
d) Natural formation

Building materials

1. Stone generally preferred for railway ballast is

a) Sandstone
b) Dolomite
c) Marble
d) Basalt or trap granite*

2. An artificial stone made from pieces of white marble, white cement and other coloring agents, generally used for floor and facing walls is known as
a) Topaz
b) Marble
c) Terrazzo*
d) Gneiss

3. Which one of the following impurity is not desirable in the soil used for brick formation
a) Alkali
b) Kankar
c) Iron oxide
d) Alkali & Kankar*

4. The Rocks formed from molten lava are called
a) Sedimentary rocks
b) Igneous rocks*
c) Metamorphic rock
d) Plutonic rock

5. Granite is obtained from
a) Igneous rocks*
b) Sedimentary rocks
c) Metamorphic rocks
d) Plutonic rock

6. Marble is obtained from
a) Igneous rocks
b) Sedimentary rocks

c) Metamorphic rocks*
d) Plutonic rock

7. Limestone is obtained from
a) Igneous rocks
b) Sedimentary rocks*
c) Metamorphic rocks
d) Plutonic rock

8. The bulking of sand with 2% moisture content is about
a) 5%
b) 10%
c) 15%*
d) 20%

9. A good building stone should not absorb water more than
a) 5%*
b) 10%
c) 15%
d) 20%

10. The standard size of modular bricks is---------- centimeters
a) 18x 8 x8
b) 19x 9x 9
c) 20x 10 x10
d) 21x 11 x11

11. The Frog of a brick is normally made on its
a) Top face*
b) Bottom face
c) Longer face
d) Shorter side

12. The minimum compressive strength of first class brick should be
a) 75 kg per centimeter square
b) 90 kg per centimeter square
c) 100 kg per centimeter square*
d) 120 kg per centimeter square

13. If first class Brick is immersed in water for 24 hours it should not absorb water by weight more than
a) 10%
b) 15%
c) 20% *
d) 25%

14. A pug mill is used for
    a) Softening brick earth
    b) Moulding brick earth
    c) Tempering brick earth*
    d) Compacting brick earth

15. Minimum crushing strength of the bricks is
    a) 35 kg/cm^2
    b) 55 kg/m^2
    c) 70 kg/m^2
    d) 105 kg/m^2

16. Normal size of brick used in India is
    a) 22 x 11.2 x 7 cm*
    b) 25 x 16 x 8 cm
    c) 19 x 12 x 9 cm
    d) 20 x 10 x 5 cm

17. The depth of frog in a brick is
a) 15 mm
b) 10 mm
c) 6. 25 mm*
d) 3 mm

18. The base material for distemper is
a) Chalk*
b) Lime
c) Lime putty
d) Cement wash

19. Timber having maximum resistance against white ants is obtained from
a) Chir
b) Sheesham
c) Sal
d) Teak*

20. Linseed oil is used in Paints as a
a) Vehicle
b) Base
c) Drier*
d) Thinner

21. The lime which contains mainly calcium oxide and slacks with water, is known as

a) Fat lime
b) Quicklime*
c) Hydraulic lime
d) Poor line
22. The property by virtue of which lime sets under water is known as
a) Slacking
b) Setting
c) Hydraulicity
d) Calcining

23. Which of the following lime can set under water also
a) Fat Lime
b) Lean lime*
c) Hydraulic line
d) Quick lime

24. Granite is not suitable for ordinary building purpose because
a) It cannot be polished
b) It is not fireproof
c) It is costly*
d) It has less crushing strength

25. Which of the following stone is best suited for construction of piers and abutments of Railway Bridge
a) Granite*
b) Sandstone
c) Limestone
d) Quartzite

26. Which of the following trees yields hardwood
a) Deodar
b) Sheesham*/
c) Chir
d) Pine

27. In which of the following directions, the strength of timber is maximum
a) Parallel to grains*
b) 45 degree to grains
c) Perpendicular to grains
d) same in all directions

28. Which of the following ingredients of Brick earth enables the brick to retain its shape a) Alumina
b) Silica*
c) Iron

d) Magnesia

29. Number of bricks required for 1 cubic meter of brick masonry is
a)400
b) 450
c) 500*
d) 550

30. Quicklime is
a) Calcium carbonate
b) Calcium bicarbonate
c) Calcium oxide*
d) Calcium hydroxide

31. The main ingredients of Portland cement are
a) Lime and silica*
b) Lime and Alumina
c) Alumina magnesia
d) Silica and Alumina

32. After storage, strength of cement
a) Decreases*
b) Increases
c) Remains same
d) Depends upon the type of cement

33. The Most common admixture used to accelerate the initial setting of concrete is
a) Gypsum
b) Calcium chloride*
c) Calcium carbonate
d) Calcium bicarbonate

34. Which type of following cement is used for mass concrete work
a) High Alumina cement
b) Quick setting cement
c) Rapid hardening cement
d) Low heat cement*

35. Le Chatelier apparatus is used to determine which of the following properties for cement
A) Soundness*
b) Initial setting time
c) Compressive strength
d) Tensile strength

36. Which of the following constituents impart plasticity to brick earth
a) Alumina*
b) Silica
c) Lime
d) Magnesia

37. Hydraulic lime is not used in plastering because it may result in
a) Blistering*
b) Efflorescence
c) Flaking
d) Fluorescence

38. Seasoning of timber essentially involve
a) Strengthening of cells in Timber
b) Replacing the moisture content to a level below its fibre saturation point
b) Facilitating equal shrinkage in all directions so as to prevent warping
c) Preventing cracking due to defects and shakes

39. The commonly used lime in white washing is
a) Hydraulic lime
b) Slaked lime
c) Plain lime
d) White lime*

40. Distemper is used to coat
a) External concrete services
b) Internal surfaces not exposed to weather*
c) Woodwork
d) Compound walls

41. Putty is made up of
a) White lead and turpentine
b) Powdered chalk and raw linseed oil*
c) Red lead and linseed oil
d) Zinc oxide and boiled linseed oil

42. The approximate ratio between the strength of cement concrete at seven days and 28 days is
a) 3/ 4
b) 2/3*
c) 1/2
d) 1/3

43. Soundness test of cement is done to determine its
a) Durability in seawater
b) Free lime content*
c) Iron oxide content
d) Alumina content

44. The volume of a bag of cement in cubic meters is about
a) 0.035*
b) 0.35
c) 0.53
d) .053

45. Terracotta is used in buildings for
a) Storage
b) Insulation
c) Ornamental work*
d) Sewer pipe

46. Sand is mixed with lime to
a) Reduced cost
b) Reduced setting time
c) Prevent shrinkage and cracking*
d) Improve visual appearance

47. The setting and hardening of cement after addition of water is due to
a) Binding action of water
b) Evaporation of water
c) Hydration and hydrolysis of some constituent compounds of cement*
d) Additional hardening compounds added to cement

48. The constituent of cement which act as Binders are
a) Sand and silica
b) Silica and carbon
c) tricalcium silicate dicalcium silicate and carbon
d) tricalcium aluminate,dicalcium silicate and tricalcium silicate *

50. A slow setting cement will have higher percentage of
a) tricalcium aluminate
b) tricalcium silicate
c) Gypsum
d) Dicalcium silicate*

51. Dicalcium silicate
a) Hydrates rapidly

b) Generate less heat of hydration*
c) Hardens rapidly
d) Reacts with water only

Question on AT Welding

1- In new Rail as well as second hand rails how much end bends of the rails in vertical are permitted when checked with one meter straight edge before welding?

(i) +0.5mm, -0 mm in vertical *

(ii) +0.2mm, -.3 mm in vertical

(iii) +0.3mm, -2 mm in vertical

(iv) 0 mm, +.5 mm in vertical

2- In new Rail as well as second hand rails how much end bends of the rails in lateral direction are permitted when checked with one metre straight edge before welding?

(i) ± 0.2 mm in lateral direction

(ii) ± 0.3 mm in lateral direction

(**iii) ± 0.5 mm in lateral direction***

(iv) All are above right

3- What is the life of portion?

(i) 2 years

(ii) No specific life.*

(ii) 6 months

(iv) 1 year

4- Life of Portion mainly depend upon?

(i) Quality of packing

(ii) Storage condition

(**iii) Quality of packing and storage condition.***

(iv) Ingredients of portions

5- How rejected portion are to be disposed-off?

(**i) By Igniting 5 Portions at a time in pit away from store?***

(ii) By throwing them away

(iii) By dispose off in a pit

(iv) By using it in Branch/Yard lines for welding

6- Where Portion sample tests(test piece) should be conducted?

(i) At desire by RDSO

(ii) At Zonal CMT's organisation or the Flash Butt Welding plant. *

(iii) In RDSO campus

(iv) As decided by in charge of the plant

7- The composition of thermit welding team?

(i) 7 Nos.

(ii) 8 Nos.*

(iii) 6 Nos.

(iv) 9 Nos

8- What is the duration for Initial course for welders (TW-1)?

(i) Two weeks*

(ii) One week

(iii) As decided by TPP/LKO

(iv) 3 working days

9- What is the duration for Refresher course for welders (TW-2)?

(i) One week*

(ii) Two weeks

(iii) As decided by TPP/LKO

(iv) 3 working days

10- What is the duration for supervisors course (TW-3)?

(i) One week *

(ii) Two weeks

(iii) As decided by TPP/LKO

(iv) 3 working days

11-Type of competency certificate issued after TW-1 course?

(i) Competency for two years

(ii) Provisional competency.*

(iii) Competency for six months

(iv) Competency to do welding independently

12- What is the validity of Provisional competency certificate?

(i) Valid for executing 50 joints or six months whichever is earlier.

(ii) Valid for executing 100 joints or six months whichever is earlier.*

(iii) Valid for executing 50 joints.

(iv) Valid for six months

13- What is the validity after Refresher course for welders (TW-2)?

(i) Six monyhs

(ii) One year

(iii) Two years.*

(iv) All are wrong

14- What is the validity after supervisors course (TW-3)?

(i) Normally, supervisors shall not be required to undergo the course again. However, they may be sent for course on performance basis.*

(ii) 2 years

(iii) 5 Years

(iv) 10 Years

15- How much rail ends are cleaned with Kerosene Oil and steel wire brush?

(i) Minimum 100 mm both side

(**ii) Minimum 50 mm both side.***

(iii) No need

(iv) As decided by site supervisor

16- What is the heating time in OXY & LPG in SPW?

(i) 2.0 - 3.5 minutes.

(ii) 2.0 - 3.0 minutes.

(**iii) 2.0 - 2.5 minutes.***

(iv) 3.0 - 4.5 minutes.

17- What is the minimum distance between AT Weld and other joint exist in track?

(i) 2 Mt.

(ii) 3 Mt.

(iii) 4 Mt.*

(iv) 4.5 Mt.

18- During AT welding reaction is ?

(i) Exothermic .*

(ii) Endothermic

(iii) No Reaction

(iv) Heating

19- What is Pre Heating Temperature of rail ends in AT Welding?

(i) 300 ± 20°C

(ii) 400 ± 20°C

(iii) 500 ± 20°C

(iv) 600 ± 20°C *

20- What action to be taken if slag is not separated within 20 ± 3 seconds?

(i) Tap inside.

(ii) Tap outside *

(iii) Good reaction

(iv) Tap well in time

21- Internal diameter of thimble in conventional type of crucible is?

(i) 14-16 mm

(i) 16-18 mm

(iii) 18-20 mm*

(iv) 20-22 mm

22- Name the material which is separated from molten steel during chemical reaction of A.T welding?

(i) Aluminium oxide (slag). *

(ii) Ferrous Oxide

(iii) Aluminium

(iv) Ferrous

23- Finishing tolerances are measured by?

(i) On 30 cm scale

(ii) 1 MT straightedge or 10 CM straightedge.*

(iii) On 15 cm straight edge

(iv) On 30 cm straight edge

24- To take care of differential cooling rail ends of 90 UTS rails are lifted by?

(i) 1 mm

(ii) 2 mm

(iii) 2 to 2.2 mm.*

(iv) 1 to 2 mm

.25- Which gauge is used to measure finishing tolerances .

(i) Tilted gauge

(ii) Filter gauge

(iii) Meter gauge

(iv) Filler gauge.*

26- Early tapping will cause defect of?

(i) No defect

(ii) Inclusion of slag*

(iii) Inclusion of aluminium

(iv) Inclusion of ferrou

27- Risers are broken at?

(i) cold. *

(ii) Hot

(iii) After 5 mints

(iv) After 3 mints

28- Pressure of compressed air is kept during preheating by CAPS?

(i) 1 to 2 kg/cm^2

(ii) .1 to .2 kg/cm^2

(iii) 2 to 3 kg/cm^2

(iv) 0.2 to 0.3 kg/cm^{2*}

29- Crucible is repaired by?

(i) Magnasite Powder

(ii) Magnasite Powder & Sodium Silicate.*

(iii) Sodium Silicate

(iv) Aluminium powder

30- Function of Calcium fluoride/flour spar in portion is?

(i) To separate slag*

(ii) To separate aluminum

(iii) To separate ferrous

(iv) No separation

Q.No.31- Finished tolerance on 1 Mt. st. edge at the centre on gauge side shall be?

(i) ± 0.2 mm

(ii) ± 0.3 mm

(iii) ± 0.5 mm*

(iv) ± 1.0 mm

32- Finished tolerance on 1 Mt. long st. edge on surface of head shall be?

(i) 0 to .1 mm

(ii) 1 to 1.5 mm

(iii) 0 mm

(iv) 0 to 1 mm*

33- Finished tolerance on 10 cm long st. edge at the centre on gauge side shall be?

(i) ± 0.4 mm

(ii) ± 0.1 mm

(iii) ± 0.2 mm

(iv) ± 0.3 mm*

34- Finished tolerance on 10 cm. long st. edge on surface of head shall be?

(i) 0 to 0.1 mm

(ii) 0 to 0.2 mm

(iii) 0 to 0.4 mm*

(iv) 0 to 0.3 mm

35- Min^{m}. deflection during transverse breaking load test is?

(i) 5 mm

(ii) 10 mm

(iii) 15 mm*

(iv) 20 mm

36- Min. breaking load of 52kg weld during transverse breaking load test is?

(i) 90MT*

(ii) 100 MT

(iii) 110 MT

(iv) 120 MT

37- Min. breaking load of 60kg weld during transverse breaking load test is?

(i) 110 MT

(ii) 115 MT*

(iii) 90 MT

(iv) 120 MT

38- To take care of differential cooling rail ends of 72 UTS rails are lifted by?

(i) 1 to 1.5 mm

(ii) 1 to 2 mm

(iii) 2 to 2.5 mm

**(iv) 3 to 4 mm *

39- The colour of bag containing Portion for 72 UTS ?

(i) Pink

(ii) Green

(iii) Red *

(iv) Black

40- The colour of bag containing Portion for 90 UTS ?

(i) Red

(ii) Green *

(iii) Pink

(iv) Black

41- The colour of bag containing Portion for 110 UTS ?

(i) Red

(ii) Green

(iii) Pink

(iv) Black*

42- Pressure of LPG during pre-heating shall be?

(i) 2.0 - 2.5 kg/ sq cm

(ii) 2.0 - 2.5 kg/ sq cm

(iii) 2.0 - 2.5 kg/ sq cm*

(iv) 2.0 - 2.5 kg/ sq cm

43- Pressure of Oxygen during pre-heating shall be?

(i) 4.0 – 5.0 kg/ sq cm

(ii) 5.0 – 6.0 kg/ sq cm

(iii) 6.0 – 7.0 kg/ sq cm

(iv) 7.0 – 8.0 kg/ sq cm *

44- Defect of Blow holes is due to?

(i) Slag

(ii) Moisture*

(iii) Lack of heating

(iv) Extra heating

45- Heating time with compressed air and petrol in SPW is ?

(i) 4.0 to 4.5 minutes.*

(ii) 4.0 to 5 minutes

(iii) 5.0 to 5.5 minutes

(iv) 5.5 to 6 minutes

46 – What is the Shelf life of mould ?

(i) 6 months minimum.

(ii) 8 months minimum

(iii) 9 months minimum*

(iv) 12 months minimum

47 – What is the Life of luting sand ?

(i) No defined *

(ii) 6 months

(iii) 9 months

(iv) 12 months

48 –Minimum traffic block required for execution of AT Weld ?

(i) 70 minutes

(ii) 70-75 minute.*

(iii) 60 mints

(iv) 1 hrs and 30 mints

49-What are the recognized systems for pre heating of rails ends for AT Welding?

(i) Oxygen –LPG & Compressed air petrol both*

(ii) Only Oxygen –LPG

(iii) Only Compressed air petrol both

(iv) both are correct

51-Weather protection of track is required during block for execution of AT Welding?

(i) Yes.*

(ii) No

(iii) As decided by site supervisor

(iv) As per site condition

52-Weather traffic block is required for execution of AT Welding?

(i) Yes.*

(ii) No

(iii) As decided by site supervisor

(iv) As per site condition

53- After AT Welding First train is to be passed after ?

(i) 20 Minutes from pouring of weld metal.

(ii) 35 Minutes from pouring of weld metal.

(iii) 30 Minutes from pouring of weld metal.*

(iv) 25 Minutes from pouring of weld metal.

54- What is the speed restriction to be observed for train passing?

(i) Necessary speed restriction shall be observed until the grinding operation is over.*

(ii) 30KMPH

(iii) 45 KMPH

(iv) Not required

.55- Normal Reaction time in SPW technique?

(i) 17 ± 3 seconds.

(ii) 15 ± 3 seconds

(iii) 23 ± 3 seconds

(iv) 20 ± 3 seconds*

56- Colour of rail ends becomes after preheating ?

(i) Golden *

(ii) Pink Red

(iii) Red

(iv) Yellow

57- How many nos. of sleepers should be loosened either side of the proposed weld?

(i) 3 sleepers

(ii) 5 sleepers.*

(iii) 2 sleepers

(iv) 4 sleepers

58- No of Ingredient of Portion are?

(i) Five.

(ii) Six

(iii) Seven*

(iv) Eight

59- Height of crucible is kept from top surface of mould?

(i) 30 mm

(ii) 40 mm

(iii) 50 mm*

(iv) 60 mm

60- Torch is kept at height from top surface of rail head?

(i) 30 to 55 mm

(ii) 35 to 40 mm

(iii) 40 to 45 mm*

(iv) 45 to 50 mm

61- Which gauge is used to measure the height of rail at the time of aligning of rails for AT welding?

(i) Height gauge.*

(ii) Vertical gauge

(iii) Horizontal gauge

(iv) As decided by site supervisor

62- Full form of SPW?

(i) Special pre heated weld

(ii) Short preheated weld.*

(iii) Short post heated weld

(iv) None of above

63- Grade of 90 UTS rail is?

(i) 880*

(ii) 1080

(iii) 710

(iv) None of above

64 – Grade of 110 UTS rail is?

(i) 880

(ii) 1080*

(iii) 710

(iv) None of above

Q.N. 65- Grade of 72 UTS rail is?

(i) 880

(ii) 1080

(iii) 710*

(iv) None of above

66- Defect of cracks in weld is mainly due to?

(i) Early opening of mould.*

(ii) Early trimming of weld

(iii) Early grinding of weld

(iv) None of above

67- Defect of short of metal is mainly due to?

(i) Less gap

(ii) Excessive gap*

(iii) Less weight of position

(iv) None of above

68- Defect of low joint is due to?

(i) Excess height

(ii) Early trimming of weld

(iii) Early grinding of weld

(iv) Nil/Less provision of height during alignment.*

69- Defect of High joint is due to ?

(i) Early trimming of weld

(ii) Excess provision of height during alignment.*

(iii) Early grinding of weld

(iv) None of above

70 -Defect of lack of fusion is mainly due to?

(i) Improper heating.*

(ii) Improper Gap

(iii) Improper grinding

(iv) None of above

71- Late tapping will cause defect of?

(i) Lack of fusion (Heat losses)*

(ii) Piping defect

(iii) Half moon defect

(iv) None of above

72- Thickness of Lining/Charge is kept?

(i) 20 mm.

(ii) 25 mm*

(iii) 30 mm

(iv) As decided by the site supervisor

73- Head of closing pin is covered with

(i) Asbestos powder

(ii) Slag Powder

(iii) Asbestos powder than slag*

(iv) None of above

74- How many grams asbestos powder is used to cover head of closing pin ?

(i) 2 grams

(ii) 3 grams

(iii) 4 grams

(iv) 5 grams*

75- What will happen if slag is not used above the layer of asbestos powder?

(i) Auto tapping*

(ii) High welding

(iii) Low welding

(iv) Nothing will happen

76- What is mould waiting time?

(i) 3 to 5 minutes.

(ii) 4 to 6 minutes*

(iii) 3.5 to 5.5 minutes

(iv) 4.5 to 6.5 minutes

77- Late tapping will cause defect of?

(i) Lack of fusion (Heat losses)*

(ii) Piping defect

(iii) kidney defect

(iv) All above are correct

78- What is the function of Zircon wash?

(i) To maintain good quality of weld

(ii)To achieve good finish of the weld surface.*

(ii) Both above are correct

(iv) Both are incorrect

Q.N.79 Main advantage of 3-piece P F Mould is?

(i) To overcome fin defect.*

(ii) To prevent the flaw of molten metal

(iii) To make proper weld size

(iv) None to the above

80 What is the time of removal the tensor from the newly executed A T Weld?

(i) 15 minutes after pouring.

(ii) 20 minutes after pouring*

(iii) 25 minutes after pouring.

(iv) 30 minutes after pouring.

81 Last flag man is deputed at which distance from last detonator during protection of welding site .

(i) 30 mts

(ii) 50 mts

(**iii) 45 mts*.**

(iv) 60 mts

82 When was the collar painting done ?

(i) After the welding *

(ii) after one week of welding

(iii) After 15 days of welding

(iv) None of the above

83 Second coat of paint is done after minim. of

(i) 2 Hrs after first coat

(ii) 4 Hrs after first coat

(i) 6 Hrs after first coat

(iv) 8 Hrs. after first coat .*

84 Painting of weld is done up to

(i) 10 CM minimum both side of weld & on welded surface .*

(ii) 15 CM minimum both side of weld & on welded surface

(iii) 20 CM minimum both side of weld & on welded surface

(iv) None of the above

85 Name the paint used in A.T. Welding painting?

(i) Black Paint

(**ii) Bituminous black IS:9862-1981.***

(iii) Any type of black paint

(iv) None of the above

86 Rails used for A T Welding shall not normally be welded?

(i) 20 years old .

(ii) 30 years old

(iii) 40 years old

(iv) 50 years old*

87. Marking on weld should be done which side?

(i) Non gauge face side of A.T. weld *

(ii) Gauge face side of A.T. weld

(iii) On web of non gauge face side of A.T. weld

(iv) On web of gauge face side of A.T. weld

88. Marking on weld should be done

(i) On centre of the rail head

(ii) 10 mm below the top surface of rail head.*

(iii) 10 mm above the bottom surface of rail head.

(iv) None of the above

89. Weather date of welding is marked on weld?

(i) Yes

(ii) As decided by the site supervisor

(iii) No*

(iv) None of the above

90. Banner flag is planted at a distance of

(i) At the site of work

(ii) At 1200 mtrs from welding site

(iii) At 30 mtrs from welding site

(iv) 600 Mt. from welding site .*

91. Ist detonator is planted at a distance of

(i) 1200 Mt. from welding site .*

(ii) 600 mtrs from welding site

(iii) 30 mtrs from welding site

(iv) None of the above

92. Distance between the two detonators should be

(i) 15 Mt.

(ii) 10 Mt.*

(iii) 20 Mt

(iv) None of the above

93. How many detonators are planted during protection of track for welding site ?

(i) One

(ii) Two

(iii) Three*

(iv) None of the above

94. New AT weld should be entered in TMS by ?

(i) Sectional JE/SSE*

(ii) Incharge SSE

(iii) Welder

(iv) None of the above

94. In how many time rough riding should be done of new AT weld ?

(i) Just after the welding*

(ii) After 8 hrs of welding

(iii) After 24 hrs

(iv) None of the above

95 In how many time final grinding should be done of new AT weld ?

(i) Just after the welding

(ii) After 8 hrs of welding

(iii) With in 24 hrs*

(iv) None of the above

96. Till USFD testing of new AT weld what is criteria for joggling ?

(i) Joggling with two far end bold

(ii) Joggling with two tight clamps*

(iii) Leave without joggling till its testing

(iv) None of the above

97. What is the testing frequency of new AT weld ?

(i) Just after the welding

(ii) After 7 days of welding

(iii) With in the one month of welding*

(iv) None of the above

97. After declare good in USFD testing what is the joggling criteria ?

(i) Joggle will be open from the AT weld*

(ii) Joggling with two far end bolting

(iii) joggling with four tight bold

(iv) None of the above

98. USFD testing of new AT weld will be done by ?

(i) JE/SSE sectional

(ii) Incharge SSE

(iii) USFD machine operator*

(iv) None of the above

99. Testing of AT weld shall be done from ?

(i) SRT

(ii) DRT

(iii) Digital weld tester

(iv) None of the above

100. After how much time lining of crucible should be changed ?

(i) After every weld

(ii) After 7 welds

(iii) After every 10 welds*

(iv) None of the above

101. Trimming of AT weld should be done by ?

(i) Chisel

(ii) Trimmer*

(iii) Both

(iv) None of the above

102. What is the app. Weight of 52 kg portion?

(i) 10 kg

(ii) 11 kg*

(iii) 12 kg

(iv) None of the above

103. What is the app weight of 60 kg portion ?

(i) 11 kg

(ii) 12 kg

(iii) 13 kg*

(iv) None of the above

104. What is the dia of thimble ?

(i) 14-16 mm

(ii) 16-18 mm*

(iii) 18-20 mm

(iv) None of the above

105 . Ignition rod can be ignited from ?

(i) Match box

(ii) Ignition match*

(iii) From fire

(iv) None of the above

106 . In AT welding process what is the role of closing pin ?

(i) To hold the portion before melt

(ii) To hold the asbestos powder & slag

(iii) Both above are correct*

(iv) None of the above

107. In AT welding process what is the role of asbestos powder & slag ?

(i) To separate closing pin from portion*

(ii) To hold the portion

(iii) Both above are correct

(iv) None of the above

Question Bank (USFD)

1. What is the meaning of HAZ ?

(i) Heat around Zone.

(ii) Heat alongwith Zone

(iii) Heat affected Zone*

(iv) Heat added zero.

2. If code of a fracture is OFW-422 then it means.

(i) AT welding with transverse crack.

(ii) Flash butt welding with transverse crack.

(iii) At welding with horizontal crack.*

(iv) None of the above.

3 45^0 probe is used for detecting defect in;

(i) FB weld

(ii) AT weld

(iii) FB weld, AT weld & SEJ

(*iv) All above

4 By 0^0 probe in AT weld testing with normal gain setting.

(i) Area below N.axis can be tested.

(ii) Area below N.axis can not be tested.*

(iii) Only web below N.axis can be tested.

(iv) All above are correct.

5 Tandem rig test with 45^0 probe for AT weld detects.

(i) Horizontal longitudinal defect in weld.

(ii) Vertical oriented defect in AT weld.*

(iii) Transverse defect in AT weld.

(iv) Defect in flange of AT welds.

6 Total no. of probes fitted on digital double rail tester for rail testing are

(i) 12

(ii) 8

(iii) 14*

(iv) 16.

7 If digital DRT is calibrated for 300 mm longitudinal wave using 0^0 double crystal probe then 60kg rail ---------peak will appear at

(i) 5.2

(ii) 5.7*

(iii) 7.8

(iv) 8.6

8 Addition gain of 10 db is used for testing.

(i) 'D' marked rails on single lines.

(ii) 'D' marked rails on double lines.

(iii) Testing on single line and 'D' marked rails on double/multiple lines section.*

(iv) None of above.

9. The increased gain of 10 dbs for single line & 'D' marks rails on double/multiple lines shall be employed for classification of defects.

(i) defect in weld

(ii) defects in rail. *

(iii) for both defects on weld & rail.

(iv) None of above.

10. On Rajdhani routes testing frequency of rail testing for rail section of 60kg with annual GMT 80, will be.

(i) 4 months

(ii) 1 ½ months

(iii) 1 months*

(iv) None of above.

10 Sensitivity calibration against temp. variation shall be carried out.

(i) At least once in month*

(ii) quarterly.

(iii) at least once in six months

(iv) Any of above.

12 The gap between probing face and probing shoe should be.

(i) 0.4 mm

**(ii) 0.2mm *

(iii) 3mm

(iv) 1mm.

13 For rolling mark 60 kg/Sail/X/2010 the first testing in the field after initial testing of rails in rail manufacturing plant, will be done.

(i) After test free period of 25%.

(ii) After passage of every 40 GMT traffic during test free period.*

(iii) After passage of 200 GMT.

(iv) On the basis of annual GMT of the section.

14 Side looking 70^0 2MHZ probe is tested for detecting.

(i) Flaw in head

(ii) Flaw in web

(iii) Half moon crack in flange.*

(iv) For all above.

16 Marking of DFWO weld is.

(i) Two red point circle on both faces of weld.*

(ii) Two red point cross on both faces of weld.

(iii) One red point circle on both faces of weld.

(iv) None of the above.

17 DFWR weld shall be replaced.

(i) Within 2 months of detection.

(ii) Within 1 year of detection.

(iii) Within 3 months of detection.*

(iv) after 3 days of detection.

18 On a branch line one new AT Weld with 0^0 probe shows a signal of 58 is.

(i) DFWO*

(ii) DFWR

(iii) IMRW

(iv) OBSW

19 During periodic testing of an AT weld with 70^0 probe, a bunch of moving signals of

less than 40% but more than 10% is observed in the head of weld, the joint will be.

(i) Good joint.*

(ii) DFWR

(iii) DFWO

(iv) OBSW

20 The frequency of a wave travelling at a speed of 500 ms^{-1} is 25 Hz. Its time period will be _____.

(i) 20 s

(ii) 0.05 s

(iii) 25 s

(iv) 0.04 s

21 The amplitude of a wave is _____.

(i) the distance the wave moves in one second

(ii). the distance the wave moves in one time period of the wave

(iii) the maximum distance moved by the medium particles on either side of the mean position*

(iv) the distance equal to one wave length

22 The physical quantity, which oscillates in most waves, is

(i) mass

(ii) energy

(iii) Amplitude*

(iv) wavelength

Sanitary Engineering

1. Sewerage system of a railway colony may be

(a) Combined system

(b) Separate system

(c) Partially combined system

(d) Any of them*

2.

3. Self cleaning velocity of a sewer line depends upon
   (a) Diameter of sewer
   (b) Gradient of ewer line
   (c) Type of sewerage
   (d) All of them*

4. For design of sewers for sullage, minimum velocity of ---- metres per second is taken.
   (a) 1.0 m sec*
   (b) 1.5 m/sec
   (c) 2.0 m/sec
   (d) 2.5 m/sec

5. For achieving self-cleaning velocity, a minimum velocity of ---- mps. Is desirable for design peak flow
   (a) 0.6 mps
   (b) 0.8 mps*
   (c) 1.0 mps
   (d) 2.0 mps

6. Indicate which of the statement is incorrect
   (a) The detritus tank is type of a grit chamber
   (b) In detritus tank, velocity of flow is further reduced
   (c) Grit chambers are provided in the sewage treatment process to remove the heavier inorganic matter as grit, sand etc. from the sewage
   (d) None of them*

7. In case of septic tank, the length (L) to width (B) ratio is generally
   (a) L = 3 B*
   (b) L = 5 B
   (c) L = 1.5 B
   (d) L = B

8. Effective depth of septic tank of 10 users is about
   (a) 1.0 m
   (b) 1.2 m*
   (c) 1.7 m
   (d) 2.0 m

9. Free board given in septic tank is about
   (a) 100 mm

(b) 200 mm
(c) 300 mm*
(d) 500 mm

10. The internal size of bio latrine tank is
(a) 1200mm. x 1200mm. x 670mm.
(b) 1200mm. x 670mm. x 1200mm.*
(c) 1200mm. x 760mm. x 1200mm.
(d) None of these

11. Indian type W.C. pan shall have 10cm. S.C.I. trap P or S type with effective seal of
(a) 5 cm.*
(b) 10 cm.
(c) 7.5 cm
(d) None of these

12. The capacity of high level flushing cistern is generally
(a) 7.5 ltrs.
(b) 10 ltrs.*
(c) 12.5 ltrs.
(d) None of these

13. Maximum height of low level cistern from top of W.C. pan should be
(a) 65 cm.
(b) 30 cm.
(c) 8
(d) 120 cm.
(e) 80 cm.

14.

15. For high level flush the nominal dia of flush pipe shall be
(a) 32 mm*
(b) 40 mm
(c) 25 mm
(d) None of these

16. The urinal basin shall be connected with
(a) High level floating cistern*
(b) Low level floating cistern
(c) Automatic floating cistern
(d) Any one of the above

15 The capacity of automatic flushing cistern connected with one urinal shall be
(a) 05 litrs.
(b) 10 litrs.
(c) 12.5 litrs.
(d) None of these

16 The capacity of automatic flushing cistern connected with two urinal shall be
(a) 10 litrs.*
(b) 12.5 litrs.
(c) 05 litrs.
(d) None of these

17 The capacity of automatic flushing cistern connected with three urinal shall be
(a) 05 litrs.
(b) 10 litrs.
(c) 12.5 litrs.*
(d) None of these

18. The wash hand basin shall be fixed at a height of
(a) 75-80 cm*
(b) 75 cm
(c) 80 cm
(d) Not specified

19. Before discharging the foul sewage into rivers, it is generally treated by
(a) screening
(b) sedimentation
(c) Oxidation
(d) sludge digestion and disinfection
(e) all the above*

20**.** If the pH value of sewage is
(a) it is acidic
(b) it is alkaline
(c) it is neutral*
(e) None of these

21. Biochemical Oxygen Demand (BOD) of sewage is the
(a) Oxygen required to oxidise
(b) Oxygen required to oxidise biologically inactive organic matter*
(c) a and b both
(d) none of these

Principles of Surveying

1. Distance between two points is measured by
(a) Pacing
(b) Pedometer

(c) Passometer
(d) Chaining
(e) All the above*

2. The following instrument is used to set out a right angle
(a) Cross staff
(b) Optical staff
(c) Prism square
(d) None of the above
(e) All the above*

3. In order to do fly levelling the following type of methodology is adopted
(a) Rise & fall method
(b) Height of instrument method
(c) Both the above*
(d) None of the above

4 For locating an inaccessible point with the help of only a plane table, one should use
(a) traversing
(b) resection
(c) radiation
(e) Intersection*

5 The method of plane tabling commonly used for establishing the instrument station is a method of

(a) Radiation
(b) Intersection*
(c) Resection
(d) Traversing

6. A metallic tape is made of
(a) Steel
(b) Invar
(c) Linen
(d) Cloth & wires*

7. Dumpy level is most suitable when
(a) The instrument is to be shifted frequently
(b) Fly leveling is being done over long distance
(c) Many readings are to be taken from a single setting of the instrument*

(d) All of the above

8. Two contour lines, having the same elevation
   (a) Cannot cross each other
   (b) Can cross each other
   (c) Cannot unite together
   (d) Can unite together*

9. In setting up a plane table at any station
   (a) Leveling is done first
   (b) Centering is done first
   (c) Both leveling and centering are done simultaneously *
   (d) Orientation is done first

10. Contour interval on a map sheet denotes
   (a) Vertical distance of contour lines above the datum plane
   (b) Vertical distance between two successive contour lines
   (c) Slope distance between two successive contour lines
   (d) Horizontal distance between two successive contour lines

11. Theodolite is an instrument used for
   (a) Tightening the capstan-headed nuts of level tube
   (b) Measurement of horizontal angles only
   (c) Measurement of vertical angles only
   (d) Measurement of both horizontal and vertical angles*

12. A series of closely spaced contour lines represent a
   (a) Steep slope*
   (b) Gentle slope
   (c) Uniform slope
   (d) Plane surface

13. Three point problem can be solved by
   (a) Tracing paper method
   (b) Bessels method
   (c) Lehman”s method
   (d) All of the above*

14. The size of a plane table is
   (a) 750mm x 900 mm

(b) 600mm x 750 mm*
(c) 450mm x 600 mm
(d) 300mm x 450 mm

15. In a theodolite the line passing through the intersection of the horizontal and vertical cross hairs and the optical centre of the object glass and its continuation, is known as
(a) Horizontal axis
(b) Vertical axis
(c) Line of collination
(d) Line of sight
(e) Either of c or d above*

16. In a theodolite a condition arising when the image formed by the objective is not in the plane of cross hairs is known as
(a) Parallax*
(b) Out of sight
(c) Out of place
(d) Transiting
(e) Centring

17. Which of the following in theodolite work is imperfect adjustment of the instrument
(a) Error due to line of collimation being perpendicular to the horizontal axis
(b) Error due to axis not to perpendicular of the vertical axis
(c) Error due to imperfect graduation
(d) Error due to eccentricity of vernires
(e) All of the above*

Engineering Surveys and Project Reports

1. Which of the following survey are required to be done before the construction of new railway line.
(a) Traffic survey
(b) Reconnaessarice survey
(c) Preliminary survey
(d) Final location survey
(e) All the above *

2. Which of the instruments is not used in Reconnaissance survey.
   (a) Prismatic compass
   (b) Dumpy level *
   (c) Aneroid Barometer
   (d) Pedometer

3. Which of the instruments is not used in Preliminary survey.
   (a) Theodelite
   (b) Tacheometer
   (c) Dumpy level
   (d) Plane table
   (e) None of them*

4. While doing final location survey, the centre line is fully marked with pegs at --- metre distance
   (a) 10m
   (b) 20m*
   (c) 30m
   (d) 50m

5. The project report of final location survey gives tabulated statement of the following
   (a) Curve abstract
   (b) Gradient abstract
   (c) Bridge abstract
   (d) Important bridges
   (e) Station machinery
   (f) Stations and stations sites
   (g) All the above*

6. The project report of the reconnaissance survey should be accompanied by a map of the area at a scale of 1 cm= --- km.
   (a) 2.5 km
   (b) 5.0 km
   (c) 10.0 km
   (d) 15.0 km
   (e) 20.0 km*

7. The project report of the reconnaissance survey should be accompanied by Index map area at a scale of 1 cm = ---- km.
   (a) 2.5 km*
   (b) 5.0 km
   (c) 10.0 km
   (d) 15.0 km
   (e) 20.0 km

8. The purpose of reconnaissance survey
   (a) To determine technical fenibility of the line*
   (b) To assess whether such a line is required or not
   (c) To decide the final alignment of the railway line
   (d) None of the above

9. Traffic survey is done to find out
   (a) The most promising route for the railway in the area
   (b) The possible traffic the railway line will carry
   (c) Standard of railway line to be followed
   (d) All the above*

10. The survey instrument used for reconnaissance survey
   (a) Theodelite & Dumpty level
   (b) Prismatic compass & Aneriod barometer*
   (c) All the above
   (d) None of them

11. A detailed project report of the proposed railway line is made after
   (a) Preliminary survey
   (b) Reconnaissance survey
   (c) Final location survey*
   (d) Traffic survey

12. Survey of the major projects is done by
   (a) Chief Engineer
   (b) Chief Administrative Officer (CAO) construction*
   (c) Divisional Railway Manager
   (d) Railway Board

13. The index map of preliminary report should be to a scale of
   (a) 1 cm to 0.5 km
   (b) 1 cm to 1.0 km
   (c) 1 cm to 2.5 km*
   (d) 1 cm to 10.0 km

New Lines, Doublings & Gauge Conversion Projects

1. A new railway line is required to be constructed beaus' of following reasons
   (a) Strategic and political considerations
   (b) Development of backward area
   (c) To shorten existing rail link
   (d) Any of them*

2. In case of emergency, land can be acquired urgently by operation of special section
   (a) Section 4 & 6
   (b) Section 9 & 17*
   (c) Section 8 & 10
   (d) None of them

3. Formation width for banks for B.G. single line section is
   (a) 6.10 m
   (b) 6.50 m
   (c) 6.85 m*
   (d) 7.0 m

4. Formation width for cuttings for B.G. single line section is
   (a) 5.40 m
   (b) 6.20 m
   (c) 6.25 m*
   (d) 6.50 m

5. Formation width for bank for B.G. double line section is
   (a) 10.82 m
   (b) 11.0 m
   (c) 11.58 m
   (d) 12.155 m*

6. Formation width for bank for M.G. double line section is
   (a) 8.50 m
   (b) 8.84 m
   (c) 9.65 m
   (d) 9.81 m*

7. The centre to centre spacing formation width for double line section is

(a) 4725 mm
(b) 5025
(c) 5330*
(d) 5500

8. The number of standard rails (13 m) for one km. BG section single line section is
(a) 120
(b) 154*
(c) 168
(d) 196

9. Number of sleepers required having sleeper density of M+7 for one Km of BG single line is
(a) 1360
(b) 1540*
(c) 1660
(d) None of the above

10. Number of Elastic clips used for one K to BG single line section having 13 length & concrete sleepers of M+7 sleeper density are
(a) 5280
(b) 6160*
(c) 6250
(d) 6500

11. Gauge conversion means:
(a) Converting MG to BG
(b) Converting NG to MG
(c) Converting NG to BG
(d) Converting MG/NG to BG*

12. For new lines, width of formation in cutting for M.G. single line is
(a) 5.25 m*
(b) 5.85 m
(c) 6.25 m
(d) 6.85 m

13 For new lines, width of formation in bank for M.G. single line is

(a) 5.25 m
(b) **5.85 m***

(c) 6.25 m
(e) 6.85 m

14 For new lines, width of formation in cutting for N.G. single line is

(a) 3.35 m*
(b) 3.70 m
(c) 5.25 m
(d) 5.85 m

15 For new lines, width of formation in bank for N.G single line is

(a) 3.35 m
(b) 3.70 m*
(c) 5.25 m
(e) 5.85 m

Railway Station and Passenger Amenities

1. A Railway Stations is provided for the following purpose
(a) To entrain or detrain the passengers
(b) To load or off load the goods or parcels
(c) To enable the faster trains to overtake the slower trains
(d) All the above*

2. For Category "A" stations, the annual passenger earning should be
(a) Rs. 10 crores of more
(b) Rs. 6 crores or more*
(c) Rs. 3 crores or more
(d) Less than Rs. 3 crores

3. Category "B" station are those, where annual passenger earnings are
(a) Rs. 6 to 10 crores
(b) Rs. 3 to 6 crores*
(c) Rs. 1 to 3 crores
(d) Less than Rs. 1 crore

4. The minimum essential facility at each type of stations A to F consist of
(a) Booking facility

(b) Drinking Water
(c) Waiting hall/shed
(d) All the above*

5. Numbers of taps on each platform of 'A' category station as per norms of minimum essential facility criteria are
(a) 6
(b) 8
(c) 12
(d) 15*

6. Numbers of taps on each platform of 'B' category station as per norms of minimum essential facility criteria are
(a) 6
(b) 8
(c) 12*
(d) 15

7. Numbers of taps on each platform of 'C' category station as per norms of minimum essential facility criteria are
(a) 6*
(b) 8
(c) 12
(d) 15

8. Numbers of latrines on 'A' category of stations as per norms for essential amenities is
(a) 2
(b) 4
(c) 6
(d) 10*

9. Numbers of latrines on 'B' category of stations as per norms for essential amenities is
(a) 2
(b) 4
(c) 6 *
(d) 10

10. Numbers of latrines on 'C' category of stations as per norms for essential amenities is
(a) 2 *
(b) 4
(c) 6
(d) 10

11. Numbers of latrines on 'D' category of stations as per norms for essential amenities is
(a) 2

(b) 4*
(c) 6
(d) 10

12. A model stations on railways should have
(a) Minimum essential facilities
(b) Desirable facilities*
(c) Recommended facilities
(d) All the above

13. For 'A' category stations it is necessary to provide
(a) High level platform*
(b) Medium level platform
(c) Rail level platform
(d) All the above

14. For 'B' category stations as per minimum essential facility it is necessary to provide
(a) High level platform
(b) Medium level platform*
(c) Rail level platform
(d) All the above

15. Foot over bridge must be provided on the following type of stations as per minimum essential facility criteria
(a) A, B, C, & D class station
(b) A,B & C class station*
(c) A, & B class station
(d) Only A class station

16. Latrines & urinals must be provided on these type of stations as per minimum essential facility criteria
(a) A, B, C, D, E & F type station
(b) A,B,C,D & E type station*
(c) A,B,C & D type station
(d) A, B & C type station

17. Number of taps to be provided on 'A' category stations on each platform as per norms of minimum essential facilities are
(a) 20 taps
(b) 15 taps
(c) 12 taps*
(d) One taps for each bogie

18. Number of urinals & latrines to be provided on 'A' category stations as per norms on main essential facilities are
(a) 15

(b) 10*
(c) 8
(d) 6

19. Urinals & Latrines for A & B stations as norms for recommended level of facilities for railway station
(a) Ndb/500
(b) Ndb/300
(c) Ndb/200*
(d) None of the above

20. Number of taps on platform as per norms for recommended level of facilities
(a) One for every coach
(b) One for alternate coach*
(c) One every 200 metres distance
(d) At the discretion of DRM

21. Which of the facilities do not exist at halt station?
(a) Facilities for stopping the train
(b) Facilities for a small waiting
(c) Facilities for crossing of train*
(d) Facilities for book of passengers

22. Height of platform of a flag station in cutting above rail level is
(a) Same height as Rail level
(b) 305 mm above rail level
(c) 455 mm above rail level
(**d) 840mm above rail level***

23. Size of cubicle of a booking office is kept as
(a) 1.20 x 1.50 m
(b) 1.50 x 1.20 m
(c) 1.50 x 1.80 m
(**d) 1.80 x 1.50 m***

24. "B" class station is provided only on
(a) Single lines
(b) Double line
(c) On both single as well as double line*
(d) None of them

25. Height of high level platform for passengers for BG is --- high
(a) 0.455 m
(b) 0.560 m
(c) 0.650 m
(d) 0.760 m*

26. Height of Low level platform for passengers for BG is --- high
(a) 0.455 m*
(b) 0.560 m
(c) 0.650 m
(d) 0.760 m

27. Number of model stations identified for development on Indian Railways is about
(a) 55
(b) 110*
(c) 265
(d) 320

28. As per norms for desirable amenity as given to model station, the refreshment rooms should be provided on stations classified as ---
(a) A & B*
(b) A,B & C
(c) A,B,C & D
(d) A, B,C, D & E
(e) A

29. As per norms for desirable amenity as given to model station, the book stalls should be provided on stations classified as ---
(a) A & B
(b) A,B & C*
(c) A,B,C & D
(d) A, B,C, D & E
(e) A

30. As per norms for desirable amenity as given to model station, the public address system should be provided on stations classified as ---
(a) A & B
(b) A,B & C*
(c) A,B,C & D
(d) A, B,C, D & E
(e) A

31. As per norms for desirable amenity as given to model station, the parking facility/circulating area should be provided on stations classified as ---
(a) A & B
(b) A,B & C
(c) A,B,C & D*
(d) A, B,C, D & E

(e) A

32. As per norms for desirable amenity as given to model station, the water coolers should be provided on stations classified as ---
(a) A & B
(b) A,B & C
(c) A,B,C & D*
(d) A, B,C, D & E
(e) A

33. As per norms for desirable amenity as given to model station, the clock rooms should be provided on stations classified as ---
(a) A & B *
(b) A,B & C
(c) A,B,C & D
(d) A, B,C, D & E
(e) A

34. As per norms for desirable amenity as given to model station, the retiring rooms should be provided on stations classified as ---
(a) A & B*
(b) A,B & C
(c) A,B,C & D
(d) A, B,C, D & E
(e) A

35. Norms for No. of seats at recommended level at Cat. A stn. is
(a) 0.4 Ndb*
(b) 0.4 Nds
(c) 0.4 Nmax
(d) 100 on each P.F.

36. Norms for No. of seats at recommended level at Cat. B stn. is
(a) 0.4 Ndb *
(b) 0.4 Nds
(c) 0.4 Nmax
(d) 100 on each P.F.

37. Norms for No. of seats at recommended level at Cat. C stn. is
(a) 0.4 Ndb
(b) 0.4 Nds*
(c) 0.4 Nmax

(d) 100 on each P.F.

38. Norms for No. of seats at recommended level at Cat. D stn. is
(a) 0.4 Ndb
(b) 0.4 Nds*
(c) 0.4 Nmax
(d) 100 on each P.F.

39. Norms for No. of seats at recommended level at Cat. E stn. is
(a) 0.4 Ndb
(b) 0.4 Nds*
(c) 0.4 Nmax
(d) 100 on each P.F.

प्रश्न बैंक राजभाषा

प्रश्न ।.संसदीय राजभाषा समिति की कौन सी उप समिति रेल कार्यालयों का निरीक्षण करती है ?
(क) तीसरी
(ख) दूसरी *
(ग) पहली
(घ) कोई नहीं.

प्रश्न 2. संसदीय राजभाषा समिति में कुल कितने सदस्य होते हैं ?
(क) 10
(ख) 16
(ग) 30 *
(घ) 20

प्रश्न 3. संसदीय राजभाषा समिति में लोक सभा के कुल कितने सदस्य होते हैं ?
(क) 20 *
(ख) 30
(ग) 16
(घ) 10

प्रश्न 4. संसदीय राजभाषा समिति में राज्यसभा के कुल कितने सदस्य होते हैं ?
(क) 8
(ख) 4
(ग) 9
(घ) 10 *

प्रश्न 5. हिंदी दिवस कब मनाया जाता है ?

(क) 18 जून
(ख) 14 सितंबर *
(ग) 14 अक्तूबर
(घ) 15 जनवरी
प्रश्न 6. भारतीय संविधान सभा ने हिंदी को संघ की राजभाषा के रुप में कब अंगीकार किया था ?
(क) 26 जनवरी,1950
(ख) 14 सितंबर,1949 *
(ग) 15 मार्च,1976
(घ) 16 अक्तूबर,1952
प्रश्न 7. भारतीय संविधान के किस अनुच्छेद में राजभाषा आयोग के गठन के बारे में प्रावधान है ?
(क) अनुच्छेद 351
(ख) अनुच्छेद 346
(ग) अनुच्छेद 344 *
(घ) अनुच्छेद 120
प्रश्न 8. भारतीय संविधान के किस अनुच्छेद में हिंदी भाषा के विकास का प्रावधान है ?
(क) अनुच्छेद 210
(ख) अनुच्छेद 351 *
(ग) अनुच्छेद 120
(घ) अनुच्छेद 343
प्रश्न 9. भारतीय संघ की राजभाषा के बारे में संविधान के किस अनुच्छेद में प्रावधान किया गया है ?
(क) अनुच्छेद 351
(ख) अनुच्छेद 344
(ग) अनुच्छेद 343*
(घ) अनुच्छेद 120
प्रश्न 10. भारतीय संविधान की अष्टम अनुसूची में कितनी भाषाएं शामिल हैं ?
(क) 32
(ख) 22 *
(ग) 18
(घ) 15
प्रश्न 11. राजभाषा नियम,1976 के नियम-12 के अनुसार केंद्र सरकार के कार्यालयों में राजभाषा अधिनियम व नियमों का अनुपालन सुनिश्चित कराने की जिम्मेदारी किसकी है ?
(क) कर्मचारी
(ख) अधिकारी व कर्मचारी
(ग) राजभाषा अधिकारी
(घ) कार्यालय का प्रशासनिक प्रधान *
प्रश्न 12. धारा 3(3) के अंतर्गत जारी किए जाने वाले कागजात किन-किन भाषाओं में जारी किए जाते हैं ?
(क) हिंदी-उर्दू
(ख) हिंदी-अंग्रेजी *
(ग) हिंदी-पंजाबी

(घ) अंग्रेजी-तमिल
प्रश्न 13. धारा 3(3) के अंतर्गत जारी किए जाने वाले कागजातों को हिंदी-अंग्रेजी दोनों भाषाओं में जारी (क) करने का उत्तरदायित्व किसका हैं ?
कार्यालय प्रधान का
(ख) राजभाषा अधिकारी का
(ग) कागजात बनाने वाले कर्मचारी का
(घ) कागजात पर हस्ताक्षर करने वाले अधिकारी का *
प्रश्न 14. संसदीय राजभाषा समिति का गठन राजभाषा अधिनियम,1963 (यथासंशोधित 1967) की किस धारा के तहत किया गया है ?
(क) धारा 7
(ख) धारा 3
(ग) धारा 4 *
(घ) धारा 8
प्रश्न 15. संसद के दोनों सदनों द्वारा राजभाषा संकल्प किस वर्ष में पारित किया गया ?
(क) 1950
(ख) 1956
(ग) 1968 *
(घ) 1976
प्रश्न 16. रेलवे बोर्ड द्वारा काव्य लेखन के लिए कौन सा पुरस्कार प्रदान किया जाता है ?
(क) प्रेमचंद
(ख) मैथिलीशरण गुप्त *
(ग) राजीव गांधी
(घ) लाल बहादुर शास्त्री
प्रश्न 17.रेलवे बोर्ड द्वारा कथा-कहानी, उपन्यास लेखन के लिए कौन सा पुरस्कार प्रदान किया जाता है ?
(क) प्रेमचंद *
(ख) लाल बहादुर शास्त्री
(ग) मैथिलीशरण गुप्त
(घ) राजीव गांधी
प्रश्न 18. रेलवे बोर्ड द्वारा तकनीकी रेल विषयों पर हिंदी लेखन के लिए कौन सा पुरस्कार प्रदान किया जाता है ?
(क) राजीव गांधी
(ख) मैथिलीशरण गुप्त
(ग) लाल बहादुर शास्त्री *
(घ) प्रेमचंद

प्रश्न 19. रेल मंत्रालय द्वारा चलाई जा रही उस पुरस्कार योजना का नाम बताएं जो आम जनता और रेलकर्मियों दोनों के लिए उनके रेल यात्रा के दौरान हुए अनुभव को हिंदी में लिखने के लिए चलाई गई है ?
(क) रेल हिंदी निबंध पुरस्कार योजना
(ख) रेल यात्रा वृतांत पुरस्कार योजना *

(ग) राजभाषा गौरव पुरस्कार
(घ) राजीव गांधी पुरस्कार योजना
प्रश्न 20.राजभाषा गौरव पुरस्कार योजना किस मंत्रालय द्वारा संचालित की जाती है ?
(क) रेल मंत्रालय
(ख) गृह मंत्रालय *
(ग) रक्षा मंत्रालय
(घ) वित्त मंत्रालय
प्रश्न 21. राजभाषा नियम,1976 के संदर्भ में भाषिक क्षेत्र के हिसाब से अंडमान निकोबार द्वीप समूह किस क्षेत्र के अंतर्गत आता है ?
(क) क क्षेत्र *
(ख) ख क्षेत्र
(ग) ग क्षेत्र
(घ) इनमें से कोई नहीं
प्रश्न 22. राजभाषा नियम,1976 के संदर्भ में भाषिक क्षेत्र के हिसाब से दमण और दीप समूह किस क्षेत्र के अंतर्गत आता है ?
(क) क क्षेत्र
(ख) ख क्षेत्र *
(ग) ग क्षेत्र
(घ) इनमें से कोई नहीं
प्रश्न 23. राजभाषा नियम,1976 के संदर्भ में भाषिक क्षेत्र के हिसाब से चंडीगढ़ किस क्षेत्र के अंतर्गत आता है ?
(क) क क्षेत्र
(ख) ख क्षेत्र *
(ग) ग क्षेत्र
(घ) इनमें से कोई नहीं
प्रश्न 24. राजभाषा नियम,1976 के संदर्भ में भाषिक क्षेत्र के हिसाब से नागालैंड किस क्षेत्र के अंतर्गत आता है ?
(क) क क्षेत्र
(ख) ख क्षेत्र
(ग) ग क्षेत्र *
(घ) इनमें से कोई नहीं
प्रश्न 25. राजभाषा नियम,1976 के संदर्भ में भाषिक क्षेत्र के हिसाब से हिमाचल प्रदेश किस क्षेत्र के अंतर्गत आता है
(क) क क्षेत्र *
(ख) ख क्षेत्र
(ग) ग क्षेत्र
(घ) इनमें से कोई नहीं

प्रश्न 26. किसी कार्यालय को कितने प्रतिशत अधिकारी/कर्मचारियों के हिंदी का कार्यसाधक ज्ञान रखने पर अधिसूचित किया जा सकता है ?

(क) 100%
(ख) 80% *
(ग) 60%
(घ) 50%
प्रश्न 27. राजभाषा नियम,1976 के किस नियम के तहत किसी कार्यालय को हिंदी में काम करने के लिए अधिसूचित किया जा सकता है ?
(क) 8(4)
(ख) 7(2)
(ग) 10(4) *
(घ) 12
प्रश्न 28. राजभाषा नियम,1976 के नियम 5 के अंतर्गत क्या प्रावधान है ?
(क) अंग्रेजी में प्राप्त पत्रों के उत्तर हिंदी में देना
(ख) हिंदी में प्राप्त पत्रों के उत्तर हिंदी में देना *
(ग) हिंदी में प्राप्त पत्रों के उत्तर अंग्रेजी में देना
(घ) मूल पत्राचार हिंदी में करना
प्रश्न 29. उत्तर रेलवे प्रधान कार्यालय में गठित क्षेत्रीय राजभाषा कार्यान्वयन समिति की वर्ष में कितनी बैठकें आयोजित की जाती हैं ?
(क) 04 *
(ख) 03
(ग) 02
(घ) 01
प्रश्न 30. उत्तर रेलवे प्रधान कार्यालय में गठित क्षेत्रीय राजभाषा कार्यान्वयन समिति का अध्यक्ष कौन होता है ?
(क) मुख्य कार्मिक अधिकारी
(ख) महाप्रबंधक *
(ग) मुख्य राजभाषा अधिकारी
(घ) मुख्य सुरक्षा आयुक्त
प्रश्न 31. राजभाषा पखवाड़े का आयोजन किस माह में किया जाता है ?
(क) जून
(ख) सितंबर *
(ग) जुलाई
(घ) दिसंबर
प्रश्न 32. राजभाषा नियम,1976 के नियम 11 के अनुसार मैनुअल, संहिताएं,प्रक्रिया संबंधी अन्य साहित्य, लेखन सामग्री आदि किन-किन भाषाओं में होनी चाहिए ?
(क) हिंदी-अंग्रेजी *
(ख) केवल अंग्रेजी
(ग) केवल हिंदी
(घ) हिंदी-उर्दू
प्रश्न 33. राजभाषा नियम,1976 के अनुसार रजिस्टरों में प्रविष्टियां किस भाषा में की जानी चाहिए?
(क) अंग्रेजी

(ख) हिंदी *
(ग) उर्दू
(घ) पंजाबी
प्रश्न 34. 9वां विश्व हिंदी सम्मेलन वर्ष 2012 में कहां आयोजित किया गया था ?
(क) न्यूयार्क
(ख) जोहांसवर्ग *
(ग) टोकियो
(घ) बीजिंग
प्रश्न 35. क क्षेत्र में स्थित केंद्र सरकार के कार्यालय से क क्षेत्र में स्थित राज्य सरकार के कार्यालय को हिंदी में मूल पत्राचार का लक्ष्य क्या है ?
(क) 65%
(ख) 55%
(ग) 100% *
(घ) 90%
प्रश्न 36. भारतीय संविधान की अष्टम अनुसूची में इनमें से कौन सी भाषा शामिल नहीं है ?
(क) सिंधी
(ख) नेपाली
(ग) अंग्रेजी *
(घ) मणिपुरी
प्रश्न 37. राजभाषा कार्यान्वयन के लिए राजभाषा लक्ष्यों के अनुपालन हेतु प्रतिवर्ष एक वार्षिक कार्यक्रम जारी किया जाता है,इसे किस मंत्रालय द्वारा जारी किया जाता है ?
(क) रेल मंत्रालय
(ख) रक्षा मंत्रालय
(ग) गृह मंत्रालय *
(घ) वित्त मंत्रालय
प्रश्न 38. संघ की राजभाषा हिंदी की लिपि क्या है ?
(क) ब्रह्मी
(ख) रोमन
(ग) देवनागरी *
(घ) इनमें से कोई नहीं
प्रश्न 39. केंद्र सरकार के कार्यालयों में रबड़ की मुहरें किन-किन भाषाओं में होनी चाहिए ?
(क) हिंदी में
(ख) अंग्रेजी में
(ग) हिंदी-अंग्रेजी में*
(घ) प्रान्तीय भाषा में
प्रश्न 40. रेलमंत्री हिंदी निबंध प्रतियोगिता के अंतर्गत कितने पुरस्कार दिए जाते हैं
(क) 04 *
(ख) 06
(ग) 08
(घ) 10

प्रश्न 41. अंग्रेजी आशुलिपिकों को हिंदी में कार्य करने पर प्रतिमाह कितने रुपये का मानदेय दिया जाता है ?

(क) 120
(ख) 240
(ग) 150
(घ) 210

प्रश्न 42. मुख्य राजभाषा अधिकारी का नामन कितनी अवधि के लिए किया जाता है ?

(क) 02 वर्ष
(ख) 01 वर्ष
(ग) 04 वर्ष
(घ) 03 वर्ष

प्रश्न 43.मंडल राजभाषा कार्यान्वयन समिति का अध्यक्ष कौन होता है ?

(क) मंडल रेल प्रबंधक
(ख) अपर मंडल रेल प्रबंधक
(ग) राजभाषा अधिकारी
(घ) वरिष्ठ मंडल कार्मिकअधिकारी

प्रश्न 44.हिंदी पुस्तकालय का कार्य देखने के लिए अंशकालिक पुस्तकाध्यक्ष को प्रतिमाह कितने रुपये का मानदेय दिया जाता है ?

(क) 300 रुपये
(ख) 400 रुपये
(ग) 500 रुपये
(घ) 200 रु.

प्रश्न 45. हिंदी आशुलिपि का प्रशिक्षण किसके लिए अनिवार्य है ?

(क) हिंदी आशुलिपिक
(ख) अंग्रेजी आशुलिपिक
(ग) लिपिक
(घ) कार्यालय अधीक्षक

प्रश्न 46. रेलवे बोर्ड राजभाषा कार्यान्वन समिति की बैठक किसकी अध्यक्षता में आयोजित की जाती है ?

(क) अध्यक्ष रेलवे बोर्ड
(ख) सदस्य कार्मिक
(ग) रेलमंत्री
(घ) निदेशक/राजभाषा

प्रश्न 47. रेलवे हिंदी सलाहकार समिति की वर्ष में कितनी बैठकें आयोजित की जाती हैं ?

(क) 02
(ख) 03
(ग) 04
(घ) 01

प्रश्न 48. रेलवे हिंदी सलाहकार समिति की बैठक किसकी अध्यक्षता में आयोजित की जाती है ?
(क) अध्यक्ष रेलवे बोर्ड
(ख) सदस्य कार्मिक
(ग) रेलमंत्री (घ) निदेशक/राजभाषा

प्रश्न 49. रेलवे स्टेशनों के प्लेटफार्मों के दोनों सिरों पर लगे स्टेशन नाम पट्टों पर लिखी जाने वाली भाषाओं का ऊपर से नीचे क्रम क्या होना चाहिए ?
अंग्रेजी-हिंदी प्रांतीय भाषा
(ख) प्रांतीय भाषा-हिंदी-अंग्रेजी
(ग) प्रांतीय भाषा-अंग्रेजी-हिंदी
(घ) हिंदी-प्रांतीय भाषा

प्रश्न 50. राजभाषा अधिनियम,1963 के अनुसार संविदा और करार किन-किन भाषाओं में निष्पादित किए जाने चाहिए ?
(क) प्रांतीय भाषा-अंग्रेजी
(ख) हिंदी-अंग्रेजी
(ग) केवल हिंदी में
(घ) केवल अंग्रेजी में

Que 1- What is the detailed procedure of imposing major penalities to staff under D & A Rules 1968 in Railways?

Sol:-The detailed procedure of imposing major penalities to staff under D & A Rules 1968 in Railways is as under:-

Issue memorandum of charges in S.F.5 and provide copies of documents or their inspection.

Obtain and consider statement of defence.

Appoint Inquiry Officer if charges are not admitted. Send record of case to the Inquiry Officer.

Inquiry Officer will allow a defence counsel. Perusal and extracting from list of documents relied upon should be permitted.Additional document,where asked for, and relevant should also be permitted.

Inquiry Officer will decide modalities of inquiry, defence witnesses to be called for fix calendar for inquiry and sort out other preliminary matters.

The procedure for conducting the inquiry is as:-

The charges will be explained to the employee. Documents may be produced as required.

The charged employee will be asked to state if he accept or denies the charge.Also if he will take a defence counsel or will defend the case himself.

The prosecution witnesses, cited in the charge sheet will be examined, each one separately.Then cross examination of each witness by the charged employee or his counsel.Re examination on any point of cross examination ,if necessary.

The defence witnesses,if any, may then be examined,cross examined and re-examined.

a) The charged employee will be permitted to submit his defence.
b) Inquiry officer may question the charged employee on the circumstances appearing against him in the evidence.
c) The charged employee will be permitted to file written briefs.

7) Based on the evidence on record, the Inquiry Officer shall draw his findings and Inquiry report and send it along with records of inquiry to the Disciplinary Authority.

8) A copy of inquiry report should invariably be given to the charged employee and his defence. If submitted, should be considered before any further action is taken.

9) The Disciplinary Authority shall consider the report and may accept it or draw its own finding or remit it or ask for fresh inquiry.

10) If it is decided to impose a penality which is within its competence, the Disciplinary Authority shall issue notice of imposition of Penality, otherwise forward the case to the competent authority.

Que 2- Design a column,square in section, to carry an axial load of 4500000N.

Sol:-Step1:-Let us adopt M25 grade concrete and mild steel reinforcements.
Allowable direct compressive stress=6N/mm2 in concrete
Allowable compressive stress in steel=130N/mm2
Min. percentage of longitudinal reinforcement=0.8%
Step2:-Let “a” be the size of square column
Then area of column= a2
Area of steel =0.008 a2
Area of concrete=a2_0.008a2=0.992 a2
As per condition,

4500000 =6X0.992a2+130X0.008a2
4500000=5.952a2 +1.04 a2=6.992 a2
We get a = 802.24 mm
Size of square column is 802.24 mm
Step 2:-Provide square column of size 810 X810 mm with 30 mm chamfering at the corner.
Area of column= 810X810-2X30X30
= 654300 sqmm
Area of steel = 0.008X654300
= 5234.4Sqmm
Let us adopt 28 mm dia bars
Area = 3.142X28X28
4
=615.75 mm2
No. of bars = 5234.4/615.75
= 8.5 say 9 nos
Provide 9 bars of 28 mm dia.

Tie Reinforcement:-
Using 8 mm dia tie reinforcement, spacing will be

a) 16 times dia of main bars
= 16X 28 = 448 mm
or
b) 48 times dia of tie reinforcement
= 48X 8 =384 mm
or
c) Last size of column = 810 mm

Provide 8 mm bars tie reinforcement at 380 mm centre to centre I e. least spacing among the three criterias.

Q 3 (a):-Write the full forms of following

1. S O R - Schedule Of Rates
2. G M F – Grow More Food
3. N H A I- National Highway Authority of India
4. P P E A-Public Premises Eviction Act
5. D F C- Dedicated Freight Corridor
6. P F T- Private Freight Terminal
7. M R T S- Mass Rapid Transport System
8. S E J- Switch Expansion Joint
9. T O S- Throw Of Switch
10. D M T –Departmental Material Train

Q 3(b)Write the answers of following.

1. **Who was our first president of India?**

Ans:- Dr. Rajendra Prasad

2. **Which is the fastest train in India?**

Ans:- Bhopal Shatabadi Express

3. **What is function of Unimat machine?**

Ans:- For packing and tamping of point and crossing.

4. **What is slope of end of passenger platform ?**

Ans:- 1 in 6

5. **What is the Squeezing pressure of track machines in case of PRC Sleepers ?**

Ans:- 110-120 kg/sqcm

Q 4(a):- Which are the categories of bridges in Railways on the basis of consideration of water way ?

Sol:- There are four categories of Railway bridges based on water way basis.

1. Important Bridges:-

   Important Bridge is one which has a very large size of waterway. i.e. the bridge having total area of water way of more than 1000 sq. metres or has a linear water way of 300 metres.
2. Major Bridges:-

   Major Bridge is one which has a total linear water way of 18 metres or which has a clear opening of 12 metres or more.
3. Minor Bridges:-

   Minor Bridges are those bridges having linear water way of less than 12 metres in case of single span bridge and less than 18 metres in case of multi span bridges.
4. Culverts:-

   A very small bridge which has span less than 6 metres is called culvert.

Q 4(b) What is distressed bridge. What are categories of distressed bridges and what is SR imposed on distressed bridges ?

Sol:- A distressed bridge is one which shows some physical deterioration of its physical condition ,indicating the need for rehabilitationthrough special repairs, strengthening or re building etc.

Categories:-

There are two categories of distressed bridges.

Category I Those bridges requiring rehabilitation to be done immediately say with in a year,s time.
Category II Those requiring to be kept under observation and to be taken up for rehabilitation on programme basis.
SR imposed:-
Category I- These bridges are recommended for SR upto 25 kmph.
Category II- These bridges are recommended for SR upto 50 kmph.

Q 4(c) What is schedule of inspection of AEN and DEN for distressed bridge?

Sol:-Category I
AEN- Once in two months
DEN-Once in three months
Category II
AEN-Once in six months
DEN-Once in a year.

Q 5(a) Define the following. (8marks)
Sol:-

1. Destressing:- This is the operation undertaken with or without rail tensor to secure stress free conditions in the LWR/CWR at the desired/specified rail temp.

2. L W R:- LWR is a welded rail, the central part of which does not undergo any longitudinal movement due to temp. variations. A length greater than 250 metres on B.G. and 500 metres on M.G will normally function as LWR.
3. Destressing temp.:- This is the average rail temp. during the period of fastening the rails to the sleepers after distressing LWR without use of rail tensor.

4. Breathing Length:- This is that length at each end of LWR/CWR which is subjected to expansion/contraction on account of temp. variations.

Q 5(b) What are duties of AEN (open line) in regard to track machine?
Sol:-

1. He shall arrange for suitable accommodation for machine staff wherever camping coaches are not provided.
2. He shall periodically inspect track machines working in his jurisdiction .
3. He shall arrange for transportation of consumables,spares etc from Depots to site of work.
4. He shall ensure adequate lighting arrangements where night working by machines are involved.
5. He shall monitor output and quality of work done by the machines.
6. He shall coordinate with other departments like Traffic, OHE ansd S&T Deptt. In the field to facilitate the work.

Q 5(c) What are different types of small track machines used on rail and welding operations in Railways?

Sol:-A)Rail:-

1.Abrasive Rail Cutter
2.Rail Cutting machine
3. Rail drilling machine
4.Hydraulic rail tensor 70t capacity
5. Hydraulic Rail Bender

B) Welding operations:-

1.Portable DC welding Generator
2. Double action weld trimmer for AT welding
3.Rail profile weld grinder.

Que 5(d) What are functions of Ballast?

Sol:-A)Resist vertical,lateral and longitudinal forces.
B)Provide resilience and absorb energy
C)Reduce formation pressure
D)Facilitate track drainage
E)Facilitate track geometry correction

Que 5(e)Write note on:-

Detailed Specifications of Ballast.

Sol:-1. Ballast should be hard,durable and as far as possible angular along edges/corners,free from weathered portions of parent rock,organic impurities and inorganic residues.

2. Ballast should be cubical in shape as far as possible. Individual pieces should not be flaky and should have generally flat faces with not more than two rounded/sub rounded faces.

3. Preferably machine crushed ballast should be used on B.G. lines. Hand broken Ballast may be used in exceptional cases with approval of CTE/CAO/C.

4. Water absorption should not be more than 1%. But as per CS no. 3 now CAO/CTE can permit relaxation upto 2.5% water absorption for specified areas.

5. Max. values of abrasion and impact should not be more than 30% and 20% respectively.

6. The gradation of ballast on sieve analysis should be as per reqd values as under:-
Retained on 65 mm sq. mesh sieve- 5% Maximum
Retained on 40 mm sq mesh sieve-40% to 60%
Retained on 20 mm sq mesh sieve- not less than 98%.

BRIDGE

Q 1 What do you understand by Camber, Dead load camber and Live load camber in steel triangulated (Open web) girders? What do you mean by Loss of camber and the reasons for it?

Answer: - camber: - It is the curvature/ deflection intentionally induced in the Girder to compensate for deflection which is to be encountered by it, during service for a particular designed load.

The part of the camber corresponding to dead load is called dead load camber and the balance left over is called Live load camber, which should be available as visible and measurable camber in the girder when not carrying load.

Loss of camber: - It is the loss in deflection between the initially induced deflection and that measured at any interval of time with no live load.

The loss of camber is due to:-

Over stressing of members beyond the elastic limit.
Over stressing of Joint Rivets.
Loose Rivets.

Qus .2. Give planning of construction of subway (LHS) in place of level Xing including block working within 5.30 hours and what precautions to be taken during block working and in monsoon.

Ans Criteria:- The level crossing having following condition should be identified to replace with LHS.

I. Accident prone LC's where visibility is not clear

II. Where embankment height is at least 3 met.

III. Where TVU is less but have potential of getting manned level crossing

IV. Other condition as required.

Methodology of execution:- there are various methods such as

I. Pre cast box segment placing (Cut & Cover method)

II. Placement of Precast box after inserting RH girder

III. Box pushing

IV. Box puling

V. Cast in Situ

The most popular method is cut & cover as per planning boxes to be casted in cess and then

If 5:30 hrs block is required to do the work

I.	Track dismantling & ballast removal	-	25 minuet
II.	Earth work in cutting	-	60 minuet
III.	Sand filling in Bed	-	15 minuet
IV.	Slab Placing	-	30 minuet
V.	Box placing	-	100 minuet
VI.	Geo Textile and Geo membrane	-	30 minuet
VII.	Back filling	-	20 minuet
VIII.	Ballast putting	-	20 minuet
IX.	Track linking	-	30 minuet

Equipment required at site during block:-

I.	Crawler crane cap-125 ton.	-	02 Nos. +01 No for emergency
II.	Poclain	-	02 Nos. +01 No. For emergency
III.	JCB	-	02 Nos.
IV.	Tippers	-	02 Nos.
V.	Water Tanker	-	01 Nos.
VI.	Gas Cutting and welding set	-	01 Nos.
VII.	Men Power	-	60 Nos.

Cut and cover method include following steps:-

I. Demarcation at site:- Demarcation at site is a pre block activity so that should be done as per site requirement well before block started .

II. Track dismantling and removal of ballast :- these activities should be done as per demarcation at the site with the help of adequate men and machine power. Dismantled material should be placed out of working space and within a easy approach to facilitate at the time of restoration work.

III. Earth cutting :- Earth cutting will be done with the help of poclain and JCB. And slop in cutting is maintained in the ratio of 2:1 to 1:2:1 depending upon the local condition of earth.

IV. Send filling :- send filling with 150mm in thickness is done over a levelled and compacted surface

V. Slab Placing :- precast slabs are placed over levelled bed of send with the help of crane and the joints of slab are filled with appropriate material.

VI. Box Placing:- the precast RCC boxes are placed as per fresh demarcation over precast slab with the help of crane in proper alignment.

VII. Geo Textile and Geo membrane :- Geo Textile is provided to the surface exposed to earth and ballast to cover the tope and side of boxes in order to filter the water during rain and the Geo membrane is pasted at the joints of boxes with the help of flame to check the flow (seapage) of water through joints of boxes.

VIII. Back filling :- Back filleting is done with machine to fill the space between side of box and embankment across the track and get compacted simultaneously.

IX. Ballast Putting:- Ballast putting is done with the help of men and machine available at site as per track profile .

X. Track linking:- Track linking is done over spreaded ballast and then track is linked with the existing track with all relevant activities and traffic to allow with S.R.

Precautions:-

1. Earth cutting to be done properly with proper slope and care should taken that it should not falled and labours/supervisor should be keep safe distance.
2. Sand begs should be provided to bank to retain earth.
3. Sling should check
4. After linking track should packed and XL and gauge should check.

Q.3 Explain classification of railway bridges. Define distressed bridge and its category and frequency of inspection. Write the various steps for inspection of triangulated girder through bridge.

1) Important bridges: Important bridges is one which has a very large size of waterway. As per the old practice*, the bridge having total areas of water-way of 110 sq. metre (1200 sq. ft.) and more, or having linear water-way of 180 metres (600 ft) or more, was classified as an ‘Important Bridge’ . The criteria for classifying the bridge has recently been revised by the Railway board.** as per the revised standers ,a bridge is an ‘Important bridge’ if it has total area of water –way of more than 1000 sq. metres or has linear water-way more than 300 metres.
2) Major bridge: major bridge is one, which have a total linear water0way of 18 metres (60 ft) or more or which have a clear opening of 12 metres (40 ft) or more.
3) Minor Bridge: The bridge having linear water-way of less than 12 metres (40 ft) in case of single span bridge and less than 18 meters (60 ft) in case of multipal span bridge is called a ‘minor bridge’
4) Culvert: a very small bridge is called a ‘culvert’. Normally a bridge, having span of less than 6 meters, may be called a culvert.

DISTRESSED BRIDGES

1. Definition of distressed bridge

A distressed bridge is one which shows some physical deterioration of its physical condition, indicating the need for rehabilitation through special repairs, strengthening or rebuilding (including replacement of girders).

2. Classification of distressed bridge

Category-1: Those requiring rehabilitation to be done immediately, say with in a year's time.

Category-2: Those requiring to be kept under observation and to be taken up for rehabilitation on a programme basis.

Group 1: Distressed bridges in Group 1 category are recommended for speed restriction upto 15 KMPH.

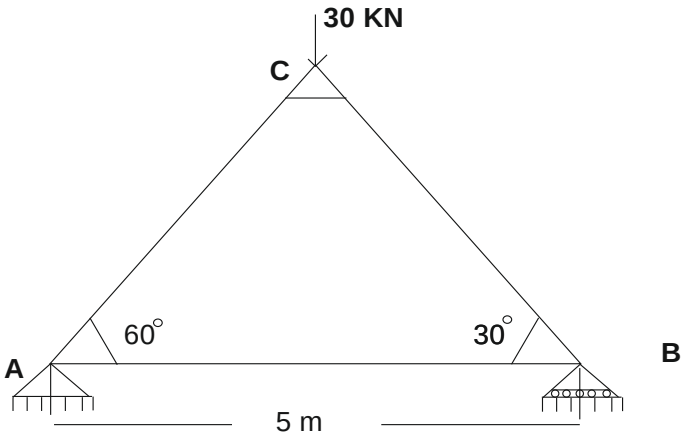
Group 2: Distressed bridges in Group 2 category are recommended for speed restriction 25 KMPH to 40 KMPH.

Schedule of inspection of distressed bridges.*

Category	Inspection By	Periodicity
1. (a)	Inspector (concerned)	Once in a month
(b)	AEN or ABE	Once in two months
(c)	DEN or Sr. DEN	Once in three months
2. (a)	Inspector (concerned)	Once in three months
(b)	AEN or ABE	Once in a six months
(c)	DEN or Sr. DEN	Once in a year

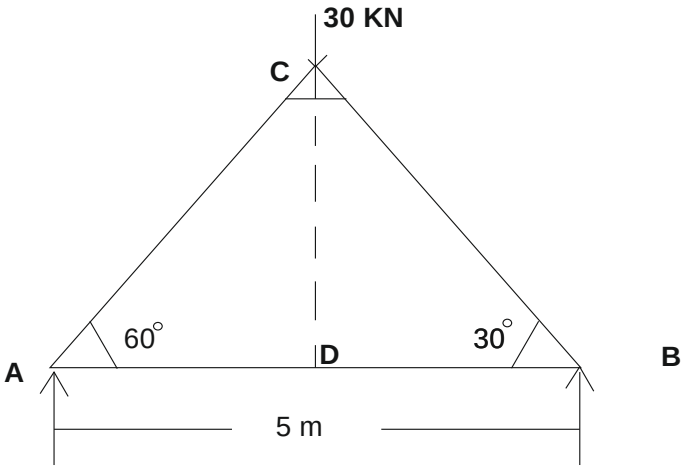
DESIGN

Q1. Determine the forces in all members of a truss with the loading and support system as given below :



Solution : Roller Support at end "B" is frictionless and provides a reaction Rb at ,right angles to the roller base. The Reaction at the hinged support at end "A" can have two components acting in the horizontal and vertical directions. Since the load of 30KN acts vertically downward, the horizontal components of reaction at "A" is zero and these will be only vertical reaction Ra.

Considering the free-body diagram of the whole truss is as given below :



The triangle ABC is a right angled triangle with angle ACB = 90

AC = AB cos60 = 5 x 0.50 = 2.5 m

Distance of line of action of 30 KN force from A,

AD=AC cos60 = 2.5 x 0.5 = 1.25 m

Taking moment about A, we obtain

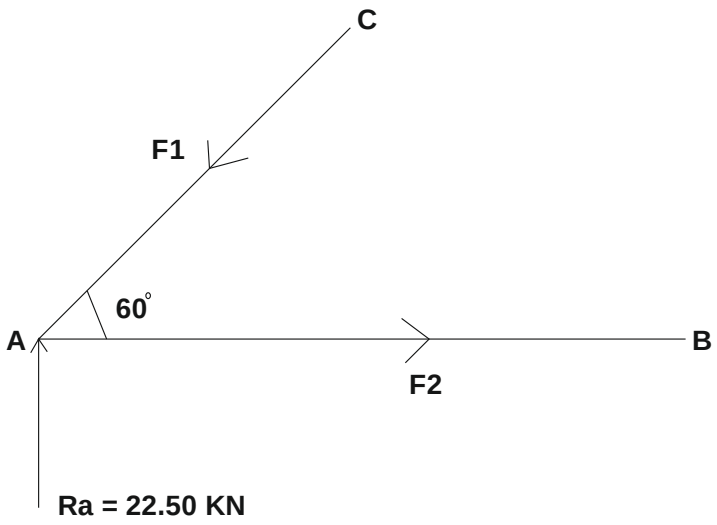
Rb x 5 = 30 x 1.25

Rb = 30 x 1.25 = 7.5 KN

5

Ra = 30 - 7.50 = 22.50 KN

Joint “A” - Consider the free body diagram of joint A with the direction of force assumed as shown in the figure given below :



Equation of equilibrium can be written as

E Fx = 0

F2-F1 cos 60 = 0

Efy = 0

F1 sin 60 - Ra = 0

Hence F1 = Ra = 22.50 = 25.97 KN (Compressive)

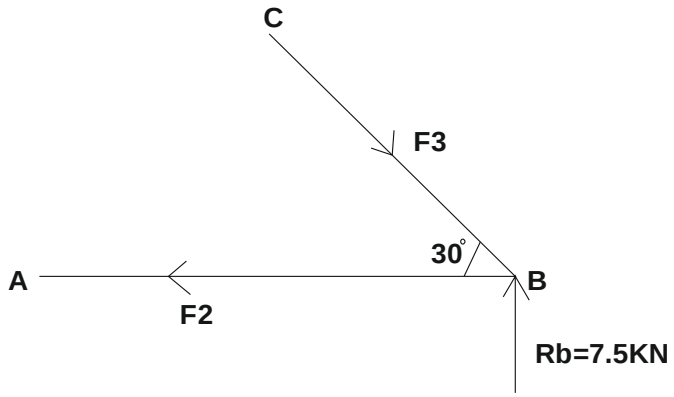
Sin 60 0.866

F2 = F1 cos60 = 25.97 x 0.50 = 12.99 KN (Tensile)

The Force F1 is acting towards the pin which means that the member AC is in compression.

The Force F2 is pulling the joint A which means that the member AB is in tension.

Joint “B” - Consider the free body diagram of joint B. The force F2 in Member AB has already been calculated above and formed to be tensile. Hence Force F2 will pull the joint B and will be directed away from its as given in the figure : -



From the equation of equilibrium,

Efx = 0

F3 cos 30 - F2 = 0

or F3 = F2 = 12.99 = 15 KN (compressive)

cos 30 0.866

The force F3 is acting towards the joint B which means that the member BC is compression

Conclusions :-

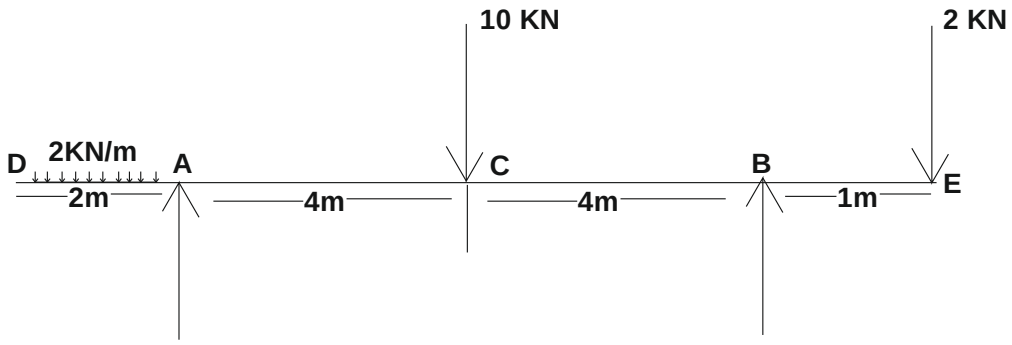
Force in the members :-

AB = F2 = 12.99 KN (Tensile)

AC = 25.97 KN (Compressive)

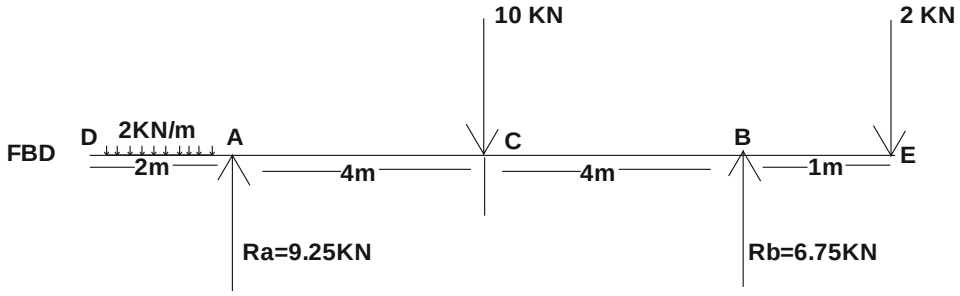
BC = F3 = 15.00 (Compressive)

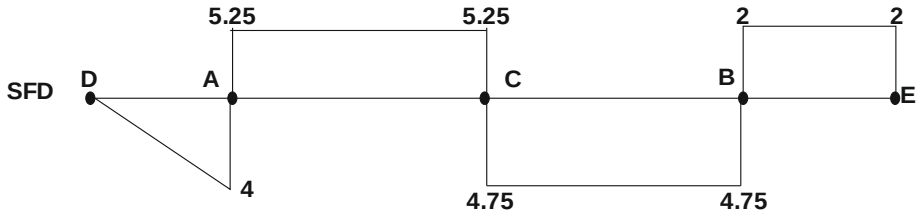
Q.2. Determine the reactions and construct the shear force and bending moment diagrams for the beam loaded as shown in figure given below. Also find the point of contraflexture if any.

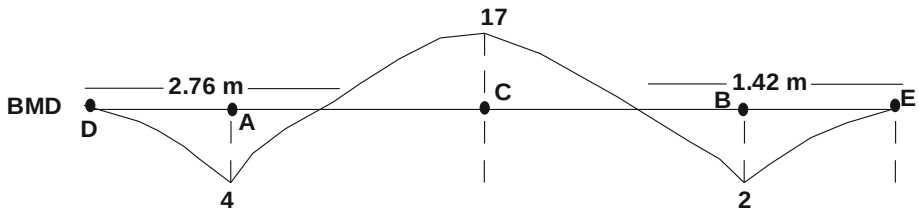


LOADED BEAM

Solution : A point of contraflexture is a point where bending moment is zero from conditions of static equilibrium.







EV = 0 and EM = 0, we have

Equation 1 = Ra + Rb = 2x 2 + 10 + 2 = 16

Equation 2 = -2 x 2 x 10 + Ra x 9 - 10 x 5 + Rb x 1 = 0

Equation 3 = 9Ra + Rb = 90

The udl is considered to be concentrated at its CG.

From equation 1 and 3

Ra = 9.25 KN and Rb = 6.75 KN

Calculation of shear force :

At D=0

Just Left of A = -2 x 2 = 4 KN

Just right of A = -4 + 9.25 = 5.25 KN

Just left of C = 5.25 KN

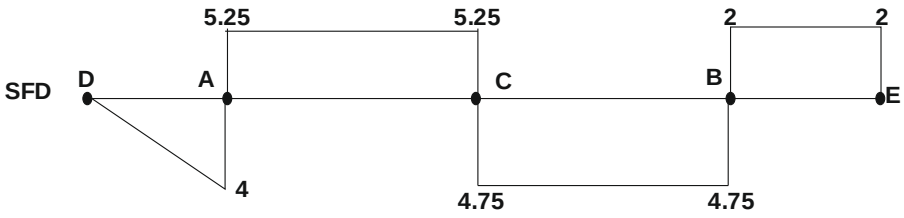
Just right of C = 5.25 - 10 = -4.75 KN

Just left of B = -4.75 KN

Just right of B = -4.75 + 6.75 = 2 KN

Just left of E = 2 KN

Just right of E = 2 - 2 = 0 KN



Calculation of bending moment : -

Md = 0

At distance x from D (within portion DA)

Mx = -2 x X x/2 = -x

hence M (at x = 1m) = 1 and

M (at x=2m) = -4

Ma = -4 KNm

Mc = -2 x 2 x 5 + 9.25 x 4 = -20 +37 = 17 KNm

Apparently there is a point of contraflexture between A & C as bending moment charges sign between A and C.

Bending moment at x between A & C with x measured from D

Mx = -4(x-1) + 9.25 (x-2) = 5.25x - 14.50

5.25x - 14.50 = 0 for point of contraflexture

That gives x = 14.50 / 5.25 = 2.75 m

Mb = -2 x 1 = -2 KN m (considering the segment EB from right hand side).

Since bending moment at C is +ve and at B is -ve, there is also a point of contraflexture between C and B

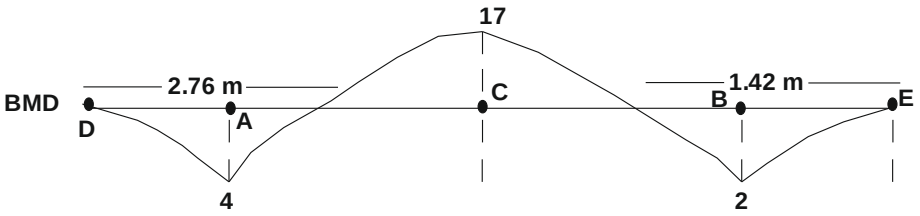
Bending moment at distance x measured from end E towards left

Mx = -2x + 6.75(x-1) = 4.75x - 6.75

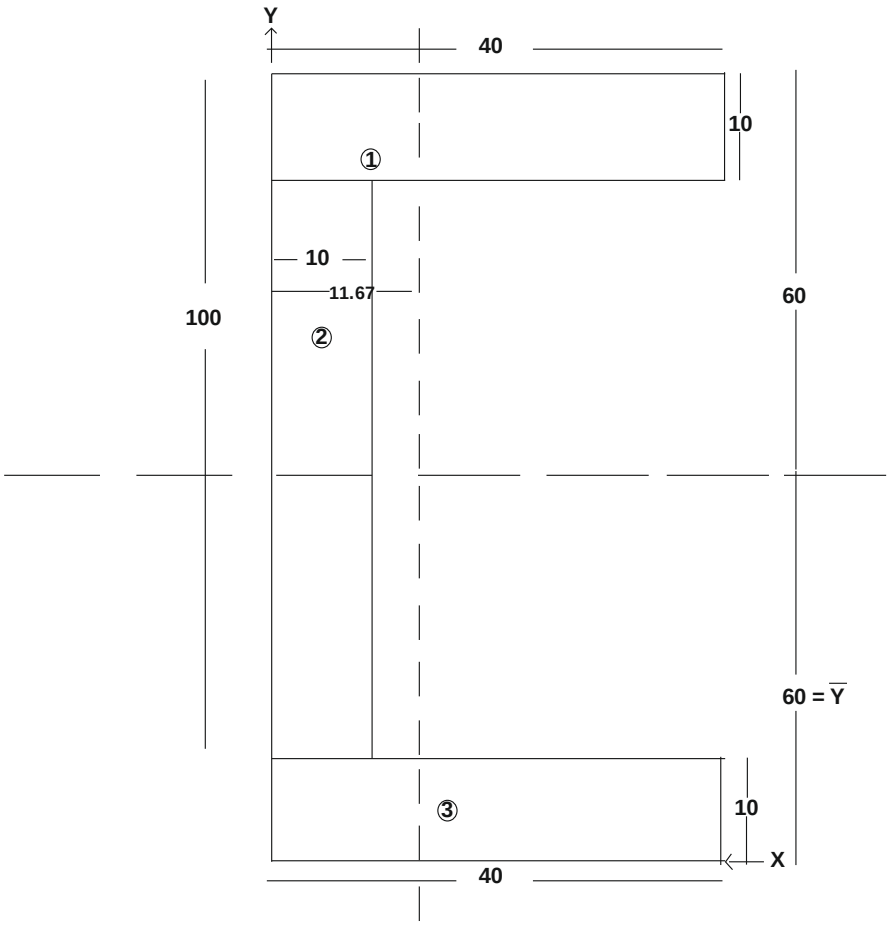
or 4.75x - 6.75 = 0 for the point of contraflexture

That gives x = 6.75 / 4.75 = 1.42 m

The shear force and bending moment diagram for the entire beam is as under :



Q.3. Determine the product of inertia of the channel section as given below with respect to its centroidial axis. All dimensions are in mm. Comment on the result.



Solution : The section consists of three rectangular segments which have been numbered as 1, 2 and 3.

Rectangular 1 -

a1 = 40 x 10 = 400 mm

x1 = 40/2 = 20 mm (From Y.Y)

Rectangular 2 -

a2 = 100 x 10 = 1000 mm

x2 = 10 / 2 = 5mm (From Y-Y)

Rectangular 3 :-

a3 = 40 x 10 = 400 mm

x3 = 40 / 2 = 20 mm (From Y-Y)

$x = \frac{a1x1 + a2x2 + a3x3}{a1 + a2 + a3}$

$= \frac{400 \times 20 + 1000 \times 5 + 400 \times 20}{400 + 1000 + 400} = \frac{21000}{1800} = 11.67$ mm (from y-y)

Further the given channel section is symmetrical about x axis and therefore

$Y = \frac{100 + 10 + 10}{2} = 60$mm (from x-x)

Product of inertia about centroidal axis

= a1 (x1 - x)(y1-y) + a2 (x2-x)(y2-y) + a3 (x3-x) (y3-y)

= 400 (20 - 11.67) (115-60) + 1000 (5-11.67) (60-60) + 400 (20-11.67) (5-60)

= 183260 + 0 - 183260 = 0

Comment The section is symmetrical about x axis. Hence the product of inertia has to be zero.

Q.4. Design an singly reinforced simply supported beam having spam of 5 mm it is carrying a load of 10000 N/m including itself wt.

Assumed

Concrete = M20 grade

steel = Tor

Allowable bending stress in steel 210 N / mm

Solution :

Let us design the beam using M20 grade of concrete and with for steel having allowable stress in bending as 210N/mm

From IS456 : 1978 allowable compressive stress in concrete for M20 concrete, 7.0 N/mm

Modular ration, m = 280 / 3 6bc

= 280 / 3 x 7 = 13.33 = 13.00

Bending moment = wl /8 = 10000 x 5 x 5 = 31250 N - m

= 31250000 N-mm

Neutral axis cofficient = N = $\frac{1}{1 + 6st / m\ 6bc}$

N = $\frac{1}{1 + 210 / 13 \times 7}$ = 0.302

Now let d/b = 2.5 or d = 2.5b

M = kbd

Where K = 1/2 6bc NJ = 1/2 x 7.0 x 0.302 x 0.899 = 0.95

J= 1 - N/3 = 1-0.302 / 3 = 0.899

M = kbd = kb x (2.5b) = 6.25 kb

= 6.25 x 0.95 b = 5.9375 b

We have already calculated that the due to load, beam is subjected to bending moment of 31250 000N - mm. Evaluating external moment with the moment of resistance

We get,

5.9375 b = 31250000

or b = 5263157.90

or b = 173.95 mm

say 180 mm

d = 2.5b = 2.5 x 180 = 450 mm

Area of Steel = M/6stJd = $\frac{31250000}{210 \times 0.899 \times 450}$

= 367.84 mm

Let us adopt 12 0 bars

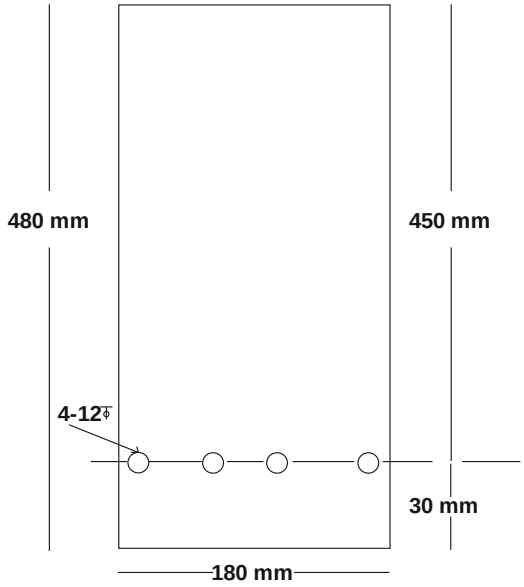
Area of each bar = A / 4 x 12 = 113.10 mm

No. of Bars required = 367.84 = 3.25

113.10

Provide 4 numbers of 12 0 bars.

Provide 30 mm of effective cover design section of the beam will be as given :-



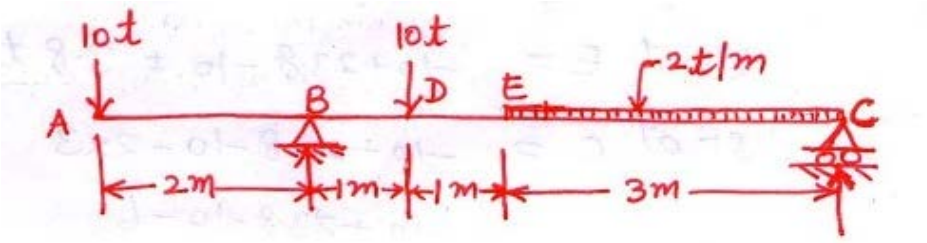
Conclusions :

Width of beam = b = 180 mm

Depth of beam = d = 480mm

Steel Reinforcement = Ast = 4-12 0

Q. No.4 Draw the Shear Force and Bending Moment Diagrams for the beam loaded as shown in figure below :-



ANS.1 SIGN CONVENTION USED AS

1 Anticlockwise moments on LH side & clockwise moments on RH side are taken as (-ve).
2 Anticlockwise moments on RH side and clockwise moments on LH side taken as

(+ve).

CALCULATION OF REACTIONS

Taking moment about C & putting ΣMc = 0

-10x7+RB x5-10x4-2x3x1.50 =0

OR 5RB =70+40+9

5RB = 119

RB = 119/5 = 23.8 t ↑

Considering ΣV = 0

-10+ RB-10-2x3+Rc = 0

OR RB+Rc = 10+10+6

RB+Rc = 26 tonne

Putting value of RB as calculated above.

OR 23.8 + Rc = 26

OR Rc = 26-23.8

OR Rc = 2.2 tonne ↑

CALCULATION OF SHEAR FORCES:-

S.F at A = -10 tonne (-ve)

S.F at B on LH Side = -10 t (-ve)

S.F at B on RH side = -10+23.8 = 13.8t (+ve)

S.F at D on LH side = -10+23.8 = 13.8t (+ve)

S.F at D on RH side = -10+23.8-10 = 3.8t (+ve)

S.F at E = -10+23.8-10 = 3.8t (+ve)

S.F at C = -10+23.8-10-2x3

= -10+23.8-10-6

= 23.8-26

= -2.2 t (-ve)

As the S.F at E is 3.8 t (+ve) and the S.F at C is -2.2 t (-ve).

Let the point of zero Shear Force be at a distance of x meters from the end C.

Considering the forces on the RH side of the point of zero S.F

$2.2 - 2x = 0$

OR $2x = 2.2$

OR $x = 2.2/2 = 1.10$m from the end C

CALCULATIONS FOR BENDING MOMENTS:-

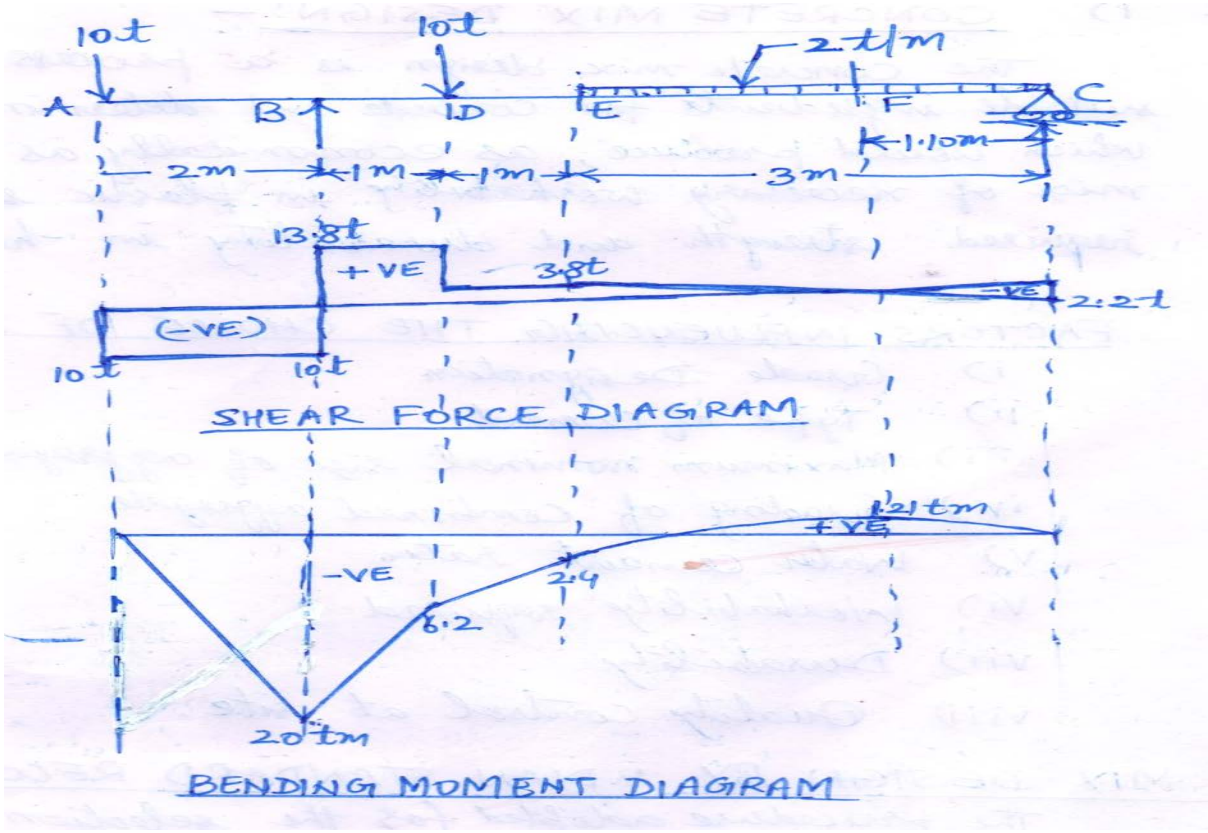
B.M at A = MA = 0
B.M at B = MB = -10x2 = -20 tm (-ve)
B.M at D = MD = -10x3+RBx1
= -30+23.8x1
= -30+23.8
MD = -6.2 tm (-ve)
B.M at E = ME = -10x4+RBx2-10x1
= -40+23.8x2-10
= -50+47.6
ME = -2.4tm (-ve)

B.M at 1.10m from the end C, (Considering forces on the RH side)

= 2.2x1.1-2x1.1x(0.55)

= 2.42-1.21

= 1.21 tm (+ve)



GENERAL

Q 1: - List out the actions to be taken by an engineering official reaching first at site of an accident of a passenger train.

Answer: - The action to be taken by an Engineering officer at an accident site involving a passenger train is as under:

A. Protection of Train.
B. First aid and Rescue.
C. Advice to nearest Station Master.
D. Line clear examination.
E. Preliminary clearing operation and preservation of clues.
F. Contacting higher officials.
G. Recording of details and advice regarding restoration time.
H. Preservation of clues

Q.No.2. What are duties of Assistant divisional engineer as ABE, AXEN/TMC, ADEN open line, Elaborate inspection schedules of Assistant divisional engineer open line.

1) Important Duties:-

Essential Duties of Asst. Engineer are:

- Inspection of all structures and their maintenance in a satisfactory and safe conditions:
- Preparation of plans and estimates;
- Execution and measurement of work;
- Verification of stores held by stock-holders;
- Submission of proposals for inclusion in the works programme and revenue budget.

OTHER DUTIES OF ASSISTANT ENGINEER*

- Execution of works:
- Control over expenditure:
- Water Supply:
- Land management:
- Training:
- Witnessing payments to staff:
- Inspection of offices and stores of Inspectors:
- Staff matters:

Duties as AEN/TRACK MACHINE

I. Inspection and maintenance of all machines in a satisfactory, efficient and effective working condition.
II. Ensure adherence to stipulated maintenance schedules.
III. Ensure availability of necessary staff for the operation and optimum utilisation of machines during track possessions/line blocks.
IV. Ensure achievement of stipulated targets in respect of both the quantity and quality of output.
V. Ensure adequate availability of all the consumables and spares of fast wearing components and unit replacement assemblies, of required quality.
VI. Initiate proposals and plan for major schedules, ensure their execution and submit completion reports for all such works.
VII. Verification of stores held by the field units, once a year. He should ensure that scraps and obsolete stores are returned to the/disposed off.
VIII. Ensure maintenance of various records and submission of various returns pertaining to machines from the field units.
IX. Training of Probationers – The Assistant Engineer shall take interest in training of all probationers sent to him and see that training is given according to the specified programme. He should periodically examine the notes made by them.
X. Training: The Assistant Engineer should take intesert in Training the probationers properly as per specified programme.

XI. Witnessing payments to staff: The Assistant Engineer should witness payments to workmen under one or more Inspector each month. This should be done by surprise.

XII. Inspection of office and stores of Inspector: The Assistant Engineer should carry out inspection of each inspector office and stores at least once a year.

Duties of ABE:

General Duties:

1. The Assistant Engineer is generally responsible for the maintenance and safety of all way & works including bridges in his charge; for the accuracy, quality and progress of new works and control over all expenditure in relation to budget allotment.
2. INSPECTION of bridges and other structure
3. A) scrutinize the bridge register sent by BRI and after inspection of bridges endorse a certificate and forward to dy CE/BRIDGE
4. TO Inspect distressed bridge, reffered bridge by BRI,10% test check of other bridges
5. Steel structure as ordered by CE
6. To ensure painting of bridge,maintenance of bearings

INSPECTION SCHEDULE OF AEN OPEN LINE

S. No.	ITEM OF INSPECTION	MINIMUM SCHEDULE
1.0	P.WAY	
1.1	Push Trolley including station & petty repair books -Main Line Branch Line	Once a month Once in two months
1.2	Motor Trolley	Nil
1.3	Footplate/Brake-van	Once a month
1.3 .1	Night foot plate/brake-van	Once a month
1.4	Private Sidings	Once in 12 months
1.5	TRC/OMS Runs	Accompanying each TRC and OMS run
1.6	Points & crossings on passenger & running lines Other lines and yard lines	Once a year 1/10th of total every year on programme basis
1.7	Curves	Once curve every quarter under each PWI
1.8	Level Crossings	Once every six months
1.9	LWRs	Creep records during routine push trolley inspections
1.1	SEJs	Once every six months preferably

0		hottest and coldest month
1.11	Night Inspection	Minimum once in a month
1.12	Night Inspection checking of patrolling	Minimum once a month in night by suitable means to match the local law and order situations.
1.13	Track patrolling	Hot and cold weather as needed
1.14	Monsoon patrolling	Minimum one inspection every month depending on requirements of terrain.
1.15	Test check of USFD testing	During every trolley inspection
1.16	At welding Site	Each site once a month
2.0	Gangs	
2.1	Gang work including Equipments and Rules	Minimum one Gang per PWI every month
2.2	Witnessing Payment	Minimum one Inspector's Gang every month
3.0	Cuttings	Once a year before onset of rains. Vulnerable cuttings to be decided by Sr. DEN/DEN
4.0	Ash pit/Inspection pit	Once a year (On passengers lines)

Q.No.3 Explain duty of first engineering official reaching at accident site.

Ans:-

(a) On receipt of intimation of the occurrence of an accident resulting in damage to any part of the Way/Works /Bridges and affecting the free passage of trains, the concerned Engineering official shall proceed to the site of accident, by the quickest available means. On his way, he should collect information about the extent of damage to Permanent Way / Works / Bridges and arrange for movement of materials required for restoration.

Action at site -

(a) Protect Train - He should ensure that protection has been done to the train in front and in the rear, in accordance with the rules. In the case of double line, if the other line is also affected by the accident, steps shall be taken to protect both the lines. If no infringement exists, trains must be controlled and passed cautiously on the unaffected track. .

(b) First aid and Rescue - He should arrange for first aid to injured passengers and Railway staff and rescue of trapped persons. If there is any Medical Practitioner on the train, his assistance should be obtained.

(c) Advice to nearest Station Master- After a rapid survey of the position, particulars should be sent to the nearest Station Master as under-

- Station at or stations between which the accident has occurred.
- Kilometrage at which the accident has occurred.
- Number and description of the train or trains involved
- Date and time of the accident.
- particulars of loss of life and injuries to passengers and staff.
- Nature and cause, if known, of accident.
- Damage to Permanent Way, Works, Bridges, Overhead equipment (in case of electrified section), signal and interlocking gear, engines or vehicles
- Probable duration the line may be blocked.
- Whether transhipment is required and if so whether it is feasible. Assistance (if any required) such as Medical assistance, break-down train etc.

(d) Line Clear examination - If the Engineering official has reached the site and no traffic official is available he should carefully secure the line clear token or ticket and any caution order, where necessary

(e) Preliminary clearing operation and preservation of clues -

(i) In all instances in which the means taken for the restoration of communication are likely to obliterate marks on the road and other evidence needed at a joint enquiry, the senior official who arrives first on the spot should carefully examine the track, train or vehicle and as soon as possible make notes, sketches etc. and hand over the same to his superior or produce them at the enquiry. He will, when the nature of the accident is such as will involve the question of eye-sight of any of the staff, verify (in case of those permitted to wear glasses) that they had worn glasses at the time of the accident and had carried a spare pair of glasses with them.

(ii) In all cases of accidents, the cause of which might possibly due to sabotage, it is essential that the clearance and restoration operations are not commenced till the Police officials arrive at the site and intimate their agreement to the commencement of clearance and restoration work, after, making thorough investigations.

A factual note of the conditions obtaining at the site prior to restoration work should be prepared and signed jointly by the senior-most Police and Railway officials at the site. In

the event of any difference of opinion between the Police and the Railway officials, such difference of opinion may be recorded on the joint factual note.

In addition it should be ascertained promptly from the C.R.S. if he would like to inspect the site, etc. before the commencement of clearance and restoration work and then action should be taken in accordance with his wishes. Before clearance and restoration operations are commenced all relevant clues, materials and damages and the deficiencies on Rolling Stock, etc. must be noted and preserved..

(iii) In other cases, clearance and restoration operations can commence even before the arrival of the Police and it is not necessary that all the rails, sleepers and fastenings involved in an accident should be preserved, but only those, whether serviceable or otherwise, which bear wheel marks, etc., especially between the points of mount and drop. In all cases of serious derailments, these are essential for a later reconstruction of the scene and should be preserved and/or recorded by the first responsible official to reach the site of the accident, as these would be valuable evidence to ascertain the cause of the accident.

(iv) After the injured persons have been attended to and arrangements made for the onward journey of the stranded passengers, the Railway officers at the site of the accident should arrange to record the preliminary statements of the staff concerned.
.
(f) Information to higher officials:- He should get in touch with the Divisional Engineer and the Controller / Chief Controller and furnish complete information advising the details of action being taken and the probable time for restoring through running.

He should arrange to organize the measure for expeditious restoration of through running and ensure incessant working till restoration.

(g) Preservation of clues - He should arrange to preserve all clues to enable reconstruction of the scene of the accident . Photographs showing the details of damage to Permanent Way and Rolling Stock at the site of accident should be taken wherever necessary; in case of suspected sabotage, the photographs of the site of the accident showing the damage and possible clues should invariably be taken.

(h) Examination of site and preparation of sketches - The first Engineering representative to arrive at site shall attend to the following :-

(1) He should examine the entire site inclusive of track over which the train has passed immediately before derailing, noting down any unusual features observed, especially any parts of vehicles or other material lying on or near the track.

(2) A dimensioned sketch should be prepared covering the entire site of accident, showing all relevant features inclusive of track leading up to point of derailment, showing position of

derailed vehicles, point of mount and drop and other relevant details. All the details given in should be incorporated in the sketch.

(3) An examination of the derailed vehicle/ vehicles for defects not caused by the derailment but which may have been the cause of the derailment should be made. He should make out notes for inclusion in the joint report.

(4) Details of Engineering works in progress, if any, at the site of accident, caution orders in force and nature of protection should be noted.

(i) Recording particulars at site of accident - (1) Permanent Way particulars -Permanent Way particulars shall be recorded jointly with the Inspectors of the other concerned departments as per These records will inter alia include particulars of the track structures, the condition of the track components, track geometry and other relevant details.

(2) Particulars with respect to Rolling Stock and signalling- Engineering representative should associate himself with the concerned representative of the other departments in recording measurements of-

(a) The locomotive,

(b) Carriages and Wagons; and

(c) Signalling and Telecommunication equipment.

(3) Operating particulars - The following operating particulars should also be recorded wherever relevant :-

(a) Speed - The actual speed at the time of derailment, from the speedometer graph or if the locomotive is not provided with the speedometer graph, by referring to inter-station timings.

(b) The direction of the locomotive i.e., shorthood or longhood leading.

(c) The brake power of the train.

(d) The marshalling of the train with reference to orders applicable on the section.

(e) Whether there has been sudden application of brakes.

(f) Whether there was sudden opening of regulators.

(g) Condition of loading in wagons, especially unequal loading, light loading, empties between loaded vehicles, over loading, moving loads and any infringement to standard dimensions.

(h) Particulars of Caution Orders issued to the Driver/Guard.

Q. No. (4)(a) What are the main duties of an Assistant Engineer?

Ans:- IRPWM Para101. General - The Assistant Engineer is generally responsible for the maintenance and safety of all way and works in his charge, for the accuracy, quality and progress of new works and control over all expenditure in relation to budget allotment.

Para 102. Essential Duties of Assistant Engineer- The duties of the Assistant Engineer are detailed in various chapters of the Indian Railways Permanent Way Manual, the Indian Railway Works Manual and the Indian Railway Bridge Manual, the most essential being:

(1) Inspection and maintenance of track and all structures in a satisfactory and safe condition;

(2) Preparation of plans and estimates; execution and measurement of works including track works;

(3) Verification of stores held by stockholders;

(4) Submission of proposals for inclusion in the track renewal programme, revenue budget and the works programme.

Q. No. 5 What inspection an AEN on open line is required to carryout & it what Periodicity?

Ans:-Inspection of Permanent Way – The important inspections to be carried out by the Assistant Engineer are summarized below:
(1) Trolley Inspection - The entire sub-division should be inspected by trolley once in two months on pro-rata basis systematically covering from one end to other end of his jurisdiction, as much inspection as possible being done by push trolley. Unimportant branch lines having less than 2 GMT traffic should be inspected once in 3 months.
(2) Fast Train inspection - The entire subdivision should be covered either by Engine/Rear Window of a fast train or by TRC/OMS once in a month.
(3) Inspection of Level Crossings - He should inspect all the manned level crossings once in six months. He should examine the Gatemen's knowledge of rules, check the equipment, track, road approaches and all other safety aspects.
(4) Checking of curves - The Assistant Engineer shall check at least one curve in each SSE/P.Way's jurisdiction every quarter by verifying its versine and super-elevation. Priority shall be given for curves having persistent bad riding.
(5) Checking of Points and Crossings - He shall inspect once a year all points and crossings on passenger lines and 10 percent of the points and crossings on other lines.
(6) Monsoon Patrolling - When Monsoon Patrolling is introduced he should check the work of Patrolmen at night once in a month, either by Train or by Push Trolley or Motor Trolley
(7) Track on Bridges - The track on Girder Bridges should be inspected as a part of the annual Bridge inspection, besides normal track inspections.
(8) Review of Inspection by Sub-ordinates - He should scrutinize the records maintained by SSE/P.Way
(9) Inspections of LWR/CWR Track - The Assistant Engineer shall inspect the SEJs/Buffer rails provided in the LWR/CWR track once in every six months. He shall check the creep records of LWR/CWR regularly

(10) Night foot plate inspection - He should carry out night inspection once in a month to check alertness of Gatemen/Station staff, patrolmen, stationary watchmen, observance of speed limits by drivers, visibility of signals/ engineering fixed signals/hectometer posts, riding quality etc. Inspection should preferably be done between 00:00 hrs to 04:00 hrs.
(11) Inspection of AT welding site - The Assistant Engineer shall inspect AT welding site as much as possible but at least once in a month.
12- Inspection of ongoing works of construction and other organization e.g. RVNL, etc - He should inspect the works going on in his section as much as possible during Foot plate/Trolley inspection to check quality and safety of the running trains.
Q. No. 6 As an Assist. Officer at a major accident site what duties as AEN required to perform and is what sequence.

Ans: - (a) Protect Train - Any engineering staff available at the site of the accident shall assist the Guard and Driver to protect the train in accordance with the General & S.Rules.
(b) First aid and Rescue -
(c) Advice to nearest Station Master- After a rapid survey of the position, particulars should be sent to the nearest Station Master as in(Para 702) above. In case of controlled sections, a field telephone should be got commissioned at once.
(d) Line Clear examination - If the Engineering official has reached the site and no traffic official is available he should carefully secure the line clear token or ticket and any caution order, where necessary. If the accident has occurred in a station yard, the train register book must be seized and if necessary, statement of staff concerned recorded; if line badges are in use, it should be recorded as to in whose possession each line badge was. The position of block instruments, signals, points, point levers, indicators, keys, etc. should be noted and recorded, jointly with the Inspectors of the other concerned departments, available at site.
(e) Preliminary clearing operation and preservation of clues -
(i) In all instances in which the means taken for the restoration of communication are likely to obliterate marks on the road and other evidence needed at a joint enquiry, the senior official who arrives first on the spot should carefully examine the track, train or vehicle and as soon as possible make notes, sketches etc. and hand over the same to his superior or produce them at the enquiry. He will, when the nature of the accident is such as will involve the question of eye-sight of any of the staff, verify (in case of those permitted to wear glasses) that they had worn glasses at the time of the accident and had carried a spare pair of glasses with them.
(ii) In all cases of accidents, the cause of which might possibly due to sabotage, it is essential that the clearance and restoration operations are not commenced till the Police officials arrive at the site and intimate their agreement to the commencement of clearance and restoration work, after, making thorough investigations.
A factual note of the conditions obtaining at the site prior to restoration work should be prepared and signed jointly by the senior-most Police and Railway officials at the site. In the event of any difference of opinion between the Police and the Railway officials, such difference of opinion may be recorded on the joint factual note.

(iii) In other cases, clearance and restoration operations can commence even before the arrival of the Police and it is not necessary that all the rails, sleepers and fastenings involved in an accident should be preserved, but only those, whether serviceable or otherwise, which bear wheel marks, etc., specially between the points of mount and drop. In all cases of serious derailments, these are

essential for a later reconstruction of the scene and should be preserved and/or recorded by the first responsible official to reach the site of the accident, as these would be valuable evidence to ascertain the cause of the accident.
(iv) After the injured persons have been attended to and arrangements made for the onward journey of the stranded passengers, the Railway officers at the site of the accident should arrange to record the preliminary statements of the staff concerned, as any delay in doing so, might result in some facts being suppressed or some evidence being fabricated during subsequent enquiries.
(v) In case sabotage is suspected, the procedure as outlined in clause (ii) above should be followed. In addition it should be ascertained promptly from the C.R.S. if he would like to inspect the site, etc. before the commencement of clearance and restoration work and then action should be taken in accordance with his wishes. Before clearance and restoration operations are commenced all relevant clues, materials and damages and the deficiencies on Rolling Stock, etc. must be noted and preserved. In other serious accidents, however, the same procedure as outlined in Clause (iii) above should be strictly followed.
(f) Contacting higher officials
(g) Recording of details and advice regarding restoration time - He should arrange to record the details of the accident and prepare notes on any special features bearing on its cause, which may be of help in the enquiry. He should send by any means available and relay a concise report of the accident as per (Para 702) to the nearest Station Master to enable him to issue all concerned message.
(h) Preservation of clues - He should arrange to preserve all clues to enable reconstruction of the scene of the accident as detailed vide (Para 704)
(1) Photographs showing the details of damage to Permanent Way and Rolling Stock at the site of accident should be taken wherever necessary; in case of suspected sabotage, the photographs of the site of the accident showing the damage and possible clues should invariably be taken.
(i) He should get in touch with the Divisional Engineer and the Controller / Chief Controller and furnish complete information advising the details of action being taken and the probable time for restoring through running.

(J) He should arrange to organize the measure for expeditious restoration of through running and ensure incessant working until this is effected.
(K) A preliminary report should be prepared.

Question No-7

a. Explain cannons of financial properties
b. Explain earnest money, Security Deposit, Performance Guarantee, Price Variation clause & Material
Modifications
c. Explain type/category of encroachments in Railway & division fixation of responsibility for encroachments
d. Explain action plan for prevention and removal of encroachments from Railway land.

Ans- (a) Cannons of financial propriety:-

In exercise of their financial powers, the sanctioning authorities must pay due regard to the following principles:-

i) The expenditure should not prime facie be more than the occasion demands and that every government servant should exercise the same vigilance in respect of

expenditure incurred from public money as a person of ordinary prudence should exercise in respect of expenditure of his own money.

ii) No authority should exercise its powers of sanctioning expenditure to pass an order which directly or indirectly be to its own advantage.

iii) Public money should not be utilized for benefit of particular person or section of community unless.

- The amount of expenditure is insignificant.
- A claim for the amount could be enforced in the court of law or
- Expenditure is in pursuance of recognized policy or custom.

iv) The amount of allowances such as travelling allowance to meet the expenditure of particular type, should be so regulated that the allowances are not on the whole sources of profit to the recipients.

b. Earnest money, security Deposit, Performance Guarantee & Price Variance Clause, Material Modification.

i. Earnest Money: - It is a security against loss, in the event of the contractor failing to undertake the contract or to furnish the required security within the appointed time after the acceptance of his tender or until such time as the sums due to him form a sufficient guarantee.

ii. Security Deposit: - Security deposits are to be paid by contractor for the due fulfillment of contracts. The amount of security deposit required will be as under.

iii. Performance Guarantee: - A clause on performance Guarantee was introduced in general conditions of contract by Railway Board in lieu of risk action procedure. This clause stands modified and the procedure for obtaining Performance Guarantee.

iv. Price Variance Clause:-In order to cater for price escalation of labor ad material and also to give equal opportunities to all contractors for competitive ad realistic bidding of tenders. In view of escalation of prices of various items, provision should normally be made in the tender for price variation clause.

v. Material Modification:-

c. i. Type/category of encroachments in Railway

Category	Type of encroachments
Category - A	Encroachments by outsiders, removal of which requires action under Public Premises Eviction Act.
Category - B	Encroachments by outsiders, which do not require action under PPE Act (e.g. temporary occupation of land by hawkers, using Railway land for cattle, cow dung, refuse etc.)
Category - C	Encroachment by Railways staff in the form of temporary huts etc.
Category - D	Encroachment by Railway staff who have been allotted railway accommodation, by way of additions to the structures, unauthorized use of land for cultivation etc.

c-ii. Division fixation of responsibility for encroachments

The following division of responsibility between the station staff and the engineering staff should be observed in regard to encroachments within the station areas:

a) At station, the Station Master is primarily responsible for preventing encroachments and for driving out trespassers by obtaining help from RPF/Police and Section Engineer (Works) as necessary.
b) In the goods shed, the chief Goods Clerk, wherever available, and the Station Master at other places is responsible for preventing encroachments and for driving out trespassers with the help of RPF/Police and Section engineer (Works) as necessary.
c) The responsibility for preventing encroachments and for driving out trespassers in circulating areas of the stations and goods sheds, normally rest with the Station Master or chief goods clerk for their respective areas. They can take the assistance from Engineering and RPF staff, as may be found necessary.

d. action plan for prevention and removal of encroachments from Railway land.

i. Preventive Steps

a) Identification of Vulnerable areas.
b) Construction of boundary wall/fencing in the vulnerable areas.
c) Plantation of Juli Flora or similarly effective bushes in the area.\
d) Ensuring proper maintenance of boundary pillars in the area.
e) Interaction with local authorities for assistance in preventing encroachments in these areas.
f) Joint visits of the vulnerable locations by representatives of concerned departments along with civil authorities with a view to create adequate impression in the locality that Railways are serious in preventing encroachments in the areas.

ii. Eviction Process

a) Identification of the existing encroachments.
b) Ensuring that all the cases under the PPE Act have been filed.
c) Estate Officers should expedite finalization of the cases pending with them.
d) Action for possession in accordance with the extant orders where eviction orders are received.
e) Mobilization of help of Civil Authorities by formal/informal requests at different levels till the required assistance is forthcoming.
f) Cases directed to the courts to be pursued for early finalization with the help of the Railway Advocates.
g) Nominating Traffic, Commercial, Engineering officials as in-charges of specified areas at medium and large sized stations to keep a watch on encroachments and report encroachments incipient or otherwise to the Engineering officials for eviction, if necessary, under PPF Act.
h) Adequate training to be given to the Estate Officers to make them well conversant with the Provisions of the PPF Act, 1971 and also various avenues available to them while dealing with the cases of encroachments. Course contents may include case histories and various relevant court judgments on the appeals against the orders of Estate Officers.
i) RPF to render all help in removal of soft encroachments as and when their assistance is sought. They should also provide assistance in co-ordination with State Police/GRP where cases have been decided by the Estate Officers.

Q. 8 Explain arrangements taken to execute the works for short duration and long duration with sketches

a) Action taken by engineering official in case of Accident

In case of derailments, the first engineering official arriving at the site of accident should take the following action:-

1. Protect the train: - Any Engineering staff available at the site of accident shall assist the guard and driver to protect the train. The Inspector should ensure that protection has been afforded to the train in front and in rear, in the case of double line, if the other lie is also affected by the accident, steps should be taken to protect both the lines. If no infringement exists, trains must be controlled and assed cautiously on the unaffected track.
2. First aid and rescue:- The Inspector should arrange for first aid to injured passengers and railway staff and rescue of trapped person. If there is any Medical practitioner on the train, his assistance should be obtained.
3. Examine the entire site: Examine the entire site inclusive of the track over which the train has passed immediately before derailing, noting down any unusual features observed, especially any part of vehicles or other materials lying on or near the track.
4. Advice to nearest Station Master: - After a rapid survey of the position, particulars should be sent to the nearest station master about the accident. In case of controlled sections, a field telephone should be got commissioned at once.
5. Detailed examination :- carry out a detailed examination of the wheel marks on the rail head, fastenings, sleepers & ballast, the wheel trail marks and the corresponding marks o the wheel sets of derailed and other vehicles to identify the wheel set which derailed first and to establish the initial point of derailment.
6. Dimensional Sketch :- Prepare a dimensioned sketch giving the full particulars of the site of accident including the track leading up to the point of derailment, path followed by derailed vehicles, place of mounting and drop, which pair of wheels and of which vehicles were first derailed and the position at which the derailed vehicle came to a stand.
7. Preserve Clues: Preserve clues which near evidence of wheel marks specially at the point of mount and drop or any other such clues which may help in analyzing the cause of accident. In particular, it should be ascertained whether the derailment has occurred due to flange climbing the rail or due to wheel set suddenly jumping the rail, leaving no mounting marks.
8. Recording of Track Geometry:- Record the details of track and measurement of track geometry in the prescribed manner in presence of representatives of other departments.
9. Gang Charts: - Examine the gang chart to ascertain the date when the track was last attended.
10. Vehicle measurements:- Record the measurement of the vehicle and its deficiency, if any, in the prescribed manner in the presence of representatives of two other departments. Also find out the history of repair of the above vehicle.
11. Operating features:- investigate and record various operating features such as speed, train formation, loading condition of the vehicles etc. and the factors which might contribute to the derailment.
12. Preliminary report :- Make out a preliminary report to be passed on the immediate superior. The report should contain the following information:- 1
    a. The nature of the accident.

ii) Cause, if known

iii) Particulars of loss of life, injuries to passengers and staff,

iv) Extent of damage to Way and Works.
v) Steps taken for resumption of traffic
vi) Probable date and time when normal working I likely to be resumed.
vii) Whether transshipment is necessary and if so, how long
viii) Whether a diversion is necessary and if so, when it is likely to be opened.
ix) Details of any assistance required, such as additional labor ballast train bridging material etc.
x) Follow up Action:- take action to collect men and material to repair the track and restore the traffic. The actual repair work should be started only when the measurements of track have been completed.

Question No- 9:- a. Write Minor & Major Penalties under DAR.
b. Explain brief procedure for imposing major penalty.

(a) Minor & Major Penalties under DAR

The discipline and Appeal Rules which are called "Railway Servants (Discipline and Appeal) Rules, 1968", apply to all Railway servants except casual labor, members of Railway Protection Force & Members of All India Services.

Minor Penalties:-

i) Censure
ii) With-holding of privilege Passes or Privilege Ticket order or both.
iii) With – holding of promotion for a specified period.
iv) Recovery from pay for any pecuniary loss caused to Govt. or Railway administration by negligence or breach of orders.
v) Withholding of increment of pay for a specified period with or without cumulative effect.
vi) Reduction to a lower stage in the time scale of pay for a period not exceeding 3 years without cumulative effect and not adversely affecting the pension.

Major Penalties:-

vii) Reduction to a lower stage in the time scale of pay other than(vi) above
viii) Reduction to a lower time scale of pay, grade, post or service.
ix) Compulsory retirement
x) Removal from service.
xi) Dismissal from service.

b) Procedure for Imposing Major Penalties

i. Issue Memorandum of charges in S.F.5 and provide copies of documents or their inspection.
ii. Obtain and consider statement of defence.
iii. Appoint Inquiry Officer if charges are not admitted. Send record of case to the Inquiry Officer.
iv. Inquire Officer will allow a defence counsel. Perusal and extracting from list of documents relied upon should be permitted. Additional document, where asked for, and are relevant should also be permitted.
v. Inquiry Officer will decide modalities of inquiry defence witnesses to be called for fix calendar for inquiry and sort out other preliminary matters.
vi. The procedure for conducting the inquiry:-

a) The charges will be explained to the employee. Documents may be produced as required.
b) The charged employee will be asked to state if he accept or denies the charge. Also if he will take a defence counsel or will defend his case himself.
c) The prosecution cited in the charge sheet, will be examined, each one separately. Them cross examination of each witness by the charged employee or his counsel. Reexamination on any point of cross-examination, if necessary.
d) The defence witnesses, if any, may then be examined, cross-examined and re-examined.
e) The charged employee will be permitted to submit his defence.
f) Inquiry authority may question the charged employee on the circumstances appearing against him in the evidence.
g) The charged employee will be permitted to file written briefs.

vii. Based on the evidence on record, the Inquiry Officer shall draw his findings and inquiry report and send it along with records of case and records of inquiry to the Disciplinary authority.

viii. A copy of the Inquiry Report should invariably be given to the charged employee and his defence. If submitted should be considered before any further action is taken.

ix. A copy of the Inquiry Report should invariably be given to the charged employee and his defence. If submitted should be considered before any further action is action is taken.

x. The Disciplinary authority shall consider the report and may accept it or draw its own finding or remit it or ask for fresh inquiry.

xi. If it is decided to impose a penalty which is within its competency authority.

Q.No.10 . Describe in details procedure for removal of track man from service including appeals, reviews etc.

Due to following activities, a railway servant (trackman) may be removed from service after following procedure— Due to act of omission/commission, the administration took the decision to take up any railway servant under D &A R, a show cause notice is served upon the employee giving him opportunity to say against the charges.

After receiving his explanation, the competent authority, if find suitable serve him major penalty chart sheet (SF-5) .provide copies of documents of their inspection with Annexure I, ii, iii & iv.

1. No order imposing any of the penalties of removal from service shall be made except after an inquiry held,

2. Whenever the disciplinary authority is of the opinion that there are grounds for inquiring into the truth of any imputation of misconduct or misbehavior against a Railway servant, it may itself inquire into, or appoint I.O

3. Where it is proposed to hold an inquiry against a Railway servant, the disciplinary authority shall draw up - (i) the substance of the imputations of misconduct or misbehavior into definite and distinct articles of charge; (ii) a statement of the imputations of misconduct or misbehaviour

in support of each article of charge which shall contain - (a) a statement of all relevant facts including any admission or confession made by the Railway servant; (b) a list of documents by which, and a list of witnesses by whom, the articles of charge are proposed to be sustained.

4. The disciplinary authority shall deliver or cause to be delivered to the Railway servant a copy of the articles of charge, the statement of the imputations of misconduct or misbehaviour and a list of documents and witnesses by which each article of charge is proposed to be sustained and shall require the Railway servant to submit a written statement of his defence within ten days or such further time as the disciplinary authority may allow.

5. The Railway servant may, for the purpose of his defence submit with the written statement of his defence, a list of witnesses to be examined on his behalf.

6. (i) On receipt of the written statement of defence, the disciplinary authority shall consider the same and decide whether the inquiry should be proceeded with under this rule. (ii) Where the disciplinary authority decides to proceed with the inquiry it may itself inquire into such of the articles of charge as are not admitted (iii) Where all the articles of charge have been admitted by the Railway servant in his written statement of defence, the disciplinary authority shall record its findings on each charge, after taking such further evidence as it may think fit and shall act in the manner laid down in Rule . If no written statement of defence is submitted by the Railway servant, the disciplinary authority may itself inquire into the articles of charge or may, if it considers it necessary to do so, appoint, under sub-rule (2) an inquiring authority for the purpose and also inform the Railway servant of such appointment. (c) Where the disciplinary authority itself inquires into an article of charge or appoints a Board of Inquiry or any other inquiring authority for holding an inquiry into such charge, it may, by an order in writing, appoint a railway or any other Government servant to be known as Presenting Officer to present on its behalf the case in support of the articles of charge.

7. The disciplinary authority shall, where it is not the inquiring authority, forward to the inquiring authority - (i) a copy of the articles of charge and the statement of the imputations of misconduct or misbehaviour; (ii) a copy of the written statement of defence, if any, submitted by the Railway servant; (iii) a copy of the statement of witnesses, if any, referred to in sub-rule (6); (iv) evidence proving the delivery of the documents referred to in sub-rule (6) to the Railway servant; (v) a copy of the order appointing the Presenting Officer, if any; and (vi) a copy of the list of witnesses, if any, furnished by the Railway servant.

8. The Railway servant shall appear in person before the inquiring authority on such day and at such time within ten working days from the date of receipt by the inquiring authority of the order appointing him as such, as the inquiring authority may, by a notice in writing, specify in this behalf, or within such further time not exceeding ten days, as the inquiring authority may allow.

9. The inquiring authority shall, if the Railway servant fails to appear within the specified time, or refuses or omits to plead, require the Presenting Officer if any, to produce the evidence by which he proposes to prove the articles of charge and shall adjourn the case to a later date not exceeding thirty days, after recording an order that the Railway servant may for the purpose of preparing his defence, give a notice within ten days of the order or within such further time not exceeding ten days as the inquiring authority may allow for the discovery or production of any documents which are in possession of Railway Administration .

The Railway servant may represent his case with the assistance of any other Railway servant (including a Railway servant on leave preparatory to retirement) working under the same Railway Administration, subject to whose jurisdiction and control he is working. He cannot engage a legal practitioner for the purpose, unless the Presenting Officer appointed by the disciplinary authority is a legal practitioner or the disciplinary authority having regard to the circumstances of the case, so permits (b) The Railway servant may also present his case with the assistance of a retired Railway servant, subject to such conditions as may be specified by the President from time-to-time by general or special order in this behalf. A non-gazetted Railway servant may take the assistance of an official of a Railway Trade Union, recognized by the Railway Administration under which the Railway servant is employed, to present his case before an inquiring authority but shall not engage a legal practitioner.

12. The inquiring authority shall, on receipt of the notice for discovery or production of documents, forward the same or copies thereof to the authority in whose custody or possession the documents are kept with a requisition for the production of the documents by such date as may be specified in such requisition: Provided that the inquiring authority may, for reasons to be recorded by it in writing, refuse to requisition such of the documents as are, in its opinion, not relevant to the case.

13. every authority having the custody or possession of the requisitioned documents shall produce the same before the inquiring authority by the specified time: Provided that if the authority having the custody or possession of requisitioned documents is satisfied for reasons to be recorded by it in writing that the production of all or any such documents would be against the public interest or security of the State, it shall inform the inquiring authority accordingly and the inquiring authority shall, on being so informed, communicate the information to the Railway servant and withdraw the requisition made by it for the production or discovery of such documents.

14. On the date fixed for the inquiry, the oral and documentary evidence by which the articles of charge are proposed to be proved, shall be produced by or on behalf of the disciplinary authority. The witnesses shall be examined by or on behalf of the Presenting Officer, if any, and may be cross-examined by or on behalf of the Railway servant. The Presenting Officer, if any, shall be entitled to re-examine the witnesses on any points on which they have been cross-examined, but not on any new matter without the leave of the inquiring authority. The inquiring authority may also put such questions to the witnesses as it thinks fit.

15. If it shall appear necessary before the close of the case on behalf of the disciplinary authority, the inquiring authority may, in its discretion, allow the Presenting Officer, if any, to produce evidence not included in the list given to the Railway servant or may itself call for new evidence or recall and reexamine any witness and in such cases the Railway servant shall be entitled to have, if he demands it, a copy of the list of further evidence proposed to be produced and an adjournment of the inquiry for three clear days before the production of such new evidence exclusive of the day of adjournment and the day to which the inquiry is adjourned. The inquiring authority shall give the Railway servant an opportunity of inspecting such documents before they are taken on the record. The inquiring authority may also allow the Railway servant to produce new evidence if it is of the opinion that the production of such evidence is necessary in the interest of justice.

16. When the case for disciplinary authority is closed, the Railway servant shall be required to state his defence orally, or in writing, as he may prefer. If the defence is made orally it shall be recorded and the Railway servant shall be required to sign the record. In either case a copy of the statement of defence shall be given to the Presenting Officer, if any.

(17) The evidence on behalf of the Railway servant shall then be produced. The Railway servant may examine himself in his own behalf, if he so prefers. The witnesses produced by the Railway servant shall then be examined by or on behalf of him and shall be cross-examined by or on behalf of the Presenting Officer, if any. The Railway servant shall be entitled to re-examine the witnesses on any point on which they have been cross-examined, but not on any new matter, without the leave of the inquiring authority. The inquiring authority may also put such questions to the witnesses as it thinks fit.

(18) The inquiring authority may, after the Railway servant closes his case, and shall, if the Railway servant has not examined himself, generally question him on the circumstances appearing against him in the evidence for the purpose of enabling the Railway servant to explain any circumstances appearing in the evidence against him.

(19) The inquiring authority may, after the completion of the production of evidence, hear the Presenting Officer, if any, and the Railway servant, or permit them to file written briefs of their respective cases, if they so desire.

(20) If the Railway servant, to whom a copy of the articles of charge has been delivered, does not submit the written statement of defence on or before the date specified for the purpose or does not appear in person before the inquiring authority or otherwise fails or refuses to comply with the provisions of this rule, the inquiring authority may hold the inquiry ex parte.

(21) Whenever any inquiring authority, after having heard and recorded the whole or any part of the evidence in an inquiry ceases to exercise jurisdiction therein and is succeeded by another inquiring authority which has, and which exercises, such jurisdiction, the inquiring authority so succeeding may act on the evidence so recorded by its predecessor, or partly recorded by its predecessor, and partly by itself: Provided that if, the succeeding inquiring authority is of the opinion that further examination of any of the witnesses whose evidence has already been recorded is necessary in the interest of justice, it may recall, examine, cross-examine and re-examine any such witnesses as hereinbefore provided.

(22)(i) After the conclusion of the inquiry, a report shall be prepared and it shall contain - (a) the articles of charge and the statement of imputations of misconduct or misbehaviour; (b) the defence of the Railway servant in respect of each article of charge; (c) an assessment of the evidence in respect of each article of charge; and (d) the findings on each article of charge and the reasons therefor.

(ii) The inquiring authority, where it is not itself the disciplinary authority, shall forward to the disciplinary authority the records of inquiry which shall include - (a) the report prepared by it under clause (i); (b) the written statement of defence, if any, submitted by the Railway servant; (c) the oral and documentary evidence produced in the course of the inquiry; (d) written briefs, if any, filed by the Presenting Officer, if any, or the Railway servant or both during the course of the enquiry; and (e) the orders, if any, made by the disciplinary authority in regard to the inquiry.

10. Action on the inquiry report :- (1) If the disciplinary authority:- (a) after considering the inquiry report, is of the opinion that further examination of any of the witnesses is necessary in the interests of justice, it may recall the said witness and examine, cross-examine and re-examine the witness; (b) is not itself the inquiring authority may, for reasons to be recorded by it in writing, remit the case to the inquiring authority for further inquiry and report and the inquiring authority shall thereupon proceed to hold further inquiry according to the provisions of rule 9, as far as may be. (2) The disciplinary authority:- (a) shall forward or cause to be forwarded a copy of the report of the inquiry, if any, held by the disciplinary authority or where the disciplinary authority is not the inquiring authority a copy of the report of the inquiring authority, its findings on further examination of witnesses, if any, held under sub-rule(1) (a) together with its own tentative reasons for disagreement, if any, with findings of the inquiring authority on any article of charge to the Railway Servant, who shall be required to submit, if he so desires, his written representation or submission to the disciplinary authority within fifteen days, irrespective of whether the report is favourable or not to the Railway Servant; 14 (b) shall consider the representation if any, submitted by the Railway Servant and record its findings before proceeding further in the matter as specified in sub-rules (3), (4) and (5). (3) Where the disciplinary authority is of the opinion that the penalty warranted is such as is not within its competence, he shall forward the records of the inquiry to the appropriate disciplinary authority who shall act in the manner as provided in these rules. (4) If the disciplinary authority having regard to its findings on all or any of the articles of charge, is of the opinion that any of the penalties specified in clauses (i) to (iv) of rule 6 should be imposed on the railway servant, it shall, notwithstanding anything contained in rule 11, make an order imposing such penalty: Provided that in every case where it is necessary to consult the Commission, the record of the inquiry shall be forwarded by the disciplinary authority to the Commission for its advice and such advice shall be taken into consideration before making any order imposing any penalty on the Railway Servant. (5) If the disciplinary authority, having regard to its findings on all or any of the articles of charge and on the basis of the evidence adduced during the inquiry, is of the opinion that any of the penalties specified in clauses(v) to (ix) of rule 6 should be imposed on the railway servant, it shall make an order imposing such penalty and it shall not be necessary to give the railway servant any opportunity of making representation on the penalty proposed to be imposed: Provided that in every case where it is necessary to consult the Commission, the record of the inquiry shall be forwarded by the disciplinary authority to the Commission for its advice and such advice shall be taken into consideration before making an order imposing any such penalty on the railway servant". rules;

1. Long absent.
2. Miss conduct.
3. Action attributable to untoward incident.
4. Involved in criminal case.
5. Convicted by court of law as the case may be.
6. Providing wrong/misinformation at the time of recruitment.
7. Any other activities fit for his removal.

Following standard forms are used under D & AR action-

SF-5 –Annexure I, II, III, IV.

SF-7 –To appoint Inquiry officer.

SF-8 – To appoint defence helper.

Enquiry report is given to servant by disciplinary athourity

After his submission against EO report disciplinary athourity.

Issue NIP with appeal review/ revision mercy appeal.

The procedure for conducting the inquiry:

- The charges will be explained to the employee. Documents may be produced as required.
- The charged employee will asked to state if he accepts or denies the charges, will take defence counsel or will defend his case himself.
- The prosecution witnesses, cited in the charge sheet will be examined. Then cross examination of each witness by the charged employee or his counsel. Examination on any point of cross-examination, if necessary.
- The defence witness, if any may then be examined, cross- examined & reexamined.
- The charge employee will be permitted to state his defence.
- Inquiry authority may question the charged employee in the circumstances appearing against him in the evidence.
- The charged employee will be permitted to state his defence.
- P.O. brief is submitted to EO who further give to CO who will submit his attendance against P.O brief.

Based on evidence on record, on record, the inquiry officer shall draw his finding & inqury report &send along with records of case & records of enquiry to the Disciplinary Authority.

A copy of the inquiry reports should invariably given to the charged employee & his defence should be considered before any further action is taken.

The disciplinary authority shall consider the report and may accept it or draw its own finding or remit it or ask for fresh inquiry.

If it is decided to impose a penalty which is In within its competence, the disciplinary authority shall issue notice of imposition of penalty, otherwise forward the case to competent authority.

APPEAL:

- The appeal against punishment lies to the appellate authority who is usually the nest higher authority to whom the disciplinary authority is subordinate.
- The limitation is a period of 45 days from the date of order of punishment. Delay on sufficient causes may be condoned.
- A single person should appeal in his own name. The appeal should be addressed to the appellate authority only. It should not be in a improper language.
- In case of major penalty subordinate staff , a reasonable opportunity will be given to make a representation.
- Normally there is no second appeal. It is permitted only I case of group “D” staff who has been dismissed, removed or compulsory retirement.

REVISION: A Group 'D' Railway servant, who has been dismissed, removed or compulsorily retired from service may, after his appeal to the appropriate appellate authority has been disposed of and within 45 days thereafter, apply to the Divisional Railway Manager and where he is not under the control of any Divisional Railway Manager to the senior-most Administrative Grade Officer under whose control he may be working, for a revision of the penalty imposed on him. The Divisional Railway Manager or the senior-most Administrative Grade Officer, as the case may be, shall thereafter dispose of the revision application in accordance with the procedure laid down in Rule 25 and pass such orders as he may think fit: Provided that the procedure mentioned in this sub-rule shall not apply where the Divisional Railway Manager or the senior-most Administrative Grade Officer or any higher authority, as the case may be, is the appellate authority: Provided further that where a revision application has been disposed of by the Divisional Railway Manager or the senior-most Administrative Grade Officer under this sub-rule, no further revision shall lie under Rule 25.

- No revision can be made after more than six months of the date of order to be revised, of it was proposed to enhance the penalty or modify it to the detriment of the employee. It will not be made after more than one year if the penalty was to be reduced or cancelled. These time limit don not apply if revision was to be made by president or ministry or the chief executive.
- The decision in revision cases may be similar to those in appeal cases. Reasonable opportunity will be given in case of enhancement of punishment.

REVIEW:

Where a new fact come to notice which is likely to affect substantially the decision in the case, the president of India may review the case. President may make this review at any time on his own motion or on a reference made to him. He may pass any orders I the case as deemed fit. If it proposed to enhance the penalty, a reasonable opportunity will be given to the employee to submit his representation.

Special provisions for non-gazetted staff - (1) Where the penalty of removal has been imposed, the appellate authority may, at its discretion and if it considers it necessary, give the non-gazetted Railway servant a personal hearing before disposing of the appeal.

The President may at any time either on his own motion or otherwise review any order passed under these rules when any new material or evidence which could not be produced or was not available at the time of passing the order under review and which has the effect of changing the nature of the case has come or has been brought to his notice: Provided that no order imposing or enhancing any penalty shall be made by the President unless the Railway servant concerned has been given a reasonable opportunity of making a representation against the penalty proposed or where it is proposed to impose any of the major penalties specified in Rule 6 or to enhance the minor penalty imposed by the order sought to be reviewed to any of the major penalties and if an enquiry under Rule 9 has not already been held in the case, no such penalty shall be imposed except after inquiring in the manner laid down in Rule 9, subject to the provisions of Rule 14 and except after consultation with the Commission where such consultation is necessary

He may knock the door of justice also against punishment imposed.

LAND

Q.1 Write the short notes on the following terms:

i) Lease and license

ii) Security deposit in case of land licensed to outsiders.

iii) Way leave facilities/easement rights

iv) Exchange of railway land

v) Demarcation of railway land

Ans:

i) Lease and License:

Railway land is given out on license only. Request of Government Department for lease may considered on merit. Leasing of land is not permitted except in case where it is approved by Railway Board. For Railway land leased/licensed to other Government Departments, the rent should be 6% of market value of land as assessed by Local Revenue Authorities at the time of leasing/licensing.

ii) Security deposit in case of land licensed to outsiders.

Agreement should provide following details:

Recovery of occupation fees monthly in advance.

Payment of security deposit, equivalent to 12 months occupation fees.

When the duration is one year or more, the 12 months occupation fees should be recovered in advance every year with the grace period of one month.

When the duration is less than one year, full fees for the period should be recovered in advance.

In case payment of occupation fees is not made within a further period of three months, the Government shall forfeit the security deposit

iii) Way Leave Facility/Easement Rights:

Way leave facility/Easement rights from railway land involve occasional or limited use of land by a party for a specified purpose i.e. passage etc without conferring upon the party any right of possession or occupation of land without in any way affecting the Railways title, possession, control and use of land. Requests are often received for provision of way leave/easement rights on railway land in the form of passage/access to private houses and establishments of underground pipelines for water supply and sewerage, electric & telecommunication lines. In case these are unavoidable in view of the very nature and extent of railway alignment.

iv) Exchange of Railway land:

A Railway Administration may at its discretion effect an equitable exchange of land in its occupation for other land equally suited to their requirements with or without a monitory adjustment, the method of transfer following with necessary changes that prescribed for disposal of land.

v) Demarcation of Railway land

All land permanently occupied for the purpose of Railway land shall have its boundaries defined on ground.

For this purpose boundary of Railway land may be defined by a continuous wall, fence, posts or pillars.

Where the boundary mark is continuous, boundary of Railway land will to be on the outer edge of wall, fence, posts etc.

Where detached marks, such as isolated posts are used boundary of Railway land will pass along outside of such posts, between the marks, the boundary will in each case be taken in a straight line from outside of one mark to outsider of other mark.

Detachment marks should in no case be at a greater distance apart (center to center) than one fifth of Km (200m). They should be of a substantial character not easily destroyed or removed.

Each detached boundary mark should bear a number.

Where a fence, wall or ditch is situated at some distance within the boundary and does not mark the actual limit of railway land, it will be necessary to have actual boundary of Railway land properly marked and defined in accordance with these rules.

Q.2 what is the procedure for acquisition of land, describe in detail?

Ans-

Following procedure will be adopted for land acquisition.

Application: Whenever land is required for Railway purposes an application should first me bade direct to Revenue Officer In charge of District in which the land is situated for statement of value of land and a draft declaration for acquiring it.

Application should set forth clearly the purpose for which land is required and should have the complete set of land plans prepared in accordance. When the work of acquisition extends to more than one district lies within the one division application should be made to Commissioner when in more than one division to the Chief Revenue Authority of State.

For better identification of land in cases where the areas to be taken up are expensive, following details should be given to State Government:

i) Name of the Railway

ii) Copy of Order of Government when necessary

iii) Brief description of route to be followed by Railway

iv) A list of Civil districts in which the land will be required for the purpose Revenue Officers' estimate of cost of land:

On receipt of application from Railway Administration a responsible Revenue Officer will forward to Railway Administration a statement showing the nearest approximate cost of land also a draft declaration under section'6' of Land Acquisition Act on which it should be recorded there is no objection to acquisition of land.

When the estimated value of land exceeds Rs 25,000 in any one district or one lac in any division, it is necessary that the data should be countersigned by the Commissioner in which land is situated or Chief Revenue Authority of State respectively.

Statement of data received from Revenue Authority should be taken as representing the value of land, exclusive of tenants rights but exclusive of value of houses, trees, standing crops etc on the land the approximate cost of which should be separately furnished by Revenue Authority. With the information in land the Railway Administration should proceed to frame an estimate (it should be specially mentioned whether or not the land estimate have been prepared from data furnished by Revenue Authority) of total cost of acquisition in detail the additional 15% laid down in section 23(2) of land Acquisition Act on market value of land under section 23 (1) Clause-1 of that Act. Railway Administration Land Estimates:

It should have the following information:

a)Value of Land:

(i)Waste (ii) Arable (iii) Homestead (iv) Bazar

b)Value of:

(i)Masonry House(ii)Trees(iii)Thatched House(iv)Standing Crops.

Add additional 15% compensation under section 23(2) on the market value of land including houses, trees and crops. Add market value of Government land taken up Add damage under clauses 2 to 6 of Section 23(1)Add capitalized value of land revenue (when necessary).Add cost of establishment (when necessary)Add contingencies Sanction to land Estimates :General Manager or any other officer duly empowered to sanction the estimate will than accord sanction and allot necessary funds and forward the estimate duly signed Accounts Office together with the draft declaration and duly signed plans and schedules to the State Government for taking necessary steps for acquisition of land. If the sanction of Railway Board is necessary to estimated cost of land Railway Administration should apply for and obtain that sanction before applying to State Government for acquisition of land. Work bonafide Railway Purpose: As a general rule land may not be acquired except in connection with a duly sanction work but this rule does not debar the acquisition of land for bonafide Railway purposes.

In case of urgency Railway Administration are empowered to depart from ordinary rule stated in the previous paragraph and sanction the acquisition of land prior to preparation and sanction of

estimate either for work or the land, provided the total probable cost of work is within the power of Railway Administration to sanction.

Q.3 Write the short notes on the following:

i) Short term licensing

ii) Safety Zone

iii) Digitization of land plan

iv) Reporting responsibilities within Railway premises;

Ans :- (i)Short Term Licensing:

Temporary licensing of land for conducting exhibitions, melas, carnivals, circus shows and such other cultural activities including temporary shops on such festive occasions should be permitted subject to maximum of three months with the personal approval of General Manager. The power is not to be delegated to other lower authority. Rate of license fee should be fixed at 20% of market value of land for shopping etc however, when more than one party is involved, open auction may be done to fetch better value.

(ii)Safety Zone:

Land within the 15 meters on either side of the center line of extreme future track called safety zone. Safety Zone should be free from any encroachment. However, in area coming under Mumbai Urban Transport Project (MUTP) it is the land within 10 m on either side of center line of extreme future track.

(iii)Digitization of Land Plans:

Digitization is the method of converting manually drawn plans drawings, etc in electronic form with the help of Auto CAD and/or scanner so that it is easy for storage updating of plans /drawings. Development of vision LIS (Land Information System) 2000 is very useful for computerization of land plans certified and updated map of Railway land/boundary are available. Digitization will stand security in court of law and helps in easy identification of funds, calculating area and other land management needs.

(iv) Reporting responsibilities within Railway premises:

Responsibility for reporting of new encroachments will be as follows:

(i)Within station premises including goods sides

(a)Station Manager/Station Master In charge he will advise such cases through numbered control message to MTS/Engineering Control through SCNL.

(b)Goods Supervisor, wherever posted for Goods shed area.

(c)SSE/Works will provide approved plan/diagrams of Station premises indicating clearly Railway boundaries to SM/GS

(ii)Within the Colony premises:

(a)At the HQ of (Sr.) Section Engineer/Works

(b)At the non headquarters station of (Sr.) Section Engineer/Works, wherever RPF Inspector is available: RPF Inspector.

(c)At other colonies: (Sr.) Section Engineer/Works Incharge (iii)In between stations: Sr. Section Engineer(P.Way) In charge(iv)In areas other than (i) (ii) & (iii): Sr. Section Engineer/Works.

Q.4 Describe the category of encroachments?

Ans. There are four categories of encroachments over the Railways. These are A,B, C& D categories. Category 'A' encroachment is of hard type and category 'B', 'C' & 'D' encroachments of soft type. Category-A: Encroachment by outsiders in the form of cemented structures or other pucca structures. Removal of 'A' category encroachment requires action under PPE Act-1971.

Category-B:Encroachment by outsiders in the form of easements e.g. temporary occupation of land by hawkers, using railway land for cattle, cowdungs, refuge, opening doors towards railway premises etc.) Which do not require action under PPE Act for removal? Such type of encroachments may be removed in consultation and with the assistance RPF, Station Master and Local Civil Authorities.

Category-C: Encroachments by Railway employees in form of huts etc who have not allotted Railway accommodation. D&AR action should be taken to remove such type of encroachments as per Railway Board's letter No. 90/LM(L)/14/34 dated 9.3.1990.

Category-D: Encroachments by Railway employees having railway accommodation and have encroached railway land in the form of extension of structures unauthorized use of land for keeping animals etc. D&AR action should be taken against such encroachers to remove as per Railway Board's letter No. 90/LM(L)/14/34 dated 9.3.1990.

Q.5 Describe the licensing of Railway land to Welfare Organization, Private School etc.

Ans.(a) For Railway land to license to temple committee, Railway co-operative stores, co-operative societies, handicrafts centers and other welfare organizations a nominal fee as per extant rules should be recovered.

(b) The license of Railway land for education purpose will require the sanction of Railway Board for privately owned school, Kendriya vidayalas etc. nominal fee should be charged. The nominal fee should be levied as per extant rules. The period of lease for railway land required by the State Government for opening of new schools for children of railway employees should not exceed 30 years. In case of Railway land leased to Kendriya Vidayalaya the lease period will be 99 years.

Q.6 Describe the procedure for disposal of surplus land?

Ans. When it has been decided that a certain or surplus area of the Land is no longer required by any department of railway and that it is therefore eligible for disposal the following procedure should be adopted.

1. If the land adjoins or in near vicinity belonging to any other Railway or Deptt. of Central Government it should first be offered. If one of these desires to acquire it a formal record of transfer should be made.

2. The State in which the surplus land is situated will be given the option of assuming possession of the whole portion. There of subject to following conditions.

a) Central Government themselves shall be the judge of whether they require to retain any particular land or not.

b) State Government desires to assume possession of land the option to do shall be exercised within 6 months)Amount payable for land will be market value at the date of transferred)If the State Government do not desire to assume possession of any land Central Government will be free to dispose it of to a third party. Government will consult the State Government as to the levy of ground rent and conditions if any subject to which it should be sold and they will, as far as possible dispose of the land.

3. If State Government is unwilling to ensure possession the land should be disposed of to the best advantage.

4. If no any department desires to acquire the land then the Railway men's Co-operative Society requested for the same land can berelinquished after obtaining necessary clearance from the respective State Government.

5. If neither Railway nor a department of Central Government nor theState Government desire to acquire the land, the land should be retained by the Railway Administration.

Q.7 Define in detail regarding extension of plot of land, change of ownership etc?

Ans. Following steps to be considered in case of extension of plot of land and change of ownership.

In case where plot holders are running their business on behalf of original licensees on power of attorney, the present plot holder may be asked to apply a fresh for allotment of the same in their name. The rate of license fee should be fixed at 20% of market value of land as provided in Board's letter No. 83/W2/LM/18/87 dated29.8.1995 (from 1.4.95 to 31.3.14) and at 10% (from1.4.04 onwards) as per master circular dated 10.2.05, subject to realization of all outstanding dues with 7%interest before entering into fresh agreement as one time exception with the condition that plot/shop should not be transferred or sold on power of attorney to anyone. Any violation in this regard would be viewed seriously.

In cases where original licensees are originally unfit to perform their functions, the ownership may be transferred to the legal heir subject to the verification of the unfitness from a Government Hospital and furnishing of legal heir certificate The transfer however, will be as per the latest terms and conditions whenever the identity of legal heir is not established, the license should be cancelled.

Regarding extension of area of existing plot/stall it is clarified that in view of the ban on licensing of land for the purpose not connected with Railway working no further extension can be allowed.

Q.8 Describe the terms and condition for utilization of railway land for Grow more food?

Ans.:- Railway Land can also be allotted to Group 'C' & 'D' railway employee with the following terms and conditions.

Railway land in urban area under threat of encroachment should be licensed for cultivation.

Preference should be given to SC, ST, OBC and economically weaker section of society.

Before allotment it should be ensured that land would not be required for railway in nears future.

Land should not be licensed to outsider or State Govt. or State Undertakings.

Size of plot should be from 1 to 3 acres. On specific request unto 5 acres may be allotted.

Suitable agreement should be signed by Rly. and allot tee and that plot should not be transferred to other employee or outsider.

An undertaking should be taken from employee that the official duties should not be suffered on account of such activity for cultivation.

An NOC from the Engg. Department should be obligatory before payment of settlement dues.

No licensed should be issued to employee who have less than 5 years of service left and license must be taken back at least 3 years before the due date of retirement.

Period of licensing should not exceed 5 years at the stretch to any particular employee.

The initial licensing for 2 years shall be issued by division and subsequent extension after recovery of license fee can be done by AEN unto total maximum period of 5 years.

Water arrangement shall be made by licensee on his cost.

Rly. Administration shall have every right to inspect the premised at any point of time.

License fee may be fixed according to the needs and merit of each case. License fee may be revised by DRM in consultation with Sr.DAO every year.

License fee for every year should be recovered in full in advance along with security deposit before renewal of license.

Details of plots licensed under this scheme should be maintained byIOW/AEN for his jurisdiction, also in divisional Headquarters.

The registers in the office of IOW, AEN should clearly indicate the location area, allotted the authority letter for initial license, the approval of extension of license granted and details of monies paid as license fee. Authority for extension being with the AEN. The AEN shall personally ensure that the register the maintained up to date.

Q.9 Describe the procedure to take up the action under PPE Act. 1971?

Ans.:- A hard type encroachment in the form of cement structure falling under category 'A' of encroachment should be removed under PPE Act 1971.

Section 10A:- Appointment of Estate Officer.

A Gazetted officer of Rly. Administration may be appointed as Estate Officer &should be notified in gazette by Central Govt. for purpose of PPE Act proceedings.

Section 10B:- Eviction from Railway Land.

If the force has a prima facie reason to believe that the person has occupied Rly Land within a period of 6 months. It shall file an application before Estate Officer as the case may be seeking an order to enter such Rly. Land & to remove such person.

If the estate Officer after making such inquiry as he deems expedient in the circumstances of the case, is satisfied that any person who were allowed occupation of any Rly. land, temporarily or on contract basis or by virtue of its appointment are in unauthorized occupation of said Rly. land. It may for the reason to be recorded in writing make an order for eviction of such person forth with and there upon if such persons refuse or fail to comply with said order of eviction he may evict them from the premises and take possession thereof and may for that purpose take the help of RPF as may be necessary.

When the force intends to enter the Rly. land to remove the encroachment it shall make an application to the State Officer for seeking permission to enter the such Rly. Land and Estate Officer after satisfying himself may grant such permission to the officer of force not below the rank of Sub inspector.

Section 10C:- Power to remove unauthorized construction.

No person shall erect or place any building on Rly. land except in accordance with authority under which he was allowed to occupy Rly. Land.

If the building or immovable structure have been place Estate Officer should serve a notice asking the encroacher to remove the structure within 7 days of notice. On refusal of such person to remove the encroachment Estate Officer shall direct the force to remove the encroachment.

When erection of Building or execution of work have been started or is being carried on or has been completed Estate Officer may in addition to any other action that may be taken under this act. Make an order for reason to be recorded and directing that such a erection shall be demolished by the personate whose instance the erection has been started or carried on or has been completed.

It will be lawful for the Estate Officer at any time before or after making an order of demolition under the aforesaid sub-section to make an order directing the sealing of such a erection.

No person shall remove such seal except under an order of Estate Officer or under an order of appellate officer. APPEAL: An appeal shall lie from any order of Estate Officer made in respect of railway line to railway claims tribunal having territorial jurisdiction over the area in which railway land is situated within a period of 30 days from such order provided that tribunal may entertain the appeal after the expiry of said period. If it is satisfy that the appellant was prevented by sufficient cause from filing the appeal in time. Passing of order: EO may pass the order to give such direction as may be necessary to give effect to its order to remove the encroachment. Execution of order: When the EO passes the order to remove the encroachment the person shall comply immediately with such direction and handed over the possession to railway administration otherwise EO shall direct the RPF to take the possession and delivered the same to railway administration.

Q.10 Procedure order for detection, Prevention and removal of encroachments?

Ans: - Following action will be taken for prevention, detection and removal of encroachments on Railway land by staff of various departments.

1. LAND RECORDS AND REGISTERS:

1.1 A register of total Railway land with up-to–date entries shall be maintained by the section engineer (concerned) of the Engineering department for the section concerned. A copy of the land plans, complete and up-to- date, will be available in the DRM's office. Clear instructions to this effect as available in paras 806 & 807 of the IRWM (2000 edition), shall be strictly followed

1.2 DEMARCATION OF LAND BOUNDARIES: Boundary pillars shall be maintained, projecting about 500 mm above ground and as per details given in Paras 1047&1048 Engineering code (Revised Edition 1993) and paras 808-811 (i) of IRWM (2000 edition) for proper maintenance of Railway boundaries.

1.3 Printed land Boundary Verification Register showing details of encroachments and missing boundary stones shall be maintained by Section Engineer (Woks /P.Way concerned) of the Engineering Department. Entries should be made in the register maintained by the Section Engineer of the sections and verification of the same should be done periodically by the AENs / DENs /SrDENs as per para 813 (d) of IRWM(2000 edition).

1.4 Each Section Engineer should have a list of encroachments, location wise, as per para 2.2 below and para 813 (d) of IRWM (2000 edition), and copy of the same is to be furnished to the

local police station and also the concerned GRP station. This list should be updated as on 1 st April every year & circulated as above.

2 . TYPE OF ENCROACHMENTS:

2.1 Encroachments may be classified under different categories as specified in para 814 (d) of IRWM (2000 edition).

2.2 A typical proforma may be followed by each sectional Section Engineer (concerned) showing the details of encroachments as under:

Details of encroachments:

Section ————- Divn ———— Sub Divn ————HQ ———

2.3 If the encroacher is a railway employee, detailed particulars should be prepared mentioning the employee's name, designation and department and controlling officer / supervisor, and forwarded to the concerned departments along with the details of encroachments by the Section Engineer (Woks/ P.Way /other)

3 . PREVENTION OF ENCROACHMENTS:

3.1 RESPONSIBILITY FOR PREVENTION OF NEW ENCROACHMENTS:

Responsibility for prevention / reporting of new encroachments will be as given below.

(i) With in station premises: Lies with the SM jointly with concerned RPF Inspector and senior most RPF officials at that station, where no RPF Inspector is posted.

(ii) With in/ around the colony premises: Lies with the concerned Section Engineer (Works) jointly with concerned RPF Inspector and senior most RPF official at that station ,where no RPF Inspector is posted .
(iii) In between stations: Lies with the concerned Section Engineer (Works /P.Way) and RPF official
(iv) In /around Loco sheds: Lies with the nominated Section Engineer of the loco shed and RPF Inspector.
(v) In/around carriage & wagon depots: Lies jointly with nominated Section Engineer of the depot and RPF official
(vi) In/around workshops: Lies jointly with the nominated Section Engineer (of the department to which the workshop belongs) of the workshops and RPF official

3.2 . All out efforts should be made to ensure that no new encroachment takes place. Proper maintenance of land boundary is the first and effective step towards prevention of encroachment. Boundary wall and fencing should invariably be erected in places where land is vulnerable to encroachment or costly. Divisional Railway Manager will be responsible for deciding the nature of boundary structure (Fencing or tree row or continuous wall or ditch etc) for each area based

on cost and vulnerability of land. Detailed directives are available in paras 1047&1048 Engineering code (Revised Edition 1993) and paras 808-811(i) IRWM (2000 Edition) in this regard.

3.3. Immediate action should be taken by the officials specified in para 3.1, where encroachment is incipient and /or is in the progress. It is easier to prevent encroachment at this stage by awareness, persuasion, watch and ward, show of force etc. Station Masters shall take the help of his staff, and persuade the encroacher to dismantle or vacate the Railway land within the station limits. Similar action should be taken by SM/Section Engineer (concerned) and the RPF Inspector.

It shall be the duty of the officials responsible for prevention of encroachments to take all measures to prevent new or incipient encroachments. In case they themselves are not successful, it shall be their duty to bring the same to the personnel notice of ADEN or DEN or Sr.DEN /AOM or DOM or Sr DOM /ASC or DSC of the subdivision and division ,as well as SP/DC/Local Police and Civil Authorities verbally as well as writing , requesting them to take measures to stop the same.
As soon as they come to know of it, the concerned Divisional Officers should make arrangements including getting in touch with Civil and Police authorities as well as HQ Office to see that encroachment does not come up.

Where persuasion by the Railway authorities does not yield any result, the construction should be stopped by force, if necessary, and thereafter an FIR under Section 147of Railways act, 1989 should be lodged by the Engineering Department with the police having jurisdiction over the area, taking assistance of the RPF Inspector, who shall coordinate. For applying the provision of Section 147(2) of the Railways Act, 1989, which states “Any person referred to in sub section (1)may be removed from the Railway by any railway servant or by any other person whom such Railway servant may call to his aid” , no FIR need be lodged.
To prevent encroachments on vacant land, plantation of suitable trees (quick growing type) should be adopted as one of the methods.
If the place is affected by recurring encroachment, plantation may be done immediately after removal of the encroachments, and the area fenced by barbed wire

4 . DETECTION AND REMOVAL OF ENCROACHMENTS:

4.1. NEW ENCROACHMENTS AND TRESPASSING:

As mentioned earlier, the main responsibility for preventing fresh encroachment / trespassing shall be with the RPF Inspector in charge and other officials of the area. In case of any sudden encroachment / construction, the concerned officials will requisition the help of RPF, where necessary and stop such encroachments / trespassing, and also file an FIR at the local police station against the concerned, if required.

The RPF Inspector /Official in charge of the place will provide full assistance to the other officials . He will arrange for extra force , if necessary from the Divisional Security Commissioner or the local Officer in charge of the Police Station to provide augmented police assistance.

4.2. HARD ENCROACHMENTS:

The Section Engineer (Works /P.Way) shall responsible for removal of hard encroachment as per procedure laid down by law under PPE Act. The Section Engineer (Works/ P.Way) shall file the cases in the court of Estate Officers against the encroachers.

During the course of hearing by the Estate Officer, concerned official from Engineering, Commercial, Traffic, Mechanical or Security depts, shall act as the Presenting Officer and proactively help in expeditious finalization of the proceedings.

As soon as the decision is given by the court of the Estate Officer gives the decision, the section engineer (Works/ Pway) shall take suitable steps in removing the encroachments as per of the order of the court. In this he shall be assisted by the concerned SM /RPF Inspector and local police. The DSC of the Division /ASC /IPF of RPF post will co-ordinate for local police assistance. At the Divisional Head Quarters, the DRMs may preside over the meetings in this connection or may attend such meetings with the District Authorities if the Civil Authorities so desire. Such steps will particularly be required if the encroachments are large and sensitive or very high potential of threat to law and order.

4.3 Trespassing and soft encroachment can be removed without recourse to the PPE Act. Encroachments by Railway employees could be removed by recourse to departmental / disciplinary action for which, the controlling Divisional Officer of the encroaching employee, will be responsible.

5. MONITORING OF ENCROACHMENTS:

5.1 An ABC analysis of the encroachment on the Railway land should be done as elaborated in the following paragraphs, Board's letter No 98/LML/14/7/dt 31.3.98 may be referred to in this regard.

5.1.1 'A' category stations:

Should be monitored at GM's level through CE/CGE.

5.1.2 'B' Category stations

should be monitored at DRM's level through Sr.DEN (Co-ord)/ DEN (Estate).

5.1.3 The remaining may be monitored at the Divisional Officer's level.

5.2 While monitoring of encroachments for 'A' category and 'B' category stations are to be done by GM and DRM respectively as stated above, review for A category will be made by Railway Board for which six monthly progress reports are to be sent from HQs. For 'B' category, review will be done at GM 's level .For others; review will be done at DRM's level.

5.2.1 In order to send the six monthly progress report Board for 'A' category, Division should send the information as per Board's Performa (Annexure C of Board letter of 31.3.98) within the last week of the fifth month positively.
Six monthly progress reports for 'B' category stations, which are to be reviewed at GM's level, should also be sent by the Divisions while sending the reports for 'A' category. Information for 'B' category may be submitted in a Performa similar to that of 'A' category.

6. JOINTLY INSPECTION AND REVIEW:

6.1 A monthly joint inspection should be conducted by the officials specified in Para 3.1 wherever other departments are responsible to study on the spot the old and new encroachments for taking immediate necessary action duly co-opting the Section Engineer (Works /P.way). The inspection report should be made out in a format given Annexure –II. Such report should be sent to the branch officers/ higher officials of the respective departments by concerned Inspector.

6.2 Section Engineer (Works /P.Way) should update the Encroachment Register maintained as per Para 814(e) of the IRWM (2000 Edition).

7. HANDING /TAKING OVER CHARGE:

(a) A joint field check on the existing encroachments will be mandatory part of the Handing over /Taking over of the Section Engineer (Works /P.Way). This should be followed by a joint signing at the end of the Encroachments Register on the number of encroachments in the jurisdiction. The fact that these steps have been completed should be an item required to be specifically mentioned in the Handing over Note of the outgoing Supervisor.

Similar procedure should be followed by the concerned officials from commercial, Traffic, Mechanical, Security and other departments.

(b) In the event of fresh encroachments having taken place being noticed at the stage of handing over of charge, and which were not specifically brought out in writing to the notice of the higher officers / authorities, suitable adverse entries shall be made in the Confidential Records of the officials concerned, and he (they) will also be liable for DAR action as per paragraph 8.

8. LIABILITY FOR DAR ACTION.

It should be imperative on the part of the concerned Branch Officer that for any new encroachments that come up on Railway land, officials responsible for safeguarding the Railway land are taken up under Railway Servants (D&A) Rules.

* Since the responsibility for prevention of new encroachments is jointly given to the RPF Inspectors, it is essential that copies of the land document showing the demarcation of the Rly. Land should be made available for RPF Officials by SE (w) so as to facilitate such identification Similarly, the updated list of encroachments prepare on 1 st April. Every year should also be made available .In Non – RPF stations where not even a single RPF staff is available, the jurisdiction RPF Inspectors cannot be held responsible for prevention of encroachments but will involve himself in all activities for dismantling and eviction of such new encroachments.

SHORT NOTES

Q.No.1. Write short Notes on-

1. Criteria for rail renewal
2. Repair of rail fracture.
3. Action taken in case check rail is broken at level crossing.
4. Explain buckling in LWR lerrotiry & its remedial measures

1. **Criteria for rail renewal**- The following are to be considered in connection with the criteria of rail renewals:-

- Incidence of rail fracture / failures.
- Wear on rails.
- Maintainability of track to prescribed standards.
- Expected service life in terms of Gross million tones carried.
- Plan based renewals.

(a) Incidence of Rail fractures/failures – A spate of rail fractures on a particular sections having 5 withdrawals of rails per 10 km. in a year due to fracture and / or rail flows defected ultrasonically falling in the category of IMR will have priority while deciding rail renewals. In case the rail failures at fish plated/ welded joints are pre-dominant, end cropping with or without wilding could be considered. Through Rail Renewal is also allowed in location of track where more than 30 defective welds per track km are existing.

(b) Wear on Rails – (i) Limiting Loss of Section- The limiting loss in rail section, as a criterion for recommending rail renewals shall be as under:

Gauge	**Rail Section**	**Loss in section in percentage**
B.G. .. …	52 Kg./meter …	6
	90 R .. …	5

Rail wear may be determined by actual weighment talking rail profiles at ends after unfishing joints and taking rail profiles with special profile measuring gadgets.

(ii) Wear due to corrosion – Corrosion beyond 1.5 mm in the web and foot may be taken as the criterion of wear due to corrosion. Existence of the localized corrosion such as corrosion pits, specially on the underside of the foot and loner biting etc. on rail foot, act as stress raiser for the origin of fatigue cracks and would necessitate renewal.

(iii) vertical wear - when the reduction of the depth of the rail head reaches a point beyond which there is a risk of wheel flanges grazing the fish- plates, such rails should be renewed. The limits of vertical wear a which renewals are too ne planned are given as below.

Vertical wear

Gauge	**Rail section**	**Vertical wear**
B.G.	**60 KG/meter**	**13.00 mm**
	52 kg/meter	**8.00 mm**
	90 R	**5.00 mm**

Vertical wear is to be measured at the centre of the rail either by measuring the height of the worn out rail by calipers or by plotting the profile. In the first case, the wear is the difference between the height of the new rail and the height of the worn out rails.

(iv) Lateral wear – Limits of lateral wear form relaying considerations are as under :

Section	Gauge	Category of track	Lateral wear
Curves	B.G. ..	Group 'A' & 'B' Routes ..	8 mm
		Group 'C' & 'D' Routes ..	10 mm
Straight	B.G.	Group 'A' & 'B' Routes ..	6 mm
		Group 'C' & 'D' Routes ..	8 mm

Lateral wear is to be measured a 13 to 15 mm. below the rail top table. Worn rail profile should be recorded and superimposed over new rail profile to find out the lateral wear.

(C) Maintainability OF Track to prescribed standards –

(i) There may be cases, where renewals may be necessary on the following consideration viz.,

(1) Poor running quality of track in spite of extra maintenance labour engaged for maintaining the same,

(2) Disproportionate cost of maintaining the portion of track in safe condition.

(ii) The condition of rails with regard to hogging/battering , scanning and wheel burns and other conditions such as excessive corrugation of rail as can be ascertained by visual inspections, which affects the running quality of track, and make the track maintenance difficult and uneconomical, should be taken into account while proposing renewals.

(iii) Renewals of rail due to hogged and battered rails ends should be considered only if other remedies have not been found to be effective.

(d) Renewal on consideration of service life in terms of total G.M.T. of traffic carried – The rail shall be planned for through renewal after it has carried the minimum total traffic as shown below:

Gauge	Rail Section	Total G.M.T. carried for T.12 Med. Manganese rails	Total G.M.T. carried for 90 UTS rails
B.G.	60 kg/m	550	800
	52kg/m	350	525

	90 R	250	375

(e) –The service life in terms of total GMT of traffic carried for considering through rail renewal on the bridge proper and in approaches (upto 100 m on either side) for all the important bridges and such of the major bridges where height of bank is in excess of 4.m, all tunnels and their approaches (upto 100 m on either side shall be half of the GMT specified.

(f) Plan bassed Renewal – Renewal to pre-determined plan with the objective of modernizing the track structure on selected routes in the quickest possible time may be planned even if it involves premature renewals.

2. Repair of Rail fracture.

RECTIFICATION OF RAIL FRACTURES

Equipment required

i. Special 1 meter long fishplates with screw clamps and joggled fishplates with bolted clamps.
ii. Steel tape capable of reading upto one mm
iii. Alumino-thermic welding and finishing equipment
iv. Equipment for distressing
v. 6.5 meter long sawn rail cut piece of the same section as LWR duly tested by USFD
vi. Rail closures of suitable lengths
vii. Equipment for protection of track
viii. Equipment for night working

Procedure for repairs

If any fracture takes place on LWR/CWR immediate action shall be taken by the official who detected the fracture to suspend the traffic and to protect the line. He shall report the fracture to the Gangmate/keyman/PWI, who shall arrange foe making emergency repairs to pass the traffic immediately. Repairs shall be carried out in four stages as described below:-

a) Emergency repairs to pass the traffic immediately
b) Temporary repairs
c) Permanent repairs
d) Destressing.

Emergency repairs

The fractured rails shall be joined by using arrangements. If the gap at fracture does not exceed 30 mm, insertion of any closure rail piece is not necessary. The traffic may then be resumed at a speed of stop dead and 10 km/h for the first train and 20 km/h for subsequent trains.

Temporary repairs

If a welding party is not easily available, the fracture shall be repaired by using a cut rail (not less than 4 metre long) and clamped/bolted as per arrangement.

i. A traffic block shall be taken as soon as possible preferably when the rail temperature is within the range specified.

ii. (a) Two points on either side of the fracture shall be marked on the rail such that the length of closure fail to inserted is equal to the total length of the rail pieces removed from the track minus allowances for two welds and saw cut (normally 51 mm).

(b) Alternately two points on either side of the fracture shall be marked on the rail at a distance equal to the length of the available closure rail. The length of closure rail should not become less than 6 metre at the time of permanent repairs.

iii. the rails shall then be cut through at these points simultaneously, if possible. The closure rail shall then be inserted and joined. After joining , the traffic shall than be resumed at restricted speed in accordance with annexure-III. In case closure rail as per above is inserted, one of the joins may have to be provides with closure piece of adequate width and joined by one metre fishplate and clamps.

PERMANENT REPAIRS

(I) after temporary repair the joints are welded and speed is relaxed.

3. Action taken in case check rail is broken at Level Crossing:

If check rail is broken then speed restriction of 30 kmph should be imposed a besides ensuring that road traffic is diverted till the check rails are put in place. In case such diversion is not possible, temporary arrangements should be made for passage of road traffic till the check rails are put in place. However, both these cases, the check rails should necessarily be provided latest by close of next day. In such cases, a stationary watchman shall be posted to ensure safety.

4. Buckling of track

General

Buckling or a tendency towards buckling may occur, among others, in the following circumstances:-

i. Failure to adhere to the temperature ranges specified for operation on LWR/CWR
ii. Inadequate resistance to longitudinal, lateral and vertical movement of track due to deficiencies in ballast section or /and inadequate ballast consolidation.
iii. Use of ineffective fastenings or missing fastenings resulting in loss of creep resistance and torsional resistance
iv. Excessive settlement of formation.
v. Improper functioning of SEJ.

Buckling and its investigation.

i. Tendency towards buckling will usually manifest itself through kinks in track. Kinks may also arise from incorrect slewing or lifting operation. By tapping sleepers for hollowness, it may be possible to notice if there is any tendency towards vertical buckling.
ii. As soon as the tendency for buckling is detected, the traffic shall be suspended and the track protected. The track shall then be stablished by heaping ballast on the shoulder upto the top of the web of the rail obtaining the ballast from inter-sleeper spaces between the rails. Thereafter full investigation shall be made to find out the cause of the tendency for buckling.
iii. Each case or buckling shall be investigated by AEN soon after its occurrence and a detailed report submitted to DEN/Sr.DEN.

Repairs to buckled track

i. When the track actually buckles, the traffic shall be suspended and the cause of buckling ascertained. The position of tongue and stock rails of the SEJ shall be checked. The methods for rectification are explained below.

ii. The rectification shall normally be carried out in the following stages under the supervision of PWI:-
    a) Emergency repairs
    b) Permanent repairs
    c) Distressing.

Emergency repairs

The buckled rails shall preferably be gas cut adequately apart not less than 6.5 metre. The track shall then be slewed to the correct alignment and cut rails of the required lengths shall be inserted to close the gaps making due provision for welding of joints on both sides. The cut rails shall then be connected by use of special fishplates and screw clamps and the line opened to traffic with speed restriction.

Permanent repairs

i. As soon as possible the clamped joints shall be welded adopting the same procedure. Additional pair of cut rails and rail cutting equipment shall also be required to adjust the gaps in case they have been disturbed in the intervening period. The speed restriction shall be removed after welding.
ii. The entire panel shall be distressed as soon possible.

Q.No.2 Write short notes on

1. HOER Act.
2. Minimum wages act.
3. Pass rules & different types of passes with eligibility criteria
4. Strengthening of bridge approaches.

1. HOER Rules

Power to declare the employment of a Railway employee Intensive or Essentially Intermittent vests with Head of the Railway Administration which can be delegated to Chief Personnel Officer.

- During emergency situations it can be exercised by an Officer not below the rank of Senior Scale.

- A copy of every declaration of classification shall be sent to Regional Labour Commissioner and if it is made by an Officer (Sr Scale) a copy to be sent to Head of the Railway Administration and Chief Personnel Officer.

Appeals against Classification

- Any Railway employee aggrieved by a declaration of classification may prefer an appeal to Regional Labour Commissioner within 90 days of the date of declaration. RLC may after srutiny of documents or fresh job analysis may order for a change in classification.
- Any Railway employee of Railway Administration aggrieved by a decision of Regional Labour Commissioner may prefer an appeal to the Secretary to the Government of India, Ministry of Labour before the expiry of 90 days from the date on which the decision of Regional Labour Commissioner is communicated.

Classification

1. Continuous : The employment of a Railway employee is said to be continuous except when it is excluded or has been declared to be Essentially Intermittent or Intensive.
2. Essentially Intermittent : The employment of a Railway employee is said to be Essentially Intermittent when it has been declared to be so by the prescribed authority on the grounds that daily hours of duty of the Railway employee normally include periods of inaction aggregating to 50% or more (including at least 1 such period of not less than 1 hour or 2 such periods of not less than half an hour each) in a tour of 12 hour duty (on the average over 72 consecutive hours) during which the Railway employee may be on duty, but is not called upon to display either physical activity or sustained attention.
3. Excluded : The employment of a Railway employee is said to be Excluded if he belongs to any one of the following categories,

- Railway employee employed in managerial or confidential capacity.
- Armed guards or other personnel subject to discipline similar to that of any armed police forces.
- Staff of the railway schools imparting technical training or academic education.
- Such staff as may be specified as supervisory.
- Matrons
- Sisters-in-charge
- Matrons not on regualar shift duty in Railway Hospitals
- Health Educators and District Extension Educators
- Family Planning Field workers

- Lady Health Visitors
- Auxiliary nurses-cum-midwives
- Projectionists.
- Other categories prescribed.

- 4 . Intensive : The employment of a Railway employee is said to be Intensive when it has been declared to be so by the prescibed authority on the ground that it is of a strenous nature involving continued concentration or hard manual labour with little or no period of relaxation.

Supervisory Staff

- Ministry of Labour by written order specify Railway employees or classes of Railway employees as supervisory on the ground of holding a position of responsibility employed on duties mainly of supervisory character and because of his nature of work comparitively free to adjust his hours of duty or work.
- Copy of every such order shall be send to Chief Labour Commissioner, New Delhi.

Criteria for Classification

1. Continuous : All Railway employees except those excluded from Hours of Employment Regulations are assumed to be 'Continuous'. Thereafter on the basis of factual job analysis, it may be classified as Essentially Intermittent or Intensive.
2. Intensive : Two important factors in declaring and employment as Intensive are : (i) strenuous nature of the work tending to cause mental or physical strain (ii) continuous application to such work with little or no period of relaxation. Thisis considered to have been satisfied where period of inaction or relaxation do not aggregate 6 hours or more in a cycle of 24 hours or one hour or more in a shift of 8 hours.
3. Essentially Intermittent : If daily duty hours which should be assumed to be 12 hour/day include

- one period of inaction of not less than one hour or two such periods of not less than half an hour each AND
- various periods of inaction (including that above) aggregating 50% or more during which he is not called upon to show either physical activities or sustained attention.
- NOTE : In calculating above, periods of inaction of less than 5" shall be ignored.

	Standard Hours	Statutory Limit(Sec 132 of Railways Act 1989)	Preparatory & Complementary work

Intensive	42 h /week	45 h /week	3 h /week
Continuous	48 h /week	54 h /week	6 h /week
Essentially Intermittent	48 h /week + 12/24 h additional hours*	75 h /week	3 or 4 1/2 h /week *

* (i) Gateman 'C' , Caretakers, Chowkidars & Saloon Attendant and Railway employees in roadside stations provided with quarterswithin 0.5 km of place of duty - *24 h additional duty and 3h/week Preparatory & Complementary work*

(ii) Other Railway employees in EI roster - - *12 h additional duty and* 4 1/2 h*/week Preparatory & Complementary work*

- Preparatory & Complementary work is treated as:

1. When it is less than 15 min - not treated as duty, not exhibited in roster
2. 15 min to less than 45 min (Continuous) - half an hour
3. 45 min to 1 hour (Continuous) - one hour
4. For Intensive & EI 15 min to 30 min is treated as half an hour

- Total hours for Preparatory & Complementary work shall be fixed so as not to exceed maximum hours.

Running Staff

- Running staff will have a link roster with standard hours 104 hours and statutory limit of 108 hours.
- Link should be such that it wont exceed 10 hours from "*signing on"* to *"Signing off"*.
- They are given 4 periods of rest 30 consecutive hours or 5 periods of 22 consecutive hours each including a full night.

Split duty

- Spells of duty shall not exceed 3 and no of breaks not to exceed two.
- In case of employment of Continuous nature Railway employee whose place of residence is beyond 1.6 km from the place of duty seven hours of split duty shall be treated as equivalent to 8 hours of normal duty.
- While preparing rosters long on and short off shall be avoided.

2. Minimum Wages act:

This act aims at securing minimum rates of wages in these categories of employment where wages are low, in order to prevent exploitation of unorganized labour. It also lays down the procedure for regulating the hours of work and payment of wages, including overtime, so as to ensure prompt payment and specifies the deductions that can be made from the wages of the workers. So far Railway Administrations are concerned the Minimum Wages Act applies to casual workmen in employment.

i. On the construction or maintenance of roads or in building operations; and
ii. In stone breaking or stone crushing.

The Act holds the employer in-charge as responsible for payment of wages to persons employed under him and also the contractor as responsible to the person he employs. The important provisions made in the rules framed under the act are as following:-

a) Wages periods should be fixed for the payment of wages at intervals not exceeding one month or such longer period as may be prescribed.
b) Wages should be paid on a working day, within 7 days of the end of the wages period or within 10 days, if 1000 or more persons are employed.
c) The wages of persons discharged but the retrenchment compensation due, if any, shall be paid at the time of the retrenchment of the workmen concerned in accordance with the provisions of the Industrial Disputes Act, 1947.
d) The wages of an employed person should be paid to him without deductions of any kind except those authorized under the Act.

The Act lays down provisions regarding a day of rest every week and extra wages for overtime.

3. Pass rules

Following types of passes are available to Railway staff & officers.

1. Duty pass
2. Privilege pass
3. Special passes.

Different type of passes available to Railway staff & officers.

1. Metal pass
2. Cheque pass

3. Trolley pass
4. School card pass
5. P.T.O.

Eligibility

S.No.	Category	Type of privilege pass & privilege Ticket order	Type of duty pass
1.	Group 'A' & Group 'B' (Gazetted)	1ST Class 'A' Pass	1ST Class 'A' Pass
Non-Gazatted employees:			
(i) In Grade pay Rs.4200/- and above		1st class pass	1st class pass
(ii) In Grade pay Rs.2800/-		2nd class 'A' pass	2nd class 'A' pass
(iii) In Grade pay Rs.1900/- and above but below Grade Pay Rs.2800/-		One 2nd class 'A' pass in a year, remaining passes and PTOs of Second/Sleeper class.	2nd class 'A' pass
(iv) In Grade pay Rs.1800/-		One 2nd class 'A' pass in a year, remaining passes and PTOs of Second/Sleeper class.	Second/ sleeper class pass

4. Inspection and maintenance of Track on Approaches of Bridges:-

(a) For all Bridges- (1) On the bridge approaches, sleepers with arrangements for fixing guard rail should be provided for provision of guard as per Para 275 above.

(2) Full complement of track fitting at bridge approaches up to 100 metres should be provide to maintain required track geometry and effort should be made to immediately recoup deficiency noticed, if any.

(3) Rail level of track at approaches of bridge should be maintained as per designed L-section and dips in rail level immediately after the abutments should be avoided. The alignment and super elevation in case of curved track should also be maintained as per provision of chapter IV of IRPWM.

(4) Rail joint should be avoided within three metres of a bridge abutment.

(5)In case of LWR track, full ballast section as specified in LWR Manual should be provide up to 100 metres from the abutment.

(6)Switch expansion joints should be provided at the bride approaches in LWR/CWR track as per provisions of LWR manual.

(b) **For important and major bridges-** In addition to **Para (a)** above, following should also be provide.

(1) In case of CST-9 or wooden sleeper track, concrete/steel trough sleepers with elastic fastenings should be provided up to 100m/upto full breathing length wherever LWR is provide in approach of bridge.

(2) On the bridge approaches, for a length of abut 100 metres, width of cess should be 90cm clear of full ballast section to maintain ballast profile. For maintaining ballast section, suitable ballast retaining arrangement should also be provided.

Q.No.3. Write short notes on.

1. Honey combing of concrete & its prevention.
2. Initial & final setting time of concrete
3. Design of concrete mix.
4. Optimum moisture content & maximum dry density.
5. Contour & contour interval.
6. Pre & post stressed concrete structures.

1.Honey combed

For laying roofs slab , loose centering should not be permitted where vibraters are used otherwise the bottom of the slab will be honeycombed .

- **Preventions**
    1. Centring should be made of steel or strong wood of which joints should be water tight.
    2. Steel form have advantage over wooden form work, it is easy assembled and dismantled.
    3. The surface of timber shuttering should be well wetted or a coat of lime wash or soap water coat before pouring the concrete.
    4. In steel shuttering oiling shall be done immediately before **the pouring the concrete.**

2. Initial & final setting time of concrete

Initial setting time:- initial setting time is that time period between the time water is added to cement and time at which 1 mm square section needle fails to penetrate the cement paste, placed in the vicar's mould 5 mm to 7 mm from the bottom of the mould. Normally initial setting time of cement is 30 minutes.

Final setting time :- Final setting time is that period between the time water is added to cement and the time at which 1 mm needle makes an impression on the paste in the mould but 5 mm attachment does not make any impression. Final setting time is 10 hours.

3. Design of concrete mix:

The aim of concrete mix design is to determine the proportions in which cement, fine aggregate, coarse and water should be mixed to produce concrete of required strength, workability and durability with minimum cost.

The design of concrete mix can be done following methods.

i. **Normal mix:**

When the proportions of cements, aggregate and water are adopted based on arbitrary standard, the concrete produced is termed as nominal mix concrete.

ii. **Design mix:**

Design mix can be defined is the process of selecting the ingredient of concrete and determine their relative proportions with the object of producing concrete of certain minimum strength and durability as economically as possible .The purpose of designing as can be seen from the about definitions is two-fold .The first object is to achieve the stipulated minimum strength and durability. The second object is make to the concrete the most economical manner.

Variables in Proportioning

With the given materials, the four variable factors to be considered in correction with specifying a concrete mix are :

a) Water cement ratio
b) Cement content or cement aggregate raito
c) Gradation of the aggregates
d) Consistency

In general all four these inter related variables can not be chosen or manipulated arbitrarily. Usually two, three factors are specified and the others are adjusted to give optimum values of strength, workability and economy.

4.Optimum moisture cement:- the maximum moisture content in the soil after which the addition of water creates hindrance in bringing the particles closer is called optimum moisture content.

If the moisture content of the soil is more than the optimum moisture content, no compaction of the soil is possible because of too wetness.

Maximum Dry Density:- The weight of dry solid matters contain in a unit volume of soil divide by total volume of soil is known as Dry density. It can be determined after water has been dried out without changing its bulk volume.

5. Contour & Contour Distance**:-** A contour is an imaginary line on the ground joining the points of equal elevation. The elevation and depression on the map are shown by means of contour. All the points on the same contour have same elevation above datum surface. The line joining those points on map is called contour line.

Contour interval is the difference in levels of two successive contour line, It may be 5 mitrs, 10 mitrs, or 50 mitrs or even 100 mitrs depending upon the purpose and scale of the map.

6.Pre and post stressed concrete structure

Prestressed concrete is the type of concrete in which permanent internal stresses are deliberately introduced to counteract to the design degree of stresses caused in the member in sauce. In this concrete tension is produced in lower side of the beam which naturalizes the comparison occur due to design load of beam.

In the procedure if wires/bars are stretched before casting of concrete is called priestesses concrete whaeas in post stressed concrete wires/bars are stretches after the casting of concrete. In the process wires/bars are pass through hole/pipe left or cast in concrete.

The working stressed adopted for prestressed concrete is much higher than the commen remforced concrete, thus it permitting the use of smaller and lighter section for the same laced.

Q.No.4. Write short Notes on.

1. Track tolerances.

2. Define super elevation, cabtt deficiency, cant excess & equilibrium cant.
3. Distressed bridge.
4. Inspection schedule of bridges of SSE/W, ADEN in field.
5. Numerical rating of bridges after inspection.

1. TRACK MAINTENANCE TOLERANCES (EXTRACT OF PARA 607(2) OF IRPWM)

- **Track Tolerances for standard of maintenance of track for sanctioned speed above 100 KMPH and upto 140 KMPH**.

	Gauge (Para 224 of IRPWM)	On Straight	+6 MM -
		On Curves With Radius 350m Or More	-6MM +15MM
		On Curves With Radius Less Than 350m	UP TO +20MM
	Alignment (7.5M Chord)	On Straight	5MM 7MM*
		On Curves	+5MM - +7MM -
		Variation Over Average Versines	
		Change of Versine from Chord to Chord	10MM
	Twist (3.5M Base)	On Straight & Curves Except Transitions of Curve	2MM/M 3.5M/MM
		On Transition of Curve	1MM/M 2.1MM/M*
	Unevenness (3.5M Chord)	Rail Joint Depressions	10MM 15MM*

	Unevenness (C&M-1, Vol.1)	Rail Joints Depressions (3.5M Chord) for Speed >140 KMPH	6MM 10MM*

- Few Isolated Location – Not Exceeding 10 Per KM
- These Tolerances are For Good Riding Comfort & Not Safety Tolerances (Para 607(3) of IRPWM).

2.Transitions, safe speed and super elevation on curves

1) Cant or super elevation is the amount by which one rail is raised above the other rail. It is positive when the outer rail on a curved track is raised above inner rail and is negative when the inner rail on a curved track is raised above the outer rail.
2) Equilibrium speed is the speed at which the centrifugal force developed during the movement of the vehicle on a curved track is exactly balanced by the cant provided.
3) Cant deficiency- cant deficiency occurs when a train travels around a curve at a speed higher than the equilibrium speed. It is the difference between the actual cant and the theoretical cant required for such a lower speed.
4) Cant excess – cant excess occurs when a train travels around a curve at a speed lower than the equilibrium speed. It is the difference between the actual cant and the theoretical cant required for such a lower speed.

3.**Distressed bridges**

As per the standards laid down,a distressed bridge is one which shows any physical sign of deterioration of its physical condition, indicating the need for rehabilitation through special repairs, strengthening or rebuilding including replacement of girders. This definitation does not include those bridges which are considered vulnerable due to hydrological factors.

The distressed bridges have been classified in 2 categories as under:-

Category I : The requiring rehabilitation to be done immediately say within a year's time.

Category II : Those required to be kept under observation and to be taken up for rehabilitation on a programmed basis.

There are a large number of distressed bridges on Indian Railways and as these are safety hazards, their repairs and rehabilitation including rebuilding has to be done on high priority. To keep watch on the rehabilitation of the bridges. It has been decided by Railway Board that the railway should maintain diagram of distressed bridges similar to track diagram.

4.**Schedule of inspection of bridges.**

Engg. Official	Frequency of inspection	Type of bridge & items to be inspected
IOW	Once a year	Foundation & Substructure & protective works

		for all bridges
AEN	Once a year	All aspects of all the bridges including foundation & flooring, masonry, protective works, bed block, nearing & expansion arrangement, condition of paint of steel work & condition of track.

5.Numerical rating system (NRS)

a) The "Numerical Rating System" for bridge inspection assigns a "Unique Rating Number" (URN) to represent the physical condition of a bridge. Lower the URN more serious is the deteriorated condition of a bridge. The system thus helps in identifying progressive deterioration in the condition of a bridge. URN can be stored in a computer for quick retrieval and fixing priorities for repairs or rehabilitation.

b) The URN of a bridge is arrived at based on the condition of components and a "condition rating number" (CRN) assigned to each of them. The various components of a bridge in sequence, are :

i. Foundations and flooring, if any,
ii. Masonry / concrete in substructure,
iii. Training and protective works, if any,
iv. Bed blocks,
v. Bearings and expansion arrangements,
vi. Superstructure – Girders / Arch / Pipe / Slab etc.
vii. Track structure.

c) The CRN is allotted to each of the above components based on their condition at the time of inspection, using the following scale:

Condition Rating No. (CRN)	Condition of bridge component
1	A condition which warrants rebuilding / rehabilitation immediately
2	A condition which requires rebuilding / rehabilitation on a programmed basis
3	A condition which requires major / special repairs

4	A condition which requires routine maintenance
5	A sound condition
6	Not applicable
0	Not inspected

d) when any component in a bridge is more than one in number CRN is assigned to each of them and the lowest value used. For example, if a bridge has five piers and two abutments, and these are given the CRN of 5,4,3,2,5,5,4 then the CRN for the substructure component of the bridge would be minimum of the above i,e. 2.

e) If in any bridge one or more components do not exist, the CRN for such components shall be shown as 6

f) From the CRNs for different components of a bridge, an overall Rating Number (ORN) for the bridge as a whole is then given. The ORN is th lowest of the seven CRNs of a bridge, except 0.

g) For a major bridge, the URN would comprise of eight digits, the first digit indication the ORN and the following seven digits the CRNs of each of its above seven components in sequence.

h) URN of minor bridge shall be represented by its ORN only, i,e. by a single digit to indicate its overall condition.

j) The physical condition of a road over bridge is to be represented as for rail bridge.

k) The CRN of different components of a bridge as evaluated above shall be entered in the "Box" to be provided in the register at appropriate places.

Q. No. 5: Write short notes on any five?

(a) Mean annual rail temperature

(b)Stress free temperature

(C) Breathing length in a LWR

(d) Gap less joint behind CMS crossing in a turnout

(e) Consolidation of track in LWR

(f) Strengthening of bridge approach

(g) Reconditioning of CMS crossing

(h) Classification of bridges as important, major, minor and culvert

(i) Railway affecting works

Ans(5)(a): Mean Rail temperature- Denoted at t_m for a section, it is the average of the maximum and minimum rail temperature recorded for the section.

$t_{m=} (t_{max}+t_{min}) / 2$

Ans(5)(b): Stress free temperature- Denoted as t_o , it is the rail temperature of which the rail is free of thermal stress.

Ans(5)(c.): Breathing length in LWR- Breathing length is that length at each end of LWR/CWR, which is subjected to expansion/Contraction on account of temperature variations.

Ans(5)(d): Gapless joints behind CMS crossing in a turnout- it is desirable to have no gap in fishplate joint behind CMS crossing to have good running and to avoid hammering actions which may cause fractures from bolt holes.

To achieve this (a) – Use a drill bit of 26.05 mm size.

(b) - Take centre of first hole at 183mm rail end and centre for second hole at 249mm from rail end.

Ans(5)(e): Consolidation of track in LWR- Consolidation of track is the process of building up sleeper to ballast resistance either initially before laying LWR or making up subsequent loss of resistance by any one of-

Passage of at 3,00,000 gross tones of traffic on BG or at least 1,00,000 gross tones of traffic on MG or a period of 02 days, whichever is later, when compaction is done by means of mechanized shoulder and crib compaction.

Ans(5)(f): Strengthening of bridge approach – To strengthen the approaches of Major/ Important Bridges –

i. PRC sleepers to Drawing No. T-4089 to T-4079 should be provided under guard rails.
ii. In case of CST-9, ST and wooden road on approaches, PRC sleepers should be provided under the guard rails as well as up to a length of 100 M on the approach with full ballast cushion.
iii. Ensure 100% fittings at all times both on running rail and guard rails and in approach track up to 100M/ breathing length.
iv. No buffer rails. Provided SEJ and full ballast section of LWR track up to 100M from abutment.
v. Provided ballast retainers for one rail length to check slipping of ballast and to ensure full ballast section.
vi. The sleeper spacing on approaches of bridges up to 100M length should be made 60Cm.
vii. Rail level of track in approaches should avoid dips immediately after abutments.
viii. Guard rails must be notching at spikes and tie bars should be fixed on outside of sleepers with hook bolts passing through tie bars.
ix. Clear timber sp[acing should be 450MM and spacing under joint sleepers should not exceed 200MM.
x. Cess width should be 90CM clear of full ballast section for 100M on either side if girder bridges.

Ans(5)(g):Reconditioning of CMS crossing – CMS crossing should be planned for reconditioning when it is chipped at nose or worn out near to the recommended limits. Presently it is being done with hand facing electrodes using welding machines. The CMS is brought to the reconditioning workshops and is kept in water tub, so that high temperature produced during welding may not damage the CMS crossing requiring reconditioning is transported to and back from the workshop. Also it needs traffic block for removing and putting back the CMS in track.

A new technology called "Translamatic Robotic Welder" has been found suitable for in-situ reconditioning of CMS crossing without any traffic block. Cost is about Rs. 40, Per CMS and reconditioning life is about 30GMT.

Ans(5)(h): Classification of bridges – On consideration of size of water way and span of the bridge, the bridges are classified as –

i. Important bridge: A bridge an "Important Bridge" if it has a total area of waterway of more than 1000Sqm or linear waterway of more than 300meters.
ii. Major bridge: Major Bridge is one, which has a total linear waterway of 18M or more or which has a clear opening of 12M or more.
iii. Minor bridge: The Bridge having a linear waterway of less than 12M in case of a single span bridge and less than 18M in case of multiple span bridge is called a "Minor bridge."
iv. Culvert: A very small bridge is called a "Culvert". Normally a bridge having a span of less than 6M may be called a culvert.

Ans(5)(i): Railway affecting works – Any work which if not constructed and maintained properly or not operated properly may result in danger to Railway line. This may include tracks, storage works, canals, bands etc.

The DEN/ADEN will maintain an up to date list of Railway affecting works as jointly approved by the Railway and the State Govt. The list should show the particulars of State Authority responsible for maintenance of each Railway affecting work.

Assistant Engineer shall jointly inspect with Civil authorities all RAW/RAT before the monsoon every year and arrange for their state maintenance to avoid any danger to nearby tracks and structures. Authorities concerned to carry out all necessary repairs before concerned to carry out all necessary repairs before the ensuring monsoon and take necessary action to ensure safety of Railway assets.

All bridges which are likely to be cancelled by Railway affecting works should be provided with a tablet on top of one of the parapets with the letters RAW engraved on it, followed by an arrow mark pointing in the direction of Railway affecting storage work in question.

Q.No. 6. Short Notes

1. What are the main cause of crushing of PRC sleeper in washable aprons and what are the remedial measures?
2. Railway affecting works.
3. Distressed bridges and schedule of inspection by official.
4. Vulnerable location & monsoon precautions.

a)Why the concrete sleeper damage

The washable aprons are constructed on the concrete raft. The PRC sleepers placed on the raft and after palcing of sleeper the crib is casted one bitumen sheet also provided under the sleepers at both ends for facilitating the elastic medium between sleeper and raft. Now during casting of crib the concrete as well as cement sullary flows under the middle of sleeper which give the rigid support to the sleeper resulting to this the sleeper becomes centre rigid and ends on elastic support due to this uneven base the sleeper sheared while wheel load comes on the sleeper .

A another cause of damage of sleeper in washable apron is regularly falling of water, and human waste from the coaches which eroded the sleeper surface and sleeper become to start damage.

As explained earlier that the ends of sleeper rests on the bitumen felt to provide elastic medium between raft and bottom of sleeper. But due to vibrations of moving trains if a small Qty. of water percolate from side of sleeper on the bitumen pad. The bitumen felt starts damage and lost its elastic property. This is the main cause of damage of concrete sleeper.

During construction of washable apron it should be ensured that the placing of bitumen pad to done on quite smooth surface and water should not percolate.

The side drain also to be made with proper slope so that water can not stagnate in drain. This stagnated water may become a source of percolation inside the bottom of sleeper.

(b)

Railway affecting works:

Railway affecting works are those, the construction, design, maintenance or operation of which may cause serious damage or breaches or flooding of railway line or bridges. Some of the examples are:

I. Irrigation and water supply tanks or reservoirs
II. Canals in embankment and river bunds
III. Road embankment with inadequate waterway for drainage situated situated upstream or downstream of railway line.
IV. Temporary channels cut for irrigation or other purpose from beds of active river
V. Other work, which alter or impede the natural course of flood or cause increase of flow such as new irrigation projects, new townships, large/scale deforestation etc.

(C)

Definition of distressed bridge:- A distressed bridge is one which shows some physical deterioration of its physical condition, indicating the need for rehabilitation through special repairs strengthening or rebuilding (including replacement of griders).

Classification of distressed bridges

Category-i: Those requiring rehabilitation to be done immediately, say within a year's time.

Category-ii: those requiring to be kept under observation and to be taken up for rehabilitation on a programme basis.

Signs of distress for Group I bridges:*

I. Foundation: Settlement of foundations, deep scour around pipers/abutment,
II. Piers and abutment: Crushing of masonry, tilled piers and abutment, wide cracks in abutment/piers, crushing of masonry.
III. Bed block and bearings: shaken/displaced/cracked bed blocks, cracks or any other distress in bearings,
IV. Arches: Diagonal cracks in arches, transverse in cracks arches, distortion of arch, displacement of brick/stone from arch ring,
V. Misc.: Progressive loss in camber of prestressed concrete/steel girders, wide cracks in Reinforced Cement Concrete/prestressed concrete members. Crack/heavy corrosion in load bearing members of steel girders, weak/corroded weak/corroded/cracked piles, particularly cast iron crew pipe, snapping of rivets.

Sings of distress for Group II bridges

I. Abutments, piers, wing wall and return walls: cracks in return walls/wing walls, slight tilting/buging of masonry in return wall/wing walls, perceivable deterioration of stone/brick masonry,
II. Arches: wide longitudinal cracks in arches, abutments and piers, cracks/lean/bulge in parapet walls of an arch, bulging or separation of spandrel from arch barrel,
III. Misc.: Spelling of concrete in beams and slabs, loose rivets above 20% at any point, observations of any excessive vibration in part of the bridge.

Category	Inspection by	Periodicity
I. (a)	Inspector (concerned)	Once in a month
(b)	AEN or ABE	Once in two months
(c)	DEN or Sr. DEN	Once in three month
II. (a)	Inspector (concerned	Once in three months
(b)	AEN or ABE	Once in six months
(c)	DEN or Sr. DEN	Once in a year

(d)

Venerable location:

Venerable locations are those spots in the track gridges etc where there is possibility of failure exists due to the constructional as well as natural conditions. These locations are listed and keep

in the office. These location should be inspected quickly. In case of extreme whather condition these locations should be watched regularly to check out any damage.

Mansoon precaution:-

I. Location and quantity of reserve stock of pitching stone, boulder and other monsoon reserves should be fixed and ensure the stock, as per requirement.
II. Arrangements should be made to stock them before the onset of monsoon at locations specified in stacks or in loaded wagons.
III. Reserve stock should not be used except in emergency; where it is used, it should be recouped.
IV. The "Reserve" for use in bridge should be stacked at suitable locations above the HGL close to the bridge and the protection works.
V. The annual return of pitching stone, boulder and monsoon reserve should be submitted. It should be accompanied by a statement of training woks added or abandoned during the year with recommendation for reduction or increase to the reserve".
VI. Permanent remedial measures should be taken as soon as possible in very case and recurring expenditure avoided or minimized.

Q. No. (7) Write short rules on any ten.

Grow more food campaign.- Surplus land along the track mast be given to railway employee group D staff with lees rates, whose retirement less than five years. A board may be displayed with location & area. Entry in service book should be done. During retirement clearance may be taken for all dues of GMF.
Catch siding: - It is made in hilly area to protect trains/engines in siding for higher grade.

Hospital leaves facilities. - Hospital leave may be granted to railway servants other than in Group A and Group B, while under medical treatment for illness or injuries if such illness or injury is directly due to risks incurred in the course of official duties. [2] Hospital leave shall be granted on production of medical certificate from an Authorized Medical Attendant. [3] (a) Hospital Leave may be granted for such period as the authority granting it may consider necessary on leave salary: - → Equal to leave salary while on leave on average pay for the first 120 days of any period of such leave; and → Equal to leave salary during half pay leave for the remaining period of any such leave. (b) The amount of hospital leave which may be granted by the General Managers to railway servant is unlimited. [4] Hospital leave shall not be debited against the leave account and may be combined with any other kind of leave which may be admissible, provided the total period of leave, after such combination, does not exceed 28 months. Note: - If the railway servant is one to whom the WC Act 1923 applies the amount of leave salary payable during Hospital Leave shall be reduced by the amount of compensation payable under Section 4 [1] [d] of
Corporate Enterprises group, its composition and its functions. Representatives of trade unions, Industry and Passenger Associations, and also some eminent economists with a view to

understanding their genuine grievances about the working of railways and inviting from them concrete suggestions to improve Railways' performance. After these fruitful discussions, I have been thinking of streamlining the administrative machinery of the Railways and of providing better amenities and facilities to the travelling public, particularly the second class passengers.

Controlled concretes :- These mixes the performance of the concrete is specified by the designer but the mix proportions are determined by the producer of concrete, except that the minimum cement content can be laid down. This is most rational approach to the selection of mix proportions with specific materials in mind possessing more or less unique characteristics. The approach results in the production of concrete with the appropriate properties most economically. However, the designed mix does not serve as a guide since this does not guarantee the correct mix proportions for the prescribed performance.

Urgency certificate: - the following are the only classes of work on which expenditure or liability may be incurred prior to the receipt of sanction of the authority competent to sanction the estimates under the ordinary rules :--

Works, which are considered to be urgently necessary to safeguard life or property or to repair damage to the line caused by flood, accident or other unforeseen contingency, so as to restore or maintain through communication. As regards class (i) in the para above, the Divisional Engineer may authorize the commencement of the work, but should at once submit, through usual channel, a report to the authority competent to give administrative approval to the work and to allot the required funds. This report which may be called an "Urgency Certificate" or "Urgency Report" (Form E 1104) should contain (i) a description of the work, (ii) the date of its commencement, (iii) the circumstances which bring the work within this category, (iv) the maximum probable cost of the work with an enclosure containing an abstract of calculations and (v) the date by which a detailed estimate of cost will be submitted. The Divisional Engineer should at the same time send a copy of this report

Stock sheets and over hauling report. - During stock verification by stock verifier the difference between ground balance & ledger balance a summary sheet prepared i.e. called stock sheet. After sock verification ISA checked the proper issue & released of each items of ledger called overhauling report

Earnest money and security money:-

(1)(a) The tenderer shall be required to deposit earnest money with the tender for the due performance with the stipulation to keep the offer open till such date as specified in the tender, under the conditions of tender. The earnest money shall be as under: Value of the work EMD A For works estimated to cost up to Rs. 1 crore 2% of the estimated cost of the work B For works estimated to cost more than Rs. 1 crore Rs.2 lakhs plus 1/2% (half percent)of the excess of the estimated cost of work beyond Rs1 crore subject to a maximum of Rs 1 crore. The earnest money shall be rounded to the nearest Rs.10. This earnest money shall be applicable for all modes of tendering. (b) It shall be understood that the tender documents have been sold/issued to the tenderer and the tenderer is permitted to tender in consideration of stipulation on his part, that after submitting his tender he will not resile from his offer or modify the terms and conditions thereof in a manner not acceptable to the Engineer. Should the tenderer fail to observe or comply with the said stipulation, the aforesaid amount shall be liable to be forfeited to the Railway. (c) If his tender is accepted this earnest money mentioned in sub clause (a) above will be retained as part security for the due and faithful fulfillment of the contract in terms of Clause 16 of the

General Conditions of Contract. The Earnest Money of other Tenderers shall, save as here before in provided, be returned to them, but the Railway shall not be responsible for any loss or depreciation that may happen thereto while in their possession, nor be liable to pay interest thereon.

Calendar Hamilton span• The modern day pref abricated Panel/Floor Beam/Deck system was f irst patented by A.M. Hamilton in 1935 • The bridge was used or quick mobilization to allow military access to remote locations or to replace destroyed bridges in times of conf lict. • The design was centered on a series of gusset plates that allowed the direct attachment of the longitudinal, diagonal, vertical, and cross framing members. • The centralizing of connection points increased the speed of construction and also allowed identical panels to be fabricated from identical members and then installed on site • This system is currently known as the Calendar-Hamilton System.

•CH Spans are designed for the purpose of building long spans as rapidly as possible to us in place of standard spans damaged due to accidents, floods or enemy action.

•This also used in case of washed away of multiple spans and there is no chance of erecting the temporary substructure in the river bed.

Completion report:- As soon as the advice of completion is received the clerk who maintains the Works Register should prepare a Completion Report in Form No. W. 1469. The figures of actual expenditure as well as those of estimated amount should be shown in the same details in which the estimate has been prepared and sanctioned, but before preparing the Completion Report it should be seen that (I) all charges under different sub-heads of estimate have been booked, and (2) the credit for released material has been adjusted.

Criteria for Rail renewal - The following are to be considered in connection with the criteria of rail renewals:-

- Incidence of rail fractures/failures.
- Wear on rails.
- Maintainability of track to prescribed standards.
- Expected service life in terms of Gross million terms carried.
- Plan based renewals.

(a) Incidence of Rail Fractures/Failures - A spate of rail fractures on a particular sections having 5 withdrawals of rails per 10 km. in a year due to fracture and/or rail flaws detected ultrasonically falling in the category of IMR & REM will have priority while deciding rail renewals. In case the rail failures at fish-plated/welded joints are pre-dominant, end cropping with or without welding could be considered.

(b) Wear on Rails - (i) Limiting Loss of Section-The limiting loss in rail section, as a criterion for recommending rail renewals shall be as under:

Gauge	Rail Section	Loss in Section in percentage

B. G	52 Kg. / metre	6
	90 R ...	5

Rail wear may be determined by actual weighment, taking rail profiles at ends after unfitting joints and taking rail profiles with special profile measuring gadgets.

(ii) Wear due to corrosion - Corrosion beyond 1.5 mm in the web and foot may be taken as the criterion for wear due to corrosion. Existence of the localised corrosion such as corrosion pits, specially on the underside of the foot, acting as stress raisers from the origin of fatigue cracks and would necessitate renewals.

(iii) Vertical Wear -When the reduction of the depth of the rail head reaches a point beyond which there is a risk of wheel flanges grazing the fish-plates, such rails should be renewed. The limits of vertical wear at which renewals are to be planned are given as below.

Vertical wear

Gauge	Rail Section	Vertical Wear
B. G.	60 Kg./ metre ..	13.00 mm.
	52 Kg./ metre ..	8.00 mm.
	90 R	5.00 mm.
M. G.	75 R	4.50 mm.
	60 R	3.00 mm

i. Census of L-Xings

Monsoon patrolling -The sections, which are normally to be patrolled during monsoon will be identified and notified by the Divisional Engineer. For every such section, the Divisional Engineer shall prescribe the period of year, when normal monsoon patrolling is to be done; patrolling should be started on these notified sections on the dates specified. If the local conditions warrant, the Permanent Way Inspector of the section concerned may introduce or continue night patrolling outside the stipulated dates, duly advising all concerned.

Preparation of Patrol Charts –

(1) The Divisional Engineer will prepare patrol charts for each of the sections where monsoon patrolling is required to be done, taking into consideration the train timings of the time table in

force during this period. The principles governing the preparation of patrol charts shall be -

(a) Ordinarily patrolling will be carried out by a single patrolman, but in regions where danger from wild animals, dacoits and other risks as in ghat sections exist, patrolling in pairs may be introduced with the approval of the Chief Engineer.

(b) All trains carrying passengers between sunset and sunrise get the maximum protection possible.

(c) As far as possible, each block section will be treated as a unit and the length will be divided into equal beats. The length of each patrol beat should not normally exceed 5 km. Where the block section is more than 10 km. an intermediate flag station, if any, or any other suitable point may be fixed as intermediate station, to keep the length of beat at about 5 km.

(d) The walking speed of a patrolman may be taken as 3 km. per hour.

(e) The maximum distance covered by a patrolman should not normally exceed 20 km. in a day.

(f) A period of at least half an hour rest is desirable between consecutive beats.

(g) If the frequency of train services is high, and one set of patrolmen is not able to cover all the trains in the section, a second set of patrolmen may be introduced to reduce the interval.

(h) For giving better protection to all passenger trains, between sun-set and sun-rise it would be advantageous to plot the scheduled paths of all passenger trains and then plot the patrol movement in such a way, so as to minimize the time interval between patrolling of the beat and passage of train.

(XII) Census of L-Xings:_

Periodical census of traffic at all level crossings, unmanned/manned should be taken at least once in three years to review the classification, in the case of manned level crossings and need for manning in the case of unmanned level crossing The total train vehicle units/day (train units x vehicle units) are worked out taking the census for a week. Train motor vehicle, Bullock carts and Tongas being considered as one unit, Cycle rickshaw/Auto rickshaw being considered as half unit. The census should bev taken in the presence of TI, PWI & SI.

Q.8. Write short note on :-

(i) Water cement Ratio
(ii) Workability of concrete
(iii) Fineness Modulus
(iv) Curing of Concrete
(v) Static Water Level and Pumping Water Level

Ans. (i) Water Cement ratio :- Water has two functions in a concrete mix.

It enables the chemical reactions, which cause setting and hardening of cement.

It lubricates the dry concrete in order to facilitate placing.

If less quantity of water is added concrete will not be workable whilst excess amount of water if added it may flow by reducing quantity of cement and consequently will reduce the strength of concrete. Dense and strong concrete can be obtained by using specific quantity of water consistent with the degree workability required to give maximum density.

Thus a specific ratio of volume of water to the volume of cement is required. At this ratio concrete is found more strong and durable. This ratio is called water cement ratio and denoted as W/C ratio.

ii) Workability of Concrete :- Workability means ease with which concrete can be placed in the forms and compacted. Water content, size shape and grading of aggregate, affect the workability of concrete. The degree of workability depends upon the required strength of concrete and its purpose. Hence workability must be considered in relation to the method of compaction and the type of construction, in order to avoid the necessity for an excessive amount of work to obtain maximum density.

(iii) Fineness modulus:- Fineness modulus of an aggregate in an index number which gives an average size of particle in the aggregate. Fineness modulus is roughly proportional to the average size of particle in the aggregate. Coarser the aggregate higher the fineness modulus and vice versa. It is determined by adding the cumulative percentage of material coarser than each of the following test sieves and dividing the sum by 100.

Test sieves 3.35 mm, 2.36mm,1.8 mm,600 micron,300 micron,150 micron and 75 micron

(iv) Curing of Concrete:- Curing of concrete is necessary to prevent rapid loss of moisture from the surface of concrete and to keep the temperature of concrete under control. After the concrete has begun to harden. i.e. about one to two hours after its laying, it shall be protected from quick drying with moist gunny bags, sand or any other material approved by the Engineer. After 24 hours of laying of the concrete the surface shall be cured by flooding with water to a minimum depth of 2.5 cm or by covering with wet absorbent materials. The curing is generally to be done for a minimum period of 14 days. Water used for curing shall be clean, land free from sediments of any sort.

(v) Static Water Level and Pumping Water Level :- It is level at which water stands in a well either penetrating an unconfined or confined aquifer is called static water level. It is measured from the ground surface.

Pumping water level :- it is the level at which water stands in a well when the water is being pumped from the well. It is also called working water level.

Q No.9: Write short notes on any five of the following:
(a) Types of L-Xing
(b) Elimination of Unmanned L-Xings
(c) Duties of Gateman
(d) Frequency of USFD Testing of Rails
(e) Fracture Repairs in LWR Track
(f) Design mode working of CSM
(g) Track tolerances for BG Track

(a) Type of L-Xing :-

L-Xings have been classified in various categories in consultation with road authorities depending upon the volume of Road/Rail Traffic passing on them and their visibility conditions. These are classified as under:-

Sr. No.	Classification of L-Xing	Criteria
1.	'Spl.' Class	TVUs Greater then 50000
2.	'A' Class	TVUs 50000 to 30000 or Line capacity utilization 80% and Road Vehicle >1000
3.	'B' Class	TVUs 30000 to 20000
	Further divided 'B1' Class 'B2' Class	TVUs 30000 to 25000 TVUs 25000 to 20000
4.	'C' Class	All others L-Xing for Road not covered in above classes
5.	'D' Class	For Cattle's Crossings

(b) Elimination of Unmanned L-Xings :-

Unmanned L-Xing are the safety hazard for railway traffic as well as for road users, efforts should be made to eliminate them. Unmanned L-Xing may be eliminating by following method.

i. By Construction of ROB.
ii. By Construction of RUB.
iii. By Construction of LHS.
iv. By merger in nearby L-Xing.
iv. By closing due to Low TVU

(c) Duties of Gateman :- Gateman is an important person and he should ensure safety at level crossing by performing following duties.

i. Alertness: He should be alert and be prepared to take immediate action in case of an emergency. The keys of gate should be on his person.

ii. Position during passages of train: The gateman should stand facing the track on the gate
Lodge side of the approaching train.

iii. The Gateman should ensure that gate lamps and lamps of all location are lighted and Kept burning continuously from sun set to sun rise.

iv. No Gateman should leave his gate unless another gateman has taken charge of it. If it is Necessary to leave his gate in case of an emergency, he should close and lock the gates against pubic road before leaving the gate.

v. The Gateman should ensure that the channels for the flanges of the wheels are kept clear.

vi. The gateman should keep the road surface well watered and rammed.

vii. The gateman should report all unusual occurrences including the damage of gate to nearest station master and the P.W.I.

viii. Parting of train: If a gateman notices that the train has parted, he shall not show a stop hand signal to the driver but shall endeavor to attract the attention of driver and guard by Shouting, gesticulating or by other means.

ix. Protection of level crossing in case of an emergency: He should protect the track as Per protection diagram.

(d) Frequency of USFD testing of rails:-

USFD testing is very important activity as by this mean various flaws developed in the rails are being detecting in the advance. Frequency of USFD testing is depends upon GMT of the sections.
At present frequency is as under.

Route	Routes having GMT	Testing frequency Once in
All BG routes (Rail head center and gauge face corner testing)	<=5	2 Years
	>5<=8	12 months
	>8<=12	9 months
	>12<=16	6 months
	>16<=24	4 months
	>24<=40	3 months
	>40<=60	2 months
	>60<=80	1.5 months
	>80	1 month

(e) Fracture repairs in LWR track:- If there is any fracture takes place in LWR/CWR immediate action shall be taken by the official detected the fracture. The repair shall be carried out in 4 stages as described below.

i. Emergency repair to pass the traffic immediately.
ii. Temporary repairs
iii. Permanent Repairs
iv. De-Stressing.

i) Emergency Repair: The fracture rail shall be joined by using ordinary/joggled fish plate with the help of clamps, if the gap at the fracture does not exceed 30mm insertion of any closer of the rail piece is not necessary, the first train should be passed at a speed of stop dead and 10 KMPH further subsequent trains should be allowed at 20 KMPH

ii) Temporary repairs: During block fracture rails should be replaced by using 6.5 mtr. rail. The cutting of rail should be done with the assessment that total length of rail removed should be equal to inserted rail including provision of welding. After this speed to be raised to 30 KMPH.

iii) Permanent Repairs: After taking proper block one joint should be weld first and thereafter second joint should be welded with the help of rail tensor.

iv) De-Stressing: De-Stressing should be done at least equal to the breathing length i.e. about 70 mtr on either side of the fracture.

(f) Design mode working of CSM:- For achieving good track geometric packing of the PRC track should be done by using CSM in design mode. However if the variation in level and alignment is very less than CSM temping may be done by using smoothing mode. In design mode temping rail levels of a particular section of track are recorded by using leveling instrument final levels along with gradients and vertical curves are to be decided carefully. The required lift and slew are finally recorded on every alternate sleeper. Temping should be carried out by entering the lift and slew at the front tower by adopting design mode of leveling and lining. By design mode temping desired track geometry can be achieved

(g) Track Tolerances for BG Track:- The safety and comfort of rail travel depend primarily on the track geometry and the standard to which it has been maintained. It is not possible in actual practice to obtain a flawless and perfect track; Parameters governing the track geometry have always certain variation. Track tolerances may be defined as the limits of variability of various parameters pertaining to track geometry.

The Type of track tolerances are as under:-

i. New track tolerances.
ii. Maintenance tolerances.
iii. Index tolerances.
iv. Good riding tolerances.
v. Slow down tolerances.
vi. Safety tolerances.

The above all tolerances are define by magnitude of track parameters i.e. alignment, defect, twist, Gauge various and unevenness.

Q No. 10: Write short notes on any five of the following:

(a) Rain water Harvesting

(b) Guideline for disposal of human waste
(c) Selection of ceramic/vitrified tiles for building work
(d) Disinfection of water
(e) Distressed Bridge
(f) River training & Protection works
(g) Basic Passenger Amenities

(a) Rain Water Harvesting:-

i) Introduction: - Rain water harvesting is the accumulation and deposition of rain water for reuse rather than allowing it to run off. In other word it is the technique of collection and storage of rain water at surface or in ground.

ii) Necessity:-Water is most essential requirement for existing living beings. Surface water and ground water are two major source of water, due to heavy demand ground water table goes down day by day. By harvesting water table get charged.

iii) Basic Types:-
   a) Roof top rain harvesting and storage in tank.
   b) Roof top rain water harvesting and recharge sub surface aquifer.
   c) Surface run of harvesting and recharging sub surface aquifer.

iv) Advantages:-
   a) Provide adequacy of underground water.
   b) Mitigate effect of draught.
   c) Reduce soil erosions as surface run off is reduced.
   d) Decrees load on storm water disposal system.
   e) The cost of recharging sub-surface aquifer is lower than surface reservoirs.
   f) Storage water under ground is environment friendly.

(b) Guideline for disposal of human waste: - Discharged from water closets urinal, sinks, cattle shad gullies etc. is known as soil waste. W.C. with sufficient water arrangement required to provide for disposal of human waste. Further connection WC has been done following manner.

i) Where water availability is sufficient and sewer line laid –by providing flushing cistern Further the sewage from sewer line connected into the treatment plant.

ii) Where sewer line is not exist and no of users are more a septic tank should be provide for disposal of human waste.

iii) Where there is no adequate water supply exists- WC with bio laterrn/sockpit shall be provided.

(c) Selection of ceramic/vitrified tiles for building work: - Floor and wall tiles of appropriate design, color and texture enhance the touch and feel of a building. However, the aesthetic improvement potential may not be achieved if proper tiles are not selected. In public area there is a need to choose good tiles of reputed manufacturers confirming IS: 15622 having wear resistance and anti skid properties, modern design, color combination and scheme of laying.

Types of Pressed Ceramic/Vitrified Tiles:-

i) Ceramic Wall Tile: These tiles have high water absorption, due to high water absorptions these tile stain after contact with liquids.

ii) Ceramic Floor Tile: These tiles have medium water absorption, less in strength and low hardness. These are generally suitable for the area not likely to be wetted frequently and where foot traffic is low.

iii) Ceramic Porcelain Tile: These tiles have low water absorption; these are hard, resistant to strain etc. These are suitable for heavy foot traffic.

iv) Ceramic Vitrified Tiles: These tiles have very low water absorption. These are very strong and durable. These tiles are suitable for very heavy foot traffic areas.

While selecting colour, design, etc. latest catalogue of manufacturer may be referred and put to record. Only qualified/trained mason should be allowed to do the work of fixing of tiles. It should be notice that all concealed pipe for plumbing/wiring should fixed in advance before laying the tiles.

(d) Disinfection of water:- Disinfection of water is required to remove disease producing organisms before it enters distribution system. The material used for disinfection of water is called disinfectants. A good disinfectant should economical and easily available in bulk quantity. It should destroy all harmful bacteria and other organisms. There should be no sludge formation in water. Working of plant, mixing of disinfectant should be simple after disinfectant, the water should not be come toxic and carry no objectionable odour and task. The dose should be such that there is always some residual concentration for protection of water from contamination during storage and conveyance of water through distribution system.

Method of disinfection are as under:-

1. Boiling of water
2. Adding Potassium Permanganate (KMNO4)
3. Excess lime Treatment
4. Ozone gas Treatment
5. Iodine and Bromine Treatment
6. Ultra Violet rays
7. Adding chlorine i.e. Chlorination

Minimum residual chlorine should be available at farthest end shall be 0.5 mg per litre. During the monsoon month or if specific complaint are there super chlorination more than 2 DPM of chlorine may be resorted to effectively get rid of bacteria.

(e) Distressed Bridge:- A distress bridge is one which show any physical sign of deterioration of its physical condition, indicating the needs for rehabilitation through special repairs, strengthening or rebuilding (including replacement of girders)

1. The DEN/Sr. DEN, while including a bridge in the distressed bridge list should also indicate the priority classification depending on nature and severity of distress as detailed below:-

(a) Category I should include those bridges where the distress is such that the rehabilitation work is required to be taken up immediately.

(b) Category should include all those bridges which do not fall in category I. They may be taken up for rehabilitation on a program bases.

Inspection of distress bridge should be carried out as under:

Category	Inspected by	Periodically
I	Inspector concerned	Once in a month
	Asstt. Enginner/ABE	Once in 2 month
	DEN/Sr. DEN	Once in 3 month
II	Inspector concerned	Once in 3 month
	Asstt. Enginner/ABE	Once in 6 month
	DEN/Sr. DEN	Once in a Year

2. Imposition of speed restriction: All distress bridge may not require speed restriction. It is not possible to lay down definite guideline for imposing speed restriction on Distress Bridge. Each case have to judge and decided on its merits by the inspecting officer, keeping in view the nature and severity of distress. However, for general guidelines speed restriction up to maximum of 15 Kmph is suggested for distressed bridge in group I and 25 to 50 Kmph for distressed bridge in group II.

Group I		Group II	
Where the sign of distress are			
1	Settlement of foundation	1	Cracks in return wall/wing wall
2	Titled Pier & abutment	2	Slight/Tilting , bulging of abutment
3	Deep scour around pier and abutment	3	Leaning/bulging of masonry in return wall
4	Shaken /Displaced cracked bed block	4	Crack/lean /bulge in para pit wall
5	Crack or any other distress in bearing	5	spelling of concrete in beam and slab
6	Diagonal crack in arch	6	Loose rivets joint above 20% at any joint

(f) River Training and protection work:- The object of river training/protection work is to prevent the river from damaging railway Formation Bridge and other structure. The following type of river training works is generally adopted in the Indian Railway:-

a. Guide Bunds: Guide bunds are meant to confine and guide the river flow through the structure without causing damage to it and its approaches.
b. Spur/groyne : It is structure constructed transverse to the river flow and is projected from the bank of the river.
c. Marginal Bunds: these are provided to contain the spread of the river when the river in flood spills over the banks upstream of the bridge site over wide area and likely to spill in the neighboring water course or cause other damages.
d. Closure of Bunds: Some time it is necessary to entirely block one or more channels of the river in order to prevent, the discharge of such channel developing into a main river channel after the construction of bridge.

<u>Protection of Approaches Banks:-</u>

1. Approaches banks of bridges may be subjected to severe attack under the following conditions.
   (a) When HFL at bridge is very high and there is spill beyond the flow channel.
   (b) When the stream meets a main river just downstream of bridge.
   (c) In case of bridge with insufficient of water way.

In all the above cases the pitching of the approaches bank upto HFL with sufficient free board is an effective solution. Provision of toe wall and narrow apron, in some cases will also useful.

2. If deep borrow pits are dug near the toe to the approaches of the bank, the water flow through pits and forms a gradually deepening water course which may eventually threaten the safety of approach of the bank. In this case put rubble T-spurs across the flow to reduce the velocity.
3. All the location with standing water against the embankment, special watch should be kept when the water level recedes rapidly and when slip is likely to occur.

(g) Basic Passenger Amenities :- When a station is constructed certain minimum are required to be provided at each category of station which are called minimum station amenities. The minimum essential amenities for various category stations should be provided as per scale specified in works manual and as Rly. Board letter no. 2012/LM(PA)/3/5 dated 11/09/2012 , described as under:-

Station- Booking facility, drinking water, waiting hall, sitting arrangements, PF shelter or shady Tree, urinal, bathrooms, latrine, lighting , FOB, Timetable, Clock, water collar, Parking with circulating area, signage, public addressing system, enquiry counter, stall, prepaid taxi booth, refreshment room,.

In addition to above facility like ramp, earmarking parking, non-slippery walk way, signage, one drinking water tap, and one toilet at ground floor, assistance booth should be provided for physically disabled persons.

Q No. 11: Write short notes on any five of the following:
(a) Quality Control measures at the Renewal sites of contractors
(b) Imprest Store
(c) Classification of defects, Marking & action taken in USFD
(d) Maintenance precaution in LWR Track
(e) Permitted location of LWR
(f) Stock Sheet
(g) Main duties of ADEN

(a) Quality Control measures at the Renewal sites of contractors:- It is very important to ensure the quality of work at renewal sites as the contractor labour are not careful about to maintains the track parameters within the safe permissible limits. Hence to ensure the track parameters within safe and permissible limits the following measures have been taken.

i. Only qualified and experienced supervisors should be deputed to execute the work.
ii. Contractors supervisors should be qualified and experienced, his knowledge must be examine by the officers not below the post of ADEN and a competency certificate should be issued in this regard.
iii. Work should not be started without the presence of both the supervisors.
iv. Sufficient and skilled labour should be available before a start of the work.
v. Proper site order book should be maintained at site and regular inspection and monitoring of track parameters must be ensured.
vi. A separate register named the quality control register should be maintained at site.

vii. At the end of the day's work all the relevant track parameters are measured not down in the quality control register carefully. A safety certificate will be given by the railway supervisor that "The track parameters of the work done today are noted carefully and found safe for the passage of train at the imposed speed at the work site.

viii. Any unusual/unsafe track parameters must be attended before leaving the site.

ix. All the instruction issued by the officers must be followed strictly.

(b) Imprest Store: - The store which is not meant for any specific work but are held in advance to meat out the emergences such as accident/derailment or to carry out the emergent renewal. These stores when used during accidents are debited to revenue and when used directed for emergent renewal are debited to DRF. Following attentions are required for imprest store.

i. Scale of imprest store is fixed by CTE.

ii. These Stores should be stacked separately

iii. These stores should not be transferred to other stock holders.

iv. These stores should not be used for routine maintenance

(C) **Classification of Defects, Marking and Action taken in USFD:-** During USFD testing of rail following to be done.

Sr. No.	Defect classification	Marking	Action Taken
1.	IMR & IMRW	Three cross with paint	The flawed portion should be replaced by a sound tested rail piece of not less than 6 mtr length within 3 days of detection. For interim measure SE/JE/USFD shall impose speed restriction of 30 Kmph or stricter immediately and to be continued till flawed rail/weld is replaced. He should communicate to sectional SE/JE (P.Way) about the flaw location who shall ensure that clamped joggled fish plate is providing within 24 hrs.
2.	OBS & OBSW	One Cross with red paint.	Rail/Weld to be provided with clamped joggled fish plate within 3 days. SE/JE (P.Way)/USFD to specifically record the observations of the location in his register in subsequent rounds of testing. SE/JE (P.Way)/USFD to advise sectional SE/JE (P.Way) within 24 hrs about the flaw location and Keyman to watch during daily patrolling till it is joggled fish plated.
3.	DFWO	One circle with red paint	SE/JE/USFD shall impose restrictions of 30 Kmph or stricter immediately and communicate to sectional SSE/JE about flaw location. Who shall protect defective rail weld by joggled fish plate using two tight clamps. Speed restriction can be relaxed to normal after protection DFWO weld by joggled fish plate with two far end tight bolts with chamfering of hole within 3 days.

4.	DFWR	Two cross with red paint	SE/JE (P.Way) USFD shall impose speed restriction of 30 Kmph or stricter immediately and communicate to sectional SSE/JE about the flaw location who shall ensure protection of DFWR weld by joggled fish plates using minimum two tight clamps immediately. SR of 30 Kmph can be relaxed to normal after providing joggled fish plates with champhering of bolts one on each side with chamfering of holes. The DFWR weld shall be replaced within three months of detection. Adequate traffic block should be grated for removal of DFWR welds. In case of non removal within three months, a speed restriction of 75 kmph for loaded goods train and 100 kmph for passenger train should be imposed.

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(d) Maintenance precaution in LWR track: - Maintenance of LWR is very sensitive and required special attention some of precaution required are as under:-

i. Any maintenance of LWR/CWR should be under competent and trained personnel
ii. Maintenance work should be confined to hours when the rail temperature is between Td + 10 and Td-30. If rail temperature after maintenance operations exceeds Td+20 Centigrade than during the consolidation period speed restriction of 50 Kmph shall be imposed.
iii. Ballast section should be properly maintained, lifting of track should be avoided during the alignment correction by crow bars.
iv. All fitting and fasting should be effective, complete and secure.
v. Not more than one sleeper in 30 consecutive sleepers shall be replaced at a time.
vi. Change of fastening not requiring lifting of rails shall be done one sleeper at a time and at least 15 sleepers in between shall be kept intact and work should be done under super vision of keyman.
vii. Change of fastening requiring lifting of rail should be done of one sleeper and atleast 30 sleepers shall be kept intact and work should be done under super vision of gang mate.

(e). Permitted Location for LWR:-

i. Complete track renewal shall provide with LWR/CWR. Existing rail laid on permitted location may also be converted into LWR/CWR.
ii. New construction/doubling/Gauge conversion shall be opened with LWR/CWR
iii. In goods running lines where condition of all the track component is sound
iv. LWR/CWR shall not be permitted where rails are subjected heavy wear, corrosion and needing frequent renewal
v. LWR/CWR shall not be permitted where formation is weak or formation soil is susceptible to competing.
vi. LWR/CWR shall not be permitted on curve sharper thann440 mtr radius.

vii. LWR/CWR shall not be permitted on reverse curves sharper than 875 mtr radius.

viii. The steepest permitted grade shall be 1 in 100

ix. Minimum radius for LWR/CWR for vertical Curve shall be 4000 mtr for A route, 3000 Mtr for B route and 2500 mtr for C,D & E route

(f) Stock sheet.:- Departmental verification of stores under subordinates is done by stock verifiers of the account department at a specified frequency. Who often physically verified the store entries in their field book.The report of verification is furnished by the stock verifiers in a standard form called stock verification sheet or stock sheet. During verification, stock sheet for irregularities if any is prepared in four copies. Original copy is sent to account officer explanation of the stock holder is recorded on second & third copy and submitted to Divisional Engineer whom retains third copy and forward second copy to account officer for further action. Forth copy is kept as office copy by stock holder.

(g) Main duties of ADEN:-

ADEN is generally responsible for the maintenance and safety of all way and works in his charge for the accuracy, quality and progress of new work and control over all expenditure in relation to budget allotment. Main duties of ADEN are as under:-

i. Inspection and maintenance of track and all structures in a satisfactory and safe conditions.

ii. Preparation of plans and estimates, execution and measurement of works including track works.

iii. Verifications of stores held by stock holders.

iv. Submission of proposal for inclusion in the track renewal program, revenue budget and the work program.

In addition of above others duties are as under:-

i. He should remain update for rules and regulation issue time to time and he shall ensured that all the staff under him are acquainted with relevant rules and regulations connected with their duties.

ii. He should cooperate effectively with officers and staff other department. In matters that warrant coordination.

iii. He has to accompany inspection by higher officials with all records.

iv. He shall conduct inspection in his jurisdiction as per the schedules laid down by the administration from time to time.

v. Inspection of permanent way – he shell inspect the permanent way under his jurisdiction by push trolley/motor trolley, by foot plate/break van inspection by the fastest train of the section, he shell inspect of all L- Xing's, Curves, Points & Xing, Bridges patrolling etc. as per laid down schedule.

vi. He shall examine the traffic renewal works, measurement of ballast.

vii. Action in case of emergencies. In case of an accident, bridge or any accident which effaced the running of train he should take all possible and prompt action to restore the traffic as soon as possible.

viii. He should accompany the TRC run in his jurisdiction and take down notes regarding the spots needing attention

Q No. 12: Write short notes on any five of the following:
(a) R.A.W.
(b) T.M.S.
(c) Works needing CRS sanction
(d) Thermit Welding & its quality control
(e) TGI & OMS
(f) GMF Scheme
(g) Buckling of Track, cause & Prevention

(a) R. A. W. (Railway Affecting Works):– Are those, the construction, defective design of which may cause serious damages/breaches or flooding of railway line or bridges. Such as irrigation and water supply tanks or reservoirs, canals in embankment and river bunds, road embankment with in adequate water way for drainage situated up-stream or downstream of the railway lines and others works or operations which might alter the natural course flood flow or cause an increasing in the volume of such flow near the railway track are called rail affecting works. A separate register is to be maintained to note down all such work. Joint inspection of all RAW should be done with state authorities every year to ensure safety of this installation.

(b) TMS(Track Management System) :- TMS is a computer software which integrates various track component data, inspection data and work report data to provide useful information for taking better decisions. Concept of need based maintenance can be introduced for maintenance of track. The Indian railway introduces the web bases system to enable railway officials to check and monitor the lowest level inspections/condition of track progress of track renewal and other works. On a one click of computer screen. By this system the paper less working introduce by which nos. of inspection register and other paper record has been eliminated. Monitoring and condition of railway track at the root level increased.

(c) Works needing CRS Sanction: - CRS sanction required for the execution of any work on the open line which will affect the running of trains carrying passengers and temporary arrangements necessary carrying out it. Such as:-

i. Addition, Extension or alteration to running lines.
ii. Alteration to Points & Xing in running line.
iii. New Signaling and inter locking installation or alteration to existing installation.
iv. New station temporary or permanent.
v. Heavy regarding of running line involving lowering/raising of track in excess of 500 mm.
vi. New Bridges, Addition or replacement of existing girders including provision of temporary girders.
vii. Provision of new L-Xings, shifting of L-Xing, Demanding and down grading, manning of unmanned L-Xing, Upgrading of L-Xings, Closing down of L-Xings.
viii. Permanent Diversion.

(d) Thermit Welding & its quality control: - A fish plated joint has been a necessary evil in the railway track right from beginning of railway. To overcome the various problems posed by the fish plated joints and reduced the maintenance cost the need for welding of rail ends was felt.

Joining of two rails end by the application of heat is called welding. Among the various tetchiness of welding the AT welding is used now days for scattered and spot welding.

Quality control:- The quality of an AT welding could be ensure by adopting the following simple precautions.

i. The rail ends must be cleaned and straight.
ii. The gap should be uniformed and within limit.
iii. All the equipment used for AT welding should be complete and in order.
iv. Only prefabricated moulds of sound condition should be used welding portion and looting sent should not be of expiry date material. Pressure of oxygen and LPG should be as per specification adequate heating time should be given to heat up the rail ends.
v. Ensure uniform heating of rail ends.
vi. Welding Portion should be dry and free from any moisture content.
vii. Corrected size of thimble should be used.
viii. Specified mould waiting time should be achieved before trimming the weld joints.
ix. Small track machine should be used for trimming and grinding.
x. Chisel cutting should be avoided.
xi. After finishing tolerances must be ensured of welding joints.
xii. No traffic should be allowed over newly welded joint within 30 minutes of the welding.

(e) TGI and OMS:- It is utmost important to ensure passenger comfort and safety of track. In order to improve longevity of assets. This can be achieved by frequent inspection, detection of irregularities and their quick elimination, various method of inspection has been adopted by P.Way engineers.

i. By manual inspection.
ii. By track recording cars.

a. OMS-2000 :- To ensure the comfort of passengers the micro processor based system adopted to record the vertical and lateral acceleration due to gravity. The results obtain digitally in the form of peaks.
b. The criteria of condition of track bases on peaks per km. (PPKM)
   i. Outstanding:- Upto 0.25
   ii. Very Good :- >0.25 to 1.0
   iii. Good :- >1 to 2.00
   iv. Below Avg. :- More than 2

TGI:- Is the method to assess the conditions of track parameters or obtained by standard deviation based composite track index which is work out for block of 200mtr track this composite index is based on the individual indices of unevenness, twist, gauge and alignment measured for a block of 200mtr length of track.

TGI is defined as under

$$TGI = \frac{2UI+TI+6AI+GI}{10}$$

UI= Unevenness Index
TI= Twist Index
AI= Alignment Index
GI= Gauge Index

Based on TGI value classification of track is as under:-

i. Outstanding:- 80 and above.
ii. Very good:- 50 to 79
iii. Good:- 36 to 49
iv. Below avg.:- Below 36

(f) GMF(Grow More Food) Scheme:- A lot of railway land remain unused for the year and no outcome has been receive from the land. This railway land suffered temporary and permanent encroachment from the outsiders, a lot of revenue loss experienced.

To secure the railway land from encroachment and to provide food grains to the poor railway employees on a small rent railway introduced the grow more food scheme for the railway employees. By this scheme railway land become secure from the outsider's encroachment as well as railway becomes neat and clean and beautiful which improve the image of railway. Earning also increased by giving surplus land to employees.

(g) Buckling of track, Cause and prevention.-

1. Buckling of Track: - When the compressive stresses become higher than the resistance (Lateral or longitudinal or both) offered by the track structure then alignment of track (vertically or laterally or both) distorted, this phenomena is called the buckling of track.
2. Cause:- Any act which reduces the resistance offered by the track such as:-

i. Weakening or removal connections between rail and sleepers such as missing or in effectiveness of rail to sleepers fitting.
ii. Reduction of ballast resistance such as inadequate ballast cushion (which provides 70% track resistance to thermal forces) are by loose packing under sleepers
iii. Lose/disturbed ballast profile.
iv. Uncompacted Ballast profile.

Prevention :-

i. To ensure complete and effective rail to sleeper fitting and fastening.
ii. Full and compact ballast cushion and profile.

No maintenance or renewal activities should be done beyond the prescribed temperature

Q.No. 13 Write short notes on :-

a) Imprest Store.,charged of store, surplus store

IMPREST STORES:-

The imprest with every subordinate should be fixed by the head of department. The scale of imprest sanctioned for each subordinate should not be increased or decreased except by the authority who originally fixed the scale.

Material issued from in present stock should be recouped as soon after the issues as possible. The subordinate concerned may place requisitions for the recoupment of imprest stores direct on the authorized stores Depot.

No transfer of stores between imprest holders should be permitted except when stores are immediately required in a particular area in an emergency and are not available at the time with the imprest holder of that area.

CHARGED OF STORES:-

The following types of stores come under this category :-
Consumable stores, such as kerosene oil, paints, varnishes, cotton waste and grease, etc. issued for ordinary repairs and maintenance, charged to revenue.
Stores such as cement, roofing sheets, tiles flooring stone, pipes and special and hard ware fittings, required for maintenance, charged to revenue.

SURPLUS STORE:-

Comprise stores wich are surplus to requirements and include materials released from renewals and replacements as well as from dismantled works. Such stores should be kept distinct from imprest or any other kinds of stores. The disposal of such stores either by transfer to other works districts or divisions or by return to stores depot or by sale should be arranged for by the executive engineer concerned and in the case of permanent way surplus stores in consultation with the track supply officer.

b) River Training works:

The following types of river training works are generally adopted on the Indian Railway:-

1 Guide Bunds:
2 Spurs (Groynes)
3 Marginal Bunds
4 Closure Bunds; and
5 Assisted cut offs.

1. Explain Steps to improve running over turn outs
2. Define soil consistency, what are consistency limit

c) PRE AND POST TAMPING WORKS – To achieve good results the P.W.I should carry out the following preparatory work before taking up the tamping:

a) Ballasting where there is shortage of ballast.

b) Heaping up of ballast in the temping zone, to ensure effective packing.

c) Making up of low cess.

d) Cleaning of pumping joints and providing additional clean ballast, where necessary.

e) Attending to hogged joints before tamping.

f) Tightening of all fitting and fastenings like fish bolts and keys, splitting of cotters, and replacement of worn out fittings.

g) Renewing broken and damaged sleepers.

h) Squaring of sleepers and spacing adjustment; regauging to be done as necessary.

i) Adjusting creep and expansion gap in rails.

j) Examination of rails for cracks etc.

k) Realigning of curves which are badly out of alignment.

l) Clearing of ballast on sleepers to make them visible to the operator.

m) All obstruction such as signal rods, cables, pipes, level crossing check rails, etc., likely to be damaged by the tampers should be clearly marked.

4) Attention during tamping :- The following points should be observed by the machine operator and the Permanent Way inspector.

a) The tamping depth i.e gap between the top edge of the tamping blade and the bottom edge of the sleepers in closed position of the tamping tool should be adjusted depending on the type of sleepers.

b) The tamping (squeezing) Pressure should be adjusted according to the track structure, as per the recommendations of the manufacturer.

c) The number of insertions of tamping tools, per sleeper tamped, varies with the type of sleeper:

i. CST-9 sleepers and steel trough sleepers require tamping twice before passing on to the next sleeper.
ii. Wooden sleepers – Normally one insertion upto 20 mm. Lift and two insertions for lifts above 20 mm may suffice. One additional insertion for joint sleepers will be required.
iii. Concrete sleepers – Generally one insertion is adequate. Two insertions may be necessary if the lift is above 30 mm.

D) While Tamping CST-9 and steel trough Sleepers, it should be checked that the keys are properly driven and they are tight.

e) The shoulders should be compacted along with tamping, where separate provision for shoulder compaction is available.

f) A run-off ramp of 1 in 1000 should be given before closing the day’s work.

Post tamping Attention – The Permanent way inspector shall pay attention to the following points :

a) As some of the rigid fastenings might get loose, tightening of fittings should be done immediately after tamping.
b) Any broken fitting should be replaced.
c) It is preferable to check gauge and do gauging, wherever necessary, after tamping.
d) Proper quality check of work done by tamping machine is important. Immediately after the tamping work, the track should be checked, in respect of cross levels and alignment, and action taken as considered necessary.
e) The ballast should be dressed neatly and proper consolidation of ballast between the sleepers should be done.

D) DS-8 NOTE:-

This is a receipt voucher on which credit is given to the party returning the released material not require for use. Such material is classified by concerned officer and credit is given to the returning party.

The following type of material should be return on DS-8 NOTE

1. Balance material after completion of specific work.
2. Release material from old work.
3. Tools and plants which is used or in broken condition.
4. Scrap.

It is prepared in 6 copies. 1st copy is office copy,(2nd ,3rd &4th) three copies are sent to the depot along with the material and 5th copy sent to account office and 6th copy is sent to divisional works account section as advance copy.

E)What are the condition for C clacc level xing close to road traffic can be kept open to Road traffic.

CLOSED to road traffic L-xing 'C' Class can be open to road traffic if following conditions are fulfilled

I. L.C. should not be located in a Suburban Section.
II. L.C. should not be in Automatic Block Signallling or Automatic permissible block signallling territories.
III. Should have a telephone connection with the nearest station with exchange of private numbers.
IV. Visibility at the level crossing should be good.

V. Should be provided with whistle boards on either side at adequate distance to enjoin the Drivers of approaching trains to give audible warning of the approach of a train to the road users.

VI. As long as the level crossing gate is kept open to road traffic a red flag by day time and red light (by using hand signal lamp) during night, should be displayed towards the approaching trains on either side of level crossing.

f) Running over t/out can be improved taking following steps
   A) All avoidable joints should be welded
   B) CMS xing should be made gapless
   C) Wear in cms xing should not be more than 6mm
   D) 1meter long fish plate to be provided at all joints
   E) Sleeper to sleeper gauge variation should not be more than 1mm

g) SOIL CONSISTENCY

The property of soil which is evident by its resistance to flow is called soil consistency. Consistency helps to understand the degree of cohesion between various soil particles.

A fine grained soil thus remain normally in any one of the flowing states:

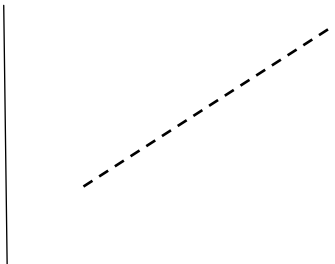
1) Liquid state
2) Plastic state
3) Semi-soil state
4) Solid state

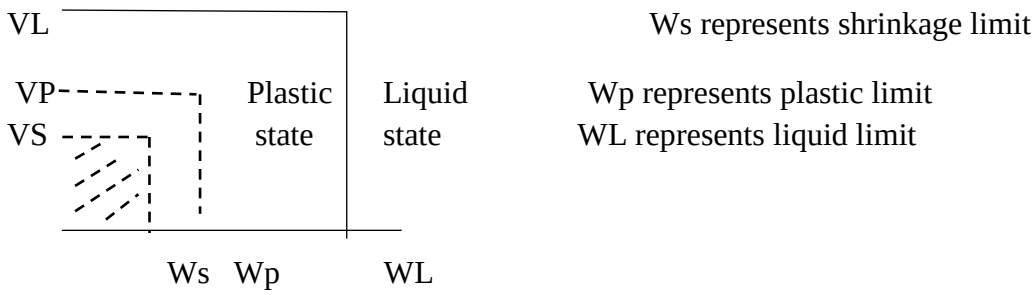
Atterberg limits or consistency limits

Atterberg limits are very useful civil engineering purposes. Brief details of these consistency limits as under:

1) Liquid limits(L.L): The minimum moisture content at which the soil remains in liquid state, possessing a very little shear strength against flowing is called liquid limit.
   Liquid limit can also be defined as the minimum water content at which a pat of soil cut by a groove of standard dimensions, will close for a distance of about 12 mm at the bottom of the groove under an impact of 25 blows in standard liquid limit apparatus.
2) Plastic limit (P.L.): Is defined as the minimum water content at which the soil can be rolled into a thred approximately 3 mm in diameter without breaking.
3) Shrinkage limit (S.L.): is define as the water content blow which further reduction in water content by evaporation does not cause a reduction in volume of the soil mass.

The above limits are shown as in figure.





Q No. 14. Define super elevation, cant deficiency, cant excess in curve & writes brief notes on

- Methods for setting out simple curve:
- Transition length
- Virtual transition.
- Criteria for Realignment of curve.
- Various steps to improve Running on curves.

SUPER ELEVATION:- Cant or superelevation is the amount by which one rail is raised above the other rail. It is positive when the outer rail on a curved track is raised above inner rail and is negative when the inner rail on a curved track is raised above the outer rail.

Cant deficiency:- Cant deficiency occurs when a train travels around a curve at a speed higer than the equilibrium speed. It is the difference between the theoretical cant required for such higer speed and actual cant provided.

Cant excess:- Cant excess occurs when a train travels around a curve at a speed lower than the equilibrium speed. It is the difference between the actual cant and the theoretical cant required for such a lower speed.

- **METHODS FOR SETTING OUT SIMPLE CURVE:**

TANGENTIAL OFFSET METHOD:

This is the method employed for settin g out a short curve of about 100 metre (300 ft) length. It is generally used for laying turn-out curve.

LONG CHORD OFFSET METHOD:

This method is employed for laying out curves of short lengths. In this case it is necessary that both the tangent points are located in such a way that the distance between them can be measured and the offsets taken from the long chord.

QUARTERING OF VERSINE METHOD:

This method is also used for laying out curves of short length of about 100 metres (300ft.) In this method, the location of two tangent points (T_1 and T_2) is first found out and the distance between them measured. The versine (V) is then calculated, using formula:-

CHORD DEFLECTION METHOD:

The chord deflection method is one of the most suited to confined situations as most of the work is done in the immediate proximity of curve.

THEODOLITE METHOD:

The theodolite method is a very popular method for setting out a curve on the Indian Railway, particularly when accuracy is required. This method isalso known as Rankine's method of tangential angles. In this method the curve is set out by tangential angles with the help of a theodolite and a chain on the curve having lengths.

Transition Length:- Transition curve is an easement curve, in which the change of radius is progressive throughout its length and is usally provided in a shape of a cubic parabola at each end of the circular curve. It affords a gradual increase of curvature from zero at the tangent point to the specified radius of circular arc and permits a gradual increase of super elevation, so that the full superelevation is attained simultaneously with the curvature of the circular arc.

1. The desirable length of transition 'L' shall be maximum of the following three values –

(a) $L = 0.008\ C_a\ X\ V_m$
(b) $L = 0.008\ C_d\ X\ V_m$
(c) $L = 0.72\ C_a$

Where: L = the length of transition in metres.

V_m = maximum permissibe speed in Km.p.h.

C_d = cant deficiency in millimeters.

C_a = actual superelevation on curve in millimeters.

- **TO IMPROVE Running ON Curve**

Running on curves:- (1) For smooth and satisfactory running on curves –

(a) There should be no abrupt alteration of curvature and/or superelevation (cant)
(b) The superelevation should be appropriate to the curvature, at each point.

(c) Versine variotation should not be more than +5 to -5mm from theoretical values, station to stn. Varion should not be more than 10 mm
(d) Cant gradient should not be steeper than 1in 360
(e) Proper ballast section, cess width to be ensured

(2) On Group 'A' and 'B' routes, gauge, versines and superelevation on each curve must be checked once in every four months and on other routes every six months.

Criteria for realignment of a curve:

(1) When as a result of inspection by trolley or from the foot plate of locomotive or by carriage or as a result of Track Recording carried out, the running on a curve is found to be unsatisfactory the curve should be realigned.
(2) The running over a curve depends not only on the different between the actual versine and the designed versine but also on the station-to-station variation of the actual versine values. This is because it is the station to station variation of versine which determines the rate of change of lateral acceleration, on which depends the riding comfort.

Service limit for station to station versine variation for 3 speed group viz. 120 Km/h and above, below 120 Km/h and upto 80 Km/h and below 80 Km/h and upto 50 Km/h, should be considered as tabulated below:

Speed Range	Limits of station to station Variation (mm)
120 Kmph and above	10 mm or 25 % of the average versine on circular curve whichever is more
Below 120 Kmph and upto 80 Kmph	15 mm or 25 5 of the average versine on circular curve whichever is more
Below 80 Kmph and upto 50 Kmph	40 mm or 25 % of the average versine on circular curve whichever is more

SERVICE TOLERANCES FOR 120 KMPH ON B.G.

PARAMETERS	TOLERANCES TOLERANCES GENERALLY IN ISOLATED LOCATIONS

1. Track Gauge	No special specifications except those Specified in I.R.W.W. Manual, which are indicated below:	
(a) On straight track	+6 mm	--
(b) On curves up to 4°	-3 mm	
(c) On curves sharper than 4° for introduction of high speeds.	+13 mm	
	-3 mm	
2. Unevenness measured under loaded conditions on a 3.5 metre base*.	+19 mm	--
(a) On long terms basis	6 mm	10 mm
(b) As an immediate measure	10 mm	15 mm
3. Cross level		
4. Twist measured under loaded condition on a 3.5 metre base:	Not specified on consideration that small but constant cross level differences do not matter much. The track should, however, be maintained to standard generally superior to that at present available on main line track with unrestricted speed.	
(a) On straight and on curved track other than on transitions.	2 mm/m	3.5 mm/m
(b) On transitions	1 mm/m	2.1 mm/m
5. Alignment measured as versine on a 7.5 metre chord.#		
(a) On straight		
(b) On curves		

	5 mm	10 mm
	5 mm	7 mm

Q.No.15. Write short notes on the following

i) Quality of drinking water

Ans:- **Quality of Water -**

It should be ensured that the water supplied for domestic and public consumption is clear, potable, and free from pathogenic organisms, undesirable taste and odour. Water should be of reasonable temperature and free from minerals which could produce undesirable physiological effects. The physical, chemical and bacteriological standards should be as per IS 10500.

ii) Chlorination of water:-

Chlorination Methods :

Generally following three methods are adopted for chlorination of water using different chlorine producing agents.

(a) Bleaching powder solution is added to the water, the chlorine available in bleaching power is used to disinfect the water. This method is suitable only for smaller requirement of water.

(b) Chlorine is produced by electrolysing a solution of brine or common salt and the chlorine so produced is used for disinfection.

(c) Chlorine is obtained directly from the cylinders filled with pure chlorine in gaseous or liquid form. This method is generally adopted for larger size of water supply plants

The residual free chlorine available one-hour after chlorination should be 0.5 mg/L.Chloroscopes to know residual chlorine and Horrocks apparatus to assess chlorine demand of water should be available with all Engineering staff in-charge of chlorination and all Health Inspectors.

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5.3 Chlorine demand

When chlorine and chlorine compounds are added to a water source, it purifies the water by damaging the cell structure of bacterial pollutants, thereby destroying them. The amount of chlorine needed to do this is called the **chlorine demand** of the water. The chlorine demand varies with the amount of impurities in the water and therefore the chlorine demand of a water source will vary as the quality of the water varies.

Chlorine and chlorine compounds are consumed by inorganic and organic matters present in water before any disinfection is achieved. For achieving proper disinfection of water by killing the pathogenic organisms, it is essential to provide sufficient time and dose of chlorine to satisfy various chemical reactions and leave adequate amount of chlorine as residual in the form of free or combined chlorine. The difference between the amount of

chlorine added to water and amount of residual chlorine after a specified contact time is the chlorine demand. In other words it is the amount Cl2 that is needed to destroy bacteria and to oxidise all organic matter and ammoniacal substances present in the water.

Chlorination Practices :

There are generally two practices as explained below :-

(i) **Plain chlorination :** This is applied where water is relatively less polluted and sufficient contact period of at least 30 minutes between the point of chlorination and consumer point is available.

(ii) **Super chlorination :** This is adopted in case of water being heavily polluted or where available contact period is short i.e. less than 30 minutes. In case of super chlorination, it may be necessary to go in for dechlorination to remove the excess residual chlorine.

Residual Chlorine:

Residual Chlorine is a low level of chlorine remaining in water after its initial application. This is an indicator that Chlorine Demand is satisfied. It constitutes an important safeguard against the risk of subsequent microbial contamination after treatment The provision of IRWM 2000 are as under:

The Health Inspectors should check the presence of residual chlorine daily at various distribution points e.g. platforms, refreshment rooms, waiting halls, hospitals, schools and in the Railway colonies (preferably from farthest taps in the distribution systems), randomly and record of the same should be kept in a register. Suitable remedial measures should be taken in case of deficiency. Health Inspectors should also test the bleaching powder used once in 3-4 months for Chlorine content (must contain at least 25% of chlorine).

The residual free chlorine available one-hour after chlorination should be 0.5 mg/L (Which is 0.5 PPM).

Detection of residual chlorine :

Detection of residual chlorine can be done by a simple apparatus known as chloroscope using orthotolidine test (OT) and orthotolidine arsenite test (OTA). The OT is used to determine the total residual chlorine concentration and the OTA is used to determine the free and combined residual chlorine separately. When orthotolidine reagent is added to water sample containing chlorine, a greenish yellow colour develops, the intensity of which is proportional to the amount of residual chlorine available in the water sample. The OT test is not as accurate as the presence of nitrates; iron and manganese also produce a yellow colour with orthotolidine. The test using OTA is more reliable.

iii) Inspection of LWR

Ans:-

While requiring less maintenance, LWR/CWR necessitate intensive inspection at supervisory and officer's level.The profile of the ballast section shall always be checked, especially at pedestrian/cattle crossings, curves, Approaches of level crossings, points and crossings and bridges. Cess level should be correctly maintained. Replenishment of ballast shall be completed before the Onset of summer.

Inspection shall be more frequent in the afternoons during summer months. During inspections, look out shall be kept for kinks, incipient buckles and checks made on functioning of the patrols. Knowledge of staff in regard to prescribed maintenance practices shall be periodically checked and it shall be ensured that the work is done accordingly.Ultrasonic examination of rails should not be in arrears. Defective rails/welds should be replaced expeditiously.

Inspections of gaps at SEJ and creep/movement at centre of LWR/CWR by Permanent Way officials would be done as per following schedule:-
i) PWI-Incharge/PWI Sub-section:-
a) Every fortnight during the two coldest and two hottest months of the year at about minimum and maximum temperatures alternately by PWI Incharge and PWI Sub-section.
b) Alternately once in two months during other months of the year.
ii) Assistant Engineer:-
At least once in six months, preferably during coldest and hottest months.

RECORDS
Record of LWR/CWR, as per the proforma laid down in LWR MANUAL shall be maintained by the PWI in a permanent register called the Sectional LWR/CWR Register. The PWI shall be responsible for keeping this register up-to-date.It should also be maintained in TMS.

An indication plate similar to that suggested in para 212(4) of Indian Railways Permanent Way Manual shall be fixed on the cess at each SEJ showing the date of destressing, destressing temperature td/ to and length of LWR/CWR.

(iv) HOT WEATHER PATROLLING:-
ANS:-
Period for hot weather patrolling shall be laid down by the Chief Engineer for each section and patrol charts prepared where necessary. Patrolling shall be organised by PWI accordingly. In addition, the PWI/PWM and the Gangmate shall be vigilant during summer and on hot days. Hot weather patrolling will also be introduced, when the rail temperature rises above td+25 degree Centigrade

1. Hot weather patrolling will be carried out as follows:-
i) On single line or where only one road in a double line section is having LWR/CWR - One patrolman for 2 km.
ii) On double line section when LWR/CWR exist on both roads - One patrolman for 1 km length of UP and DN road. The beats of each hot weather patrolman will thus be restricted to 2 km.
2. The hot weather patrolman should always carry the following equipments:-
HS Flags - Red 2
Staff for Flags 1
Detonators 10
Canne-a-boule 1

3. Duties of hot weather patrolman are as follows:-

He will walk over his beat slowly over one rail in one direction and on the other rail in the return direction. On double lines, he will repeat this procedure alternately on UP and DN tracks. He will be vigilant and look out for kinks in the rail especially during the hottest part of the days. When a kink is observed, he shall immediately examine at least 100 sleepers ahead and in the rear of the kink for any floating condition of track. He should meticulously sound each and every sleeper, 100 sleepers on either side of the kink, to determine any floating condition. The sounding will be done by dropping a canne-a-boule on each end of the sleeper to determine the extent of void under the sleeper. Should the sounding reveal a floating condition, under which a buckle may be anticipated or the patrolman has detected actual buckling of track, he will take immediate steps to protect the affected portion by display of hand signals as per rules in force. After protecting the track, the patrolman will arrange to advise the Gangmate, PWM, PWI of his apprehension of a buckle/actual

Qus. 16. <u>Write short note on</u>

a. **Monsoon Precautions**

Ans:-

1. All catch water drains and side drains must be cleared of silt, vegetation and other obstructions to be ensure free flow and quick drainage of storm water. The waterways of bridge must be cleared of vegetation and other obstruction. If silting is noticed some span, it should be removed to ensure that the full waterways is available for the discharge of flood water, During desilting, care should be taken to remove the silt only up to the bed level.
2. Protective and river training works must be maintained in good condition and repairs carried out wherever necessary. Scour holes should be filled with boulders.
3. The High Flood Level (HFL), full supply level (FSL) in the case of canals, and danger level (DL) must be painted. The danger level mark shall painted with bright red band across each pier adjacent to the abutment so as to be clearly visible to the patrolmen, special watchman and Drivers Flood gauges shall be painted on important bridges specified.
4. Water shall not be allowed to stagnate on the track. For this purpose, cross drains should be provided at regular intervals. In yards, cross drains and longitudinal drains should be cleared/provided to proper grades.
5. In hilly areas, where there is incidence of falling boulders, a survey should be carried out to locate loose boulders. Such loose boulders should be dropped in a systematic manner.
6. Selection of patrolman and watchman should be made in accordance with Para 1008 and they must be trained and tested for their knowledge of rules. The duties to be performed by them should be clearly explained to them.

The equipment of Patrolmen and other watchman shall be complete in all respects.

7. Spare trollies should be kept in readiness at he headquarters of the Permanent way inspector and at other stations in the proximity of vulnerable locations. Motor Trollies must be overhauled and kept in fit condition.

7. Rivers in the upstream reaches should be inspected for guarding against possible change in water course.

7. The prescribed reserve stock of boulders, empty cement bags, wire netting and sand/quarry dust should be kept at specified locations for rushing to site, in case of emergency and should be made good, in case of deficiency.

Maintenance of PRC sleepers

Ans:- (I) Concrete sleepers should normally be maintained with heavy on track tamers. For spot attention, off track tampers may be used.

(ii) Only 30 sleeper spaces are to be opened out at a time between two fully boxed stretches of track of 30 sleeper lengths each in case LWR track exists.

(III) The concrete sleepers should be compacted well and uniformly to give a good riding surface centre binding of mono block concrete sleepers should be avoided and for that purpose the central 800mm. Of the sleeper should be hard packed.

(iv) Both ends of concrete sleepers should be painted with anti corrosive paint periodically to prevent corrosion of the exposed ends of pre-stressing wires.

(v) The laying and maintenance of concrete sleepers should be done by mechanical equipments as far as possible.

(vi) Wherever casual renewal of concrete sleepers is to be done, normally precautions required for LWR track should be taken.

(vii) The elastic rail clip should be driven properly to ensure that the leg of the clip is flush with the end face of the insert. Over driving and under driving should be guarded against as this causes eccentric loading on the insulation and this results in their displacement and of the load.

(viii) vigilant watch should be kept to ensure that not creep takes place in any portion of the concrete sleeper track and there is no excessive movement near SEJ.

(IX) Rubber pads: It must be ensured that the rubber pads are in correct position. Wherever it is found that the rubber pads have developed a permanent set, these should be replaced by new ones. Such examination can be done at the time of de-stressing. Loss of toe load can also be due to ineffective pads.

(x) Insulating liners: Nylon or composite insulating liners used with pandrol clips should be examined periodically for sign of cracking and breakage. Adequate care should be exercised while driving the clip at the time of installation to prevent damage.

(xi) Special attention to prevent seizure of elastic rail clips: One of the biggest problems of maintenance of concrete sleeper track is that elastic rail clips get seized with MCI inserts not only in regular maintenance, but also during de-stressing, other incidental works and derailments etc. Following remedial measures are suggested.

a. Measures to prevent corrosion and seizure of ERCs with M.C.I. inserts : At the base depot, all the elastic rail clips and MCI inserts should be thoroughly cleaned. Grease should then be applied on the central leg of the ERC and eye of the MCI insert and then the clip should be driven at the time of assembly of the service panel.

b. All the elastic rail clips are to be taken out during service from the MCI inserts and should be cleaned with wire brush and emery paper specially on the central leg. The eyes of the

MCI inserts are also to be cleaned of any debris or rusted material the central leg of the ERC should then be applied with proper quality of Grease.

c. **Distressing of LWR**

Ans:- When is distressing Necessary:- Whenever there is abnormal behaviour of LWR as indicated

below, distressing should be done:

i. Gaps at SEJ : whenever the gap observed at SEJ differs beyond limits specified or exceeds the maximum designed gap of SEJ or when stock/tongue rail crosses the mean position.

ii. After special maintenance operation: After special maintenance operations viz. Deep screening, lifting or lowering of track major realignment of cures sleeper renewals other the casual renewals and rehatibiliation of bridges and formation causing disturbance to track.

iii. Unusual occurrences: after unusual occurances viz rail fractures or replacement of defective rail/glued joint, damage to SEJ/ Buffer rails, bucking & breaches etc.

iv. Temporary repairs: if number of locations where temporary repairs have been done exceed three per km.

Procedure for Destressing without use of rail tensors.

(i) A traffic block of adequate duration say about 3 hours is taken at such a time when the rail temperature is between tm+5 and tm+10c, for 60kg/52kg rail or tm- to- tm+ 5c for lighter rail sections, Before the block is taken a speed restriction of 30 kmph is imposed and fastenings on alternate sleepers loosened.

(ii) During the block the closure rail are disconnected and the S.E.Js are adjusted to be in the mean position.

(iii) The sleeper fastenings on both the rails are loosened, starting from the S.E.Js to the centre of LWR

iv. The rails are lifted and placed on the rollers at about every 15th sleeper, to permit free expansion the rails are also struck with wooden hammers to help in distressing.

iv. The rollers are then removed and the fastenings tightened, starting from the centre of LWR towards SEJ the tightening of the fastenings must be completed in the defined temperature range of destressings.

iv. A cut rail is provided between the S.E.J and LWR keeping adequate provision for thermit welding.

iv. Thermit welding of joints is done subsequently to complete all the operations of distressing.

Destressing of the rails should be done simultaneously. While distressing on curves the rails should be provided with the lateral supports at an interval of 10 sleeper on the inside of curves and at an interval of 30 sleeper on the outside of curve. At time of distressing, a gap of 7 to 8mm should be provided at each of the fish plated joints of the buffer rail assembly.

d. **Winter Precautions**

Ans:- Winter Precautions:-

1. Winter de- stressing should be carried out to reduce the temperature forces wherever due, to check the occurrence of Rail/weld fractures and record of such de-stressing should be maintained.

2. Majority of fractures occurs, when the rail temperature is minimum during early hours in the morning. To detect the fractures during winter months, Kerman's duty roster should be changed to have early morning patrol so that failures, if any can be detected in time, in addition to cold weather patrolling to be carried out as per stipulated instructions.
3. Gap survey should be done in SWR territory and gap adjustments shoald be done where needed. Creep should be measured and action taken to arrest it.
4. For urgent temporary repairs of locations of rail/weld fractures, spare joggled fish plates, clamps bolts, wooden blocks should be kept at every km gate lodges, and gang huts.
5. Shallow screening of pumping joints should be carried out.
6. The joint sleeper spacing should be rectified wherever required.
7. Ensure zero missing fittings by recouping deficiency , if any immediately.
8. No new holes should be drilled without proper equipment and chamfering. All location or the holes in the rails should be visually examined for any cracks.

e. **Maintenance of CMS Xing**

Ans:- (i) The procedure followed for inspection and maintenance of ordinary points and Crossings should be followed in the case of CMS crossing also.

(ii) Due to heavier weight of the CMS crossing the sleepers under the crossings are likely to develop a concave shape in the central portion tending to minimize the life of wooden sleepers it is therefore, important that the crossing sleepers are well- packed.

(III) Incorrect gauge at the crossing may lead to excessive wear on the nose or check rail and may result in possible derailment. The gauge, therefore, at the crossing should always be correct; there is likelihood of gauge face of wing rails developing sharp corners due to wear and inadequate flange way clearance which would result in rapid wearing of the wheels passing over them. In such cases the gauge faces should be rounded off to 10 mm radius by grinding.

(iv) The flange ways of the CMS crossings should be ground to proper radius after it has been in service from 3 weeks to 3 months. Depending on the traffic. A second grinding two or three months later is also recommended as this will increase the life of the crossing before it will need further attention.

(v) Whenever the metal has flown out on nose or wing rails, the extra metal should be filed in such a way that the contour profile is not disturbed . where filing becomes difficult the only alternative is to try grinding by means of a portable pneumatic or electric grinder taking care that the location does not get excessively heated up .

(vi) No attempt should be made to make holes in the CMS crossing by flame cutting, as this will lead to cracking of the crossing.

(vii) When laid in locations subjected to heavy traffic density. a careful watch should be kept to find out development of hair cracks and wavy corrugations. If these develop, the crossing should be replaced and sent for metallurgical investigations.

(viii) After laying the CMS crossing an initial speed restriction of 50 kmph should be imposed for about 3 weeks or the passage of 50,000 axles, The crossings should then be inspected for cracks defects and if they are found to be free from any cracks, defects etc. The speed restrictions may be withdrawn at the discretion of the chief Engineer.

f. **How to arrest the weld failure.**

Ans:-

1. In case of welding of rail on cess, full rail length should be supported on at least ten wooden blocks either side of proposed weld and rails should be properly aligned spiked and held in position. Welding should be carried out on proper cess and not on the ballast shoulder.
2. In case of in-situ welding, rails fastenings of at five sleepers on either side of proposed weld should be loosened.
3. Ensure that rails are with nil battering & nil hogging at their ends.
4. Ensure that portions being used match with type and chemistry of rail i.e. weight & UTS.
5. Rail end should be cleaned with wire brush & k-oil.
6. Rail ends should be cut straight and square.
7. Gap should be as per welding technique being used.
8. Ensure correct alignment of rails prior to welding.
9. Ensure that prefabricated moulds are as per welding techniques, free from any moisture & cracks.
10. Pre-fabricated moulds should be dressed with respect to actual rail profile being welding prior to their fixing
11. Prefabricated mould should be centrally fixed and central lines of two halves of prefabricated moulds should be coinciding with each other.
12. Ensure that mould shoes are in proper shape.
13. Prefabricated mould should be gently inserted / adjusted in mould shoe.
14. Spatulea should be used for luting of the joint-gap ensure that premixed luting sand is not older than four months from its date of manufacture.
15. Ensure that no foreign elements are mixed in luting sand.
16. For proper and uniform preheating of both rail ends, vaporizers should be placed/set at proper height. Maximum height of gooseneck from rail top should be 40mm.
17. Ensure that crucible is properly dried/charged and respaired with magnasite prior to pouring o portions.
18. Enusre that thimble is dry and free from moisture and also thimble shape is round and of dia 18-20mm (25mm Technique)and 20-22mm(75mm Technique)
19. Maximum height of crucible from top of prefabricated mould should be 50mm.
20. Workability of pressure gauge fitted on petrol tank in case of pre-heating by petrol and gauge fitted on Oxygen & L.P.G. cylinder in case of preheating. With oxy-LPG mixture should be checked before carrying out of welding of rails.
21. Ensure that portion bags are properly sealed and intact at the time of opening for use.
22. 90 UTS portion should be used when welding of 72 UTS & 90 UTS rails is being done under unavoidable circumstances.
23. Portion being used should not be of more then two years old from the date of manufacturing provided packing is intact and there is no entry of moisture.
24. Portion should be stored in steel box at the site of welding.

25. Parameters of traffic block, preheating pressure and preheating should be adhered as stipulated for AT welding.

Table 10.20 Traffic block and pre-heating time for different types of pre-heating

Type of pre-heating	Preheating by Air Petrol Mixture		Oxygen LPG mixture preheating process
Type of weld	SPW	Wide Gap	SPW
Traffic block (in Minutes)	60	70	60
Preheating pressure	100-110 P.S.I	100-110 P.S.I.	2 TO 2.5KG. Cm LPG 7-8 Oxygen kg./cm
Preheating Time in (Minutes)	10-12	10-12	2.00 to 2.50

26. Ensure proper plugging of crucible.
26. Portion should be thoroughly mixed in the pan before pouring it into the crucible for ignition\
26. Ensure reaction time after ignition of portion, as 25±3 seconds and portion in the crucible should be covered by crucible cap after start of reaction.
26. Molten metal should be tapped on completion of reaction and after slag separation.
26. Bottom half of prefab mould and risers should be preserved at the time of demoulding to ensue controlled cooling.
26. Chipping of hot metal should be done after 4-6 minutes of pouring of molten metal into the gap for 25mm gap joint & 12 minutes for 75 mm gap joint.
26. In case of in-situ welding newly welded joint should be supported on wooden block joggle fish plated and first train should be passed with restricted speed after rough finishing of joint after 30 minutes of pouring molten metal.
26. Ensure final finishing of joint within 24 hours of its execution.
26. Ensue that there is no chisel mark on rail surface after final finishing.
26. Ensure that each weld bears distinctive mark indicating month, year, agency, welder's code and weld number punched on an aluminium, stop and fixed to the weld with epoxy adhesive at 30mm from joint. No punch marking should be done on the rail and particulars of welds are recorded are per proforma.
26. Ensure that weld are stencilled with welder's code and particulars of welds are recorded as per proforma circulated by Railway Board.
26. Repair to crucible shall be done using magnasite
26. Weld collar should be painted upto 10 cms on either side of weld by usmg correct procedure.
26. In case of emergency if joint is to be executed in failing temperature use tensor.

g. **Fabrication of Glued joint INSITU.**

Ans:- General:-

1. Glued joints are laid at place where insulation of rails as well as continuity of rails is required .

2. Normally Glued joints are fabricated in shop floor and transported to the site however as the glued joints fabricated at the site save effort needed in transportation and also save at least two thermit welds. Welds. Which are a weak link in track. Repairs to a failed/damaged glued joint can also be conveniently done at site, carefully fabricated glued joint in the field can given as good a service as a shop fabricated glued joint.

Fabrication works:-

1. In case the fabrication is being done in running track, minimum traffic block of 2 hours shall be taken and track protected with banner flag and detonator. Rail should be made free of fittings over as length of 2.00 m on either side.
2. Grinding of rialto a length of 50cms on either end should be done with the AG-9 grinder and it shall be ensured that no rolling mark, rust dents are in contact with the fishplate.
3. Both the fishplates shall be ground to make the surface free form dust dents grease etc.
4. The gap shall be maintained slightly more than 10mm to accommodate the end post (to achieve this tensor shall be applied)
5. The rail end shall be aligned laterally and vertically with straight edge using suitable wedges. After aligning no hammering/disturbance to ends should be done.
6. The rail and fishplates surface shall be cleaned with acetone and dried completely.
7. The resin and hardener shall be thoroughly mixed to get homogeneous mixture. The mixed glue shall be consumed within it pot life (Generally 30 minutes)
8. A thick layer of glue shall be applied on mating surface of the fishplates simultaneously be two workmen.
9. One piece of clean glass cloth carrier shall be placed on the fishplates and evenly pressed so that the glue squeezes out through the glass cloth. The oozing shall be uniformity spread over. A layer of glue shall be applied on inside of the insulating channel followed by then placement on the glued glass cloth carrier on the two fishplates.
10. A layer of glue shall then be applied on the outside of the insulating channel and a clean piece of glass cloth carrier shall be laid. The oozing glue shall be uniformly spread.
11. Glue shall be applied to both the faces of end posts and placed between the two rail ends. The tensor may be tightened to place the end post firmly if the same is loose due to more gap. Alignment checked again at this stage and corrected i disturbed.
12. The insulating bushes duly dipped in glue shall be placed in rail holes. The bonding surfaces of the rail shall then be coated with a layer of glue and the fish plates made ready shall be placed in position in contact with the rail web.
13. H.T.S. bolts washers and nuts well cleaned and free from oil, dust etc. Shall be placed in position and tightened with torque wrench. The torque shall be increased gradually on all the bolts, care shall be taken to tighten inner bolts first and than outer bolts. Finally all the bolts shall be tightened with the torque of 105 kg-M.
14. The above `operation shall be finished within 45-60 minutes so that minimum 60 minutes setting time is achieved.
15. About 20 minutes after initial tightening, all the bolts shall be re-tightened with the torque of 105kg-M
16. The joint shall be finished by covering all the visible edges of glass cloth carrier with glue.
17. After re-tightening the bolts. Joint is left for setting with tensor in clamped condition.

18. After setting, the removed fittings are restored in position tensor removed and traffic block shall be cancelled.
19. Before passing the traffic, it shall be ensured that no extra material like settled glue3 etc. Remains on top of the head & gauge face side of the rail.
20. Traffic may be passed at restricted speed of 30 kmph for about two hours after which the speed restriction shall be relaxed to normal.

Qus.17. Write Short Note on

a. **Handling of 90 and higher UTS rails.**

Ans:- Higher UTS RAILS (90uts & above are sensitive to handling and require special precautions to avoid damage. The guidelines and instructions in this regard are given in a tabulated statement in the forms of "Avoid" and "Ensue".

Guidelines for handling of 90 UTS & above UTS Rails.

Items	Avoid Ensure	Guidelines
1. Protection of Straightness	Avoid	1. Heavy static loading and sudden impact. 2. Single point slinging. 3. End drop and flange overlap or crossing of rails 4. Localized point or line contact when stacking.
	Ensure	1. Two point slinging for rails up to 13m length. Increase slinging point at the rate of 1 per 6.5m. 2. Rails are kept horizontal and straight as far as possible while lifting carrying or stacking. 3. Provide suitable dunnage/spacer to protect rails against point contact. 4. Rails of same length are stacked on a firm level base providing uniform Support. Successive layers may be of the same or decreasing width for stacking of unequal length of rails. 5. Subsequent layers should be separated with uniformly placed suitable spacers or dunnage in vertical alignment with the base supports. 6. Rail ends are protected.
2. Protection of Rail	Avoid	1. Impact or abrasion of rails and rail bundles against structures,

surface		buildings, ship hatches wagons vehicles. 2. Crossing or flange overlap while stacking or making rail bundles, suitable spacers to be used while making rail bundles. 3. Any rail support handling or clamping device and rail pinch rollers which apply localized or point contact to the rail
	Ensure	1. Where conventional slings are employed, use of fabric, e.g. polypropylene slings/sleeves is recommended. As an alternative, if flat link chains are used, these should be fitted with fabric sleeves. 2. Rail should be protected against bruising , notching or scoring of surface. 3. Wherever possible, the profile of rails support handling or clamping device and rail pinch rollers should be contoured to rail profile. 4. Use of round link chain sling. Ideally lift the rails by using electro magnetic lifting devices.
3.Prevention of Metallurgical Damage	Avoid Ensure	All heating. Flame cutting, welding and spot welding during rail handling or transit. Protection of rail from electric are from adjacent cables or molten metal splashes from nearby welding operations.
4. Protection from contact with injurious substances.	Avoid Ensure	Contact with injurious substances such as acids alkalis, salts, fertilizers, sulphates, chlorides and nitrates. Rail stock piles should be built on a well drained base substance as per drawing no. RDSO/T-6219.

b. **Frequency of USFD testing of rails.**

Ans:- (1) Frequency of ultrasonic testing of rails.

BG routes

GMT	Frequency
Less than 5	Once in 2 years
5 to 8	12 Month
8 to 12	9 Months
12 to 16	6 Months
16 to24	4 Month
24 to 40	3 Month
40 to 60	2 Month
>60	1.5 Month

Note: (i) frequency of testing of welded

(ii)frequency of USFD testing of welds.

Conventional

Acceptance - After execution

Ist periodical - 40 GMT and part thereof .

Skv.

Acceptance - After execution

Ist Periodical - After 1 year

IInd periodical - 0 – 15 GMT - 5 Year

15-30 GMT - 4 Year

30-45 GMT - 3 Year

45< - 2 Year

c. **Cant deficiency & Cant Excess.**

Ans:- (i) Cant deficiency occurs when a train travels around a curve at a speed higher than the equilibrium speed . it is the difference between the theoretical cant required for such higher speed and the actual cant provided.

In normal – 75mm , special case- 100mm. For A&B route with the permission of CE.

(ii) Cant excess occurs when a train travels around a curve at a speed lower than the equilibrium speed. It is the difference between the actual cant provided and the theoretical cant required for such lower speed.

Limiting value – 75mm.

d. **Greasing of ERCs, inserts, liner seats including sealing of liners.**

Ans:-

1. **Following action therefore , is to be taken while greasing of ERC.**

i. Greasing of ERC's should be done by the keyman in PSC sleeper track. Keyman should carryout greasing of ERCs in a systematic manner from one end at the rate of 20 sleepers (80 clips) per day. Greasing should be planned in such a way that entire length of beat is tackled once in a year, however, in severe corrosion prone areas greasing of ERC's shall be done once in six months. The severe corrosion prone areas are listed in CE's circular no 260 to supplement the efforts of keyman, each gang shall also be engaged to grease ERCs in their respective gang beat as it will not be possible for keyman alone to complete the work. In addition to greasing by keyman it shall also form part of systematic maintenance of track by the gang.

ii. Before greasing & transfer & slightly strike ERC on rail head to cause it to vibrate and distress. For ERC's which have got stuck into the inserts due to prolonged negligence, use of suitable de-rusting chemicals shall be made to ease out the clips.

iii. Greasing of ERC's should not be carried out during extreme o summer and heavy rainfall. At a time ERC's should not be removed from more than one sleeper. If for any reasons mass lubrication of ERC's is taken up at least 15 sleepers shall be kept intact between any two sleeper taken up for lubrication of ERC's at the same time. The ERC's should be cleaned by wire brush and emery paper. The eye of the insert shall also be cleaned by round wire brush. After cleaning, grease graphite shall be applied to the inside surface of eye of insert and leg of ERC.

iv. However for increased retentivity of toe load in ERC, the contact surface of ERC needs to be changed periodically. This will facilitate relief from partial permanent set under constant stress accumulation in a particular position for long time. Change in contact points will form new lines of stress forces in ERCs Inside/Outside ERCs should be interchanged and fixed again ERC should be driven back up to correct length.

3. Toe load of ERCs has been found to be decreasing during service. It is therefore necessary to periodically check the toe load of ERCs to ensure a certain minimum toe load at all time.

3. Sample size and frequency to be adopted for measurement of toe load of ERCs during services is as mentioned below:

I. Toe load to be measured on 1 % of ERCs randomly in every 100sleeper (all 4 ERCs to be measured on one sleeper)

II. Initial testing frequency of ERC to be after 4 years or passage of 200 GMT traffic, Whichever is earlier and afer 2 years or 100 GMT, Whichever is earlier in severe corrosion prone areas.

III. Subsequent testing will be done every four years or 200 GMT in normal areas and two years or 100 GMT in severe corrosion prone areas, whichever is earlier. However, if 20% or more of sample size records toe-load below 600 kg, both frequency of inspection and sample size are to be doubled.

5. Replacement of ERC:- If 20% or more of sample size records toe load below 400 kg which is to be confirmed by 5% sample size, proposal of through fastening Renewal (TFR) should be initiated.

But before initiation of the proposal for through fastening renewal consideration should be given to over all condition of track GMT of route importance priority in the works Programme etc.

2. **Maintenance of insulated joints.**

Ans:- For efficient and trouble free maintenance of insulated joints, following precaution should be taken:

i. Insulated joints must be maintained as square joints and in any case the distance between staggered joints should not exceed the minimum wheel base of the vehicles.

ii. Rail ends, where insulated joints are fitted must be square and true. Battered ends must be eliminated by cropping and the gap between the rails, if excessive, must be reduced.

iii. Fish plates at the joints must be kept tight and the sleepers well packed in the vicinity of the joints to prevent movement of rails, adequate creep anchors should be provided.

iv. Rail ends must be kept free from dust dirt, sand rust and other foreign materials etc. All rough edges and burners at the rail ends must be removed.

v. The head of dog-spikes should not be allowed to touch the fish plates: Keys of anti-creep Dearing plates on adjacent sleepers of the insulated joints should not be allowed to touch each other as they may cause short circuiting. Particular care should be taken to ensure that the spikes do not protrude below the sleeper, as this may cause leakage of track circuit current through moisture in ballast.

vi. Shims should not be provided at insulated joints.

vii. To avoid crushing of centre parts of insulation joints creep should be effective assessed. At least one rail length on either side of the insulation joint should be box anchored.

Q.No..18. Write Short Note on.

a. Rain water Harvesting.
b. Classification of Railway station.
c. File foundation
d. Mix design.
e. Tiles and Checker Tiles.

a. Rain water Harvesting.

Ans:- Rain water harvesting :- it is technique of collection and storage of rain water at surface or in sub surface aquifer. Before it is lost as surface run off. The augmented resource can be harvested when need. Thus it comes wide range of means of collecting and storing water but popularly this items is becoming synonymous to artificial recharging of ground water aquifer.

Following are the three basis type follow for rain water harvesting.

a. Roof top rain water harvesting and storage in tanks.

b. Roof top rain water harvesting and recharging sub surface aquifer.

c. Surface run off harvesting and recharging sub surface aquifer.

Advantages of Rain water harvesting:-

a. Promotes adequacy of underground water.

b. Mitigates the effect of drought.

c. Reduces soil erosion as surface run-off is reduced.

d. Decreases load on storm water disposal system.

e. Reduces flood hazards.

f. Improves ground quality/decreases salinity (by dilution)

g. Prevents ingress of sea water in subsurface aquifers in coastal areas.

h. Affects rise in ground water table. Thus saving energy(to lift water)

i. The cost of recharging subsurface aquifer is lower than surface reservoirs.

j. The subsurface aquifer also serves as storage and distribution system.

k. No land is wasted for storage purpose and no population displacement is involved.

l. Storing water underground is environment friendly**.**

b. **Classification of Railway Station** :- railway station can be classified in 3 main consideration.

A. Operation consideration.

B. Earning consideration

C. Functional consideration.

a. The classification of station as per operational consideration as category as block & non block station. Block station are further classified as A class, B class & C class. Station. Non block station are classified as D class station and flag station.

b. 2 On basis of earning consideration. Station are also classified as per condition of annual passenger earning. As per the consideration station have been classified in 6 categories as A,B,C,D,E&F categories.

c. On the basis of functional consideration station are classified based on the function as their function as The station are required to performed. Under this category station are classified as Halt station, Flag station, Crossing station or way side station, Junction station and terminal station.

c. **File foundation.**

Ans:- Pile foundation are slender, circular member of timber, hollow pipes, or RCC , either driven or cast in situ. Due to slender ness pile are not used in those bridges where scouring are involved. Pile are classified as under.

i. Based on load

a. Friction Pile – it transfer load by skin friction

b. Bearing Pile – it transfer load by end bearing

c. Bearing cum friction pile - it transfer load by skin friction and end bearing

ii. Based on construction method.

a. Driven – Pre cast pile and cast in Situ pile

b. Bored Pile - cast in situ pile and compact pile

iii. Based on construction material.

a. Timber Pile

b. Steel pile

c. RCC Pile

d. **Mix design** .

Ans:- Cement , Sand, Coarse aggregate are mix in a certain proportion which can be 1:4:8, 1:3:6, 1:2:4, 1:1.5:3 i.e. M-10, M-15, M-20 grade of concrete such mixes are known as nominal mix and prepare by volume or weight batching. However if grade of concrete exceed M-20 than proportion of ingredients design in lab than implicated in filled. Such higher grads of concrete are complemented by inclusion of admixture so as to achieve higher compressive strength. Proportion of such admixture are essential in mix design to get more workability with less water cement ratio. Design mix is adopted in important nature of works and a weigh batcher is also must at site to mix proper weight of ingredients.

e. **Tiles and Chequered Tiles.**

Ans:- The tiles are very important building material for floor and dado treatment and kitchen bath & toilet walls and flooring .The tiles shall be of approved Indian manufacture and conform to specifications IS:777-1970. They shall be flat and true to shape and free from cracks, chips, craze, specks, crawling or other imperfections detracting from the appearance. The glaze shall be either glossy or matt. The body of the tile on fracture shall appear fine grained in texture, dense and homogeneous. The special consist of cove- bases, angles, beads, round edge tiles, corner cups, ridge and legs etc.

Chequered Tiles:- These tiles are very important building material for providing antislipry surface such as path for physically challenged person at station in different location. These tiles shall conform to Indian standard laid down in IS: 1237-1980, The size of tiles to be used shall be as laid down in the drawing. The colour and texture of the wearing layer in the tiles shall be uniform throughout its thickness. The wearing face of the terrazzo tiles shall be free from projections, depressions and cracks. The angles shall be straight & true. The upper layer shall consist of marble chips and cement(with or without pigment).

Q.19. Short Notes :

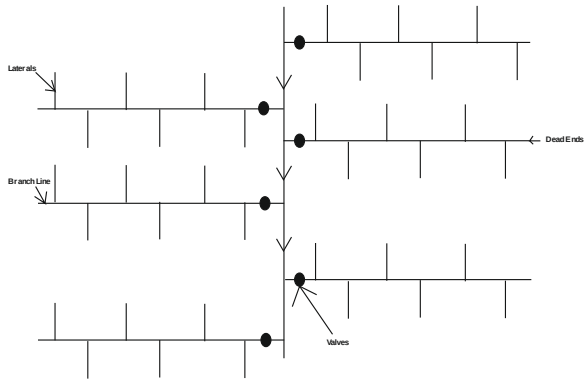
1. Water supply distribution system.
2. Water closets and urinals, Flushing cisterns, wash basin.

3. Well Foundation.
4. Licensing of Railway land for cultivation.
5. Earnest money, security deposit.
6. Zonal works contract, quotations.
7. Delayed and Late tenders.

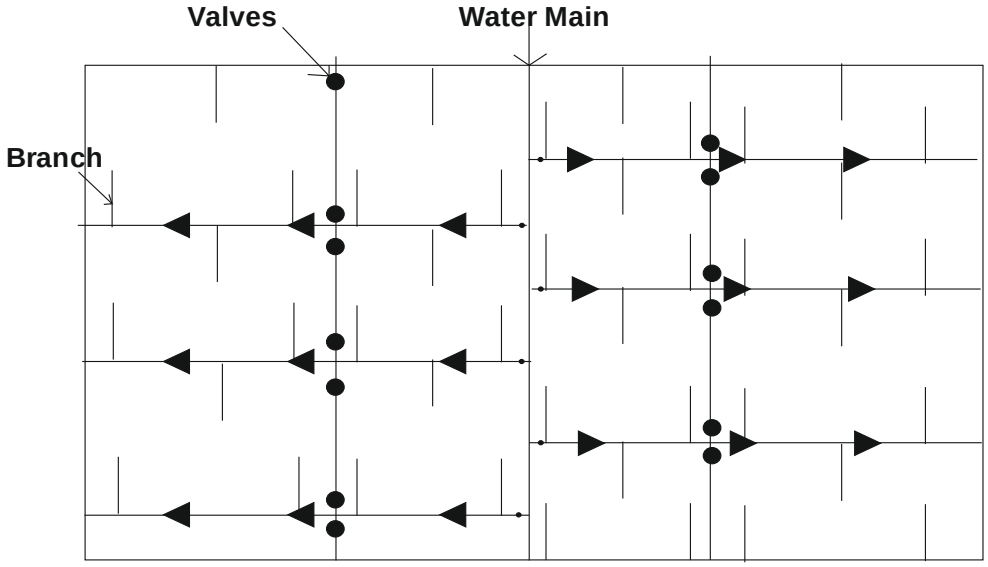
a. Water Supply distribution System : System depending upon the general topography of the area. Local conditions, orientation of the road. The types of system is as under :-

(I)Dead end system or Tree System : In this system a main pipeline is laid in the centre of the area from where a numbers of sub-mains originate.

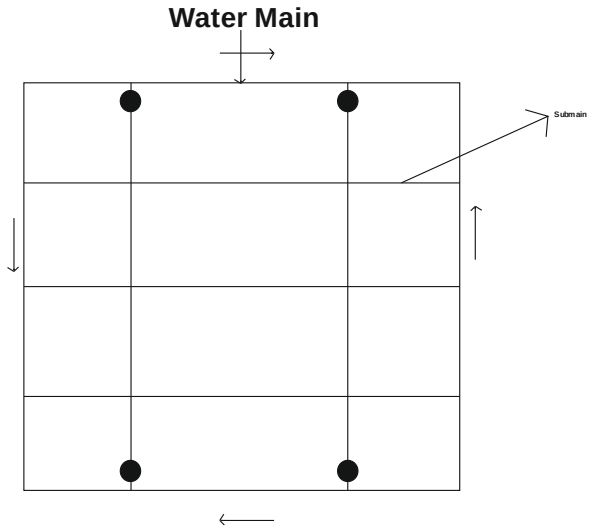
Each sub-main is further sub-divided into branches pipes called laterals.



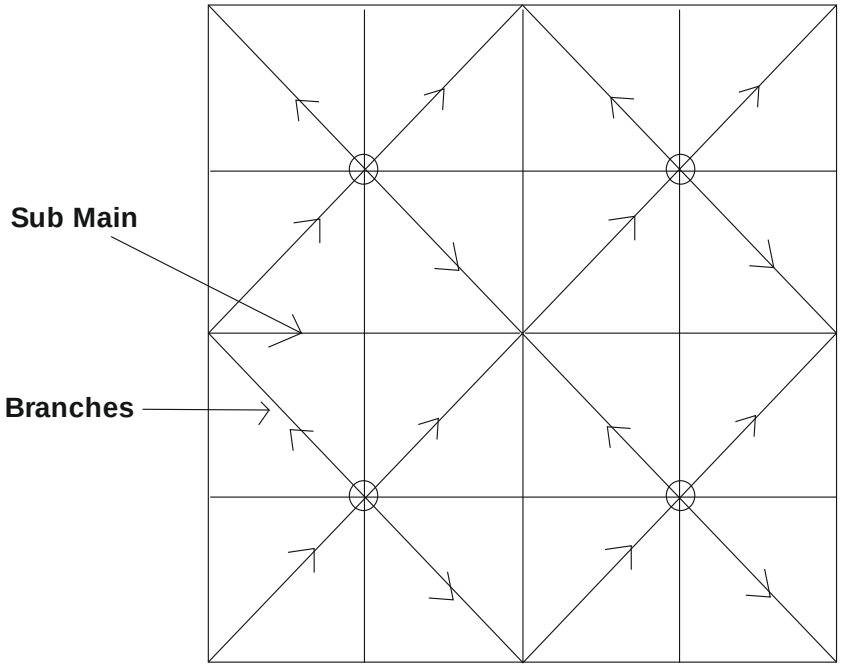
(ii) Grid Iron System : In this system the main sub main and branches are all inter-connected with each others. This system is most suitable for the cities having roads.



(iii) Ring System : In this system the main pipe lines is laid around the area in a closed ring either circular or rectangular.



(iv) Radial System : In this system water from main pipes is pumped to the distribution resevoir at the centre of the location of the localities.



(b) Water Closets and Urinals : The sanitary fittings which receives the human excreta directly and filled with a S or P trap for water seal to prevent the entry of foul gases backward from the soil pipe, is called a water closet.

Urinals : A system receives of urine is called urinals.

Flushing Cisterns : Flushing Cisterns are provided for flushing the water closets and urinab. The may be of cast Iron, Viterous China or plastic china or plastic. For Indian type of WC, flushing cisterns generally provided Cast Iron.

Wash Basin : A washbasin is used for washing hands, face, etc. It is available in various pattern and sizes. Normally, oval shaped bowl type wash basin with over slow slot is used in houses. The wash basin is normally mounted on angle irons fixed on wall. The wash basin is provided with two taps - cold water and hot water.

(c) Components of the Well Foundation :

(I)Well Curb and Cutting Edge : Bottom portion of the well is tapered and is called well curb. It should be strong enough to transfer the design load. Cutting edge, which is integral part of the well curb, is usually made of rails or mild steel plates and angles. Edge of the cutting is sharp to facilitate cutting of soil. Inclined portion of the well curb facilitates easy sinking. After the well curb, outer dimension of the well is very slightly reduced. and this facilitates in reducing skin friction, while sinking the well.

(II) Bottom Plug : As shown in the drawing, bottom portion of the well is filled up with M-15 grade concrete and is known as bottom plug. In most of the cases, there is always water in the well and bottom plug is to be done under water. Bottom plug should preferably be 300 mm above well curb.

(III) Top Plug : A 300 mm thick plug of at least M-10 grade of concrete is provided to work as top plug, as per section.

(IV) Well Steining : The thickness of steining is normally kept as one fourth the outside diameter of railway bridges. As per latest instructions, the thickness of well steining should not be less than 50 mm.

Well steining is either constructed of mass concrete or reinforced concrete. Bond rods, disturbed uniformly on both the faces of steining, should be provided at a rate not less than 9kg/m to bond the units of the steining during the process of construction. They are tied up by providing adequate horizontal hoop reinforcement, which should not be less than 9kg/m. The cover for the rod should not be less than 75 mm.

(V) Well Cap : The bottom of the well cap should, as far as possible, be located 300 mm above the low water level. All the longitudinal bars from the well steining should be anchored into the wall cap. Well cap should be designed as a slab resting on the well steining.

LICENSING OF RAILWAY LAND FOR CULTIVATION

(I) Unused/unlicensed cultivable land should normally be utilized for afforestation purposes only.

(ii) Land given to State Government for GMF scheme should be taken back for afforestation.

(iii) Land licensed to outsiders should be taken back on expiry of current license terms and to be used for afforestation except on grounds of compassion or in case of those belonging to the categories of scheduled castes/scheduled tribes, landless poor or other weaker sections of Society on the specific approval of G.M.

(iv) Land licensed to Category 'C' Staff should be taken back for afforestation. Continuation of licenses permitted to Group 'D' Railway employees belonging to the categories of scheduled castes / schedules tribes and other weaker sections of society by Chief Engineer. However, land adjacent to gate lodges and ganghuts may be licensed to gateman and gangmen for cultivation purposes.

Quotations :

In special situations, normal calling of tenders may be dispensed with and works can be executed by calling local quotations.

The powers will be executed by the officers with their own administrative approval and no separate administrative approval is necessary subject to the following condition.

1. Normally powers to dispense with calling of tenders should be exercised sparingly. The circumstances under which quotations have to be called should be spelt out.

2. The work should not be spilt up for the purpose of bringing it within a ambit of this dispensation.

3. The reasonableness of rates should be gone into objective by the accepting authority.

4. Quotations should not be items, which can be executed through the existing contracts including Zonal contacts.

5. Quotations should not be for fancy items (expensive but of low utility).

6.Quotations should only be for works, which are urgent in nature.

7. Quotations should normally be invited for atleast 3 well experienced contractors/agencies not necessarily borne on the approved list.

8. Accepting authority must take precautions to see that the quotations/are from genuine firms (and not from fictitious firms), and

9. A register showing full particulars of works authorized through quotations will be maintained by the officer having powers to dispense with the calling of tenders. The register may also be sent to Associate finance while seeking their concurrence.

EARNEST MONEY

(I) It is a security against loss, in the event of contractor failing to under take the contract or to furnish the required security within the appointed time after the acceptance of his tender or until such time as the sums due to him form a sufficient guarantee.

(II) Amount of Earnest Money :

The tender shall be required to deposit earnest money with the tender for the due performance with the stipulating to keep the offer open till such date as specified in the tender under the condition of tender. The earnest money shall be 2% of the estimated tender value as indicated in the tender notice. The earnest money shall be rounded to the nearest Rs. 10/-. This earnest money shall be applicable for all modes of tendering.

The Earnest Money of the requisite amount is required to be deposit either in cash with the Chief Cashier or in any of the following form :-

(I) Deposit receipts pay orders & demand drafts. These forms of earnest money could be either of the State Bank of India or of any of the Nationalized banks. No confirmatory advice from Reserve Bank of India will be necessary.

(ii) Deposit Receipts executed by the scheduled banks (other than the State Bank of India and the Nationalized Banks) approved by the Reserve Bank of India for this purpose. The Railways will not, however, accept deposit receipt without getting in writing the concurrence of the Reserve Bank of India.

No interest will be payable upon the Earnest Money and Security Deposit of amounts payable to the contractor under the contract.

Standing earnest money deposit (EMD)

The practice of following earnest money deposit (EMD) has been dispensed with :

SECURITY DEPOSITS

(I) Amount of Security Deposit

Security deposits are to be paid by the contractor for the due fulfilment of contracts. The security deposit/rate of recovery/mode of recovery on acceptance of tender shall be as under :

a. These security deposit for each work will be 5% of the contract value.

b. The rate of recovery will be at the rate of 10% of the bill amount till the full security amount is recovered.

c. Security Deposit will be recovered only from the running bills of the contract and no other mode of collecting security deposit such as security deposit in the form of instruments like BG FD etc. shall be accepted towards security deposit.

Delayed and Late Tenders

Tender upto the time indicated in NIT, are normally received in a Tender Box which is sealed at the closing time. 'Delayed Tenders' received between the closing time and time of opening and 'Late tenders' received after the opening of tenders can be considered if tenders have been received from established /reliable suppliers conferring substantial financial advantage subject to approval of the Railway Board in each case.

Zonal Work Contracts :

These zonal work contracts mostly cover new works, ordinary repairs and maintenance works in particular zone/area costing over Rs. 100,000. The zonal contracts are generally for one year and are awarded for each sub-division headed by Asstt. Engineer or Division is headed by Senior Scale or Junior Administrative grade officer. These are based on % above/below schedule of Rates. These have been adopted on a lumpsum amount of estimated cost of works during the year and the overall value of works to be done is specified. A work order is to be issued for each item of work to entrusted to the contractor.

Question:20. Write short notes on:

- Completion report
- Material modification
- Urgency certificate
- Abstract estimate

Answer:

1. Completion Report: The object of a completion Report is to compare the cost of work actually constructed with those provided in the last sanctioned estimate. The completion report of a project duly verified by the Accounts Officer should be submitted to the Railway Board within 18 months after the end of the financial half-year in which the completion estimate is submitted. It should state the expenditure in the same details as the abstract estimate sanctioned by the Railway Board and should indicate any material modifications thereto. In addition it may contain such other information as would in the opinion of the Railway Administration be of interest to the Railway Board.

The completion report should be prepared in the following form and brief explanations should be furnished for:-

Excess of not less than 10 percent or Rs. 25,000 whichever is less over the estimated provision under each sub-work.

Saving of not less than 20 percent or Rs. 1.00 lac whichever is less, occurring under any sub-work.

2. Material Modifications:- In the case of estimates sanctioned by the Railway Board or higher authority, instances of what will be considered to be material modifications of a sanctioned project or work are given below. The following may be taken as material modifications on lines under construction and open line works estimated to cost rupees one crore and over.

Any change in the alignment likely to affect the facilities offered to the public in the neighborhood or likely to increase or decrease the length of the line by over one kilometer.

Introduction of any new station or omissions of any station.

Any alteration in the type or number of enginens or vehicles provided in an estimate for rolling stock.

A change in the layout of a yard affecting the general method of working or increasing or reducing the number of trains that can be dealt with.

Any departure from the standard of construction as prescribed in Chapter II or as accepted by the Railway Board in the Abstract Estimate or use of any second hand material, if it affects the speed of trains or the number of trains to be dealt with than contemplated originally.

The introduction or omissions of any work or facility involving a sum of Rs. 5 lakhs and over.

Any modification of a sub-work provided for in the estimate of a sanctioned work involving an additional outlay on that sub-work of more than Rs. 5 lakhs.

The introduction of the new sub-work not provided for in the estimate of a sanctioned work involving an outlay of more than Rs. 5 lakhs.

Any alternation in the standards of interlocking.

3. Urgency Certificates:- Expenditure or liability may be incurred prior to the receipt of sanction of the authority competent to sanction the estimates under the ordinary rules:-

Works, which are conside3red to be urgently necessary to safeguard life or property or to repair damages to the line caused by flood, accident or other unforeseen contingency, so as to restore or maintain through communication.

Works considered urgent but not failing within(i) above, as for instance, works, required to meet the immediate needs to traffic, which are considered by the General Managers so urgent that they must be started before the earliest date by which detailed estimates could be prepared.

Divisional Engineer may authorize the commencement of the work, but should sent a report to the authority competent to give administrative approval to the work and to allot the required funds. This report may be called an “Urgency Certificate”

Q.No.21. Write short notes on:

1. Concrete mix design.
2. Blanketing materials
3. Chlorination of water.
4. Achieve earth pressure and passive earth pressure.

Ans. 21. I) **CONCRETE MIX DESIGN:-**

The concrete mix design is a process of selecting suitable ingredients for concrete and determining their proportions which would produce, as economically as possible, a concrete mix of necessary workability in plastic stage and provide required strength and durability in hardened stage.

FACTORS INFLUENCING THE CHOICE OF MIX PROPORTIONS:-

i. Grade Designation
ii. Type of Cement
iii. Maximum nominal size of aggregate
iv. Grading of combined aggregate
v. Water cement ratio
vi. Workability required
vii. Durability
viii. Quality control at site

MIX DESIGN BY INDIAN STANDARD RECOMMENDED GUIDELINES:-

The procedure adopted for the selection of mix proportions is as follows:-

i. The Target Mean Strength (ft) is determined by using the relation

Where fck is the characteristic compressive strength of concrete at 28 days.
'S' is the standard deviation (the value of 's' varies with the degree of quality control and grade of concrete)

ii. The water cement ratio for the target mean strength is determined from the standard curves released by IRC (IRC:- 44 -1972). The water cement ratio so choosen is compared with the maximum water-cement ratio specified for durability and the lower of the two values is used.

iii. The degree of workability required in terms of slump, compacting factor or Vee- Bee time is selected.

iv. Approximate air content is estimated from the available table corresponding to the maximum nominal size of aggregate used.

v. The water content per cubic meter of concrete and percentage of sand in total aggregate (by absolute volume) are next selected from the available table for the standard reference conditions.

vi. The water content and percentage of sand in total aggregate are adjusted for any deference in workability, water cement ratio, grading of fine aggregate for the particular case from the reference values.

vii. Cement content is calculated using the selected water cement ratio and the final water content of the mix obtained after adjustment. The cement content so calculated is compared with minimum cement content from the requirement of durability and the greater of the two values is used.

viii. The total aggregate content (saturated surface dry condition) per unit volume of concrete is determined by subtracting the air, cement and water quantities per unit volume of concrete.

With the percentage of sand in total aggregate as already determined, the coarse and fine aggregate contents per unit volume of concrete are calculated.

$Vab = 1.0 – [W+C/Sc]1/1000 – V$

Where Vab = Absolute volume of total aggregate per unit volume of concrete

W = Mass of water (kg)

C = Mass of cement (kg)

V = Air content per cubic meter of concrete

Sc = Specific gravity of cement

Also absolute volume of fine aggregate $Vf(ab) = ƥ. Vab$

and absolute volume of coarse aggregate $Vc(ab) = (I- ƥ)xVab$

ix. Now the mix proportions by mass (kg) can be calculated as under:-

Water	:	Cement	: fine aggregate	: coarse aggregate
W	:	C	: [Vf(ab)xSfax1000]	: [Vc(ab)xScax1000]

Where Sfa and Sca are the specific gravities of saturated surface dry fine aggregate and coarse aggregate in kg/liter respectively.

x. The adjustments for free moisture contents in fine and coarse aggregates are to be done in the calculated quantities and the final mix proportions by mass are calculated.

xi. The actual mix proportions are arrived at by means of tests on number of trial mixes prepared by varying the water-cement ratio by ± 10% of the pre selected values.

II) BLANKETING MATERIAL:-

A layer of specified coarse, granular material of designed thickness provided over full width of formation between sub-grade and ballast is called BLANKET. The main functions of the Blanket layer are as under:-

i. It reduces the traffic induced stresses at top of sub-grade to a tolerable limit to avoid track foundation failure.

ii. It prevents penetration of ballast into the sub-grade and also prevents the upward migration of fine particles from sub-grade into the ballast.

iii. It intercepts downward percolation of water, facilitates run off of water from top surface of blanket layer and provide drainage path for upward movement of water from sub-grade ensuring dissipation of excess pore water pressure.

SPECIFICATIONS OF BLANKET MATERIAL:-

The blanket material should generally conform to the specifications prescribed as under:-

i. It should be coarse, granular and well graded.

ii. The co-efficient of uniformity Cu should be > 7 and Cc between 1and 3.

iii. Fines (passing 75 microns) should be limited 3% to 10%.

iv. Minimum CBR value 25 of the blanket material compacted at 100% of MDD.

v. The size gradation should be within the specified range or enveloping curves.

vi. Los Angeles Abrasion value < 35-40%

vii. Filter criteria should be satisfied with sub-grade layer, as given below: (OPTIONAL)

CRITERIA-1 : D15 (Blanket) < 5xD85 (Sub-grade)
CRITERIA-2 : D15 (Blanket) > 4 to 5 D15 (Sub-grade)
CRITERIA-1 : D50 (Blanket)< 25xD50 (Sub-grade)

III) CHLORINATION OF WATER:-

The process of disinfection of water with the use of chlorine in its various forms is called the chlorination of water. It is cheap, reliable, easy to handle, easily measurable and above all, it is capable of providing residual disinfecting effects for long period, thus affording complete protection against future recontamination of water in the distribution system.

DISINFECTING ACTION OF CHLORINE:-

$Cl_2 + H_2O$ $\beta^H > 5$ HOCL + HCL

Hypochlorous Acid

In the β^H range below 5, chlorine does not react and remains as elemental chlorine

The hypochlorous acid is unstable and may break into hydrogen ions and hypochlorite ions

HOCL $\beta^H > 8$ $H^+ + OCL^-$

$\beta^H < 7$ Hypochlorite ions

The above reaction is reversible and depends upon the β^H value of water. Out of these forms of free available chlorine, the hypochlorous acid is most destructive, being about 80 times more effective than hypochlorite ions. For this reason, the β^H value of water during chlorination is generally maintained slightly less than 7, thereby keeping more HOCL in solution compared to OCL ions.

Moreover, the chlorine will immediately react with ammonia present in water to form various chloramines as:-

$NH_3 + HOCL$ $NH_2CL + H_2O$ (Mono chloramines)

$NH_2CL + HOCL$ $NHCL_2 + H_2O$ (Di- chloramines)

$NHCL_2 + HOCL$ $NCL_3 + H_2O$ (Nitrogen Tri-chloramines)

The chloramines so formed are stable and found to possess disinfecting properties.

When the added chlorine has consumed all the ammonia available in water, then it would persist as free chlorine. The combined chlorine with ammonia in the form of chloramines is much less effective in causing disinfection compared to the free chlorine, being about 25 times less effective.

DOSES OF CHLORINE:-

The amount of chlorine required for water depends upon the inorganic and organic impurities present in it. When chlorine is added to water, it first of all reacts with the inorganic impurities like S^{--}, Fe^{++}, Mn^{++}, NO_2^- etc, that convert the chlorine into chloride, which has no residual oxidizing powder. Excess chlorine, after this point is consumed by ammonia to form chloramines. Simultaneously, chlorine will also react with organic impurities present in water. The chlorine consumed in all the above reactions represents the CHLORINE DEMAND OF WATER. When once it gets satisfied, the chlorine will appear as FREE CHLORINE.

In general, most of the waters are satisfactorily disinfected if the free residual chlorine is about 0.5 mg/liter, 30 minutes after the chlorine is applied.

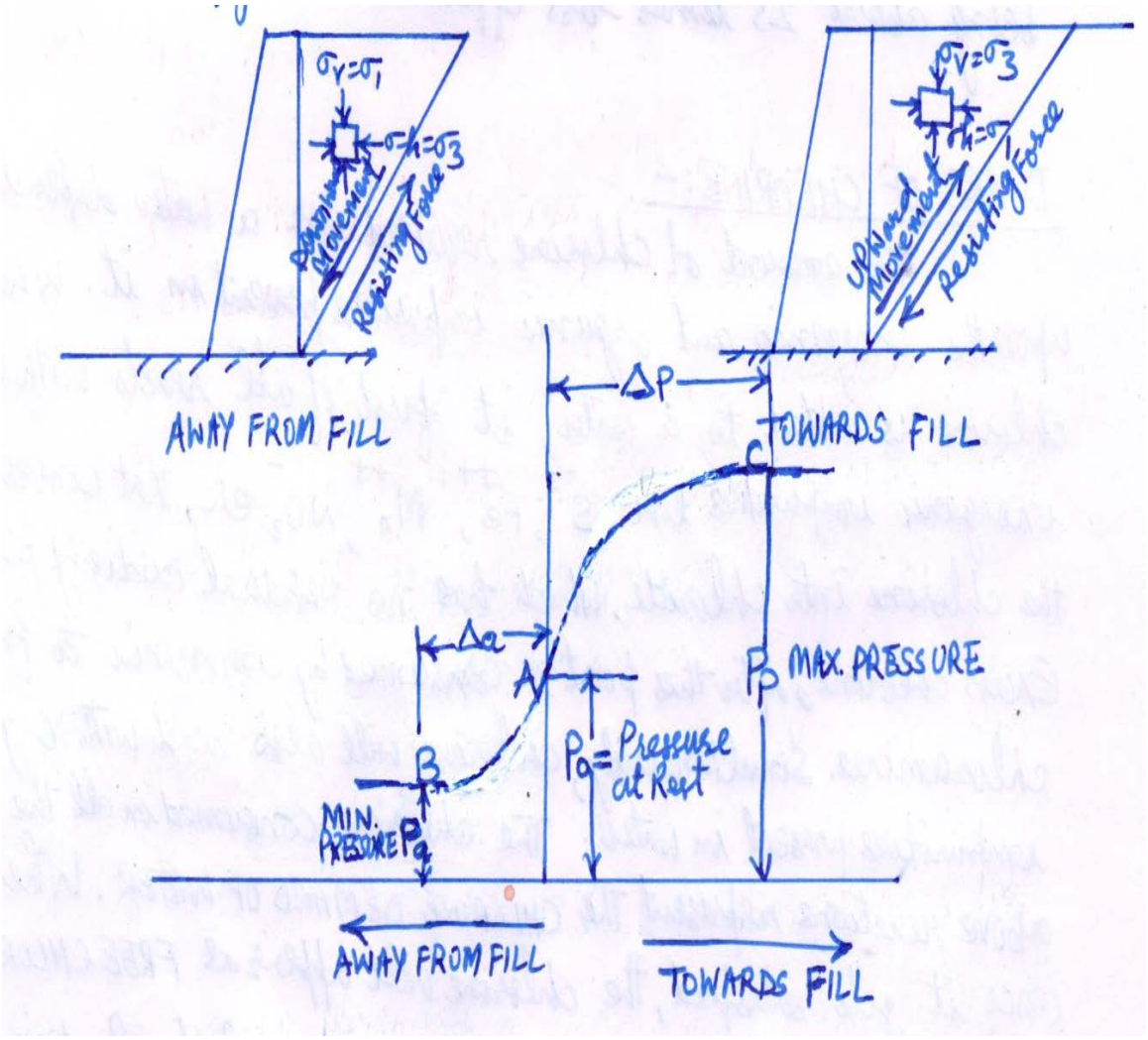
VARIOUS FORMS IN WHICH CHLORINE CAN BE APPLIED:-

1. In the form of liquid chlorine or as chlorine gas (As free chlorine).
2. In the form of hypochlorite or Bleaching Powder.
3. In the form of chloramines i.e. a mixture of ammonia & Chlorine.
4. Use of Chlorine Dioxide gas.
5. Use of Chlorine tablets.

vi) ACTIVE EARTH PRESSURE AND PASSIVE EARTH PRESSURE:-

The magnitude of the lateral earth pressure depends upon the movement of the retaining wall relative to the backfill and upon the nature of soil.

Considering a rigid retaining wall with a plane vertical face, backfilled with cohesion less soil. If the wall does not move even after filling the material, the pressure exerted on the wall is termed as **Earth Pressure at Rest**. The point A represent it is fig. below:-



ACTIVE EARTH PRESSURE:-

If suppose the wall gradually moves away from backfill, mobilization of the internal resistance i.e. shearing resistance of soil builds up in direction away from the wall, hence, the earth pressure on the wall decreases and after a particular displacement of the wall, the pressure reaches a constant value and does not decrease beyond this point B with further movement of the wall. This minimum pressure as a result of the movement of the wall away from backfill is called the ACTIVE EARTH PRESSURE.

PASSIVE EARTH PRESSURE:-

If on the other hand, the wall moves towards the fill, the earth pressure increases, because the shearing resistance builds up in direction towards the wall. The pressure reaches a maximum value (Point C) when the shearing resistance of the soil has been fully mobilized and any further movement of the wall does not increase the pressure. This maximum pressure as a result of movement of wall towards the backfill is called the PASSIVE EARTH PRESSURE.

Q No. 22 (i) SETTING OUT OF CIRCULAR CURVE BY THEODOLITE AND TAPE METHOD.

i) First of all the tangential angles δ_1, δ_2, δ_3 etc are calculated by the formula given below.

$$\delta_1 = 1718.9 \times \frac{C_1}{R} \text{ minutes}$$

$$\delta_2 = 1718.9 \times \frac{C_2}{R} \text{ minutes}$$

$$\delta_3 = 1718.9 \times \frac{C_3}{R} \text{ minutes and so on}$$

Also the total deflection angel for the 1st Chord $_1 = \delta_1$

For 2nd chord $_2 = \delta_1 + \delta_2$

For 3rd chord $_3 = \delta_1 + \delta_2 + \delta_3$

ii) Then set up a theodolite over the first tangent Point T_1 and level it.

iii) With both the plates clamped at Zero, dissect the telescope to the ranging rod at the point of intersection B and bisect it.

iv) Release the vernier plate and set the vernier A to the first deflection angle $_1$, the telescope being thus directed along T_1D.

v) Pin down the Zero end of the chain or tape at T_1, and holding the arrow at a distance on the chain equal to the length of the 1st chord (C_1) swing the chain around T1 until the arrow is bisected by the cross hairs, thus fixing the 1st point D on the curve.

vi) Unclamp the upper plate and set the vernier to the second deflection angle $_2$, the line of sight being now directed along T_1E.

vii) Hold the Zero end of the chain at D and swing the other end around D until the arrow held at a distance equal to the length of 2nd chord C_2, is bisected by the line of sight, thus locating the 2nd point E on the curve.

viii) Repeat the process until the end of the curve is reached.

Q No. 22 (ii) SLENDERNESS RATIO:-

Slenderness ratio is defined as the ratio of effective length of a column or strut to its least radius of gyration i.e.

Slenderness ratio = $\frac{l_{ef}}{r_{min}}$

Where the effective length of a column or strut depends upon the degree of end restraints of the same.

and $r_{min} = \frac{I_{min}}{A}$

Q No. 22 (iii) GROW MORE FOOD SCHEME:-

Under this scheme, the licensing of surplus railway land to railway employees is permitted in all type of railway land whether in urban or non urban areas for group C & D railway staff only. Preference should be given to gatemen, gang men and staff belonging to SC/ST/OBC category and those belonging to the economically weaker section of the society. This policy of licensing of surplus railway land shall be governed by the following stipulations/guidelines:-

a) Railway may identify the surplus land in urban as well as in non-urban areas which can be given for the purpose of cultivation of crops.

b) Size of the plot to be licensed under this scheme would be generally not more than 1 hectare. However, where large plots of land are available and demand from the employees is not much, licensing of plots up to 2 hectares can also be considered on specific request.

c) Railway land may be licensed to serving permanent railway employees in group C & D categories only. Preference should be given to gatemen, Gang men, staff belonging to SC/ST/OBC category and those belonging to the economically weaker sections of the society.

d) No licensing shall be allowed to employees who have less than 5 years of service left and licensed land must be taken back at least 1 year before the due date of retirement of the employee.

e) An entry should be made in the service record of the employee to the effect that employee is in occupation of railway land for cultivation purpose and NOC from engineering deptt would be obligatory before payment of settlement dues in case of retirement/ leaving railway services for any reason whatsoever.

f) In each case of license, proper agreement must be executed between the railway administration and the licensee before the possession of land.

g) Initial licensing which shall be for two years, shall be done by the division and subsequent extensions after recovery of license fee can be done by the ADEN up to total maximum license period 5 years.

h) The license fee has to be fixed based on the revenue generating potential of land. the license fee should be between 1/4th to 1/3rd of the annual revenue expected to be earned by the employee and should be decided by the DRM with the concurrence of the Sr DFM/DFM. However the license fees shall not, in any case, be less than Rs. 1.0 per square meter per annum. License fee may be revised by DRM in consultation with Sr.DFM/DFM every year before commencement of the crop year.

i) License fee for a year should be recovered in full in advance along with a security deposit which is equal to one year license fee before licensing or renewal of license is granted to the employee. The security deposit shall be refunded after vacation of railway land by the employee.

j) Any immovable fixture for watering made by the railway employee shall be brought to the notice of ADEN and shall become the property of railways as and when the land is vacated. No permanent structure on such licensed railway land shall be allowed.

k) Each licensee shall erect and maintain the railway boundary pillars/fencing at his own cost.

l) No plot of land shall be licensed for more than 5 years at a stretch to any particular employee so that tenancy rights do not accrue in favor of the licensee.
m) The licensee shall not grow any such crop/plantation which may hinder the visibility or endanger safety of train operations.

n) Details of the plots licensed under this scheme would be maintained by every IOW/ADEN for his/her jurisdiction and also in the divisional H.Q on a computer data base as a "Register for Utilization of vacant Railway land for Grow More Food Purpose" This data should be updated every year and a summarized position advised to H.Q.

o) "Register for Utilization of vacant Railway land for Grow More Food Purpose" to be maintained in the IOW/ADEN's office should clearly indicate the location of the area allotted, the authority letter for the initial license, the approval for extension of license granted and the details of the license fees deposited, The ADEN personally shall ensure that the registers are updated every year.

Q No. 22 (iv) SAFTEY AT P.WAY WORK SITE:-

The following measures should invariably be adopted for ensuring safety at P.Way Works sites:-

i. The contractor shall not start any work without the presence of railway supervisor at site.

ii) Wherever the road vehicles and/or machinery are required to work in the close vicinity of railway line, the work shall be so carried out that there is no infringement to the Railway's schedule of dimensions.

For this purpose, the area where road vehicles and/or machinery are required to ply, shall be demarcated and acknowledged by the contractor. Barricading shall be provided wherever justified and feasible as per site conditions.

iii) The “look out " and "Whistle" caution orders shall be issued to the trains and "speed restriction" imposed where considered necessary. Suitable flagman/detonators shall be provided where necessary for protection of trains.

iv) The supervisors and workmen should be counseled about safety measures. A competency certificate to the contractor's supervisors shall be issued by ADEN, which will be valid only for the work for which it has been issued.

v) The unloaded ballast/rails/sleepers/other P.Way materials after unloading along the track should be kept clear off moving dimensions and stacked as per the specified heights and distance from the running track.

vi) While working in OHE area, the structure bonds, track bonds, cross bonds, longitudinal rail bonds etc. are not to be disturbed and if disconnected after taking "Permit to work" they are reconnected properly when the work is completed. Also all other instructions in this regard are to be followed strictly.

Q No. 22 (v) ANALYSIS OF RATES:-

The determination of the rate of a particular item of work from the quantities of materials likely to be consumed and labours required and their cost at the prevailing market rates is known as analysis of rates. A profit of 15% for the contractor is also included in the analysis of rates.

All expenditures likely to be incurred on the item of the work are taken in to account. Generally, it comprises of the following:-

1. **COST OF MATERIALS:-**

In analysis of rates the cost of materials is taken at site including carriage, local taxes etc.

2. **COST OF LABOUR:-**

The Labour required for each item depend upon the nature of work. Their wages are also taken into consideration to arrive at the cost. The base for wages may be taken as the minimum wages fixed by the State govt./Central govt. for the zone in which the work is to be executed.

3. **T & P AND SUNDRIES:-**

A lump sum amount is provided in the analysis of rates for tools & plants (T & P) and other petty items (Sundries) which cannot be accounted in detail.

4. CONTRACTOR's PROFIT:-

Contractor profit@ 15% of the cost of materials & Labours must be added to obtain the rate per unit of the item of work.

Q. No. 23. Write Short Notes on

(a) Pre & post tamping operations for TRT machines.

TRT machine is being used for carrying out TRR and TSR simultaneously in the field.

Pre-Tamping operation :

i. Field survey should be carried out to determine existing profile of track and to decide the general lift. In case of design mode working, the survey should be done as per guidelines.
ii. The beginning and the end of curves/ transition curves should be marked on sleepers. Super- elevation and slew should e marked on alternate sleepers to act as guide for the operator.
iii. Low cess should be made-up.
iv. Track drainage should be improved for better receptivity of packing. Pumping locations should be attended. Rounded ballast should be replaced with clean and angular ballast.
v. Deficient fittings and fastenings should be made food and all fittings and fastenings like fish bolts. Keys, cotters, loose jaws elastic rail clips, pads etc. should be properly tightened. Worn out fittings should be replaced.
vi. Broken and damaged sleepers shall be replaced.
vii. Distressing of rails, adjustment of creep, expansion gaps in joints, buffer rails and SEJs etc, if necessary, shall be carried out.

POST TAMPING OPERATIONS:-

The section engineer (P.Way) shall pay attention to the following items:-

i. Checking and tightening of loose fittings.
ii. Replacement of broken fittings.
iii. The ballast shall be dressed neatly; proper consolidation of ballast between the sleepers shall be done.

Parameter	Not more than 10 peaks per km to exceed this value	Any peak exceeding this value
Alignment	± 4mm	± 6mm
Cross level	± 6mm	
Unevenness	6mm	10mm

iv. If the recorder is not available parameters of at least four stretches of 25 sleepers each per kilometer of tamped track should be recorded, in addition the versins and super- elevation of curves shall be recorded for at least ten stations at a specified chord length.

iv. While working in LWR territory, the provisions of manual of instructions on long welded rails-1996 should be followed.

iv. The fixture like check rails removed during pre-tamping operation should be restored.

(b) Describe procedure of Deep screening in single rail section, SWR & LWR, pre caution to be observed at site also to be mentioned.

Ans. Due to presence of bad formation abrasion and attrition of ballast, impact loads excessive rainfall, ballast gets chocked up and track drainage is impaired. At this stage entire ballast under sleeper and crib right up to formation level/sub ballast level is removed to improve drainage and running quality of tack, the process is called Deep screening. It can be carried out at following locations:

1. Deep screening shall be done after 500GMT or 10 years whichever is earlier. However Deep screening can be carried out when clean cushion ballast is less than 150mm to ensure dropper machine temping.
2. Prior to CTR
3. Prior to TSR
4. Due to caking of Ballast resulting into unsatisfactory riding.
5. Need of intermediate Deep screening is to be decided by C.T.E.

Process of Deep screening in track other than LWR is as below.

i. Longitudinal section of the track shall be prepared indicating the rail level at every 30 m. including changes of grades obligatory points like culverts, Bridges, Tunnels, Level crossing points & Crossing etc.

ii. In station yards on run through lines x-section at every 50 m. shall be plotted indicating platforms levels, Rail Levels etc.

iii. On the bases of L-section and x-section the Final level shell be decided keeping in view the

a. Depth of Ballast cushion to be provided

b. Lifting and lowering track

c. Possibility of elimination humps, sags and unevenness in the existing longitudinal section.

<u>Screening operation:-</u>

1. The work of Deep Screening shall be done under the supervision of authorized supervision having compliancy certificate.
2. The rail direction of Deep screening should be in opposite direction of traffic.

A B C D

1 2 3

a. Remove ballast from ‘A’, B on either side sleeper ‘I’ down to final formation level and provide wooden block to support the rail level for passing Train.
b. Remove ballast from Under ‘1’ down to final track level sub ballast level, screen ballast put back under sleeper ‘1’ and pack.
c. Remove wooden block from space “A”.
d. Remove ballast from space ‘c’ down to formation level, screen it and place in space support the rail in space ‘C’ with wooden blocks.
e. Remove ballast from under sleeper ‘2’ down to formation level.
f. Provide screened ballast under sleeper ‘2’ and pack.
g. Remove ballast from space ‘D’ down to formation level, screen it and place in space ‘B’ up to bottom of sleeper. Take ballast from quantity outside and screen the
h. Remove ballast from under sleeper’3’ and so on till the entire length is provided with screened ballast up to bottom of sleepers.
i. Lift the track to provide additional cushion where required. Pack the track in final passion and box.

Precautions during the work

Following precaution should be observed strictly to avoid any undesirable situation during the deep screening work-

i. No unscreened length is left in between the screened portion as it may lead to uneven settlement.
ii. When ballast is being removed from any sleeper, invariably there will be at least 4 fully supported sleepers In between and next sleeper tackled.
iii. Lifting shall be limited to 50mm at a time .
iv. Working tools such as beater, crow bar and ballast etc. is removed before the passage of traffic.
v. Rail is supported properly on wooden blocks before any traffic is allowed to passes.

During manual deep screening the S/R will be as under:-

Details of work	Day of work	Speed restriction and length
		Broad Gauge
Deep screening and initial packing … ….. …. First through packing … … … .. Second through packing …. …. ….	1 2 3	20 km.p.h.
Picking up slacks as required …. … ….. … Third through packing … … … … … … … … … … …	4 5 6 7 8 9	45 km.p.h.

… …	… 10	
Picking up slacks as required … … … Fourth through packing …. …. …. …..	11 12 13 14 15 16 17 18 19 … 20	75 km.p.h.
	21 onwards	Normal sectional speed

Deep screening operation in LWR track:-

Precautions during Deep Screening:-

i. Ballast cleaning machine, Tamping machine and dynamic Track stabilizes shall as for as possible, be deployed in one consist.

ii. Temperature records of the section when deep screening is to be undertaken, shall be studies for the previous and the current year. The maximum and minimum rail temperature attainable during the period of deep screening ad during the period of consolidation shall be estimated.

a. If range of rail temperature falls within Td + 10 degree to Td- 20 degree, deep screening may be done without cutting or temporary distressing.

b. If range of rail temperature fall outside (a) above Temporary deep screening shall be carried out 10 degree below the maximum rail temperature likely to be attained during the period of work.

c. Wherever rail renewals are being carried out, LWR/CWR may be converted into three rail panels and deep screening done.

iii. Constant monitoring of rail temperature shall be done during the progress of work should the temperature rise more than 10 degree above Td/temporary distressing temperature, adequate precaution shall be taken including another round of temporary distressing .

iv If min. rail temp. falls TD=30 degree, cold weather patrolling is to be introduced to detect/guard against rail fractures.

V Deep screening of LWR may done from one end of LWR to another end.

Vi The Deep screening in LWR is to be carried preferably by ballast.

The Speed Restriction schedule be as under:-

Details of work	Day of work	Speed restriction and their length

Deep screening with initial packing … … First machine packing.. …. ..	1 2	20 km. p. h.
Picking up slacks as required … … Second machine packing … …. ….	3 4 5 …. 6	45 km. p. h.
Picking up slacks as required … … … Third machine packing … …. …	7 8 … 9	75 km. p. h.
	10 onwards	Normal sectional speed

The period mentioned in the schedules shown above is the minimum and can be suitably increased to suit local condition of the track consolidation.

Precaution during BCM working at site ---

Precaution to be taken during deep screening of track by BCM followed by TTM and DTS machines; (The section can be opened at a speed of 45 kmph subject to fulfilling of conditions as stipulated).

i. All precautions laid down in LWR manual shall be strictly followed.
ii. Hard sal wood blocks of size 600 x 300 x 300mm (six numbers) duly end bounded shall be arranged for supporting ends of three adjoining sleepers where cutter bar is left in the track and remains untamed.
iii. Sleepers of cutter bar area shall be manually packed and ballast under cutter bar location sleeper shall be removed only half an hour before the expected traffic block. Adequate care shall be taken to ensure that wooden blocks are not dislodged before arrival of BCM at site.
iv. Fish plated joint shall not be located in cutter bar location.
v. Ramp shall not be located in locations like level crossing, girder bridge, transition portion of curve etc. It shall be kept minimum two rail length away.
vi. In case of fracture or cut in CWR/LWR, a speed restriction of 20 Km/h shall be imposed till it is repaired.
vii. In case of malfunctioning of TTM and /or DTS, deep screening shall be stopped and track which has not been tamped and stabilized shall be attended manually by ballast ramming.
viii. In case of non- availability of traffic block on subsequent days of deep screening by BCM, speed restrictions shall be Imposed and relaxed as per procedure.
ix. When BRM is not deployed, adequate track men shall be deputed to recoup ballast, particularly in shoulder and maintain ballast profile after machine working.
x. Lifting of track shall be resorted after ensuring adequate availability of ballast for maintaining ballast profile for planned lifting.
xi. Adequate arrangements for supply and training out of ballast prior to deep screening should e made. Special care shall be taken by deploying watchman on stretches overdue for rail renewal.

(C) Procedure of distressing with rail tensor in LWR & CWR territory.

Distressing of LWR/CWR shall be done whenever required as per condition and behavior of LWR/CWR. But in any case it shall be done at least once in 5 years as per CE circular 300.

Distressing is to be done when –

Abnormal behavior of LWR/CWR whenever gets manifested in one or more of the following, distressing shall be undertaken as per procedure.

i. When the gap observed at SEJ.

a. Differs beyond limits.

The gaps between the reference mark and tongue rail tip/stock rail corner at various tail temperatures shall not differ by more than +/-10 mm from the theoretical range.

Where fish plated or SWP track is joined on one side of SEJ, the gap between the reference mark and tongue rail tip/stock rail corner on LWR/CWR side shall not differ by more than +/- 10 mm from the theoretical range.

Exceeds the maximum designed gap of SEJ

b. When stock/tongue rail crosses the mean position.

After special maintenance operations such as:

- Through fittings renewal
- Deep screening/mechanized cleaning of ballast
- Lowering/lifting of track
- Major realignment of curves
- Sleeper renewal other than casual renewals
- Rehabilitation of bridges and formation causing disturbance to track

ii. After restoration of track following an unusual occurrence.

ii. If number of locations where temporary repairs have been done exceed three per km.

Distressing of CWR shall be done by cutting it into LWRs of about 1 km length which shall be joined after distressing.

DESTRESSING OF LWR

General

i. The work of distressing shall be done during a traffic block under the personal supervision of a PWI.

ii. It is preferable to impose a speed restriction of 30 km/h before actually obtaining the traffic block and to loosen/remove fastenings on alternate sleepers to reduce total duration of the traffic block.

Sequence of operation

The procedure to be adopted for distressing consists of the following steps:-

i. Remove impediments to free movement of rail such as rail anchors, guard rails, check rails etc.

ii. Create gap of about 1 metre at the centre of LWR during a traffic block and insert a closure rail there at a restricted speed.

iii. Mark anchor lengths at either end of the proposed LWR.

iv. Erect marker pillars at the ends of anchor lengths on either side and at 100 metre intervals thereafter.

v. Obtain a traffic bloc when t_p is less than the desired installation temperature (t_p), remove the closure rail at the centre and unfasten the full length of rails leaving only the anchor lengths at either end. Mount the rails on the rollers.

Side rollers shall also be used while undertaking distressing on curved track. Side supports on the inside of curve should be spaced at every nth sleeper,

Where, $n = \frac{\text{Radius of curve (R) x No. of sleepers per rail length}}{50 \times (t_o - t_p)}$

Outside supports shall be used in addition at the rate of one for every three inside supports.

vi) Fix rail tensor across the gap at the centre ad apply tension so as to get the required amount of extension.

vii) Re- fasten the rail starting from the anchor lengths at either end after removing the rollers progressively and adjusting tension at the rail tensor to make sure that the required extension has been achieved at each marker pilar. put paints marks on either side of the gap at the centre , spanning over the gap at a distance of 6.5 metre. Inset a coosure rail of a length equal to (6.5 metre-2 gaps for welding + 1 mm for saw cut ends) and clamp.

ix) Release and remove the rail tensor.

x) During another traffic block, weld both the joints of the closure rail at the centre.

xi) Equalize stress at the centre and at the anchor lengths.

DESTRESSING OPERATION OF LWR WITH THE USE OF RAIL TENSORS

For distressing of LWR with the use of rail tensor, the following procedure shall be adopted:-

i. During the first traffic bloc, create a gap of 1 metre at location ‘B’ i.e. centres of LWR. Introduced rail closure as required and fasten with special fishplates and clamps. Allow traffic at restricted speed.

ii. Mark the anchor length A_1A_2 and C_1C_2 each equal to I_a at either end of the length A_2C_2 to be distressed.

iii. Erect marker pillers W_1W_2 etc., on each of the length A_2B and C_2B. transfer the marks W_o onto the rail foot. The distance WoW1W1W2 etc. shall be marked at about 100 metre intervals, the distance from the previous pillars and the last pillar WB may be less than 100 metre.

iv. During the second traffic block, when tp is less than the desired to, destressing operation shall be carried out for the lengths A2B and C2 B as described below:-

a) Remove the closure rail from location 'B' Unfasten and mount on rollers the portion from A2C2.

b) Fix the rail tensor across the gap at 'B' and apply tension so as to contain some movement at Wo to remove any kinks or misalignment and to minimize the friction in the rollers etc. Release the tension and note the movement Yo at Wo.

c) Transfer marks W1,W2 …….. onto the rail foot and note temperature tp.

d) Calculate the required movement at W1 as under :-

Movement at W1=Yo+ elongation of length WoW1 (L) due to temperature difference (to-tp)= Yo= Lα(to-tp)

Calculate the required movement at W2 as under :-

Movement W2=movement at W1+ elongation of length W1W2(l) due to temperature difference (to-tp).

Similarly calculate the required movements successively at each of the transferred marks referred at ©above on the rail foot on the side away from the tensor.

Apply the tension by means of rail tensor till the mark of required extension comes opposite to the mark on the marker pillar W1. Fasten down the segment WoW1.

Then check at W2,bring the mark of required extension at this location opposite to the mark on the marker pillar W2, by adjusting the tensor either by reducing or increasing tension and fasten down the segment W1W2. Similarly , check the remaining marks, adjust the tension as required and fasten down each segment before proceeding to the next.

ii) Only one value of tp has to be taken at the time of marking W1,W2 etc. on the rail foot. The values of tp is not required to be taken thereafter. The variation of temperature, if any during the distressing operation shall automatically be taken care of by reducing or increasing the tensile force from the tensor, while coinciding the reference mark on rail with the corresponding mark on pillars.

iii) if for any reason, both the length A2B and C2B cannot be fastened down simultaneously, the final adjustment in pull and fastening down of individual segments may be done in series, first from A2 to B and then, from C2 to B.

e) After the fastening down of the last length A2B and C2B is completed, make a paint mark near free end of one rail at a distance of (6.5 metre +2x25mm-1mm), measured from the end of the other rail across the gap spanned by the rail tensor.

f) Remove the tensor, close the 1 metre gap temporarily and allow traffic at restricted speed.

v) During another traffic block, cut the rail at the paint mark, insert a rail closer of length exactly equal to 6.5 metre and weld one end thereof. If the gap at the other end is also 25mm, it can be welded in the same block. Otherwise fasten with special fishplates and clamps and allow traffic at restricted speed. In the latter case, during a subsequent block when tp is not greater than to, release rail fastening on either side to the required extent and pull the rails with rail tensor to get the desired gap of 25mm refasten the rail and weld the joint. Release the tensor after a lapse of a minimum of 20 minutes after pouring of the weld metal.

vi) During a sun sequent traffic block, when tp is less than td, equalize the forces in the rail by releasing the fastenings over a length of 100metre on either side of location 'B' and rapping with wooden mallets etc. Fasten down the rail and allow traffic.

vii) During another traffic block, when tp is within the range of temperature destress the end 100 metre from SEJ. Thereafter ,weld th closure rail next to SEJ duly ensuring setting of the SEJ.

(d) Elimination of level crossing. Enumerate various methods.

The level crossings can be eliminated by following methods subject to:

1.Consent of district administration:

The consent of district administration for elimination of LC by closure/diversion/RUB/ROB will be processed and obtained.

2.Sanction of commissioner of Railway safety for closure of manned level crossings is required before closure of L-xing.

HOWEVER: By following method the LC, manned or unmanned can be eliminated

1) By provision of ROB/RUB/LHS

2) By merger with adjacent L-xing

3) By direct closure due to low TVU.

(e) List out work required CRS sanction before execution at site.

1. Under section 20 of Indian railway act and chapter VI of the "Rules for opening of a Railway of section of a Railway for the public carriage of passengers,1933" the sanction of commissioner of railway safety is required for the execution of any work on the open the open line, which will affect the running of trains carrying passengers and any temporary arrangement necessary for carrying it out, except in cases of emergency.

2. For the commencement and opening of the following works, when they are connected with or form part of railway already opened, the sanction of the commissioner of railway safety shall be obtained:

(a) Additions, extensions or alternations to running lines.

(b) Alterations to points and crossings in running lines.

(c) New signaling and interlocking installations or alterations to existing installations.

(d) New stations, temporary or permanent.

(e) The construction of an ash pit on a running line.

(f) Heavy regarding of running lines involving lowering/raising of track in excess of 500mm.

(g) New bridges including road over and under bridges, foot over-bridges, strengthening, raising, reconstruction, dismantling or extension of existing bridges, addition or replacement of existing girders, including , provision of temporary girders. Here, bridges shall include road over and under bridges, foot over bridges an subways affecting running lines.

(h) Provision of new level crossing , shifting of existing level crossing on running lines, demanning and downgrading of level crossing ,manning of unmanned level crossings, upgrading of level crossing involving changes in the method of working or operation (such as interlocking) and closing down of manned level crossing.

(i) Permanent diversion (deviation) more than 2 kms. In length without any station in between and irrespective of length, when a new station is involved.

(k) Temporary diversion irrespective of length, except those laid for restoration of through communication after accident.

(l) Addition or alteration to the electrical instillations of tracks equipped for electrical traction.

(m) movement of ODC where the clearance between the moving dimensions and a fixed structure is less than 150mm.

(n) increase in the sanctioned speed.

(o) Infringement of maximum/minimum dimensions.

(p) use of any locomotive or rolling stock differing from those already running on any section of railway or increasing maximum permissible speed of those already in use.

Q 24. Write short note on following:-

a. Safe bearing capacity
b. Porosity
c. Void Ratio
d. Degree of Saturation

e. Active and passive earth pressure.
f. Maximum dry density and Optimum moister content
g. Aterberg limets
h. Cohesive and non-cohesive soils

b. **bearing capacity:-**

The Maximum load intensity which the soil can take without any risk of shear failure is called safe bearing capacity of soil. It is generally calculated by dividing the ultimate bearing capacity by a factor of safety

c. Porosity

Volume of soil mass is called porosity. It is denoted by 'n' and is expressed as a percentage.

$n=(V_V/V)*100$ ---------- (i)

It can also be expressed as the total volume of all voids within a unit volume of soil mass whether it is fully or partially saturated.

Now "$V=V_s+V_V$

From eq. (i): $n=(V_V/ V_s+V_V)*100$ ----------(ii)

Or $n= ((V – V_s)/V)* 100$

d. Void Ratio

The ratio of the volume of voids to the volume of solids is called void ratio. It is denoted by 'e'

e. Degree of saturation

The ratio of volume of water in a given soil mass to the volume of voids is called degree of saturation. It is denoted by 'S' and is expressed as a percentage. Therefore, it is also known as percentage of saturation.

$$\mathbf{S= (V_w/V_v)* 100}$$

(i) Dry, if ' S ' is zero percent
(ii) Fully saturated, if ' S ' is 100 percent
(iii) Partially saturated, if 'S 'is between 0 and 100 %.

Soil Classification (Degree of Saturation)

Sr.	**Degree of saturation in percent**	**Description of soil**
1	0	Dry soil
2.	0 – 25	Damp soil
3.	26 – 50	Moist soil
4.	51 – 75	Very moist soil
5.	76 -99	Wet soil

6.	100	Saturated soil

f. Active earth pressure & passive earth pressure

i. Active earth pressure

When a retaining wall holds back a mass of clean , dry sand the sand has tendency to slip laterally in order to seek its natural slope or angle of repose thus exerting a push against the wall . This kind of pressure is called active earth pressure. It is a minimum pressure and it occurs when the retaining wall is at point of failure by moving away from the retained material.

ii. Passive earth pressure

The pressure which the soil develops in response to movement of retaining wall towards it is called passive earth pressure. It is the maximum pressure to which the retaining wall subjects before its failure by heaving up of the soil.

g. Maximum dry density & Optimum moister content

If a curve is obtained by plotting the moisture contents and their corresponding dry densties, the moisture content goes on increasing the value of dry density also goes on increasing till its maximum value is reached. This maximum value of dry density is called maximum dry density

&

"The moisture content corresponding to maximum dry density is called optimum moister content (OMC)"

h. <u>Aterberg limits</u>

The consistency limits are called Atterberg limits.

These limits were first demonstrated by Atterberg in 1911, a Swedish soil scientist. His limits are based on the concept that a fine grained soil can exist in any of the four states i.e. solid, semi-solid, plastic and liquid. Therefore, Aterberg limits, most useful for civil engineering purposes are:-

- Liquid limit:- The boundary between liquid and plastic state of soil.
- Plastic limit:- The boundary between plastic and semi-solid state of soil.
- Shrinkage limit:- The boundary between semi-solid and solid state of soil .

i. Cohesive and non cohesive soils

Cohesion is the property of holding the soil particles together. The soils which have the properties of holding the soil particles together are called cohesive soils. Cohesion is used for shear strength of soil when tested with no lateral load applied to the soil sample.

The soils which have not properties of holding the soil particles together are termed as cohesiveness soils. Cohesion is zero in case of dry soil.

Q.No.25. Write short notes on:

1. Leaky roof treatment.
2. Inspection of FOB and other steel structure.
3. Design mix concrete.
4. Various methods of chlorination in Railway colonies and station.

Ans. (i) LEAKY ROOF TREATMENT

It is very important for good maintenance that all buildings are made with leak proof roof. Water proofing system on the roofs gets deteriorated due to weathering effect, development of cracks and such other reasons. Disintegration of water proofing material , provision of less no. of drainage pipes, improper detaining at junction of parapet and roof etc are other major contributions in making the roof leaky.

Basic requirement arresting leakage of roofs.

i. Provision of adequate slope
ii. Provision of adequate openings
iii. Proper detaining at junction of roof with parapet wall
iv. Expansion joints.

Prevalent water proofing system for roofs

i. Lime concrete terracing
ii. Mud-phuska treatment
iii. Water proofing using polyethylene films
iv. Water proofing using polymer cementations slurry coatings
v. Water proofing using polymer modified bitumen membranes
vi. Water proofing using bitumen felts.

Ans (ii) INSPECTION OF FOB AND OTHER STEEL STRUCTURES

Every structure on the section/sub division shall be inspected in details by the section engineer (works) and Assistant Engineer.

1.	The structures such as workshops, running sheds, platform covers & FOB	SE(W) Once a year during the prescribed month	ADEN 1/5 every year on a programme basis
2	Cast iron, wrought iron or pressed steel plate, water tanks and staging's whether of steel section or rails	Once a year on programme basis	As required
3.	Structure with roof traces prescribed	Once a year during the of structures month	10% to 20% test check inspection
4	Other structure in which timber, rail or	-do-	-do-

	steel work is used to support any part of structure		
5.	Tie rods of arched roof excluding jack arches	-do-	--------
6.	Wrought iron or mild steel tanks on sleeper cribs at temporary working station/kilometrage	-do-	--------

The SE(W) shall record result in ink in the structural steel inspection register, in the standard form and submit the same by the prescribed date to the Asstt. Engineer, who should scrutinized the entries, issue such orders as deemed necessary and return the register, prompt action shall be taken to carry out repairs required.

The SE(W) shall accompany the Asstt. Engineer on the later inspection of structures carried out during the prescribed period.

The Asstt. Engineer shall record results of his inspection in ink in the structural steel register in the form given, maintained by SE(W) and ensure expeditious compliance of notes recorded.

STRUCTURES- The condition of which warrant special attention should be inspected more frequently.

ENTRIES IN COLUMN "Condition of structure at the time of inspection" should be in the nature of statements. A defect once mentioned should not be omitted in future years unless it has been eliminated through repairs in which case a note should be made to that effect.

DETAILS OF INSPECTION During inspection the following points should receive intention-

i. The condition of paint
ii. Whether any corrosion in steel is taken place
iii. In case of steel work connected to masonry such as tie rods or arched building and roof trusses whether any corrosion is apparent near the masonry.

The condition of welds, rivets, bolts and the rods particularly of water storage tanks, cast iron tanks plates should be examined for any cracks whether any deformation of structure has occurred, foundation and bearing with particular references to tightness of anchor bolts.

The inspection official shall make a through examination of every part of a structure in all respects, using ladders and scaffolding for examining portions beyond reach from the ground. If so considered necessary, the assistance of the bridge staff may be requisite for the purpose.

Ans. (iii) DESIGN MIX CONCRETE

The aim of concrete mix design is to determine the proportion in which cement, fine aggregate, coarse and water should be mixed to produce concrete of required strength, workability and durability with minimum cost.

The design of concrete mix can be done by following methods :-

1. Nominal Mix
2. Design Mix

Design Mix can be defined as the process of selecting suitable ingredients of concrete and determining their relative properties. With the object of producing concrete of required strength and durability as economically as possible. The purpose of designing as can be seen from the above definition in two fold. The first object durability, the second is make to the concrete in visible proportioning.

With the given materials, the four variable factors to be considered in connection with specifying a concrete mix are –

i. Water cement ratio
ii. Cement concrete or cement aggregate ratio
iii. Gradation of concrete
iv. Consistency

Ans (iv) VARIOUS METHODS OF CHLORINATION IN RAILWAY COLONIES AND STATION

Definition- It is the method of disinfection by which the micro organisms are killed in chlorine. Chlorination serves not only for disinfection, but as an oxidant for other substances (iron, manganese, cyanide, etc) and for taste and odor control in water and wastewater. Other chemical disinfectants include chlorine dioxide, ozone, bromine, iodine. The last two chemical are generally used for personal application & not for the public water supply.

TYPES OF CHLORINATION

1. Plain Chlorination

   Chlorination of water relatively free from suspended matter without any other treatment.

2. Pre chlorination

   The application of chlorine to raw water before any other treatment to improve the coagulation and to remove the taste, odor & colour.

3. Post Chlorination

   Application of chlorine to treated water after all the other treatment. Dosage chlorine range from 0.25- 5.0mg/lit in order to obtain the combined residual chlorine in range of 0.1-0.2mg/lit.

4. Double chlorination

Chlorine is added to raw water at more than one point. This is done when water is highly contaminated.

5. Break Point Chlorination

It is the amount of chlorine that is, needed to destroy bacteria and to oxidise all the organic matter and ammonia cal substances present in the water. The point at which the chlorine demand of water sample is met is called the break point. If further chlorine is added beyond the break point, free chlorine in the form of HOCL (Hypochlorous acid) and OCI (Hypochlorite ion) begin to appear in the water.

6. Super chlorination

This is done when there is epidemic in the area. The dose varies from 0.5 to 2.00 ppm depending upon the impurities of water.

Q.No.26. Write short notes on:

1. Anti corrosive treatment of plate/rail screw,
2. Protection of rail from liner biting.
3. Renewal of rail on major bridges and their approaches.
4. Handling of 90 UTS rails.

Ans (i) Anti corrosive treatment of plate/rail screw

It has been observed that the plate screws and rail screws provided on PSC sleepers on turnouts, SEJs, bridge guard rail and level crossings are getting corroded due to either aggressive environmental conditions or in stretches where passenger trains reach destinations in the early morning hours. This results in corrosion of screws and often shank of the screw is left inside sleeper and can not be taken out, due to corroded head. This renders sleepers totally useless.

Due to excessive corrosion of plate/rail screws, maintenance has been badly affected as the thickness of screws gets reduced and in time they get jammed/loosened resulting in loosening grip with plates and sleepers become useless.

Remedial Action

To minimize the occurrence of this problem, as a preventive measure, lubrication of plate screws and rail screws should be done. Grease graphite used for this purpose shall be as per IS specification number IS:408 grade ‘O’.

METHOD OF LUBRICATION

Prior survey shall be done to ascertain number of corroded screws. New screws shall be procured as per assessed numbers and provided in place of corroded ones after applying 'O'- graphite grease/black oil.

Plate/rail screws should be removed one by one from track. Then screw as well as dowel be properly cleaned for corroded material from the surface with the help of wire brush and then dipped in black oil uniformly both on the surface of plate/rail screw and dowel and fixed back head of plate/rail screw should also be either coated with hot bitumen to avoid corrosion.

FREQUENCY –

1. At new turnout/SEJ/bridge guard rail/level x-ing renewal site, the greasing of new plate/rail screws should be done while providing in the track.
2. Once a year in areas not prone to corrosion.
3. Once in six month in corrosion prone areas.

RECORD - Each PWI should maintain a record of the location of greasing of plate/rail screws as per Performa given in Annexure-I.

Record for lubrication if plate/rail screws –

Point/SEJ/ Bridge/ Level x-ing No.	Location Km. From-To	Up/Dn Line	Station/ Section	Month & year Of Laying	Condition of plate/ rail screws	Date of lub-rication done	Remarks

Ans. (ii) Protection of rail from liner biting-

Generally in yards due to drainage problem, which causes dampness conditions, there is corrosion mainly in the rail foot area. In addition in stretches where passenger trains run in the early morning hours, due to toilet droppings, there is reduction in the rail foot in the area which is in contact with the liners. The remaining section of the rail is normally not affected in such cases.

In case of rail corrosion at fastening location, the measurement of rail corrosion in rail foot it to be done at every 500mm or part once a year. The format for this measurement shall be as given below :-

Date of Inspection	Kms. & UP/DN/SL	Rail Section UTS	Thickness of rail foot under liner		Remarks
			LR	RR	

Rail corrosion at fastening location –

1. To minimise the occurrence of this problem, as a preventive measure, at the time of initial provision as well at the time of periodic cleaning of central leg of elastic rail clips. Graphite grease grade 'O' to IS:408 shall be applied on the underside of liners as well as moisture to the surface of the liner and rail foot, grease shall be applied along the

boundary of liner to seal the liner boundary. In areas indentified to the prone to such corrosion. This treatment shall be done once a year and in other sections with concrete sleepers once in two years.

2. In case of location identified to be prone to corrosion, shifting of rail from its position will result into stopping of further development of corrosion at same location and will result into increase in life. By shifting of rail from its posisition, the reduced foot section due to corrosion gets shifted away from the liner. Thus, its further reduction in foot thickness at same location due to corrosion gets eliminated and new location with normal thickness comes under the liner to accept further corrosion. Thus the reduction of foot thickness at one location gets stopped. This is to be done when the rail is relatively new and reduction in rail foot area is less i.e. reduction in rail foot is less then 1.5mm. This may be done by de-stressing.
3. As this type of corrosion is observed more on gauge face side, changing/turning of rail will result into making the gauge face as non gauge face which will result into increase in life of rail as the reduction of foot thickness at same location will get stopped.

Ans4 (iii) RENEWAL OF RAIL ON MAJOR BRIDGES AND THEIR APPROACHES –

Renewal of rails on major bridges and their approaches shall be done after passing of 50% of the stipulated GMT of rail as per the rail section. There should not be any fitted, corroded, wheel burnt rail on bridge or its approaches. Regular visual examination and pre winter USFD testing of rail/welds shall be carried out invariably. New rails should not be unloaded on bridge itself to avoid any infringement to passing trains. Uniform rail section shall be maintained on bridge and its approaches upto 100m on either side.

Ans (iv) HANDLING OF 90 UTS RAILS

1. PROTECTION OF STRAIGHTNESS-

Barely visible straightness deviations, for example, a deflection of 0.75mm over 1.5 meters span renders a rail unacceptable and require careful handling and stacking therefore.

AVOID-

1. Heavy static loading
2. Sudden impact of dynamic loading
3. Localised point on line contact loading in stacking.
4. Excessive end drop and flange overlaps while lifting/moving.
5. Criss – Cross stacking of rails of alternative layers at rightangle as far as possible.

DO

1. Keep rails horizontal and straight while lifting/moving.
2. Stack rails of same length on firm level base of well drained platform, preferably of concrete.
3. Stack subsequent layers on uniformly placed spacers in vertical alignment with base supports.

4. Keep rail ends in vertical alignment
5. Place rails of shorter length in upper layers.

2. PROTECTION OF RAIL SURFACE-

Surface notches of even less than 0.75mm in depth are liable to cause rail fracture in service. Therefore-

AVOID

i. Impact abrasion of rails against separators in wagon.
ii. Round link chain slings for securing the rails.

DO

i. Use conventional slings for lifting rails made of flat link chains.
ii. Lifting of rails preferably with magnet lifting device.

3. PREVENTION OF METALLURGICAL DAMAGE

These rails are thermally very sensitive and are likely to develop metallurgical defects, if exposed to localised heating, which produces very hard, brittle and cracked metallurgical structures which may lead to sudden failures. Therefore,

AVOID

i. Heating, flame cutting on or adjacent to rails.
ii. Contact with electric area and molten metal splashes i.e. from loose cables or adjacent welding operations.

DO

Flame cutting when found essential after pre heating minimum of 10cm of rail length on either side of the cut to about 250-300 degree ˚C by uniform movement of heating torch.

4. PROTECTION FROM CONTACT WITH INJURIOUS SUBSTANCES

These rails can withstand normal degree of rusting but localised corrosion pitting may cause subsequent rail fractures. Therefore

AVOID

Contact with injurious substances which produce high corrosion of steel i.e. acids, alkalis, salts etc.

DO

Stack rails on well drained platform preferably of concrete.

5. SLINGING PRINCIPLES

The single point aligning increases risk of excessive lending and surface damage to the rails the overhang beyond the outer lifting joint should not be greater than one half the distances between lifting points. Therefore,

AVOID

i. Single point slinging

DO

Use two point slinging for rail length upto 18m. Next four point slinging with 26 met. Rails.

Recommended location of lifting points for various rail lengths are tabulated below –

Rails length meters	No. of lifting points	Distance between lifting points (Met.)	Max. Rail end overhanging (Met.)
12-13	2	6-6.5	3-3.25
26	4	6.5	3.25
39	6	6.5	3.25
130	20	6.5	3.25
260	40	6.5	3.25

Use of lifting beams fitted with slings would be necessary for handling rails in rail rolling plants, ports and flash butt welding plants.

6. SAFETY OF PERSONNEL

AVOID

Standing under suspended loads.

DO

1. Use protective gloves and clothing's to minimise the risk abrasion.
2. Wear distinctive colures helmet and clothing for easy identification by crane and machinery drivers to avoid accidents.

Q.No.27 Write the short notes of the followings:-

(i) Causes of rehabilitation of bridges

(ii) Rail Clusters

(iii) Sleeper Cribs

(iv) Railway Affecting Works

(v) Types of bearings in bridge.

i. Causes of Rehabilitation

A bridge may require rehabilitation on account of the various reasons some of the reasons may be as under:

(i) Physical distress

(ii) Vulnerability on hydrological consideration

(iii) Use of obsolete/non standard materials such as

a. Early steel girders
b. Laterite stones
c. Cast iron screw piles
d. Corrugated steel pipes

e. Earthen ware pipes

In case, due to introduction of new rolling stock, existing bridge is not safe, both its strengthening is to be done and, if not possible, rebuilding is to be done.

(b) Rail Clusters

Rail clusters are used for temporarily supporting the track for spans upto 3.66m(12ft).These are designed for M.L standard loading with 10% impact.90 Ibs.&75 Ibs. rails are normally used for the rail clusters. Number of rails required for 90Ibs & 75 Ibs section. Temporary arrangements with rail cluster on sleeper cribs

16.17(a) Details of Rails for Rail clusters

Clear span	Section of	No. of Rails	Rail Cluster	Remarks
3.660M	90Ibs	8		1.All rails are F.F rails
3.050M	75Ibs	12		2.Rail clusters are to be upon normally up to 3.05m
	90 Ibs	5		
	75 Ibs			And in no case above1in m span. above this span service girders should be used
2.440M	90Ibs	8		
(8')	75Ibs	5		
1.830M	90 Ibs	7		
(6')	75 Ibs	3		
		5		

Sleeper Cribs:-

Sleeper Cribs are required for supporting the rail clusters or Service spans at a particular height. Sleeper cribs are designed for a base loading of 1 Ton/Sq ft. If it is considered that soil is not fit for this loading, boulders must first be laid in such a manner as to spread the load until a safe bearing pressure is reached. The top surface of boulders is leveled with smaller stones to form an even surface for the first layer of sleepers. Single Cribs of wooden sleepers are made for height up to 3.05 meters (10ft),whereas double cribs are made for greater heights.

Following points require special attention during construction of cribs.

(i) Size of crib depends upon the type& span of temporary girder and nature of rail.

(ii) Cribs should be constructed of good sound sleepers of size 2750x250x130mm(9'x10'x5").

(iii) Sizes of sleeper cribs ranging from 1.525m to 7.625m(5ft to 25 for height and above along with speed restriction generally being followed for each, are given below:

S .No.	Size of crib	Speed restriction under service girders
1.	9'x9'(height 5')	Non-stop 15kmph
2.	9'x9'(height 10')	Stop dead & 8kmph
3.	9'x18'height 10'to 18	Stop dead & 8kmph
4.	(Double crib)	Stop dead & 8kmph
	9'x18'+9'x9'	Stop dead & 8kmph
5.	Height 18'to25'	Stop dead & 8kmph
	18'x18(height25'&above)	

(iv) Rails in sleeper cribs should be introduced at more than 1.83m(6') interval in height.

(v) A layer of kacha plaster 75mm(3inches) thick should be laid on all exposed surfaces on the crib after the track has been laid to prevent danger from fire.

(vi) Should the height of the crib exceed 1.5m(5'),the cribs should be suitably tied with through bolts.

(vii) A watchman, equipped with fire fighting appliances such as fire buckets etc. should be employed to deal with any fire that may break out on the cribs.

(viii) Cribs forming abutments have to take the side thrust due to earth pressure of the embankment,

apart from the load of the Engine& the train, and therefore such cribs require special attention.

Normally an auxiliary crib is used behind the main crib to lower the plane at which the live load is

applied and reduce the horizontal earth pressure on the main crib.

(ix) The arrangement of sleepers directly below the girder seating should be so done that the concentrated load gets spread over the length & breadth of cribs.

16.26. Railway Affecting Works :

Railway Affecting Works are those, the construction, design, maintenance of operation of which may cause serious damage or breaches or flooding of Railway line or bridges. Some of the examples are:

(i) Irrigation and Water supply tanks or reservoirs

(ii) Canals in embankment and river bunds

(iii) Road embankment with inadequate waterway for drainage situated upstream or downstream of railway line.

(iv) Temporary channels cut for irrigation or other purpose from beds of active rivers

(v) Other works, which alter or impede the natural course of flood or cause increase of flow such as new irrigation projects, new townships, Large scale deforestation etc.

Types of bearing “

1. **Shoe-plates**: Shoe plates are attached to the underside girder and these rest directly on masonry. This is an unsatisfactory arrangement, as due to figh action between masonry &steel, expansion is resisted and heavy longitudinal and forces are imparted to the masonry, these type of bearings are gradually being replaced by centralized bearings.
2. **Centralized bearings or flat bearings:** These are provided for plate girders generally up to a span of 24.4(80ft).In this arrangement, a curved or chamfered bearing plate is fixed to the bottom flange of the plate girder just below the bearing stiffener and the same rests on a bed plate fixed to the heel block. The bed plate at the free end has to be periodically greased to reduce the co-efficient of action. Greasing also prevents rusting of steel surface. This works as preventive maintenance of bearing as well as of bed plates and prolongs their service life. The rocking ‘of the girder is facilitated by the curved shape of the bearing plate.
3. **Phosphorous bronze bearings:** In this type of bearings the bed plate has a phosphor bronze surface. This is useful for long spans, particularly for spans above 10.5m (100ft.) because of the lower co-efficient of friction of steel on bronze surface(0.15),than that on steel surface(0.25).It has however to be ensured that the hearings are very clean, without any dirt. Phosphor bronze bearings need not be greased as these are corrosion resistant and retain the smooth surface.
4. **Rocker and Roller bearings :** In this type of the bearings at the fixed end, the girder end is fixed in a position but rocking due to deflection under load is permitted by the curved knuckle pin. At the free end, the arrangement for rocking is similar but the knuckle assembly is mounted on a set of rollers to take linear expansion. It has to be ensured during inspection that the knuckle pin and the rollers are well lubricated.
5. **Elastomeric bearings or Neoprene bearings : T**hese are provided for bridges having RCC or prestressed girders and can take deflection as well as movement . Normally, these bearings are provided for Road bridges, but recently Railway bridge are also being provided with this type of bearings.

(i) Elastomeric bearings are made of natural or synthetic rubber if shore hardness of approximately 50 to 70. They are very stiff in resisting volume change but are very flexible when subjected to shear or pure uni-azial tension. They are generally reinforced with steel or concrete girder these permit moderate longitudinal movements ad small rotations at the ends.

(ii) These bearings require periodic cleaning . they may require replacement in service depending on the condition and usage**.**

6. **Oil bath bearings** :- this type of bearings is encased in oil baths and does not need periodic oiling and greasing.
7. **P.T.F.E. bearings** :- this type of bearings consists of a self lubricant ply-tetra-fuoroethylene surface across a smooth stainless steel plate , fixed on a mild-steel plate which

slides on it, it makes a non-rotational free end by vulcanizing the P.T.F.E. sheet on an elastomeric bearing. This also gives a very low coefficient of friction in its sliding action.

These bearings also require periodic cleaning of the bearing surface. The interface should be protected from dust. Lubricating the mating surface by silicon grease reduces the coefficient of friction and is desirable.

8. **Segmental bearings** : these are provided in special situations where piers are too slender, as in case of RCC piers.

TRACK

Q.No. 1 Describe the method of taking up mechanized renewal of PSC sleepers in compound curve in electrified track circuited SWR track.

Ans : Mechanized renewal of PSC sleepers can be taken up either by PQRS or by TRT-

By PQRS –

At site – Pre block activities-

1. Linking of auxiliary track to connect line and level will be required.
2. Lubrication of bolts in fishplates joints of SWR track to be done in advance.
3. Recoup all fittings in PSC sleepers.
4. Remove U/s sleepers and joggle fish plate and wooden blocks after imposing speed restriction. Also remove S&T fittings and OHE earthing strips.
5. If required the SE of track can be modified under SR to facilitate lifting of panels by PQRS.

At Base Depot-

1. Sufficient P-Way materials like PSC, fittings, lubricants etc and T&P with portal cranes to be arranged.
2. Pre-fabrication of panels by standard service rails at required sleeper density to be done.
3. Loading of Pre-fabrication panels on to the PQRS rake and proper marshalling of rake with empty wagons, machine wagon and staff rest van etc.

At site – During block activities-

1. Removing of fish plates and cutting of rails to make panels of adequate length for lifting by PQRS portal cranes.
2. Loading of panels from track on PQRS rake and laying of fabricated panels in track with proper line and level on prepared ballast bed.
3. All S&T and OHE fittings will be restored.

Post block activities-

1. Ballasting, boxing, aligning and packing of tracks (At least four rounds by ON Track tampers) to relax speed restrictions.
2. Welding of rail joints and correct setting of gaps in SWR track.

By TRT- At Base Depot-

1. Loading of PSC and marshalling to form proper rake.
2. Loading of new fittings in fittings wagon

At site – Pre block activities-

1. Lubrications of all fittings to release jammed ERC.
2. Easement of SE if required for working of TRT .
3. Removal of joggle fish plates, wooden blocks, rail pegs, S&T fittings, OHE earthing strips.

At site – During block activities-

1. Six PSC at the start of work will be removed to lower sled/plough.
2. TRT will pick up old PSC from track and load it on conveyor from where portals will load them on empty BFRs. Also new PSC from BFR will be loaded on Conveyors and laid in track at required sleeper density
3. All S&T and OHE fittings will be restored.

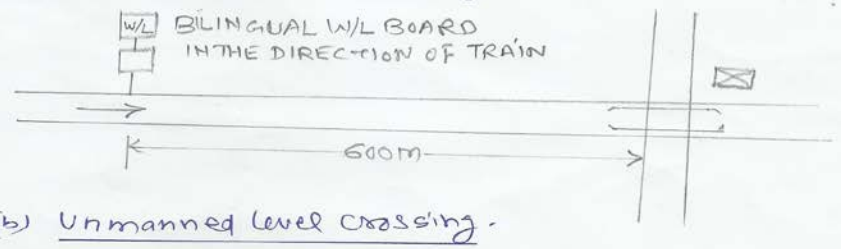
Post block activities-

1. Ballasting, boxing, aligning and packing of tracks (At least four rounds by ON Track tampers) to relax speed restrictions.
2. Welding of rail joints and correct setting of gaps in SWR track.

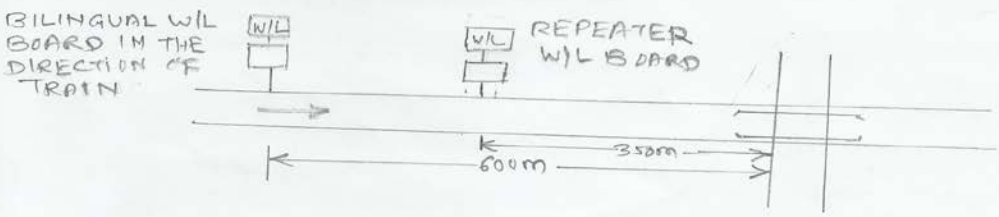
Q.No.2 .Describe with sketch the signages to be provided at manned and unmanned level crossings for both train drivers and road users.

Ans 3(a): For train Drivers –

(a) Manned level crossing –

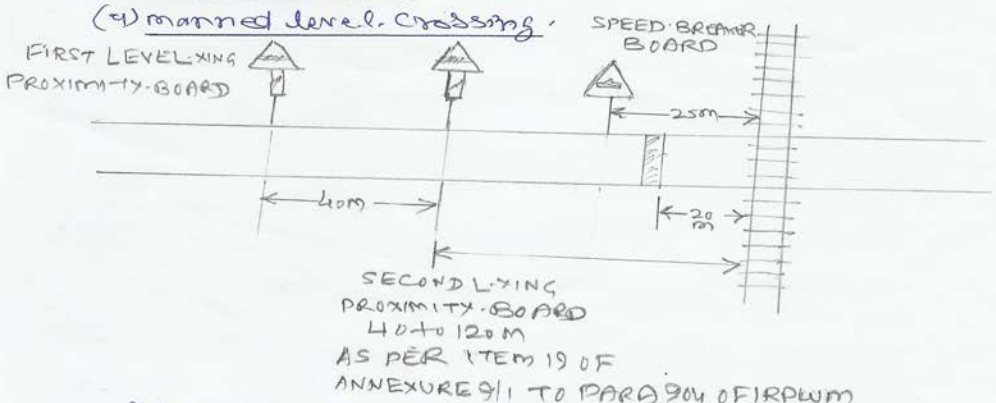


(b) Unmanned level crossing.

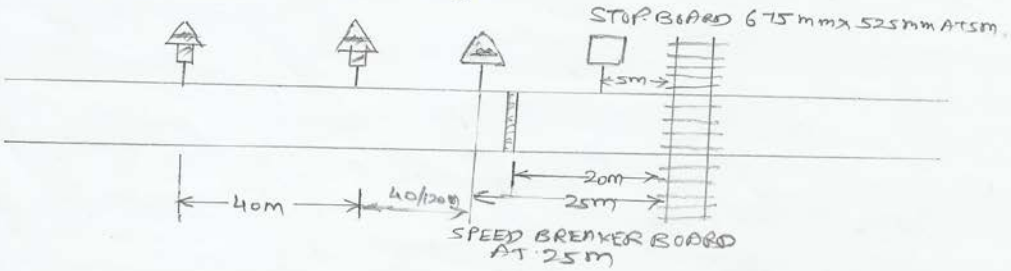


For Road users –

(a) manned level crossing.



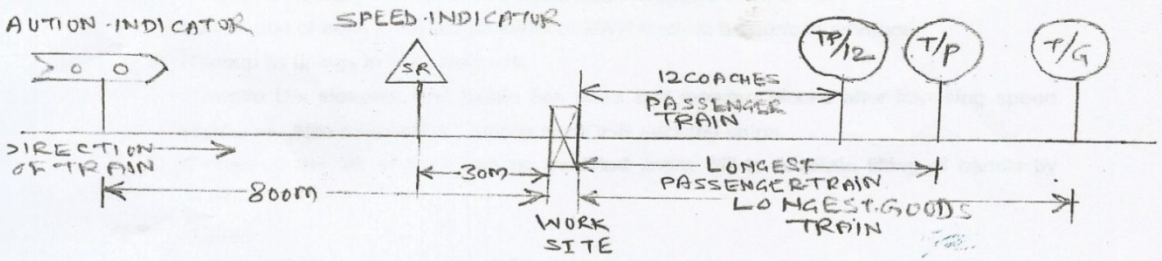
(b) Unmanned level crossing.



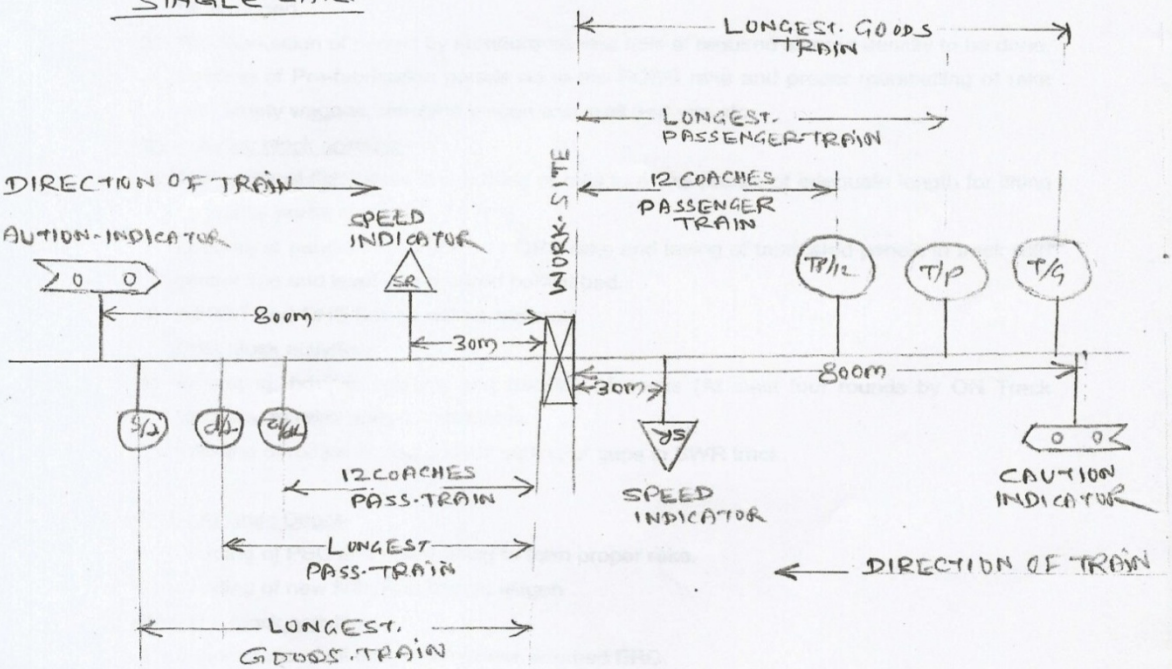
Q.. 3).Describe with sketch the correct placement of indicators for a track renewal site in site in suburban section for both single line and double lines?

Ans 3(b):

DOUBLE LINE:-



SINGLE LINE:-



Q.No.4. Maximum speed of loop lines in a section is to be increased from 15KMPH to 30 KMPH what is the track standard required for the same. What sanctions will be required to implement the same?

1. Turnouts: Speed in excess of 15KMPH should be permitted on turnouts laid with ST or PRC sleepers only. All turnouts should be laid with curved switches with minimum rail section being 52kg. All rail joints on these turnouts should be welded to the extent possible.

   1in8.5 Symmetrical split with curved switch = 30KMPH
   1in12 Curved Switch = 30KMPH

2. Track on running loops: The minimum track structure on the running loops should be 90R rails laid as short welded panels, M+4 density on PRC, ST CST-9 sleepers and 150MM ballast cushion, out of 150MM total cushion, clean cushion of 75MM of least should be available.

2. Turn in curve : Should be laid with the same rail section as on the turnout with PSC, ST or CST-9 sleepers with sleepers spacing being 65MM Centre to Centre (Maximum).

Extra shoulder ballast of 150MM should be provided on outside of turn-in-curve. The frequency of inspection of turn-in-curves should be same as that for main line turnouts.

Wooden sleepers are not allowed for speed above 15KMPH.

A committee of senior sub ordinates from Loco, Engg, Signal and Traffic department will footplate the section and certify the signal visibility and braking distance feasibility.

CRS sanction will also be required for raising of speed.

Question:5. Describe the operations to be carried out before tamping (pre-tamping) by TTMs.

Answer:- The following preparatory works shall be completed before undertaking tamping of track:-

i) Field survey should be carried out to determine existing profile of track and to decide the general lift. In case of design mode working,the survey should be done.

ii) The beginning and the end of curves/transition curves should be marked on sleepers. Super-elevation and slew should be marked on alternate sleepers to act as guide for the operator.

iii) Ballast shall be heaped up in the tamping zone to ensure effective packing. However, sleeper top should be visible to the operator and the ballast should not obstruct the lifting rolers.

iv) Hogged, battered and low joints shall be attended.

v) Low cess should be made-up.

vi) Track drainage should be improved for better retentivity of packing. Pumping locations should be attended. Rounded ballast should be replaced with clean and angular ballast.

vii) Deficient fittings and fastenings should be good and all fittings and fastenings like fish bolts, keys cotters, losse jaws, elastic rail clips, pads etc.should be properly tightened. Wornout fittings should be replaced.

viii) Broken and damaged sleepers shall be replaced.

ix) Sleepers should be squared, correctly spaced and guage corrected.

x) Distressing of rails, adjustment of creep, expansion gaps in joints, buffer rails and SEJs etc.,if necessary shall be carried out.

xi) Guard rails at the approach of brides and check rails shall be removed temporarily.

xii) All obstructions such as rail lubricators, signal rods and cable pipes which are likely to obstruct the tamping tools should be clearly marked and made known to the operator before the start of work.

xiii) Wooden blocks and joggled fish plates shall be removed temporarily ahead of tamping.

xiv) In electrified sections, the earthing bond should either be removed or properly adjusted for tamping.

Q.No. 6. Describe different type of Patrolling on railway track with time period, periodicity petrol chart. Also describe rules for patrol chart.

PATROLING OF THE RAILWAY LINE:- To ensure safety of track following type of patrolli introduced on track from time to time as per decision of competent authority:-

(a) Keyman's daily patrol.
(b) Gang patrol during abnormal rainfall or storm.
(c) Night patrolling during monsoon.
(d) Security patrolling during civil disturbances and for movement of VIP special.
(e) Hot weather patrolling for long welded rails/continuous welded rails.
(f) Watchmen at vulnerable locations.
(g) Cold weather patrolling.

(a) Keyman's Daily Patrol – Every portion of the permanent way shall be inspected daily to foc the keyman of the beat in which the portion of the track falls. Provided that the interval between inspections may, under special instructions, issued by Chief Engineer be increased to once in two in the case of specified section of lines with light and infrequent traffic.

(b) Gang Patrol during Abnormal Rainfall or storm – In the event of abnormal rainfall or s during day or night, the Mate, should on his initiative organize patrolling over the length affe independently of other patrolling, if any being done. This patrol should, in case of heavy rai confine its inspection to known points of danger, such as cutting or culverts likely to scour, b affected by banks likely to breach and bridge approaches. In case of high winds, the patrolman sh inspect the length of track likely to be fouled by falling of tree etc.

Arrangement exist with the meteorological Department of the Government of India for iss

telegrams of warning, wherever storms, gales or heavy rainfall are expected. On receipt of inspector will arrange to advise monsoon patrolmen, watchmen and gangmates to be extra vigilant be prepared to introduce patrolling, as necessary.

(c) Night Patrolling during Monsoon – During the monsoon, certain section of the railway lin may be specified, shall be patrolled to detect damage by flood, such as breaches, settlements, slips scours and immediate action taken to protect trains, when so warranted.

(d) Security Patrolling during Civil Disturbance and on Special occasions –

(a) On apprehension of a Civil disturbance, the Divisional authorities should contact the local C authority and arrange, as circumstances may warrant for security patrolling of the railway line. may be arranged on the pattern of the monsoon patrolling with modifications, as deemed necessar consultation with Civil authorities.

(b) Security patrolling on special occasions should be carried out according to the special instruct issued by the administration.

(C) The primary duty of the patrolman employed on security patrolling shall be to protect t against any condition of danger, such as tampering track or obstruction placed on line.

(e) Hot weather Patrolling for LWR/CWR- Hot weather patrol is carried out when the temperature reaches.

(i) td + 25º C on PSC sleeper track with sleeper density 1540 nos. Per Km and above
(ii) td + 20º C on PSC sleeper track with sleeper density less than 1540 nos. Per km and track other than PSC sleeper.

The patrolling should be done in accordance with the provisions of manual of long welded rails.

(f) Watchmen at vulnerable locations- In addition to patrolmen, stationary watchmen are poste known or likely locations of danger or trouble.

(g) Cold weather patrolling – Cold weather patrolling is carried out when temp. is ≤ td-30 or as directions.

Protection of line in case of Emergency – Should any patrolma/statio watchman/Gangman/Keyman deputed for the purpose of patrolling notice andy condition likel affect the safety of trains, he shall at once protect the line and report the damage to the nearest sta master as laid down in Para 1011.

Preparation of Patrol Charts (1)- The Divisional Engineer will prepare patrol charts for each o sections where monsoon patrolling is required to be done, taking into consideration the train tim of the time table in force during this period. The principles governing the preparing of patrol cl shall be –

(a) Ordinarily patrolling will be carried out by a singly patrolman, but in region where danger f wild animals, dacoits and other risks as in ghat sections exist, patrolling in pairs may be introdu

with the approval of the chief Engineer

(b) All trains carrying passengers between sunset and sunrise get the maximum protection possible

(C) As far as possible, each block section will be treated as a unit and the length will be divided equal beats. The length will be divided into equal beats. The length of each patrol beat should normally exceed 5 Km. where the block section is more than 10 km. an intermediate flag static any, or any other suitable point may be fixed as intermediate station, to keep the length of be about 5 Km.

(d) The walking speed of a patrolman may be taken as 3 Km per hour.

(e) The maximum distance covered by a patrolman should not normally exceed 20 Km. in a day.

(f) A period of at least half an hour rest in desirable between consecutive beats.

(g) If the frequency of train services is high, and one set of patrolmen is not able to cover all the tı in the section, a second set of patrolmen may be introduced to reduce the interval.

(h) For giving better protection to all passenger trains, between sun-set and sun-rise it would advantageous to plot the scheduled paths of all passenger trains and then plot the patrol moveme such a way, so as to minimise the time interval between patrolling of the beat and passage of train

(i) Patrol charts should show all vulnerable locations where stationary watchmen are posted.

Distribution of patrol charts – Before commencement of the monsoon, requisite number of copie patrol charges should be supplied by the Divisional Engineer to the Assistant Engineers, Perma way inspectors.

Patrol books and systematic Patrolling – A patrol book containing sufficient number of p should be supplied to each patrol with a tin case.

Patrolmen shall be on duty at the time specified for each in the patrol chart.

The patrolman whose beat commences/terminates at a station shall present the patrol-book in possession to the station master/block hut-in-charge who will enter therein the time of arrival departure and sign the book. The station master block hut –in-charge will also record the tim arrival and departure in his Diary/Train Register Book. The patrolman shall then patrol his leng the end of which, he will exchange his patrol book with that of the next patrolman and retrace his l The intermediate patrols do likewise. In this way each patrol-book will be conveyed a from one sta to the other and back against. Owing to close proximity of stations, patrol books may be pa through one or more intermediate stations, before it is returned to the original station.

If a patrolman on arrival at the end of his beat does not find the next patrolman to take over the b he must proceed ahead, until he meets him. The patrolman should report the absence of any man f his beat to the Mate the next day.

Station Masters will see the men come on duty sober and fully equipped, that their lamps are trim and filled with oil and that they leave for their patrol duty in time.

If a patrolman who is due to arrive at a station does not turn in time or does not turn up at all station master/block hut-in-charge will advise station Master hut-in-charge at the other end of block section of the absence of the patrolman and both station masters/block hut-in-charges will i caution orders to all trains entering the section until the patrolman from the other end of the “Pa section” arrives at the station and reports that all is well.

Equipment of Patrolmen – (1) Each Patrolman shall be provided with the following equipment such other, as may be prescribed by special instructions:-

(a) One staff.
(b) Number plate 15 cm. square (to be numbered consecutively from the beginning of permanent way inspector's length in white letters on black background.)
(c) 12 fog signals in a tin case.
(d) Two tricolor hand signal lamps.
(e) Protective clothing according to local dress regulations.
(f) One match box.
(g) Two red flags and one green flag (day patrol only).
(h) Patrol book in a tin case.
(i) One three cell Electric torch.
(j) Whistle thunderer.
(k) One haversack.
(l) Three flare signals (fusees) on double/multiple lines, ghats, suburban and automatic b territories and one fuse on single line sections.

(2) Where patrolling is undertaken in paris or stationary patrol consists of two men, equipment need not be duplicated but the additional patrolman will be provided with an e hand signal lamp, whistle thunder and protective clothing.

Certificate to be submitted by Permanent Way Inspector – The Permanent way inspector s submit a certificate to the Divisional Engineer through Assistant Engineer a month in advance be the commencement of the monsoon patrolling and for watching vulnerable locations/ bridges and the patrolmen and the watchmen have been made conversant with their duties, rules for the protect of the line and vulnerable locations in their beats. He will also submit the Assistant Engineer a li name of patrolmen and watchmen with their duties/locations assigned during the patrolling season.

Duties of Patrolmen – (1) The duties of a patrolman shall be as follows :

a. Walk to and fro over the beat in accordance with the chart pertaining to his "patrol-sect looking across the track during storms or any other causes likely to endanger the safety of Bridges and their approaches should be especially watched.
b. Apprehend damage to line when.
i. The flood exceeds danger level at any of the bridges.
(ii) When there is damage to the protection work or on approaches even before danger lev reached.
(iii) the water on one side of the embankment is at a much higher level than on the other side.
(iv) When any obstruction such as a fallen tree is blocking the water-way of a bridges.
(v) the track shows signs of settlement.

(C) Take immediate steps in accordance with to stop trains when any portion of the line is likely t rendered unsafe due to abnormal rain or flood or any other cause.
l. When no danger is apprehended stand on the cess on the left hand side facing the train and ex his number plate, turning the light of his lamp on to it, so that the number can be seen from passing train. He should also blow the whistle, when the engine and the brake-van of the train

him.

d. Obtain the signature of the station master/block Hut-in-charge on duty at the station/Block concerned for his arrival and departure and exchange patrol books with adjacent patrolmen.

d. Exchange the reports as to the conditions on their beats with adjacent patrol men and statio watchmen on the way.

d. Heed instructions from driver who may report a condition of danger at a kilometrage proceed to the place indicated and take necessary measures.

(2) it is of supreme importance that patrolmen and watchmen thoroughly understand what they hav do in the event of emergency. Every effort should be made to instruct and drill the men in duties. In the even of an emergency the patrolmen should devote their whole time and energ the protection of the line and summoning of assistance. Having protected the line and sumn assistance, they should resume their patrolling.

Q.No.7 EXPLAIN TRACK RENEWAL WORKS BY PQRS AND TRT TRACK RENEWAL MACHINES IN LWR TERRITORY WITH MINIMUM SPEED RESTRICTIONS.

LWR territory with minimum speed restrictions

Track renewal work by PQRS:-

Base depot on PQRS to prepare prefabricated panels.

The following preparatory works before renewal shall be done.

Foot by foot, survey id done to collect information about ballast requirement, lifting of track and depth of deep screening required.

I. Final rail levels should be paint marked on OHE masts or level pegs should be provided.
I. Realignment of curves, of necessary.
I. Deep screening of track in advance of sleeper renewal.
r. LWRs to be distressed at proper temperature and converted to panels. (multiple of sleeper spacing).
r. Impose speed restriction of 20 kmph before starting the work.
I. Auxiliary track is linked with service/new rails.
I. Opening of ballast
I. Recoupment of missing fittings (keys & cotters etc. for CST-9 sleepers)
:. Oiling & greasing of bolts.

EXECUTION OF RENEWAL

I. Under traffic block relaying train is taken to block section. Portal cranes are unloaded on A.T.
I. A.T. should be laid in advance at the place of working.
I. Fish plate gang goes well ahead of portal crane removing fish plates for 5-6 rail lengths.
r. Assuming 2 portal cranes are available, the portal cranes are positioned at the centre of first & second rail panel to be lifted. The rail grippers are lowered. They should be in alignment with rail head at 4 points. First & second panels are lifted up and cranes move towered the PQRS

train. The released panels are unloaded centrally on empty BFRs.

7. Similarly 2 more panels 3rd &4th are lifted and unloaded on empty BFR.

I. Ballast is leveled up manually to correct level. It is desirable to use template.

I. On return 2 preassembled panels are lifted from loaded BFRs, cranes move and place at position (1) & (2) in correct alignment.

I. 5th & 6th panels of old track are lifted and operations repeated.

:. In the last, new panels are placed to close the gap at predetermined point depending on block duration.

:. Fish plate gang fixes the fish plates on newly laid panels. The new panels should be properly matched in the base depot, otherwise adjustment of the rail gap at joints of newly laid panels will be required. At the closing point insertion of rail closer will be required.

I. Ballast is inserted below sleeper seat and kuttcha packing is done with showel.

TRT can work in following these modes-------

I. Complete track renewal.

I. Replacement of sleepers.

I. Replacement of rail.

A. Base Depot---

a. Base depot for TRT working shall be centrally located in working area of 30-40 kms, shall have the facility of water, electricity, communication and accommodation for machine & P.way staff.

b. Provide sufficient stock of new sleeper, ERCs/ fastenings, liners, rail pads in the base depot.

c. 30 Nos. modified BFRs/BRHs shall be required for one set of TRT (10 Nos. for 1600 sleepers + 1 empty & remaining for rectifying supply & dispatch of released material). Wooden battens of 75*75 mm shall be provided between two layers on the outside of MCI inserts.

d. Load fastening s like ERCs, liners and rail pads as required during block.

B. Preparatory arrangements in the field.

a. Sleepers shall be checked for their condition. All corroded broken / steel / cst-9 sleepers shall be marked. Foot by foot survey shall be carried out to identify the locations having lateral or longitudinal infringements within one metre of sleeper ends like creep posts, alignment posts etc.

b. Availability of adequate ballast before relaying shall be ensured foe tamping and restoration of speed at the earliest.

c. Deep screening shall be carried out in advance, excess ballast removed 7 shoulders brought down to sleeper level. Consolidation of ballast bed shall be ensured.

d. Check rails at level crossing falling in the working range shall be removed in advance.

e. All longer fish plates / joggled fish plates clamps and wooden blocks etc. shall be removed from the working range.

f. New rails shall be unloaded paired, fish plated or welded in one piece as required foe day's work and set around 1.5m from centre of track. Rails shall be kept o for with adequate support to avoid shifting during working of TRT.

g. In case of CST-9 sleepers all reverse jaw sleepers shall be removed or their lip may be

cut by lip cutter and gauging done.

h. Interlaced sleepers if any having difference in height shall be removed.

i. Ensure easing out of fitting s/fastenings.

j. Seven wooden sleepers shall be laid in track out of which 5 sleepers behind the rail cut and ballast around them removed for easy lowering of plough.

k. Walkie - talkie sets for communication should be available with engine driver, JE/SE (P.Way), machine staff and adjoining stations.

l. Ensure availability of S&T and OHE staff (in electrified section) for removal and bonding back including earth bonding of new rail panels where required.

m. Replace 2 rail lengths of existing PSC sleeper with wooden.

n. Existing track shall be distressed at 10^0C below the maximum temperature likely to be attained during the work if the rail temperature falls beyond td-20^0C +10^0C

C. Sequence of Operations-----

- TRT is stopped at site in a position that side plough is on first of cut rail
- Shoulder/side plough is lowered.
- Remove 3.40 m long rail closure.
- Lower sled from beam car on to the rail seats of rail closure.
- Bring idle bogie of handling car on to the sled and lock up (by bringing back the machine)
- Slew out old rail and move TRT ahead so that sled clears rail closure portion.
- Remove the old sleepers manually from the closure area and level the ballast bed.
- Old sleeper pickup wheel & dynamic plough are lowered in space cleared by removal of old sleepers.
- Rail ends of preceding day's work shall be connected to the new rail laid on the sleeper shoulder
- Start removing old sleepers by pick up wheel.
- Set CAM wheel on to the rail and commence laying of new concrete sleepers by advancing the machine by automatic mode.
- As TRT moves ahead old rails are threaded out and new rails are threaded in with the help of 5 pairs of guiding rollers provided all along the length of TRT.

D. Operations during block---

- Ensure proper protection at work site, lookout and hooter in proper working order to give warning or train approaching on the adjacent line.
- Take power block if staff is required to climb on the top of machine for repairs in case any breakdown.

E. Post Block operations----

- Ballasting of track shall be done immediately after relaying.
- Ballast regulator, tie tamping machine and dynamic track stabilizer shall be deployed to enable restoration of speed at the earliest.
- In- situ welding of isolated joints shall be done to convert the track in LWR/CWR.
- SEJs shall be provided at locations as per approved LWR/CWR plan.

TRT is used for track relaying works. The CTR/TSR can be done by TRT.

Before introducing TRT for track renewal works, there are some pre- requisite before deployment of any machine in section, which are as under—

Pre-Tamping operation & the following temporary shall be completed before undertaking work---

i. Field survey should be carried out to determine existing profile of track and to decide the general lift. In case of design mode working, the survey should be done as per guidelines.
i. The beginning and the end of curves/ transition curves should be marked on sleepers. Super- elevation and slew should e marked on alternate sleepers to act as guide for the operator.
i. Low cess should be made-up.
/. Track drainage should be improved for better retentivity of packing . pumping locations should be attended. Rounded ballast should be replaced with clean and angular ballast.
/. Deficient fittings and fastenings should e made food and all fittings and fastenings like fish bolts. Keys, cotters, loose jaws elastic rail clips, pads etc. should be properly tightened. Worn out fittings should be replaced.
i. Broken and damaged sleepers shall be replaced.

ii.Distressing of rails, adjustment of creep, expansion gaps in joints, buffer rails and SEJs etc, if necessary, shall be carried out.

Q.8. What precautions should be observed while unloading a Ballast DMT in the section?

Answer: -

1) SSE/P.Way/ Incharge should supervise unloading of Ballast DMT personally.
2) Sufficient trained departmental personnel along with blacksmith must be deputed for unloading of Ballast.
3) Ensure timely examination of Ballast hoppers by TXR.
4) Before unloading of DMT, doors of all hoppers must be checked & released. There should be no Jamming of doors.
5) Brake power must be checked by Driver and the DMT should be manned by a Guard.
6)Proper planning for unloading of Ballast hoppers TP wise should be done by PWI in advance and clear signal should be shown to drivers to stop at exact required locations.
7) PWI must explain and brief the mate, keyman, Driver and Guard about the location and safe working of DMT.
8) Door flaps of Ballast hoppers should be opened slowly to avoid sudden discharge and heaping of ballast.
9) PWI must move along with the DMT while ballast is being unloaded and instruct the staff on DMT as per need.
10) Do not move DMTs at speeds higher than 8 to 10 kmph while unloading of Ballast.
11) DMT shall move only in one direction and no pushing back should be done.
12) Do not stop DMT while unloading is in process.
13) Do not move DMT if it has stopped to any reason without ensuring clearance of ballast from track.

14) Ballast should not be unloaded on and near Level X-ings, points and crossings and Girder bridges.
15) Do not work DMTs after sunset and on foggy days.
16) Uneven unloading must be avoided.

Q.No.9. Describe working of TRT with requirement of yard, loading/unloading of sleepers, marshaling of rake to achieve optimum out put. Also mention benefits over renewal with PQRS.

Ans. Pre work for TRT working –

1. Removal of crib ballast 4 to 5" from top of sleeper
2. Fitting should not be jammed.
3. All the broken sleepers should be removed/replaced in advance.
4. Any lateral obstruction min 50cm from the end of PRC to be removed.
5. Electrical/S&T/Water pipes etc buried under the ballast or sleeper upto 6" to be protected to facilitate complete renewal
6. Long size fish plate bolts/joggle plate removed.
7. SEJ falling in length should be replaced with rail.
8. During night halogen at interval of 30m in operator side and in the length of work to be targeted plus the length of rake should to provided. Stand by generator should be available.
9. OHE & S&T staff should be informed well in advance.
10. Gas cutter should be available at site.
11. It should be ensured that all 4 dowels and 2 locks of each rail bridge are available.

Just before block-

1. Caution of 20 KMPH should be imposed at TSR site to be renewed by TRT.
2. After imposing caution at TRT site a hacksaw cut should be made in advance and a gap of 10mm should be created in fish plated joint.
3. Cut should be 40 sleepers away from fixed location
4. 07 sleepers opening upto bottom of PRC to be done.
5. Alternative ERC should be removed before block.

During block period-

TRT is a system for complete mechanisation of trak renewal process. It does the following jobs :-

a. Threads out old rails from track.
b. Removes old sleepers.
c. Levels and compacts ballast bed.
d. Places new sleepers.
e. Threads in new rails into track.
f. Driving of ERC in following of TRT block is done manually or by clip applicator.

Progress of TRT-

1. Progress of TRT is 600 Nos. PRC sleepers/Eff hours.

After block activity-

1. Gas cut if any should be replaced immediately with new rail hacksaw cut.
2. Boxing of ballast is to be done.
3. Speed can be raised upto 40 KMPH immediately after block if no gas cut existing.

Requirement of yard in TRT Depot

1. Minimum three tracks should be available in TRT Depot, One separate track should be available for TRT and other associated machines and their rest vans.
2. Layout should be so that there is no block of running lines while shunting.
3. For loading/unloading of PRC sleepers gantry should be provided on two lines/three lines.
4. Auxiliary track should be there for running of gantry.
5. There should be one office cum store in yard and emergency control phone should be there.
6. Space should be available for stacking new/release PRC sleepers.
7. Road approach should be available for loading of new/SH PRC sleepers.
8. Lighting arrangement should be there for night working.
9. Drinking water arrangement should be available for staff.
10. As far as possible TRT yard should be made in middle of relaying stretch.

Loading of sleepers-

1. Loading of PRC sleeper should be done by gantry/portal crane.
2. Floor of BFR should be free from ballast.
3. Wooden batten 75mmx75mm in full length of 20 PRC sleepers be used.
4. Each layer should consist of 20 PRC sleepers.
5. Loading of PRC sleepers should not be eccentric.
6. Special type BRN, in which rail must be fixed on the BFR's for loading of first layer of sleeper.

Unloading of sleepers-

1. Unloading of PRC sleepers should be done by gantry/portal cranes.
2. Sorting out of SH/US PRC sleeper should be done just after unloading before stacking.
3. SS sleepers should be stacked separately and U/S sleepers should be stacked separately.
4. Disposal of SS/US PRC should be done as soon as possible to make sufficient room for further incoming sleepers.

Marshalling of rake to achieve optimum output-

1. After block release sleepers, BRN must be sorted out otherwise it will waste time of gantry of TRT for leading of PRC sleepers.
2. Next to TRT, ½ BRN should be kept empty to keep starting release sleepers then sequence of lifting new PRC/putting release PRC will build up automatically.

3. Planning for quantity of TSR with TRT in particular block should be done in advance and according to that, number of BRN loaded with PRC should be attached with rake.
4. Quantity of TSR with TRT will depend upon (a) Duration of block/probable extension of block (b) Stretch of last block.

Benefits over renewal with PQRS-

1. There is no need to prefabricated panels.
2. No auxiliary track is to be laid at site.
3. Concrete sleepers loaded on modified BRNs are directly taken to site and relayed one by one.
4. Existing track rails not required to be cut in length of 13.00 mtr.
5. New rails unloaded at site on shoulders and duly pairs or fish plated are replaced with old rails along with sleeper renewals.
6. The quality of track produced by TRT is very good and the traffic is allowed at 40 KMPH just after relaying.

Q.No.10. Describe scheme for combined mega blocks for maintenance of busy yards with coordination of other departments i.e. S&T, TRD, Electrical.

Ans. SELECTION OF SITE/LOCATION OF MEGA BLOCK –

1. Site for mega block should be so selected that only one line UP/DN may blocked.
2. Meticulous planning should be done by all departments to obtain maximum out put.
3. Each activity by each department should be planned.
4. Material and machinery should be locationed nearest to the work place.
5. Sufficient staff should be nominated for every location.
6. Effective lighting arrangement should be made for night working

REQUIREMENT OF P.WAY

1. Each site of mega block of busy yard must be supervised by separate JE/SSE. Request to ADEN/Sr.DEN to be submitted to arrange additional JE/SSE from adjoining section as per requirement.
2. Sufficient labour for each site should be arranged.
3. If blacksmith work involves, separate blacksmith should be arranged.
4. Mini store in Tata/small truck should be arranged having all P.way small fittings and after bock release could also be loaded.
5. Communication system should be effectively working.

Q.No.11 (i).Planning of various maintenance activities in current scenario after entry of new track maintainers.

(ii) Use of small track machines.

Ans (i) PLANNING OF VARIOUS MAINTENANCE ACTIVITIES IN CURRENT SCENORIA AFTER ENTRY OF NEW TRACK MAINTAINERS.

1. Initial training of new trackmen should be got done as early as possible after joining of new trackmen.
2. All uniform summer/winter should be given to new trackmen just after joining.
3. Work of maintenance should be so distributed that one new and one old trackman could perform the work simultaneously.
4. New trackman should not be deployed individually on safety location such as gateman banner flag, Trollyman etc.
5. New trackman should not be deputed as single Hot weather patrolman/cold weather patrolman.
6. Safety quiz and safety seminar should be organised at the regular intervals to counsel the new entrants. They should be counselled for personal safety also.
7. New trackman are more qualified. They should be encouraged to adopt small track machines for better result with less efforts.
8. The staff should be motivated to accept the safety precautions in religious manner.

Ans (ii) USE OF SMALL TRACK MACHINES

Due to growing traffic and introduction of heavier track structure, faster and more efficient methods of maintenance are needed to be evolved. In the

changed socio-economic scenario, role of small track machines has increase for quality maintenance of track. Different types of small machines have been developed for various activities on track. These small track machines are to be used for day-to-day maintenance, laying and construction of track. Based on field experience. Following machines are extremely useful –

1. Abrasive rail cutter
2. Rail cutting machine (saw type)
3. Rail drilling machine
4. Double action weld trimmer
5. Rail profile weld grinder
6. Portable DC welding generator
7. Toe load measuring device
8. Chamfering kit

Qus.12. Assembling & Laying of fan shaped pts & crossing by T-28 machine with quality.

Ans:- Assembling:

a. Ensure the availability of all fittings at site strictly as per requirement of latest drawings for switch portion, lead and crossing portion.

b. The complete turnout will be assembled on a level ground adjacent to the site of laying or on the loop line connected to turnout.

c. Red/blue rounded marking on the sleepers should invariably be kept on the right hand side irrespective of left hand or right hand turnout.

d. Spacing of sleepers should be strictly as per layout drawing.

e. The sleepers shall be perpendicular to the straight track in switch portion only.

f. In lead portion the sleeper will be inclined at half the angle between the normals to straight and curve track at that point. Proposed disposition is appended.

g. To ensue correct layout laying of sleeper falling at transition from switch to lead and lead to crossing portion should be paid special attention sleepers in the switch portion lead portion and crossing portion are as under:-

Turnout	Switch	Lead	Crossing
1:8.5	1-13	14-41	42-54
1:12	1-20	21-64	65-83

h. The spacing of the sleepers in the lead portion should be as per layout drawing to make a radial or fan shaped layout. the spacing has been worked out separately for both the rails. The separate spacing on two rails make the layout far shaped in lead portion.

h. The sleeper in the crossing portion shall be perpendicular to bisecting line of crossing.

h. Sleeper no 3&4 may be placed for housing motor with the extended portion of sleeper in reverse direction only in circumstances where it cannot be avoided.

h. The approach sleeper in advance of switch portion should be provided without fail, they are for gradual elimination of slope of rail top(1:20)

h. The exit sleeper behind the crossing portion should also be provided for gradual introduction rail slope(1:20)

Site preparation for laying:-

a. The site preparation to be competed well before laying turnout ensuring deep screening of ballast in turnout length and 30m on either side along the track**.**

b. All jammed fitting to be ease out.

Laying : By T-28 Machine:-

I. Take the appropriate traffic block and do the track protection.

II. S&T staffs allow to disconnect the gears and the same time dismantling of xing and leads to be done.

III. After dismantling materials to be kept in safe distance.

IV. After dismantling work. The ballast/ground should perfectly levelled, variation in level may affect the gauge adversely.

V. T-28 machine allowed to laying the assembled P&C.

VI. Ensure proper alignment of P&C

VII. Both ends to be connected.

VIII. Kutcha Packing of newly assembled track to be done and allow the traffic with restricted speed.

Ensure parameters of track as per manual

Q No. 13

a. What is pre-stressed concrete structures
b. Explain advantages & disadvantages of pre-stressed concrete.
c. Describe the details of mix design and design M-40 grade concrete.

a. What are pre-stressed concrete structures?

Pre-stressing cab be defined as the application of a predetermined force or moment to a structural member in such a manner that the combined internal stresses in the member resulting from this force or moment and from any anticipated condition of external loading will be confined within specific limits.

In general, pre-stress involves the imposition of stresses opposite in sign to those which are caused by the subsequent application of working loads. For example, pre-stressing wires placed eccentrically in simple bam produce in the concrete an axial compression and hogging moment. Under service loads the same beam will develop sagging moment. Thus, it is possible to have the entire section in compression when service loads are imposed on the beam. This is the main advantage of pre-stressing concrete. It is well known that reinforced concrete cracks in tension. But there is no cracking in the pre-stressed concrete since the entire section is in compression. Thus, it can be said that pre-stress provides a means for the most efficient use of concrete.

The basic principles and mathematical equations used in the analysis and design of pre-stressed concrete flexural members are same as those used for the reinforced concrete members. Though the form in which the relationships appear in a discussion of pre-stressed concrete may different to facilitate their application.

a. Explain advantages & disadvantages of pre-stressed concrete.

The most significant feature of pre-stressed concrete is that is free of cracks under service loads and enables the entire section to take part in resisting moments. Pre-stressed concrete is more predictable than ordinary reinforced concrete in several respect. Once concrete cracks, the behavior of reinforced concrete structures become quite complex. Since there is no cracking in pre-stressed concrete, its behavior can be explained on a more rational basis. In pre-stressed concrete structures sections are much smaller than those in reinforced concrete structures because dead load moments are neutralized by the pre-stressing moments and shear stresses are reduced.

Other features of pre-stressed concrete are its high ability to resist impact, high fatigue resistance and high live load carrying capacity. It is possible to assemble precast pre-stressed elements thus saving cost shuttering and centering, and time besides maintaining a high quality control.

Pre-stressed concrete construction has become extremely useful in the construction of liquid retaining structures and nuclear power reactors where absolutely no leakage is acceptable. This technique is of great value in railway sleeper, large span roofs.

Some of the disadvantages of pre-stressed concrete construction are as follows:

a) Is uses high strength concrete and steel,
b) It requires and anchors and bearing plates,
c) It may require complicated form work,
d) Labor cost may be greater, and
e) It requires a better quality control.

Yet there is an overall economy in using pre-stressed concrete construction as the decrease in member section results in the decrease in design loads and an economical substructure is required.

Concrete mix design is the step by step procedure to define the proportions of various ingredients of concrete (cement, flyash, water, aggregate, admixtures). The fundamental requirement of a concrete mix is that it should be satisfactory both in the fresh as well as in the hardened state, possessing certain minimum desirable properties like workability, strength and durability. The design should accommodate locally available materials in the best possible way without sacrificing the quality of the final product.

There are various methods available which are developed by research institutes for the design of concrete mixes. The Bureau India Standards has also framed a standard (IS 10262-1982) Recommended Guidelines for Concrete Mix Design which has recommended procedure for design of concrete mixes for general type of construction using concreting materials normally available.

d. Describe the details of mix design and design M-40 grade concrete.

Target mean strength
= FCK+ TXS
TMS= 40+ 1.65X5
=48.25 Say 49 MPA
W/C Ration
Suppose the exposure conditions is –severe than minimum cement
Content = 320kg/cum
W/C ration = 0 .45
And minimum grade = M-30 where as we are designing for M-40 Gd. Hence safe
Now as per IS-10262-1982 water cement ration for 49 MPA concrete = 0.04

20mm size Aggregate: analysis MAS-20

Sieve size	% passing
20mm	88%
10mm	3.5%
4.75mm	0.6%

Suppose the ration of irregular gravel & crushed agg.
= 70% = 30%
Now analysis of 10 mm size agg.

Sieve size	%passing
10mm	77%
4.75mm	17%
2.36mm	6.6%

Suppose
Irregular gravel: crashed gravel
70% : 30%
Sand analysis

Sieve size	%passing
20mm	95%
10mm	91%
4.75mm	86%
600m	55%

In this analysis pure sand = 86%
And 600m passing = 55x100/86= 63.95, say 64%
Suppose the sand shape irregular: rounded
50% : 50%
According to D.O.E method (department of environment)
Recommended proportion of fine agg. For percentage passing 600 micron sieve 9 (MAS-20MM) for 60mm to 180mm slump.
As per experimental date
The percentage of sand at 0.4 water cement ration in MAS-20MM concrete will be as under
For 60 % sand passing through 600M,
Seive, the ration of sand to be mixed in concrete = 35% and for sand in which 600M passing, sand is 80% than the ration of sand in the concrete to be taken 30%
Hence in 64% 600m passing sand the ration of fine aggregate in the concrete to be taken 34%
Now
F.A ; CA
34 : 66%
The CA is further partning as
CA-I (MAS-10M)
CA-II (MAS-20)
Proportion of coarse aggregate.
In MAS 20MM concrete
The ration of CA I & CA-II
10MM : 20MM
33% : 67%
66% : 67% of 66%
22% : 44%

Ratio of aggregate.

Sand	CA-I	CA-II
34%	22%	44%
+6%	-3%	-3%
40%	19%	41%

DO 10 mm

-3	+3	0

Final ratio
37% 22% 41%
A/C ration for the Mix of sand = 37%
20mm= 41%
10mm = 22%
Suppose that the actual specific gravity of coarse agg. & fine Agg = 2.67.
Than A/C ration for medium workability = 4.1
Hence for 50Kg cement
Agg. = 50x4.10
= 205 kg

Sand	10mm	20mm
37%	22%	41%

=75.85kg 45.10kg 84.05 kg
Water = 20kg
Cement 50kg.
Again if suppose there is 3% moisture in sand
2.27 Kg water is available in 75.85kg sand
Therefore putting correction in sand & water Qty.
Cement = 50kg
Water = 20-2.28= 17.72kg
Sand = 75.85 + 2.28 = 78.13 kg
10mm size aggregate. = 45.10 kg
20mm size aggregate.= 84.05 kg

Q No:- 14.

a. **Explain criteria for Rail Renewal**
b. **Explain pre temping and post temping attentions.**

a) Criteria for Rail renewals

The following criteria have been prescribed for rail renewals:-

1. Incidence of rail fractures or rail failures
2. Wear of rails
3. Maintainability of track to the prescribed standards.
4. Service life of rails
5. Services life of rails
6. Plan based renewals

These will be discussed in detail in subsequent paras.

i. Incidence of rail fractures/failures

This factor which involves safety should have over riding priority while deciding rail renewals. A spate of rail failures on a particular length may necessitate rail renewal. In such cases ultrasonic testing of rail should be done and the results of such testing taken into consideration. If the rail failures are high on a section 4% in a year or 10% the section should be considered for rail renewal.

ii. Wear of rails: - rail renewals may become necessary, because of excessive wear. The following different criteria have been laid for the same:-

a) Limiting loss of section
b) Wear due to corrosion
c) Vertical wear
d) Lateral wear

iii. Maintainability of track to the prescribed standards.

There may be cases where though the service life of a rail has not yet reached, yet due to local factors like curves, steep gradients, high speeds, heavy axle loads, burrs, scabbing, wear of rails etc. renewals become necessary due to following considerations:-

a) Poor running quality of track in spite of extra maintenance labour engaged on the section.
b) Disproportionate cost of maintain the track in safe condition.
c) Poor condition of rail due to hogging, battering, scabbing, wheel burn, and other conditions such as excessive corrugation of rail etc. as can be ascertained by visual

inspections and which make the track maintenance difficult and uneconomical and affect the running quality of track.

iv. <u>Service life of rails</u>

a) Due to the passage of moving loads, alternating stresses are created in the rail section. The number of reversal of stresses is directly related to gross million tones carried by the rails. Majorituy of rail fractures originate formthe fatigue cracks, which depend on the total G.M.T. carried. The track is considered for renewal after it has carried threshold GMT.

b) Sleepers are considered overdue renewal when they have completed service lie as follow us:-

Wooden …… 10 years

ST & CST-9 …….20 years for A, B, C routes and 25 years on D & E routes.

c) The condition of rails and sleepers is the ultimate criteria for track renewal.

v. Plan based renewals: - Renewals to pre-determined plan with the objective of modernizing the track structure on selected routes in the quickest possible time may be plaaned even if it involves pre-mature renewal of track.

b. <u>Arrangements taken to execute the works of Short duration & long durations with sketch.</u>

Works of Short duration

These are the engineering works which involve the safety of trains and are required to be completed by the sunset. Before commencing any work of this type, the P.W.I should issue a notice to the Station Master in-charge at each end of the block section and obtain their acknowledgment. No engineering work involving the danger to trains should be commenced unless the site has been protected by hand signals, banner flags and detonators. Depending as to whether the train is to be passed through the work site after stopping or at a restricted speed, the line should be protected in the following manner.

Case I : When a train is required to pass at a restricted speed in block section (work to be completed before sunset)

Case II : When the train is required to stop at site of work in block section (work to be completed before sunset)

Works of long Duration

These are the planned track works like track renewal works, rebuilding of bridges etc. and the speed restriction is to last for more than a day.

Case III : Protection of line for works of long duration –Train to stop dead

Case IV : Protection of line of works of long duration :(Train to pass at a restricted speed)

b) Pre-temping and Post –temping attentions

Pre –temping Operations

The following preparatory works should be completed before undertaking the work:-

i. Field Survey:- Field survey should be carried out to determine existing profile of track and to decide the general lift.

ii. Curves:- The beginning and the end of curves/transition curves should be marked on sleepers. Super-elevation and slew should be marked on alternate sleepers to act as guide for the operator.

iii. Ballast :- Ballast should be heaped up in the tamping zone to ensure effective packing. However, sleeper top should be visible to the operator and the ballast should not obstruct the lifting rollers.

iv. Track drainage and cess: Track drainage should be improved for better retentively of packing. Pumping location should be attended. Low cess should be made-up.

v. Fittings: deficient fittings and fastenings should be made good and all fittings and fastenings like fish bolt, keys, cotter, loose jaws, elastic rail clips, pads etc. should be properly tightened. Worn out fittings should be replaced. Hogged, battered and low joints should be attended.

vi. Sleepers: sleepers should be squared, correctly spaced and gauge corrected. Broken and damaged sleepers should be replaced.

vii. De-stressing of rails: distressing of rails. Adjustment of creep, expansion gaps in joints, buffer rails and SEJs etc, if necessary should be carried out.

viii. Electrified section: In electrified sections, the earthing bond should either be removed or properly adjusted for tamping.

ix. General:

a) Guard rails at the approach of bridges and check rails should be removed temporarily.

b) All obstructions such as rail lubricator, signal rods and cable pipe which are likely to obstruct the tamping tools should be clearly marked and made known to the operator before the start of work.

c) Wooden blocks and joggled fishplates should be removed temporarily ahead of tamping.

(d) Post tamping operation

The section engineer (P. Way) should pay attention to the following item:-

I. Checking and tightening of loose fittings.

II. Replacement of broken fittings.

III. The ballast should be dressed neatly. Proper consolidation of ballast be between the sleepers should also be done.

IV. Final track parameters should be recorded with the help of recorders provided on the tamping machine. A copy of this record should be kept with the section engineer (P-way) and the recorded values should not exceed the following limits:-

Limit of Track parameters after tamping

Parameter	**Not more than 10 peaks per km to exceed this value**	**Any peak exceeding this value**
Alignment	+4mm	+ 6mm
Cross level	6m	
Unevenness	6mm	10m

If the recorder is not available, then track parameters of at least four stretches of 25 sleepers each per kilometer of tamped track should be recorded. In addition the versines and supper-elevation of curves shall be recorded for at least ten stations at a specified chord length.

vi. While working in LWR territory, the provisions of manual of instruction on long welded rails- n1996 should be followed.

vii. The fixtures like check rails removed during pre-temping operation should be restored.

Q. no. 15(i) As a P.Way Engineer how will you use the data of track recording (TRC) to improve the TGI values?

Ans:- The formula for calculation of TGI value is given as under

$$TGI = \frac{2UNI+TWI+GI+6ALI}{10}$$

Where UNI=Unevenness Index
TWI=Twist Index
GI = Gauge Index
ALI=Alignment Index

All these indices i.e. UNI, TWI, GI & ALI are calculated from the standard deviations of the track defects measured by the TRC. Thus, TGI is a standard deviation based Track Index and is computed by using the standard deviations of the recorded track parameters viz unevenness, twist, gauge & alignment for each block of 200m length.

Higher the values of SD, poorer the condition of track. Thus, the stretches of track needing attention can be identified. Also the specific parameters of track needing attention are identified from the values of standard deviations. Now only the selected portion of track is attended thoroughly to improve the TGI values instead of attention to whole length of track.

In addition to SD values the results of TRC provide the records of peak distribution, ABCD categorization of track on short chords, WXYZ categorization on long chords, information of isolated defects with location and magnitude and many other information which help in identification of bad stretches of track needing urgent attention.

Thus, the information given by the TRC can be conveniently used for identification of stretches of track needing attention, parameters of track needing attention. Hence, the TGI values can be improved by imparting the planned resources for attention to track parameters at the selected locations instead of attending whole length of track.

Q. 15 (ii) DESCRIBE THE PROCEDURE FOR IN SITU FABRICATION OF GLUED JOINTS.

Ans: - **PRE FABRICATION WORKS:-**

i. First of all materials and equipments to be used are to be arranged.
ii. The rail to be converted into glued joint and the exact location of the glued joint is selected.
iii. Speed restriction of 30 Kmph should be imposed.
iv. The rail shall be cut with rail cutting machine. The cuts made should be square and right up to the bottom edge of the rail. All burrs should be removed.

v. The holes in the rail should be drilled with 30mm dia H.T.S drill bit concentric to the holes of the fish plates. All the holes should be chamfered and the burrs around holes should be removed.

vi. Proper round holes are cut on the glass cloth carrier and insulating channels, coinciding with the holes of the fish plates to accommodate the bolts,

vii. Rolling marks of the rail, occurring in the zone of contact of rail & fish plates shall be ground with a grinder so as to merge with the parent profile/contour.

viii. It should be checked that the fish plates should have correct profile so that contact with rail on the fishing surface and web is proper.

FABRICATION WORKS:-

1. In case the fabrication is being done in running track, minimum traffic block of 2 hours shall be taken and track protected with banner flag and detonators. Rail should be made free of fittings over a length of 2.0m on either side.
2. Grinding of rail to a length of 50cm on either end should be done with AG-9 grinder and it shall be ensured that no rolling mark, rust, dents are in contact with the fish plates.
3. Both the fish plates shall be ground to make the surface free from dust, dents, grease etc.
4. The gap shall be maintained slightly more than 10mm to accommodate the end post. (To achieve this tensor shall be applied).
5. The rail ends shall be aligned laterally and vertically with straight edge using suitable wedges.
6. The rail ends and fish plates surfaces shall be cleaned with acetone and dried completely.
7. The resin and hardener shall be thoroughly mixed to get homogeneous mixture. The mixed glue shall be consumed within its pot life (Generally 30 minutes).

8. A thick layer of glue shall be applied on mating surfaces of the fish plates simultaneously by two workmen.

9. One piece of clean glass cloth carrier shall be placed on the fish plates and evenly pressed so that the glue squeezes out through the glass cloth. The oozing glue shall be uniformly spread over. A layer of glue shall be applied on inside of the insulating channel followed by then placement on the glued glass cloth carrier on the two fish plates.

10. A layer of glue shall then be applied on the outside of the insulting channel and a clean piece of glass cloth carrier shall be laid.

11. Glue shall be applied to both the faces of end post and placed between the two rail ends. The tensor may be tightened to place the end post firmly if the same is loose due to more gap.

12. The insulating bushes duly dipped in glue shall be placed in rail holes. The bonding surfaces of rail shall then be coated with a layer of glue and the fish plates made ready shall be placed in position in contact with the rail web.

13. H.T.S. bolts, washers and nuts well cleaned and free from oil, dust etc shall be placed in position and tightened with torque wrench. The torque shall be gradually increased on all bolts. Care shall be taken to tighten inner bolts first and then outer bolts. Finally all the bolts shall be tightened with the torque of 105 kgm.

14. The above operation shall be finished within 45 to 60 minutes, so that minimum 60 minutes setting time is achieved.

15. About 20 minutes after initial tightening, all the bolts shall be re-tightened with the torque of 105 kgm.

16. The joint shall be finished by covering all the visible edges of glass cloth carrier with glue.

17. After retightening the bolts, the joint is left for setting with tensor in clamped condition.

18. After setting the removed fitting are restored in position, tensor removed and traffic block cancelled.

19. Traffic may be passed at restricted speed of 30kmph for about 2 hours after which the speed restriction shall be relaxed to normal.

Q. no. 15 (iii) **DRAW THE SCHEMATIC DIAGRAM OF PQRS DEPOT.**

Base P.Way Depot for PQRS:-

Q.No. 4(iii) DRAW the schematic diagram of PARS Depot.

Base P. Way Depot FOR PARS:-

A suitable yard is selected where a base P. Way Depot along with assembly yard is developed for receipt of concrete sleepers and other track components as well as for assembling of panels. Concrete sleepers are unloaded in the yard with the help of portal cranes and stacked at nominated places.

Fig 16.7 Recommended layout for assembly yard

The base depot should ideally have 3 lines. A portion of two lines in the rear is used for stacking incoming concrete sleepers. A small siding of about 200 metres is also laid for stabling and repairing machines. The typical lay out of basic depot is given in the figure.

Q.16. Design an singly reinforced simply supported beam having spam of 5 mm it is carrying a load of 10000 N/m including itself wt.

Assumed

Concrete = M20 grade

steel = Tor

Allowable bending stress in steel 210 N / mm

Solution :

Let us design the beam using M20 grade of concrete and with for steel having allowable stress in bending as 210N/mm

From IS456 : 1978 allowable compressive stress in concrete for M20 concrete, 7.0 N/mm

Modular ration, m = 280 / 3 6bc

= 280 / 3 x 7 = 13.33 = 13.00

Bending moment = wl /8 = 10000 x 5 x 5 = 31250 N - m

8

= 31250000 N-mm

Neutral axis cofficient = N = 1

1 + 6st / m 6bc

N = 1 = 0.302

1 + 210 / 13 x 7

Now let d/b = 2.5 or d = 2.5b

M = kbd

Where K = 1/2 6bc NJ = 1/2 x 7.0 x 0.302 x 0.899 = 0.95

J= 1 - N/3 = 1-0.302 / 3 = 0.899

M = kbd = kb x (2.5b) = 6.25 kb

= 6.25 x 0.95 b = 5.9375 b

We have already calculated that the due to load, beam is subjected to bending moment of 31250 000N - mm. Evaluating external moment with the moment of resistance

We get,

5.9375 b = 31250000

or b = 5263157.90

or b = 173.95 mm

say 180 mm

d = 2.5b = 2.5 x 180 = 450 mm

Area of Steel = M/6stJd = 31250000

210 x 0.899 x 450

= 367.84 mm

Let us adopt 12 0 bars

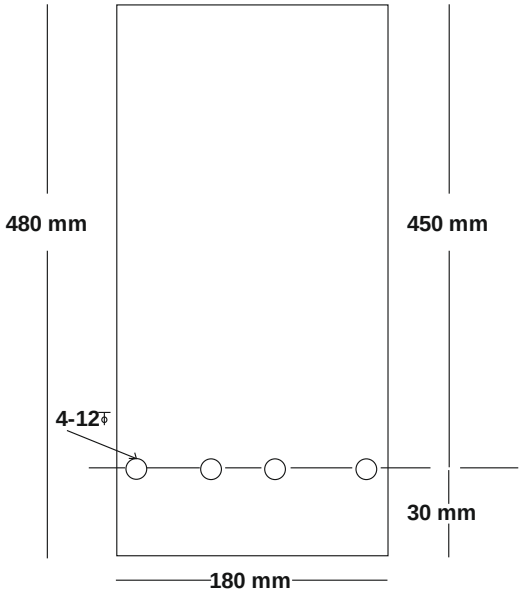
Area of each bar = A / 4 x 12 = 113.10 mm

No. of Bars required = 367.84 = 3.25

113.10

Provide 4 numbers of 12 0 bars.

Provide 30 mm of effective cover design section of the beam will be as given :-



Conclusions :

Width of beam = b = 180 mm

Depth of beam = d = 480mm

Steel Reinforcement = Ast = 4-12 0

Q.No.17 what are the important safety aspects, to be inspected during inspection of manned and unmanned lever crossing?

1) Inadequate visibility: Un manned level crossings are more prone to accidents which can be avoided by maintaining proper visibility. At un manned level crossings where visibility is not clear up to 600 m along the track at a distance of 5 m centre of track, suitable speed restriction should be imposed with the approval of Chief Engineer so as to avoid accidents. All trees, bushes or undergrowth that interfere or tend to interfere with the view from the Railway or roadway when approaching level crossings, should be cut down.

2. Overhauling of level crossing: The level crossings having sleeper other than concrete sleepers overhauled at least once a year or more frequently, as necessary.
However level crossings laid on concrete sleepers should be overhauled with each cycle of machine packing or more frequently as warranted by conditions and in no case, should be delayed by more than two years. During overhauling, the condition of sleepers and fastening, rails and fastening should be examined. The wooden sleepers are given a coat of coal tar. In all cases, rail and fastening in contact with road shall be thoroughly cleaned with wire brush and a coat of coal tar applied. Flange way clearance, cross levels, gauge and alignment should be

checked and correct as necessary, and the track packed thoroughly before reopening the level crossing for road traffic.

3. Maintenance of check rails: Check rails of level crossings are required to be removed for tamping, over hauling destressing, track renewal and should be re fixed as quickly as possible preferably before leaving site. In case check rails cannot be fixed a speed restriction of 30 km ph will follow, a standing watch man shall be posted to ensure safety besides arrangement for diverting the passage of road traffic. Check rail clearance should be maintained between 51-57 mm. Check rail should be clear and flange way depth should be more than 38 mm.

4) Difference in level between check rail and running rail: At level crossings, at some locations there may be difference of level between check rail and running rail resulting in inconvenience to the road users. Hence, proper attention should be made at the time of overhauling of level crossing by providing proper sleepers underneath the rails.

5. Whistle indicator:-

(i) At the approach to all unmanned 'C' class level crossings or manned level crossing where the view is not clear on either side for a distance of 600 meters and those which have normal position open to road traffic, without interlocking and protection by signals , under special conditions, bilingual whistle boards as per IRPWM annexure 9/5 should be erected at 600 meters along the track from the level crossing to enjoin the Drivers of the approaching trains to give audible warning of the approach of a train to the road users. The Drivers of the approaching train should whistle continuously from the time they pass whistle boards to the time they cross the level crossing.

Additional repeater W/L board should also be provided on all unmanned Level crossings.

6 Stop' Boards

(a) On the road approaches to all the unmanned 'C' class level crossings 'Stop' Boards should be provided on the road at either sides of the level crossings at 5 mtr from centre line of nearest track.

(b) This shall consist of a board 675 mm X 525 mm on a suitable post bearing the indication of an engine and the legend **"Stop, look out for trains before crossing"** in English, Hindi and Regional language. The paint used shall preferably be of luminous variety

Generally indicators and warning boards get faded with time when ordinary paint is used. Hence as for as possible luminous paints / luminous strips should be used. As far as luminous strip and luminous paint are concerned, for speed breakers sign boards, whistle boards and stop boards etc. the luminous strip are more effective rather than luminous paint as it is just a like a pre-cast concrete which cannot be deteriorated immediately.

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7) Speed breaker

Provision of rumble strips on approaches of level crossings as per the standard design is the responsibility of Road authorities. Matter may be pursued with all State Governments/Road authorities to ensure that rumble Strips are provided on all level crossings as per standard design over the total width of the road i.e edge of the berm to edge of berm with proper road warning signs as per the standard design. However, it is incumbent upon Railways to provide speed

breakers as per the standard design on both manned as well as unmanned level crossing irrespective of whether the approach road are metalled are um-metalled, as a temporary safety measure, till such time these are replaced with rumble Strips of proper design by the Road authorities. While providing speed breakers, following guidelines may be observed.

(a) One speed breaker should be provided on either approach of level crossings located within the Railway land boundary at 20m covering full width of the road including berms. For safety reasons, the paint marking should be provided and their maintenance ensured.

(b) Standard warning signs for speed breakers should be invariably provided at a prescribed distance as follows.

(c)

Class of Road	**Plain Area**	**Hilly area**
Class I	120 m	60 m
Class II	60 to 90 m	40 to 50 m
Class III	40 m	30 m

8) Road surface: Road surface is made smooth in such a way that vehicles are not struck to the track. Patch work should be done immediately if required. Hexagonal concrete blocks may be provided, which are durable against wear and tear in gauge conversion and new construction. It has been proved more useful and durable for maintaining the road surface. Secondly it gives better appearance to the road surface and having high resisting power during monsoon season. It should be provided in between the two gates. Outside the gate road surface can be maintained by black top road.

9) **Height gauges: - On Electrified sections** height gauge should be erected suitably on either side of level crossing so as to ensure that all vehicles can pass with adequate clearance. The height gauge shall be located at a minimum distance of 8 m from the gate post. The road surface up to height gauge is at same level as the road surface inside the gate post.

10) Fencings: Sometimes fencing along the level crossings get damaged, so it become unsafe. If fencing is found broken, it should be immediately attended.

11) Gates and locks are not working properly; there should be arrangement of spare chain in case of emergency.

12) Telephone instrument: Telephone instrument should be always in working order for exchanging the private numbers. If it is out of order it reported immediately for repairing for S&T department.

13) Duty rosters of gateman should be maintained in such a way that gate should always be operated with those gatemen, who are having adequate knowledge of operation of gate as well as protection of train in case of emergency. Those trackman/ gang man/ key man should not be deployed who are not having proper knowledge of safety. However, in case of unavoidable circumstances, it is the duty of PWI in charge to issue competent certificate to those railway staffs who are not working in the capacity of regular gateman. Gate should never be operated under the influence/ pressure of road users. Hence it should always be operated as per railway working rules.

Q.No. 18. Explain periodicity of USFD testing of Rails & welds. Write down various probes being used in USFD testing there function. Action to be taken after defection of defect.

Rails After initial testing of rails ,first test free period will be 15%of service life of GMT.

Gauge	Rail section	Assessed GMT service life for T.12 72 UTS rails	Assessed GMT service life for T.12 90 UTS rails
B.G	60 Kg	550	800
	52 Kg	350	525
	90 R	250	375

Route	Routes having GMT	Testing frequency Once in
All BG routes (rail head center and gauge face corner/non-gauge face corner testing)	≤ 5	2 years
	$>5 \leq 8$	12 months
	$>8 \leq 12$	9 months
	$>12 \leq 16$	6 months
	$>16 \leq 24$	4 months
	$>24 \leq 40$	3 months
	$>40 \leq 60$	2 months
	$>60 \leq 80$	$1^{1/2}$ months
	>80	1 month

AT WELDS

S. No.	**Type of welds**	**Type of Testing**	**Testing schedule**

1	**Conventional AT WELD**	Preiodic Tests	Every 40 GMT	
2	**SKV Weld**	Acceptance Test	Immediately after welding	
3		First Periodic Test	1 year	
			Route having GMT	**Frequency**
4		Further tests based on route GMT	>45	2 years
5			>30 ≤45	3 years
6			>15 ≤30	4 years
7			0-15	5 years

- **Different type 0f probes**:

(a) Single rail tester: Single rail tester is provided with seven probes i.e. 0`, 70` Center Forward)C F), 70` Center Backward (C B), 70` Gauge Face Forward (GF), 70` Gauge Face Backward (NGB). The normal probe (0`) is utilized for the purpose of detecting horizontal defects situated in head, web or foot.

(b) Double Rail tester: The double rail tester is capable of testing both the rails at a time. For each rail, seven probes have been provided for the present i.e. 0`, 70` Center Forward (C F), 70` Center Backward (C B), 70` Gauge face Forward (G F), 70` Gauge Face Backward (G B), 70` Non-gauge face Forward (NGF) and 70` Non-gauge Face Backward (NCB).

Other types of probes:

45`, 2MHz probe half junction and SEJ. probes in a rig) for detection of welded rail joints. For testing Gas Pressure, Flashbutt Welded rail joints and Moon Defect in AT Welds below web foot Tandem Scanning (2 Nos. of 45` lack of fusion in AT

70`, 2MHz probe 20 mm circular Flange & Head testing of AT welds
(or 20 mm x 20 mm square crystal)

70`, 2MHz Side looking probe (SLP) Half Moon defect in AT welds below web foot junction

.

Action to be taken after Detection of defects:- Following action shall be taken in respect of defective rails & welds:

S. No.	Classification	Painting on both faces of web	Action to be taken	Interim action
1	IMR IMRW	Three cross with red paint	The flawed portion should be replaced by a sound tested rail piece of not less than 5.5 m length (in case of fish plated track) & 4 m (in case of welded track) within 3 days of detection.	SE/JE(P.Way)/USFD shall impose speed restriction of 30 Kmph or stricter immediately and to be continued till flawed rail/weld is replaced. He should communicate to sectional SE/JE(P.Way) about the flaw location who shall ensure that clamped joggled fish plate is provided within 24 hrs.
2	OBS OBSW	One cross with red paint	Rail/Weld to be provided with clamped joggled fish plate within 3 days. SE/JE(P.Aay)/USFD to specifically record the observations of the location in his register in subsequent rounds of testing.	SE/JE(P.Way)/USFD to advise sectional SE/JE(P.Way) within 24 hrs about the flaw location. Keyman to watch during daily patro;;ing till it is joggled fish plated.

Q No. 19:

(a) Give in tabular form the latest standard for track structure (Rails, Sleepers with density,

Fastening etc) as prescribed by Railway Board for different type of BG Track. (b) Explain the criterion laid down for proposing rail renewal.

(a) As per correction slip no 129 & 130 of IRPWM 2004 the desired track structure for BG route should be as under.

Sr. No	Description	Rail Section	Sleeper Density
1	Track Renewal and Doubling	60 kg 90 UTS	1660 per km.
2	All Gauge conversion and new line construction work except those indicated (3below)	60 kg 90 UTS	1660 per km.
3.	Gauge conversion and new line project heaving expected traffic of less than 5 GMT not lightly to have CC+6+2T Trains in future.	52 kg 90 UTS	1660 per km.
4	Loop lines and siding heaving a speed up to 50 KMPH	60 kg (SH) or 52 Kg (SH)	1540 per km.
5	Siding having speed more than 50 KMPH	60 kg	1660 km.

i) PSC sleeper shall be used for all type of renewal.
ii) Minimum clean stone ballast caution below the bottom of sleeper well be 250mm.

(b) The following are to be considered for the criteria for rail renewal.

a. Incidence of rail fractures/failure.:- Where rail fractures occurred in particular section are 5 no. per 10 km stretch per year. Through rail renewal is also allowed in location of track where more than 30 defective welds exists per km.
b. Wear on Rail:- Rail renewal required to be done in following case.
   i. Where loss in section reached 6% for 52 Kg. and 5% for 90 R rail.
   ii. Where corrosion beyond 1.5mm in the web and foot occurred.
   iii. When vertical wear 13mm for 60Kg, 8mm for 52Kg and 5mm 90R rail occurred.
   iv. When lateral wear on curved track on group A & B route 8mm and on C & D route 10mm occurred. On a straight track these limit are 6mm and 8mm respectively.
c. Maintainability of track to prescribed standards:-
ii. Where poor running quality of track in spite of extra maintenance labour engaged.
iii. Condition of rails with regard to hogging/battering, scabbing and wheel burns becomes bad and not maintainable.

d. Expected service life in terms of GMT carried: - The rail shall be planned for through renewal when total traffic GMT passed beyond 800 for 60 Kg 90 UTS, 525 for 52 90UTS and 350 for 52 kg 72 UTS reached.
e. Plan based renewal:- Renewal to pre determined plan with the objective of modernizing the track structure of selected routes in the quickest possible time may be planned even if it is involves pre mature renewal.

Q No. 20:
(a) Indicate various types of mechanical tempers available with the Railways for maintenance of plain track as well as points & crossings also describe pre & post temping attentions to be given to the Track.
(b) Describe the activities to be carried out with BCM working i.e. before screening and after screening.

a)

(a) There are two type of mechanical tempers generally used on the railways as followings:-
   i. Off Track Temper
   ii. On Track Temper

Off Track Temper:-

These are portable tempers and can be taken off the track in a short time. These temper are like tools driven by compressed air, electricity or petrol these tempers work during the interval between trains and do not required any traffic blocks. There are various type of Off Track Temper are available and these are worked in pairs from opposite side of the sleepers diagonally under the rail seat. In order to have maximum consolidation of ballast. The ballast is first loosened around the rail seat in the crib with the help of beaters for a distance of 450mm on either side of the foot of the rail. The temper is then inserted vertically and the temping tools blades are kept about 75 to 100mm away from sleeper so that enough ballast is available between the sleeper and the temping tool blade. The temping period with Off Track Temper is normally about 50 second per sleeper for a lift up to 20mm. One party with two sets consisting of eight persons can temp about 300 sleepers per day.

On Track Temper:-

On Track Tempers are self propelled vehicle in which the temping of sleeper is done automatically through the control provided in the operators cabin. There are two type of Track Temper i. e. Light on track temper and heavy on track tempers. Heavy on track temper are superior to the light on track temper and can do automatically and simultaneously lifting, aligning, leveling and temping. Most of the major heavy track tempers/track machines which are in use of Indian Railway are indicated below.

A. Temping Machines for plane track temping are as under:-
   i. 08-16 Unomatic
   ii. 08-32 Duomatic
   iii. 09-32 CSM
   iv. 09-3X Temping Express
B. Temping machines for Points & Xing are as under:-
   i. 08-275-2S Unimate
   ii. 08-275-3S Unimate
   iii. 08-275-3S

Pre Temping Attentions:- The following preparatory works should be completed before undertaking the work:-

i. Field survey: should be carried out to determine existing profile of track and to decide the general lift.

ii. Curves : The beginning and the end of curves/transition curves should be marked on sleepers super elevation and slew should be marked on alertnate sleepers for guidance of operator.
iii. Wooden blocks and joggled fish plates provided with defective welds and OHE bonds shall be removed temporarily ahead of temping.
iv. All obstruction such as signal roads, cable pipes etc. which are likely to obstructs temping tools shall be clearly marked.
v. Guard rails at the approach of bridge and check rails at level crossing shall be removed temporarily.
vi. Ballast shall be heaped up especially in temping zone to ensure effective packing, Sleeper top shall be kept free from the ballast.
vii. Blowing/Pumping joints shall be attended and round ballast replaced with clean and angular ballast.
viii. Sleeper shall be squared, correctly spaced and gauged properly.
ix. Fitting and fastenings deficient shall be restored, loose tightened and wornout replaced.
x. Hogged, battered and low joints shall be attended.

Post tamping attentions:- Section P.Way Engineer attached with machine shall ensure about the following items:-

i. Checking and tightening of loose fittings
ii. Replacement of broken fittings
iii. Dressing up of the ballast and proper consolidation of ballast in crib/shoulder.
iv. Final track parameters shall be recorded in the register.
v. The fixtures like check rail, guard rail, wooden block, joggled fish plates bonds etc. removed/adjusted from the track shall be restored.

(b)

1. Activities to be carried out with BCM working before screening are as under:-
   i. Foot by Foot survey of the section should be done to see the condition of ballast, track components, cess width and availability of land for waste disposal.
   ii. Longitudinal profile and alignment should be final. Depth of cutting and magnitude of lifting of track should be decided on the bases of proposed rail level.
   iii. Putting extra ballast into screening zone of BCM to ensure that the maximum possible ballast is screened by the BCM
   iv. Renewal of worn out and broken fittings.
   v. All type of obstructions should be removed in advance .
   vi. L-Xing should be opened in advanced so as to enable machine to work.
   vii. Sleeper should have all the fitting intect so that no sleeper become loose and come in the way of cutter chain.
   viii. Gas cutting equipment should be available at site to cut of any obstruction like rail pieces, pipe etc. which might get in tangled with cutting chain.
   ix. A trench of 30 cm depth and 1mtr wide should be made for lowering cutter bar by removing one sleeper.
2. Operations required after BCM working
   i. At the end of work, about five sleeper spaces are left without ballast. These should be filled manually with the clean ballast.

ii. The vertical and lateral clearances for OHE signal post and any other structure should be checked and adjusted before clearing the BCM block.
iii. Ballast recoupment activity should synchronies with deep screening activity so as to enable raising to normal after necessary packing.
iv. One watchman should be posted at the location where cutter bar and chain are left whenever considered necessary.
v. It is desirable that one round of tamping along with DTS should be carried out immediately after deep screening to resume traffic at a speed of 40 Kmph.
vi. Cleaning of cess, screening of left over ballast and making standard of ballast profile.
vii. Removal of the muck and disposed the same away from the track.

Q. No. (21)(a) Describe have relaying work by PQRS or TRT M/c including pre & post relaying activities.
(10)

Ans:- **Portal Cranes (PQRS)**

Para 3.5. 1. **General**

i) Portal Cranes, commonly referred to as PQRS, are used for mechanized tack renewals. These are loaded on BFRs' and hauled to the site. Normally two portal cranes are deployed for the relaying work at site, while the third one is utilised for pre-assembly of new track panels at the base depot. The third portal crane also acts as a standby in case of breakdown of the portals at site.

ii) Tamping machine should be deployed behind the portal cranes for lifting and tamping of newly laid track.

iii) Minimum block of 2 hours and 30 minutes duration should be arranged.

iv) Adequate spares for working of all the machines (Portal Cranes and Tampers etc) should be arranged in advance and regular supply should be ensured

The base depot is required to cater to the following activities:

a) Unloading of PSC sleepers from the rake and staking.
b) Fabrication of new panels.
c) Unloading of released panels.
d) Dismantling of released panels.
e) Loading of pre-fabricated new panels.
f) Formation of PQRS rake.
g) Maintenance of machines.
h) Dispatch of released materials.
i) Loading/unloading of ballast, if the base depot is also to be used as ballast depot.
a) Unloading of PRC sleepers from the rake and stacking.
b) Fabrication of new panels.
c) Unloading of released panels from PQRS rake.
d) Dismantling of released panels.

ii) It is desirable to locate the Base Depot at a central place such that the distance of remotest work site on either side does not exceed 60-70 kms. At the same time, the site

selected should be accessible by road; there should be electric power supply and watering facilities. The base depot may have facility of entry and exit on both sides from the running line

iii) For smooth working, the base depot should have at least three sidings of 500 metres each connected to a shunting neck of 350 meters. Of these, at least two sidings should be provided with auxiliary track for movement of portal cranes.

iv) It is desirable to illuminate the base depot so that the activities listed in item (i) above can be undertaken safely at night.

v) To strengthen depot working, it is desirable to install a few hand operated/motorised gantry cranes moving on auxiliary tracks in addition to the third portal crane in the depot. Some of these gantry cranes can be of 6.5 metres height from rail level to facilitate repair to portal cranes.

Pre-Relaying Operations Following operations should be ensured before actual relaying:- i) The requisite survey shall be carried out and the longitudinal profile and alignment shall be finalised as per relevant provisions in the Indian Railways Permanent Way Manual- and schedule of dimensions

ii) Track may be deep screened one or two days in advance of relaying. The ballast section should be built up to the bottom of sleepers to facilitate relaying. The balance quantity of screened ballast should be trained out after relaying.

iii) Auxiliary track should be laid at 3400 mm gauge keepingthe central line same as that of main line track, as shown in Sketch 3.4, CST-9 plates or wooden blocks ofsize 560 × 250 × 125 mm should be used at 1.5 to 2.0 metres distance for laying the auxiliary track. The length of auxiliary track should match with the daily progress of work.

iv) The level of auxiliary track should be same as that of existing main line track and must have proper longitudinal and cross levels to avoid derailment of portal cranes. In no case, the auxiliary tack should be more than 50mm higher than the existing track.

v) Removal of ballast from the crib and shoulders up to the bottom level of the sleepers should be ensured.

vi) Fullfittings of the old sleepers should be ensured to avoid their falling off while lifting released panels.

vii)Sleepers must be in single piece. All Broken sleepers should be removed or replaced in advance.

viii) On girder bridges, the guard rails at the approaches on both ends should be removed temporally. ix) In case a level crossing is to be encountered, it should be opened in advance.

x) Proper planning and insertion of Switch Expansion Joints at correct locations should be ensured.

xi) Cutting of LWR/SWR to single rails should be ensured for liftingreleased panels. Otherwise, replace the existing running rail by service rails for the stretches which are to be relaid during the next day.

xii) Temporally disconnect or remove any other permanent obstructions such as cables, signalling rods and any other installations like embedded rail pieces, tie bars etc. to allow unhindered progress of work.

xiii) Availability of under noted equipments should be ensured at site:- a) One set each of rail cutting and gas cuttingequipment in good working condition. b) Two sets of rail closures of the each rail section being laid, in various sizes from 0.5m to 3m lengths. c) 4

sets of junction fish plateswith bolts. xiv) Portable walkie-talkie sets should be provided at each relaying site for effective communication between the site of work and the adjoining stations. xv) Extra number of track panels should be fabricated in the base depot to maintain a buffer stock for one or two days of relaying work so that work at site does not suffer for want of depot working.

Post Relaying Operations Following post relaying operations should be ensured :-

i. Clearance of track from any obstructions before removal of traffic block.

ii. ii) Complete track lifting including their correct positioning & tightness.

iii. iii) Proper lifting, packing, ballast regulating and compaction/stabilization of track to raise the speed of the different stretches as per the table II of para 308 of IRPWM

iv. . iv) Training out of adequate quantity of ballast over the newly relayed track to full ballast section. Ballast recoupment activity should be properly synchronized with the relaying activity so as to enable raising of speed to normal in three cycles of tamping by on-track tampers.

v. v) Picking up of left over released materials.

vi. vi) Dismantling of auxiliary track and relaying the same in advance for the next day's work.

vii. vii) Restoration of cables and other fixtures e.g. guard rails on level crossing which were removed temporarily.

viii. viii) Tie tamping machines, BRM and Dynamic Track Stabilizer should be deployed to enable raising of speed to normal. ix) Provision of SEJ as per approved plan. In-situ welding of panels and destressing of LWR should be done after welding of panels.

Track Relaying Train (TRT)

Operations Prior to Development of Machine

i. Base Depot a) Ensure proper selection of Base Depot site. The base depot for TRT should be centrally located (30-40 kms. lead) in the area of working. It should have water, electricity and communication set up. Also, accommodation for machine and P. way staff should be available. b) Provide sufficient stock of new sleepers, elastic rail clips fastenings, liners and rail pads in the base depot. c) Ensure proper line and level of auxiliary track for 3400/3700 mm gauge portal working. d) 30 nos. BFR's should be modified for one set of TRT. 160 sleepers are loaded in one BFR and about 1500-2000 sleepers should be loaded as required during block. While loading PSC sleepers on special BFRs, wooden battens of 75 mm × 75 mm should be provided between different layers on the outer side of MCI inserts. This will enable gripper to function properly. e) Load rail fastening like elastic rail clips, liners and rail pads as required during block.

Condition ofsleepers should be seen .All corroded and broken steel/CST-9 sleepers should be marked.

ii. iii) Foot by foot survey should be carried out to identify the locations having lateral or longitudinal infringements. There should be no infringement within one metre of sleeper ends.

ii. iv) Adequate ballast should be available before relaying operations start sothat tamping and raising of speed is not delayed.

ii. v) Deep screening should be carried out in advance wherever feasible. Excess ballast should be removed and shoulders should be brought down wherever feasible to sleeper level. It should be ensured that the ballast bed is fully consolidated.

ii. vi) Check-rails of the level crossings falling in the range of work should be removed in advance.

ii. vii) All longer fish bolts and joggled fish-plates should be removed from the range of work.

ii. viii) New rails should be unloaded, paired, fishplated or welded in one piece (as required for a day's work) and set at about 1.5 metres from track centre. Rails should be kept on foot with adequate support so that they do not get shifted during working of the TRT.

ii. ix) All obstructions like creep posts, alignment posts etc. within 1 metre ofsleeper end should be removed.

ii. x) All reverse jaw sleepers in case of CST-9 sleeper track should be removed. Alternatively, their lip may be cut by lip cutter sothat railremoval is not obstructed.

ii. xi) All longer wooden sleepers from joints be either removed or cut to size in advance of TRT working.

ii. xii) Interlaced sleepers of height different from remaining sleepers should be removed.

ii. xiii) Ensure that the fittings in old track are not jammed and can be removed while working. Loosen them if any problem is anticipated.

ii. xiv) In case o f CST-9 sleepers, gauging should be done in advance to avoid hittingof sleepers by sled assembly during lifting of CST-9 sleepers.

ii. xv) Seven wooden sleepers should be laid in track at location 5 sleepers behind the rail cut and ballast around them removed for easy placement of plow.

ii. xvi) The location of cut at new site of work should be so planned that it matches with the new rail end for threading at the start of work.

ii. xvii) At location where relaying is to start, two rail pieces of 7.3 metres length are cut and connected together using well greased fishbolts to enable quick opening during block.

ii. xviii) Plan the location of cut in the old track at the closing of work site so that it matches with the rail end of new rail panel. Some extra gap is preferable, as the new rail while threadingin is likely to straighten and extend.

ii. xix) Walkie-talkie sets for communication should be available with engine driver, Junior/Section Engineer (P. way) machine staff and adjoining stations.

ii. xx) Ensure availability of S & T staffto connect- any wire/rodding disturbed during the block, and OHE staff (in electrified section) for opening of temporary bonds and bondingback after the work.

ii. xxi) Ensure removal of OHE bonds before the block. Temporary bonding of the OHE masts should be done by OHE staff while removingthese bonds .

ii. xxii) Ensure earth bonding of new rail panels. There should be minimum 3 bonds in each panel length of 300 metres.

ii. xxiii) Ensure removal of alternate keys in case of CST-9 sleepers and inside alternate keys in case of ST sleepers. The remaining keys should be checked for easy removal.

ii. xxiv) Existing small nos. of PSC sleepers (2 rail lengths) should be replaced with wooden sleepers to avoid loss of time while working.

High temperature destressing of the old tack should be carried out as provided

(b) For a 1° curve on BG 110 Kmph line with 80mm cant & 100 meter transition length find out.

(i) Safe & equilibrium speed and rate of change of cant and cant deficiency at 110 KMPH.

(5)

Ans. Given D=1° so R=$\frac{1750}{D} = \frac{1750}{1} = \frac{1750}{M}$

Ca = 80MV, T_2=100M

Safe speed on the theoretical considerations

V=0.27√R(Ca+Cd) = 0.27√1450(80+100) = 151.3 Kmph say 150Kmph

MPS will be lesson of safe speed i.e. 110 Kmph for speed

SE = $\frac{GV^2}{127R}$, 80 = $\frac{1750xV^2}{127x1750}$

V=100.79 say 100 Kmph

Now we find rate of cant

Vm=$\frac{Rcax3.6xT_L}{Ca}$

110= $\frac{Rcax3.6x100}{80}$

Rca=24.44Min/Sec

When is less than 35Min/Sec hence OK

Now rate of cant deficiency Rcd

Rcd=$\frac{V_m \text{ x cd}}{T_L x3.6}$ =$\frac{110x100}{100x3.6}$ = 30.55min

Which is <35min/sec

Hence OK

(ii) If Rajdhani express is made to run at 130 KMPH speed on this curve, it will be at what cant deficiency and rate of change of cant and will that be as per rules (10)

Ans. G_{30} =$\frac{GV^2}{127R}$ =$\frac{1750 \text{ x } 130^2}{127 \text{ x } 1750}$ =133.07 say 135 mm

Cd at 130 Kmph = G_{30}-Ca = 135-80=55

How we find recd at 130 Kmph

Rca = $\frac{Vm \text{ x } Ca}{3.6 \text{ x } 100}$ = $\frac{130 \text{ x } 135}{3.6 \text{ x } 100}$ =60.93

This is more than permissible value 55min/sec

Hence Rajdhani Express can not be allowed to run

Hence OK

Q. No. (22) (a) What are the classifications of high speed routes and what are the standards for each route category of the following –

(i) Rails (ii) sleepers (iii) Fastenings (iv) Ballast cushion.

Classification of High Speed Route	Rails	Sleepers	Fastenings	Ballast Cushion
Group A – Speed upto 160 Kmph	60 Kg	PSC 1660	Elastic	300
Group B – Speed upto 130 Kmph	60 Kg	PSC 1660	,,	,,
Group C – Subarban sections	60	PSC	,,	,,

	Kg	1660		
Group D Spl. Traffic may be higherin future but speed upto 110 Kmph	60Kg	PSC 1660	,,	,,
Group D – Speed upto 110 Kmph	52 Kg	PSC 1540	,,	250
Group E Spl. Traffic may be rise in future but speed 110 Kmph	60 Kg	PSC1660	,,	300
Group E Speed 110 Kmph	52 Kg	PSC 1540	,,	250

(b) Pre & post attentions for working of unimate M/c and what is JPO for Points & xings packing by Unimate M/c. (15)

Para 3.**2 Tamping Machine For Points & Crossing (Unimate)** Tamping of turnouts shall be planned to cover sufficient length of approach track taking into account the special track features on either side. In case of the turnout leading to loop line, the turn in-curve shall also be tamped. In addition to provisions contained for plain track tamper, the following aspects shall be taken care of.

Para 3.2.**1 Pre Tamping Operations**

i. Layout including spacing of sleepers as per relevant drawings shall be ensured.

ii. The nose of the crossing may get battered or worn or the sleepers below it may get warped or bent. In such cases, the crossing should be reconditioned or replaced and sleepers below the crossing should be attended.

iii. High points on the turn out and approaches should be determined and general lift should be decided. General lift of minimum 10 mm must be given.

Para3.2.2 **Operations during Tamping**:

i. For packing turnout, main line is to be tamped first. While tamping mainline, the additional lifting arrangement lifts the turnout side rail also. The lifted end of sleepers should be adequately supported on wooden wedges till it is packed/tamped

ii. The machine carries out correction of alignment and levels on main line portion. On the turnout side, only tamping without lifting and lining shall be done.

iii. The squeezing pressure to be applied is as follows: a) ST sleepers/wooden sleepers: 110-115/sq.cm b) PSC sleepers: 135-140 kg/ sq. cm

iv. In case there is hindrance to achieve adequate penetration of tool, penetration assistance system should be used to facilitate insertion of tools in ballast and to accelerate lowering of tamping units.

v. During and before tamping, S&T and Electrical staff should also be associated to complete their portion of work 3.2.3 Post Tamping Operations The post tamping operations shall be same as that of plain track tamping. Special care should be taken to tighten and complete the fittings. All S&T/Electrical connections removed before tamping shall be restored back.

JPO for points & Crossing packing by Unimate:-

<u>Pre-Traffic Block activities</u>

i. Oiling & greasing of P.Way connections.

ii. Oiling & greasing of S&T connections.

iii. Oiling & greasing of S&T gears of point machine.

iv. Application for disconnection by S&T Deptt.
v. Application for Traffic Block by Engg. Deptt.

During-Traffic Block

i. Machine movement for site & setting up of machine.
ii. Removal of S&T gears during the disconnection of point.
iii. Start of Tamping Work.
iv. Tamping of switch portion should generally by taken up first so that while tamping work is in progress, S&T reconnection work can go ahead.
v. Reconnection of S&T gears after tamping of switch portion.
vi. Completion of tamping, S&T reconnections & remaining work.
vii. Clearance of traffic block.

Q. no. 23 Describe the benefits of tamping in design mode. Also write down the pre tamping and post temping operations for tamping of T/outs including the points to be observed during tamping of turnouts for better retention of packing?

Ans: - **BENEFITS OF TAMPING IN DESIGN MODE:-**

Working of tamping machine in smoothening mode reduces the track defects viz unevenness, cross levels and alignment to only limited extent. Wherever, the tamping in design mode correct the track parameters up to a design value thereby eliminating the track defects to a larger extent. Thus, good track geometry is achieved by working of tamping machines in design mode.

Comparatively longs sags and dips in track are eliminated by designing the vertical profile of the track. Also the long alignment defects are removed by using the sufficiently long chords for designing the slews. However, obligatory points are to be kept in mind while designing the vertical profile and slews for tamping in design mode.

PRE-TAMPING OPERATIONS FOR TAMPING OF TURNOUTS:-

i) Layout including spacing of sleepers as per relevant drawings shall be ensured.

ii) Battered/Worn out crossings should be reconditioned or replaced.

iii) Warped/bent or worn out sleepers under crossing should be replaced.

iv) The joints of the CMS crossing should be made gapless.

v) Avoidable joints in turnout portion and on its approaches should be welded.

vi) High points on the turnout and its approaches should be determined and general lift should be decided. General lift of minimum 10mm must be given.

vii) The field survey should be carried out to design the vertical profile/general lift and slews for rectification of alignment defects.

viii) Ballast shall be heaped up in the tamping zone to ensure effective packing.

ix) Hogged, battered and low joints shall be attended.

x) Track drainage should be improved for better retention of packing.

xi) Deficient fittings and fastenings should be made good and properly tightened.

xii) Wooden blocks and joggle fish plates shall be removed temporarily ahead of tamping.

OPERATIONS DURING TAMPING OF TURNOUTS:-

i) For packing turnout, main line is to be tamped first. While tamping main line, the additional lifting arrangement lifts the turnout side rail also. The lifted end of sleepers should be adequately supported on wooden wedges till it is packed/tamped.

ii) The machine carries out correction of alignment and levels on main line portion. On the turnout side, only tamping without lifting and lining shall be done.

iii) The squeezing pressure to be applied should be as follows:-

a) ST/Wooden sleepers – 110-115 Kg/Sqcm

b) PSC sleepers – 135-140 Kg/Sqcm.

iv) In case there is hindrance to achieve adequate penetration of tools, penetration assistance system should be used to facilitate insertion of tools in ballast and to accelerate lowering of tamping units.

v) During and before tamping, S&T and Electrical staff should also be associated to complete their portion of work.

vi) Tamping of all sleepers should be ensured specially in switch portion by opening out all the stretcher bars including leading stretcher bar by taking proper disconnection of the point through S&T supervisor at site.

vii) The parameters of tamped track should be checked immediately after tamping for cross level and alignment and necessary corrective action should be taken.

POST TAMPING OPERATIONS:-

i) All S&T and Electrical connections removed before tamping shall be restored back.

ii) All broken/missing fittings and fastenings should be recouped and loose ones should be tightened.

iii) The ballast should be dressed neatly. Proper consolidation of ballast between the sleepers should be done.

iv) Final track parameters should be recorded.

WORKS

Q 1: - What precautions should be taken while collecting water samples from tap for Bacteriological testing?

Answer: - The precautions to be observed while taking water samples for bacteriological test from a tap are as under.
Only sterilized bottles with lid should be used.
The paper cover from the sterilized bottle should be removed just before taking samples.
The stopper/lid should be removed just before filling the bottle.
The stopper/lid should be held from the top while the bottle is being filled.
Contamination while filling the bottle must be avoided.
The mouth of the tap from which the sample is taken should be heated by a spirit lamp for three minutes.
Water shall than be allowed to flow freely for 5 minutes before sampling.
Bottles containing samples of water should be properly labeled, packed around with Ice and saw dust and sent without any delay to reach the DMO for examination.

Q 2: - List out the division of responsibilities for prevention / reporting among the various staff in regard to new Encroachment.
Answer: -

1. Within station premises: Lies with the Station master jointly with concerned RPF inspector and senior most RPF official at that station where no RPF inspector is posted.
2. Within / around the colony premises : Lies with the concerned Section Engineer works jointly with concerned RPF inspector and senior most RPF official at that station where no RPF inspector is posted.
3. In between stations: Lies jointly with concerned Section Engineer works/ P.way and RPF official.
4. In Loco sheds: Lies jointly with the nominated section Engineer of the loco shed and RPF Inspector.
5. In carriage & Wagon depots: Lies jointly with nominated section Engineer of the depot and RPF official.
6. In workshops: Lies jointly with nominated section Engineer (of the department to which the workshop belongs) of the Workshops and RPF official.

Q.No.3 (A) Describe minimum passenger amenities for deferent classes of railway stations including adarsh, model and modern stations.

Minimum essential amenities.

Availability of these amenities at the prescribed scale will have to be ensured.

MINIMUM ESSENTIAL AMENITIES AT EACH CATEGORY OF STATIONS.

AMENITIES	STATION CATEGORY						
	A1	**A**	**B**	**C**	**D**	**E**	**F**
Booking facility	**15**	**10**	**6**	**4**	**4**	**2**	**1**
Drinking water No. of taps/P.F	**20**	**20**	**20**	**6**	**8**	**2**	**APPROPRIATE DRINKING WATER FACILITY**
UTS	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**-**
Waiting Hall/ Shed @ Sqm	**250**	**125**	**75**	**0**	**30**	**15**	**10 sqm booking office cum waiting hall**
Seating arrangement (No. of seats / PF)	**150**	**125**	**100**	**10**	**50**	**10**	**-**
Platform shelter (on each PF)#	**500sqm**	**400sqm**	**200sqm**	**200**sqm	50 sqm+	**50 sqm +**	Shady trees
Urinals	12	10	6	4	4	1	-
Latrines	12	10	6	2	4	1	-
Foot over bridge	1 with cover	1 with cover	1	1	@@		
Water cooler	2 on each PF	2 on each PF	2 on each PF	2 on each PF	1 on each PF	-	-
Signage (standardized)	Yes	Yes	Yes	-	-	-	-
Platforms***	High level	High level	Medium level	High level	Medium level	Rail level	
Lighting ++	As per annexure II of Board's letter No. 2004/elec(G)/109/1dated 18.05.2007						
Fans	As given below						
Time table display	As per extant instructions.						
Clock	To be decided by zonal railways.						
Public address	As per extant instructions						

system/compute r based announcement	
Parking-cum-circulatory area, with lights	As per extant instructions
Electronic train indicator board.	As per extant instructions
Public phone booth	As per extant instructions

MODEL STATION:-

SN	Station amenities with category of station where facilities to be provided	A1	A	B	C	D	E
1	Retiring room (A1,A,B & D)	Y	Y	Y	-	Y	-
2	Waiting room with bathing facilities						
	Common (A1,A,B &D)	Y	Y	Y	-	Y	-
	Separate for upper and 2nd class (A1,A,B,D)	Y	Y	Y	-	Y	
	Separate for ladies and gents (A1,A)	Y	Y	-	-	-	-
3	Clock room (A1,A&B)	Y	Y	Y	-	-	-
4	Enquiry & compute based announcement (A1,A,B,C &D)	Y	Y	Y	Y	Y	-
5	National train enquiry system (A1,A,)	Y	Y	-	-	-	-
6	Interactive voice response system(A1,A,B)	Y	Y	Y	-	-	-
7	Public address system. (A1,A,B,C &D)	Y	Y	Y	Y	Y	-
8	Book stall/other stall of essential goods.(A1,A,B,C &D)	Y	Y	Y	Y	Y	-
9	Refreshment room.(A1,A,B) Y Y			Y	-	-	-
10	Parking/circulating area. (A1,A,B,C &D)	Y	Y	Y	Y	Y	-
11	Washable apron with jet cleaning. (A1,A,B)	Y	Y	Y	-	-	-
12	Electronic train indicator board. (A1,A,B&C)	Y	Y	Y	Y	-	-
13	Public phone & internet(All)	Y	Y	Y	Y	Y	Y

14	Touch screen NTES(A1,A)	Y	Y	-	-	-	-
15	Watering vending machines.(A1)	Y	-	-	-	-	-
16	Water coolers. (A1,A,B,C &D)	Y	Y	Y	Y	Y	-
17	Standard signages. (A1,A,B,C &D)	Y	Y	Y	Y	Y	-
18	Modular catering stalls. (A1,A,B,C &D)	Y	Y	Y	Y	Y	-
19	Automatic vending machine(A1,A,B,C)	Y	Y	Y	Y	-	-
20	Pay & use toilets.(All)	Y	Y	Y	Y	-	-
21	SPTMs/UTS(A1,A,B,C,D&E)	Y	Y	Y	Y	Y	Y
22	Computersisation of complaints. (A1,A)	Y	Y	-	-	-	-
23	Provision of cyber cafes.(A1)	Y	-	-	-	-	-
24	Provision of ATMs. (A1,A,B,C,D&E)	Y	Y	Y	Y	Y	Y
25	Provision of at least one VIP AC longue. (A1)	Y	-	-	-	-	-
26	Food plaza. (A1)	Y	-	-	-	-	-
27	Train coach indication system. (A1)	Y	-	-	-	-	-
28	CCTV for announcement and security purpose. (A1)	Y	-	-	-	-	-
29	Coin operated ticket vending machines. (A1)	Y	-	-	-	-	-
30	Pre paid taxi services. (A1)	Y	-	-	-	-	-
31	Static mobile charging facility. (A1)	Y	-	-	-	-	-
32	Face lift of station building including façade. (A1)	Y	-	-	-	-	-

ADARSH STATION:-

1	Improvement to façade of the station building				
2	Retiring room				
3	For upper class with TV				
4	For other class with TV				
5	Separate for ladies				
6	Clock room				
7	Computer based public address system				
	Circulating area with lighting				
	Landscape of circulating area				
8	Earmarked parking				

9	Prepaid taxi/radio booth				
10	Electronic train indicator board/plasma TV train indicator system				
11	Life/escalator (subject to feasibility)				
12	Signage				
13	Pay & use toilets in circulating area/ concourse area				
14	Level of platform				
15	AC VIP longue				
16	Coach indication board				
17	Foot over bridge				
18	Water cooler				
19	Passenger reservation system				
20	Unreserved ticketing system				
21	Adequate lighting arrangements with energy efficient fittings and fixtures in platform				
22	Battery car				
23	Ramps at entry to station for physically handicapped and senior citizens				
24	Separate parking for disabled persons				
25	Non slippery walkway from parking lot to station building				
26	A toilet for physically handicapped				
27	May I help you booth				
28	Trolley path end pathway for inter platform movement of wheel chair for physically handicapped.				
29	Wheel chair				
30	Mobile charging points				
31	Mobile charging points				

MODERN STATIONS:-

Improvement in façade of station building					
Improvement to circulating area w.r.t proper entry and exit of vehicles etc.					
Lighting tower at appropriate place for proper illumination					
improved modern cost effective lighting arrangements at PFs and concourse					
Renovated water booths					
Renovated modern pay and use toilets					
Good waiting and retiring retiring rooms with modern furniture					
Good passenger guidance system					
Signage’s and coach indication boards					
Improvement to platform surface					
Improvement to booking and inquiry offices with facelift					
Lighting of booking office and queuing area in front of booking windows					
Whether reputed architects/consultants engaged for beautification?					
Target date of completion					
Cost of civil engg. Works in cr. of Rs.					
expenditure					

Q.N.3(B) Describe various types of floorings to be adopted on platforms on different category of stations.

		Earning more than Rs. 50 crore	Earning more than Rs.6 crore and upto Rs. 50 crore	Earning Rs.3 crore to Rs. 6 crore	Sub urban station	Earning between Rs. 1 crore & Rs. 3 crore	Earning less than Rs. 1 crore	Halt
1.	Platform (covered area)	1. fibre reinforced vacuum dewatered concrete flooring 2. kota or similar stone flooring with or without stone cladding	1. fibre reinforced vacuum dewatered concrete flooring 2. kota or similar stone flooring with or without stone cladding	1. fibre reinforced vacuum dewatered concrete flooring 2. kota or similar stone flooring with or without stone cladding	1. fibre reinforced vacuum dewatered concrete flooring 2. kota or similar stone flooring with or without stone cladding	1. fibre reinforced vacuum dewatered concrete flooring 2. bituminous flooring	1. fibre reinforced cement concrete/ CC flooring 2.rough dressed stones slab flooring 3. Bituminous flooring. 4.brick on edge	1. moorum surfaces flooring 2. brick on edge 3. rough dressed stone
SL	Utility place	A1	A	B	C	D	E	F
2.	Platform (open area)	1. fibre reinforced vacuum dewatered concrete flooring 2. kota or similar stone flooring with or	1. fibre reinforced vacuum dewatered concrete flooring 2. kota or similar stone flooring with or	1. fibre reinforced vacuum dewatered concrete flooring 2. kota or similar stone flooring with or	1. fibre reinforced vacuum dewatered concrete flooring 2. kota or similar stone flooring with or	1. fibre reinforced vacuum dewatered concrete flooring 2.interlocking precast cement concrete paver blocks flooring 3. terrazzo	1. Rough dressed stones slab. 2. fibre reinforced vacuum dewatered concrete in 3 m width towards track	1.Brick on edge 2. interlocking pre-cast cement concrete paver Blocks flooring 3. Moorum surface

		without stone cladding 3. interlocking precast paver blocks using plastic moulds	without stone cladding 3. interlocking precast paver blocks using plastic moulds	without stone cladding 3. interlocking precast paver blocks using plastic moulds	without stone cladding 3. interlocking precast paver blocks using plastic moulds	tiles flooring	3.brick on edge 4. Bitumino us flooring 5. Moorum surface flooring	flooring

Q.No.3.C. describe schedule of white washing / paintings on service and residential buildings with type of materials to be used for exterior walls and methods for carrying out such works on high rise buildings.

SCHEDULE OF COLOUR WASHING AND SISTEMPERING

	Colour washing exterior plastered surface		Interior white washing including ceiling	White washing of kitchen and pantry	Interior distempering
	Areas with not less than 1500 mm rainfall per year 1.	Areas with less than 1500mm fall per year 2	3	4	5

I. **Service building**:					
1. Hospitals	Once in a years	Once in 2 years	Once in a years	Once in 6 months	Once in 2 years
2. Refreshment rooms	-do-	-do-	-do-	-do-	-do-
3. Rest houses for officers and subordinates.	-do-	-do-	Once in a years	Once in 2 years	-do-
4. Running rooms	-do-	-do-	Once in a years	Once in 6 months	-do-
5. Station building:-					
(a) Concourse, waiting hall waiting rooms and bathrooms	-do-	-do-	-do-	-	-do-
(b) other rooms	-do-	-do-	Once in 2 years	-	-do-
6. Officers	-do-	-do-	-do-	-	-do-

7. workshops and running sheds etc.	-do-	-do-	-do-	-	-
8. Good sheds transshipment sheds, repacking sheds etc.	-do-	-do-	-do-	-	-
9. Gate- lodges, cabins etc.	Once in a years	Once in 2 years	Once in 2 years	-	-
10.Schools	-do-	-do-	Once in a years	-	-
11. Institutes and clubs	-do-	-do-	Once in 2 years	Once in a years	Once in 2 years
II. Residential Buildings:-					
1. Officers Bungalow	Once in 2 years	Once in 2 years	Once in 2 years	Once in 2 years	Once in 2 years
2. class III staff Qrs.	-do-	-do-	-do-	-do-	-do-
3. Class IV staff Qrs.	-do-	-do-	Once in a years	-do-	-

1. External painting of high rise building involves more effort, time and risk due to requirement of high scaffolding and other temporary arrangement. It is there for desirable that the exterior painting in these building should last more than 5 years without losing sheen. Exterior wall paint should be resistant to algae, fungus, moss growth, ultraviolet rays, etc. it should be capable to fill up micro cracks on wall surface and should not allow dust/ pollutant s to adhere to its surface.

2. Contrary to this , useful life of waterproofing cement paints is very less. These paints lose their sheen and look shabby in a short period of time and often require painting every year/ alternate year depending upon climatic conditions, dust and pollution etc.

3. In case exterior wall painting of old high rise buildings (G+4 & above), the old paint should be removed completely by scraping . Plastered surface may need repair/ re-plastering . Depending upon the surface condition. Leakage, dampness, etc. has to be completely attended. If needed, thin layer of white cement based putty can be applied on the plastered surface to fill mirror cracks/ crevices in the wall surface and reduce seepage & surface irregularities. These activities can be done under relevant items of Northern Railway USSOR/Non schedule items. Subsequently, painting can be done with premium acrylic smooth exterior paint with silicon additives as per NR-USSOR Item No. 115180.

4. It is important that to get better quality, paints from very reputed brands only should be used. For guidance, some of the reputed brand names are dulux, Asian brochures, regarding application methodology, should be followed for getting desired performance.

5. Such “premium Acrylic smooth exterior paints with silicon additives” are expected to last in serviceable condition for about 5 years, if painted after proper surface preparation. In case, re-

painting before 5 years is required o condition basis, Pr. Chief Engineer's prior approval should be obtained.

6. In case of buildings having floors less thanG+4, but otherwise important in \character, such exterior wall painting , if required, can be done, with the approval of DRM.

Q.No.3(d) Explain works certificate to be issued to artisan's staff to be deployed by contractors on works site by respective ADENs.

Before the artisans are allowed on the job at site, the ASEN concerned shall examine their training certificate and or works experience certificate mentioned artisan staff on a particular railway work.

Any artisan without "permit to work certificate" by the ADE in charge of the work shall not be deployed at the work site.

"The contractor shall place and keep on the works at all times efficient and competent staff to give the necessary directions to his workmen and to see that they supervisors, workmen and labourers in or about the execution of any of these works as are careful and skilled in the various trades".

Due to lack of emphasis on deployment of adequately skilled staff, the quality and workmanship of works suffer so also the life of assets. As such for all the contracts under execution or to be awarded in future, it should be ensured that any artisan deployed by the contractor/out sourced agency, shall have any of the following skills certificate and or experience certificate:

i. Minimum three years of experience of having worked satisfactory for similar skill trade at any important site with reputed contractor / outsourced agency.
ii. Certificate of excellence by railway officer(minimum ADEN level).
iii. Certificate of training in particular trade for ITI or National Skilled Development Corporation (NSDC) or any similar recognized Institution for training in that particular trade.

The above experience/ skills certificate criteria shall be applicable for all artisans like mason(of concerned skill e.g. mason skilled for brick work and mason skilled for tilling work are different sills), fitter, blacksmith, painter (of concerned skill). Whitewasher, carpenter, receptionist/ supervisor/housekeeping staff etc.

Question.4: What are the various planning aspects for planning Railway Staff Colonies?

Answer:- For Planning of railway staff colonies, following factors should be considered.

a) Orientation of buildings:- The Chief aim of orientation of buildings is to provide physically and psychologically comfortable living inside the building by creating conditions which suitably and successfully ward off undersirable effects of severe weather to the best possible extent.

Prevailing Winds and relative humidity

b) In the coastal areas, because of less diurnal variation of temperatures along with high humidity, the emphasis should be on prevailing winds.

The best orientation from solar point of view requires that the building as a whole should receive the maximum solar radiation in winter and the minimum in summer.

c) Water supply, drainage and sewerage system:- Adequate water supply and sullage and storm water drains should be provided. The water supply system should be designed on the basis of at least 200 litres/person/day (which includes 45 litres for flushing requirements) due allowance being made for gardens. Where common hydrants are provided, these may be equipped with suitable anti-waste water taps. For multi-stories builds, necessary static tanks may be provided for fire fighting arrangement in accordance with the regulations laid down.

Where water borne sewerage/exists in the vicinity, open drains and soak-pits should be dispensed with and an adequate underground system provided. For colonies provided with adequate piped water supply with overhead storage facilities and where no sewerage system exists in the vicinity, an under ground sewerage system with one or two septic tanks according to the layout of the ground should be provided.

Guidelines for the selection of an appropriate sanitation system are given.

Groups of latrines or urinals should not be located within 15 meters of living quarters, 30 meters of any cook house or food stall, 45 meters of any well supplying drinking water and should be located away from public buildings adjoining railway colonies.

d) DUSTBINS:- These should be conveniently located with respect to the quarters and regularly cleared by the conservancy staff. In the case of multi storied buildings garbage chutes may be provided with opening in each floor with arrangements for closing the openings.

e) SHADY TREES:- Shady trees like Gulmohur, Neem should be provided along service roads at close intervals. Such trees should be provided along the periphery of parking areas and in the circulating areas in railway stations. Some ornamental trees like Alstonia,

Kachnar, Bottlebrush, Cassia, Silver Oak, Mulsari,

Plumerica, Ashoka and shrubs like, Chandani, Gardinia, Chinese Orange and Jatruca may also be plated. For beautification of circulating areas of stations, service of the Guardens may be maintained in circulating areas through voluntary agencies or business houses on terms and conditions to safeguard the interest and rights of the railways.

f) PLAY GROUNDS FOR CHILDRENS:- An open space at an appropriate place in the colony may be left for entertainment and sports of the employees and their wards.

Question.5.: What is controlled concrete? Differentiate it from ordinary concrete. Generally what type of **concrete mix are used for various structures.**

Answer:- Types of Concrete:-

Ordinary concrete: The concrete, in which no preliminary test are performed for designing the mix, is called ordinary concrete.

Controlled concrete: The concrete, in which preliminary tests are performed for designing i.e. the mix, is called controlled concrete. The controlled concrete described as M10,M15,M20,M30,M35 & M40 etc. depending upon characteristic strength of concrete.

General Concrete Mix for Various Purposes.

S.No.	Grade	Concrete mix(general)	Type of Construction
1	M10	1:3:6	Mass concrete in piers abutments, massive reinforced concrete members.
2	M15	1:2:4	Normal RCC work i.e. slabs, columns, beams, walls, small span arches.
3	M20	`1:1 ½ :3	Water retaining structures i.e. reservoirs columns & piles.
4	M25	1:1:2	Long span arches, and highly loaded column.
5	M30,35etc .	to be designed	Post tensioned pre-stressed concrete & other important works.

Q.6. Define Earnest Money, Security Deposit and performance Guarantee. In which form Earnest Money Deposit, Security Deposit and Performance Guarantee should be submitted.

Ans. **EARNEST MONEY**: Earnest Money is the amount asked from the participating tenderer in token of the genuine interest in the work on the part of the tenderer. On acceptance of the offer, total EMD becomes part of the security deposit for the performance of the contract. The Earnest Money Deposit(EMD) of unsuccessful tenderer is returned immediately on finalization of the tender. In case of withdrawn of the offer after opening of the tender but before finalization of the tender within validity period, EMD is forfeited. The cost of work, on which EMD is calculated should be realistically assessed considering the prevalent market rates. The scale of EMD is given below:

	Value Of The Work	**Earnest Money Deposit (EMD)**
A.	For works estimated to cost upto Rs.1 Crore	2% of the estimated cost of the work
B.	For works estimated to cost more than Rs.1 Crore	Rs.2 lakh plus ½% (half percent) of the excess of the estimated cost of work Beyond Rs.1 Crore subject to a maximum of Rs.1 Crore

The earnest money shall be rounded to the nearest Rs.10.

SECURITY DEPOSIT: It is the amount to be deposited by the successful tenderer as a token of the guarantee for the due and faithful fulfillment of a contract. The scale of Security Deposit is as given below:

a)	The security deposit for each work will be **5% of the contract value**
b)	The rate of recovery will be **at the rate of 10% of the bill amount** till the full security deposit is recovered

PERFORMANCE GUARANTEE :

The performance guarantee is the amount which shall be submitted by the successful tenderer for the satisfactorily completion of work. The successful tenderer shall submit the performance guarantee (PG) amounting to 5% of the contract value.

(a) The successful bidder shall have to submit a Performance Guarantee (PG) within 30 (Thirty)days from the date of issue of letter of Acceptance (LOA). Extension of time for submission of PG beyond 30 (Thirty)days and upto 60 days from the date of issue of LOA may be given by the Authority who is competent to sign the contract agreement. However, a penal interest of 15% per annum shall be charged for the delay beyond (Thirty) days, i.e.from 31st day after the date of issue of LOA. In case the contractor fails to submit the requisite PG even after 60 days from the date of issue of LOA, the contract shall be terminated duly forfeiting EMD and other dues, if any payavble against that contract. The failed contractor shall be debarred from the participating in re-tender for that work.

The following are the forms in which the earnest money can be deposited.

i) A deposit of cas with the Chief Cashier,Northern Railway,Delhi an any working day before 14.00 hrs.

ii) Banker's cheque/Demand drafts executed by State Bank of India or any of the Nationalized banks or by a scheduled bank.

The security deposit will be recovered only from the running bills of the contract and no other mode of collecting security deposit such as security deposit in the form of instruments like BG,FD etc.shall be accepted towards security deposit.

The successful bidder shall submit the Performance Guarantee(PG) in any of the following forms:

(i) A deposit of cash.

(ii) Irrevocable Bank Gurantee.

(iii) Government Securities including State Loan Bonds at 5% below the market value;

(iv) Deposit Receipts, Pay Orders, demand Drafts and Guarantee Bonds. These forms of Performance Guarantee could be either of the State Bank of India or of any of the Nationalized Banks;

v) Guarantee Bonds executed of Deposits Receipts tendered by all Scheduled Banks;

(vi) A deposit in the post office saving bank.

(vii) A Deposit in the National Savings Certificate;

(viii)Twelve years National Defence Certificate;

(ix) Ten years Defence Deposits;

(x) National Defence Bonds and

(xi) Unit Trust Certificates at 5% below market value of at the face value whichever is less.

Q.7. Describe various types of Estimates and discuss them in short.

Ans. Various types of estimates are as follows:-

i) Abstract Estimate
ii) Detailed Estimate
iii) Supplementary Estimate
iv) Revised estimate
v) Project Abstract Estimate
vi) Construction Estimate
vii) Completion Estimate

i) Abstract Estimate :- An abstract estimate is prepared in order to enable the authority competent to give administrative approval to the expenditure of the nature and the magnitude contemplated to form a reasonably accurate idea of the probable expenditure and such other data sufficient to enable that authority to gauge adequately the financial prospects of the proposal. Abstract estimates avoid the expense and delay of preparing estimates for works in detail at stage when the necessity or the general desirability of the works proposed has not been decided upon by competent authority. An abstract estimate should contain a brief report and justification for the work, specifications, and should mention whether funds are required in the current year and to what extent. It should also show the cost subdivided under main heads and sub-heads or specific items, the purpose being to present a correct idea of the work and to indicate the nature of the expenditure involved. The allocation of each item as between capital Development Fund, Open Line works- Revenue, depreciation reserve fund and Revenue should be indicated.
ii) Detailed Estimate :- On receipt of administrative approval to a project or scheme other than that for which construction estimate in Form E-533 is prepared and, conveyed through the sanction to the abstract estimate relating there to detailed estimate for various authority. It should be prepared in sufficient detail to enable the competent authority to exceeded. No work included in an abstract estimate should be commenced till a detailed estimate for same prepared and sanctioned and adequate funds are allotted by the competent authority. The detailed estimate of an open line work will comprise (i) statements showing details of estimated cost and (ii) an outer sheet giving the abstract of cost of work, the report, the financial justification and the allocation.
iii) Supplementary Estimate :- Supplementary estimate should be prepared for any item of work, which ought to have been included in the first instance in an estimate already

sanctioned but has not been so included or which is found later, should be considered as being a part or a phase of an estimate already prepared and sanctioned, it cannot be met out of contingencies. Such a supplementary estimate should be prepared I he same from and the same degree of detail as the main estimate and for all purposes be treated as a part of the main estimate.

iv) Revised Estimate :- As soon as it becomes apparent that the expenditure on a work or project is likely to exceed the amount provided in the detailed estimate or construction estimate a revised estimate should be prepared and submitted for the sanction of the competent authority. It should, unless otherwise ordered by the sanctioning authority, be prepared in the same from and the same degree of detail as the original estimate, it should be accompanied by a comparative statement showing the excess of saving under each sub-head of account against he latest sanction. In cases where a supplementary estimate or a previous revise estimate has been modified by such further sanctions.

v) Project Abstract Estimate :- The abstract estimate of a construction project should be submitted for the approval of the railway Board on Form E.554" abstract cost of Railway" accompanied by (i) An abstract estimate of junction arrangements (ii) Narrative report explaining the salient features and major items of expenditure (iii) detailed estimates on form E. 553 prescribed for a construction estimate.

vi) Construction Estimate :- When it is decided to undertake the execution of a new line gauge conversion, or doubling of lines a final location survey should be made and based on the information collected in the survey detailed estimates of all the works included in the project as a whole should be prepared. These detailed estimates are collectively called he " Construction estimate" of the project. It should be prepared after a careful examination of the various details of construction involved in the project. It should be in such detail as to render it possible to dispense, with working estimates or any other further estimating after the construction Estimate has been sanctioned (except when supplementary or revised estimates and necessary. It should provide for the buildings and equipment of the railway up to a standard that will be sufficient for working such traffic as may be expected during the first year or two after opening of the line. It is the basis on which technical sanction to the various works included in the construction of a project is accorded works both as regards estimate and expenditure. In forwarding, therefore, estimates for sanction the work in connection with new lines opened, it should be clearly indicated whether the cost of the work is chargeable to capital construction of Open line Capital.

vii) Completion Estimate :- A completion estimate should show following particulars in respect to all the works included in the construction estimate.

Amount of the sanctioned estimate,

1. Actual expenditure on all works up to the date of construction estimate,
2. Commitment on that date,

Q.8. Describe the procedure for construction of houses for public sector undertaking under Ministry of Railway.

Ans. Following conditions for const. of houses for public sector undertaking under ministry of Railways to be considered.

There is general shortage of houses for officers and it has been decided that Railway PSUs may be allowed to construct houses on Railway land to overcome the shortage of houses on terms and conditions as mentioned below:-

i) Of the total number of flats constructed by Railway PSU, 50% will be for use by the Railway Administration and the remaining 50% will be licensed to the Railway PSU at normal license fee of Rs. 1000/- per annum per house, which may be paid annually.

ii) The Railway PSU concerned will bear full cost of construction on Railway land. The developments of surroundings and provision of services like road, water/electric connections, telecom and drainage and lifts etc. would also be provided by the PSU constructing the quarters.

iii) Ownership of the land and structure thereon will continue to be with the railways ad Railway will only license out 50% houses to the PSU. PSU at no stage will sell/Sublet for transfer these flats or any of the services to any other individual/authority.

iv) Maintenance of the flats licensed to the PSU will be done by the concerned PSU. It should be ensured that proper maintenance to be done by PSUs so that at the time of handing over these houses to the Railways, they are in safe condition as at the time of aging over except the natural aging. All the taxes payable on these flats to the concerned civil authority will also be paid by PSU. The electric and water charges should be recovered as per rules from the officers of PSUs and remitted to Railways.

v) No structural change whatsoever will be made by the PSUs in the flats.

vi) These flats will be licensed for a period of 30 years from the date of handing over of the flats to the PSU or till such time it exists or remains attached to the Ministry of Railways, whichever date falls earlier. After this period, the flats allotted to the PSU will be taken over by the Railways without any compensation/payment whatsoever to the PSU.

vii) Railway will have unrestricted and unconditional authority to enter the premises by its authorized representative for inspection or for safety of for any other purpose as and when required.

viii) These houses will be allotted only to railway officers on dep8tatiojn ot the concerned PSUs or who have come on absorption. The allotment and retention of these houses will be governed by the Railway rules and consultants/Advisers to PSUs will not be eligible.

Q.9. What are the various planning aspects for planning New Railway colonies in Metro cities.

Ans. For Planning of railway staff colonies, following factors should be considered :

i) Orientation of buildings :- The chief aim of orientation of buildings is to provide physically and psychologically comfortable living inside the building by creating conditions which suitably and successfully ward off undesirable effects of severe weather to the best possible extent.

ii) Prevailing Winds and Relative humidity

In the coastal areas, because of less diurnal variation of temperatures along with high humidity, the emphasis should be on prevailing winds.

In other areas, the emphasis should be on protection from solar radiation.

The best orientation from solar point of view requires that the building as a whole should receive the maximum solar radiation in winter and the minimum in summer.

iii) Water supply, drainage and sewerage system :- Adequate water supply and sullage and storm water drains should be provided. The water supply system should be designed on the basis of at least 200 litres/person/day(which includes 45 litres for flushing requirement) due allowance being made for gardens. Where common hydrants are provided, these may be equipped with suitable anti-waste water taps. For multi-stories buildings, necessary static tanks may be provided for firefighting arrangements in accordance with the regulations laid down.

Where water borne sewerage/exists in the vicinity, open drains and soak-pits should be dispensed with and an adequate underground system provided. For colonies provided with adequate piped water supply with overhead storage facilities and where on sewerage system exists in the vicinity, an underground sewerage system with one or two septic tanks according to the layout of the ground should be provided.

Guidelines for the selection of an appropriate sanitation system are given.

Groups of latrines or urinals should not be located within 15 meters of living quarters, 30 meters of any cook house or food stall, 45 meters of any well supplying drinking water and should be located away from public buildings adjoining railway colonies.

iv) DUST BINS: These should be conveniently located with respect to the quarters and regularly cleared by the conservancy staff. In the case of multi stories buildings garbage chutes may be provided with opening in each floor with arrangements for closing the openings.

v) SHADY TREES: Shady trees like Gulmohur, Neem should be provided along service roads at close intervals. Such trees should be provided along the periphery of parking areas in railway stations. Some ornamental trees like Alstonia, Kachnar, Bottlebrush, Cassia, Silver Oak, Mulsari, Plumeria, Ashoka and shrubs like Chandani, Gardinia, Chinese Orange and Jatruca may also abe planted. For beautification of circulating areas of stations, service of the Gardens may be maintained in circulating areas through voluntary agencies or business houses on terms and conditions to safeguard the interest and rights of the railways.

vi) PLAY GROUNDS FOR CHILDREN: An open space at an appropriate place in the colony may be left for entertainment and sports of the employees and their wards.

Q.10(a). What is the main cause of damaging the sunshades in old building? What precautions to be taken for providing RCC sunshades in new building construction?

(b) What is main cause of roof leakage and what are the remedial measures in old flat roofs.

(c) What precautions to be taken when construction of new buildings, that the roof leakage problem may not arise?

(c) Explain water cement ratio, How the water cement ratio effects the strength of concrete.

(d) Explain, design mix concrete and nominal concrete etc.

(a) What are the main causes of damaging of sunshades in old buildings. What precautions to be taken for providing RCC sunshades in new building construction.

Ans.

Mostly it is seen that the sunshades of old building starts damaged after few years of construction. The followings are the main cause.

I. The top surface of sunshade having not proper slope due to which the rain water stagnating on the top surface.
II. Lack of compaction of sunshade during casting.
III. Binding of reinforcement in wrong position or-mis-placing of reinforcement during casting.

The precautions to be taken while casting a sunshade in new building.

I. The shuttering of sunshade to be done more causiorsly and totally leak proof. The compaction of sunshade to be done with shutter vibration, because due to less thickness of concrete, the needle vibrator is not fruitful to compact the concrete.
II. The reinforcement (main) to be placed on top surface and ensured during casting that it will not misplaced.
III. The top surface to finished sloppy as the water cannot stagnate on surface.

(b)Main cause of roof leakage.

I. Poor slope of top surface of roof.
II. Damaging and erosion of top surface treatment.
III. Badly provided khuras.
IV. Badly provided CC bata.
V. Leakage from sewer and drainage pipe and traps laid in roof.

Precautions to be taken while construction of new building.

I. The shuttering of roof to be done having camber as per specification, so that during casting of slab the depression in roof may not arise. A slight depression in top surface of roof is very harmful although.
II. The casting of khura to be done cautiously with zero tolerance and the rain water to be fixed properly.
III. The CC bata to be done prior to parapet plaster and as per specification.
IV. Minimum 1:4 slpe to be provided in top surface of roof treatment.
V. The over head tanks (if required to be placed on roof) to be placed on proper plate form and nearly to khura.

(c)Water cement ration:- The ratio of the weight of water, to weight of cement used in a concrete mix is termed as water cement ration. As a results of experiments, it is observed that for a given proportion of ingredients in a concrete mix, there is almost a fixed amount of water (optimum) which gives maximum strength. A small variation in qty of water causes much wider variation in the strength of concrete.

When the water comes.

With contract of cement particle, and react with cement particle some roofs are generated from the cement particle. These roofs are binding the particle of ingredient of concrete. If we mix less water from optimum Qty. of water, the all roots can not generate and the concrete will not gain proper strength, but if we add more water than optimum requirement, the roots become diluted and the grip of these roof become less, resulting to this the lesser strength concrete obtained.

(d)Nominal mix concrete

Nominal mix concrete is used in works where the quality control requirements for designed mixes are difficult to be implemented. The nominal mix concrete can be produced by taking cement, fine aggregate and coarse aggregate in the ration of 1:n:2n for normal work. However, the ration of coarse aggregate to fine aggregate can vary from 1 ½: 1 to 2 1/2 :1 in situations where denser or more workable concrete is to be produced.

Mix design concrete:- the aim of mix design is to determine the proportion in which, cement, fine sand, coarse aggregate and water should be mixed to produce concrete of required strength,

workability and durability with minimum cost. When the task of deciding the proportion of the constituents of concrete is accomplished by use of certain established relationship (which are based on inferences drawn from large number of experiments) the concrete these produced is termed as design mix concrete.

Q.11(a) What are the pre fab buildings? Describe in details, what is advantage and disadvantage of these buildings?

(b) What are new building materials generally available in markets and what are the advantages over conventional building materials?

(a)

Prefabricated homes, often referred to as **prefab homes** or simply **prefabs**, are specialist dwelling types of prefabricated building, which are manufactured off-site in advance, usually in standard sections that can be easily shipped and assembled. Some current prefab home designs include architectural details inspired by postmodernism or futurist architecture

Advantages

The advantages of using prefabrication in housing are that:

- prefabricated components speed up construction time, resulting in lower labour costs;
- prefabrication allows for year-round construction;
- work is not affected by weather delays (related to excessive cold, heat, rain, snow, etc.);
- the mechanization used in prefabricated construction ensures precise conformity to building code standards and greater quality assurance;
- there are less wasted materials than in site-built construction;
- there is less theft of material/equipment (and less property damage due to vandalism);
- materials are protected from exposure to the elements during construction;
- worker safety and comfort level are higher than in site-built construction;
- computerization of the production process permits a high degree of customization, at an affordable cost;
- quality control and factory sealing and design can ensure high energy

efficiency; and

- cost savings through prefabrication can reduce the income required to qualify for a high ratio mortgage by up to one third compared to a conventionally built home of the same size.

DISADVANTAGES

The issues related to using prefabrication in housing are that:

- many municipalities zone against manufactured housing because of earlier perceptions created by trailer parks;
- concerns have been raised by local and regional governments with regard to whether the taxation paid by manufactured homes is sufficient to offset public costs such as schools;
- the requirement to transport manufactured homes or modules to their intended site can mean that prefabrication potential may be limited for infill projects in inner city areas; and
- Increased production volume is required to ensure affordability through prefabrication.

(b)

New Bldg. material: - The various new bldg material generally available in the market as

1. Sand lime/calcium silicate bricks.
2. Fly ash lime bricks.
3. Clay fly brick fly
4. Burnt clay flooring tiles.
5. Burnt clay flat terracing tiles.
6. fibrous gypsum plaster board.
7. Precast channel unit for floors/roof
8. Pre cast RC plancks & joints
9. Thin RC ribbed slab for floors & roofs.
10. Pre cast waffle unit for floor/roof.
11. Pre cast reinforced concrete panels for roofs.
12. Pre cast doubly curved shell unit for floor/roof.
13. Prefabricated brick panels for floor/roof
14. Pre cast solid cement concrete block
15. Precast concrete stone masonry block
16. Hallow & solid light for concrete block
17. RCC door & window frame
18. Ferro cement doors shutters
19. Ferro cement write tender 250-1000

20. Concrete man hole cover & frame
21. Flyash/ red mud polymer door shutter
22. Rubber wood flush door shutter.
23. Finger jointing & shaping technology
24. Micro concrete roofing tiles.
25. Ferro cement roofing channels
26. Glass fibre reinforce polymer door & door frame
27. Bamboo mat corrugated roofing sheet
28. Bamboo mat ridge cap
29. Two storey bamboo housing system
30. Pre-fab double wall composite house.

Advantages of new material over conventional material

1. New bldg. material are cost effective, environment- friendly & energy efficient.
2. These new material technology are based on agro-indistrial waste such flymesh boord bricks/block, cellnar light weight concrete, bamboo board material, bag are bond.
3. Conventional bldg. technology burnt bricks, steel, & cement utilize size large amount of non-renewable like energy, miniral top soil, forest cover etc. these are dependence on external natural and manpower, harm the locol energy & are generally polluting in nature.
4. New bldg. material are not danger to bio-reserve & are Non- polluting
5. There are self sustaining & promote self reliance
6. Uses locally available material.
7. Law in monetary cost
8. Utilize reasonable energy

Q.12(a). What is chlorination and what is the function of chlorination. Why the super chlorination is required in a water supply network?

(b) Give a reasonable estimate of daily consumption of 700 four storied colony having all desirable amenities and design the water supply network accordingly.

(a)

What is chlorination and what is the function of chlorination.

Chlorination:- Disinfection of water is necessary to kill pathogenic bacteria of water-born diseases to make it safe for human. Consumption where the contamination of water is suspected, water has to be sterilized to remove the bacterias which may dangerous. There is every chance of water being contaminated during distribution, especially, and generally adopted in an intermittent system of water supply where the pipe remains empty for long period, sterilization

of water cab be done in a number of ways. One of most commonly used system is to add chlorine in the water supplied. This type of sterilization of water is called chlorination of water.

Chlorine is available in solid, liquid and gaseous form in solid form it is available in bleaching powder and chlorine tablets.

When the chlorine is added to water, the following recttions take place

Cl2 + h2o = Hcl + Hoel

Hocl ____ H+ocl.

In this chemical reaction nascent fly drogen is formed which get evaporated. Also HOcl (Hypochlorous acid) and ocl (Hypochlorite ions) are formed which are responsible for disinfection. They destroy all the bacteria and help in oxidizing matter and ammonia cal substance present in the water.

When there is epidemic in the area and the residual chlorine drops suddenly. A high dose chlorination is done(0.50 to 2.0 ppm) depending upon the impurities this term is called super chlorination.

(b)

Sol

Step-I (per day requirement)
Assuming 5 persons in each qtrs.

i. In qtrs. 700x 5x 200 = 700000 Lit/day
ii. For loan 2x22500 hec/day = 45000 Lit/day
iii. For office staff of service dept. 50x45lped = 2250 Lit/day
iv. For road water 2800x5km= 14000 Lit/day

Total = 761250 Lit/day

Add 15% Extra for fire demand = 114188 Lit/day

Net Total = 875438 Lit/day

Max water demand

Taken 1.5 times the normal daily demand

= 1.5x875438

= 1313157 Lit/day

Max Discharge

= Q= 1313157/24x3600x1000

= .015 m^3/sec.

Step-II

Economical dia of rising main as per lea's formula

D = $(1.22)^{1/2}$

= $(1.22)^{½}$

= .15 meter say 150mm

Step III

Assuming suction head = 8m

Delivery head= 25 mts, suppose the length of rising main = 2.00 km

Total = 33mt

Velocity =V= Q/A= .015x4/3.14x.15^2

= 0.849 m/sec

Now frictional head loss in rising main

Hf = 4 $flv^2/2gd$

= 4x0.0075x2000x$(0.849)^2$ / 2x9.81x0.15

= 14.96 mts.

Total Head = 33+14.69

= 47.69mts.

Say 48 mts.

Water horse power = RHQ/75 = 1000HQ/75

= 1000X48X.015/75

= 9.6

Say = 10 HP

Assuming effacing 80%

BHP= 10/0.80=12.5Hp

Q. 13.(a) What precautions should be taken while casting of sunshades in a building to obtain dense concrete of desired strength?

Ans 13(a): General sunshades are a structurally weak link in a building and very first collapse during earth quakes.

1. Adequate cover to reinforcement should be ensured.
2. Shuttering should be of sufficient strength to with stand vibration compaction.
3. Compaction of concrete should invariably be done by vibrator.
4. Adequate water cement ratio and proper mixing of concrete should be ensured.
5. Top slope should drain out rain water immediately without ant stagnation.

(b) What precautions should be taken to avoid foul smells and seepage in toilet blocks of buildings?.

Ans 13(b): Toilets blocks of building are observed to have seepage of water, peeling of plaster and paint and foul smells.

1. All joints in plumbing work should made water tight.
2. Proper trap should be used with WC to provide sufficient water seal. This will keep away foul smells.
3. Adequate ventilation and sunlight should be planned by providing required ventilators and exhaust fans.
4. Good quality toilets fittings which do not spill water help keep the toilet clean, dry and free from bad smell.
5. Floors should have correct slope and floor traps and drain pipes should be kept clean to carry discharge of Urinal pots and wash basins.

Q.No.14 Explain the method of construction of a subway by box pushing technique.

Ans- Box Pushing Technique, is the technique of construction of subway/under bridge, by which precast box segments of bridge are pushed under the track without disturbing the existing Railway / Road embankment by deploying adequate nos. of jacks. During execution of work by this method railway traffic is allowed to pass at restricted speed. In this method a thrust bed of suitable length is cast and thereafter R.C.C. Boxes segments are cast on thrust bed. These boxes are pushed through the Railway embankments by Jacking. The required thrust is generated through thrust bed. This method may be called safest method of crossing underground / Embankment, without disturbing overhead traffic /Structures for R.U.B.

Steps involved in construction of Subway by box pushing technique.

1. Soil investigation.
2. Design of thrust bed and RCC box.
3. Excavation work and construction of thrust bed.

4. Provision of drag sheet to reduce frictional forces acting on box during pushing and thereby minimizes jacking effort and track disturbances.

5. Construction of precast boxes of suitable length on thrust bed.
6. Provision of cutting edge on front box and intermediate guiding shield on other intermediate boxes.
7. Preparation for pushing i.e. Isolation of affected length of track from LWR and imposition of speed restriction, arrangement of all necessary tools plants ,materials and labours for pushing work. CRS sanction should also be obtained before starting the pushing work.
8. Starting of pushing work and maintenance of track during pushing. Record of pushing shall be maintained in pushing register.
9. Welding of track after completion of pushing and gradual raising of Speed as per IRPWM.

Approaches of bridge to be watched during monsoon and track should be frequently attended on both side approaches due to settlement of earth.

Box Pushing Operation

• To push precast box segment, reaction is obtained from thrust bed. For this, screed is dismantled at pin pocket location, pin pockets are cleaned, pins are inserted and hydraulic Jacks-8/10 nos. are installed between pins and bottom slab of the box with packing plates and spacers.

• A 20mm thick plate is provided, butting against bottom slab of box, in front of the Jacks to avoid damage to concrete surface and uniform pressure is applied to the jacksthrough Power Pack.
• After complete push (maximum 300mm) jacks are released, and jacks again packed with packing plates and spacers. Process is repeated till front box is pushed to required position.

• Then 2nd box segment is slewed and brought in position behind 1st box segment.

• Suitable nos. Jacks, each of 200 Tons capacity, are housed between two box segments in addition to Jacks already provided between thrust bed and 2nd box segment.

• 3 nos. Jacks, each of 100 Tons capacity, are provided in 3 slots made in each side walls to facilitate correction of line and level of box during pushing.

• Earthwork is now done in front of 1st box segment and it is pushed.

• Thereafter, jacks housed between two box segments are released and then 2nd box Segment is pushed.

• Process is repeated till both the box segments are pushed to required position.

• Cutting Edge is dismantled & front face of 1st box segment is cast in plumb.

Precautions

1. Pushing shall be done only in presence of competent Railway P Way and works Engineer, who shall be in touch by walky talky/mobile phone.
2. At least 3 nos. Walkie -Talkie sets to be provided at site for effective communication between Power Pack Operator, SE/Works and SE/P.way.
3. Adequate work force inside the box for earth cutting and on the track for maintenance should be available before starting the pushing.
4. Proper protection of track should be done before starting the pushing.
5. No pushing should be done during passing of train. Pushing should be done in day hours.
6. Train shall be allowed to pass only after correcting the disturbed track by P way staff.
7. Earth cutting should not be done beyond the tip of top cutting edge (i.e. tip of cutting edge must always remain buried in earth) to avoid collapsing of earth.
8. Soil nailing should be done in case of sandy and cohesion less soil in the embankment.
9. Safety equipment such as safety belts, helmets, reflective jackets should be provided to the workers
10. After closing of the day's work earth cut embankment should be supported by providing earth filled bags to prevent any chance of collapsing of earth due to movement of trains.
11. All consumables such as hydraulic oil and spare parts of jack pipes fittings should be kept available at site.
12. Adequate nos. of jacks, based on weight of box and loading capacity of jack should be utilized for pushing work.
13. Constant watch should be kept on the pressure gauge of power pack during pushing and it should be ensured that pushing should be stopped when pressure gauge shows the reading near 80% of the max pressure, to avoid busting of pipe and fittings.
14. Additional jacks should be provided in wall and roof to correct the horizontal and vertical misalignment of the box.
15. Level and alignment of the box should be checked frequently with the help of dumpy/auto level and theodolite.

Q.No.15 what precaution is to be taken during construction of LHS by cut and cover method?

LHS may be constructed at level crossings having following conditions:-

I) Accident prone LC's where visibility is not clear

II) Where embankment height is 3 meter or more.

III) Where ground water level is not high.

Steps involved in execution: -

1. Soil investigation of the proposed LHS site.

2. Casting of box as per approved RDSO drawing.
3. Casting of slabs as per approved drawing.
4. Obtaining CRS sanction if manned level crossing is involved.
5. Imposing speed restriction of 20 KMPH one day prior to traffic block.
6. Placing the box segments under track in mega traffic block.
7. Normalization of speed restriction.

Approaches of LHS should be kept under observation during monsoon and frequent attention would be required due to settlement of earth in approaches.

Tools and equipment required at site:-

I)	150 MT capacity crane	-	02 Nos. +01 No standby
II)	Poklain	-	02 Nos. +01 No. standby
III)	JCB	-	02 Nos.
IV)	Tippers	-	02 Nos.
V)	Water Tanker	-	01 Nos.
VI)	Gas Cutting and welding set	-	01 Nos.

Sufficient manpower is also required for track and Works by the agency to execute the work.

Pre block activities

I) **Demarcation at site: -** Demarcation at site of proposed LHS is done and points for cutting of track are marked with paint taking side slope into account.

II) **Imposition of speed restriction and cutting of track rails**: - Rail cut is made in track after imposition of speed restriction and 1 mtr fish plate is provided on all four joints.

III) **Placing the precast box segments and slabs as near as possible** to the proposed alignment with the help of 150 MT capacity crane.

IV) **Adequate qty of ballast may be procured to make good the deficiency after block.**

During block activities

I) **Track dismantling and removal of ballast: - As soon as the block is permitted the fish bolts of all the joints are opened and track is lifted with**

the help of crane and placed at suitable place. Ballast is removed and placed within at suitable place so that it may be used at the time of restoration work.

II) **Earth cutting: -** Earth cutting will be done with the help of poklain from both ends and JCB. A suitable side slope is maintained to suit the local condition of earth. After completion of earth cutting up to desired level , Earth surface is leveled and rammed to obtain uniform level.

III) **Sand filling: -** Approx 150 mm thick layer of sand is provided over a leveled and compacted earth surface.

IV) **Placing of slab: -** Precast slabs are lifted with the help of crane and placed over leveled bed of sand at proper alignment of LHS. The joints of slabs are filled with cement sand mortors .

V) **Box Placing:- T**he precast RCC boxes are placed over precast slab with the help of crane in proper alignment.

VI) **Geo membrane and Geo textile**: - Geo membrane is pasted at the joints of boxes to check the seepage of water through joints of boxes and Geo Textile is provided at the surface exposed to earth and ballast to cover the top and side of boxes in order to filter the water during rain and prevent the embankment earth from flowing with seepage water.

VII) **Back filling: -** Back filleting is done with machine to fill the space between side of box and embankment across the track and get compacted simultaneously.

VIII) **Ballast Putting**: - Ballast putting is done with the help of men and machine available at site as per track profile.

IX) **Track linking**:-Track linking is done over spreaded ballast bed and then track is linked with the existing track. Track is attended and all parameters are checked before allowing the traffic at restricted speed.

Break up tentative time taken in all during block activities is as under :-

I)	Track dismantling & ballast removal	-	25 minutes
II)	Earth work in cutting	-	60 minutes
III)	Sand filling in Bed	-	15 minutes
IV)	Slab Placing	-	30 minutes
V)	Box placing	-	90 minutes
VI)	Geo Textile and Geo membrane	-	20 minutes
VII)	Back filling	-	20 minutes

VIII) Ballast putting - 20 minutes

IX) Track linking and packing - 50 minutes

Total block required = 5 hrs and 30 minutes

Precautions:-

1. Earth cutting to be done properly with proper slope and care should taken that side slope may not collapsed during block.
2. All engineers and workers should wear safety helmets before allowing them to work.
3. Sand bags should be provided on all four corners of the bank to retain and support the filled earth.
4. The entire Sling should be checked before starting the block and defective ones should be replaced.
5. After linking track should packed and XL and gauge should check before allowing first trains.
6. Standby crane should be placed at such location that it may be used in case of emergency without wasting much time.

Q.16. Design a column, square in section, to carry on axial load of 5000000N.
Define bearing capacity of soil, explain different bearing capacity of soil,
Explain plate load test of soil.

Solution:-

a) Let us adopt M25 grade concrete and mild steel reinforcements
Allowable direct compressive stress = 6 N/mm^2 in concrete
Allowable compressive stress in steel = 130 N/mm^2
Minimum percentage of longitudinal reinforcement = 0.8%

b) Let 'a' be size of square column
Then area of column = a^2
Area of steel = 0.008 a^2
Area of concrete = a^2-0.008a2 = a^2(1-0.008) = 0.992 a^2
Now P = qc Ac + qs As (qc compressive stress in concrete ,qs compressive stress in steel)
500000 = 6x0.992 a^2 + 130 x 0.008a^2 = 5.952 a^2 + 1.04 a^2 = 6.992 a^2
Size of square column (a) = 845.63 mm

c) Provide square column 810 mm x 810 mm with 30 mm of chamfering at the corner.
Area of column = 845 x 845 x -2 x 30 x 30 = 712225 sqmm
Area of steel = 0.008 x 712225 = 5697.8 sqmm

Let us adopt 28mm dia bars

Area = $\frac{\pi d^2}{4}$ = 615.75 mm^2

No of bars = $\frac{5697.8}{615.75}$ = 9.24

Provide 9 bars of 28 mm dia

Tie reinforcement

Using 8 mm tie reinforcement, spacing will be

a) 16 times the dia of main reinforcements = 16 x 28 = 448 mm

Or

b) 48 times dia of transverse (tie) reinforcement = 48 x8 = 384 mm

Or

c) Last size of column = 845 mm

Provide 8 mm tie reinforcement at 380 mm centre to centre i.e. the least spacing among the three criterias.

BEARING CAPACITY OF SOIL

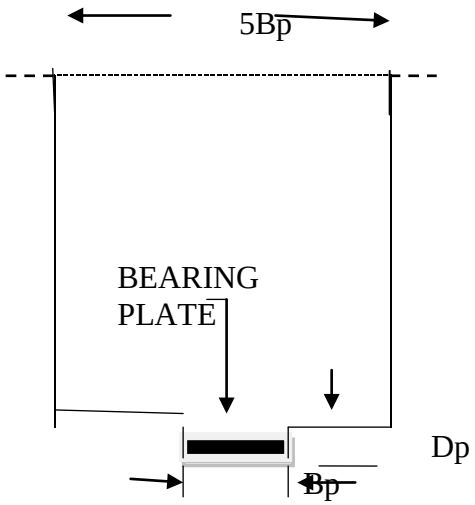
1) Bearing capacity: The bearing capacity may be define s the ability of the soil to support the load of the structural foundations without failure or deformation.
2) Ultimate bearing capacity: the maximum load intensity transmitted by the base of the footing of a structure to the soil causing the soil mass to fail in shear, is defined as ultimate bearing capacity.
3) Safe bearing capacity: the maximum load intensity the soil can take without any risk of shear failure is called safe bearing capacity of soil. It is generally calculated by dividing the ultimate capacity by a factor of a safety.

Determination of ultimate bearing capacity of soil in the field

To determine the ultimate bearing capacity of soil in the field ‘Plate loading test’ is normally carried out. (IS: 1888-1962)

Plate loading test: This is a simple test to determine the ultimate bearing capacity of soil in the field.

1) The test essentially consist of rigid plate placed at the foundation on level. The ultimate bearing capacity is determine by loading the plate till it starts sinking at a rapid rate.
2) The bearing plate is of square section of least 30 cm side and maximum 75 cm. the plate should have sufficient thickness to withstand the anticipated maximum load and in no case it should be less than 25 mm



3) The test pit width is kept five times the width of the plate. At the centre of the pit, a square hole of the size of the plate is made whose bottom is kept at the actual level of the fitting. The depth of the hole should be determine by the formula, $\frac{Dp}{Bp} = \frac{D}{B}$

Apply a static load at the centre of the plate through a calibrated jack and the reaction is taken by a load truss.

Procedure: the following step are involved.

1. Place the plate in the hole, a seating load of 70 g/cm^2 is to be applied before actual test is started.
2. Apply the load in convenient increment, one-fifth of the expected safe bearing capacity or one-tenth of the ultimate bearing capacity.
3. Observe the settlement with the help of two dial gauges fixed diametrically opposite each other, having the sensitivity of 0.02 mm.
4. Observe the settlement of each increment of load after an interval of 1,4,20,40 and 60 minutes and thereafter at hourly intervals until the rate of settlement becomes less than 0.02 mm per hour.
5. Now, apply the nest load increment till the maximum load that is applied corresponds to 1/1/2 times the estimated ultimate load or three times the proposed allowable bearing pressure.

Q. No. 17. As a AEN submit proposal for works programme 2016-2017 for construction of 100 type- II, 30 type-III and 10 type-IV quarters with justification, Abstract cost on forma chargeable Plan and covering letter addressed to Sr. DEN. (25)

Ans. The Preliminary Works Programme for the following year should be submitted by the Railways to the Railway Board by 1st week of September or such earlier date as may be laid

down by the Board. Proper financial appraisal of each work should be given in the Preliminary Works Programme together with the comments of the financial adviser and Chief Accounts Officer.

WORKS PROGRAMME2016-17

Demand No..... **Figures in thousands of rupees)**

Item No.	**Authority**	**Particulars of Works**	**Cost**	**Expenditure to end of 3/74**	**Outlay for**		**Balance**
					2016-17	**2017-18**	
1	2	3	4	5	6	7	8

The works should be arranged as per the Plan Heads.

The items in the Works Programme should be grouped under the following categories while compiling the Works Programmes :--

- (i) New Works.
- (ii) Works in Progress.
- (iii) Works approved in earlier years, which have not been actually commenced and on which no expenditure has been incurred till 30th June of the year previous to the Programme year.
- (iv) Works approved in the earlier years but estimates for which have not been sanctioned
  The items in the Works Programme should be grouped under the following categories.

Abstract estimate for construction of new staff qtr. In the section of ADEN/NR

Chargeable to Hand 53

S. No.	Brief Description or items	Qty.	Rate/Per	Amount
1.	Construction of 100 Type –II qtr., 30 Type-III qtr. And 10 nos. Type-IV qtr. In the section. 100 Nos. Type-II=45x100=4500 Sqm 30 Nos. Type-III=30x55.75=1672.50 Sqm 10 Nos. Type-IV=10x83.60=836 7008.50 Add for 1% contingencies charges Add for electric charges	7008.50 Sqm	10500/- Sqm 1% 2500000/-	7358925.00 735892.50 2500000.00

Total Rs. 76825142.50
Say Rs. 7.70 Crore

Justification:- The fourth line work is in progress between JNC-PWL on TKD-PWL section and expected to complete within two years. In connection with this many staff to be deputed in the section. For this about 140 nos. staff qtr. Are to be required. Hence an estimate of Rs. 7.70 Crore have been framed for inclusion in WP 2016-17 at an earliest please.

Forwarding Letter

Sr. DEN-C

Subject: - Proposal for works programme 2016-17

A abstract estimate with justifications are herewith enclosed for sanction & further disposal please.

DA/As above

ADEN/NR

Qus. 18. What is the disinfection of water? What are the precautions to be taken in collection and transportation of water sample? When in a water sample considered to be chemically and bacteriologically satisfactory?

Ans:- The disinfection of water has to be done to remove organisms that causes disease, before entering in to distribution system chlorination is used for disinfection of water.

The water should be collected in sterilized gals stopper bottle. There should be no external contact of mouth of the bottle the bottle should be filled to about 25mm below its neck , when sample of water is taken from a tab, the mouth of the tab should be heated by a sprit lamp for 3 minute. Then water should flow for about five minute before sampling bottle is filled. The bottle should be properly labelled and backed and should be sent for testing without delay. A sample is considered chemically satisfactory when the PH value should be between 6.5 to 6.8, Hardness between 300 to 600 mg/l calcium between 75 to 200 mg/l, Magnesium between 30 to 100 mg/l, Dissolved solid between 500 to 2000 mg/l, Chloride between 250 to 1000 mg/l, Sulphate between 200 to 400 mg/l. And bacteriologically satisfactory when coliform is Nil. Water should be colour less and odour less.

Qus.19. What is the specification of blanketing material and how arrest the failure of railway embankment.

Ans:- The blanketing material should cover the entire width of formation from shoulder to shoulder except that in case of sent or similar erodible material. The depth of blanket should normally be about 30 cm ordinary clay soil. However if formation soil is week, a thickness layer up to 60 cm may be necessary depending upon the shear properties of the formation soil. Blanket material should have the following properties .

a. For sand, query, grit, gravel and other non cohesive material.

i. The blanket material should be coarse & granular.

ii. If the material the material contain plastic fine, the %age of fines should not exceed 5%. If fines are non plastic there can be allowed up to maximum of 12%

iii. The material should be properly graded to its particle size distribution.

b. For Mooram.

i. The liquid limit should not exceed 35% and plasticity index should be below 10.

ii. The uniformity coefficient should be above for and preferable about 7. Coefficient of curvature should be within 1&3.

iii. When mooram is used as blanketing material, should be compacted in layers at OMC so as to obtain optimum dry density.

iv. If erodible material is used as blanket. It should be conformed in a trench and sand drains should be provided across the cess to drain the track & blanket mechanical **compaction** of earth work are recommended for adoption. These may require some modification to suit local condition.

i. Sub Grade compaction:- After site clearance all pockets and depression. Left in soil should be made good & compacted suitably.

ii. Method of compaction:- Earth work should be done in layer not exceeding 300mm to 600 mm thick. In the loose state with the static and vibratory rollers respectively. These layers should be compacted properly at or near the OMC to achieve the maximum den sity as per 15:2720(Pt-viii)-1983.

The cracks in the embankment can be avoided by adopting following methods.

1. Drainage of blanketing material should be kept adequate so as to avoid stagnation of water in the formation.
2. Grass pitching should be done on side cess of embankment so as to restrict the propagation of cracks.

Qus.20. Design of a water supply scheme for railway colony of 375 quarters. In addition there is a diesel loco shed housing 85 locos and 10 NOS subordinate offices. Workout capacity of source, pumping and storage requirement. Assume data as required.

Ans:- A 1 For staff (Domestic demand)

a. Water requirement for staff @ 200 litter per member 375x5x200=375000 lit

(b) For diesel loco - 85x1210 = 102850 lit

(c) For subordinate office = 10x10x45 =4500 lit

Total = 4,82,350 lit. Say 5.00 lac.

2. For Public purpose

(a) Assume that colony has a garden of 4 hectare

(B) Water requirement = 4x22500 = 90000 lit.

Total water requirement = 4,90,000 +90000 =5,80,000 lit.

a. Normal water requirement per day after taking lose of water in consideration (20% extra) 5.00lacx1.2=6.00lac

b. Water requirement per day in summer 25% extra 6.0 lacx 1.2= 7.5lac lit.

b. Future water requirement per day (50% extra) 7.5 lacx1.5lac=11.25 lac lit.

(B) Yield from the source :- In summer season, the source should be able to supply in 8 hrs the quantity of water normally required.

Yield of well, 60000/8=75000 lit/day

C. Pumping capacity requirement :-

The pumping system should be able to supply the water as per the following requirement

a. Normal quantity of water requirement of 24 hrs in 12 hrs time or less 6.0 lac/12=50000 lit/hrs.

b. Maximum quantity of water requirement of 24 hrs in 16 hrs time or less = 7,50000/16= 45,312 lit /hrs

C Future quantity of 24 hrs of water requirement in 20 hrs or less = 11,25000/20=56250 lit

Taking maximum of the above 3 entries which is 56,250 lit. Say 60000 lit per day

Requirement pumping capacity =60000 lit per hrs. And as such provide 1 service pump and

One stand by pump of full capacity .

D. Sunction Pipe and rising main of pump.

Assume velocity of water =2 met/sec.

Discharge =AxV

Discharge = Pumping capacity =60000 lit per hrs

= 60000/1000x60x60=M^3/sec.

AxV

=60000/1000x60x60=.01666

22/7 d^2/4X2=0.01666

D=0.103 MET=103MM=say 120mm

E. Height of water tank :- the height may be calculated as follow.

(i) Building height of 4 storey housing =3.5 x4 = 14 met.

(ii) Residual head assume =3.00 met.

(iii) Height of water tank above roof level (3 met.) = 3 met.

(iv) Pipe line below plinth level = 1.5 met app. = 1.5

(v) Loss for bend etc (10%) = 10%

TOTAL HEAD =(14+3+3+1.50)X1.1 =25 Met.

F Required discharge head and PHP of pump

a. Discharge head (H) = seasonal variation + Draw down + GL to water tank.

Assume seasonl variation as 3 met. Draw dawn 2 met. Ground level to water table as 3 met. And GL TO water tank as 25 met.

Discharge head (H) =3 +2+30+25=60 mtr.

b. To this discharge head (H), We should add the head loss due to frication(ht)

Hf=4fl v^2 /2GD

V= 2.5m/s

` F=/0.01

l= length of pipe (say 100 met)

d=dia of rising main= .12 met.

g=9.81

hf= 4x.01x100mx2.5x2.5/2x9.81x0.12=10.61 met. Say.11 met.

(C) PHP= W(H+hf)/75xn

Where n=efficiency of pump & may be taken as 75%(0.75)

W= Wt. of discharge of water in k.g. per second

In this case Quantity of water (Q)= 60,000 litres per hour

=60,000/1000x60x60 Cu M/sec

=0.01666 cum per second

W=1000 x Q kg as one cum of water weight 1000 kg

= 1000x0.01666=16.66 kg/second

PHP=W(H+hf)/75xn

=16.66(60+11)/75x0.75 = 21.03 HP

=21.03 X 0.735 K w

= 16 K w

Alternatively

Horse power of pump = Q1(H+hf)/4510xn

Where Q1= pumping capacity in litres per minute.

(h+hf)=Total head of water including frictional losses

n= efficiency of pump, which is 75%

BHP = 60000/60 X(60+11)/4510X0.75

= 21.00 HP

= 21.00X0.735 kw

= 15.42 kw

G. High level storage:- The storage capacity of the high level storage tank should be higher of the following:

a. With efficient stand-by pump ¼ of maximum water consumption in 24 hours =M/4=750000/4=187500 Lit.

b. With efficient stand-by pump, 1/3 of normal water requirement in 24 hour=N/3

= 600000/3=200000 lit.

(c) Without stand by pump , 1/3 of maximum water consumption in 24 hours

=M1/3 =750000/3=250000 lit.

(d).Without stand by pum,1/2 of normal water requirement in 24 hour=N1/2

=600000/2=300000 lit

In view of above, the high storage tank should have the capacity of

i. 2,00,000 lit with an efficient stand- by pump.

ii. 3,00,000 lit in case there is no stand – by pump

Presuming that there will be an efficient stand-by pump, the storage tank should have the capacity of 200,000 litres.

Design of distribution system:-

i. It is presumed that colony is laid in rectangular position.

ii. Assume that blocks are 20m x20m and spacing in 5 metres between them: centre of road is presumed to be 10 m.

iii. The distribution system should be designed so as to have a residual head of 3m.

iv. Rising main is of 120 mm dia and it is proposed to provide distribution mains of 12mm dia. = (D/d)5/2

=120/100x5/2

= 1.60 say 2 No.

v. Take 2 sub-mains of 100 mm dia each.

v. It is proposed to take 3 distributor pipes from= each of 100mm dia main

Diameters of sub-mains = $d=D/n^{2/5}$ =100/ $3^{2/5}$=64.44mm

Provide 65mm dia distributer pipes (6 Nos)

Summary of Water supply system

(i) Future water requirement per day = 11.25 lac litres

(II) Yield of well =75,000 litres per hours

(III) Provide one service pump and one stand by pump of capacity = 60,000 lit P/hrs

(iv)Rising main and suction pipe =120mm dia each

(V)Discharge head =(60+11=71m) =71 met.

(vi) PHP of pump = 16 kw

vii. Storage tank (with an efficient stand-by pump) =2,00,000 lit.

vii. Distribution main (120mm dia) =1x120 mm dia

Sub-main (100mmdi x 2 No) =2x100 mm dia

Distribution pipes (3 from each sub-main) = 6x65mm dia.

Q. No:- 21.

a. Explain rain water harvesting, why it is required?

b. Explain advantages of rain water harvesting.

c. Explain methods of rain water harvesting & maintenance tips for rainwater harvesting.

a. i. Rain water harvesting

For our water requirement we entirely depend upon rivers, lakes and ground water. However rain is the ultimate source that feeds all these sources. Rain water harvesting means to make optimum use of rain water at the place where it falls i.e. conserve it ad not allow to drain away and cause floods elsewhere.

The rain water harvesting may be defined as the technique of collection and storage of rain water at surface or in sub-surface aquifer before it is lost as surface run off. The augmented resources can be harvested whenever needed.

b. ii. Need for rain water harvesting

Water is one of the most essential requirements for existence of living beings. Surface water and ground water are two major sources of water. Due to over population and higher usage levels of water in urban areas, water supply agencies are unable to cope up demand from surface sources like dams, reservoirs, rivers etc. this has led to digging of individual tube wells by house owners. Even water supply agencies have resorted to ground water sources by digging tube-wells in order to augment the water supply. Replenishment of ground water is drastically reduced due to paving of open areas. Indiscriminate exploitation of ground water results in lowering of water table

rendering many bore-wells dry. To overcome this situation bore wells are drilled to greater depths. This further lowers the water table and in some areas this leads to higher concentration of hazardous chemicals such as fluorides, nitrates and arsenic. In coastal areas like Chennai, over exploitation of ground w2ater resulted in seawater intrusion thereby rendering ground water bodies saline. In rural areas also, government policies on subsidized power supply for agricultural pumps and piped water supply through bore wells are resulting into decline in ground water table. The solution to all these problems is to replenish ground water bodies with rain water by manmade means.

b) Advantages of rain water harvesting

a) Promotes adequacy of underground water
b) Mitigates the effect of drought
c) Reduces soil erosion as surface run-off is reduced
d) Decreases load on storm water disposal system
e) Reduces flood hazards
f) Improves ground water quality/decreases salinity
g) Prevents ingress of sea water in subsurface aquifers in coastal areas.
h) Improves ground water table, thus saving energy (to lift water)
i) The cost of recharging subsurface aquifer is lower than surface reservoirs
j) The subsurface aquifer also serves as storage and distribution system
k) No land is wasted for storage purposes and no population displacement is involved
l) Storing water underground is environment friendly.

c) Methods for harvesting rain water

There are three methods of harvesting rain water are given below:-

i. Storing rain water for direct use
ii. Recharging round water aquifers, from roof top run off.
iii. Recharging ground water aquifers with runoff from ground area.

i. Storing rain water for direct use

In place where the rains occur throughout the year, rain water can be stored in tanks. However, at places where rains are for 2 to 3 months, huge volume of storage tanks would have to be provided. In such places, it will be more appropriate to use rain water to recharge ground water aquifers rather than to go for storage. If the strata is impermeable, then storing rain water in storage tanks for direct use is a better method. Similarly, if the ground water is saline/unfit for human consumption or ground water table is very deep. This method of rain water harvesting is preferable.

ii. Recharging round water aquifers, from roof top run off

Rain water that is collected on the roof top of the building may be diverted by drain pipes to a filtration tank (for bore well, through settlement tank) from which it flows into the recharge well. The recharge well should preferably be shallower than the water table. This method of rain water harvesting is preferable in the areas where the rainfall occurs only for a short period in a year and water table is at a shallow depth. The various methods of recharging ground water aquifers from roof top runoff.

iii. Recharging ground water aquifers with runoff from ground areas

The rain water that is collected from the open areas may be diverted by drain pipes to a recharge dug well/bore well through filter tanks. The abandoned bore well/dug well can be used cost effectively for this purpose. The various methods of recharging ground water aquifers with runoff from ground areas.