

**SPECIALCONDITIONS (TECHNICAL) FOR EARTHWORK AND MINOR BRIDGES**  
**CONCRETE WORKS**

**1.0 EXECUTION OF EARTHWORK:**

- a) **In foundations** shall be as per IRU Standard specifications (Formation works, Bridge works and P.Way works), 2021 for S.C. Rly's IRUSSR, 2021 & CPWD specifications, 2019 for DSR, 2023.
- b) **In embankment** shall be as per IRU Standard specifications (Formation works, Bridge works and P.Way works), 2021 for S.C. Rly's IRUSSR, 2021 & CPWD specifications, 2019 for DSR, 2023.

**GE:G-0014 has been superseded by RDSOs GE:IRS-0004. Accordingly wherever GE:G-0014 is mentioned in item description, the same should be read as GE:IRS-0004 and work shall be executed as per GE:IRS-0004 specifications.**

- c) **In cutting** shall be as per IRU Standard specifications (Formation works, Bridge works and P.Way works), 2021 for S.C. Rly's IRUSSR, 2021 & CPWD specifications, 2019 for DSR, 2021.

- 1.1 **JUNGLE CLEARANCE:** Before the work is started, the contractor shall clear the areas on ground between the toes plus additional extra width of 1.00 m on both sides of the new bank/cutting, all the jungle, grass, shrubs, trees including roots etc. In case the new bank is to be made in contact with the slope of the existing bank, slopes of the existing bank/cutting coming in contact with the new earthwork shall be cleared of all jungles, bushes, trees etc., and properly Benched. No extra payment will be made for clearance of the jungle, shrubs, bushes, trees, etc. The jungle and trees so cleared shall be given to the contractor free of cost except trees having girth of more than 30 cm which will be the property of Railways. The rates quoted for earth work are deemed to include the charges for clearance of jungle, shrubs trees etc. and for providing benching on the existing banks slopes as per specifications including all labour, T & P etc.

**1.2 EARTH WORK IN EMBANKMENT:**

- 1.2.1 The following paragraphs are intended only to give a general idea to the tenderer/ contractor about the specifications & procedure to be adopted in earth work. However the work of formation, prepared sub-grade and blanketing material is to be carried out as per RDSO guide lines issued vide GE: IRS-0004 (Sept, 2020) as amended from time to time. The contractors are required to go through these RDSO specifications in detail and understand the implications of conducting quality assurance test with respect to availability of earth fill, prepared sub-grade and blanketing materials and accordingly the rates may be quoted.

- 1.2.2 **SOURCE OF SOILS:** Earth work in embankment to RDSO standards is to be done with earth obtained from outside railway land by carting from contractor's own borrowed areas with contractor's vehicles. No borrow pits should be made within (H+3)m from the toe of the proposed embankment either in Railway land or private land without specific approval of the Engineer-in-charge, where H= height of bank in meters.

- 1.2.3 The execution of the earth work in formation may involve re-handling, carting and dumping by head loads, as vehicles may not be able to come near the bank and directly unload at the locations required. The work may also involve crossing of nallahs, and crossing of the existing track. The rates adopted for earthwork are inclusive of cost for existing embankment, jungle clearance, re-handling and crossing of nallahs and the existing track wherever required.

- 1.2.4 The embankment fill shall be formed by means of (1) Contractor's own earth and (2) by leading cut spoils from the cuttings with leads as mentioned in the respective items.

- 1.2.5 Embankment fill so made shall consist of soil other than Organic Clays, silts, peat, chalk, dispersive soils, poorly grade gravel and sand with uniformity coefficient <2, clays and silts of high plasticity (CH&MH).Soils with plasticity index>7 are not permitted.

- 1.2.6 **PAYMENT FOR ITEMS OF EARTHWORK FIGURING IN IRUSSR 2021:** Payment for earth work to the finished profile as required for the work shall be made as specified in Indian Railways Unified Standard Specifications-2021.( para 1.1.7.8)

The gross volume of earth work shall be calculated from the original and finished profile of the bank/ cutting. For the purpose of payment the gross quantity thus calculated shall be reduced by 10% towards shrinkage allowance for earth work in embankments only, but no such deductions shall be made for earth work in cuttings. Where the embankment has been compacted by heavy machinery as stipulated in Para 1.6 of IRU standard specifications (Formation works, Bridge works and P.Way works), 2021 or in accordance with any other special specifications, on the specific instructions of the Engineer in writing, shrinkage allowance shall be deducted at the rate of 5% of the gross quantity of earth work.

1.3 **SUB-GRADE / PREPARED SUB-GRADE:** The soil /earth proposed to be used for sub-grade / prepared sub grade (below blanket layer) should be as per RDSOs comprehensive guidelines and specifications for Railway formation vide specification No. RDSO/2020/GE: IRS-0004. The frequency of quality assurance test shall be conducted by the contractor as specified in the specified in the chapter -7 GE:IRS- 0004 (Sept.2020) at his own cost, the specification and thickness of sub-grade layers for heavier axle loads (25T) shall also be as per GE:IRS 0004 chapter-3. The work of sub-grade will only be commenced after recording finished levels for earth fill.

1.4 **BLANKETING:**

Blanket material proposed to be used for blanketing shall be as per para 3.10 of RDSOs comprehensive guidelines and specifications for Railway formation vide specification No. RDSO/2020/GE: IRS-0004. During the course of supply of the blanketing material samples shall be subjected to necessary physical, technical tests and only those samples which pass such tests will be accepted. Rates quoted are inclusive of all such tests.

1.4.1 Before blanketing is provided, the top surface of the embankment should be dressed giving across slope of 1 in 30 on both sides from the center and compacted with a suitable capacity vibratory roller which gives equivalent compaction. Any undulation or pot holes should be filled with earth and rolled.

1.4.2 The blanketing material should be laid over the prepared sub-grade as per the specifications of GE: IRS-0004.

1.5 **APPROVAL OF SOIL SAMPLES:**

1.5.1 The earth work in both the cases for widening / new embankment has to be done with non-expansive soils and use of expansive soil is prohibited. The successful contractor is required to submit samples of ordinary earth, prepared sub-grade soil (SQ2/SQ/3) and blanketing material within 25 days after issue of acceptance letter. Each sample shall be submitted in three wide mouthed sealed glass jars containing the representative sample approximately 0.0035cum (1/8cft) in each bottle. Those soils which are approved shall only be used at site. No work should start until soil sample is approved. Any delay in submission /approval of soil sample will not be compensated. It is for the agency to study necessary specification for soil and to submit soil sample which will confirm to the specifications.

1.5.2 Quality control tests on the barrow material (Embankment fill, sub-grade / prepared sub-grade, blanket materials) shall be conducted in terms of chapter 7 of GE: IRS – 0004 and only those samples which meet the technical specifications shall be used at site after taking necessary approval from Engineer-in-charge. Frequency such tests shall be as per table 7.2 of GE: IRS – 0004.

1.5.3 Extract of relevant / important paras of comprehensive guidelines and specifications for Railway formation i.e. specification No. RDSO/2020/GE: IRS-0004 is enclosed as **Annexure-I & II** for General guidance. For any further explanation / details, the original specifications shall be referred.

1.6 **COMPACTION OF EARTH WORK:**

1.6.1 Compaction of embankment as contemplated in the relevant items of the Schedule shall be carried out under the direction of the Engineer and as per the specifications given below:

i) After site clearance, all pockets and depressions left in the soil, if any, shall be made good and

compacted.

- ii) Thickness of layer: Suitable thickness of soil of each layer is necessary to achieve uniform compaction. Field tests to be conducted to arrive at optimum layer thickness for achieving homogeneous compaction and required MDD. Normally, 200-300mm layer thickness is optimum to obtain the density specified as per IS 10379-1982 read with Para 6.2.3 of GE: IRS-0004.
- iii) The moisture content in the blanketing material/prepared sub-grade / embankment fill shall be pre-determined before rolling. Deviation of moisture content from the optimum moisture content shall not exceed 2.0%. If water is to be added, it shall be done after spreading the COE/ prepared sub-grade/ blanketing materials, on the formation and the quantity of the water to be added shall be arrived at in liters for every strip of 5 meters of the formation. Strict control shall be exercised in adding the water. The water shall be sprinkled on the formation through a truck mounted water tank sprinkling system. Use of hose pipe for water need to be avoided. If the COE/prepared sub-grade/blanketing materials contains excessive moisture, the rolling shall be commenced only after the materials are allowed to dry and the moisture content is brought down to permissible limit.
- iv) The number of passes of the roller and the optimum thickness of each layer will be fixed after carrying out field trials with the roller proposed to be used, from time to time and from location to location, the main criteria being to obtain the maximum density achievable uniformly. However, a good practice thickness of layer should be generally kept as 300mm for fill material and 250mm for prepared sub-grade and blanketing in loose state before compaction. The directions of the Engineer with regard to the degree of compaction to be achieved and/or process of compaction should be strictly followed. The quoted rate should be deemed to include all the charges for the field compaction trials.
- v) Cohesion less soil shall be compacted to get a minimum density index (relative density) of 70 percent as obtained in accordance with IS: 2720 (Pt. XIV)-1983.
- vi) All other types of soils when compacted shall attain at least 98 percent of the maximum dry density as determined using heavy compaction in accordance with IS: 2720 (Pt. VIII)-1983 followed by field trials as per IS: 10379-1982. Field compaction of each layer shall confirm to the specifications as mentioned in table 3.3 ( single layer system )/ table 3.4 (two layer system) of GE : IRS – 0004,
- vii) While compacting, it shall be ensured that there is a minimum overlap of 150mm between each run of the roller.
- viii) Mechanical compaction of the embankments shall be done only with vibratory roller/ equipment. The suitability of the equipment will have to be demonstrated by field trials before employing it on the work.
- ix) Care should be taken during the compaction operation, to slope the surface of the bank to facilitate draining of rain water and to minimize the absorption of rain water.
- x) The top of the formation shall be finished to a slope of 1 in 30 away from the centre.
- xi) The densities of the finished formation work shall be checked as per the frequency mentioned in Chapter -7 (Para 7.5) of **GE: IRS- 0004** at every layer level and records maintained. Wherever the density is falling short of the minimum specified density, the surface shall be re-compacted to attain the desired density. The contractor shall be allowed to lay a further layer of soil only after the compaction of a particular layer has been found satisfactory. During the progress of the work, the contractor shall afford all facilities to the Engineer or his authorized representative to carry out such field tests wherever necessary.
- xii) If the soil is dry, water shall be sprinkled either in the borrow pit or over the spread layer, as convenient in order to obtain a workable moisture content before rolling is commenced. Where the natural moisture content of borrow soil is high, compaction at higher moisture contents can be allowed by the permission of Engineer-in-charge.
- xiii) Each layer shall be compacted to the specified density over its entire width commencing from the two sides, before another layer is started.
- xiv) The Railway shall ascertain the density of each layer of compacted soil by testing adequate number of soil samples.

- xv) The quality of work shall be determined by considering the mean density of the samples in each layer. The mean dry density shall be equal to or exceed the minimum specified density. In no individual case shall the density be less than the minimum value specified by more than 2 percent; otherwise further rolling shall be done at the appropriate location.
- xvi) The Contractor shall be allowed to lay a further layer of soil only after the compaction of a particular layer has been found satisfactory.
- 1.6.2 Extra width of 50 cm shall be rolled on either side, which after finishing the bank upto the final height, shall be dressed by removing the loose earth. This is done to account for the rollers not being able to compact the soil at the edge of the formation. The rate quoted is inclusive of the same.
- 1.6.3 Places inaccessible to rolling equipment shall be compacted by hand tampers.
- 1.7 **RECORDS OF COMPACTION:** The rate quoted shall include establishment of contractor's own well equipped site laboratory with all contractor's staff, equipment, consumables, etc., for the purpose of conducting all required tests in the presence of Railway's representative as directed by the Engineer. All the test results obtained shall be maintained in a proforma approved by Railways and shall be produced at the time of inspection of Railway officials. The signature of the Railway's representative who witnessed the testing shall be obtained in the register.
- 1.8 Soil test reports from "In house labs or site lab established under provisions of the contract or National Test House or Government Engineering Colleges/NITs/IITs. In exceptional cases when (i) there are no in-house facilities or site-lab for testing and National Test house nearby and (ii) Govt. Engineering Colleges may take longer time causing undue delay in the progress of project, any nearest NABL accredited laboratory having scope and validity of accreditation may be used for periodic testing of soil during execution. However Tests required for initial acceptance of material or design shall be done in any of the "In house labs or site lab established under provisions of the contract or National Test House or Government Engineering Colleges/NITs/IITs", and as per the directions of Engineer-in-charge will be considered. Charges for such tests shall be borne by the contractor. Further in this regard instructions issued by DyCE/Works/HQ vide letter no. SCR-HQOENGG (SOR)/21/2019, dated 08.12.20 to be followed.
- 1.9 **LEVELS AND CROSS SECTIONS:**  
It shall be the responsibility of the contractor to ensure that no work on the embankment is commenced until the existing ground levels at different cross-sections have been taken and recorded and such records of levels have been jointly signed and dated by the contractor and the Engineer or their authorized representatives. Cross-sectional profiles plotted on the basis of the observed ground levels shall also be jointly signed by the Contractor and the Engineer. The points at which the cross section ground levels are to be recorded and the extent of leveling work to be done shall be decided by the Engineer. The contractor may bring to the notice of the engineer such additional cross-sections that in his opinion should be taken for proper assessment of quantities. Such representation however should be made well before the commencement of any earth work. The engineer's decision thereon shall however be final and binding on the contractor. The contractor should inspect the site and make himself familiar with site conditions and the works to be done.
- 2.0 **Special Note :** The following notes shall be applicable for the operation of IRUSSR items to avoid ambiguity at the time of execution:  
**Note for Earthwork in cutting:**
- (i) All usable earth arising from cut spoils shall be led into bank formation and unusable spoils shall be dumped / stacked.
  - (ii) All hard rock / and boulders not fit for filling will be best asked by the contractor and will be property of the Railways.
  - (iii) The item of earthwork in cutting is inclusive of leading all cut spoils either to make spoil dumps or for filling In embankment with leads within 2 km on either side of edge of the cutting(s) including all lifts, ascent, descent, loading, unloading, etc. Extra rate for any additional lead beyond lead of 2 Km will be paid under relevant IRUSSR, 2001 item provided in the schedule.
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**EXTRACT OF RELEVANT/IMPORTANT PARAS OF RDSO/2020/GE:IRS-0004**

Soil Quality Class SQ1, SQ2 & SQ3 has been given in Table below:

(Authority: Para 3.9 of RDSO/2020/GE: IRS-0004: Soil Quality Class.)

Soil Quality	Description w.r.t. Fine-Particles(sizelessthan75micron)
SQ1	Soils containing fines>50%
SQ2	Soils containing fines from12% to 50%
SQ3	Soils containing fines<12%

**1.0 RECOMMENDEDSPECIFICATIONSOFLANKETMATERIAL (Mandatory)**

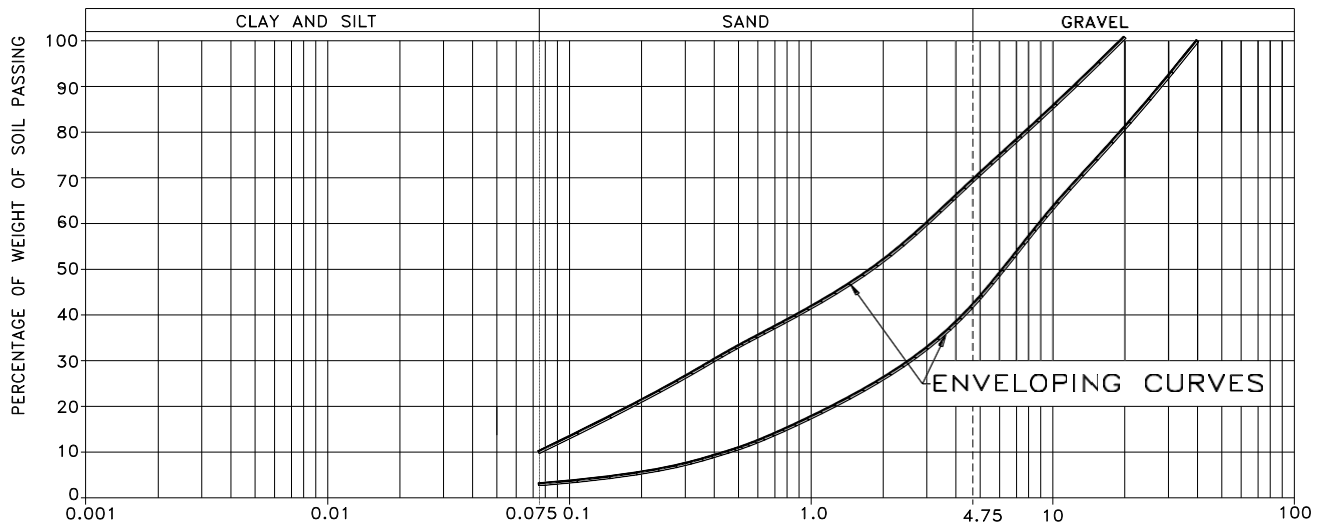
1. Specifications of the material for blanket layer over prepared sub-grade should be such that it is well-graded sandy gravel layer of adequate hardness. Particles size gradation curve should be more or less within Enveloping Curves of blanket material as shown in Fig.9 below &Grading Percentages within the range given in Table-3.3 below and should also have following criteria satisfied:

**Specifications of the material for blanket layer for 25T axle load: Single layer system.**

- i)  $C_u > 7$  and  $C_c$  between 1 and 3.
  - ii) Fines (passing 75 microns): 3% to 10%
  - iii) Minimum soaked CBR value  $\geq 25$ , (Soil compacted at 100% of MDD \* in Lab)
  - iv) Los Angeles Abrasion value  $< 40\%$
  - v) Field Compaction : Min. 100% of MDD \* in field trial
  - vi) Minimum  $E_{v2}^{**} = 100 \text{ MPa}$
  - vii) Size gradation – within specified range (as table-3.7) or should lie more or less within enveloping curves (as Fig-3.8)
  - viii) Filter criteria (**\*\*\*Optional**) should be satisfied with sub-grade layer as given below:
    - Criteria-1:  $D_{15} \text{ (blanket)} < 5 \times D_{85} \text{ (sub-grade)}$
    - Criteria-2:  $D_{15} \text{ (blanket)} > 4 \text{ to } 5 \times D_{15} \text{ (sub-grade)}$
    - Criteria-3:  $D_{50} \text{ (blanket)} < 25 \times D_{50} \text{ (sub-grade)}$
- \*\* $E_{v2}$  is Modulus of deformation (Para 2.0 of Appendix-Hof GE: IRS-0004)
- \*\*\* With the application of Non-woven Geotextile as a separator layer below the blanket, filter criteria will not be required or mandatory.

**Table – 3.7 of GE : IRS 0004 : Gradation Percentage of Blanket Material:**

Sl. No.	IS Sieve Size	Percent Passing (by weight)
1.	40mm	100
2.	20mm	80–100
3.	10mm	63–85
4.	4.75mm	42–68
5.	2mm	27–52
6.	600micron	13–35
7.	425micron	10–32
8.	212micron	6–22
9.	75micron	3 -10



**Fig-3.8: Enveloping Curves for Blanket Material**

## 2.0 QUALIFYING AND QUALITY ASSURANCE TESTS(Mandatory)

2.1 Qualifying tests as part of pre-selection of good earth for track sub grade, embankment fill is required to be carried out as detailed in Chapter -7 of. RDSOs comprehensive guidelines and specifications for Railway formation vide specification no. RDSO/2020/GE: IRS-0004. Also, quality of compaction is required to be done to ensure good quality construction.

2.2 Selection of soil: For selection of soil to be used as embankment fill *CBR test* is required to be conducted on material. CBR test is conducted on ground soil, embankment fill, prepared sub-grade & blanket material to ensure the minimum specified CBR value of these material to be used in construction. This test is carried out on soil sample in laboratory as per procedure given in IS: 2720 (Part16)-1987 & in field as per IS:2720 (Part31)-1969.

2.3 **QUALITY ASSURANCE TEST ON COMPACTED LAYER:** Quality Assurance Tests are required to be conducted on part completion stages of formation, prior to clearing for further earthwork, track linking work:

- a) Heavy Proctor test is required to be conducted to determine the Maximum Dry Density of soil as per IS: 2720 (part 8). In-situ density is measured in the field by Sand Replacement Method (IS: 2720-part28) or Core Cutter Method (IS: 2720-part 29) to calculate the degree of compaction. This shall be determined in laboratory as per BIS procedure with the specified frequency of earthwork quantity, as envisaged in RDSOs comprehensive guidelines and specifications for Railway formation vide specification No. RDSO/2020/GE:IRS-0004.
- b) Second Step Plate Load Test is required to be conducted in-situ for measurement of Deformation Modulus EV2 of compacted layers of embankment, blanket, prepared sub-grade etc., at 1.0 Km interval or as directed by Engineer - in -charge. The test procedure has been detailed in German Code DIN: 18134- 2001, "Determining Deformation & Strength Characteristics of Soil by Plate Loading Test". The minimum value of EV2 should be ensured at different levels as specified.

2.4 **FREQUENCY OF QUALITY ASSURANCE TESTS:** Quality control of Earthwork shall be as per chapter -7 of RDSOs comprehensive guidelines and specifications for Railway formation vide specification No. RDSO /2020/GE: IRS-0004.

2.4.1 CBR test for selection of barrow materials and other tests required for ensuring conformation of the materials (blanket, sub-grade) as per specification e.g. size gradation, Cu, Cc, Los Angeles Tests, OMC/MDD etc. shall be conducted at following frequency:

- a) Embankment Fill, Sub grade/ Prepared sub grade: At least one test at every change of sub

grade / prepared sub grade material, subject to a minimum of one test for every 5000cum.

b) Blanket material: At least one test for every 500 cum or part thereof.

2.4.2 **In-situ Degree of Compaction** (or In-situ dry density measurement) test shall be conducted on each compacted layers in random pattern at following frequency for different layers:

a) At least one density check for every 30 m length for blanket layers and top one meter of prepared sub grade/sub grade along the alignment in a staggered pattern of each compacted layer.

b) At least one density check for layers other than as specified in(i) above, every 500 sqm or 75 m c/c whichever occurs earlier along the alignment in a staggered pattern of each compacted layer.

c) In case of important bridge approaches (100 m length on either side), at least one density check for every 25 m length.

2.4.3 **Second step Plate Load Test:** This test is in practice in German Railways and recommended by UIC Code 719 to measure the quality of earthwork and blanketing after compaction. For Indian Railways, this test is made optional presently. In the guidelines, this test has been included as a future development for quality assurance test on compacted surface. This should be done for EV2 measurement at top of each formation layers e.g. At sub-soil, compacted sub- grade, prepared sub-grade, blanket etc. At the frequency of one test per km length of section.

### 3.0 **GROUND IMPROVEMENT METHODS:**

3.1 Field tests are required to be conducted on sub-soil strata, such as Plate load test for determination of Elastic Modulus at second loading (EV<sub>2</sub>), Standard Penetration test to determine N-value, and Unconfined Compression Test or Vane Shear Test to determine unconfined compressive strength or undrained cohesion, Cu. If values of these test parameters, as specified in following para do not meet with specified requirement then ground improvement is needed to be under taken.

3.2 *For ground soil/sub-strata layers with low bearing capacities, assessed by following evaluation parameters:*

a. Ev<sub>2</sub> value less than 20 MPa, or

b. Untrained cohesion (Cu) < 25 kPa, only for soils having particles finer than 75 microns exceeding 12 % or

c. N-value (determined from Standard Penetration Test–SPT) < 5, shall require Ground Improvement.

3.3 *Ground improvement can be carried out using one or more of the following techniques, as given in Chapter -2 of GE: IRS - 0004.*

a) Removal and replacement of weak sub-soil

b) Preloading– The pre-loading technique takes two forms:

i) Overloading

ii) Stage construction

c) Ground improvement using Vertical drains

d) Ground improvement using Stone Columns

e) Ground Improvement for expansive soils using CNS material

3.4 *Stabilization & Ground Improvement Methods Using Geo-synthetics :*

Some of the ground improvement methods, wherein geo – synthetics are used are:

a) Use of Geo-composite drain for Construction of new embankment over soft sub soil.

b) Use of Geocell

c) Use of Prefabricated vertical drain (**PVD**):

d) Geosynthetic encapsulated Stone column:

*Note: All the above methods are suggestive in nature and final methodology to be adopted will depend on site condition and topography, soil type, drainage condition etc.*

#### 4.0 DESIGN OF FORMATION & SPECIFICATION FOR FORMATION LAYERS:

- 4.1 Formation comprises of blanket and sub-grade / prepared sub-grade. Depending upon the techno economic considerations it can be single layer or two layer construction, as described in chapter 3 of GE: IRS 0004.
- 4.2 Specifications and thickness of formation layers for 25 ton axle load shall be as per table 3.3 (single layer system), table 3.4 (two layer system). Specifications and thickness of formation layers for 32.5 tonne axle load shall be as per table 3.5 (single layer system), table 3.6 (two layer system).
- 4.3 Cross section of formation for 25 tonne axle load shall be as per figure 3.4 (single layer system), figure 3.5 (two layer system). Cross section of formation for 32.5 tonne axle load shall be as per figure 3.6 (single layer system), figure 3.7 (two layer system). Sketches are appended as Annexure - II
- 4.4 In order to design & construction of stable formation for heavy axle load, EV2 should be determined in the field as per procedure given in German Code DIN: 18134 at ground. If EV2 value is less than 20MPa or Sub-soil strata having (Cu)<25KPa (mostly in Marshy area )or N- value <5will also require ground improvement.
- 4.5 If, naturally available materials do not meet the desired specifications, blanket material can be produced by mechanical process from crushing or blending method or combination of these two methods. Details of these two methods are given in Appendix–A of GE:IRS 0004.Naturally available sand, quarry dust or crusher run, if available at low cost, can be used as prepared sub grade also.

#### 4.6 SPECIFICATIONS AND THICKNESS OF FORMATION LAYERS:

- (A) The Railway Formation may be constructed with Single Layer System or Two Layer System based on availability of local soils/materials and on economic considerations. The thickness of the prepared sub-grade and blanket layer has been rationalized based on UIC-719R calculation for ballast cushion of 350 mm. The specifications and thickness of Blanket layer, Prepared subgrade, Subgrade (Top Layer & Lower layer) and Sub-Soil are tabulated for Single layer system andTwo-layersystemfor25T Axleload as below:-

**Table-3.1:For25T AxleLoad:**

S. No.	Soil type Category in Sub-grade	Prepared Sub-grade		Recommended Blanket Thickness (mm)	Remarks
		Soil Type	Thickness (mm)		
1.	SQ1	SQ1*	--	550	Single layer
2.	SQ1	SQ2	500	400	Two layer
3.	SQ1	SQ3	500	300	Two layer
4.	SQ2	SQ2*	--	400	Single layer
5.	SQ2	SQ3	350	300	Two layer
6.	SQ3	SQ3*	--	300	Single layer

\* Sub grade soil is continued upto blanket layer

#### (B) Formationfor25T Axleload:

**Table 3.3:** Specification and Thickness of Formation Layers for 25T axle load: Single layer system

Layers	Specification	Thickness
<b>Blanket</b>	i) $C_u > 7$ and $C_c$ between 1 and 3. ii) Fines (passing 75 microns): 3% to 10%	<b>30cm</b> over SQ3 sub-grade

	<ul style="list-style-type: none"> <li>iii) Minimum soaked CBR value <math>\geq 25</math>, (Soil compacted at 100% of MDD *in Lab)</li> <li>iv) Los Angeles Abrasion value <math>&lt; 40\%</math></li> <li>v) Field Compaction : Min. 100% of MDD * infield trial</li> <li>vi) Minimum <math>E_{v2}^{**} = 100 \text{ MPa}</math></li> <li>vii) Size gradation – within specified range (astable-3.7) or should lie more or less within enveloping curves (as Fig-3.8)</li> <li>viii) Filter criteria (<b>***Optional</b>) should be satisfied with sub-grade layer as given below: <ul style="list-style-type: none"> <li>Criteria-1: <math>D_{15}(\text{blanket}) &lt; 5D_{85}(\text{sub-grade})</math></li> <li>Criteria-2: <math>D_{15}(\text{blanket}) &gt; 4 \text{ to } 5 \times D_{15}(\text{sub-grade})</math></li> <li>Criteria-3: <math>D_{50}(\text{blanket}) &lt; 25 \times D_{50}(\text{sub-grade})</math></li> </ul> </li> </ul>	<p><b>40 cm</b> over SQ2 sub-grade</p> <p><b>55 cm</b> over SQ1 sub-grade</p>
<p><b>Sub-grade</b></p> <p>Top Layer</p>	<p>SQ1/SQ2/SQ3 soil</p> <p><b>SQ1 soils (To be used only with dispensation of PCE/CAO)</b></p> <ul style="list-style-type: none"> <li>i) <math>\text{CBR} \geq 6</math> (soil compacted at 98% of MDD *)</li> <li>ii) <math>\text{CBR} \geq 4</math> soil compacted at 98% of MDD*</li> <li>iii) Field Compaction: Min. 98% of MDD *</li> <li>iv) Minimum <math>E_{v2} = 45 \text{ MPa}</math> (for SQ1 soil) 60 MPa (for SQ2/SQ3)</li> </ul>	100 cm
<p><b>Lower layer (fill)</b></p>	<p>SQ1/SQ2/SQ3 soil (+)</p> <ul style="list-style-type: none"> <li>i) <math>\text{CBR} \geq 3</math> (soil compacted at 97% of MDD*)</li> <li>ii) Field Compaction: Min. 97% of MDD *</li> </ul>	As per Embankment height
<p><b>Ground Soil/Sub-soil Strata</b></p>	<ul style="list-style-type: none"> <li>i) Undrained Cohesion of soil (<math>c_u</math>) <math>\geq 25 \text{ KPa}</math> (only for soil Shaving particles finer than 75 micron exceeding 12%)</li> <li>ii) <math>E_{v2}</math> (determined from PLT) <math>\geq 20 \text{ MPa}</math></li> <li>iii) <math>N</math> (determined from SPT) <math>\geq 5</math> Ground Improvement is required, if any of the above parameters not complied with</li> </ul>	--

\* MDD mentioned in the above table

- (a) For determination of CBR-MDD achieved in Lab
- (b) For field compaction-MDD achieved in field compaction trials which should not be less than 98% of MDD in lab.

\*\* $E_{v2}$  is Modulus of deformation (**Para 2.0 of Appendix-H of GE: IRS-0004**)

\*\*\* With the application of Non-woven Geotextile as a separator layer below the blanket, filter criteria will not be required or mandatory.

+No dispensation of PCE/CAO required for use of SQ1 soil in Lower layer (fill) of Sub grade.



## 5.0 OTHER IMPORTANT GUIDELINES FOR EARTH WORK:

- 5.1 **Unsuitable Soils for Construction of formation layers: Soils to be normally avoided are:**
- a) Organic clays, organic silts, peat, chalks, dispersive soils, poorly graded gravel and sand with uniformity coefficient (Cu) less than 2,
  - b) Clays and silts of high plasticity (CH & MH) into p3m of embankment.
  - c) Shales & Soft rocks which become muddy after coming into contact with water.
- 5.2 **Formation width:** The formation width of embankment for single line BG should normally be 7.85m or as decided by Engineer-in-Charge.
- 5.3 For banks higher than 4.0metres, suitable slope stability analysis, reinforcement of slopes, plantation of deep root grass and toe wall construction shall be suitably adopted. In case of high bank on soft sub-soil, flatter slope with berm/sub-bank should be provided after slope stability analysis.
- 5.4 Adequate drainage arrangement should be made by providing cross slope at top of formation and side drains/catch water drains, wherever required.
- 5.5 Stable slopes and adequate drainage arrangements in cutting areas should be provided as per details given in „Guidelines for Cutting in Railway Formations-No.GE: G-2, August 2005“.
- 5.6 For high banks at approaches of rail bridges, providing approach slabs and geo-grid layer shall also be considered and adopted, if required.
- 5.7 Reinforced Earth Construction may be adopted wherever steep slope/vertical wall construction is required due to space constraint or otherwise.
- 5.8 Adequate erosion control measures on slopes of bank & cutting should be ensured by vegetation on slopes with deep-rooted Vetiver grass & geo-jute textile, if necessary. In areas susceptible to flooding, the sides of an embankment should be protected with a layer of rock fill or stones with an intermediate granular layer upto 1m above HFL.
- 5.9 At locations, where water table is high and fill-soil is fine-grained, it may be desirable to provide a granular layer of about 30 cm thickness at the base, above sub-soil across the full width of formation. Boulder pitching should be done on embankment slope.
- 5.10 Use of geo-synthetics improves the performance of formation. Geo-grid at ballast & blanket interface can reduce blanket thickness requirement. Geo-textile/geo-composite can be provided at the blanket-sub grade interface and/or blanket-prepared sub grade interface for the purpose of separation, filtration & drainage and better performance of the track substructure system as whole. In this connection para 2.4 of GE: IRS 0004 may be referred.
- 5.11 Apart from the above main & other recommendations, other provisions given in RDSOs comprehensive guidelines and specifications for Railway formation vide specification No. RDSO/2020/GE: IRS-0004 such as construction procedure, drainage, erosion control etc. should also be followed.
- 5.2 Appendix – H of GE: IRS 0004 may please be referred for standard test procedures for various quality assurance tests.
- 5.3 Extract of chapter 9 of GE: IRS 0004 is appended as Annexure – III regarding widening of embankment and raising of formation including cess repair.

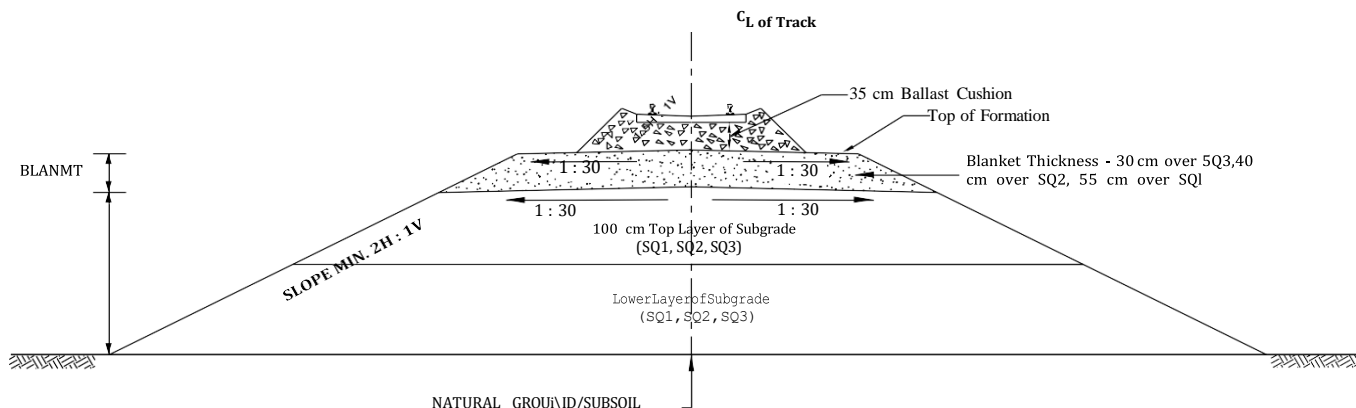


Fig-3.4: Track Formation for 25 T Axle Load (Single layer system)

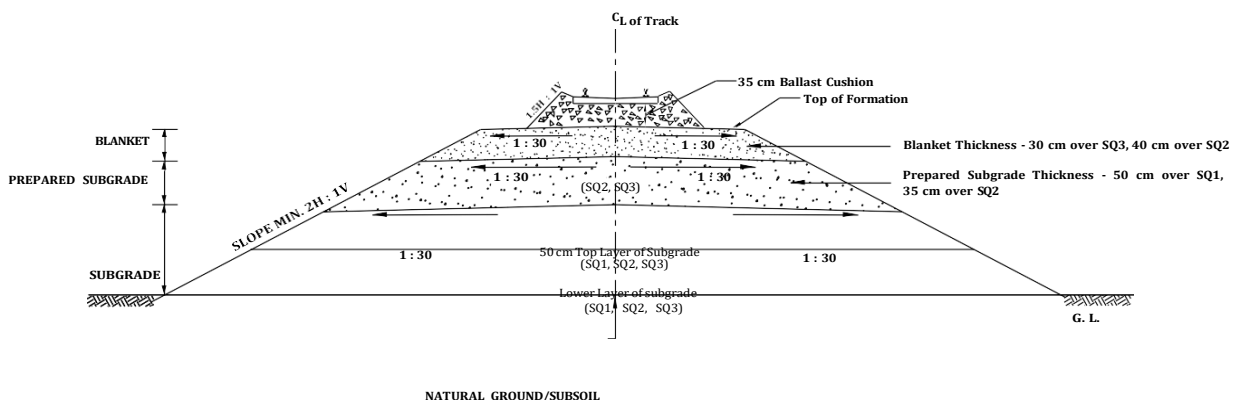
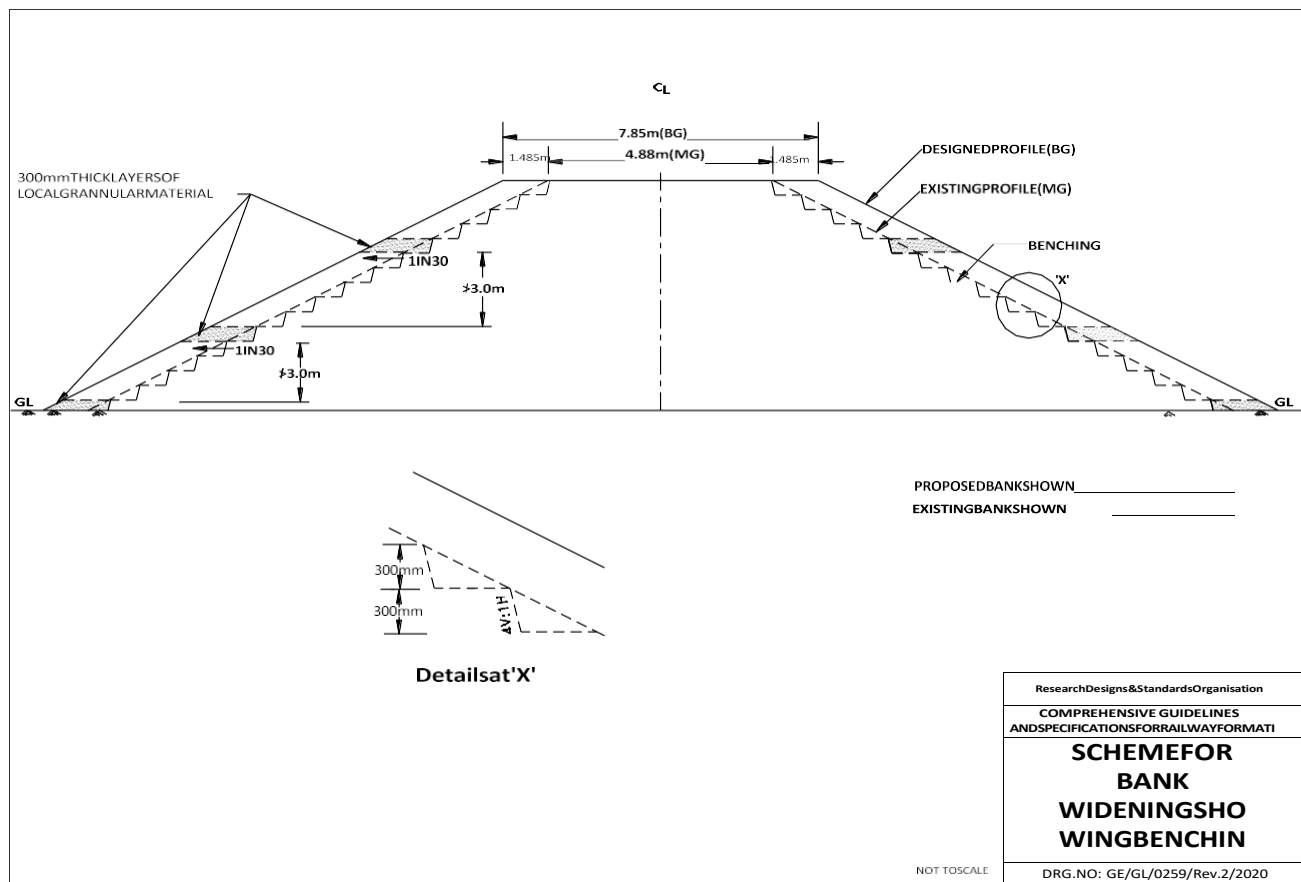


Fig-3.5: Track Formation for Two layer system (for 25 T Axle load)

## Annexure – III

**EXTRACT OF CHAPTER 9 OF GE: IRS – 0004 ( Sept 2020)****WIDENING OF EMBANKMENT AND RAISING OF FORMATION, INCLUDING CESS REPAIR****9.1 Widening of Embankment****9.1.1 Widening of Embankment for Gauge conversion**

- i) Before taking up widening of Embankment for gauge conversion, it should be ensured that remedial measures for unstable formation have been taken.
- ii) All vegetation shall be uprooted and taken away from the site of work. The loose materials removed from the slope should be dumped to form the bottom most layer on the ground in the width to be widened. If required, it shall be supplemented with local granular soil.
- iii) Starting from the toe, benching on the slope at every 30cm height shall be provided on the slope surface as shown in **Fig-9.1** below so as to provide proper amalgamation between the old and new earthwork.

**Fig-9.1: Scheme for bank widening showing benching**

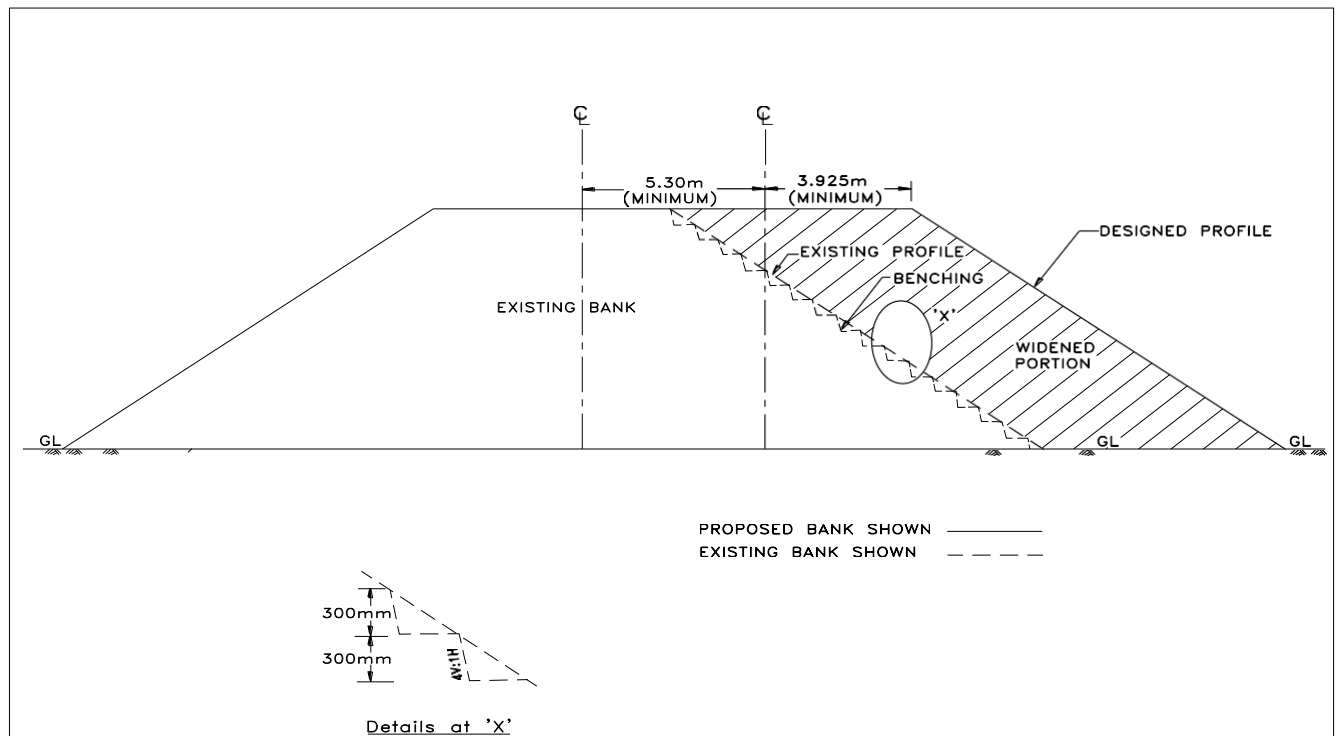
Earthwork shall be carried out in layers, each layer sloping out 1:30 and compacting it mechanically using vibratory rollers of around 0.9m width (which are available in the market); 6 to 8 passes of such rollers shall usually suffice to provide the Compaction to the specified level. Compaction on slope shall be ensured by using slope vibratory roller of 10-20t. Preferably, this should be a separately payable item.

- iv) The width of each layer of earthwork shall be in excess by 300mm of the designed profile to enable compaction near the edges. The excess width, thereafter, be cut and dressed, so as to achieve the required embankment profile.

In case of widening for gauge conversion, Earthwork shall be completed upto design formation level with due allowance of provision of blanket (as per RDSO specification) on entire formation width i.e. extended portion as well as in existing formation. If blanket layer does not exist on the existing formation, top layer of existing embankment shall be replaced with required depth of blanket layer in pursuance to guideline for fitment of existing formation for running of 25T axle load at 100 kmph (as per details given in Appendix-I).

### 9.1.2 Widening of Embankment for doubling

- i) Before taking up widening of Embankment for doubling, it should be ensured that remedial measures for existing unstable formation have been taken.
- ii) All vegetation shall be uprooted and taken away from the site of work. The loose materials removed from the slope should be dumped to form the bottom most layer on the ground in the width to be widened. If required, it shall be supplemented with local granular soil.
- iii) Starting from the toe, benching on the slope at every 30cm height shall be provided on the slope surface as given in **fig. 9.2**, so as to provide proper amalgamation between the old and new earthwork.



**Fig-9.2: Widening of Embankment for doubling**

**Note 1-** In case of existing formation is of minimum 7.85m width, widening is to be done only on one side as indicated in sketch above.

**Note 2-** In case of widening of existing formation (formation width 6.85 m or below as per previous provisions of IRSOD), the requirement of minimum formation width of 13.16 m & minimum cess width of 900mm may not be fulfilled on other side of existing embankment which is not widened. In that case, cess width of existing track is to be increased on programmed basis as stipulated in para 9.2. The total formation width i.e. existing plus widened of minimum 13.16m shall have to be ensured as per latest provisions of IRSOD.

**Note 3-** Additional width of formation on curves should also be accounted for as per relevant provisions of IRSOD/IRPWW.

- iv) In case of doubling with widening of existing embankment, various provisions & methodology for new construction as stipulated in **Chapter 3 & 6**, shall be followed.

**Note: Design and construction of any detours (for easing out of existing sharp curves, rebuilding of important bridges etc.) shall be carried out in accordance with provisions of new construction as stipulated in Chapter 3 (Table 3.1 to 3.6).**

- v) In case, height of embankment (as per required top level of formation) is less than the required depth of formation layers (Blanket/Prepared sub-grade/Top layer of sub-grade), then also provision as stipulated for formation layer shall have to be ensured for effective stress dispersal. If required, excavation belowground level will have to be done as given in **Para 3.11 of Chapter 3 & Appendix-B**.
- vi) Suitable drainage arrangement as given in **Chapter 6 – Execution of Earthwork** is to be provided.

### 9.1.3 Raising of Existing Formation

After widening of the embankment to the level of the existing formation, raising shall be done as under:

- i) Raising less than 150mm shall be done with ballast, restricting total ballast cushion to 350mm.
- ii) Raising from 150mm to 1000mm: The existing ballast shall be taken out under suitable speed restriction and raising should be done in suitable steps with the material as per specification of blanket material. After raising to the desired level, clean ballast shall be inserted. Limiting value of 1000mm may be reduced depending on the site conditions.
- iii) Raising of more than 1000mm, shall be done by laying temporary diversion for passage of traffic.

## 9.2 Widening/Repair of Cess for Open Line maintenance

### 9.2.1 Introduction

Adequate formation width, ballast profile and cess width/height are required to maintain desired track geometry. Minimum width of cess is needed for following purposes:-

- i) To provide adequate confinement and to minimize track settlement.
- ii) For efficient and safe execution of track maintenance / renewal activities like casual renewal of rails / sleepers.
- iii) Welding of rails
- iv) De-stressing of LWR/CWR
- v) Operation/placement/movement of small track machines.
- vi) Unloading/loading of free rails / rail panels / sleepers and placing them on cess before and after the renewal.

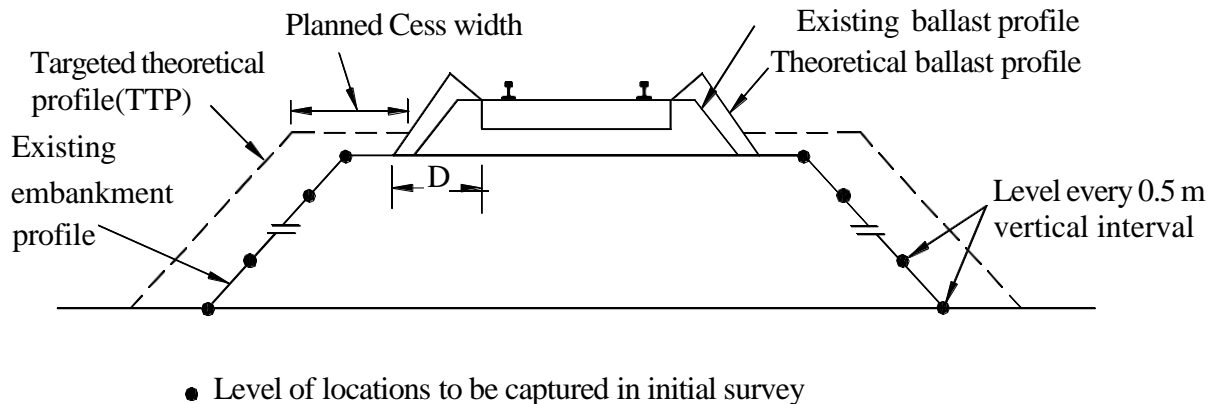
### 9.2.2 Preliminary works:

The work of cess repairs may be planned when the distance of edge of formation, from center of track, becomes less than 3300 mm and the cess width should be made minimum 1200mm during the cess repair work. Cess width for new construction with formation width of 7.85m (single line) is around 1100mm, hence considering additional extra margin for any shrinkage/settlement, 1200mm cess width is required to be provided during cess repair works.

Before undertaking the cess repair work, a detailed field survey should be carried out to plot the existing profile of track including embankment, identification of suitable earth for carrying out cess repair and fixing Targeted Theoretical Profile (TTP) of cess for proposed work. The TTP should include cess width to be made up, proposed raising of cess if any and flattening of side slopes.

- (i) **Field survey to plot existing profile of track including embankment**

- a) Longitudinal level of rail at every 30m interval should be recorded along with existing cess level.
- b) Cross sectional profile including that of existing embankment should be taken at every 30m. The distinctive points of reference in cross section are rail level, toe of ballast, edge of cess and level at every 50cm interval (vertical height) of slope of embankment.



**Fig-9.3**

- c) The TTP with required longitudinal level of rail and cess at every 30m and also cross section as mentioned in above para should also be plotted. These levels should be recorded by SSE/SE and got approved by ADEN.
- d) In case of existence of level crossings, bridges or any other prominent track features, additional cross sections should be drawn based on site specific requirements.
- e) Location of Trolley Refuges etc. should also be identified and levels at these locations should be taken in sufficient detail to work out the quantity of earth required.
- f) To the extent possible, railway earth if found suitable may be used for cess repairs. The borrow pits should be dug along the edge of the railway boundary, duly ensuring that no borrow pits are dug within  $(H+3)$  m distance from the toe of the embankment, where "H" is the height of embankment. In case of non-availability of railway earth, suitable contractor's earth may be used.

## (ii) Identification of suitable earth

Soils which are normally unsuitable for construction are stipulated in Para 3.7 of Chapter-3. Barring these, locally available soils of adequate strength can be used.

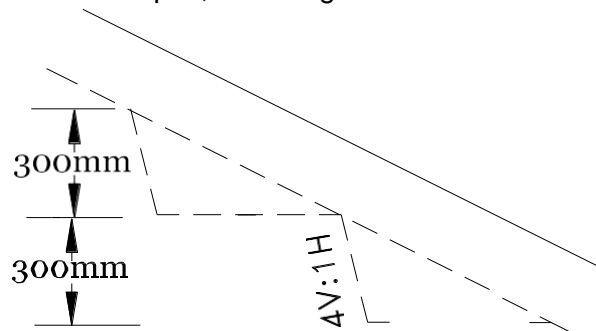
## (iii) Targeted Theoretical Profile (TTP)

- a) In case, track renewal, deep screening, track lifting works are sanctioned, targeted theoretical profile should be finalized taking into account proposed longitudinal level of rail & cess, additional cess width required and sub bank if any required.
- b) Proposed TTP should be drawn for longitudinal levels of Rail/Cess and at every cross section as taken in Para 9.2.2(i) above should be fixed.
- c) Proposed rail level, cess level, edge of cess and level at every 50cm vertical interval on slope for TTP should be calculated and plotted
- d) Due care should be taken while fixing TTP and must take into account any future proposed lifting to improve track geometry
- e) On bridge approaches (up to the length of 50m on either side) where height of bank is more than 3m, extra 300mm cess width should be provided in addition to calculated above for cess repaired.

- f) The TTP should also include any additional width of cess or milder slope of embankment or sub-bank requirement based on site conditions and specific requirements with approval of Sr.DEN/DEN in charge of section

### 9.2.3 Execution

- a) During earthwork on slopes, benching at the interval of 0.3m (vertical height must be done ).



**Fig-9.4**

- b) Moisture to be added in the earth, to bring it near the Optimum Moisture Content value, shall be calculated and added to the soil. The moisture shall be mixed thoroughly using suitable means.
- c) After the final layer's compaction, the surface of earthwork executed must be as per desired level and slope to the satisfaction of the engineer incharge's representative.
- d) The earthwork shall be done in layers, compacting each layer with 10 passes of small width vibratory rollers. In top layers, where the working of rollers is not practical, suitable plate compactor may be used. After completing the earthwork of full height, the slope may be dressed and compacted with 10 passes of slope vibratory roller/compactor. The compaction on cess and slopes shall be kept as a separately payable item.
- e) For the repair work done on slope(s) of the embankment, suitable erosion control measures shall be adopted.
- f) Levels should be recorded at 30m length after completion of cess repair work and "as done" profiles should be plotted on the same sheets. Payment of cess repairs shall be based on the quantities worked out from the cross sectional calculations.
- g) Any excess repair work done beyond 10cm of the TTP shall not be paid.

In cess repair work, field measurement of compaction such as density and moisture content may not be insisted upon. Instead, record of compaction done, with machinery used & number of passes shall be maintained for each layer of earthwork done by concerned SSE, duly checked by

## Annexure-IV

LIST OF EQUIPMENT FOR FIELD LAB

Contractor should provide a testing lab at site / nearest station / nominated / specified location as instructed by the Engineer-in-charge in Railway premises with the following facilities:

Sl. No.	DESCRIPTION OF EQUIPMENT	REFERENCE OF I.S CODE (latest version to be used)	UNIT
1	IS set of sieves with base & top lid 20mm, 19mm,10mm, 4.75mm, 2mm 600mic, 425mic, 212mic, 75mic,.	IS- 460	2 Sets
2	Hand operated sieve shaker for above sieves.		2 No.
3	BALANCE		
	i) Pan balance/Electronicweighingmachine-10kg capacity (with 1.0gm Least Count)		2No.
	ii) Electronic balance-500 gm capacity (with0.1gmLeastCount )		2 No.
	iii) Electronic weighing machine200grm(LC-0.01g)		2 SETS
4	Field density apparatus complete.	2720-1974 Part-xxviii.	5 SETS
5	Sand replacement Core cutter with dolly	2720-1975 part-XXIX	2 SETS
6	Heavy Compaction Test apparatus fullunit.	2720 PART-8-1983	1 SET
7	Laboratory California Bearing Ratio(CBR) Test Apparatus & it"s required accessories	2720 PART-16-1987	2 SETS
8	Abrasion Test Apparatus		1 No.
9	Liquid Limit apparatus hand operated with counter & grooving tools.	IS 2720 part-5 1985	1 No.
10	Shrinkage limit apparatus	IS 2720 part-6 1972	3 No.
11	Stainless steel spatula - 25cm long		4 No.
12	Porcelain bowl for LL - 15cm dia.		6Nos
13	Aluminium dish with lid – 5cm dia.		2 Nos
	Wash bottle - 1 lit. capacity		2 Nos
	500ml capacity		3 Nos
14	Glass plate 10mmthick50x50cm		3 Nos
15	Ground glass5mm thick 50x50 Cm		10 Nos
16	Enameled trays 45x30cm		10 Nos
	20x20cm		10 Nos
17	Enameled plates 6 inch dia		3 Nos
	8 inch dia.		2 Nos
	10 inch dia.		3 Nos
18	Frying pans		3 Nos
19	Stove janta		1 Nos
20	Straight edge 300mm long		2 Nos.
21	Sample Tube (Size Dia-150mm, Length-450mm)		5 Nos.
22	Grain size analyser of fines	IS-2720 part-4-1985	
	a) Hydrometer		2 Nos.
	b) Thermometer 0 to 50 c		1 Nos.
	c) Glass cylinder 1000cc capacity with 60mm dia.		5 Nos.
	1 Nomogram chart		1 Nos.
	2 Stop Watch		1 Nos.
23	Desiccators as IS –6128		2 Nos.

24	Gallon of 10 litter capacity for distilled water		3 Nos.
25	Wooden mortar and pestle		2 Nos.
26	Specific gravity test apparatus		2 Nos
27	Density bottle- 50ml capacity		2 Nos
28	Glass cylinder 100 cc capacity (for Free Swell index test)		1 Nos
29	Oven- thermostatically controlled to maintain a temperature 105-110c		
30	Relative Density test Apparatus	IS-2720 part-14-1983	1 Nos
31	Standard Penetration Test(SPT) Apparatus	IS-2131-1981(Reffeed-1997)	1 Nos
32	Nuclear Moisture Density Gauge (NMDG) Apparatus		
33	Note-Preparation of dry soil samples for various test	Follow IS – 2720 part-1-1983	
34	Consumable Item		
35	Sieve brush		
36	Wire brush		
37	Sodium carbonate		
38	Sodium hexa meta phosphate. Kerosene		
39	Kerosene		
40	Mercury		
	<b>Additional Equipment</b>		
	Hand auger 150mm dia with extension rod		
41	Samplingtube100mm dia. and 450mmlength		
42	All machines and equipments should have Calibration Certificate		
43	Concrete Cube Testing Machine – 200 Tonne capacity – Electrical-cum-hand operated with single pressure gauge		1 Nos
44	Slump cone test apparatus with tamping rod		2 Nos
45	Cube moulds 150x150x150mm		24 Nos
46	Vikat's needle tst apparatus with dashpot		1 Nos
47	Flakiness Index Test apparatus		1 Nos
48	Elongation Test apparatus		1 Nos
49	Aggregate Impact value test apparatus		1 Nos
50	Auto Level with Accessories		2 Nos
51	Thermometer for concrete		2 Nos
52	Digital camera off 10.0 megapixel or above of reputed brand like Sony, Canon etc., with still/video shooting and SD card		1 Nos
53	Desktop PC, with LCD monitor minimum 20" wide or Note book with WIN-10 OS, MS Office & MS project		1 Nos
54	All in one A3 size Ink Jet Printer & Mobile / portable colour printer		1 No each
55	Screw Gaugze		1 Nos
56	Vernier caliper		1 Nos
57	Total Station		1 Nos

**Note:**

1. No payment will be made to the contractor on this account. Land / open space required for the laboratory will be provided by the Railway free of cost. After completion of the work, contractor can take back all machinery and establishments etc., contractor is deemed to have taken this in to consideration while quoting his rates.
2. The above list is only tentative and the actual requirement will be given by the Engineer-in-charge before commencement of work. The above equipment can be taken back by the contractor after completion of work as and where is basis.

## **10.0 OPEN EXCAVATION: The work shall be carried out as per Indian Railways Unified Standard Specifications (Formation Works, Bridge Works & P. Way Works) -2021.**

- 10.1 Open excavation done for foundations may be executed with sloping sides with or without timbering or may be excavated with vertical sides properly timbered and shored from ground level up to the bottom of the excavation and the work should be efficiently carried out in such away so as to ensure its own stability as well as the safety of adjoining lands, structures, moving rail/road traffic and labour working there on and also in such away as will prevent them from being in any way detrimentally affected. However temporary shoring with timbering is to be provided if necessary to protect the track and road embankment from slipping for which the contractor will have to use his timbers. No extra rate will be paid for and the rates quoted for excavation will include the same.
- 10.2 The excavation must also be kept free from water at all times during the progress of the work by means of bailing or pumping out, making channels, leading water away from the excavation as well as diversion of water to prevent its ingress into foundations, or otherwise till the work below water is completed in all respects. The rates quoted for excavation shall exclude the charges for all such work.
- 10.3 Any unforeseen, under lying cables, pipe lines etc., if met with during execution should be taken care to either safeguard or divert the same with the approval of departments concerned. All necessary administrative help will be given in this matter. However, escalation over the original agreement rates will not be entertained because of delays in such clearances
- 10.4 **PAYMENT FOR OPEN EXCAVATION:** Payment for excavation in foundation shall be measured as Specified in Indian Railways Unified Standard Specifications (Formation Works, Bridge Works & P.Way Works) - 2021.
  - 10.4.1 The quantity for excavation will be determined by multiplying the plan area of the open foundations with the depth from the average foundation bottom level up to which the excavation is carried out to the average ground level from where excavation is started. If any excavation is done for side slopes of foundations will not be paid for. Any extra area of excavation made for provision of working space shuttering and other supports also will not be paid for. The rates quoted for excavation of foundation shall include the cost of all such works.
  - 10.4.2 The excavated soil should not be left out in heaps causing obstruction after the work is completed in all respects. All excavated soil should be lead out to the places indicated by the Engineer.
  - 10.4.3 While quoting the rates for Bridge work, the contractor should note that the Proposed bridges wherever to be constructed under the conditions both rail and road traffic nearby shall be identified and should have to be done with restricted space of working and should consider these aspects, as applicable.

**SPECIAL CONDITIONS (TECHNICAL) AND SPECIFICATIONS FOR CONCRETING,  
READY MIXED CONCRETE & STEEL REINFORCEMENT**

**1.0 MATERIAL & IS CODES.**

- i) Concrete : IS 456, IS 4926 (Ready Mixed Concrete)
- ii) Cement : IS 12269 (53 grade OPC).
- iii) Aggregates : IS 383-1970.
- iv) Steel Reinforcement : IS 1786

2.0 **CEMENT:** Supply and usage of cement shall be as per the IRU standard specifications (Formation works, Bridge works and P.Way works), 2021 for S.C.Railway IRUSSR 2021 & CPWD specifications, 2019 for DSR 2021.

2.1 The cement shall conform to the specifications of ordinary port land cement as per the site requirement and as approved by the Engineer-in-charge.

2.2 In addition to conforming to IS specifications as detailed above, the contractor(s) shall procure Cement from the reputed cement companies/brands but not cement manufactured by minor cement plants. The make should be approved by the Railways.

2.3 The contractor should submit the bill of purchase of cement to the Railways for Verification and record. Contractor shall also submit attest certificate issued by the manufacturer for standard properties of cement for verification & record.

2.4 Occasionally Cement has to be got tested from in house labs or site lab established under provisions of the contractor National Test House or Government Engineering Colleges/NITs/IITs. In exceptional cases when (i) there are no in-house facilities or site-lab for testing and National Test house nearby and (ii) Govt. Engineering Colleges may take longer time causing undue delay in the progress of project, any nearest NABL accredited laboratory having scope and validity of accreditation may be used for periodic testing of cement during execution. However, Tests required for initial acceptance of material or design shall be done in any of the In house labs or site lab established under provisions of the contract National Test House or Government Engineering Colleges/NITs/IITs, and as per the directions of Engineer-in-charge and submit the report. Charges for such tests shall be borne by the contractor. Further in this regard instructions issued by Dy.CE/Works/ HQ vide letter No. SCR-HQENGG (SOR)/21/2019 dated 8.12.20 to be followed.

**2.5 Storage of cement:**

2.5.1 The contractor shall make his own arrangements for storage of cement and other materials and see that no damage takes place during storage. The storage of cement should conform to standard height in a column to avoid damage during storage.

2.5.2 The Railway reserves the right to inspect the storage accommodation of the contractor and to reject in the event of any clotted cement is noticed or any other cement which is not suitable for usage of work and not conforming to the specifications and no compensation will be made for the loss if any sustained by contractor on this account. A ledger shall be maintained at site showing the quantities of cement procured, date wise consumption, and balance available at site. These Ledgers are to be jointly signed by the JE/ SE/Works at site and contractor/his representative.

**2.6 CONSUMPTION/USAGE OF CEMENT:**

2.6.1 The contractor shall take all precaution for effective usage of cement between the period of procurement and period of usage without losing any strength of cement.

2.6.2 The contractor shall ensure the consumption of cement specified under each item of work correctly. No sub-standard work on this account shall be permitted. If for any item of work at any stage, the Railway finds that less consumption were effected, such item of work will be rejected and cost of removal of such items of work, and re-doing the same shall be borne by the contractor. The decision of the Engineer in charge in this regard is final & binding on the

contractor. No claims will be entertained on this account. Cement when brought to work site shall not be more than 6 weeks old from the date of manufacture.

- 2.6.3 Cement should be consumed within 3 months from the date of manufacture, if due to any reasons it is not possible to use the cement within 3 months then it should be tested and if found fit then it may be permitted to use in the lean concrete or other unimportant items of work. However, cement older than 6 months should not be allowed to use in any type of works.

## 2.7 PAYMENT FOR CONTRACTOR'S CEMENT:

- 2.7.1 For IRUSSR, 2021 items involving cement consumption as per description of item, payment for the supply of cement will be paid under relevant IRUSSR 2021 item of supply of cement incorporated as separate schedule. Payment for above item will be made on the basis of actual consumption in the item/as per approved design mix as applicable and no advance payment will be made on procurement of cement. No extra payment will be made for wastage.

- 2.7.2 For DSR 2021 items involving cement consumption as per description of item, no extra payment for the supply of cement will be made and the rates are inclusive of supply and usage of cement.

- 3.0 **AGGREGATES:** Shall be as per the IRU standard specifications for formation works, Bridge works, and P.Way works, 2021 & CPWD specifications, 2019 for DSR 2021, IR concrete Bridge code.

- 3.1 Aggregate shall consist of naturally occurring stones, gravel & sand. They shall be hard, strong, dense, durable, clear, and free from injurious amounts of disintegrated pieces, alkali, vegetable matter, and other deleterious substances.

- 3.2 Materials for concrete such as granite stone metal, sand, etc., should also be collected from outside Railways land and the Contractor shall pay all seigniorage charges.

- 3.3 Aggregate shall not contain any harmful material such as pyrites, coal, lignite, mica, shale or similar laminated material.

- 4.0 **COARSE AGGREGATE** shall be as per the IRU standard specifications for formation works, Bridge works, and P. Way works, 2021 & CPWD specifications, 2019 for DSR, 2021.

- 4.1 Limestone, quartz and shale is not acceptable for concrete or masonry work. The contractor will have to use hard granite/ basalt stone aggregate for RCC, PSC works and other concrete items and quote the rates accordingly. Occasionally aggregate has to be got tested from "In house" labs or site lab established under provisions of the contract or National Test House or Government Engineering Colleges/NITs/IITs. In exceptional cases when (i) there is no in-house facilities or site-lab for testing and National Test house nearby and (ii) Govt. Engineering Colleges may take longer time causing undue delay in the progress of project, any nearest NABL accredited laboratory having scope and validity of accreditation may be used for periodic testing of aggregate during execution. However Tests required for initial acceptance of material or design shall be done in any of the "In house" labs or site lab established under provisions of the contractor National Test House or Government Engineering Colleges/NITs/IITs and as per the directions of Engineer-in-charge for chloride, Sulphates, abrasion, impact value and water absorption and submit the report. Charges for such tests shall be borne by the contractor. The tests are to be conducted at every stage of change in quarry besides occasional tests as ordered by the engineer or his representative. . Charges for such tests shall be borne by the agency. Further in this regard instructions issued by Dy.CE/Works/HQ vide letter no. SCR-HQ ENGG (SOR) / 21/2019 dt.08.12.20 to be followed.

- 5.0 **FINE AGGREGATE:** Shall be as per the IRU Standard Specifications for formation works, Bridge works, and P.Way works, 2021 & CPWD specifications, 2019 for DSR, 2021.

- 5.1 Fine aggregate shall be of approved quality and grading to IS 383, IS 456 & IS 1343 standards. It shall be clean, sharp, angular, and gritty to touch and composed of hard siliceous material. It should also be free from impurities & deleterious substances.

- 5.2 FA grading shall fall within the limits of grading Zone I, II & III as per IS 383. The decision of Engineer in charge shall be final and binding on the contract or regarding the approval of the coarse and fine aggregate for concreting works.

- 5.3 The contractor shall be required to carry out weighing and sieving aggregates, if directed by Engineer in charge and all cost shall be borne by the Contractor.
- 6.0 **CONCRETE WORKS:** Shall be as per IRU Standard Specification for formation works, Bridge works, and P.Way works, 2021 & CPWD specifications, 2019 for DSR, 2021, IR concrete Bridge Code.
- 6.1 **SUPPLY OF RMC:**
- a) In case the total quantity of RCC/PSC/CC/MCC involved is significant (say 15,000Cum or more) the Contractor shall preferably set up his own RMC plant at site or shall make suitable exclusive arrangement close to the site to ensure high quality RMC supply.
  - b) Use of RMC shall also be mandatory in the work where substantial quantity (say 500Cum or more) of RCC/PSC/CC/MCC is involved and work site is located in Urban areas and RMC plants are readily available nearby.
  - c) The specification for RMC shall confirm to IS 4926-2003 as well as IRU Standard Specifications, for formation works, Bridge works and P.Way works, 2021 & CPWD specifications, 2019 for DSR, 2021.
  - d) The RMC plant shall be inspected and approved by concerned Dy.CE/C. The accepted rates of items of RCC/PSC/CC/MCC shall be deemed to be for RMC. Nothing extra will be payable for RMC in the Contract of work. However, if RMC is not feasible in certain isolated portion of work, then conventional concreting can be allowed by Engineer-in-charge in such isolated locations/portions with the same rates.
- 6.2 Concrete required for all works shall be machine mixed using weigh batches. Hand mixing will not be permitted. The Contractor should keep vibrators of 25mm needle for jacketing work and 40mm needle for concrete work. Standby needles and vibrators should be kept. During the course of concrete work if vibrator is not working the work shall be stopped.
- 6.3 The materials proposed to be used for the work should pass tests/analysis as prescribed in relevant IS/ IRS codes & manuals. An approval given by the Railway in consequences of such tests or analysis shall limit or interfere with the absolute Right of the Railway to reject the whole or portions of such materials supplied which, in the judgment of the Railway do not comply with the specifications. The decision of the Railway in this regard shall be final and conclusive for all purposes.
- 6.4 The contractor shall prepare at his own cost, standard cubes of concrete at specified intervals during concreting operations under the supervision of the Engineer or his authorized representatives and submit the same to the Railway for testing and approval. Contractor should arrange equipment for testing of concrete cubes at site. Based on the discretion of Engineer –in –charge certain cubes shall be got tested from In house labs or site lab established under provisions of the contract or National Test House or Government Engineering Colleges/NITs /IITs. In exceptional cases when (i) there is no in-house facilities or site-lab for testing and National Test house nearby and (ii) Govt. Engineering Colleges may take longer time causing undue delay in the progress of project, any nearest NABL accredited laboratory having scope and validity of accreditation may be used for periodic testing of concrete cubes during execution. However Tests required for initial acceptance of material or design shall be done in any of the “In house” labs or site lab established under provisions of the Contractor National Test House or Government Engineering Colleges/NITs/IITs and as per the directions of Engineer- in – charge. Charges for such tests shall be borne by the agency further in this regard instructions issued by Dy CE/Works/HQ vide letter no. SCR-HQENGG (SOR)/21/2019 dt. 08.12.20 to be followed.
- 6.5 While executing all concrete works below sub-soil water level the foundation pit must be kept free of all seepage water by bailing or pumping or in any other manner. The rates adopted for concrete items below bed/ground level are inclusive of the charges.
- 6.6 As this work is located in “Moderate” category of environment, the minimum cementations material content in concrete structures shall be as given below and the actual consumption of cement depends upon the requirement as per design mix.

Plain concrete --240 Kgs. per cum of concrete.

R.C.C. –300Kgs. per cum of concrete.

PSC - 400 Kgs. per cum of concrete.

In all cases, the maximum content of cementations material shall not be more than 500 kgs. per cum of concrete.

- 6.7 For under water concrete 10% extra cement should be added over and above the normal cement content of the concrete mix specified above. For SSR items the cement consumption shall be as specified in the USSR, for formation works, Bridge works, and P.Way works, 2021 & CPWD specifications 2019 for DSR 2021.
- 6.8 **DESIGN MIX:** Nominal mix concrete shall be permitted for concretes of M-20 and lower. For all other grades design mix concrete shall be used. All the concrete mixes richer than M-20 specified in the schedule of items for various works shall be designed by conducting tests on raw materials such as aggregate, sand and cement on strength criteria only. The contractor has to submit the design for design mix concrete “In house” labs or site lab established under provisions of the contractor National Test House or Government Engineering Colleges/NITs/IITs. In exceptional cases when (i) there is no in-house facilities or site-lab for testing and National Test house nearby and (ii) Govt. Engineering Colleges may take longer time causing undue delay in the progress of project, any nearest NABL accredited laboratory having scope and validity of accreditation maybe used for periodic testing of design mix during execution. However Tests required for initial acceptance of material or design shall be done in any of the “In house” labs or site lab established under provisions of the contract or National Test House or Government Engineering Colleges/NITs/IITs, and as per directions of Engineer in-charge. Charges for such tests shall be borne by the agency. Further in this regard instructions issued by Dy CE/Works/HQ vide letter no. SCR-HQ.ENGG(SOR)/21/2019 dated 08.12.20 to be followed. Designing of concrete mix shall confirm to IS 10262. These design mixes will be approved by Engineer-in-charge before commencement of concrete works, only after conducting tests and sample test cubes cast as per design mix with the ingredients available at work spot and intended to be used in the works. Minimum and maximum cement content in the design must be as per Indian Railway concrete Bridge code, read along with all relevant correction slips issued up to date.
- 6.9 All the concrete works shall be done only in the presence of the SSE/JE/Work. The programme/ planning of the concrete works shall be submitted to XEN/AXEN well in advance so as to direct SSE/JE/Works for witnessing the same.
- 7.0 **Curing:** shall be done as per IRU Standard specification for formation works, Bridge works, and P.Way works, 2021 & CPWD specifications, 2019 for DSR, 2021, IR concrete bridge code.
- 7.1 All concrete work in cement, mortar/plaster pointing etc., shall be continuously cured for the prescribed period as per direction of the Engineer. Curing shall be done by covering the newly laid concrete with gunny bags and keeping them wet constantly .If it is found that the contractor is not properly observing these instructions, the Engineer may undertake the curing through another Agency/ labor without any notice to the Contractor at the cost of the contractor. The cost incurred along with incidental charges @ 2% and along with supervision charges 12.5%of the cost will be debited to the Contractor. Intimation of the employment of another agency, for curing will be given to the Contractor as soon as possible. This intimation in writing to the Contractor under the head of the Engineer-in-charge of the work shall be conclusive evidence of the employment of another agency.
- 8.0 **USE OF SAND COLLECTED FROM THE WATER COURSES WITH IN RAILWAY LAND:**  
If the sand available in the river bed water course with in the Railway land, and if it is found suitable for the works, the contractor can collect the sand from the area within the Railway boundary and utilize the same for the works. The Railway will not levy any charges for sand so collected for the work within the Railway boundary. However, seignior age charges if any payable to state or local authorities shall be borne by the Contractor. The tenderer shall take

these aspects in to account while quoting the rates. The location of the borrow pits for collection of sand within the Railway area should be approved by Engineer-in-charge.

- 9.0 **SHUTTERING ARRANGMENTS:** shall be executed as per IRU Standard specification-for formation works, Bridge works, and P.Way works, 2021 & CPWD specifications, 2019 for DSR, 2021, IR concrete bridge code.
- 10.0 **SUPPLY, FABRICATION AND ERECTION OF STEEL WORK:** Supply and placement of reinforcement steel and supply, fabrication and erection of structural steel shall be as per IRU Standard specifications (Formation works, Bridge works and P.Way works), 2021 for S.C. Rly's IRUSSR, 2021 & CPWD specifications, 2019 for DSR, 2021, IR concrete Bridge code.
- 10.1 For works under this contract, the contractor is required to use own steel for reinforcement. Payment for supply of reinforcement steel in MCC / RCC/PSC items will be made under respective Schedule.
- 10.2 The Contractor is required to safeguard the steel and use the same on the work in accordance with the actual requirement as approved by the Engineer and as may be indicated in the relevant drawings or specifications.
- 10.3 The Railway reserves the right to inspect the storage yard of the contractor, where the steel materials are stored and take samples wherever considered necessary, got them tested by agency for Physical & Mechanical properties, chemical composition as directed by the Engineer-in-charge from "In house" labs or site lab established under provisions of the contract or National Test House or Government Engineering Colleges/NITs/IITs. In exceptional cases when (i) there is no in-house facilities or site-lab for testing and National Test house nearby and (ii) Govt. Engineering Colleges may take longer time causing undue delay in the progress of project, any nearest NABL accredited laboratory having scope and validity of accreditation may be used for periodic testing of steel during execution. However, tests required for initial acceptance of material or design shall be done in any of the "In house" labs or site lab established under provisions of the contractor National Test House or Government Engineering Colleges/NITs/IITs and as per the directions of Engineer-in-charge and submit the report. Charges for such tests shall be borne by the contractor. Further in this regard instructions issued by Dy.CE/Works/HQ vide letter no. SCR-HQENGG (SOR)/21/2019 dt. 08.12.20 to be followed".
- 10.4 If the steel is found to be not confirming to relevant IS 1786 and IS: 2062 provisions, the entire steel lot represented by the tested sample will be rejected. The contractor shall not use any such reinforcement & will lift them from site at his own expenses. The contractor cannot claim in such an event any losses, damages, expenditure incurred by him and Railway shall not entertain any claim on this account.
- 10.5 The payment for the steel reinforcement will be made on bar bending schedule and the quantity shall be arrived by converting the lengths into weight based on sectional weight. While working out the quantity consumed, the overlaps, hooks, bends, chains will be taken into account. If there is any wastage, it shall be to the contractor's account. The item for placement of reinforcement steel is provided with cost of binding wire.
- 10.6 All Reinforcement Steel (TMT Bars) and Structural Steel shall be procured as per specifications mentioned in BIS"s documents – IS: 1786 and IS: 2062 respectively. Independent tests shall be conducted, wherever required, to ensure that the materials procured conform to the specifications. The Contractor shall submit a bill copy along with manufacturer's test certificate at the time of supply of material.
- 10.6.1 The reinforcement steel and structural steel shall be procured from the following firms, circulated as per sl.no.4 & 39 vide PCE/SC's office letter No.SCR-HQ0ENGG (SOR)/1/2020- Dy.CE/WORKS/SCR dt.06.03.2020, which are Established, Reliable, Indigenous & Primary Producers of Steel, having Integrated Steel Plants (ISP), using iron ore as the basic raw material and having in-house iron rolling facilities, followed by production of liquid steel and crude steel, as per Ministry of Steel guidelines.

S.No.	Brand	Make
1	SAIL	Steel Authority of India Ltd
2	VIZAG	Rastriya Ispat Nigam Ltd
3	TISCO	TATA Steel Ltd
4	JSW	JSW Steel Ltd
5	JSPL	JINDAL Steel & Power Ltd.

- 10.6.2 **The Brands/Makes for the materials used in works shall be as per the approved list (except item no.11 & 12 i.e. RMC concrete & AAC blocks) circulated by PCE/SC office vide letter no.SCR-HQ0ENGG (SOR)/1/2020-Dy.CE/WORKS/SCR dt.26.02.2026 for all materials except item no.11 & 12 i.e. RMC concrete & AAC blocks.**
- 10.6.3 However, only certain isolated sections of structural steel, not being rolled by ISPs, can be procured from the authorized re-rollers of ISPs or authorized licensee of BIS having traceability system and who use billets produced by ISPs. The traceability of the material shall be ensured by an officer authorized by the concerned CE/C on case to case basis for this purpose.
- 11.0 **Special Note:** The following notes shall be applicable for the operation of IRUSSR items to avoid ambiguity at the time of execution:
- 11.1 Note:  
**In case of deduction item for 40 mm available in the schedule**  
 IRUSSR Item No. 022040, 022051 & 022052 for concrete work proposed are with 20mm graded stone aggregate. In case these items are operated with 40mm graded stone aggregate, corresponding deduction will be made as per item No.025012 as provided in the relevant schedule.
- OR**
- In the absence of deduction item for 40 mm:**  
 IRUSSR Item No. 022040, 022051 & 022052 for concrete work proposed are with 20mm graded stone aggregate. In case these items are operated with 40mm graded stone aggregate, corresponding deduction will be made by operating IRUSSR item No.025012 through the LS provision for IRUSSR items provided.
- If plasticizer has not been used in Design Mix Concrete of any grade as per approved mix design, necessary deduction for not using plasticizer in approved proportions (as per IS:9103) for any grade of Design Mix Concrete will be made as per item no.025011 as provided in the relevant schedule.
- 11.2 **Notes for Structural steel work:**  
 Note for **DSR Item 10.2:** Purlins and wind bracings shall be paid separately under **DSR item 10.1,**  
 Note for items **DSR Item No.10.1 & 10.2:** These rates are not to be paid for iron work with rails, which should be paid under each item separately.
- 12.0 **DRILLING OF HOLES AND PROVIDING ANCHOR RODS:**  
 If the foundations are to be laid on the rock bed met in the river bed anchoring the rock surface by providing anchor rods of 25mm diameter MS/HYSD bars of suitable lengths at intervals as per the drawings. 40mm diameter of holes are required to be drilled for this purpose at the bottom of foundation level to suitable depths at required spacing as per approved drawing and the anchor rods of 25mm diameter should be fixed with contractor's cement capsules. The other end of the rod should be made bent suitably and buried in the foundation concrete for the bonding.
- 13.0 **TRANSPORTATION AND STORAGE OF PRECAST UNITS:**
- 13.1 Pre-cast Girders/slabs shall be transported in an upright position, and points of support and the direction of reactions during transportation and storage as when the same is in its final position.

- 13.2 When Pre-cast Girders/ Slabs are to be stored, they shall be firmly supported at such bearing positions as will ensure that the stresses induced in them are always less than the permissible design stresses. Care shall be taken during storage, hoisting and handling of the pre-cast units to prevent their cracking or being damaged. Units damaged by improper to ring or handling shall be replaced by the Contractor at his cost.
- 14.0 **LAUNCHING OF PSC SLABS/ PRE-CAST RCC BALLAST RETAINERS:**  
Launching the PSC slabs/Pre-Cast RCC ballast retainers shall be carried out as per the programme submitted by the contractor. Skilled men, tools, plant and machinery required for launching of slab shall be arranged by the contractor at his cost. A scheme of launching/ erection of pre stressed slabs should be briefly indicated along with the tender. The successful tender shall submit detailed scheme of launching/ erection of slabs with the drawings and calculations for the approval from the office of the Chief Administrative Officer/ Construction. The scheme of launching of PSC slabs / Pre-Cast RCC ballast retainers shall be approved by the Railway before commencement of the work, if launching is carried out by the road cranes, temporary road/ path way required for the movement of crane and road vehicles for launching of slabs shall be borne by the contractor.
- 14.1 The contractor shall carry out non-destructive tests on the spans as per the method of test submitted by contractor and approved by Railways. The rates adopted for initial test on one span and subsequent tests are deemed to include the charges for repeating the tests, in case, if the recovery of deflection is less than 85% within 24 hours of removal of the load. The Railway will supply rails, for this purpose of test to the extent available at the stores depots/mid-section in S C Railway at free of hire charges.

**ANNEXURE**  
**SPECIAL CONDITIONS FOR SUBMISSION OF DETAILED DESIGNS AND DRAWINGS**  
**INCLUDING PROOF CHECKING.**

- 1 The Detailed design and drawings prepared by the reputed consultants in Structural Engineering should be submitted duly proof checked by IITs/ NIT / Government College of Engineering / Deemed Universities.

All the firms / institutions making Design / Proof check shall follow the conditions given below :

**The Scope of Work for the Design Consultants:**

- I. Design of and preparation of working drawings for:
  - a. Box culverts with or without box pushing technique
  - b. Substructure of Railway/Highway bridges
  - c. Superstructure of Steel, PSC, RCC & Composite/Bow string steel girder construction (Rail/Road),
  - d. Important station, residential and industrial buildings.

All the above works should be done in consultation with officers of South Central Railway, incorporating all relevant codal provisions, safety requirements for safe and economic design of bridges and buildings with proper specifications for various works and construction methodology, temporary works and preparation of relevant working drawings, including discussions at Secunderabad, site or any other location.
2. All the designs, drawings, schemes & methodology shall be scrutinized and certified by the authorized and competent design engineer/s as per applicable latest codal provisions and relevant specifications and include:
  - a. Submission of designs and drawings may be required in stages.
  - b. Conduct Design Alternatives on the conceptual design provided in the contract package using principles for cost-effective designs. The conceptual design can be a General Arrangement Drawing showing the tentative layout or any other document presented by the Railway.
  - c. Perform detailed designs of structures (Superstructure, substructure, foundation, expansion joints, bearings & Seismic restrainers etc.) considering all load combinations including earthquake, wind, erection and other loads, as per prevailing IR/IRC/BIS and other Codes.
  - d. Various codes and manuals in order of preference: The List of various codes and manuals to be adopted for the design shall be as provided in the drawings given and provisions in the contract agreement for the particular work. Wherever such codal provisions are not available, DDC shall use sound engineering practices and provide the complete logic for using the practice.
  - e. Prepare the detailed design document which can be easily understood by the approving authority i.e. the Railway. For this purpose, the design shall be comprehensive with full sequence of the steps with design formulae used and relevant codal provisions brought out.
  - f. Manage the design task for cost, schedule and performance compliance.
  - g. Incorporate and co-ordinate changes in design due to system wide interfacing.
  - h. Incorporate changes in design resulting from the Railway's/approved proof consultant's design reviews.
  - i. Plan, design, detail, control, co-ordinate, and execute the design phase of the

Works for production of drawings, documents and reports to meet the key schedule date included in the Agreement and as directed by the Railway.

- j. Prepare and submit a Design Quality Control Plan to the Railway, wherever required, for approval;
- k. Maintain a Quality Control activity and an effective internal procedure for checking the accuracy of Work and assuring compliance with contract requirements;
- l. Attend all meetings and prepare reports, notes and other documents of whatever nature required during the course of the work;
- m. Proof checking of designs and drawings shall be done by the Railway or any person/entity so authorised by the Railway.
- n. Maintain a qualified design and drafting team for engineering services to prepare bar bending schedules, shop and working drawings for the Works for compliance with the design requirements and contract documents; to prepare supplemental reports, calculations, recommendations, etc. or modify existing drawings as necessary to incorporate system wise requirements and unforeseen conditions
- o. Providing solutions to the various problems during construction raised by the field engineers

1. The various details to be given in general for each type of design include, but are not limited to, the following:

a. **Details to be given in Steel design for bridges:**

- i. Detailed design booklet and soft copy of design as per conditions of contract
- ii. Detailed drawing for each joint, bearing etc
- iii. General arrangement drawing and Detailed drawing for compression or tension members and bracings
- iv. Fabrication drawings; temporary arrangement drawings and execution drawings, where required.
- v. Details of Shear Connectors and RCC Slab in case of Composite construction
- vi. Details for load testing, where involved
- vii. Detailed drawing for foundation and sub-structure, where design of sub-structure is involved

b. **PSC design and RCC design for bridges:**

- i. Super- structure design for all components- booklet and soft copy of calculations as per contract conditions
- ii. Super- structure general arrangement- drawing
- iii. Details of bearings - drawing
- iv. Details of cable profile & prestressing details-drawing
- v. Reinforcement details of deck slab-drawing.
- vi. Reinforcement details of girder and diaphragm –drawing along with bar bending schedule.
- vii. Detailed drawing for foundation and sub-structure, where design of sub-structure is involved
- viii. Design and detailed drawing for load test.

c. **Details to be given in Steel design for industrial buildings and other structures:**

- i) Detailed design booklet and soft copy of design as per conditions of contract

- ii) Detailed drawing for each joint, support etc
- iii) General arrangement drawing and Detailed drawing for compression or tension members and bracings
- iv) Fabrication drawings and execution drawings, where required.
- v) Detailed drawings for foundations

**d. Details to be given in RCC design for buildings:**

- i. Detailed design booklet and soft copy of design
- ii. Foundation, columns arrangement drawing Beams, slabs and column drawings along with reinforcement details and bar bending schedule. Staircase and/ or lift well drawing, where involved.
- iii. Any other relevant design/drawing required for all the above structures.
- iv. The design/drawing shall be submitted within 20 days after design task is assigned and within 10 days after correction is suggested by railway/ authorised proof check consultant.
- v. Attending the meetings with South Central Railway officers and Proof check Consultant at Secunderabad as and when required as per the decision of Engineer in Charge in connection with the above work. Liaison with the proof check consultant for expeditious finalization of the designs and drawings.

**2.0 The scope of work for Proof Checking includes the following:**

- 2.1 Proof checking of designs and drawings, in consultation with officers of South Central Railway, for incorporation of all relevant codal provisions, safety requirements for safe and economic design of bridges and buildings with proper specifications for various works and construction methodology including discussions at Secunderabad, or any other location as required on item rate basis as per the schedule of items given.
- 2.2. Proof checking involves checking of all designs and working drawings prepared by the design consultant of the required structure for substructure and superstructure, construction scheme and methodology, temporary works etc and submitting consolidated reports regarding the correctness and acceptability of the design, expert comments with relevant copies of codal provisions, specifications etc complete. All the design reports, drawings, schemes & methodology shall be scrutinized and certified by the authorized and competent design engineer/s as per applicable codal provisions and relevant specifications. Designs and drawings may be required to be proof checked in stages as and when submitted by Design Consultant.
- 2.3. The proof check consultant is required to check the design submitted by the Design Consultant for the steel, PSC, RCC & composite bridges and other structures. A comparison statement bringing out the design details carried out by Design Consultant shall be submitted along with the report. Any design criteria given by the Railways shall be considered in this regard.
- 2.4 Attending the meetings with South Central Railway officers and Design Consultant at Secunderabad as and when required as per the decision of Engineer in Charge in connection with the above work. Liaison with the design consultant for expeditious finalization of the designs and drawings.
- 2.5 The proof check of the designs, drawings & schemes above, has to be completed within 15 days from the day of handing over of the design papers. Initial report shall be submitted within 7 days and final report within 15 days. The

report shall be complete, bringing out all details, procedure, checks, codal provisions compliance, with proper recommendations for approval by the Railway. A soft copy of the same shall also be submitted.

### **3.0 Design Criteria for bridges and buildings:**

**3.1** Where standard designs for the super-structure are available, the same shall be followed for the work. The availability/ non-availability of the standard drawings shall be got confirmed by the contractor, in writing from the Railway. Any designs shall be submitted by the Contractor only after a written instruction/ confirmation to this effect, that the designs are not available, from the in-charge Dy.CE/Construction of the work. In the absence of the above, the contractor shall have no claim against such designs/drawings submitted.

**3.2** The designs and drawings, where required, are to be got done by Design Consultant and then proof checked as per the latest instructions. The design shall satisfy all the safety and serviceability conditions under various stages of loading. Where the codes provide for Limit state method of design, the same shall be followed. The designs and drawings shall be made according to the conditions and relevant codes mentioned in the General Arrangement Drawings supplied by the railway for the work. Where any relevant code is not mentioned in the General Arrangement Drawings, the designs and drawings shall conform to the codes and specifications mentioned hereunder for various types of structures. Where any provision in General Arrangement Drawings differs from that in the codes mentioned hereunder, the former shall prevail.

### **3.3 Scope of design**

**3.3.1** Bridges – super-structure: It involves design of Railway and Highway bridges as the case may be, with reference to relevant codes referred. The scope of design of super-structure of a bridge includes the structural Analysis & Designs of Super structure including Bearings with pedestals, expansion joints, crash barriers (in case of ROBs), shear connectors (in case if composite girders), erection scheme, temporary arrangements, load test etc. Where designs/drawings are already available for superstructure, contractor can follow the same. In case of non- standard design, super-structure design shall be got done by an approved Design Consultant.

**3.3.2** Bridges – sub-structure: The design of sub-structure of a bridge includes that of Foundations including load test where required, Piers/Abutments, trestle beams and bed blocks and any temporary arrangements. Where standard designs and drawings are available with Railway for the super-structure, design for the substructure needs to be done considering the super-structure drawings.

**3.3.3** **RCC structures:** The scope of design includes residential building, office and other buildings, water tanks and other structures and includes the structural analysis and Design of all the elements of the structure.

**3.3.4** **Steel structures:** The scope of design includes Industrial buildings like workshops, Platform shelters, water tanks and other structures and includes the structural analysis and Design of all the elements of the structure.

### **4.0 The design considerations:**

**4.1** **Railway bridges and RUBs:** Unless otherwise mentioned, the bridges carrying

Railway loading shall be designed for 25Ton/ 32.5Ton loading standard as per the Indian Railway Bridge Rules and & other relevant codes and as mentioned in the General Arrangement drawing.

**4.2 Highway bridges (ROBs):** Unless otherwise mentioned, the bridges carrying Highway loading shall be designed for Class A/70R loading as per IRC-6: Standard specifications and Code of practice for Road Bridges - Section-II – Loads & stresses and other relevant codes.

**4.3 Buildings - RCC:** These shall be designed as per IS-456 -2000 and loading standards of IS-875 and other relevant codes.

**4.4 Buildings and other structures- Steel:** These shall be designed as per IS-800- 2007 and loading standards of IS-875 and other relevant codes.

**4.5** For the all codes and specifications mentioned above, reference shall be made only to latest editions of codes with upto date correction slips.

**5.0 Earth quake, wind and other loads:**

**5.1** The design shall cater for the earthquake, wind, erection and other loads as per the relevant codal provisions. Any additional loads specially given shall also be considered.

**6.0 Design and detailing:**

**6.1** The design calculations shall be self-explanatory giving the relevant formulae, references to latest standard codes and clauses. Non-standard references and assumptions will not be accepted. Where codes provide for SI units, the same shall be used in the calculations. Where codes provide for SI units, the same shall be used in the design.

**6.2** In case of structures with concrete, the complete reinforcement details including bar bending schedule and quantities of steel of various categories/dimensions shall be given, along with the other working drawings. In the case of structures with steel the fabrication and connection drawings shall also be given.

**6.3** Computerized analysis using software like Staad Pro shall be made. Where required (like in skew bridges), 2D/3D analysis shall be made.

**6.4** Two copies of the designs and drawings along with a soft copy shall be submitted to the Railway, which will be proof checked by the Railway or its nominee. The design consultant shall attend the office, when called upon, for any clarifications required by the Railway. Any deficiencies noticed and corrections advised shall be made good and resubmitted for final approval. After the final approval, one copy of the final detailed design and the detailed drawings on tracing paper shall be submitted to the Railway for final approval.

**6.5** The designs and drawings shall be signed along with name and stamp of the designer, proof checker.

**6.6** The designs and drawings submitted shall remain the property of the Railway and Railway shall have full rights over them.

**6.7** The contractor/ Design consultant shall attend the office of the Chief Administrative Officer/Construction/Secunderabad whenever called for any clarifications regarding the Designs/Drawing submitted.

**7.0 CODES AND SPECIFICATION:**

The following codes and specifications shall apply for the various types of designs and drawings:

1. South Central Railway Engineering Department General conditions of contract and instructions to tenderers and Standard Form of Contract,

2. South Central Railway Engineering Department I R U Standard Specifications for material and works, 2021 for S.C.Railway IRUSSR, 2021 with errata and correction slips up to date.
3. CPWD's DSR-2021 with errata and correction slip up to date.
4. I.R.S. Code of practice for plain concrete construction, 1982.
5. I.R.S. Code of practice for electric welding of mild steel structures.
6. Indian Railway Code of Practice of Plain/Reinforced and prestressed concrete for general/bridge construction (Concrete bridge Code adopted in 1936 revised in 1962 and May, 1982 latest revision and all latest correction slips) including supplemental measures as incorporated in Correction Slip No. 20 dated 20.3.89.
7. Indian Railway Bridge Rules, specifying the loads for Design of Superstructure and substructure of Bridge including chapter-VII for the rule for the opening of Railway adopted in 1941 – Revised - August, 1982 incorporating up-to-date corrections slips including RDSO letter No. CSB/PBR/RCS, dated 31/12/87 (herein after referred to as the bridge rules).
8. Indian Railway Standard (IRS) Bridge sub-structure and foundations code - code of practice for the design of the substructure and foundation of Bridges adopted 1936 – Revised – 1985 (Hereinafter referred to as “Substructure Code”) – with up to date correction slip.
9. Indian Railways Schedule of dimensions for Broad Gauge.
10. IRS: Welded Bridge Code for steel bridge girders, 2001.
11. IRS: Fabrication and Erection of Steel Girder Bridges & Locomotive Turn Tables. (B1-2001)
12. IRS: Erection and Riveting of Bridge Girders (B2-1979)
13. IRS: Specification for Steel Bridge code Revised 1962
14. Indian Railways Bridge Manual, 1998
15. Indian Railways P. Way Manual.
16. Indian Railways Works Manual.

### **INDIAN ROADS CONGRESS CODES AND SPECIFICATIONS.**

1. IRC-5: Standard specifications and Code of practice for Road Bridges -Section-I – General features of design.
2. IRC-6: Standard specifications and Code of practice for Road Bridges -Section-II – Loads & stresses.
3. IRC-18: Design Criteria for Prestressed Concrete Road Bridges (Post-Tensioned Concrete) (Third Revision)
4. IRC-21: Standard specifications and Code of practice for Road Bridges - Section-III - Cement concrete (Plain & reinforced)
5. IRC-22: Standard Specifications and Code of Practice for Road Bridges, Section VI – Composite Construction (First Revision)
6. IRC-24: Standard specifications and Code of practice for Road Bridges - Section-V- Steel Road Bridges.
7. IRC-83: Bearings for bridges.
8. IRC-78: Road Bridges.
9. IRC-87: Design and erection of false work for road bridges.

### **INDIAN STANDARDS CODES & SPECIFICATIONS:**

1. IS: 34 – White lead for paints.
2. IS: 57 – Red lead for paints and other purposes

3. IS: 75 – Linseed oil, raw and refined
4. IS: 77 – Linseed oil, boiled for paints
5. IS: 102 – Ready mixed paints, brushing, red lead, non-settling, priming
6. IS: 104 – Ready mixed paint, brushing, zinc chrome, priming
7. IS: 123 – Ready mixed paints, brushing, finishing, semi-gloss, for general purposes to Indian Colours etc.
8. IS: 280 – Mild steel wire for general engineering purposes
9. IS: 383 – Coarse and fine aggregates from natural sources for concrete
10. IS: 456 – Plain and reinforced concrete
11. IS: 487 – Brush, paint and varnish
12. IS: 516 – Method of test for strength of concrete
13. IS: 786 – Conversion factors and conversion tables
14. IS: 800 – General construction in steel
15. IS: 814 – Covered electrodes for manual metal arc welding
16. IS: 816 – Metal arc welding for general construction in mild steel
17. IS: 817 – Training and testing of metal arc welders
18. IS: 819 – Resistance spot welding for light assemblies in mild steel
19. IS: 875 (all 5 parts) – design loads (other than earthquakes) for buildings and structures
20. IS: 883 – Design of structural timber in buildings
21. IS: 887 – Animal tallow
22. IS: 1024 – Welding in bridges and structures subject to dynamic loading
23. IS: 1030 – Carbon steel castings for general engineering purposes
24. IS: 1148 – Hot rolled rivet bars ( up to 40mm dia) for structural purposes
25. IS: 1149 – High tensile steel rivet bars for structural purposes
26. IS: 1182 – Radiographic examination of butt joints in steel plates
27. IS: 1200 (all relevant parts) – Method of measurement of building and civil engineering works
28. IS: 1261 - Seam welding in mild steel
29. IS: 1270 – Metric steel tape measure
30. IS: 1323 - Oxy-acetylene welding for structural work in mild steel
31. IS: 1363 (all 3 parts) – Hexagon head bolts, screws and nuts of product grade C
32. IS: 1367 (all 20 parts) – Threaded steel fasteners
33. IS: 1786 - High strength deformed steel bars & wires for concrete reinforcement
34. IS: 1791 – Batch type concrete mixers
35. IS: 1852 - Rolling and cutting tolerances for hot rolled steel products
36. IS: 1892 – Subsurface investigations for foundations
37. IS: 1893 : 1984, 2002 – Earthquake resistant design of structures
38. IS: 1929 – Hot forged steel rivets for hot closing (12 to 36 mm dia)
39. IS: 2004 – Carbon steel forgings for general engineering purposes
40. IS: 2062 – Steel for general structural purposes
41. IS: 2074 - Ready mixed paint, air drying, red oxide-zinc chrome, priming
42. IS: 2131 – Standard penetration test for soils
43. IS: 2132 – Thin walled tube sampling of soils
44. IS: 2339 – Aluminum paints for general purposes, in dual container
45. IS: 2386 (all 8 parts) – Tests for aggregates for concrete
46. IS: 2595 – Radiographic testing
47. IS: 2629 - Hot Dip Galvanize

48. IS: 2633 – Methods of testing Uniformity of coating
49. IS: 2720 (all 41 parts) – Method of tests for soils
50. IS: 2911 – Design and construction of pile foundation (all 4 parts)
51. IS: 3025 (all 49 parts) – Methods of sampling and test for water and waste water
52. IS: 3085 – Method of test for permeability of cement mortar and concrete
53. IS: 3370 – concrete structures for storage of liquids.
54. IS: 3400 (all 22 parts) – Methods of tests for vulcanized rubbers
55. IS: 3502 – Steel Chequered Plates
56. IS: 3757 – High strength structural bolts
57. IS: 3764 – Safety code for excavation work.
58. IS: 3935 – Composite Construction
59. IS: 3955 – Design and construction of well foundations
60. IS: 4000 – High strength bolts in steel structures – code of practice
61. IS: 4031 (all 15 parts)– Physical tests for hydraulic cement
62. IS: 4081 – Safety code for blasting and related drilling operations
63. IS: 4326 – Earthquake resistant design and construction of buildings
64. IS: 4634 – Methods of testing performance of batch type concrete mixers
65. IS: 4736 – 1986. Galvanising of Mild Steel
66. IS: 4759 – 1968 Hot Dip Zinc coating on structure and other allied structures
67. IS: 4991-1968 – Blast Resistance of design of structure for explosions above ground
68. IS: 5513 – Vicat apparatus
69. IS: 5515 – Compaction factor apparatus
70. IS: 5624 – Foundation bolts
71. IS: 5666 – Etch primer
72. IS: 6586 – Metal spraying for protection of iron steel
73. IS: 6639 – Hexagonal bolts for steel structures
74. IS: 6745 – Determination of mass of zinc coating on zinc coated iron /steel article
75. IS: 6925 – Methods of test for determination of water soluble chlorides in concrete admixtures
76. IS: 7205 – Safety code for erection of structural steel work
77. IS: 7215 – Tolerances for fabrication of steel structures
78. IS: 7293 – Safety code for working with construction machinery
79. IS: 7320 – Concrete slump test apparatus
80. IS: 8112 – 43 Grade OPC
81. IS: 8500 – Structural steel – Micro alloyed (Medium and high strength qualities)
82. IS: 8629 – Protection of iron and steel structures from atmospheric corrosion
83. IS: 9103 – Admixtures for concrete
84. IS: 9595 – Metal Arc Welding
85. IS: 10080 – Vibration machine for casting standard cement mortar cubes
86. IS: 10262 – Concrete mix design
87. IS: 13920 – Ductile detailing of reinforced concrete structures subjected to seismic forces
88. IS: 14268 – Uncoated stress relieved low relaxation seven-ply strand for pre-stressed concrete specification.

89. SP 6, 7, 16, 21, 22, 23, 24, 34, 36, 52, 60

**INTERNATIONAL CODES:**

1. UIC-772R: Bearings of rail bridges.
  2. UIC-776-2R Bridges for high and very high speed.
  3. UIC-778-1-R Recommendations for consideration of fatigue in the design of steel bridges.
  4. BS : 8081 : 1989 Code of practice for ground anchorages (or latest edition)
  5. BS-5400 (all parts).
  6. Other relevant UIC and BS Codes for bridges and Structures
- 7.1 The design shall be carried out in terms of specifications/codes of the latest editions of IRS (Indian Railway Standards) including RDSO (Research Design Standard Organization) Guidelines, Engineering codes and other South Central Railway Specifications; IRC (Indian Road Congress), BIS and UIC (Bureau of Indian Standards) where specifically not mentioned in the General Arrangement Drawing.
- 7.2 The priority of the Codes and Specifications to be followed for Railway bridges shall be IRS, IRC, UIC, IS and other International specifications. In case of contradictory specifications, the specifications given in the IRS code shall be prime governing. For Road bridges, IRC specifications and for building works IS specifications shall govern first, followed by other specifications where referred or required.

**NOTE:**

- a. Latest edition including correction slips up to the time of submission of the tender/ negotiated rates for acceptance, shall govern.
- b. Codes indicated above are by no means not exhaustive. All IS, UIC, IRC and IRS codes pertaining to the work shall be applicable.
- c. Omissions, errors if any shall be exempted.
- d. All relevant codes and as directed by Engineer-in-charge shall be made available by the consultant at any time at his own cost. Authorized representative of Railway shall have free use of any of the codes.
- e. Among the International Codes, UIC will hold precedence, followed by other codes such as BS Codes, and Other relevant codes.

**8.0 SUBMISSION OF DETAILED DESIGN AND DRAWING FOR APPROVAL**

- 8.1
- a) After award of the tender the contractor shall submit the detailed design calculations in 3 copies along with the drawings for Railway Administrative approval within a period of 30 days after issue of the acceptance letter.
  - b) It shall be responsibility of the successful tenderer(s) to ensure continued attendance and assistance of his design Engineer's representative and get the design and drawings approved by the Chief Administrative Officer / Construction / S.C. Railway / Secunderabad.

- c) After the designs and drawings have been approved the contractor is required to submit 6 copies of approved design. The original being typed on electronic typewriting machine on bond paper, the report being bound suitably and super scribed detail design calculations for the proposed span The format being as decided and approved by Engineer-in-charge. The final design report shall be comprehensive text giving all the detailed design calculations, brief theory for the basis of design etc., as directed by Engineering-in-charge. The contractor shall also submit approved detail drawings on re- producible ( tracing / polythene film ) media to the full drawing sheet A0 size as well as 4 sets of drawings reduced to size using the standard reductions procedure.

The cost of above items (a) to (c) will be deemed to have been included in Schedules and the percentage quoted by the tenderer is deemed to be inclusive of these elements and nothing extra is payable, including revision of design and drawings if so required by the Railway before giving approval.

## 8.2 DESIGN AND DRAWINGS OF TEMPORARY ARRANGEMENTS

- a) The successful tenderer is also required to elaborate details of the method of construction. He shall be required to give along with detail designs at each stage the calculations for stresses and displacements at various constructions stages. These shall also be got approved from S.C. Railway and shall form part of the reports as above. Nothing extra is payable for above and the cost of the same shall be deemed to have been included in the rates quoted for the various items of work.
- b) The Contractor shall ensure timely and regular attendance of his consultant for discussion and checking of the detailed design calculations in the office of the Chief Administrative Officer, Construction, S. C. Railway, Secunderabad. All the corrections as required are to be done in the design and drawings as directed by the Chief Administrative Officer, Construction, S. C. Railway, Secunderabad shall be carried out promptly and the necessary corrected designs and drawings resubmitted within 7 days
- c) The design and drawings after approval shall be the property of the S.C. Railway and S.C. Railway shall have exclusive right to use and reuse it elsewhere. The contractor shall have no claims whatsoever in this regard
- d) In case computer programmes are used for analysis and design of the bridge structure, the same shall be used so as to give a format of output as would be for manual calculations copy of the computer programme shall be supplied. Design calculations shall, in such a case be validated by sample manual calculations to the satisfaction of the Chief Administrative Officer/ Construction / S.C. Railway / Secunderabad. Otherwise the entire calculations shall have to be carried out by detailed manual calculations.
- e) The contractor shall specially note that while every effort shall be made to approve the design and drawings expeditiously, no claim shall be entertained on account of delay in approval of design and drawings for whatsoever reason.

**SPECIAL CONDITIONS AND SPECIFICATIONS OR SUPPLY,  
FABRICATION AND ERECTION OF STEEL STRUCTURES**

**Note:** Steel fabrication work for FOOT OVER BRIDGE shall be carried out only in the approved workshop of vendors borne on current Master list of approved vendors for “STEEL BRIDGE GIRDERS” published by Quality Assurance - Civil Directorate of Research Designs & Standards Organization (RDSO), Lucknow-226001.

- 1.0 The supply of materials and the fabrication of steel work should confirm to the following codes of practice and specifications as amended from time to time till the date of opening of tenders.

**Material:** The material shall conform to the specifications as given below:

Sl. No.	Material	Specification
1.1	Steel	IS 2062
1.2	Welding consumables - Covered electrode for manual metal arc welding of carbon and carbon manganese	IS 814
1.3	Bolts & Nuts	IS 1363, IS 1364
1.4	Washers	IS 5369 / IS 5372 / IS 5374
1.5	Fasteners single coil rectangular section spring washers	IS 3063
1.6	Paint:	IS 104
	i. Ready mix paint brushing zinc chrome priming	
	ii. Ready mix paint air drying red oxide zinc chrome painting	IS 2074
	iii. Alluminium paint	IS 2339
1.7	Other materials used in association with structural steel works and not specified above but require as per approved drawings	Confirming to relevant Indian standards of latest edition.

- 2.0 **Other Specifications:** The work shall be executed to the following specifications:

Sl. No.	Reference to Standard specification	Subject matter
2.1	IS 800	Code for practice for general construction of steel.
2.2	IS 123	Ready mixed paint, brushing, finishing, and semi-gloss for general purposes of Indian standard colours.
2.3	IS 808	Dimensions for hot rolled steel beams, columns, channels and angle sections.
2.4	IS 1730	Steel plates, sheets, strips and flats for structural and general engineering purposes-dimensions.
2.5	M-28	Classification, testing and approval of metal arc welding electrode for use on Indian Railways.
2.6	IS 5624	Specification for foundation bolts.
2.7	IS 816	Code of practice for use of metal arc welding for general arc welding for general construction in mild steel.
2.8	IS 9565	Metal arc welding of carbon and carbon manganese steels recommendations.
2.9	IS 822	Code of procedure for inspection of welds.
2.10	IS 1367	Technical supply conditions for threaded fasteners.

Sl. No.	Reference to Standard specification	Subject matter
2.11	IS 7215	Tolerances for fabrication of steel structures.
2.12	IS 962	Code of practice for architectural and building drawings
2.13	IS 8976	Guide of preparation and arrangement of sets of drawings & part list.

- 3.0 Any other IS code/IRS specification not covered above but relevant for the proposed work shall also be applicable.
- 4.0 Wherever reference to the specifications mentioned in para 1, 2, and 3 above shall be taken as a reference to the latest version of the standard till the date of opening of tender.
- 5.0 **Drawings:**
- 5.1 The General arrangement and structural drawings required for execution of work will be supplied by railway. However, the detailed drawings if required are to be prepared by the contractor. The rates for the items are inclusive of preparing detailed execution/fabrication drawings and no extra payment will be made for this job.
- 5.2 **Exhibited Drawings:** The exhibited drawings refer to the drawings, which shall be issued for the guidance of the person tendering. For this purpose the following drawings will be exhibited drawings. General layout drawing showing location of the structures, main dimensions, internal and external requirement etc. Drawings showing the span arrangement, spacing of columns and other relevant dimensions.
- 5.3 **Contract drawings:** The contractor has to design and develop detailed execution and fabrication drawing based on the requirement given by the Railway through the exhibited drawings or in person or through other communication subsequent to finalisation of tender. The drawings supplied by the contractor as per which the fabrication is to be executed when approved by the Engineer-in-charge will become "Fabrication drawings". Similarly, other detailed structural and execution drawings to be exhibited when approved by the Engineer-in-charge will become the execution drawings. Also on completion of the work the contractor should supply completion drawings along with alteration if any on tracing cloth/film and also two sets of hard copies and two sets of soft copies on CD.
- 5.4 The rates for the items are inclusive of the work of design and preparing detailed execution/fabrication drawings along with alteration if any on tracing cloth / film and also two sets of hard copies and two sets of soft copies on CD.
- 5.5 On completion of the work the contractor should supply completion drawings along with alteration if any on tracing cloth/film and also two sets of hard copies and two sets of soft copies on CD.
- 6.0 **STEEL shall be procured as per special conditions (annexure).**
- 6.1 All steel sections shall bear the steel makers and in addition where sections are not covered by test certificates shall have the heat/cast mark number or other distinguished marks stamped at the end. On plates and sections on which rolling mark is not possible, shall be legibly stenciled with marker's name with reference marks enabling identification being made with invoice documents and test certificate. All the steel sections used in fabrication must have test certificate clearly indicating the specification to which the steel confirms.
- 6.2 Any approval given by the Railway in consequence of such test certificates shall in no way limit or interfere with the absolute right of the Railway to reject the whole or portion of such materials brought which in the judgment of the Railway do not comply with the specifications and conditions of contract. The decision of railway shall be final and binding for all purposes.

**7.0 Responsibilities of completeness:**

- 7.1 The Contractor shall be entirely responsible for the execution of the contract in all respects in accordance with the terms of this specification and the conditions of contract, notwithstanding any approval which the Engineer-in charge may have given to the detailed drawings prepared by the contractor for the work involved in the contract or for tests carried out either by contractor or by the Engineer-in-charge.
- 7.2 Any fitting accessory or apparatus which may not have been mentioned in the specifications, but which are usual or necessary in the execution of such work, are to be provided by the contractor without extra charge. The whole work must be completed in all details, whether mentioned in the specifications or not.
- 7.3 The fabrication can be done by the contractor at his established workshop if any or at site by creating the required facilities. In case of site fabrication, the Railway will make available the space to the extent possible, free of cost.
- 7.4 The contractor shall bring the material at fabrication site and shall advise the Engineer-in-charge, so that he can depute the inspecting official to verify with the markings shown on the marking plan of the part list which shall be supplied by the contractor for defects and shall make entries in the register to be maintained at site.
- 7.5 No damaged material shall be used for the final work. The record of fabrication shall be maintained in the register in the proforma as supplied by the Engineer-in-charge.

**8.0 Manufacture:**

- 8.1 The whole work shall be representative of workmanship and finish shall be equal to the best general practice in modern structural shop. The greatest accuracy shall be observed in the design, manufacture and erection of every part of the work to ensure that all parts will fit accurately together on erection. All similar parts shall be strictly interchangeable.
- 8.2 The contractor shall maintain a master steel tape of approved make for which they have obtained a certificate of accuracy from any National test house or Government recognized institutions competent to do so.

**9.0 Templates:**

- 9.1 The templates used throughout the work shall be of steel. The template shall be used for marking of cutting material and as well as profile machining, marking of drilling of holes wherever required. Engineer-in-charge will decide whether templates are fit to be used as a part of the finished structure.

**10.0 Flattening and straightening:**

- 10.1 All steel materials, plates, bars and structural shall have straight edges, flat surfaces and be free from twist. If necessary, they shall be cold straightened or flattened by pressure before being worked or assembled unless they are assembled unless they are required to be of curvilinear form. Pressure applied for straightening or flattening shall be such as it would not injure the material and adjacent surfaces or edges shall be in close contact or at uniform distance throughout.
- 10.2 Flattening and straightening under hot condition shall not be carried out unless authorized or approved by the Engineer-in-charge.

**11.0 Planning, Shearing & flame cutting:**

- 11.1 Cutting of all plates and sections shall be affected by shearing, sawing or flame cutting. All edges shall be clean, reasonably square and true. Wherever possible the edges shall be cut in a shearing machine, which shall take the whole length of the plate in one cut. The cut edges shall be ground afterwards.
- 11.2 Planning or machining of the edges or surface shall be carried out when so specified in the contract drawings or where specially ordered by the Engineer-in-charge. Where machining is specified, the plates or all sections shall be cut in the first instance to such a size so as to permit not less than 3mm of metal being removed from each sheared edge or end, in the case of plates or sections of 12mm or less in thickness and not less than 6mm of metal being removed in the case of plates and sections exceeding 12mm in thickness.

- 11.3 In the case of compression members the face shall be machined so that the faces are at right angle to the axis of the members and the joint when made, will be in close contact throughout. At the discretion of the Engineer-in charge, a tolerance of 0.4mm may be permitted at isolated places on the butting line.
- 11.4 Flame cutting by mechanically controlled torch/torches shall be accepted, provided the edge as given by the torch is reasonably clean and straight. Plates may be cut to shape and beams & other sections cut to length with a gas cutting torch, preferably oxyacetylene gas should be used.
- 11.5 All flame cut edges shall be ground to obtain reasonably clean square and true edges. Draglines produced by flame cut should be removed.
- 11.6 Unless machining has been specially provided for special care is to be taken to ensure that ends of all plates and member are reasonably in close contact and the faces are at right angles to the axes of the members and joints, when made, are also reasonably in close contact.

## **12.0 Drilling and sub-punching:**

- 12.1 All holes shall be drilled but the contractor may, if so prefer sub-punch them to a diameter 6mm less than that of finished holes. e.g. a punched hole which is to be drilled out of 25mm in diameter shall not exceed 19mm in diameter at the die end. When the rivetholes are to be punched, they shall be marked with a center punch and made with anipple punch or preferably, shall be punched in a machine in which the position of the whole is automatically regulated. The punching shall be so accurate that when the work has been put together before drilling, a gauge 1.5mm less in diameter than the size of thepunched holes can be passed easily through all the holes. Holes for counter shrunk head of rivets, bolts or screws shall be drilled to the correct profile so as to keep the heads flush with the surface holes.
- 12.2 Holes for turned bolts should be 1mm under drilled in shop and should be reamed at site to suit the diameter of turned bolt.

## **13.0 Parts in contact:**

- 13.1 All steel work intended to be welded, riveted or bolted together shall be in contact overthe whole surface.
- 13.2 Drifts may be used for drawing light members into position but their use on heavymembers should be restricted to securing them in their correct positions. In no case, shalldrifting be allowed to such an extent that holes are distorted.
- 13.3 Drifting to enlarge unpaired holes is prohibited. The holes that will have to enlarge toadmit rivets/ bolts should be reamed provided the Engineer-in charge permits such reaming after satisfying himself about the extent of inaccuracy and the effect of reaming on the soundness of the structure. The Railway retains the right to reject all steel work if the holes are not properly matched.
- 13.4 **Cleaning of permanent contact surfaces:** Surfaces which will have permanent contact shall be removed of paints and mill scale down to bare metal, clean and dried and immediately a coating of zinc chrome red oxide priming to IS 2074 shall be applied. Care shall be taken to see that all burrs are removed and no surface defects exist before the parts are assembled.

## **14.0 Erection and Equipment:**

- 14.1 The contractor shall provide at their own cost all tools, machinery, equipment and the erection material necessary for the expeditious execution of the work and shall erect the structural steel and iron work, in every respect as covered by the contact and in accordance with the drawings and specifications.
- 14.2 Before starting the work, the contractor shall advise the Engineer-in-charge fully as to the method they proposed to follow and the amount and character of equipment they proposes to use, which shall be subjected to the approval of the Engineer-in charge. The approval of the Engineer-in charge shall not be considered as relieving the contractor of responsibility for the safety of their method or equipment or from carrying the work in full accordance with the drawings and specifications.

- 14.3 All temporary work shall be properly designed and substantially constructed for the loads, which will be called upon to support. Adequate allowance and provision of a lateral forces and wind loads shall be made according to local conditions and ensure that support shall not settle during erection.
- 14.4 Careful and periodical inspection of plants shall be made by the contractor to ensure that all tackle, ropes, chains and other important lifting gear and machinery are in good order and fit for service and well up to the capacity for which they are required.
- 14.5 When the chains are used for lashing, care must be taken to protect the edges of members to avoid the marking and distortion otherwise caused.
- 14.6 The method used for lifting and slinging flexible members shall be brought to the notice of the Engineer-in-charge and shall be subject to his approval.
- 15.0 Bearings and Anchorages:**
- 15.1 The contractor shall drill the holes where necessary and set the anchor bolts. The bolts shall be set accurately and fixed with cement grout or any other grouting material as approved by the Engineer-in charge completely filling the holes.
- 16.0 Welding:**
- 16.1 Welded construction work shall be carried out generally in accordance with the provisions of IS specifications / Indian Railway Standard Welded Code of practice for metal arc welding in structural steel issued by RDSO.
- 16.2 The Arc welding should be done for fully automatic or Semi-Automatic as decided by the Engineer-in-charge.
- 16.3 Except for special type of edge preparation, such as single and double U single and double J fusion edges of all the plates which are to be joined by welding may be prepared by using mechanically controlled automatic flame cutting equipment and then ground to a smooth finish. Special edge preparation should be made by machining or gouging.
- 16.4 **Welding procedures:** The welding procedure shall be such as to avoid distortion and minimize residual shrinkage stress. Properly designed jigs should be used for assembly. The welding techniques and sequence, quality, size of electrodes, voltage and current required shall be as prescribed by the manufacturers of the material and welding equipment. The contractor should submit full details of welding of welding procedure in proforma specified by the Engineer-in-charge.
- 16.5 **Welding plant:** The welding plant shall be capable of maintaining the voltage and current specified by the manufacturer of the electrodes used. The contractor shall supply instruments for verifying voltage and current as and when required by the Engineer-in charge.
- 17.0 Painting:**
- 17.1 **Surface preparation:** Remove oil/ grease/ rust particle from the metal surface by using petroleum Hydrocarbon solvent to IS 1745 or by brushing with wire brush.
- 17.2 **Painting primer coat:** One coat of ready mixed paint zinc chrome priming of 25 micron DFT followed by one coat of ready mixed paint red oxide zinc chrome priming of 35 micron DFT.
- 17.3 **Finishing coat:** Two coats of aluminium paint over the primer coats for DFT 2x45 micron. One coat shall be applied before the fabricated steel work erected and the second coat & final coat shall be applied duly touching up the primer and finishing coat if damaged in the erection process.
- 17.4 **Surfaces** not accessible for cleaning/ painting after fabrication shall be applied one heavy coat of Zinc chrome red oxide before being assembled for welding/ bolting. Bolts, nuts, washers etc, are to be thoroughly cleaned and dipped in the boiled linseed oil to IS 77.
- 17.5 All machined surfaces are to be well coated with a mixture of white lead to IS 349 and Animal tallow to IS 887.
- 17.6 The contractor must fix a neat casting bearing plate having the name of the contractor, place and year of the manufacture, drawing no., contact no. and shall be bolted conspicuously on the column on the column at one place in each shed separately or at locations specified by Engineer-in charge.

- 18.0 **Weight of steel work for payment:** Shall be as per IRU Standard Specifications for formation works, Bridge works and P.Way works USSR 2021 & CPWD specifications 2019 for DSR 2021.
- 18.1 Any steel work the weight of which differs by more than 2.5% from the calculated weight determined from the normal weight of the sections shall be liable for rejection.
- 18.2 Payment shall be made on the weight to be calculated in accordance with the nominal weight of the sections as specified on the contract drawings. An addition in weight for welds and rivet heads is made as per IRU Standard Specifications, for formation works, Bridge works and P.Way works USSR 2021 & CPWD specifications 2019 for DSR2021.
- 18.3 Should the actual weight fall short of the calculated weight by more than 2.5% the material if accepted, will be paid for the actual weight only. Should the actual weight exceed the actual calculated weight, payment will be made for calculated weight only.
- 18.4 The weight of all plates and sections shall be calculated from the overall lengths as per final position with square dimensions and theoretical unit weights. No deductions being made for holes, notches and skew cuts. Each gusset shall be paid on the dimension of the smallest enclosing rectangle.
- 18.5 In the event of dispute arising as to the weight of a portion of steel work, a weighing shall be made in the presence of the Engineer-in charge.

**19.0 Inspection and progress report:**

- 19.1 The work of fabrication will at all times be open for inspection by the Railway. Before dispatch of fabricated steel from the shop/site they will be inspected by the Inspecting officials as approved by Railway Administration who will thereafter issue inspection certificate. Any defects noticed during inspection in the execution of the works shall be rectified or replaced by the contractor at his own cost. The decision of the Railway as to the existence of the defect the manner in which the defective work was to be rectified shall be final and conclusive.
- 19.2 The progress of fabrication of steel work as well as erection and execution of all works a site will be subject to periodical review by the Railway Administration. The contractor will offer all facilities to the Railway's representative to make periodical detailed assessment of the progress of the works. Such information and progress reports as may be called for by the Railway and at such intervals and specifications shall also be made available.
- 19.3 The contractor should prepare and submit at their cost Drawing Office Dispatch (DOD) list in sufficient copies for all the steel fabrication work under relevant item of the Schedule giving the full particulars of all members of steel work as per the approved drawings.

**20.0 TERMS OF PAYMENT FOR STRUCTURAL STEEL:**

i)	Material at site	-	40%
ii)	Fabrication at site	-	20%
iii)	Erection/Launching	-	20%
iv)	Completion including painting & finishing.	-	20%.

NOTE: 1) The on account bill will be paid to the Contractor on submission of invoice bills from authorized dealers for raw steel supply.

2) The expenditure shown in the bill is as recorded in the expenditure shown in respect of the bill has been incurred properly accounted against this particular contract.

3) The expenditure in respect of the bill relates to the raw materials only required for this particular contract and necessary indemnity bond to cover the advance "on account" payment for raw steel should be produced.

4) The above terms of payment are subject to the conditions that provisional on account payment will be restricted only to 90% of purchase of steel subject to a limit of 40% of the value of the steel work with through rate of supplied quantity at site and no payment will be made for fabrication and erection until the contract agreement is executed.

## **SPECIAL CONDITIONS ( TECHNICAL)**

### **ANNEXURE**

#### **SPECIAL CONDITIONS FOR LAYING AND LINKING OF RAILWAY TRACK**

##### **1.0 SETTING OUT OF WORK:**

- 1.1 The marking for the proposed track including curves will be initially set out by the Engineer or his representative. The Contractor thereafter shall set out the parts and carry out the works thereof fully. The contractor shall be responsible for the accuracy of the lines, levels and dimensions of the work in accordance with the standards conforming to specification and manuals specified at clause No.3 of Special Conditions. The contractor shall also alter or amend any error in the dimensions, levels or lines of work set out or laid by him to the satisfaction of the Engineer.
- 1.2 The quoted rates should be deemed to include charges for any and all site facilities that are considered necessary for the execution of the works mentioned in the Schedule.

##### **2.0 EXECUTION OF WORKS:**

- 2.1 The contractors are requested to inspect the site and availability of road for transportation of P.Way materials before quoting their rates. The quoted rate for linking items is inclusive of transportation of P.way fittings like fish plates, fish bolts & nuts, rubber pads, liners and elastic rail clips etc., from existing stacks at DSK/C Depot to site of work including leading, loading and unloading. No extra payment will be made for transportation of P.Way fittings like fish plates, fish bolts & nuts, grooved rubber pads, metal liners, elastic rail clips etc.,
- 2.2 The contractor should make his own arrangements for the required trucks/tractor/trailers for the expeditious transport of rails, sleepers and other P.Way materials at his own cost with his fuels, consumables and sufficient men etc., complete.
- 2.3 The contractor has to handle the P.way materials carefully while trucking out. Any loss or damage / shortage involved while handling will have to be borne by the contractor at the rate fixed by the Railways and the materials damaged / made out of use the Railways property.
- 2.4 Before dismantling, the inventory of the existing P.Way materials should be taken jointly by the contractor and SSE-P.Way-in-charge. The contractor should sign on the inventory as a token of his acceptance. While dismantling existing BG track including points and crossings the contractor has to take care of P.way materials without causing any damage to the materials and also to the running electrified track nearby. The contractor is responsible for safe custody of released materials with him until they are handed over to the Railway as per inventory.
- 2.5 Leveling the existing ballast including the ballast dumped in advance is to be spread suitably to standard profile of BG track. After spreading of ballast, it should be rolled with 8 / 10 tons power roller.
- 2.6 The PSC sleepers are available along the alignment i.e on cess / bank / formation / in yard limits, the contractor has to move the sleepers onto levelled ballast surface and lay them to the correct centre line of the track given and to correct spacing and specified sleeper density as directed by the Engineer-in-charge.
- 2.7 The contractor has to lead the 52 kg / 60 kg free rails / welded rail panels available along the alignment onto already laid PSC sleepers. The rails shall be connected by Fishplates, bolts and nuts duly lubricating the same with contractor's grease, graphite and oil with his labour and

- tools. The linking shall be done to correct gaps as directed by the Engineer-in-charge.
- 2.8 Paint marks shall be made on the rails with contractor's paint as directed by the Engineer-in-charge to indicate the spacing of sleepers to be adopted.
  - 2.9 The elastic rail clips should be fixed in the holes of M.C.I inserts after providing the grooved rubber pads under the rails seats and liners in position for fastening the rails with sleepers as directed by the Engineer-in-charge.
  - 2.10 The newly linked track has to be brought to the standards / tolerances as specified in Para 3.0 below for BG by attending to the track as required.
  - 2.11 After linking the BG track, the track is to be lifted upto 150mm with Railway's ballast including doing kutchha packing and one round of through packing will be given and the track shall be lifted further upto 150mm in stages including two rounds of through packing after completion of final stage of lift, complete as detailed under para 224 of I.R.P.W. Manual and after packing the sleepers shall be checked with can be double for looseness and the loosely packed sleepers if any should be repacked.
  - 2.12 Laying and linking of BG track on loop lines will be with 52 Kg./90 R rails on any sleeper density. The contractor has to transport the fittings like fish plates, bolts and nuts and any type of sleepers' fittings from DSK/C Depot to site of work. The quoted rate is inclusive of all these operations.
  - 2.13 After linking the BG track in loop lines the track is to be lifted upto an extent of 250mm in convenient stages with Railway's ballast. After completion of final stage of lift, the track is to be packed with two rounds of through packing including spacing, squaring, gauging, aligning, leveling etc. and brought to the correct standards.
  - 2.14 While dumping the ballast onto the newly linked BG track the existing ballast stacks are to be fully cleared, without leaving any amount of ballast. If any ballast is leftover in the stacks, such stacks will not be paid.
  - 2.15 The pre-assembled turnouts / trap switches are to be inserted on to the new BG track by making necessary temporary arrangements, lifting and packing the same after insertion to the required level including three rounds of through packing. Wherever space is not available for assembling points and crossings, the same to be assembled at nearby place in all respects complete and the same to be kept near the location where the insertion of points and crossings to be done in-situ.
  - 2.16 If the contractor fails to employ adequate labour during the course of execution of the work at any stage the Railway will take action to employ such labour as necessary or get the work done by fixing up an agency even on single tender basis or executing the work through existing agency at other stations at the risk and cost of the contractor. The decision of the Engineer / his representative is final and binding.
  - 2.17 The released BG P.way materials are to be transported by the contractor by any means by any convenient shortest route including loading the materials onto his vehicles, transportation and unloading and handed over to the depots as directed under clear acknowledgement. The materials are to be handed over duly stacked material-wise and classification-wise as directed by PWI/DSK by removing all the fittings from the sleepers. A wastage/loss upto 2 % will be

permitted on released P.way fittings such as round spikes, dog spikes, cotters, keys and fish bolts etc.

### 3.0 SPECIFICATIONS FOR FINISHED WORK:

3.1 The track should be brought to the standards as per para 316 of IRPW Manual after completion of work in all respects. Extract of certain vital parameters are appended as below:

Gauge	Sleeper to sleeper variation	2mm
Expansion Gap	Over average gap worked out by recording 20 successive gaps	± 2mm
Joints	Low joints not permitted	---
	High joints not more than	± 2mm
	Squaring of joints on straight	± 10mm
Spacing of sleepers	With respect of theoretical spacing	± 20mm
Cross level	To be recorded on every 4th sleeper.	± 3mm
Alignment	On straight on 10M.Chord	± 2mm
	On curves of Radius more than 600 M. on 20M Chord.	
	Variation over theoretical versines shall not exceed	5 mm
	On curves of Radius less than 600M. On 20M Chord.	
	Variation over theoretical versines shall not exceed	10mm
Longitudinal level	Variation in longitudinal level with reference to approved longitudinal section not to exceed	50mm
Loose sleepers	After packing	Not more than 20%
Greasing of ERCs	Entire leg of ERC should be applied with grease conforming to IS 408-1981 as amended from time to time.	

3.2 **ALIGNMENT:** Alignment should be straight as verified by sighting. On curved alignment correct versines shall be provided as directed by the SSE/P.way-in-charge. However not more than a variation of 20% will be permitted at any of the location over the prescribed versines. The alignment shall not deviate by more than the permissible limits detailed above. Resetting of curves shall be done as many numbers of times as required to get the desired profile for smooth running.

3.3 **GAUGE:** Gauge shall be checked with standard gauge and should be 1676mm. on straight and curves upto 4 degrees and 6mm slack on curves sharper than 4 degrees. Permissible variation from sleeper to sleeper shall not exceed 2mm.

3.4 **LEVELS:** Levels shall be checked by level board and spirit level. Track should be free from sags and low joints, permissible variation of crossover being ±3mm at every 4th sleeper but not exceeding 1mm between any two consecutive sleepers.

### 4.0 P.WAY TOOLS, etc.:

4.1 The contractor shall make his own arrangements for P.Way tools and instruments etc. and the Railway will not supply any tools or instruments or any other appliances required for this work.

4.2 All consumable stores like graphite, grease, oil, paint coal tar, cotton waste etc. required for the work shall be arranged by the contractor at his own cost.

### 5.0 OTHER CONDITIONS:

- 5.1 The work of laying of BG track with PSC sleepers is to be carried out partially by the side of existing BG track, certain points and crossings have to be inserted in the existing BG track after dismantling the track under traffic conditions during block period.
- 5.2 The fittings such as fish plates, bolts, rubber pads, liners and elastic rail clips, rail screws and SEJ fittings etc., required for plain track will be issued to the contractor at Railway's nominated depot which are to be transported by his vehicles to the site of work. The rate includes the cost of loading the materials into contractor vehicles, transportation and unloading of above track fittings from Railway's nominated depot to the site of work. The contractor has to quote the percentage rate for the schedule duly considering the above aspect of transportation cost involved.
- 5.3 No loss of fittings will be permitted in case of 60Kg/ 52kg fish plates, bolts, elastic rail clips, rubber pads and liners. The cost of the material not accounted for will be recovered from the contractor.
- 5.4 The contractor must ensure safety of labour engaged by him while working on the track during the course of execution of this work. The Railway will not be responsible for any injury or damages sustained by the Contractor's labour. The work has to be carried out observing all safety precautions.
- 5.5 The work should be carried out without any interference to the normal working of the track and structures. The contractor will be responsible for any loss or damage to Railway and public property if it occurred during the course of execution and the Railway reserves right to have the damages made good by the contractor.
- 5.6 If the contractor's vehicles or persons are involved in any accident, it would be the responsibility of the contractor and Railway will not be responsible for any damage or compensation thereof.
- 5.7 The contractor shall permit carriage of Railway representative free of charges in his lorry while transporting Railway materials from loading point to unloading point.
- 5.8 The work should be executed in workman like manner to the satisfaction of the Engineer-in-charge.
- 5.9 The contractor should provide necessary barricades while executing the works at level crossings for safety of road users and the works at level crossings should be completed expeditiously to avoid inconvenience to the road users.
- 5.10 The weight of the class II/released materials used for the work will be arrived based on theoretical weight less 5% for wear and tear.
- 5.11 One track running meter for the purpose of payment is measured on the centre line of the track which includes rails on either side with sleepers and fittings.
- 5.12 A register will be opened at the site in which all the material handing over to the contractor should be recorded with date of handing over the Railway material / released material. In the same register there will be corresponding entry of the handing over the released material / Railway materials back to the Railway by the Contractor.

## **6.0 ACCURACY OF DRILLING HOLES ON RAILS:**

- 6.1 The contractor should note the accuracy of the dimension of the holes to be drilled for each rail which should conform to the dimensions mentioned in the Railways manuals and to be checked by actually fixing 52 Kg/90 R fish plates on bothsides of the rails with fish bolts and nuts. The holes should be perpendicular to the axis of the rails. Reaming and chamfering

should be done and drilling to be done without any burrs. The rate quoted includes the above verifications also. If any hole is drilled wrongly the contractor will have to cut out the ends of the rails as directed by the Engineer-in-charge at his own cost and penalty of Rs. 50/- (Fifty only) per each hole drilled wrongly will be recovered and no payment shall be made for drilling fresh holes. The cut pieces of the rails shall be the property of the Railway and should be handed over to Railways and the cost of the same will be recovered from the Contractor at twice the normal rate. The normal rate would be Railway's procurement rate prevailing at the time of last receipt of the rails plus 5% towards freight charges. The decision of the Railways regarding this shall be final and binding.

#### **7.0 ACCURACY OF SQUARING OF JOINTS:**

7.1 Rails supplied by Railway are likely to have slight variation in length. The contractor has to ensure the correctness of pairing before starting the leading and linking of rails for track work to ensure correct squaring of joints within permissible limits of 10mm. No extra payment shall be made on this account.

#### **8.0 ACCURACY IN CUTTING OF RAILS:**

8.1 Cutting of rails by contractors is to be done with their tools, plant and labour etc., and the cutting must be square in section. The cut pieces left over are the property of the railways and they should be handed over to DSK/C depot as directed by the Engineer-in-charge.

8.2 The contractor should arrange for required number of hacksaw blades or Rail cutting machine and labour for cutting / operating the machines at his own cost. Petrol and other consumables required for the above should also be arranged by him at his own cost.

#### **9.0 SUPPLY OF MATERIALS BY RAILWAY:**

9.1 The Railway materials will be issued on specific requisition by the contractor and as per requirements by the consistent with the progress of the works. The materials will have to be lead by the contractor to the site of work at his own cost. No claim will be entertained on account of crossing of track if any and the rate quoted should be inclusive if all lead, handling and also cover all precautions to life and properly as are considered necessary during the course of execution.

9.2 The materials issued by the Railway shall be used solely and economically for the purpose of the work covered by this contract only. The materials shall be used in such quantities and proportions as specified in the items of work and as are indicated in the schedule or in the relevant specifications or drawings or as approved by the Engineer-in-charge, whose decision thereto shall be final. Wastage or damage to such materials in any matter shall be totally avoided.

9.3 Any leftover P.way materials / fittings as surplus out of the materials supplied by the Railway free of cost, should be returned to the DSK/C depots as directed by the Engineer-in-charge. Surplus materials should be returned in good and whole condition.

9.4 The Contractor will be liable to render full account for all the materials issued by Railway free of cost. If any quantity of Railway materials issued free of cost is consumed in excess or wasted or damaged or lost or not satisfactorily accounted for, recovery shall be made from the contractor at twice the issue rate.

9.5 The issue rate will be Railway's procurement rate at the time of last issue of material concerned plus 5% freight charges.

9.6 Though most of the materials will be arranged by the Railway before commencement of mega block, some minor item / quantities may have to be arranged during mega block.

**10.0 PROCUREMENT OF PLANT AND MACHINERY BY CONTRACTOR:**

- 10.1 It should be clearly understood that it is entirely contractor's responsibility and liability to find and procure all the machinery, tools and plant and their spare parts, fuel, consumable stores and labour that are required for the efficient and methodical execution of the work. The quoted rates shall be deemed to be inclusive of all charges for such items including man power required to operate such plants and machinery. Delay in procurement of such items due to their non-availability or import difficulties or any other causes, whatsoever, shall not be taken as an excuse for slow progress or non-performance of the work.
- 10.2 The contractor should have the following workmen, tools and machinery during execution of work for linking of track as required by agency to complete the work in time.

**i) WORKMEN:**

The contractor shall mobilize adequate labour in the order of 75 to 100 for ballast dumping and in orders of 50 to 75 for linking etc., this is only an indication & requirement may vary on day to day basis, depending up on the site condition. Contractor should always equipped with adequate man power for complete the work in time.

**ii) TOOLS:**

The contractor shall provide adequate tools for the work men.

- a) Hook and chain arrangements for handling sleepers / Rails - 2 Nos.
- b) Tractor for dragging sleepers / Rails - 1 Nos.
- c) Rail dollies -1 Set.
- d) Rail drilling machine -1 Nos (With template and operator)
- e) Rail cutting parties - 1 sets (With hacksaw blades or rail cutting machine)
- f) Crow bar / beaters - 10 Nos.
- g) Shovels - 10 Nos.
- h) Wire claws- 10 Nos.
- i) Fish bolts spanners - 2 Nos.
- j) Simplex / track lifting jacks - 2 Nos.
- k) Chamfering kit - 1 No.

**iii) MACHINERY:**

The contractor shall provide adequate machinery for the work.

- a) Road roller 8 / 10 MT capacity - 1 No.

## ANNEXURE

**SPECIAL CONDITIONS FOR PAINTING OF RAILS ON CESS****(A) PAINTING OF NEW RAILS ON CESS**1.0 Surface preparation:

- (a) The surface preparation of rails is one of the most important pre-requisites for the painting to serve the purpose. Sufficient care should therefore be taken in preparing the surface. The surface shall be made free from oil, grease and dust. The surface shall be rubbed with wire brush and sand paper/emery paper. The tools used may be hand or power operated such as scrappers, wire brushes, emery/sand paper; pumice stones, brick bats etc. Wire brushing should invariably be done at the end so as to obtain a uniform rubbed surface. The surface prepared may be checked by visual observation for uniformity of surface
- (b) Surface preparation shall not be done unless the approved paints of sufficient quantities are available in stock at site. Special care should be taken in preparing the surface at the weld collars, liner contact areas and uniformity of preparation at these locations shall be attained to that of rest of the surface. Generally, weld collars and liner contact areas are considered most corrosive prone areas, from which fatigue failures develop.
- (c) Surface preparation/painting shall not be done in the following conditions.
  - (i) When the ambient temperature is below 10° centigrade or above 50° centigrade.
  - (ii) In rainy season.
  - (iii) During night.
  - (iv) In winter before 8.00 a.m.
  - (v) In summer between 11.00 AM. and 3.00 PM on areas that are likely to be exposed to direct sun light.
  - (vi) Extremely wind/misty/dust blowing conditions.
- (d) Chemicals should not be used for surface preparation.

2. Painting Scheme:

- (i) 1<sup>st</sup> Coat: Anti corrosive bituminous black paint conforming to IS 9862-1981 to a thickness of 100 microns.
- (ii) 2<sup>nd</sup> Coat: Anti corrosive bituminous black paint conforming to IS 9862-1981 to a thickness of 100 microns.

NOTE: 1. Surface preparation by way of cleaning, wiping, brushing may be required between successive coats to remove dust, mud, night-soil etc.

2. The thickness of the film mentioned above is to be ensured at :

- (i) Junction of web flange
- (ii) Liner contact area
- (iii) Flange curve near foot

### 3.0 Supply of paints:

Paints shall either be procured through Stores Department or supplied by the contractor against painting contracts. Paints manufactured by the following Firms of repute alone shall either be procured or be permitted to be used by contractors through composite contract involving supply and painting of rails.

- 4.1 Paints should be used within the prescribed shelf life from the date of manufacture. The quantity of paint procured should be such that it is fully used before the prescribed period for its use.
- 4.2 The Contractor/Supplier shall furnish to the Railway the date of manufacture of the paint as certified by the manufacturer. The labels on the containers should furnish information regarding the date of manufacture, batch no. etc.

### 5.0 Application of paint:

- (i) First coat of painting shall be done only after the surface preparation is approved by the SSE (P.Way)/AXEN. Paint shall be applied on dry surface free from any type of moisture and shall not be done under the conditions mentioned earlier in 1 (c) of Para (A).
- (ii) Paint shall be mixed well in the container before it is applied. Over mixing shall not be done. Visible air bubbles or foam formation shall totally be avoided.
- (iii) Brush shall not be less than 2" (5 cm.) in width and should have good flexible bristles. If a new brush is used, the same should be soaked in Raw Linseed Oil for at least 24 hours before using the painting. The brushes shall be cleaned at the end of each day's work.
- (iv) Dust settled after scraping shall be cleaned before applying paint.
- (v) When the paint is applied by brush, the brush shall be held at 45° to the surface and paint applied with several light vertical/lateral strokes turning the brush frequently and transferring the paint and covering the whole surface. After this, the brush shall be used cross-wise for a complete coverage and finally finish with vertical/lateral strokes to achieve uniform and even surface.
- (vi) Rags, waste cotton, cloth or similar articles should not be used for applying paint.
- (vii) The coat of paint applied shall be such that the prescribed dry film thickness is achieved by actual trial for the particular brand of paint. The applied coat of paint shall be uniform, and free from brush marks, sags, blemishes, scattering, crawling, uneven thickness, holes, lap marks, lifting, peeling, staining, cracking, checking, scaling, holidays and allegating.
- (viii) Each coat of paint shall be left to dry till it sufficiently hardens before the subsequent coat is applied. Each coat of paint shall be inspected by SSE (P.Way)/AXEN and certified as satisfactory before applying the subsequent coat.
- (ix) The thickness of the dry film shall not be less than the specified thickness. If the thickness is found less than specified thickness, additional coat of paint has to be applied to bring it to the required thickness. The thickness shall be measured at various locations to ensure that the minimum prescribed thickness is attained all over the areas painted. Engineer-in-charge should satisfy himself that the thickness obtained is not less than that specified.
- (x) Painted surface shall be smooth and uniform in colour. The thickness of each coat

of paint shall be measured by ELCO Meter.

- (xi) The time lag between successive operations indicated below shall under no circumstances be exceeded.
  - (a) Between completion of surface Preparation standard and the application of primer coat. - 4 hours.
  - (b) Bet. The 1st finishing coat and the 2nd finishing coat - 7 days.

#### 6.0 Testing of the Paint :

- (i) The paints/painting shall be tested by the following instruments in the field by SSE (P.Way)/AXEN in addition to the tests conducted by CMT/LGD or any national Test house.
  - (a) Weight per liter cup 100 ml. capacity stainless steel
  - (b) Ford Cup No.4
  - (c) Scratch Hardness Tester Hand Operated preferably with lighting arrangement.
  - (d) Flexibility and adhesion Tester with ¼" (6.25 mm)dia. rod.

Representative samples from each Batch of paint shall be got tested by either the Chemist & Metallurgist/Lallaguda (Secunderabad) or at any other National Testing Laboratories, whichever, is convenient at the cost of the Contractor. If the samples of paint tested, do not conform to the ISI specifications the whole lot of paint pertaining to that Batch shall be rejected.

#### **(B) Painting of In-service Rails:**

1. Surface preparation: The surface preparation may be carried out as described at Para(A)(1.0) as in case of new rails, except removal of loose paint/flaked paint also to be removed.
2. Painting Scheme :
  - (i) 1<sup>st</sup> Coat: Anti corrosive bituminous black paint confirming to IS 9862-1981 to a thickness of 100 microns.
  - (ii) 2<sup>nd</sup> Coat: Anti corrosive bituminous black paint confirming to IS 9862-1981 to a thickness of 100 microns.

#### **(C) Maintenance of Field-cum-site Order Books:-**

**(1)**

- (i) Field-cum-site order books shall invariably be maintained for the painting work. Two separate Field Books shall be maintained so that one Book can be with the Inspector concerned, while the other book accompanies the Bill and M.Book for checking and passing of the Bill. All the field books shall accompany the Final bill and they shall be finally filed in Dy.CE's Office.
- (ii) Inspector-in-charge shall record certificates in both Field Books and M.Books on completion of each stage of work i.e. surface preparation, primer coats, 1st finishing coat and 2nd finishing coat in token of the completion of each stage of

work confirming that each operation is done satisfactorily and completely. The minimum thickness of paint for each coat has to be recorded by SSE (P.Way) and AXEN shall test check the same.

(iii) The certificate to be forwarded by SSE(P.Way)/AXEN and shall read as

under: 1st finishing coat of Km \_\_\_\_\_ to km \_\_\_\_\_  
2nd finishing coat of Km \_\_\_\_\_ to km \_\_\_\_\_

is satisfactorily completed in full (except for-----)  
The total quantity of paint consumed is \_\_\_\_\_ liters. And  
the minimum thickness of the paint is \_\_\_\_\_ Microns”

A similar certificate shall be furnished for the surface preparation either

- (iv) Field-cum-site order Book shall contain the following information
- (a) Section, km. TP, LH/RH, Rail, Gauge / non-gauge face side.
  - (b) Contractor's Name and Address: Details of Agreement.
  - (c) Name of manufacturer of the Paint, Specifications. Batch No. Manufacturing Date, expiry date, Reference to Certificate by the Chemist and Metallurgist, Lallaguda or certificate issued by National Test House.
  - (d) Date of commencement and completion of each of the following operations :
    - Surface preparation
    - Painting 1st Finishing coat
    - Painting 2nd finishing coat
  - (v) (a) The paints supplied shall be taken into account by the SSE/P.Way and issue back to the agency for painting as per requirement.
  - (b) The Agency on completion of the work shall return back the empty drums to the SSE/P.Way, who shall ensure that the empty drums are kept safe for a minimum period of 3 months after completion of work and thereafter return the same to Stores/Shop them duly obtaining concurrence from AXEN.
- (2) Results of tests conducted by SSE/P.Way on Paint shall also be recorded in the field/ Site Order Books. A minimum of two tests per batch of paint shall be conducted at random.

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