

E.10: GENERAL SPECIFICATION FOR RAILWAY TRACKWORK

RAILWAY ENGINEERING

SPECIFICATION

E.10: GENERAL SPECIFICATION FOR RAILWAY TRACKWORK CONTENTS

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E10 - SPECIFICATION FOR RAILWAY TRACKWORK

1. INTRODUCTION

Specification E.10 for Railway Trackwork consists of the following:

- (i) This page
- (ii) The general specification, E.10 Gen
- (iii) The following supplementary specifications which may, or may not, be bound into the contract document:

E.10/1	LAYING OF RAILS
E.10/2	LAYING OF SLEEPERS
E.10/3	BALLAST CLEANING
E.10/4	BALLASTING AND TAMPING
E.10/5	DESTRESSING OF RAILS
E.10/6	BUILDING AND REPLACEMENT OF SETS
E.10/7	FIELD WELDING OF RAIL JOINTS
E.10/8	FIELD WELDING AND CORRECTIVE GRINDING OF BATTERED RAIL JOINTS, SKID MARKS AND RAIL CROWN DAMAGE
E.10/9	SLEWING AND ALIGNMENT
E.10/10	DRAIN CLEANING
E.10/11	SURVEY AND SETTING OUT OF TRACK ALIGNMENT AND REFERENCING
E.10/12	INSTALLATION OF INSULATED RAIL JOINTS (BLOCK JOINTS)
E.10/13	MISCELLANEOUS
E.10/14	BUILDING OF NEW LINES

Only those supplementary specifications relevant to the project will be bound into the contract document, as listed in the Project Specifications.

2. SUPPORTING SPECIFICATIONS

- 2.1 Where this specification is required for a project, the following specifications shall, inter alia, form part of the contract document:
 - a) The Project Specification
 - b) Transnet specification E7/1 for work on, over, under or adjacent to railway lines and near high voltage equipment.
- 2.2 Some clauses in the supplementary specifications are left void. In such cases, the requirements are specified elsewhere in this specification.

1. SCOPE

This specification covers the general requirements for all types and methods of railway trackwork.

2. INTERPRETATIONS

This specification must be read together with all contract documents and specifications, (specifically with the E7/1 Specification for work on, over, under or adjacent to railway lines and near high voltage equipment), the specific supplementary specifications hereof applicable to the project as well as the Project Specification.

2.1 SUPPORTING SPECIFICATIONS

The following specifications shall form part of the contract documents.

- a) Spoonet's Track Welding Specification SSS-8.

2.2 DEFINITIONS

To ALIGN TRACK means to correct the horizontal geometry of a track to a defined centre line, to within the specified geometric standards.

BALLAST means broken stone used to support sleepers.

To BOX IN AND TRIM means to place the correct quantity of ballast between the sleepers and on the ballast shoulders to form the specified ballast profile.

To CLEAN BALLAST means to remove all ballast and fouling matter to a specified depth below the required rail level, screen the ballast and return it to the track.

CONSTRUCTION SIDING means a railway line built for the purpose of handling construction traffic, or an incomplete new line on which construction traffic is handled.

CONSTRUCTION TRAFFIC means wagons carrying material required by the Contractor or others for construction purposes.

CONTINUOUS WHEEL SPIN DAMAGE means wheel spin damage to the rail crown occurring continuously over a length of more than 150 mm.

Cr Mn RAILS means chrome - manganese rails.

CROSSING FROG means that part of the crossing of a set which enables a train wheel on one rail to cross over another rail at the same level. (See Annexure B).

To CURVE a RAIL means to give a rail a permanent set of the required radius, by bending of the rail.

DESTRESSING means the process whereby rails are relieved from all internal stresses existing in them at that moment in time.

To **DISTRIBUTE MATERIAL** means to place material on the formation clear, of the structure gauge of open lines and drains, in the required quantities along the track to suit the Works.

FORMATION, when referring to the laying of new track, means the prepared layer works on which railway tracks are to be laid. When referring to an existing track on which work must be done, **FORMATION** means the earthworks to a specified width at a specified depth below the required rail level.

FREE HAUL DISTANCE means the distance specified in the Project Specification over which the Contractor moves material without separate compensation for distance travelled.

GAUGE, when referring to a railway track, means the shortest distance between the running edges of a pair of rails which are fastened to the sleepers, measured as shown in Annexure F hereof. **BROAD GAUGE TRACK** means track with a nominal gauge of 1065 mm, and **NARROW GAUGE TRACK** means track with a nominal gauge of 610 mm.

HEAVY MACHINE means an on-track machine which may not be operated on open lines without a prior notice having been issued by an operating office of the Railway Authority.

INSULATING JOINT, INSULATED RAIL JOINT or BLOCK JOINT means a rail joint at which the adjacent rails are electrically insulated from each other.

To **LAY TRACK** means to lay sleepers on the formation, place rails on the sleepers, apply or tighten sleeper and rail fastenings, adjust the gauge and expansion gaps, and pack.

To **LIFT** means to raise the track from one level to another level.

LIGHT MACHINE means a machine which may be operated on open lines, without a prior notice having been issued by an operating office of the Railway Authority.

LONG WELDED RAILS (LWR) or CONTINUOUS WELDED RAILS (CWR) means rails which have been welded into lengths longer than 36m.

To **MAINTAIN** means to do the day-to-day repairs and adjustments necessary to keep earthworks and drains in good order and to keep the track at the required standard for trains to run at the prescribed speeds.

MATERIAL TRAIN means a train of wagons and a locomotive for loading or offloading

of material at a construction siding, or open lines.

MULTIPLE LINES means a group of tracks of which the maximum distance between any 2 adjacent tracks does not exceed 7,5 m.

OPEN LINE means a railway track that is already in use by the Railway Authority for its everyday business, and under control of its operating department.

To OPEN UP a TRACK means to remove all ballast and fouling matter above the level of the bottom of the sleepers.

To PACK means to insert approved material under a sleeper in such a way that the sleeper will have even bearing over at least 450mm of its length under each rail seat for the full width of the sleeper, and will carry a train without damage to the permanent way material or the formation.

RAILWAY AUTHORITY means the owner and his appointed operator of the railway system designated in the Project Specification.

RAILWAY TRACK, TRACK or LINE means a route on which trains travel on steel rails.

RAIL FASTENINGS means the components used to fasten rails to rails.

To REALIGN TRACK means to align the track on the specified centre line, where the horizontal movements are not more than 100mm.

To RELAY means to perform the combined operations defined as RESLEEPER , RERAIL, LIFT, TAMP and ALIGN.

To RERAIL means to remove the rails and rail fastenings from the track and to replace them with other rails and rail fastenings of the same or different mass and/or length with minimum disturbance of the sleepers or ballast.

To RESLEEPER means to remove designated sleepers and sleeper fastenings from the track, and replace them with other sleepers and sleeper fastenings, at the same or a different spacing.

To RESPACE SLEEPERS means to loosen the sleeper fastenings, move the sleepers along the length of the track to the required spacing, thereafter tighten the sleeper fastenings, and tamp the sleepers.

SET means the arrangement of permanent way material, assembled so as to form a unit which enables a train to switch from one railway line to another, or to cross another railway line at the same level. Turnouts, slips and diamond crossings are examples of sets.

SLEEPER means an item of permanent way material designed to support the rails and

to hold them at the correct gauge.

SLEEPER FASTENINGS means the components used to fasten rails to sleepers or other railbeds.

To **SLEW TRACK** means to move a track horizontally by more than 100mm to a different defined centre line of the track.

SPLICE JOINT means an expansion joint inserted in the track.

STABILISED TRACK means track of which the ballast remaining loose after completion of tamping, has been compacted either by the passing of a sufficient number of trains, or by mechanical means designed to expedite the compacting action.

SUPERELEVATION or **CANT** means the difference in level between the two rails of a track.

To **TAMP**, **TAMP BALLAST** or **TAMP TRACK** means to place and compact sufficient ballast under the sleepers to form a firm interlocking mass which will support the sleepers at the correct level and enable trains to run at the permissible speed.

TOTAL OCCUPATION - is defined in specification E7/1.

TRANSITION CURVE means a curve of decreasing or increasing radius used to connect a straight track to a curved track of uniform radius, or a curved track of one uniform radius to a curved track of another uniform radius.

WAGON means a goods-carrying on-track vehicle.

WORK, OR OCCUPATION, BETWEEN TRAINS - is defined in specification E7/1.

WORK PERMIT - is defined in specification E7/1.

3. MATERIALS

3.1 The Railway Authority will supply all permanent way material and ballast required for the Works except that detailed in the Project Specification and in 3.2 hereof.

3.2 Unless otherwise stated in the Project Specification, the Contractor shall supply the following:-

- i) Exothermic portions and moulds for welding of rail joints.
- ii) Welding rods.
- iii) Cleaning materials, oil, grease, black lead and graphite for treating contact surfaces and sliding surfaces of items of permanent way material.

- iv) Track thermometers for measuring rail temperature.
- v) Shims for setting expansion gaps at rail joints.
- vi) Tar.
- vii) Dowels and creosote for plugging holes in wood sleepers.
- viii) Grease for rail and flange lubricators in accordance with Transnet specification CSS 181/63/1315.
- ix) White P.V.A. paint for switch boxes, tumbler mass pieces, clearance marks, scotch blocks, derailleurs, stop blocks and cattle guards.
- x) Steel pegs at least 10mm diameter and 300mm long for survey and setting out.
- xi) Concrete materials and ingredients for fixing steel pegs in position.
- xii) Suitable carbon books with detachable sheets, as required.
- xiii) Other miscellaneous items as stated in the Project Specification.

- 3.3 All material delivered for the works prior to the Contractor starting work on site, will be distributed or stacked by the Engineer, as detailed in the Project Specification.
- 3.4 Should the Contractor fail to start work by the time specified in the Project Specification, the Engineer may, at his sole discretion, offload and stack or distribute material, and recover money as a penalty from the Contractor, as specified in the Project Specification.
- 3.5 Immediately after he starts work, the Contractor shall check the quantities of all the material distributed or stacked by the Engineer and give the Engineer a receipt therefore, and thereafter, accept responsibility for the protection and safe custody of such material. Should the Engineer agree that it is necessary, the Contractor shall move the material in order to check the quantities.
- 3.6 The Contractor shall provide the Engineer together with all construction programs, a detailed Schedule of required dates of delivery of materials, for approval. When approved the Engineer will base orders for material thereon. The Contractor shall continuously ascertain whether the material provided by the Engineer satisfies his needs, and he shall advise the Engineer of any shortages which might delay progress in terms of his approved tender programme. All requests for and advice concerning material shall be made in writing, numbered consecutively and dated. Should the Contractor require material outside his approved schedule, he shall provide the Engineer with detail and a revised schedule for approval. The Engineer will not be obliged to approve the revised schedule, if the material cannot be supplied in accordance therewith.
- 3.7 The Contractor shall give the Engineer receipts for material offloaded from wagons. These receipts shall show the date on which the material was offloaded and the numbers of the wagons from which it was offloaded. The wagon labels shall be attached to the receipts.
- 3.8 The Contractor shall bring to the notice of the Engineer any shortages or defects in any material supplied, and shall endorse the relevant receipt accordingly. If steel or concrete sleepers or second hand permanent way material is supplied, the Contractor

shall examine each and every item and shall not use any item which he considers damaged or sub-standard unless the Engineer instructs otherwise.

4. PLANT

- 4.1 The Contractor shall submit with his tender a list of vehicles, heavy machines, light machines and other tools and equipment he intends to use, with a statement of how these will be applied in his proposed method of construction.
- 4.2 The Contractor shall submit for the approval of the Engineer, a list of any additional heavy machines he intends using prior to the use thereof.
- 4.3 The Engineer may by his written instructions, hire the Contractor's vehicles or plant, including operators at the rates quoted in the Schedule of Quantities and Prices.
- 4.4 When laying track on new formation the Contractor shall not use machines that may damage the formation.
- 4.5 The Contractor shall make his own arrangements with the relevant Railway Authorities, for transport of heavy machines to and from the site. Such transport shall be at the cost of the Contractor. Delays due to whatever reasons, occurring while the Contractor's heavy machines travel to the site on open lines as trains controlled by the operating department of the Railway Authority, shall be at the risk of the Contractor, subject to extension of time claims in accordance with the Contract document.
- 4.6 Once the use of heavy machines have been accepted in terms of 4.1 or 4.2, the risk of delays caused by actions of the Engineer or the Railway Authority to these machines once they are on the worksite or travelling to the worksite from the specified or approved staging point, will be on the Railway Authority.

The estimated cost to the Railway Authority of hauling these machines on site, during the execution of the works, will be taken into account to the extent as specified in the Project Specification.
- 4.7 Heavy machines used on the works, shall comply with the following basic requirements:-
 - 4.7.1 All machinery shall be in good condition initially, and the Contractor shall maintain the machinery in good condition for the duration of the contract.
 - 4.7.2 Axle loads shall not exceed 20 tons.
 - 4.7.3 All machines shall have service brakes and independent emergency brakes capable of providing retardation of not less than 12,5% and 6% of gravitational acceleration respectively, on dry rail.

4.7.4 All machines shall actuate all signalling equipment used by the Railway Authority for traffic control.

4.7.5 Each machine shall be operated by a qualified operator.

5. CONSTRUCTION

5.1 GENERAL

5.1.1 The Contractor may use machine based or labour based methods, or a combination thereof, for the execution of the Works. He shall submit with his tender a method statement of how he proposes to carry out the work.

5.1.2 The Engineer and the Contractor may agree on normal working hours other than those defined in the contract, to suit local conditions.

5.1.3 The Contractor shall only employ supervisors with knowledge and experience of railway trackwork construction and maintenance, and capable of supervising all phases of the work. Their competence to undertake the work will be assessed by the Engineer.

5.1.4 The Engineer will have the right to stop any work where adequate supervision is not present and no claims will be considered in respect of such stoppage.

5.1.5 The Contractor shall record daily in a triplicate carbon copy book sufficient information (and any additional information requested by the Engineer), to enable the contract to be efficiently managed and to have available all relevant facts for payment purposes. Each and every sheet of the book must be signed and dated, on the day it is completed, by the Contractor and by the Engineer who will remove and retain the original of each set of sheets immediately after he signs it. The Contractor may remove the first copy but the book with the second copy shall remain on site.

5.1.6 When the Contractor causes work planned to be done during normal working hours, to extend to outside normal working hours, the cost of overtime payable to the Engineer's staff, will be recovered from the Contractor, at the rates specified in the Project Specification. Vice versa, when the work is caused to go outside normal working hours by actions of the Engineer or the Railway Authority, the Contractor's cost of overtime will be paid for at the extra-over rate quoted for in the Schedule of Quantities and Prices.

5.2 SAFETY PRECAUTIONS

5.2.1 The safety of the public, the employees of the Railway Authority and the Engineer's and the Contractor's own staff shall be the primary consideration of the Contractor.

5.2.2 The Contractor shall not do any work on an open line without the knowledge and consent of the Engineer.

- 5.2.3 The Engineer will decide whether a temporary speed restriction is required or not and will arrange for it to be applied. The Contractor shall keep the track safe for the passage of trains at the maximum speed allowed, and he and his workmen shall be prepared to stand aside to allow trains to pass.
- 5.2.4 The Contractor shall ensure that he obtains the temporary speed restriction notices applicable to the site and that he does no work outside the limits given in such notices. The Contractor shall check that the temporary speed-reduction boards have been erected and that the speed shown on the boards agrees with the notice. If there is any discrepancy, the Contractor shall immediately advise the Engineer.
- 5.2.5 During and after completion of each day's work, the Engineer will evaluate the safety of the track, and the Contractor shall do all work deemed necessary by the Engineer to make it safe for the passage of trains at the arranged speed. The line will not be reopened until the Engineer certifies in writing that it is safe to do so.
- 5.2.6 Before the start of any occupation, the Contractor shall ensure that he has sufficient workmen, tools and material on site to complete the work planned to be done during the occupation.
- 5.2.7 The Contractor shall not move any clearance mark or obscure it unless work is being done in its immediate vicinity, in which case he shall replace or clear it as soon as it is physically possible to do so and before the end of each working day. Clearance marks shall be replaced in position where the adjacent track centres are 3,45m or 2,75m apart for broad-gauge and narrow-gauge tracks respectively. If the rails are bonded, the Engineer must be advised before a clearance mark is moved, and it shall be repositioned as directed by him.
- 5.2.8 The Contractor shall not move any electrified track vertically or horizontally unless the Engineer gives permission to do so.

5.3 **PROGRAMME**

- 5.3.1 Details of available occupation times and other limitations will be given in the Project Specification, around which the Contractor shall plan his programme.
- 5.3.2 The Contractor shall submit with his tender a proposed programme of work. The Contractor shall indicate, as part of this programme, the total number of occupations required, as well as for each occupation, the duration thereof, and the production rate for and type of work intended during that occupation.

The above information will be taken into account when adjudicating the tender.

- 5.3.3 Before he starts work, the Contractor shall, if requested by the Engineer, elaborate on the proposed programme, in writing, for approval by the Engineer. Work on open lines tends to disrupt railway traffic, and the work itself is subject to disruption due to the

needs of the Railway Authority. The programme must therefore allow for work to be limited as specified in the Project Specification. Should the Contractor be prevented from carrying out a particular activity, he must be prepared to carry on with other activities, when and where possible.

5.4 METHODS AND PROCEDURES

5.4.1 HANDLING OF MATERIAL

- 5.4.1.1 After he has started work, the Contractor shall load, offload, transport, stack as directed by the Engineer, and distribute permanent way material and ballast as required for the works and as approved by the Engineer. The sites at which material is to be stacked shall be cleared of all rubbish and vegetation by the Contractor.
- 5.4.1.2 Failure on the part of the Contractor to offload wagons built specially for the conveyance of ballast or rails could result in delays in delivery of subsequent consignments of such materials and this aspect will be taken into consideration if a claim for late supply is made. The Contractor shall as far as is reasonably possible plan and execute the Works so that it will not be unduly delayed by the late arrival of any specific item of material. Demurrage charges as specified in the Project Specification will be applicable to delaying of wagons.
- 5.4.1.3 The Contractor shall take the utmost care when off-loading wagons, that offloaded material or ballast does not damage or interfere with drainage, cables, wires, the movement of the wagons or the running of trains after offloading is complete.
- 5.4.1.4 If permanent way material or ballast is incorrectly offloaded and/or distributed by the Contractor, he shall bear all costs of rectifying the errors. If material has been incorrectly distributed by the Railway Authority, the Contractor shall rectify the errors as directed by the Engineer. Payment at daywork rates will be made for such correction of errors.
- 5.4.1.5 The Contractor shall obtain the approval of the Engineer for the route over which he intends conveying material.
- 5.4.1.6 The Contractor shall record at least the following information about material handled on site :-
 - (a) Wagon numbers and details of contents of any wagons loaded or offloaded.
 - (b) The kilometre distances at or over which materials were loaded or offloaded.
 - (c) The type and quantity of material handled.
 - (d) Deficiencies in quality of material.
 - (e) Delays in delivery.
 - (f) Shortages of material.
- 5.4.1.7 The Contractor shall provide the driver of each lorry with a suitable triplicate carbon book with detachable numbered sheets. All such books shall be written up in the same

manner. Each time a lorry is loaded, one set of 3 sheets of the book shall be legibly completed by the Contractor or his representative to show the following:

- a) The lorry registration number.
- b) The date.
- c) The time loading was completed.
- d) The quantity and type of material loaded.
- e) The odometer reading.
- f) The signature of the driver.

The driver shall also record the time of arrival and odometer reading on the same set of sheets in the book. Both the driver and the Engineer's representative shall sign the book and the Engineer's representative will retain the original sheet.

- 5.4.1.8 Should the odometer of any lorry become defective, the lorry shall be withdrawn from service until the odometer has been repaired.

5.4.2 LEVEL CROSSINGS

- 5.4.2.1 When it is necessary for the Contractor to disturb the road surface at a level crossing, he shall give the Engineer 3 weeks' written notice, or such other period specified in the Project Specification, and shall carry out all instructions and comply with all requirements laid down by the road authority as directed by the Engineer and as specified in the Project Specifications. When the crossing is fitted with precast concrete slabs, they shall be uplifted and replaced by the Contractor as directed by the Engineer. On lines within 30 m of an electrified line, the Contractor shall paint the buried lengths of rail at level crossings with tar.

- 5.4.2.2 The Contractor shall remove cattle guards, repaint them with white P.V.A. paint and refix them as shown on the drawings and shall correct the drainage if necessary. While any portion of a cattle guard is not in its proper position, the Contractor shall, at his own cost, ensure that no animals gain access to the right-of-way.

5.4.3 MATERIAL TRAINS

- 5.4.3.1 The Engineer will arrange material trains for off-loading of material, under the same conditions specified in clause 3.6. The Contractor shall order material trains for loading of released material timeously, as specified in the Project Specifications. The Engineer will give the Contractor at least 24 hours notice of the date and time for which a material train has been arranged and give details of types and approximate quantities of material to be offloaded.
- 5.4.3.2 The Contractor shall supply sufficient supervision and labour to offload or load all the wagons in material trains during the hours which the trains are scheduled to work. The Contractor shall close all doors before the train departs whether he opened them or not.

- 5.4.3.3 If a material train is delayed in any way by any act of the Contractor, he will be held liable for demurrage charges on any wagons so delayed at the rates specified in the Project Specifications for the full period of such delay.
- 5.4.3.4 The Engineer will keep the Contractor informed as to the running times of material trains and their expected arrival times. The Contractor shall arrange his work to avoid, as far as possible, any loss of working time while waiting for a material train to arrive. The Contractor will be compensated for time lost due to a material train being late only if the material train arrives more than 30 minutes late, or is cancelled, and provided that the Engineer certifies that no other work was available within a reasonable distance of where the train was arranged to stop first.
- 5.4.3.5 The Contractor shall record at least the following information about material trains :-
- a) The time a material train was due.
 - b) The time a material train stopped at the site.
 - c) All interruptions in excess of 30 minutes in working a material train.
 - d) The time a material train left the site.
 - e) The names of the Contractor's and the Engineer's representatives attending to a material train.
 - f) The number of the Contractor's workmen assigned to work with a train.
- 5.4.4 PLATELAYING
- 5.4.4.1 The Engineer will provide the Contractor with survey information as specified in specification E10/11, as well as in the Project Specification, for alignment of the works.
- 5.4.4.2 Before any items of permanent way material subject to movement are assembled, all contact surfaces shall be cleaned, oiled, greased or blacklead and polished as required. The contact surfaces between the rails, sleepers and sleeper fastenings shall be kept free of oil, grease and foreign matter.
- 5.4.4.3 Unless self-locking nuts are supplied, spring washers must be fitted under the nuts.
- 5.4.4.4 Permanent way material shall be assembled as shown on the relevant drawings.
- 5.4.4.5 When curved track is aligned, the high leg must be positioned at 533 mm from the centre line pegs for broad gauge track, and at 305 mm for narrow gauge track.
- 5.4.4.6 The Contractor shall destress the rails after certain operations on open lines, as specified in the Project Specification.
- 5.4.4.7 The Contractor shall at all times ensure that sleepers are adequately packed to avoid derailments or damage to perway material or the formation. Any such damage will be for the Contractor's account.
- 5.4.4.8 If there is a mismatch at a fish-plated railjoint of more than 1 mm, this mismatch shall

be reduced to less than 1 mm, as specified in Track Welding Specification SSS-8.

5.4.4.9 When joints in rails, which are to be welded, are temporarily fishplated the following shall apply:

- a) The joint shall be midway between sleepers, to be achieved by either moving of sleepers or cutting off short sections of rail.
- b) The cutting of rails shall generally be in accordance with specification E10/1.
- c) The joint may be fishplated by either :-
 - i) Using joggle type fishplates (painted yellow), together with four clamps; or
 - ii) Using conventional fishplates with drilling and bolting, except that this method may not be used on CrMn - rails.
- d) On open lines, temporarily fishplated joints may not be left in the track for longer than three days.
- e) The Contractor shall obtain the Engineer's approval of the position of the joints. The Engineer will only certify payment for the joint if the joint was made at his request or instruction, and not when it was provided for the convenience of the Contractor.

5.4.4.10 The Contractor shall record daily at least the following information about work performed :-

- a) The amount of work performed per scheduled item.
- b) Whether the work was done under total occupation, occupation between trains or work permit.
- c) The weather conditions.
- d) The state of the work site and roads.
- e) Details of any occurrence which may have a bearing on any claim which the Contractor may wish to make. No claims will be considered unless supported by an entry in the diary containing all the facts on which the claim is based.

5.4.5 FINISHING

5.4.5.1 After the track has been brought to the final level, the Contractor shall check and correct the running top, the expansion gaps, gauge and superelevation. He shall arrange with the Engineer to check, together with the Signalling Technician of the Railway Authority, turnouts, slips, scissors and diamond crossings and derailleurs to ensure that they have been installed correctly and operate correctly. He shall realign the track, tighten all fastenings, check and correct the quantity of ballast, and box in and trim.

5.4.5.2 The Contractor shall be responsible for all maintenance of the Works until such time as the track is taken over by the Engineer, when the standard of the track shall be as specified.

5.4.6 RELEASEMENTS AND SURPLUS MATERIAL

- 5.4.6.1 The Contractor shall dispose of released and surplus material in accordance with the Project Specification.
- 5.4.6.2 Released material shall not be stacked or loaded into wagons together with new or second-hand material supplied surplus to requirements for the works. Each type of permanent way material shall be stacked separately. Material shall be loaded into wagons as directed by the Engineer.
- 5.4.6.3 Material trains for the loading of released and surplus material will be arranged as provided for in the Project Specification.
- 5.4.6.4 To achieve safe working conditions at the site, clearing and loading of released material shall be a continuous operation which shall be done as the work proceeds. Small items of released rail and sleeper fastenings, as well as wood sleepers, shall be cleared out of the section before the end of each day, as specified in the Project Specifications.
- 5.4.6.5 The Contractor shall, on every day that material is loaded, give the Engineer a signed, dated list in duplicate for each wagon, detailing the type and quantity of material in each wagon and giving the wagon number and place where loaded. The Engineer will sign the lists and return the duplicate to the Contractor as a receipt.
- 5.4.6.6 If the Engineer instructs that material is to be left in stacks, the Contractor and Engineer shall together count it. The Contractor shall give the Engineer a signed list in duplicate of all such material. The list shall indicate where and on what date the stack was made. The Engineer will sign the list and return the duplicate to the Contractor as a receipt. Thereafter the Railway Authority will be responsible for that material.

5.5 STANDARDS

5.5.1 GENERAL

- 5.5.1.1 Lines are classified into the following classes :-

Class	S
	N1
	N2
	N3
	Yard lines

- 5.5.1.2 An outline of the track design standard applicable to each class of line is shown in Annexure C Sheet 1 hereto.
- 5.5.1.3 For each class of line, A, B or C categories of track condition standards are defined herein and in the supplementary specifications. The condition standards with which

completed trackwork shall comply, are as specified in the Project Specification.

5.5.1.4 During construction, the following interim condition standards shall apply :-

- a) For opened up track, to allow trains to run at the temporary restricted speed. - C standard.
- b) For distressing of rails - B standard, unless C standard has been specified for the completed trackwork.

5.5.2 TRACK GAUGE

5.5.2.1 The nominal gauge on the straight for broad-gauge track shall be 1 065 mm and for narrow-gauge track 610 mm.

5.5.2.2 The gauge for track on curves shall be as follows:

5.5.2.3

RADIUS OF CURVE	NOT CHECK-RAILED	CHECK-RAILED
BROAD-GAUGE TRACK		
Under 135 m	1 085 mm	1 090 mm
135 m - 150 m	1 080 mm	1 085 mm
151 m - 175 m	1 075 mm	-
176 m - 200 m	1 070 mm	-
Over 200 m	1 065 mm	-
NARROW-GAUGE TRACK		
Under 201 m	620 mm	
201 m - 300 m	615 mm	
Over 300 m	610 mm	

5.5.2.3 Gauge widening on circular and transition curves, shall be provided in accordance with Annexure F hereof.

5.5.3 SUPERELEVATION

5.5.3.1 The Contractor shall provide superelevation as specified in the Project Specification or as directed by the Engineer. In the absence of such directives, it shall be provided in accordance with the clauses below.

5.5.3.2 Superelevation shall be provided on curves on open lines in accordance with annexure

G hereof. In yard tracks the superelevation shall be 10 mm on all curves.

- 5.5.3.3 On curves without transitions, two thirds of the full superelevation shall be provided at the beginning and ends of the curves. The superelevation shall be increased to the full amount towards the middle of the curve and decreased to zero into the straight at a rate not exceeding 20 mm in 10 m.
- 5.5.3.4 On curves with transitions, application of superelevation shall commence at the point where the transition curve meets the straight and be provided at a uniform rate over the transition curve, to reach the required value for the curve at the beginning of the circular curve, provided that the rate of application of superelevation does not exceed 20 mm in 10 m. If it is not possible to reach the required superelevation at the beginning of the circular curve at the abovementioned maximum rate, the increase of superelevation at this maximum rate shall be continued into the circular curve until the required superelevation is reached.
- 5.5.3.5 On reverse curves where the intervening straight is less than 40 m, zero superelevation shall be provided for a distance of 6 m between the two curves.

5.5.4 TORQUE

Unless otherwise specified in the Project Specification or supplementary specification E.10/12, all rail and sleeper fastenings, bolts and screws, shall be tightened to a torque of 340 N.m.

5.5.5 CLEARANCES

At specific points, the Engineer may instruct that clearances less than the minimum specified in specification E7/1 shall apply.

5.6 COMPLETION

5.6.1 TAKING OVER

- 5.6.1.1 The Contractor shall complete trackwork ready for taking over, at the rates and in quantities as specified in the Project Specification. The Engineer may at his sole discretion, take over portions of the work under lesser conditions than those specified in the Project Specifications, of which he will advise the Contractor.

- 5.6.1.2 Work will only be taken over after it has been tested and found to be satisfactory.

5.6.2 MAINTENANCE PERIOD

Notwithstanding the requirements in the contract dealing with maintenance of the Works after completion thereof, the Contractor will be relieved of all responsibilities for the maintenance of any portion of the trackwork after the Engineer has taken it over, except that latent defects shall be rectified.

6. TOLERANCES

Unless otherwise specified in the Project Specification, the permissible deviations from the specified standards shall be within the limits specified hereinafter.

6.1 HORIZONTAL ALIGNMENT

6.1.1 TRACK CENTRELINE

The centreline of the track shall be aligned correctly to within 20 mm from the staked line, on all classes and standards of lines.

6.1.2 STRAIGHT TRACK AND CURVES

On straight track and curves, the mid-ordinate measured on the gauge side of both rails from a chord of 10 m, shall not exceed the value calculated from the formulae specified in table A1 of Annexure A hereto. In addition, the number of measurements allowed to be one standard lower, is also specified in the above table.

6.2 VERTICAL ALIGNMENT

6.2.1 TRACK LEVEL.

Track levels shall be within 10 mm of the specified levels.

6.2.2 RUNNING TOP AND VERTICAL CURVES

The maximum permissible deviation from the theoretical grade measured by means of a standard track gauge measuring instrument, shall not exceed the values calculated from the formulae specified in table A1 Annexure A hereof. In addition the number of measurements allowed to be one standard lower, is also specified in the above table.

6.2.3 SUPERELEVATION

The superelevation at any point, shall not differ from the required superelevation by more than the values in table A1 of Annexure A hereof. In addition, the number of measurements allowed to be one standard lower, is also specified in the above table.

6.2.4 TWIST

The algebraic difference between the measured superelevations at any two measuring points, shall not exceed the theoretical difference by more than the values calculated from the formulae in table A1 of Annexure A hereof. The values given in brackets in the table, is the calculated value for measuring points 5 m apart.

6.3 TRACK GAUGE

The algebraic difference between the actual gauge and the required gauge shall not be more than the maximum nor less than the minimum shown in table A2 of Annexure A hereof. In addition, the algebraic difference between the deviations at any two measuring points 5 m apart, shall not be more than the maximum values in the abovementioned table.

6.4 SLEEPER SPACING

The spacing between any two adjacent sleepers shall not exceed the specified spacing by more than the values shown in table A3 of Annexure A hereof.

In addition, the total number of sleepers on a 50 m portion of track, shall not differ from the specified number of sleepers by more than the numbers shown in table A4 of Annexure A hereof.

6.5 SQUARENESS OF SLEEPERS

Sleepers shall not be out of square relative to the centreline of the track, by more than 25 mm for A Standard and 50 mm for B and C Standard lines, measured at the running edges of the rail crowns.

6.6 BALLAST PROFILE

The dimensions Y, K and Z defined in the diagram in Annexure C sheet 2, shall not be less than the minimum nor more than the maximum values in the table in that Annexure, unless otherwise specified in the Project Specification.

6.7 STRUCTURE GAUGE

The horizontal and vertical clearances shall be not less than those specified in specification E7/1. The horizontal distance from track centreline to a platform shall not exceed the specified distance by more than 20 mm.

7. TESTING

7.1 QUALITY

7.1.1 Testing of the trackwork will take the form of the checking of construction generally to comply with the specifications, and by measuring the items listed in 6 hereof.

7.1.2 The Contractor shall measure and mark the track at 5 meter intervals and indicate the kilometre distance at each 20 m mark. The horizontal and vertical track alignment, and the gauge shall be measured at each 5 m station, clearance to obstructions where necessary, and the rest at 20 m stations. The results shall be recorded and evaluated

by the Contractor before handing them to the Engineer. On open lines, this shall be done before the end of each day and prior to the opening of the track to traffic. Final measurements shall be made not longer than 24 hours before final handover, or as detailed in the Project Specification.

- 7.1.3 The Contractor shall advise the Engineer in writing (stating kilometre distances), when he considers that he has completed all the work on a section which he wishes the Engineer to take over, and after he has done his own inspection and measuring of the work. The Engineer will, within 3 days of receipt of such notification, inspect the section in the company of the Contractor. The Engineer will point out any defects he sees to the Contractor who shall record such defects in duplicate. On completion of the inspection, both parties shall sign the record and the Engineer will endorse the record that either he is prepared to take over the track immediately subject to the defects being remedied within a specified time or that the Contractor shall remedy the defects and then ask for another inspection. The Engineer will retain the original of the record.
- 7.1.4 At the start of any inspection by the Engineer in accordance with 7.1.3 hereof, the Engineer may define a sample test portion of that section that the Contractor wants him to take over. When inspection of that sample portion indicates defects at more than 5% of the number of measurements, the Engineer may abandon the inspection and will endorse the record accordingly. Before requesting another handover of that section, the Contractor shall re-inspect the section, and rectify all faults.
- 7.1.5 The testing of the track will be deemed to be successful, if all measurements are within the specified tolerances.

7.2 PRODUCTION

- 7.2.1 The production rate tendered for work to be done under occupations, will be used as the basis to test the production actually achieved, for which penalties or bonuses will be calculated in terms of the Project Specification.

8. MEASUREMENT AND PAYMENT

- 8.1 The Contractor shall tender for each item in the Schedule of Quantities and Prices on the assumption that the work will be done during normal working hours, unless otherwise specified in the Project Specification.
- 8.2 Work done on instructions from the Engineer outside normal working hours will be paid for at normal rates plus the percentage tendered therefore in the Schedule of Quantities and Prices.

8.3 SCHEDULED ITEMS

- 8.3.1 **OverhaulUnit:- (Unit of item). km.**

Separate items will be provided for all items of material transported in excess of the free haul distance.

The overhaul distance for an item of material will be measured along the approved route to the nearest 0,1 km, based on the average haul distance for that item. The free haul distance for rails will be 0 km.

The rate tendered shall include for all costs associated with the transport of the specific item.

8.3.2 Disturb and re-instate road surface at level crossings- Unit:-m²

The area of road surface necessary to be disturbed and re-instated, shall be measured.

Separate items will be provided for various road classifications and road surfaces.

The rate shall include all costs to -

Meet the requirements set out in the Project Specifications ;

Break up the road surface and open up to the level required ;

Backfill and compact material, required to re-instate the level crossing ; and,

Provide the surface layer, as required.

8.3.3 Move and refix cattle guards when disturbing level crossings.....Unit:- set

A set includes all items required to guard both sides of a level crossing.

Separate items will be provided for:

- Single line crossings

- Multiple line crossings

The rate tendered shall include for all costs to -

Remove the cattle guard;

Ensure that no animals gain access to the right of way while the guard is not in position;

Correct drainage at the cattle guard;

Paint the cattle guard white; and,

Refix the cattle guard in accordance with the drawings.

8.3.4 Temporarily fishplated joints Unit:- Joint

Each fishplated joint in each rail requested or instructed by the Engineer, will be taken as one joint. Joints provided for the convenience of the Contractor, will not be paid for.

The rate tendered shall include for all work necessary, as specified, including -

Positioning the joint midway between sleepers in accordance with 5.4.4.9 (a) hereof;

and,

Boxing in of disturbed ballast at the joints.

8.3.5 Daywork.....Unit:- Hour

Daywork will only be paid for if such daywork was done on the instruction of the

Engineer. Payment will be made only for the personnel agreed to.
Typical items for which daywork will be the basis of payment, include:-

- a) To move material to check quantities, in accordance with clause 3.1.5.
- b) To move material distributed incorrectly by the Railway Authority in accordance with clause 5.4.1.4.
- c) Delays to the Contractor where material trains arrive late, are cancelled or are interrupted during loading or offloading, in accordance with clause 5.4.3.4.

In the case of (c) above, the period for which daywork will be paid will be measured as follows :-

- ii) For trains that are cancelled, the period will be the time between the time the Contractor is advised of the cancellation and the expected time of arrival, less 30 minutes. One hour will be added to this period to allow for the Contractor to make safe the track, and re-organise.
- iii) For worktrains interrupted during the loading or offloading of material for an interval of more than 30 minutes because of the requirements of the Railway Authority, payment will be made at daywork rates for workmen who could not be productively employed during this period, less 30 minutes.

Separate items will be provided for different grades of staff.

8.3.6 Plant Hire Unit:-Hour

As specified in the Project Specification.

8.3.7 Extra-over scheduled items, for working outside normal working hours, on instruction of the Engineer Unit:-as per item

Work performed outside normal working hours on instruction of the Engineer, will be paid for at the scheduled rates, enhanced by an extra-over percentage.

The percentage tendered shall include for all additional costs for working outside normal working hours.