

TS 7.12 Assembly Marks

- (1) Bridge members to be assembled on site shall have assemble marks painted at prominent places. With respect to members which are prohibited to be painted, tags or some suitable means shall be used for marking.
- (2) Members weighing more than two tons per piece shall have their weight and position of gravity center indicated with paint at prominent places.
- (3) The paint used to indicate the assembly marks and the position of gravity center shall not be of such a type as to cause detrimental effect for the paint to be applied thereon later.

TS 7.13 Shipping

- (1) Appropriate safeguarding measures shall be taken to protect the parts of members liable to damages during the course of transportation.
- (2) As to gusset plates, splice plates, connection angles, lateral angles, anchor bolts, shoe washers and other smaller parts, pieces of similar shape shall be gathered together and fastened with bolts or bound with SWM-A (Annealed Steel Wire) of JIS G 3532 (Steel Wire) into handy packages.
- (3) Prior to packing, ordinary bolts, nuts and washers shall be soaked into machine oil. These parts and filed rivets shall be classified by both sets of bridge and types of parts and put into jute bags separately, each of which shall have a tag fixed to it. These bags shall be put into designated boxes which respectively show list of names, types, sizes and quantities of contents. The total weight of what are contained in one box shall as a rule not exceed 50 kg.
- (4) High-tension bolts shall be paired with nuts, coated with rust-preventing oil and thereafter put into moisture-proof bags. Then they shall be encased in sturdy wooden boxes or cardboard boxes so as to be protected from injury. Washers, after being coated with rust-preventing oil, shall be grouped by types and sizes and put into bags, which shall as a rule be placed into the same boxes with the bolts. In case washers have undergone the surface lubrication treatment, no rust-preventing oil shall be given to them.  
On each of these boxes the following items shall be clearly indicated.
  - (a) Name of standards of the bolts sets.
  - (b) Types classified by their mechanical properties
  - (c) Types classified by the values of torque coefficients.
  - (d) Nominal diameter size and length of bolt.
  - (e) Quantity
  - (f) Other designated affairs.
  - (g) Manufacturer's name or trade mark.
  - (h) Production lot number of the bolt sets.
  - (i) Date of inspection of the bolt sets
- (5) The contractor shall prepare 5% supplement pieces for the number of pieces of high-tension bolts for erection required in the design drawings.

- (6) The contractor shall prepare the following number of drift pins and ordinary bolts for erection of structural members.

Drift pin for flange:	1% ordinary bolt 5%
Drift pin for Web:	1% ordinary bolt 3%

TS 7.14 Test and Inspection

- (1) Radiographic Test and Inspection
- (a) Groove welded joints shall be subjected to radiographic test and inspection in accordance with JIS Z 3104 (Methods of Radiographic Test and Classification of Radiographs for Steel Welds) except for cases specified by drawings and Par. (1) (b).
- (b) Radiographic test and inspection may as a rule be omitted with regard to groove weld joint of below-listed members.
- (i) Groove weld joint of gusset plates to connect the main girder flanges and lateral bracings or floor beam lower flanges (except the gusset plates for floor beams which are expected to produce an effect of grating action between main girders).
- (ii) Groove weld joint of secondary members.
- (c) The radiographic test and inspection shall be conducted as instructed below.
- (i) The radiographic test shall be carried out about the places shown in the following Table and the test results shall conform to the prescribed grades.
- (ii) The length of the film for the radiograph shall be as a rule longer than 30 cm.
- (iii) In case two or more radiographs are taken in continuation, films shall be partly overlapped.
- (iv) The range of radiographing shall include the part of the end tab distanced 20 mm at least from the touching edge of the base metal with the end tab. However, only the weld of base metal shall be examined, and the weld on the end tab shall be examined.
- (v) In the case of radiographing after cut-down of the end tab, due care shall be exercised not to let the scattered-ray-preventing lead plate cover the base metal more than 1 mm from the edge.
- (d) Engineers to take radiographs and those to judge the result in radiographic tests shall be respectively qualified as approved by the Engineer.
- (e) When the design drawing prescribes removal of reinforcement weld metal and surface finish, radiographs of the special grade in quality as specified by JIS Z 3104 (Methods of Radiographic Test and Classification of Radiographs for Steel Welds) shall be taken after the surface finish. In other cases, radiographs of the regular grade in quality of the same Standard shall be taken.
- (f) The method to show the positions of radiographing shall be as provided for by the following paragraphs.
- (i) Marking plates made of lead on which the symbols for radiographed

Tabel 7-16 Places of Radiographic Test and Grades

Places of Radiographing		Range of Radiographing	Grade	
Members Principally Subject to Bending Moment such as Plate Girders	Joint of Tension Flange		1st Grade	
	Joint of Compression Flange		2nd Grade of Higher	
	Web Plate	Vertical Joint	Take one radiograph for each of the both edges and central part	1st Grade for one radiograph at tension end and 2nd Grade or higher for others
		Horizontal Joint	Take one radiograph for each of the both edges and for every spacing not larger than 3 meters	2nd Grade of Higher

position and the company's inspection mark are stamped shall be fitted on steel members at the position shown in Fig. 4, and the radiographs shall be taken in that state. The stamped marks must be clearly discernible on the radiographed films

- (ii) When two or more radiographs are taken in continuation, a marking plate shall be placed on the overlapped part of the films as shown in Fig. 3 (b); or a set sign shall be put on every overlapped part as shown in Fig. 3 (c) and a marking plate shall be placed on each film.

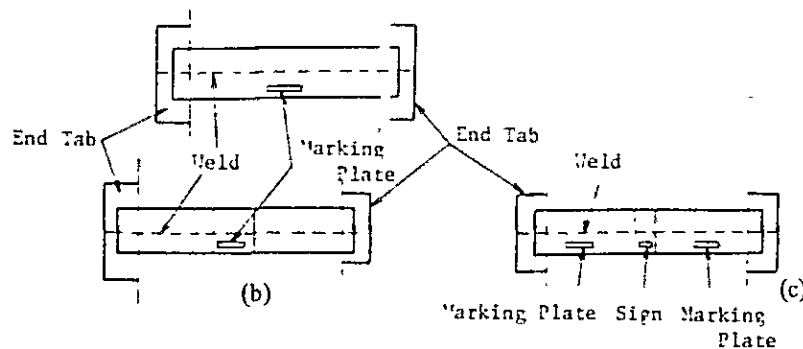


Fig. 3 Films and Method of Marking

TS 7.15 Delivery

(1) Delivery Schedule

The contractor shall submit to the Engineer a Delivery Schedule in accordance with the construction schedule. In case of making any change in the Delivery Schedule

dule, he shall also obtain on the followings the approval of the Engineer.

- Method of delivery and route;
- Transportation schedule;
- Crating, method of loading and protection for damages;
- Loading and unloading the structural members; and
- Temporary storage.

(a) **Safety**

The structural members while in delivery shall be rigidly fixed with appropriate method and shall be thoroughly protected from damages or deformation caused by moving and the contractor shall deliver the members to the site for erection, with a complete method of transportation.

(b) **Damages while delivery**

Should any damages be made while in delivery, the contractor shall repair or remedy the defects as directed by the Engineer.

(c) With regard to the delivery of the bridge girder, attention shall be paid to the type of the flat car together with the holding method of the flat car as well as the bridge girder so that the freight may not be destroyed.

TS 7.16 **Erection**

(1) The contractor shall collate the measuring steel tapes to be used at construction site and for erection. The tape shall be compensated according to the temperature by establishing the standard temperature.

(2) **Erection schedule**

The contractor shall submit to the Engineer an erection design and implementation schedule consisting of the following, based on the construction schedule.

In the event of making a change thereof, the same procedure should be followed.

(a) **General**

- Site organization (responsible engineer, engineer in charge, site geological map, site facilities, etc.) and the erection site conditions;
- Method of erection and erection sequence erection preparatory works;
- Materials for erection, erection equipment, erection work, structures for erection, power facilities;
- Erection works; (Delivery, custody, assembling, connections at site and survey.)
- Safety; and
- Schedule.

(b) **Inspection**

Prior to the commencement of the erection, the contractor shall prepare the records of internal inspection and other necessary documents so that they may be reviewed by the Engineer, however, the contractor may omit a part thereof, provided that the Engineer's consent is obtained.

- (i) Erection inspection;
- (ii) Inspection for connections;
- (iii) Inspection for completed erection (including the partial completion of the erection)

- (3) **Temporary storage of the structural members**  
 Should the structural members be stored at site temporarily, care shall be exercised so that no members are directly contact the ground surface.  
 Careful protective action should be taken so as not impair by contacting other structural members and/or falling down from the supporting platform while in temporary storage.  
 A long piece of member, such as chord member, skew member, etc. should be fully supported so as not to be damaged while they are stockpiled temporarily.  
 Should the period of the temporary storage be prolonged, an adequate protective method shall be made to protect the members from stain or erosion.  
 The contractor shall make sure that the temporary facilities and erection equipment to be used in erecting the members are rigid and extent to ensure the safety while the work is under-way.
- (4) Should the erection be carried out by using a crane, the equipment having the capacity appropriate to the working conditions shall be used and the equipment shall be carefully operated.
- (5) The erection of the bridge shall accurately be carried out in accordance with the erection symbol, specified sequence of erection, etc. and the members while in assembling shall be carefully handled so as not to cause any damages. The contacting surfaces between the members shall be cleaned prior to the erection.  
 The total number of the temporary fastening bolts, drift pins, etc. shall be as specified in TS 7.10 (3) and the number for the drift pins shall be limited to such extent needed to meet the number of pin holes so that the total number of the bolts may be maximized.  
 The contractor shall examine whether the shape of bridge meets the design or not, prior to the final fastening
- (6) The bearing shall be provided accurately at the specified location. The fixing between the lower structure and the bearing, and the embedding the anchor bolts shall be carefully made with hard mix of cement mortar.  
 Upon installing the bearing, consideration shall be paid to the temperature when the work is carried out and the final location shall be decided based on the standard temperature by compensating the temperature so that the relative positions between the bridge and the bearing may become the standard position.  
 After the erection work has been completed, the contractor shall confirm that the bearing is equipped with a capacity specified in terms of the moving, rotation, etc.
- (7) The painting work for welded portion shall be as specified in paragraph 11.

TS 7.17

**Basis of Payment**

- (1) After completing the delivery of all members to the site as well as the erection thereof, the contractor shall receive the Engineer's inspection needed in making the payment, which will be made as summarized in the following:

<u>Pay Item No. and Name</u>	<u>Unit</u>
712	Span
712	Span



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## SECTION 8 TRACK CONSTRUCTION

### TS 8.01 Scope

This work consists of the laying and ballasting of the tracks on previously prepared subgrade and conditioning them for the operation of trains at the location mentioned in General Specifications Clause GS.03 "Description of Work". The scope of work includes the construction of a single main track and side tracks including buffer stops at four intermediate stations, the construction of two conjunctions with the existing main track, the construction of railway crossings, and the installation of various railway track signs, etc., including supply of materials and the execution of work in accordance with these specifications and the alignment and gradients as shown on the drawings.

### TS 8.02 Preparation

- (1) The contractor shall obtain the approval of the Engineer on the track construction schedule including the force to be employed and the speed with which the work shall proceed. Prior to commencement of the work the Contractor shall notify the Engineer at least five working days in advance so that adequate arrangements can be made by the Engineer for the execution of work.
- (2) The Contractor shall supply and transport all track materials to the job site and all materials shall be subject to the approval of the Engineer.
- (3) The Contractor shall provide all tools and equipment needed in connection with the work.
- (4) The Contractor shall obtain the approval of the Engineer on the centerline stakes for track laying purpose specified in General Specification clause GS 15 (5) before the commencement of track construction. After those stakes for track laying were approved by the Engineer the Contractor shall follow those stakes in track laying, lining and surfacing
- (5) No material shall be placed and no track shall be laid on the subgrade until the subgrade has been constructed and finished to true line and planes according to the stakes set by the Contractor on the completed subgrade approved by the Engineer. In case when the prepared subgrade was used for the purpose of transportation of materials and equipment by trucks and/or for the operation of heavy equipment under the approval of the Engineer, the subgrade shall be restored to the original state by grading and compacting to the satisfaction of the Engineer at the Contractor's own cost before the track construction is commenced.

### TS 8.03 Materials

#### (1) Rails

##### (a) Designation

Rails are designated "Common Rail 37A (with bolt holes at both ends)" JIS-E-1101-1980 (37.2 kt/m) or its equivalent.

##### (b) Chemical Components

Chemical components of rails shall conform with the following allowable limits:

<u>Chemical Components</u>	<u>Allowable Limits</u>
Carbon (C)	0.55 - 0.70 %
Silicon (Si)	0.10 - 0.35 %
Manganese (Mn)	0.60 - 0.95 %
Phosphorus (P)	below 0.045%
Sulphur (S)	below 0.050 %

(c) **Mechanical Properties**

Rails shall conform with the following mechanical properties:

Elongation:	More than 9%
Tensile strength:	70 kg. force/mm <sup>2</sup> as minimum (686 mega pascal/mm <sup>2</sup> as minimum)

(d) **Manufacture**

- (i) The ingots or cast billets shall be manufactured by the process of basic oxygen furnace (symbolized in Characters LD) or of electric furnace (symbolized in character E).
- (ii) Sufficient length of discard shall be taken from the ends of ingots or cast billets to insure freedom from injurious segregation and pipe in manufactured rails.
- (iii) In case when continuous casting is made same heat number shall be used.
- (iv) When ingots or cast billets are rolled, rolling shall not be commenced before ingots or cast billets get hardened. Ingots or cast billets shall not get hardened in overturned state.
- (v) The original cross-section of ingots or cast billets shall have an area of more than eight times of cross-section of rails to be manufactured.
- (vi) An appropriate treatment shall be applied to rails so as not to cause any shatter cracks.

(e) **Branding of Rails**

- (i) Branding on rails shall be rolled in raised characters on the side of the web of each rail in accordance with the following requirements:
  - The data and order of arrangement of the branding shall be as shown in the following typical brand, the design of letters and numerals to be optional with the manufacturer.

	37A	LD	Manu- facturer	1980	111111
(Arrow symbol indicating the direction of head of ingot or cast billet at the time of rolling)	(Section Name)	[Symbol of furnace, Refer to (1)(d)(i)]	(Mill Brand)	(Year Rolled)	(Month Rolled)

- (ii) The heat number, ingot number and rail number shall be hot stamped into the web of each rail, on the opposite end of the brand.
- On the other side of branding the data and arrangement shall be hot stamped as shown in the following stamping example:

A	12	35218	II	65
Rail order letter rolled from ingot or billet	Ingot or billet number	Heat number	Work gang number	Carbon content

The top rail from each ingot or cast billet shall normally be hot stamped Rail Order Letter "A" and succeeding ones "B", "C", "D", etc., consequently, but if the top discard is greater than normal, the rail number shall conform to the amount to discard, with the top rail becoming "B" or other succeeding letter to suit the condition. When rails are produced more than eight rails (A-H, inclusive) per ingot or cast billet, additional rails may be stamped with the letter "H".

- Ingots shall be numbered in the order cast.

(f) Rolling

- (i) Bends of rails which will take place after rolling and cooling shall be kept in possible minimum and downward bends at both rail ends shall be avoided.
- (ii) In correcting bends of rails such treatment that gives unfavorable effects to rails shall be avoided.
- (iii) At ends of rails with bolt holes and on circumference of bolt holes edge cuts shall be applied as shown in Fig. 8-1, and bolt holes shall be drilled correctly.

(g) Control Cooling

- (i) All rails shall be control-cooled in accordance with the following procedure except when produced from vacuum steel, in which case the rails may be air cooled and 2) through 7) are not applicable.

- (ii) All rails shall be cooled on the hot beds or runways until the temperature is between 1000 deg F (654°C) and 725 deg F (468°) and then charged immediately into the containers.
- (iii) The temperature of the rails before charging shall be determined at the head of the rail at least 300 mm from the rail ends.
- (iv) The cover shall be placed on the container immediately after completion of the charge and shall remain in place for at least 10 hours. After removal of rails of the lid of the container, no rail shall be removed until the temperature of the top layer of rails has fallen down to 300 deg. F (181°C) or lower.
- (v) The temperature of an outside rail or between an outside rail and the adjacent rail in the bottom tier of the container, at a location not less than 300 mm nor more than 900 mm from the rail end, shall be recorded. This temperature shall be controlled for judging rate of cooling.
- (vi) The container shall be so protected and insulated that the control temperature shall not drop below 300 deg. F (181°C) in 5 hours from the time that the bottom tier is placed in the container. If this cooling requirement is not met, the rails shall be considered control-cooled, provided that the temperature at a location not less than 300 mm from the rail end at approximately the center of the middle tier does not drop below 300 deg. F (181°C) in less than 15 hours.
- (vii) The Employer shall be furnished a complete record of the process for each container of rails.

(h) **Standard Dimensions**

Major standard dimensions of rail shall be as follows:

Length	18,000 mm
Height	122.24 mm
Width of head	62.71 mm
Width of base	122.24 mm
Thickness of web	13.49 mm

(i) **Chemical Analysis Tests**

- (i) Sampling of material shall be conducted according to JIS G 0303 (General Rules for Testing Steel Material).
- (ii) Chemical analysis tests shall be conducted in accordance with following testing standards:

Test results of chemical analysis shall conform with the requirement provided in Clause TS 8.03 (1)(b).



(j) **Tension Test and Sampling**

Tension test of rails shall be performed conforming with JIS Z 2241 (Tension Test of Metallic Materials). Specimen for tension test shall conform with JIS Z 2201 (Test Specimen for Tension Test of Metallic Materials) and a specimen shall be taken from the rail head rolled from per optional ingot or cast billet of same heat number.

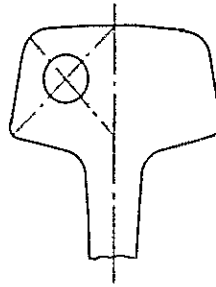


Fig. 8-2 Position from which specimen for tension test of rail shall be taken.

(k) **Impact Test and Sampling**

Rails shall be tested by the impact test to be conducted under the presence of the Engineer at the mill where the rails for this project were manufactured under the following guidelines:

- (i) Resistance to impact shall be determined on a machine which conforms to the requirements of the A.R.E.A. Specification for a Drop Test Machine or of JIS E 1101 Common Rail, Attached Document.
- (ii) Drop tests shall be made on test specimens of rail cut in length of 1,500 mm.
- (iii) Test specimens shall be taken conforming with the following conditions:

(a) **Case of Rails rolled from Ingots**

Assuming all steels having the same heat number to be a set of ingots, one specimen shall be taken from the rear end of discarded portion of rails rolled from optional ingots excluding the rail from which the test specimen for tension test was taken.

(b) **Case of Rails rolled from Casted Billets**

Assuming all strands having the same heat number to be a set of cast billet, one specimen shall be basically taken from optional portion of optional rail rolled from optional cast billet excluding such strand from which the test specimen for tension test was taken. But in case of continuous casting any test specimen for impact test shall not be taken from the portion in which steels of two different heat number are mingled.

- (iv) The distance between supports of specimen shall be 914 mm; the specimen shall be placed head upwards on the supports and subjected to one blow of weight of 907 kg falling freely from the height of 5,000 mm.

**(l) Inspection of Chemical and Physical Qualities**

The Employer reserves the right to visit the steel mill where rails for this project are to be produced for the purpose to inspect the manufacturing rails and the procedure of quality control at any time.

In the inspection of chemical composition and mechanical properties the Contractor shall submit to the Engineer the certificates of chemical analysis and tests of mechanical properties conducted by rail-manufacturer or authorized institution approved by the Engineer. Such results of test and/or analysis shall satisfy the requirements provided in Clause TS 8.03 (l)(b) and (c).

**(i) First Tension Test**

In the tension test of rails if the test specimen breaks at a point outside more than 1/4 of distance between marked points from the center of such points and the test results do not satisfy the requirements specified in TS 8.03 (1)(b) then the first test shall be regarded as invalid and the second test shall be carried out on the material again from which the first test piece was taken.

**(ii) First Impact Test**

In the impact test of rails no break, crack or fragment shall not take place.

If the test results of tension test and impact test do not satisfy the requirements retests shall be carried out under the following procedure by taking the second test pieces of the same set of rails.

**(iii) Retest of Tension Test**

**(a) Case of rails rolled from Ingots**

After discarding as unacceptable 300 kg portion from front ends of all rails of same heat number which was represented by the first test piece the second test specimen shall be taken from the front end of rest rails and retest shall be carried out. If the retest satisfies the requirements the remaining rails will be regarded as acceptable. If the results of retest does not satisfy the requirements the retest shall be repeated again by the aforementioned procedure.

**(b) Case of rails rolled from Cast Billet**

Retest shall be conducted on two test specimens after taking them, one from the adjacent portion where the test specimen for the first test was taken and another from such portion, specified by the Engineer, of rails of optional strand of same heat number except for the rails from which the test specimen for the first test was taken.

If the test results for those two test specimens satisfy the requirements all rails which are represented by those test specimens are regarded as acceptable. But in case of continuous casting in which results of the retest satisfy the requirements rails of unacceptable portion as well as those rails in which the heat number of unacceptable portion is mingled, are regarded as unacceptable.

(m) Interior Inspection

- (i) A test specimen representing the top end of the top rail of each ingot or cast billet of each heat rolled, which has passed the impact test requirements, shall be nicked and broken. If the fracture on any test specimen exhibits seams, laminations, cavities, or interposed foreign matter, the heat number and ingot number shall be recorded and the top end and bolt holes of the finished rail, so recorded, shall be closely examined for those defects. If the finished rail is clear of the above defects when presented for specimen, it shall be accepted as subject to the requirements of surface inspection. If the finished rail shows defects, it shall be broken back to sound metal and accepted as a short rail, subject to the requirements of surface inspection and length inspection.
- (ii) If the nick-and-break fracture on any test specimen exhibits a distinctly bright or fine-grained structure, the heat number and ingot number shall be recorded, and the top rail represented shall automatically be broken back to sound metal and accepted as a short rail, subject to the requirements of surface inspection and the length inspection.

(n) Surface Inspection

- (a) No. 1 Rails shall be free from injurious surface defects and flaws of all kinds.
- (b) Rails which conform to the following requirements will be regarded as No. 2 Rails.
  - Rails which do not meet the requirements of allowable rail flaws provided in Table 8-2
  - Rails arriving at the straightening presses with sharp kinks or greater camber than indicated by a middle ordinate of 150 mm in 10,000 mm.
  - Rails that are not hot stamped.

(o) Dimensions Inspection

Standard length of rails shall be 18,000 mm when measured at a temperature of 20 degrees in centigrade. Tolerances of length and sectional dimensions in such a temperature specified herewith shall be within the allowable limits as shown in the following table:



Table 8-1 Allowable Rail Flaws in Surface Inspection

Classification of Defects		Position	Allowable Dimension of Defect	Remarks
Category	Item			
Pipes	Pipe	In any part of rail section		In case of rails with bolt holes and pipe is existing in the part of web in such dimensions as 2/5 of rail height in case of sawn section and 4/5 of rail height in case of put sut and polished section and also pipe does not show its opening on the surface, such flaws are not regarded as rail flaws.
	Mechanical pipe & intrusion of foreign materials			
	Blister			
Longitudinal crack	Longitudinal	Any part of surface		
	Hair crack	Head	$D \leq 0.4 \text{ mm}$	
Bottom		$D \leq 0.4 \text{ mm}$		
Others		$D \leq 0.6 \text{ mm}$		
Crow-feet	Crow-feet	Any part of surface		
		Head	$D \leq 0.6 \text{ mm}, S < 0$ ; or $D \leq 0.4 \text{ mm}, S < 150 \text{ mm}^2$	
Scab	Scab	Others	$D \leq 0.6 \text{ mm}, S < 0$ ; or $D \leq 0.4 \text{ mm}, S < 200 \text{ mm}^2$	
		Any part of surface		
Refractory inclusion	Refractory	Any part of surface		
		Head	$D \leq 0.4 \text{ mm}$	
Overlap	Overlap	Bottom	$D \leq 0.4 \text{ mm}$	
		Others	$D \leq 0.6 \text{ mm}$	
		Head	$D \leq 0.6 \text{ mm}, S < 0$ ; or $D \leq 0.4 \text{ mm}, S < 150 \text{ mm}^2$	
Stickings	Stickings	Others	$D \leq 0.6 \text{ mm}, S < 0$ ; or $D \leq 0.4 \text{ mm}, S < 200 \text{ mm}^2$	
		Head	$D \leq 0.6 \text{ mm}, S < 0$ ; or $D \leq 0.4 \text{ mm}, S < 150 \text{ mm}^2$	
		Others	$D \leq 0.6 \text{ mm}, S < 0$ ; or $D \leq 0.4 \text{ mm}, S < 200 \text{ mm}^2$	
Silber	Silber	Any part of surface		
Others	Scale	Head		
		Others	Except noticeable	
		Any part of surface	Except noticeable	
Caliber flaws	Caliber flaws	Head & bottom surface	$H \leq 0.4 \text{ mm}$	
		Upper & lower part of head	$H \leq 0.6 \text{ mm}$	
		Others	Except noticeable	
Scratched flaws	Scratched flaws	Upper & sides of head, bottom	$D \leq 0.4 \text{ mm}$	
		Others	Except noticeable	
		Any part of surface	Except noticeable	
Flaws due to rough handling	Flaws due to rough handling	Any part of surface	Except noticeable	
		Any part of surface	Except noticeable	

Notes: (1) Those flaws without any allowable dimension are those to be rejected.  
(2) D, H and S mean depth, height of sinking out from surface and surface area respectively.



Table 8-2 Allowable Tolerances of Dimensions of Rails

Dimension Items		Allowable Tolerances (mm)
(i)	Length	+10 ~ -10
(ii)	Height	+10 ~ -0.5
(iii)	Width of head & Thickness of web	+1.0 ~ -0.5
(iv)	Overall width of base & width of each leg of base	+1.0 ~ -1.0
(v)	Deviation in verticality between the centerlines of head and base	1.0
(vi)	Out of square by cutting at end	1.0
(vii)	Diameter of bolt hole	+0.5 ~ -0.5
(viii)	Position of bolt hole	+0.8 ~ -0.8
(ix)	Railend bend (Deviation of straightness measured at railend per length of 1.5 m)	right or left 1.0 upward 1.2 downward 0
(x)	Clearance between rail and standard joint bar when the latter is fixed to former	outside 2.0 inside 1.0

(p) Drilling Inspection

- (i) Circular bolt holes for joint bars shall be drilled to conform to the drawings and dimensions shown in Fig. 8-3. Tolerances of dimension and positions of bolt holes should be within the allowable ranges as shown in category (o).

(q) Workmanship Inspection

- (i) Rails shall be straightened in a press roller machine to remove twists, waves and kinks excluding of those greater than specified in category (m) until they meet the surface and line requirements specified, as determined by visual inspection.
- (ii) When placed head up on a horizontal support, rails that have ends higher than the middle will be accepted if they have a uniform surface upsweep, the maximum ordinate of which does not exceed 0.7 mm at the middle per 1.5 m length at the rail ends.
- (iii) Surface downsweep and drop at rail ends will not be acceptable.
- (iv) Sharp deviation from uniform lateral (horizontal) line either direction shall not be acceptable. Deviations of the lateral (horizontal) line in either

direction at the rail ends shall not exceed a maximum ordinate of 0.5 mm at the middle of in 1.5 m at the rail end.

- (v) When required, proof of compliance with (ii), (iii) and (iv) items shall be determined by string (wire) lining, and a 1,500 mm straightedge and taper gage shall be used to determine rail end surface and line characteristics. All ordinate determinations shall be made on the concave side, between the rail surface and the straight-edge or stringline.
- (vi) Rails shall be hot stamped, cold sawed, milled, abrasive wheel cut, or ground to length, with a variation in end squareness of not more than 1.0 mm allowed. Burrs on cut surface shall be completely removed.
- (vii) Rails presented for inspection which do not conform to the requirements of the items (i) through (vi) may be reconditioned by the mill.

(r) **Acceptance of Rails**

- (i) To be accepted, rails offered must meet all the requirements of these specifications.
- (ii) No. 2 rails classed in Surface Inspection will not be accepted.

(s) **Markings on Rails**

- (i) Individual rails accepted shall be paint-marked with only one-color, according to the order listed below.
- (ii) Paint markings will appear on end surfaces excluding railhead portion at both rail ends.
- (iii) Accepted rails shall be paint-marked blue.
- (iv) No. 1 rails less than 17,997 mm long shall be painted-marked green.
- (v) Rejected rails shall be painted-marked red.
- (vi) "A" rails shall be painted-marked yellow.

(2) **Joint Bars**

- (a) Joint bars are designated JIS E 1102-1978 (Four holes type) for 37A "Common Rails" or its equivalent and its chemical components shall conform with the following allowable tolerances:

**Table 8-3 Allowable Tolerances of Chemical Components**

Chemical components	Allowable Tolerances
Carbon (C)	0.35 - 0.50%
Silicon (Si)	less than 0.4%
Manganese (Mn)	0.55 - 1.00%
Phosphorus (p)	less than 0.040%
Sulphur (S)	less than 0.045%

(b) Mechanical Properties shall be as follows:

**Table 8-4 (a) Tensile Requirements of Joint Bars (Type 1)**

Tensile strength	55 kg force/mm <sup>2</sup> as minimum (539 Mega Pascal/mm <sup>2</sup> as minimum)
Elongation	more than 18%

**Table 8-4 (b) Hardness, Tensile and Elongation Requirements of Joint Bars (Type 2)**

Brinell Hardness of surface	Hb 262 - 331
Tensile strength	70 kg force/mm <sup>2</sup> as minimum (686 Mega Pascal/mm <sup>2</sup> as minimum)
Elongation	More than 12%

(c) Standard dimensions and weight of joint bars shall be as follows. (As for detailed dimensions refer to Fig. 8-3).

**Table 8-5 Standard Major Dimensions and Weight**

Length	560 mm
Height	90.2 mm
Thickness of web	18.2 mm
Calculated weight per piece	8.6 kg.

The allowable tolerances of dimensions are as shown in Table 8-6.

Table 8-6 Allowable Tolerances of Dimensions of Joint Bars

Items		Allowable Tolerances of Dimensions (mm)
Length		+3 ~ -3
Thickness		+0.5 ~ -0.5
Dia. of bolt holes		+1.0 ~ -0.5
Distance of holes		+1.0 ~ -1.0
Dimension of hacked parts		+1.0 ~ -1.0
Position of hacked parts		+1.5 ~ -1.5
Distance between holes and hacked parts		+1.5 ~ -1.5
Bends	Upward at middle point	1.5
	Downward at middle point	0.5
	Outward at middle point against rail	1.5
	Inward at middle point against rail	1.5
Distance from rail when fitted to rail form		+2 ~ -1

(d) **Manufacture**

- (i) Ingots or cast billets to be used for joint bars shall be manufactured by the process of electric furnace, basic oxygen furnace and open hearth furnace. Cast billets include billets manufactured by continuous casting.
- (ii) Ingots or cast billets shall be rolled after they got hardened. They shall not be hardened in the overturned state.
- (iii) Ingots or cast billets shall be sufficiently discarded from their ends to insure freedom from injurious segregation and pipe in manufactured joint bars.

(e) **Cutting and Drilling**

- (i) Both ends of joint bar shall be cut in right angle to its longitudinal direction and burrs on out faces shall be completely removed.
- (ii) Drilling for bolt holes shall be made at correct positions as specified in Fig. 8-3.

(f) **Heat Treatment**

Joint bars are classified into the following two types with and without heat treatment:

- (Type 1) Joint bars without heat treatment.
- (Type 2) Joint bars applied with heat treatment and controlled cooling.

(g) **Branding**

Branding on joint bars shall be rolled in raised characters on the outside web surface against rails in accordance with the following requirements:

37	A	81
Symbol of type	Symbol of manufacturer	Year rolled

(h) **Tests**

(i) **Chemical Analysis Tests**

- Sampling of material shall be conducted according to JIS G0303 (General Rules for Testing Steel Materials)
- Chemical Analysis Tests shall be conducted in accordance with the following testing standards:

- JIS G 1211 (Carbon Determination of Iron and Steel);
- JIS G 1212 (Silicon Determination of Iron and Steel);
- JIS G 1213 (Manganese Determination of Iron and Steel);
- JIS G 1214 (Phosphorus Determination of Iron and Steel);
- JIS G 1215 (Sulfur Determination of Iron and Steel);
- JIS G 1253 (Spectrographic Analysis of Iron and Steel by Photoelectric);
- JIS G 1256 (Spectral Analysis of Iron and Steel by Fluorescence X-Ray Spectrometer); and
- JIS G 1257 (Analysis of Iron and Steel by Molecular Spectroscopy by means of Difference Absorption Spectrum)

(ii) **Tension Test and Sampling**

Tension test of joint bars shall be performed conforming with JIS Z 2241 (Tension Test of Metallic Materials). Specimens for Tension Test shall conform with No. 4 type of JIS Z 2201 (Test Specimens for Tension Test of Metallic Materials). In Type 1 joint bars a specimen shall be taken from the middle point of head portion of an optional joint bar per set of ingots or cast billet assuming all ingots or cast billets manufactured from the same heat number as a set. In Type 2 joint bars a specimen shall be taken from the middle point of head portion of an optional joint bar per set of ingots or cast billets assuming all ingots or cast billets manufactured from the same heat number accompanied by the same heat treatment as a set.

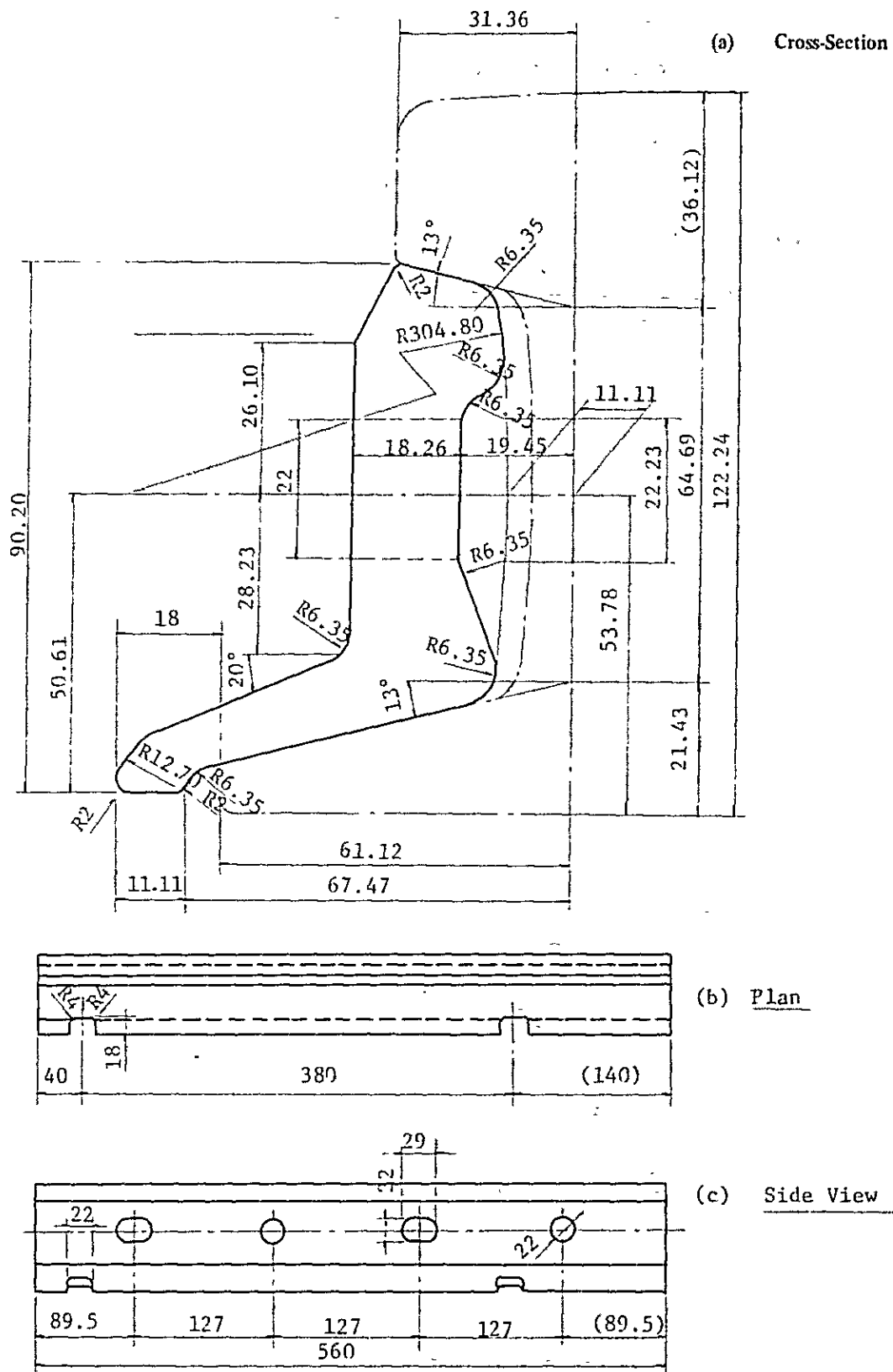


Fig. 8-3 Standard Dimensions of Joint Bar (Unit: mm)  
(JIS-E-1102-1978 Four holes type)



(iii) **Hardness Test**

Hardness Test shall be conducted only for Type 2 Joint Bars. Test shall be performed in accordance with JIS Z 2243 (Hardness Test of Metallic Material by Brinell's Method) applying to the head and bottom portions of specimens sampled in the same way in Tension Test.

(iv) **Inspection for Acceptance**

**Chemical and Physical Qualities Inspection**

In the inspection for acceptance of chemical and physical properties the Contractor shall submit to the Engineer the certificates of chemical analysis and tests of mechanical properties conducted by manufacturer or authorized institution approved by the Engineer. Such results of tests and/or analysis shall meet the requirements provided in TS 8.03 (2) (a) and (b).

In the tension test of joint bars if the test specimen breaks at a point outside more than  $\frac{1}{4}$  of distance between marked points from the center of such points and the test results do not meet the requirements specified in Table 8-2 (a) in case of Type 1 joint bars and Table 8-2 (b) in case of Type 2 joint bars such inspection shall be regarded as invalid and a reinspection shall be conducted on a joint bar sampled from the portion where the first specimen was taken.

(i) **Shape and Dimension Inspections**

In Shape and Dimension Inspections results of direct measurement shall meet the requirements of allowable tolerances of dimensions to be provided in Table 8-5.

(3) **Track Bolts**

Track bolts shall be of the hexagon-nut type and of the quality specified in the followings:

- (a) Material designation: JIS G 3102 (rolled steel for general structure)  
(SS 50)
- (b) Chemical Components shall be as follows:

**Table 8-7 Allowable Tolerances of Chemical Components**

Components	Allowable Tolerances
Phosphorus	less than 0.050%
Sulphur	less than 0.050%

Standard dimensions shall be as follows:

Table 8-8 Allowable Tolerances of Dimensions

Dimension symbols (Refer Fig. 8-4)	Standard dimensions (mm)	Allowable tolerances (mm)
d	19.05	
D	34	+0.5 ~ -0.5
d1	27	+0.5 ~ -0.5
d2	19.0	+1.0 ~ -0.5
C	26	
H	14	+0.5 ~ -0.5
h	12	
h1	3	
S	50	+8 ~ 0
K (approx.)	2.5	
a - b (max.)		1.5
E (max.)		2 degrees
L	115	+2.0 ~ -2.0

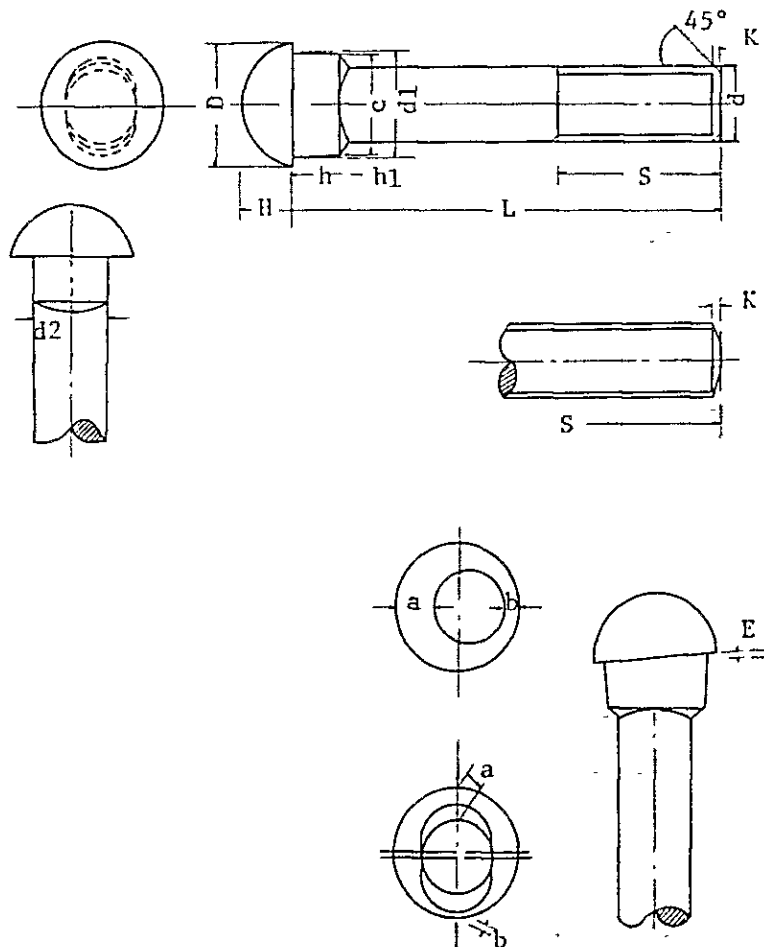


Fig. 8-4 Track Bolt of Square-Nut Type for Rail 37A Type

(4) Spring Washers

Spring washers are designated as follows:

- (a) Material designation: JIS G3506 (High carbon steel wire rods)  
SWRH 62A, 62B, 67A, 67B, 72A, 72B, 77A,  
77B, 82A, 82B

- (b) Standard dimensions shall be as follows:

11 mm thick and 20 mm (+1.0 ~ 0.0 mm) in inside dimension.

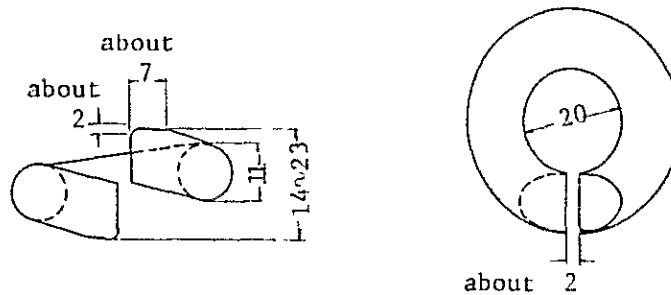


Fig. 8-5 Standard Dimension of Spring Washer

(5) Drive Spikes (Skrew Spikes)

Drive spike is designated: 3M-63-AREA timber drive spike type

- (a) Manufacture

Drive spikes shall be of the steel manufactured by one or more of the following processes:

Open-hearth, electric furnace, acid-bessemer, basic-oxygen.

The heads of spikes shall be formed and the threads rolled out hot or cold.

- (b) Chemical Composition

The steel shall conform to the following requirements as to chemical composition:

Carbon, minimum	0.18%
Copper, minimum	0.20%

- (c) Mechanical Properties

The full-size finished spikes shall conform to the following minimum requirements as to tensile properties:

Tensile strength	60,000 psi (4,218 kg/cm <sup>2</sup> )
Yield point	0.5 psi, tensile strength
Elongation in 2 inches (50.8 mm), minimum	18%

The body of full-size finished spike shall stand being bent cold through 90 degrees around a pin the diameter of which is not greater than three times the diameter of the spike without cracking the outside of bent portion.

(d) Number of Tests

- (i) One tension test and one bend test shall be made from each lot of 100 kegs or fraction thereof.
- (ii) If any test specimen develops flaws, it may be discarded and another specimen substituted.

(e) Retests

If the percentage of elongation of any tension test specimen is less than specified in category (c) and any part of the fracture is more than  $\frac{3}{4}$  inch (16.9 mm) from the center of the gage length, as indicated by scribe scratches marked on the specimen before testing, a retest shall be allowed.

(f) Standard Dimensions and Allowable Tolerances

The finished spikes shall conform to the dimensions and allowable tolerances in dimensions specified in following Figure. Major dimensions as follows:

Diameter:  $\frac{9}{16}$  inch (14.3 mm)  
 Length under head:  $4\frac{1}{2}$  inches (114.3 mm)

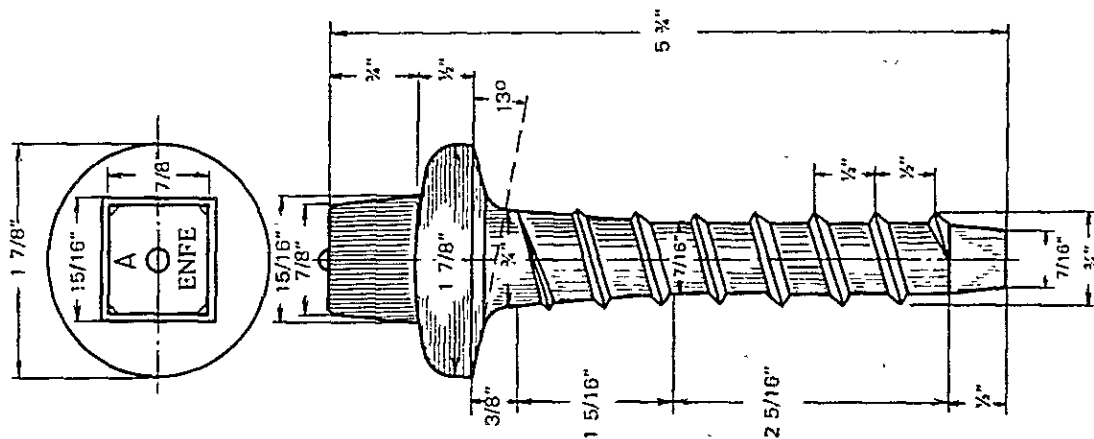


Fig. 8-6 Dimensions of 3M-63-AREA Timber Drive Spike

(g) Finish

The head shall be concentric with and firmly joined to the body of the spike. The material shall be free from injurious defects and shall have a workable finish.

(h) Marking

A letter of brand indicating ENFE shall be located on the top washer part of the spike head as shown on Fig. 8-6.

(i) Inspection

The inspector representing the Employer shall have free entry, at all times while work on the contract of the Employer is being performed, to all parts of the manufacturer's works which concern the manufacturer of the material ordered.

The manufacturer shall afford the inspector, without charge, all reasonable facilities to satisfy himself that the material is being furnished in accordance with these specifications. All tests and inspections shall be made at the place of manufacture, prior to shipment, unless otherwise specified, and shall be so conducted as not to interfere unnecessarily with the operation of the works.

(j) Acceptance

Material that meets the requirements of these specifications will be accepted.

Material that shows injurious defects subsequent to its acceptance at the manufacturer's works will be rejected and the manufacturer shall be notified.

(6) Wood Cross Ties

Wood ties shall be of untreated Quebracho timber and shall conform with the following standard dimensions and their allowable tolerances:

Table 8-9 Standard Dimension and Allowable Tolerances of Wood Ties

(Unit: cm)

		Thickness	Width	Length
Common Cross Ties	Standard Dimension	12	24	200
	Allowable Tolerance	+1.2 ~ -0.6	+3.6 ~ -1.2	+10.0 ~ -6.0
Turnout Cross Ties	Standard Dimension	12	24	Variable
	Allowance Tolerance	+0.6 ~ -0.5	+1.2 ~ -0.5	+4% ~ -2%
Bridge Cross Ties	Standard Dimension	20	25	240
	- Allowable Tolerance	+0.8 ~ -0.4	+1.0 ~ -0.5	+10.0 ~ -5.0

(7) Ballast

(a) Ballast shall be of the product of quarries approved by the Engineer.

(b) Ballast shall be limestone or granite that is durable, angular and does not contain any organic substances, soils and debris, and shall conform with the following requirements of grading:

Table 8-10

Dia of circular hole of shieve	Percentage by weight passing circular holes of shieve	Remarks
100 mm	100	Plus tolerance
80 mm	97 - 100	} Standard Ballast
60 mm	95 - 100	
45 mm	54 - 75	
25 mm	0 - 20	
15 mm	0 - 5	
10 mm	0	Minus tolerance

(c) For the purpose to control the quality of ballast the Contractor shall perform on his own cost the following tests:

- (i) Visual test to confirm the qualities provided in TS8.03(7)(b);
- (ii) Resistance to abrasion of small size coarse aggregate by use of the Los Angeles Machine (ASSHTO-T-96-77);
- (iii) Soundness of aggregate by use of Sodium Sulfate or Manganese Sulfate (ASSHTO-T30-78)
- (iv) Sieve analysis of fine and coarse aggregates (ASSHTO-T-27-74).

(d) Qualities

- (i) The Coefficient of abrasion of sampled ballast shall not basically exceed 30% but the Engineer may approve up to 35% based on his judgement if it is appropriate.
- (ii) The Coefficient of material loss in soundness test of sampled ballast shall not exceed 10%.

(e) Sampling

The method of sampling ballast, the quantity to be sampled and the number of sampling shall be directed by the Engineer.

(f) Inspection of Ballast

Inspection of ballast shall be performed by the Engineer either at quarry every time when freight cars were loaded with ballast or at work site when dump trucks loaded with ballast arrived at work site, or at ballast piles at locations specified by the Engineer. Measurement shall be made on volume basis.

(8) Turnouts

- (a) Turnouts shall be of the type of # 10 single switch of JIS-E-1101-1980 37A typed rail, the details of which are shown in the drawings. They are of the independently

manually-operated type with switch stand with high target and the wing lever with lock.

- (b) Guard rails shall be made of used rails of afore-mentioned type after correcting their twists, waves and kinks.

**(9) Track Signs**

Track signs consist of kilometer posts, gradient signs, curve radius signs, beginning and ending posts of transition curves and circular curves, superlevation signs, slack signs, speed limit signs, bridge signs and clearance posts for side tracks etc.

They shall be manufactured in shapes, sizes and qualities as specified in the standard drawings of track signs of the Bolivian National Railway.

**TS 8.04 Handling Track Materials**

For the transportation of track materials the Contractor shall take precautions and observe requirements provided in GS 29 "Transportation of Materials and Equipment". In handling track materials the Contractor shall fully discuss with the Engineer in advance on locations and times of loading and unloading those materials.

**(1) Handling of Rails at Ports**

Handling of rails at ports, when rails are imported from abroad, shall be performed under the following conditions:

- (a) At shipping and unloading ports packed rails shall be handled with a beam of 18 m long with hanging wire-ropes so as to avoid the deformation of rails;
- (b) Rails should be loaded into and stored in such boats, the loading opening of which is longer than the standard rail length;
- (c) Bed plates of 3 cm thick should be attached to rail pack so as to make easy going through of hanging wire-rope under packed rails

**(2) Handling Rails on Land**

A derick crane should be used for loading rails onto and unloading rails from railway freight cars when it is available.

At site, it is necessary to load or carry rails by rail carrier with derick crane. In handling by hand using rail tongs never attempt to throw rail. Special care should be taken in handling tongrails of turnout so as not to give any damage thereon.

**(3) Distribution of Rails**

The Contractor shall distribute rails so that they can be laid without unnecessary additional handling, taking care in the following categories.

- Place rails base down, parallel with the track and with sufficient bearing to prevent bending or swinging.
- Proper lengths of rail for road crossings, bridges, and other special locations shall be

unloaded in a safe and convenient location, where they will not constitute any obstruction.

- To minimize the cutting of new full-length rails, shorter rails should be distributed in proper places to provide for proper spacing in curved portions and locations for connections to switches.
- Proper lengths of rail for road crossings, bridges, and other special locations shall be unloaded in a safe and convenient location, where they will not constitute any obstruction.
- Joint-bars, track bolts, spring washers, turnouts, and drive spikes should be unloaded and distributed concurrently with the rail.

(4) Handling Wood Ties

(a) Preservative Treatment of Wood Ties

- Any fabricating such as end trimming and, if required, adzing and boring or application of anticracking devices should be performed by the Contractor at the Project Site.
- Because turnout ties are not of uniform length and because locations of switch components cannot be predicted, turnout ties are not adzed or bored before. The prefabrication of turnout ties should consist of curting and "ironing" only. The field adzing and boring of turnout ties are to be followed by careful field preservative treatment.

(b) Unloading and Stacking Wood Ties

Wood ties should not be unloaded by dropping or throwing them onto rails, rocks or hard surface.

Ties should be handled with tongs and not with bars or sharp tools to avoid any damage.

(5) Handling Ballast

In loading and unloading of ballast the Contractor shall take precaution not to mingle soils or dust into ballast.

TS 8.05 Storage of Track Materials

- (1) The Contractor shall fully discuss with the Engineer and obtain the approval of the Engineer on locations, method and time of storage of track materials;
- (2) Rails and turnouts should be placed on appropriate supports so as not to prevent giving any damages or bends; In station grounds rails should be stacked well out of the way of trainmen and in a place convenient for distribution.
- (3) Wood ties shall not be placed directly on the ground but shall be stacked on appropriate supports when they are not used immediately. Stacks of ties should be protected from drying, sparks or other fire hazards by covering with appropriate measure.



- (4) In case where ballast is piled in storage yards the ground should be graded and vegetations and rubbish should be removed before piling ballast.
- (5) Joint bars, track bolts, spring washers and drive spikes and accessories of turnouts should be stored in warehouses or sheds. If they have to be stored outdoors appropriate protective measures against rain water should be taken.
- (6) Quantities of materials by type stored at site should be confirmed by the Contractor and should be approved by the Engineer.
- (7) The Contractor shall be responsible for security from any damages and losses of materials under storage at Site.

TS 8.06 Use of Materials

(1) Use of Rails

- (a) On the main track and side tracks those rails having more bolt holes than specified and those rails shorter than 18 m should not be used. Specified shorter rails should be used in curved portion on main track, in order to arrange rail joints even on both rails, for connections to turnouts and to avoid rail joints within railway crossings. No rails less than 10 m long shall be used on main track and for connections within turnouts and those less than 5 m long shall not be used on side tracks.
- (b) Rails to be used on severe curves should be bent in advance of laying on track.
- (c) Rails which ends are heat-treated should not be used as shorter rails.
- (d) Rails to be used on main track should be made as 36 m long by welding two 18 m rails.
- (e) When shorter rails are mixedly used in curved portion on main track the arrangement of shorter rails should be approved by the Engineer in advance.
- (f) Rail arrangement in specified locations should be approved by the Engineer in advance.

(2) Cutting and Drilling Rails

(a) Cutting Rails

When available, the Contractor shall use either an automatic tooth or friction type rail-saw for cutting rails. The cutting face should be in right angle to centerline of rail. In cases of emergency when it is necessary to heat, cut and/or weld rails with gas torches the Contractor may do so under the approval of the Engineer by qualified operators, but such rails in track should be replaced as soon as possible.

(b) Drilling Rails

When drilling new bolt holes on rail webs is necessary to prepare shorter rails drilling shall be done according to standard drilling practices at correct positions in correct

dimension of holes as specified in drawings. No hole shall be punched, or burned with a torch in rails under any circumstances. After drilling all chips and burrs shall be neatly removed. No hole shall not be drilled between existing holes.

(c) **Grinding Edges**

At all cut surfaces of rail (excluding the case of rail-welding) and drilled bolt holes all edges shall be ground by using file or grinder.

(3) **Welding Rails**

(Refer to TS 8.13 "Thermite Welding of Rail Joints")

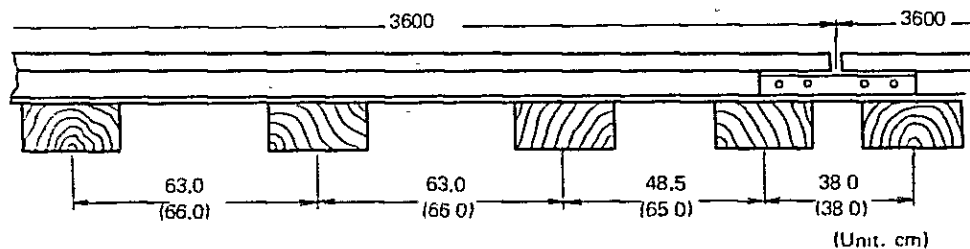
(4) **Laying Ties**

(a) Ties shall be laid at right angle to the rail in straight portions and concentrically in curved portions in an uniform interval at the rate of 1,612 pieces per kilometer on main track and 1,529 pieces per kilometer on side tracks (Secondary main track in stations).

(b) Ties shall be laid with heart side down. If the cross-section is of round corners wider side shall be placed downward.

(c) Tie shall be properly adzed, if necessary, to give a full bearing when the rail is placed at proper gage. The bottom of the rail and the bearing surface of ties shall be cleaned before rail is laid.

(d) The center line of the tie length should coincide with the centerline of track alignment.



Note: Upper figures are in case of main track and lower figures are in case of secondary main track.

(In Case of Main Track)

58 wood ties per 38 m long track panel, which means (58 wood ties) x (27.8 track panel) = 1,612 wood ties/km

(In Case of Secondary Main Track)

55 wood ties per 38 m long track panel, which means (55 wood ties) x (27.8 track panels) = 1,529 wood ties/km

Fig. 3-7 Standard Wood Tie Arrangement per Track Panel by Class of Track

**(5) Laying Rails**

In laying rails the Contractor is requested to pay special attention to the followings:

- Never lay more rails than can be properly secured during the day in which they are laid.
- Utilize mechanical devices to lay rails whenever possible. If this is not possible, extreme care must be exercised by personnel to preclude serious personal injury.
- Tamp beneath loose ties to provide a good bearing under the new rails.
- Lay rails one at a time in order to insure good adjustment. Bring rails ends squarely together against suitable rail expansion gages, and bolt them before spiking. Stretches of rail not over 300 m long may be bolted together, and then line them into place. Proper allowance for expansion must be maintained; requisite rail expansion should remain in place until rails are set in final position.
- Gaging of track shall be done at least every third tie when the second line of rail is laid against the requisite track gage in straight portions and against the requisite track gage plus required slack in curved portions.
- Install gage rods in sharp curves of side tracks and turnouts before allowing trial operation of train over new track.

**(6) Rail Joints**

- (a) Joints in opposite rails shall be located even unless otherwise directed by the Engineer. In laying rails on curves care shall be taken to put in shorter rails on the location of inside rails so as to maintain even joints throughout curves.
- (b) Rail joints shall be kept out of road crossings.
- (c) Installing space allowance for expansion of rails shall follow the criteria to be provided by the Engineer. Approved expansion shims of metal or fibre shall be used to provide the proper space allowance between adjacent rail ends, and a rail thermometer shall be used to determine the proper thickness of shims to be inserted in accordance with rail temperature. After laying rails and setting up rail joints all records of expansion spaces set up in track should be submitted to the Engineer for review and approval.
- (d) Contact surfaces between all rails and joint bars shall be greased and those between joint bars and track bolts and on threads of track bolts shall be painted with a lubricant just before laying rails.
- (e) All rail joints shall be fully bolted and fitted with approved spring washers. All bolts shall be tightened to the following torque before track is turned over to operation:

Common track bolts	2,000 kg.cm
--------------------	-------------

Bolts shall be tightened in the proper sequence properly to seat joints, beginning at the center of the joint and working both ways to the ends of the joint.

When bolts are tightened the surfaces of rail heads and gage line of both rails shall be set coinciding one another.

(7) Driving Spikes

- (a) Securing rails onto ties firmly by drive spikes (skew spikes) specified in the drawings shall be done by using manual, or pneumatic or electric screw drivers.
- (b) Four drive spikes per tie shall be used on straight track or curves of long-radius. Spikes shall be staggered so that all the outside spikes and inside spikes on the opposite end of the tie are relatively the same position in the tie. Spikes should be driven in about 5 cm from the edge of the tie. On curves less than 600 m in radius and other critical points use two spikes inside of the rail and one outside, namely six spikes per tie.
- (c) Spikes shall be driven down snugly, but not tight against the rail. A space of approximately 3 mm should be left between the head of the spike and the base of the flange of the rail.

TS 8.07 Track Laying

According to TS 1.01 the re-establishment of the centerline on main track as well as side tracks shall be made by the Contractor on the completed subgrade of earthwork which cost shall be included in pay items of track laying. The re-established centerlines, on which exact location of turnouts as well as buffer stops shall be indicated by staking, shall be checked and approved by the Engineer prior to commencement of track laying.

Track laying shall be performed by the Contractor conforming with alignment, profile, track-structure, inclination of rail level and superelevation, and gage and slack of track specified in the drawings.

Track laying shall be carried out either by the following "Method A" or "Method B" as specified by the Engineer.

(1) Method A

- (a) Track shall be fabricated on the subgrade according to the provisions provided in TS 8.06 (4) through (7), keeping gage and joining with the track already laid on the subgrade.
- (b) Then ballast shall be unloaded by means approved by the Engineer.
- (c) The unloaded ballast should be levelled down by means of ballast plow or spreader. Hand method requires special attention to placement of ballast under the full tie length. Care shall be taken not to destroy or disturb the grade stakes.
- (d) Ballast must be well packed with hand tools or machines approved by the Engineer from a line about 250 mm inside of each rail to the ends of the ties. Tamping will not be permitted at the center of ties between the above stated limits, but this center space should be filled lightly with ballast fork or shovel. Ballast shall be tamped under both ends of the ties simultaneously, and tamping inside and outside of the rail at the same time. Tamping under the rail seat must be thorough.

- (e) The preliminary surfacing gang shall follow the unloading of ballast as closely as the regularity of the ballast supply will permit. When using jacks, they shall be placed close enough together to prevent undue bending of the rail or strain on the joints. Both rail shall be raised at one time and nearly uniformly as possible.  
The track shall be so lifted that after a period of not more than 3 days after the last lift, it will be necessary to give it a final lift of not less than 25 mm or not more than 50 mm to bring it to the grade of the stakes. All ties that are pulled loose shall be replaced to the proper positions and shall have a bearing against the rail and be properly secured to the rail.
  - (f) When the track has been raised to the final grade finishing lift shall be made by jacking up the track to the height provided by the grade stakes, making necessary allowance for settlement. In making the finishing lift, a spot board and level board or tamping jack with built-in raising wire and level, or other suitable mechanical means shall be used to bring the track to a true finishing surface.
  - (g) The track shall be placed in good alignment before the finishing lift is made, but a lining gang or other mechanical means of lining shall follow immediately behind the finishing lift and shall line the track to accurate alignment.  
Stakes shall not be removed from the alignment before the finishing lift is made and the final alignment conforms to the stakes and its acceptance by the Engineer.
  - (h) The Contractor shall trim the ballast to conform to the standard ballast section provided in the drawings.  
The portion of the subgrade outside of the ballast line shall be left with a full, even surface and the shoulder of the subgrade properly to the standard roadbed section.  
The Contractor shall dispose of any surplus ballast after trimming the ballast section as directed by the Engineer.
  - (i) If, as the work proceeds, ballasting should lag behind the track laying or if for any other cause the track should require a running surface to prevent the bending of rails or injury to the track by reason of trains being operated over the track at moderate speeds, such work shall be done on the written order of the Engineer who shall specify the stations between which such work shall be done.
  - (j) Gage rods shall be used on sharp curves in side tracks and frog portion of turnouts that are difficult to hold gage, and where the track may shift because of unstable subgrade conditions. Two to four gage rods shall be used for 10 m of rail length, applied so that the rods are at right angles to the rail and the jaws have a firm grip on the base of the rail
- (2) **Method B**
- (a) Primary ballasting shall be performed directly on the subgrade by dumping, spreading and levelling down ballast by means approved by the Engineer.
  - (b) The unloaded ballast shall be graded and compacted by bulldozer to the satisfaction of the Engineer up to the level 5 cm lower than the final bottom level of ties.
  - (c) Track shall be prefabricated at a fabricating yard in panels of 38 m long each according to the provisions provided in TS 8.06 (4) through (7) and shall be carried to the site by means approved by the Engineer, unloaded and joined to the track already laid.

- (d) The secondary ballasting shall be performed after the track is laid in specified position to fill up the remaining ballast to reach to the final level of tie bottom.
- (e) Track shall be lifted up to the specified final level in the way provided in "Method A" and also lined and surfaced in the ways provided in the provisions in method.
- (f) The third ballasting shall be performed after the track is lifted to the final line and surface to fill up spaces between ties to the specified ballast cross-section.

TS 8.08 Track on Bridges

- (1) After bridge girders are completed bridge ties, which have bored holes for anchoring bolts, shall be laid in specified intervals and shall be tightened to the girders with anchor-bolts and spring washers as specified in the drawings so as to maintain even surfaces of bridge ties to support rails.
- (2) Rails shall be laid according to the provisions provided in TS 8.07 (4) through (7) and be secured onto bridge ties with drive spikes as provided in TS 9.06 (7) maintaining the specified gage and space allowance of railway expansions as provided in TS 8.06 (6) (c).

TS 8.09 Installation of Turnouts

- (1) Turnouts to be used shall be of the type as specified in TS 8.03 (8) and in the drawings. The standard layout of switch ties and their dimensions are as shown in the drawings.
- (2) The way of transportation of turnouts to the site, the exact locations of their installation and the way of turnout laying shall be approved by the Engineer in advance.
- (3) Turnout laying shall consist of installation of all components of the turnout consisting of switch cross-ties, one-piece crossings (frogs), straight and curved leading portions, movable portion including tong rails, and guard rails assemblies. Rail braces shall be either fixed or adjustable type of standard manufacture. Switch stand shall consist of switching assemblies with a throwing lever, a connecting bar, a switch lock and a movable switch sign, and is operated manually.
- (4) All tong rails, frogs and guard rails shall be placed in accordance with the drawings and trackwork plan approved by the Engineer.
- (5) Switches shall be left in proper adjustment, special care being given to avoid the bending of the tong rails for which appropriate protective measures should be taken by the Contractor before they are installed in place.
- (6) At movable parts of turnouts shall be kept in well-cleaned condition by removing floating rusts and applying lubricant oil thereto so as to keep them movable freely.
- (7) Once turnouts are fabricated in place they shall be inspected by the Engineer.

TS 8.10 Railway Crossings

- (1) The standard cross-sections and plans of railway crossings are as shown in the drawings.
- (2) Guard rails at crossings shall be made of used rails.

The dimension of the flange way between the running rail and the guard rail shall be 65 mm on straight portions and 65 mm plus slack on curved portion. Guard rails at their both ends shall have an opening of approximately 250 mm which shall be tapered off over the length more than 0.5 m.

Rail joints of running rails shall be basically avoided at railway crossings. At the joints of guard rails they shall be joined with joint bars of respective rail type. Bolts for such joints shall be tightened on the outside of flangeway when guard rails are installed inside of gauge. Securing of guard rails to ties shall be done with drive spikes basically in every two ties. Used rails to be installed as guard rails shall be straightened to correct their bendings and kinks before installation.

#### TS 8.11 Track Signs

The Contractor shall install all necessary track signs of number and type specified in the drawings at such locations specified in the drawings.

#### TS 8.12 Buffer Stops

- (1) Buffer stops to be installed at the end of sidings shall be of the type and dimensions as shown in the drawings.
- (2) Rails to be used for buffer stops may be used rails.

#### TS 8.13 Thermite Welding of Rail Joints

Rails of standard length of 18,000 mm shall be welded into 36,000 mm rails with Thermite Welding in which heat to be produced by the reaction of aluminum with a metal oxide is utilized in welding. Filler metal is obtained from the reduction of the appropriate oxide. The basic requirements to be observed in welding rails are as follows:

- (1) Remove moisture and all foreign substances such as dirt, grease, loose oxide, slag, etc., from the welding portions; Casting Sand to be used in welding shall be approved by the Engineer.
- (2) Align rail ends appropriately. Joint gaps shall be 15 mm plus or minus 2 mm and lateral and vertical positioning of the ends particularly on rail tops and gage sides of rail heads shall be kept in correct state.
- (3) Apply mold in exact location over rail gap and properly sealed.
- (4) The joint gap may be either saw, or abrasive-disc cut.
- (5) All burrs should be removed from the cut rail ends at the joint gap, all fins and head metal flow in relayer rail should be ground away, and loose oxides and foreign material should be removed from the welding portion for at least 130 mm back from the ends of the rails.
- (6) Appropriate inverse camber shall be given to rails so as to become level after cooling.
- (7) In preheating rail-ends should be heated up to 850 – 900 degrees in centigrade so as the heat to pervade over the total length of rails and to produce good fusion.
- (8) The luting or sealing of the molds to the rails should be performed with care so that the luting materials is not introduced into the weld chamber.

- (9) The crucible or reaction chamber should be dry and clean at all times.
- (10) When the reaction time becomes longer due to cool weather the mixture of aluminum and iron oxide shall be preheated up about to 30 degrees in centigrade.
- (11) When the reaction takes place in the reaction chamber and also when the molds are removed care should be taken so as melted steel and slag not to fly away out of welding portion.
- (12) Molds should be removed 4 – 5 minutes after the melted steel flows into the molds.
- (13) In the case of processes in which the filler material is tapped manually, it is desirable that the metal should not be tapped until the reaction is complete and the slag has separated from the filler metal.
- (14) After the molds have been removed, and the temperature of rail heads and webs had cooled down lower than 300 degrees in centigrade, the excess weld metal should be chiseled off and ground to match the rail contour, at least on the top and sides of the head and casting sand should be removed. Chiseling off of webs and base flanges should be avoided. It is not permissible at any time to use a cutting torch to perform the above operation.
- (15) Heat treatment should be made in the heat treatment chamber for the portion of 180 mm as the welded portion as its center. The temperature of heat treatment shall be kept at 850 to 900 degrees in centigrade for a period of 20 minutes and then shall be cooled off in the air.
- (16) Rail welding with thermite reaction shall not be performed on rainy days or such days when it looks to rain during welding process, immediately after rainfall, windy days and when the air temperature is lower than 5 degree in centigrade, and also when the Engineer judges it unsuitable to weld rails.

TS 8.14      **Conditioning of Tracks**

After laying track the overall conditioning of track shall be carried out to finish the track construction in favourable condition by overall tamping and trimming ballast section according to the alignment, gradients based on grade stakes, superelevation, track gauge and slack.

TS 8.15      **Allowable Tolerances of Track Construction Work**

The measurement of tolerances of tracks and turnouts constructed in place shall conform with the following conditions:

- (1) Measuring instruments shall be those examined and approved by the Engineer in advance of their uses.
- (2) Tolerances of tracks shall be measured in their static condition.
- (3) The measurement of track tolerances shall be conducted at every 5 m along the track center-line.
- (4) The tolerances are indicated by expressions as shown in the followings where measuring unit is mm.  
Tolerances in superelevation, slack of track gage and ordinates from grade lines are the



measured magnitudes minus the specified magnitudes.

(a) **Track gage**

Excessive magnitudes are expressed with (+) sign and magnitudes in shortage with (-) sign.

(b) **Difference of railtop elevations between right and left rails**

The Left rail in straight portions and the inner rail in curved portions are used as the base of levelling, and (+) sign expresses the higher tolerances and (-) sign the lower tolerances of the opposite rail.

(c) **Lining of Track**

Measurement shall be conducted on the left rail in straight portions and on the inner rail in curved portions where (+) sign expresses the outward tolerances and (-) sign expresses the inward tolerances of track gage.

(d) **Surfacing of Track**

Tolerances are expressed with the vertical tolerances of railhead tops from the string line tolerances with (+) signs and upward tolerances with of 10 m in length, expressing upward tolerances with (+) sign and downward tolerances with (-) sign.

(e) The measurement of lining and surfacing tolerances shall be conducted by using a string with an effective length of 10 m to be stretched with a weight of 2 kg, and the measurement of tolerances shall be made at the middle of the string. In measuring tolerances of surfacing 1.0 mm shall be deducted from the measured tolerances as the sag of string.

(5) The measurement of tolerances at turnouts shall be conducted on the following items at the following points.

(a) **Track gauge**

- At rail joints, pointed edges and heels of tong rails;
- At middle point of straight leading portion;
- At curved point and middle point of curved leading portion;
- At nose and heel of frog.

(b) **Difference of railtop elevations between right and left rails**

- At rail joints, pointed edges and heels of tong rails;
- At middle point of leading portion;
- At front end, nose and rear end of frog.

(c) **Surfacing**

- At front end of tong rails;
- At middle point of straight leading portion;

- At middle point of curved leading portion;
  - At nose of frog.
- (d) Lining
- At front ends of long rails;
  - At middle point of straight leading portion;
  - At 1/2 point, 1/4 point and 3/4 point of leading rails of curved leading portion;
  - At nose of frog.
- (e) Back-gauge
- At crossing point of frog.
- (6) The allowable tolerances of newly constructed tracks at the time of inspection to be conducted prior to the actual operation are as shown in the following table:

Table 8-7 Allowable Tolerances of Track

Measuring Items	Allowable Tolerances (mm)	
	Main Track	Side Tracks
a) Track gauge	+6 ~ -4	+6 ~ -4
b) Difference of railtop elevations of right and left rails	7	10
c) Surfacing	7	10
d) Lining	7	10
e) Deviation of tie intervals from the standard one	+20 ~ -20	
f) Track gauge at frog portion	+5 ~ -3	

- (7) At rail expansion joints the tolerances are allowed within the range of +2 mm to -2 mm against the required magnitudes and also the average of 10 expansion joints the arithmetical means of succeeding 10 expansion joints shall be within the range of +1.0 mm to -1.0 mm.

#### TS 8.16 Trial Train Operation on Newly Constructed Tracks

In case when train operation is carried out on newly constructed track the operation shall be carried out under the assignment of a responsible person of operation under the following guidelines:

- (a) Prior to the trial train operation tolerances of such measuring items aforementioned shall be measured by the Contractor, the records of which shall be submitted by the Contractor to the Engineer for review and approval.
- (b) Prior to the trial train operation instruments to measure the settlements of tracks and temporary structures thereof shall be installed by the Contractor under the instruction given by the Engineer, and their installations shall be examined by the Engineer for approval.
- (c) Upon the trial train operation the Contractor shall measure the settlement of track by the afore-mentioned instruments installed, the records of which shall be submitted to the Engineer for review and approval.

- (d) After the trial operation was carried out the Contractor shall carry out the track conditioning again only at such locations instructed by the Engineer as the results of trial train operation, the second trial operation will be carried out, the records of second measurement shall be submitted to the Engineer again for review.
- (e) After the results of measurements were approved as satisfactory by the Engineer all temporary structures and measuring instruments provided for the trial operation shall be removed by the Contractor under the instructions to be given by the Engineer.

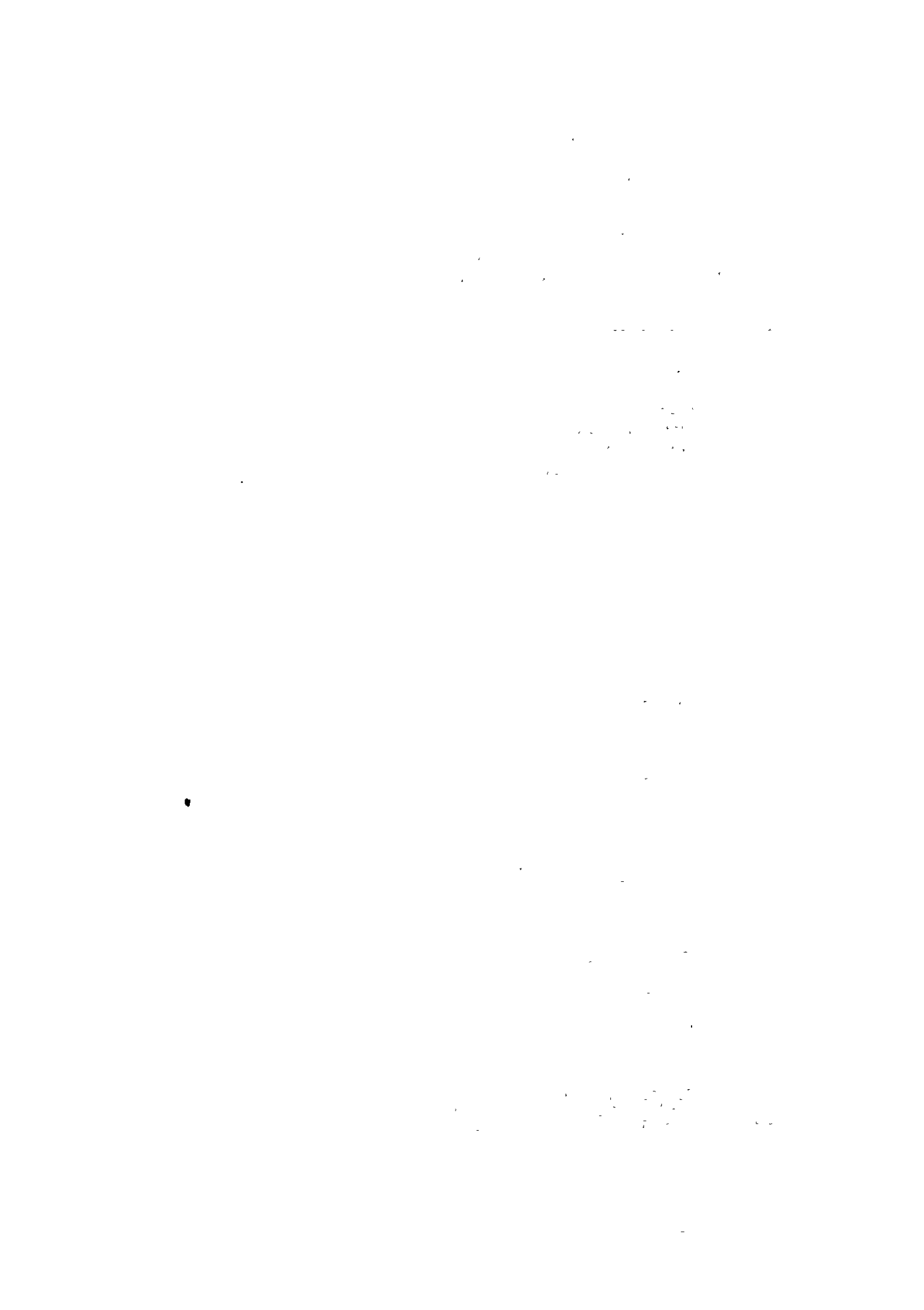
**TS 8.17 Measurement**

Measurements for payment of track construction work are to be carried out by the Engineer in two stages; namely, the first measurement is performed when all rails including joint bars, track bolts, spring washers and drive spikes arrived at the Site and also when all # 10 single-switch turnouts together with their accessories arrived at the Site. Costs of those materials including costs of transportation, handling and, exporting procedure at loading port and also handling and importing procedure at unloading port and railway freight costs including loading cost at origine and unloading cost at destination, etc., are paid for when all those materials were inspected and approved by the Engineer at Site.

The second measurement is to be carried out when the track construction was completed by the Contractor and inspected and accepted by the Engineer. The second payment is performed which includes all cost of execution of track construction including material costs of ballast and wood ties. The measurement for payment of track construction is basically carried out on the length of track centerlines of main track as well as of side tracks which were established on the completed subgrade prior to the commencement of track construction.

**TS 8.18 Basis for Payment**

<u>Pay Item No. and Name</u>	<u>Unit of Measurement</u>
811 Manufacture & transport to Site of 37.2 kg/m rails	Linear meter (m)
812 Manufacture & transport to Site of # 10 single-switch turnout of 37.2 kg/m rails including accessories	Set
821 Track construction of single main track including material costs of wood ties, ballast, joint bars, track bolts, spring washers and drive spikes and construction cost of crossings	Linear meter (m)
822 Track construction of side track including material costs of wood ties, ballast, joint bars, track bolts spring washer, drive spikes and Buffer stops	Linear meter (m)
823 Fabrication and installation of # 10 single-switch turnout, including turnout accessories, ties and ballast	Set
831 Installation of track signs	Lump sum



## SECTION 9 BUILDINGS AND FACILITIES

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## SECTION 9 BUILDINGS AND FACILITIES

### TS 9.01 Applicable Scope of Work

This Section deals with the materials and construction methods in relation to the construction of the railway station buildings and the ancillary facilities within the proposed site. The construction work shall be carried out strictly in accordance with these specifications and drawings.

### TS 9.02 Detail Design

In carrying out the detail design, the Contractor shall refer to the basic design and the foundation structure shall conform to the geotechnical condition at site and the roof structure shall withstand the wind velocity of 30 m/sec, all of which shall be approved by the Engineer.

### TS 9.03 Principal Materials

#### (1) General

- It is the basic policy that the materials and products to be incorporated in the work shall be of a famous brand known as the first class items
- If it is impossible to procure a specific material or product designated in the tender documents, the substitution may be authorized by the Engineer.
- The Contractor shall submit to the Engineer for approval a construction schedule as soon as possible after the contract has been duly signed.

#### (2) Earth Work

##### (a) General

- (i) The proposed site for construction of the railway station shall be referred to Section 4 "Earth Work".

##### (b) Materials

- (ii) The materials for back-fill and embankment may be used those become available in the course of the earth works.

##### (c) Construction method

- (iii) The back-fill shall be made in layers accordingly and shall be compacted with a mechanical tamper or other approved methods. Should it be a sandy material, water shall be added to ensure satisfactory compaction.
- (iv) The excess materials, if any, shall be disposed of at the outside of the proposed site as directed by the Engineer.

**(3) Ground Preparation**

**(a) General**

(i) The area where subject to the construction of the building facilities shall be prepared to provide a stable area as directed by the Engineer.

**(b) Material**

(ii) The coarse aggregates shall be those available naturally at site or crushed stone.

**(c) Construction Method**

(iii) The coarse aggregate shall be thoroughly compacted with a mechanical tamper.

**(4) Concrete Work**

**(a) General**

(i) The concrete to be used under this Section of the specification shall be in accordance with those specified in Section 6, "Concrete Structures".

(ii) The class of concrete to be used shall be Class "C", as per Clause TS 6.02 of the specification.

(iii) For a relatively small quantity of concrete other than the above, volume mix may be allowed on site with the approval of the Engineer.

(iv) Admixture for the relatively small quantity of concrete shall be 1:3:5, which shall be mixed with a mechanical mixer. The mixing time shall be at least five (5) minutes.

**(5) Wood Work**

**(a) General**

(i) The wood shall be dried during the period of at least ninety (90) days after its trimming and free from a significant scratch, hole, corrosion, dead-knot and other defects.

**(b) Material**

(ii) The type of wood to be incorporated in this work shall be "Dahibo" or "Mala" as the standard materials.

**(c) Material for Fittings**

(iii) The material visible to the eyes the surface of which shall be smooth with a plainer or sand paper.



**(d) Construction Method**

- (iv) The joint of woods shall be free from irregularities caused by the shrinkage of the wood or other causes
- (v) The contacting surface of the frame wood onto the concrete or masonry works shall be treated with a creosote and shall be rigidly nailed with a steel nail of 12 cm at every 70 cm.
- (vi) Metal fixtures to be incorporated in connection with the wooden works shall be installed in a workmanlike manner acceptable to the Engineer.

**(6) Roofing Work**

**(a) General**

- (i) In constructing the building roof, the type of materials and their dimensions shall be in accordance with the following specifications. Special care shall be exercised to ensure free from leaks.

**(b) Materials**

- (ii) The materials to be incorporated in the roofing works shall be of a Brazil type roof tile or a long size Zinc galvanized sheet or an ordinary size of galvanized sheet having the thickness of not less than 0.4 mm, an eaves trough or spout shall be of a rigid vinyl chloride or steel pipe for piping works.

**(c) Construction Method**

The construction methods and the ancillary materials shall be in accordance with a separate drawing.

**(7) Masonry Work**

**(a) General**

- (i) Prior to the masonry works, a detailed shop drawing showing the divisional plan and installation onto other members shall be prepared.

**(b) Materials**

- (ii) The bricks to be incorporated in the masonry works shall be such to produce a metallic sound when it is knocked and the surface shall be smooth and free from any deformation.
- (iii) The "Gambote" type of hollow bricks made of a porcelain shall be used for the exterior or decorated portion visible to the eyes.

**(c) Construction Methods**

- (iv) The construction methods for the masonry works shall be in accordance with the dimensions specified and shall be installed horizontally or vertically

to ensure straight formation throughout and the joints shall be neatly arranged. The materials shall be piled up in order to meet with these requirements.

- (v) The joint mortar in the masonry works shall consist of cement and fine aggregate mixed with a ratio of 1:3.

**(8) Fitting Work**

**(a) General**

- (i) The door shall not originate any sound when closing and shall be free from any withstanding touch.
- (ii) The in and out opening facing to the outside shall be equipped with a wire-mesh screen.
- (iii) The exterior surface of the doors and windows shall be applied with an oilpaint and the interior surface shall be painted with a varnish.

**(b) Materials**

- (iv) The materials to be incorporated in the wooden fitting works shall be of a "Mala" locally available and shall be dried during the period of not less than ninety (90) days, which is free from any scratch or deformation.
- (v) The sash materials for the fitting works shall be of a "Dahibo" available locally and shall be dried during the period of more than ninety (90) days.
- (vi) The glasses to be used shall be those available in the market and the surface shall be uniform and transparent and free from bubbles, scratches, etc.
- (vii) The metal fittings to be incorporated in the wooden fitting works shall be approved by the Engineer by submitting a sample thereof prior to the use.

**(c) Construction Method**

- (viii) The method of holding the glasses in place shall be with a frill or putty. Should the putty be used, it shall be thoroughly filled along the edge. Any excess putty shall be removed accordingly.

**(9) Painting Work**

**(a) General**

- (i) Colour sample shall be submitted to the Engineer for his approval prior to determining the colour to be used.
- (ii) As soon as the painting materials arrive at site, the contractor shall submit a report to the Engineer covering the name of the manufacturers, date of production, type, kind, quantities, etc.

(b) **Materials**

- (iii) The materials to be used in the painting works shall comprise oil paint, water paint, varnish, etc., in accordance with the drawings.

(c) **Application Method**

- (iv) The surface subject to the painting works shall be smoothed with a sand paper enabling the painting materials to adhere easily.
- (v) The painting works for steel members shall be three (3) coats including one coat of rust inhibitive paint. Other installations shall be painted with two (2) coats.
- (vi) The painting works shall not be carried out on a rainy day or on a strong windy day which may cause a unfavourable influence with dust onto the painting membrane.

(10) **Plastering Work**

(a) **General**

- (i) Special care shall be exercised so as not to cause any changes in the quality of the materials while they are in storage. Any materials such as cement, plastering materials, etc. which are deteriorated shall not be used.

(b) **Materials**

- (ii) The cement to be used in the mortar work shall be of an ordinary portland cement.
- (iii) The water-proof chemical agent to be used in the water-proof mortar shall be of a famous product known as the first class.
- (iv) The dolomite plaster material to be used for the dolomite plaster wall shall be of a famous product known as the first class.
- (v) The stone to be used for the artificial tarazzo plastering works shall be of a *hard marble stone*.

(c) **Application Method**

- (vi) The cement mortar application method shall be in accordance with an additional drawing:

Type of Materials	:	Cement-Sand
Base Material	:	Concrete
Standard Thickness	:	30
Finish	:	Steel trowel
Joint	:	"V" type steel trowel
Admixture	:	Cement 1 : Sand 2

Remarks : The thickness of plastering may be varied according to the circumstances.

Type of Materials : Cement-sand-water-proof chemical agent  
Base Material : Concrete  
Standard Thickness :  $15 + 15 = 30$   
Finish : Steel trowel  
Joint : No joint  
Admixture : Cement 1 : Sand 2 + Water-proof Chemical Agent

Remarks : Depending upon the type of water proof chemical agent, the standard thickness and the admixture may be varied.

Type of Materials : Cement-sand : Special surface finishing material  
Base : Concrete  
Standard Thickness : 30  
Finish : Steel trowel  
Joint : "V" type steel trowel  
Admixture : Cement 1 : Sand 2

Type of Materials : Cement : Sand  
Base : Concrete  
Standard Thickness :  $6 + 11 + 3 = 20$   
Finish : Wooden trowel : Steel trowel : Brush finish  
Admixture : Basic plastering:  
Cement 1 : Sand 2  
Intermediate plastering:  
Cement 1 : Sand 3  
Final plastering:  
Cement 1 : Sand 3 : Hydrated lime 0.3

(vii) The application method of dolomite plaster wall shall be in accordance with the following Figure.

Type of Materials : Dolomite plaster  
Base : Concrete  
Standard Thickness :  $7 + 6 + 2 = 15$   
Finish : Steel trowel  
Admixture Basic plaster : Dolomite plaster 0.8  
Cement 0.2:  
Sand 2 + glue  
Intermediate Plaster : Dolomite plaster 0.9  
Cement 0.1: Sand + Gluse  
Final plaster : Dolomite plaster 1 + glue

(viii) The application method of an artificial terrazzo plastering shall be in accordance with the following table and shall be applied to the height specified measuring from the floor level, after the cement mortar plastering work has been carried out.

**Table 9-1 PROPORTIONS**

Item	Cement	White Cement	Stone	Thickness of Plastering
Mix by volume	1	1	1.5	Floor 30 mm, Wall 25 mm

The blasting finish shall consist of smooth finish of basic mortar and blasting with appropriate spray blaster.

**(11) Tile Work**

**(a) General**

(i) The tile work, before starting, a divisional plan shall be prepared and be submitted to the Engineer.

**(b) Material**

(ii) The tile to be used for floor shall be of porcelain type mosaic tile and shall be of a good quality and the size shall be 2 cm x 25 cm x 25 cm. The color of the tile shall be as directed by the Engineer.

(iii) The tile to be used for wall shall be of a semi-glazy type of porcelain and shall be of a good quality. The size shall be as indicated on the drawings.

**(c) Application Method**

(iv) The application method of tile for floor and wall shall be in accordance with the following standard Figure.

**For Floor**

Type of Materials	:	Porcelain type of mosaic tile
Base Material	:	Concrete
Standard thickness	:	50
Joint	:	2
Admixture	:	Mortar in place Cement 1 : Sand 3  Finishing joint : Cement 1 : Sand 2
Remarks	:	In the event of providing water-proof layer, the thickness shall be 50 + 20 = 70

For Wall

Type of Materials	·	Semi-glazy type, porcelain tile
Base Material	:	Concrete, Lath
Standard thickness	:	30
Joint	:	3
Admixture	·	Base Mortar, with glue Cement 1 : Sand 3  Finishing joint: Cement (white) 1 : Sand 1

(12) Interior Work

(a) General

- (i) Prior to the commencement of work, a proposed divisional diagram shall be prepared to ensure a well balanced divisions of the interior finishing materials.

(b) Materials

- (ii) The materials to be used for the interior work shall consist of the exterior gypsum board, gypsum board, plywood, cloth, etc. The color of these materials shall be as directed by the Engineer.
- (iii) The glue material to be incorporated in the work shall be of a famous product known as the first class.

(c) Application Method

- (iv) Should the basic material consist of a wood, the plywood shall be nailed on to the frame as specified in Clause 9.03 (5). On top of it, the interior material shall be glued or nailed.
- (v) Should the basic material consist of a concrete, the interior material shall be glued on to the finished surface as specified in clause 9.03 (10) "plastering work".

(13) Water Supply, Sewage and Sanitary Works

(a) General

- (i) The water supply, sewage and sanitary works shall only be carried out by a qualified workmen having a certificate, in accordance with the existing laws and regulations set out by the Santa Cruz City and the contract drawings.

(b) **Materials**

- (ii) The pipe to be used for water supply shall be of a hard vinyl chloride for water supply, lining steel pipe, zinc galvanized steel pipe or lead pipe.

In the event of the zinc galvanized steel pipe or lead pipe, the minimum weight per one meter shall be as shown in the following table.

**Table 9-2 WEIGHT OF PIPE (per meter)**

Pipe Diameter	Zinc Galvanized Steel Pipe	Lead Pipe	Remarks
1/2 inch	1,280 kg/m	2,950 kg/m	
3/4 inch	1,700 kg/m		
1 inch	2,530 kg/m		
1-1/2 inch		10,300 kg/m	
2 inch		13,000 kg/m	

- (iii) The pipe to be used for sewage shall be cast iron pipe for drainage or porcelain pipe.
- (iv) The catch basin to be used for drainage shall be of a concrete (1:3:5) and the size shall be 60 cm x 60 cm, which is equipped with a reinforced concrete cover.
- (v) The sanitary equipment to be incorporated in the work shall comprise stool, urinal, washstand, sink, lavage, flush valve, etc.
- (vi) The ventilating pipe shall be of a concrete pipe or steel pipe.

(c) **Construction Method**

- (vii) The joint of the steel pipe for water supply shall be of a screw joint as the standard construction method.
- (vii) The piping for the sewage work shall be provided to ensure smooth flow so as not to cause separation between the muck and water with the exception of a vertical pipe.
- (vii) The pipe joint for the sewage work, in the event of a cast iron pipe, shall be mechanical type. Other joints shall be sealed with a mortar of

cement 1 sand 2.

(ix) In the event of installing a cesspit tank, an invert shall be provided to the bottom. For the rain catch-basin, the bottom shall be provided with a dirt layer of not less than 15 cm.

(d) Others

(x) The pipe embed at outside of the buildings shall be tested with a water flowing test prior to the back-filling. The interior pipe shall be tested, as necessary, with a full water supply test to ensure that it is free from a leak or clogging.

(xi) The vent pipe shall be as indicated on the drawings and shall project toward outside at least 70 cm higher than the tallest portion of the roof and shall be provided with a hood of galvanized steel sheet.

#### TS 9.04 Affiliated Facilities

(1) Principal Facilities

(a) General

The principal facilities shall comprise an electric generating plant, electric installations, water supply tank, water supply pumping station, septic tank facility and railway station platform installations. The electric generating plant and water supply pumping station shall be provided with a separate building.

(2) Electric generating Plant

(a) The power source shall be gasoline engine or diesel engine and the output shall be not less than 10 KW.

(b) The frequency shall be 60 HZ.

(c) The voltage shall be both of 100 V and 200 V.

(3) Electric Installations

(a) The electrical work shall be carried out in a workmanlike manner by the electrical engineer.

(b) The location and number of lighting fixture, switch, receptacle, terminal box, etc. shall be as shown on the drawings.

(c) The switch, receptacle and terminal box shall be of a tarpolin steel and the shape shall be of a rectangular. A sample of the socket for the lighting fixture, porcelain insulator, etc. shall be submitted to the Engineer for approval.

(d) For exterior lighting, a pole of Urundey tree having approx. 20 cm diameter and 7.0 m long shall be provided in accordance with the contract drawings.



- (e) The control panel provided with a switch, fuse, etc. shall be installed on individual building.
  - (f) The embeded piping shall be of a plastic pipe for which diameter shall be as indicated on the drawings.
- (4) **Water Tank Supply Installations**
- (a) The elevated tank shall be of a ready made re-strengthened plastic (F.R.P.) or re-inforced concrete structure and the capacity shall be 15 m<sup>3</sup>.
  - (b) The stand of the elevated tank shall be of a concrete structure and shall be built in accordance with the contract drawings.
- (5) **Pumping Installations for Water Supply**
- (a) The water supply, as the basic principle, under this contract shall consist of a well water, the source of which shall be from a well drilled on individual railway station.
  - (b) The pump for elevation shall be of a deep well submerged pump and the voltage shall be 200 V. The output shall be 3.7 KW and the frequency shall be 60 HZ.
  - (c) The diameter of the pump outlet shall be 50 mm and the output volume shall be not less than 0.2 m<sup>3</sup> /min.
- (6) **Septic Tank Installations**
- (a) The Septic Tank shall be of a decomposition type, the capacity of which shall be 20 persons. The size shall be 210 x 180 x 170 cm and the vent pipe shall be in accordance with Clause 9.03 (13), "Water Supply, Sewage and Sanitary Works.
  - (b) The type of the material for the Septic Tank shall be of a re-strengthened plastic (F.R.P.) or re-inforced concrete structure and shall be constructed in accordance with the drawings.
  - (c) The drainage of the Septic Tank shall be such that it is flowing towards outside naturally.
- (7) **Platform Installations**
- (a) The railway platform shall be constructed with embankment, concrete and flat concrete plates in accordance with the contract drawings.
  - (b) The fence to divide the railway station platform and the station plaza shall be provided in accordance with the contract drawings.
  - (c) The location and the number of the sign board indicating the name of the Railway Station and others shall be of a wood and shall be provided in accordance with the contract drawings.
- (8) **Exclusive Building for Electric Generating Plants and Water Supply Pumping Stations**
- The building shall be constructed in accordance with the contract drawings and the location

thereof shall be approved by the Engineer.

**TS 9.05 Railway Station Plaza and Access Road**

**(1) General**

- (a) The construction of the station plaza and the access road in the vicinity of the railway station shall be as shown on the drawings and the grading of the area shall be in accordance with Section 4 "Earth Work" in this specification.
- (b) The facilities to be installed in the station plaza shall be constructed in accordance with clause 9.03 "Principal Materials" specified in this specification.

**TS 9.06 Basis of Payment**

**(1) Measurement**

- (a) The measurement shall be taken by the Engineer if requested by the Contractor.
- (b) The Engineer shall examine carefully the workmanship of the completed items, prior to make the payment to the contractor.

**(2) Payment**

- (a) The payment for the works covered under this Section may be made to the contractor in three (3) instalments for the works completed by the contractor.
- (b) The initial payments shall be as per indicated in the following table:

<u>Pay Item No.</u>	<u>The Number of Payment</u>	<u>Pay Items</u>	<u>Percentage of Payment</u>
911	The First Payment	Upon completion of the railway station building foundation and brick wall construction.	30% of the total contract value (one payment)
	The Second Payment	Upon completion of the roof and exterior wall finish (although the work relative to the "principal work" specified in Clause 9.04, (1) of this specification has been commenced, the payment thereof shall not be included in this 2nd Payment)	40% of the total contract value (one payment)

<u>Pay Item No.</u>	<u>The Number of Payment</u>	<u>Pay Items</u>	<u>Percentage of Payment</u>
	The Third Payment	Upon completion of the building construction as well as of all auxilliary facilities, and accepted by the Engineer, including the cleaning and clearing of the construction area. The construction cost relative to the "Principal installations as specified in Clause 9.04, (1) of this specification shall be included in this payment.	The balance of the above.



## SECTION 10 COMMUNICATION FACILITIES

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## SECTION 10 COMMUNICATION FACILITIES

### TS 10.01 Descriptions

This work shall consist of the supply, fabrication, delivery to the site and erection complete of all communication facilities for the distance between Taperas and Robore Stations, in accordance with the specifications and in reasonably close conformity with the drawings or as directed by the Engineer.

### TS 10.02 Design

The Contractor shall prepare a shop drawing bearing in mind to conform to the local conditions showing the erection of the electric poles, using the Standard Typical Diagram as a reference material attached hereto and shall submit it to the Engineer for approval. The distance between the poles shall be within 100 m, however, the same for a long span of the railway bridge, it shall be within 60 m.

### TS 10.03 Materials

- (1) **Electric pole:** The electric pole shall be of a wood, having the cut end of approx. 20 cm dia. and 8 m long which can endure the weather and of straight section as far as practicable.
- (2) **Stay Wire:** The stay wire shall be of a zinc galvanized steel strand wire consisting of the cut section of 38 mm<sup>2</sup> and 7 strands.
- (3) **Electric Wire:** The main electric line shall be of a bare hard copper wire having 3.5 mm diameter.
- (4) **Arm:** The arm shall be of a hard wood conforming to the dimensions of 7.6 cm x 7.6 cm x 1.20 m.
- (5) **Insulator:** The insulator shall be of a porcelain and of a dual threaded type as approved by the Engineer.
- (6) **Telephone:** The direction telephone of a push button call-out type as well as a magnetic type telephone shall be installed at each railway station. The electric source to be used for the magnetic telephone shall be of a dry battery.

### TS 10.04 Construction Method

#### (1) Electric Poles

- (a) **Erection of electric pole:** The Contractor shall erect the electric poles vertically, however, in case of an anchor pole or pole on the curved railway alignment, the pole shall be erected with maximum five (5) degrees inclination toward the opposite direction of the composite tensile force.
- (b) **Pole base:** The pole base of the electric pole shall be of a horizontal log laying underground, which shall be rigidly tied up three times in cross formation with a galvanized steel wire having 4.5 mm diameter as shown on the Standard Typical Diagram attached hereto.

- (c) **Anchor** In the event of erecting the electric pole, supporting pole and stay wire in a swampy area or on a compressible soil, the embedded portion shall be strengthened with an anchor as approved by the Engineer.

(2) **Arms**

- (a) **Installation of arm:** The electric pole shall be recessed to accommodate the wooden arm and shall be set up vertically to the electric pole and be fastened onto the electric pole rigidly with a steel bolt (dia 13 m/m) and nut.
- (b) The arm shall be set up alternatively on each opposite side of the electric pole.

(3) **Staying Wires & Supporting Poles**

- (a) **Installation of the staying wire and supporting pole:**

They shall be installed at the following locations:

- (i) Along the railway curves:
- (ii) Anchored portion (wherever the direction is sharply changed):
- (iii) On a compressible soil condition

- (b) **Connection with the Electric Pole:**

Wherever, the stay-wire is tied up with the electric poles and anchored poles, it shall be rigidly fastened to prevent sliding.

- (c) **Anchor of the Stay-wire:**

The depth of the anchored pole to be embedded shall be not less than 1.2 m from the ground level and it shall be driven vertically as directed by the Engineer.

(4) **Installation of Electric Lines**

- (a) In the event of installing the electric line, special care shall be exercised so as not to cause a kink, bending or scratch.
- (b) The extent of relaxation (to be expressed in millimeter) of the electric line shall be as tabulated in the following based on the lowest temperature in each regional area:



Table 10-1 Relaxation of the electric line

(Relaxation: mm)

Distance between the Poles (m)	Temperature raise from the lowest temperature				
	0°	10°	20°	30°	40°
80	64	74	85	97	109
90	81	93	105	118	131
100	101	113	127	141	156

(c) Installation of Insulator

In the event of installing the insulator, it shall be fastened rigidly with a nut. The lower part of the leg of the insulator shall be painted to prevent loosening of the nut.

(d) Transposition

In order to prevent a noise or cross-talking on the telephone circuit, the line shall be provided with an ordinary transposition. The arm which is provided with the transposition shall be installed with the transposition insulator as shown on a separate drawing to keep the line its possession and the line shall be transpositioned.

(5) Telephone Equipment

- (a) The telephone shall be installed on the wall or desk at each railway station.
- (b) The terminal plate of the telephone shall be fastened at least 30 cm above the floor with a wooden screw at such location that it can avoid dust or spray water.
- (c) For interior wiring, a vinyl wire shall be used as directed by the Engineer.
- (d) The dry battery to be used for the station to station telephone shall be accommodated in an appropriate box as directed by the Engineer. The vinyl wire shall be used between the battery and the terminal plate.

(6) Changeover between the Existing and New Communication Lines

- (a) In order to enabling changeover between the existing and new communication lines in the proximity of Taperas and Robore, a changeover switch shall be provided.
- (b) Installation of the changeover switch shall be carried out to take advantage of an appropriate time zone so as not to conflict the train operation.

(7) Trial Test

After the telephone equipment have been installed, a trial test of the signal talking shall be carried out as directed by the Engineer.



## SECTION 11 MISCELLANEOUS

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## SECTION 11 MISCELLANEOUS

### TS 11.01 Applicable Scope of Work

This work deals with the preparing and furnishing materials for levelling concrete of structure, stone masonry, stone riprap, etc. The work shall be carried out strictly in accordance with the Specifications.

### TS 11.02 Stone Masonry

#### (1) Description

This Section shall consist of the stone masonry work to be constructed at such location as shown on the drawings or as directed by the Engineer.

The masonry shall be constructed on the prepared foundation bed in accordance with these Specifications and the Specifications for other work items involved, and in conformity with the lines, grades, sections and dimensions shown on the drawings or required by the Engineer.

#### (2) Materials

##### (a) Stone

The stone shall be clean, hard, and of a kind known to be durable having appropriate shape and dimensions, and shall be subject to the Engineer's approval. Adobe blocks shall not be used unless otherwise specified. The surface of the stone shall be trimmed by removing a thin or weakened portions.

##### (b) Mortar

Unless otherwise shown on the plans, the cement mortar shall consist of 1 part by volume of Portland cement and 2 parts by volume of fine aggregate. The Portland cement and fine aggregate shall conform to the requirements specified in Section 6 of this Specification.

#### (3) Construction

##### (a) Selection and Placing

When the masonry is to be placed on a prepared foundation bed, the bed shall be firm and normal to, or in steps normal to, the face of the wall, and shall have been approved by the Engineer before any stone is placed.

Care shall be taken to prevent the bunching of small stone or stones of the same size. Large stones shall be used for the bottom courses and large, selected stones shall be used in the corners.

All stones shall be cleaned thoroughly and wetted immediately before being set, and the bed which is to receive them shall be cleaned and moistened before the mortar is spread. They shall be laid with their longest faces horizontal in full beds of mortar, and the joints shall be flushed with mortar.

The exposed faces of individual stones shall be parallel to the faces of the walls in which the stones are set.

The stones shall be so handled as not to jar or displace the stones already set. The rolling or turning of stones on the walls will not be permitted. If a stone is loosened after the mortar has taken initial set, it shall be removed, the mortar cleaned off, and the stone relaid with fresh mortar.

(b) **Beds and joints**

Beds for face stones may vary from 2 cm to 5 cm in thickness. They shall not extend in an unbroken line through more than five stones. Joints may vary from 2 cm to 5 cm in thickness. They shall not extend in an unbroken line through more than two stones. They may be at angles with the vertical from 0° to 45°. At no place shall corners of four stones be adjacent to each other.

The wall shall be finished free from any significant variation in level.

(c) **Headers**

Headers shall be distributed uniformly throughout the walls of structures so as to form at least one fifth of the exposed faces. They shall be of such lengths as to extend from the front face of the wall into the backing at least 30 cm. When a wall is 45 cm or less in thickness, the headers shall extend entirely from front to back face.

(d) **Weep Holes**

All walls shall be provided with weep holes. Unless otherwise shown on the drawings or directed by the Engineer, the weep holes shall be placed at the lowest points where free outlets can be obtained and shall be spaced not more than 2 m center to center.

(e) **Cleaning Exposed Faces**

Immediately after being laid, and while the mortar is fresh, all face stones shall be thoroughly cleaned of mortar stains and shall be kept clean until the work is completed.

(f) **Curing**

In hot or dry weather the masonry shall be satisfactorily protected from the sun and shall be kept wet for a period of at least 3 days after completion.

(4) **Method of Measurement**

The quantity to be paid for shall be the number of cubic meters of stone masonry complete in place and accepted. Projections extending beyond the faces of the walls will not be included. In computing the quantity for payment, the dimensions used shall be those shown on the drawings or ordered in writing by the Engineer. No deductions shall be made for weep holes, drain pipe, or other openings of less than 0.10 m<sup>2</sup> in area.

(5) **Basis of Payment**

The quantity, determined as provided above, shall be paid for at the Contract Price per unit of measurement for the item listed below, which price and payment shall be full compensation for furnishing and placing all materials, including cement mortar, for all necessary excavation and backfill, and for all the costs indicated in applicable sections of these specifications, and all other costs necessary or usual for the proper completion of the work prescribed in this Section.

<u>Pay Item No. and Name</u>	<u>Unit of Measurements</u>
1111 Stone Masonry	Cubic meter (m <sup>3</sup> )

TS 11.03 **Dry Riprap and Grouted Riprap**

(1) **Description**

This work shall consist of stone riprap (dry or grouted as the case may be) furnished and constructed in accordance with these Specifications and the Specifications for other work items involved and in conformity with the lines, grades and dimensions shown on the drawings or required by the Engineer.

(2) **Materials**

Stone for riprap shall consist of field stone or rough unhewn quarry stone as nearly rectangular in section as is practical. The stone shall be sound, tough, durable, dense, resistant to the action of air and water, and suitable in all respects for the purpose intended. Adobe blocks shall not be used for riprap work, unless otherwise specified.

Sound pieces, of broken concrete obtained from the removal of bridges, culverts, and other structures may be substituted for stone upon approval by the Engineer.

Grout for cement mortar shall conform to the requirements of Section TS 11.02.

(3) **Construction**

(a) **Excavation**

The bed for the riprap shall be excavated to the required depths and properly shaped.

(b) **Placing**

Unless specifically directed by the Engineer, the placing shall be carried out manually. It shall be laid with close, broken joints and shall be firmly bedded into the slope and against the adjoining stones. The stones shall be laid perpendicular to the slope with ends in contact. The riprap shall be thoroughly compacted as construction progresses and the finished surface shall present an even, tight surface. The larger stone shall be placed in the lower course. Interstices between stones shall be chinked with spalls firmly rammed into place.

Unless otherwise provided, riprap shall be at least 30 cm in thickness, measured perpendicular to the slope.

(c) **Grouted Riprap**

When grouted riprap is specified, all the stones shall be placed by manually unless specifically directed by the Engineer. The spaces between the stones shall then be filled with cement mortar. Sufficient mortar shall be used to completely fill all voids, except that the face surface of the stone shall be left exposed.

Group shall be placed from bottom to top and the surface swept with a stiff broom. After grouting is completed, the surface shall be cured as specified for "Concrete" for a period of at least 3 days.

(4) **Method of Measurement**

The quantities to be paid for shall be the number of cubic meters of dry or grouted riprap measured in place and incorporated in the completed work in accordance with the Contract. Only accepted work will be measured for payment and the computation of the quantity thereof will be based on the volume within the limiting dimensions designated on the drawings or ordered by the Engineer.

(5) **Basis of Payment**

The quantities, determined as provide above, shall be paid for at the Contract Price per unit measurement, respectively, for each of the particular pay items below that is shown in the Schedule of Rates and Prices, which prices and payment shall be full compensation for excavation and preparation of the bed, for furnishing and placing all materials, for furnishing and placing backfill, and for all the costs indicated in Section of these Specifications, and all other costs necessary or usual for the proper completion of the work prescribed in this Section.

<u>Pay Item No. and Name</u>	<u>Unit of Measurements</u>
1121 Dry Riprap	Cubic meter (m <sup>3</sup> )
1131 Grouted Riprap	Cubic meter (m <sup>3</sup> )

TS 11.04 **Wire Gabion**

(1) **Description**

The wire gabion work shall be carried out as follows:

- (a) The gabion shall be packed tightly with stones larger than the opening of the wire gabion.
- (b) When the wire gabion are piled, they shall be tightly fastened at the intervals of and within 3 m long.

(2) **Basis of Payment**

Payment shall be made at the Contract Price per cubic meter for wire gabion packed with stone in place.



<u>Pay Item No. and Name</u>	<u>Unit of Measurements</u>
1131 Wire gabion	Cubic meter (m <sup>3</sup> )

**TS 11.05 Levelling Concrete**

**(1) Description**

This work shall be carried out as shown on the drawings or as directed by the Engineer, in conformity with the line, grade, section and dimensions.

**(2) Materials**

The concrete intended to be used for levelling concrete shall be Class "D" as specified in Section 6 of this Specification.

**(3) Placing**

In placing the levelling concrete, the bottom of the excavated area shall be free from any soaked water or undisturbed conditions. Should the bottom consist of a rock, it shall be cleaned of broken pieces, and if the same is disturbed, a levelling stone shall be provided and be thoroughly compacted with a mechanical tamper or approved equipment.

No levelling concrete shall be placed until the matters mentioned above have been confirmed.

The levelling concrete shall be finished to the elevation specified, in accordance with Section 6 of this Specification.

The finished surface shall be flush. The concrete shall be cured at least 3 days.

**(4) Basis of Payment**

The payment shall be made at the Contract Price per cubic meter for levelling concrete in place.

<u>Pay Item No. and Name</u>	<u>Unit of Measurements</u>
1141 Levelling concrete	Cubic meter (m <sup>3</sup> )

**TS 11.06 Linking of New Main Track with Existing Main Track**

**(1) Scope**

This work will be applied to two locations on the existing main track, namely at the kilometerages of 310.17 km and 415.37 km from the starting point at Santa Cruz of Eastern Line, where the newly constructed main track of 101.93 km in length are to be linked with the existing main track.

**(2) Description**

The Contractor shall, prior to the actual linking of the new main track with the existing

main track, perform successive compacting operations by locomotive in low speed over the whole length of new main track and official trial operation in a speed specified by the Engineer under the presence of the Engineer. Before the opening of official train operation the whole project work shall be subject to the Comprehensive Inspection of the Project Work to be conducted by the Engineer and shall be approved by the Engineer.

The Contractor shall at least two months prior to the official linking of main tracks the date thereof to the Engineer and also shall at least seven days prior to the official linking the method of the specific time and the method of linking together with details of operation thereof and shall obtain the permission of the Engineer on main track linking.

After successful linking of the new main track with the existing main track including trial operation the Contractor together with his track workers team equipped with necessary track tools shall be presence at the linking sites when the first official train passes through the new main track so as to cope with any operational emergency.

(3) Payment

This work will be paid by the pay item 1151 in lump sum.

<u>Pay Item No. and Name</u>	<u>Unit of Measurements</u>
1151 Linking New Main Track with Existing Main Track in Lump Sum	Lump sum

TS 11.07 Construction and Removal of Temporary Main Track

(1) Scope

This work will be applied to the site on the existing main track in the vicinity at the kilometerage of 414.9 km from the starting point at Santa Cruz of the Eastern Line for the purpose of constructing a new plate-girder bridge of through type in a length of 20 m.

(2) Description

A temporary main track of approximately 220 m long with affiliated earthwork and a large pipe culvert as an opening for stream shall be constructed parallel to the existing main track on the upstream side, which is to be linked with the existing track at both ends. After the temporary main track was linked with the existing main track, then a part of the existing embankment shall be removed to give an opening for the proposed bridge, and a new bridge shall be constructed therein.

After the new bridge was completed the original main track shall be restored by cutting off and removing the temporary track together with removing the middle part of the temporary embankment as wide enough as the flowing cross-section of the new bridge. Track materials removed such as rails, joint bars, track bolts, and wood cross ties shall be returned to the Employer.

(3) Design

The Contractor shall propose the detailed drawings of the temporary main track conforming

with the following conditions and shall submit them to the Engineer for review and approval.

- (a) The temporary main track shall be located far enough from the existing main track so as not to interfere the construction of the bridge.
- (b) Minimum radius of curvature 100 m
- (c) Radius of vertical curve 2,000 m
- (d) Maximum grade in profile 20 %
- (e) Minimum straight length between curves 20 m
- (f) Width of Subgrade 4 m
- (g) Side slope of embankment 1 : 1.0
- (h) Track structure Track without ballast as rails and cross ties, refer to Clause TS 8,03.
- (i) Opening for a stream A pipe culvert of 1,000 mm in dia.
- (j) Design Load Train loading of Copper E-45.

(4) **Linking of Main Tracks**

For linking the temporary track to the existing main track and also restoring and opening of the original main track, the Contractor shall, after obtaining the approval of the Engineer by inspection on the workmanship of the said work, inform in writing to the Engineer for review and approval at least 7 days prior to actual main track linking the method, time and date thereof. After successful linking of the temporary main track with the existing main track including successive compacting operations by locomotive over the temporary main track in low speed and an official trial operation at a speed specified by the Engineer. The Contractor shall be present at site until the first official train passes through the temporary main track safely. And also after restoring and opening the original main track on the completion of the bridge including compacting operation and an official trial operation the Contractor shall be present at site until the first official train passes safely through the restored main track including the bridge.

(5) **Payment**

In connection with this construction of bridge and the construction and removal of the temporary main track the cost of the latter is construed to be included in the pay item 1161 "Construction and Removal of Temporary Main Track", while the cost of the former and its affiliated earthwork will be paid with related pay items of earthwork and related pay items of structures. The cost of removal and restoration of the existing main track, the latter of which constitutes laying bridge ties and original rails thereon, is construed to be included in the above mentioned cost of construction and removal of temporary main track.

<u>Pay Item No. and Name</u>	<u>Unit of Measurements</u>
1161 Construction and Removal of Temporary Main Track	Lump sum







