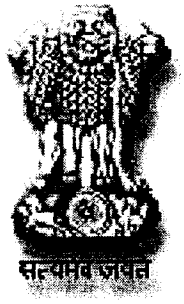
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Government of India - Ministry of Railways
Research Designs & Standards Organisation
LUCKNOW – 226011

GUIDELINES

ON

SIGNALLING CABLE LAYING

Issued by

SIGNAL DIRECTORATE

RESEARCH, DESIGNS & STANDARDS ORGANISATION
MINISTRY OF RAILWAYS
MANAK NAGAR
LUCKNOW – 226 011

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AMENDMENTS

Document Number	Version	Amendment	Amendment Details	Effective Date
----------	Version 1.0	-	First issue	31/10/2011
RDSO/SI/G/2010	Version 1.1	-	Cl. 7.1.8 para (iv) and 7.3.13 added	04.02.2014

1. Background

1.1 The Signal Engineering Manual (SEM) covers broadly various instructions on laying of signalling cables. Railway Board have also issued guidelines on the subject from time to time. This issue of cable laying practices has also been discussed in many forums like CSTE's Conference, MSG's etc.

1.2 On account of multiple faults in the cable and inadequate protection arrangement against short/open circuit faults, failures of point and other signalling gears have taken place on various Zonal Railways. In some of the cases, Railways signalling cables are invariably damaged by JCB & other track machine operated by Engineering Department, which resulted in serious dislocation to train services inviting criticism from different quarters. In view of this, board has asked RDSO to prepare detailed instruction for laying of signaling cable.

1.3 Following documents are also considered while preparing this document:-

1.3.1 Railway Board's Joint Procedure Order No. 1/SG/2004 issued under D.O. letter No. 2004/Sig/G/7 dated 17.12.2004.

1.3.2 Railway Board's letter No. 2004/Sig/A/WR/1 dt. 20.07.2007 enclosing Joint Committee Report No. SS-117/2007 and RDSO's comments on the report.

1.3.3 Cable Laying Practices followed by various Zonal Railways i.e. CR, WR, SR & RE etc.

1.3.4 Railway Signalling Installation and Quality Handbook.

1.4 These guidelines on signalling cable laying containing consolidated instructions on the subject are being issued for uniform adoption by Railways.

2 General

2.1 Railway signalling circuits shall normally be carried on cables. For new works, signalling circuits shall only be carried on cables. In 25 KV AC electrified areas overhead lines shall not be used.

3 Planning for cables

3.1 Cables used for carrying signalling, circuits shall conform to relevant approved specification. The conductors used shall be of annealed copper and of approved size. For this purpose, specification No. IRS:S 63 may be referred.

3.2 Power cable used for carrying power supply for signalling circuits shall conform to relevant approved specification. The size of conductor shall be so selected as to suit the electrical load. For this purpose, specification No. IRS:S 63 may be referred.

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3.3 The Core-wise usage of signalling cable is as given below:-

Core & Cross section	RDSO Specification	Usage
6 Core × 1.5 mm^2	IRS S 63	Tail Cable
12 Core × 1.5 Sq. mm^2	IRS S 63	Tail Cable/LC Gate/ Main Cable
19 Core × 1.5 Sq. mm^2	IRS S 63	Main Cable
24 Core × 1.5 Sq. mm^2	IRS S 63	Main Cable
30 Core × 1.5 Sq. mm^2	IRS S 63	Main Cable
2 Core × 2.5 Sq. mm^2	IRS S 63	Track circuit lead connections
12 Core × 2.5 Sq. mm^2	IRS S 63	Main/Tail Cable
2 Core × 16 Sq. mm^2	IRS S 63 & IS 1554	Power cable
2 Core × 25 Sq. mm^2	IRS S 63 & IS 1554	Power cable
2 Core × 35 Sq. mm^2	IRS S 63 & IS 1554	Power cable
2 Core × 50 Sq. mm^2	IRS S 63 & IS 1554	Power cable
4/6 Quad Cable (0.9 mm)	IRS TC:30	Axle Counter

3.4 A cable core distribution plan is required to be prepared for each installation. Cables for power distribution shall be indicated for each signaling gear. A sketch No. SDO/CABLE LAYING/001 showing typical main cable distribution plan including power cable for field gears for a typical double line (4 lines) PI station is enclosed **(Annexure-4)**.

3.5 The distribution of various power supplies for operating signalling gear in yard shall be covered in cable distribution plan issued by CSTE of Zonal Railways. However, following guidelines may be followed:-

3.5.1 In general following power supplies and required to distribute on each side of the station:-

(i) 110V AC for track feed battery charger etc.
(ii) 24/60 DC for external for TPR, point detection etc.
(iii) 24 DC external for electronic equipment like Axle Counter, BPAC etc.

3.5.2 The above power supplies as per the requirement of the station may be extended on each side of station and terminated at all main location boxes/huts.

3.5.3 ✓ All the power supplies at wayside stations as well as major yards may be laid with redundancy i.e. 2 power cables for each circuit to avoid major signalling breakdown affecting punctuality of train services during any damage/cable becoming faulty. A changeover switch may be provided at either end of the station for extending the alternate power supply in case of failure.

3.5.4 In RE area, for automatic signalling, IBH, mid-section, level crossing gates and at station where location boxes/huts are more than 2 km power supply may be taken from auxiliary transformer.

3.5.5 In Non-RE area, for automatic signalling, IBH and mid-section level crossing gates, power supply may be extended from stations on either side. The arrangement shall be such that the power supply from one of station can be extended while at same time power supply from other station shall remain isolated.

3.6 While planning for cabling on a route, the number of conductors required, for the circuits shall be first determined. Recommended core sizes shall be used.

3.7 Adequate spare conductors to a minimum of 20% of the total conductors used shall be provided for in each main cable up to the farthest point zone, beyond this there shall be a minimum of 10% spare conductors of the total conductors used. The spare conductors shall be provided on the outermost layer. 2 numbers of 12 Core dedicated spare cable from home signal to home signal may be laid and terminated in all locations for instant transfer of these dedicated conductors in case of cable failure and cable testing.

3.8 Where a number of cables have been laid along a route, the circuits shall be so distributed that cables can be disconnected for maintenance purpose with the least possible dislocation to traffic. Line wise and, if necessary; function wise cable shall be provided. Auxiliary signals shall be taken in different cables.

3.9 Separate cables of suitable size shall be laid for point operation.

3.10 Numbering of cable to be done in ascending order from right hand side of the cable core distribution plan.

3.11 Number of location boxes shall be kept at minimum. Where too many locations boxes (say more than 10) are coming in a close proximity generally between starter & home signal, it is proposed to use location huts instead of location boxes for security, proper protection and ease of maintenance. Prefabricated huts (approximate size 10 feet x 10 feet) may be used, the drawing/design of which shall be issued by RDSO separately.

4 Planning for cable route

4.1 After deciding the size and the number of conductors in the different types of cables to be used on a route, a foot survey along the track shall be done to determine the best route for the cable.

4.2 The route shall be shown clearly on a cable route plan showing the actual alignment of track, giving offsets from permanent way or permanent structures. The diagram shall indicate the various road and track crossings, crossing with power cables, water and sewage mains and other points of importance. It is preferable to chart the route on a route plan on which the existing routes of power cables, etc. are shown. Changes, if any, shall be incorporated in the chart/plan.

4.3 While planning cable route plan, any future yard modification/doubling etc. shall also be kept in view.

4.4 Cable route plan shall also be approved by Engineering and Electrical Department. Cable route plan shall also be approved by Branch Officer of Signal & Telecom (Open Line) wherever it is prepared by organization other than open line.

4.5 As far as possible low lying areas, platform copings, drainages, hutments, rocky terrains, points and crossings, shall be avoided.

4.6 Wherever JCB/Mechanized trenching or any kind of digging cases near existing cables is resorted, instructions contained in Railway Board's JPO No. 1/SG/2004 issued under D.O. letter No. 2004/Sig/G/7 dated 17.12.2004 **(Annexure-1)** shall be followed.

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5 Laying of cable above ground

5.1 Signalling cables for outdoor circuits shall not normally be laid above ground. In exceptional cases where it becomes unavoidable, the following precautions shall be taken:-

i) The cable shall be suspended in wooden cleats, from cable hangers or in any other approved manner so that no mechanical damage occurs to the cable even under exposed condition.

ii) The cable supports shall be so spaced as to avoid sag.

iii) In station yards, cable shall be laid in ducts suitably protected.

5.2 Indoor signalling cable shall normally be laid on ladders, channels or in any other approved manner. The cables shall be neatly tied/laced.

5.3 In AC electrified areas cables shall be laid underground only. For laying cables in RE area instructions laid down in Chapter XXII of SEM shall also be followed. Extract of this chapter are available in para 22 of these guidelines.

6 Excavation and backfilling of the trenches

6.1 Manual trenching is recommended for laying of signalling cables in the station yards from Home to Home signal and mechanized trenching is recommended from Home to distant signal and beyond into block/automatic section.

6.2 Under road/platforms/railway tracks/difficult terrain etc., trench less horizontal directional drilling (HDD) method may be adopted under the supervision of competent staff for laying of GI/DWC-HDPE pipe. Both ends of GI/DWC-HDPE pipes shall be closed properly using accessories and the pits shall be properly backfilled. There shall be no damage to the road/platform/tracks or any such structures etc. enrooted during or after the HDD operations.

6.3 Excavation of cable trench shall be made in all kinds of soils including clearing roots of trees, rocks etc. Trenches shall be straight as far as possible and steep angles shall be avoided.

6.4 The bottom of the trench shall be levelled and got rid of any sharp materials. No sharp object like stone chips, iron pieces etc. shall ever come in contact with laid cables irrespective of the method of laying the same.

6.5 After cable has been laid and until the whole of the cables to be laid in the trench have been covered with their protective covers, no sharp metal tool such as spades, crowbar or fencing pins shall be used in the trench or placed in such a position that they may fall into the trench.

6.6 When cables are laid in trunking, care shall be taken to see that no ballast or stones have been dropped inside the trunking. The trunking shall be cleared of all ballast and stones before the cover is secured. When the ends of covers are joined together with cement plaster, a piece of paper or wood shall be placed under the joint to prevent the cement plaster from falling on the cable.

6.7 It is desirable that the excavation of the trenches is not done in long lengths and does not remain uncovered for long period. It is preferable that cables are laid and refilling done on the same day.

6.8 Before commencement of the laying, inspection of the trench and inspection of protection works shall be carried out so as to ensure their conformity with the specification. A sketch No. SDO/CABLE LAYING/022 rule made of pipe for measuring depth is enclosed **(Annexure-25).**

6.9 Backfilling of the trenches shall be done properly. The earth excavated shall be put back on the trench, rammed and consolidated.

6.10 During excavation, the earth of the trenches shall not be thrown on the ballast. The earth shall be thrown by the side of the trenches away from the track.

7 Cable laying in underground

7.1 General

7.1.1 Cables may be laid underground, either in the trench, in ducts, in cement troughs, in pipes or in any other approved manner.

7.1.2 Cables shall be laid generally as per instructions given in these guidelines. However, special precautions to be taken in the station yards etc. where a number of other utilities may be existing, may be detailed in a joint circular issued by the Civil Engineering, Signalling and Electrical Department (where applicable) of the Railway. Railways may provide any additional protection as necessary at a particular location due to prevailing law and order problem.

7.1.3 Cable is generally laid parallel to the track beyond Home signal with minimum deviations and on one side of the yard.

7.1.4 As far as possible, cable shall be crossed only at two locations, i.e. one crossing on each side of the yard.

7.1.5 The cable laid parallel to the track shall be buried at a depth of minimum 1.0 metre (top most cable) from ground level. A sketch No. SDO/CABLE LAYING/003 showing cable trench is enclosed **(Annexure-6)**. While those laid across the track must be minimum 1.0 metre below the rail flanges. However, in case of rocky soil, the depth may be reduced suitably. When it concerns the laying of tail cables which serve the track apparatus etc. the depth shall not be less than 0.50 metres. In theft prone areas the cables may be laid at a depth of 1.2 metres with anchoring at every 10 metres.

7.1.6 The width of manually made cable trenches shall commensurate with number of cables. The minimum width shall be kept as 0.3 meters. The bottom of the cable trench shall be levelled and got rid of any sharp materials. In the soft ground, the cable shall be laid at the bottom of the trench previously levelled. In the rocky ground, the cable shall be laid on a layer of sand or sifted earth of 0.05 metre thickness previously deposited at the bottom of the trench. In both the above cases, the cable shall be covered with a layer of sand or sifted earth of 0.10 metre thickness and thereafter a protective cover of trough or a layer of bricks shall be placed.

7.1.7 Normally, not more than 12 cable are to be laid in one trench as it shall be difficult to attend failure at a later date. At a moderate size station with electrical signaling installation, generally the numbers of cable are more up to home, it is recommended that cables are laid in RCC duct up to home signal on both side of the station and may be extended up to distant, if required. This will also help later for laying of additional cable later without carrying out trenching.

7.1.8 While laying the cables in accordance with the above instructions, the following instructions shall be adhered to for the safety of the track:-

i) Outside the station limits, the cables shall generally be laid at not less than 5.5 metre from the centre of the nearest track.

ii) Within the station limits, the trenches shall preferably be dug at a distance of not less than 3 metre from the centre of the track, width of the trench being outside the 3 metre distance.

iii) At each end of the main cable an extra loop length of 6 to 8 metre shall be kept.

iv) Extra loop length of the cable should also burried at same depth as that of cable in the same trench and not projected outside to ensure that cable is free from theft/outside interference.

7.1.9 Before starting cabling work location boxes shall first be erected so that cable after laying is directly taken inside location box and its multiple handling/damage by re-digging and taking inside location box/Relay Room is eliminated.

7.1.10 A sketch No. SDO/CABLE LAYING/002 showing position of trenches for cable laying is enclosed **(Annexure-5).**

7.2 Laying of different type of cable in same trench

7.2.1 Where several cables of different categories have to be laid in the same trench, they shall be placed as far as possible in the following order starting from the main track side, so that in the event of failures, the maintenance staff may easily recognise the damaged cables:-

i) Telecommunication cable

ii) Signalling cable

iii) Power cable

7.2.2 A distance of approximately 10 cm must be maintained between telecommunication cable and signalling cables. The signalling cables must be separated from power cables by a row of bricks between them.

7.2.3 A sketch No. SDO/CABLE LAYING/004 showing laying of signalling cable & Telecom/Power cable in same trench is enclosed **(Annexure-7).**

7.3 Cable laying in ducts

7.3.1 RCC, masonry or any other approved type of ducts may be used for laying the cable. The ducts shall have suitable covers and shall rest on walls of duct.

7.3.2 The ducts shall be of such design as to prevent water collecting in the duct.

7.3.3 After placing the trunking in the trench the ducts have to be aligned using 8 mm rod. For this purpose, a hole is left in the trunking for insertion of rods. Wherever there is a diversion proper care shall be taken to cover the cables, either by smoothly forming a curve with duct or a masonry structure can be constructed to protect the cables. After laying of cables the ducts shall be covered with RCC slab and shall be continuously plastered at the end with trunking.

7.3.4 When cables are laid in rocky area, it is desirable to protect them with split RCC ducts of suitable design.

7.3.5 Where it is necessary to take the cable between the tracks, it shall be carried in trunking kept sufficiently below the ballast level.

7.3.6 Cables for longer distances shall be laid on bottom layer. Duct shall be filled up with sand after cable is laid to avoid entry of rodents.

7.3.7 From Home to Home Signal, where number of signalling cables required are more, subject to availability of space adjacent to tracks, RCC ducts with removable top cover with larger width up to 500 mm are recommended to be used.

7.3.8 Beyond Home Signal and up to distant signal including block section/ automatic section RCC ducts with a width up to 300 mm are recommended to be used.

7.3.9 Partition of RCC duct for accommodating different types of signalling/telecom cables/ power cables may be provided, wherever required. This can be achieved by earmarking about 80% of inner space for multi core signalling/ telecom cables and the remaining 20% of space for carrying power cable more than 110V in a separate of chamber.

7.3.10 In RCC ducts it is recommended to have height of maximum 300 mm (outside dimension inclusive of removable top cover). Length of the duct shall be between 700 mm to 1000 mm (outside dimension). This is mainly required for easy transport of ducts from factory premises to the work sites.

7.3.11 Depth of 600 mm to 1000 mm is recommended according to requirement of Zonal Railways depending on site condition and Law & Order situation.

7.3.12 A sketch No. SDO/CABLE LAYING/005, 006 & 007 showing RCC duct is enclosed **(Annexure-8, Annexure-9 & Annexure-10).**

7.3.13 For jointing ends of RCC ducts precaution should be taken for proper alignment of RCC ducts, so that gap between two ducts is kept minimum.

7.4 Laying cable in solid & rocky soil

7.4.1 In case of rocky soil the depth may be reduced suitably.

7.4.2 Sharp edges on the sides must be smoothened out and bottom of the chase shall be leveled. In the rocky ground the cable shall be laid normally on layer of sifted earth of 0.05 metres thickness previously deposited at the bottom of the trench. Cable shall be covered with the layer of sand or sifted earth of 0.1 metre thickness.

7.4.3 In case sharp edge of rocky ground cannot be protected with sifted earth, concrete/GI/CI/PVC/DWC-HDPE pipe shall be used if number of cables are small. If number of cables are large, RCC duct shall be used. In isolated cases, it can be given smooth surface by using either masonry bricks or cement concrete.

7.4.4 A row of bricks shall then be placed lengthwise on the top and jointed with cement mortar and a layer of concrete with cement plaster shall be provided on the top of the same.

7.5.5 A sketch No. SDO/CABLE LAYING/008 showing laying of cables in rocky area is enclosed **(Annexure-11).**

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7.5 Laying in special soil condition

7.5.1 Cable shall not be run through abnormally high acidic or alkaline soil or through sewages. If this is unavoidable special measures shall be taken against corrosion. Cable may be laid in the concrete/GI/CI/PVC/DWC-HDPE pipes properly jointed to prevent ingress of moisture.

7.6 Cable laying in residential area

7.6.1 When laying the cable in residential area, the cable shall be specially protected on both sides up to a distance of about 300 metres beyond the building line. In such cases, the cable shall be protected by means of concreting of 50 mm as proposed for rocky soil. This is better than using bricks as in a residential area bricks are usually found while digging and its special significance of cable protection may be overlooked.

7.7 Cable laying in large yard and suburban area

7.7.1 Main signalling cable in large yards including suburban section shall be laid in RCC ducts/DWC-HDPE pipes.

7.7.2 Tail cables shall be laid through DWC-HDPE pipes of suitable sizes and buried in trenches at a depth of not less than 1000 mm from ground level.

8 Track crossing

8.1 As far as possible, cable shall be crossed only at two locations, i.e. one crossing on each side of the yard.

8.2 When a cable has to cross the track, is shall be ensured that-

i) The cable crosses the track at right angles;
ii) The cable does not cross the track under points and crossings and
iii) The cable is laid in concrete/GI/CI/PVC/DWC-HDPE pipes or suitable ducts or in any other approved manner while crossing the track.
iv) Cable laid across the track must be 1.0 metre (minimum) below the rail flanges.
v) No digging shall be done below the sleepers. Digging work while crossing a track shall be done between sleepers in the presence of a Railways representative.

8.3 A sketch No. SDO/CABLE LAYING/009 showing track crossing is enclosed **(Annexure-12)**.

9 Road Crossing

9.1 The cable is laid in concrete/GI/CI/PVC/DWC-HDPE pipes, suitable ducts or in any other approved manner while crossing the road at the depth of 1 metre from the ground level. It shall extend 1 metre (minimum) on each side of the road keeping in view the future increase of width of the road.

9.2 When crossing roads, it is necessary to lay the cables in such a manner as to avoid the necessity of bending the cable sharply and minimise the excavation of road surface as far as possible.

9.3 The crossing of main roads often involves difficulties, especially if traffic is heavy. Precautions to avoid accidents to workmen, pedestrians and vehicles shall be taken. On minor roads, which can be temporarily closed to traffic it is possible to open up across the entire width of the road, pipes shall be installed quickly in the cutting, which is then filled in there by reducing to a minimum the time for which the road is closed.

9.4 Some roads, which are broad, may be opened for half their width allowing the other half for use of traffic, pipes are laid, trench filled in the first half and the other half opened up after the first half is opened half is linked with those laid in the first half.

9.5 Whenever a cable is laid across an important road, particularly one with a special surface, it is good investment to provide for future expansion. Either the following methods may be adopted:-

(a) The size of the pipe shall be so chosen that provision for laying few cable is future is kept in view. Pipes having diameters ranFng from 100 to 200 mm are suggested, or

(b) A spare pipe may be laid, through which a cable can be drawn when required. It will be advantageous to leave a lead wire of G.I. wire in the pipe for drawing the cable in future.

9.6 A separate pipe of suitable dia shall be used for telecommunication cable.

9.7 A sketch No. SDO/CABLE LAYING/010 showing road crossing is enclosed **(Annexure-13).**

10 Cable laying on bridges/culverts

10.1 Wherever practical, the cable may be taken underground across the drain bed at a suitable depth for crossing small culverts with low flood level. A sketch No. SDO/CABLE LAYING/011 showing cable laying on culverts with low flood level is enclosed **(Annexure-14).**

10.2 Where cable may not be taken underground across the drain bed, cable shall be taken on the culvert through GI/DWC-HDPE pipe of suitable sizes. A sketch No. SDO/CABLE LAYING/012 showing cable laying on culverts with high flood level is enclosed **(Annexure-15).**

10.3 When cables have to cross a metallic bridge, they shall be placed inside a metallic trough which may be filled, as an anti-theft measure, with sealing compound. The cable shall be supported across the bridge in a manner which would involve minimum vibrations to the cable and which will facilitate maintenance work. Adequate cable length to the extent of 2 to 3 meters shall be made available at the approaches of bridge. A sketch No. SDO/CABLE LAYING/013 & 014 showing cable laying on metallic bridges is enclosed **(Annexure-16 & Annexure-17).**

10.4 In case of arch bridges, cable shall be taken through GI/DWC-HDPE pipes on top of the arch adjoining the parapet wall. The pipe shall be covered with ballast. A sketch No. SDO/CABLE LAYING/015 & 016 showing cable laying on arch bridges is enclosed **(Annexure-18 & Annexure-19).**

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10.5 Concreting of 50 mm shall be done throughout from entry/exit end of cable up to diversion point including slope on either side. The entry and exit ends of the cable from the pipe to the diversion point of the cable shall be concreted for 1 metre (minimum).

10.6 As the laying involves movement of a large number of staff over the bridge the line shall be blocked and flagman posted on other side. On a double line only the line near which the cable is being laid shall be blocked but care shall be taken to see that staff are aware of this and measures taken to prevent staff from straying on to the unblocked line.

10.7 Damage to cable is likely to occur if care is not taken in laying cable where the bed changes from solid support such as a foundation, pier of bridge to soft support such as soft soil. The cable must not press against the edge of the solid support. The soft soil near the edge must be tamped and the cable raised slightly.

10.8 In order to prevent theft and miscreant activities on approach of cable to bridge/culvert where it is not possible to ensure adequate depth, concrete protection is proposed.

11 Laying near to sleeper

11.1 In places where cables are to be laid within 1 metre from sleeper end, digging beyond 0.50 metre shall be done in the presence of an official from Engineering Department, and the laying of the cable and refilling of trench shall be done with least delay. Laying may be undertaken under block protection as needed.

12 Jumper cables for track circuits

12.1 There are numerous instances of jumper cable cut due to Engineering staff working. Such instances can be minimized if jumper cable is tied with the nearest sleeper. This shall be done on wooden sleepers using iron clamps/hooks. On PSC sleepers jumper cable shall be tied using clamps. A sketch No. SDO/CABLE LAYING/017 showing arrangement of jumper cable is enclosed **(Annexure-20)**.

12.2 Where sleeper ends, cable shall be buried underground in the line of sleeper and taken to TLJB. Wherever required, cable may be laid in DWC-HDPE pipe.

12.3 Jumper cable shall be laid at least 0.5 metre below ground level excluding ballast depth.

12.4 Jumper cable shall be laid neatly in squared manner and shall not be kept in loose coils above the ground near TLJB.

12.5 Top surface of TLJB shall not be 1 feet above rail level.

13 Cable markers

13.1 Cable markers wherever provided shall be placed at 30-40 metre interval and at diversion points.

13.2 There are three types of cable markers in use in different Zonal Railways:-

(a) Cast iron Tablet type cable markers.

(b) Concrete cable markers.
(c) Electronic Markers

13.3 Concrete cable markers can be adopted where RCC ducts are used or area is prone to theft. Concrete markers are projected above surface level for at least 300 mm.

13.4 A sketch No. SDO/CABLE LAYING/018, 019 & 020 showing cable marker is enclosed **(Annexure-21, Annexure-22 & Annexure-23)**.

14 Storing & transportation of cable

14.1 Cable drums shall not be stacked on flat side. Suitable stoppers shall be placed for stability.

14.2 Cable drums shall have easy access for lifting and moving.

14.3 When rolling the cable drum either for unloading or transportation, the drum shall always be rotated in the direction of the 'arrow' which is marked on the drum.

14.4 The drums shall not be rolled over objects that could cause damage to the protective battens of the cable.

14.5 When unloading is carried out from the vehicle the drum shall not be dropped on the ground directly to avoid damage due to impact. Fork lifter or ramp shall be used.

14.6 During all stages of storage, it is essential that the ends of the cable are effectively sealed by end cap or in any other approved manner to avoid water entry into the cable.

14.7 It is desirable that cable drums are stored in covered shed to protect against direct exposure to sun.

15 Paying out the cable

15.1 For paying out cables, the cable drums shall be mounted on cable wheels. It shall be ensured that no kink is formed while paying out the cable. A sketch No. SDO/CABLE LAYING/021 showing method of unrolling cable is enclosed **(Annexure-24)**.

15.2 The drum on the wheel shall be brought to one end of the trench and the end of the cable freed and the cable shall be laid along the trench.

15.3 The cable duct shall be brought as close to the cable trench if possible. The cable drum shall clear the ground by 5 to 10 cm.

15.4 The wooden battens on the drums shall be carefully removed shortly prior to laying and before the drum is mounted on the jack.

15.5 A party of labourers shall move along the trench carrying cable at suitable intervals so that cable is not damaged due to dragging along the ground or bent unduly.

15.6 The in-charge of cable laying shall ensure proper synchronization of all labourers for smooth laying.

15.7 In cases where the wheels are not available, the drum shall be mounted on an axle at one end of the trench and cable paid out and carried by labourers.

15.8 In no case, shall the drum be rolled off on to the road for laying the cable and the cable dragged on the ground for laying purposes.

15.9 Whenever mechanized equipment is used, the work shall be carried out by a trained operator under the supervision of SSE/SE/JE (Signal) in-charge of the work.

15.10 Where the cable drum is in damaged condition the cable may be placed on a horizontal revolving platform and the cable paid out in the same manner as given in paras above.

15.11 Paying out of cable shall be done by rotating the cable drum and not by pulling the cable with excessive force.

15.12 Wherever flaking of cable is required, it shall be done by making a succession of loops in the form of Figure '8', these loops being disposed on top of each other to avoid tangling of cable. Figure of '8' flaking shall only be carried out under the direct supervision of an experienced official.

16 Laying in monsoon season

16.1 It is not advisable to lay cables in monsoon when the precipitation is heavy. The trenches will be inundated and visual inspection of the bedding of the trench will be rendered difficult. Threading the cable in pipes will also be more difficult.

16.2 When however cable laying is necessary during the monsoon season, the cable ends shall be inserted in a pipe sealed at one end and the pipe buried. Termination work shall be started only when there is likelihood of a clear weather for three or four days.

17 Entry of cable at cabin, relay room, location boxes etc.

17.1 All cable entry points in cabin, relay room, battery room, SM's room, location boxes, location huts, junction boxes, etc. must be closed with suitable masonry works, sand covered and plastering to prevent entry of rats etc. RCC slab shall be provided on the cable pit of cabin and relay room/station.

17.2 Cable shall be protected on both sides up to a distance of 10 metre beyond building line of cabin, relay room, battery room, SM's room. In case of location boxes, location huts, junction boxes etc. cable may be protected for 1 metre on each side.

17.3 Damage to cable is likely to occur if care is not taken in laying cable where the bed changes from solid support such as a foundation/masonry to soft support such as soft soil. The cable must not press against the edge of the solid support. The soft soil near the edge must be tamped and the cable raised slightly.

18 Cable termination

18.1 The cable termination of signalling cables shall be undertaken by providing suitable location boxes/junction boxes on approved type termination.

18.2 All the core of the cable (used or spare) shall be terminated on approved type termination in cabin/SM's office or apparatus cases. Each core so terminated will be provided with identification ferrules with letters or/numbers embossed on them as per requirement of circuitry.

18.3 Termination of signalling cable on CT rack in relay room and in location boxes shall be done duly using identification marking on cable and on conductors/terminals. This will enable easy identification of conductors in case of any failures or cable disconnections or cable cut done by outsider/ miscreants. A proper marking and termination practice ensures quick and easy restoration during failures.

18.4 For quad cable, jointing may be done as per instructions of Telecom Directorate of RDSO. For jointing of signal cable in straight portion arrangement shall be issued by RDSO separately.

19 Testing of cable

19.1 Before the cable is laid in the trench, a visual inspection of cable shall be made to see that there is no damage to the cable. It shall be tested for insulation and continuity of the cores. Thereafter, the cable shall be laid into the trench. Record of insulation and loop resistant must be maintained.

19.2 Testing of all main and tail cables after laying of the cable in trenches and also after termination in apparatus cases, in boxes and relay room shall be done.

19.3 Any defect noticed during the testing after laying the cable the same will be replaced.

19.4 All conductors in signalling cables must be tested for their insulation in dry weather every year as per instructions in para 20 below. A comparison of the test results between successive tests carried on a cable under similar conditions will give an indication of the trend towards deterioration of the insulating material over a period of time. If a sudden fall in insulation is observed, the cause shall be investigated and immediate steps taken up to repair or replace the cable.

19.5 In addition to the regular testing of cables in dry weather, random tests in wet weather may also be carried out, where considered necessary, to localise any sudden deterioration in insulation of cables.

19.6 After completion of any P.Way work in the vicinity of existing cable, testing of all cable may be undertaken to verify proper working of cable.

20 Instructions for insulation resistance testing of signalling cable

20.1 General

20.1.1 These instructions apply only to cables used for Railway Signalling and do not cover open line wires and internal wiring.

20.1.2 Insulation Resistance tests shall be made in such a manner that safe operation of trains is not affected. It shall be ensured that no unsafe conditions are set up by the application of test equipment.

20.1.3 All conductors in signalling cables must be tested for their insulation at the time of commissioning and thereafter in dry weather every year preferably during the same part of the year.

20.1.4 The insulation resistance tests shall be made when conductors, cables and insulated parts are clean and dry.

20.1.5 In addition to regular testing of the cables in dry weather, random tests in wet weather may also be carried out where considered necessary.

(21)

20.1.6 The conductors of the cables possess appreciable electrostatic capacity and may accumulate electrostatic charge. The cable conductors shall be shorted or earthed to completely discharge any accumulated charge (i) before connecting the insulation tester while commencing the test (ii) before the insulation tester is disconnected when the test is completed. This is in the interest of safety of personnel and protection of equipment

20.1.7 A 500V insulation tester shall be used for insulation testing. The fact that the cable has capacitance means that it has to be discharged before a measurement of the insulation resistance can be made. The insulation resistance shall therefore be recorded after the test voltage has been applied for one minute or so when the indicator of the insulation tester shows a steady reading.

20.1.8 Any metallic sheath or metal work of any rack or apparatus case shall be bonded to earth during test.

20.2 **Procedure**

20.2.1 Disconnect all cores of a cable at both ends. The disconnection may be made through links of approved type terminals, if provided.

20.2.2 Connect one terminal of the insulation tester to the conductor under test and other terminal to all the other conductors being bunched together and connected to earth.

20.2.3 Similarly test remaining conductors of the cable one by one.

20.2.4 Insulation Resistance so measured shall not be less than 5 mega ohms per kilometer at buried temperature. If the insulation resistance is found to be lower than 5 mega ohms, the cause shall be investigated and immediate steps taken to repair or replace the cable to prevent any malfunctioning of the equipment and circuits.

20.2.5 The results of the insulation resistance tests shall be recorded in approved proforma. A comparison of test results between successive tests carried out on a cable under similar conditions will give an indication of the trend towards deterioration of the insulation resistance of the cable. If sudden fall in the insulation resistance is observed the cause shall be investigated and immediate steps taken to repair or replace the cable.

21 Supervision of cable laying

21.1 The work shall be supervised at site personally by an official of the Signal & Telecommunication Department not below the rank of a JE/SE/SSE (Signal).

21.2 Orders will be given by the Inspector in charge only. He will be assisted by others at vulnerable places to inform him of the position and possible danger.

21.3 All concerned staff shall have full knowledge of their duties and the material handled by them.

21.4 No work shall be started unless all types of materials, tools consumable materials and staff are available. Location boxes and junction boxes shall be in position. If the cable ends are left in the ground unattended, damage is likely to take place.

21.5 Following record shall be maintained by JE/SE/SSE in-charge of the work/section:-

21.5.1 Cable route plan

21.5.2 Cable distribution chart

21.5.3 Cable termination diagram

21.5.4 Cable Testing Record : Summary Sheet, including supply details etc. as per **Annexure 2.**

21.5.5 Cable Insulation Resistance Test Sheet as per **Annexure 3.**

22 Special requirements in 25 kV AC electrified area

22.1 Only unscreened cable shall be used.

22.2 Screened signalling cable may be used on signalling installations where screened cable is already in use and site condition demand its further use.

22.3 PVC insulated PVC sheathed and armoured unscreened cable to an approved specification (IRS-63) shall be used for carrying signalling circuits. Only approved type (IS-1554) power cable shall be used for signalling purposes.

22.4 The screened cable, if used, shall be PVC insulated, armored and to an approved specification IRS S-35.

22.5 The cable shall be so laid that it is not less than one meter from the nearest edge of the mast supporting the catenary or any other live conductor, provided the depth of the cable does not exceed 0.5 meters. When the cable is laid at a depth greater than 0.5 meters, a minimum distance of 3 meters between the cable and the nearest edge of the O.H.E structure shall be maintained. If it is difficult to maintain these distances, the cable shall be laid in concrete/heavy duty HDPE/Ducts or any other approved means for a distance of 3 meters on either side of the Mast. When so laid, the distance between the cable and the mast may be reduced to 0.5 meters. These precautions are necessary to avoid damage to the cable in the event of the failure of an overhead insulator.

22.6 In the vicinity of traction sub stations and feeding posts, the cable shall be at least one metre away from any metallic part of the O.H.E and other equipment at the substation, which is fixed on the ground, and at least one metre away from the substation earthing. In addition, the cable shall be laid in concrete or heavy-duty HDPE pipes/or other approved means for a length of 300 meters on either side of the feeding point. As far as possible, the cable shall be laid on the side of the track opposite to the feeding post.

22.7 In the vicinity of the switching stations, the cable shall be laid at least one metre away from any metallic body of the station, which is fixed in the ground, and at least 5 meters away from the station earthing. The distance of 5 meters can be reduced to one metre provided the cables are laid in concrete pipes/ heavy-duty HDPE pipes/ducts or any other approved means.

22.8 Where an independent Earth is provided for an OHE structure, i.e. where the mast is connected to a separate Earth instead of being connected to the rail, the cables shall be laid at least one metre away from the Earth.

22.9 Where there are O.H.E structures along the cable route, the cable trenches shall as far as possible, be dug not less than 5.5 meters away from the centre of the Track.

22.10 In a cable run, the number of circuits carrying 300V at any given instant shall not exceed three.

*Note: 300 V feed system shall not be used in future installations.

23 Drawings for cable laying

23.1 The sketches for cable laying in different areas, soils, bridges etc. are listed below and are enclosed. However, Railways may issue detailed drawings as per local requirement of Railways and number and size of cables required.

S. N.	Description	Drawing No.	Annexure
1.	TYPICAL MAIN CABLE DISTRIBUTION PLAN FOR DOUBLE LINE (4 LINES) PI STATION	SDO/CABLE LAYING/001	Annexure-4
2.	POSITION OF TRENCHES FOR CABLE LAYING	SDO/CABLE LAYING/002	Annexure-5
3.	CABLE TRENCH	SDO/CABLE LAYING/003	Annexure-6
4.	LAYING OF SIGNALLING CABLE & TELECOM/ POWER CABLE IN SAME TRENCH	SDO/CABLE LAYING/004	Annexure-7
5.	RCC DUCT 300 MM	SDO/CABLE LAYING/005	Annexure-8
6.	RCC DUCT 500 MM	SDO/CABLE LAYING/006	Annexure-9
7.	RCC DUCT 500 MM	SDO/CABLE LAYING/007	Annexure-10
8.	LAYING OF CABLES IN ROCKY AREA	SDO/CABLE LAYING/008	Annexure-11
9.	TRACK CROSSINGS	SDO/CABLE LAYING/009	Annexure-12
10	ROAD CROSSINGS	SDO/CABLE LAYING/010	Annexure-13
11	CABLE LAYING ON CULVERTS WITH LOW FLOOD LEVEL	SDO/CABLE LAYING/011	Annexure-14
12	CABLE LAYING ON CULVERTS WITH HIGH FLOOD LEVEL	SDO/CABLE LAYING/012	Annexure-15
13	CABLE LAYING ON METALLIC BRIDGES	SDO/CABLE LAYING/013	Annexure-16
14	CABLE TROUGH FOR METALLIC BRIDGES	SDO/CABLE LAYING/014	Annexure-17
15	CABLE LAYING ON ARCH BRIDGES	SDO/CABLE LAYING/015	Annexure-18
16	BRICK MASONRY CHANNEL FOR ARCH BRIDGE	SDO/CABLE LAYING/016	Annexure-19
17	ARRANGEMENT OF JUMPER CABLE	SDO/CABLE LAYING/017	Annexure-20
18	CI CABLE MARKER & CONCRETING	SDO/CABLE LAYING/018	Annexure-21
19	CI CABLE MARKER	SDO/CABLE LAYING/019	Annexure-22
20	CONCRETE CABLE MARKER	SDO/CABLE LAYING/020	Annexure-23
21	METHOD OF UNROLLING CABLE	SDO/CABLE LAYING/021	Annexure-24
22	RULE MADE OF PIPE FOR MEASURING TRENCH DEPTH	SDO/CABLE LAYING/022	Annexure-25

Annexure-1
JPO No. 1/SG/2004
(Issued under CRB's D.O. letter No. 2004/Sig/G/7 dated 17.12.2004)

JOINT PROCEDURE ORDER FOR UNDERTAKING DIGGING WORK IN THE VICINITY OF UNDERGROUND SIGNALLING, ELECTRICAL AND TELECOMMUNICATION CABLES

A. A number of Engineering works in connection with gauge conversion/doubling/third line are in progress on various railways, which require extensive digging work near the running track, in close vicinity of the working S&T cables carrying vital safety circuits as well as electrical cables feeding the power supply to Cabins, ASM room, RRI Cabin, Intermediate Block Huts (IBH) etc. Similarly, S&T organization under open line or construction units under CAO/C are executing various signalling and telecommunication works requiring digging of earth for laying of cables or casting of foundations for the erection of signal posts etc. RailTel are also executing the work of laying of quad cable and OFC on various Railways as a part of sanctioned works for exclusive use of Railways for carrying voice and data i.e. administrative and control communication, PRS, FOIS etc. or shared by RailTel Corporation of India Ltd. On certain sections digging is also required for laying of electrical cable and casting of foundation for the erection of OHE masts by Electrical Deptt. Generally, these works are executed by contractors employed .by these organizations.

B. However, while carrying out these works in the vicinity of working signalling, telecommunication and electrical cables, at times, cable cuts take place due to JCB machines working along the track or during the digging work being done by Contractors carrying out the Civil Engineering Works. Similarly, such cable cuts are also resulting due to works undertaken by S&T or Electrical deptts. Such Cable faults results in the failure of vital signalling and telecommunication circuits.

C. Henceforth, the following joint procedure shall be followed by Engineering, Electrical and S&T (and RailTel organization, wherever such works are being done by them) Officers of the respective divisions and by the Construction Organization, while carrying out any digging work near to existing signalling & telecommunication and electrical cables, so that the instances of cable cut due to execution of works can be controlled and minimized.

1. S&T Department (and RailTel, where they have laid the cables) & Electrical Deptts. shall provide a detailed cable route plan showing exact location of cable at an interval of 200m or wherever there is change in alignment so that the same is located easily by the Engineering official/contractor. This cable route plans shall be made available to the DSE/DEN or Dy. CE/C as the case may be by Sr. DSTE/DSTE or Sr. DEE/DEE of the divisions or Dy. CSTE/C or Dy. CEE/C within a reasonable time in duplicate. DSE/DEN or Dy. CE/C will send copies to their field unit i.e. AEN/SE/P.Way & works.
2. Before taking up any digging activity on a particular work by any agency, Sr. DSTE/DSTE or Sr. DEE/DEE of the section shall be approached in writing by the concerned Engg or S& T or Electrical officer for permitting to undertake the work. After ensuring that the concerned executing agencies including the contractor have fully understood the S&T and Electrical cable route plan shall permit the work in writing.
3. After getting the permission from S&T or Electrical Deptt. as the case may be, the

relevant portion of the cable route plan shall be attached to the letter through which permission is issued to the contractor by concerned Engg. official for commencement of work and ensuring that the contractors have fully understood the cable route plan and precautions to be taken to prevent damage to the underground cables. The contractor shall be asked to study the cable plan and follow it meticulously to ensure that the safety of the cable is not endangered. Such a provision, including any penalty for default, should form part of agreement also. It is advisable that a suitable post of SE (Sig) or SE (Tele) or SE(Elect.) shall be created chargeable to the estimates of doubling / Gauge conversion, who can help engg agencies in the execution of the work. However basic responsibility will be of the Department executing the work and the Contractor.

4. The SE (P.Way) or SE (Works) shall pass on the information to the concerned SE (Sig) or SE (Tele) or SE (Elect.) about the works being taken up by the contractors in their sections at least 3 days in advance of the day of the work. In addition Engineering control shall also be informed by SE(P.Way) or SE (Works), which in turn shall pass on the information to the Test Room/Network Operation Centre of RailTel/TPC/Electrical Control.
5. On receiving the above information, SE (Sig) or SE (Tele) or SE (Elect.) shall visit the site on or before the date of taking up the work and issue permission to the contractor to commence the work after checking that adequate precautions have been taken to avoid the damage to the cables. The permission shall be granted within 3 days of submission of such requests.
6. The name of the contractor, his contact telephone number, the nature of the work shall be notified in the Engineering Control as soon as the concerned Engg. official issued the letter authorizing commencement of work to the contractor. Test Room be given a copy and Test Room shall collect any further details from the Engineering Control and shall pass it on to S&T/RailTel & Elect. officials regularly.
7. In case of works being taken up by the State Government, National Highway Authority etc., the details of the permission given i.e. the nature of work, kilometer etc. be given to the Engineering Control including the contact person's number so .that the work can be done in a planned manner. The permission letter shall indicate the contact numbers of Test Room/Network Operations Centre of RailTel/TPC/Elect. Control.
8. Where the nature of the work taken up by the Engineering department is such that the OFC or other S&T cables or Electrical cables is to be shifted and relocated, notice of minimum one week shall be given so that the Division/RailTel/Construction can plan the works properly for shifting. Such shifting works shall, in addition, for security and integrity of the cables, be supervised by S&T supervisors / RailTel supervisors/ Electrical Supervisors.
9. The concerned SE(P.Way)/SE(Works)/SE(Sig)/SE(Tele)/SE(Elect.) or RailTel supervisors, supervising the work of the contractor shall ensure that the existing emergency sockets are not damaged in view of their importance in providing communication during accident/emergency.
10. In case of minor nature of works where shifting of cable is not required, in order to prevent damage to the cable, the Engineering Contractor shall take out the S&T or optical fibre cable or Electrical cable carefully from the trench and place it properly alongside at a safe location before starting the earthwork under the

supervision of SE (Sig) or SE (Tele) or SE (Electrical). The cable shall be reburied soon after completion of excavation with proper care including placement of the brick over the cable by the concerned S&T supervisors or Electrical Supervisors. However, the work will be charged to the concerned engineering work.

11. In all the sections where major project are to be taken up/going on RailTel/S&T Deptt. shall deploy their official to take preventive /corrective action at site of work.
12. No new OFC/Quad cable shall be laid close to existing track. It shall be laid close to Railway boundary as per extant instructions i.e. 1.0 m from the Railway boundary to the extent possible to avoid any interference with future works (doubling etc.). It shall be ensured in the new works of cable laying that the cable route is properly identified with electronic or Concrete markers. Henceforth, wherever cable laying is planned and before undertaking the laying work, the cable route plan of the same shall be got approved from the concerned Sr. DEN or Dy. CE/Constn. to avoid possible damages in future. Such approvals shall be granted within 7 days of submission of the requests.
13. The works of excavating the trench and laying of the cable should proceed in quick succession, leaving a minimum time between the two activities.
14. Any damage caused to OFC/Quad cable or Electrical cable during execution of the work, necessary debit shall be raised on Engineering Department who shall bear the cost of the corrective action.
15. All types of bonds i.e. rail bond, cross bond and structure bond shall be restored by the Contractor with a view to keep the rail voltage low to ensure safety of personnel.
16. Above joint circular shall be applicable for construction as well as open line organization of Engineering, S&T & Electrical.
17. The S&T cable and Electrical cable route plan should be got approved from the concerned Sr. DSTE/ DSTE & Sr. DEE/DEE respectively, before undertaking the work and completion cable route plan should be finalised Block section by Block section as soon as the work is completed.

-sd-	-sd-	-sd-	-sd-
(R.S.Grover)	**(N.K.Goel)**	**(R.C.Sharma)**	**(R.Sundararajan)**
AM (Elec.)	**Adv (Sig)**	**AM (Tele)**	**AM (Works)**

Annexure-2

CABLE TESTING RECORD: SUMMARY SHEET

Cable No.		Cable Function	
Cable Size		Make	
Length		PO No. and date	
Between Locations		Inspection No. and Date	
Type of Protection		Spare Core Nos.	

SN	Date of Testing	Insulation Test Results		Ref. No. of Test Sheet*	Remarks and Signature
		Core to Core	Core to Earth		

*Tests sheets for Insulation and Loop resistance results in matrix format to be maintained separately for each cable in the cable testing register.

Annexure-3

CABLE INSULATION RESISTANCE TEST SHEET

Date of Meggering: **Signature**

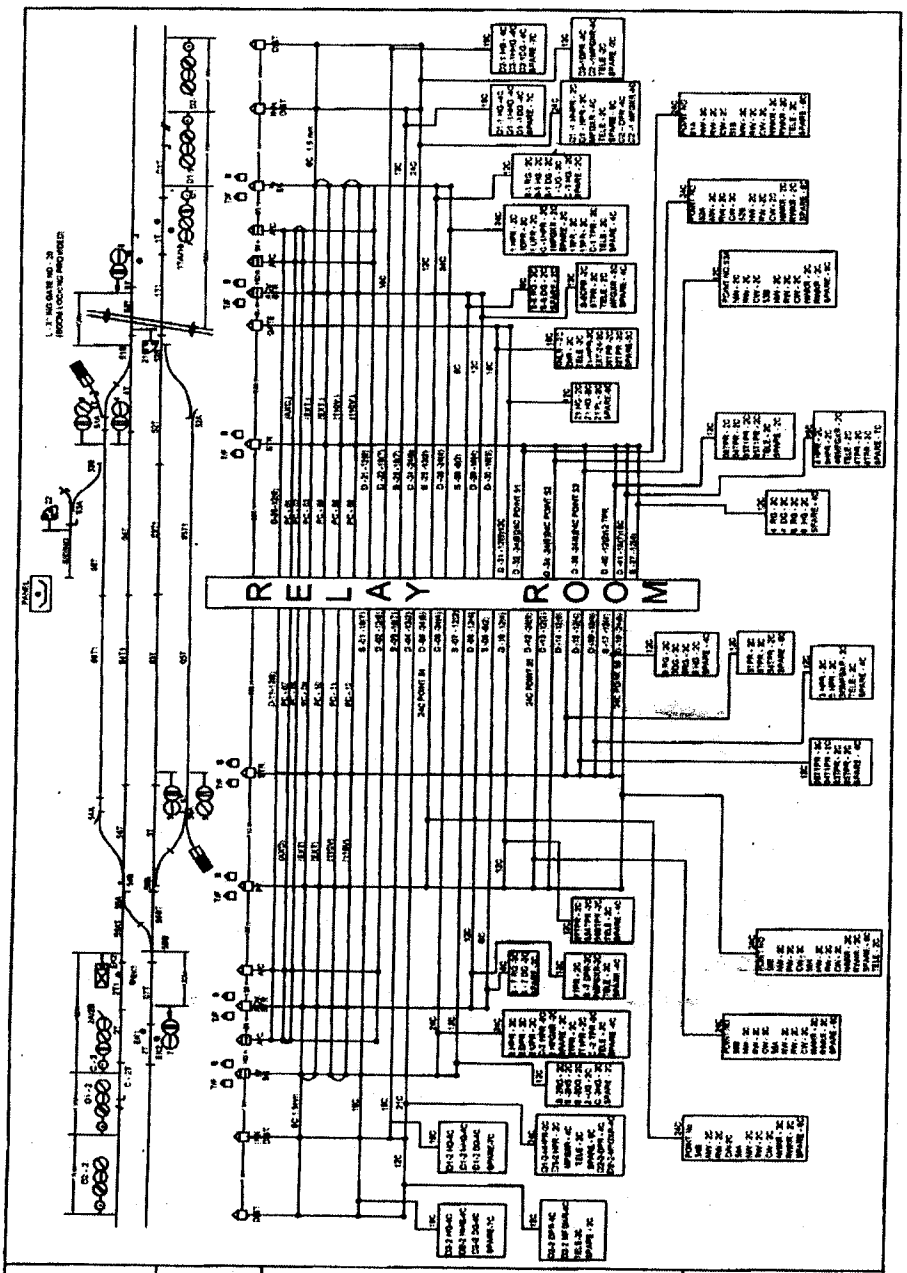
(All figures in mega ohms unless otherwise specified)

No	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
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(All figures in mega ohms unless otherwise specified)

Date of Meggering: **Signature**

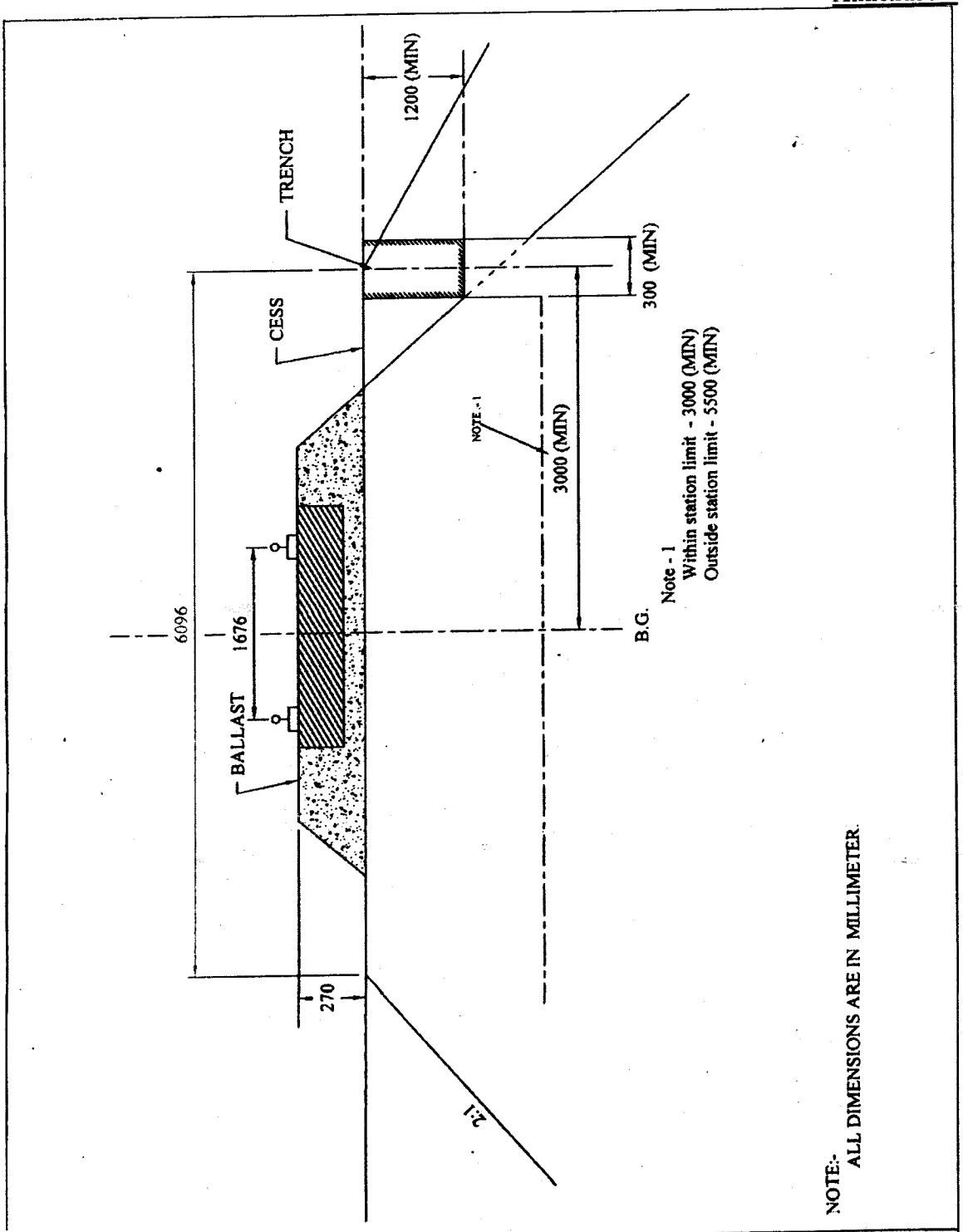
Annexure-4



CHECKED BY	JE/SE/SSE	TYPICAL MAIN CABLE DISTRIBUTION PLAN FOR DOUBLE LINE(4 LINE) P.I.STATION	SDO/CABLE LAYING/001
APPROVED BY	ADE	RDSO	DATE :-31-10-2011
		NOT TO SCALE	

4

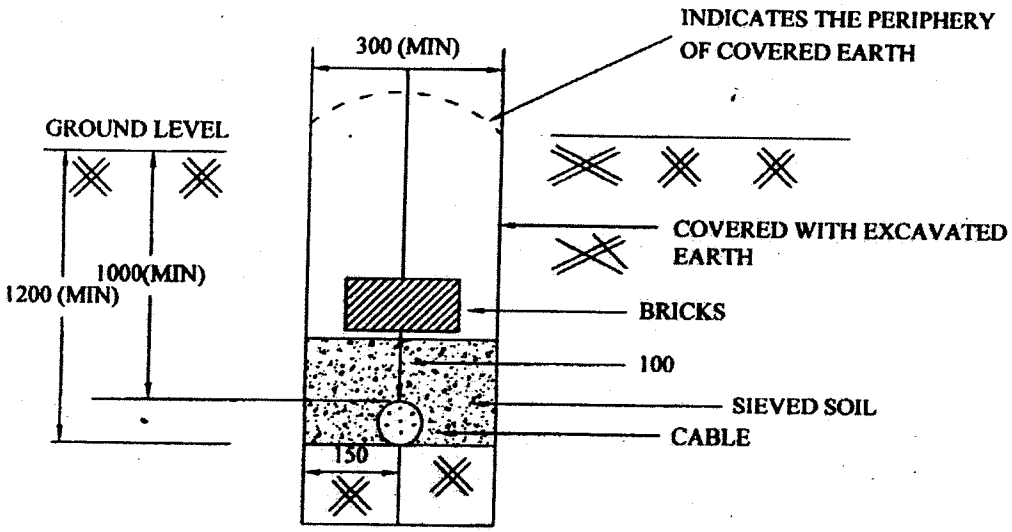
Annexure-5



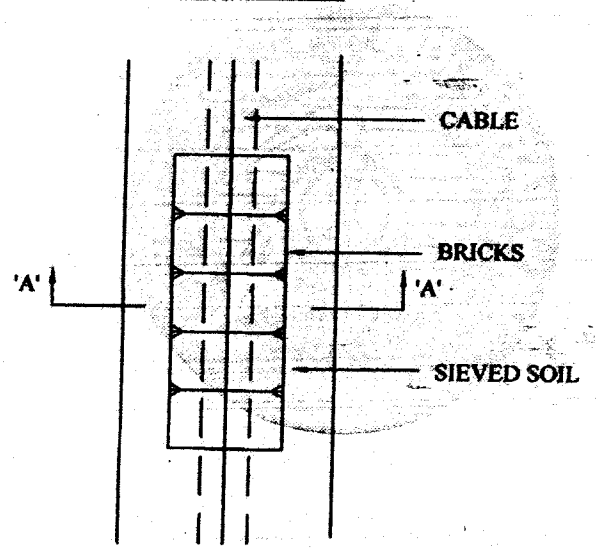
CHECKED BY	JE/SE/SSE	POSITION OF TRENCHES FOR CABLE LAYING	SDO/CABLE LAYING /002
APPROVED BY	ADE	RDSO	DATE : 31-10-2011
NOT TO SCALE			

(16)

Annexure-6



CUT SECTION 'AA'

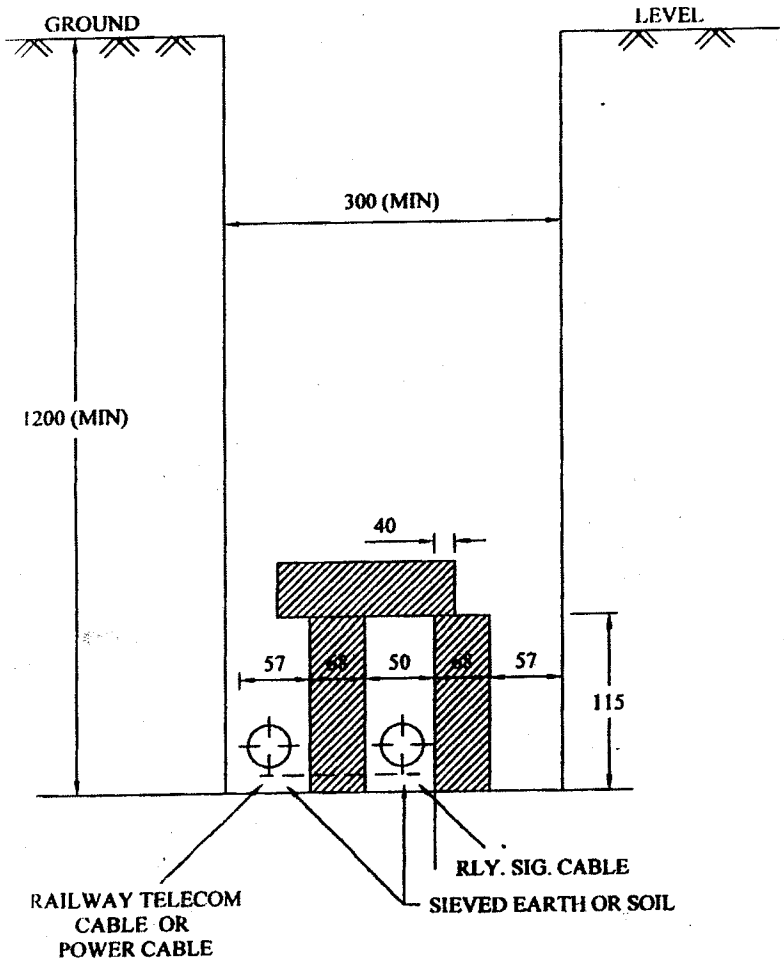


PLAN VIEW

NOTE :
1. ALL DIMENSIONS ARE IN MILLIMETER.

CHECKED BY	JE/SE/SSE	CABLE TRENCH	SDO/CABLE LAYING/003
APPROVED BY	ADE	R. D. S. O.	DATE : 31-10-2011
NOT TO SCALE			

Annexure-7



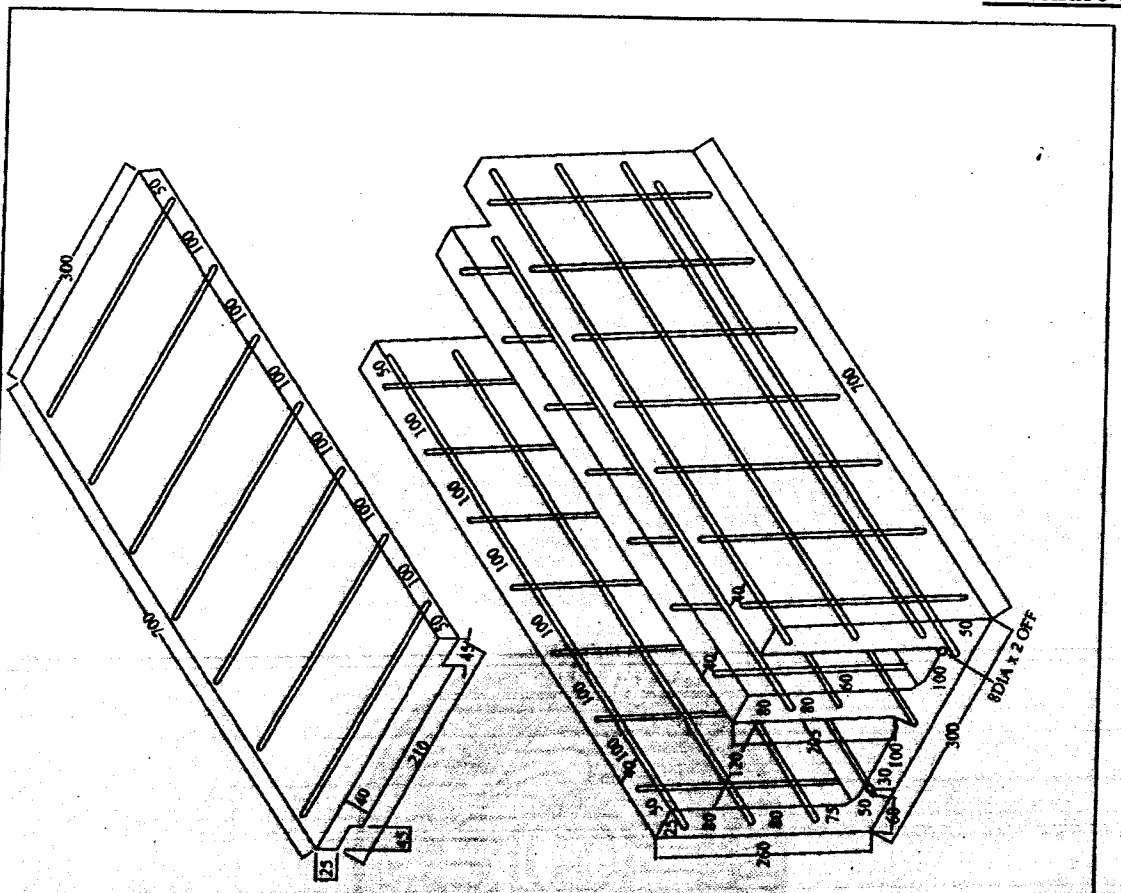
NOTE:

2. TELECOM CABLE/POWER CABLE TO BE LAID AWAY FROM THE TRACK
1. DIMENSIONS ARE IN MILLIMETRES

CHECKED BY	JE/SE/SSE	LAYING OF SIGNALLING CABLE & TELECOM/POWER CABLE IN SAME TRENCH	SDO/CABLE LAYING/004
APPROVED BY		R. D. S. O.	DATE :- 31-10-2011
NOT TO SCALE			

(B)

Annexure-8

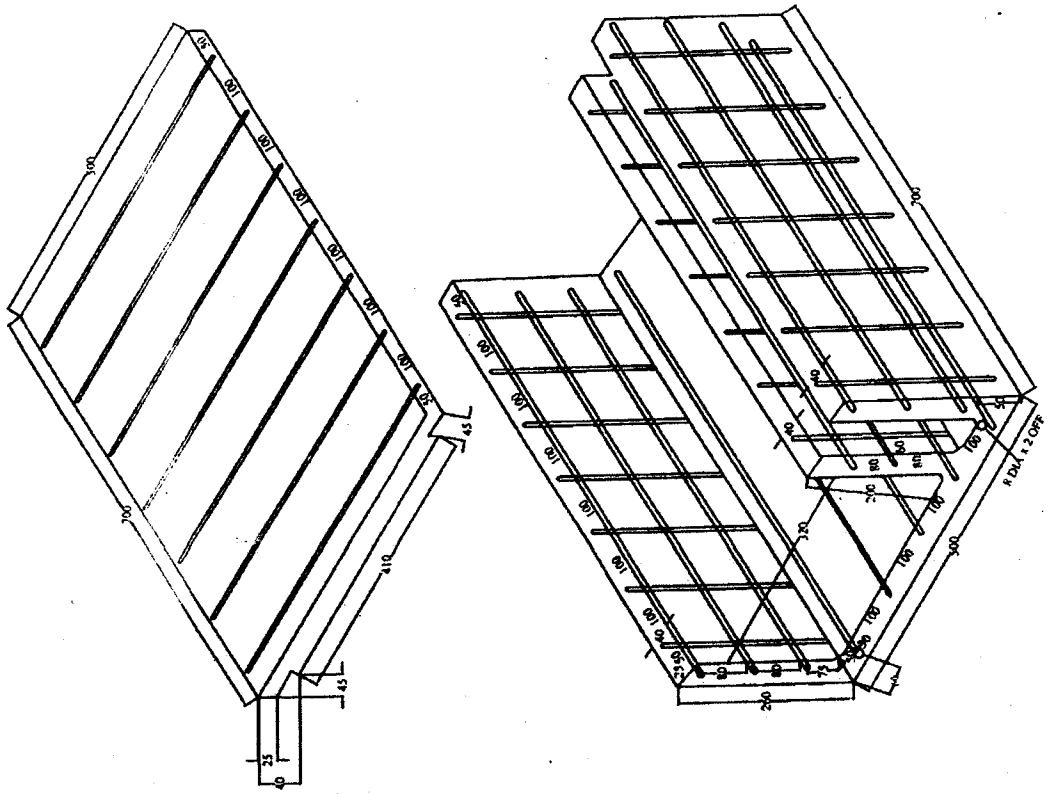


Note :-

1. TRUNKING AND CAPPING ARE SUITABLE FOR BURYING ADJACENT TO THE TRACKS IN TRENCHES WITH MINIMUM DEPTH OF 600 mm.
2. THE TRUNKING TO BE ALIGNED BY PUTTING AN MS ROD OF 8 mm DIA X 100mm LONG AS PER IS:432 PART (1)-1982 IN THE TWO HOLES PROVIDED.
3. 6.0 mm DIA HIGH STRENGTH DEFORMED STEEL BARS CONFORMING TO IS:11786 TO BE USED FOR REINFORCEMENT
4. M - 25 GRADE OF CONCRETE TO BE USED CONFORMING TO IS:10262 - 1982 AND IS:456 - 2000 - 10 mm SIZE COURSE AGGREGATE TO BE USED.
5. OPC OF 43 GRIDE TO BE USED CONFORMING TO IS:8112 - 1989.
6. THE ACCEPTANCE TEST SHALL BE CONDUCTED IN A RECOGNISED LABORATORY AND THE COST OF THE TEST AS CHARGED BY THE LABORATORY SHALL BE BORNE BY THE CONTACTOR.
7. CURING SHALL BE DOBE AS PER THE IS: 456:2000.
8. DUCT MAY BE IN-SITU OR FACTORY MADE
9. ALL DEMENSION ARE IN MILLIMETER

CHECKED BY	JE/SE/SEE	RCC DUCT 300 MM.	SDO/CABLE LAYING/005
APPROVED BY	ADE	R.D.S.O.	DATE :- 31-10-2011
NOT TO SCALE			

Annexure-9



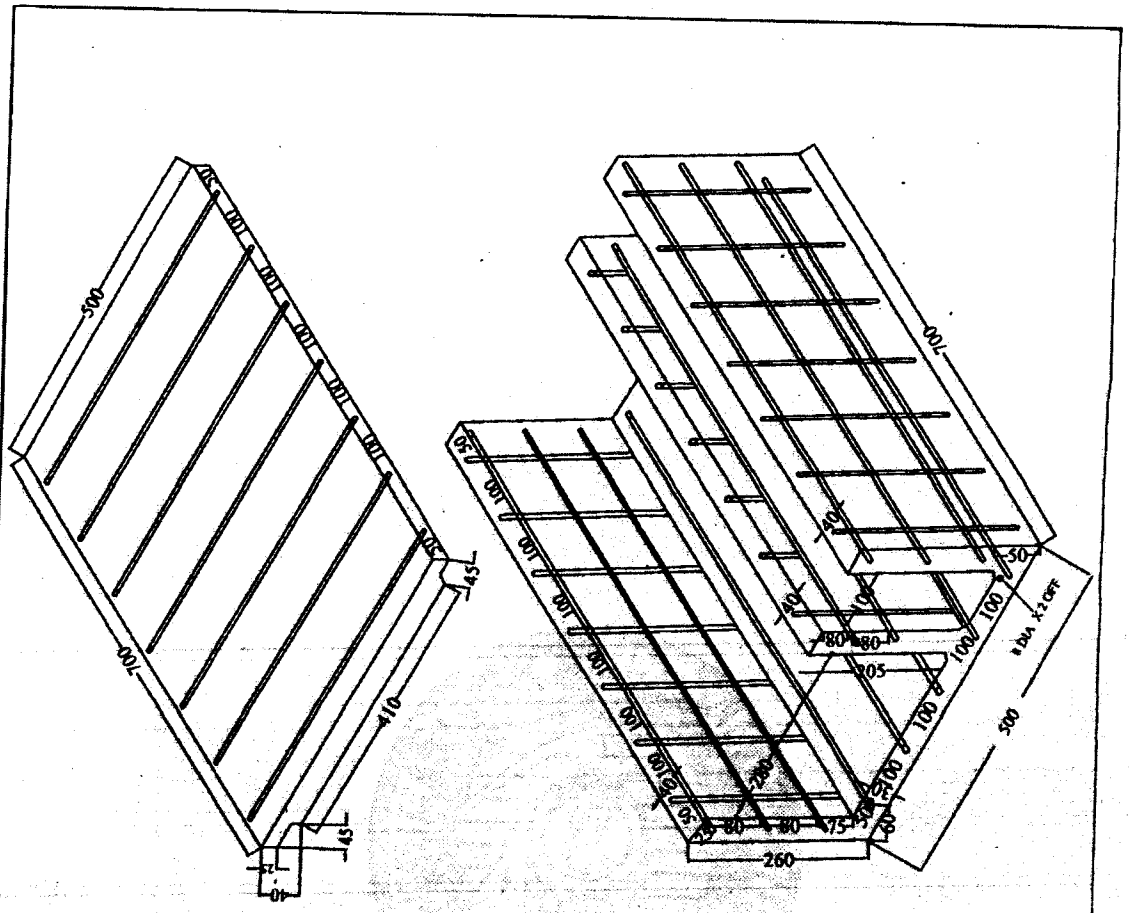
Note :-

1. TRUNKING AND CAPPING ARE SUITABLE FOR BURYING ADJACENT TO THE TRACKS IN TRENCHES WITH MINIMUM DEPTH OF 600 mm.
2. THE TRUNKING TO BE ALIGNED BY PUTTING ANCHOR BOLT OF 8 mm DIA X 160mm LONG AS PER IS 432 PART I (1982) IN THE TWO HOLES PROVIDED.
3. 6.0 mm DIA HIGH STRENGTH DEFORMED STEEL BARS CONFORMING TO IS:11786 TO BE USED FOR REINFORCEMENT
4. M - 25 GRADE OF CONCRETE TO BE USED CONFORMING TO IS:10262 - 1982 AND IS:456 - 2000 - 10 mm SIZE COURSE AGGREGATE TO BE USED.
5. OPC OF 43 GRDE TO BE USED CONFORMING TO IS:8112 - 1989.
6. THE ACCEPTANCE TEST SHALL BE CONDUCTED IN A RECOGNISED LABORATORY AND THE COST OF THE TEST AS CHARGED BY THE LABORATORY SHALL BE BORNE BY THE CONTACTOR.
7. CURING SHALL BE DOBE AS PER THE IS: 456:2000.
8. DUCT MAY BE IN-SITU OR FACTORY MADE
9. ALL DEMENSION ARE IN MILLIMETER

CHECKED BY	JE/SE/SEE	RCC DUCT 500 MM.	SDO/CABLE LAYING/006
APPROVED BY	ADE	R.D.S.O.	DATE :- 31-10-2011
NOT TO SCALE			

(14)

Annexure-10

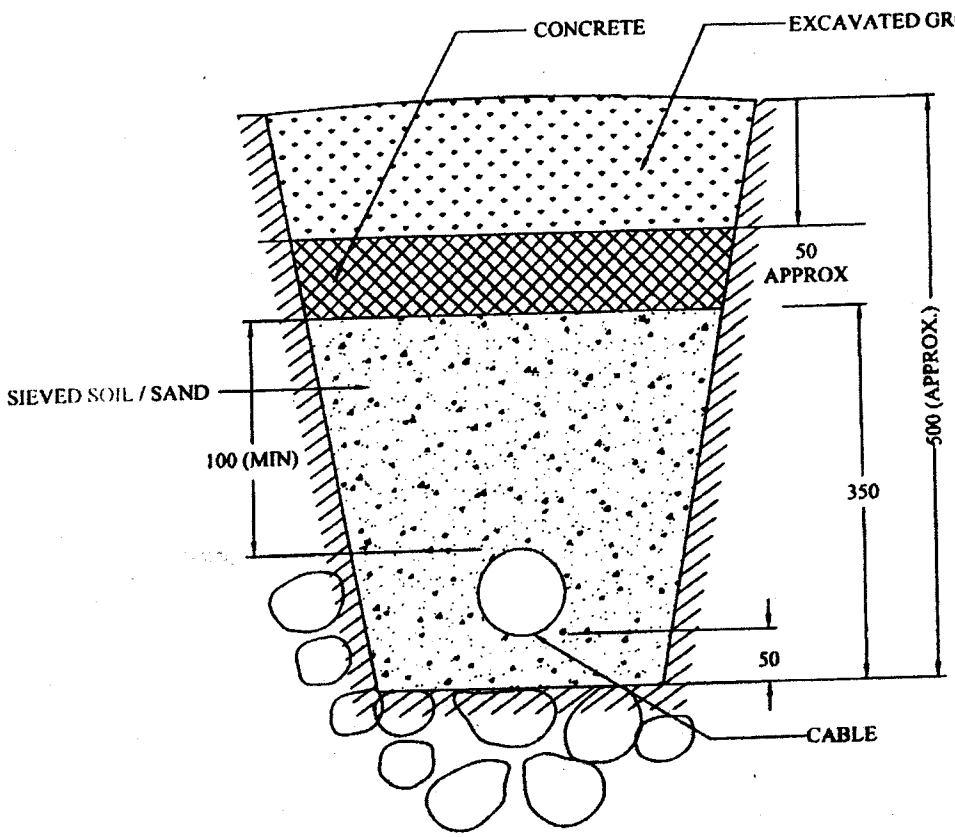


Note :-

1. TRUNKING AND CAPPING ARE SUITABLE FOR BURYING ADJACENT TO THE TRACKS IN TRENCHES WITH MINIMUM DEPTH OF 600 mm.
2. THE TRUNKING TO BE ALIGNED BY PUTTING AN MS ROD OF 8 mm DIA X 100mm LONG AS PER IS:432 PART (1)-1982 IN THE TWO HOLES PROVIDED.
3. 6.0 mm DIA HIGH STRENGTH DEFORMED STEEL BARS CONFORMING TO IS:1786 TO BE USED FOR REINFORCEMENT
4. M - 25 GRADE OF CONCRETE TO BE USED CONFORMING TO IS:10262 - 1982 AND IS:456 - 2000
5. 10 mm SIZE COURSE AGGREGATE TO BE USED. OPC OF 43 GRDE TO BE USED CONFORMING TO IS:8112 - 1989.
6. THE ACCEPTANCE TEST SHALL BE CONDUCTED IN A RECOGNISED LABORATORY AND THE COST OF THE TEST AS CHARGED BY THE ABORATORY SHALL BE BORNE BY THE CONTACTOR.
7. CURING SHALL BE DOBE AS PER THE IS: 456:2000.
8. DUCT MAY BE IN-SITU OR FACTORY MADE
9. ALL DEMENSION ARE IN MILLIMETER

CHECKED BY	JE/SE/SEE	RCC DUCT 500 MM.	SDO/CABLE LAYING/007
APPROVED BY	ADE	R.D.S.O.	DATE :- 31-10-2011
NOT TO SCALE			

Annexure-11

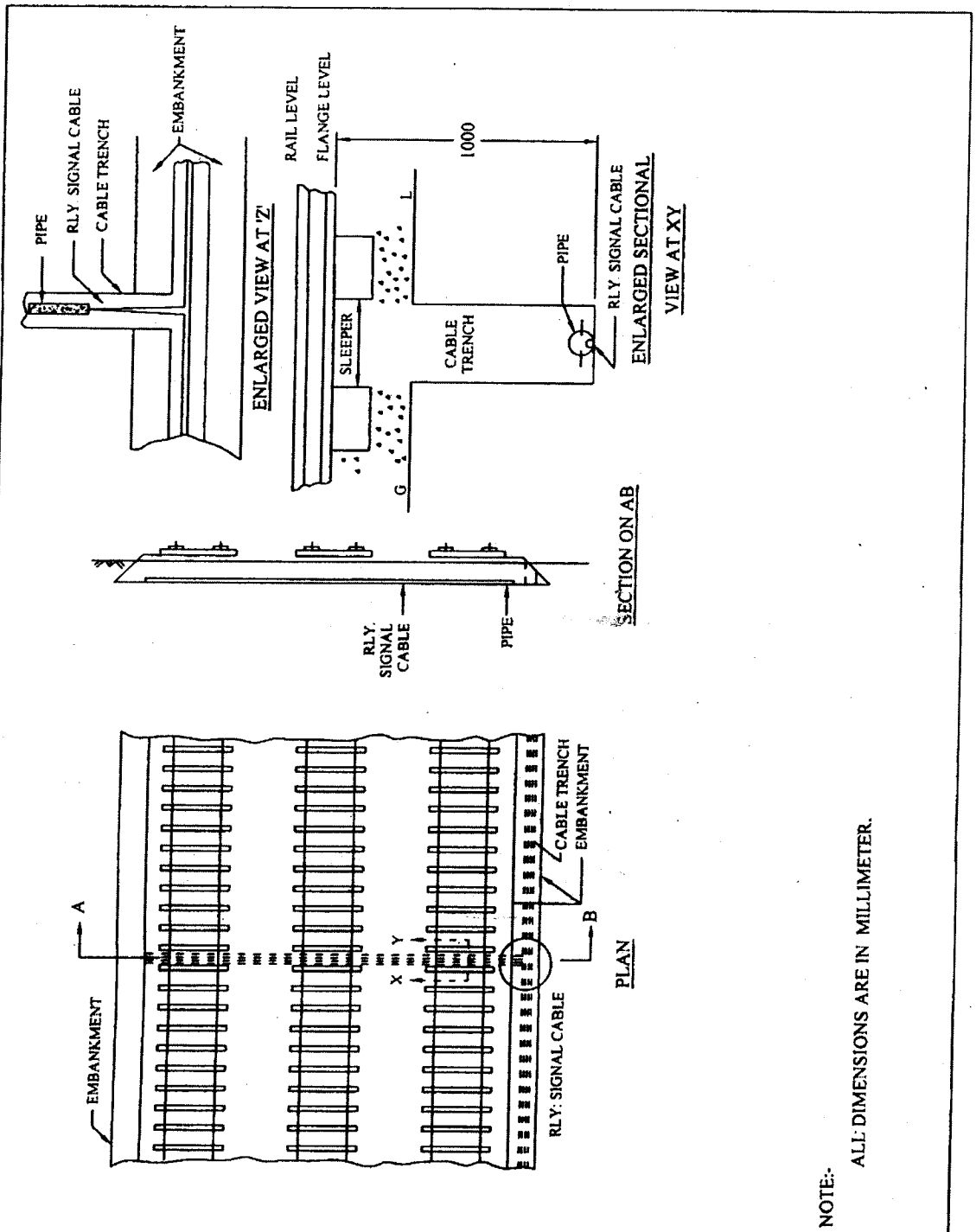


NOTE:-
ALL DIMENSIONS ARE IN MILLIMETER.

CHECKED BY	JE/SE/SSE	LAYING OF CABLES IN ROCKY AREA	SDO/CABLE LAYING/008
APPROVED BY	ADE	R. D. S. O.	DATE :- 31-10-2011
NOT TO SCALE			

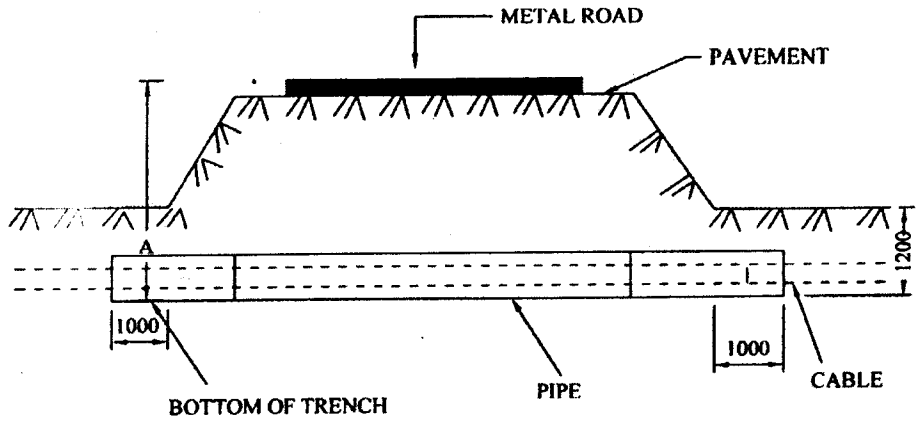
(15)

Annexure-12



CHECKED BY	JE/SE/SSE	TRACK CROSSING	SDO/CABLE LAYING/009
APPROVED BY	ADE	R. D. S. O.	DATE :- 31-10-2011
NOT TO SCALE			

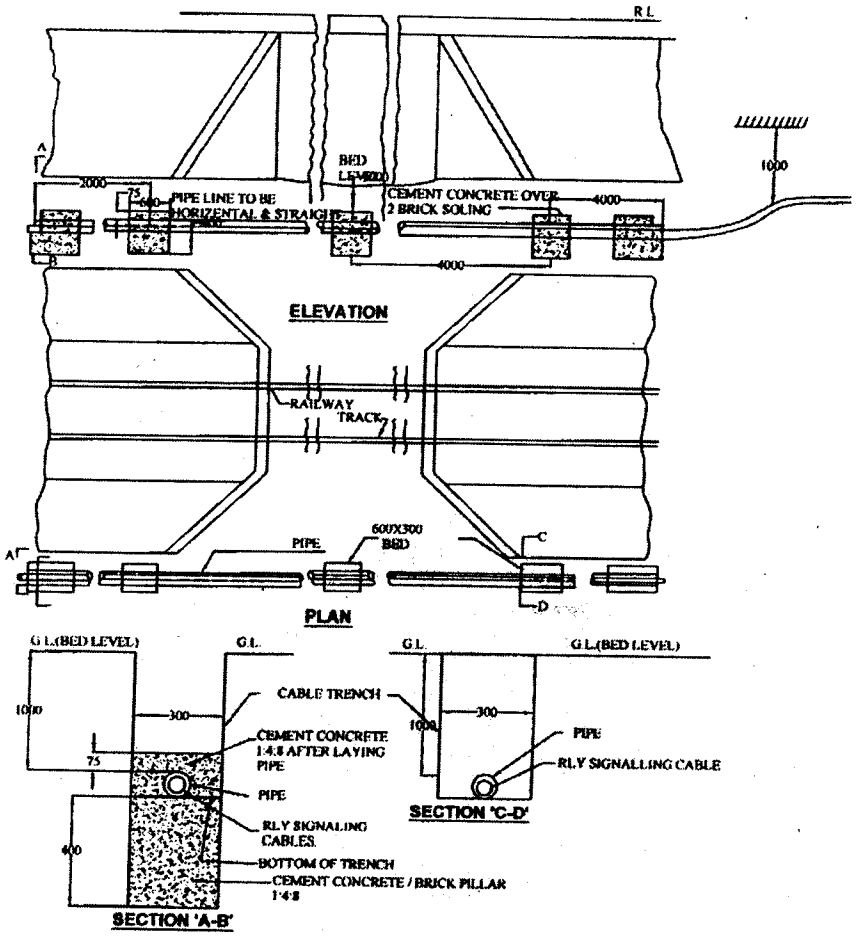
Annexure-13



NOTE:-
ALL DIMENSIONS ARE IN MILLIMETER.

CHECKED BY	JE/SE/SSE	ROAD CROSSINGS	SDO/CABLE LAYING/010
APPROVED BY	ADE	R. D. S. O.	DATE :- 31-10-2011
NOT TO SCALE			

Annexure-14

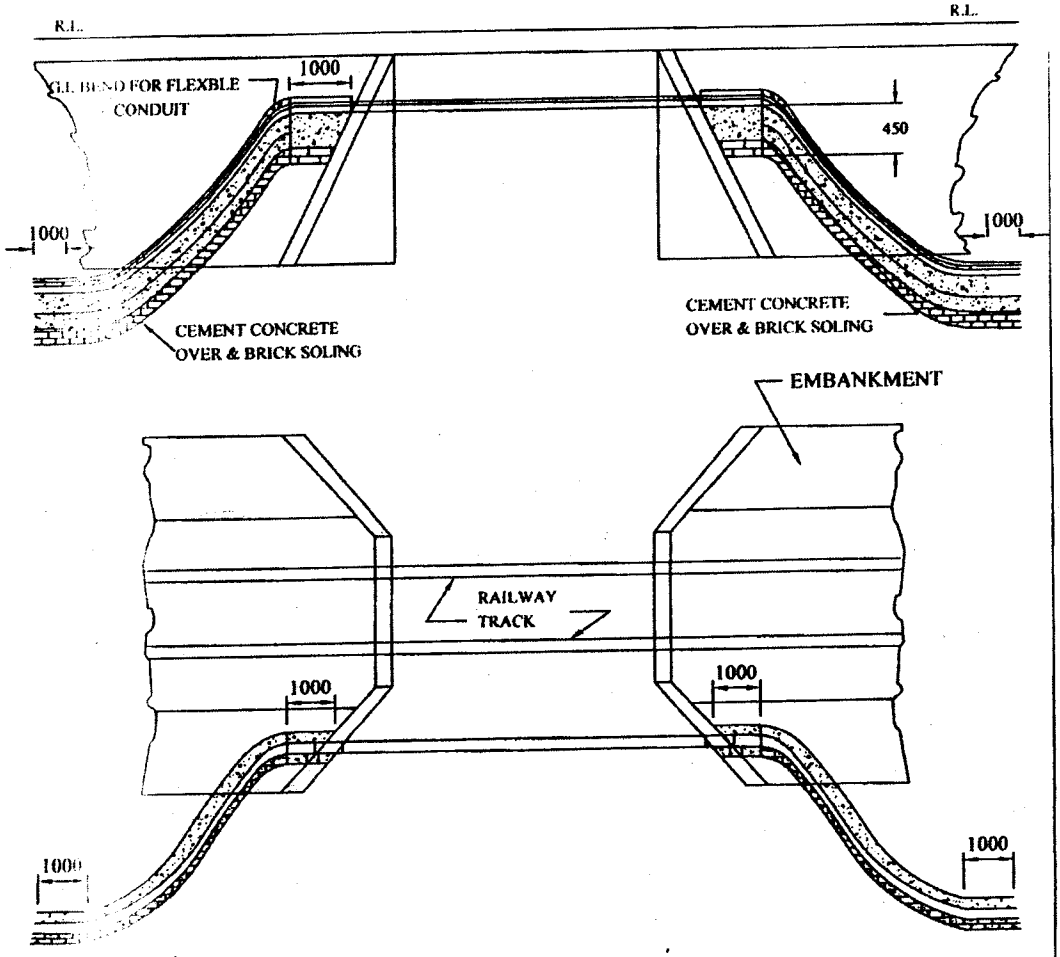


NOTE:-

ALL DIMENSIONS ARE IN MILLIMETER.

CHECKED BY	JE/SE/SSE	CABLE LAYING ON CULVERTS WITH LOW FLOOD LEVEL	SDO/CABLE LAYING/011
APPROVED BY	ADE	R.D.S.O	DATE :- 31-10-2011
NOT TO SCALE			

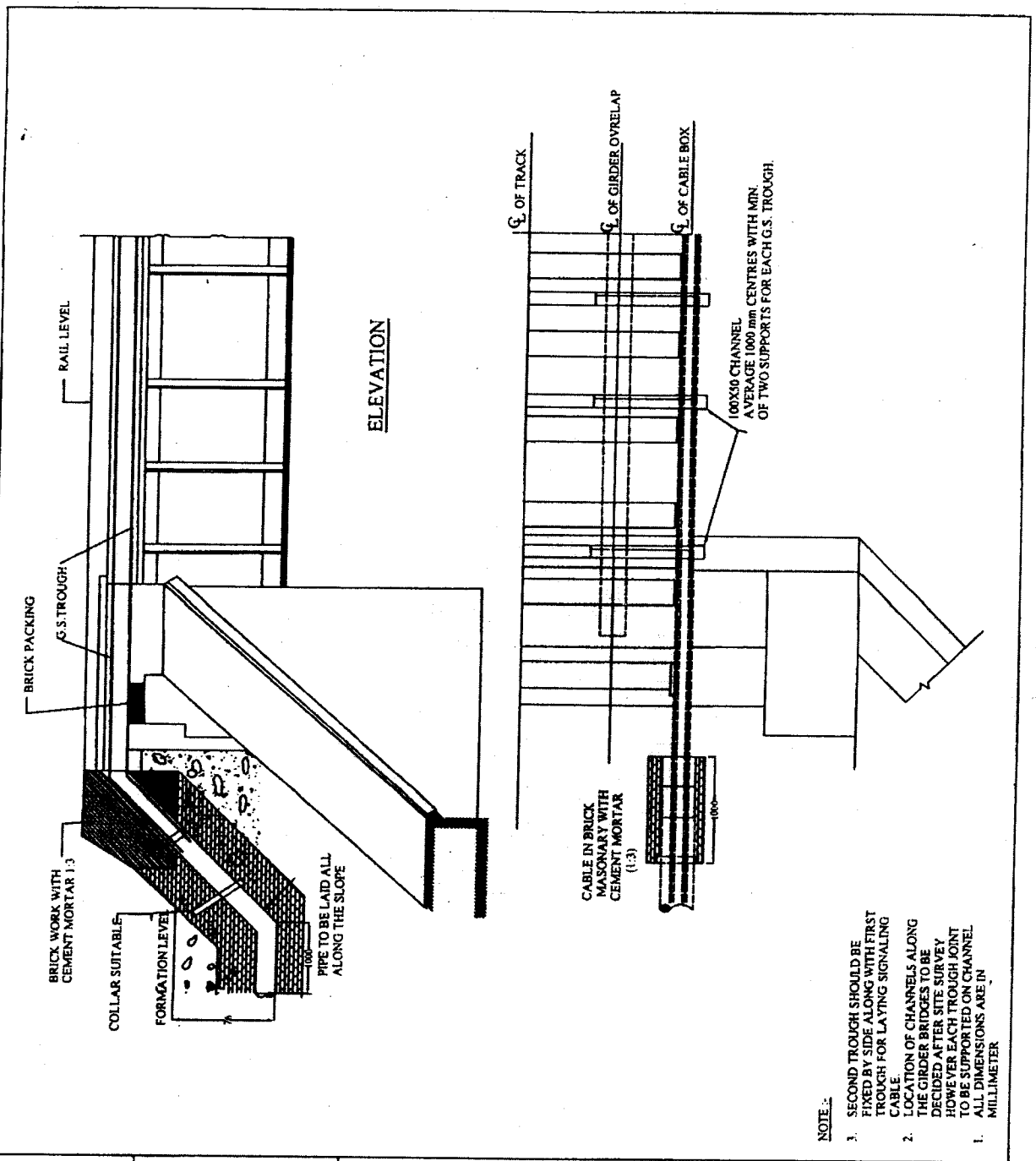
Annexure-15



NOTE:-
ALL DIMENSIONS ARE IN MILLIMETER.

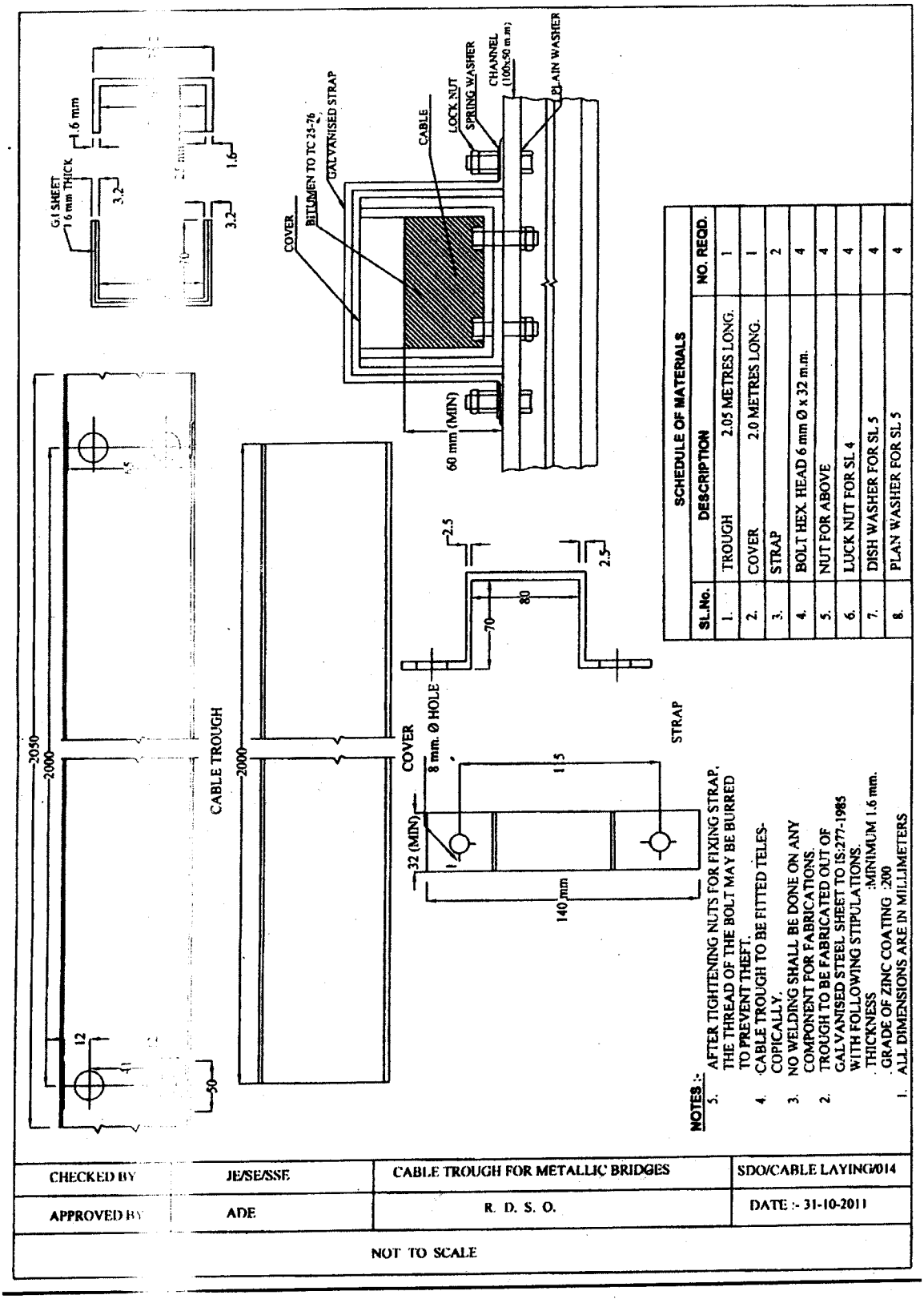
CHECKED BY	JE/SE/SSE	CABLE LAYING ON CULVERTS WITH HIGH FLOOD LEVEL	SDO/CABLE LAYING/012
APPROVED BY	ADE	R.D.S.O	DATE :- 31-10-2011
		NOT TO SCALE	

Annexure-16



CHECKED BY	JE/SE/SSE	CABLE LAYING ON METALLIC BRIDGES	SDO/CABLE LAYING/013
APPROVED BY	ADE	R. D. S. O.	DATE :- 31-10-2011
NOT TO SCALE			

Annexure-17



SCHEDULE OF MATERIALS

SL.No.	DESCRIPTION	NO. REQD.
1.	TROUGH 2.05 METRES LONG.	1
2.	COVER 2.0 METRES LONG.	1
3.	STRAP	2
4.	BOLT HEX. HEAD 6 mm Ø x 32 m.m.	4
5.	NUT FOR ABOVE	4
6.	LUCK NUT FOR SL 4	4
7.	DISH WASHER FOR SL 5	4
8.	PLAN WASHER FOR SL 5	4

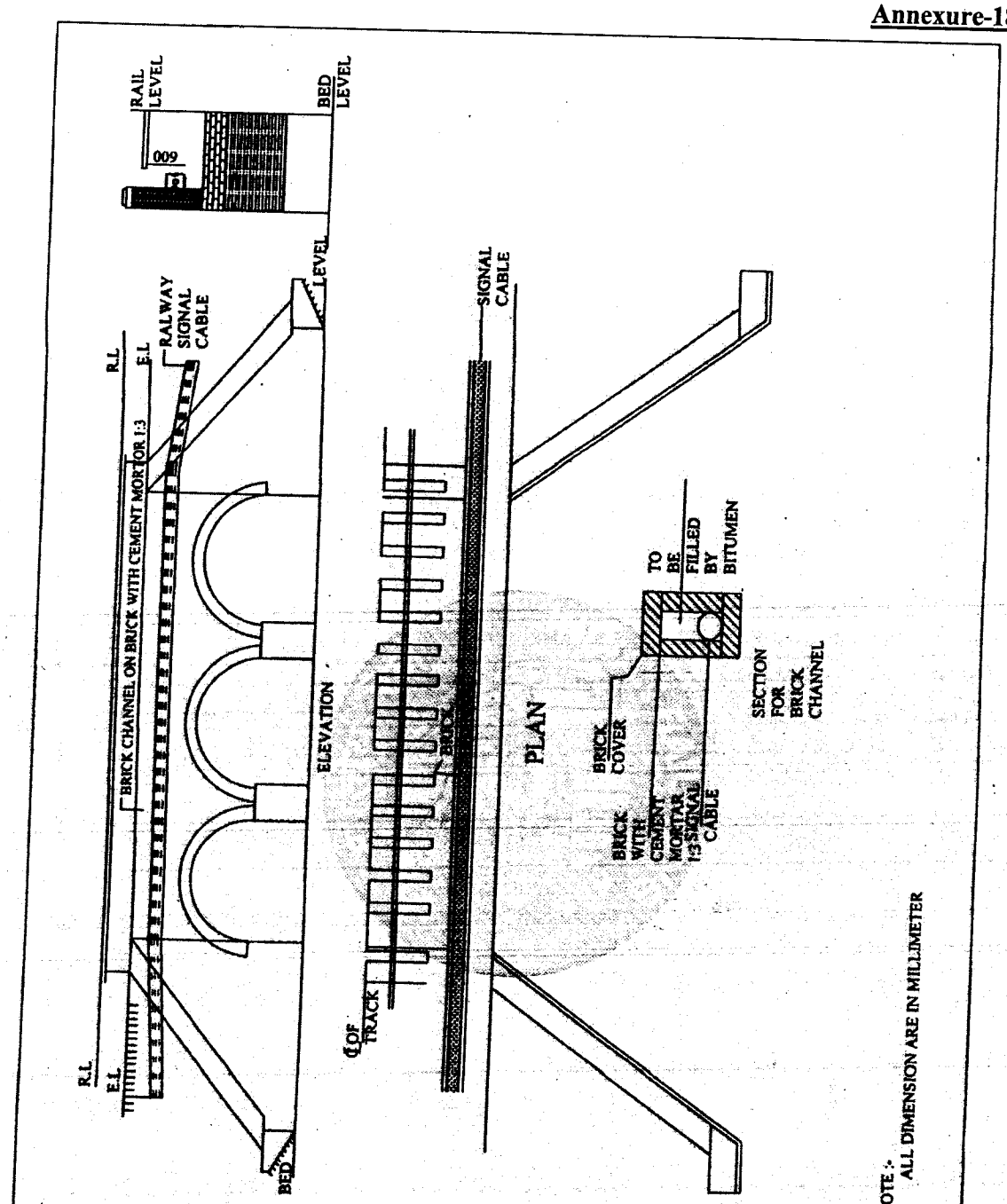
NOTES :-

5. AFTER TIGHTENING NUTS FOR FIXING STRAP, THE THREAD OF THE BOLT MAY BE BURRED TO PREVENT THEFT.
4. CABLE TROUGH TO BE FITTED TELES-COPICALLY.
3. NO WELDING SHALL BE DONE ON ANY COMPONENT FOR FABRICATIONS.
2. TROUGH TO BE FABRICATED OUT OF GALVANISED STEEL SHEET TO IS:277-1985 WITH FOLLOWING STIPULATIONS.
   - THICKNESS :MINIMUM 1.6 mm.
   - GRADE OF ZINC COATING :200
1. ALL DIMENSIONS ARE IN MILLIMETERS

CHECKED BY	JE/SE/SSE	CABLE TROUGH FOR METALLIC BRIDGES	SDO/CABLE LAYING/014
APPROVED BY	ADE	R. D. S. O.	DATE :- 31-10-2011
NOT TO SCALE			

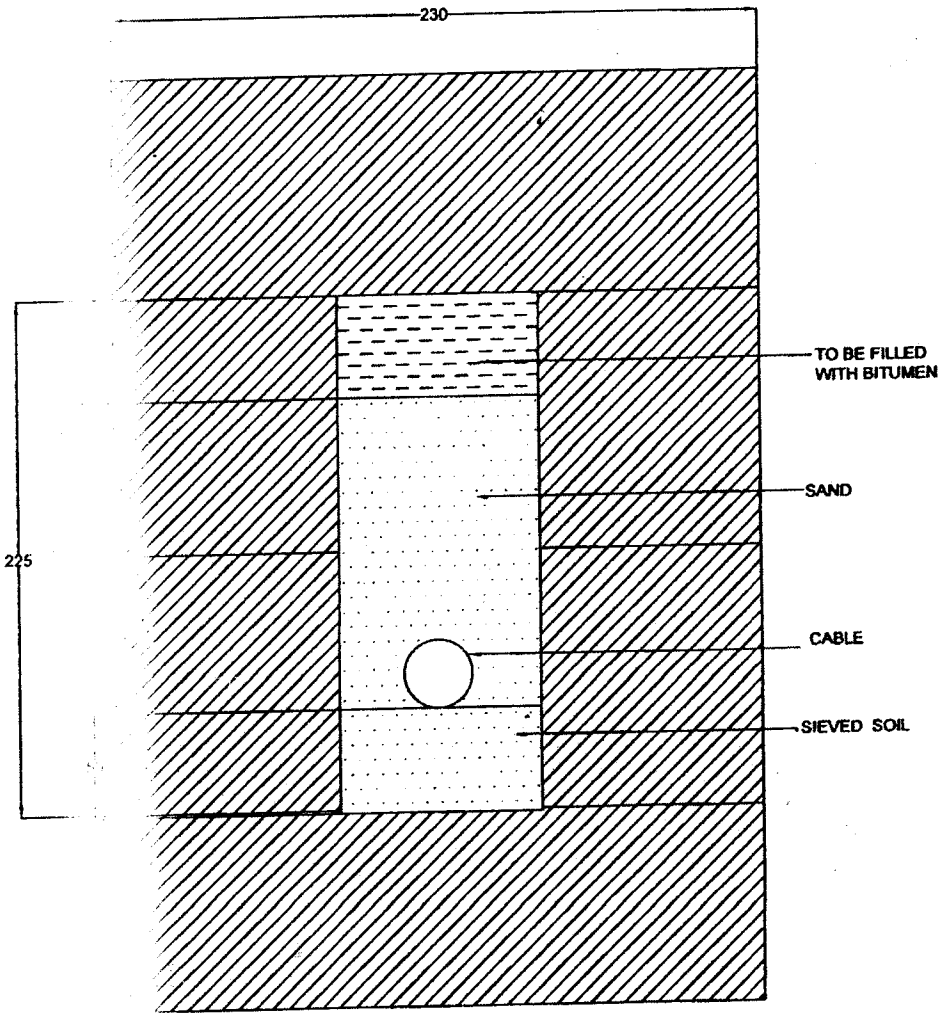
(18)

Annexure-18



CHECKED BY	JE/SE/SSE	CABLE LAYING ON ARCH BRIDGES	SDO/CABLE LAYING/015
APPROVED BY	ADE	R. D. S. O.	Date :- 31-10-2011
NOT TO SCALE			

Annexure-19

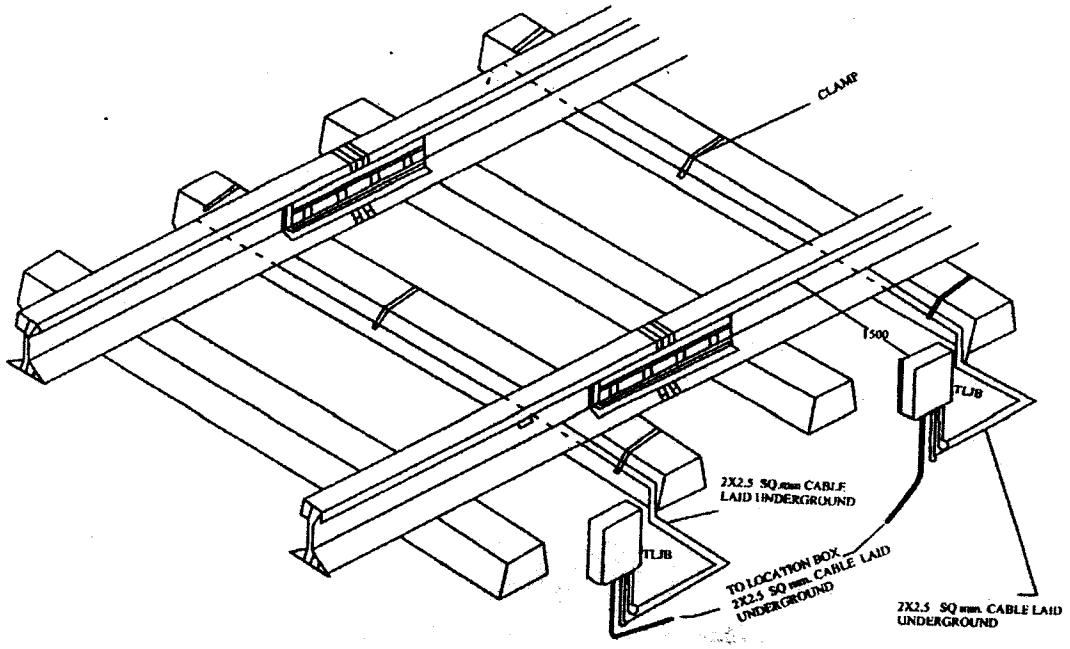


NOTE :-

ALL DIMENSION ARE IN MILLIMETER.

CHECKED BY	JE/SE/SSE	BRICK MASONRY CHANNEL FOR ARCH BRIDGE	SDO/CABLE LAYING /016
APPROVED BY	ADE	R. D. S. O.	DATE :- 31-10-2011
		NOT TO SCALE	

Annexure-20

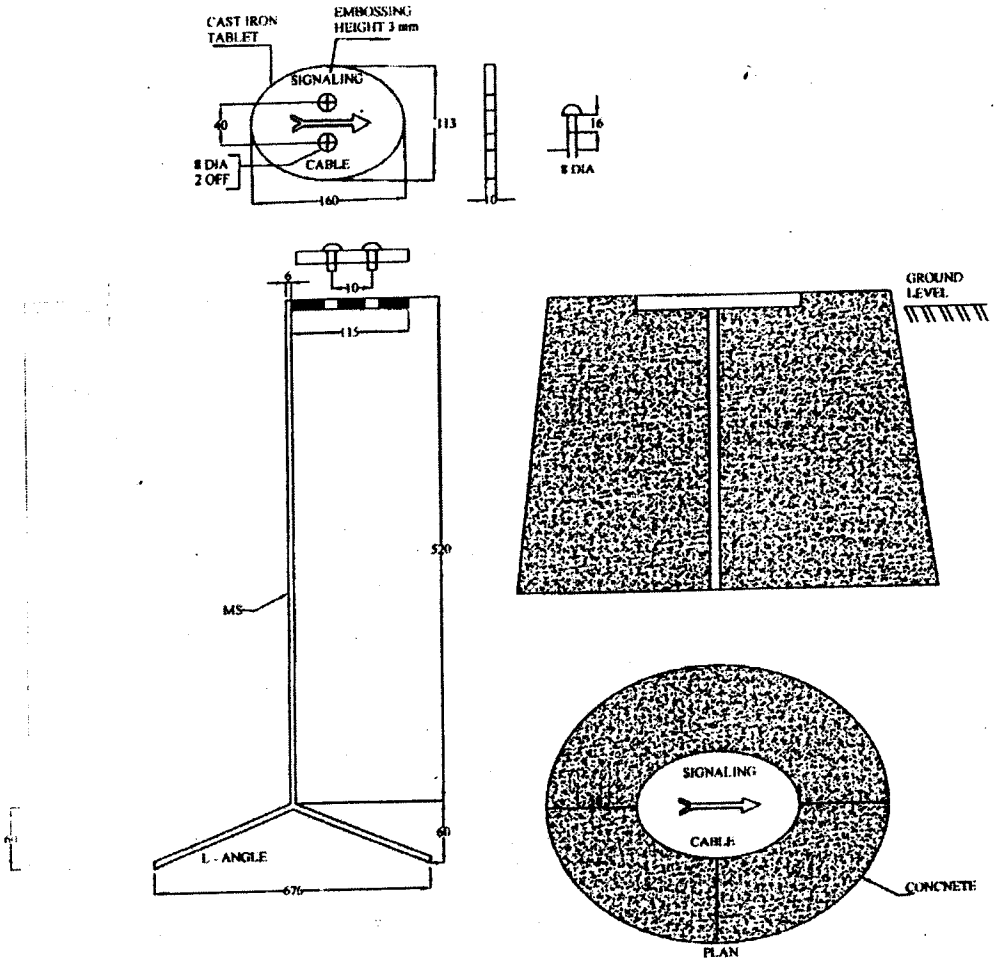


NOTE:-

. ALL DIMENSIONS ARE IN MILLIMETER.

CHECKED BY	JE/SE/SSE	ARRANGMENT OF JUMPER CABLE	SDO/CABLE LAYING/017
APPROVED BY	ADE	R.D.S.O	DATE :- 31-10-2011
		NOT TO SCALE	

Annexure-21

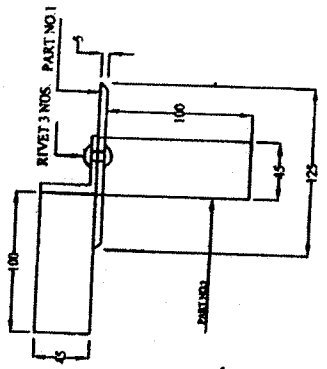


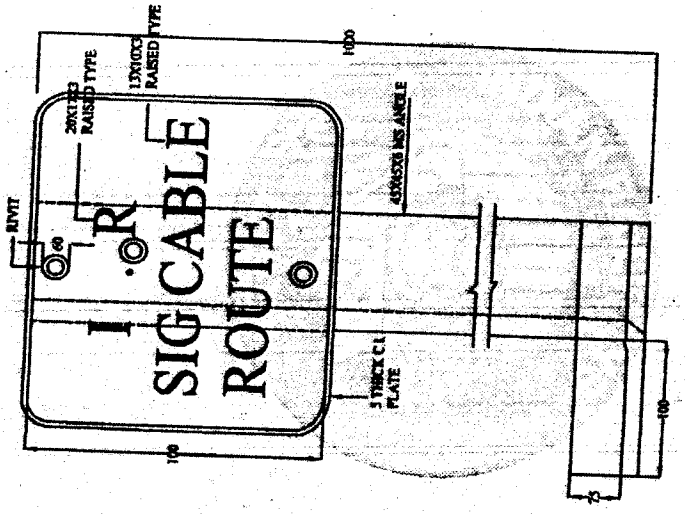
NOTE
1. A... ...N ARE IN MM.
2. C... ...LET IS TO BE RIVETTED TO ... ...LE ON THE 2 HOLES

CH... ...BY	JE/SE/SSE	CI CABLE MARKER & CONCRETING	SDO/CABLE LAYING/018
A... ...BY	ADE	R. D. S. O.	DATE :- 31-10-2011
NOT TO SCALE			

(8)

Annexure-22

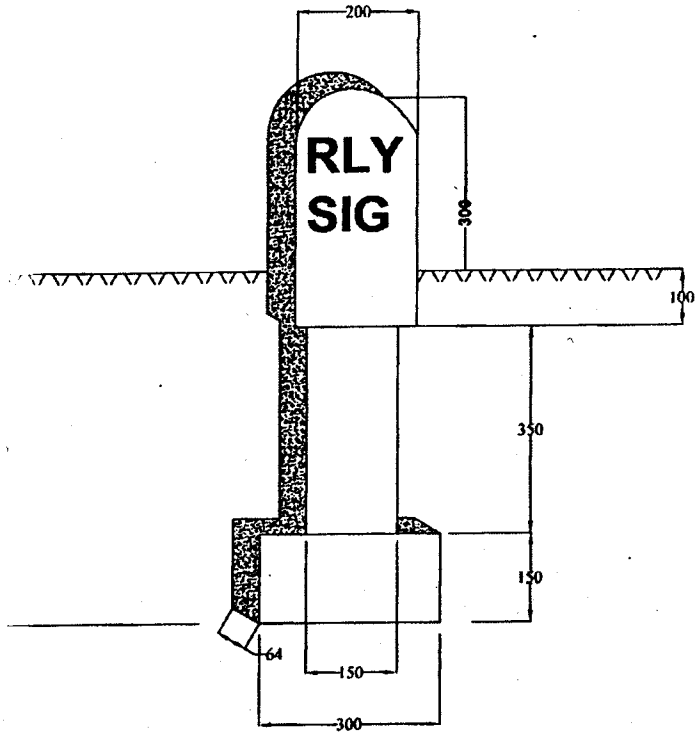




NOTE:-
1. ALL DIMENSION IN MILLIMETER.
2. PART NO 1 C.I. MARKER PLATE RIVETTED ON ANGLE IRON
3. PART NO 2 M.S. ANGLE IRON WITH HOLES
4. PAINT: (1) PLATE TO BE PAINTED BY ALUMINIUM PAINT
(2) ANGLE IRON TO BE PAINTED BY RED OXIDE

CHECKED BY	JE/SE/SSE	CI CABLE MARKER	SDO/CABLE LAYING/019
APPROVED BY	ADE	R.D.S.O.	DATE :- 31-10-2011
NOT TO SCALE			

Annexure-23

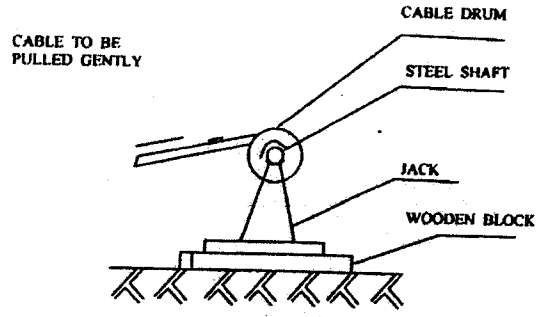


NOTE :

1. ALL DIMENSIONS ARE IN MILLIMETER
2. PAINTING WHITE LETTERS ON RED BACKGROUND.
3. FIXATION ON CONCRETE OF 300 mm FROM THE BASE OF THE MARKER
   SHALL BE DONE AT SITE AT ALL PLACES WITH MIX 1:3:5.
4. CONCRETE OF CONCRETE SHALL BE OF M25 MIX AND WIRE MESH OF
   THICKMESS SHALL BE USED.
5. PAINTING OF "RLY" & "SIG" SHALL BE DONE ON BOTH
   SIDES OF THE MARKER.

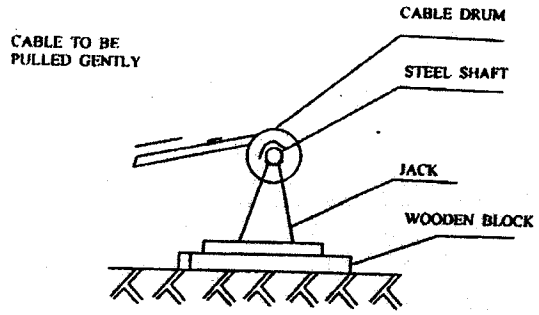
CHE	JE/SE/SSE	CONCRETE CABLE MARKER	SDO/CABLE LAYING/020
APPR	ADE	R.D.S.O.	DATE :- 31-10-2011
	NOT TO SCALE		

Annexure-24



CHECKED BY	JE/SE/SSE	METHOD OF UNROLLING CABLE	SDO/CABLE LAYING /021
APPROVED BY	ADE	R.D.S.O.	DATE :- 31-10-2011
NOT TO SCALE			

Annexure-24



CHECKED BY	JE/SE/SSE	METHOD OF UNROLLING CABLE	SDO/CABLE LAYING /021
APPROVED BY	ADE	R.D.S.O.	DATE :- 31-10-2011
NOT TO SCALE			