SOUTH AFRICAN TRANSPORT SERVICES

ELECTRICAL SIGNALLING INSTALLATIONS

SPECIFICATION NO. CSE-516/1

JANUARY 1988

TRENCHING AND OUTDOOR CABLE INSTALLATION

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1.0 SCOPE

This specification covers the trenching for, and installation of, outdoor signalling cable. It does not include the jointing or termination of cables.

2.0 GENERAL

2.1 A proposed main cable route survey plan shall be submitted by the contractor and written approval obtained from the Engineer before any cables are laid.

2.2 Any deviations from the approved route must be agreed to in writing by the Engineer.

3.0 TRENCHING (REFER TO DRAWING CSE.516/1 ANNEX. 1)

3.1 The main cable trench shall be 4 m from the fence line. Attention is drawn to the fact that where there is an existing communication cable, this cable shall be within 2,5 metres from the fence unless indicated otherwise by cable markers.

Under no circumstances shall the cable trench be as the crow flies. All main or tail cable trenches must be at a straight line and any change of angle therefrom must be at 90°.

3.2 The depth of the trench shall be 500 mm minimum, unless otherwise specified. The depth of a trench, crossing a service road must be at 800 mm minimum.

3.3 Where a trench depth of 500 mm cannot be attained, the Engineer is empowered to authorise relaxation provided the cables are protected by a layer of reinforced concrete cover slabs and confirmation thereof has to be obtained in writing by means of an eligible site instruction.

The depth of all cable trenches on formations shall be at 500 mm depth and the cables must due to re-attain specified formation compaction be protected by a layer of reinforced concrete slabs.

These concrete cover slabs must be of a sufficient width to overlap the outside cables by at least 50 mm on either side. The minimum dimensions of these slabs shall be 40 mm thick, 300 mm wide and 500 mm long.

3.4 Where due to the terrain, trenching is not possible, the use of galvanised steel ducting and/or concrete troughs is permissible.

3.5 Where the trench is being excavated in uneven ground, reasonably long sections of consistent grading shall be dug rather than following every undulation of the ground.

3.6 Trenching is not permitted up and down the slopes of banks or cuttings. In such cases, galvanised steel ducting must be used and the method adopted must be discussed and approved in writing by the Engineer.

3.7 The bottom of the trench shall be compacted and smooth with a view to obviating voids forming under the cable.

3.8 All outdoor cables shall be laid on sand, to be supplied by the contractor, or approved soil passed through a 5 mm riddle. The bottom of the trench shall thus be covered with a 50 mm layer of sand or approved soil.

3.9 The contractor shall be responsible for supplying and operating his own compressor plant for trenching and where blasting is required, he must make his own arrangements.

3.10 The contractor's attention is drawn to the conditions pertaining to blasting as set out in clauses 24 and 25 of the E.5(S & T) (1978) (Revised November 1987) General Conditions of Contract.

3.11 Where trenches are excavated in rock, the contractor shall dispose of the excavated material as directed by the Principal Contractor.

4.0 HANDLING AND LAYING OF CABLE

4.1 Before the commencement of any cable-laying, the trench must be inspected and approved by the Engineer or his deputy.

4.2 It must be emphasised that special care shall be taken in handling of cables and under no circumstances must the cable be dragged or the PVC sheath damaged.

4.3 No direct laying will be permitted.

4.4 Cable shall not be layed in ash, unless it is surrounded at least by 300 mm of sand or approved soil, and the trench depth is increased to 1 050 mm .

4.5 At each relay room, apparatus case or pothead location, 3 metres of cable slack must be provided.

4.6 If the apparatus case is not yet in position, the cable ends must be properly sealed, and then coiled and buried.

4.7 Each cable must be identified by a PVC, aluminium or lead strap which is tied around the cable at each end and which is inscribed with the cable size and number.

4.8 Where cables are to be jointed, 3 metres of overlap (1,5 metre per cable) must be provided.

5.0 BACKFILLING OF TRENCHES (REFER TO DRAWING CSE.516/1 ANNEX. 2 SHEET 2)

5.1 Before the commencement of any backfilling, and after cables have been laid, the trench must be inspected and approved by the Engineer or his deputy.

5.2 Should the contractor lay cable or backfill the trench without the inspection stipulated in clauses 4.1 and 5.1 having been conducted, the Transport Services reserves the right to request the contractor to re-open the trench and/or remove the cable, as the case may be, so that inspection may be carried out. Such re-opening of the trench and/or removal of the cable shall be for the contractor's account and he shall be liable for any damage done to the cable during the re-opening of the trench.

5.3 Backfilling must be preceded by the covering of the cables with a layer of sand or approved soil passed through a 5 mm riddle, to a minimum depth of 75 mm from the top of the cable. This material must be supplied by the contractor.

5.4 On completion of the laying of cables or pipes in trenches the latter shall be filled and compacted to the level of the ground or earthworks before trenching was commenced. When backfilling on the formation, an initial layer of 200 mm shall be compacted thereafter layers not exceeding 100 mm in loose thickness shall be compacted. Compaction shall be carried out by a mechanical rammer or other approved power tool to the minimum dry density hereinafter specified. Where necessary water shall be added to obtain the specified compacted density. Each layer shall be completed before the next layer is commenced. The contractor shall be responsible for ensuring that no damage is caused to the cable or pipes from the filling and compaction, and shall take such steps as are necessary to prevent any such damage, including the provision of concrete slabs or other approved means.

5.5 The excavated material for the trenches may only be used for backfilling if it has an acceptably low amount of rock and stones in it, therefore, large stones shall not be used for backfilling.

5.6 The minimum dry densities of backfilling after compaction are specified as :

(a) Within the earthworks to provide the formation, both in bank and in cut, and on the formation and floor of cuttings : 1 760 kilograms per cubic metre.

(b) In all other cases : 1 600 kilograms per cubic metre.

5.7 Special care must be taken to avoid contamination of the ballast with soil.

5.8 When trenches are excavated on the formation, on the slopes of embankments, or on the slopes and floors of cuttings other than in rock, backfilling on the the trench will not obstructed or divert the natural water flow in such a way as to lead to erosion.

Freedom from erosion of the trench itstelf an freedom from erosion caused by the trench must be guaranteed.

5.9 The replacement of made-up and concreted surfaces such as roads, pavements, platforms, etc., necessitated by trenching, must be arranged by the Contractor and the cost there included in his tender price.

5.9.1 In the case where the made-up surface consists of specially planted (hydroseeded) grass surfaces or/and grass soddings the hydroseeded surfaces are to be reseeded by the Contractor with seed mixtures as specified by Civil Department. Grass soddings is to be reinstated by the Contractor. The restoration of the made-up surface must be at the cost of the Contractor.

6.0 CROSSINGS

6.1 Cables crossing culverts, bridges and rock formation shall be laid in galvanised piping, G.I. ducts or concrete troughs. Where piping is attached to a structure which is an electrical conductor such as steel, then the piping must be insulated from this structure by means of wooden cleats. Allowance must be made for expansion and contraction of pipes on bridges.

6.2 Cable passing through tunnels shall be placed in G.I. pipes or approved G.I. ducting with clip-on covers, when suitable cable ducts, let into the wall of the tunnel, are not provided. The minimum height shall be 1 500 mm from rail level.

6.3 As it is impossible at the site meeting to determine the quantity of crossings the pipe and/or ducting requirements should be worked out by the contractor and submitted with this tender.

6.4 Track crossings (Refer to drawing CSE.516/1 Annex. 2 Sheet 1)

6.4.1 All track crossings are to be made using pitch fibre pipes to specification No. SABS 921 of 1982 and subsequent amendments or G.I. piping as specified in the main specification or at the site meeting. The length of pipe is approximately 4 m per track to be crossed, i.e. the pipe must protrude beyond the edge of the ballast.

6.4.2 Digging under the track, including shoring, as determined by the Engineer, is the Contractor's responsbility. This work will be supervised by the Engineer who will be responsible for strengthening the track where necessary and tamping the ballast after refilling.

6.4.3 For track crossings, a minimum of two weeks notice must be given to the Engineer in advance for preparation to be effected.

6.5 Road crossings

6.5.1 Sufficient G.I. pipes must be provided at road crossings to cater for the cables to be installed. The total cross-sectional area of cables per pipe shall not exceed 60% of the cross-sectional area of the inside of the pipe.

6.5.2 For cables crossing under road :

(a) Authority to dig must be obtained from the appropriate authorities by the Contractor.

(b) The trench must be at a depth of 800 mm .

(c) Minimum pipe size - 100 mm dia. G.I.

(d) At least one spare pipe must be provided.

(e) Cables crossing public roads shall be piped throughout where cable laid is not on Transport Services' property.

6.5.3 Temporary roads must not be piped but slabbed.

6.5.4 All pipes to be surrounded by at least 50 mm of sand or approved soil.

7.0 INSTALLATION OF STEEL-DUCTING AND CONCRETE TROUGHING (REFER TO DRAWING CSE.516/1 ANNEX. 4)

7.1 Steel ducting installed on concrete or steel surfaces (as in tunnels, on bridges or culverts) must be firmly attached by an approved means.

7.2 In the case of slopes of banks or cuttings, the ducting must be firmly secured. The means of securing the ducting is subject to the approval of the Transport Services' Engineer in charge of the project (galvanised spike 1 m in length, concrete, etc.)

7.3 Concrete troughs (with lids) shall be in accordance with specification No. CSE-514 (latest amendment) and the relevant drawings.

7.4 Where troughing is laid alongside the track it shall be laid in such a manner so as not to prevent the placing or removal of sleepers from the track and must not obstruct civil maintenance.

7.5 Exit of cable from the main trough must be via the side of the trough and not underneath.

7.6 Reducing pieces for the transition from one size troughing to another should be designed along the lines of the troughing drawing provided.

7.7 Joint boxes should be approximately double the width of the respective trough, and should be provided for all main troughing runs.

7.8 For the purpose of calculation of the quantity of joint boxes, it should be assumed that cables are supplied in drum lengths of 500 m and 650 m .

8.0 CABLE-JOINTING, JOINT-PITS AND MANHOLES

8.1 Joint-pits must be excavated from the main trench towards the track, and must be a semi-circle of 1,5 m radius. (Refer to CSE.516/1 Annex. 1.)

8.2 If used, manholes must be constructed of brickwork or cast concrete and waterproofed. Each shall be equipped with a conetre floor, a sump, steel rungs and a suitable cover. Manholes shall not be smaller than 1 m by 1 m . The tenderer is to forward his proposal with his tender.

9.0 INSTALLATION OF CABLE-MARKERS (REFER TO DRAWING CSE.516/1 ANNEXS. 1 AND 2)

9.1 Concrete type

9.1.1 Within station limits the position of the the main cable run shall be indicated by means of concrete cable markers. Cable markers shall be buried to a depth of approximately 250 mm, so that ± 50 mm protrudes above the ground, and bearing the identification letters as per drawing ST.CCA.11-DF. They shall be installed at intervals of 15 metres on straight runs, and at every change of direction to cable markers at the angle of change shall be installed. Special designating cable markers bearing the marking "SI-X" (or latest amendment) shall be installed at every joint. See drawing No. ST.CCA.11-DF (latest amendment) for dimensions of cable markers.

9.1.2 Cable markers must be painted on the top and sides down to 150 mm from the top, with two coats of yellow traffic paint.

9.1.3 Joint markers must be painted as for cable markers.

9.1.4 All tail cable routes must be marked with concrete cable markers.

9.2 Metal (fence) type (Refer to drawing CSE.516/1 Annexs. 1 and 3)

9.2.1 These are to be installed outside station limits or where it is not practicable to install concrete markers.

9.2.2 Main cable route :

Fence markers painted yellow (paint must withstand field fires; HD cedar Radex paint or similar) and affixed securely to the fence uprights every 15 metres, must be used. If for any reason the cable route is shifted from the specified distance of 4 m from the fence line this must be indicated on the fence markers by punching the actual distance of the cable route from the fence. In addition the main cable route outside the servitude must be marked by means of special markers (pipes, rails etc.) painted yellow with approved paint. The fence markers shall be made from a suitable metal, of sufficient thickness (±2 mm) to ensure

rigidity. Minimum dimensions shall be 300 mm x 100 mm, and they shall be permanently marked in accordance with the instruction of the Engineer. Proposals for fence type markers are to be submitted with the tender.

9.2.3 Cable joints :

Two fence markers will be used to indicate cable joints on the main cable route. Refer to drawing CSE.516/1 Annexure 1.

AS WITNESSES

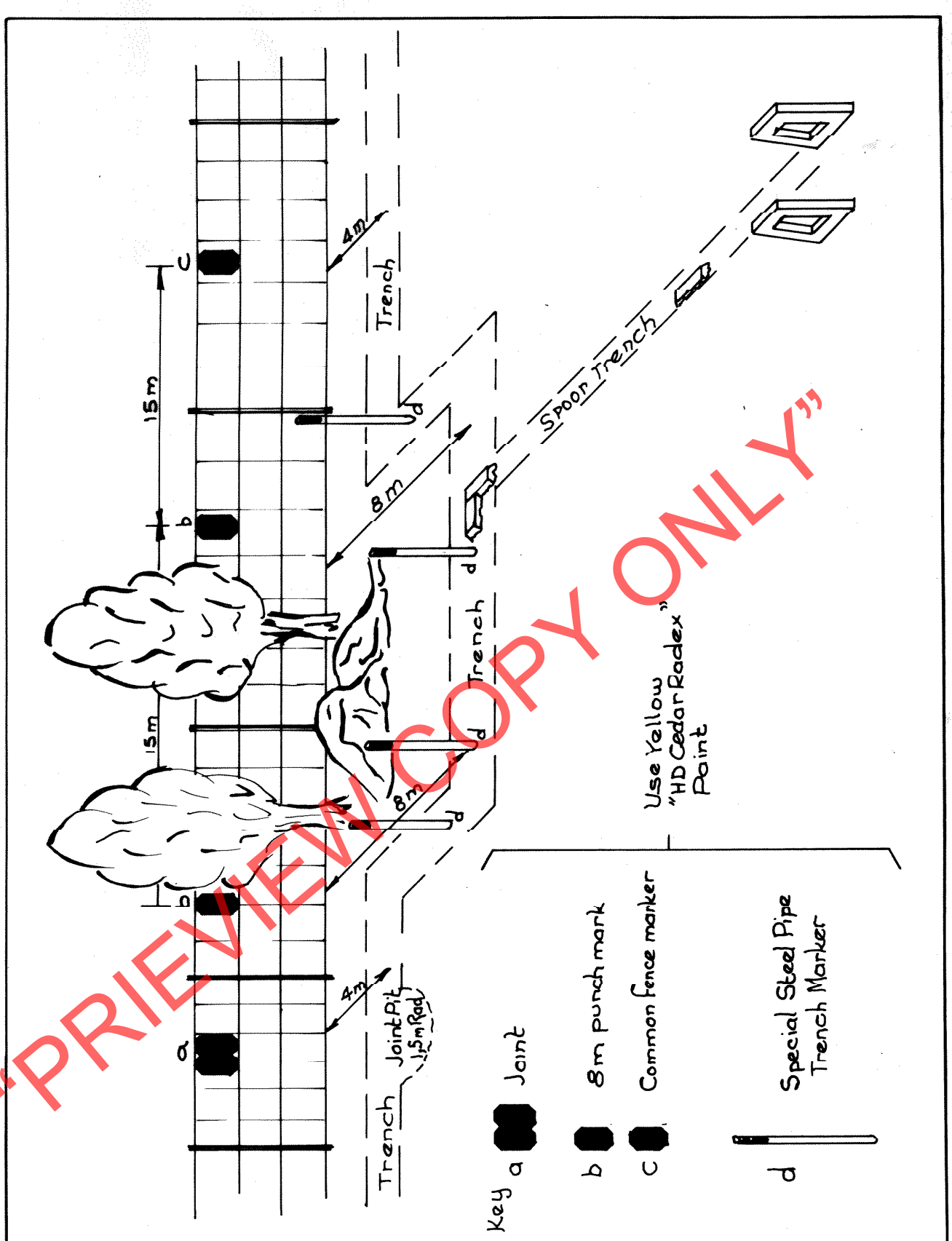
1. _____ _____
CONTRACTOR

2. _____ DATE: _____

AS WITNESSES

1. _____ _____
CHIEF ENGINEER
(Signals and Telecommunication)

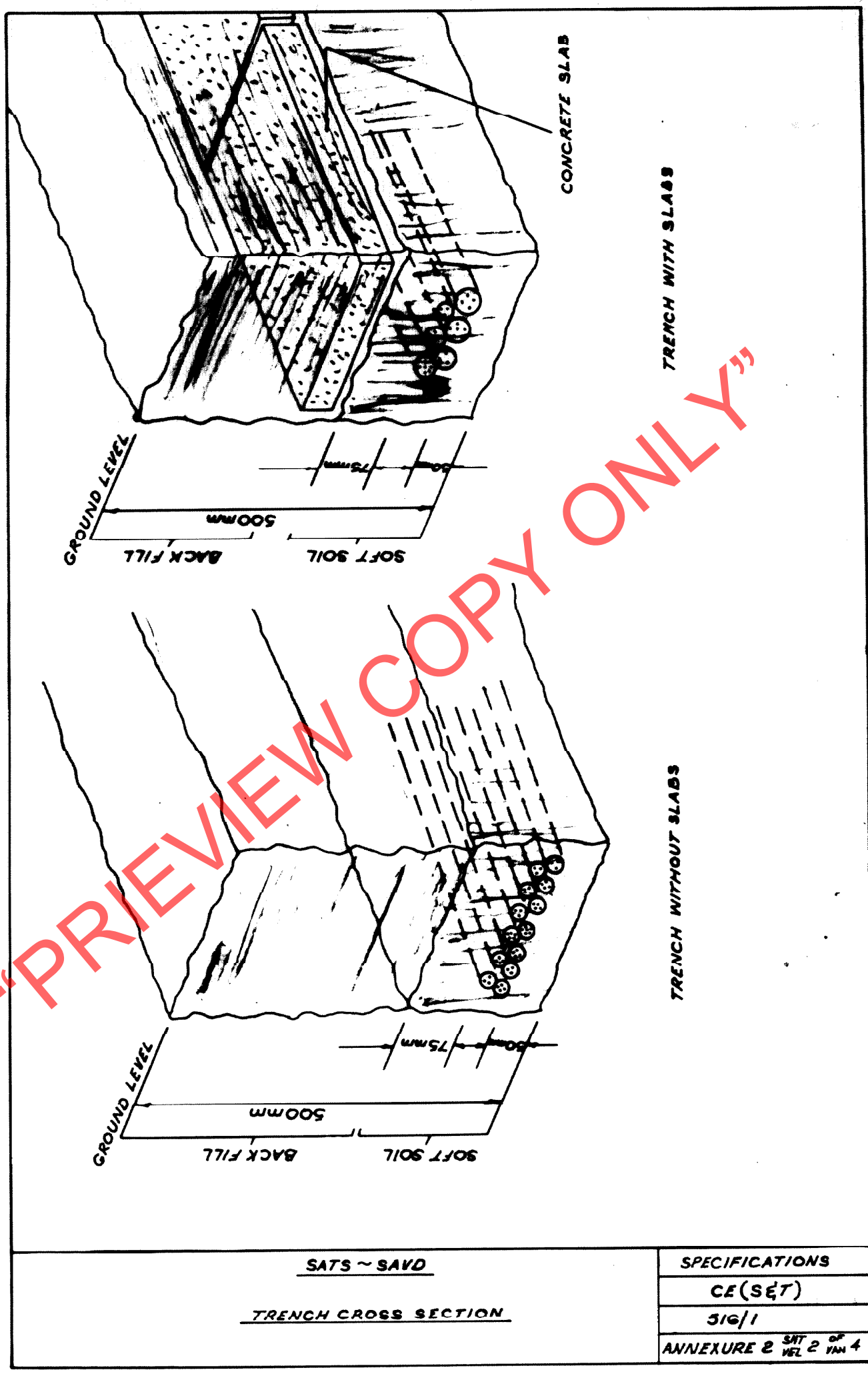
2. _____ DATE: _____



SATS ~ SAVD

TYPICAL CABLE TRENCH

SPECIFICATIONS
CE (S&T)
SIG/1
Annexure 1 OF VAN 4



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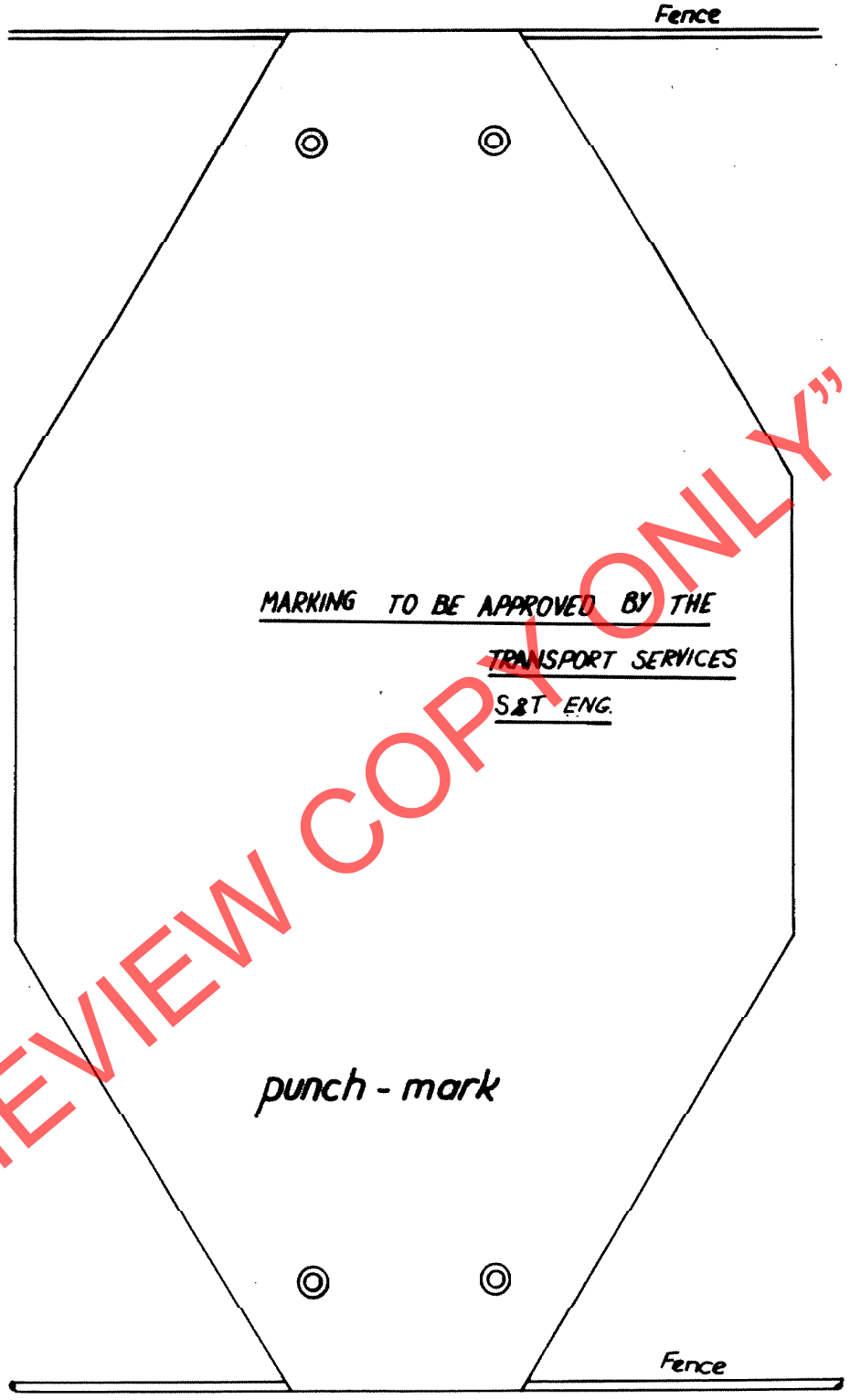
TRENCH CROSS SECTION

SPECIFICATIONS
CE(SET)
316/1
ANNEXURE 2 SHT VEL 2 OF VAN 4



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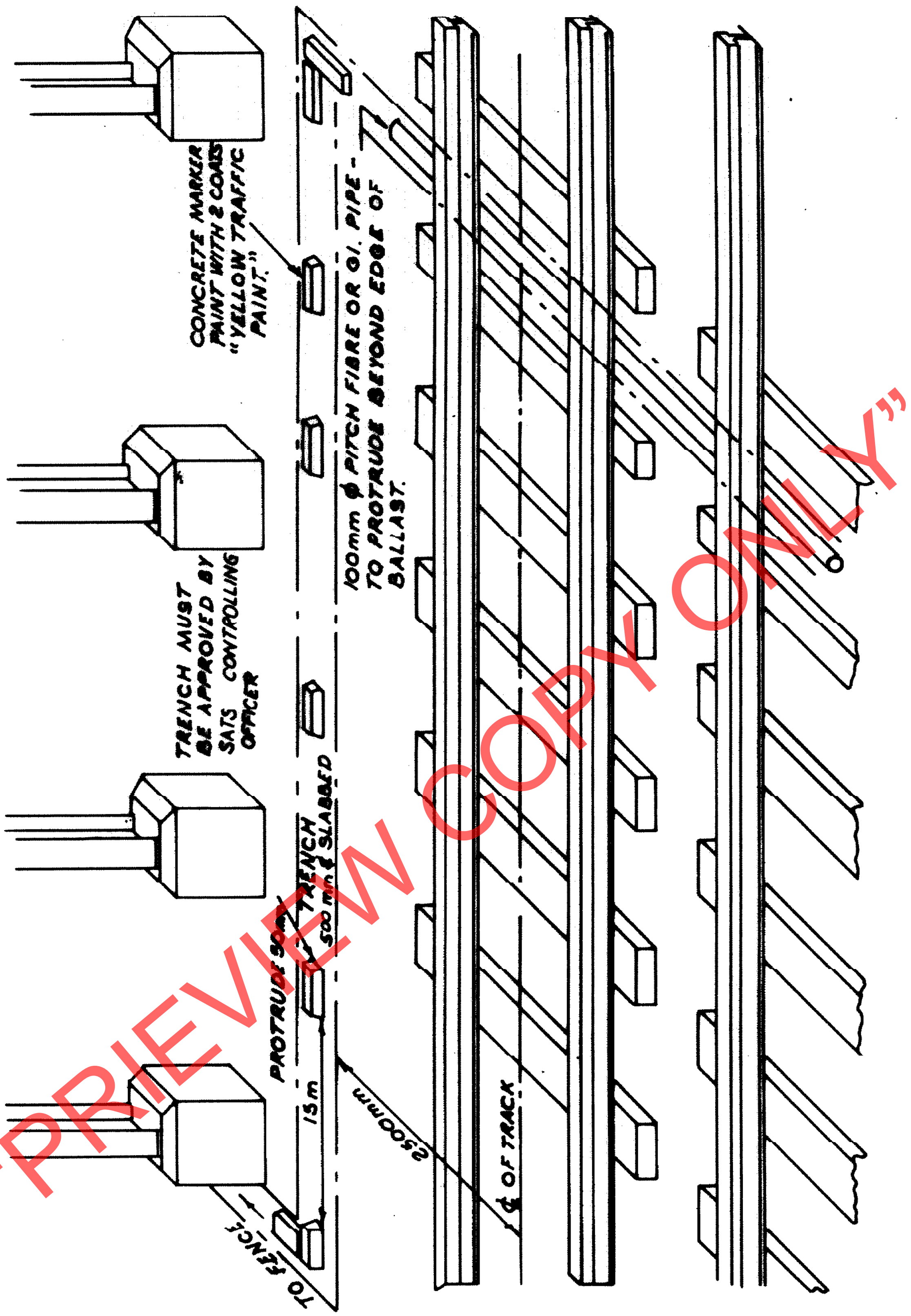
APPROVED METAL FENCE MARKER

SPECIFICATIONS
CE (S&T)
SIG/1
Annexure 3 OF VAN 4



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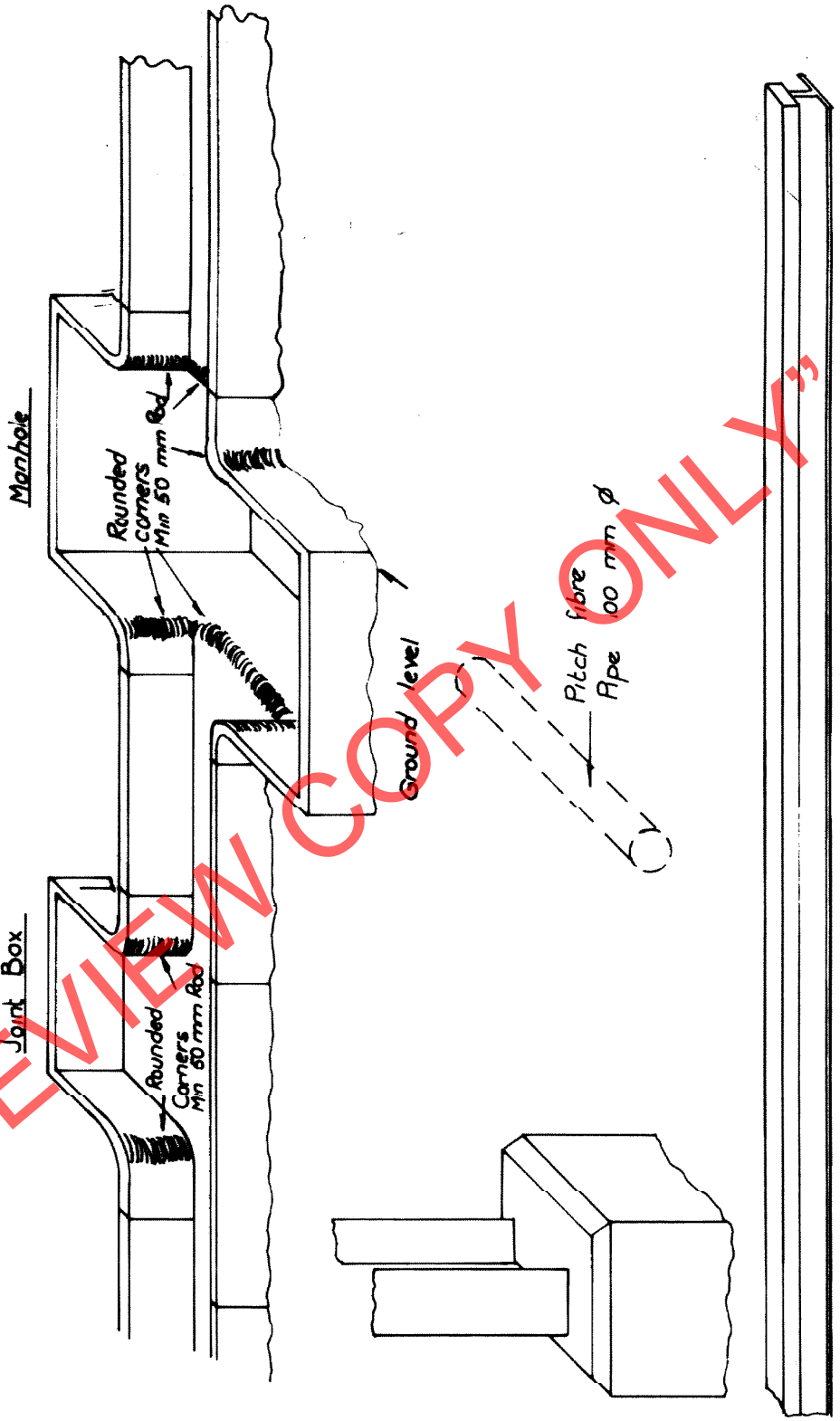
TRENCH PARALLEL TO TRACK AND TRACK CROSSING

SPECIFICATION	
CE (S&T)	
SIG/1	
ANNEXURE 2	Sht. 1 of 1



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INSTALLATION OF CONCRETE TROUGHING

SPECIFICATION
CE (S&T)
SIG/1
Annexure 4 OF VAN 4