

3.16 PREPARATION OF CABLE FOR JOINTING

- 3.16.1 During the installation, a minimum of 10 meters of cable of each end is coiled in the jointing pit to provide for jointing to be carried out at convenient location as well as spare length to be available for future use in case of failures.
- 3.16.2 The pit size must be chosen carefully to ensure the length of the way on which joint is mounted is greater than closure length plus twice the minimum bending radius of the cable. A pit length of 1 meter is sufficient for most of the cable and joint closures. Bracket to support the cable coil are also fixed on the wall of the pit.
- 3.16.3 The cable is then coiled on to the pit wall in the same position as required after the joint is complete. The marking is done on all the loops so that it will be easier to install it later.
- 3.16.4 The distance from the last centre to the end of the cable must be at least 1.8 meter. This is being the minimum to be stripped for preparation of joint.
- 3.16.5 Sufficient cable at each end up to the jointing vehicle/enclosure is then uncoiled from the pit for jointing.

3.17 STRIPPING/CUTTING OF THE CABLE

- 3.17.1 The cables are stripped of their outer and inner sheath with each sheath staggered approximately 10mm from the one above it.
- 3.17.2 Proper care must be taken when removing the inner sheath to ensure the fibers are not scratched or cut with the stripping knife or tool to prevent this, it is best to only score the inner sheath twice on opposite sides of the cable, rather than cut completely through it. The two scores marking on either side of the cable are then stripped of the inner sheath by hand quite easily.
- 3.17.3 The fibres are then removed from cable one by one and each fibre is cleaned individually using Kerosene to remove the jelly.

3.18 PREPARATION OF CABLE JOINT CLOSURE FOR SPLICING The type of preparation work performed on the cable prior to splicing differs on the type of joint closure and fiber organizer used. However, the following steps are usually common:

- 3.18.1 The strength member of each cable is joined to each other and/or the central frame of the joint closure.
- 3.18.2 The joint closure is assembled around the cable.
- 3.18.3 The sealing compound or heat shrink sleeve is applied to the cables and closure or prepared for application after splicing is complete.
- 3.18.4 The fibers are protected (usually with plastic tubing) in their run from the cable core to the fibre organizer trays (particularly if cable construction is slotted core type).
- 3.18.5 Tags which identify the fibers nos. are attached at suitable locations on the fibres
- 3.18.6 Splice protectors are slipped over each fiber in readiness for splicing over the bare fibre after splicing.

3.19 STRIPPING AND CLEAVING OF FIBRE

- 3.19.1 Prior to splicing each fiber must have approximately 50mm of its primary protective U.V. cured coating removed, using fibre stripper which are manufactured to fine tolerances and only score the coating without contacting the glass fibre.
- 3.19.2 The bare fiber is then wiped with a lint free tissue doused with ethyl alcohol.
- 3.19.3 Cleaving of the fiber is then performed to obtain as close as possible to a perfect 90 degrees face on the fibre.

3.20 METHOD OF FUSION SPLICING OF THE FIBER some of the general steps with full automatic microprocessor control splicing machine is as under:

- 3.20.1 Wash hands thoroughly before start of splicing.
- 3.20.2 Dip the clean bare fibre in the beaker of ethyl alcohol of the ultrasonic cleaver. Switch on ultrasonic cleaver for 5-10 seconds (some of the manufacturers does not prescribe the above cleaning).

- 3.20.3 Place the bare fiber inside 'V' groove of the splicing machine by opening clamp handle such that the end of fiber is app.1 mm. over the end of the 'V' groove towards the electrodes.
- 3.20.4 Repeat the same procedure for other fibre, however first insert heat shrink splice protector.
- 3.20.5 Press the start button on the splice controller.
- 3.20.6 The machine will pre fuse, set align both in 'X' and 'Y' direction and then finally fuse the fiber.
- 3.20.7 Inspect the splice on monitor if provided on the fusion splicing machine and assure no nicking, bulging is there and cores appear to be adequately aligned if the splice does not visually look good repeat the above procedure.
- 3.20.8 Slide the heat shrink protector over the splice and place in tube heater. Heat is complete when soft inner layer is seen to be 'oozing' out of the ends of the outer layer of the protector.
- 3.20.9 Repeat the same procedure for all the other fibers
- 3.21 **ORGANISING FIBER AND FINISHING JOINTS**
- 3.21.1 After each fiber is spliced, the heat shrink protection sleeve must be slipped over the bare fiber before any handling of fiber takes place, as uncoated fibers are very brittle and cannot withstand small radius bends without breaking.
- 3.21.2 The fiber is then organized into its tray by coiling the fibers on each side of the protection sleeve using the full tray side to ensure the maximum radius possible for fiber coils.
- 3.21.3 The tray is placed in the position.
- 3.21.4 **OTDR reading taken for all splices in this organized state and recorded on the test sheet to confirm that all fibers attenuation are within 0.02 dB per splice. This OTDR test confirms fibers were not subjected to excessive stress during the organizing process.**
- 3.21.5 After this the joint can be closed with necessary sealing etc and ready for placement in the pit.
- 3.22 **PLACING OF COMPLETED JOINT IN PIT**
- 3.22.1 Joint is taken out from the vehicle and placed on the tarpaulin provided near the pit.
- 3.22.2 The cable is laid on the ground, loop the cable such that pen mark previously place on the cable line up. Tape these loops together at the top of the coil.
- 3.22.3 The joint can now be permanently closed and sealed by heating heat shrinkable sleeve etc. However, before closing, silica gel to be kept inside for moisture protection.
- 3.22.4 Now the joint closure is fixed to the bracket on the pit wall and pit is closed.
- 3.23 **OPENING OF THE JOINT.** If required for attending to faults etc., manufacturers supply special kits for opening of the joint and the steps to be followed. However the general steps are as under:
- 3.23.1 Using suitable knife cut heat shrink sleeve longitudinally along its entire length.
- 3.23.2 Do not damage the smaller heat shrunk sleeve on the ends of the joint.
- 3.23.3 Apply heat to the cut sleeve until it begins to separate.
- 3.23.4 Gently remove the cut sleeve from the joint. Now the joint can be opened.
- 3.23.5 Protective sleeve/cover can be removed for attending to faults etc.
- 3.24 **RCC joint/Loop Chambers.** RCC joint/loop chambers of 0.9 mts inner dia, 60cm depth and 3mm thickness with 2 piece top cover with two hooks each and bottom cover with holes for drainage and cable entry as per drawing No RAILTEL/SR/ OFC/2009/12. and as directed of RailTel engineer to be provided at every KM for OFC joint/ loop. The Chamber shall be filled with sand mixed with anti termite powder .

Installation Specification:

1. A pit of Diameter 1200mm and of depth 1300mm has to be dug.
2. The bottom plate type cover has to be placed first and the chamber to be inserted later.
3. Cable duct entry window to be opened at the semi closed circular cuts on the enclosure by hitting with hammer/screw driver as per no. of ducts.
4. Top cover should be place slowly in its position as shown in the drawing.
5. The soil has to be pulled back over the chamber buried 600mm below the ground level.
- 3.25 **Termination of OFC in FMS:** The OFC has to be terminated in the FDMS supplied by RailTel as directed by the RailTel Engineer-in-Charge as per site requirement. Fiber 1-4 has to be

terminated in every Railway station in FDMS supplied by RailTel. Branch joint to be made in each station by cutting only tube no.1. All 24 fibers to be terminated at important stations specified by RailTel.

- 3.26 **Testing of fibers and submission of as made drawings:** The contractor has to do the testing and commissioning of OFC system from Cable hut to cable hut with proper lead in and lead out through G.I Pipe, splicing and termination as directed by RailTel engineer. Testing and commissioning after defect rectification if any defects located during the testing, obtaining the clearance from RailTel in the form of acceptance certificate, preparation of test reports, as build drawings of cable route plan and OFC jointing location schedules in CAD format and submission of 2 soft copies in Pendrive and 3 hard copies in A3 size etc., complete to the finished item of work and as directed by the RailTel Engineer-in-charge.
- 3.26.1 **Testing** consists of **OTDR** reading and **power meter** reading of all fibers. Station to station testing is required for fibers terminated at block stations. Run through fibers may be tested from end-to-end terminations only. OTDR readings are to be taken in 1310 nm and 1550nm windows and one set of readings to be recorded in soft as well as hard copy and submitted duly counter signed by contractor's authorized representative and RailTel's engineer – in - charge.
- 3.26.2 **Reports:** The reports consists of (a) tabulation of all events reported by OTDR of more than 0.2 db over the section for all fibers tested, (b) Tabulation of power loss from A-B & B-A direction, average and loss per km in both 1310 & 1550 nm. for all the fibers tested.

TEST PROTOCOL FOR OPTICAL FIBRE CABLE

SYSTEM TEST PROTOCOL	OPTICAL FIBRE CABLE	FIELD TEST

Route: -----		Date: -----
Station: -----		No. of mid- section splices: -----
Section: -----		Measured by: -----
Length (by OTDR): -----		Length as per meter marking on cable sheath-----
Optical measurements (On Line):		

Measurement	Fibre – number 1 2 3 422 23 24	Accepted Value
1.1 Total attenuation at 1300/1550 nm with OTDR		
1.2 Total attenuation per Km at 1300/1550 nm:		<0.40 dB/Km at 1300 nm & <0.25 at 1550 nm
1.3 Splice Loss in dB with OTDR Location		Average splice loss
OHE Mast No. / Overhead alignment post no. A. B. C. D. E.		
Average Splice Loss		0.15 dB/Splice

NOTE: ALSO ATTACH OTDR RESULTS |----|

2) Visual Inspection (On Line):

2.1 No. of Cable drum used in the section: -----

2.2 S.No. of cable and length of each drum:

<u>S.No.</u>	<u>LENGTH</u>
1. -----	Mtr
2. -----	Mtr
3. -----	Mtr
4. -----	Mtr
5. -----	Mtr

2.5 Location of Isolation Sleeves: 1. 2. 3.

Contractor's Representative

RailTel's Representative

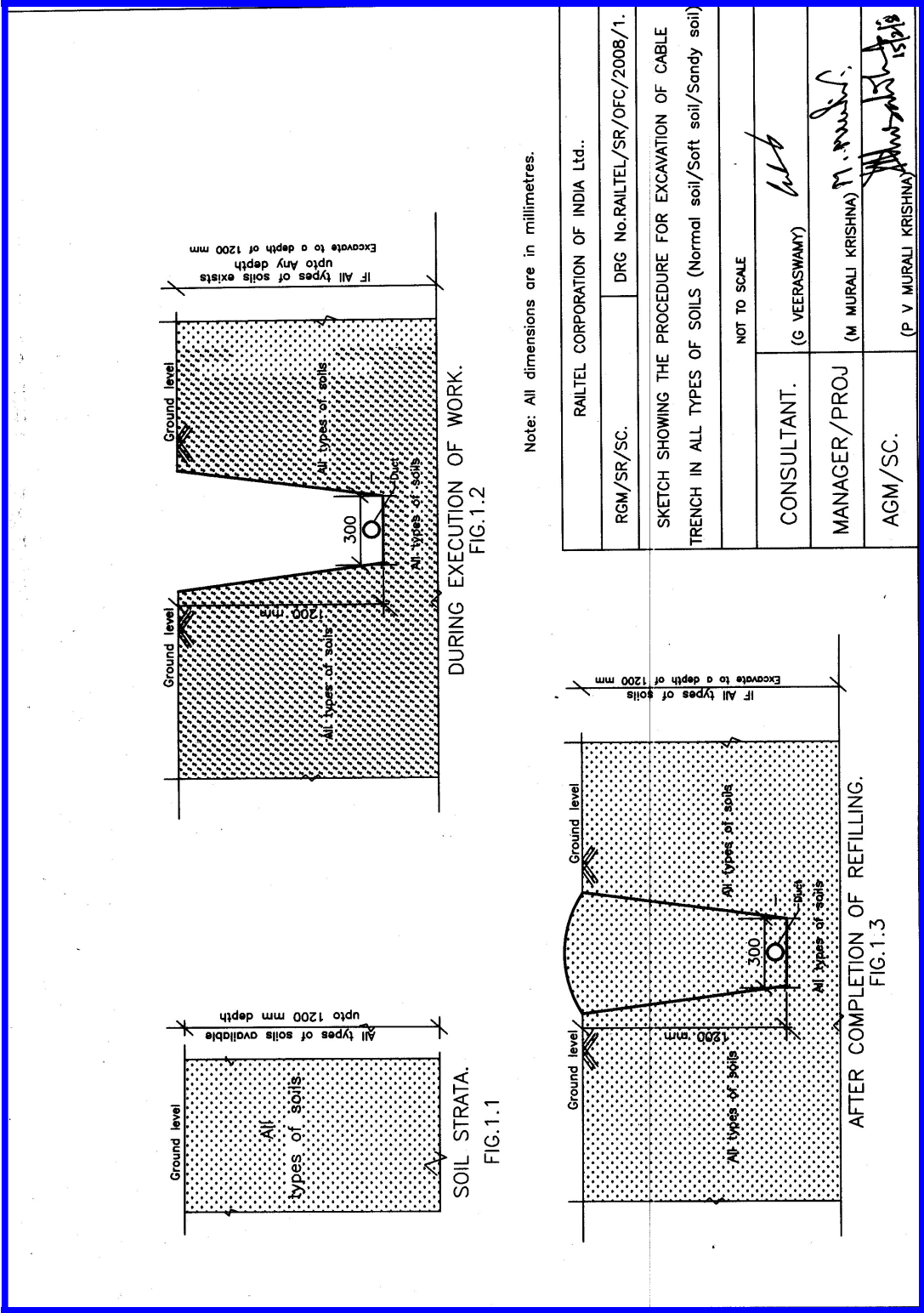
3.27 **TOOLS AND EQUIPMENTS REQUIRED FOR JOINTING AND TERMINATION OF FIBRE OPTIC CABLE.****S.No. Tool's Name**

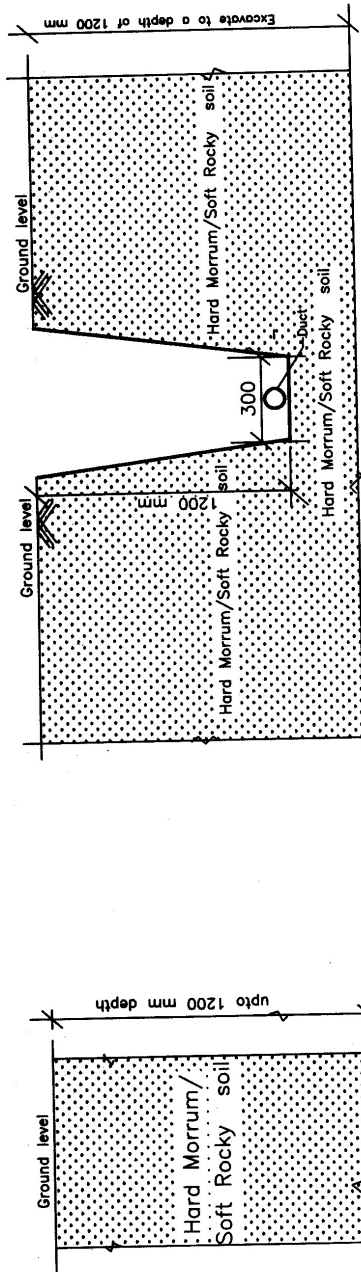
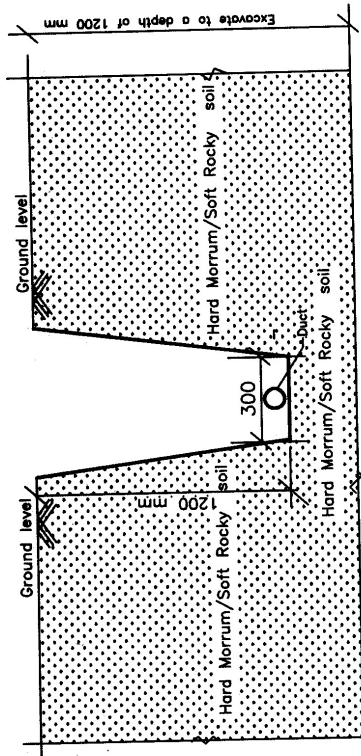
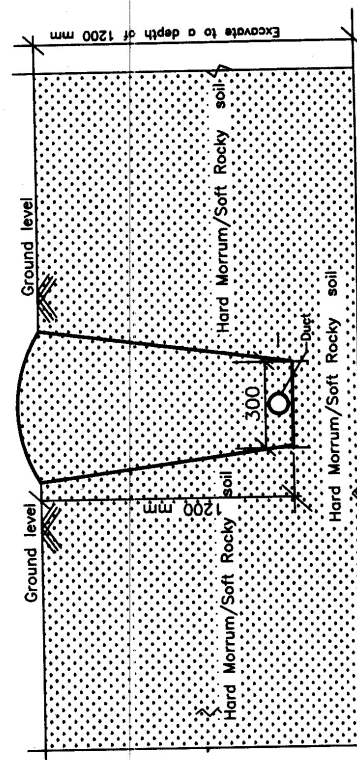
1. Branch Joint Closure
2. Termination Box
3. Rubber end Block
4. Sheath Clamp
5. Bushing
6. Strength Member holder
7. Heat Shrinkage tube
8. Arc fusion splicer machine.
9. Power cord AC/DC
10. Walkie-Talkie 12V DC source
11. Tube heater
12. Precision cleaver
13. Cable sheath stripper
14. Fibre stripper
15. Knife for HDPE cutting
16. Hexa for strength membrane
17. Isopropyl alcohol or methanol of high specific gravity
18. Johnson Buds
19. Tweezers
20. Gun heater Blower type
21. Sleeve for splice protection
22. O.T.D.R.
23. Stickers for numbering of splicers.
24. Portable k. oil generator
25. Umbrella 2 Nos.
26. Dust protection for splicing machine

Note:-Wherever cable has to be coiled/looped, the diameter of the coil/loop shall be greater than 50 times the diameter of the cable.

Replacement of Defective OFC: No defects like high loss events and fiber breaks are permitted and the contractor shall at his cost replace the entire drum length of cable of RAILTEL's specification and in any case not less than the length of the drum being re-laid. The contractor also at his cost blows the cable again including the splicing/Termination of the cable. No joints with pieces of OFC are permitted. In case of any deviation, specific approval from Competent Authority of RailTel should be obtained

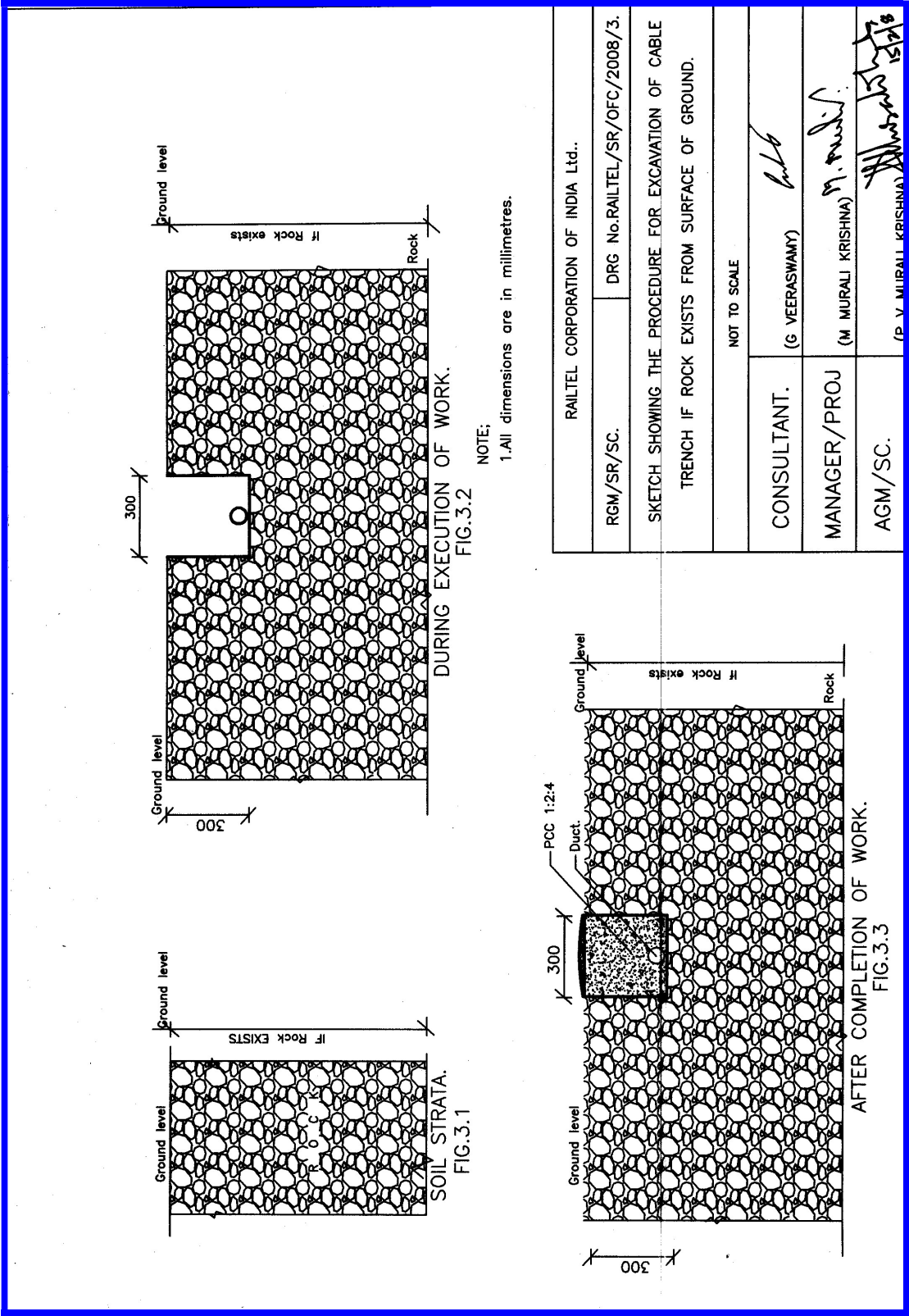
SECTION IV
CHAPTER 1
DRAWINGS

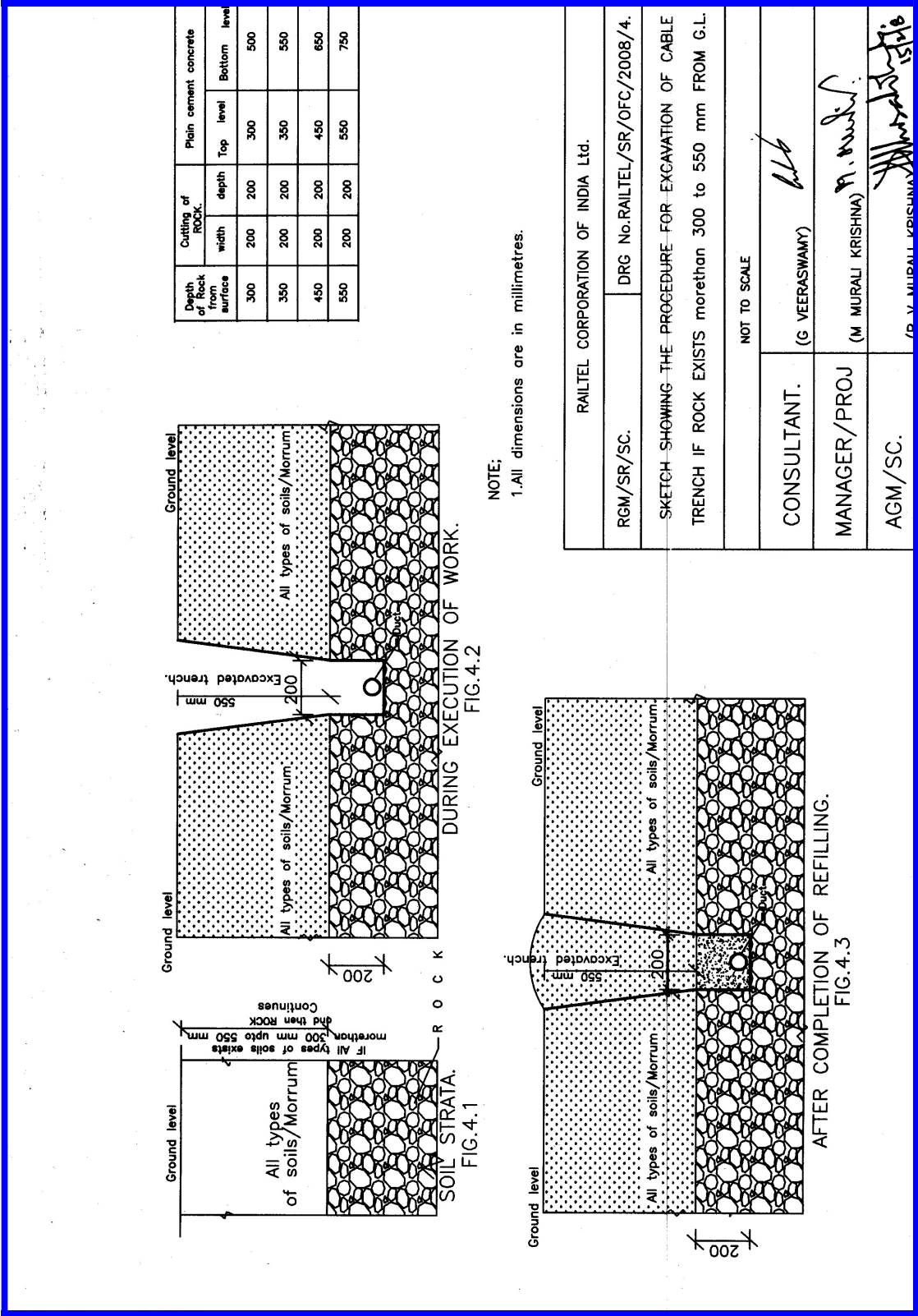


FIG.2.1
SOIL STRATA.FIG.2.2
DURING EXECUTION OF WORK.FIG.2.3
AFTER COMPLETION OF REFILLING.

Note: All dimensions are in millimetres.

RAILTEL CORPORATION OF INDIA Ltd.	
RGM/SR/SC.	DRG No.RAILTEL/SR/OFC/2008/2.
SKETCH SHOWING THE PROCEDURE FOR EXCAVATION OF CABLE TRENCH IN Hard Morrum/Soft Rocky soil	
NOT TO SCALE	
CONSULTANT.	(G VEERASWAMY)
MANAGER/PROJ	M. MURALI KRISHNA
AGM/SC.	(P V MURALI KRISHNA) 15/12/18





RAILTEL CORPORATION OF INDIA Ltd..	
RGM/SR/SC.	DRG No.RAILTEL/SR/OFC/2008/5.
SKETCH SHOWING THE PROCEDURE FOR EXCAVATION OF CABLE TRENCH IF ROCK EXISTS morethan 550 and lessthan 1050	
NOT TO SCALE	
CONSULTANT.	 (G VEERASWAMY)
MANAGER/PROJ	 (M MURALI KRISHNA)
AGM/SC.	 (P V MURALI KRISHNA)

