Ref No: NSU/PIA/ASCON/001/156 Date: 10.11.2020

TENDER

FOR

SELECTION OF "PROJECT IMPLEMENTATION AGENCIES [PIA]" FOR THE ROLLOUT OF

OPTICAL FIBRE NETWORK FOR ARMY

Last Date and Time for submission: 01/12/2020, 12.30 Hrs

Network System Unit
ITI Limited
Dooravani Nagar
BENGALURU-560016
Ph: 080-25650054

TABLE OF CONTENT

Read, understood and complied with Signature of the Bidder

SECTION I: INTRODUCTION TO THE PROPOSAL

1.1. Brief about Intender and Tender Intent

ITI Limited ("ITIL"), the first CPSU of the Independent India is a manufacturer of Telecom equipment and is providing various Telecom and IT goods and services to its users. ITI has diversified into new areas of providing end to end, infra services and turnkey solutions in the domain of IT, Telecom, IoT and Smart city for various Government / Private users. There are many ongoing OFC infra projects, Inter City /Intra City at hand and under progress. ITIL already has done many such project as MSI for Government Departments and their subsidiaries. ITI has an experience and track record to execute such projects with highest degree of efficiency and skill and earned good name to execute projects in given time lines.

ITI Ltd has been entrusted to execute a most prestigious Communication Network for the use of Indian Army in Various areas including different terrains in northern, north-eastern and western regions of our country as well as some locations in the hinterland on turnkey basis and seeking the capable partners to roll out the Optical Fibre Network which is an essential component in accomplishment of this prestigious project. Accordingly, ITI Ltd is seeking Zone-wise experienced, efficient and capable project implementation agencies to deliver the awarded part(s) of the project in strict time lines with highest degree of quality and efficiency in given areas/regions (Zones).

In this Connection, ITI Ltd invites sealed tenders for the selection of "Project Implementation Agencies" (PIAs) to roll out of Optical Fiber Network For ARMY, involving underground excavations and laying OFC infrastructure as per the specifications and requirements of the project in various jurisdictions of awarded area(s).

1.2 Purpose of Tender:

To invite ZONE wise SEPARATE Tender Bids from the interested companies having relevant financial Capacity, Experienced work force and domain knowledge expertise to manage such projects in respected areas of their interest, matching with their experience in most professional and efficient manner to meet the aspirations of User (Army) and value preposition to ITI Ltd (ITIL). Scope of Work (SoW) is mentioned in this document in general and in details.

1.3 Scope of work:

The general scope of work would include, Trenching (open trenching/HDD where ever applicable), Laying of Ducts, Pulling Fibre through the Duct, Installation, Testing, Restoration and Commissioning of Optical Fiber Network as per the specifications, along with obtaining (Right of Way) RoW and Public ROW permissions from respective agencies after route survey as required. The detailed Schedule and Scope of Work is also provided in the Tender Document.

SECTION II: SCOPE OF WORK (General)

2.1 The overall scope of work is construction of Optical Fiber Network link by link in the awarded Zone(s) followed by maintenance, during warranty period.
The major activities include:

OFC Links:
Execution of OFC works as per specifications including Survey of Routes, liaising and obtaining RoW permissions, making way to lay HDPE duct at the specified depths by the methods of HDD/Trenching/Moiling/Chiseling/Surface Cutting etc. in all types of strata and all types of terrain. Providing mechanical protection for low depth & Road / Rail/River/Bridge crossings with GI pipe/RCC pipes etc; as the case may be. Laying of HDPE Duct, OF Cable Blowing, splicing of joints, supply and fixing of RCC Joint Chambers/Manholes as per specifications. Supply and Installation of RCC Route Indicators and Electronic Route Markers, over ground and underground. Refilling of excavated trenches after laying Brick lining and restoration of excavated surfaces as per the RoW conditions. Duct Integration, complete end to end testing in all respects and acceptance by the user (AITP). As built drawings, detailed drawings, information of rocky spots enroute, GIS based route maps in KMZ/KML and progress report in prescribed formats shall also be part of the scope. After final acceptance, the OFC routes need to be maintained during warranty period of two years (at the option of ITIL). Maintenance of OSP route will include preventive and corrective maintenance to meet TAT/SLAs as per tender.
Note:
(i). The HDPE Duct, Optical Fibre Cable and FDF shall only be supplied by ITIL, rest all other allied material viz. Bricks, Joint Chambers, Route Indicators/RCC Pipes/GI Pipes and Masonry works etc. to be arranged and supplied by the PIA. Lid for joint closures/ chamber, Manhole etc needs to be embossed as per requirement/ instruction.
(ii). Some of the items in the scope of supply of PIA are MAF based. Arrangements shall be made by ITIL to fix the ceiling price with the OEMs to help control the maximum price of such items.
(iii). The OFC Network proposed shall normally be underground only, except in exceptional Circumstances wherein it may be required to lay it aerially as per the site compulsions, after specific pre-approval of the user. The difficulty of strata alone shall not be the valid reason of such deviation.

2.2 Overall scope of work is construction of fiber connectivity roll out as per the specifications in the awarded zone and ordered Links to meet the needs of the project and to the satisfaction of the end user.

--- END OF SECTION II ---

Read, understood and complied with Signature of the Bidder

SECTION III: MINIMUM ELIGIBILITY CRITERIA

Sl. No.	Criteria	Documentary Proof to be Submitted
1	The bidder must be, a company registered under the Companies Act, 1956/2013 or LLP, under LLP act 2008 or Partnership firm under Partnership Act 1932 and should be in operation for at least 5 years in the business of creating Telecom Infrastructure.	Copies of the Certificate(s) of Incorporation/Partnership Deed.
2	The bidder's Average Annual Financial Turnover from the Provisioning of Telecom Infrastructure during the last 3 years, ending 31st March-2020 must be at least, as given at Table (I) appended below as per Zone(s) bid for.	Audited financial statements for the last 3 years (2017-18, 2018-19 and 2019-20) to be enclosed. In case, 2019-20 Balance Sheet is not audited till bid submission, CA Certified report shall be accepted to be supplanted by audited report soon, it is available.
3	The bidder should be financially strong, profitable having Positive Net worth in each of the last 3 financial years.	Audited Balance Sheet for the last 3 years (2017-18, 2018-19 & 2019-20) from Statutory Auditors/CA.
4	The bidder must have a sound financial health with enough cash flow to timely and efficiently execute the awarded project. A solvency certificate from it's banker for at least an amount as indicated in Table-(I) below as per the Zone(s) Bid for, shall be essential during the currency of the project.	Solvency Certificate in favor of the bidder from any Nationalized/Scheduled Bank issued during last 6 months, from the tender opening date.
5	The Bidder must have successfully executed OFC laying projects (Under Ground), during the last five years (till 31st March'2020). The essential minimum eligibility experience sought in this regard is given in Table-(I) below as per the Zone(s) intended for Bidding. The OFC work experience submitted, must also consist of rollout in hilly terrain as mentioned in Table-(I).	Copy of relevant work order(s)/Proof of execution along with completion/ ongoing certificate(s) with details from the client(s)/Users stating the work(s) executed by the bidder.
6	The Bidder must have co-ordinated and obtained ROW permissions from the agencies like Cantonment Boards, BRO, Local Municipal Bodies, Gram Panchayats, NHAI, Railways, PWD, Forests etc. for at least the number of route KMs as mentioned in Table-(I), below as per the Zone(s) Bid for.	List with Routes/Location and details of User and Agencies with self-certification of having coordinated to obtain the RoW.

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Sl. No.	Criteria	Documentary Proof to be Submitted
7	The PIA must maintain a team of Supervisors/Engineers/Technicians at its permanent rolls from at least past one year, to help efficient delivery of project awarded and maintain the OFC network post execution. Minimum man power details to qualify are at Table-I	List of Supervisors and Engineers/ Technicians etc. at the rolls of bidder with EPF/ESI contribution proof needs to be enclosed with the bid.
8	The Bidder should not be blacklisted by any Govt. Dept. or any PSU in India as on the date of publication of this Tender.	Self-declaration by the bidder duly signed by the authorized signatory.

TABLE-(I): Essential Eligibility Criteria (Zone Wise):

Zone-Wise Essentials#		Zone-I (N)	Zone -II (W)	Zone -III(NE)
		(Details of Area/Region available at Detailed SoW)		
Turn-Over (Rs. Cr.)		325	275	200
Solvency (Rs.Cr.)		100	85	60
OFC Laying Experience (KM)	Total	4000	4000	2500
	Single Project	2500	2500	1500
	In Hilly Terrain*	1000	0	500
RoW (KM)		3000	3000	2000
Man Power on Roles				
Supervisors,Engineers/Technicians etc		150	175	100
ISO Certification		TL-9000/ISO 9001:2015		
EMD (Rs. Crore)		6.5	5.5	4.0

 # The companies, bidding for multiple* Zones*, need to meet minimum essential criteria Cumulatively, prescribed for such Zones. In case the cumulative credentials fall short of multiple bids attempted, first opened first serve criteria shall be adopted.

****** Hilly Terrain would mean OFC Routes, having mean HASL above 3,000 Meters for Zone-I and 2,000 Meters for Zone-III.*

--- END OF SECTION III ---

Read, understood and complied with Signature of the Bidder

SECTION IV: INSTRUCTIONS TO BIDDERS

1.1. Invitation to Bid:

Bids are invited from Companies/LLPs/Firms to participate in this Tender for "Selection of Project Implementation Agency" for the rollout of Optical Fibre Network For Army in particular, who meet the minimum eligibility criteria as specified in this Tender.

1.2. Bid Preparation Costs

1.2.1. The bidder shall be responsible for all costs incurred in connection with participation in this Tender process, including, but not limited to, costs incurred in conduct of informative and other diligence activities, participation in meetings/discussions/presentations, preparation of bid, in providing any additional information required by the ITI to facilitate the evaluation process, and in negotiating a definitive contract or all such activities related to the bid process.

1.2.2. ITIL shall in no case be responsible or liable for those costs, regardless of the conduct or outcome of the bidding process.

1.3. Authentication of Bid

A bid should be accompanied by a power-of-attorney in the name of the signatory of the bidder.

1.4. Bid Submission

1.4.1. ITI's Tender document can be downloaded from ITI web site www.itiltd.in or CPP portal www.eprocure.gov.in The hard copy of the Tender document is not available for sale by ITI.

1.4.2. Tender document fee of Rs. 25,000 (Rupees Twenty Five Thousand Only) plus GST @18% (Total Rs. 29,500) shall be payable with the bid. This shall be submitted as a Demand Draft or through NEFT or bank transfer or Pay Order drawn at a Scheduled Bank/Post Office in favor of ITI Limited (N S UNIT), Dooravani Nagar, Bengaluru - 560016. The Bank details for crediting/Transferring money to ITIL is as below.

Account No:*38779898110*
Bank: *State Bank of India*
Branch: *Dooravani Nagar*
IFSC Code: *SBIN0001438*

1.4.3. The Tender document fee is non-refundable.

1.4.4. Bid shall be valid for at least 120 days from the date of Bid opening.

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1.4.5. Each bid shall be accompanied with an EMD (Separate for Separate Zone) from a Scheduled Bank for an amount commensurate to the Zone, applied for bidding and as mentioned in the **Table-(I)** in the form of DD/Bankers Cheque/Bank Guarantee in favor of "ITI Ltd, Bengaluru-560016" valid for a minimum period of 150 days from the date of bid opening.

1.4.6. The successful bidder shall submit a Performance Bank Guarantee (PBG) from a Scheduled Bank to ITI Ltd for an amount equal to 10% of the work awarded valid for three years. The PBG should be submitted latest within 14 days from the date of ITI's requisition (LOI). The validity of the PBG shall be extended in case of the extension of original delivery time lines of the project.

1.4.7. The EMD of the unsuccessful Bidder will be returned/discharged to the Bidder within 30 days of finalization of selection of the Bidder. The EMD of the successful Bidder ("PIA") will be returned on submission of Performance Bank Guarantee for an amount equal to 10 % of the total value of the project awarded, for implementation.

Bids in prescribed Electronic forms shall be submitted in sealed manner (Technical and Financial Bids, separately) mentioning clearly, the **Name of the Zone** applied for, with such super- scription on the top of envelope *(For Physical Copy)* and submitted to:

"Additional General Manager (ASCON),
NS Unit, ITI Limited,
Dooravani Nagar, Bengaluru – 560016"
Phone: 080-25650054, 25662284
eMail: ascon_nsu@itiltd.co.in

2. The Bid submitted shall consist of two covers as below

2.1. **e-Envelope-I [Technical Bid]**

It will have the full name, address of the Bidder and of the authorized agent delivering the Tender at the bottom left-hand corner of the sealed cover. The cover shall consist of the following:

2.1.1. Cover note by the Bidder indicating name of the Company/Organization, address, communication details (like, mobile numbers, land line numbers, fax numbers, e-mail ids for correspondence), name and designation of the Bid submission authority etc.)

2.1.2. Copy of ITI's Tender document signed by the authorized person of the Bidder at bottom of each page of the Tender document as an acceptance for having read and understood the Tender and compliance.

2.1.3. Power of attorney in case of authorized representative having signed the Tender.

Read, understood and complied with Signature of the Bidder

2.1.4. Bid document fee of Rs. 29,500/- (Rs Twenty-Nine Thousand Five Hundred Only) submitted as detailed above.

2.1.5. GST Registration document

2.1.6. All Documents as proof of meeting eligibility conditions and satisfying all other requisites for each bid separately.

2.1.7. EMD from a Scheduled Bank for a prescribed amount as mentioned in the **Table-(I)** valid for a minimum period of 150 days from the date of bid opening.

2.2. **e-Envelope 2 [Financial BID]**

It shall consist of financial bid complete, for all the items mentioned.

2.2.1. The bidders shall be free to bid for any or many Zone(s), strictly as per the bid format and separate bid for each Zone. In case of bids submitted for more than one Zone, minimum eligibility criteria need to be met cumulatively.

2.2.2. Each Bid must be complete in itself for the applied Zone independently.

2.2.3. Incomplete bids are liable for rejection.

2.2.4. **The financial bid/quote at any other place than designated, will make the bid liable for rejection.**

2.3. **Important Information:**

Sl. No.	Information	Details
1	Tender Number	Ref No: NSU/PIA/ASCON/001/156 Date: 10.11.2020
2	Tender Name	Tender for the Selection of "Project Implementation Agencies (PIA)" for the Roll-out of Optical Fibre Network For Army
3	Work description/Nature of the work	To rollout Optical Fibre Backbone & Access Network for Army (End User)
4	Date of Issue/Publishing of the Tender	10.11.2020
5	Last Date Of Clarifications on Tender	20.11.2020
6	Pre-Bid Meeting (Virtual)	21.11.2020
7	Last Date and Time for Submission of Bids	Up to 12.30 pm on 01.12.2020
8	Date and Time of Opening of Technical Bids	3.00pm on 01.12.2020

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9	Date and Time of Opening of Financial Bids	11.00am on 07.12.2020 or to be intimated later
10	Tender Fee	Rs. 29,500/-(Rupees Twenty Nine Thousand, Five Hundred only)
11	EMD	As per TABLE**-(I)**
12	Bid Validity	120 Days
13	Validity of the contract	Three Years (extendable)
14	Attachments/Annexures	Formats and Specifications
15	Tender issuing Authority	Additional General Manager (A), NS Unit, ITI Limited, Dooravani Nagar, Bengaluru – 560016

2.4. **CLARIFICATIONS:**

Bidders desirous of seeking clarifications on the Tender, may send their queries through email to: **ascon_nsu@itiltd.co.in** at the following address:

AGM (A),
NS Unit, ITI Limited,
F-100, West Wing,
Bangalore Complex, Dooravani Nagar, Bengaluru-560016
Ph: 080-25650054, 080-25662284

2.5. On the Bid opening day, only technical bids will be opened. The Bidders who are desirous of attending bid opening may do so as per the e-Tendering process (TOE).

2.6. Bids without authenticated proof of Bid document fee, EMD and other technical compliances as required and prescribed in this Tender, will be rejected.

2.7. The date for opening the financial bids will be communicated to all technically qualified and eligible bidders separately, through registered email.

2.8. The address for all correspondences regarding this Tender shall be:

AGM (A),
NS Unit, ITI Limited
F-100, West Wing,
Bangalore Complex, Dooravani Nagar, Bengaluru-560016
Ph: 080-25650054 / 25662284
E-mail: ascon_nsu@itiltd.co.in

2.9. The offers prepared by the Bidders and all the correspondences and documents relating to the offers submitted/exchanged by the Bidder, shall be written in English

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language.

2.10. ITI reserves the right to suspend or cancel the Tender process at any stage, or to accept, or reject any, or all offers at any stage of the process and / or to modify the process, or any part thereof, at any time without assigning any reason, without any obligation or liability whatsoever and the same shall be published in the ITI website or intimated through email.

2.11. The Bidder shall bear all costs associated with the preparation and submission of its Tender, including cost of presentation for the purpose of clarification of the offer, if so desired by ITI.

2.12. At any time prior to the last date for receipt of offers, ITIL, may, for any reason, whether at its own initiative or in the response to a clarification requested by the prospective bidders, modify the Tender document.

2.13. Also, ITI may, at its discretion, extend the last date and time for the receipt of offers and/or make other changes in the requirements set out in the Invitation for Tender at its own accord or in order to provide reasonable time to bidders to take the amendments into account in preparing their offers.

2.14. If the last day for the bid submission is declared as a holiday, the bid will be opened at the same time on the next working day.

2.15. Tender will be received/submission up to 12:30 Hrs. on 01/12/2020 and technical bid will be opened on same day i.e. 01/12/2020 at 15:00 Hrs.

2.16. Any change/clarifications in the Tender Terms or Schedule shall be notified at ITI Ltd's website: www.itiltd.in (Tender Section) and CPP Portal www.eprocure.gov.in. The intended bidders need to take notice of the same.

3. BID PRICES:

3.1 The bidder shall quote the item wise price for all the items and including all incidentals, inclusive of all taxes and levies but exclusive of Goods and Service Tax. Goods and Service Tax shall be paid extra, as applicable. The PIA shall be responsible for loading/unloading and transporting the materials supplied by ITIL, from it's designated Delivery Point to the work site.

3.2 The safety and security of all the material supplied by ITIL or arranged by PIA itself, till handing over of the project, shall solely be of PIA, who shall make all arrangements of Watch and Ward including Insurance.

3.3 The bidder shall quote against all the items of the chosen Zone. Bids not having quote for all the items/components as per the financial bid format, Main or Incidental, shall be termed as incomplete and liable for rejection.

4. PERIOD OF VALIDITY OF BIDS:

4.1 Bid shall remain valid for 120 days from date of opening of the bids (Qualifying Bid). A Bid valid for a shorter period shall be rejected by ITIL as non-responsive.

4.2 In exceptional circumstances, the tendering authority may request the consent of the bidder for an extension to the period of bid validity. The request and the response thereto shall be made in writing. In such cases, the bid security provided shall also be suitably extended. The bidder may refuse the request without

Read, understood and complied with Signature of the Bidder

forfeiting its bid security. A bidder accepting the request and granting extension will not be permitted to modify its bid.

5. SIGNING OF BID:

5.1 The bidder shall prepare, as a part of his bid, the bid documents duly signed on each and every page submitted (digital signatures accepted on e-tendering portal), establishing the conformity of his bid to the bid documents of all the works to be executed by the bidder under the contract and the credentials claimed to comply the bid conditions.

5.2 The bid shall contain no inter-lineation, erasures or overwriting except as necessary to correct errors made by the bidder in which case such corrections shall be signed with dated by the person or persons signing the bid.

5.3 In case of any difference between the figures at E-Tender Site and Physical copy submitted, the one at E-Tender Portal, shall prevail.

6. Disclaimer:

6.1. ITI and/or its officers, employees disclaim all liability from any loss or damage, whether foreseeable or not, suffered by any person acting on or refraining from acting because of any information including statements, information, forecasts, estimates or projections contained in this document or conduct ancillary to it whether or not the loss or damage arises in connection with any omission, negligence, default, lack of care or misrepresentation on the part of ITI and/or any of its officers, employees.

6.2. All information contained in this Tender provided / clarified is in good faith and interest. This is not an agreement and is not an offer or invitation to enter into an agreement of any kind with any party.

6.3. Though adequate care has been taken in the preparation of this Tender document, the interested bidders shall satisfy themselves that the information contained in the document is complete in all respects to enable to make an informed decision to bid. Interested Bidders are required to make their own enquiries and assumptions wherever required.

6.4. **Information provided in this document or imparted to any respondent as part of the Tender process is confidential and shall not be used by the respondent for any other purpose, distributed to, or shared with any other person or organization**

6.5. Bid received / submitted after due date and time will not be considered.

----- END OF SECTION IV ----

Read, understood and complied with Signature of the Bidder

SECTION-V: INSTRUCTIONS FOR ONLINE BID SUBMISSION TO BIDDERS

1.	Submission of Bids shall be only through online process which is mandatory for this Tender.
1.1	**Tender Bidding Methodology:** **Sealed Bid System** Tender Type: Two bids i.e., Technical and Financial Bids shall be submitted by the bidder at the same time on the portal.
1.2	**Broad outlines of the activities from Bidders perspective:**
1.2.1	Procure a Digital Signing Certificate (DSC)
1.2.2	Register on Electronic Tendering System® (ETS)
1.2.3	Create Users and assign roles on ETS
1.2.4	View Request for Proposal (Tender) on ETS
1.2.5	Download Official Copy of Tender Documents from ETS
1.2.6	Clarification to Tender Documents on ETS
1.2.7	Query to ITI LTD (Optional)
1.2.8	View response to queries posted by ITI LTD, as an addendum/corrigendum.
1.2.9	Bid Submission on ETS
1.2.10	Attend Public Online Tender Opening Event on ETS Opening of Technical/Financial Part
1.2.11	View Post-TOE Clarification posted by ITI LTD on ETS (Optional) Respond to ITI LTD's Post-TOE queries.
1.3	For participating in this tender online, the following instructions need to be read carefully. These instructions are supplemented with more detailed guidelines on the relevant screens of the ETS. **Note 1**: It is advised that all the documents to be submitted are kept scanned or converted to PDF format in a separate folder on your computer before starting online submission. BOQ (Excel Format) may be downloaded and rates may be filled appropriately. This file may also be saved in a secret folder on your computer. **Note 2:** While uploading the documents, it should be ensured that the file name should be the name of the document itself.
1.4	**Digital Certificates:** For integrity of data and its authenticity/ non-repudiation of electronic records, and be compliant with IT Act 2000, it is necessary for each user to have a Digital Certificate (DC) also referred to as Digital Signature Certificate (DSC) of Class 3 or above, issued by a Certifying Authority (CA) licensed by Controller of Certifying Authorities (CCA) [refer http://www.cca.gov.in].
1.5	**Registration in e-procurement portal:** Bidder has to Register first in https://www.tenderwizard.com/ITILIMITED.and then Tender document can be downloaded from the web site: https://www.tenderwizard.com/ITILIMITED and bid has to be submitted in the e-format.

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1.6	**ITI LIMITED has decided to use process of e-tendering for inviting this tender and thus the physical copy of the tender would not be sold.**
1.7	**Special Note on Security of Bids:** Security related functionality has been rigorously implemented in ETS in a multi-dimensional manner. Starting with 'Acceptance of Registration by the Service Provider', provision for security has been made at various stages in Electronic Tender's software. Specifically, for Bid Submission, some security related aspects are outlined below: - As part of the Electronic Encrypt functionality, the contents of both the 'Electronic Forms' and the 'Main-Bid' are securely encrypted using a Pass-phrase created by the server itself. The Pass phrase is more difficult to break. This method of bid-encryption does not have the security and data-integrity related vulnerabilities which are inherent in e-tendering systems which use Public-Key of the specified officer of a User organization for bid-encryption. Bid-encryption in ETS is such that the Bids cannot be decrypted before the Public Online Tender Opening Event (TOE), even if there is connivance between the concerned tender opening officers of the User organization and the personnel of e-tendering service provider.
1.8	**Public Online Tender Opening Event (TOE):** ETS offers a unique facility for 'Public Online Tender Opening Event (TOE)'. Tender Opening Officers as well as authorized representatives of bidders can attend the Public Online Tender Opening Event (TOE) from the comfort of their offices. For this purpose, representatives of bidders (i.e. Supplier organization) duly authorized are requested to carry a Laptop and Wireless Connectivity to Internet. Every legal requirement for a transparent and secure 'Public Online Tender Opening Event (TOE)' has been implemented on ETS. As soon as a Bid is decrypted with the corresponding 'Pass-Phrase' as submitted online by the bidder himself (during the TOE itself), salient points of the Bids are simultaneously made available for downloading by all participating bidders. The work of taking notes during a manual 'Tender Opening Event' is therefore replaced with this superior and convenient form of 'Public Online Tender Opening Event (TOE)'. ETS has a unique facility of 'Online Comparison Chart' which is dynamically updated as each online bid is opened. The format of the chart is based on inputs provided by the User for each Tender. The information in the Comparison Chart is based on the data submitted by the Bidders in electronic forms. A detailed Technical and/ or Financial Comparison Chart enhance Transparency. Detailed instructions are given on relevant screens. ETS has a unique facility of a detailed report titled 'Minutes of Online Tender Opening Event (TOE)' covering all important activities of 'Online Tender Opening Event (TOE)'. This is available to all participating bidders for 'Viewing/ Downloading'.
1.9	**Other Instructions:**

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	For further instructions, the vendor should visit the home page of the portal i.e. https://www.tenderwizard.com/ITILIMITED. **Important Note**: It is strongly recommended that all authorized users of Supplier organizations should thoroughly peruse the information provided under the relevant links, and take appropriate action. This will prevent hiccups, and minimize teething problems during the use of ETS.
1.10	**The following 'FOUR KEY INSTRUCTIONS for BIDDERS' must be assiduously adhered to:**
1.10.1	Obtain individual Digital Signing Certificate (DSC or DC) well in advance of your tender submission deadline on ETS.
1.10.2	Register your organization on ETS well in advance of your tender submission deadline on ETS.
1.10.3	Get your organization's concerned executives trained on ETS well in advance of your tender submission deadline on ETS.
1.10.4	Submit your bids well in advance of tender submission deadline on ETS to avoid any unforeseen last-minute problems due to internet timeout, breakdown, etc. While the first three instructions mentioned above are especially relevant to first-time users of ETS, the fourth instruction is relevant at all times.
1.11	**Minimum Requirements at Bidders end:** Computer System with good configuration and OS preferably supporting Windows, Word, Excel & PDF, High Speed Broadband connectivity, Internet Browser and Digital Certificate(s).

----- END OF SECTION V ----

Read, understood and complied with Signature of the Bidder

SECTION VI: FINANCIAL BIDS

- **The bidders are to quote the prices after fully understanding the scope of complete Service and Supply (as applicable) for the chosen Zone (s).**
- **The rates must be quoted for all the items irrespective of their actual quantum of execution.**
- **The bids with incomplete rates, not quoting for all the items, shall be rejected.**
- **The work shall be awarded to the eligible, lowest weighed price bidder in the Zone.**
- **The item of Maintenance Services during warranty shall be optional for ITIL to award or not but necessary for the bidder and must for the assessment of the bids.**
- **The quantum of incidental item of Supply/Service (Aerial OFC Erection) is only for the purpose of assessing the rates and may or may not be required to be executed or may vary in quantity. Must be quoted and shall be counted for the assessment of Bids.**
- ***GST shall be extra, payable at the prescribed rate against the GST invoice.***
- ***RoW Charges shall be reimbursed to the PIA separately as per actuals.***
- THE QUANTITIES AND WEIGHTS APPLIED TO QUOTED BID PRICES ARE ONLY INDICATIVE AND ASSUMPTIVE TO ASSESS THE COMPARATIVE RANKING. ACTUAL QUANTITIES MAY VARY AS PER ACTUAL SITE AND WORK CONDITIONS.
- ***ZONE I AND ZONE III SHALL NOT BE AWARDED TO SAME BIDDER.***

Read, understood and complied with Signature of the Bidder

ZONE – I [N] [Consisting of Region 1 & Region 2 Spreaded over:JK,LA,HP,PB and HR]

(I). MAIN SERVICE & SUPPLY ITEMS:

Name of Zone Bid For:				**ZONE - I**		
SN	Item	Link,ID/ Name/Details $	Link Trench Length (KM)	Quoted Rates Per K**M (Rs)**		Itemized Bid Value (Qty x Rates)
				In Figures	in Words	
			A	B	B	A x B
1	Execution (Complete with supply of items and Services as per SoW & Specs)	1.1.01				
		1.1.02				
		….				
		1.2.n				
2	Maintenance of OFC during Warranty **for 2 Years**	Complete routes, executed by the PIA	4,254			
3	**TOTAL, Itemized Bid Value (X)**					

(II). Incidental Supply & Service Item (on need basis, after specific approval of the User):

II.	Items	Qty (KM)	Quoted Rate (Rs.) per KM		Bid Value
			In Figures	In Words	
		(a)	(b)	(b)	(a)x(b)
(i)	Erection of Aerial OFC Alignment, complete with material as per Specs. (Cable supply by ITIL)	Total Estimated Route KMs **45 KMs**			
(ii)	Total Assessed Quote **(Y)**				

OVERALL WEIGHTED BID PRICE FOR the "ZONE-I": X+Y

Note : Link Details provided are for estimation purposes. Exact locations, distances (RKM) and other parameters/attributes needs to be ascertained by the bidder after reconciling with the list, receivable under NDA.

Read, understood and complied with Signature of the Bidder

ZONE-II [W] [Consisting of Region 3 & Region 4, spreaded over RJ and GJ]

(I). MAIN SERVICE & SUPPLY ITEMS:

Name of Zone Bid For:				**ZONE - II**		
SN	Item	Link,ID/ Name/Details $	Link Trench Length (KM)	Quoted Rates Per K**M (Rs)**		Itemized Bid Value (Qty x Rates)
				In Figures	in Words	
			A	B	B	A x B
1	Execution (Complete with supply of items and Services as per SoW & Specs)	2.3.01				
		2.3.02				
		….				
		2.4.n				
2	Maintenance of OFC during Warranty **for 2 Years**	Complete routes Executed by the PIA	4,451			
3	**TOTAL, Itemized Bid Value (X)**					

(II). Incidental Supply & Service Item (on need basis, after specific approval of the User):

II.	Items	Qty (KM)	Quoted Rate (Rs.) per KM		Bid Value
			In Figures	In Words	
		(a)	(b)	(b)	(a)x(b)
(i)	Erection of Aerial OFC Alignment, complete with material as per Specs. (Cable supply by ITIL)	Total Estimated Route KMs **45 KMs**			
(ii)	Total Assessed Quote **(Y)**				

OVERALL WEIGHTED BID PRICE FOR the "ZONE-II": X+Y

Note : Link Details provided are for estimation purposes. Exact locations, distances (RKM) and other parameters/attributes needs to be ascertained by the bidder after reconciling with the list, receivable under NDA.

Read, understood and complied with Signature of the Bidder

ZONE-III [NE] [Consisting of Region 5 & Region 6, spreaded over: UK,UP,WB,AS,SK and AR etc.]

(I). MAIN SERVICE & SUPPLY ITEMS:

Name of Zone Bid For:				**ZONE - III**		
SN	Item	Link,ID/ Name/Details $	Link Trench Length (KM)	Quoted Rates **(Rs)** Per K**M**		Itemized Bid Value (Qty x Rates)
				In Figures	in Words	
			A	B	B	A x B
1	Execution (Complete with supply of items and Services as per SoW & Specs)	3.5.01				
2		3.5.02				
		….				
		3.6n				
3	Maintenance of OFC during Warranty **for 2 Years**	Complete route Executed by the PIA	2,536			
4	**TOTAL, Itemized Bid Value (X)**					

(II). Incidental Supply & Service Item (on need basis, after specific approval of the User):

II.	Items	Qty (KM)	Quoted Rate (Rs.) per KM		Bid Value
			In Figures	In Words	
		(a)	(b)	(b)	(a)x(b)
(i)	Erection of Aerial OFC Alignment, complete with material as per Specs. (Cable supply by ITIL)	Total Estimated Route KMs **65 KMs**			
(ii)	Total Assessed Quote **(Y)**				

OVERALL WEIGHTED BID PRICE FOR the "ZONE-III": X+Y

Note : Link Details provided are for estimation purposes. Exact locations, distances (RKM) and other parameters/attributes needs to be ascertained by the bidder after reconciling with the list, receivable under NDA.

Read, understood and complied with Signature of the Bidder

$: Actual Link details (with Link IDs) to be handed over physically, to intended bidders under NDA. Price bid format on-line, shall be available only with Link IDs. Bidders need to co-relate.

---------- END OF SECTION-VI ----------

Read, understood and complied with Signature of the Bidder

SECTION VII: DETAILED SCOPE OF WORK

The scope of the work has been defined in Tender and explained as below-

It is proposed to establish Army Communication Network through this project of laying Optical Fibre Cable in various regions and zones. The scope of work includes Survey, Installation, Commissioning and Testing of Optical Fibre Cable (OFC) Network, distributed in three Zones and proposed to be executed Zone wise by the selected, Experienced and Competent Project Implementation Agencies (PIA) to connect given locations/Nodes with the links created through this OFC networking exercise. The work would include following, apart from various other related activities:

Digging and laying of Optical Fibre Cable (OFC) underground, in trenches in different types of soil and back-filling the same after HDPE pipe is laid & providing Brick layer longitudinally on top of the HDPE pipe for single Duct and Transversally for multi-ducts.

All the OFC work including provision of Joint pits/Chambers and route markers, RCC and Electronic, as per DOT's/TEC (BSNL)'s latest specifications and OFC construction practices. In the areas where underground OFC is susceptible to extensive damage due to infrastructure development (road widening, construction etc.), the PIA may submit an option for laying of OFC over Power Grid Pylons/NHAI/Rail ducts etc; Such susceptible routes after survey will be clearly submitted for the approval from the User (Indian Army in this case) and ITIL before commencement of OFC laying aerially.

Activities will include survey of routes, approval of survey reports from the user, deployment of HDD machine, open trenching, Chiseling, hammering, crow beating etc to make way to lay the HDPE-PLB ducts. Construction and fixing of Manhole/ Joint Chamber, coupler fixing, Route marker installation, OFC pulling/Blowing in duct and overhead aerial fibre laying with accessories (wherever necessary), jointing, FDF installation at Link ends and in-between nodes of any link, terminating fibres on the FDF and end to end testing. All the activities to be completed as per latest DoT/TEC/BSNL Specifications. The engineering instructions by ITIL/DoT/Army for OFC laying presently, are as under and also as mentioned in Technical Specifications section: -

(a) Laying Practices of OFC, ref number D-001, issue No IV dated 31 Jan 2007 (Annexure 1)

(b) Installation Practice of Self-Supporting Metal Free Areal OFC, ref number TR/COFC/I-001, issue No 01 dated 10 Jun 2011. (Annexure 2)

(c) Laying Practices of OFC by HDD Method, ref number TR/OFC/A-001, issue No 01 dated 31 Jan 2007 (Annexure 3)

(d) Provision of Hand Hole in case of HOD on OFC Laying, ref number TR/COFC/1-004, issue No 01 dated 04 Oct 2011(Annexure 4).

(e) Micro Tunneling for Laying of· OFC, ref number TR/COFC/A-002, issue No 01 dated 22 Feb 2010 (Annexure 5).

Apart from above, OFC CONSTRUCTION PRACTICE TEC/IR/SCB-08/02 SEP 2009 shall also be followed for OFC Laying.

PIA needs to conduct a field survey with DGPS for assigned fiber route considering existing ground utility and terrain conditions with detailed plan to be submitted for approval

before execution. Survey plan should have detail drawings, GIS information-based route map in KMZ/KML and in given report formats. Once route plan is verified and approved, PIA has to coordinate with relevant departments of government or concerned authority or local authority for ROW permission for creation of fiber network for and on behalf of Indian Army (User). PIA needs to do required documentation for ROW application and follow up. PIA will be responsible for getting ROW permission in time, to match delivery timelines.

PIA shall normally lay single length of supplied 40mm HDPE pipe. All Material for creation of OFC network will be in scope of PIA (excluding OFC Cable, HDPE Duct and FDF) as per given specifications. Transportation from Delivery Point of ITIL up to the execution site with local storage if required, and insurance will be in the scope of PIA. In case of theft/physical damage to the supplied material, same shall be replaced at PIA's cost till Network AT and final Make Over as per Terms and conditions.

PIA has to depute sufficient teams/resources for the project work along with a site supervisor. All field safety norms to be adhered strictly. The minimum PPE requirement of people working on site is Safety shoes / Gum boots, Hard hats, florescent jackets with proper barricading, sign boards and arrangement for traffic control to be ensured while working on site. PIA need to deploy hands and safety at work trained resources.

Daily consumption report of material and progress of work link and site wise shall be submitted and entered by PIA supervisors online for all the relevant fields of progress monitoring in the Project management system meant for it and periodically reconcile the stock as directed by ITIL.

Any site issue or deviation in submitted plan is needed to be intimated immediately and obtain the approval and clearance from the user. Any damages to utilities/field infrastructure and 3rd party OSP infrastructure during creation of fibre network connectivity will be responsibility of PIA. In case of any damages, PIA has to restore as it was. PIA shall backfill and reinstate the excavated surfaces to their original condition to the satisfaction of the concerned. PIA shall dispose the surplus debris and earth material to a suitable location as indicated by concerned authorities. Reinstatement as per RoW conditions shall be in the scope of PIA. Any penalty and restoration charges with material beyond RWA charges will be borne by PIA.

PIA needs to prepare proper documents, drawings and reports for PDI/FAT/JRI. PIA will have to be present during the final acceptance testing when planned with ITIL and User representatives.

1. WORK:

1.1	**Project:** The PIA shall act as a single agency to organize and manage the assigned creation of fiber network, which includes Route Survey, approval of survey reports from user, follow-up for swift RoW permissions for the life time of the project (10 Years), Supply (except: OFC,HDPE Pipe and FDF), Installation, Commissioning, Handover of end to end connectivity of Network and maintenance of the routes till warranty phase gets over.

Read, understood and complied with Signature of the Bidder

1.2	**Fiber Network Rollout Arrangements**: - The PIA shall provide complete details of route in GIS based monitoring tool of ITIL with a layout plan after finalizing the route of link(s). The PIA shall execute Works/Project and Cabling as per the layout plan, which will be pre-approved by the user.
1.3	**Resources Deployment**: The PIA shall prepare and submit the Project Plan, work plan and implementation schedule with list of equipment/implement and personnel to be deployed on field for execution of works for approval of ITIL.
1.4	**Safety:** The PIA shall carry out all the activities (HDD, Open trenching, Ducting,Chamber fitting etc) as per the safety guidelines, with safety standards and norms defined by relevant statutory authorities.
1.5	**Reporting:** - Detailed report is required to be submitted for the work under progress and work completed on daily, weekly and monthly basis per link and overall. The PIA shall put in place the system of onsite progress reporting by the Men at site with the help of different Project Management Tools and Apps decided for this purpose so as to help ITIL and User to monitor progress and pace of work continuously. The system and method of reporting also needs to be as agreed and accepted by the user and ITIL appointed Project Management Agency (PMA).
1.6	**Documents**: - The PIA shall provide two set of documents and manuals (hard copy, soft copy) for end to end optical fiber route as per format which shall be shared by PMA/ITIL/User.
1.7	**Inspection: -** The material supplied and used in the OF construction shall be put to inspection (JRI) as per the directions and instructions of the user before and after the commissioning.
1.8	**Acceptance Testing: -** The OFC links shall be put to end to end testing as per the specifications mentioned in Acceptance Test Procedure (AITP) by the User.

2. PRESENTATION ON "APPROACH AND METHODOLOGY" OF EXECUTION:

2.1 Soon after opening of the Tender the bidder needs to be ready to give a presentation before the Tender Evaluation Committee (TEC), exhibiting how and with which methodology it plans to meet the objectives of this tender. The TEC will consider the Technical Suitability of the submitted bids based on such presentation along with other essential eligibility conditions. Amongst other things the presentation must contain:

- Method and tools of Survey of routes and preparation of Survey reports.
- The management to arrange and follow-up RoW permissions.
- The details of mechanized tools and implements available with the bidder to fast execute the OFC Laying work.
- The logistics and man power resources available in the areas of Zone bid for and planned to be deployed for the execution, once the work is awarded.
- The time taken to start the work once LoI is awarded.
- The methodology to monitor the progress of work.
- The Material and inventory management with arrangements of safety and security of material and work under progress.
- The arrangements and precautions to ensure safety of Men at work and Property & People around the sites of work.

Read, understood and complied with Signature of the Bidder

- The Measures to ensure timely delivery and completion of work keeping different possible obstacles natural or manmade in view.
- The financial strength of the bidder to timely deliver the project.
- Any other aspects it may like to present before the Tender Evaluation Committee.

An advance copy of this presentation if submitted in advance, with the bid shall be appreciated.

3. QUANTUM OF WORK:

3.1 The region wise, estimated quantity of work and link details are as below:

ZONEs	***REGIONs***	***AREAS***	***Route Length (KM) (Approximately)***	***OFC Links* (Numbers)***
ZONE-I (North)	1	J&K and Leh/Ladakh	***2,716***	***33***
	2	HP,PB & HR	***1,538***	***43***
ZONE-II (West)	3	RJ	2,785	31
	4	GJ	1,666	19
ZONE-III (North-East)	5	UK, UP,BH,CG and OD	1,303	13
	6	WB,AS,SK,MN and AR	1,233	25

**** The link details can be collected from ITIL by the prospective bidders who have signed the NDA and deposited the bid document fee.***

3.2 Locations with distances giving OFC routes are tentative and link details provided as above may change during implementation. Exact Locations, distances and other parameters /attributes will be determined by the User/ITIL after survey by the PIA. Payments for execution of links shall be made as on actuals.

Read, understood and complied with Signature of the Bidder

SECTION VIII: GENERAL (COMMERCIAL) CONDITIONS OF THE TENDER

1. APPLICATION:

The General conditions shall apply in contracts made by the ITIL for the execution of Laying HDPE-PLB pipes by Open Trench Method/Trenchless Technology, Optical Fibre Cable Pulling/Blowing, splicing, terminating and supply & Service of Associated works

2. STANDARDS:

The works to be executed under the contract shall confirm to the standards prescribed by TEC/Army in general, for the OF Cable construction practices using open trenching and trenchless technology methods.

3. PRICES:

Prices charged by the PIA for the works performed under the Contract shall not be higher from the prices quoted by the PIA in his Bid. Price once fixed will remain valid for the period of contract. Increase and decrease of taxes/duties will not affect the price except Goods and Service tax (GST) which will be paid at prevailing rate, during this period

4. SUBCONTRACTS:

The PIA shall not assign, sub contract or sublet the whole or any part of the works covered by the contract, under any circumstances without written approval of ITIL in advance.

5. LIABILITY:

ITIL will not be liable to the PIA for any losses or damages, costs, charges which the PIA may in any way sustain/suffer due to non-issue of work order/delay in making store available or delay in receipt of RoW permission from any of the custodians of Roads and Pathways required to be dug.

6. PERFORMANCE SECURITY:

6.1 The successful bidder shall submit a bank guarantee for an amount equivalent to 10% of the value of work awarded at the Tender approved price as security deposit (Bank Guarantee) towards performance of the contract called PBG within 14 days from the date of issue of LOI, in favor of 'ITI Limited, (NS Unit), payable at Bengaluru from any scheduled bank in India, valid for 36 months extendable till the completion of Network Acceptance Testing and starting of warranty Phase.

6.2 On receipt of PBG from the bidder and after confirmation of the genuineness of the PBG from the bank, the EMD, received earlier, will be returned.

6.3 A separate Security in the form of Bank Guarantee may also be taken for the Material issued during the execution of project if the progress of work is not in pace of issue of material.

6.4 Before release of PBG, the PIA shall submit a Bank Guarantee equivalent to 5% of the value of work awarded at the Tender approved price towards performance of maintenance during warranty, called PWBG for a period of 24 months, if ITIL decides to give maintenance to the PIA during Warranty period.

Read, understood and complied with Signature of the Bidder

6.5 The proceeds of the PBG or PWBG shall be payable to the ITIL as compensation for any loss resulting from the PIA's failure to perform the obligations under the contract and warranty obligations including the cost of material of ITIL or any other liability incurred.

6.6 The warranty security deposit (PWBG) shall be refunded after completion of Warranty phase and start of the AMC period and handover of the project in zero fault condition to the AMC agency, provided there are no recoveries/LD Charges to be paid arising out of poor quality of work, incomplete work and/or default towards any terms and conditions of the contract as stipulated in the bid document and agreement. In case, the Maintenance of the OFC network during warranty period is awarded to an agency other than PIA itself, the PWBG shall be released accordingly.

6.7 If there are recoveries to be made, PIA shall deposit the money before the release of PBG or PWBG as the case may be. In case of failure to make good the charges payable towards ITIL including accrued penalties, PBG/PWBG will be forfeited and recovery to be effected from the realized amount. The balance amount, if any, after adjustment of above recoveries, same shall be paid to the PIA.

6.8 It is the responsibility of the PIA to submit the proof that he has deposited the Goods & Services tax in time, otherwise ITIL will recover from subsequent bills or PWBG as the case may be.

6.9 No interest will be paid to the PIA on the security deposit(s).

6.10 The maintenance services being rendered by PIA during warranty may be extended for a maximum period of one year at the mutually agreed terms and conditions.

7. ISSUE OF WORK ORDERS AND DELIVERY SCHEDULE:

7.1 Work will be executed by way of issuing work orders. Work orders may be issued in parts for a period as specified in the work order. The work order shall be for a part of work which will have to be completed in time as specified in work order.

7.2 The work orders shall be issued by the Designated Officer in-charge of OF cable construction works after general approval from ITIL. The Designated Officer in charge of work shall issue the work order after examining the technical and planning details of the works to be executed.

7.3 The ITIL reserves the right to cancel or modify the scope of work stipulated to be carried out against the work order in the event of change of plan necessitated on account of technical reasons or in the opinion of work order issuing authority or competent authority, the PIA is not executing the work at the required pace.

7.4 The work orders shall be issued as per the work execution plans of the user and not as per the convenience of the PIA.

7.8. The work orders for the difficult portions of the route may be awarded first by the designated Officer in-charge and PIA would have no claim what so ever to demand for a particular route or Zone for execution first.

7.9. PIA will start the work execution after arranging required ROW for the work.

Read, understood and complied with Signature of the Bidder

8. EXTENSION OF THE DELIVERY SCHEDULE:

8.1 General:

8.1.1 In each work order, the work order issuing authority shall specify the time allowed for completion of work consistent with the guidelines on pace of work, magnitude and urgency of work. The time allowed for carrying out the work is to be strictly observed by the PIA and shall be reckoned from the day of issue of work order.

8.1.2 In as much as "the time being the essence of contract", throughout the stipulated period of contract, the work is to be proceeded with all due diligence on the part of the PIA.

8.2 Application for Extension of Time and Sanction of Extension of Time (EOT):

8.2.1 There may be some hindrances, other than covered under force majeure, while execution of work and in such cases the PIA shall apply in writing to the Designated Officer-in-charge for extension of time (EOT), on account of which, he desires such extension, on the same day of occurrence of hindrance. The Designated Officer-in-charge shall forward the request to the competent authority with his detailed report, who may or may not grant extension of time for completion of work or may allow so with certain conditions.

8.2.2 The application must contain the ground(s), which hindered the PIA in execution of work.

8.2.3 The Designated Officer-in-charge would be given the grounds for extension of time.

8.2.4 The designated authority may consider the request keeping all the facts and circumstances in view and discuss with the User before grant of extension of time, if there are reasonable and sufficient grounds for granting such extension and the reasons for delay are not ascribable to the PIA.

8.2.5 The competent authority may also grant extension of time for completion of work in cases where reasons for delay are ascribable to the PIA, but such extension of time shall be with LD charges as per clause dealing with Liquidated damages (LD) for delays in execution of works.

8.2.6 The competent authority shall grant EOT with time period for completion of work clearly mentioned.

If the competent authority is of the opinion that the grounds shown by the PIAs are not reasonable and sufficient and declines to grant the extension of time, the PIA cannot challenge the soundness of the opinion by reference to arbitration. The decision of the competent authority on period of extension of time or refusal for extension of time shall be final and binding on the PIA.

NB: SINCE THE WORK IS TO BE EXECUTED FOR AND ON BEHALF OF AN END USER, THE NEED AND EXEGENCIES OF THE USER SHALL PREVAIL UPON ALL THE COVENENTS AND ALL DECISIONS SHALL BE TAKEN WITH THE KNOWLEDGE OF SUCH USER. THE USER HERE

BEING INDIAN ARMY AND THE PROJECT BEING OF NATIONAL IMPORTANCE, A SPECIAL CARE AND PREPERATION WILL BE EXPECTED FROM THE PIA.

9. BID OPENING AND EVALUATION:

9.1 Opening of bids by the ITIL :

The Electronic Envelope marked as '**Bid Security, Bid cost & Authorization Envelope**' shall be opened first and examined by the designated Bid Opening Committee (TOC) of ITIL. The TOC shall ascertain that the documents submitted in the envelope meet the requirements of eligibility for opening the qualifying bid of a bidder for this tender then only the TOC shall open and download the Qualifying Bids online after the due date and time by logging into the e-tender portal. The bidders whose Physical Envelopes are either not received in time or the documents do not meet the preliminary requirement of eligibility, their bids shall not be opened/downloaded from the E tender portal.

The Qualifying Bids downloaded shall be evaluated by the designated TEC and the result of evaluation after approval by the competent authority shall be declared for the information of all concerned clearly mentioning the qualified bidders and non-qualified bidders.

10. **CLARIFICATION OF BIDS BY THE ITIL :**

To assist in examination, evaluation and comparison of bids, the ITIL may, at its discretion ask the bidder for clarification of its bid. The request for its clarification and its response shall be in writing. However, no post bid clarification at the initiative of the bidder shall be entertained.

11. **VERIFICATION OF BIDS BY THE ITIL :**

If any of the documents, required to be submitted along with the technical bid is found wanting, the offer is liable to be rejected at that stage. However, the ITIL at its discretion may call for any clarification regarding the document within a stipulated time period. In case of non-compliance to such queries in the given time, the bid will be out rightly rejected without entertaining further correspondence in this regard.

12. **PRELIMINARY EVALUATION :**

ITIL shall evaluate the bids to determine whether they are complete, whether any computational errors have been made, whether required securities have been furnished, whether the documents have been properly signed/authenticated and whether the bids are generally in order.

Prior to the detailed evaluation, the ITIL will determine the substantial responsiveness of each bid to the bid document. For purpose of these clauses a substantially responsive bid is one which conforms to all the terms and conditions of the bid documents without deviations.

The ITIL may waive any minor infirmity or non-conformity or irregularity in a bid which does not constitute a material deviation, provided such waiver does not prejudice or affect the relative ranking of the bidder.

Bids found Technically and commercially compliant and suitable would only be considered for Price bid opening.

Read, understood and complied with Signature of the Bidder

13. INFLUENCING THE ITIL:

13.1 No bidder shall try to influence the ITIL on any matter relating to its bid, from the time of bid opening till the time the contract is awarded.

13.2 Any effort by the bidder to modify his bid or influence the ITIL in the ITIL's bid evaluation, bid comparison or the contract award decisions shall result in the rejection of the bid.

14. ITIL'S RIGHT TO ACCEPT ANY BID AND TO REJECT ANY OR ALL BIDS;

The ITIL reserves the right to accept or reject any bid and to annul the bidding process and reject all bids, at any time prior to award of contract without assigning any reason whatsoever and without thereby incurring any liability to the affected bidder or bidders on the grounds for the ITIL's action.

15. ISSUE OF LETTER OF INTENT:

15.1 The issue of letter of intent (LoI) shall constitute the intention of the ITIL to enter into the contract with the bidder. LoI will be issued as offer to the successful bidder(s).

15.2 The bidder shall within 14 days of issue of letter of intent, give his acceptance along with Performance Security (PBG).

16 SIGNING OF AGREEMENT:

16.1 Once the tender is approved by the competent authority and Letter of Intent (LoI) is issued, the PIA shall deposit the Performance Bank Guaranty (PBG) within fourteen days. The Bid Security deposited along with the tender shall be refunded to the bidder after signing of the agreement.

16.2 An agreement based upon the terms and conditions mentioned in this document shall be signed after submission of PBG.

16.3 ITIL may at any time during the progress of work, ask for an additional Material Security in the form of Bank Guaranty (BG) if it feels the PBG security to be insufficient to mitigate the risk of the value of the Supplies made to the PIA. This action shall be initiated once it is established that there is a difference of more than 20% quantity in the material issued and laid.

17. MEASUREMENT, INSPECTION, TESTING AND ACCEPTANCE TESTING:

17.1 Open Trenching:

17.1.1 Measurement:

The measurement books are to be maintained by the Designated Officer-in-charge of the work in the format as prescribed by the User. The entries shall be made in ink. No entry shall be erased. If a mistake is made, it should be corrected by crossing out the incorrect words or figures and inserting the corrections, the corrections thus made shall be initialed & dated by the officer concerned. Each and every measurement has to be signed and accepted by the representative of the User for its correctness.

Read, understood and complied with Signature of the Bidder

17.1.2 **Responsibility of taking and recording measurements:**
The measurement of various items of work shall be taken and recorded in the measurement books issued for the purpose. The measurement shall be taken and recorded by a designated officer of ITIL, supervising the work. However the acceptance by the user shall prevail upon all.

17.1.3 Method of recording of nomenclature of items: Complete nomenclature of items, as given in the agreement need not be reproduced in the measurement book for recording the measurements but corresponding Item Code if provided, shall be used.

17.1.4 Method of measurements: The measurements of the work shall be done activity wise as and when the item of work is ready for measurement and shall also be uploaded in near real time in the special GIS based Monitoring tools meant for this purpose. The PIA may be required to equip its work force and supervising personnel with necessary devices to accomplish this requirement.

17.1.5 The rates of payment shall be as agreed and payable, if the work is accomplished as per the scheduled specifications.

17.1.6 **Measurement of length of cable**: The length of cables laid in trenches, through pipes and through ducts shall be measured by use of RODO Meter/Measuring Tape or any acceptable modern tool in practice generally acceptable for the purpose as per the choice of ITIL. The length should be cross verified with the marking of lengths on the cables. The lengths shall be recorded in sheet provided in the measurement book. But the payable length shall be based on the trench length.

17.1.7 **Method of measurement**. The measurement of the work shall be done activity-wise as and when the item of work is ready for measurement. The methods of measurement of various items are enumerated as under:

Measurement of Depth of Trenches. The cable route shall be divided into a number of segments each of maximum 200 Meters length bounded by identifiable landmarks at both the ends of the segments. If landmarks are not available, length of segment may be maintained at 200 Meters. The measurement of depth shall be recorded at each point of measurement (POM) in the measurement book in Meters in the multiples of 5 Centimeters.For example, 97 centimeters will be recorded as 95 centimeters and 103 centimeters as 105 centimeters. The points of measurements shall be at a distance of 10 Meters starting from 0 (Zero) Meter. For example, if the length of segment is 75 Meters, the POMs shall be at 0 M, 10 M, 20 M, 30 M, 40 M, 50 M, 60 M, and 70 Meters. The last POM shall be at 75^{th} Meter to be recorded against residual POM. This is a general procedure but a special procedure as per the need of project or the instructions of the user can be made and followed for the measurement and recording provided the payability by ITIL not impacted adversely. During the execution of work there may be depth deviations due to site conditions and other obstacles.

Read, understood and complied with Signature of the Bidder

Depth deviation shall be considered on case to case basis by Project Director,(Engineer in Charge of the Project), based on merit of the case duly recommended by local monitoring agency of Army.

In case of lesser depth, the bidder shall compulsorily provide adequate protection to offset the reduced depth in the following manner:

- **0 Cms. to 30 Cms**. Not Permitted
- **30 Cms. to 60 Cms**. GI Pipe class B (nominal bore 65 mm) with Concrete Work.
- **60 Cms. to 120 Cms**. DWC
- **> 120 cm**. No protection, however the payment shall be made as following:

Approved rate x (Actual Depth in cm/165).

Note: However, PIA shall take prior permission of ITIL and User for digging lesser depth based on site constraints such as rocky area, presence of pipelines, power cables, City Congestion or RoW Condition etc.

(THE PROVISIONS IN THE SPECIFICATIONS AT ANNEXURE I, SHALL PREVAIL IN CASE OF ANY CONFLICT)

- **Measurement of lengths and profiles of strata and protection**.
  The measurements of length of trenches are on running Meter basis, irrespective of type of soil encountered while digging. The type of protection utilized (item code – wise) to include RCC Half Round and Full Round Pipe, DWC HDPE Pipe, GI Pipe, MS Weld Mesh etc in a segment shall be recorded in the measurement book in the sheet provided for this purpose.
- **Measurement of length of cable**. The length of cables laid in trenches, through pipes and through ducts shall be measured by use of OTDR. **The payment shall be made as per the RODO Meter readings and not as per the OTDR readings.** The length should be cross-verified with the marking of lengths on the cables. The lengths shall be recorded in sheet provided in the measurement book.
- **Measurement of other items**.
  (i).Termination of Cable in Building Premises/Equipment Room/Shelter and number of joints.
  (ii). Numbering of Poles/Pillars/Cabinets/Boxes.
  (iii). Counting of Bricks laid over the duct.
  (iv). Length of GI/RCC pipes used for special protection.
  (v). The length of Rocky strata encountered.
  (vi). Numbering of Network Components such as Route Indicators, Joint Markers, Splice Chambers, Manholes, Splice Locations, OLA (Optical Line Amplifiers) and Optical Distribution Frames (ODF/FDF) etc.
  (vii).The rates payable shall be per KM length including Trenching-HDD, Crossing of Bridges, culverts, railway Sections, highways etc. etc. for all kinds of Strata and all kind of regions, for complete work.

17.1.8 The PIA shall sign all the measurements recorded in the measurement book. This will be considered as an acceptance by the PIA, of

measurements recorded in the MB. In case PIA fails to attend at the measurements or fails to countersign or to record the difference, then in any such events the measurements taken by Designated Officer-in-charge or his subordinate as the case may be, shall be final and binding on the PIA and the PIA shall have no right to dispute the same.

17.1.9 The Designated Officer or the User's representative before accepting the invoice for sections covered by each set of measurement may carry out test check by re-opening trench at as many locations as necessary and bills will be processed only when he is personally satisfied of the correctness of entries in the "measurement Book" and also when he is satisfied of other aspects of the work as per the terms of the contract. The PIA shall provide the necessary assistance of labour for re-opening of trench for test check by the Designated Officer. Separate payment shall not be made to the PIA for excavation of such test checks.

17.1.10 Measurement of the work of cable Blowing/pulling through pipe/duct will be taken equal to the length of the pipe / duct through which the cable has been pulled and not the total length of the cable pulled through pipe/duct. However, the cable pulling/blowing cost is inclusive in this tender.

17.1.11 In case of HDD, depth of the pipes and depth AT shall be done during the drilling from Entry pit towards Exit pit only. Hence the Depth AT for the HDD work shall be done in real time along with supporting documents.

18. **Inspection and Quality Control:**

18.1 The Quality of Works: The importance of quality of Optical Fibre Cable Construction works especially laying of multiple PLB pipes/coils using open trenching and trenchless technology method cannot be over-emphasized. The quality and availability of connectivity and success of overlay access network depends upon quality of laying of Optical Fibre Cable. Further, the OF cables are vulnerable to damages due to work of other agencies.

18.2 **It is imperative that the PIA(s) is/are fully conversant with the construction practices especially laying multiple pipes by trenchless technology using HDD machine and shall be fully equipped to carry out the work in accordance with the specifications**. The PIAs are expected and bound to ensure quality in construction works in accordance with specifications laid down. The PIA shall engage adequate and experienced supervisors to ensure that works are carried out as per specifications and with due diligence and in a professional manner. The PIAs shall satisfy himself/themselves that the work conforms to the quality specifications before offering the same for Acceptance and Testing by the User.

18.3 An assessment of extent of interest shown by the PIAs in executing the works with requisite quality may be recorded and used in evaluating the PIAs' Performance Rating.

18.4 In addition to Acceptance Testing being carried out and supervision by Constructions Officers, all works at all times shall be open to inspection by any representative of ITIL or the end User. The PIAs shall be bound, if called upon to do so, to offer the works for inspection without any extra payment.

18.5 **Site Order Book**: The site order book is one of the primary records to be maintained by the Site In charge supervising the work during the course of

execution of works. The noting made by officers as well as PIAs, will form as basis for operation of many contractual clauses. The PIA shall remove all the defects pointed out by the officers in the Site order book. The PIA or their authorized representatives shall also be at liberty to note their difficulties etc. in these books. The site order books may also be consulted at the time of making final payments to the PIA. The site order book shall be maintained Link wise by the PIA.

18.6 Work shall be recorded in the site register by the site Engineer. The PIA or his authorized representative shall sign in the site register held by the site Engineer.

18.9 Due to underground utilities, if the manhole cannot be constructed at the site marked in the survey, the decision of the user shall be final and binding on the PIA. If it is decided to shift the manhole within the neighborhood, the PIA shall construct at the place shown by the site engineer in consultation of the user.

19. Testing and Acceptance Testing:

19.1 The work shall be deemed to have been completed only after the same has been accepted by the Acceptance Testing Team of the User. The PIA shall make test pits at the locations desired by A.T. Officers for conducting test checks without any extra payment. The PIA shall restore the pits after test measurements to its original shape. The PIA shall be responsible to provide test/measurement tools and testers for conducting various acceptance tests.

19.2 **Scope of Acceptance and Testing:** The purpose of acceptance and testing is to verify integrity of measurement and quality of work done. The A.T. Officer shall not be responsible for recording of measurements for the purpose of billing and contractual obligations. However, if the measurements taken by AT officer are found to be lesser than the measurements recorded by the officer responsible for recording the measurements, the measurement taken by AT officer shall prevail without prejudice to any punitive action against the PIA as per provisions of the contract and the officer recording the measurements. The PIA shall be obligated to remove defects/deficiencies pointed out by the AT officer without any additional cost to ITIL or to the user.

19.3 **Offering the work for acceptance and testing:** The PIA representative responsible for construction, after having satisfied himself of completion of work ready for AT for completed link shall offer the work to AT Officer of the user for conducting Acceptance and Testing. The work shall be offered for AT as soon as part of work is complete in all respects. The work against any work order can be offered for AT in a number of stages.

19.4 IT SHALL BE THE SOLE RESPONSIBILITY OF THE PIA TO GET THE WORK DONE, TESTED AND ACCEPTED BY THE USER.

20. WARRANTY:

20.1 The PIA shall warrant that the material supplied for the work for which it was responsible, shall be new and free from all defects and faults in material, workmanship and manufacture and shall be of the highest grade and consistent with the established and generally accepted standards for materials of the type ordered and shall perform in full conformity with the specifications and drawings. The PIA shall be responsible for any defects that may develop under the conditions provided by the contract and under proper use, arising from faulty materials, design or workmanship such as corrosion of the equipment, inadequate quantity of materials, deficiencies in the construction practices etc. and shall remedy such defects at his own cost when called upon to do so by

the ITIL who shall state in writing in what respect the supplies or the services are faulty. This warranty shall survive inspection or payment for, and acceptance of goods, but shall expire except in respect of complaints notified prior to such date, **twenty four months after the final Network acceptance testing and makeover of the network to the user.**

20.2 If it becomes necessary for the PIA to replace or renew any defective portion/portions of the works and material under this clause, the provisions of the clause shall apply to the portion / portions of works and or material so replaced or renewed or until the end of the above mentioned **period of twenty four months**, whichever may be later. If any defect is not remedied within a reasonable time, as prescribed by the ITIL, the ITIL may proceed to do the work at the PIA's risk and costs, but without prejudice to any other rights which the ITIL may have against the PIA in respect of such defects.

20.3 **The Cable joint shall be guaranteed for the fault free working**. In case of failure of the joint due to poor workmanship i.e. failure of joint without external damage, with in the stipulated period of warrantee, the PIA shall repair the joint(s) at his own cost within the stipulated timelines**, failing which the ITIL may carry out the repairs and compensation equivalent to five times of the approved/assessed rate of the jointing work plus the cost of materials used shall be** recovered from the PIA from his pending bill/SD or any amount due to him without prejudice to any other action as per terms and conditions of the tender. The material used to mend such defects shall be borne by the PIA.

20.4 Replacement under warranty clause shall be made by the PIA free of all charges at site including freight, insurance, cost of works and other incidental charges.

21. **AUDIT AND TECHNICAL EXAMINATION:**

21.1 ITIL shall have the right to cause an audit and technical examination of the work and the final bills of the PIA including all supporting vouchers, abstract etc. to be made after payment of the final bill and if as a result of such audit and technical examination any sum is found to have been overpaid in respect of any work done by the PIA under the contract or any work claimed by him to have been done by him under the contract and found not to have been executed, the PIA shall be liable to refund the amount of over payment and it shall be lawful for ITIL to recover the same from him in the manner prescribed in clause or in any other manner legally permissible and if it is found that the PIA was paid less or more than what was due to him under payment shall be duly reconciled between ITIL and the PIA.

21.2 Any sum of money due and payable to the PIA (including security deposit returnable to him) under this contract may be appropriated by the ITIL for the payment of a sum of money arising out or under any other contract made by the PIA with the ITIL

22. **PAYMENT TERMS:**

22.1 **Procedure for Preparation and settlement of bills:**

22.1.1 All items of work involved in the work order shall be completed in all respects before preparing the bills for the work against the work order. The details of payment of bills is enumerated as under:

Read, understood and complied with Signature of the Bidder

i) 80% progressively on completion of OFC links (Cable Laying end to end) as per entries recorded/certified in measurement Books maintained for this purpose, duly signed by the authorized representatives of the USER and authorized representative of ITIL and on receipt of the payment from customer/ end user.

ii) 10% on completion of all OFC links for any Region completed.

iii) 10% on handing/ taking over and completion of AITP (Acceptance Testing) jointly signed by authorized Board of Representatives of the USER and authorized representative of ITIL or within one year of completion of the awarded Zone.

iv) Payments shall however be linked with completion of all other activities as per Specifications, SoW, ABD and submission of material account etc. for each link, Region and Zone.

NB: 1. Payment shall be made only for the OFC laid or Erected not for the Spare loops provisioning, for maintenance etc.

2. The payment towards shadow maintenance services after 3 months of the link AT, shall be made quarterly, after deducting the LD charges levied, if any by the user on non-compliances of Maintenance, T&C towards OFC shadow maintenance.

3. The payment towards maintenance services during warranty if requisitioned, shall be from the date of start of warranty period and be paid quarterly (equally divided for the period of Warranty), after deducting the LD charges levied, if any by the user on non-compliances of Maintenance, T&C towards OFC.

22.1.2 The PIA shall prepare the final bill in triplicate after completion of the work entrusted after acceptance and testing and submit the same to project in-charge of work. The final bill shall be prepared for all the measurements of all items involved in execution of complete work order. The PIA shall prepare the final bill containing the following details:

- The bill for all the quantities as per Measurements at the approved rates.
- Store reconciliation statement furnishing account of stores received against the **Work Order** and returned/reconciled with the designated delivery Points with requisite verifications from store in-charge or the officer in-charge of the work.
- RoW Permission copy or Security refund order as per the conditions.
- Details of recoveries/penalties for delays, damages to various departmental/Third party properties as per provisions of the contract. In case no recovery is to be made, NIL report needs to be submitted.
- Details of empty cable drums.
- Copy of the Wage Register, Attendance Register, Monthly EPF & ESI Deposit Challan may also be demanded as an option.

Read, understood and complied with Signature of the Bidder

22.2 Procedure for payment for substandard works:

22.2.1 The PIAs are required to execute all works satisfactorily and in accordance with the specifications. If certain items of work are executed with unsound, imperfect or unskilled workmanship or with materials of any inferior description or that any materials or articles provided by him for execution of work are unsound or of a quality inferior to that contracted for or otherwise, not in accordance with the contract (referred to as substandard work hereinafter), the Designated Officer in-charge shall make a demand in writing specifying the work, materials or articles about which there is a complaint.

22.2.2 **Timely action by Site-In-charge/Supervisors of PIA: Timely reporting and action, to a great extent, can prevent occurrence of substandard work, which will be difficult or impossible to rectify later on. It is incumbent on the part of PIA's Site-In-charge, supervising the work, to get rectified the defects in work in time during progress of the work.**

22.2.3 Once a defective work is pointed out to the PIA by ITIL or the User, asking the PIA to rectify/replace/remove the substandard item of work in a defined time period. After expiry of such time period, if the PIA fails to rectify/replace/remove the defect, the defects shall be got rectified/replaced/removed through some other agency at the risk and cost of the PIA.

22.2.4 Non-reporting of the substandard work in time by ITIL or the User shall not in any way entitle the PIA to claim that the defects were not pointed out during execution and as such the PIA cannot be absolved of the responsibility for substandard work and associated liabilities.

22.2.5 **Authority and Procedure to accept substandard work and payment thereof**: There may be certain items of work pointed out as substandard which may be difficult to rectify and in the opinion of ITIL Authority or user, the items in question will not materially deteriorate the quality of service provided by the construction. The payment shall be deducted on prorate basis if it has prior approval of the designated officer I/c. Else, the deduction shall be at double the rate of prorate that too only if such portion of lesser depth has been secured by way of extra protection. A working group may also be made who shall take into account the approximate cost of material/work pointed out as substandard and recommend the rates payable for substandard work or item in question. The recommendations however must be preapproved by the user.

22.2.6 Record of substandard work: The items adjudged as substandard shall be recorded properly underlined and highlighted.

22.3 No claim for delayed payment due to dispute etc: No claim for interest or damage will be entertained or be payable by the ITIL in respect of any amount or balance which may be lying with the ITIL owing to any dispute, difference or misunderstanding between the parties or in respect of any delay or omission on the part of the Engineer in charge in making intermediate or final payments or in any other respect whatsoever.

23 LIQUIDATED DAMAGES/COMPENSATION CLAUSE:

23.1 Liquidated Damages clause for Delays in the PIA's performance:

23.1.1 The time allowed for completion of the work as per work order shall be strictly adhered by the PIA and shall be deemed to be the most important aspect of the contract on the part of PIA and shall be reckoned from the day, work order is issued by ITIL. The work shall, throughout the stipulated period of contract, be proceeded with all due diligence to achieve the desired progress uniformly, and the PIA shall pay as LD for delay in execution of the work @ 0.5 % of the cost of the delayed link for each week of delay or part thereof, till it reaches 10 % value of the work awarded. Once the LD payable as above, approaches 10 (ten) percent of the cost of the work, the competent authority reserves the right to short close the work order and get the remaining work done at the risk and cost of the PIA.

23.1.2 The Minimum Expected Pace of Work:

20 KM per day.

(10 KM Per day in Hilly Terrains and City Areas)

This is an averaged output to be counted from the date of first Work order to the date of completion of the link(s) and would include local holidays/bundh days etc. But the progress has to be monitored on daily basis and the PIA shall be liable to maintain the per day average for the work done.

23.1.3 The progress of work shall be monitored Link wise and on Daily basis. Whereas, the daily expected average progress shall be as above, the minimum Link wise progress should be as below:
(a). For links up to the length of 25 KMs, the average allowed time shall be @1 KM per day per link, beyond which the time allowed shall be @ 2KM Per day per link (beyond 25 KMs of any link).
(b). In case of encountering the rocky strata, the allowed pace shall be halved for such rocky portion.
(c). The survey reports being available before hand, the work orders shall be issued showing the time period of completion keeping link length, strata in view.

23.1.4 As already explained, the work orders shall be issued link wise and there should be no impact on the pace of work on account of number of Work Orders issued parallelly.

23.1.5 ITIL shall be in its rights to attach importance to any link(s) and PIA has to impart priority in completion of such important links.

23.1.6 The delay caused if any shall be calculated link wise, with the prioritized links first. In case of multiple work orders, the average pace of work (20 KM/day), shall guide before imposing any LD except the priority links which would fetch penalty if not completed within allowed time lines, irrespective of maintaining overall average progress.

23.1.7 The calculation for the delay caused and penalty accrued shall be done on each 30th day (Month end) from the first Work Order.

23.1.8 In case, the penalty is accrued due to slow progress of links or due to poor average, but the same is compensated in future without impacting overall project, by increased pace of progress by the PIA, it shall be optional with

ITIL to re-consider the LD imposed, by averaging the work out-put on larger period of calculation or with multiple number of links.

23.1.9 PIA needs to make efforts and arrange RoW for all the links in the awarded zone immediately after award of the tender and would not demand grace in meeting the above time lines for execution of OFC Laying work.

23.2 A special onetime, 30 days period may be allowed for submitting and approving the survey reports.

23.2.2 Although the completion of any link is linked with the signing of the MB and acceptance of the link for Ist phase of payment by the User, but in cases of the link being final as per the report of ITIL and is no action is pending to be taken by the PIA but the AT of the link is not taken up or completed by the user, the delay for the LD purposes for such link shall cease. However, such link shall not be considered as commissioned till accepted by the user.

23.2.3 The days on which work is not done due to reasons beyond the control of PIA, such as natural calamities, law & order situation, local Government's proclamation etc; as accepted by the user, shall not be counted towards penal delay.

23.2.4 The closure or slowing of work on account of expected seasonal changes or mass movement such as Flood, Snow, other public functions in the awarded Zone shall not be a valid reason for claiming relaxation in time lines of work. The PIA shall plan the work in such a way so as to maximize the work output in the available working window.

23.2.5 LD for delay in completion of the work shall be recoverable from the bills of the PIA and/or by adjustment from the security deposit (PBG) or from the bills of any other contract. However, adjustment from security deposit will be made only when the contract has been terminated or at the time of final settlement of bills on completion of work.

23.2.6 The sequence of work order(s) for any route or section shall be as chosen by the work awarding authority. PIA would not claim to ask for any section or route to be executed first.

23.2.7 In case of slow progress of the work in a Zone or region of the Zone, awarded to a particular PIA, if the user interest does not permit extension of time limit for completion of the work, then ITIL will have the full right to restrict the scope of the contract, to such fraction of the work as it may deem fit in the interest of the project and get the balance work executed at the risk and cost of the PIA. All such payments shall be recovered from the PIA's pending bills or security deposit.

23.2.8 ITIL reserves the right to cancel the contract and forfeit the security deposit if the PIA fails to commence the work within 10 days after issue of the work order or as the time permitted by the competent authority.

23.2.9 The slow pace of work shall be a reason enough to award the work to alternate agency.

24 PROTECTION OF LIFE AND PROPERTY AND EXISTING FACILITIES:

24.1 The PIA is fully responsible for taking all possible safety precautions during preparation for and actual performance of the works and for keeping the construction site in a reasonable safe condition. The PIA shall protect all life and property from damage or losses resulting from his construction operations and shall minimize the disturbance and inconvenience to the public.

24.2 If the excavation of trench alters the contours of the ground around road and highway crossing in such locations become dangerous to traffic, the PIA shall at

his own cost, take all necessary precautions to protect public and shall comply with all the ITIL regulations as to placing of warning boards (Minimum size 3' x 2'), traffic signals, barricades, flags etc. at such location. If the PIA does not put the warning signal as per above directions, then a compensation of Rs. 500/- per day shall be levied on the PIA, till the directions are compiled by the PIA. The PIA shall take due precautions to avoid damages to other pipe lines, water, mains, sewers, telephones, telegraphs and power conduits, laid wires poles and guy wires, railways, highways, bridges or other underground or above ground structure and/or property crossing or adjacent to the cable trench being excavated.

24.3 The PIA shall restore the cut portions of BT/Concrete roads to their original conditions immediately on completion of the pipe laying works. If the restoration work is not satisfactory with reference to the standards prescribed by the Corporation/ Highways/respective RoW granting authority, the amount equal to the charges as claimed by the Corporation/Highways will be recovered from the PIA.

24.4 Attention of the PIA is drawn to the rules regarding laying of cables at road crossing, along Railways Bridges, Highways safety precautions while working in Public Street. The PIA in writing shall obtain the detailed engineering instructions from the Designated Officer of the area.

If the PIA does not provide the barricades, warning cones, warning tapes and work notice board, the same shall be provided by ITIL and 1.5 times of the cost of the items shall be recovered from the PIA apart from the penalty accrued on non compliance.

24.5 The PIA shall be solely responsible for location through approved non-destructive means and ensuring the safety of all existing underground pipeline, electrical cables, and or other structures.

24.6 The PIA shall be solely liable for all expense for and in respect of repairs and / or damage occasioned by injury of or damage to such underground and above structures or other properties and undertake to indemnify the ITIL from and against all actions, cause of actions, damages, claims and demands what-so-ever, either in law or in equity and all losses and damages and costs (inclusive between attorney and client), charges and expenses in connection therewith and / or incidental thereto. The PIA shall take all responsibilities and risks in crossing other pipelines and cables and shall be responsible for protecting all such existing pipelines, poles, electric lines, sewers, cables or other facilities from damage by the PIA's operation in connection with the work. The PIA without cost of the ITIL shall promptly repair any damage incurred.

24.7 The current market value of any commodities lost as a result of any damage to the aforesaid existing facilities shall be paid by the PIA together with such additional sums necessary to absolve the personal of property damages, resulting there from.

24.8 PIA Shall restore the cut / damage portion carried for HDD/execution work of BT/concrete road to their original condition on completion work at their own cost.

Read, understood and complied with Signature of the Bidder

25 Penalty/Compensation

25.1 Compensation/Penalty for causing inconvenience to the Public:

25.1.2 To ensure progress during the execution of work and to cause minimum inconvenience to the public, PIA shall cause to lay duct/cable and close such trenches expeditiously. The PIA shall not leave the trenches open for more than 24 hours at a stretch in a route at a time and should take due precautions to avoid any mishap. In case of any accident, the PIA shall be fully responsible for the same and any compensation imposed on this account by any statutory authority shall be paid by the PIA. In case of failure to pay the same by the PIA it shall be recovered from his pending payment/security deposit.

25.1.3 The PIA shall not be allowed to dump the empty cable drums/waste materials in Govt./public place, which may cause inconvenience to Govt./Public. If the PIA does not dispose off the empty cable drums/waste materials within 3 days of becoming empty, the ITIL is at liberty to dispose off the drum in any manner deemed fit along with the costs incurred by the ITIL in disposing off such materials. The ITIL may also levy a compensation up to Rupees ten thousand for each such default/incident.

25.2 Compensation for cutting / damaging the old cables/Burried Properties:

25.2.1 Compensation for cutting/damaging the old cables:

During excavation of trench utmost care is to be taken by the PIA, so that the existing underground cables/Pipes/lines/properties are not damaged or cut. In-case any damage/cut is done to the existing cables, a compensation as per the schedule and procedure of the agency put to loss and inconvenience caused has to be compensated/settled by the PIA. Besides the above penalty/compensation, the PIA shall carry out such repairs for restoration of the damaged cables/Pipes/properties free of charge and to the satisfaction of the person or agency concerned. In case of damage to the cables of the user, apart from the damage compensation, the cost of jointing kits, shall also be borne by the PIA. If PIA fails to repair the damage, the cost of repair (including cost of Labour + Material) and any other damages if any, shall be recovered from the PIA.

25.2.2 Penalty to damage stores/materials supplied by the ITIL while laying:

The PIA while taking delivery of materials supplied by the ITIL at the designated place shall thoroughly inspect all items before taking them over. In case of execution of the work, if any material is found damaged/working unsatisfactorily, then a penalty equivalent to the cost of material + 10% as penalty shall be recovered from the PIA's payments/securities.

However, PIA will not be penalized for any manufacturing defect or poor workmanship of the material supplied by ITIL, which shall however be intimated immediately on receipt.

26 LABOUR WELFARE MEASURES AND WORKMAN COMPENSATION:

26.1 Obtaining License before commencement of work:

The PIA shall ensure all labor regulations and follow the relevant Contract Labour Act and the Contract Labour Regulations, Minimum Wages act etc before commencement of the work, and continue to have a valid license as required until the completion of work. The PIA shall also abide by the provisions of the Child Labour (Prohibition and Regulation) Act. Any failure to fulfill the statutory requirements may attract the penal provisions in this contract and PIA shall be fully responsible.

26.2 **INSURANCE:**

Without limiting any obligations or liabilities, the PIA shall at his own expense, take and keep comprehensive insurance including third party risk for the plant, machinery, men, materials etc. brought to the site and for all the work during the execution. The PIA shall also take out workmen's compensations insurance as required by law and undertake to indemnify and keep indemnified the ITIL from and against all manner of claims and demands and losses and damages and cost and expenses that may arise in regard to same or that the ITIL may suffer or incur with respect to and / or incidental to the same.

27. COMPLIANCE WITH LAWS AND REGULATION:

27.1 During the performance of the works the PIA shall at his own cost and initiative fully comply with all applicable laws of the land and with any and all applicable by-laws rules, regulations and orders and any other provisions having the force of law made or promulgated or deemed to be made or promulgated by the Government, Governmental agency or ITIL, municipal board, Government of other regulatory or Authorized body or persons and shall provide all certificates of compliance therewith as may be required by such applicable law, By-laws, Rules, Regulations, orders and / or provisions. The PIA shall assume full responsibility for the payment of all contributions and payroll taxes, as to its employees, servants or agents engaged in the performance of the work specified in the PIA documents. If the PIA shall require any assignee or sub-PIA to share any portion of the work to be performed hereunder, the same may be assigned, sub-leased or sub-contracted to comply with the provisions of the clause and in this connection the PIA agrees as to undertake to save and hold the ITIL harmless and indemnified from and against any/all penalties, actions, suits, losses and damages, claims and demands and costs (inclusive between attorney and client) charges and expenses whatsoever arising out or occasioned, indirectly or directly, by failure of the PIA or any assignee or sub-PIA to make full and proper compliance with the said by-laws, Rules, Regulations, Laws and Order and provisions as aforesaid.

27.2 The PIA shall also comply with the rule and regulation of EPF & ESI as per government rule and regulation from time to time at his own cost and expenses. The PIA shall indemnify the ITIL from any act or action in future or during the course of work in this regard at his own cost and expense. ITIL reserves the right to withhold an amount from the bills of PIA/security deposit to comply with any such direction which may be so issued by any authority or statutory body in case of non-compliance of these rule and regulation by the PIA.

28. TOOLS AND PLANTS

The PIA shall provide at his own cost all tools, plants appliances, implements, measuring instruments etc. required for proper execution of works. The PIA shall also supply without charge the requisite number of persons with the means and

materials necessary for the purpose of setting out works, counting, weighing and assisting the measurements for examination at any time and from time to time. The PIA shall be responsible to make all arrangements, at his own cost for dewatering of trenches / ducts and de-gasification of the ducts before carrying out the work. The PIA shall also be responsible to make arrangements at his own cost, for water required for carrying of works at sites including curing of CC/RCC works, failing which the same may be provided by the Designated Officer-in-charge of ITIL at the expense of the PIA and the expenses shall be deducted from any money due to the PIA under this contract or otherwise.

29. Rescission / Termination of Contract :

29.1 **Circumstances for rescission of contract:** Under the following conditions the Tender Issuing Authority may rescind the contract:

i. If the PIA commits breach of any item of terms and conditions of the contract.

ii. If the PIA suspends or abandons the execution of work and the engineer in-charge of the work comes to conclusion that work could not be completed by due date for completion or the PIA had already failed to complete the work by that date.

iii. If the PIA had been given by the officer-in-charge of work a notice in writing to rectify/replace any defective work and PIA fails to comply with the requirement within the specified period.

iv. PIA, either directly or through their employees or agents commits any breach of their obligations hereunder.

v. PIA, either directly or through their employees, violates the confidentiality of the information of ITIL or the user, Uses or divulges any documents, data, or other information to its own formation not directly involved in the work execution or to any third party.

vi. Such suspension or termination is necessary, in the sole discretion of ITI, to comply with:

• any applicable law, regulation or court order, the Rules

• Security requirements,

• Legal proceeding or settlement which may affect ITI or any of its affiliates.

• Revelation of a fact proving information submitted by the PIA during bid process to be as false.

29.2 Before effecting the final termination, all the pending financial issues have to be settled between PIA and ITI Ltd. In such a case, PIA shall peacefully handover all the executed portions of the project and works on ‘as is where is basis’ including all the material, documentation and all the records etc. so that implementation of the project do not get adversely impacted. In such a situation, PIA shall not be entitled for any compensation and/or claim whatsoever.

29.3 Upon rescission of the contract, the security deposit of the PIA shall be liable to be forfeited and shall be absolutely at the disposal of the ITIL as under:

29.3.1 Measurement of works executed since the date of last measurement and up to the date of rescission of contract shall be taken in the presence of the PIA or his authorized representative who shall sign the same in the MB. If the PIA or his authorized representative do not turn

up for joint measurement, the measurement shall be taken by ITIL officer, authorized for this purpose after expiry of due date given for joint measurement. The measurement taken by the officer so authorized shall be final and no further request for joint measurement shall be entertained.

29.3.2 The unused material (Supplied by the ITIL) available at site, shall be transported back by the ITIL to the Store at the risk and cost of the PIA. If any such material is found damaged/lost then the compensation shall also be recovered from the PIA as per conditions in tender documents/bid.

29.3.3 The un-executed work shall be got executed through any other PIA/agency approved in the city or adjoining area or anywhere else in the same state or other state by ITIL at the approved rates of that particular area/city/state or to execute the work directly, as is convenient or expedient to the ITIL at the risk and cost of the PIA. In such an event no compensation shall be payable by the ITIL to the PIA towards any inconvenience/loss that he may be subjected to as a result of such an action by the ITIL. In this regard the decision of ITIL shall be final and binding. In all these cases, expenses which may be incurred in excess of the sum which would have been paid to the original PIA if the whole work had been executed by him shall be borne and paid by the original PIA and shall be deducted from any money due to him by the ITIL under the contract or his any other account whatsoever anywhere in the ITIL or from a security deposit.

29.3.4 The certificate of the Designated Officer in-charge of work as to the value of work done shall be final and conclusive against the PIA, provided always that action shall only be taken after giving notice in writing to the PIA.

29.4 Termination for Insolvency:

The ITIL may at any time terminate the Contract by giving written notice to the PIA, without any compensation to PIA, if the PIA becomes bankrupt or the level of solvency declined as declared and shown at the time of bidding or otherwise insolvent as declared by the competent court provided that such termination will not prejudice or affect any right or action or remedy which has accrued or will accrue thereafter to the ITIL.

Such action may also be initiated on deterioration of financial strength of the PIA as claimed during the bid process such as solvency and liquidity.

29.5 Optional Termination by ITIL (other than due to default of the PIA):

29.5.1 The ITIL may, at any time, at its option cancel and terminate this contract by a written notice to the PIA, in which event the PIA shall be entitled to payment for the work done up to the time of such cancellation.

29.5.2 In the event of the termination of the contract, the PIA shall forthwith clear the site of all the PIA's materials, machinery and equipment and hand over possession of the work / operations concerned to the ITIL or as the ITIL may direct.

29.5.3 The ITIL may, at its option, cancel or omit the execution of one or more items of work under this contract or any part of such items without any compensation, whatsoever, to the PIA.

29.5.4 The notice for rescission of contract to the PIA shall expressly state the precise date and time from which the rescission would become effective. The following safe guards shall be taken while issuing the final notice.

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i. During the period of service of notice and its effectiveness, the PIA should not be allowed to remove from the site any material/equipment belonging to the ITIL.
ii. The PIA shall give in writing the tools and plants he would like to take away/remove from the site. Such of the materials as belong to him and which may not be required for future execution of balance work may be allowed by the Designated Officer in-charge of work to be removed with proper records.
iii. No new construction beneficial to the PIA shall be allowed.
iv. Adequate ITIL security arrangement in replacement of the PIA watch and ward shall be made forthwith.

30. **FORCE MAJEURE:**

30.1 If any time, during the continuance of this contract, the performance in whole or in part by either party or any obligation under this contract shall be prevented or delayed by reason of any war, or hostility, acts of the public enemy, civil commotion sabotage, fires, floods, explosions, epidemics, quarantine restrictions, strikes, lockouts or act of God (Herein after referred to as events) provided notice of happenings of any such eventuality is given by either party to the other within 21 days from the date of occurrence thereof, neither party shall by reason of such event be entitled to terminate this contract nor shall either party have any such claim for damages against the other in respect of such non-performance and work under the contract shall be resumed as soon as practicable after such event may come to an end or cease to exist, and the decision of the ITIL as to whether the work has been so resumed or not shall be final and conclusive, provided further that if the performance, in whole or part of any obligation under this contract is prevented or delayed by reason of any such event for a period exceeding 60 days, either party may, at his option terminate the contract.

30.2 Provided also that if the contract is terminated under this clause, the ITIL shall be at liberty to take over from the PIA at a price to be fixed by the ITIL, which shall be final, all unused, undamaged and acceptable materials, bought out components and stores in the course of execution of the contract, in possession of the PIA at the time of such termination of such portions thereof as the ITIL may deem fit excepting such materials, bought out components and stores as the PIA may with the concurrence of the ITIL select to retain.

31. ARBITRATION:

31.1 **ARBITRATION (Applicable in case of supply orders/Contracts with firms, other than Public Zone Enterprise)** (Not applicable in cases valuing less than Rs. 5 lakhs)

Except as otherwise provided elsewhere in the contract, if any dispute, difference, question or disagreement arises between the parties hereto or their respective representatives or assignees, in connection with construction, meaning, operation, effect, interpretation of the contract or breach thereof which parties unable to settle mutually, the same shall be referred to Arbitration as provided hereunder:

i. A party wishing to commence arbitration proceeding shall revoke Arbitration Clause by giving 60 days' notice to the designated officer of the other party. The notice invoking arbitration shall specify all the points of disputes with details of the amount claimed to be referred to arbitration at the time of invocation of arbitration and not thereafter. If the claim is in foreign currency,

the claimant shall indicate its value in Indian Rupee for the purpose of constitution of the arbitral tribunal.

ii. The number of the arbitrators and the appointing authority will be as under:

Claim amount (excluding claim for counter claim, if any)	**Number of arbitrator**	**Appointing Authority**
Above Rs. 5 lakhs to Rs. 5 crores	Sole Arbitrator to be appointed from a panel of arbitrators as may be fixed by ITIL.	ITIL (Note: ITIL will forward a list containing names of three arbitrators to the other party for selecting one from the list who will be appointed as sole arbitrator by ITIL)
Above Rs. 5 crores	3 Arbitrators	One arbitrator by each party and the 3rd arbitrator, who shall be the presiding arbitrator, by the two arbitrators. ITIL will appoint its arbitrator from its panel.

iii. Neither party shall appoint its serving employee as arbitrator.

iv If any of the Arbitrators so appointed dies, resigns, becomes incapacitated or withdraws for any reason from the proceedings, it shall be lawful for the concerned party/arbitrators to appoint another person in his place in the same manner as aforesaid. Such person shall proceed with the reference from the stage where his predecessor had left it both parties' consent for the same; otherwise, he shall proceed de novo.

v. Parties agree that neither party shall be entitled for any pre-reference or pendente-lite interest on its claims. Parties agree that any claim for such interest made by any party shall be void.

vi. Unless otherwise decided by the parties, Fast Track procedure as prescribed in Section 29 B of the Arbitration Conciliation Act, 1996 and amended in 2015 for resolution of all disputes shall be followed, where the claim amount is upto Rs. 5 crores.

vii. The Arbitration proceeding shall be held at Bengaluru.

viii. Subject to the aforesaid conditions, provisions of the Arbitration and Conciliation Act, 1996 amended in 2015 and any statutory modifications or re-enactment thereof shall apply to the arbitration proceedings under this clause.

32. SET OFF:

Any sum of money due and payable to the supplier (including security deposit refundable to him) under this contract may be appropriated by the purchaser or the ITIL or any other person(s) contracting through the ITIL and set off the same against any claim of the Purchaser or ITIL or such other person or person(s) for payment of a sum of money arising out of this contract or under any other contract made by the supplier with the Purchaser or ITIL or such other person(s) contracting through the ITIL. In case of set off of the security deposit against any claim of the purchaser or ITIL or such other person or person(s) for payment of a sum of money arising out of this contract or under any other contract made by the supplier with the Purchaser or ITIL or such other person(s) contracting through the ITIL, the GST on such set off will be borne by the supplier. GST would not be liable on security deposit. But if supplier's security deposit is set off against any claim of the purchaser or ITIL or

such other person or person(s) for payment of a sum of money arising out of this contract or under any other contract made by the supplier with the Purchaser or ITIL or such other person(s) contracting through the ITIL, then GST would be levied on such amount as being set off".

33. Indemnity:

The PIA shall fully indemnify and defend ITIL and its representatives & employees and hold ITIL, its representatives, employees harmless from the following :-

33.1 Damages and losses caused by its negligent or intentional act or omission or any damages and losses caused by the negligent act of any third party or agency engaged by the PIA;

33.2 Damages or compensation payable at law in respect of or in consequence of any accident or injury to any workman or other person engaged by PIA.

33.3 Damages and losses resulting from the non-compliance with the established obligations; Third Party claim against ITIL or its nominated agency that any Deliverables/Services/Equipment provided by the PIA infringes a copyright, trade secret, patents or other intellectual property rights of any third party in which case the PIA shall defend such claim at its expense and shall pay any costs or damages that may be finally awarded against ITIL or its nominated agency.

33.4 If any Deliverable is or likely to be held to be infringing, the PIA shall at its expense and option either (i) procure the right for ITIL to continue using it, or (ii) replace it with a non-infringing equivalent, or (iii) modify it to make it non-infringing.

33.5 Any environmental damages caused by it and/or its representatives or employees or employees of any third party or agency engaged by the PIA;

33.6 Abundant care shall be taken by the PIA to ensure safety of all the patrons, public persons and work force employed or associated during the execution of the project from the ill effects of epidemics like COVID-19 by taking all necessary precautionary measures as stipulated by the Local agencies and the Government and also comply the SOP issued by Ministry of Home Affairs.

33.7 Breach (either directly by it or through its representatives and/or employees) of any representation and guarantee declared herein by it;

33.8 From any and all claims, actions, suits, proceedings, taxes, duties, levies, costs, expenses, damages and liabilities, including attorneys' fees, arising out of, connected with, or resulting from or arising in connections with the services provided due to neglect omission or intentional act.

33.9 Any liability or penalty (including taxation issues) which may be imposed by the Central, State or Local Authorities.

34 Liability of the PIA towards the Purchaser:

34.1 Except in case of gross negligence or willful misconduct on the part of the PIA or on the part of any person or company acting on behalf of the PIA in carrying out the Services, the PIA, with respect to damage caused by the PIA to ITIL resulting in bodily injury, death or damage to physical property with respect to all claims arising under this Contract, shall in aggregate not be liable to ITIL:

(i) For any indirect or consequential loss or damage; and

(ii) For any direct loss or damage that exceeds the total payments payable under this contract to the PIA hereunder.

34.2 This limitation of liability shall not affect the PIA liability, if any, for direct damage to Third Parties resulting in bodily injury, death or damage to physical property caused by the PIA or any person or firm/company acting on behalf of the PIA in carrying out the Services. Notwithstanding anything stated to the contrary in the tender, Limitation of liability, including for direct damage to Third Parties, shall be to the extent of 100% of the total cost of the project calculated up to and as on the date when such section / clause is required to be invoked.

35. Transfer of Ownership:

35.1 The PIA must transfer all titles to the assets and goods procured for the purpose of the project to the end user.

35.2 In case of any loss/damage to the Material or any equipment due to any reason before the transfer of ownership, the same shall be made good at the cost of PIA.

36. Confidentiality:

36.1 The PIA shall not use Confidential Information, the name or the logo of the ITIL except for the purposes of providing the Service as specified under this Tender;

36.2 The PIA shall not, either during the term or after expiration of this Contract, disclose any proprietary or confidential information relating to the Services, Contract or the network architecture, User's deployment/Link details or other plans and operations at all to any third party.

36.3 The PIA may only disclose Confidential Information in the following circumstances:
with the prior written consent of the ITIL;

(i) to a member of the PIAs' Team ("Authorized Person") if:

a) the Authorized Person needs the Confidential Information for the performance of obligations under this contract;

b) the Authorized Person is aware of the confidentiality of the Confidential Information and is obliged to use it only for the performance of obligations under this contract.

36.4 The PIA shall sign a Non-Disclosure Agreement (NDA) with the ITIL on mutually agreed terms & conditions. The PIA and its antecedents shall be bound by the NDA. The PIA shall be responsible for any breach of the NDA by its antecedents or delegates.

36.5 PIA shall notify the ITIL promptly if it is aware of any disclosure of the Confidential Information otherwise than as permitted by this Contract or with the authority of the ITIL.

36.6 The ITIL reserves the right to adopt legal proceedings, civil or criminal, against the PIA in relation to a dispute arising out of breach of obligation by the Bidder(s) under this clause.

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37. Suspension of Work:

37.1 The PIA shall, if ordered in writing by the ITIL, temporarily suspend the works or any part thereof for such a period and such a time as ordered, then PIA shall not be entitled to claim compensation for any loss or damage sustained by him by reason of temporary suspension of the works as aforesaid but shall be eligible for the payment (of products/services delivered and accepted as per the instructions of ITIL) during the suspension period as per contract.

37.2 An extension of time for completion, corresponding with the delay caused by any such suspension of the works as aforesaid shall be granted to the PIA after having due concurrence of end user, if request for same is made and that the suspension was not consequent to any default or failure on the part of the PIA.
37.3 In case the suspension of works is not consequent to any default or failure on the part of the PIA and lasts for a period of more than 2 months, the PIA shall have the option to request the ITIL to terminate the Contract with mutual consent.

38. No Assignment:

The PIA shall not transfer any interest, right, benefit or obligation under this Contract without the prior written consent of the ITIL.

39. Successors:

39.1 This contract is personal to PIA and shall not be assignable by PIA without the prior written consent of ITIL.

39.2 PIA shall not appoint subcontractors to perform any part of the Services under the Agreement, without ITIL's prior written consent.

39.3 ITIL may assign its rights under this Agreement, without the prior consent of PIA, to any successor in interest to ITIL, whether by way of merger, reorganization or sale of assets (including any sale of a line of business).

39.4 This Agreement shall inure to the benefit of and be binding upon ITIL and its successors or assigns.

40. Integrations:

PIA shall at all times carry out his scope of work and implementation of the project in a close integration with ITIL and the USER and their representatives.

41. Survival:

The provisions of the clauses of this Contract in relation to documents, property, Intellectual Property Rights, indemnity, publicity and confidentiality and ownership survive the expiry or termination of this Contract and in relation to confidentiality, the obligations continue to apply unless the ITIL notifies the PIA of its release from those obligations.

42. Entire Contract:

The terms & conditions laid down in the RFP and all the annexures thereto as also the Bid and any attachments/annexes thereto shall be read in consonance with and form an integral part of this Contract. This Contract supersedes any prior Contract, understanding or representation of the Parties on the subject matter.

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43. Severance:

In the event any provision of this Contract is held to be invalid or unenforceable under the applicable law, the remaining provisions of this Contract shall remain in full force and effect.

44. Publicity:

The PIA shall not make or permit to be made a public announcement or media release about any aspect of this Contract unless the ITIL first gives the Bidder/PIA its written consent.

45. Waiver:

45.1 Any waiver of any provision of this Contract is ineffective unless it is in writing and signed by the Party waiving its rights.

45.2 A waiver by either Party in respect of a breach of a provision of this Contract by the other Party is not a waiver in respect of any other breach of that or any other provision.

45.3 The failure of either Party to enforce at any time any of the provisions of this Contract shall not be interpreted as a waiver of such provision.

46. Modification:

Any modification of this Contract shall be in writing and signed by an authorized representative of each Party.

47. Time is of Essence:

Time shall be of the essence in respect of any date or period specified in this Tender or any notice, demand or other communication served under or pursuant to any provision of this Tender and in respect of the completion of the Services by the PIA by the completion date.

48. Access to Premises:

From time to time PIA or its employees may access Sites to deliver or install Materials or perform Services. PIA shall fully familiarize itself with ITIL and end user's applicable customer's safety, security and conduct rules and regulations at any Site. PIA shall take appropriate care of any property owned by ITIL and its customers which is in PIA's custody, care, or control; and, such care shall not be less than that taken by PIA with respect to its own similar property (but in no event shall less than due care be employed) and PIA shall be responsible for any loss of, or damage to, such property while in the custody, care or control of PIA.

49. Construction and Interpretation of Agreement:

The language in all parts of this Agreement shall in all cases be construed simply, as a whole and in accordance with its fair meaning and not strictly for or against any Party. The PIA hereto acknowledges and agree that it has been given the opportunity to independently review this tender with legal counsel, and that PIA has the requisite experience and sophistication to understand, interpret and agree to the particular language of the provisions hereof. Accordingly, in the event of an ambiguity in or dispute regarding the interpretation of this this tender or the contract emanating as its result, shall not be interpreted or construed against ITIL.

50. Governing Law:

This Contract shall be governed in accordance with the laws of India.

51. Jurisdiction of Courts:

The courts of India at Bengaluru have exclusive jurisdiction to determine any proceeding in relation to this Contract.

--- END OF SECTION-VIII ---

Read, understood and complied with Signature of the Bidder

SECTION IX: SPECIAL (COMMERCIAL) CONDITIONS OF THE TENDER

1. GENERAL:

1.1 The ITIL reserves the right to disqualify such bidders who have a record of not meeting contractual obligations against earlier contracts entered into with the ITIL.

1.2 The ITIL reserves the right to black list a bidder for a suitable period in case he fails to honor his bid or submits false certificates or false bank instruments to defraud ITIL and to faulter ITIL's bidding process. Such black listing or disqualification order would be for a minimum period of one year and maximum for three years.

1.3 No consortium partner shall be allowed.

1.4 The ITIL reserves the right to counter offer price(s) against price(s) quoted by any bidder.

1.5 Any clarification issued by ITIL, in response to query raised by prospective bidders shall form an integral part of bid documents and it may amount to amendment of relevant clauses of the bid documents.

1.6 While considering the experience of any bidder having executed underground OFC Laying in hilly terrains, the average HASL of the ends of any link with Via Stations points enroute, executed by the bidder shall be taken to assess the eligibility. The enroute points chosen to prove the average height of any route would not be more than five and be spreaded evenly from the end points. The links/routes having average minimum HASL not qualifying the minimum eligibility criteria for the zone, shall not be considered for counting the total Hilly terrain experience.

In the cases, where the HASL of some route/points is not easily available, the average HASL of the district(s) having such route shall be considered.

1.7 Tender will be evaluated as a single package of all the items given in the price schedule for each Zone separately.

1.7.1 Any bidder can bid for any number of Zones but can be awarded maximum two Zones choosing only one out of Zone I and Zone III (i.e. Zone-I and Zone-III can't be awarded to a single bidder).

(a).	The financial bids shall be opened in a sequence of Zone-I, followed by Zone-II and then Zone-III.
(b).	A bidder, if participated in both Zones, Zone I and Zone III and if declared L-1 in Zone-I, shall not be eligible for his bid opening in Zone-III.
(c).	Zone -II shall be awarded to the Lowest eligible bidder irrespective of above.

1.8 The work in each Zone or Link to be executed by ITIL may be split up between two or more sub-zones or may accept any bid in part and not in its entirety, if considered expedient by ITIL management before award or after award of the work.

1.9 All works to be done under the contract shall be executed as per the direction and subject to the approval in all respects of the Designated Officer or Site Engineer in-charge of Link who shall be entitled to direct at what point or points and what manner they are to be commenced.

1.10 The work shall be accepted only after Acceptance Testing carried out by ITIL and the USER team, as per prescribed testing schedule and work/material passing the inspection test successfully.

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1.11 If the PIA shall desire an extension of time for completion of the work on the grounds of unavoidable hindrance in execution of work or any other ground, he shall apply in writing to the Designated Officer on the same day of occurrence of hindrance on account of which he desires such extension as aforesaid. In this regard the decision of ITIL shall be final.

1.12 If at any time after the commencement of the work, ITIL feels that execution of whole or part of work, as specified in the tender is not required to be carried out, then the ITIL shall give notice in writing of the fact to the PIA who shall have no claim to any payment of compensation whatsoever on account of any profit or advantage which he might have derived in consequence of the full amount of the work not having been carried out neither shall he have any claim for compensation by reason of any alterations having been made in the original specifications, drawings, designs and instructions which shall involve any curtailment of the work as originally contemplated.

1.13 After the work commences, the PIA or his authorized representative(s) shall always be present at the site. The representative shall be authorized by the Designated Officer in-charge based on the PIA's request.

1.14 The Right of Way (RoW) shall be obtained by the successful PIA on behalf of the User, including various permissions from authorities like water, power, utilities, traffic police before start of execution of work. The RoW charges shall be reimbursed by the User against the proof of payment which has been approved by the user and paid by the PIA. The work shall be carried out as per terms and conditions and timelines mentioned in the RoW permission. The PIA shall deploy adequate men and machine so as to complete the work within permitted time.

1.15 Since the pace of progress is also linked with the RoW, same shall be given highest priority and shall not be delayed on want of submission of RoW charges which shall be paid by the PIA first and to be re-imbursed by the User on submission of invoices/bills on case to case basis.

1.16 If the work is not progressing as per the schedule, the work may be either restricted or terminated.

1.17 After the ducts are laid by either Open trenching method or by HDD, the duct integrity test shall be carried out immediately on the same day or by next day to facilitate the PIA to commence the manhole work.

1.18 If any one or more number of ducts are found to fail the duct integrity test, additional laying/ HDD of pipe/s shall be carried out by the PIA at no extra cost. The cost of the damaged pipe(s) shall be recovered from the PIA with overhead charges if incurred.

1.19 The fact that the PIA is working simultaneously in more links in the same Zone or in other Zone, will not absolve him from the responsibility of completing the work in time allocated for the ordered Link.

1.20 The price quotes have been asked link wise in all the zones. It is a common prudence that the terrains having higher altitudes and rocky strata would demand more efforts and expenditure to accomplish. In case it is observed that the links falling in difficult terrains/ areas have been quoted with lower price than those falling in comparatively plain and soft strata shall be termed as non-serious bids and shall be liable for rejection. This shall be applicable particularly for Zone I and Zone III.

2. QUALITY OF WORK:

The User shall be the final judge of the quality of the work and the same has to meet the satisfaction of the ITIL as per the specifications laid down for the purpose. Laxity or failure to enforce compliance with the contract documents by the ITIL and / or its representative shall not manifest a change or intent of waiver, the intention being that,

notwithstanding the same, the PIA shall be and remain responsible for complete and proper compliance with the contract documents and the specification therein. The representative of Tender Issuing Authority has the right to prohibit the use of men and any tools, materials and equipment which in his opinion do not produce work or performance to meet the requirement of the contract documents.

3.Incidentals:

IN general, provision has been made for executing all the activities involved in the OFC network envisaged, however following eventualities shall be inclusive with or without additional remuneration:

i) No additional charges, for laying of Second duct in the same trench if required to be laid within 0.05% of the total route length, beyond which this shall be payable @ 5% of the per KM charges, fixed for the main Supply & Service Items for the respected geographical area.

ii) No additional charges for the leading-in OFC in the premises of the user, without trenching/HDD, for a fraction of 0.05% of the total route length, beyond which this shall be payable @ 5% of the per KM charges, fixed for the main Supply & Service Items for the respected geographical area. The leading in shall be done as per the standards prescribed for the internal wiring specifications for OFC laying such as FTTH.

iii) There may be circumstances wherein, the substantial time is lapsed between the OFC Link completion and the final acceptance of the network and start of the Warranty phase. During this intervening period, the PIA would be obliged to provide shadow maintenance to the executed OFC links by it so as to keep the links always ready for Acceptance Test and ready for use without any additional cost to ITIL. However, if this waiting phase extends beyond a period of 03 (Three) months after a link passes first phase of acceptance (completion of Link as per MB signed by User for 80% payment after receipt of payment from end user/customer), the PIA shall be eligible for prorate 25% of the Maintenance charges for such link(s) per KM as agreed against the Warranty Maintenance for the respective Zone. The links shall be maintained by PIA and have to be always kept ready for use and may be put to Test for vouching it's working status. In case any such link is not maintained or deteriorates during this shadow maintenance period, the PIA would be required to restore it and shall be levied with penalties as per Clause (j) and (k) of Appendix B of Annexure-VII. The OFC parameters shall be recorded at the onset of Shadow Maintenance as per Table 8 (i) of Part-III, OFC Maintenance at Appendix "A" of Annexure VII which shall be measured and recorded quarterly and needs to be within permissible limits with reference to the initial records.

iv) All the material and services required for the maintenance of the OFC links shall be the responsibility of the PIA except the OFC cable and HDPE duct. The OFC and HDPE duct shall be supplied to the PIA on imprest basis @ 1% of the RKM of the Links completed, to be reconciled and recouped after the same is exhausted by 50%. The PIA would require to give the details and account of each incidence consuming the OFC and duct out of the said imprest stock. In case this material is consumed on any activity caused due to carelessness or default of PIA and same shall be charged to the account of PIA. The imprest stock shall be handed over to PIA from a pre-determined node/place in the Zone.

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v) A usual wastage allowance towards jointing/spoilages etc for HDPE duct supplied by ITIL shall be allowed @ 2.5% and for the OFC @ 0.5% of the link KMs completed, shortages beyond this shall be chargeable.

4. **TAXES AND DUTIES:**

PIA shall pay all rates, levies, fees royalties, taxes and duties payable or arising from out of, by virtue of or in connection with and/or incidental to the contract or any of the obligations of the parties in terms of the contract documents and / or in respect of the works or operations or any part thereof to be performed by the PIA and the PIA shall indemnify and keep indemnified the ITIL from and against the same or any default by the PIA in the payment thereof. However, service tax (GST) shall be paid extra by ITIL as applicable.

5. AWARD OF CONTRACT & DISTRIBUTION OF WORK:

5.1 The ITIL shall consider Zone wise award of contract to L-1 bidder whose offer has been found technically, commercially and financially acceptable. The L-1 bidder is one whose overall quote is the lowest for the quoted Zone. However, the competitiveness and genuineness of L-1 rates shall be an underlined criterion before acceptance of such rates and efforts may be made to reach such rates with the L-1 bidder.

5.2 Should there be an eventuality that the pace of progress is not coming from the deployed PIA(s) in any of the Zone as a whole or with some links of a Zone and the LDs are mounting towards outer limits, ITIL shall resort to awarding the whole or part of such work to alternate PIA at Risk & Cost of the defaulting PIA. The alternate PIA may be chosen from amongst the bidders who were technically qualified in the process of this very tender for the Zone under consideration or for any other Zone by inviting separate competitive financial bids for such pending work from such interested bidder Companies/Entities. Cost escalation if happens in this process, shall be recoverable from the faltering PIA(s) of such Zone/Link(s).

5.3 The work needs to be executed link wise, once the work order(s) for the link(s) to be executed is issued by ITIL. The PIA cannot demand the work order for specific link(s) for what so ever justification. The work orders may be restricted if unfinished links are pending for the reasons of the PIA. The site encumbrances if any, needs to be managed by the PIA and shall not be the acceptable cause for the pending links. The decision and judgement of Designated Site In-charge of ITIL shall however be final in all such cases of issue of Work order(s).

6. Supply and Maintenance of Stores:

6.1 ITIL shall be responsible to supply HDPE duct and Optical Fibre Cable as per the pace of work and need/request from the PIA. Generally, these items shall be manufactured/supplied by ITIL at various factories of ITIL and shall be transported to ITIL's temporary Warehouse/**Delivery Points** which shall be one per 1000 KMs work awarded (Fractions to be rounded off to the nearest integer). These delivery points can be mutually decided between ITIL and the PIA but shall generally be located in plain areas of the awarded zone, within in one or more states falling in that zone. The PIA shall make arrangements of receiving the material from such delivery points, arrange to issue receipts at such delivery points and carry the material to the actual work site or to it's temporary storage yard with a suitable arrangement to take care of GST/Tax compliances. ITIL shall have no objection if the PIA makes a tie up with the ITIL's transporter to carry the stores further from

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such Delivery Points at it's cost. The PIA shall provide the forecast of material requirement at least a month in advance, based on the work plans and progress.

6.2 The supply of HDPE Duct and OFC cable shall generally be made against the specific Link(s) as requisitioned by ITIL and RoW already arranged for the link. PIA needs to keep pace and account of the material received and consumed, link wise. The PIA shall not divert the material issued for specific link or part of the link, towards unauthorized link(s) unless such re-allocation is allowed by ITIL. The security of the material laid or kept in its stock shall be the responsibility of the PIA and if the stores received, accounts to more than 20% of the laid, PIA may be asked to submit a separate PBG against the stores demanded.

6.3 In case any quantity of HDPE Duct or OFC cable issued by ITIL, is lost, wasted or consumed unaccounted, same shall be charged to the PIA's account @ Rs.50/Mtr for duct and @ Rs.100/Mtr for OFC cable.

IN CASE OF ANY CONFLICT BETWEEN GENERAL COMMERCIAL CONDTIONS AND SPECIAL COMMERCIAL CONDITIONS OF TENDER, LATTER SHALL PREVAIL.

----- END OF SECTION IX ----

Read, understood and complied with Signature of the Bidder

SECTION X:

GENERAL OFC CONSTRUCTION PRACTICES

1. The detailed survey of all the links in the awarded zone needs to be carried out by the PIA for the implementation of the project. The ROW for assigned Links/Zone as per the survey, needs to be applied and arranged after assent of the User. Considering existing ground utilities and terrain conditions, a detailed layout plan shall be submitted by PIA for ITIL/User's acceptance. Survey plan shall have detailed drawings, GIS information based, route maps in KMZ/KML and in the given formats (The necessary GIS hardware and software shall be arranged by ITIL). Once route plan is verified and approved, PIA has to coordinate and pursue with the relevant departments of government or concerned authority or local authority for ROW permission for creation of the fiber network. PIA needs to do required documentation for ROW application. PIA will be responsible for getting ROW permission (wherever required) in time, to match delivery timelines. The request letters shall be prepared in favour of the concerned RoW granting authorities on behalf of the user with and without references of ITIL and PIA as instructed by site in charge or by way of general instructions in this regard. ROW charges, payable to the RoW granting authorities against their invoice/demand letter, shall be paid initially by the PIA which shall be reimbursed by the user. The RoW shall be applied and obtained for the entire duration of the project (10 Years from the date of final makeover to user after N/W AT). A repository of (Photocopy) of ROW payment will be maintained by PIA and ROW payment receipts from various ROW agencies mentioning link wise details (distances etc) including the period covered will be submitted along with the bill for reimbursement.

2. OFC Links will be laid for creating the Access and Back-bone of Army's Communication Network. OFC network route will be laid to connect various Nodes via pre-decided routes. Activities will include but not limited to survey of routes, deployment of HDD machine, open trenching, Manhole/Chamber fixing, coupler fixing, OFC pulling in duct and sporadic overhead laying as per Tender construction guidelines. Choice of Implementation through HDD method or Open trench method or Aerial and side of the road shall be negotiable with ITIL or the end user's representative, whose decision shall prevail in case of any conflict. Implementation of Optical fiber cable network with HDD method or Open trench method or Aerial method and side of laying will be finalized before the issue of work order.

3. OFC data base shall be created during the laying of route. Following attributes of the optical fibre cable will be included. These attributes, will be upgraded during each iteration, while developing the application: - (a) Route Chart, Month/Year of laying, Details of Terminations, Nodes, Route layouts-waypoints, type of OFC (number of fibers), important landmarks, Crossings/Bridges/Man-holes, Fibre patching/joints, distance from last joint, etc. Number of joints along a given route with exact location (Eight-Figure Grid-Reference) also required.

4. The work which shall be carried out as per the Construction Specifications contained in this Tender document. In case of any doubt or conflict, Engineering Instructions and specifications annexed shall generally be referred.

5. Supply of material for creation of OFC network except HDPE pipes and OFC cable and FDF shall be arranged by the PIA as per the make/model/specifications.

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In case of specific make ITIL shall fix the ceiling price after negotiating with the Source(s) of such item(s) and PIA shall be free to arrange such items but with the assured Quality at any rate but not more than the ceiling price in it's own interest. It may be kept in mind by the PIA that each and every store used in the network has to be of best quality and reliability which shall not only be put to rigorous testing by the user but also needs to support the network for at least 10 years and the same needs to be assured from the source of such supplies.

6 For understanding Execution of the project in detail, bidder is advised to go through the Construction Specification & Guidelines as annexed.

Other Terms:

- Gantt chart/road Map of delivery visibility of each route should be submitted by PIA.
- PIA should give DPR (Daily Progress Report) along with as per the format shared by the User/ITIL. This can be modified as per requirement from time to time
- PIA to share material requirement for next month by 7th of current month and should provide rolling forecast for 3-month requirement.
- PIA's corresponding payment may be withheld and separate PBG asked, if Fiber/Duct/FDF Material inventory exceeds > 20% than used.
- Line Amplifiers/Repeaters wherever needed on the way (at in between stations), FDF needs to be installed as per the plan/Survey approved by User/ITIL.
- Dedicated resources to be employed for daily progress report, MIS and Inventory management etc.

THESE ARE GENERAL CONSTRUCTION PRACTICES OF OFC. IN CASE OF ANY CONFLICT BETWEEN THESE AND SPECIFIC TECHNICAL SPECIFICATIONS AT ANNEXURE-I, LATTER SHALL PREVAIL.

----- END OF SECTION X ----

Read, understood and complied with Signature of the Bidder

SECTION-XI: LIST OF DOCUMENTS TO BE SUBMITTED AS A PART OF THE BID

Check list of documents/information to be submitted with the bid:	
a.	Bidder's Profile.
b.	Certificates of Incorporation/ Partnership deed
c.	Memorandum & Articles of Association.
d.	Audited financial statements for the last 3 years. (2017-18, 2018-19 & 2019-20) and CA certificate in case of Unaudited report of 2019-20 with an undertaking to submit the audited report, soon it is available.
e.	Certificate from Statutory Auditor/CA specifying the Annual Turnover from Telecom Infrastructure services during last three years (2017-20).
f.	EMD (for a Value as indicated in **Table-I)** in the form of DD or BG valid for 150 days from a Nationalized / Scheduled bank as per format at **Annexure-III** (in case of EMD being in BG form)
g.	Experience Certificates: Work Order / Agreements of the Project along with completion certificates clearly highlighting Scope of the Work (SOW), Bill of Material (BOM), cost of the Project(s) with specific mention of the cost towards OFC laying (Underground and Aerial, separately) and the area of work to ascertain the geography towards claim of experience in Hilly terrains, where applicable. The experience as required to meet eligibility conditions during the last 5 years only (period ending 31st March 2020), shall be considered.
h.	Net Worth positive and the bidder company being profitable,certificate for the last 3 years (2017-20).
i.	Liquidity certificate from the banker for the minimum amount as mentioned at Table-I
j.	GST Registration Certificate.
k.	Copy of PAN Card.
l.	CIN (Corporate Identity Number).
m.	Self-declaration in **Annexure-VI.** non barring from business on account of blacklisting etc.
n.	Authorization letter in the bidder company's letterhead authorizing the person signing the bid for this Tender and Power of Attorney (POA).
o.	Clause by clause compliance to all the terms and conditions.
p.	Undertaking in letter head to indemnify ITIL from any claims / penalties / statutory charges, liquidated damages, with legal expenses etc.
q.	NDA (Non-Disclosure Agreement) as per **Annexure-IV** (to be submitted in advance to obtain the Link details)
r.	List of Node Locations/Links for the Network execution, follow-up and obtaining the RoW for and on behalf of the user (After Signing NDA).
s.	Pre-Contract Integrity Pact **Annexure –V**
t.	A detailed exhibit on the "Approach and Methodology", bidder proposes to adopt if the project is awarded to it, refer Section IX Clause 2.

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u.	List of Tools & Implements such as JCB, HDD M/Cs, Splicing Machines etc as mentioned in table-I with ownership proof by the bidder.
v.	Self-certified list of Employees for being on rolls of the bidder as per table-I, with verifiable EPF & ESI Details.
w.	An undertaking to submit PBG along with LOI acceptance for 10 % of the contract value valid for 36 months, extendable further till onset of warranty phase.
x.	Financial Bid Formats **Annexure-IX**
y.	BOM for Delivery of OF Links **Annexure-VII**
z.	Warranty SLA and Testing/Inspection Requirements **Annexure-VIII**
aa.	All other docs as mentioned in this Tender elsewhere.

Note:

- All the documents to be submitted separately with each bid for each Zone irrespective of bidder being common.
- ITIL or its nominee reserves the right to cross check / validate the authenticity of the documents submitted and the information provided in the Pre-qualification and Eligibility criteria. The requisite support to prove the claims must be provided by the Bidder failing which the supporting document shall be taken as not proved followed with attached consequences of false claim.

----- END OF SECTION XI ----

Read, understood and complied with Signature of the Bidder

SECTION-XII: GLOSSARY

Abbreviation/ Acronym	Description
ABD	As Built Diagram
ITIL	ITI Limited
User	Director General of Signals
RoW	Right of Way
HDPE-PLB	Pre Lubricated-High Density Polyethylene
FTF	Fibre Termination Frame
HH	Hand Hole
MH	Man Hole
AITP	Acceptance & Inspection Procedure
GIS	Geographic Information System
PIA	Project Implementation Agency
KMZ/KML	Keyhole Markup Zip/ Keyhole Markup Language
FDF	Fibre Distribution Frame
GI Pipe	Galvanized Iron Pipe
MAF	Manufacturer Authorization Form
OFC	Optical Fibre Cable
BRO	Border Road Organization
MES	Military Engineering Service
NHAI	National Highway Authority of India
PWBG	Performance cum Warranty Bank Guarantee

Read, understood and complied with Signature of the Bidder

ANNEXURE-I

Technical Specifications

SPECIFICATIONS FOR OPTICAL FIBRE CABLE LAYING WORKS

1. Bidders are required to quote single all inclusive rate per Km per link. for complete works which includes survey/Re-survey of the routes, preparation of survey reports, obtaining RoW permissions, trenching / HDD, HDPE duct laying, providing mechanical protection, OF Cable blowing, splicing of joints, placing of RCC splicing chamber / MH's, Route indicators, electronic indicators, providing GI pipes over bridges, RCC pipes at road crossings, Fibre Termination Boxes/Fibre Distribution Frames and acceptance testing, complete end to end in all respects **including supply of all required materials except HDPE Duct, 24F OF Cable and FDF which will be supplied by ITI.**

(i) Execution of the work and stores supplied shall be as per DoT/TEC (BSNL) specification.

(ii) Trenching shall be at minimum depth of 1.65 m then HDPE duct be laid without twists.

(iii) Trenches shall be filled with soft excavated soil 300mm thick over the laid HDPE Duct, then mechanical protection of bricks of compressive strength not less than 50 kg / sq.cm. shall be provided, longitudinally for one duct and transversally for more ducts, there after trenches can be filled up with excavated earth with warning tape laid at specified depth from ground level.

(iv) In rocky area depth of the trench shall be made min 900 mm by chiseling / cutting etc and protection of GI pipe with sockets etc. 50 mm nominal bore, medium class shall be provided.

(v) At bridges, flyovers etc; GI Pipe 50 mm nominal bore, medium class with minimum one hole per feet shall be provided and covering GI pipes with cement concrete 1:2:4 (1 Cement: 2 Sand: 4 aggregate) minimum 75 mm thick around GI pipe or clamping with MS clamps of heavy duty.

(vi) In trenching works at road crossing RCC Hume pipe NP-2 class of 100 mm dia or GI pipe 50 mm nominal bore, medium class with cement concrete 1:2:4 (1 Cement: 2 Sand: 4 aggregate) 75mm thick shall be provided.

2.0 If HDD (horizontal direction drilling) method is adopted then minimum depth shall be 1.65 Mtrs.

3.0 (i) Digging of pit for pre-cast jointing chamber of internal diameter of 1.2 meter and minimum height of 1.0 meter with 1.50m base and top cover of 1.3 Mtr. dia or as per specific design and dimensions of specifications. Cable loop of at least 40 Mtrs shall be left in pull through chambers of the same size. RCC chambers shall be plastered inside and filled with river sand after splicing of joints/ loops. Top cover of splicing chamber shall be marked ARMY OFC with enamel paint in inscribed.

(ii) Where the precast chamber is not possible to place/ available then brick chamber may be constructed after approval from User/Engineer In Charge by digging of pit of size

2meter x 2 meter x 1.8 meter (depth) for construction of jointing chamber at approximately every one kilometer of internal size of 1.5 meter x 1.5 meter x 1.2 meter using bricks and mortar or fixing, filling of jointing chamber with clean sand, placing either pre-cast RCC cover or stone of suitable size on jointing chamber to protect the joint and back filling of jointing chamber with excavated soil.

(iii) RCC route indicator shall be provided at every 200 Mtrs., wherever the route changes direction, both ends of road crossings and also at every splicing chamber / loop chambers. RCC route indicator shall be painted with red paint at joint chambers, others with yellow paint and painted with white in engraved with specific words to be informed separately. The height is 1250 mm., with base 300mmX300mm tapering to 150mmX150mm.

4.0 (i) OF cable blowing work shall be executed immediately after laying of HDPE duct and the work to be completed in continuation from start point without leaving any patches.

(ii) Fiber termination boxes (FTB)/ (FDF) of approved make and customized, shall be fixed and OFC be spliced at both the ends of the link then acceptance testing shall be carried out jointly with ITI and Army reps.

(iii) An as-built diagram of the OFC route has to be prepared as per the requirement of the Engineer in Charge/ITIL and submitted in duplicate (both soft and hard copies) by the PIA upon completion of the work. OTDR tracing indicating overall db losses, splice losses and related details shall also be submitted by PIA after completion of link and AT.

5.0 Measurement book shall be recorded simultaneously during execution of work indicating on site work details, in association with ITI's / Army's reps and finally shall be submitted to ITIL.

6.0 (i) All stores required for execution of the work shall be got tested and approved by Engineer in Charge before execution of the works.

(ii) Stores required to be supplied by ITIL for execution works such as HDPE Duct and OF Cable, shall be supplied and may be stored at nearest Network Node. The average distance from the Site of work (Node end of the Link) shall be about 250 KMs. Further transportation of stores to the work site, by PIA at no extra cost to ITIL.

LAYING PRACTICES OF OPTICAL FIBRE CABLE

The following practices as prescribed by DoT/TEC (BSNL)shall be adopted to execute the work:

Ser. No.	Name of Engineering Instruction	Reference No
01	Laying Practices of Optical Fibre Cable Local Area Network Optical fiber Cable	D – 001 Issue No IV Dated 31 Jan 2007

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02	Laying Practices of Optical Fibre Cable by HDD (Horizontal Directional Drilling) Method	TR/OFC/A-001 Issue No 01 Dated 31 Jan 2007
03	Provision of Hand Hole in Case of HDD on OFC Laying	TR/COFC/I-004 Issue No 1 04 Oct 2011
04	Micro -Tunnelling for Laying of O.F.Cable	TR/COFC/A-002 Issue No 01 Dated 22 Feb 2010
05	Installation Practice of Self Supporting Metal Free Aerial Optical Fibre Cable	TR/COFC/I-001 Issue No 01 Dated 10 Jun 2011

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यांत्रिक अनुदेश
ENGINEERING INSTRUCTION

LAYING PRACTICES OF OPTICAL FIBRE CABLE
LOCAL AREA NETWORK, OPTICAL FIBRE CABLE

(NO. D – 001)

पृष्ठसंख्या (No of Pages)	:	21
जारी क्रमांक (Issue Number)	:	IV
जारीकर्ता (Issued By)	:	T&D, Circle
अनुमोदित (Approved By)	:	CGM T&D Circle
जारी करने का दिनांक (Date of Issue)	:	31/01/2007

संशोधन क्रमांक (यदि कोई) (Amendment No. If Any):
(Note: Issue I Dated 5/9/97, Issue II Dated 11/07/2005
Issue III Dated 03/12/2005, Issue IV Dated 31/01/2007)

पृष्ठ संशोधित (Page Nos. Amended)	: 5,6,10
जारीकर्ता (Issued By)	: T&D, Circle
अनुमोदित (Approved By)	: CGM T&D Circle
जारी करने का दिनांक (Date of Issue)	: 31/01/2007

केवल भारत संचार निगम कर्मचारियों के उपयोग हेतु
(Restricted use by BSNL Employees only)

All efforts have been made to incorporate all relevant up to date information available, any discrepancies or need for addition or deletion is felt necessarily may please be intimated to this office for further improvement, on E-Mail Id agmnt1_tnd@rediffmail.com.

BSNL Connecting India

भारत संचार निगम लिमिटेड,
(भारत सरकार का उपक्रम)
तकनीकी एवं विकास परिमंडल,
(आई.एस.ओ. 9001 : 2000 प्रमाणित)
संचार विकास भवन,
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मध्यप्रदेश -482001

BHARAT SANCHAR NIGAM LIMITED
(A Govt. of India Enterprise)
TECHNICAL & DEVELOPMENT CIRCLE,
(ISO 9001:2000 Certified)
SANCHAR VIKAS BHAWAN,
RESIDENCY ROAD,
JABALPUR,
MP-482001

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LAYING PRACTICES OF OPTICAL FIBRE CABLE

1. **SCOPE**

1.1 This Engineering instruction deals with the methods to be adopted in laying of HDPE pipes for Optical Fibre Cable and laying of optical Fibre Cable. The following laying practices are to be adopted.

2. **DETAILED SURVEY:**

A detailed measurement of lengths of cable route along with details of rail/road crossings, culverts, causeways etc. "may be recorded in the detailed survey register. The probable location of joints, terminations and repeaters may also be decided and marked on the road map.

2.1 On the basis of surveys, general permission from road and rail authorities for laying the Optical Fibre Cable along the suitable roads and at particular rail / road crossings will have to be obtained. Generally, O.F. Cable may preferably be laid straight as far as possible along the road near the boundaries, away from the burrow pits. When the O.F. Cable is laid along the National Highways, Cable should run along the road land boundary or at a minimum distance of 15 meters from the center line of the road where the road land is wider.

In special cases where it may be necessary to avoid burrow pits or low lying areas, the Cable may be run underneath the shoulders at a distance of 0.60 meter from the outer edge of the road embankment provided the same is located at least 4.5 meters away from centre line of road and 1.2 meter below the road surface.

3.0 General:

3.1 Soil Categorization:

Soil is categorized only under two broad categories i.e. "Rocky" and "Non Rocky", for purpose of deciding the depth at & which the cable is to be laid. The soil is categorized as rocky if the cable trench cannot be dug without blasting and / or chiseling. All other types of soils shall be categorized as “Non rocky” including Murrum & soil mixed with stone or soft rock. However for the purpose of execution of trenching contracts, project authorities may classify the soil in more than one group and decide contractual obligations suitably.

3.2 Types of pipe to be used for Optical Fibre Cable:

Optical Fibre Cables should be pulled through Permanently Lubricated HDPE Duct of 40 mm-OD and 33 mm ID Pipe in 500/1000 Meter Coil which meets the specification as given in G/R No-G/CDS-08/01 Dec 99 with latest amendments shall only be used for laying the O.F. Cable. Wherever DWC pipe or GI pipes or R.C.C. pipes are used for protection, the two ends of the pipe should be properly sealed to protect HDPE pipe from sharp edge of GI pipe and to bar the entry of rodents. For providing additional protection Split RCC/GI pipes should be used from top instead of full RCC/GI pipes.

Use of normal duty DWC (Double walled corrugated) HDPE pipe – ISI marked and antirodent conforming to IS 14930 (Part - II) can also be utilized as preferable choice due to economic consideration for protection of optical fibre cable (choosing suitable DWC

from nominal OD/ID dia. 90/76 or 120/103 as decided by the Engineer in Charge). It is recommended that where ever OFC is passing over the ground surface (exposed outside) and more prone to damage 50mm dia. GI pipe may to be used.

Depending upon the site conditions and cost consideration one of the protection viz DWC/ GI / RCC pipe may be used as approved by ITI / User.

4.0 All Depths should be measured from the top of pipe. However, the depth is considered acceptable if it is not less by more than 8 cm from the specified depth of 1.60 M in non rocky soil and 0.90 m in case of rocky soil. This margin of 8 cm is not applicable for the minimum depth prescribed for providing protection i.e. 1.20 m in non rocky / rocky soil and 0.50 m in case of rocky soil.

5.0 TRENCHING:

Major specifications for trenching are:

(i) Normally depth of the trench should be more by 10 cm. with respect to the depth which is required to be attained as prescribed in para 6.0.
(ii) Top and bottom width of the trench should normally be 45 cm and 30 cm respectively. In loose soils it may be necessary to increase the width at the top to avoid collapsing of trench.
(iii) Trenching wherever possible, should be at the road boundary and as far as possible, straight.
(iv) Whenever curves or deviations are encountered it should be a very smooth curve, the radius of curvature should be more than 50cm. at least.
(v) Bottom of the trenches should be at uniform level without any abrupt ups and downs. After the trenching is done for sufficient length, the bottom leveling should be inspected for uniformity to ensure that pipe should be laid without sharp bends.
(vi) In exceptional cases, the depth of the trench could be much more than 1.65 m due to undulating terrain as shown in figure (1)
(vii) In certain cases, in a uniform terrain a sudden burrow pit of short length might be encountered as in fig (2). In such cases, the HDPE pipe can be further protected by DWC / GI / RCC pipes of suitable size.
(viii) In water logged area digging should be done in shorter sections and dewatering should be got done before pipe laying.
(ix) When trenching is done close to power cables precautions should be observed.
(x) When trenching is undertaken along streets and railway lines, safety precautions should be observed.
(xi) Caution boards should be provided at each end of the trench to caution the traffic. Red flags may also be planted at suitable intervals throughout the trench. If trench is to remain open at night red lamps or luminous caution boards on either ends should be provided.
(xii) After the trench is ready, bed of trench is prepared by even & soft layer of 5.0 cm sieved earth and properly leveled. Now the trench is ready for laying the HDPE pipe.

Layinq / Construction practices

6. In cross - country routes.

6.1 Optical Fibre cables shall be laid through HDPE pipes at a depth of 1.60M as measured from top of HPPE pipe. Taking into account the diameter of the HDPE pipe and provision of soft soil below HDPE pipe, it will be desirable to have the trench dug to depth better than, 1.65 meters. In case of obstructions etc, the cables can be laid at a lesser depth provided.

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(a) A minimum depth of 0.90 is achieved in case of rocky soil.

In case of non-rocky soil where due to any obstructions in built up areas it is not possible to dig deeper, a minimum depth of 1.00 meter from top of pipe shall be maintained. Wherever the minimum depth of 0.9M in rocky soil cannot be adhered to, depth can further be reduced up to 0.5M but only for such cases where relaxation is approved by ITI & User concerned who have jointly visited the sites. In all such cases where the depth is less than 0.90m, mechanical protection by reinforced concrete casing 4" round should be provided.

(b) Suitable mechanical protection by using DWC / RCC / GI pipes to be provided for all cables laid at a depth less than 1.20 M. No protection, however, need be given if the cable depth is more than 1.20 M.

(c) The reasons for not laying the cable at stipulated depth of 1.50 M are recorded "and certified by the Engineer/User in charge of cable laying.

Note: Where rocky soil is encountered for a distance of 50 meters or less, the cable depth will be maintained at 1.50 m as in case of adjoining non-rocky soil.

6.2 **In hilly areas**

6.2.1 Optical Fiber cables shall be laid on the valley side where depth may be achievable, if the permission for laying the OF Cable on the valley side is available. If the permission for laying the OF Cable is not available, then OF Cable shall be laid on the hill side. The PLB pipe laid, in hilly areas at depths lower than one meter can be protected by direct concreting instead of using GI pipe and concreting thereafter. Laying of overhead OFC may be the third option. Laying of cable on valley side or overhead should be approved by ITI & User.

Normal standard of 25X25 cm of concreting cannot be followed in the hilly terrain as the groove /trench made in the rocks are generally are not of standard size of 25X25 cm. Hence the PLB pipe may be laid in the trench/groove of the requisite pipe width and at least 20 cm of concreting may be done above the pipe covering the entire width of the trench at 20 cm above the pipe.

6.3 **In built up areas**

6.3.1 City / Town, urban areas falling within municipal / Corporation limits shall normally fall under this category where the following laying / Construction practices shall be adopted. For other inhabited villages / towns etc. not falling under any municipal / corporation limits suitable cable depth/protection is to be decided jointly by ITI & User.

6.3.2 **On ducted route**

Optical fibre cables may be laid through the existing ducts wherever the ducts are available. As far as possible the cable may be diverted to the new ducts laid subsequently. When the cables are laid in ducts, no particular depth is prescribed. End of the ducts should be properly sealed and necessary protection by way of DWC / G. I. pipe / RCC

pipe should be provided at the entry and exit of the duct till the cable is buried to a depth of 1.50m. The above is applicable in town or 'any other' ducts laid cross country.

6.3.3 **On Non-ducted routes:**

As the non-ducted routes in built up areas are more vulnerable to faults due to cables / pipes of other services laid it is essential to take special care while laying optical fibre cables on these route. The OF cable shall be laid through HDPE pipes at a depth of 1.50m, and additional protection by using DWC / RCC / GI pipes shall be provided. If need be the OF cable can be laid below the cables and pipes of other agencies including local telephone cables and if required cable may be laid via alternate longer route. Only in exceptional cases the depth of cable laying may be relaxed to 1.00m in non rocky soil and 0.90m in rocky soil as in case of cross country routes, provided the reasons for not laying the cables at a stipulated depth of 1.50m are recorded and certified by ITI/User in charge of cable laying, The minimum depth of 0.90m in rocky soil may further relaxed to 0.50m for location where permission for blasting is not granted by local authorities. In all such cases mechanical protection by reinforced concrete casing 4" round shall be provided.

6.4 **On Culverts / bridges Nullahs :**

6.4.1 **Nullahs dry for nine months in a year:**

The Cable shall be laid at 1.50m depth below the bed of nullah through HDPE pipe and protection provided by using DWC of suitable dia / RCC pipe of minimum internal dia of 100mm. The DWC / RCC pipe shall extend 2M minimum beyond the end Nullah on either side. Depth of 1.50m can further be reduced depending on nature of soil & other conditions in accordance with para 6.1 & 6:2. with a view to minimize the damage to the OF Cable during flood season the cable should be laid on upstream side of causeway at an approximate distance of about 4 times than depth of the flow during high floods.

6.4.2 **On culverts / bridges over other nallahs:**

Various options are available as depicted in figures 3a, 3b, 3c, 3d & 3e for laying the O. F. Cable along the parapet wall of the culverts / bridges. One of these options may be adopted depending upon site conditions. On approach roads to these bridges / culverts also, protection by using DWC / RCC pipes shall be provided for 2M on both sides.

6.4.3 **On rail bridges / crossings:**

On rail bridges / crossings the optical fibre cables shall be laid through HDPE pipe which shall be encased in suitable cast iron / GI / RCC pipe as prescribed by Railway authorities.

6.4.4 **On road crossings**

The optical fibre cable shall be laid at a depth of 1.50m through HDPE pipe encased in DWC/RCC pipes which shall extend three meters on either side of the end road to take care of any future expansion. Depth of 1.50M can further be reduced depending on nature of soil & other conditions in accordance with para 6.1 & 6.2.

7. PIPE LAYING:

Cable laying is to be done by blowing method. However, where constraints are there, for pulling the cable manually through the pipes, it is necessary to have suitable manhole of about 02 x 02m^2 made at every 200M length and at suitable bends and corners. The

construction of manhole & jointing manhole is shown in fig. 4a and 4b. The pipes are laid for 200M or less, at a time, depending upon the distance between two manholes. For a 200M trench Single HDPE 40/33 mm is required. In addition, for closing the ends of the two extreme end pipes 2 special types of caps are also needed (fig.4c). A 4mm polypropylene rope could be drawn through the pipes and safely tied to the caps at either end with hooks. These 4mm ropes are to be provided throughout the route which could, serve to pull the l2mm rope which is ultimately required to pull the cable. Single HDPE duct of 40/33 mm of 200 M length with 2 caps and 210M of 4mm polypropylene rope drawn through them and safely tied as shown in fig. (5) would complete 200M of pipe laying. After the pipes are laid as mentioned above with ropes and leaving gaps for manholes, indicators are to be provided at the 200M gap locations to identify the manholes. Necessary offset diagrams are also required indicating the distance from the centre of the road. The depth of the trench is also to be recorded.

7.1 Laying of pipes on bridges, culverts, etc.

7.1.1 In small bridges and culverts across canals, different methods as given below could be followed.

7.1.2 If the bridge or culvert is broad and is having sufficient cushioning, the pipes can be buried inside, the cushioning as shown in fig. (6).

7.1.3 If the bridge/culvert is provided with raised and hollow foot - path or wheel guard, the pipe encased in GI can be buried inside the hollow foot - path or can be laid over the wheel guard and chambered as shown in fig. (7) and (8).

7.1.4 If the 'supporting pillars are having projections and between pillars the distance is less, then the pipes (HDPE with GI encasing could be laid over the pillar projections as shown in fig. (9)

7.1.5 If none of the solutions is possible, then outside the parapet wall, GI troughs can be fitted with suitable clamps. For smaller bridges, the HDPE pipes can be laid inside the trough. However, for long bridges, HDPE pipes need not be laid inside the trough. While laying the cable, glass wool or other cushioning items may be used. In either case, the gaps between two troughs after putting the lids should be thoroughly covered to prevent entry of rodents.

7.1.6 Special type of bridges such as cantilever type requires special type of troughs to be locally manufactured to withstand the vertical and horizontal movement of the joints of cantilever bridge.

8. ROUTE INDICATORS:

8.1 The RCC indicators embedded in concrete of specified size and shape may be provided at every 200M or at suitable bends and corners as may be required. A minimum of 30cm of its top portion should be kept above the ground level. The route indicators may be painted and numbered as directed and may be put along the road at a suitable distance away from the cable trench such that they are clearly visible from road side. Electronic markers shall also be buried at specified intervals for route indicators.

8.2 JOINT INDICATORS:

8.2.1 The RCC joint indicators embedded in concrete similar to that of Route Indicators may be provided at joint locations & may be buried in ground with at least 30cm of it above the ground level. The joint indicator may be kept along the road side clearly visible from road and may be painted red. Electronic markers shall also be buried for joint indicators.

9. DEPTH A/T:

9.1 Before the cable is actually blown / pulled through the pipe, the route should be offered for A/T of the depth and position of the cable and correctness of the route diagram. The best way should be to offer it in stretches of 10-20 kms soon after the HDPE pipe is buried.

9.2 The route diagram should be prepared and made over to the A/T unit in advance. The A/T unit will specify the spots roughly two per km for checking of depth and position of the cable, sound laying practice and prescribed protection. Wherever depths are prescribed the tolerance upto minus 8 cm is permissible. For checking accuracy of the route diagram and position of the cable, the permissible tolerance will be +/- 0.50 meter. For checking position of the cable, standard survey tapes will be used.

9.3 If the pipe is found to be at depth less than prescribed, O.F. Cable should not be drawn through HDPE pipe and pipe should be lowered to the proper depth at the locations where necessary relaxation of competent authority as mentioned in earlier paras is not available.

10.0 GENERAL PRECAUTIONS:

10.1 Handling of cable drums:

10.1.1. The optical fibre cable drums should be handled with utmost care. The drums should not be subjected to shocks by dropping etc. The drum should not be rolled along the road for long distances and when rolled, should be in the direction indicated by the arrow. The covering planks should be removed only at the time of actual laying

10.1.2. The previously laid pipes manholes and portion of bends etc. on the cable route as records maintained at the time of laying pipes, should be got cleaned of earth and the pipes may be cleaned thoroughly before pulling of cable is stared

10.1.3. Depending upon the length of the drum (1km/2km) and coiling required for jointing purposes, chain measurement is taken from the starting end of section and exact joint location is marked. If it does not fall at the existing manhole location, a separate manhole is to be made to accommodate the joint box as well as coil.. All the joint locations are fixed in a similar manner. The intermediate manholes are also to be kept ready for pulling purposes.

10.1.4. As the drums are standardized for 2km for highways, it is preferable to lay the cable by placing the cable drum at the manhole point nearest to 1km from the joint locations.

10.1.5. The standard practice to keep the clock wise end of the cable to the 'A' side of the route and the anti clock wise end to 'B' side. Also, it is the practice to have the clockwise

end on top and anticlock wise at the bottom of ' the drum. With the above in view, cable drum is to be mounted on the jack and wheel with drum shaft (Axle) in horizontal position.

10.1.6. The rope end is to be fixed at one end of a swivel (Anti-twist device) permanently or by means of a shackle. The other end of the swivel is tied to the pulling eye of the cable. If a pulling eye is not available, then a cable grip is to be used.

10.1.7. As the cable length is 2 km, during cable laying work, proper communication is to be established. This can be done with walkie talkies or mobile phones.

11.0 Precaution against damage by termites & rodents: 'In the rodent prone areas Optical fibre cable joint closures should be applied with BHC 10% dust (Benzene Hydro Chloride 10%) to prevent rodent & termite damage. The method suggested is "BHC 10% dust of 1Kg. is to be mixed in approximate 2Kg of sand and applied around the optical fibre cable joint enclosures.

12.0 CABLE LAYING:

12.1 List of tools & other items required for cable laying is given below.

This can be taken as a check list.

a) Jack - one pair
b) Rope for unloading/loading. Metallic ramp for loading / unloading.
c) Cable winch.
d) Nylon rope drum of 1250M (For machine pulling).
e) 4mm rope.
f) Swivel and Shackle.
g) pulling socks or cable grip.
h) Lubricant.
i) plastic bowls for lubricant.
j) sponge.
k) Walkie-Talkie 6 Nos.
l) Mobile phones 6 Nos.
m) Rubber 2/manhole.
n) Half round (split) pipes 2/manhole.
o) polythene tape 5m/manhole.
p) Clamps 4/prs,/manhole.
q) Cleaning brush for cleaning pipes.
r) Mandrill.

Sometimes there is considerable lapse of time between the pipe laying and cable laying. This intervening period could have heavy rains too. Therefore, there is possibility of entering dissolved muddy water into the HDPE pipes. This dissolved muddy water may

transform into a thick paste or solid mud. Cleaning of the pipes before the cable laying is absolutely necessary to remove any such obstructions. A 4mm nylon rope is already laid in HDPE pipe. One end of this rope is connected to Mandrill. The other end of mandrill is connected to another rope of 4 mm size and suitable length to cover the distance between two manholes. The existing 4 mm rope is pulled from other manhole and thus the mandrill will clear the pipes. Similar operation is then done by replacing mandrill with nylon brush and rugs.

12.2 The pulling of the cable can be done in three ways:

a) By Cable Blowing Machine (preferred)
b) By cable winch assisted by manual pulling at intermediate manholes.
c) By manual pulling at all the manholes.

12.3 For manual pulling, the rope may be attached to 9 diameter and then to the pulling eye which is fixed to the cable end by supplier. The pulling may be done either manually under close supervision watching all the time the pulling tension or by means of winch with automatic cut off at set tension monitored through dynamometer fitted in the pulling winch.

12.4 To reduce the friction between the cable and HDPE, a suitable lubricant may be continuously applied with a sponge to the cable surface during pulling at every intermediate man-hole. The types of Lubricants with their frictional co-efficient are given in the table.

12.5 As soon as 1km cable or so is pulled towards one side of the route, sufficient overlap of cable may be kept at splicing location so that the ends may be taken into the Air conditioned splicing van placed at a convenient and nearby place. 15metre cable may be the maximum requirement.

12.6 Laying the remaining half of the cable:

a) Take out the winch to the other end if, machine pulling is done.
b) Uncoil the cable and make the formation of 8. This should be done manually with sufficient care and minimum bending radius.
c) Repeat the process of connecting the end of the cable with eye or pulling grip to the swivel to which the pulling rope is attached.
d) Repeat the process of pulling the cable by winch or manual with special attention to lubricant super vision and coiling the overlapping length in the pit. .
e) The mouth of the HDPE pipes at every man hole is closed by rubber bushing as shown in fig. (10). This is mainly required for prevention of rodent entry.
f) The cable at the intermediate man holes are to be covered by split 65mm OD 10kg/cm^2 HDPE, pipes, covered with polythene tapes and clamped at 4 places, as shown in fig. 4a. Thereafter re-instatement of the man holes is to be done.

Note: - All Figures appearing in the document correspond to 40/33 mm size Permanently Lubricated HDPE Duct (in place of 50 mm OD HDPE Pipe) mentioned in the drawing/figures.

Read, understood and complied with Signature of the Bidder

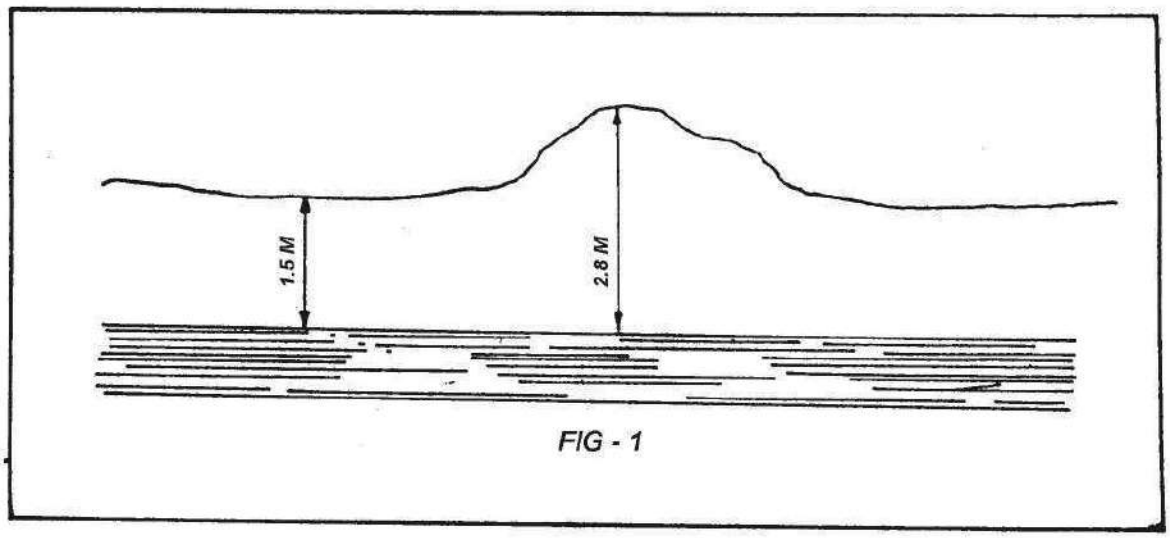

FIG - 1

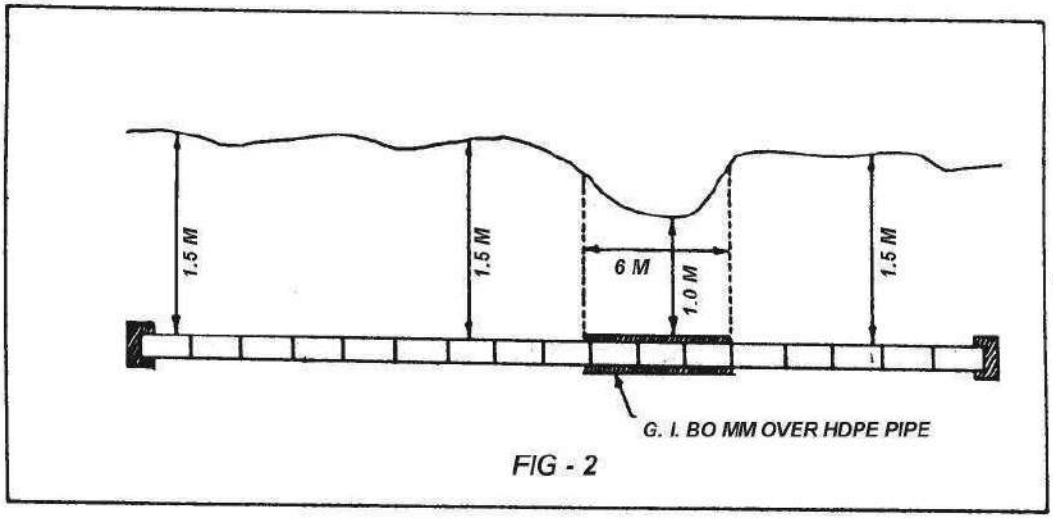

FIG - 2

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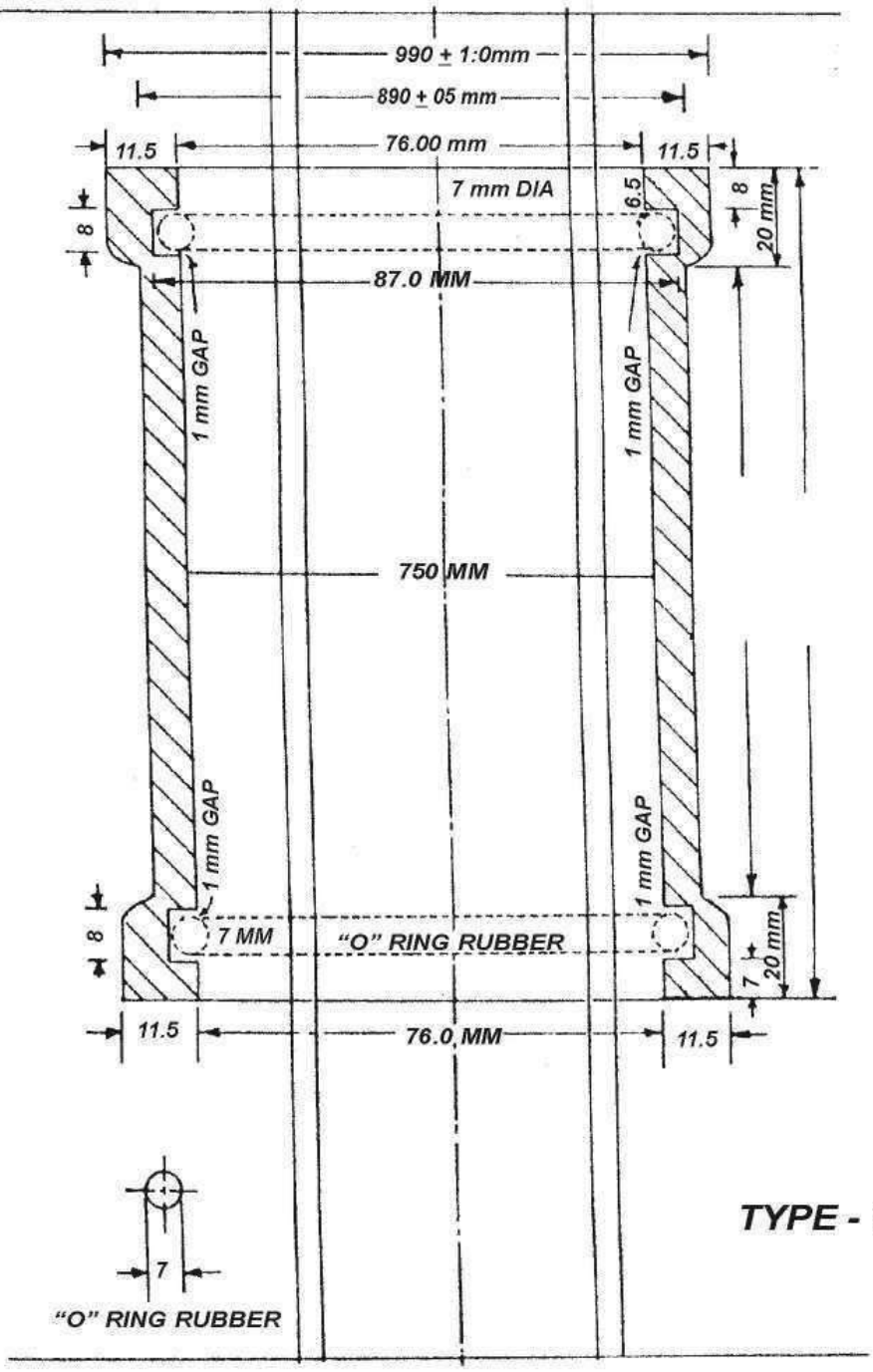

FIG - 3

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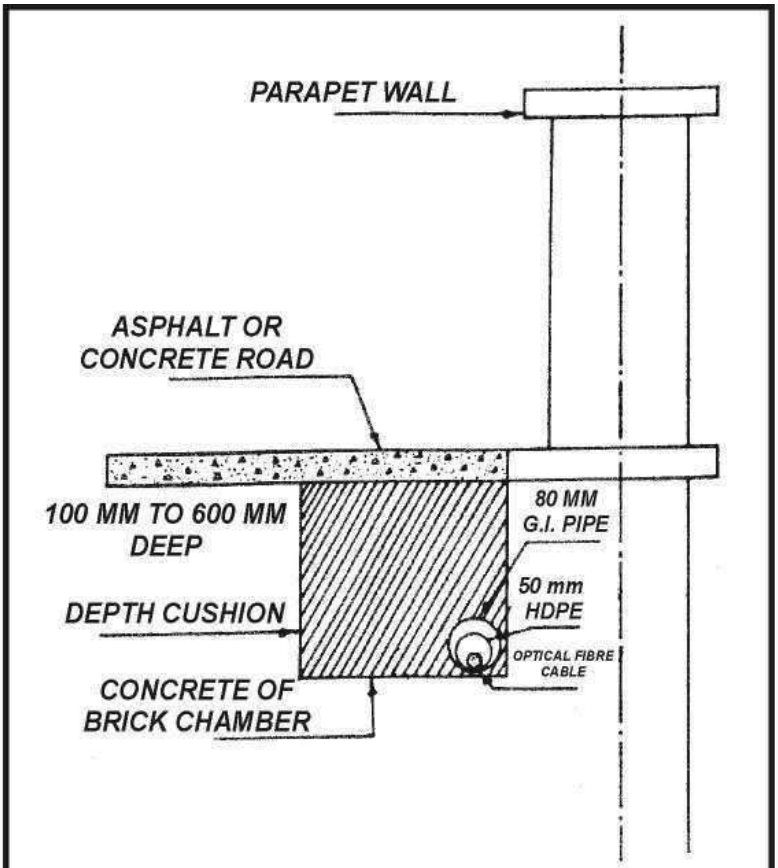
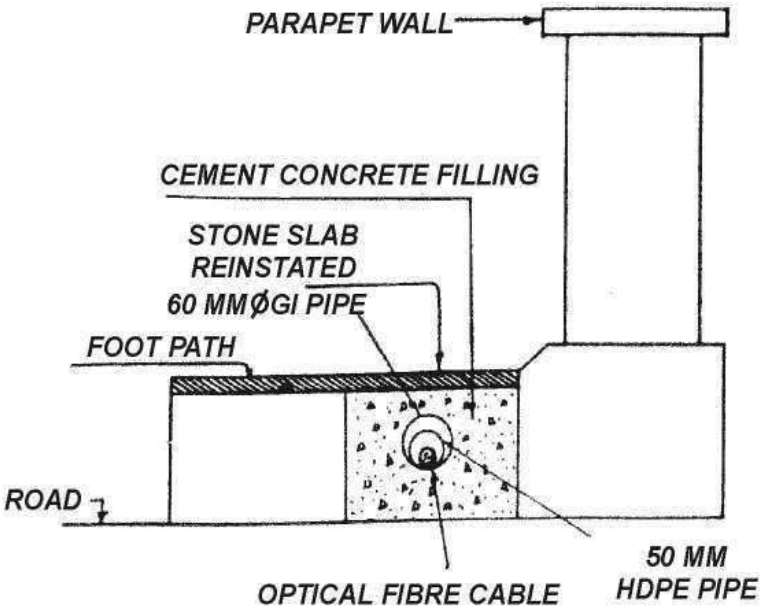


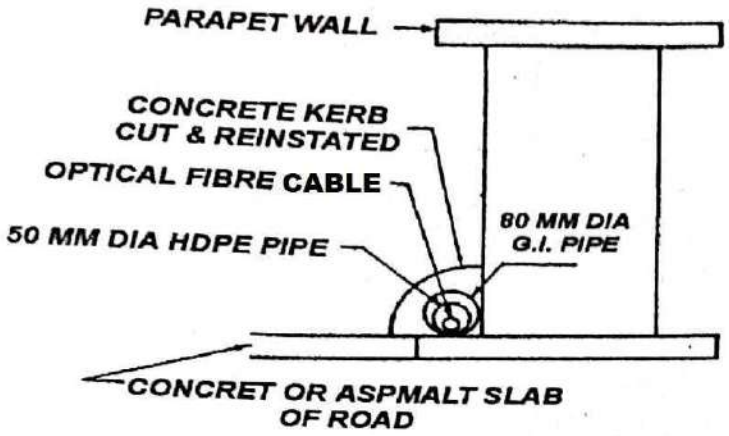
LAYING OPTICAL FIBRE CABLE IN 80 MM DIA G.I. PIPE IN EARTH CUSHION OF THE BRIDGE

FIG - 3 (a)



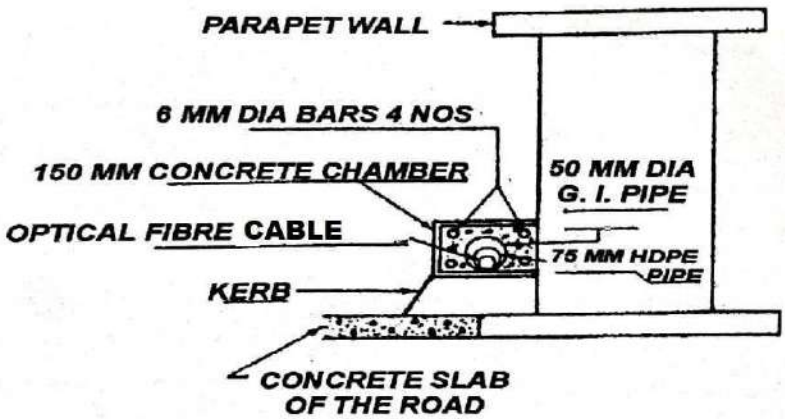
LAYING OPTICAL FIBRE CABLE IN G.I. PIPE 80 MM BELOW FOOT PATH OF THE BRIDGE

FIG - 3 (b)



LAYING OPTICAL FIBRE CABLE
IN G. I. PIPE BY CUTTING THE EXISTING KERB
OF THE BRIDGE

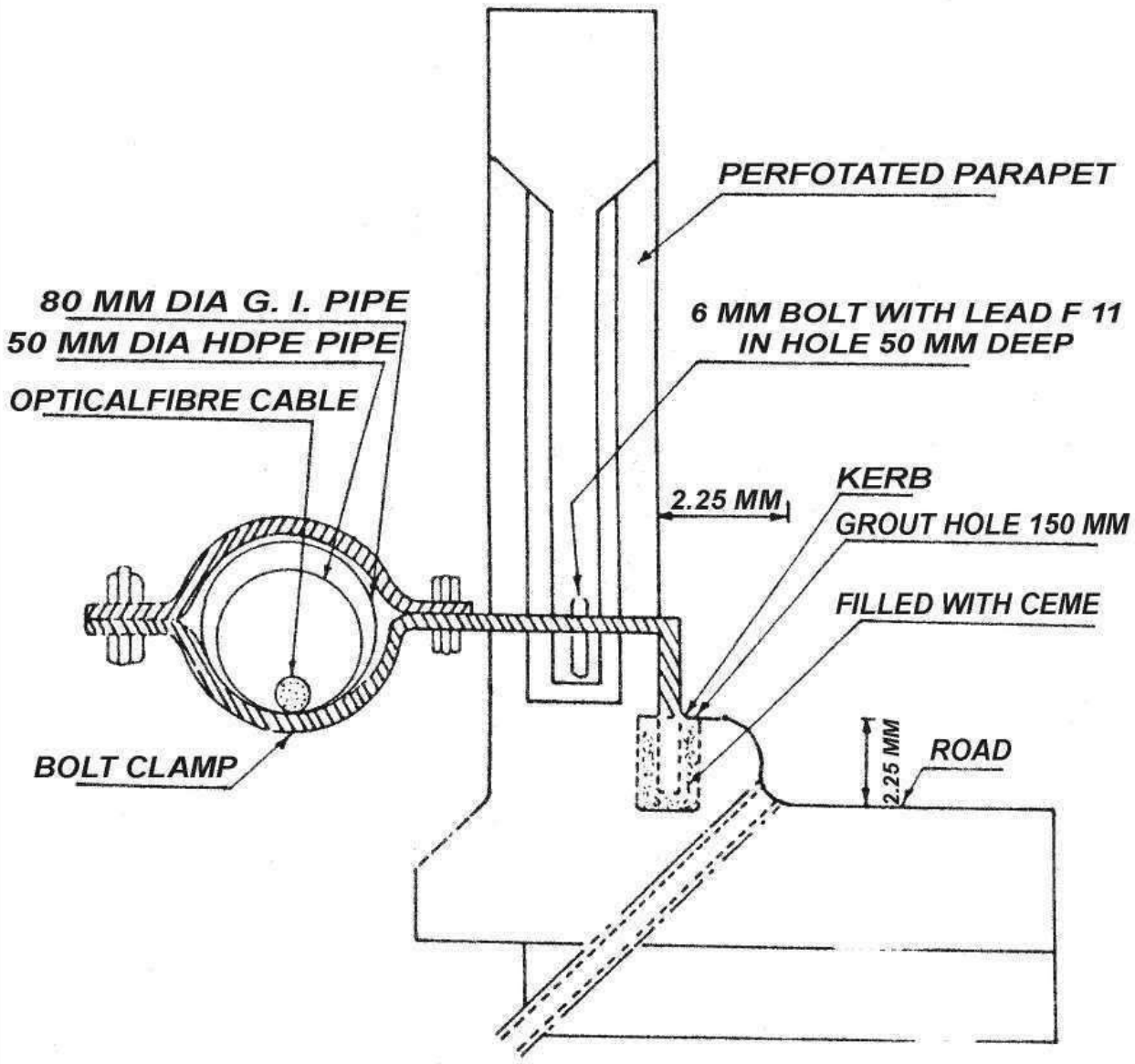
FIG - 3 (c)



LAYING OPTICAL FIBRE CABLE
(IN G. I. PIPE PLACED ON THE KERB OF THE BRIDGE)

FIG - 3 (d)

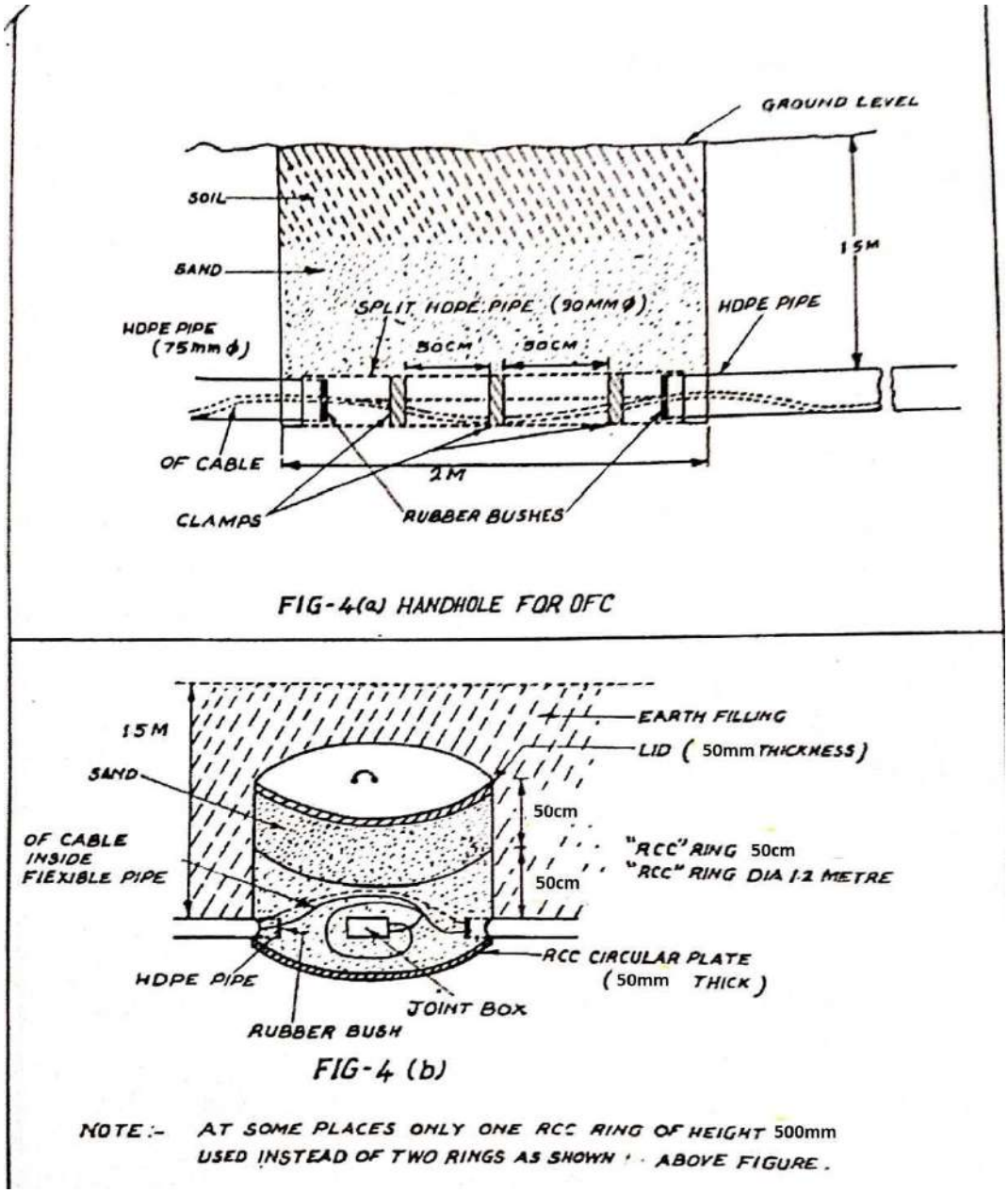
Read, understood and complied with Signature of the Bidder



LAYING OPTICAL FIBRE CABLE
DIA G. I. PIPE SUSPENCED BY MEANS OF CLAMPS
OUT SIDE THE PARAPET WALL

FIG - 3 (e)

Read, understood and complied with Signature of the Bidder



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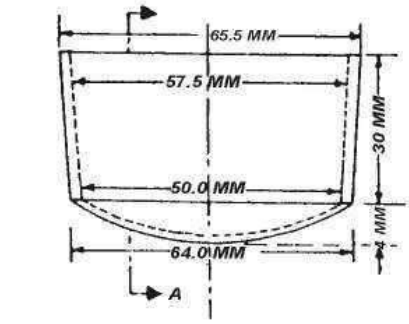
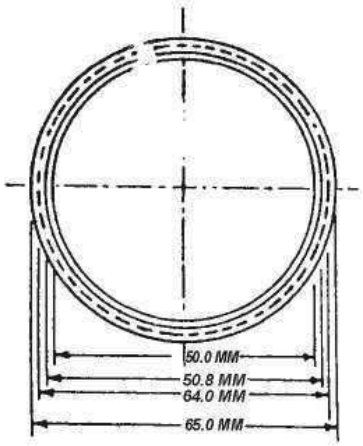


FROM : A SIDE ELEVATION



PLAN

FIG - 4 C

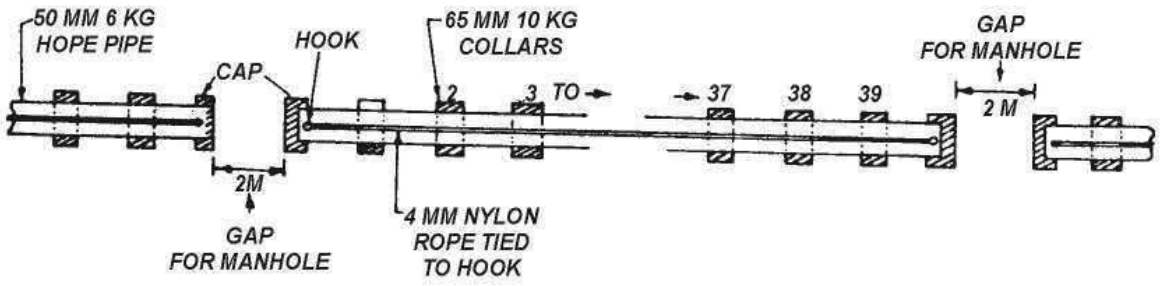


FIG - 5

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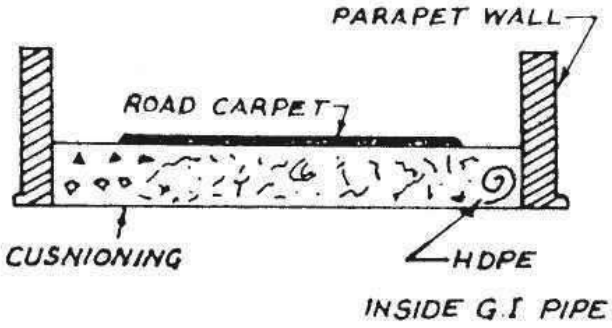

FIG - 6

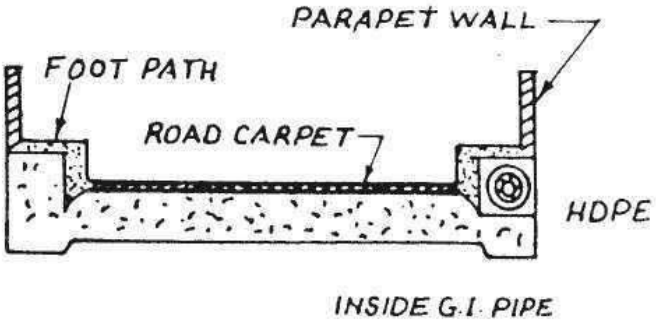

FIG - 7

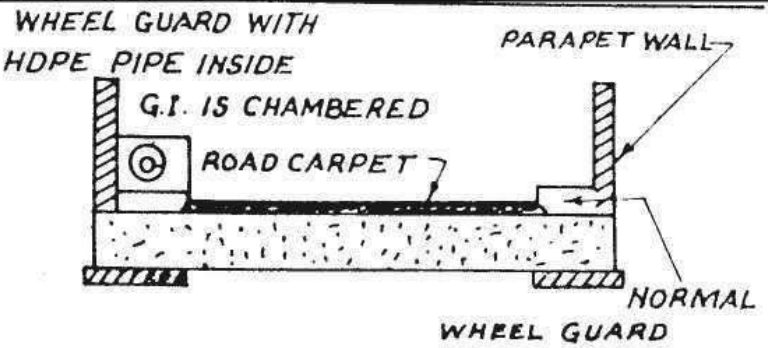

FIG - 8

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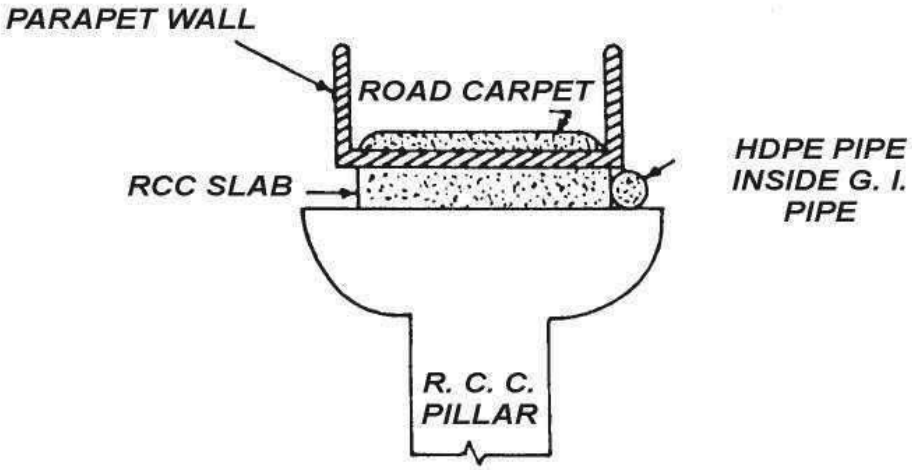

FIG. 9

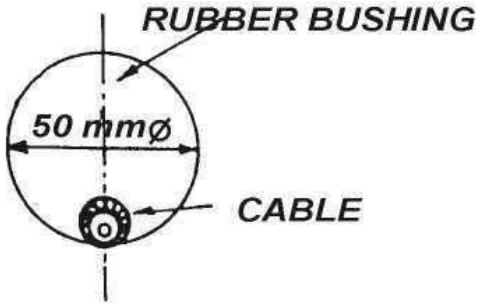

FIG. 10

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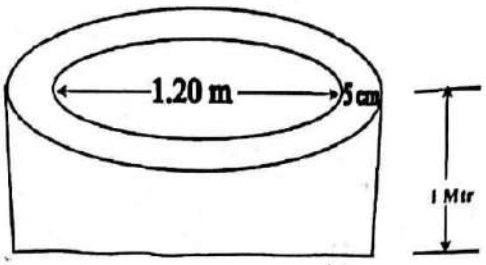
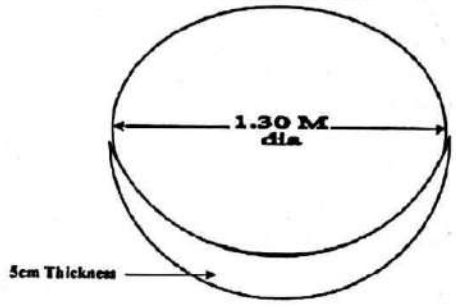
Pre Cast RCC Chamber At Cable Jointing Plate



Specifications :

1) Inner Diameter : 120 cm
2) Outer Diameter : 130 cm
3) Height :100cm
4) Thickness : 5 cm
5) Two number of 80 mm diameter semi-circular holes for cable entry diametrically opposite to each other at bottom end of the collar.
6) RCC Rings shall be NP-2 Class.
7) Pre Cast Joint Chamber with 2Half Covers & Base Plate

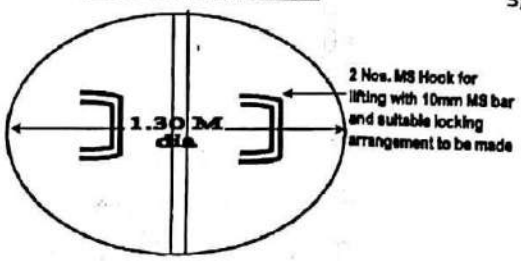
BOTTOM COVER



Reinforcement Details

1) 8 mm Horizontal Iron round rings 200mm C/C
2) 8 mm Vertical bars 200mm C/C
3) 12 gauge GI wire mesh to be wrapped before reinforcing the concrete.
4) Concrete Mix: 1:2:3 (1 cement : 2 sand : 3 graded stone aggregate 20 mm nominal size)
5) Finishing: Smooth

TOP COVER IN TWO PIECES



ITI	ITI LTD (NS UNIT) BANGALORE	
DRN	LAYING OF PRELUBRICATED 40MM HDPE PIPES	
APPVD.	ETAILS OF GENERAL CROSS SECTIO	
	DRG. NO. ITI-OFC-01	REV 0

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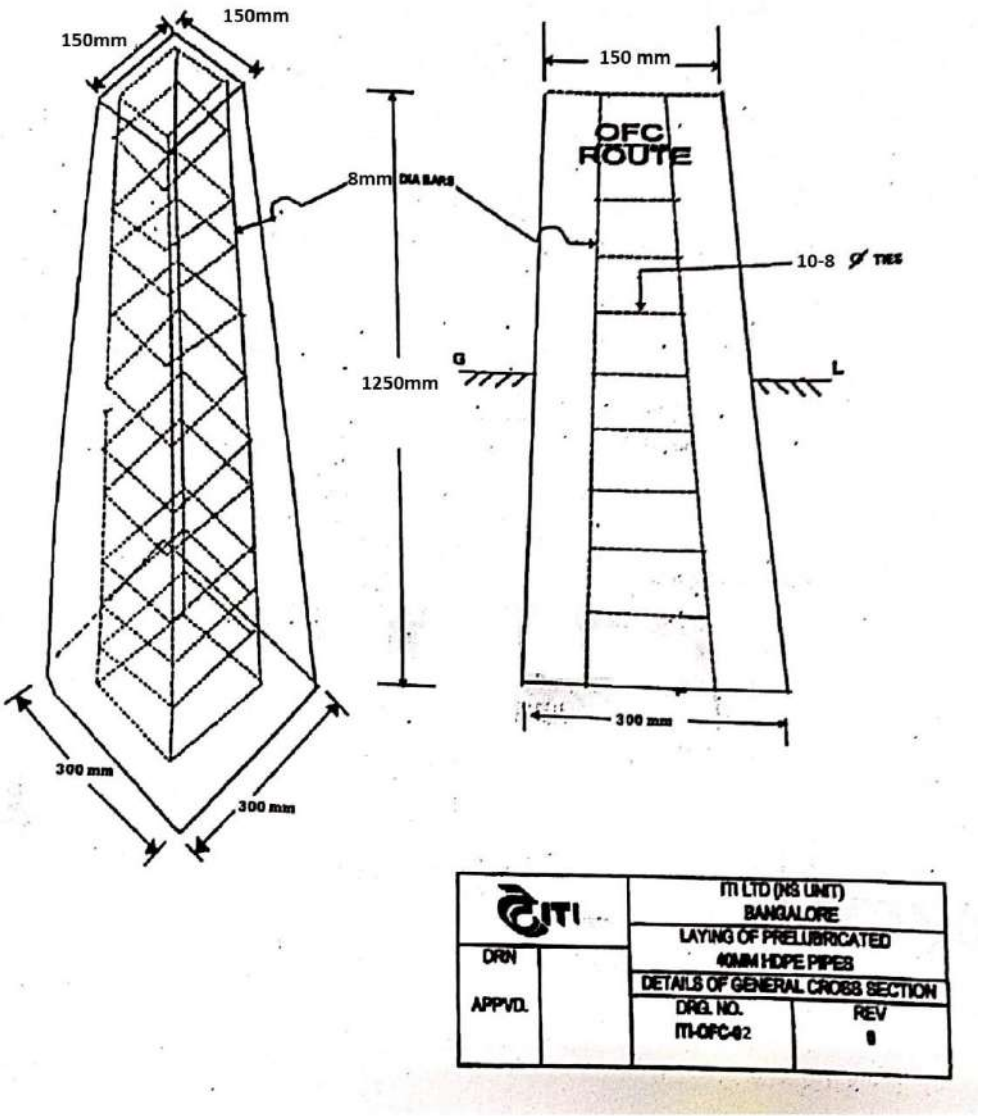

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यांत्रिक अनुदेश
ENGINEERING INSTRUCTION

LAYING PRACTICES OF OPTICAL FIBRE CABLE BY HDD

(HORIZONTAL DIRECTIONAL DRILLING) METHOD

(No.: TR/OFC/A-001)

पृष्ठसंख्या (No of Pages)	:	46
जारी क्रमांक (Issue Number)	:	01
जारीकर्ता (Issued By)	:	T&D, Circle
अनुमोदित (Approved By)	:	CGM T&D Circle
जारी करने का दिनांक (Date of Issue):		31/01/2007
संशोधन क्रमांक (यदि कोई) (Amendment No. If Any):		Nil
पृष्ठ संशोधित (Page Nos. Amended)	:	
जारीकर्ता (Issued By)	:	
अनुमोदित (Approved By)	:	
जारी करने का दिनांक (Date of Issue)	:	

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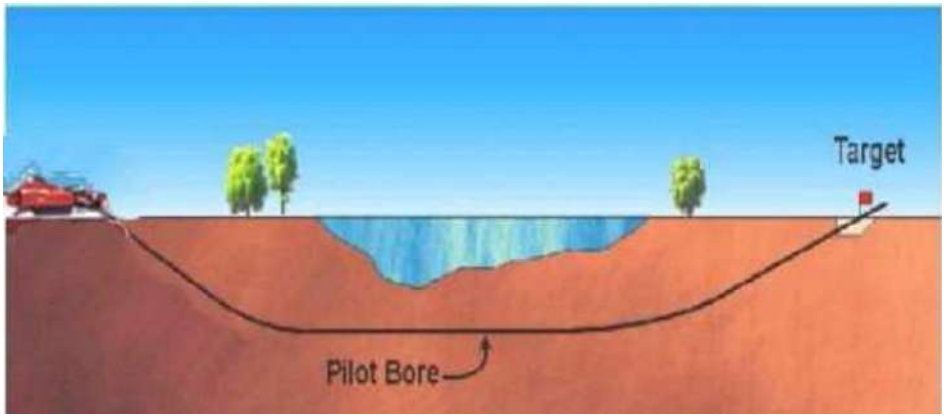
Read, understood and complied with Signature of the Bidder

LAYING PRACTICES OF OPTICAL FIBRE CABLE BY HORIZONTAL DIRECTIONAL DRILLING (HDD) METHOD

1. **Scope**. This Engineering Instruction deals with the methods to be adopted in laying of PLB HDPE pipes for Optical Fibre Cable using Horizontal Directional Drilling (HDD - also called as the trench less technology or micro tunneling) and laying of Optical Fibre Cable using the cable blowing method. The following laying practices may be adopted by the field units. This EI exclusively deals with the HDD only and only a few references are given with respect to conventional open trench method. However, for regular open trench OF cable laying work involved in between HDD works, the EI issued by T&D circle vide 'Local Area Network OF cable D-001 dated 11-07-2005' along with the latest amendments may please be referred.

2. **General**

2.1 The OF cables can be laid in multiple ducts using Horizontal Directional Drilling (HDD) or the conventional Open trenching method.



2.2 HDD may be deployed mainly within the corporation / municipality limits of the District Head Quarters. Further, deployment may be as per the local requirement as mentioned in para 2.4 also. The HDD deployment may be justified financially with reference to the right of charges to be paid to the local authorities for the open trenching and other associated expenditure.

2.3 Multiple ducts used in HDD should essentially have different colours. More than twelve different colours are prescribed for laying.

2.4 The HDD may also be used for the water canal crossings, highway crossings and railway crossings also. These crossings may be made as part of the open trench work itself after exactly assessing the crossing requirement.

2.5 The areas of the deployment of HDD and the Conventional open trenching should be indicated clearly in the preliminary survey report of the OF cable route proposed. Financial justification is to be incorporated in the survey reports. ITI / User may approve the areas of the deployment as per the above guidelines.

2.6 PLB pipe coils of one Km length shall be economical and result in less wastage in HDD deployment.

2.7 HDD Operation: The operation of HDD is explained in Fig.2.

Read, understood and complied with Signature of the Bidder

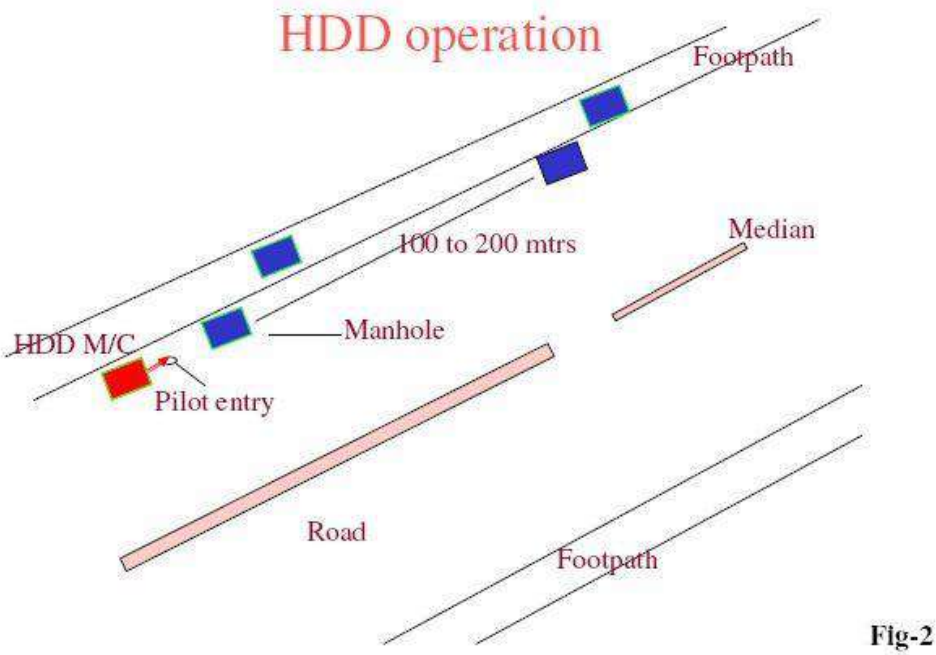


Fig-2

3. **Detailed Survey**

3.1 Following alternatives should be considered after techno-economic evaluation to meet the planned objectives of the scheme.

3.1.1 The HDD is normally deployed in the soft soils only. HDD deployment in rocky areas and laterite soils may be very expensive and hence may not be financially viable. In addition, HDD operation in rocky areas shall be extremely slow. Thus only in soft soil areas this technology may be deployed.

3.1.2 Deployment of HDD may be the choice in congested roads where open trenching is not possible (mainly in District Head Quarters). In addition, in some states/cities Black Top roads, Pre-stressed Cement Concrete roads are made from end to end leaving no margin for PLB pipe laying by open trenching.

3.1.3 Ease of obtaining the right of way by deployment of HDD for laying the OF cables may be another reason for deploying this method. Very low charges may need to be paid where this technology is deployed. The charges for the Manholes, which are being installed may needs to be paid additionally.

3.1.4 Ground Probing Radar (GPR) may be used, to identify the Cable duct path and the proposed manhole locations, in the roads where the underground assets are densely located.

3.1.5 The approximate location of the manhole and the length of the route should be clearly recorded in the report.

3.1.6 The number of coloured PLB pipes proposed to be laid should be recorded along with the approximate quantity required. 5 % additional pipe length may be taken as the requirement for executing the work.

3.1.7 For maintenance purpose 5% more additional pipe provision may be made in the report.

3.2 **Cable Laying**. After deciding above mentioned issues a detailed measurement of lengths of cable route along with the details of rail / road crossings, culverts, causeways etc. may be recorded in the detailed survey register. The probable location of joints, terminations and leading-in may also be decided and marked on the road map.

3.3 On the basis of surveys, general permission from road and rail/local authorities for laying the Optical Fibre Cable along the suitable roads and at particular rail/road crossings will have to be obtained. Generally OF Cable may preferably be laid straight as for as possible along the road near the boundaries, away from the burrow pits/when the OF Cable is laid along the National Highways, Cable should run along the road land boundary or at a minimum distance of 15 to 30 meters from the centre line of the road where the road land in wider.

3.4 In special cases where it may be necessary to avoid burrow pits or low lying areas, the cable may be run underneath the shoulders at a distance of 0.6 meter from the outer edge of the road embankment provided the same is located at least 4.5 meters away from the centre line of road and with standard depth below the road surface.

3.5 In the cities the OF cable alignment may be planned on the footpath or along the edge of the road. Manholes may also be located along the alignments.

4. **Trenching and Drilling**.

Major specifications for trenching are: -

4.1 Normally depth of the drilled portion should be more than 250 cm. This depth may be achieved at a distance of 10 meters from the leading edge of the **proposed Manhole.**

4.2 Manhole to be opened for the entry pit and the exit pit shall be minimum of 1.5 x 1.5 x 1.7 mtrs. Both entry and exit pits are opened before drilling is commenced.

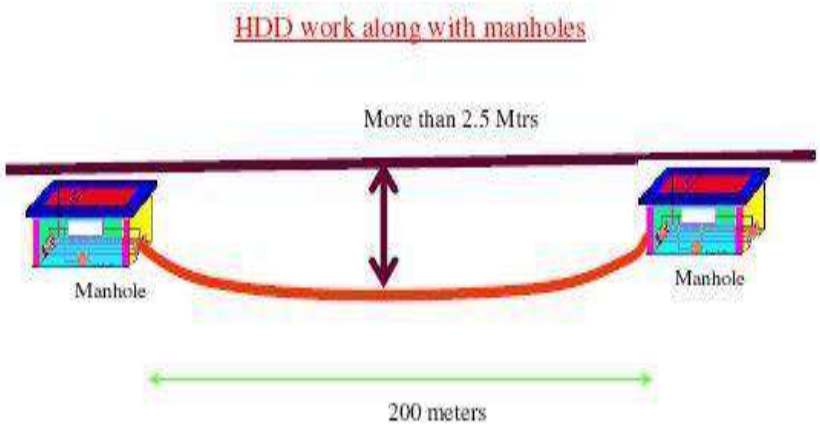


Fig-6

4.3 Drilling wherever possible, should be at the road boundary and as far as possible, straight.

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4.4 Where 4 PLB pipes or less are to be laid, 100mm dia bore may be done by the HDD machine. Where 5 to 8 PLB pipes are to be laid, 200 mm dia bore may be done by the HDD machine.

4.5 The machines should be capable of drilling for minimum 150 mtrs at a time without fail in the soft soil. The drill lengths of 200 to 250 mtrs are also desirable. In general, the machines with 10 tonnes or more thrust capacity are having the capability for this purpose.

4.6 The depth at the entry pit shall be 165 cms. For achieving this depth in the manhole a pilot entry pit shall be opened with min 20 cm depth for enabling the drill pilot to enter. (Figure-2 & 7). The pilot entry pit shall be at least 4 meters away from the manhole.

4.7 Whenever curves or deviations are encountered it should be a very smooth curve, the deviations should not be more than 100 cm from the mean line joining the centre of entry pit and the centre of the exit pit. A nylon wire shall be fixed between these two pits before the drilling operation

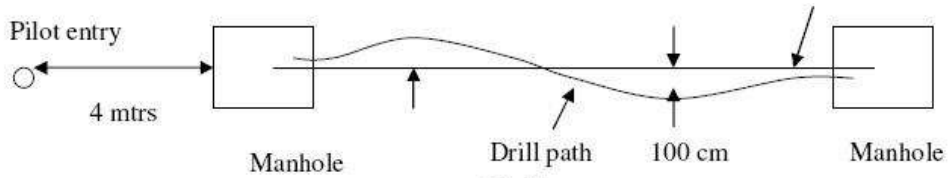

Fig-7

4.8 After the drilling operation commences, the depth and offset of the pilot is to be recorded at every 3 mtrs using the hand held tracker. The tracker should have been properly calibrated. The offset of the drill shall be recorded with reference to the edge of the road and also the deviation with reference to the mean line represented by the Nylon rope on the ground.

4.9 The depth, deviations and offset readings may be provided by the machine automatically, apart from the manual records made.

4.10 Bottom of the trenches should be at uniform level without any abrupt ups and downs. After the trenching is done for sufficient length, the bottom levelling should be inspected for uniformity to ensure that pipe could be laid without sharp bends.

4.11 In exceptional case, the depth of the trench could be less than 2.50 m due to undulating terrain. However, in no case it should be less than 1.20m.

4.12 In certain cases, in a uniform terrain a sudden burrow pit/old culvert of short length might be encountered. In such case, the HDPE pipe can be further protected by GI/RCC pipes of suitable size.

4.13 In water logged area drilling should be done in the dry areas and dewatering should be got done before pipe laying.

4.14 When trenching is done close to power cables precautions detailed in EI lines & cables underground should be observed.

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4.15 When trenching is undertaken along streets and railway lines safety precautions given in EI lines and cables underground should be observed.

4.16 Caution boards should be provided at each entry, exit and pilot pit of the trench to caution the traffic. Caution tapes/red flags may also be planted around the working area throughout the drilling path. This is essential to track the drill pilot with the tracker and to record the accurate depth and offset.

4.17 If the manholes are to remain open at night red lamps or luminous caution boards on either ends should be provided.

4.18 After the pipe laying is completed, bed of manhole may be prepared for constructing the RCC manhole. After the manhole is constructed the PLB duct is ready for laying the OF cable.

4.19 It is very much necessary to use the ground penetrating radar to localizing other utilities in the absence of accurate documents depicting the position of other utilities. Hence, the ground penetrating radar is a must during survey and as well as while carrying out the job to follow the path of the horizontal drilling.

4.20 All the trenching drilling operations are to be continuously monitored by the Engineer / User and should also visit the site during the execution.

5. **Laying/Construction Practices**

5.1 HDD may not be deployed in the cross country areas. It may be deployed only for the water canal crossings, Highway crossings and Railway crossings. Exceptional cases where the HDD needs to be deployed may be decided suitably.

5.2 **In Built Up Areas** 6.2.1 City/Town, urban areas falling within municipal /Corporation limits normally fall under this category where the following laying /Construction practices shall be adopted. For other inhabited villages / towns etc. not falling under any municipal /corporation limits suitable cable depth / protection is to be decided jointly by ITI / User.

5.2.1 **On Ducted Routes**. Optical fibre cables may be laid through the existing ducts wherever the concrete ducts are available. As far as possible the cable may be diverted to the new ducts laid subsequently. When the cables are laid in ducts, no particular depth is prescribed. End of the ducts should be properly sealed and necessary protection by way of W.I. pipe / RCC pipe should be provided at the entry and exit of the duct till the cable is buried to a depth of 1.5 m. The above is applicable in town or any other ducts laid cross country.

5.2.2 **On Non-Ducts Routes**

5.2.2.1 PLB pipe laying may be done as per the approved detailed survey report.

5.2.2.2 **Open Trenching.** As the non-ducts routes in built up areas are more vulnerable to faults due to cables/pipes of other services laid close to ITIL cables, it is essential to take special care while laying optical fibre cables on these routes. The OF cable shall be laid through PLB HDPE pipes at a depth of 1.5m, and additional protection by suing RCC/GI pipes shall be provided. If need be the OF cable can be laid below the cables and pipes of other agencies including local telephone cables and if required cable may be laid via alternate longer route. Only in exceptional cases the depth of cable laying may be relaxed to 1.00 in non rocky soil and 0.9 in rocky soil as in case of cross country routes, provided the reasons for not laying the cables at a stipulated depth of 1.5m are recorded and

certified by Engineer in-charge of cable laying. The minimum depth of 0.9m in rocky soil may further relaxed to 0.5m for location where permission for blasting is not granted by local authorities even after taking up for the same at DGM/User level. In all such cases mechanical protection by reinforced concrete casing of suitable size shall be provided.

5.3 **HDD**. The pipe laying shall be done as described in 5.0. Due to intangible underground hindrances / old buried structures, HDD work may be converted as the open trenching work.

5.4 **On Culverts / Bridges over Nullahs : Dry for Nine Months in a Year** The cable shall be laid at 1.5 m depth below the bed of nullah through HDPE pipe and protection provided by using RCC pipe of minimum internal dia of 100 mm. The RCC pipe shall extend 2 M minimum beyond the end Nullah on either side. Depth of 1.5 m can further be reduced depending on nature of soil and other conditions in accordance with para 6.1 & 6.2 with a view to minimize the damage to the OF cable during flood season the cable should be laid on upstream side of causeway at an approximate distance of about 4 times than depth of the flow during high floods.

5.4.1 **On Culverts/Bridges over Other Nullahs**. Various options are available as depicted in figures 3a, 3b, 3c, 3d & 3e for laying the O.F. cable along the parapet wall of the culverts/bridges. One of these options may be adapted depending upon side conditions. On approach roads to these bridges/culverts also, protection by using RCC pipes shall be provided for 2 M on both sides.

5.4.2 **On Rail Bridges /Crossings**. On rail bridges / crossings the optical fibre cables shall be laid through HDPE pipe which shall be encased in split able cast iron / RCC pipe as prescribed by Railway authorities.

5.4.3 **On Road Crossings**. The Optical fibre cable shall be laid at a depth of 1.5 m through HDPE pipe encased in RCC pipes which shall extend three meters on either side of the end road to take care of any future expansion. Depth of 1.5 M can further be reduced depending on nature of soil & other conditions in accordance with para 6.1 & 6.2.

6. **Pipe Laying**

6.1 PLB pipes are uncoiled from the PLB coils using the roller jack mechanism. Removing the pipes from the coil in this manner will avoid the coil effect, which makes the pipes to wind in curls even though the pipes are laid straight.

6.2 Pipes may be cut from the original coil using the duct cutter only.

6.3 The pipe may be laid in the most economical manner. The total length of the PLB pipes left unused may not be more than 5% of the length measured between the centre of the two manholes (entry pit and exit pit).

6.4 The start reading and the end reading for each PLB pipe shall be recorded by the Engineer-In-Charge.

6.5 The pipes may be laid in the manholes so that the bunch of pipes shall overlap on the pipes laid from the other side.

6.6 Push-fit couplers may be used for joining the PLB pipes.

6.7 Open Trenching or pulling the cable manually through the pipes, it is necessary to have suitable manhole made at every 200 M length and at suitable bends and corners. The

construction of manhole hole and jointing man hole is shown below. The pipes are laid for 200 M or less, at a time, depending upon the distance between two manholes. For a 200 M trench 200 M length of 40 mm PLB pipes of continuous length and two end plugs are required for laying one duct. In addition for closing the ends of the two extreme end pipes 2 special types of caps are also needed. A 4 mm polypropylene rope could be drawn through the pipes and safely tied to the caps at either end with hooks. These 4 mm ropes are to be provided throughout the route which could serve to pull the 12 mm rope which is ultimately required to pull the cable. Necessary offset diagrams are also required indicating the distance from the centre of the road. The depth of the trench is also to be recorded.

6.8 **HDD** The multiple PLB pipes are bunched together at the exit pit. At every one meter length, the pipes are bundled using the flexible iron wire tightly. The end plugs shall be tightly fixed on both ends. Chinese fingers are to be used as the pulling grips for all these bundled pipes. All the Chinese fingers shall be combined and tightened together to connect to the back reamer of the HDD machine. The machine pulls the pipes towards it. After the pipes are pulled out for about one and half meter from the drill entry point in the Entry pit which is near the HDD machine, the pipes may be de linked from the back reamer. The Chinese fingers may be detached from the PLB pipes. Leaving one and half meter length of the bunch of pipes in the exit pit, the additional pipes may be cut and necessary. During execution, in many cities where soil is sandy or otherwise not compact, the maximum length of drilling and subsequent pipes pulling is less than even 100 meters. So, while execution all the lengths of pipes are brought to road surface, keeping them peep about 1 ft. when subsequently they are lowered down at the depth of the trench, they are cut and thus there is wastage of pipe.

Leading out Arrangement in Manhole

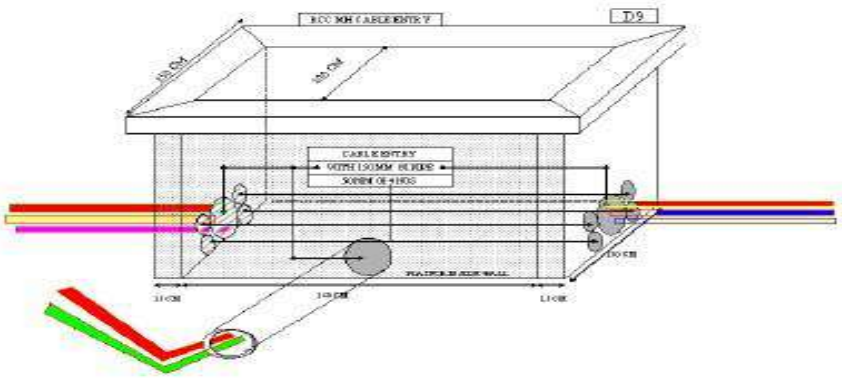

Fig - 8

Read, understood and complied with Signature of the Bidder

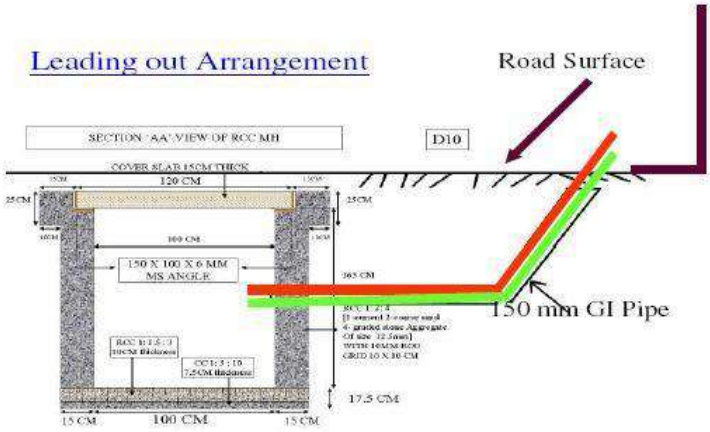

Fig - 9

6.9 **Duct Integrity Test**. Continuity of the pipe is to be tested and ensured. It is quite possible that the pipe may get elongated and its bore may get reduced in the process of pulling up the pipe which may ultimately result into difficulty in pulling cables. The DIT should be conducted after the pipes are laid either in open trench method or in the HDD method for verifying this problem. The DIT involves two tests. In one test one side of the PLB pipe laid is sealed using the end plug. On the other side air compressor/blower is used to hold the 5 Kg/cm-cm pressure inside the pipe under test. The pressure should be held for 1 hour without any leakage. In the second test a wooden bullet having 80% of the diameter of inner diameter of PLB pipe and having a length of 2 inches may be blown from one side of the PLB pipe. The other side of the pipe shall be left open. The bullet should fly out without any blockage. Then the PLB pipe laying is successful. Care should be taken by covering the end of the PLB pipe with a nylon/wire mesh so that the flying bullet shall not hit anyone.

7. **Protection of ducts**.

No protection is required for pulling pipes in HDD method.

8. **Laying of pipes on bridges, culverts, etc**.

8.1 In small bridges and culverts across canals, different methods as given below could be followed:

8.1.1 If the bridge or culvert is broad and is having sufficient cushioning, the pipes can be buried inside the cushioning.

8.1.2 If the bridges / culvert is provided with raised and hollow foot-path or wheel guard, the pipe encased in GI can be buried inside the hollow foot-path or can be laid over the wheel guard and chambered.

8.1.3 If the supporting pillars are having projects and between pillars the distance is less, then the pipes (HDPE with GI encasing could be laid over the pillar projections.

8.1.4 If none of the above solutions is possible, then outside the parapet wall, GI troughs can be fitted with suitable clamps. For smaller bridges, the HDPE pipes can be laid inside the trough. However, for long bridges, HDPE pipes need not be laid inside the trough. While laying the cable, glass wool or other cushioning items may be used. In either case, the gaps between two troughs after putting the lids should be thoroughly covered to prevent entry of rodents.

8.1.5 Special type of bridges such as cantilever type requires special type of troughs to be locally manufactured to withstand the vertical and horizontal movement of the joints of cantilever bridges.

8.2 **Depth A/T**. Two types of Depth AT are proposed. Traditionally Depth AT is done after PLB pipes are buried. While deploying HDD, it may be required to carry out the Depth AT simultaneously. In case the machine deployed is capable of providing the automatic depth, deviation and offset details depth AT can be conducted at a later date also. User shall decide on the method of A/T to be followed.

9. **Traditional Depth AT**

9.1.1 Before the cable is actually pulled through the pipe, the PIA should offer the route for A/T of the depth and position for the cable and correctness of the route diagram. The best way should be to offer it in stretches of 10-20, kms. soon after the HDPE pipe is buried.

9.1.2 The route diagram should be prepared and made over to the A/T unit in advance. The HDD machine recording of the depth deviations authenticated by the division head is to be provided to the A/T unit. The A/T unit will specify the sports roughly two per km for checking of depth and position of the cable, sound laying practices and prescribed protection. Wherever depths are prescribed the tolerance upto minus 8 cm is permissible. For checking accuracy of the route diagram and position of the cable, the permissible tolerance will be +/- 0.5 metre. For checking position of the cable, standard survey tapes will be used.

9.1.3 If the pipe is found to be at a depth less than prescribed, OF cable should not be drawn through HDPE pipe and pipe should be lowered to the proper depth at the locations where necessary relaxation of competent authority as mentioned in earlier paras is not available.

9.1.4 Duct Integrity test should be carried out as specified at 6.9.

9.1.5 Duct sealing is also to be tested. One end of each of the duct should be closed at the air pressure should be maintained at constant rate of 5Kg/mt2 for 5 mins. The pressure leakage should not be more than 1% in these 5 mins. All the laid pipes must be sealed used the end plugs.

9.1.6 Cable sealing plugs must be used for sealing the PLB pipes in which OF cables are laid. Cable sealing test is also conducted for the ducts where the cable is laid.

9.1.7 The duct integrity test and duct sealing test shall be carried out for all the ducts laid.

9.2 **Concurrent Depth AT**. At present there is no specification for conducting depth A/T for HDD. However, acceptance testing is offered by considering the Depth graph given by the site in charge at entry / exit points of bore. Taking the test pits will be difficult as the Bore line is passing through tarred / concreted and congested areas. Test pits may be taken where ever feasible and earthen surface is available. For acceptance test pits may not be permitted in city areas since it involves digging to a depth of 2 mts. To 3 mts. Hence depth AT may also be done while the work is in progress. During the execution, on intimation, the AT-in charge may inspect the site and measure the depths of the duct at four places which are at least 20 mtrs away from each other. This shall be in addition to the depth of the drill at the entry pit or the depth of the duct at the exit pit.

9.2.1 Duct Integrity test should be carried out as specified at 6.9.

9.2.2 Duct sealing is also to be tested. One end of each of the duct should be closed at the air pressure should be maintained at constant rate of 5Kg/mt2 for 5 mins. The pressure leakage should not be more than 1% in these 5 mins. All the laid pipes must be sealed using the end plugs.

9.2.3 Cable sealing plugs must be used for sealing the PLB pipes in which OF cables are laid. Cable sealing test is also conducted for the duct where the cable is laid. 9.2.4 The duct integrity test and duct sealing test shall be carried out for all the ducts laid.

10. General Instructions on AT of the OF cable laying by HDD are available below.

11. **General Precautions**

11.1 The optical fibre cable drums should be handled with utmost care. The drums should not be subjected to shocks by dropping etc. The drum should not rolled along the road for long distance and when rolled, should be in the direction indicated by the arrow. The covering planks should be removed only at the time of actual laying.

11.2 The previously laid pipes, manholes and portion of bends etc. on the cable route as per records maintained at the time of laying pipes, should be got cleaner of earth and the pipes may be cleaned thoroughly before pulling of cable is started.

11.3 Depending upon the length of the drum (1 km / 2 km) and cooling required for jointing purposes, chain measurement is taken from the starting end of section and exact joint location is marked. If it does not fall at the existing manhole location, a separate manhole is to be made to accommodate the joint box as well as coil. All the joint locations are fixed in a similar manner. The intermediate manholes are also to be kept ready for pulling purposes.

11.4 As the cable drums are standardized for 2 km, it is preferable to lay the cable by placing the cable drum at the manhole point nearest to 1 km from the joint locations.

11.5 The standard practice is to keep the clock wise end of the cable to the ‘A’ side of the route and the anti clock wise end to ‘B’ side. Also, it is the practice to have the click wise end on top and anti-clock wise at the bottom of the drum. With the above in view, cable drum is to be mounted on the jack and wheel with drum shaft (Axle) in horizontal position.

11.6 The rope end is to be fixed at one end of a swivel (Antitwist device) permanently or by means of a shackle. The other end of the swivel is tied to the pulling eye of the cable. If a pulling eye is not available, then a cable grip is to be used.

11.7 As the cable length is 2 km, during cable laying work, proper communication is to be established. This can be done with walkie talkies or magneto telephones with drop wire.

12. **Precaution against Damage by Termites & Rodents**. In the rodent prone areas Optical Fibre cable joint closures should be applied with BHC 10% dust (Benzene Hydro chloride 10%) to prevent rodent & termite damage. The method suggested is “BHC” 10% dust of 1 kg is to be mixed in an approximate 2 kg of sand and applied around the optical fibre cable joint enclosures.

13. **Cable Laying**

13.1 Cable laying is proposed either by traditional Cable pulling method or by Cable blowing method.

13.2 **Cable Blowing**

13.2.1 **Laying of Permanently Lubricated HDPE Telecom Duct by Blowing Technique Scope**. This EI describes the procedure for lying of PLB HDPE TELECOM DUCT. Telecom Duct is an advanced pre-lubricated duct system. Lubricants are built in to a durable polymer base. Duct has a low coefficient of friction and the built in lubricants do not diminish with age.

13.2.2 **Advantages of Duct Systems**. Duct systems may provide several significant advantages:

13.2.2.1 HDPE Telecom Duct provides the mechanical protection to the Optic Fibre Cable and eliminates the need for armoured cable, which is more expensive. The combination of the un-armoured cable and the HDPE duct offers a better cable protection system as compared to the armoured configuration.

13.2.2.2 Empty ducts can be placed during initials construction for future use when more fibre optic capacity is needed, this eliminates the entire re-digging / construction process against and again. This reducing future upgrade costs. With HDPE duct it is possible to access the cable from manhole at any time. It is therefore not necessary to redig and block off streets and pathways, which is both time consuming and expensive. It is possible to install longer cable lengths into HDPE Telecom Duct with fewer splicing points in the network. This saves money and time on installation. Fewer splicing points along the cable route also offers better transmission parameters. Fewer splices mean less down time during the network's lifetime. Most faults requiring maintenance appear at splice points. Significant savings, both immediate and long term, are achieved by limiting the number of splice points. Limiting the no. of splice points increase the transmission quality of the fibre optic network.

13.2.2.3 When encountering defective cable or if the cable does not meet the capacity of one's bandwidth needs, it is possible to withdraw existing cables and replace them with different cable. Removed cables can be reused in other parts of the network with lower bandwidth needs. With HDPE Telecom ducts this process can successfully be executed without digging the earth. This can be achieved simply by opening two manholes. HDPE Telecom Ducts ensures the same technical conditions related to the ease with which cable can be inserted or withdrawn from the system regardless of whether this action is taken after 10 days or 10 years of the proper installation of the duct system.

13.2.3 **Duct Unloading and Loading**. Different ways of unloading the HDPE Duct:

13.2.3.1 Using ways of unloading the HDPE Duct:

13.2.3.2 When using a boom truck to unload the Duct Coil, place a bar through the reed / coil arbour, then attach a chain to the bar. DO NOT wrap the chain around the duct to lift the coil.

13.2.3.3 Open the tail board of truck, carrying coil and put wooden or metallic planks at appropriate places, slopping from the floor of the truck to ground Roll down over these planks to rest on ground.

13.2.3.4 Duct coil can also be dropped from the floor of truck on sand or soft soil bed of about 12" height or more.

13.2.4 **Duct Mounting**

13.2.4.1 Place "Flange No. 1" of Collapsible Steel Reel on ground. 13.3.4.2 Put Duct Coil on "Flange No. 1" evenly in such a way that all holes of Flange No. 1 are accessible for fixing the traverse Bars from inner space of Duct Coil.

13.2.4.2 Place "Flange No. 2" on top of the coil and fix it in a placeby tightening them with Traverse Bars by means of bolts and nuts.

13.2.4.3 Lift the Reel with the Coil and mount it on proper Jack Stand with the help of a strong iron shaft passing through the centre of the Collapsible Reel.

13.3 **Duct Installation**. For installation ducts in an open trench, use of the methods described below: -

13.3.1 **Manual Laying**. This method is efficiently used when installing single duct in an open trench or when there are many obstructions like trees etc along the route. Steps in manual laying: Place the Jack Stand along the sides of the trench.

13.3.1.1 Observe correct drum position i.e. duct should be uncoiled from the bottom of the drum by anticlockwise rotation of the drum. NOT from the top of the drum.

13.3.1.2 Drive the reel slowly to avoid spinning of reel while pulling HDPE Duct for installation.

13.3.1.3 Unroll the duct to the required length spacing the workers after every 15-20 mtrs.

13.3.1.4 When encountering an obstruction, utility crossing or bore, pull the HDPE Duct beyond the obstruction until enough duct to manoeuvre it through or under the obstruction and then repull the duct.

13.3.1.5 Duct can be placed into open trench either directly from a drum or temporally laid along the side of trench and placed later on.

13.3.2 **Multi Duct Laying**. Foreseen Duct Laying Whenever it is foreseen that in future more no. of cables will required, a 110 mm PVC Duct can be laid and 4 nos. of sub duct can be pulled, which can be tighten by Anchor block at the end of PVC pipe.

13.3.2.1 In long distance network this 110 mm pipe can be buried directly in the Sand, and in the Built up areas it can be encased in the 200x200x200 MM Cement Concrete.

13.3.2.2 3 to 4 Kms length of OF cable reel is recommended to reduce the no. of splices.

13.3.2.3 Coordination can set-up with Central / State government authorities, that while construction of Bridges / Culverts, provision of 8 to 10 Ducts of 110 mm.

13.3.2.4 The cost of the same can be born by ITIL.

13.3.3 **Moving Trailer Method**. This method is most efficiently used when path of duct does not contain any road bores, utility crossings and other obstructions that require the duct to be placed under or pulled through without unloading it.

13.3.3.1 Mount the duct on the reel.

13.3.3.2 Fix the Jack Stand properly on the trailer.

13.3.3.3 Mount the duct along with the reel on the Jack Stand.

13.3.3.4 Secure the cut end at the desired start location.

13.3.3.5 Move the trailer slowly along the trench route pay out the duct and avoid over spinning of the reel.

13.3.4 **Attaching Mechanical Pulling Machines to HDPE Telecom Ducts**. This method is suitable for laying multiple ducts simultaneously. In this method duct is pulled by mechanical pulling machine with the help of Pulling device that is fitted in-between duct and mechanical pulling machine. Two types of pulling devices commonly used are:

13.3.4.1 **Pulling Grip**. These offer excellent means of pulling ducts. Grips are made of high quality galvanized steel stand to assure long life.

13.3.4.1.1 Apply compressible bands of tape to HDPE ducts before installing the grip. Make the bands more than 1/16" thick using friction, vinyl or duct tape. Make these bands one tape width wide.

13.3.4.1.2 Start first band of tapes about 6-8 inches behind the cap on the duct end. Remember to keep the duct capped.

13.3.4.1.3 Start the second band of tape 6-8 inches behind the first band the grip will shorten when you stretch it to fit over the duct. Add bands until you have covered the length of duct, the grip will cover.

13.3.4.1.4 Pass the grip over the capped duct end and bands of tape. Apply tape on the grip.

13.3.4.1.5 **Thread-In-Pulling Eye**. These are used to pull HDPE duct, when properly sized and installed, these eyes will not pull out from duct.

13.4 **Procedure for Duct Laying Using Pulling Devices and Mechanical Pulling Machines**.

13.4.1 Mount duct coil on Collapsible Steel Reel (Refer to Procedure For Duct Mounting).

13.4.2 Put the duct, wound on collapsible still reel, on a rigid Jack Stand with the help of a strong iron shaft passing through the centre of collapsible steel reel.

13.4.3 Connect one end each of multiple ducts (already mounted on collapsible steel reel) to the pulling devices (pulling grip / pulling eye).

13.4.4 Attach ducts (connected to pulling devices) to Multiple Pulling Harness.

13.4.5 Connect the multiple pulling harness to suitable Mechanical Handling Machine (Excavator, Jeep etc.).

13.4.6 Move the Mechanical Handling Machine along the side of trench, while unwinding duct from collapsible steel reel. Feed the ducts directly in to the trench without entanglement so that duct are laid without crisscrossing.

13.5 **Duct Laying in Culverts, Bridges, Railway Crossing and Rivers**: -

13.5.1 **Duct Laying in Culverts / Bridges**.

In culverts without earth cushioning or less cushioning, the wheel guard (kerb) may be broken and G.I. pipe is fixed and kerb is rebuilt enclosing the G.I. pipe. HDPE DUCT can be pushed or pulled through the G.I. pipe. At slopes, G.I. shall be

enclosed in brick masonry chamber for better protection. At curves flexible G.I. shall be used.

13.5.2 NOTE: Do not use plastic couplings inside the G.I. pipe.

13.5.3 If the kerb is of RCC and where breaking is not permitted, 150 mm x 150 mm concrete chamber shall be constructed on kerb to enclose the G.I. pipe. If neither of above method is possible, a G.I. pipe should be clamped to the outside of parapet wall.

13.5.4 At railway crossings, mole or Directional Boring system is used for boring hole under railway track and G.I./C.I. pipe is introduced through the hole. Always use a bigger diameter G.I./C.I. pipe at railway crossing so that one can use it in future when traffic increases.

14. **Placement of Duct into an Open Trench**

14.1 When placing the duct into an open trench, the bottom of the trench must be reasonably flat, free of horizontal and vertical bends, and free of stones and debris. If surrounding soil contains sharp stone or other materials, the duct should be insulated with a protective layer of fine sand (approximately 5 to 10 cm under and above the duct).

14.2 Place the duct as straight as possible. In case of any directional changes, keep the bending radius as big as possible. A min. bending radius, which is 10 times the outer diameter of the duct, is to be maintained.

14.3 Vertical and horizontal winding in the trench directly lowers the distances. The cable can be pulled or blown.

14.4 When duct takes a vertical position, it is important to support the duct to prevent damage or kinking during restoration. To accomplish this, compact the soil under and behind the bend.

14.5 Use backfill to make rapid changes more gradual. During transportation and storing at the site duct, it is necessary to seal the ends of the duct with the proper End caps against water penetration or other impurities. Sand, soil or water and other impurities significantly increase the friction between the duct and the cable out sheet.

14.6 When installing duct into an open trench from a drum, correct drum position should be observed. Duct should be uncoiled the bottom not from the top of the drum.

14.7 When placing multiple ducts in a single trench simultaneously, it is important not to cross or twist the ducts inside the trench. When installing large quantities of ducts it is possible to stack them one on top of the other in addition to side by side. However, positioning of the ducts must be designed in the planning stage to ensure clarity between duct placement.

14.7 When placement of the duct is over and connections of duct ends are deferred to a later stage, it is advised to overlap duct ends by one meter from each side. Both ends of the duct must be properly sealed with End Plug to prevent water, dust or any other foreign articles from entering into the duct.

14.8 Duct can be placed into an open trench either directly from a drum or temporarily laid alongside the trench and placed later on. It is not recommended to hang ducts on fences, barriers, etc.

14.9 When crossing the rivers and streams, duct is typically buried 120 cm below the riverbed. Vertical bends required to descend to this depth below the river floor must be executed as gradually as possible to ensure optimal cable installation lengths.

14.10 When crossing bridges, HDPE Telecom Duct can either be bound directly to the bridge frame or it can be pulled within a Metal/PVC/ Concrete pipe fixed to the bridge frame. As always, sharp bends should be avoided. An ideal installation should have only gradual bends.

14.11 Pump out water, if any, from the trench before placement of duct.

14.12 Whenever tree roots are found in the trench, make sure to lay the duct under tree roots and not above.

14.13 Place the duct along the trench as straight as possible. Tightly close the ends of the ducts with self-tightening End Plug to that no dirt, dust or moisture enters into the duct.

15. **Duct Spacer**. When multiple ducts are placed in a single trench, it is better to use Duct Spacers so that ducts do not cross each other inside the trench. Duct end connections: There are two main choices for connecting duct ends: 1. Metalnon- reusable connectors or 2 plastic-reusable Couplers. Metal connectors made of Aluminum are recommended when installing sub duct into a main duct system. This type of metal connector is not typically water or airtight. It is recommended to use heat shrink sleeve over metal cover to ensure water tightness and to protect against corrosion. The Plastic Couplers are re-usable and versatile, however, they double the outer diameter of a duct, which can cause problems in a main duct system. They may still be used in a broad spectrum of installation situations. They are pressure tight and water tight, can withstand a minimum pressure of 10bar.

16. **The Installation of Metal Connectors**.

16.1 Metal connectors have clockwise threads in one half and counter clockwise threads in the other half of one continuous piece of metal. This design enables the engineer to tighten both duct ends to the connector simply by twisting the connector in one direction.

16.1.1 Cut the duct at the same place where they overlap. The cutting of two duct ends should match up perfectly. Each end must be chamfered with a deburring toll in both the outer and the inner diameter ends. This is to prevent any sharp duct ends from catching the cable as it shoots through the HDPE Telecom Duct.

16.1.2 Mark duct on the duct ends before attaching the connectors to see how much of the duct will enter to the centre of the connector.

16.1.3 Push on the heat shrink sleeve and put both ends of the duct into the connector.

16.1.4 Tighten metal connectors with an installation tool in the direction of the arrow until the marked point is reached.

16.1.5 Centre the heat shrink sleeve over the connector. Heat the sleeve with a heat source such as a blowtorch until it shrinks tightly over the metal connector. Heat should be applied from the centre of the sleeve towards the ends. When using the heat shrink, follow the instructions from the manufacturer. Let the finished heat shrink cool for approximately ten minutes.

16.1.6 The installation of plastic coupler. 16.1.6.1 Cut the duct at the same place where they overlap, in such a way that the duct end matches with each other perfectly because

it is very important for the Coupling joints to be airtight. Proper pipe shears or cutters must be used for smooth cutting. Do not use a hacksaw to cut the duct.

16.1.7 Debar both the inside and the outside edges of the duct with a debarring tool.

16.1.8 Apply a small amount of proper lubricant (liquid detergent) for better installation of plastic Couplers.

16.1.9 Tighten the plastic coupler with C-Spanner.

16.2 **End Plug**

16.2.1 Close the ends of duct with End Plugs so that moisture, dirt and dust do not enter the duct.

16.2.2 It seals the duct ends completely and prevents air, moisture from entering the duct, even when it is laid underground.

16.2.3 Further, interior surface of empty ducts also remains clean even after several years.

16.2.4 Inspect the Neoprene Rubber for various defects such as pinholes, cuts, etc. In case of any such defect, replace the rubber gasket with a new one.

16.3 **Simple Plug**

16.3.1 When the cable is already installed inside the duct, seal the duct with “SIMPLE PLUG”.

16.3.2 It also saves the cable from dust, dirt, moisture etc. and increases the life of cable, since the contact with moisture is eliminated.

16.4 Duct Cutters and C – Spanner

17 **Methods for Fibre Optic Cable Installation Into HDPE Ducts**: The two most common methods are generally used for installation of O.F. Cable into HDPE Telecom duct, which are:

17.1 Cable Pulling.

17.2 Cable Blowing.

17.3 **Cable Blowing**. This advanced method is based on the concept of a consistent high pressure airflow, equally distributed along the entire cable throughout the duct. The cable is mechanically fed into the pressurized space to overcome the pressure drop at the entry point. The additional pushing force at the entry point is important to increase the total blow able length. A cable jet-blowing machine is combination with an appropriate Compressor is essential for optimal blowing. For an effective Cable Blowing an average speed of 50-60 meter /min is desired.

17.3.1 Factors Influencing the Blow able Length:

- Inside diameter of the duct.
- Outside cable diameter.
- Cable weight.
- Coefficient of friction between cable sheath and duct inner surface.

- Number of slopes.
- Cable stiffness
- Compressor parameters.
- Straightness of route.
- Degree of winding of the duct in the trench.
- Ambient temperature.

17.3.2 **Blowing Chamber & Manhole**

17.3.2.1 These Chambers at a distance of 1 Km, are required. The size of the Blowing Chamber is 3m x 1m x 1.5m (length x width x depth). These Blowing Chambers are temporary Chambers and are refilled after accomplishing the blowing operation.

17.3.2.2 **Joint Pit**. These are required at the termination locations. The distance of the Splice Chambers depends upon the length of the Optic Fibre Cable being used. Generally, 2 Kms. length of Optical Fibre Cable is used. However, in developed countries, 4/6 Kms. of Optic Fibre Cable lengths are used. Pit size must be chosen carefully, taking into account length of Splice Closure and cable loop required for splicing and future repair. Joint Pit is always greater than Splice Closure length plus twice the minimum bending radius of the cable. A pit length of 1 metre is sufficient for most of the splice Closures.

17.3.2.3 The basic Rules and Recommendations for Blowing Cable into HDPE Telecom Duct: Use a proper compressor, never under estimate the compressor parameters. Ideally, internal diameter (I.D.) of the duct should be 2 times the outer diameter (O.D) of the cable, For appropriate duct size please refer the following table:

Ser. No	**Outer Dia of OF Cable (mm)**	**Recommended Duct Size (OD/LD) mm**
1.	9.0 – 12.5	32/26
2.	13.0 – 16.0	40/33
3.	16.5 – 20.0	50/42

17.3.2.4 Before starting the Cable blowing, be sure that duct is free of any obstacles or damage. Use a proper mandrel equipped with a transmitting device. This method will quickly locate the damaged areas if any, which must be replaced immediately.

17.3.2.5 When cable blowing is carried in high temperatures, protect cable from direct sunlight where possible. High temperature drastically reduces blow able lengths.

17.3.2.6 The blowing method is far less sensitive to bends and curves along the route compared to the pulling technique. When using state-of-the art HDPE Telecom Duct and Cable jet blowing machines, it is possible to safely install fibre optic cable around 30° to 90° bends without any additional lubricant.

17.3.2.7 Before beginning the cable blowing survey the route to determine the best locations, for access points for blowing machines and compressors. This can save considerable

materials and labour. Always blow downhill wherever possible. Up-hill slopes located at the beginning of the route reduce the blow able length. The blowing technique can be used in almost any situation and reduces costs relative to the pulling method in many cases, blowing exerts less stress on the cable.

17.3.2.8 This lowered stress combined with fewer splices to the fibre optic cable increases overall network quality.

17.3.2.9 The average blow able distance with one machine ranges between 700 and 2000 metres depending on the abovementioned parameters. Longer utilizing several blowing machines in tandem can accommodate blowing lengths, positioned in a series of access points along the route. Another technique for achieving extra long cable installation, distances is to access, the cable at manholes like 8 then pull out the cable and continue installation from this point along the route.

18 **How to Repair Damaged HDPE Telecom Duct**. The HDPE Telecom duct system can be damaged during the construction activities of other utilities or agricultural activities, if the duct route is not traced properly, or when executing agencies do not respect the importance of tracing the duct route. Often people who dig the trenches or construct the main duct, route damage existing communications networks, because they have not properly identified the location of the underground network, before digging. Duct can be damaged either when empty or white housing optic fibre cable. The methods to repair these two possible situations are quite different.

18.1 How to Repair Empty Duct: The location of the damage should be excavated for three meters along the troubled area. The manhole must be big enough, including width, for labourers to work comfortably.

18.1.1 Cut off the damaged part of the duct.

18.1.2 Prepare the same length, same size, and same colour of spare length.

18.1.3 Debar the ends of both ducts entering the manhole and the two ends of the new piece. Connect the joints with plastic Couplers.

18.1.4 Place locator or markers on the newly placed Couplers and enter this data into any relevant documentation.

18.1.5 Place the Coupler into the ground and cover with fine sand or soil. Place warning tape and cover with earth when finished.

GENERAL INSTRUCTIONS ON THE ACCEPTANCE PROCEDURE FOR OF CABLES LAID BY HDD

1. Following are the major observations/tests to be conducted during Acceptance testing of OFC by HDD method.

1.1 Check at entry/exist pits: -

1.1.1 As far as feasible, the A/T representative should be called during start of HDD operation. At the entry pit proper protection should be provided if the depth of duct is less than prescribed depth.

1.1.2 It may be ensured that proper caution boards and other barricades are provided to prevent any accidents during HDD operation.

1.1.3 It may be ensured that at entry and exist pit duct is brought to proper level manually and joint with coupler.

1.1.4 The Route Index Diagram (RID) of HDD duct route made with the help of tracker should be verified with reference to various landmarks on the duct route.

1.1.5 The cable route indicator to be provided suitably on the pavement or walls depending on the feasibility. In case of normal trunk route the route indicators to be provided on each manhole.

1.1.6 The reference of other operators existing in the near vicinity should also be indicated in the RID.

1.1.7 The duct at the lowest depth and the maximum depth of the duct should also be recorded. If A/T is done concurrently then tracking of ducts can also be verified with the help of tracker & preparation of RID.

1.2 Check of manholes: - Verifying the following major points with reference to manholes:

1.2.1 Check that the construction of manholes is as per the drawing & design approved by the competent authority (verify size/depth etc).

1.2.2 Please ensure that duct is having proper hangers for keeping the coil of slack OFC.

1.2.3 Ensure that unused ducts are provided with end caps.

1.2.4 Check that proper holes are provided at suitable depth for taking the fibre to different buildings as per the requirements.

1.2.5 Ensure the proper placement of FDMS and proper workmanship to ensure the fault free operation.

1.2.6 Suitable arrangements are made to avoid entering water and mud in the manhole.

1.2.7 Check of provision of manhole numbering plate properly fixed at the manhole or imbedded on nearby wall or pavements with suitable direction and distance for easy location of manhole on sides of manhole.

1.2.8 Ensure that spare OFC cable is coiled with one meter Dia roll and hanged properly.

1.2.9 Record the depth of PLB duct at the manhole (it should be more than 1.65 meters).

1.3 Duct Integrity Test (DIT).

1.3.1 Conduct the Duct Integrity Test from manhole to manhole or for specified duct length as per instructions already given in paras above.

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1.3.2 Please ensure that the ducts are laid with proper colour code as specified for OAN (Over lay Access Network).

1.4 Check of proper documentation

1.4.1 Please ensure that proper RID is made and the duct route is drawn on the geographical map to the extent feasible. In larter projects GIS based route map may also be floated.

1.4.2 Please ensure that in less depth case if any are covered by relaxation by competent authority and proper mechanical board is provided as per the standards laid by ITILTD.

1.4.3 Please also record the routes of other operators if any and details of distance from out duct route for future reference.

1.5 Check of HDD laid duct on bridges and culverts: -

1.6 Provision of site register.

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HDD OPERATION

Contents

HORIZONTAL DIRECTIONAL DRILLING (HDD)

1. **HDD Overview**. Horizontal directional drilling is an excellent alternative to traditional utility installation methods. Unlike manual labor, trenching or excavation, the HDD process is highly suitable in urban areas or places where aboveground obstructions exist that are expensive, inconvenient or impossible to disturb for product installation. HDD machines install utilities under obstacles such as roads, rivers, creeks, buildings and highways — with little or no impact to the aboveground surface.

2. **Drill Rig**. Horizontal directional drilling machines are available in many sizes. Regardless of a machine's size, it has three main functions — rotation, forward thrust/pullback and fluid flow.

3. **HDD Process**. Horizontal directional drilling machines will bore under or around obstacles. Once the drill path is planned, an underground pilot bore is performed utilizing a series of drill rods connected to a drill head. After the pilot bore is completed, a back reamer is attached to the drill string that enlarges the drill path to accommodate the product that will subsequently be pulled into place. Vermeer NAVIGATOR horizontal directional drilling machines can install product under roads, buildings, railroad tracks, street, rivers, creeks and in congested underground areas.

4. **Steering**. Steering refers to control of the direction of a drill path. The shape of a drill bit on the drill head allows an operator to change the drill path direction during a bore. When an operator points the drill bit downward to the 6 o'clock position and pushes the drill head forward, the drill head goes deeper. When the drill faces the 12 o'clock position, the drill head will rise. Pushed to the 9 o'clock position, the head

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goes left. Pushed to the 3 o'clock position, the head goes right. If no change in drill path is needed, the drill head and rod are rotated while thrusting.

5. **Locating**. Prior to starting a bore, the drill head is equipped with a transmitter that sends signals to an aboveground receiver during the bore. The drill head' s location must be tracked during a bore in order to provide steering position information to the HDD operator.

6. **Backreamers**. When a pilot bore is complete, the drill head exits the drill path and a backreamer is attached. Utilizing drilling fluid and the drill string, the backreamer is pulled back through the path to enlarge it to accommodate the product that will be pulled into place. Sometimes prereaming is performed to incrementally enlarge the drill-path wall. The installation product is then attached to the drill string and pulled into place. Many backreamer styles and sizes are available for different ground conditions and product sizes.

7. **Mud Flow**. Mud flow is an important component of the HDD process. Mud flow is created by pumping a combination of water and specialized drilling fluid additives through the drill rod and head (or backreamer). The drilling fluid then mixes with soil in the drill path and creates a flowing slurry back out of the path as the product pipe is pulled into place. Mud flow cools the transmitter housing in the drill head, suspends cuttings to help prevent product pipe from getting stuck during the bore and seals the bore to help prevent fluid loss and bore wall collapse.

Applications of HDD

8. **Applications Overview**. The horizontal directional drilling process has several distinct advantages over other methods of utility product installation. The HDD process offers precise installation, minimizes traffic interruption and excavation, and eliminates the need to dig up roads and disturb commercial interests.

Project Planning

9. **Project Planning Overview**. Prior to starting an HDD project, certain steps should be taken to ensure that you are performing the bore as efficiently as possible.

10. **Safety**. A thorough understanding of all safety and operating procedures is necessary to successfully operate an HDD. Each HDD unit is equipped with an

operator's manual in a protected storage location. It is essential to study this manual before using the HDD unit.

11. **Exposing Utilities**. Location and exposure of utilities must be completed prior to starting an HDD project. Locating underground utilities and obstacles before beginning a project will help to ensure the final success of a bore. Ground-penetrating radar systems (GPR) can be used in conjunction with traditional locating techniques to help provide more accurate production of underground information.

12. **Machine Setup**. Proper placement of the machine prior to starting the project can greatly affect the efficiency of your bore. The HDD unit must be placed at the job site with care to ensure that the maximum depth of the bore can be obtained without overstressing the drill rods or the product being installed. The Vermeer Terrain Mapping System is available to help map geographical conditions at the job site. Information from the Terrain Mapping System can also be uploaded directly to software to help ensure proper machine placement.

HDD Tooling

13. **Tooling Overview**. Tooling is an essential component of the HDD process. Because tooling is subject to wear, choosing high-quality tooling for your HDD unit will help keep your projects more productive in the long run. Specialty tooling is also available for applications like rock and sewer. Customized tooling created to fit your work environment is available by special order.

14. **Drill Rod**. Drill rod is designed for pushing drill heads and pulling backreamers and new product through the drill path. They are made with a hollow center to allow drilling fluid to flow through the rod, into the drill head or backreamer and out into the bore path. Drill rod has an allowable bend radius which determines how much it can be steered to produce the desired drill path. The bend radius is specific to each rod length and diameter.

15. **Drill Heads**. A drill head connects to the end of the drill rod and houses the locating transmitter and cutting bit. Drill heads also transfer drilling fluid from the drill rod to the drill bit. Drill heads can be connected to the drill rod using a connection system or hex collar connection system. A variety of drill heads is available for use in different ground conditions and applications.

    15.1 For use in standard dirt-based soil conditions.

    15.2 For use ranging from standard soil conditions to softer rock formations.

    15.3 For short- to mid-range use in solid rock formations.

    15.4 For use with bores involving wire line, gravity sewer or extended-battery operation.

16. **Drill Bits**. A drill bit attaches to the drill head and accomplishes the cutting action during a bore. There are many drill bits available for various underground conditions. Vendors offers a large variety of drill bits, several of which include standard bits for use in normal soil conditions and carbide-tipped and carbide-fragmented bits for tougher, more abrasive soil conditions.

17. **Backreamers**. There is a large variety of backreamers available for various soil conditions. The primary function of all backreamers is to prepare the bore path by cutting, shearing and mixing soil and drilling fluid into a flowing substance called slurry. When pulling product into place, the size of the backreamer used is larger than the outside diameter of the product(s), creating a flowing slurry between the bore path wall and product(s).

18. **Pipe-Pulling Accessories**. Pipe-pulling accessories are used to enhance the performance of a product pullback and project efficiency. Several commonly used pipe accessories include:

    18.1 Swivels — Prevent product from twisting while being pulled into the bore path.

    18.2 Pipe pullers (including pull grips, expanding taper pullers and carrot-type pullers) — Allow product to be pulled into the bore path.

Locating

19. **Locating Overview**. The type of locator most commonly used in HDD is a walkover system. The walkover system consists of a transmitter and a receiver. This type of system allows the user to walk over the top of the drill head with a receiver that interprets signals from the transmitter in the drill head. Information from these transmissions allows the user to determine the position of the drill head and displays several important pieces of information including pitch, roll, depth and location. This information is then relayed to a remote screen at the machine for the operator to see.

20. **Depth/Position**. To determine location of the drill head, the receiver uses signal strength from the transmitter in the drill head to indicate its depth and position. The depth and position information is displayed on the locator screen.

21. **Roll**. Roll is the rotary position of the drill head. It is indicated by a clock-face reading. Roll is very important when making a steering correction. When the operator of the drill rack faces the direction that the drill is advancing, 12 o'clock means the drill head will steer upward, 6 o'clock indicates a downward thrust, 9 o'clock is left and 3 o'clock is right. A bit can be positioned to move two directions at the same time by choosing a clock position in between any of the main clock positions. Example: 2 o'clock would cause the drill head to move mainly to the right, but a little upward as well.

22. **Pitch**. Pitch is the inclination of the drill head and can be expressed either in degrees or as a percentage of slope. If the pitch is zero, the drill head is level. If the pitch is minus, then the drill head is pointed down. A positive pitch indicates the drill head is pointed up. By knowing the pitch, you can calculate how much depth change there will be.

HDD Fluids

23. **Fluids Overview**. Drilling fluid is a mixture of water and specialized additives used in the drilling process. Drilling fluid cools the drill head and transmitter, lubricates the drill string and product being pulled back and suspends drill path cuttings into a slurry which flows out of the drill path as the product pipe is pulled into the bore path. A key requirement of drilling fluid is the ability to stay in the drill path without dissipating into the surrounding soil. The type of drilling fluid used depends upon the type of soil at the HDD project site.

24. **Soil Types**. Soils can be placed into two general categories — coarse and fine. Coarse soils consist of sands and gravels. Fine soils are comprised of clay. Coarse soils are non-compactable and allow water to flow freely into the formation. Fine soils will usually prevent water from flowing into the formation, but have a strong tendency to become sticky and swell when mixed with water. It is possible to have a soil type that is a mixture of these two general types.

25. **Fluid Additives**. Depending upon work-site soil conditions, certain additives are mixed with the drilling fluid.

25.1 Bentonite is added to drilling fluid that will be used in coarse soil types. Bentonite forms a filter cake around the bore wall to prevent drilling fluid from dissipating into the surrounding soil.

25.2 Polymers and surfactants are used for fine soil types. Polymers reduce swelling of the soil and lubricate the drill path to reduce friction on the drill stem and product.

26. **Pullback Volume**. The amount of drilling fluid used on an HDD project is equally important to the type of drilling fluid used. Your objective is to have enough fluid to allow cuttings (slurry) to flow out of the drill path as it is displaced by the product being installed. The size of the drill path and soil conditions should be considered when determining pullback fluid volume. To determine the amount of soil in a bore path, the following formula should be used:

26.1 **Metric**

26.1.1 Reamer in inches squared then divided by 2 = liters per meter.

26.1.2 Liters per meter multiplied by meters of drill path = liters of soil in bore path.

26.2 **English**

26.2.1 Diameter of back reamer squared then divided by 24.5 = gallons per foot.

26.2.2 Gallons per foot multiplied by feet of drill path = gallons of soil in bore path.

26.2.3 Enough drilling fluid needs to be added to the drill path to create a flow able slurry. As a general rule, the minimum amount of fluid required will produce a 1:1 ratio of drilling fluid to soil in the bore path. In some ground conditions like dry, reactive clay, a higher ratio of drilling fluid to soil is required. A leading cause of failed or stuck bores is not using enough drilling fluid. The pullback volume formula will assist in planning how much drilling fluid will be required at the job site.

27. **Pullback Speed**. Patiently pulling in product and using enough drilling fluid will contribute greatly to ensuring a successful pullback. After determining how much drilling fluid will be used per meter (foot), it is helpful to multiply this measurement by the length of drill rod being used to determine the volume of fluid that will be needed per rod. Dividing total volume per rod by the volume of fluid pumped per

minute will provide a minimum pullback time for that rod. In some cases, the pumping capability of a unit could theoretically reduce pullback time to a minimum. It is extremely important that the pullback is slow enough to allow proper mixing of drilling fluids and soil in the bore path.

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ENGINEERING INSTRUCTION

ओ.एफ.सी. केबिल की एच.डी.डी. द्वारा संस्थापन प्रक्रिया में हैंड होल व्यवस्था

PROVISION OF HAND HOLE IN CASE OF HDD ON OFC LAYING

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(NO.: TR/COFC/I-004)

पृष्ठ संख्या (No of Pages)	:	08
जारी क्रमांक (Issue Number)	:	01
जारीकर्ता (Issued By)	:	Inspection Circle
अनुमोदित (Approved By)	:	CGM, Inspection Circle
जारी करने का दिनांक (Date of Issue)	:	04.10.2011
संशोधन क्रमांक (यदि कोई) (Amendment No. If Any)	:	Nil
पृष्ठ संसोधित (Page Nos. Amended)	:	
जारीकर्ता (Issued By)	:	
अनुमोदित (Approved By)	:	
जारी करने का दिनांक (Date of Issue)	:	

केवल भारत संचार निगम कर्मचारियों के उपयोग हेतु
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PROVISION OF HAND HOLE IN CASE OF HDD ON OFC LAYING

1. Scope. This Engineering Instruction provides instructions about hand hole in case of Horizontal Directional Drilling (HDD) on OFC laying. The purpose of the hand hole is to have more pulling points which can be easily located and opened so as to locate the fault. Beside this the spare OFC cable in the hand hole can be used for jointing.

2. Introduction. HDD Overview: Horizontal directional drilling is an excellent alternative to traditional utility installation methods. Unlike manual labor, trenching or excavation, the HDD process is highly suitable in urban areas or places where aboveground obstructions exist that are expensive, inconvenient or impossible to disturb for product installation. HDD machines install utilities under obstacles such as roads, rivers, creeks, buildings and highways — with little or no impact to the aboveground surface. The hand hole can be similar to joint chamber. The joint chambers being used in projects are mainly of two types

2.1 Brick chambers

2.2 Pre casted RCC chambers

3. General Constructional Requirements

3.1 Bonding and Grounding attachments

3.2 The Pulling Eyes shall be located at opposite ends of each conduit entrance point and shall have diameter as per requisite specifications(7/8 inches minimum)

3.3 All Hand Hole covers shall be marked for easy identification and have a permanently attached label indicating the assigned Hand Hole number.

3.4 All Hand Holes shall be equipped with slip resistant covers with height adjustment brack, torsion assisted openings, guard bars and hexagonal head type bolts.

3.5 All covers shall be rated for heavy and constant vehicular traffic regardless of placement location.

3.6 Care should be taken to avoid placing the Hand Hole in a main conduit route between two Maintenance Holes.

3.7 Splices may be permitted in Hand Holes depending upon cable type and size with all Hand Hole splice locations approved prior to their installation.

3.8 Hand Holes shall be placed at different locations in a conduit system to allow installers to pull the cable through the conduit with minimum difficulty and to protect the cable from excess tension.

3.9 Care should be taken to avoid lateral conduits entry/exit of Hand holes.

3.10 Hand Holes conduits shall be plugged with duct seal material to prevent the entrance of water and gases.

3.11 No more than two 90-degree sweeps/bends shall be allowed between buildings & Hand Holes and between Hand Holes to Hand Holes. Regardless of depth, all bends and sweeps shall be concrete encased to prevent movement and “burning through” by the pull rope during cable installations.

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3.12 Types of pipe to be used for Optical Fibre Cable: Optical Fibre Cables should be pulled or blown through 50mm/40 mm/32 mm (outer dia) PLB HDPE pipes having strength of 10 kg/cm2. The HDPE PLB pipe will have the specification as given in GR No. G/CDS-05/01 DEC 94, shall only be used for laying the OF Cable. Wherever GI pipes or R.C.C. pipes are used for protection, the two ends of the pipe should be properly sealed to protect HDPE PLB pipe from sharp edge of GI pipe and to bar the entry of rodents. For providing additional protection Split RCC/GI pipes should be used from top instead of full RCC / GI Pipes.

4. Brick Chamber Type Hand Hole

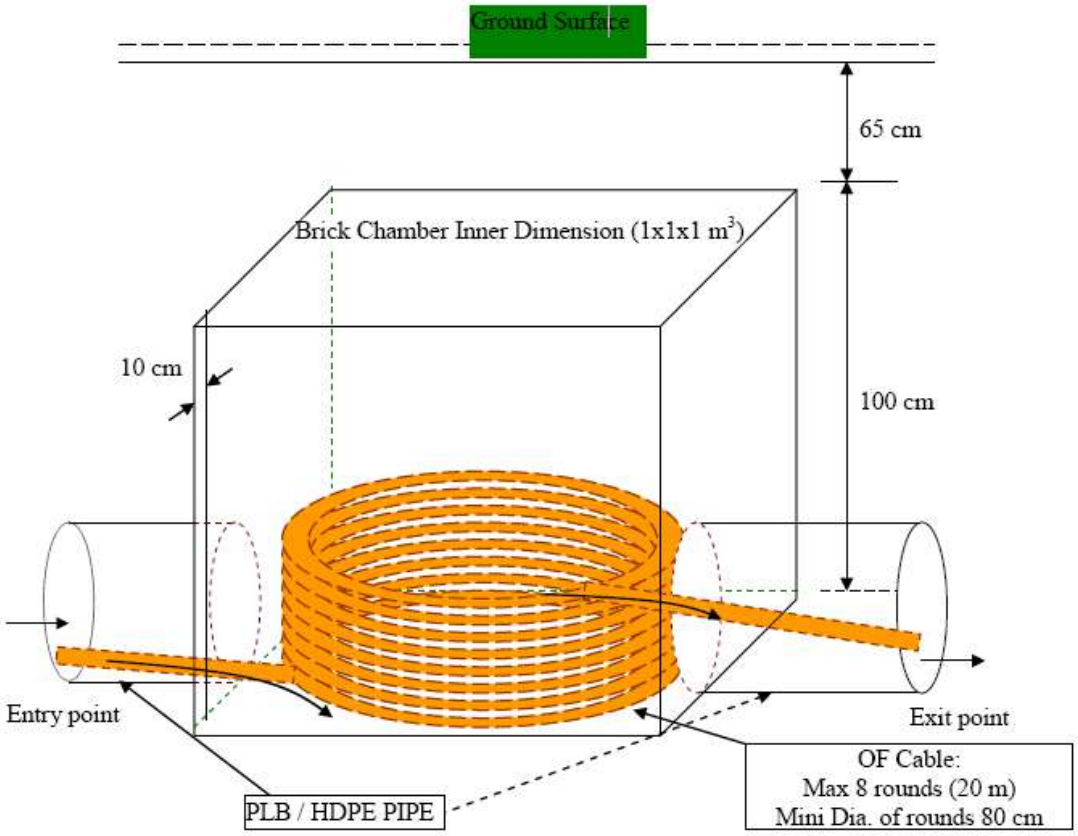

Figure: Block diagram of a brick chamber type Hand hole

4.1 For constructing brick chamber, first , base of the chamber is made using concrete mix of 1:5:10 (1: cement, 5: coarse sand, 10: graded stone aggregate 40mm nominal size) of size of 1.5m x 1.5 m x 0.15 m (thickness). Wall of brick chamber having internal dimensions of 1 m x 1 m x 1 m (H) should be constructed on this base having wall thickness of 9” using cement mortar mix of 1:5 (1: cement, 5: fine sand). The bricks to be used for this purpose should be of size 9” x 4.5” x 3”, best quality available and should have smooth rectangular shape with sharp corners and shall be uniform in color and emit clear ringing sound when struck. The joint chamber should be so constructed that HDPE/PLB pipe ends remain protruding minimum 5cms inside the chamber on completion of plastering. The HDPE/PLB pipes should be embedded in wall in such a way so that, the bottom brick should support the pipe and upper brick should be provided in a manner that HDPE/PLB pipe remains free from the weight of the construction.

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4.2 The joint chamber should be plastered on all internal surfaces and top edges with cement mortar of 1:3 (1: cement, 3: coarse sand), 12 mm thick finished with a floating coat of complete cement as per standard. Pre-cast RCC slab with two handles to facilitate easy lifting and of thickness of 5 cm having one handle for each half in centre and with specific words to be engraved on it and informed separately are to be used to cover the joint chamber. Two numbers of such slabs are required for one joint chamber. This pre-cast slab should be made of cement concrete mix of 1:2:4 (1: cement, 2: coarse sand, 4: stone aggregate 6 mm nominal size) reinforced with steel wire fabric 75 x 25 mm mesh of weight not less than 7.75 Kg per sq. meter. The joint chamber is filled with clean sand before closing. Lastly, back filling of joint chamber pit with excavated soil is carried out.

4.3 The depth should be sufficient (165cm, plz. refer EI on laying practices of Optical Fiber Cable by HDD,NO.TR/COFC/A-001 dated 31-01-2007) so that the hand hole is safe i.e. not damaged by normal city activities. The top of the hand hole should about 60 cm +/- 10 cm. This depth will be neither too much for maintenance work nor too less.

5. Pre Cast RCC Chamber (Ring) Type Hand Hole

5.1 RCC ring should confirm to NP2 class pipe as given in table above as per dimensions given in drawing. RCC TOP and BOTTOM plate shall have reinforcement as:

5.1.1 Single round ring of 8mm dia.

5.1.2 Horizontal and vertical rods of 8mm dia.

5.2 Cement concrete of 1:2:4 where 1Cement, 2 Sand and 4 Stone aggregate of 6 mm size should be used. It should be finished in dimensions as per drawing. Surface should be smooth and finished. It should be of sufficient strength, so that it may not get damage while heading i.e. loading, unloading and fixing at site. The two entry points as mentioned in the drawing for facilitating entry of OF cable.

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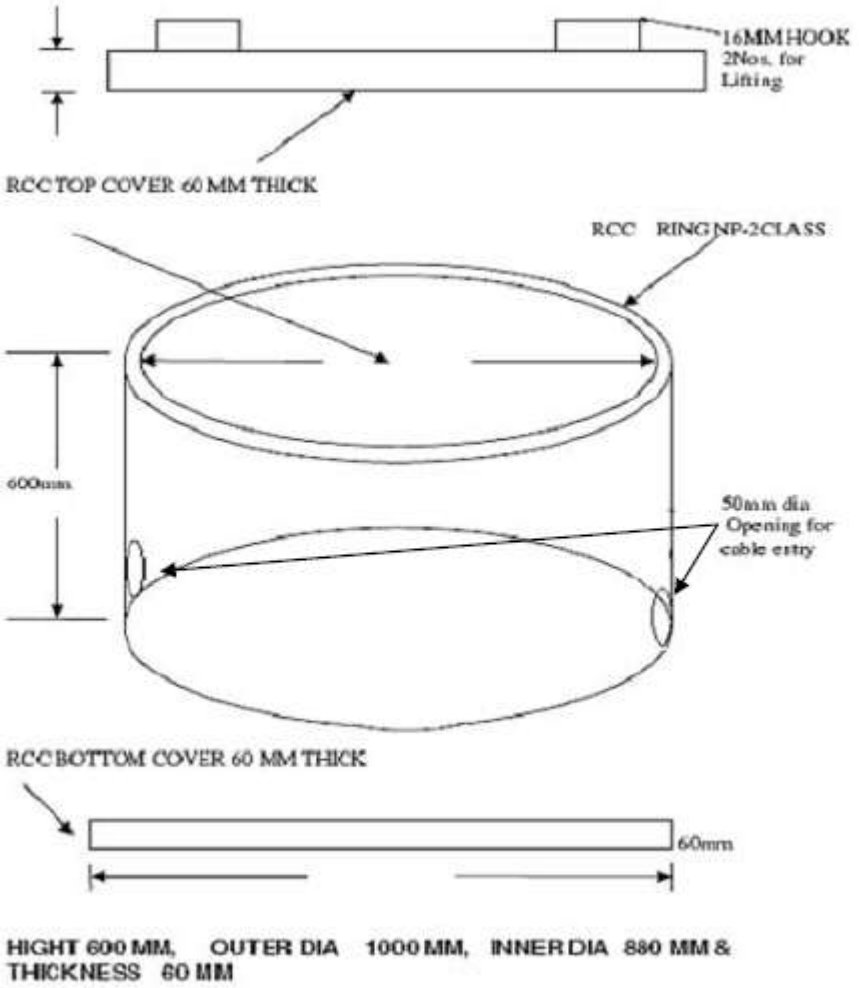

Figure: Drawing for Pre cast RCC Chamber with Base Plate and Cover

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6. General Technical Requirements

6.1 The minimum diameter of the roll in hand hole should be 80 cm. (safe limit of bending radius is about 15 times the diameter of cable)

6.2 Approximate length of cable to be kept in hand hole should be 20 m or 8 rolls.

6.3 The OF cable rolls will be kept horizontally as being done in joint pits.(to keep cable vertically fixers are to be provided which will increase the cost of hand hole)

6.4 There will be no clamp and fixers at entry point. The entry and exit will be same as in joint pit.

6.5 The depth should be sufficient so that the hand hole is safe i.e. not damaged by normal city activities. The top of the hand hole should about 60 cm +/- 10 cm. This depth will be neither too much for maintenance work nor too less.

6.6 The distance between hand holes should be 400m. Cost of fiber used as roll in hand hole and resultant increase in optical length. The approximate cable in 200m hand hole will be 9 x 20 m i.e. 180 m i.e. about 9% of fiber length. The approximate cable in hand hole at distance of 400 m will be 4 x 20 m i.e. 80 m i.e. about 4 % of fiber length (i.e. 5% saving of OFC cable, constructional cost saving is extra). The 400 m span is tradeoff between the expenditure and need. Since the roles will be made

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similar to practice in joint pit so there will be no significant detrimental effect on technical performance of the fibre i.e. attenuation/absorption and other losses.

6.7 One PVC/HDPE or any suitable pipe should be kept vertically over the top of hand hole up to a height 5cms below surface. This will further help in locating hand hole in future.

7. Numbering scheme. The numbering scheme for these hand holes will be hand hole No followed by the joint no. For example 2/2 hand hole means 2nd hand hole after 2nd joint. Hand hole no 3/14 means this is third hand hole after the 14th joint. Hand hole no 4/0 means that it is 4th hand hole after the termination (0 joint). The numbering existing hand holes should not be disturbed on account of additional joints. The location of hand hole should be properly marked on route index diagram(RID) and the location of its indicator should be properly indicated in RID so that its location is easy and correct in future during maintenance.

8. Customization Requirements

8.1 In case of situation demand / very dense population / highly revenue or market area the hand hole may be constructed at 200m distance, instead of 400m.

8.2 In case of difficulties being faced for digging bigger pit due to soil or municipal restrictions, chamber of smaller size can be constructed of specific dimensions at the description of competent authority on case by case basis.

9. Conclusion

9.1 The Brick chamber (in the northern region) and the Pre cast RCC (in the western region) Hand holes are continuously in practice since about 30 year in the Telecom Zone of India.

9.2 The revised process and necessary instructions to change the construction practices are changed time to time as per instructions from Engineer-In-Charge/User. The amendments in this EI shall be incorporated as and when the instruction received from Engineer-In-Charge/User.

GLOSSARY (TR/COFC/I-004)

1. Bonding. The permanent joining of metallic parts to form an electrically conductive path that will ensure electrical continuity and the capacity to conduct safely any current likely to be imposed.
2. Conduit A raceway of circular cross-section.
3. Cross-connection. A connection scheme between cabling runs subsystems, and equipment using patch cords or jumpers to attach to connecting hardware on each end.
4. Entrance point. The point of emergence of telecommunications conductors through an exterior wall, a concrete floor slab, or from a rigid metal conduit or intermediate metal conduit.
5. Grounding conductor.A conductor used to connect the grounding electrode to the building's main grounding bus bar.
6. Grounding electrode. A conductor, usually a rod, pipe or plate (or group of conductors) in direct contact with the earth for the purpose of providing a low-impedance connection to the earth.
7. Hand hole. A structure similar to a small maintenance hole in which it is expected that a person cannot enter to perform work.
8. Inner Duct. Typically, a nonmetallic pathway within a pathway. Also known as sub duct.
9. Manhole (Manhole). A vault located in the ground or earth as part of an underground duct system and is used to facilitate placing, connectorization, and maintenance of cables as well as the placing of associated equipment, in which it is expected that a person will enter to perform work.
10. Pathway. A facility for the placement of telecommunications cable.
11. Pull cord or pull wire. A cord or wire placed within a raceway and used to pull wire and cable through the raceway.
12. Raceway. Any enclosed channel designed for holding wires or cables.
13. Splice. A joining of conductors generally meant to be permanent, generally from separate sheaths.
14. Splice box. A box, located in a pathway run, intended to house a cable splice.

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Abbreviations (TR/TOFC/I-004)

EI	Engineering Instruction
HDD	Horizontal Directional Drilling
NTR	Northern Telecom Region Circle
OFC	Optical Fibre Cable
PVC/HDPE	Polyvinyl chloride/ High Density Polyethylene (type of pipes)
RID	Route Index Diagram
RTPC meeting	Regional Trunk Planning Committee Meeting of ITILTD.

Reference:

1. EI on laying practices of Optical Fiber Cable by HDD,NO.TR/COFC/A-001 dated 31-01-2007.
2. Telecom Standards from the Net.

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यांत्रिक अनुदेश

ENGINEERING INSTRUCTION

ओ.एफ.सी.केविल लेयिंग में माइक्रो टनलिंग का परिचय

INTRODUCTION OF MICRO-TUNNELLING IN LAYING OF O.F.CABLE

क्रमांक : टी.आर./सी.ओ.एफ.सी./ए-002

(No.: TR/COFC/A-002)

पृष्ठसंख्या (No of Pages)	:	08
जारी क्रमांक (Issue Number)	:	01
जारीकर्ता (Issued By)	:	Inspection Circle
अनुमोदित (Approved By)	:	CGM Inspection Circle
जारी करने का दिनांक (Date of Issue):		22/02/2010
संशोधन क्रमांक (यदि कोई) (Amendment No. If Any):		Nil
पृष्ठ संशोधित (Page Nos. Amended)	:	
जारीकर्ता (Issued By)	:	
अनुमोदित (Approved By)	:	
जारी करने का दिनांक (Date of Issue)	:	

केवल भारत संचार निगम कर्मचारियों के उपयोग हेतु
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MICRO-TUNNELLING FOR LAYING OF OPTICAL FIBER CABLE

1. **Scope**. This Engineering Instruction deals with the methods to be adopted in laying of PLB HDPE pipes for Optical Fiber Cable using micro-tunneling or Horizontal Directional Drilling (HDD) -also called as the trench less technology.

2. **General**

2.1 Micro-Tunneling boring, commonly known as horizontal directional drilling or HDD, is a steerable trenchless method for installing underground pipes and cables in a shallow arc along a prescribed bore path by using a surface launched drilling rig, with minimum impact on the surrounding area. Directional boring is used when trenching or excavating is not practical. Directional boring minimizes environmental disruption. It is suitable for a variety of soil conditions and jobs including road, landscape and river crossings. In ITILTD directional boring is used for installing PLB-HDPE pipe for laying of Optical Fiber Cable and U/G telephone cable. It is used for crossing waterways, roadways, congested areas, environmentally sensitive areas, and areas where other methods are costlier. It is used instead of other techniques to provide less traffic disruption, lower cost, deeper and longer installation, no access pit, shorter completion times, and environmental safety. The technique has extensive use in urban areas for developing utility services as it helps to avoid huge disruption and hazards created during open cut trenches. The use however necessitates that the operator must have the complete information about the existing utility services so that he can plan his whole alignment to avoid damaging those utility services. Since uncontrolled drilling can lead to such damages, different agencies/government authorities owning the urban utility services have formed their rules for safe work execution. To standardize the techniques, different trenchless technology promoting organizations have developed guidelines for this technique.

2.2 ITILTD has already introduced Optical Fiber Transmission systems for local junctions and for long distance routes. For local junction and long distance routes different types of Optical Fiber Cables like 24Fibres, 12Fibres & 6Fibres (metallic & non-metallic) have already been introduced in ITILTD for installation of Optical Fiber Cable Transmission systems. As Optical Fiber is going to be the ultimate medium for most of the access technologies in future, high count fibers like 48Fibres,96Fibres & 144Fibres O.F Cables are deployed in large scale in the recent years. All these high count cables are ribbon fiber cables with 12Fibers in one ribbon. Under the Overlay Access Network Project, these cables are laid in ducts using Micro-tunneling trench. The Micro tunnel duct or Horizontal Directional Drilling (HDD) usually deployed mainly for the O.F.C routes within the corporation & municipality limit. The Micro tunnel duct may also be used at the water canal crossings, highway crossings and railway crossings. HDPE pipe coil of 1Km. length shall be economical resulting less wastage in micro-tunneling process.

3. **Detailed Survey**

3.1 The HDD is normally deployed in the soft soils only. In rocky areas and laterite soils deployment of this technology shall be very expensive and hence may not be financially viable. In addition, HDD operation in rocky areas shall be extremely slow. Thus only in soft soil areas this technology is preferable.

3.2 Deployment of HDD may be the first choice in congested road, Cement Concrete roads made from end to end leaving no margin, where PLB pipe laying by open Trenching is not possible.

3.3 A detail survey is to be done on the roads having maximum number of business buildings, with a good number of important commercial and potential customers. The routes proposed should include various Nodes/Repeater stations.

3.4 The commercially important customers and the buildings of interest, if little away from the proposed main route may also be covered in the survey and dropping of O.F. Cable may be planned through outdoor FDMS and Customer Premises FDMS.

3.5 High count fibers may be planned so that the ultimate capacity of the ducts and the cables to be laid shall meet the demands of the future access.

3.6 In the cities where the Overlay Access Network (OAN) is being planned, the O.F. Cable alignment may be planned on the footpath or along the edge of the road. Manholes may also be located along the alignments. Fiber to the home (FTTH) technologies are being introduced in the network, hence the planning of the fibers needs to be done as per the ultimate customer demand. In every manhole 30 meter Coil should be kept for every cable.

3.7 The route survey should include the planning of manholes / new buildings for OF cable terminations on main route or housing the terminations in the existing Exchange buildings on the routes.

3.8 On the basis of surveys, general permission from road and rail/local authorities for laying the Optical Fiber Cable along the suitable roads and at particular rail/road crossings will have to be obtained. The OF Cable preferably be laid straight as for as possible along the road. When the OF Cable is laid along the National Highways, Cable should run along the road land boundary or at a distance of 15 to 30 meters from the centre line of the road where the road land is wider.

4. **Soil Categorisation**. Soil is categorized only under two broad categories i.e. “Rocky” and “non Rocky”, for purpose of deciding the depth at which the cable is to be laid. The soil is categorized as rocky if the cable trench cannot be dug without blasting or chiseling. All other types of soils shall be categorized as “Non rocky” including soil mixed with stone or soft rock. Micro-tunneling usually deployed in the soft soils only, but in some exceptional cases this technology may be used in other soils.

5. **Laying Details**

5.1 Horizontal directional drilling is an excellent alternative to conventional installation methods. Unlike manual labor, trenching or excavation, the HDD process is highly suitable in urban areas or places where aboveground obstructions exist that are expensive, inconvenient or impossible to disturb. Deployment of HDD machines overcome the obstacles such as roads, rivers, buildings and highways — with little or no impact to the aboveground surface.

5.2 The Micro-Tunneling machine should be capable of drilling for minimum 150 meters to 250 meters at a time without fail in the soft soil. In general, the machines with 10 Tones or more thrust capacity are having the capability for this purpose. Normally depth of the drilled portion should be more than 2.5 meters. This depth may be achieved at a distance of 10 meters from the leading edge of the Manhole. Manhole to be opened for the entry pit and the exit pit with minimum measurement of 1.5m x1.5m x 1.7m.Both entry and exit pits are opened before drilling is commenced. The depth at the entry pit should be 1.65 metres and for achieving this depth in the manhole a pilot entry pit shall be opened with minimum 2 meters depth for enabling the drill pilot to enter. The pilot entry pit shall be at least 4 meters away from the manhole.

5.3 Whenever curves or deviations are encountered it should be a very smooth curve, the deviations should not be more than 100 cm from the mean line joining the centre of entry pit and the centre of the exit pit. A nylon wire shall be fixed between these two pits before the drilling operation commences, for identifying the deviations.

5.4 After the drilling operation commences, the depth and offset of the pilot is to be recorded at every 3 meters using the properly calibrated machine tracker. The offset of the drill shall be recorded with reference to the edge of the road and also the deviation with reference to the mean line represented by the Nylon rope on the ground. The depth, deviations and offset readings may be provided by the machine automatically, apart from the manual records made.

5.5 Bottom of the trenches should be at uniform level without any abrupt ups and downs. After the trenching is done for sufficient length, the bottom leveling should be inspected for uniformity to ensure that pipe could be laid without sharp bends.

5.6 In exceptional case, the depth of the trench could be less than 2.50 meters due to difficult terrain. However, in no case it should be less than 1.20 meters. In certain cases, in a uniform terrain a sudden burrow pit or old culvert of short length might be encountered. In such case, the HDPE pipe can be further protected by GI/RCC pipes of suitable size.

5.7 When trenching is done close to underground power cables proper precautions to be taken to avoid hazards. When trenching is undertaken along street and railway lines, caution board or red flags are to be provided at each entry, exit and pilot pit of the trench to alert the traffic. If the manholes are to remain open at night, red lamps or luminous caution boards on either ends should be provided. Cables should be pulled or blown through 50 mm (outer dia.) PLB HDPE pipes .Wherever GI pipes or R.C.C. pipes are used for protection, the two ends of the pipe should be properly sealed to protect HDPE PLB pipe from sharp edge of GI pipe. For providing additional protection Split RCC/GI pipes should be used from top instead of full RCC / GI Pipes.

5.8 In the Overlay Access Network, since manholes are placed on road surface at every 200 metres, no route indicators and joint indicators are required. Indicators may be used where the manholes are below the road surface and cannot be visible .Where manholes are not placed at every 200 metres or less, route indicators may be used. The G.I. indicators in square plate shape with base of 10"x10" of suitable thickness to be provided at every manhole. These plates may be fixed on the wall against the manhole. The G.I. Joint Indicators embedded in concrete similar to that of Route Indicator may be provided at joint locations and may be buried in ground with at least 30 cm of it above the ground level. The joint indicator may be kept along the road side clearly visible from road and may be painted red.

5.9 It is quite possible that the pipe may get elongated and its bore may get reduced in the process of pulling up the pipe which may ultimately result into difficulty in pulling cables. To overcome this Duct Integrity Test (DIT) should be conducted after the pipes are laid either in open trench method or in the HDD method for verifying the continuity of the pipe. The DIT involves two tests. In one test one side of the PLB pipe laid is sealed using the end plug and on the other side air compressor or blower is used to hold the 5 Kg/cm-cm pressure in side the pipe under test. The pressure should be held for 1 hour without any leakage. In the second test a wooden bullet having 80% of the diameter of inner diameter of PLB pipe and having a length of 5 cm. may be blown from one side of the PLB pipe. The other side of the pipe shall be left open. The bullet should fly out without any blockage then the PLB pipe laying is successful. Care should be taken by covering the end of the PLB pipe with a nylon wire so that the flying bullet shall not hit anyone. While laying for inter district or inter

state routes, normally open trenching process is adopted, but Micro-tunneling may be deployed at the water canal crossings, highway crossings and Railway crossings.

5.10 The O.F. Cable had to be laid in the trench through HDPE pipes at a depth of 1.65M measured from top of HDPE pipe. Taking into account the diameter of the HDPE pipe and provisions of soft soil below HDPE pipe, it will be desirable to dug the trench at a depth better than, 1.60 meters. In case of rocky soil a minimum depth of 0.90mtr. is to be achieved. In case of non-rocky soil where due to any obstructions in built up areas it is not possible to dig deeper, a minimum of 1.00 meter from top of pipe shall be maintained. Wherever the minimum depth of 0.9 meter in rocky soil cannot be adhered to, depth can further be reduced up to 0.5 meter with prior relaxation from competent authority. In all such cases where the depth is less than 0.9m, mechanical protection by reinforced concrete casing should be given. Suitable mechanical protection by using RCC/GI pipes to be provided for all cables laid at a depth less 1.2M. No protection, however, need to be given if the depth is more than 1.2m.

5.11 When the cables are laid in ducts, no particular depth is prescribed. End of the ducts should be properly sealed and necessary protection by G.I. pipe / RCC pipe should be provided at the entry and exit of the duct till the cable is buried to a depth of 1.5 m.

5.12 HDPE pipe laying in built up areas become vulnerable to faults due to cables/pipes of other essential services laid close to ITILTD cables. Special care is essential while laying optical fiber cables on these routes. If necessary the OF cable may be laid below the cables and pipes of other agencies including local telephone cables and in particular case cable may be laid via alternate longer route.

5.13 On Culvert & bridge over nullah HDPE pipe is to be laid at 1.5 M depth and protection provided by using RCC pipe. The RCC pipe shall extend 2 M minimum beyond the end Nullah on either side.

5.14 On rail bridges / crossings the HDPE pipe must be encased in split able cast iron / RCC pipe as prescribed by the Railway authorities.

6. Micro-Tunnelling Process

6.1 The method comprises a three stage process. In the first stage, the machine drills a pilot hole on the designed path and the second stage enlarges the hole by passing a larger cutting tool known as the back reamer. The third stage places the casing pipe (i.e. PLB-HDPE pipe) in the enlarged hole. The directional control capabilities assist the rig operator in making necessary changes in the directions of the drilling head.

6.2 Horizontal directional drilling is done with the help of a viscous fluid known as drilling fluid. It is a mixture of water and, usually, bentonite or polymer continuously pumped to the cutting head or drill bit to facilitate the removal of cuttings, stabilize the bore hole, cool the cutting head, and lubricate the passage of the product pipe.

6.3 Location and guidance of the drilling is a very important part of the drilling operation, as the drilling head is under the ground while drilling and, in most cases, not visible from the ground surface. Uncontrolled or unguided drilling can lead to substantial destruction, which can be eliminated by properly locating and guiding the drill head. There are two types of locating equipment for locating the bore head, the ‘walk-over’ locating system or a 'wire-line' locating system. In both of the systems a device comprising of a transmitter behind the bore head registers angle, rotation, direction and temperature data. This information is encoded into an electro-magnetic signal and transmitted through the ground to the surface in a walk-over system. At the surface a receiver (handheld 'locator') decoded the signal and steering directions are relayed to the bore machine operator. In a wireline system, this information is

transmitted through the cable fitted within the drill string. Both systems have their own merits and depending upon the site requirements a particular system is chosen. Directional drilling machines will bore under or around obstacles. Once the drill path is planned, an underground pilot bore is performed utilizing a series of drill rods connected to a drill head. After the pilot bore is completed, the back reamer enlarges the drill path to accommodate the product that will subsequently be pulled into place.

6.4 Steering refers to control of the direction of a drill path. The shape of a drill bit on the drill head allows an operator to change the drill path direction during a bore. When an operator points the drill bit downward to the 6 o'clock position and pushes the drill head forward, the drill head goes deeper. When the drill faces the 12 o'clock position, the drill head will rise. Pushed to the 9 o'clock position, the head goes left. Pushed to the 3 o'clock position, the head goes right. If no change in drill path is needed, the drill head and rod are rotated while thrusting.

6.5 After completion of pilot bore, the drill head exits the drill path and the back reamer is attached. Utilizing drilling fluid and the drill string the back reamer is pulled back through the path to enlarge it to accommodate the product that will be pulled into place. Sometimes prereaming is performed to incrementally enlarge the drill-path wall. The installation product is then attached to the drill string and pulled into place.

6.6 Many back reamer styles and sizes are available for different ground conditions and product sizes.

6.7 Mud flow is an important component of the HDD process. Mud flow is created by pumping a combination of water and specialized drilling fluid additives (Bentonite / Polymer) through the drill rod and head (back reamer). The drilling fluid then mixes with soil in the drill path and creates flowing slurry back out of the path as the product pipe is pulled into place. Mud flow cools the transmitter housing in the drill head, suspends cuttings to help prevent product pipe from getting stuck during the bore and seals the bore to help prevent fluid loss and bore wall collapse.

7. Concerned Points

7.1 The horizontal directional drilling process has several distinct advantages over other methods of utility product installation. The HDD process offers precise installation, minimizes traffic interruption and excavation, and eliminates the need to dig up roads and disturb commercial interests. Prior to starting an HDD project, certain steps should be taken to ensure efficient boring.

7.2 A clear conception regarding all safety and operating procedures is necessary to operate a HDD machine successfully. Each Machine should be equipped with an operator’s manual and it is essential to study this manual before using the HDD unit.

7.3 Locating underground utility services and obstacles before beginning a project will help to ensure the final success of a bore. Ground-penetrating radar systems (GPR) can be used in conjunction with traditional locating techniques to help provide more accurate production of underground information.

7.4 Proper placement of the machine before starting the project, increases the efficiency of the bore. The HDD unit must be placed at the job site with care to ensure that the maximum depth of the bore can be obtained without overstressing the drill rods or the product being installed.

7.5 The tooling of HDD is an essential component of the process. As tooling is subject to wear, selection of high-quality tooling for the HDD unit will help to keep more productive in the long run.

7.6 Drill rod is designed for pushing drill heads and pulling backreamers and new product through the drill path. They are made with a hollow center to allow drilling fluid to flow through the rod, into the drill head or backreamer and out into the bore path. Drill rod has an allowable bend radius which determines how much it can be steered to produce the desired drill path. The bend radius is specific to each rod length and diameter.

7.7 A drill head connects to the end of the drill rod and houses the locating transmitter Drill heads also transfer drilling fluid from the drill rod to the drill bit. Drill heads can be connected to the drill rod using a connection system. A variety of drill heads is available for use in different ground conditions and applications.

7.8 There is a large variety of Backreamers available for various soil conditions. The primary function of all backreamers is to prepare the bore path by cutting, shearing and mixing soil and drilling fluid into a flowing substance called slurry. When pulling product into place, the size of the backreamer used is larger than the outside diameter of the product, creating flowing slurry between the bore path wall and product.

7.9 The type of locator most commonly used in HDD is a walkover system. The walkover system consists of a transmitter and a receiver. This type of system allows the user to walk over the top of the drill head with a receiver that interprets signals from the transmitter in the drill head. Information from these transmissions allows the user to determine the position of the drill head and displays several important pieces of information including pitch, roll, depth and location. This information is then relayed to a remote screen at the machine for the operator to see.

7.10 To determine location of the drill head, the receiver uses signal strength from the transmitter in the drill head to indicate its depth and position. The depth and position information is displayed on the locator screen.

7.11 Roll is the rotary position of the drill head. It is indicated by a clock-face reading. Roll is very important when making a steering correction. When the operator of the drill rack faces the direction that the drill is advancing, 12 o'clock means the drill head will steer upward, 6 o'clock indicates a downward thrust, 9 o'clock is left and 3 o'clock is right. A bit can be positioned to move two directions at the same time by choosing a clock position in between any of the main clock positions. Example: 2 o'clock would cause the drill head to move mainly to the right, but a little upward as well.

7.12 HDD Fluids is a mixture of water and specialized additives used in the drilling process. Drilling fluid cools the drill head and transmitter, lubricates the drill string and product being pulled back and suspends drill path cuttings into slurry which flows out of the drill path as the product pipe is pulled into the bore path. A key requirement of drilling fluid is the ability to stay in the drill path without dissipating into the surrounding soil. The type of drilling fluid used depends upon the type of soil at the HDD project site.

7.13 **Soil Types**. Soils can be placed into two general categories — coarse and fine. Coarse soils consist of sands and gravels. Fine soils are comprised of clay. Coarse soils are non compactable and allow water to flow freely into the formation. Fine soils will usually prevent water from flowing into the formation, but have a strong tendency to become sticky and swell when mixed with water. It is possible to have a soil type that is a mixture of these two general types.

7.14 **Fluid Additives**. Depending upon work-site soil conditions, certain additives are mixed with the drilling fluid. Bentonite is added to drilling fluid that will be used in coarse soil types. Bentonite forms a filter cake around the bore wall to prevent drilling

fluid from dissipating into the surrounding soil. Polymers are used for fine soil types. Polymers reduce swelling of the soil and lubricate the drill path to reduce friction on the drill stem and product.

8. **Depth A/T**. Two types of depth A/T are followed normally. Traditional depth A/T is done after completion of PLB pipes laying. While deploying HDD, it may be required to carry out the depth A/T simultaneously i.e. concurrent A/T. In case the machine deployed is capable of providing the automatic depth, deviation and offset details, depth A/T can be conducted at a later date also. The A/T Authority of the respective area shall decide on the method of A/T to be followed.

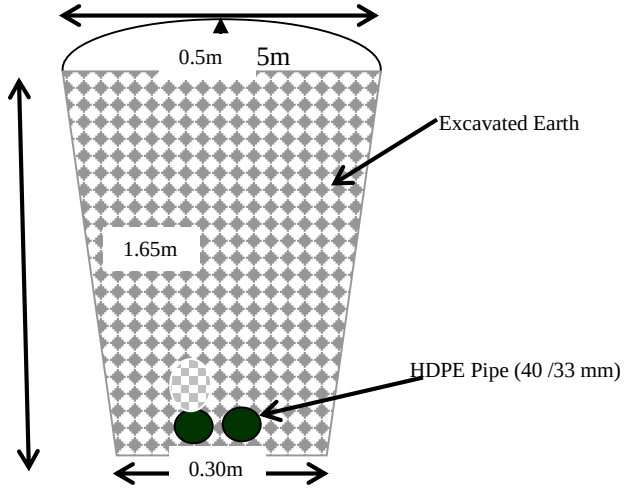
8.1 **Traditional Depth A/T**. Before the cable is actually pulled through the pipe, the project circle should offer the route for A/T of the depth and position for the cable and correctness of the route diagram. The best way should be to offer it in stretches of **10-20 kms**soon after the HDPE pipe is buried. The route diagram should be prepared and made over to the A/T unit in advance. The HDD machine recording of the depth deviations authenticated by the division head is to be provided to the A/T unit. The A/T unit will specify the test pit roughly two per km for checking of depth. Wherever depths are prescribed, the tolerance up to minus 5 cm is permissible. If the pipe is found to be at a depth less than specified value O.F cable should not be drawn through HDPE pipe and pipe should be lowered to the proper depth at the locations where necessary relaxation of competent authority is not available.

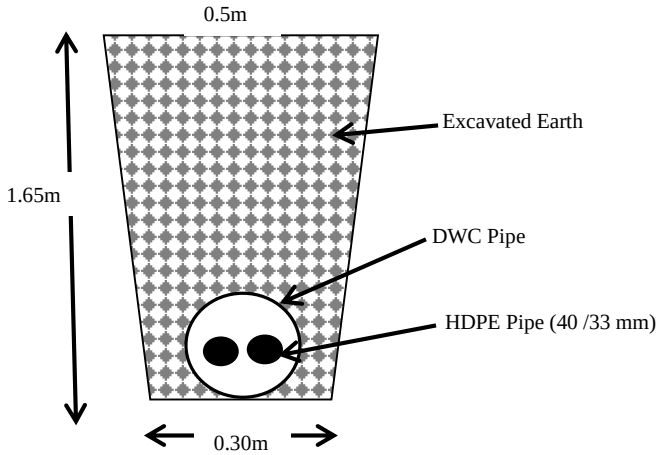
8.2 **Concurrent Depth A/T**. At present there is no specification available for conducting depth A/T for HDD. However acceptance testing is offered by considering the Depth graph given by the site In-charge at entry / exit points of bore. When the Bore line is passing through concreted and congested areas, test pits may be taken where ever feasible and earthen surface is available. Test pits may not be permitted in city areas since it involves digging to a depth of 2 meters to 3 meters. Hence depth A/T is preferable to perform while the work is in progress. During the execution, on intimation, the AT-In-charge may inspect the site and measure the depths of the duct at four places which are at least 20 meters away from each other. This shall be in addition to the depth of the drill at the entry pit or the depth of the duct at the exit pit.

9. **Conclusion**. Micro-Tunneling boring or horizontal directional drilling (HDD) is a trenchless method for installing underground pipes and cables in developed locations along a prescribed bore path by using a surface launched drilling rig, with minimum impact on the surrounding area. Directional boring is used when trenching or excavating is not practical. Directional boring minimizes environmental disruption. It is suitable for a variety of soil conditions and jobs including road, landscape and river crossings. In directional boring is used for installing PLB-HDPE pipe for laying of Optical Fiber Cable and U/G telephone cable.

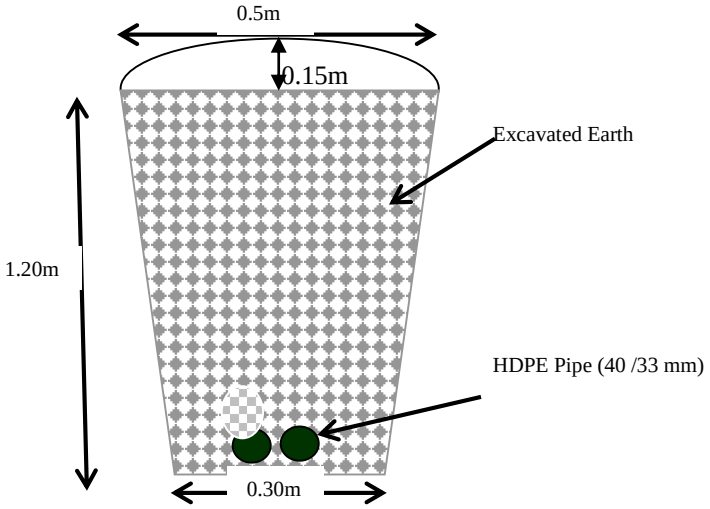
TECHNICAL SPECIFICATIONS FOR LAYING OF DUCT

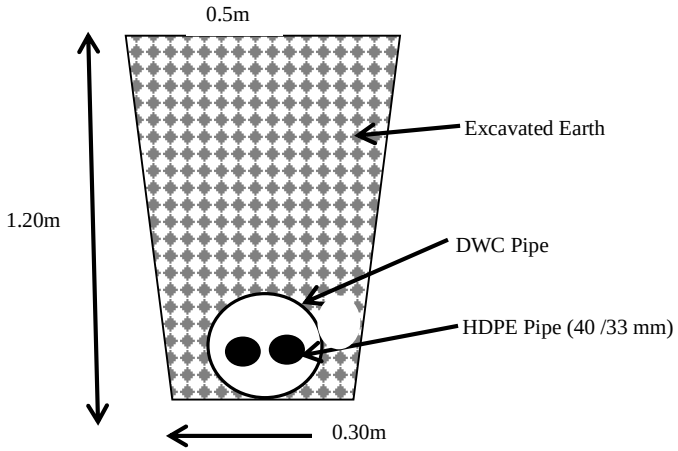
OPEN CUT METHOD	
SPECIFICATION DRAWINGS	
SPECIFICATION DRAWINGS	
Excavation and Backfilling [Depth 1.65 m]	Road / Culvert Crossing [Depth 1.65m]



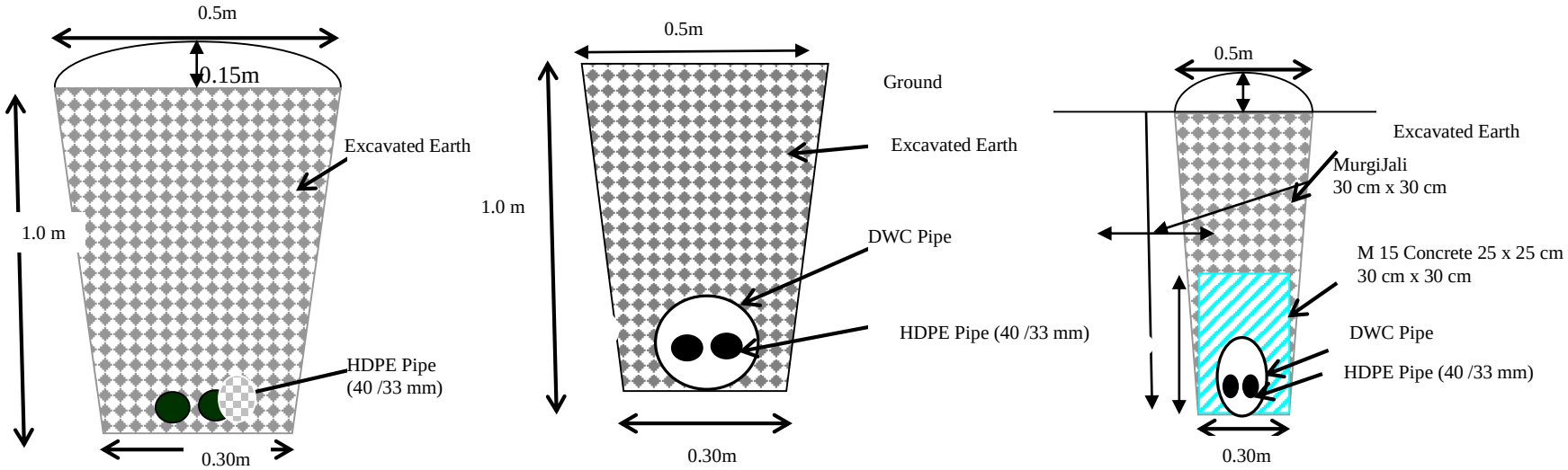


SOFT ROCK	
Excavation and Backfilling [Depth 1.20 m]	**Road / Culvert Crossing [Depth 1.20m]**

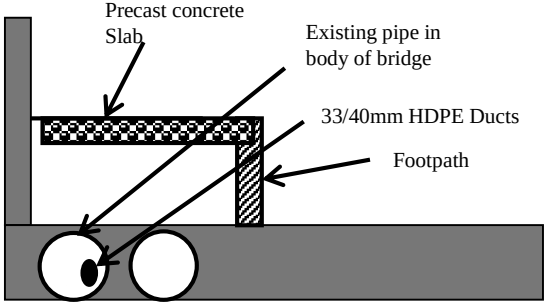


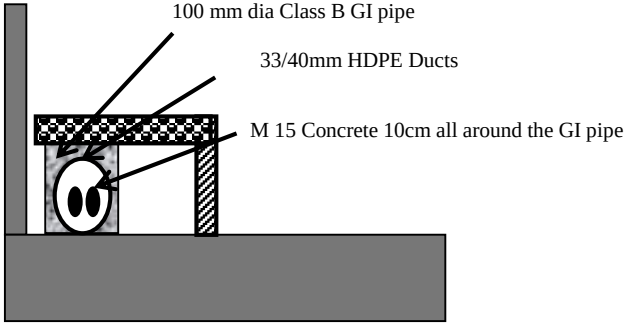


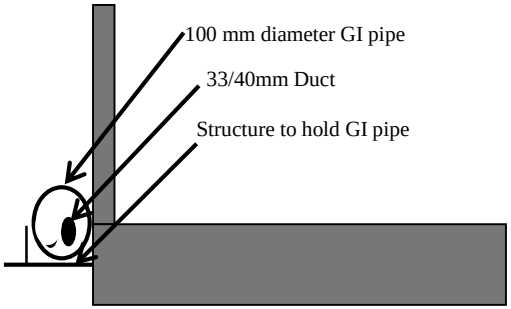
HARD ROCK		
Excavation and Backfilling [Depth 1.0 m]	**Road / Culvert Crossing [Depth 1.0m]**	**Excavation and Backfilling [Depth 0.65 m]**



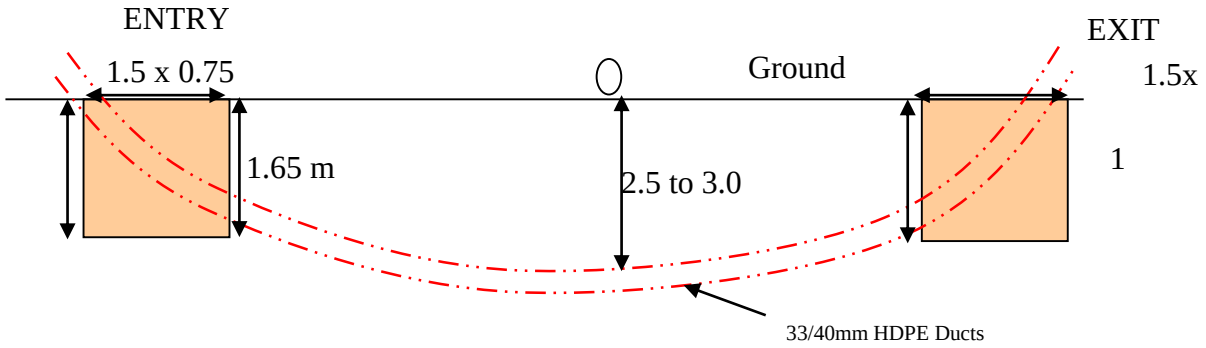
BRIDGE CROSSING METHOD		
Crossing through existing pipe in bridge body	**Crossing through Foot path (GI pipe with concrete encasement)**	**Crossing through GI Pipe Clamped at Side**



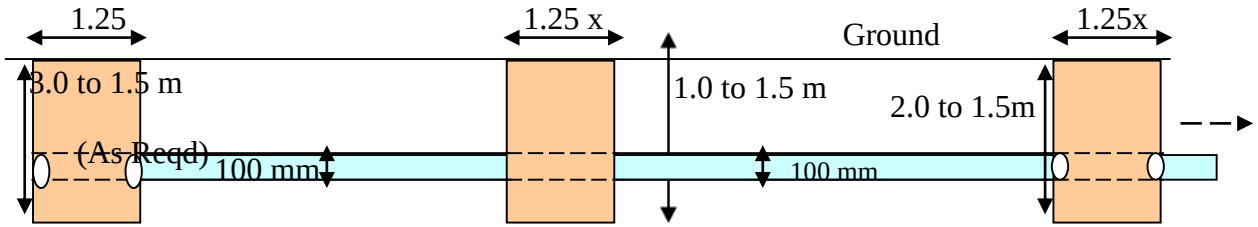




TRENCHLESS METHOD



MAULING METHOD



यांत्रिक अनुदेश

ENGINEERING INSTRUCTION

सेल्फ सपोर्टिंग मेटल फ्री एरिअल ओ.एफ.सी. केबिल की संस्थापन प्रक्रिया

INSTALLATION PRACTICE OF SELF SUPPORTING METAL FREE AERIAL OPTICAL FIBRE CABLE

क्रमांक : टी.आर./ सी.ओ.एफ.सी./आई-001

(NO.: TR/COFC/I-001)

पृष्ठ संख्या (No of Pages)	:	28
जारी क्रमांक (Issue Number)	:	01
जारीकर्ता (Issued By)	:	Inspection Circle
अनुमोदित (Approved By)	:	CGM Inspection Circle
जारी करने का दिनांक (Date of Issue):		10.06.2011
संशोधन क्रमांक (यदि कोई) (Amendment No. If Any):		Nil
पृष्ठ संसोधित (Page Nos. Amended)	:	
जारीकर्ता (Issued By)	:	
अनुमोदित (Approved By)	:	
जारी करने का दिनांक (Date of Issue)	:	

केवल भारत संचार निगम कर्मचारियों के उपयोग हेतु
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INSTALLATION PRACTICE OF SELF SUPPORTING METAL FREE AERIAL OPTICAL FIBRE CABLE

1. **Scope**. This engineering Instruction (EI) deals with the guidelines and the installation practice for installing self supporting metal free aerial optical fibre cable.

2. **General**. Department Of Telecommunication has already introduced self supporting metal free aerial optical fibre cable for local junctions and short haul trunk working. This is particularly useful in situations where underground cable laying is not possible. It is also recommended for short term working.

3. **Route Survey**. The route should be inspected before the actual installation of optical fibre cables. Survey of the aerial route should be carried out pole by pole.

4. **Over Head Alignment**. The existing route alignment wherever available should be used. On new routes, alignment should be erected. The span length must not exceed above 90 metres.

5. **Line Diagram**.A line diagram should be prepared to mark the poles & the actual distance between the poles in a splice section (Normally 15 poles per km are recommended). Additional poles should be erected if required to keep the span length within the specified limits. Care should be taken that the alignment is easily accessible from the road. It is necessary to keep d clear head way (Ground clearance) of 12 to 15 feet in a section. A complete line diagram should be prepared i.e. from station A to station B. The number of road crossings, canals or nallahs, electric lines should be clearly marked in the route diagram.

6. **Hilly Regions**.Line erection rules must be strictly followed. Additional poles may be erected for better support to optical fibre cable & to avoid sharp curves & bends. Span lengths should be reduced to avoid sags in case of steep slopes.

7. **Tension Poles**. Tension poles are dead end or termination poles. The tension poles shall have dead end fittings. The dead end fittings offer a continuous run of the aerial optical fibre cable. These fittings relieve the optical fibre cable of its compressive, bending & clamping stresses. The performed dead end fittings are suitably gritted for excellent tensile holding strength.

7.1 **Selection of Tension Poles**. Selection of tension poles depends upon the actual site location of the route. Every fifth pole should be a tension pole in straight alignment. Splicing location poles should be tension poles or wherever alignment takes a sharp turn (more than 15 degrees) should also be a tension pole.

8. **Suspension Poles**. The suspension pole assembly is designed to offer cushion to aerial optical fibre cable against the dynamic stress of Aeolian vibration at the suspension point. They also reduce static stresses at the Support point.

8.1 **Selection Poles**. Selection of suspension poles also depends upon actual site location of route. All the intermediate poles between two tension poles will be suspension poles.

9. **Selection of Splice Location**. The splice box of the aerial optical cable should be buried underground. Therefore it is necessary to fix & determine the splicing location as per the designated cable drum length.

10. **Aerial Optical Fibre Cable Specifications**

Ser No	Description	Specifications
1.	Maximum span length	100metres
2.	Maximum ice loading	1 Kg per meter
3.	Operational wind velocity	75Kms per hour
4.	Maximum sag allowed (without excess load)	2% of span length
5.	Maximum sag allowed (with excess load)	3% of span length
6.	Temperature range	
	operation & storage	-30 to +70 degree C
	installation	-15 to +50 degree C
7.	Minimum bend radius	2D (D-Dia of cable)
8.	Tensile force (where w is the mass of 1 km length of cable, in kg)	
	During installation	9.81 x 1.3 x w
	Permanent with ice & wind load	9.81 x 3 x w

11. **Types of Accessories and Fixtures**

11.1 **Formed OFC Dead End and Termination Fittings**. These fittings are used at tension/termination poles (dead end poles), or poles where splices are located and the poles where the overhead alignment takes a turn, (angle exceeding more than 15 degrees) as shown in fig. 1.

11.1.1 **J-Shaped Tension Hook**. J-Shaped tension hook is for the installation on cross arm channel C (C-Bracket) of the poles as shown in fig. 2.

11.1.2 **Turn Buckle**. Galvanized forged steel turn - buckle is used at the dead end and at tension positions (for adjusting the sag & tension) as shown in fig. 3.

11.1.3 **Extension Link**. Galvanized steel extension link is used along with turn buckle as shown in fig. 4.

11.1.4 **Clevis Thimble**. Aluminium alloy die cast thimble is used to attach the extension link and for accommodating the loop of the helically formed terminating helix at the other and its smooth internal contour as shown in fig.5.

11.1.5 **Protective Helix (T)**. Set of aluminium alloy helically formed protective helix having predetermined spiral shape is used & making them conveniently applied on the optical fibre cable without excessive clamping pressure at any point. See fig. 6.

11.1.6 **Terminating Helix**. Helically formed terminating helix of Aluminized steel having a prefabricated loop shall be to fit into the grooved contour of the thimble and for fixing over protective helix over the optical fibre cable. See fig. 7.

11.1.7 **Jumper Cable Clamp**. Galvanized steel jumper cable clamp is used to support the through length of optical fibre cable at the intermediate tension poles as shown in fig. 8.

11.1.8 **Pole Mounted Stay Clamp (Tubular) OR Pole Mounted Stay Clamp (Rail)**. Galvanized mild steel pole mounted stay clamp should be used at the pole for the fixing with a twisted eye & turn buckle; see figs. 9 & 10. The selection of the type of stay clamp will depend upon the type of poles.

11.2 **OFC Suspension Fittings**. Helically formed suspension fittings along with the elastomeric pads inserts strapped by a galvanized steel eye-band is used to hang from the twisted eye-link connected to a pole mounted stay clamp or on the tension hook (J-shaped) installed on the C bracket at the intermediate poles as shown in fig. 11.

11.2.1 **Pole Mounted Stay Clamp (Tubular) OR Pole Mounted Stay Calmp (Rail)**. Galvanized mild steel pole mounted stay clamp shall be for use at the pole for the fixing with a twisted eye & turn buckle. See figs. 9 & 10.

11.2.2 **Tiwsted Eye Link**. The twisted eye link is used for installing suspension fitting on stay clamp or on tension hook as shown in fig. 12.

11.2.3 **Protective Helix(S)**. Set of aluminium alloy helically formed protective helix having predetermined spiral shape is used & making them conveniently applied on the optical fibre cable without excessive clamping pressure at any point. See fig. 13.

11.2.4 **Armour Grip Helix**. Set of aluminium alloy armour grip helix is used or fixing on the profile shaped elastomer pad for proper strut action, grip & bird caging as shown in fig, 14.

11.2.5 **Suspension Clipper With Elastomer Pad**. Set of suspension clipper (made of aluminium alloy permanent mould die cast split type clamp) is used to support the elastomer pad inserts & is strapped by a galvanised steel eye-band in order to hang from a twisted eye-link connected to a pole mounted stay clamp or tension hook as shown in fig. 14.

11.2.6 **Spiral Vibration Damper (SVD)**. Helically formed spiral vibration dampers are used on both sides of suspension fittings as shown in fig. 15.

12. **Demountable Pulley**. Demountable pulleys are used during the installation of aerial optical fibre cables see fig.16. These are made from mild steel & the contour of the wheel is coated with rubber or any other suitable material for free movement of cable.

13. **Material Requirement of Installation Accessories and Fixtures**

13.1 **For Double Tension Poles**

Ser No	Description	Quantity
1.	J-shaped tension hook (For C-bracket)	2
2.	Turn buckle	2
3.	Extension link	2
4.	Clevis thimble	2
5.	Protective helix (T)	2

6.	Terminating helix	2
7.	Jumper cable clamp	
8.	a) Pole mounted stay clamp(Tubular)	1 (Pole having C-bracket)
	b) Pole mounted stay clamp (Tubular)	2(Pole without C-bracket)
	OR	
	a) Pole mounted stay clamp (Rail)	1(Pole having C- bracket)
	b) Pole mounted stay clamp (Rail)	2 (pole having C-bracket)

13.2 **For Suspension (Intermediate Poles)**

Ser No	Description	Quantity
1.	a) Pole mounted stay clamp(Tubular)	
	b) Pole mounted stay clamp (Tubular)	
	OR	
	a) Pole mounted stay clamp (Rail)	
	b) Pole mounted stay clamp (Rail)	
2.	Twisted eye link	
3.	Suspension clamp consisting of the following	
3.1	Protective Helix (S)	1 set
3.2	Armour grip helix	1 set
3.3	Suspension clipper with elastomer pad etc.	1 set
3.4	Spiral vibration damper	2
3.5	J-shaped tension hook	1 (Pole with C-bracket)
4.	Demountable pulley	One per pole in the splice section

14. **Entry of the O.F. Cable in the Building**. Normal methods for leading in and precautions recommended for leading-in of the optical fibre cable should be followed. A conduit pipe should be laid for leading-in the O.F. cable. Inside the building; the cable may also be taken directly from the nearby O/H pole to inside of the building for termination.

15. **Preparation**

15.1 Before the installation the O.F. cable should be tested.

15.2 As per requirement install the additional new poles.

15.3 Each pole should be checked for its strength. Provide extra stays if more strength is required.

15.4 The Aerial O.F. Cable is recommended to be installed on the outermost hole of bracket towards road on the existing bracket/new bracket on the poles.

15.5 Replace weak and other poles for clear ground clearance and strength as per the field conditions.

15.6 Provide ground clearance of 12 feet in non-obstructing areas.

15.7 Raise the height to minimum 16 feet at all the road crossings.

15.8 Maintain the alignment as straight as possible.

15.9 Construct splice chambers.

16. **Splice Locations** The field splices should be buried underground. The cable should be brought down through a 40mm dia GI pipe clamped on the pole. Proper bends (120-135 degree) are recommended for negotiating the bend. Wooden/hard rubber bushes shall be used at the entry and exit points of the GI pipe to avoid damage to the cable. A splice chamber as per the standard practice shall be made. The selection of the splice point shall depend upon the availability of space and the cable length.

17. **Calculation of Section Length**. Aerial O.F. cable is supplied as per TEC GR in a length of 2 Kms + 10%. To arrive at the section length and allocating a particular reel of the cable to a particular section following consideration are required.

17.1 **Section Length**

17.1.1 Actual section length measured.

17.1.2 Allowance for sag 2% for each span length.

17.1.3 Cable at each through tension pole (4 meters).

17.1.4 Drop length.

17.1.5 Extra spare cable for coiling at the splice location (10 meters).

18. **Installation Material Required During Installation**

Ser No	Description	Requirement
1.	Demountable pulleys	1 each for each pole in the installation section
2.	Jack for cable drum	1 set
3.	Ladders	For each pole
4.	Tools	Screw drivers C&T pliers Spanner set & hammer etc.

5.	Manila rope 12 mm dia	250 meters
6.	Cable pulling winch machine with tension monitoring device	1
7.	Anti twist device	1
8.	Cable pole fork	10
9.	Flat twin open type cable grip	2
10.	Communication link to connect feeding, pulling and intermediate points.	
11.	40 mm 61 pipe, bends, bushes & clamps for fixing the pipe at the splice location.	
12.	First aid box.	

19. **Installation of Aerial Optical Fibre Cable**. The following steps are recommended: -

19.1 Install the accessories and fixtures as per the requirement of the individual poles it tension and suspension fittings.

19.2 Install the demountable pulley on all the poles in the section before pulling the cable.

19.3 Keep the cable drum over the jack near the 1st pole at the beginning of the section.

19.4 Attach anti twist device and the shackle hook along with the rope to the front and of the cable on pulling eye or on the cable grip. Carry the attached rope over the demountable pulleys for pulling the cable.

19.5 Depute one person at each pole to monitor and in case it is required to guide the cable over the demountable pulley during pulling operation.

19.6 The cable should be pulled till the cable reaches the last pole of the section.

19.7 Wherever in the pulling section; through pulling is difficult; half section or one fourth, action pulling method may be adopted by using figure of a techniques.

19.8 The feeding and pulling of the cable should be synchronized by using communication link. Care is required to be taken so that the cable is not accumulated at any one point during pulling operation and sharp bends are avoided.

19.9 Once the cable reaches the other end actual tensioning of the cable and fixing the installation of the accessories and fixtures shall be taken up with the help of cable pulling winch. The pulling tension must be monitored during tensioning.

19.10 Install the tension fittings and accessories at the 1st pole.

19.11 Fix a flat twin open type cable grip on the cable after tension pole for tensioning the cable in the preceding tension section.

19.12 The cable shall be tensioned to a tension of 1-3 to 1-6 times of the cable weight. The sag shall be monitored and kept between 0.25 to 0.5% of the span length.

19.13 The cable should be lifted between two poles by using cable pole fork during tensioning and fixing of the cable.

19.14 During the fixing operation the cable shall remain under required tension for minimizing the sag in the splice section.

19.15 Now install tension fitting and accessories at the all tensioned pole at the end of the tension section.

19.16 Install the suspension fitting and accessories on the intermediate poles in the tensioned section.

19.17 Similarly installation should be carried out in each tension pole in the entire section and the tension and suspension fittings are in stalled.

19.18 At the Through tension poles the cable shall be kept loose and shall be supported by cable jumper clamp.

19.19 At the end pole where the cable reel is kept; the cable to be taken through GI pipe (fixed to the pole) to the splice location. Extra care for the aerial O.F. cable may be taken at the bends and at entry and at the exit of the pipe. About 10 meters of cable shall be kept at the splice location for coiling (spare cable) and jointing requirement.

19.20 Test the installed OF cable.

19.21 Coil the OF cable and keep it safe in the splice location for splicing.

20. **Precautions**

20.1 Provide display boards.

20.2 Provide sufficient number of road sign and traffic cones.

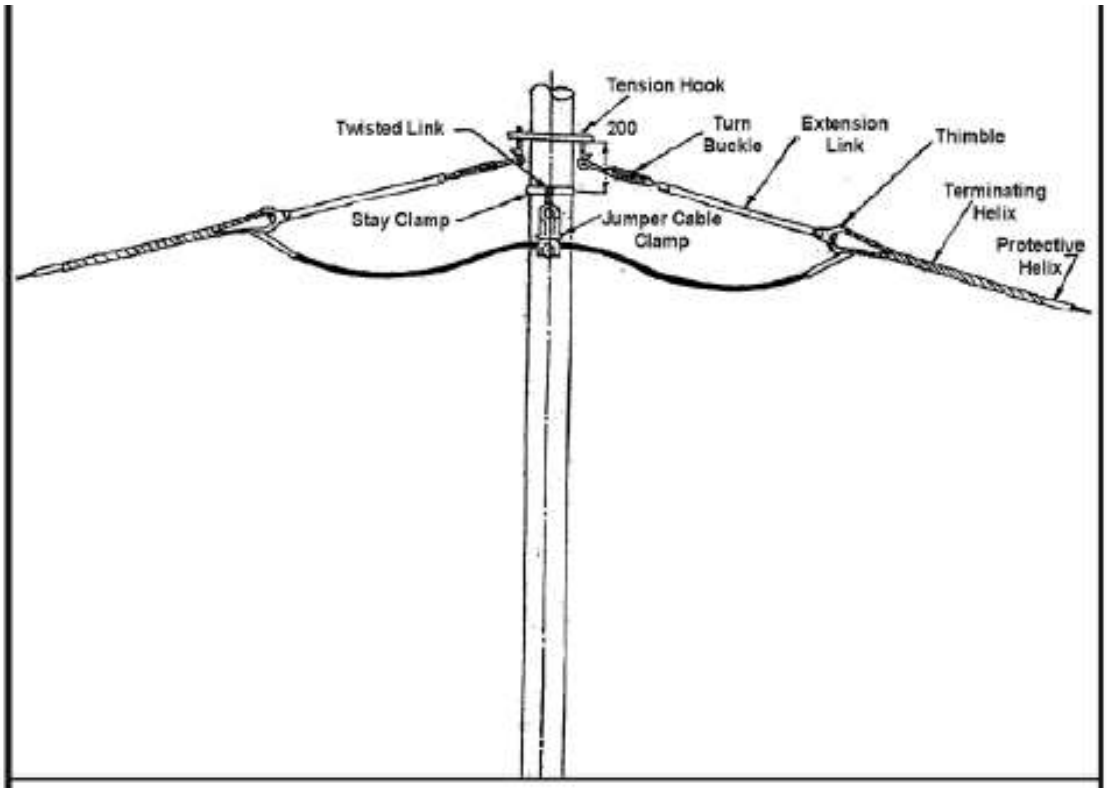
20.3 Avoid sharp bending of the OF cable during installation.

20.4 The OF cable should not be given extra tension than the permissible tension limits.

20.5 While crossing the overhead electric installations, safety measures should be taken. Also provide guard wire.

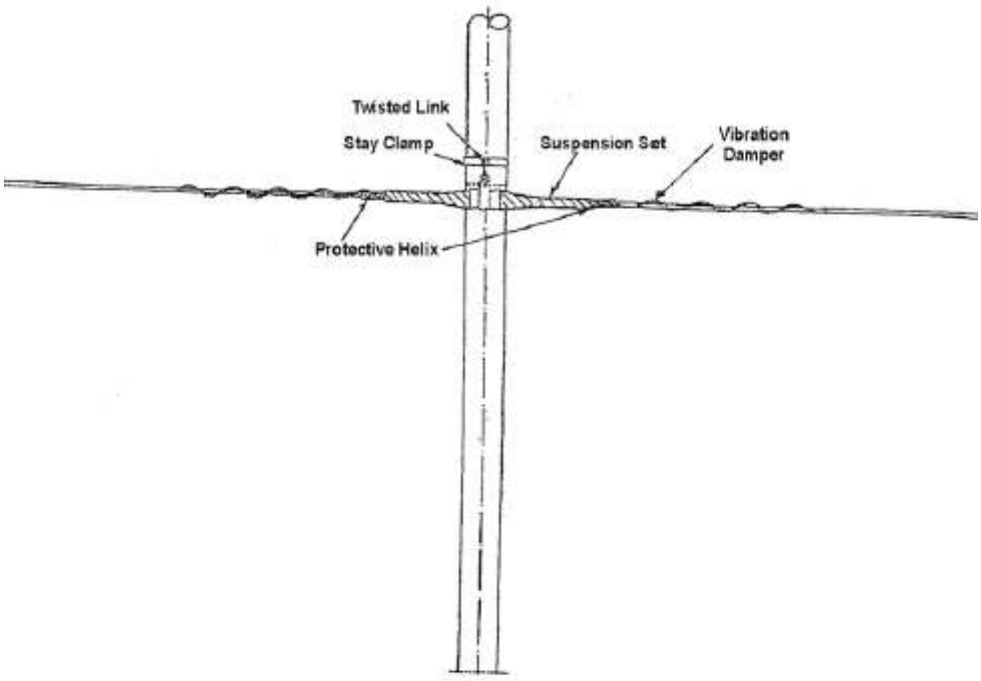
20.6 To avoid man made damages, safety measures should be taken for each pole.

21. **Reference**. TEC GR on Planning Guidelines and the Installation Practices for the installation of self-supporting metal free aerial optical fiber cable.



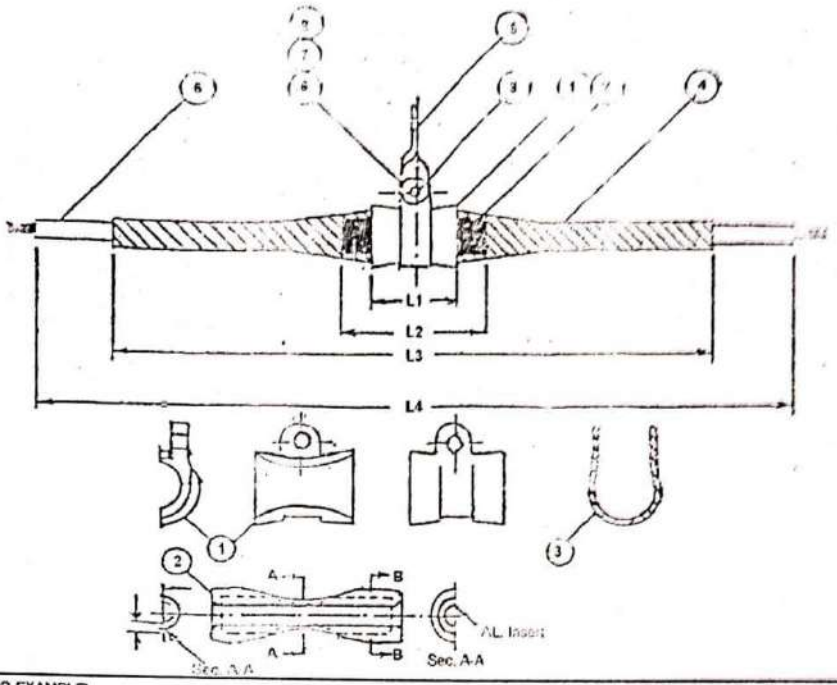
SUSPENSION POLE ASSEMBLY	
NOT TO SCALE	UNIT - MM

FIG -1



SUSPENSION POLE ASSEMBLY	
NOT TO SCALE	UNIT - MM

FIG - 2



(FOR EXAMPLE)
DIMENSIONS :- CABLE SIZE - 14.4 MM DIA

CABLE DIA	L1	L2	L3	L4	COLOUR CODE	DIA AGS ROD
14.4	115	200	800	1400	BROWN	3.25± 0.1

NOTE :- DIMENSIONS FOR DIFFERENT CABLE SIZES TO BE DECIDED AFTER TYPE TEST APPROVAL

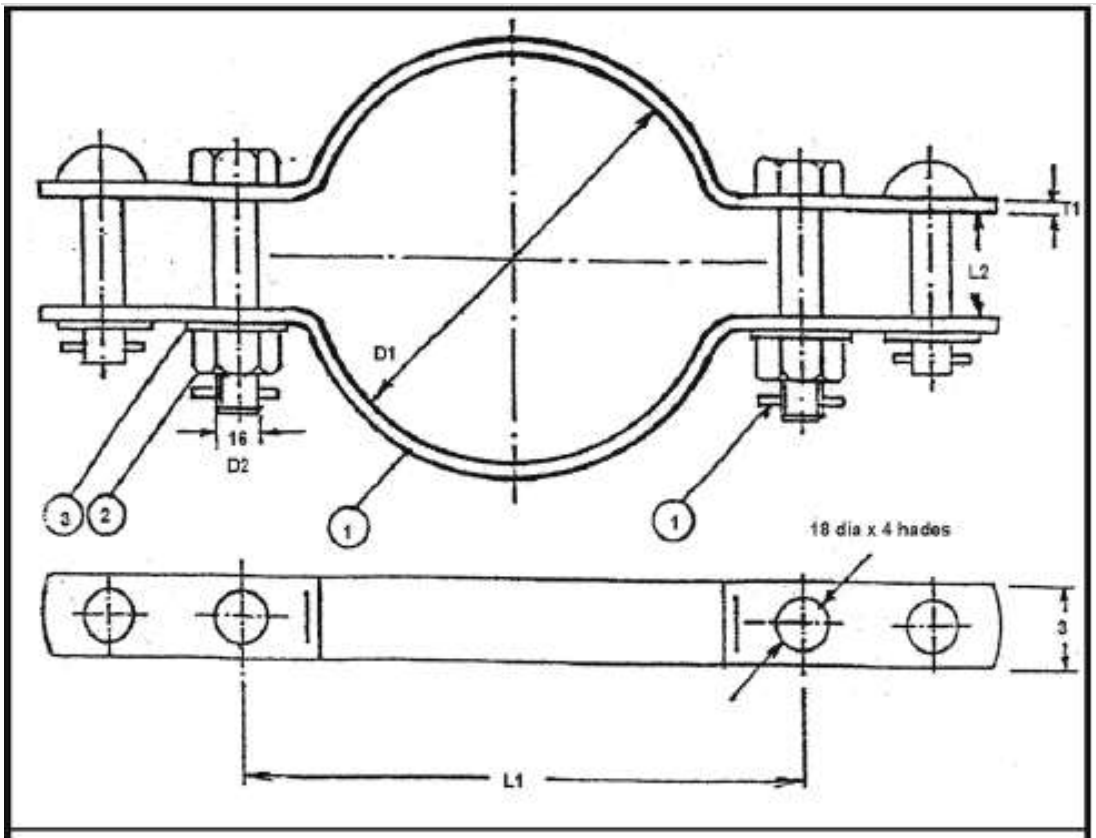
INSERT DIMENSIONS IN MM

INNER DIA.	AT - A - A	AT - B - B
	22	22
OUTER DIA	33	60

	DESCRIPTION	METERIAL	REF Spec	QTY.
1	CLAMP)	ALUMINIUM ALLOY GDC	IS : 617	1 SET
2	INSERTS) SUSPEN. CLIPPER	POLYCHLOROPRENE COMPOUDED	1 PAIR	1 PAIR
3	STRAP)	ALUMINIUM ALLOY	IS : 617	1
4	AGS HELIX	ALUMINIUM ALLOY 6061		1 SET
5	PROTECTIVE HELIX	ALUMINIUM ALLOY 6061		1 SET
6	RIVET M 16	MILD STEEL GAVLVANISED	IS : 2062	1
7	FLAT WASHER	MILD STEEL GALVANISED	IS : 2016	1
8	SPLIT PIN	STAINLESS STEEL	IS : 2549	1
9	TWISTED EYE	MILE STEEL GALVANISED	IS : 2062	1

ARMOUF GRIP SUSPENSION SET	
NOT TO SCALE	UNIT - MM

FIG - 3



POLE MOUTED STAY CLAMP (RAIL)

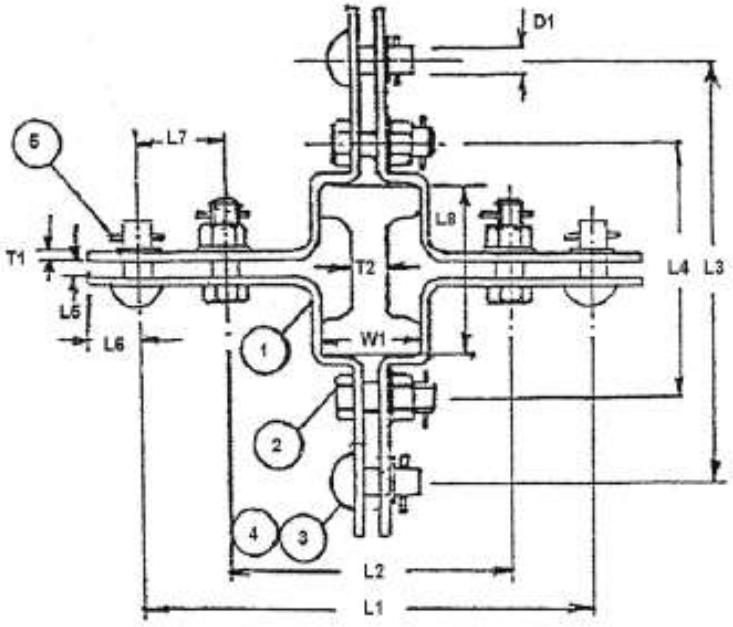
L1	L2	L3	L4	L5	L6	L7	L8	T1	T2	D1	W1
270	170	251	151	20	32	50	120	5	20	16	60

NOTE :- TOLERANCE SHALL BE AS PER IS : 2102
(DETAIL AS PER GR UNLESS UNTILL SPECIFIED)
HOT dIP Galvainised as per is : 2629

	DESCRIPTION	METERIAL	REF. Spec	Qty.
1	CLAMP	MILD STEEL GALVANISED	IS : 2062	1 SET
2	BOLT & NUT M 16	MILD STEEL GALVANISED	IS : 1363	2
3	RIVET 16	MILD STEEL GALVANISED	IS : 2016	2
4	WASHER	MILD STEEL GALVANISED	IS : 2016	4
5	SPILT PIN	STAINLESS STEEL	IS : 549	4

POLE COLLAR CLAMP	
NOT TO SCALE	UNIT - MM

FIG - 4



DIMENSIONS IN MM :
POLE MOUTED STAY CLAMP TUBULAR

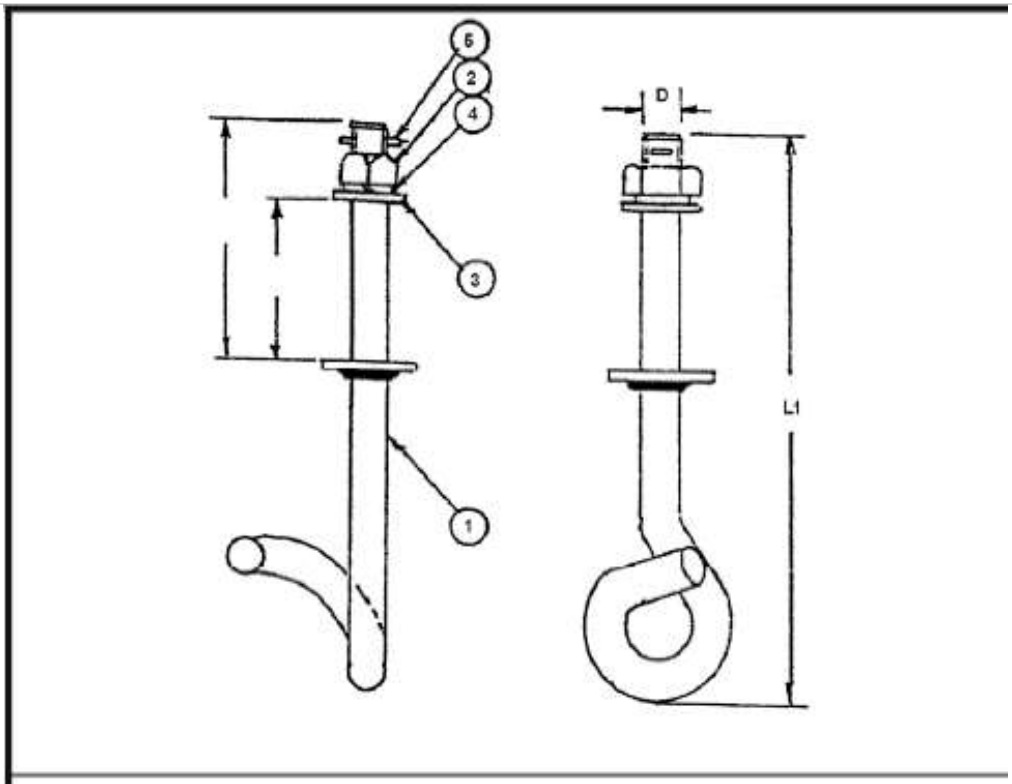
L1	L2	D1	D2	T1	W
210	20	150	16	5	30

NOTE :- TOLERANCE SHALL BE AS PER IS : 2102
(DETAIL AS PER GR UNLESS UNTILL SPECIFIED)
HOT DIP GALVANISED AS PER IS : 2629

	DESCRIPTION	METERIAL	REF. Spec.	Qty.
1	CLAMP	MILD STEEL GALVANISED	IS : 2062	1 SET
2	BOLT & NUT M 16	MILD STEEL GALVANISED	IS : 1363	4
3	RIVET 16	MILD STEEL GALVANISED	IS : 2016	4
4	WASHER	MILD STEEL GALVANISED	IS : 2016	8
5	SPILT PIN	STAINLESS STEEL	IS : 549	8 SET

POLE COLLAR CLAMP (R)	
NOT TO SCALE	UNIT - MM

FIG - 5



DIMENSIONS IN MM :

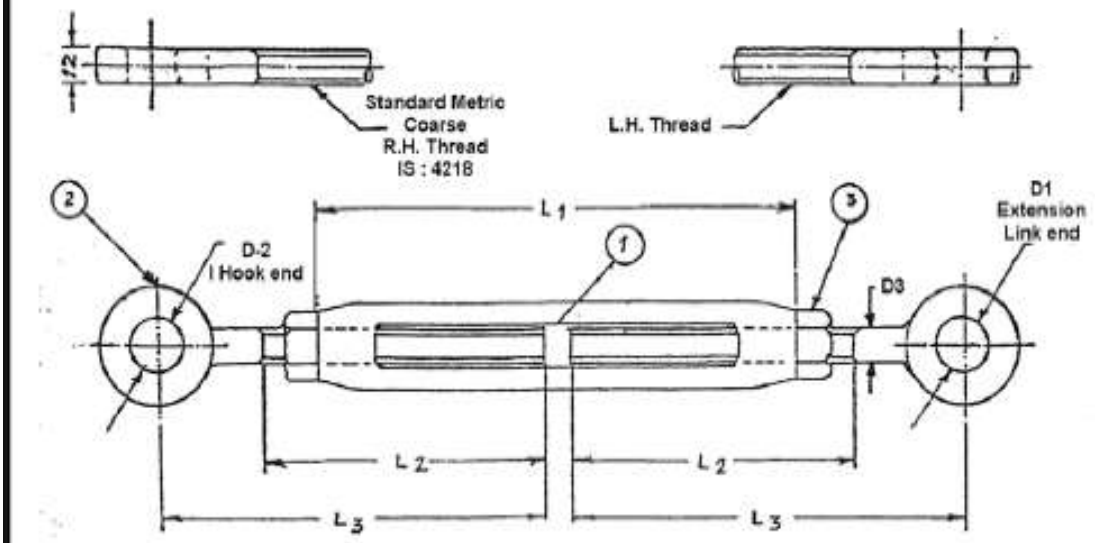
L1	L2	L3	D
177	75	50	12

NOTE :- TOLERANCE SHALL BE AS PER IS : 2102
(DETAIL AS PER GR, UNLESS UNTILL SPECIFIED)
TO BE USED HERE C-BRACKET IS AVAILABLE ON POLE FOR FITMENT OF TENSION HOCK
HOT DIP GAVANISED AS PER IS : 2629

	DESCRIPTION	METERIAL	REF. Spec	Qty.
1	BODY	ALLOY STEEL GALVANISED	IS : 2004	1
2	NUT	MILD STEEL GALVANISED	IS : 1363	1
3	PLAIN WASHER	MILD STEEL GALVANISED	IS : 2016	1
4	SPRING WASHER	SPRING STEEL GALVANISED	IS : 3063	1
5	SPILT PIN	STAINLESS STEEL	IS : 549	1

TENSION HOOK	
NOT TO SCALE	UNIT - MM

FIG - 6



DIMENSIONS IN MM :

L1	L2	L3	D1	D2	D3
170	100	140	18	18	12

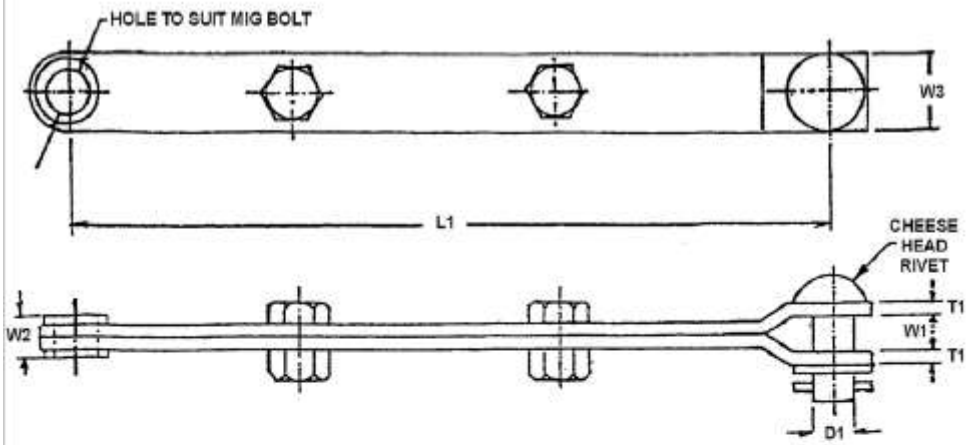
NOTE :- TOLERANCE SHALL BE AS PER IS : 2102
(DETAIL AS PER GR, UNLESS UNTILL SPECIFIED)

MIN. LENGTH : 290 MM
MAX. LENGTH : 400 MM
RANGE OF ADJ. : 110 MM
HOT DIP GALVANISED AS PER IS : 2629

	DESCRIPTION	METERIAL	REF. Spec	Qty.
1	BODY	MILD STEEL FORGED GLAV.	IS : 2004	1
2	NUT BOLT	MILD STEEL FORGED GLAV.	IS : 2062	2
3	NUT	MILD STEEL	IS : 1363	2

TURN BUCKLE	
NOT TO SCALE	UNIT - MM

FIG - 7



DIMENSIONS IN MM :

L1	T1	W1	W2	W3	D1
465	5	14	16	30	16

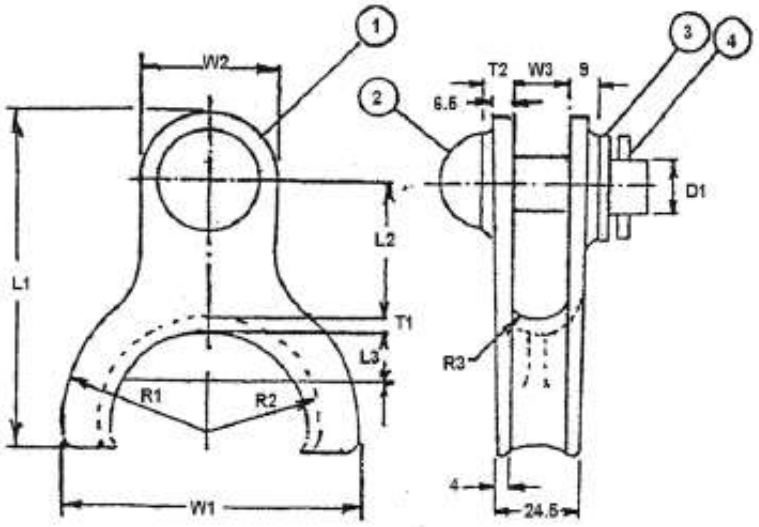
NOTE :- TOLERANCE SHALL BE AS PER IS : 2102
(DETAIL AS PER GR, UNLESS UNTILL SPECIFIED)

HOT DIP GALVANISED AS PER IS : 2629

	DESCRIPTION	METERIAL	REF. Spec.	Qty.
1	STRAP	MILD STEEL GALVANISED	IS : 2067	1
2	RIVET & WASHER	MILD STEEL GALVANISED	IS : 2016	1
3	SPLIT PIN	STAINLESS STEEL	IS : 549	1
4	BOLT & NUT M 16	MILD STEEL GALVANISED	IS : 1363	1

EXTENSION LINK	
NOT TO SCALE	UNIT - MM

FIG - 8



DIMENSIONS IN MM :

L1	L2	L3	T1	T2	R1	R2	R3	W1	W2	W3	D1
102	42	15	4	9	23	15	8	92	40	18	16

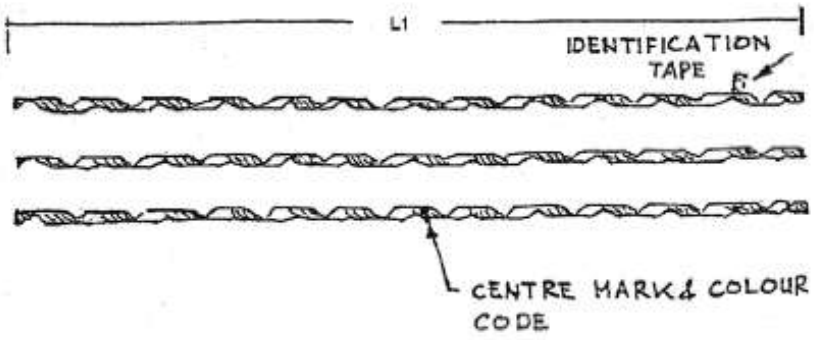
NOTE :- TOLERANCE SHALL BE AS PER IS : 2102
(DETAIL AS PER GR, UNLESS UNTILL SPECIFIED)

FEROUS PARTS ARE HOR DIP GALVANISED
AS PER IS : 2629

	DESCRIPTION	METERIAL	REF. Spec	Qty.
1	CLAMP	ALUMINIUM ALLOY GDC.	IS : 617	1
2	RIVET M16 x 45	GALV. STEEL	IS : 2016	1
3	WASHER	GALV. STEEL	IS : 2016	1
4	SPLIT PIN	STAINLESS STEEL	IS : 549	1

CLEVIS THIMBLE	
NOT TO SCALE	UNIT - MM

FIG - 9



FOR EXAMLE
DIMENSIONS (FOR CABLE SIZE, D - 14.4 MM)

I. DIA OF EACH WIRE - 3.2 ± 0.1
II. NO. OF SETS - 3
III. NO. OF WIRE PER SET - 5
IV. LENGTH OF HELIX - 1400

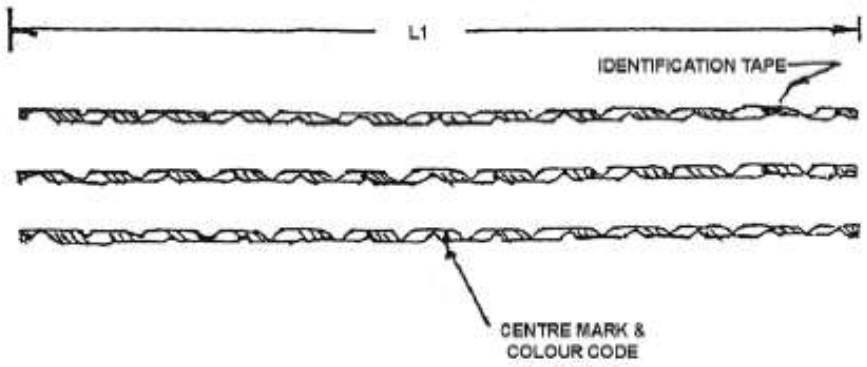
DIMENTION DETAILS FOR OTHER CABLE SIZE SHALL BE INDICATED BY THE MANUFACTURER INCLUDING THE PITCH OF HELIX

NOTE : ENDS OF RODS SHALL BE DEBURRED TOLERANCE SHALL BE AS PER IS : 2102 (DETAIL AS PER GR, UNLESS UNTILL SPECIFIED)

	DESCRIPTION	METERIAL	REF. Spec	Qty.
1	PROTECTIVE HELIX	ALUMINIUM ALLOY 6061		

PROTECTIVE HELIX (S)	
NOT TO SCALE	UNIT - MM

FIG - 10



FOR EXAMLE
DIMENSIONS (FOR CABLE SIZE, D - 14.4 MM)

I. DIA. OF EACH WIRE - 3.2 ± 0.1
II. NO. OF SETS - 3
III. NO. OF WIRE PER SET - 5
IV. LENGTH OF HELIX - 1000

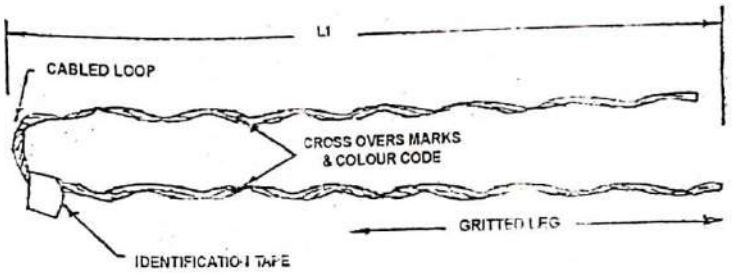
DIMENTION DETAILS FOR OTHER CABLE SIZE SHALL BE INDICATED BY THE MANUFACTURER INCLUDING THE PITCH OF HELIX

NOTE : ENDS OF RODS SHALL BE DEBURRED TOLERANCE SHALL BE AS PER IS : 2102 (DETAIL AS PER GR, UNLESS UNTILL SPECIFIED)

	DESCRIPTION	METERIAL	REF. Spec	Qty.
1	PROTECTIVE HELIX	ALUMINIUM ALLOY 6061		

PROTECTIVE HELIX (T)	
NOT TO SCALE	UNIT - MM

FIG - 11



DIMENSIONS
FOR EXAMPLE

L1	T1
1000	2.2+0.1

D IS DIA OF EACH WIRE ROD
NO. OF WIRES USED 5

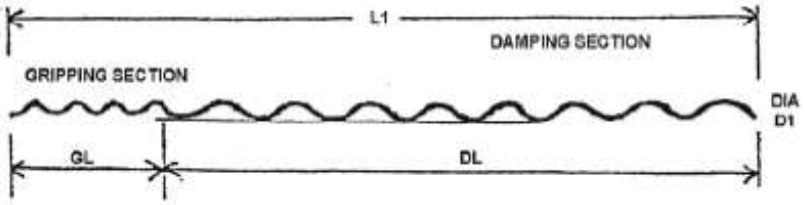
NOTE : TOLERANCE SHALL BE PER IS : 2102
(DETAIL AS PER GR, UNLESS UNTILL SPECIFIED)

DIMENSION DETAIL FOR DIFFERE CABLE SIZES TO BE DECIDED AP TYPE TEST APPROVAL
FOR EXAMPLE CABLE SIZE
ENDS OF RODS SHALL BE DEBUR LENGTH OF TERMINATING HELIX 1000 MM.
TER MINATING HELIX TO BE USED WITH THIMBLE C DIA - 14.4 MM

	DESCRIPTION	METERIAL	REF. Spec	Qty.
1	DEADEHD GRIP	ALUMINISED STEEL		

TERMINATING HELIX	
NOT TO SCALE	UNIT - MM

FIG - 12



DIMENSIONS IN MM

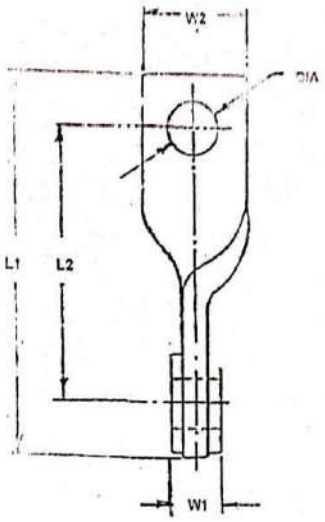
L1	GL	DL	D1
1346	446	900	12±1

NOTE : TOLERANCE SHALL BEAS PER IS : 2102
(DETAIL AS PER GR, UNLESS UNTILL SPECIFIED)

	DESCRIPTION	METERIAL	REF. Spec.	Qty.
1	SPIRAL VISRATION DAMPER	POLYVINYL COKPOUNDED		

SPIRAL VIBRATION DEMPER	
NOT TO SCALE	UNIT - MM

FIG - 13



DIMENSIONS IN MM

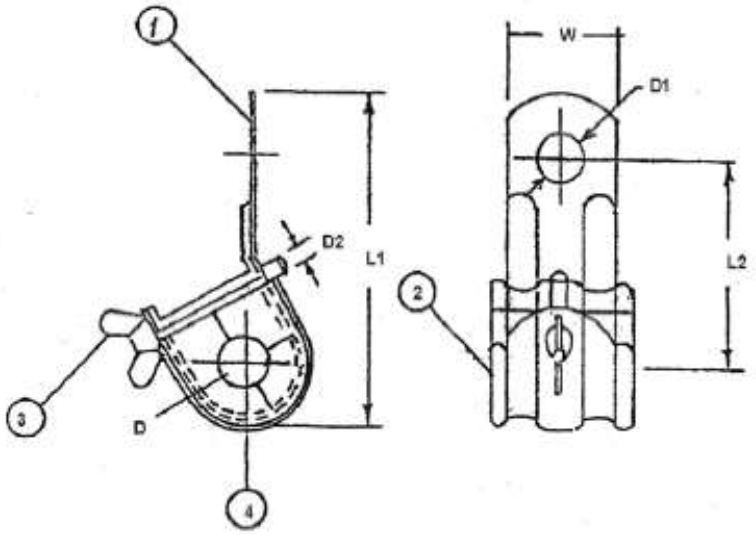
L1	L2	W1	W2	DIA
138	100	27	38	18

NOTE : TOLERANCE SHALL BE AS PER IS : 2102
(DETAIL AS PER GR, UNLESS UNTILL SPECIFIED)
HOT DIP GAVANISED AS PER IS : 2629

	DESCRIPTION	METERIAL	REF. Spec	Qty.
1	LINK	MILD STEEL	IS : 2062	1

TWISTED EYE LINK	
NOT TO SCALE	UNIT - MM

FIG - 14



DIMENSIONS IN MM

L1	L2	D1	D2	W
105	65	17.5	5-6	35

DIMENSIONS IN MM OF INSERT PAD

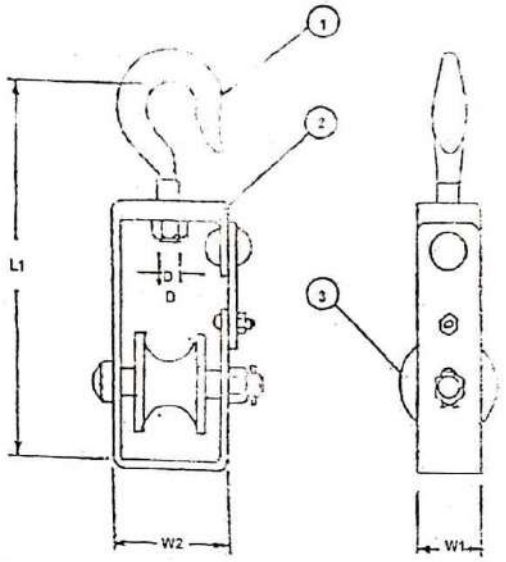
L	INNER DIA	OUTER DIA
40	15	30

NOTE : TOLERANCE SHALL BE AS PER IS : 2102
(DETAIL AS PER GR, UNLESS UNTILL SPECIFIED)
INSERT IN TOW HALVES D TO SUIT CABLE DIA FERROUS PARTS ARE HOT DIP GALVASIED AS PER IS : 2629

	DESCRIPTION	METERIAL	REF. Spec.	Qty.
1	STRAP	MILD STEEL GALY	IS : 2062	1
2	INSERT	POLYCHLORADPRENE COMPOUNDED		1
3	WING BOLT	MILD STEEL GALY	IS 2062	1

JUMPER CABLE CLAMP	
NOT TO SCALE	UNIT - MM

FIG - 15



DIMENSIONS IN MM

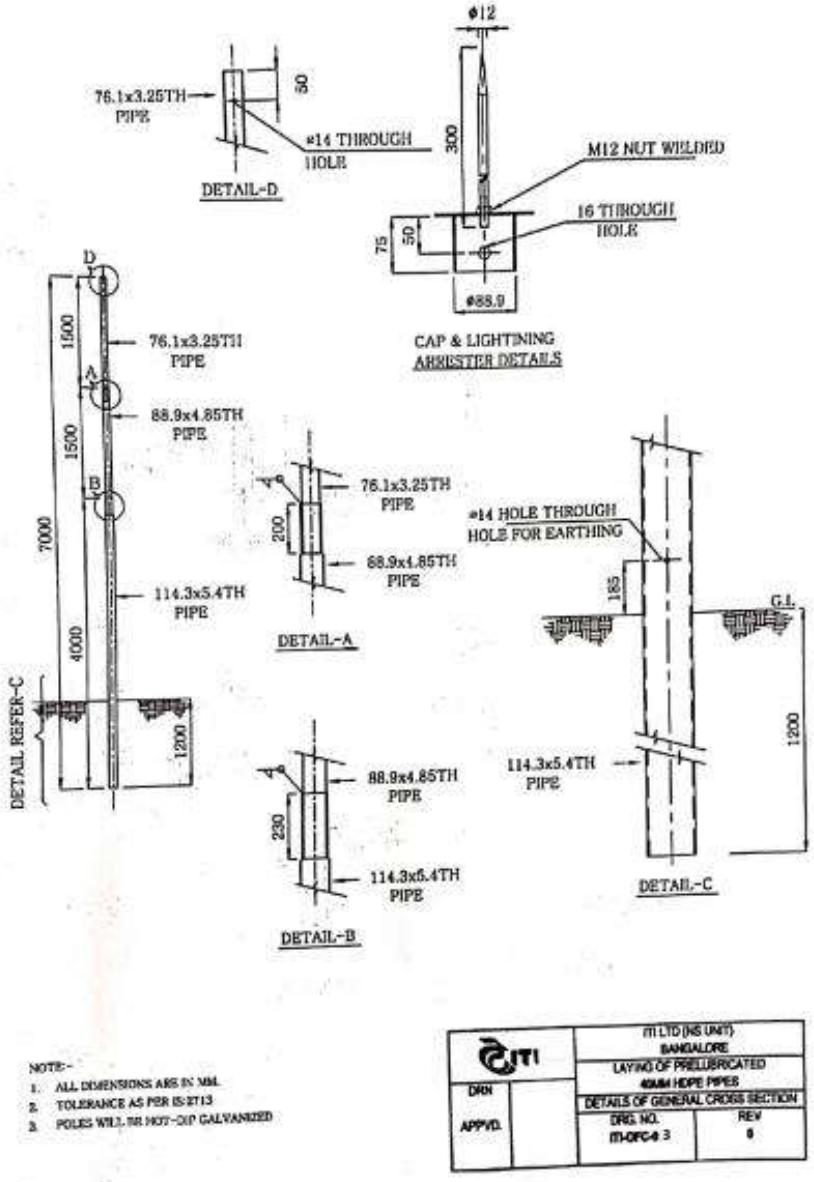
L1	W1	W2	D
280	50	92	12

NOTE : TOLERANCE SHALL BE AS PER IS : 2102
(DETAIL AS PER GR, UNLESS UNTILL SPECIFIED)
FERROUS PARTS ARE HOT DIP GALVANISED AS PER IS : 2629

	DESCRIPTION	METERIAL	REF. Spec.	Qty.
1	HOOK	GALVANISED STEEL		
2	BODY	GALVANISED STEEL		1 SET
3	SPOOL	ALUMINIUM COATED NEOPRENE		

DEMOUNTABLE PULLEY	
NOT TO SCALE	UNIT - MM

FIG - 16


ø12
76.1x3.25TH PIPE
50
ø14 THROUGH HOLE
DETAIL-D
300
M12 NUT WELDED
16 THROUGH HOLE
75
50
ø88.9
CAP & LIGHTNING ARRESTER DETAILS
D
1500
76.1x3.25TH PIPE
A
88.9x4.85TH PIPE
1500
B
7000
114.3x5.4TH PIPE
4000
DETAIL REFER-C
1200
4
200
76.1x3.25TH PIPE
88.9x4.85TH PIPE
DETAIL-A
ø14 HOLE THROUGH HOLE FOR EARTHING
185
G.L.
1200
114.3x5.4TH PIPE
DETAIL-C
4
230
88.9x4.85TH PIPE
114.3x5.4TH PIPE
DETAIL-B
NOTE:-
1. ALL DIMENSIONS ARE IN MM.
2. TOLERANCE AS PER IS:2713
3. POLES WILL BE HOT-DIP GALVANIZED
ITI
ITI LTD (NS UNIT) BANGALORE
LAYING OF PRELUBRICATED 40MM HDPE PIPES
DETAILS OF GENERAL CROSS SECTION
DRN
APPVD.
DRG. NO. ITI-OFC-0 3
REV 0

ANNEXURE-II

PROFORMA OF BANK GUARANTEE FOR PERFORMANCE

(On non judicial stamp paper of value not less than ₹ 100 /-)
The non-judicial stamp paper should be in the name of
issuing bank

Ref. Bank Guarantee No.
Date..... 20___.

The Addl. General Manager (A)
NS Unit, ITI Limited
East Wing Dooravani Nagar,
Bengaluru - 560 016.

Dear Sirs,

In consideration of the ITI Limited, (herein after referred to as **'ITI'** which expression shall unless repugnant to the Context or meaning thereof include its successors, administrators and assigns) having awarded to M/s. _____ with its Registered/Head office at _____ (here in after referred to as the **'Project Implementation Agency' (PIA)** which expression shall unless repugnant to the context or meaning thereof, include its successors, administrators, executors and assigns), a LoI dated _____ _____ and the same having been unequivocally accepted by the PIA resulting in a "LoI" bearing No. _____ dated _____ valued at

_____for_____(Scope of LoI) and the PIA having agreed to provide a performance guarantee for the faithful performance of the entire LoI equivalent to **-----%** (-------- percent) of the said value of the LoI to ITI.

We_____having
(Name and Address)
its Head Office at_____(hereinafter referred to as the `Bank', which expression shall, unless repugnant to the context or meaning thereof, include its successors, administrators, executors and assigns) do hereby guarantee and undertake to pay ITI, on demand any and all monies payable by the PIA to the extent of
_____as aforesaid at any time up to
_____(days/month/year) without any demur, reservation, recourse or protest and/or without any reference to the PIA Any such demand made by the ITI on the Bank shall be conclusive and binding not withstanding any difference between ITI and the PIA or any dispute pending before any court, tribunal or any other authority .The Bank undertakes not to revoke this guarantee during its currency without previous consent of the ITI and further agrees that the guarantee herein contained shall continue to be enforceable till the ITI discharges this guarantee.

The ITI shall have the fullest liberty without affecting in any way the liability of the Bank under this guarantee from time to time to extend the time for performance of the contract by the PIA. The ITI shall have the fullest liberty, without affecting this guarantee, to postpone from time to time the exercise of any powers, vested in them or of any right which they might have against the PIA, and to exercise the same any time in any manner, and either to enforce or to for bear to enforce any covenants, contained or implied, in the contract between the ITI or any other course of or remedy or security available to the ITI. The Bank shall not be released of its obligations under these presents by any exercise by the ITI of its liberty with reference to the matters aforesaid or any of them or by reason of any other acts of omission or commission on the part of the ITI or any other indulgence shown by the ITI or by any other matters or thing whatsoever which under law would, but for this provision, have the effect of relieving the Bank.

The Bank also agrees that the ITI at its option shall be entitled to enforce this Guarantee against the Bank as a principal debtor, in the first instance without proceeding against the PIA and not withstanding any security or other guarantee that the ITI.

have in relation the PIA's liabilities.

Notwithstanding anything contained here in above our liability under this guarantee is restricted to_____and it shall remain in force upto and including _____*** *** and shall be extended from time to time for such period (not exceeding one year), as may be desired by M/s._____whose behalf this guarantee has been given.

Dated this_____day of_____202___ at _____.

WITNESS

Signature ----------

Signature

(Name)

---------- (Name)----------

Official address

----------Designation with Bank stamp

Attorney as per power of Attorney No. -----

Dated ----------

Annexure-III

(FORMAT FOR THE BID SECURITY/ EMD)

(To be typed on Rs.100/- non-judicial stamp paper)

To

ITI Limited, Dooravani Nagar,
Bengaluru-560016.

Sub: Bid Security/EMD guarantee.

Whereas .....(herein after referred to as Bidder) has approached us for Giving Bank Guarantee of **Rs./-(Rupees Only)** (here after known as the" B.G. Amount") **valid up to …….** (hereafter known as the "Validity date") in favour of ITI Limited, Bengaluru Herein after referred to as ITI) for participation in the tender of work of……..…Now at the request of the Bidder, We .....Bank
……Branch having …… …….
……. (Address) and Regd. office address as ……
……..…… ……
…… ……. (Hereinafter called 'the Bank') agrees to give this guarantee as hereinafter contained:

1. We the Bank do hereby undertake to pay the amounts due and payable under this guarantee without any demur, merely on a demand from the ITI stating that the amount claimed is due by way of loss or damage caused to or would because door suffered by the ITI by reason of breach by the said BIDDER of any of terms or conditions contained in the said Agreement or by reason of the BIDDER failure to perform the said Agreement. Any such demand made on the bank shall be conclusive as regards the amount due and payable by the Bank under this guarantee where the decision of the ITI in these counts shall be final and binding on the bank. However, our liability under this guarantee shall be restricted to an amount not exceeding the "B.G. Amount".

2. We undertake to pay to the ITI any money so demanded not withstanding any dispute or disputes raised by the BIDDER in any suit or proceeding before any court or tribunal relating thereto our liability under this present being absolute and unequivocal. The Payment so made by us under this bond shall be valid discharge of our liability for payment there under and the BIDDER shall have no claim against us for making such payment.

3. We the Bank further agree that the guarantee herein contained shall remain in full force and effect during the period that would be taken for the performance of the said agreement and that it shall continue to force able till all the dues of the ITI under or by virtue of the said Agreement have been fully paid and its claims satisfied or discharged or till ITI certifies that the terms and conditions of the said Agreement have been fully and properly carried out by the said BIDDER and accordingly discharge this guarantee. Unless a demand or claim under this guarantee is made on us in writing or before the expiry of Validity date from the date hereof, we shall be discharged from all liability under this guarantee thereafter.

4. We the Bank further agree with the ITI that the ITI shall have the fullest liberty without our consent and without affecting in any manner our obligations hereunder to vary any of the terms and conditions of the said Agreement or to extend time of performance by the said BIDDER from time to time or to postpone for any time or from time to time any of the powers exercisable by the ITI against the said BIDDER and to for bear or enforce any of the terms and conditions relating to the said agreement and we shall not be relieved from our liability by reason of any such variation, or extension being granted to the said BIDDER or for any forbearance, act or omission on the part of the ITI or any indulgence by the ITI to the said BIDDER or by any such matter or thing whatsoever

which under the law relating to sureties would, but for this provision, have effect of so relieving us.

5. Notwithstanding anything here in contained;

(a) The liability of the Bank under this guarantee is restricted to the "B. G. Amount" and it will remain in force up to its Validity date specified above.

(b) The guarantee shall stand completely discharged and all rights of the ITI under this Guarantee shall be extinguished if no claim or demand is made on us in writing on or before its validity date.

6. In case ITI demands for any money under this bank guarantee, the same shall be paid through banker's Cheque in favour of "ITI Limited, Bengaluru" payable at Bengaluru.

7. The Bank guarantees that the below mentioned officer who have signed it on behalf of the Bank have authority to give this guarantee under its delegated power.

Notwithstanding anything contained herein:

1. Our liability under this Bank Guarantee shall not **Rs. /- (Rupees Only)**

2. This Bank Guarantee shall be **valid up to…..**

3. We are liable to pay the guarantee amount or any part thereof under this Bank Guarantee only if you serve upon us a written claim or demand on or before**……**

(date of expiry of guarantee)

Place: ……

Date:…….. (Signature of the Bank Officer)

Rubber stamp of the bank

Authorized Power of Attorney Number: Name of the Bank officer:

Designation:

Complete Postal address of Bank: Telephone Numbers.

Fax numbers

Annexure-IV

NON-DISCLOSURE AGREEMENT

(Between M/s. ITI Ltd & M/s …….)

This Agreement is made on……day of……..……between **M/s ITI Limited** a company incorporated under the Indian Companies act. 1956 and having its registered office at **ITI Bhavan, Dooravani Nagar, Bengaluru-560016 with** CIN No: L32202KA1950GOI000640 herein after called "ITI"

AND

M/s. xxxxx, a Company/LLP/Partnership Concern incorporated under the Companies Act, 1956/2013 or registered under partnership act 1932, having its Registered Office at ……, CIN No - …….. (hereinafter referred to as "Prospective Implementation Agency (PIA)" which shall include its successors and permitted assigns, herein after referred to as PIA);

which expression shall unless repugnant to the subject or the context mean and include its successors, nominees or assigns.

PIA and ITI are hereinafter also referred to individually as "Party" and collectively as "Parties".

Background:

The Parties are evaluating and negotiating a potential contractual relationship, subject to mutually agreed definitive agreement, as per Tender No. ----------due on ……. issued by ITI Limited for The FOR THE ROLLOUT OF, OPTICAL FIBRE NETWORK FOR A SPECIAL COMMUNICATION PROJECT OF THE INDIAN ARMY.

(A) ITI may in these evaluations and negotiations disclose certain Confidential Information (as defined below) to PIA;

(B) The Parties agree that the disclosure and use of Confidential Information is to be made on the terms of this Agreement.

The Parties agree as follows:

Whereas PIA is a prospective party to bid for the execution of OFC network for a turn key project being handled by ITI of Army project. The PIA will be issued details pertaining to locations which is highly classified and confidential information. The information is to protect from unauthorized use and disclosure.

In consideration of this, the PIA agrees as follows:-

1. This Agreement will apply to all information including information listed in Exhibit A attached hereto pertaining to project disclosed by M/s ITI Ltd to the PIA in writing or otherwise. Information consists of location details, equipment details and /or technical information, and all copies and

derivatives containing such information that may be disclosed to PIA for and during the Purpose. Information may be in any form or medium, tangible or intangible, and may be communicated / disclosed in writing, orally, or through visual observation or by any other means by ITI to the PIA.

2. The PIA shall use the information pertaining to this project only for the purpose and shall hold information in confidence using the same degree of care as it normally exercise to protect its own proprietary information, but not less than reasonable care, taking into account the nature of the information and shall grant access to information only to its employees who have need to know, but only to the extent necessary to carry out the business purpose of this project as defined. The PIA shall cause its employees to comply with the provisions of this Agreement applicable and shall not reproduce information. The PIA may, however, disclose the information to its consultants as per need to know requirement, provided that by doing so, the PIA agrees to bind those consultants to terms at least as restrictive as those stated herein, advising them of their obligations and indemnify ITI Ltd for any breach of those obligations.

3. The PIA shall not disclose any information pertaining to this project to any third party.

4. The PIA recognized and agrees that all the information pertaining to this project is highly confidential and is owned solely by Ministry of Defence, Government of India and that the unauthorized disclosure or use of such confidential information would cause irreparable harm and significant injury, the degree of which may be difficult to ascertain. Accordingly, the PIA agrees that ITI will have the right to obtain an immediate injunction enjoining any breach of this Agreement, as well as the right to pursue any and all other rights and remedies available at law or in equity for such a breach.

5. The PIA’s failure to enforce any provision, right or remedy under this agreement shall not constitute waiver of such provision, right or remedy.

6. This Agreement will be construed in, interpreted and applied in accordance with the laws of India.

7. This Agreement attached hereto constitutes the entire agreement with respect to the PIA’s obligations in connection with information disclosed hereunder.

8. The PIA shall not assign this Agreement without first securing ITI’s written consent.

9. This agreement will be in effect from the date of the disclosure of confidential information.

IN WITNESS WHEREOF, the parties hereto have executed this agreement by their duly authorized officer or representatives.

M/s---------- **M/s ITI Limited**

Signature _____ Signature _____

Printed Name _____ Printed Name _____

Title _____ Title _____

Witness No. 1 _____ Witness No. 1 _____

Name _____ Name _____

Witness No. 2 _____ Witness No. 2 _____

Name _____ Name _____

Annexure-V

PRE-CONTRACT INTEGRITY PACT

GENERAL

This pre-bid pre-contract agreement (hereinafter called the Integrity Pact) is made on day of ……..... the month of ……..., between, ITI Limited, ITI Bhavan, Dooravani Nagar, Bengaluru – 560016, India, (hereinafter called the "ITI", which expression shall mean and include, unless the context otherwise requires, his successors in office and assigns) of the First Part and M/s ……. (*address of the intending bidder*) (hereinafter called the "Bidder " which expression shall mean and include, unless the context otherwise requires, his successors and permitted assigns) of the Second Part.

WHEREAS the USER proposes to invite Expression of Interest (EoI) for selection/ empanelment of technology partner for a technical tie-up with ITI for the marketing/manufacturing of ……. ….. (*name of the product*) and the IP is willing to participate in the EoI as per the terms and conditions mentioned thereon;

WHEREAS the IP is a private company/public company/Government undertaking/partnership company (*strike off whichever is not applicable*), constituted in accordance with the relevant law in the matter and the USER is a PSU under the Department of Telecommunications, Ministry of Communications & IT, Government of India.

NOW, THEREFORE,

To avoid all forms of corruption by following a system that is fair, transparent and free from any influence/prejudiced dealings prior to, during and subsequent to the currency of the contract to be entered into with a view to: -

Enabling the USER to select/ empanel a technology partner for the marketing/ manufacturing of …. (name of the product) through the EoI in a transparent and corruption free manner, and

Enabling IPs to abstain from bribing or Indulging in any corrupt practice in order to secure the contract by providing assurance to them that their competitors will also abstain from bribing and other corrupt practices and the USER will commit to prevent corruption, in any form, by its officials by following transparent procedures.

The parties hereto hereby agree to enter into this Integrity Pact and agree as follows:

1. Commitments of the USER

1.1 The USER undertakes that no official of the USER, connected directly or indirectly with the contract, will demand, take a promise for or accept, directly or through intermediaries, any bribe, consideration, gift, reward, favour or any material or immaterial benefit or any other advantage from the IP, either for themselves or for any person, 'organization or third party related to the contract in exchange for an advantage in the bidding process, bid evaluation, contracting or implementation process related to the contract.

1.2 The USER will during the pre-contract stage, treat all IPs alike, and will provide to all IPs the same information and will not provide any such information to any particular IP which could afford an advantage to that particular IP in comparison to other IPs.

1.3 All the officials of the USER will report to the appropriate Government office any attempted or completed breaches of the above commitments as well as any

substantial suspicion of such a breach.

2 In case any such preceding misconduct on the part of such official(s) is reported by the IP to the USER with full and verifiable facts and the same is prima facie found to be correct by the USER, necessary disciplinary proceedings, or any other action as deemed fit, including criminal proceedings may be initiated by the USER and such a person shall be debarred from further dealings related to the contract process. In such a case while an enquiry is being conducted by the USER the proceedings under the contract would not be stalled.

3 Commitments of IP

3.1 The IP commits itself to take all measures necessary to prevent corrupt practices, unfair means and illegal activities during any stage of its bid or during any pre-contract or post-contract stage in order to secure the contract or in furtherance to secure it and in particular commit itself to the following: -

a) The IP will not offer, directly or through intermediaries, any bribe, gift, consideration, reward, favour, any material or immaterial benefit or other advantage, commission, fees, brokerage or inducement to any official of the USER, connected directly or indirectly with the bidding process, or to any person, organization or third party related to the contract in exchange for any advantage in the bidding, evaluation, contracting and implementation of the contract.

b) The IP further undertakes that it has not given, offered or promised to give, directly or indirectly any bribe, gift, consideration, reward, favour, any material or immaterial benefit or other advantage, commission, fees, brokerage or inducement to any official of the USER or otherwise in procuring the Contract or forbearing to do or having done any act in relation to the obtaining or, execution of the contract or any other contract with the Government for showing or forbearing to show favour or disfavor to any person in relation to the contract or any other contract with the Government.

c) IPs shall disclose the name and address of agents and representatives and Indian IPs shall disclose their foreign principals or associates.

d) IPs shall disclose the payments to be made by them to agents/ brokers or any other intermediary, in connection with this bid/contract.

e) The IP further confirms and declares to the USER that the IP is the original manufacturer/ integrator and has not engaged any individual or firm or company whether Indian or foreign to intercede, facilitate or in any way to recommend to the USER or any of its functionaries, whether officially or unofficially to the award of the contract to the IP, nor has any amount been paid, promised or intended to be paid to any such individual, firm or company in respect of any such, intercession, facilitation or recommendation.

f) The IP either while presenting the bid or during pre-contract negotiations or before signing the contract, shall 'disclose any payments he has made, is committed to or intends to make to officials of the USER or their· family members, agents, brokers or any other intermediaries in connection with the contract and the details of services agreed upon for such payments.

g) The IP will not collude with other parties interested in the contract to impair the transparency, fairness and progress of the bidding process, bid evaluation, contracting and implementation of the contract.

h) The IP will not accept any advantage in exchange for any corrupt practice, unfair means and illegal activities.

i) The IP shall not use improperly, for purposes of competition or personal gain, or pass on to others, any information provided by the USER as part of the business relationship, regarding plans, technical proposals and business details, including information contained in any electronic data carrier. The IP also undertakes to exercise due and adequate care lest any such information is divulged.

j) The IP commits to refrain from giving any complaint directly or through any other manner without supporting it with full and verifiable facts.

k) The IP shall not instigate or cause to instigate any third person to commit any of the actions mentioned above.

l) If the IP or any employee of the IP or any person acting on behalf of the IP, either directly or indirectly, is a relative of any of the officers of the USER, or alternatively, if any relative of an officer of the USER has financial interest/stake in the IP's firm, the same shall be disclosed by the IP at the time of filing of tender. The term 'relative' for this purpose would be as defined in Section 6 of the Companies Act 1956.

m) The IP shall not lend to or borrow any money from or enter into any monetary dealings or transactions, directly or indirectly, with any employee of the USER.

4 Previous Transgression

4.1 The IP declares that no previous transgression occurred in the last three years immediately before signing of this Integrity Pact, with any other company in any country in respect of any 'corrupt practices envisaged hereunder or with any Public-Zone Enterprise in India or any Government Department in India that could justify IP's exclusion from the tender process.

4.2 The IP agrees that if it makes incorrect statement on this subject, IP can be disqualified from the tender process or the contract, if already awarded, can be terminated for such reason.

5 Sanctions for Violations

5.1 Any breach of the aforesaid provisions by the IP or anyone employed by it or acting on its behalf (whether with or without the knowledge of the IP) shall entitle the USER to take all or any one of the following actions, wherever required: -

a) To immediately call off the pre-contract negotiations without assigning any reason or giving any compensation to the IP. However, the proceedings with the other IP(s) would continue.

b) To immediately cancel the contract, if already signed, without giving any compensation to the IP.

c) To cancel all or any other Contracts with the IP. The IP shall be liable to pay compensation for any loss or damage to the USER resulting from such cancellation/rescission.

d) To recover all sums paid in violation of this Pact by the IP(s) to any middleman or agent or broker with a view to securing the contract.

5.2 The USER will be entitled to take all or any of the actions mentioned above, also on the Commission by the IP or anyone employed by it or acting on its behalf (whether with or without the knowledge of the IP), of an offence as defined in Chapter IX of the Indian Penal code, 1860 or Prevention of Corruption Act, 1988 or any other statute enacted for prevention of corruption.

5.3 The decision of the USER to the effect that a breach of the provisions of this Pact has been committed by the IP shall be final and conclusive on the IP. However, the IP can approach the Independent Monitor(s) appointed for the purposes of this Pact.

6 Independent Monitors

6.1 The USER appoints Independent Monitor (hereinafter referred to as Monitor) for this Pact in consultation with the Central Vigilance Commission.

6.2 The task of the Monitor shall be to review independently and objectively, whether and to what extent the parties comply with the obligations under this Pact.

6.3 The Monitor shall not be subject to instructions by the representatives of the parties and perform their functions neutrally and independently.

6.4 Both the parties accept that the Monitor have the right to access all the documents relating to the project/procurement, including minutes of meetings.

6.5 As soon as the Monitor notices, or has reason to believe, a violation of this Pact, he will so inform the Authority designated by the USER.

6.6 The IP(s) accept(s) that the Monitor has the right to access without restriction to all Project documentation of the USER including that provided by the IP. The IP will also grant the Monitor, upon his request and demonstration of a valid interest, unrestricted and unconditional access to his project documentation. The Monitor shall be under contractual obligation to treat the information and documents of the IP with confidentiality.

6.7 The USER will provide to the Monitor sufficient information about all meetings among the parties related to the Project provided such meetings could have an impact on the contractual relations between the parties. The parties will offer to the Monitor the option to participate in such meetings.

6.8 The Monitor will submit a written report to the designated Authority of USER within 8 to 10 weeks from the date of reference or intimation to him by the USER / IP and, should the occasion arise, submit proposals for correcting problematic situations.

7 Facilitation of Investigation

7.1 In case of any allegation of violation of any provisions of this Pact or payment of commission, the USER or its agencies shall be entitled to examine all the documents including the Books of Accounts of the IP and the IP shall provide necessary information and documents in English and shall extend all possible help for the purpose of such examination.

8 Law and Place of Jurisdiction

8.1 This Pact is subject to Indian Law. The place of performance and jurisdiction is the seat of the USER.

9 Other Legal Actions

9.1 The actions stipulated in this Integrity Pact are without prejudice to any other legal action that may follow in accordance with the provisions of the extant law in force relating to any civil or criminal proceedings.

10 Validity

10.1 The validity of this Integrity Pact shall be from date of its signing and extend up to the contract period with the USER in case a contract is signed. In case IP is unsuccessful, this Integrity Pact shall expire after six months from the date of the signing of the contract.

10.2 Should one or several provisions of this Pact turn out to be invalid, the remainder of this Pact shall remain valid. In this case, the parties will strive to come to an agreement to their original intentions.

11 The parties hereby sign this Integrity Pact.

USER	IP
Name of the Officer.	CHIEF EXECUTIVE OFFICER
Designation	M/s …. (address)
ITI Limited (address)	
Place:	Place:
Date:	Date:

Witness:

1. ……..	1. ……
2. ……..	2. …….

Annexure-VI

Declaration that the Bidder has not been blacklisted/debarred

(To be submitted on Non-Judicial Stamp Paper of Rs. 100/- duly notarized)

Place:
Date:
To,
<name and address>
Ref: Tender Notification no dated
Subject: Declaration of Bidder being not blacklisted

Dear Sir,

It is certified that our firm/company or any of our entity is **not** black listed/Debarred from doing business or put on holiday list etc by any Govt. Organization / PSUs for any reason. However, if we fail to complete the awarded work / fulfill the Tender conditions or if any of the information submitted by our company or its employee or associate, proves to be false, ITI Ltd shall be free to take action / black list our firm / company notwithstanding of taking any other legal action."

Place :
Date :
Bidder's Company Seal :
Authorized Signatory's Signature :
Authorized Signatory's Name and Designation:

ANNEXURE-VII

BOM (Part of Main Supply & Service)

S No	Items	UNIT	Qty			Make & Model
			ZONE-I	ZONE-II	ZONE-III	
1	Warning Tape	Kms	4,254	4,451	2,536	
2	Joint Closure	Nos	2364	2470	1409	TEC approved
3	GI Pipe	Mtr	As per requirement			As per relevant IS B Class
4	RCC Pipe	Mtr	As per requirement			NP-2 Class Pipe
5	RCC Route Indicator	Nos	As per Requirement			TEC Approved
6	Electronic route marker - over ground (every 500M)	Nos	8,500	8,900	5,070	ATTL TRACE MARK B (Aishwarya Telecom)
7	Electronic route marker - Underground (every 100M)	Nos	4,254	4,451	2536	ATTL TRACE MARK B (Aishwarya Telecom)
8	Any Other associated equipment/Connectors/ Accessories as required for commissioning of links	Lot	As per requirement			
9	DWC Pipe	Mtrs	As per requirement			As per relevant IS 60mm
10	Chamber	Nos	As per requirement			As per Specs & competent authority
11	Bricks	Nos	As per requirement			As per Specs & competent authority
12	Electronic Locator	Nos	9	12	9	As per Specs & competent authority

Annexure-VIII

WARRANTY AND AMC-SLA

A. INSPECTIONS AND MAINTENANCE

1. **Pre-Dispatch Inspection (PDI)** would be at the discretion of the customer at the OEM's factory premises. The User's representatives will carry out Pre-Dispatch Inspection (PDI) of the Equipment in order to check their compliance with specifications in accordance with Acceptance Test Procedures (ATP). Upon successful completion of Pre-Dispatch Inspection by User, the PIA and ITI will issue and sign a Certificate of Conformity in a pre-designed format as per the requirement of the equipment.

   The PIA shall intimate ITI at least **45 days** before the scheduled date of PDI

The User however reserves the right not to attend the Pre-Dispatch Inspection or to request for a next date. In case the User decides not to attend the PDI, the PIA shall be entitled to carry out said tests alone as scheduled. The Certificate of Conformity and the Acceptance Test Report will be signed by the PIA's QA representative alone and such documents bearing the sole signature of the PIA's QA representative shall have the same value and effect as if they have been signed by both parties.

2. Joint Receipt Inspection (JRI) of delivered goods and Services shall be conducted at the designated location(s) to be nominated by the user. The PIA would be informed of the date for JRI.JRI will consist of:-

(a) Quantitative checking to verify that the quantities of the delivered goods and services correspond to the quantities defined in the contract and the invoices.

(b) Complete functional checking of the Goods and Services as per specifications in this contract and as per procedures and tests laid down in **AITP**.

3. Jointly Signed Documentary Proofs or entries in Measurement Books maintained for this purpose having signatures of authorized representatives of the User and authorized representative of the PIA are required for: -

User's endorsement verifying the conformation of the specifications of the OFC work after inspection by representatives of the User on site will form part of AITP.

OFC Laying as per AITP. Following documents must form part of AITP:-

(a) Certificate of inspection.

(b) Proof of dispatch and its receipt at site by representative of the User at site (applicable for the Supply Items).

(c) Measurement log books specifying the stores used on ground/works undertaken.

(d) OTDR traces certifying the serviceability of the route/segment.

(e) Record of Hard Rock would be an essential pre-requisite.

(f) ATP as per format to be suggested by the PIA and approved by the User.

(g) Final handing & taking over after completion of Network AITP and rectification of all observations.

4. <u>WARRANTY CLAUSE</u>

The PIA would warrant that the goods/services supplied under this contract conform to technical specifications prescribed and shall perform according to the said Technical Specifications.

The PIA would warrant for a period of **24 months** from the date of final taking over the entire integrated network, (i.e. from date of Network AITP) that the goods/stores including software *components*, infrastructure and network integration support supplied under this contract and each component/service used in the manufacture there of shall be free from all types of defects/failures.

If within the period of warranty, the goods are reported by the User to have failed to perform as per the specifications, the PIA shall either replace or rectify the same as per clauses of warranty. Record of the down time would be maintained by User in log book. However, for critical components affecting the uptime of the network, the same will be repaired/replaced in-situ and the same needs to be catered for by pre-positioning of the spares/standby equipment. Spares and all consumables required for warranty repairs shall be provided free of cost by PIA. All activities including diagnosis, rectification, calibration, transportation etc, required for making equipment serviceable and available would be the PIA's responsibility. The PIA also undertakes to diagnose, test, adjust, calibrate and repair/replace the goods/equipment arising due to accidents by neglect or misuse by the operator or damage due to transportation of the goods during the warranty period, at the cost mutually agreed to between the User/ITIL and the PIA. The PIA shall intimate the assignable cause of the failure which is mutually agreeable. Details of the reasons leading to the conclusion must be furnished, so as to enable the User in ascertaining the legitimacy while accepting the same.

PIA hereby warrants that necessary service and repair back up during the warranty period of the links shall be provided by the PIA and he will ensure that the UPTIME of **99.97%** is maintained at all times within warranty period. In the event of not adhering to the specified Uptime for the equipment/system,per week penalty shall be levied as per terms and conditions defined in AMC/Warranty Contract.

If a particular equipment/goods fails frequently and/or, the cumulative down time exceeds **0.015%** of the warranty period (i.e. 3 hours) **or a common defect is noticed in more than 10% of the quantity of goods with respect to a particular system/sub-system/equipment/item/ component/sub-component, that complete system/sub-system/equipment/item/component/sub-component** shall be replaced free of cost by the PIA

within a stipulated period of ten days of receipt of the notification from the User duly modified/upgraded through design

PIA shall associate technical personnel of maintenance agency and QA of User during warranty repair and shall provide complete details of defect, reasons and remedial actions for averting recurrence of such defects.

The PIA warrants that the goods supplied will conform to the Temperature and Humidity conditions as mentioned at Annexure II to this contract.

NB: THE PROVISIONS MENTIONED ABOVE, IN CONFLICT IF ANY, WITH THE PROVISIONS AT ANNEXURE-VII, LATTER SHALL OVERRIDE.

Note:-

(i). **Fibre Repair Teams (FRTs)**. FRTs will be placed for maintenance of OFC Route during the warranty, duly approved by the USER (One FRT for a span of 125 KMs). Each FRT shall be available at the allotted route locations. The location of the FRT would be defined as approved by the User. However, their presence would be dynamic with no restriction across network area on the sole discretion of the User requirement.

(ii). Repair and replacement of all defective equipment/part including overhaul/factory repairs, as specified by the supplier in the technical manuals of the equipment.

(iii). All expenses incurred on replacement or repair of faulty equipment during warranty period shall be entirely borne by the PIA.

(iv). The Detailed Terms and conditions shall be same as that of AMC applicable to OFC and is appended as below (Appendix A to Annexure VII)

Appendix "A" to Annexure VII
OPTICAL FIBRE CABLE MAINTENANCE (DURING WARRANTY AND AMC)

OFC Maintenance

1. **Fiber Repair Teams (FRTs)**. Repair and maintenance of OFC routes will be the primary role of these FRTs. PIA shall provide **FRTs as Below:**

(a) Zone-1---34 FRTs
(b) Zone-2---36 FRTs
(c) Zone-3---20 FRTs

2. PIA shall provide OFC maintenance service on round the clock basis for rectifying the OFC fault within specified time from the time of generation of alarm by GIS based Remote Fibre Test and Measuring System (RFTMS) or lodging of complaint to the representative of PIA. FRT's will be placed as per ITIL's discretion for maintenance of OFC routes during the warranty and AMC period, as per the following details:-

(a) **Equipping**. FRT's will be equipped with vehicle and other necessary accessories required to maintain/repair/replace the OFC.

(b) **Maintenance of OFC**. Each FRT will cover and maintain at least a distance of 125 kms on the OFC route. Adjustments in route length if any for ease of management will be carried out in consultation with ITIL.

(c) **Route length**. Route Length (**only to calculate responsibility of a FRT)** shall be the physical road length / trench length and not OFC cable length. Route Length is inclusive of in-city connectivity. The route length should be verified and certified by the PIA representative and ITIL representative after conducting the Survey during the Test Bed. The Survey Report should be duly signed by the signing authorities from both the parties.

(d) **Specialized Engineer**. The PIA shall provide **one specialized Engineer** for OFC maintenance adequately trained on OFC maintenance for **every 05 FRTs**. They shall be present at the time of restoration of a fault and shall submit report to the Commanding Officer of Network Signal Regiment/ITIL representative after the rectification of fault.

(e) **Reporting**. After attending the fault & permanent restoration of Fault it will be logged in to the NMS on daily basis.

(f) **Replacements**. PIA shall arrange to provide replacement of individuals belonging to FRTs (at no extra cost) in case regular people are sick/ on leave within 24 hours. This clause is applicable for FRTs and will not be read in conjunction of leave of MSO

(g) **Usage Report**. Weekly material / spares usage report will be submitted to ITIL by the PIA. The same shall be integrated and updated in NMS.

(h) **Examination of Work before Covering Up**. The PIA shall give advance notice to ITIL or its representatives whenever any work or materials are intended to be covered up in the earth or walls or otherwise to be placed beyond the reach of measurement, in order that the work may be inspected or that correct measurement may be taken. In default of such notice, the same shall, at the discretion of ITIL or its representative, be uncovered and measured at the PIA's expenses. The work shall again be covered up at the PIA's expenses. Once finished work is inspected to ascertain the parameter for digging and laying and OFC maintenance and the said work is found to be defective then the **PIA** shall bear the extra loss of redoing the OFC work.

3. **Time to Restore Fiber Cuts**.

(a) **Response Time**. The maximum response time is **01 (One)** Hour from the time alarm is generated in the NMS / fault is logged. The responsibility of informing the FRT regarding the occurrence of fault lies with the PIA's representative.

(b) **Localization Time**. The localization of fault will be done by GIS based RFTMS. In case GIS based RFTMS is faulty a localization time subject to maximum of 01 **(One)** hour will be permitted.

(c) **Vehicle Travel time**. The vehicle travel time will be defined by ITIL based on average travelling time from location of FRT to the faulty location of OFC.

(d) **Formula of Restoration Time**. Restoration Time = Response Time + Localization time + Vehicle Travel time + Repair time including excavation, splicing and covering up of Earth.

(e) **Restoration Time Limit**. The maximum restoration shall not exceed Five (05) hours in plains and shall not exceed 06(six) hours in hilly areas where approach roads are difficult.

(f) **Recording of Restoration of OFC**. Time taken from the time of generation of alarm in NMS / lodging the complaint to the PIA to the time of restoration of end-to-end traffic after rectification of OFC cut(s)/fault(s) including the traveling time will be logged in NMS. After restoration of the link, losses on the cable will be re- measured and entered in log and checked against the acceptable limits.

Preventive Maintenance

4. Preventive maintenance activities will be done by PIA monthly. Taking OTDR traces in all fibers, inspection and cleaning of all manholes / jointing pits etc as and when necessary (to be jointly decided by the ITIL and the PIA) will be done.

5. **Route Index Diagram (RID) of OFC Routes**. Maintenance of RIDs of

the routes will be responsibility of PIA. One copy of RIDs of all OFC routes will be handed over to ITIL and the two sets will be reconciled by the 5th of each month. On termination of contract the RIDs will be handed over to ITIL.

6. Splicing involved in preventive action (aerial cabling splicing, taking OTDR traces etc.) will not be counted towards system outages but will be undertaken after permission of the ITIL. However, the same has to be converted to permanent within the stipulated timelines.

7. Preventive maintenance on the OFC routes will be carried out by the FRTs on daily basis subject to maximum running (of Vehicle) of 3600 Km per month and the same will be authenticated by the ITIL and will be at ITIL discretion.

8. **Logs**. Preventive maintenance activities will be logged in NMS and reviewed monthly and a satisfactory report needs to be signed by ITIL's representatives and Zonal manger during the monthly review meeting and forwarded to ITIL. The responsibility of maintaining the record will be with the Zonal Managers. The record will be put up periodically to the designated representative of the ITIL.

PIA's Obligation

9. PIA's obligations are as under:-

(a) **Location**. FRTs will be located preferably on the OFC route on each stretch and will provide round the clock services. The deployment of FRTs and its locations will be finalized before commencement of the warranty during network AITP and will be approved by the ITIL.

(b) **Spares.** Spares for OFC include one time OFC spares, OFC for 20 % replacement (during the period of warranty and AMC) and spares for repair of OFC. PIA will cater for repair of at least 05 (five) fiber cuts to be maintained at one time with each of the FRTs. The stocking of these spares will be done at location in consultation and approval of ITIL. The spares should conform to latest TEC GR.

(c) **Liaison with other Agencies**. PIA will maintain good rapport and coordination with the entire local govt. & Non govt. bodies/ agencies, farmers, private construction agencies etc. to collect their plans, which may impact the OFC network in future.

(d) **Aerial Cabling**. During preventive maintenance as and when a network threatening activity is observed by PIAnecessary actions shall be undertaken by PIA to avoid fibre cut. However, if damage to OFC in a particular stretch cannot be avoided, the PIA shall create a shunt (aerial cabling) in time so that when the actual damage happens the network downtime is minimum that is equal to the splicing time involved at the two ends of the aerial cable. This is a preventive action. The cable used for this shall be aerial cable.

(e) **Permanent Restoration**. In case the site condition is not favorable for the immediate restoration of the fault, the temporary restoration of the OFC shall be carried out immediately. Permanent

restoration of joint pits is to be carried out within **48 hours in plains and 96 hours in hills** from time of fault / OFC cut. Permanent restoration beyond 48/96 hours will be treated as outage and will attract penalties. Permanent restoration work of these temporary work/ joints will not be considered as breakdown time unless there is another cut during restoration job. In case the site is not conducive for permanent restoration within **48/96** hours arrangement of manpower will be done by PIA for safeguarding exposed OFC till permanent restoration. Penalty

will not be imposed if delay is due to work by external agency like road widening, force majeure etc. However, Penalty will be applicable after the work by external agencies has been finished.

stipulated losses by laying overhead OFC initially which then shall be made underground on obtaining of fresh ROW permissions. The period from making the OFC functional on overhead OFC and the obtaining of fresh ROW permissions shall not be counted towards penalty on the PIA. The actual period required beyond the fresh ROW permission for laying/repair of underground OFC shall be decided by the ITIL in consultation with vendor and the said period shall also not count towards penalty on the PIA.

(f) **Material Reconciliation**. It shall be the effort of the PIA to reduce wastage at every level. At the end of the specified work as per work order, ITIL would undertake a joint reconciliation of all the materials issued. The maximum allowable wastage for the various items are given below: -

(i) Conduits wastage not greater than 0.5%.
(ii) Cables wastage not greater than 0.5%.

(g) **Instruments and Tools**. Instruments and tools to include OTDR, Splicing Machine, Power Meter, Laser source, DG set (Compact Honda), Dewatering pump (compact ½ HP), Radiometer, Optical tool kit, Civil Tool kit, GSM Phone, Digital Camera, Electronic locator will be provided to each FRT. The equipment thus provided should be capable of handling the system with its specifications. **These instruments and tools will be replaced after every two years during the AMC period which amounts to total of 4 sets in complete life cycle of AMC**. On replacement, the old equipment will be handed over to ITIL. The PIA will ensure that the tools and test and measurement instrument of any FRT shall not be moved to any other FRT/sites/ works without permission of ITIL. Penalty for not providing the replacement items will be applicable if not delivered within 30 days of completion of second year, fourth year and sixth year of AMC. However, if the PIA fails to provide replacement in second, fourth and sixth years of AMC and the existing old equipment is faulty and remains so, then penalty shall be **1.5 times the deficiency of resource / equipment in FRTs**.

The tools and test and measurement equipment provided by the PIA shall be inspected every month by ITIL's representative. If the quality of the tools or the technical standard (refer TEC GR) of any test and measurement instrument is found below average and declared so by the ITIL representative the PIA shall replace the instrument / tool with immediate effect.

(j) **OFC Parameters**. Before the commencement of the warranty ITIL and the PIA will tabulate the OTDR event and the power measurement of each stretch of OFC confirming to the technical requirements jointly and sign the same. Any variation of parameter for each fibre during the contract period shall be measured from this tabulation. Losses in dB will be the average loss over the route length measured on all the cores of fibres.

Ser No	OFC Route	Route Length in (km)	Losses in dB per core	Remarks

(k) **Damage to Other Cables / person /property etc**. During the maintenance or fault rectification work, should any damage occur to any other cables, the complete cost of repair will be borne by the PIA. ITIL shall not be responsible or held liable for any damage to person or property consequently upon the use and or misuse or failure of any construction tools and equipment used by the PIA, even though such construction tools and equipment may be furnished, rented or loaned by the PIA. The PIA accepts all responsibility in this connection and agrees to indemnify and save BUYER from any and all claims for said damages. In any case, the PIA shall be liable for all damages and consequences arising out of neglect in this regard.

(l) **Protection of Existing Plant and Equipment**. During construction activity by another PIA / agency, any plant, equipment or heavy machinery in the vicinity of ITIL's network, the PIA shall protect all existing structures, piping conduits, equipment and facilities of ITIL against damage.

(m) **Items with FRTs**. Items and material listed below will be placed at FRT locations for maintenance of OFC routes. In addition if any other item to maintain OFC is felt by ITIL / PIA it shall be incorporated in the list of items. Any additional items required by the FRT's will be provisioned by **PIA** without any additional cost. **PIA** shall arrange for logistics to provide facilities such as AC/DC power source, lighting arrangement, dewatering facility, DG sets etc., which may be required during the execution of maintenance job at the site.

Ser No	Item Name	Quantity	Remarks
OFC Spare For Maintenance (Stocked) (Location of spare to be decided in consultation with ITIL)			

(i)	Unarmored composite OFC -24 Core NZDS metal free.	As reqd	As per BSNL TEC GR in vogue
(ii)	Aerial / composite OFC-24 Core NZDS metal free.	As reqd	As per BSNL TEC GR in vogue
(iii)	GI Pipes with minimum three holes per feet drilled in to the body to make it less vulnerable to theft	As reqd	Each of 20 ft. length and of 50 mm dia.
Ser No	**Item Name**	**Quantity**	**Remarks**
(iv)	500 Mtr. roll per drum of 40mm dia HDPE Duct of Gray, Blue and Purple colour (With stripes).	As reqd	
(v)	RCC Pipe - Half cut	As reqd	100mm dia, 1 mtr length
(vi)	RCC Pipe - Full	As reqd	100mm dia, 1 mtr length
(vii)	Splice Chambers	As reqd	As per Specification
(viii)	Route Markers	As reqd	As per Specification
(ix)	Cement Bags	As reqd	Best Quality
(x)	Ballies (up to 6 M)	As reqd	Best Quality
<u>OFC spare Per FRT (For 05 Jointing at one go)</u>			
(i)	Patch cords	As reqd	as specified by ITIL
(ii)	Couplers for HDPE Duct	As reqd	
(iii)	Simple Plug	As reqd	
(iv)	End Plug	As reqd	
(v)	Joint Closures	04 Nos	
(vi)	Mechanical Splices	100 Nos	
(vii)	Splicing sleeves	As reqd	

Instruments Per FRT			
(i)	Vehicle	1	Light Vehicle, 3600Km per month
(ii)	OTDR	1	Latest TEC GR of BSNL in Vogue
(iii)	Splicing Machine	1	
(iv)	Power Meter	1	
(v)	DG Set	1	1.5 KVA portable - Honda make
(vi)	Dewatering Pump	1	Compact 1/ 2 HP
(vii)	Rodo meter	1	Latest TEC GR of BSNL in Vogue
(viii)	Optical Tool Kit	1	
(ix)	Civil work tool	1	
(x)	GSM Phone	1	
(xi)	Digital Camera	1	
(xii)	Electronic Locator	1	Latest TEC GR of BSNL in Vogue
(xiii)	LASER Source	1	
Optical Tool kit Per FRT			
(i)	Cable Sheath Cutter	2	
(ii)	Stripper	2	
(iii)	Cleaver	2	
(iv)	Ceramic Scissors	2	
(v)	Loose Tube Cutter	2	
(vi)	Fiber Cleaner	As Required	
(vii)	Visual Fault detector	1	
(viii)	Fiber Scope	1	
(ix)	Fiber Microscope	1	
(x)	Duct Cutter Simple	1	Preferably Taparia Make
(xi)	Duct Cutter Rotary	1	Preferably Duraline Make
(xii)	Chamfering Tool	1	Preferably Duraline Make, 1 each for 40/50/75mm
(xiii)	Allen Key Set	1 Set	Preferably Taparia Make
Civil work Tool kit Per FRT			
(i)	Mason Tool Kit	1 Set	

(ii)	Nylon Rope	500 mtr	Best Quality
(iii)	Tools for digging	2 each	Spades, Shovels, Pick-axe, Crow bar, Steel chain
(iv)	Emergency Light	1	With four hours' backup +S are batteries
(v)	Tent + Bamboo	1	Canvas/Tarpaulin waterproof Tent
(vi)	Warning Tape	500 mtr	Bright Color, work in progress printed
(vii)	Measuring Tape	100 mtr	

Note: -

1. All equipment / Vehicle to be approved by **ITIL** team will be inspected on regular basis. Any vehicle not being road worthy as communicated by **ITIL** team should be considered as non-availability of resource. Absence of any equipment as mentioned for each FRT during surprise inspection shall result in a suitable penalty per incident.

2. The tools and test and measurement instrument of any FRT shall not be moved to any other FRT / Sites / Work without written permission of ITIL representative.

Penalties: OFC Maintenance and FRTs

10. Penalties on account of any deficiency or deviation of OFC Maintenance are as under.

Sl No	Category	Description	Amount (Rs)	Frequency
(a)	Manpower of FRT	If any manpower of FRT is not available penalty shall be levied on **PIA**.	Rs 9365	Per day per person
(b)	Resources/ equipment of FRT	If any equipment and resources of FRT is not available, penalty shall be levied per equipment/ resource not available.	Rs 9365	Per day
(c)	Vehicle	If vehicle of FRT is not available to **ITIL** without replacement, penalty shall be levied .	Rs 9365	Per vehicle per day

(d)	Response time	In case the **PIA** fails to mobilize the FRT team to proceed to the fault location within one hour of the intimation of the fault by system / **ITIL**, penalty would be levied .	Rs 9365	Per hour per Incident till the FRT reaches the location
(e)	Not following official timings	FRT manpower absent for certain duration in a day during official timing will attract penal deductions.	Rs 234	Per hour per individual
(f)	Emergency situation	FRT manpower not reporting within 01(one) hour when called in emergency situation (off duty hours) will attract penal deductions	Rs 468	Per hour per individual
(g)	Penalty for Violation of Restoration time(MTTR)	In the event that rectification is delayed beyond the restoration time specified in the contract for any reasons attributable to the **PIA**, penalty will be imposed.	Rs 9365	Per incident Per day up to 72 hours and additional penalty of Rs 936 per day overand above per day penalty.
(h)	Permanent Restoration	The time defined for permanent restoration 48/96 hours is not adhered to then a penalty would be levied	Rs 9365	Per incident Per day up to 72 hours and additional penalty of Rs 936 per day over and above per day penalty.
(j)	Splicing	If the splice losses in the fiber spliced in a cable during any fault on an average are not limited to 0.05 dB then penalty will be imposed.	Rs 9365	Per instance per joint
(k)	Preventive Maintenance	Inability on the part of **PIA** to perform regular preventive O&M activity as per schedule mentioned	Rs 18730	Per incident

(l)	Unreasonable Degradation of OFC parameters	Cumulative loss including dispersion and jointing losses should not increase beyond 1 dB over any section of OFC route. (For example, if the loss increases between 1.01 to 2.0 dB the penalty would be 2.8 lakhs and in case the losses are between 2.01 to 3.0 dB the penalty would be 5.6 lakhs and so on).	Any violation, as a result of the repair of the cable or due to any other reason, shall invite a penalty of 2.8 lakhs per additional dB loss or part thereof	Per incident

PART IV - OTHER TERMS AND CONDITIONS

11. **Non Disclosure of Contract Documents**. Except with the written consent of the BUYER, other party shall not disclose the contract or any provision, specification, plan, design, pattern, sample or information thereof to any third party.

12. **Warranty of Item supplied during AMC Period**. The PIA warrants that the goods supplied under this AMC conform to technical specifications prescribed for equipment and shall perform according to the said technical specifications. The PIA warrants for a period of 24 months from the date of Final AITP, that the goods / stores supplied under this AMC and each component used during AMC shall be free from all types of defects / failures. If within the period of warranty, the goods are reported by the BUYER / ITIL to have failed to perform as per the specifications, the PIA shall either replace or rectify the same free of charge, maximum within 30 days of notification of such defect received by the PIA, provided that the goods are used and maintained by the ITIL as per instructions. Warranty of the equipment would be extended by such duration of downtime. Record of the down time would be maintained in NMS / by ITIL in logbook. Spares required for warranty repairs shall be provided free of cost by PIA.

13. **Performance cum Warranty Bank Guarantee**. A performance cum warranty Bank Guarantee (PWBG) bond equal to 10% (ten percent) of total project cost will be furnished in form of bank guarantee through public sector bank or private sector bank authorized by RBI, in favor of Government of India, Ministry of Defence by the PIA. This shall cover up to period of warranty.

14. **Performance Bank Guarantee for AMC**. A Performance Bank Guarantee (PBG) for AMC period amounting to 10 % (ten percent) of Total AMC cost will be issued in form of Bank Guarantee will be furnished by PIA in favour of Government of India, Ministry of Defence, through public sector bank or private sector bank authorized by RBI. Advice of State Bank of India or any other back for confirmation of same is not required. The performance bank guarantee will remain valid up to 90 days after expiry of AMC period. In case, any claim or any other contractual obligations are outstanding, the PIA will extend the bond as asked by BUYER till such time the PIA settles all claims and completes contractual obligations. The performance bank guarantee bond will be subject to encashment by the BUYER, in case, conditions regarding adherence to warranty, delivery schedule, settlement of claim and other provisions of AMC are not fulfilled by the PIA.

15. **Payment procedure, Recovery of Liquidity Damage Charges, Penalties etc**.

(a) **Payment procedure**. Payments will be made on **quarterly basis** during the time of AMC. The penal deductions will be calculated per quarter by respective Commanding Officers of the Network Signal Regiment /**ITIL** representative. The bills will be forwarded to **ITIL** for further processing.

(b) **The LD's/Penalties Imposed during AMC period**. All LD's/penalties will be imposed on **PIA** on quarterly basis except for system Uptime.

(c) **System Uptime Penalty**. The Penalty for maintaining the required system uptime will be imposed at the end of AMC year and will be adjusted against the payment of 4th quarter, once of the system uptime availability of the year is ascertained.

(d) In case the AMC contract is awarded to the 3rd party due to any reasons as deemed suitable to the BUYER, the LD/penalty applicable to PIA will be recovered for the pending bill / Performance Bank Guarantee submitted by the PIA.

16. **Sub Contract**. The **PIA** shall not sub-contract any part or the whole of the work. The PIA has no right to give, bargain, sell assign or sublet or otherwise dispose of the Contract or any part thereof, as well as to give or to let a third party take benefit or advantage of the present contract or any part thereof. AMC will be governed by article of transfer and subletting as given in main contract document (Refer Article 27).

17. **Annual Lineup / Technical inspection**. Annual line up and technical inspection will be carried out Unit wise and or Zone wise or as defined by ITIL. All system parameters and network performance parameters if required by ITIL will be checked and optimization for performance / realignment / readjustment to meet the performance parameters will be done before the inspection including that of Test and measurement equipment.

18. **Log Book Maintenance**. All equipment will have log books. The faulty equipment/modules/cards shall have the Log book entry indicating the nature of the problem experienced, giving detailed information and fault diagnosis. The maintenance of log books shall be the responsibility of the PIA. The log books will be inspected by Zonal managers and managers during monthly visits.

19. **Packaging and Transportation**. PIA shall provide packing and transportation of the equipment/modules/cards in accordance with generally accepted methods for international shipping. PIA shall be responsible for any damage in transit.

20. **Training**. The PIA will train sufficient number of personnel of ITIL annually with the periodicity mutually agreed upon (in coordination with ITIL). Practical training will be imparted to ITIL personnel in the field by PIA engineers. The syllabus for training will be prepared by PIA in consultation with ITIL. ITIL will arrange the training place with all necessary resources like projector along with equipment/access to network. Training will also be imparted at Training nodes of ITIL at Delhi, Mhow, Jabalpur and Goa by suitable Engineers and Technicians quarterly for approx 10 to 14 days each.

21. **Communication**. PIA shall provide communication facilities to the maintenance teams. This shall include landline phone at office location and mobile phone to members of the maintenance teams for the purpose of contacting on an urgent need basis. The team-in-charge shall have mobile phone of mobile operator whose coverage is available in the desired section and it should be always be on.

22. **Octroi**. Any tax implications including octroi etc. during the transport within the territory shall be the responsibility of the PIA. No certificate in this regard shall be handed to PIA by ITIL. During the currency of the contract, the PIA shall be responsible for the safe custody of such materials till the final installation and will make good, any shortages/ damages which occur during transportation to the sites / storage at its cost.

23. **Service Level Agreement (SLAs) Between PIA and the OEMs**.

PIA will formulate SLA with the OEM as per the maintenance philosophy of the project contract and will submit it for approval of **ITIL** during the time of Test Bed implementation. In case of any acquisition or mergers of the OEM firm/company the legal inheritor should accept all the terms and conditions of the contract including

providing OEM Engineers and should be legally binding on the inheriting firm /company to fulfill the obligations. The clause should be built in the backend SLA of PIA and OEM. In addition efforts should be made by PIA to undertake SLA extension beyond AMC Period preferably by 02 - 03 years i.e. total SLA of 12 - 13 years.

24. **Product Support**. The PIA is bound by a condition that he is in a position to provide product support in terms of maintenance, materials and spares for a minimum period of eight years post warranty, including extended warranty, if any. Even after the said mandatory period, the PIA/OEM is bound to give at least two years notice to the Government of India prior to closing the production line so as to enable a Life Time Buy of all spares before closure of the said production line.

25. **Theft of Assets**. In case of theft/loss/damage to equipment/materials while in the custody of the PIA, BUYER shall assess and recover an amount equivalent to the loss incurred. This recovery shall be made against payments to PIA against various bills and various Bank Guarantees submitted by the PIA.

26. **Reporting of Theft and FIR**. Theft Incident Report shall be submitted by the **PIA** to concerned police station and photos taken immediately on the spot. FIR should be taken from concerned police station and submitted to the **ITIL.** If and when, the police station ask for signatures of ITIL representatives for registering the FIR, the same to be facilitated by ITIL.Optical Fiber Cable damage or theft / HDPE damage / manhole lid damage and the replacement of such Optical Fiber Cable are the responsibility of PIA.

27. **Patents and Other Industrial Rights**. The prices stated in the present contract shall be deemed to include all amounts payable for the use of patents, copyrights, registered charges, trademarks and payments for any other industrial property rights. The PIA shall indemnify the BUYER against all claims from a third party at any time on account of the infringement of any or all the rights mentioned in the previous paragraphs, whether such claims arise in respect of manufacture or use. The PIA shall be responsible for the completion of the supplies including spares & training irrespective of the fact of infringement of any or all the rights mentioned above.

28. **Penalty for Use of Undue Influence**. The PIA undertakes that he has not given, offered or promised to give, directly or indirectly any gift, consideration, reward, commission, fees brokerage or inducement to any person in service of the BUYER or otherwise in procuring the Contracts or forbearing to do or for having done or forborne to do any act in relation to the obtaining or execution of the contract or any other Contract with the Government for showing or forbearing to show favour or dis-favour to any person in relation to the contract or any other contract with the government. Any breach of the aforesaid undertaking by the PIA or any one employed by him or acting on his behalf (whether with or without the knowledge of the PIA) or the commission of any offers by the PIA or anyone employed by him or acting on his behalf, as defined in Chapter IX of the Indian Penal Code, 1860 or the Prevention of Corruption Act, 1947 or any other act enacted for the prevention of corruption shall entitle the BUYER to cancel the contract and all or any other contracts with the PIA and recover from the PIA the amount of any loss arising from such cancellation. A decision of BUYER or his nominee to the effect that a breach of the undertaking had been committed shall be final and binding on the PIA.

29. Giving or offering of any gift, bribe or inducement or any attempt at any such act on behalf of the PIA towards any officer / employee of the BUYER or to any other person in a position to influence any officer / employee of the BUYER for showing any

favour in relation to this or any other contract shall render the PIA to such liability / penalty as the BUYER may deem proper, including but not limited to termination of the contract, imposition of penal damages, forfeiture of the Bank Guarantee and refund of the amounts paid by the BUYER.

30. **Agents Agency Commission**. The PIA confirms that he has not engaged any individual or firm, whether Indian or foreign whatsoever, to intercede, facilitate or in any way to recommend to the Government of India or any of its functionaries, whether officially or unofficially, to the award of the contract to the PIA; nor has any amount been paid, promised or intended to be paid to any such individual or firm in respect of any such intercession, facilitation or recommendation. The PIA agrees that if it is established at any time to the satisfaction of the BUYER that the present declaration is in any way incorrect or if at a later stage it is discovered by the BUYER that the PIA has engaged any such individual / firm, and paid or intended to pay any amount, gift, reward, fees, commission or consideration to such person, party, firm or institution, whether before or after the signing of this contract, the PIA will be liable to refund that amount to the BUYER. The PIA will also be debarred from entering into any supply contract with the Government of India for a minimum period of five years. The BUYER will also have a right to consider cancellation of the contract either wholly or in part, without any entitlement or compensation to the PIA who shall in such event be liable to refund all payments made by the BUYER in terms of the contract along with interest at the rate of 2% per annum above PLR rate. The BUYER will also have the right to recover any such amount from any contract concluded earlier with the Government of India.

31. **Access to Book of Accounts**. In case it is found to the satisfaction of the BUYER that the PIA has engaged an Agent or paid commission or influenced any person to obtain the contract as described in clauses relating to agents / agency commission and penalty for use of undue influence, the PIA, on a specific request of the BUYER shall provide necessary information / inspection of the relevant financial documents / information

32. **Indemnification**. The **PIA** hereby releases and shall indemnify, defend and hold harmless the **BUYER** and its subsidiaries and affiliates and their officers, agents, employees, successors and assignees and authorized representatives against any and all suits, actions, legal or administrative proceedings, claims, damages, liabilities, interests, attorney's fees, costs and expenses of whatsoever kind or nature, including those arising out of damage to property (including but not limited to property of third parties, principal) and injury to or death of persons (including but not limited to the PIAs, employees and third parties) whether arising during or after completion of the work hereunder directly or indirectly caused, occasioned, or contributed to in or whole or in part, or claim to be caused, occasioned or contributed to in whole or in part, by reason of any act, omission, fault or negligence whether active or passive of the PIAs, sub-PIAs or of any one acting under its direction or control or on its behalf in connection with or incidental to this contract. The PIA shall pay and meet all expenses including legal costs incurred by BUYER in responding to and defending all such claims and the PIA shall meet and pay all damages awarded against BUYER and keep BUYER harmless and indemnify to the fullest extent. There will not be any claim insurance BUYER such amount shall be borne by the PIA himself. In the event, BUYER is required to pay any royalty, penalty or other sum by whatever name known to any of its contracting partners or agencies, either on account of time over runs or the project not being made operational in full by the PIA, or suffering any other disability, loss, damage or other inconvenience, on account of any delays or lapses in executing the

project and rendering it fully operational, for any reasons not attribute directly to BUYER, the PIA agrees and undertake to indemnify, keep indemnify and save harmless BUYER from all such costs, damages, expenses, disability.

33. **Risk Purchase**. In the event the PIA fails to execute the work as per agreed productivity/ quality norms of works as mentioned elsewhere in this contract and timelines, BUYER after giving one week notice to the PIA can get executed/ re-executed the work through any other PIA /sub PIA / agencies as BUYER deems fit and at the costs and expenses of the PIA, provided however that the estimated cost for execution of such work as certified by the BUYER representative shall be less than the proportionate contract price. The benefit, there from, shall be to BUYER account. And if the same shall be estimated more than the proportionate contract price, the excess amount incurred by BUYER in this connection shall be reimbursed by the PIA, which may be adjusted by the BUYER against any outstanding dues payable to the PIA under this contract. BUYER shall have the right to retain and hold in its custody and possession of all requisite equipment, materials, tackles, machinery etc. belonging to the PIA in connection with the work, as it deems necessary so as to put them in use in the event the PIA does not perform/ fails to fulfill his obligations as per this agreement, or his workmanship is found to be substandard or not as per specifications of BUYER, at any point of time during the tenure of this agreement. BUYER shall be at liberty to sell the materials belonging to the PIA if in the opinion of BUYER, it is necessary to avoid any loss / hardship/ damages that may be incurred by BUYER on account of the PIAS failure to execute the work to the satisfaction of BUYER.

34. **Wartime Support**. PIA shall extend its maintenance support during wartime also. However, safety of the movement of materials and personnel of both PIA shall be the responsibility of the BUYER. The movement includes the journey from station and also from zone to zone. The security and safety of the personnel shall be the responsibility of the BUYER. The BUYER shall provide adequate escort till the job is completed and the personnel are shifted to safer place after the completion of the job. Damages on account of war, civil disturbances, and other force majeure clause would be assessed by a committee consisting of reps of PIA, Directorate General (Signals)/ AWG and any other department as felt necessary by the presiding Chairman of the committee after the eventuality has come to an end or has ceased to exist. The financial charges for the wartime support shall be decided by the above referred committee on the basis of expenses incurred including the cost of equipment, if any, as it may not be possible to estimate the same during wartime situations.

35. **Cancellation of AMC**. In the event of the cancellation of the AMC at the behest of the BUYER due to non-performance or any other reason, the BUYER shall reserve the right to award the AMC to a third party. The ITIL shall make good the difference in amounts payable to the third party, the recovery of which shall be decided by the BUYER.

FIBRE REPAIR TEAM (FRT) consisting of Following:

Ser No	Description of Resource
1	Supervisor
2	Splicer
3	Driver
4	labour (02)
5	Lt Vehicle depreciated amount per year
6	Fuel Charges for 3600Kms / month @ Rs. 12.50 per kms@75 Rs per litre ,@ 06 kmpl average of vehicle
7	Maintenance Charges for FRT vehicles
8	Instruments & Tools
9	One time OFC spares
10	Specialized Engineers for OFC maintenance for every 5 FRTs

Note:-

1. The cost breakdown has been extracted from CNC and given here to bring out the various heads of Establishment cost. Discounts offered under this head have not been factored and accounted. It is only to give the analytical breakdown under this head.

2. For subsequent years the cost is escalated by a factor of 5.5 % per year.

Appendix F
PENALTIES: OFC MAINTENANCE

1. The sample calculation for penalties for OFC maintenance is given below:-

S No	Category	Description	Amount
(a)	Manpower of FRT	Number of days absent by any employee in the month (monthly cycle) = 05 daysOver quarter such absentees - 10 days	9365 x 10 = Rs 93650
(b)	Resources /equipment of FRT	02 x contractually agreed resource / equipment in one FRT is not available for 03 days in one quarter. **Note**: List of agreed resources has to be carried by per FRT is mentioned under OFC Maintenance.	9365 x 02 (Number of resources) x 03 (No of days) = Rs 56190
(c)	Vehicle	Number of days for which FRT vehicle for one FRT is not available in one quarter = 04 Number of days for which another FRT vehicle is not available in one quarter = 06	(i) 9365 x 10 (No of days vehicles not available) = Rs 93650
(d)	Response time	(i) Alarm on OFC breakage/ Informed by ITIL at 2000 Hrs. (ii) FRT reached at fault location (travel time is say 2 hours) at 2330 hrs. (iii) Total late Response = 2330hrs-2000hrs- 60 min (permitted response time) - Travel Time (02 Hours) = 1/2 hours.	9365 x 1 (Per hours late after permitted time) = Rs 9365

(e)	Not following official timing	(i) 01 person of FRT reported late at respective Node at 1030 hours. (ii) Entire FRT left the Node early at 1630 hours. (iii) Total hours of absence = (01 person x 01 hours) + 06 (members of FRT including specialist Engineer) x 01 (left Early by an hour) = 07 hours. (iv) Total hours of absent in that quarter by adding such incidents are say 07 hours only.	Total penalty = 234 x 07 = Rs 1638
(f)	Emergency situation	Incident occurred and alarm raised at say 2250 hours. FRT reported at the location at 0300 hours next day. A delay of one (01) hour from expected response time as calculated for para (d).	9365 x 01 =Rs 9365
(g)	Penalty for violation of Restoration time (MTTR)	(i) Suppose the fault is reported / alarm generated at 0600 hours for a cut at a location which is four hours from the node in plains (travelling time). The fault is restored at 1800 Hours. Total time taken is 12 hours including response time of 01 hour of FRT and travel time of 04 hours as ascertained by ITIL and localization one hour and restoration time is 05 hours. The total delay is of 02 hours then. Converted in to day (= 01 day). (ii) Suppose the delay is 98 hours then penalty would be as Upto 72 hours - 9365 Beyond 72 hours - 9365 + 936	(i) 9365 x 01 =Rs 9365 (ii) 9365 x 03 + 10301 x 2 + = Rs 48697

(h)	Permanent Restoration	Same as above except that permanent restoration time is 48/96 hours for plains/ mountains. This penalty is independent of penalty for violations of restoration time.	Calculation same as above
(j)	Splicing	(i) If the reading of losses after a joint in a fiber increases by 0.05 dB or more, then a penalty will be imposed. Regular log of losses per link will be maintained by Zonal managers and ITIL representatives. In case of discrepancy the log of ITIL will be authority. (ii) If the reading of loss after the splice is of 0.05dB.or more in three joints. Penalty will be imposed as given.	Rs 9365 x 03 (Number of joints having 0.05 dB or more loss) = 28095
(k)	Unreasonable Degradation of OFC parameters	Cumulative loss including dispersion and jointing losses should not increase beyond 1 dB over any section of OFC route. (i) If the loss increases in dB over a section between 1.01 to 2.0 dB. (ii) If the losses increases and increase of loss is between 2.01 to 3.0 dB.	(i) 2.8 lakhs (ii) 5.6 lakhs and so on
(l)	Preventive Maintenance	Say the ITIL represents informs that one incidence of preventive maintenance has not been adhered by the FRT.	Rs 18730

Appendix I to Annexure-IX

FINANCIAL BID: **ZONE-I[Consisting of Region 1 & Region 2 Spreaded over:JK,LA,HP,PB and HR]**

- ***GST shall be extra, payable at the prescribed rate against the GST invoice.***
- ***RoW Charges shall be reimbursed on actuals.***

Name of Zone Bid For: ZONE - I

(I). MAIN SUPPLY & SERVICE ITEMS:						
SN	Items	Link Name/(Via) $	Link Trench Length (KM)	Quoted Rates Per K**M (Rs)**		Itemized Bid Value (Qty x Rates)
				In Figures	in Words	
			A_n	B_n	B_n	A_n x B_n
1	Execution (Complete with supply of items and Services as per SoW & Specs)	1.1.01				
		1.1.02				
		….				
		1.2.n				
2	Maintenance of OFC during Warranty **for 2 Years** (Optional)	Complete route, executed by the PIA	4,254			
3	**TOTAL, Itemized Bid Value (X)**					

(II). Incidental Supply & Service Item (on need basis, after specific approval of the User):					
SN	Items	Qty (KM)	Quoted Rate (Rs.) per KM		Bid Value
			In Figures	In Words	
		(a)	(b)	(b)	(a)x(b)
(i)	Erection of Aerial OFC Alignment, complete with material as per Specs. (Cable supply by ITIL)	Total Estimated Route KMs **45 KMs**			
(ii)	Total Assessed Quote **(Y)**				

OVERALL WEIGHTED BID PRICE FOR the "ZONE-I": X+Y

Note : Link Details provided are for estimation purposes. Exact locations, distances (RKM) and other parameters/attributes needs to be ascertained by the bidder after reconciling with the list, receivable under NDA.

$ The Detailed, Price Bid with Link List is available in separate Excel Sheets.

(IMPORTANT: The Quantities and Weights applied to quoted bid prices are only indicative and assumptive to assess the comparative ranking. Actual quantities may vary as per actual site and work conditions).

Appendix II to Annexure-IX

FINANCIAL BID: ZONE-II[Consisting of Region 3 & Region 4, spreaded over RJ and GJ]

- ***GST shall be extra, payable at the prescribed rate against the GST invoice.***
- ***RoW Charges shall be reimbursed on actuals.***

Name of Zone Bid For: ZONE - II

(I). MAIN SUPPLY & SERVICE ITEMS:						
SN	Item	Link Name/(Via) $	Link Trench Length (KM)	Quoted Rates Per K**M (Rs)**		Itemized Bid Value (Qty x Rates)
				In Figures	in Words	
			A_n	B_n	B_n	A_n
1	Execution (Complete with supply of items and Services as per SoW & Specs)	2.3.01				
		2.3.02				
		….				
		2.4.n				
2	Maintenance of OFC during Warranty **for 2 Years** (Optional)	Complete route Executed by the PIA	4,451			
3	**TOTAL, Itemized Bid Value (X)**					

(II). Incidental Supply & Service Item (on need basis, after specific approval of the User):					
SN	Items	Qty (KM)	Quoted Rate (Rs.) per KM		Bid Value
			In Figures	In Words	
		(a)	(b)	(b)	(a)x(b)
(i)	Erection of Aerial OFC Alignment, complete with material as per Specs. (Cable supply by ITIL)	Total Estimated Route KMs **45 KMs**			
(ii)	Total Assessed Quote **(Y)**				

OVERALL WEIGHTED BID PRICE FOR the "ZONE-II": X+Y

Note : Link Details provided are for estimation purposes. Exact locations, distances (RKM) and other parameters/attributes needs to be ascertained by the bidder after reconciling with the list, receivable under NDA.

$ The Detailed, Price Bid with Link List is available in separate Excel Sheets.

(IMPORTANT: The Quantities and Weights applied to quoted bid prices are only indicative and assumptive to assess the comparative ranking. Actual quantities may vary as per actual site and work conditions).

Appendix III to Annexure-IX

FINANCIAL BID : ZONE-III[Consisting of Region 5 & Region 6, spreaded over: UK,UP,WB,AS,SK and AR etc.]

- ***GST shall be extra, payable at the prescribed rate against the GST invoice.***
- ***RoW Charges shall be reimbursed on actuals.***

Name of Zone Bid For: ZONE - III

(I). MAIN SUPPLY & SERVICE ITEMS:						
SN	Item	Link Name/(Via) $	Link Trench Length (KM)	Quoted Rates Per K**M (Rs)**		Itemized Bid Value (Qty x Rates)
				In Figures	in Words	
			A_n	B_n	B_n	A_n
1	Execution (Complete with supply of items and Services as per SoW & Specs)	3.5.01				
		3.5.02				
		….				
		3.6.n				
2	Maintenance of OFC during Warranty **for 2 Years** (Optional)	Complete route Executed by the PIA	2,536			
3	**TOTAL, Itemized Bid Value (X)**					

(II). Incidental Supply & Service Item (on need basis, after specific approval of the User):					
SN	Items	Qty (KM)	Quoted Rate (Rs.) per KM		Bid Value
			In Figures	In Words	
		(a)	(b)	(b)	(a)x(b)
(i)	Erection of Aerial OFC Alignment, complete with material as per Specs. (Cable supply by ITIL)	Total Estimated Route KMs **65 KMs**			
(ii)	Total Assessed Quote **(Y)**				

OVERALL WEIGHTED BID PRICE FOR the "ZONE-III": X+Y

Note : Link Details provided are for estimation purposes. Exact locations, distances (RKM) and other parameters/attributes needs to be ascertained by the bidder after reconciling with the list, receivable under NDA.

(IMPORTANT: The Quantities and Weights applied to quoted bid prices are only indicative and assumptive to assess the comparative ranking. Actual quantities may vary as per actual site and work conditions).

$: Actual Link details (with Link IDs) to be handed over physically, to intended bidders under NDA. Price bid format on-line, shall be available only with Link IDs. Bidders need to co-relate.

.

{The EXCEL Sheets for Financial Bidding Attached Separately}

ANNEXURE - X

Appendix I to Annexure-IX
FINANCIAL BID: **ZONE-I**

- ***GST shall be extra, payable at the prescribed rate against the GST invoice.***
- ***RoW Charges shall be reimbursed on actuals.***

Name of Zone Bid For: ZONE - I [Consisting of Region 1 & Region 2 Spreaded over:JK,LA,HP,PB and HR]

Bidder's Name

(I). MAIN SUPPLY & SERVICE ITEMS:

Sl. No.	ITEM	Link Details		Quoted Rates Per KM (Rs)		Itemised Bid Value
		Link Number	Link Trench Length (KM)	In Figures	In Words	
			A	B	B	A*B
1	Execution (Complete with supply of items and Services as per SoW & Specs)	1.1.1	**210**			
		1.1.2	**150**			
		1.1.3	**75**			
		1.1.4	**15**			
		1.1.5	**8**			
		1.1.6	**40**			
		1.1.7	**75**			
		1.1.8	**235**			
		1.1.9	**18**			
		1.1.10	**155**			
		1.1.11	**65**			
		1.1.12	**120**			
		1.1.13	**140**			
		1.1.14	**80**			
		1.1.15	**70**			
		1.1.16	**180**			
		1.1.17	**45**			

		1.1.18	**90**		
		1.1.19	**85**		
		1.1.20	**75**		
		1.1.21	**40**		
		1.1.22	**165**		
		1.1.23	**160**		
		1.1.24	**15**		
		1.1.25	**35**		
		1.1.26	**45**		
		1.1.27	**25**		
		1.1.28	**15**		
		1.1.29	**20**		
		1.1.30	**30**		
		1.1.31	**35**		
		1.1.32	**140**		
		1.1.33	**60**		
		1.2.01	**8**		
		1.2.02	**30**		
		1.2.03	**1**		
		1.2.04	**8**		
		1.2.05	**30**		
		1.2.06	**8**		
		1.2.07	**38**		
		1.2.08	**5**		
		1.2.09	**140**		
		1.2.10	**35**		
		1.2.11	**18**		
		1.2.12	**57**		
		1.2.13	**9**		
		1.2.14	**120**		
		1.2.15	**28**		
		1.2.16	**22**		
		1.2.17	**13**		
		1.2.18	**25**		
		1.2.19	**60**		
		1.2.20	**80**		
		1.2.21	**25**		
		1.2.22	**23**		
		1.2.23	**25**		
		1.2.24	**8**		
		1.2.25	**24**		

		1.2.26	**15**			
		1.2.27	**8**			
		1.2.28	**50**			
		1.2.29	**26**			
		1.2.30	**30**			
		1.2.31	**28**			
		1.2.32	**55**			
		1.2.33	**50**			
		1.2.34	**39**			
		1.2.35	**15**			
		1.2.36	**25**			
		1.2.37	**18**			
		1.2.38	**40**			
		1.2.39	**28**			
		1.2.40	**60**			
		1.2.41	**68**			
		1.2.42	**110**			
		1.2.43	**33**			
			4254			
2	Maintenance of OFC during Warranty for 2 Years (Optional)	Complete route, executed by the PIA				
3	**Total Itemized Bid Value (X)**					

II. INCIDENTAL SUPPLY & SERVICE ITEM(on need basis, after specific approval of the User):

4	Erection of Aerial OFC Alignment, complete with material as per Specs. (Cable supply by ITIL)	Total Estimated Route KMs **45 KMs**			

5	**Total Accessed Quote (Y)**	

6	**OVERALL WEIGHTED BID PRICE FOR the ZONE-I: X+Y**

Note : Link Details provided are for estimation purposes. Exact locations, distances (RKM) and other parameters/attributes needs to be ascertained by the bidder after reconciling with the list, receivable under NDA.

Appendix II to Annexure-IX
FINANCIAL BID: **ZONE-II**

- ***GST shall be extra, payable at the prescribed rate against the GST invoice.***
- ***RoW Charges shall be reimbursed on actuals.***

Name of Zone Bid For: ZONE - II [Consisting of Region 3 & Region 4, spreaded over RJ and GJ]

Bidder,s Name

(I). MAIN SUPPLY & SERVICE ITEMS:

Sl. No.	ITEM	Link Details		Quoted Rates Per KM (Rs)		Itemised Bid Value
		Link Number	Link Length (KM)	In Figures	In Words	
			A	B	B	A*B
1	Execution (Complete with supply of items and Services as per SoW & Specs)	2.3.1	157			
		2.3.2	100			
		2.3.3	30			
		2.3.4	80			
		2.3.5	58			
		2.3.6	306			
		2.3.7	54			
		2.3.8	100			
		2.3.9	50			
		2.3.10	60			
		2.3.11	50			
		2.3.12	50			

		2.3.13	**74**			
		2.3.14	**20**			
		2.3.15	**70**			
		2.3.16	**32**			
		2.3.17	**39**			
		2.3.18	**45**			
		2.3.19	**85**			
		2.3.20	**15**			
		2.3.21	**245**			
		2.3.22	**20**			
		2.3.23	**25**			
		2.3.24	**75**			
		2.3.25	**27**			
		2.3.26	**177**			
		2.3.27	**40**			
		2.3.28	**115**			
		2.3.29	**320**			
		2.3.30	**228**			
		2.3.31	**38**			
		2.4.01	**130**			
		2.4.02	**90**			
		2.4.03	**100**			
		2.4.04	**60**			
		2.4.05	**126**			
		2.4.06	**15**			
		2.4.07	**22**			
		2.4.08	**80**			
		2.4.09	**80**			
		2.4.10	**45**			
		2.4.11	**50**			
		2.4.12	**222**			
		2.4.13	**25**			
		2.4.14	**25**			
		2.4.15	**35**			
		2.4.16	**175**			
		2.4.17	**181**			
		2.4.18	**125**			
		2.4.19	**80**			
			4451			

2	Maintenance of OFC during Warranty for 2 Years (Optional)	Complete route, executed by the PIA			
3	**Total Itemized Bid Value (X)**				
II. INCIDENTAL SUPPLY & SERVICE ITEM(on need basis, after specific approval of the User):					
4	Erection of Aerial OFC Alignment, complete with material as per Specs. (Cable supply by ITIL)	Total Estimated Route KMs =45 KMs			
5	**Total Accessed Quote (Y)**				

6	**OVERALL WEIGHTED BID PRICE FOR the ZONE-II: X+Y**	
Note : Link Details provided are for estimation purposes. Exact locations, distances (RKM) and other parameters/attributes needs to be ascertained by the bidder after reconciling with the list, receivable under NDA.		

Appendix III to Annexure-IX
FINANCIAL BID: **ZONE-III**

- ***GST shall be extra, payable at the prescribed rate against the GST invoice.***

- ***RoW Charges shall be reimbursed on actuals.***

Name of Zone Bid For: ZONE - III [Consisting of Region 5 & Region 6, spreaded over: UK,UP,WB,AS,SK and AR etc.]

Bidder's Name

(I). MAIN SUPPLY & SERVICE ITEMS:

Sl. No.	ITEM	Link Details		Quoted Rates Per KM (Rs)		Itemised Bid Value
		Link Number	Link Length (KM)	In Figures	In Words	
			A	B	B	A*B
1	Execution (Complete with supply of items and Services as per SoW & Specs)	3.5.1	**205**			
		3.5.2	**270**			
		3.5.3	**43**			
		3.5.4	**65**			
		3.5.5	**75**			
		3.5.6	**65**			
		3.5.7	**37**			
		3.5.8	**41**			
		3.5.9	**95**			
		3.5.10	**305**			
		3.5.11	**33**			
		3.5.12	**34**			
		3.5.13	**35**			
		3.6.01	**16**			
		3.6.02	**37**			

		3.6.03	**16**			
		3.6.04	**49**			
		3.6.05	**57**			
		3.6.06	**27**			
		3.6.07	**55**			
		3.6.08	**101**			
		3.6.09	**8**			
		3.6.10	**40**			
		3.6.11	**24**			
		3.6.12	**45**			
		3.6.13	**45**			
		3.6.14	**20**			
		3.6.15	**320**			
		3.6.16	**147**			
		3.6.17	**12**			
		3.6.18	**11**			
		3.6.19	**35**			
		3.6.20	**20**			
		3.6.21	**36**			
		3.6.22	**28**			
		3.6.23	**43**			
		3.6.24	**30**			
		3.6.25	**11**			
			2536			
2	Maintenance of OFC during Warranty for 2 Years (Optional)	Complete route, executed by the PIA				
3	**Total Itemized Bid Value (X)**					

II. INCIDENTAL SUPPLY & SERVICE ITEM(on need basis, after specific approval of the User):

4	Erection of Aerial OFC Alignment, complete with material as per Specs. (Cable supply by ITIL)	Total Estimated Route KMs =**65 KMs**			
5	**Total Accessed Quote (Y)**				

6	**OVERALL WEIGHTED BID PRICE FOR the ZONE-III: X+Y**	

Note : Link Details provided are for estimation purposes. Exact locations, distances (RKM) and other parameters/attributes needs to be ascertained by the bidder after reconciling with the list, receivable under NDA.