

Section - 7

General Specifications

Section 7.General Specifications

Outside Plant (OSP) works

7.1. SCOPE OF WORKS

Bangladesh Telecommunications Company Limited (BTCL) is going to provide optical fiber connectivity to new sites. The scope of works under this tender is construction of Outside Plant (OSP) by laying OFC in selected locations to build up OFC connectivity between different sites through BTC's existing optical fiber as shown in Annex-1.

7.1.1 Works to be done:

This Tender intends to procure the following works, major goods and related services:-

Description	Scope
Laying of underground OFC.	As per BoQ (Section-6) and Drawing (Section-9)
Supply of GI Pipes, MS pipe DWC Pipes, PVC pipes, Pig- tails etc	As mentioned in the BoQ (Section-6)
Use of OFC and HDPE pipe for the network.	OFC and HDPE pipe will be supplied by BTCL through Bangladesh Cable Shilpa Sangstha (BCS) Ltd., Shiromoni, Khulna. The Contractor shall receive OFC& HDPE pipe from BCS and shall carry the OFC& HDPE from BCS store up to the particular sites at their own cost and risk.
Use of Joint Closure & ODF for the networks (for jointing/splicing, termination).	Bidder has to supply and install and to perform all jointing/splicing as mentioned in the BoQ (Section-6)
Construction of Man-Hole/ Hand-Hole	As mentioned in the BoQ (Section-6)
Transportation	All related goods to be used in the works shall be transported to the sites by the Contractor at his own cost and risk including loading & unloading .
Testing (PAT, FAT etc.)	These tests shall be performed as per Section-8: Particular Specifications. Testing of cable and HDPE pipes has to be done before take over from BCS/BTCL to ascertain the workability.
Handover	After successful completion of PAT, the works will be handed over to BTCL

7.1.2 The Contractor shall not execute any work or use any of the facilities of the establishment beyond the scope of the Contract Agreement. **The Contractor shall not install any duct or cable in the BTCL trench for any other agency/company/service provider.**

7.1.3 Route Survey Report and Network Diagram

A list of the link and selected sites to be connected through BTCL OFC under this tender is given in Annex-1. The successful bidder(s) has to perform Route Survey of the sites and has to prepare a Network Diagram/ Design and the BoQ (Section-6) may be modified accordingly without major variation. These Route Survey Reports/ Network Diagrams have to be done by successful Bidder after signing the Contract Agreement.

7.1.4 As-Built Drawings

During execution of the works if any change is required in the design, it may be done with the written approval of the Project Director. Based on the actual works done, the Contractor shall prepare the “As-Built” drawing (link wise) after completion of the works (but 7 days before starting of PAT).

The length of OFC actually laid, quantities of the materials used and all other works done will be measured during PAT and shall be included in this documentation which will have to be handed over to BTCL during PAT.

7.1.5 Maintenance Support

7.1.5.1 Maintenance Support up to the end of the Guarantee Period

The Contractor at his own cost shall keep sufficient number of technical personnel to provide full maintenance support for OSP works at all sites under this purchase and provide all necessary maintenance support during the Guarantee Period, also termed as the Defect Liability Period. The Defect Liability Period shall commence from the date of successful completion of PAT and issuance of PAC of any Section and last for further 01 (one) year for that Section. For maintenance purpose during the Guarantee Period, the Contractor will do all the rectification works at his own cost. But if any fault occurs due to natural calamity, theft of OFC etc which are beyond the control of the Contractor, then BTCL will supply the OFC and related accessories and the Contractor will do the physical rectification works.

7.1.5.2 On Demand Maintenance Assistance (Optional Item)

The Contractor shall provide on Demand Maintenance Assistance services after the Guarantee Period and up to the life time of the system under the terms and conditions as per Form D. Any bidder fails to quote optional item will be declared **Non – Responsive.**

7.1.6 Project Management

The Bidder shall furnish in the Technical Documents which consists a complete description of its **intended method** for Project Management including the proposed Management Organization, Work Organization and proposed Communication Organization between the Bidder and BTCL. The Bidder shall also provide a **detail Work Plan** with his bid.

The Project Management Personnel must have adequate knowledge for technical discussion in Bangla as well as English.

7.2 TECHNICAL SPECIFICATIONS OF OUTSIDE PLANT (OSP) MATERIALS

7.2.1 DWC Pipe specifications:

Double Walled Corrugated (DWC) HDPE Telecom ducts will be used for Bridge/Culvert crossing. The specifications of the DWC as follows:-

No	Parameter	Specification
1	Construction	There shall be no sharp edges, burs or surface projections
2	Outside Diameter	90± 1.7mm
	Inside Diameter	76 ± 0.9mm
3	Wall thickness	Outer layer: 0.7 ± 0.1mm, Inner layer: 0.9 ± 0.1mm
4	Compression Test	>450N @ 5% defln. After the test, there shall be no crack allowing the ingress of light or water between the inside & the outside.
5	Impact Test	There shall be no crack allowing the ingress of light or water between the inside & the outside
6	Bending Test	Samples bend to 90 degree to a radius of 02(two) meters. A ball of dia 95% of ID will pass freely.
7	Length	Minimum 6 meter
8	Color	Any (Gray preferred).

7.2.2 HDPE Duct :

All HDPE Duct to be used in this project will be supplied by BTCL from Bangladesh Cable Shilpa (BCS) Ltd, Khulna

7.2.3 Pre-Tests:

HDPE duct will be supplied by BTCL. Prior to use these items, all the **HDPE ducts/ DWC ducts** shall be pre-tested. This will be ensured in two phases- Factory Tests and Performance Tests.

7.2.3.1 Factory Test Certificate:

The Bidder shall submit a copy of the Factory Test Certificate(s) of the goods to the Project Office. If the Factory Test Certificate conforms to the Technical Specifications of above Clause, the Project Director will allow the Contractor to proceed for Performance Tests.

7.2.3.2 Performance Tests:

For foreign goods/materials, the Bidder shall perform the tests from BUET through the Project Office and such performance test certificate(s) of the goods will be issued by BUET stating that the goods meet the specifications of Clauses 7.2.1 & 7.2.2. In case of locally manufactured goods, the Bidder shall arrange factory test(s) of those goods/materials in the manufacturing premises in presence of BTCL Engineers not exceeding 03 (three) in numbers, and the BTCL Engineer(s) will issue Performance Test Certificate(s) of them. The Contractor shall arrange travelling of the BTCL Engineers during the office hours to the factory premises, free accommodation & fooding and shall pay per-diem charges @ Tk 1000 per day per person.

7.2.4 Technical specification of G.I pipe

1. The GI Pipes shall be welded or seamless, free from dents and internal roughness.
2. The ends of the Pipes shall be reamed to prevent abrasion against cable
3. The outside of the Pipe ends shall be threaded with a Pipe Thread.
4. The Pipes shall be jointed together by means of a Coupler of the same material as the Pipes
5. After the forming operations, the Pipes and Couplers shall be hot-dip-galvanized to meet the requirements.
6. The detailed dimensions of 75 mm GI Pipes are as shown in the following table:

Item	Specific value
Outside diameter	75 ± 1mm
Wall thickness	2.5 ± 0.2 mm
Length (excluding coupler)	6.0 ± 0.1 m

7.2.5 Technical specification of 75mm and 110mm PVC pipe

7.2.5.1 Material

- (1) The pipe and coupler shall be manufactured by an extrusion process from material composed of polyvinyl chloride polymer to which suitable additives are added.
- (2) No constituent material which will adversely affect long term mechanical strength, creep, fabrication, solvent-welding and weathering properties of the PVC, shall be used.
- (3) PVC raw material must include 92%-95% of pure resin. The tolerated adjuncts (in the limits of 5%-8%) as stabilizers, filler, colorings, anti-oxidizers, etc, must be free from any plasticizer or volatile components.

- (4) All constituents shall be uniformly and fully dispersed.
- (5) The color of pipes shall be any color.
- (6) PVC compound shall contain stabilizer, lubricant, filler and pigment consisting of standard polymers.
- (7) The pipes and couplers must have resistance to acid, alkalis, oxidizing and reducing agent, weather and rust.
- (8) The pipes and couplers must remain unaffected by fungus, bacteria and termites.

7.2.5.2 Requirement

- 1) The pipe and couplers shall have smooth outside and inside surface and also smooth at the edges and shall be free from injurious flaws streaks, cracks, twists and other defects.
- 2) The pipe shall be practically straight in form.
- 3) Both end of the pipe shall be cut exactly perpendicular to the pipe axis and shall be free from chips and edges.

7.2.5.3 Dimensions

The detailed dimensions of 75mm and 110mm PVC pipe are as shown in the following table;

SL No	Item	Specific value
1.	Outside diameter	75mm& 110mm
2.	Tolerance for mean outside diameter	±0.6mm
3.	Length (including socket)	6 meter
4.	Tolerance for length	± 10mm
5.	Wall thickness	3.0mm
6.	Tolerance for wall thickness	± 0.25mm

7.3 REQUIREMENTS FOR CIVIL WORKS

7.3.1 Common criteria

- a) Generally 1 x 40mm or 2x40mm HDPE duct shall be laid on a 10-cm thick bed of sand in a 1.2 m ± 0.1 m deep trench. For the sand back filling and brick protection, the Bidder shall refer to the detailed drawings of Standard Trench Section Diagrams in Section-9.0. The First class bricks will be laid lengthwise along the route.
- b) Generally 1 x 110mm or 2 x 110mm PVC duct shall be laid on a 10-cm thick bed of sand in a 1.2 m ± 0.1 m deep trench. For the sand back filling and cc slab protection,

the Bidder shall refer to the detailed drawings of Standard Trench Section Diagrams in Section-9.0. The CC slab will be 50x30x5cm size and will be laid longitudinally.

- c) HDD will be done only market place road/river crossing bus stand petrol pump where there is no space for open cut. No HDD work will be allowed where open cut is possible without the permission of BTCL. Generally 40 mm HDPE 1-way Horizontal Directional Drilling (HDD) for crossing road /Rail way (UC-CB-1) or along the road at the depth of 1.85 meter with operational pit at the same depth.
- d) In exceptional circumstances (rocky areas, due to other utility services etc) where digging up to the required depth is not possible, the duct may be laid with appropriate protection at a lesser depth with the prior permission of the Project Director.

7.3.2 Man-Hole and Hand-Hole

a. Man-Hole

- (1) In many areas where new duct roads are to be laid. Manholes instead of Hand holes are to be constructed.
- (2) The location of manholes is to be approved by BTCL.
- (3) Cable /PVC/ HDPE Sub-duct entry to the Manhole should be done using Bell mouth with Rubber End Cap with appropriate holes for PVC/HDPE ducts. All Unused duct entry through Bell mouth must be sealed by Rubber End Cap
- (4) The manhole shall be equipped at the time of construction with frame and covers, ladders, pulling-in irons, steps, cable racks and name plates.
- (5) The standard and special type of manholes shall be design by Bidder complying with the following requirements. The design, drawing and calculation data shall be submitted to BTCL for approval.
- (6) All manholes shall be constructed of reinforced concrete and shall be made waterproof. Bidder is responsible for making water proofing in construction works. The detailed drawing/ or the method of water proofing shall be submitted to BTCL for approval.
- (7) All manholes shall withstand a live load of 20 ton vehicle plus thirty (30) percent for impact from moving vehicles.
- (8) All manholes shall make the cable installation possible in bending radius of not smaller than eight (8) times of the outer diameter of the largest local cable.
- (9) All manholes shall be so design as to have sufficient racking space for the required number of cables and splice closures to meet the number of conduits entering from exchange side to the Manhole.
- (10) During PAT, if more racks are required to support cables inside manholes, Bidder shall provide without extra cost to BTCL.

- (11) All manholes shall be so design that the cable placed does not restrict the future utilization of the manhole and conduit.
- (12) All manholes shall have sufficient width to provide working clearness of 70 cm.
- (13) Bidder shall follow the sequence in construction of manholes:-
- a) Basement
 - b) all and top slab
 - c) Type of neck length
 - Type – 1: 50cm –80 cm (minl.50cm)
 - Type – 2: 81cm –150 cm
 - Type – 3: more than 151cm.
- (14) Bidder shall comply with the following specifications for mixing and placing of concrete :
- 1) All manholes, cable trenches and foundation shall be constructed of ready – mixed or site –mixed concrete and to be poured at a time in so far as possible.
 - 2) The concrete, when made with ordinary Portland cement, shall attain a minimum compressive strength on 28- days of 1800 N/cm^2 (180 kg/ cm^2), or,
 - 3) When made with high early strength Portland cement, it shall acquire the same strength in seven (7) days.
- (Test to be per formed on cylindrical type concrete specimen of size 150 mm x 300mm)
- 4) The slump range for the concrete used in manholes, cable trench, and foundation construction shall be between 4 and 15cm, when using vibrator, BTCL may require this test for every batch of the concrete.
 - 5) BTCL may order three (3) test specimens (Cylindrical type) from each one of the structures
- The test specimen shall be properly marked with paint showing the date of making, proportion of mix and the name of the structure for which the specimen will be taken for Inspection/Test, as required.
- 6) Concrete cylinders retained by Bidder shall be tested from Bangladesh University of Engineering and Technology or Bangladesh Standard Testing Institution.
 - i. The concrete shall be deposited, not thrown, in its intended position as quickly as possible just after being mixed sufficiently,

- ii. Regarding construction of manholes, cable trenches and foundation, the concrete shall be thoroughly poured and tamped in to all parts of the molds of forms and around the reinforcement.

All concrete shall be compacted by using vibrator until a densely solid mass without cavities is obtained.

- iii. The concrete, once mixed, shall be used within 60 minutes (1 hour). After one hour, any remaining concrete shall be condemned and shall not be used.
- (15) The bottom pit shall be tempted and carefully leveled and shall covered with approximately 50mm of lean and concrete approximately 100mm of Gravel.
 - (16) Cement mortar shall consist of 1 (one) measure of Portland cement and 2 (two) measures of sand. While the composition of concrete mixing material ration will be as follows:
 - (17) Stone chips (20 mm downgraded): sand (Sylhet): Portland Cement = 3:1.5: 1.
 - (18) After the concrete has been placed, for the purpose of curing the concrete slab shall be protected so as to limit the loss of moisture from the surface.
 - (19) The concrete shall cover with saturated sackcloth or similar material and kept moist for a period of 7 (seven) days.
 - (20) Removal of forms shall not be permitted earlier than five (5) days after concrete pouring, Upon removal of forms surrounding area of the manholes shall be immediately backfield.
 - (21) Interim restoration and backfilling shall not commence until the work to be carried out has been approved by BTCL.
 - (22) No traffic shall be permitted over manholes earlier than seven (7) days after concrete pouring.
 - (23) Each Manhole will equipped with 1 Manhole cover, 1 Manhole Ladder, 1 Sump pit cover, 4 Pulling in iron, 2 Sets of Cable Rack (Each set contains 3 Vertical and 3 Horizontal racks/brackets), and required hook, nut and bolt to fix these cable racks and brackets.

(i) **M/H cover and frame**

The detail specification of M/H cover and frame should be as follows:

- The M/H cover and frame must withstand load of 400kN.
- The M/H cover overall diameter must be ≥ 700 mm.
- The M/H cover shall be made by cast iron.
- The M/H cover and frame shall be designed to fit together in such a way that there is no risk of rocking.

- The top surface of M/H cover shall have the “BTCL” mark on the cover center and anti-skid profile shall be made.

- The M/H cover must be properly connected to the frame with suitable arrangement to avoid theft.

- State the details of M/H cover and frame (dimension, weight etc.) and submit drawings with load test results and standard method for load test in order to demonstrate the proof of load withstanding capacity of 400kN.

(24) Standard type of Manhole

a) The inner size of the standard type of manholes is tabulated below:

Type	Length (cm)	width (cm)	Height (cm)	Wall and Floor thickness (cm)	No. of conduits to be accommodated for Termination	No. of conduits to be accommodated for along the path
S-1	220	130	180	20	4	4

b) The inner size of the standard type of manholes is tabulated below:

Type	Length (cm)	Width (cm)	Height (cm)	Wall and Floor thickness (cm)	No. of conduits to be accommodated for Termination	No. of conduits to be accommodated for along the path
S-2	320	130	200	20	4	8

The dimensions shall have the following tolerances.

Inside Dimensions

(i) Length: $\pm 25\text{mm}$

(ii) Width: $\pm 15\text{mm}$

(iii) Height: $\pm 15\text{mm}$

The structure of manhole is shown in Annex 1.

(25) Tentative numbers of Man-Hole are given in the respective BoQ forms.

b. Hand Holes

i) Hand Holes to secure splice closures and excess cable length as well as for the ease of drawing of the OFC. All Cable splicing and branching should be invariably done in Hand Holes.

ii) Hand Holes shall be constructed as per Drawing 9.1.2 of Section-9, and in the following

way:-

Reinforced concrete Hand Holes placed on a concrete or gravel foundation are to be used to prevent their sinking in the soil.

The nominal dimensions of the Hand Hole shall be as follows:

Length (inside)	-	1.20 meter
Width (inside)	-	1.00 meter
Depth (inside)	-	1.00 meter
Wall & floor thickness	-	12.0 cm
Cover slab thickness	-	16.0 cm

The dimensions shall have the following tolerances:

a) Inside Dimensions

Length	:	± 2.5 cm
Width	:	± 1.5 cm
Height	:	± 1.5 cm

b) Composition of concrete:

Stone chips (20 mm downgraded): sand (Sylhet): Portland cement = 3:1.5:1

iii) All unused duct must be sealed by end cap and live duct having cable may be sealed by simple plug.

iv) Outside city/town areas, the Hand Holes will be at 1km interval for straight road section and at the points of splicing, while on the zigzag road section, the Hand Hole span may be shorter considering OFC pulling tension of 2000 Newton. Also in case of long bridges (30 m or more) there will be two Hand Holes at the two ends of the bridge. All these Hand Holes shall be covered with easily removable reinforced concrete Hand Hole cover. Hand- Hole cover will be made of 3 part reinforced concrete pieces for easy opening. The top surface of Hand-Hole cover shall have "BTCL" mark on the cover Centre. Galvanized rack structures (2 nos. of I shape rack) of proper size have to be provided for each Hand Hole.

v) Tentative numbers of Hand Hole are given in the respective BoQ forms.

7.3.3 Excavation for Man-Hole, Hand-Hole and / or conduit.

- 1) All excavation works shall be done in a thorough and workmanlike manner in accordance with the detailed drawings and the specifications under the directions of BTCL and subject to the approval and acceptance by BTCL.
- 2) The Contractor will assist BTCL for obtaining road-cutting permissions from relevant authorities. The relevant authorities may include Municipal Authorities, R&H Dept., LGED, Union Parishad, Rail way Dept., Electricity, Water, Sewerage, Gas, etc. Necessary correspondences to the respective authorities will be made by BTCL.
- 3) The Contractor has to refill the trench with sufficient sand and excavated soil, and a

good compaction has to be done for good repairing of the road without any additional cost to BTCL. **The contractor has to repair the road and bring it to the original shape and it is to be confirmed by the owner of the road, project personnel and contractor jointly.**

- 4) The Contractor shall obtain all pertinent records from the electric company, water supply, gas Supply Company and sewerage authority and other underground utilities organization in order to conduct his work and safe-guard of other utilities.
- 5) The Contractor shall take all precautions necessary for safety of general public and for protective and preserving all temporary or permanents utilities.
- 6) If during the execution of the construction and installation, existing underground facilities are inevitably interrupted, or any part thereof is disturbed, the Contractor shall immediately notify the facts to BTCL and owner of the utility.
- 7) The Contractor will be directly responsible for all damages to existing utilities including telecommunication facilities and shall restore these damages immediately at his own expense.
- 8) If the presence of underground facility is apprehended or when required by BTCL, the Contractor shall excavate test pits at his own expense at the location of question.
- 9) If any obstructions which interfere with excavation of Man-Hole and Hand-Hole site or conduit trench are encountered, the Contractor shall consult with the Project Director about necessary modifications of the drawing.
- 10) The Contractor shall dispose off all excavated materials except what to be used for backfilling.
- 11) The Contractor shall at all times adequately protect the sides of the excavation against cave-in. Sheeting and shoring/ supporting works shall be applied wherever required by BTCL, and/ or considered to be necessary at the Contractor's own cost.
- 12) The Contractor shall confer with the proper road administrative authority and ensure that the proposed depth of Man- Hole and Hand-Holes, conduits conform to the final grades of carriageways and footways.
- 13) The Contractor shall excavate insofar as possible complying with the trench width requirements as detailed in the drawings given in Section 9. Any excess in this width, unless specifically authorized by BTCL, shall be at his own expense. This includes extra restoration expenses of pavements, macadam and /or tiles.
- 14) Upon completion of trenching and Hand-Hole which will contain metallic sheath cable, it shall be earthed as illustrated in the drawings given in Section 9. The trench shall be so arranged as to avoid any dip profile of conduit and be arranged with smoothly and gradually descending grade so as to terminate conduits at the specified location of the Hand Hole as shown in "outside plant construction drawings" which will be provided by Contractor and approved by BTCL.

- 15) The Contractor shall at his own expense protect and support any type of utility services like pipe, conduit, cable, wire or any other item of telephone and other services that are visibly exposed or encountered during excavation. The Contractor is obligated to restore these services to their original conditions and to the satisfaction of BTCL and the owners of such plants.

7.3.4 Installation procedures for underground conduits

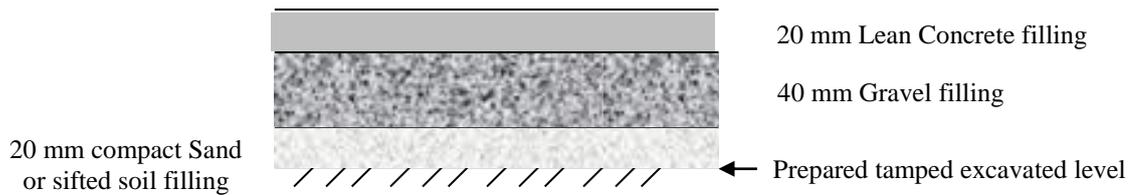
In addition to the general procedural requirements stated above, the Contractor shall have to conduct all installation works related to underground conduits abiding by the following specific procedures. Any deviation from these procedures shall have to be pre-approved by the Project Director.

- 1) Trench walls shall be vertical. Width of the trenches for HDPE duct shall be the minimum required to install HDPE ducts and protective bricks. In case of underground HDPE duct, the width of the trenches is max 30 cm for both bottom and top for 1-way duct. Unnecessary disturbance of the surrounding earth shall be avoided wherever possible.
- 2) The excavated trench shall be straight horizontally at its height level. Zigzag trench will not be allowed.
- 3) After proper excavation, the bottom of the trench bed shall be properly tamped down, carefully leveled, compacted and dried.
- 4) The Contractor shall ensure that there are no sharp materials or leftover garbage inside the trench.
- 5) For all major roads, railway and waterway crossings, Hand Holes shall be constructed at either side of such crossings as per instruction of BTCL.
- 6) Duct Integrity Test shall be performed with 10 Bar air pressure for 100% of the 1-way HDPE duct route before laying of OFC through the duct. There shall not be any drop of Air pressure within a pressurization duration of 5 (five) minutes during the test.
- 7) 40 mm HDPE 1-way/2-way and 110mm PVC 1-way/2-way Horizontal Directional Drilling (HDD) will have to be done for crossing road /Rail way or along the road at the depth of minimum 1.85 meter. The operational pit should have the same depth.

7.3.5 Installation procedures for Man-Hole and Hand-Holes

Contractor shall have to conduct all installation works related to hand Holes abiding by the following specific procedures. Any deviation from these procedures shall have to be pre-approved by the Project Director.

- 1) After proper excavation, the bottom of the structure shall be properly tamped down, carefully leveled, compacted and dried.
- 2) The foundation for Man-Hole and Hand-Holes shall be prepared as follows:



- 3) Metal forms, with error free surfaces and proper attachments shall be used for all structures.
- 4) All RCC & CC works shall be constructed by ready mixed or site-mixed concrete.
- 5) The Contractor shall confirm that before start of the concrete deposition the bed of the structure is completely dry.
- 6) For other working procedures of concrete work such as concrete mixing, placing, curing, form removing and protections, the Contractor shall refer to 7.4.1 “Common Criteria”
- 7) BTCL may order three (3) test specimens (cylindrical type) from each of the structures. Whenever such test specimens are ordered, they shall be properly marked with paint showing the date of making, proportion of mix and the name of the structure for which the specimen will be taken for inspections tests as required. The Contractor, at its own cost, shall arrange for testing of those specimens either from Bangladesh University of Engineering and technology or Bangladesh standard testing institution. (as per decision given by BTCL at the relevant time).

7.3.6 Concrete Marker Post installation

Concrete Marker Posts shall be installed at each Hand Hole location with the feature illustrated in the drawings given in Section 9. The marker will be situated at a location not to interfere the traffic flow and the exact location is subject to approval of BTCL.

7.4 REQUIREMENTS OF OFC INSTALLATION

7.4.1 Common criteria

- 1) The OFC shall be installed in a new HDPE sub-duct or in new HDPE duct depending upon actual site condition.
- 2) Fiber optic cables in bridges and culverts etc. should be placed in 40mm HDPE and the HDPE duct itself will be placed inside a 90mm DWC pipe.
- 3) The Contractor shall lay the OFC alongside the roads and highways keeping distance as maximum as possible from the edge to protect it from damage during expansion of the road, with the following minimum conditions:-
 - a) 90mm DWC pipe duct will be fixed to bridge /culvert using galvanized clamps

with royal bolts at each 1m distance where the bridge/culvert authorities do not permit to place the duct at the inner side of the bridge/culvert. But where possible 90mm DWC pipe duct should be placed on the footway of the bridge/culvert. 90mm DWC pipe should be covered with cc.

- b) Cable splicing on bridges shall be avoided.
 - c) In bridges, having high vibration risk or excessive bending risk (section linking bridges and steep banks), cables should be adequately secured by means of protective pipe, elastic padding or flexible mounting.
 - d) HDPE Duct shall be used all through the route.
- 4) As the cable will be along roads, crossing the water surface will be through bridges or culverts. In cases where crossing of bridges is difficult due to weak construction of the bridge or if the crossing along the bridge is not permitted by the relevant authority, Water Course Crossing (such as HDD, Open Cut, Cable Around etc) will have to be done in consultation with BTCL.

For crossing of bridge/culverts by Cable Around (CA) method, 75mm PVC pipe to be installed in the bed of the Canal/Drain at proper depth (not less than 90 cm) and concrete casting to be done over the PVC pipe. The minimum dimension of the concrete casting shall be of 20cm(W) X 20cm(H). Composition of concrete shall be **Brick chips (First class) :Sand :Cement = 4 :2 :1**

- 5) At every cable joint, the steel tape of in and out bound cable end shall be electrically bonded and earthed through connecting to H.H earthing lead wire.

7.4.2 Installation of cables in buildings

- 1) While installing cables inside buildings, the Contractor should strictly maintain recommendations for maintaining adequate bend radii, protection of cables against stress and guard against excessive tensile and bending loads.
- 2) Cables entering exchange buildings or transmission stations should reach the premises housing cable terminals.
- 3) The followings are the ways for entering into exchange premises and transmission stations:-
 - i) Cables entering the buildings must end with branching or termination splices placed in durable closures or junction boxes, well protected against unauthorized interference.
 - ii) Cables installed in cable tray, shafts, risers or very steep ducts should be fastened with grips at intervals not greater than 6m. In case of longer shafts (above 30m), reinforcement with a layer of aramid yarn or glass fiber should be made.
 - iii) Cables installed in shafts longer than 10 m should be filled with non-dripping gel or have partitioned cores, preventing gel from dripping inside cable

coatings. Partitions should be made of epoxide resins or materials with similar sealing characteristics and should be distributed at intervals not longer than 10m. The bottom section of a cable in a shaft should be joined to the outgoing cable in such a way that the junction prevents leakage of gel.

7.4.3 Cable length and Marking

1. Excess cables
 - a) Excess cable coils of 15 m should be placed along OFC lines at every splice Hand Hole.
 - b) Excess cable at a splice should be coiled up and properly tied up and secured against mechanical damage.
2. Marking
 - a) Cable runs should be identified by means of marker posts according to BTCL requirement and standard.
 - b) “CAUTION: BTCL OPTICAL FIBER CABLE BELLOW” caution marks in English and Bangla should be printed in every two meter of the yellow warning tape to be placed in the cable trench (10cm width and 0.10 mm thickness).

7.4.4 Cable laying and splicing

- 1) OFC blown into ducts must not be exposed to excessive tensile or bending stress. Bending radius must not be less than 20 times the cable outer diameter. However, if tensile stress affects a cable, the acceptable bending radius must not be less than 25 times the cable diameters.
- 2) The minimum splice distance between splices shall be not less than 2 km. The average splice distance should be stated on the As-Built document.
- 3) Cable pulling, Cable splicing in route, splicing with pig tail, installation of ODF, termination in ODF etc should be done in proper way.

7.4.5 Installation documentation

- 1) Installation drawings (As-Built drawing of a Section) should be supplied (in hard & soft copy) by the Contractor upon completion of the works of that Section. The drawing should be supported by accurate data of the following:
 - a) Route drawing with actual distance (both route distance and OFC distance) between joints, Hand-Hole, direction change, bridge/culvert/water- crossing etc.
 - b) Location of each Hand-Hole and CP showing correct Latitude and Longitude
 - c) Location of excess cable length
 - d) Location of each splice
 - e) Latitude & Longitude of each turning point in the route

- 2) The Documentation should also include the result of all tests, including the following;
 - a) Reflectometric graph, tested bi-directionally from both ends of regeneration section.
 - b) Optical path loss after installation and before installation.

7.5 TESTS AND MEASUREMENTS

7.5.1 Tests during Optical Line construction:

- 1) The Contractor shall test the continuity of each fiber and measure the attenuation loss dB/km of each OFC drum before taking delivery from BTCL/BCS. The Contractor must submit a copy of the test report to the project office. If any discontinuity of fiber and/or any abnormal attenuation loss dB/km (i.e more than the specified value of the OFC) of any fiber in any cable drum is found, the Contractor shall not use that OFC without the permission of the Engineer in charge.
- 2) Following cable installation but prior to fiber splicing, all fibers have to be uni-directionally tested by means OTDR (Optical Time Domain Reflectometer) to verify fiber continuity.
- 3) During fiber assembly, tests are to be performed by means of special “Splicing Test Sets” included in the fiber bond equipment (LID and PAS methods).
 - a) LID (Local Injection & Detection) method - consists of aligning fiber cores in a splice by injecting light through the splice and measuring the amount of light lost.
 - b) PAS (Profile Alignment System) - consists of observing fiber cores in a splice by means of an Optical Camera.
- 4) After all splices are installed, bi-directional reflectometric measurement has to be done for all Optical Fibers, in order to obtain reflectometric graph. All faulty splices must be detected and, having adjusted them, the lines with new characteristic need to be entered into a chart and field.
- 5) Tests and inspections performed during installation also comprise quality control of construction work, installed equipment and material used and compliance of construction with the contract provisions.

7.5.2 OFC Test

- 1) Prior to the site installation work, the Contractor shall submit the test results of OFC to be used to the project office as per instruction mentioned in clause 7.5.1 and also as per the following table.

Sl no.	Identification of Cable Drum	Delivery length of OFC	No. of cores of OFC	Core	Continuity Test result of fibers		Optical loss dB/km	Remarks
					If Ok marked as ‘√’	If not Ok marked as ‘X’		
				1				
				2				

				3				
				4				
				5				
				6				
				7				
				8				
				9				
				10				

2) This test should be performed on all fibers between Optical Cable Terminal (OCT) of each section by means of an Optical Power Meter set using table below;

Test item	Testing at	Test Method	Performance	Remark
Continuity test, post placement	1310±20nm 1550±29nm	Back Scattering	1310nm: 1550nm:	To verify any error during cable blowing/pulling
Post splicing test		Back Scattering	1310nm: 1550nm:	To justify the integrity of splicing
Total attenuation		Cut Back	1310nm: 1550nm:	Quality inspection prior to termination
Final Acceptance Test		Intersection	1310nm: 1550nm:	For acceptance after completion of a Section/entire work