



# BHARAT BROADBAND NETWORK LIMITED

(A GOVERNMENT OF INDIA ENTERPRISE)

## **Engineering Instructions** **ON** **Under Ground Optical Fibre Cable Laying Works**

### **1.0 SCOPE**

- 1.1** The Engineering Instructions spelt out in this document deal with the methods to be adopted for underground Optical Fiber Cable laying in PLB HDPE ducts and inter connection of the existing Optical Fiber Cables with the newly laid OF cables and termination of OF Cables at Gram Panchayats (GPs) for National Optical Fiber Network.

### **2.0 INTRODUCTION**

- 2.1** The existing core Optical Fiber Cable (OFC) network already deployed by various service providers mostly covers State/District/Block headquarter but does not extend upto most of the Gram Panchayats. Under the NOFN project all 250000 Gram Panchayats across the country are proposed to be connected to the Block HQs by laying incremental Optical Fiber Cable.

### **3.0 OF CABLE LAYING APPROACH**

- 3.1** On the basis of the survey reports routes for OF cable laying shall be finalized. Road Cutting Permission shall be obtained from road and rail authorities for laying the Optical Fiber Cable along the finalized roads and at rail / road crossing along the route. 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 as the OFC carries high capacity traffic and is planned for about 25 to 30 years of life. It is essential that the cable is laid after obtaining due permission from all the concerned authorities to avoid any damage (which may result in disruption of services / revenue loss) and shifting in near future due to their planned road widening works.
- 3.2** In special cases where it may be necessary to avoid burrow pits or low lying areas, the Cable may be laid 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 centre line of road.

## 4.0 GENERAL

### 4.1 Soil Classification

Soil shall be classified under two broad categories Rocky and Non Rocky, The soil is categorized as rocky if the cable trench cannot be dug without blasting and / of chiseling. All other types of soils shall be categorized as Non Rocky including Murrum & soil mixed with stone or soft rock.

#### 1. Rocky soil .

The terrain which consists of hard rocks or boulders where blasting/ chiseling is required for trenching such as quartzite, granite, basalt in hilly areas and RCC (reinforcement to be cut through but not separated) and the like.

#### 2. Non Rocky soils

This will include all types of soil- soft soil/hard soil/murrum ie. any strata, such as sand, gravel, loam, clay, mud, black cotton murrum, shingle, river or nullah bed boulders, soling of roads, paths etc. (All such soils shall be sub-classified as **kachcha soil**) and hard core, macadam surface of any description (water bound, grouted tarmac etc), CC roads and pavements, bituminous roads, bridges, culverts (All such soils shall be classified as **Pucca soils**)

### 4.2 The Optical Fibre Cable shall be laid through PLB HDPE Ducts buried at a nominal depth of 165 cms. The steps involved in OF Cable construction are as under

4.2.1. Excavation of trench upto a nominal depth of 165 cms. **in non-Rocky soil**, according to construction specifications. along National/State Highways/other roads and in built up / rural areas. Under exceptional conditions/ genuine circumstances due to site constraints/ soil conditions, relaxation can be granted by the competent authority for excavation of trench to a depth lesser than 165cm. Such relaxation shall be given as per the laid down norms/ procedures being followed by the concerned CPSUs for their own works and with the approval of the competent authority. The payment in such cases shall be made on pro-rata basis as per the existing norms adopted by the concerned CPSUs.

4.2.2. Laying of PLB HDPE Ducts/coils coupled by sockets in excavated trenches, on bridges and culverts, as per construction specification and sealing of PLB HDPE Ducts pipe ends at every manhole by end-plugs of appropriate size.

4.2.3. Providing additional protection by R.C.C. Pipes/GI pipes and/or concreting/chambering, wherever required. according to construction specification.

4.2.4. Fixing of GI pipes/troughs with clamps on culverts/bridges and/or chambering or concreting of G.I. Pipes/troughs, wherever necessary. Normally, RCC/DWC pipes shall be used and use of GI pipes shall be avoided. However, in case it is felt that GI pipe is unavoidable in certain circumstances this should be done with the prior approval of competent authority within the concerned CPSUs. This shall be recorded appropriately.

4.2.5. **Laying Protection Pipes On Bridges And Culverts.** In case trenching and pipe laying is not possible on the culverts, the pipes shall be laid on the surface of the culverts/bridges after due permission from the competent authority **as per construction specification**

4.2.6. Back Filling and Dressing of the Trench according to construction specifications.

- 4.2.7.** Making manhole (of size 2.0 m length x 1.0 m width x 1.65 m Depth) at every Cable pulling location for housing the OF Cable loop & Pulling Optical Fibre Cable using proper tools and accessories. Sealing of both ends of the PLB HDPE pipe in manhole by hard rubber bush of suitable size to avoid entry of rodents into the PLB HDPE Ducts, putting split PLB HDPE Ducts and split RCC pipes with proper fixtures over cable in the manhole to protect the bare cable.
- 4.2.8.** Digging of pit of size 2 meter x 2 meter x 1.8 meter (depth) for fixing of Jointing chamber 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.
- 4.2.9.** Digging of pits 500 cm to 1000 cm towards jungle side at every manhole and jointing chamber along the route to a depth of 75 cms., fixing of route Indicator/joint indicator, concreting and back filling of pits. Painting of route indicators with Blue colour and joint Indicator by Grey colour and sign writing denoting route/joint indicator number and marked as "BBNL", as per construction specification.

### **4.3 Specifications of Materials to be used**

#### **4.3.1. PLB HDPE Duct**

Optical Fiber Cables should be pulled through Permanently Lubricated HDPE Duct of 40 mm/33 mm size conforming to the specifications as per TEC GR No. TEC/GR/TX/CDS-008/03/MAR-11 with latest Amendments. The Ducts shall be blue in colour and have the identification markings as per TEC GR wherein BBNL logo shall be marked as purchaser's name.

#### **4.3.2. PLB HDPE Duct Accessories**

##### **a) Push fit Coupler**

Push Fit couplers shall be used for coupling PLB HDPE ducts/coils. The specifications of the couplers shall be as per TEC GR no TEC/GR/TX/CDS-008/03/Mar11 with latest amendments.

##### **b) PP Rope**

Should conform to TEC GR No. TEC/GR/TX/CDS-008/03/MAR-11 with latest Amendments. However, this is optional and CPSUs may use the same on need basis. The PP rope can be ordered along with the PLB duct as required. In this case PP rope is drawn through the HDPE/PLB pipes/coils and safely tied to the end caps at either ends with hooks to facilitate pulling of the OF cables at a later stage. The rope used is 3 strands Polypropylene Para Pro rope having yellow colour and size of 6 mm diameter. It should have a minimum breaking strength of 550 kgs. The length of each coil of rope should be 5 meter more than the standard length of duct (or as ordered) and it should conform to (i) BS 4928 Part-II of 1974 (ii) IS 5175 of 1982. It should be of special grade and should have ISI certificate mark. It should be manufactured out of industrial quality Polypropylene.

##### **c) End Cap**

End Cap shall be used for sealing the ends of the empty ducts, prior to installation of the OF Cable and shall be fitted immediately after laying the duct to prevent the entry of any dirt, water, moisture, insects/rodents etc. It should conform to TEC GR No. TEC/GR/TX/CDS-008/03/MAR-11 with latest amendments. The ends of the PLB HDPE ducts/coils laid in the manholes should be closed with End Caps. The End Caps used should be suitable for closing 40mm/33mm PLB HDPE ducts/coils. A suitable arrangement should be provided in the End Cap to tie PP Rope. (See figure-1 for details)

**d) Cable sealing Plug**

This shall be used to seal the end of the ducts perfectly, after the OF cable is pulled in the duct. For pulling the cable through the ducts, it is necessary to provide man holes at that location and also at bends and corners wherever required. The ends of the PLB HDPE ducts/coils are closed with Cable sealing Plugs. The End Plugs used should be suitable for closing 40mm/33mm PLB HDPE ducts/coils. The Cable sealing plug shall conform to TEC GR No. TEC/GR/TX/CDS-008/03/MAR-11 with latest amendments. (Wherever blowing technique is used for laying OF Cable, at the discretion of the CPSUs concerned, the hand holes/manholes required for accessing the cable during cable laying can be at longer distances depending upon requirement.)

**4.3.3. Material for Providing Additional Protection**

**a) RCC Full Round Pipes**

Reinforced cement concrete pipes (spun type) coupled with RCC collars sealed with cement mortar used to provide additional protection to PLB HDPE Ducts/coils at lesser depths should be of full round, NP-2 class and size 100 mm (internal diameter), conforming to IS standard 458-1988 with latest amendments. The pipes should have a nominal length of 2 meters.

The RCC collars should be properly sealed using cement mortar 1:3 (1:53 grade cement of reputed brand, 3: fine sand without Impurities). In case of long spans, every third joint will be embedded in a concrete block of size 60 cms (L) x 40 cms (W) x 25 cms (H) of 1:2:4 cement concrete mix (1: cement, 2: coarse sand, 4: stone aggregate of 20 mm nominal size) so that the alignment of RCC pipes remain firm and intact. Also, both ends of RCC pipes spans will be sealed by providing concrete block of size 40 cm (L) x 40 cm (W) x 25 cm (H) of 1:2:4 cement concrete mix to avoid entry of rodents.

**b) RCC Split Pipes**

The split Reinforced cement concrete pipes (spun type) with in-built collars are used to provide additional protection to PLB HDPE Ducts/coils should be of 100mm internal dia.(Spigotted), Class--NP-3, Thickness: 25mm, Length: 2Meters with inbuilt collar at one end, Conforming to ISI Specification IS: 458, 1988 with latest amendment

**c) G.I. Pipes**

G.I. pipes should be of medium duty class having inner diameter of 50mm and should conform to specifications as per IS 554/1985 (revised upto date) IS 1989 (Part-I), 1900 Sockets (revised upto date) & IS 1239 (Part-II) 1992 (revised upto date).

**d) DWC Pipes**

Use of normal duty DWC (Double walled corrugated) HDPE pipe – conforming to TEC GR no.GR/DWC-34/01 Sep.2007 with latest amendments shall be preferably utilized as first choice for protection of Optical Fiber Cable instead of GI pipes. The DWC pipes used shall be of size 75/61 mm as per table 2 of the said TEC GR.

**e) M.S. Weld Mesh**

The PLB HDPE Ducts can also be protected by embedding it in concrete of size of 25 cms x 25 cms reinforced with MS weld mesh. The MS weld mesh used should be of 50 mm x 100 mm size, 12 SWG, 120 cms in width in rolls of 50m each. One meter of MS weld mesh caters to approx. 3 meters of concreting. (See figure '2' for details)

The strength of RCC/CC is dependent on proper curing, therefore, it is imperative that water content of CC/RCC mix does not drain out into the surrounding soil. In order to ensure this, the RCC/CC work should be carried out by covering all the sides by yellow PVC sheets of weight not less than 1 kg per 8 sqm to avoid seepage of water into the soil.

#### **4.3.4. Joint Chamber**

The Joint chamber shall be provided at every joint location to keep the OF cable joint well protected and also to house extra length of cable which may be required in the event of faults at a later date. The Joint chamber shall be of pre-cast RCC type as per construction specification. Brick chamber can also be made with prior permission of Engineer in-charge.

#### **4.3.5. Rubber Bush**

To prevent entry of rodents into PLB HDPE DUCTS, the ends of PLB HDPE DUCTS are sealed at every manhole and joint using rodent resistant hard rubber bush (cap) after optical fibre cable is pulled. The rubber bush should be manufactured from hard rubber with grooves and holes to fit into 40 mm PLB HDPE DUCTS pipe, so that it should be able to prevent the entry of insects, rodents, mud, and rainwater into the PLB HDPE DUCTS pipe. It should conform to TEC GR with latest amendments.(see Figure-3)

#### **4.3.6. Route/Joint Indicator**

The Route/Joint indicators are co-located with each manhole/joint chamber. In addition Route indicators are also to be placed where route changes direction like road crossings etc. Either RCC/Pre-cast or Stone based route indicators can be used. The detailed specification and design of the same shall be as per construction specification. Generally, Stone Route indicators shall be used for the NOFN project

## **CONSTRUCTION SPECIFICATIONS**

### **1. EXCAVATION OF TRENCHES**

#### **1.1. Trenching**

##### **1.1.1. Location and Alignment of the Trench**

In built up areas, the trench will normally follow the foot-path of the road except where it may have to come to the edge of the carriage way cutting across road with specific permissions from the concerned authorities maintaining the road (such permissions shall be obtained by the department as per MOU signed with respective State Govt.). Outside the built up limits the trench will normally follow the boundary of the roadside land. However, where the road side land is full of burrow pits or afforestation or when the cable has to cross culverts/ bridges or streams, the trench may come closer to the road edge or in some cases, over the embankment or shoulder of the Road (permissions for such deviations for cutting the embankment as well as shoulder of the road shall be obtained).

The alignment of the trench will be decided by a responsible official of the CPSUs, not below the rank of a Junior Telecom Officer in case of BSNL and similar level in case of other CPSUs

Once the alignment is marked, no deviation from the alignment is permissible except with the approval of Engineer-in-charge. While marking the alignment only the centre line will be marked and the Contractor shall set out all other work to ensure that, the excavated trench is as straight as possible. The Contractor shall provide all necessary assistance and labour, at his own cost for marking the alignment. Contractor shall remove all bushes, undergrowth, stumps, rocks and other obstacles to facilitate marking the centre line without any extra charges. It is to be ensured that minimum amount of bushes and shrubs shall be removed to clear the way and the contractor shall give all, consideration to the preservation of the trees.

The line up of the trench must be such that PLB pipe(s) shall be laid in a straight line, both laterally as well as vertically except at locations where it has to necessarily take a bend because of change in the alignment or gradient of the trench, subject to the restrictions mentioned else where.

##### **1.1.2. Line-Up**

The line-up of the trench must be such that PLB HDPE Ducts shall be laid in a straight line except at locations where it has to necessarily take a bend because of change in the alignment or gradient of the trench, subject to the restrictions mentioned elsewhere.

#### **1.2. Method of Excavation**

In built up areas, the contractor shall resort to use of manual labour / HDD only to ensure no damage is caused to any underground or surface installations belonging to other public utility services and/or private parties.

However, along the Highways and cross country there shall be no objection to the Contractor resorting to mechanical means of excavation, provided that no underground installations exist in the path of excavation, if any, are damaged.

There shall be no objection to resort to horizontal boring to bore a hole of required size and to push through G.I. Pipe (50 mm ID) through horizontal bore at road crossing or rail crossing or small hillocks etc.

All excavation operations shall include excavation and 'getting out'. 'Getting out' shall include throwing the excavated materials at a distance of at least one meter or half the depth of excavation, whichever is more, clear off the edge of excavation. In all other cases 'getting out' shall include depositing the excavated materials as specified.

In Rocky strata excavation shall be carried out by use of electro mechanical means like breakers/ jack hammers or by blasting wherever permissible with express permission from the competent authority. If blasting operations are prohibited or not practicable, excavation in hard rock shall be done by chiseling/ jack hammers.

Trenching shall as far as possible be kept ahead of the laying of pipes. Contractor shall exercise due care that the soil from trenching intended to be loose for back filling is not mixed with loose debris. While trenching, the Contractor should not cause damage to any underground installations belonging to other agencies and any damage caused should be made good at his own cost and expense.

Necessary barricades, night lamps, warning board and required watchman shall be provided by the contractor to prevent any accident to pedestrians or vehicles. While carrying out the blasting operations, the contractor shall ensure adequate safety by cautioning the vehicular and other traffic. The contractor shall employ sufficient man-power for this with caution boards, flags, sign writings etc. The contractor should provide sufficient width at the trench at all such places, where it is likely to cave in due to soil conditions without any extra payment. A minimum free clearance of 15 cms. Should be maintained above or below any existing underground installation. No extra payment will be made towards this. In order to prevent damage to PLB HDPE DUCTS over a period of time, due to the growth of trees, roots, bushes, etc., the contractor shall cut them when encountered in the path of alignment of trench without any additional charges.

In large burrow pits, excavation may be required to be carried out for more than 165 cms in depth to keep gradient of bed less than 15 degrees with horizontal. If not possible as stated above, alignment of trench shall be changed to avoid burrow pit completely.

### **1.3. Depth and Size of the Trench**

The depth of the trench from top of the surface shall not be less than 165 cms unless otherwise relaxation is granted by competent authority under genuine circumstances.

In rocky terrain, less depth shall be allowed only in exceptional circumstances with additional protection where it is not possible to achieve the normal depth due to harsh terrain/ adverse site conditions encountered. This shall be done only with the approval of the competent authority and consent of the Engineer in-charge after following the laid down norms and procedures being followed in the CPSUs concerned. This shall be properly documented. In all cases, the slope of the trench shall not be less than 15 degrees with the horizontal surface. The width of the trench shall normally be 45 cms at the top & 30 cms at the bottom.

In case, additional pipes (HDPE/GI/RCC Pipes) are to be laid in some stretches, the same shall be accommodated in this normal size trench.

When trenches are excavated in slopes, uneven ground, inclined portion, the lower edge shall be treated, as top surface of land and depth of trench will be measured accordingly. In certain locations, such as uneven ground, hilly areas and all other Places, due to any reason whatsoever it can be ordered to excavate beyond standard depth of 165 cms to keep the bed of the trench as smooth as possible. Near the culverts, both ends of the culverts shall be excavated more than 165 cms. to keep the gradient less than 15 degree with horizontal. For additional depth in excess of 165 cms., no additional payment shall be applicable.

If excavation is not possible to the minimum depth of 165 cms., as detailed above, full facts shall be brought to the notice of the Engineer in charge in writing giving details of location and reason for not being able to excavate that particular portion to the minimum depth.

Approval shall be granted by the competent authority in writing under genuine circumstances. The decision of the competent authority shall be final and binding on the contractor. All the relaxations granted as specified above shall be dealt with as per the laid down norms and procedure of CPSUs .

- 1.3.1. Dewatering:** The Contractor shall be responsible for all necessary arrangements to remove or pump out water from trench. The Contractor should survey the soil conditions encountered in the section and make his own assessment about dewatering arrangement that may be necessary. No extra payment shall be admissible for this.
- 1.3.2. Wetting:** Wherever the soil is hard due to dry weather conditions, if watering is to be done for wetting the soil to make it loose, the same shall be done by the contractor. No extra payment shall be admissible for this.
- 1.3.3. Blasting:** For **excavation in hard rock**, where blasting operations are considered necessary, the contractor shall obtain approval of the Engineer-in-Charge in writing for resorting to blasting operation. The contractor shall obtain license from the competent authority for undertaking blasting work as well as for obtaining and storing the explosive as per the Explosive Act, 1884 as amended upto date and the explosive Rules, 1983. The contractor shall purchase the explosives fuses, detonators, etc. only from a licensed dealer. Transportation and storage of explosive at site shall conform to the aforesaid Explosive Act and Explosive Rules. The contractor shall be responsible for the safe custody and proper accounting of the explosive materials. Fuses and detonators shall be stored separately and away from the explosives. The Engineer-in-Charge or his authorized representative shall have the right to check the contractor's store and account of explosives. The contractor shall provide necessary facilities for this. The contractor shall be responsible for any damage arising out of accident to workmen, public or property due to storage, transportation and use of explosive during blasting operation. Blasting operations shall be carried out under the supervision of a responsible authorized agent of the contractor (referred subsequently as agent only), during specified hours as approved in writing by the Engineer-in-Charge. The agent shall be conversant with the rules of blasting. All procedures and safety precautions for the use of explosives drilling and loading of explosives before and after shot firing and disposal of explosives shall be taken by the contractor as detailed in **IS: 4081** safety code for blasting and related drilling operation.
- 1.3.4. Trenching Near Culverts/ Bridges:** The PLB HDPE Ducts shall be laid in the bed of culvert at the depth not less than 165 cms protected by RCC pipes as decided by Engineer- in charge. Both ends of culverts shall be excavated more than 165 cms in depth to keep the gradient of not less than 15 degree with horizontal. The bed of trench should be as smooth as possible.

**1.3.5. While** carrying out the work on bridges and culverts, adequate arrangement for cautioning the traffic by way of caution boards during day time and danger lights at night shall be provided. In case of small bridges and culverts, where there is a likelihood of their subsequent expansion and remodeling, the cable should be laid with some curve on both sides of the culvert or the bridge to make some extra length available for readjustment of the cable at the time of reconstruction of culvert or the bridge.

## **2. Laying OF PLB HDPE Ducts**

After the trench is excavated to the specified depth, the bottom of the trench has to be cleared of all stones or pieces of rock and leveled up properly. A layer of soft soil/or sand (in case the excavated material contains sharp pieces of rock/stones) of not less than 5 cms is required for leveling the trench to ensure that the cable when laid will follow a straight alignment. Adequate care shall be exercised while laying so that the OF cables are not put to undue tension/pressure after being laid as this may adversely affect the optical characteristics of cables with passage of time.

The contractor shall ensure that trenching and pipe laying activities are continuous, without leaving patches or portions incomplete in between. In case intermediate patches are left, measurement of the completed portions will be taken only after work in such left over patches are also completed in all respects.

Preparatory to aligning the pipe for jointing, each length of the PLB HDPE Ducts shall be thoroughly cleaned to remove all sand, dust or any other debris that may clog, disturb or damage the optical fibre cable when it is pulled at a later stage. The ends of each pipe and inside of each Socket shall be thoroughly cleaned of any dirt or other foreign materials.

After the trench is cleaned the PLB HDPE Ducts/Coil shall be laid in the cleaned trench, jointed with Sockets. Drawing up of PP rope is optional as per TEC GR. In case of use of PP Rope, at every manhole approximately at every 200m or at bends or turns the PP rope will be tied to the HDPE end caps used for sealing the PLB HDPE Ducts, to avoid entry of rodents/mud etc.

At the end of each day work, the open ends of the pipes sections shall be tightly closed with end caps to prevent the entry of dirt/mud, water or any foreign matter into PLB HDPE Ducts until the work is resumed. In built up area falling within Municipal/Corporation limits, the PLB HDPE Ducts shall be laid with protection using RCC Pipes/ Concreting reinforced with weld mesh (only in exceptional cases).

For lesser depths requiring additional protection in built up areas, towns and cities falling within the municipal limits, suitable protection shall be provided to PLB HDPE pipes/coils using RCC/DWC full round/split pipes or GI pipes or cement concreting reinforced with MS weld mesh or a combination of any of these as per the site requirement. This shall be done only with the prior instructions/approval of the Engineer-in-charge. The specifications for providing each of these protections are given later in this document.

Moreover, in cross country routes, if depth is less than 1.2 meters, protection by using RCC/DWC Pipe shall be provided. Engineer-in-Charges shall decide about such stretches and type of protection to be provided in view of the site requirements. Normally 100 mm RCC /DWC Pipes shall be used for protecting PLB HDPE Ducts but if more than one PLB pipe is to be laid and protected, RCC/DWC Pipe of suitable size to accommodate the required number of PLB Pipes shall be used.

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The PLB HDPE Ducts shall be laid in RCC Full Round spun Pipes/GI Pipes as required at Road crossings. The RCC pipes/GI pipes shall extend at least 3 meters on either side of the road at Road crossings. At Road crossings, extra GI/PLB HDPE Ducts may be laid as per the direction of the Engineer-in charge. On Rail bridges and crossings, the PLB HDPE Ducts shall be encased in suitable cast iron as prescribed by the Railway Authorities.

Wherever RCC pipes are used for protection, the gaps between the RCC collars and the RCC pipes shall be sealed using cement mortar 1:3 (1:53 grade cement of reputed brand, 3: fine sand without impurities) to bar entry of rodents. Every third collar of RCC pipes (normally of 2 meters length) and also both ends of RCC Pipes will be embedded in a concrete block of size 40 cms (L)x 40 cms (W) x 25 cms (H) of 1:2:4 cement concrete mix (1:53 grade cement of reputed brand, 2: coarse sand, 3: stone aggregate of nominal size of 20 mm ) so that the alignment of RCC pipes remain firm and intact and to avoid entry of rodents.

Wherever GI pipes are used, special care should be taken to ensure that G.I. Pipes are coupled properly with the sockets so as to avoid damage to PLB pipe and eventually the OF Cable in the event of pressure coming on the joint and G.I. Pipe joint giving its way. Rubber bushes shall be used at either ends of the GI pipes to protect PLB pipe. Both the ends of G.I. Pipe will be embedded in a concrete block of size 40 cms (L)x 40 cms (W) x 25 cms (H) of 1:2:4 cement concrete mix (1:53 grade cement of reputed brand, 2: coarse sand, 3: stone aggregate of nominal size of 20 mm) so that the alignment of G.I. Pipes remain firm and intact and to avoid entry of rodents.

In case of protection by concreting at site, the nominal dimension of concreting shall be 250 mm x 250 mm section. Cement Concrete Mixture used shall be of 1:2:4 composition i.e. 1:53 grade Cement of a reputed company , 2: Coarse Sand, 4: Graded Coarse Stone aggregate of 20 mm nominal size, reinforced with MS weld mesh. As the RCC is cast at site, it is imperative to ensure that special care is taken to see that proper curing arrangements are made with adequate supply of water. The contractor shall invariably use mechanical mixer at site for providing RCC protection, to ensure consistency of the mix.

For carrying out concreting work in trenches, yellow PVC sheets of width not less than 1.0 M and of weight not less than 1 kg. Per 8 sq. meters shall be spread and nailed on sides of the trench to form trapezoidal section for concreting in the cleaned trench, to avoid seepage of water into the soil.

A bed of cement concrete mixture of appropriate width and 75 mm thickness shall be laid on the PVC sheet, before laying PLB HDPE ducts. The PLB HDPE Ducts shall then be laid above this bed of concrete. After laying the PLB HDPE Ducts, MS weld mesh is wrapped around and tied and concrete mix is poured to form the cross sectional dimensions as instructed by the Engineer-in-charge.

The strength of RCC is dependent on proper curing therefore, it is imperative that water content of RCC mix does not drain out into the surrounding soil. Portions where cement concreting has been carried out shall be cured with sufficient amount of water for reasonable time to harden the surface. After curing, refilling of the balance depth of the trench has to be carried out with excavated soil.

The PLB HDPE Ducts/RCC/GI Pipes shall be laid only in trenches accepted by Engineer-in-Charge or his representative. The Contractor shall exercise due care to ensure that the PLB HDPE Ducts are not subjected to any damage or strain.

Water present in the trench at the time of laying the PLB HDPE Ducts shall be pumped out by the contractor before laying the pipes in the trench to ensure that no mud or water gets into the pipes, thus choking it.

In case of nallahs, which are dry for nine months in a year, the PLB HDPE Ducts shall be laid inside the RCC Pipes laid at a minimum depth of 165 cms., as instructed by the Engineer-in-charge. The mechanical protection shall extend at least 5 meters beyond the bed of nallah on either side.

Notwithstanding anything contained in clauses referred above, the Engineer-in-charge may order, based on special site requirements, that the PLB HDPE Ducts may be encased in reinforced cement concrete, as detailed, ibid

While laying the pipes, a gap of 2 M is kept at convenient locations approx. 200 m apart and at the bends and turns, which will be used as manholes during OF cable pulling. Ends of the PLB HDPE Ducts at the manholes shall be sealed using end caps after tying the PP rope to the end caps to avoid choking of the pipes. In a similar manner, manholes shall be kept while approaching bridges, road crossings etc., as instructed by the Engineer-in-charge. The location of the manholes will be decided by the Engineer-in-charge.

### **2.1. Laying Protection Pipes On Bridges And Culverts:**

In case trenching and pipe laying is not possible on the culverts, the pipes shall be laid on the surface of the culverts/bridges after due permission from the competent authority. Of late the bridge construction authorities are providing channel ducts on the footpaths on the bridges for various services. The RCC/DWC/ G.I. Pipes can be laid in these ducts for pulling cables. However, for laying cables on existing bridges, where duct arrangement does not exist, one of the following methods may be adopted.

- a. In case of the Bridges/Culverts, where there are no ducts and where the cushion on the top of the Arch is 50 cm to 100 cm or more, G.I. Pipe (Carrying PLB HDPE pipe and cable ) may be buried on the top of the Arch adjoining the parapet wall, by digging close to the wheel guards. Every precaution shall be taken to see that no damage occurs to the arch of the culvert. After burying the GI pipe, the excavated surface on the arch shall be restored.
- b. Where the thickness of the Arch is less than 50 cms, the pipe must be buried under the wheel guard masonry and the wheel guard rebuilt.
- c. If neither of the two methods is possible, the G.I. Pipes/GI Troughs must be clamped on the parapet wall with the clamps. If necessary, the pipes may be taken through the parapet wall at the ends where the wall diverges away from the road.

Methods cited in above clauses should be carried out under close supervision of Road authorities.

The surface to be concreted should be thoroughly cleaned and leveled before concreting. At both ends of the Bridges/Culverts, where the GI Pipes /GI Troughs slope down and get buried, the concreting should be extended sufficiently to ensure that no portion of the GI Pipes/GI Troughs is exposed as approved by the Engineer- in- charge to protect the pipe/trough from any possible externally caused damage.

Where white wash/colour wash is existing on the Bridges/ Culverts, the same should also be carried out on the concreted portion to ensure uniformity.

### **3. Back Filling and Dressing of the Trench**

Provided that the PLB HDPE pipes have been properly laid in the trench at the specified depth, the back filling operation shall follow as early as practicable. The earth used for filling shall be free from all roots, Grass, shrubs, vegetation, trees, saplings and any other kind of garbage or pebbles. The back filling operation shall be performed in such a manner so as to provide firm support under and above the pipes and to avoid bend or deformation of the PLB HDPE pipes when the pipes get loaded with the back filled earth.

At locations where the back filled materials contains stones/sharp objects which may cause injury to the PLB HDPE pipes and where the excavated or rock fragments are intended to refill the trench in whole or in part, the trench should be initially filled, with a layer of ordinary soil or loose earth (free from any stones/pebbles) not less than 10 cms thick over the pipes.

Back filling on public, roads, railway crossings, footpaths in city areas shall be performed immediately after laying the HDPE pipes. Back filling at such locations shall be thoroughly rammed, so as to ensure original condition so that it is safe for the road traffic. All excess soil/ material left on road/ footpath/railway crossing shall be removed by contractor. However, along the highways and in country side, the excess dug up material left over after refilling should be kept in a heap above over the trench.

In city limits, at any given time more than 50 Meters length of trench should be kept open and in all places where excavation has been done, no part of the trench should be kept open over night to avoid occurrence of any mishap or accident in darkness.

#### **4. CABLE PULLING AND JOINING/SPLICING**

##### **4.1. CABLE PULLING**

Manholes marked during PLB HDPE Ducts pipe laying of approx.. size of 2.0 m length x 1.0 m width x 1.65 m depth shall be excavated for pulling the cables. There may be situations where addition manholes are required to be excavated , for some reasons, to facilitate smooth pulling of cable. Excavation of addition manholes will be carried out, without any extra cost. De-watering of the manhole, if required, will be carried out without any extra costs. Dewatering/ De-gasification of the Ducts, if required, will be carried out without any extra costs.

The Optical Fibre cables are available in drums in lengths of approx. 2 kms. The cables shall be blown / manually pulled (in exceptional cases) through already laid PLB HDPE DUCTS. This work is to be carried out under the strict supervision of site in-charge. It shall be ensured that during the blowing / pulling of Cable the tension is minimum and there is no damage to the Cable/Optical fibers.

After pulling of the drum is completed, both ends of the PLB HDPE DUCTS pipe in each Manhole should be sealed by hard rodent resistant rubber bush, to avoid entry of rodents/mud into PLB HDPE Ducts.

The Manholes are prepared by providing 40 mm split PLB HDPE DUCTS pipe of 2.5 to 3m length and closing the split PLB HDPE Ducts by providing necessary clamps/ adhesive tape as per the directions of Engineer-in- charge. Afterwards, the split/cut PLB HDPE DUCTS pipe are covered with 100 mm split RCC pipe of 2m length and sealing the ends of RCC pipe with lean cement solution for protecting bare cable in the manhole . After fixing of RCC Split Pipes necessary back filling/reinstatement and dressing of manholes should be carried out as referred under trenching. The location of the pulling manhole should be recorded for preparation of documentation.

#### **4.2. Jointing/ Splicing**

Optical Fibre Cable Joints will be at varying distances depending upon the incremental fiber to be laid for connecting Panchayats. The 24 fibers are to be spliced at every Joint & at both ends (Terminations) in the equipment room as directed by the Engineer-in-charge. The Infrastructure required for cable splicing i.e.

- Splicing machine
- OTDR
- Optical talk set
- Tool kit etc.

will be arranged by the CPSU and also any additional accessories. e.g. Engine etc. required at site for splicing will also be arranged by the CPSU.

The Optical Fibre Cable thus jointed end-to-end will be tested by an officer of Acceptance Testing unit of the concerned CPSUs for splice losses and transmission parameters as specified by BBNL and prevalent at that time. The through Optical Fibre should meet all the technical parameters, specified and no relaxation will be granted.

#### **5. Construction of Jointing Chamber :**

The joint chambers are provided at every joint to keep the O.F.C. joint well protected and also to keep extra length of cable, which may be, required to attend the faults at a later date. Jointing chambers are to be prepared at the Fiber Point of Interconnect (FPIO) or normally at distance of every 2 kms. Actual location of jointing chamber depends on length of cable drum and appropriateness of location for carrying out jointing work. The location is finalized by Engineer-incharge.

The jointing chambers are constructed by way of fixing pre-cast RCC chambers/Brick Chambers and covers as per the instructions from Engineer-in- charge.

##### **5.1. Pre cast RCC chamber**

For fixing pre cast RCC chamber, first a pit of size 2 m x 2 m x 1.8 m depth shall be required to be dug. Pre cast RCC chamber shall consist of three parts (i) round base plate of 140 cm diameter and 5 cm thickness in two halves (ii) full round RCC joint chamber with diameter of 120 cm and height of 100 cm and thickness of 5 cm (iii) round top cover will be in two halves with diameter of 140 cm and thickness of 5 cm having one handle for each half in centre and word ' BBNL OFC ' engraved on it. (See figure '4'). After, fixing the pre cast RCC joint chamber, the joint chamber is filled with clean sand before closing. Back filling of joint chamber pit with excavated soil shall be carried out in the end.

##### **5.2. Brick Chamber**

For constructing brick chamber, first a pit of size 2m x2 mx1.8 m depth is shall be required to be dug.. Then, base of the chamber shall be made using concrete mix of 1:5:10 (1 cement, 5 coarse sand, 10 graded stone aggregate of 40mm nominal size) of size of 1.7m x 1.7 m and 0.15 m thickness. Wall of brick chamber should be constructed on this base having wall thickness of 9" using cement mortar mix of 1:5 ( 1: cement, 5: fine sand). The chamber should have internal dimensions of 1.2 m x 1.2 m amd 1 m height.. 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 colour and emit clear ringing sound when struck.

The joint chamber should be so constructed that PLB pipe ends remain protruding minimum 5 cms inside the chamber on completion of plastering. The PLB pipes should be embedded in wall

in such a way that, the bottom brick should support the pipe and upper brick should be provided in a manner that PLB HDPE pipe remains free from the weight of the construction. 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, of size 0.7 m x 1.4 m and of thickness of 5 cm having one handle for each half in centre and word 'OFC' engraved on it 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. Back filling of joint chamber pit with excavated soil shall be carried out in the end

## 6. Fixing of Route Indicators / Joint Indicators

Pits shall be dug 500 cm to 1000 cm towards jungle side at every Manhole and Jointing chamber for fixing of Route/Joint Indicator. In addition, Route Indicators are also required to be placed where O.F. Cable changes directions like road crossing etc.

The pits for fixing the indicator shall be dug for a size of 60 cms. x 60 cms. and 75 cms. (depth). The indicator shall be secured in upright position by ramming with stone and murrum upto a depth of 60 cms. and concreting in the ratio of 1:2:4 (1: cement, 2: coarse sand, 4 stone aggregate 20 mm nominal size) for the remaining portion of 15 cms. Necessary curing shall be carried out for the concreted structure with sufficient amount of water for reasonable time to harden the structure.

### 6.1. RCC/Pre cast Route Indicators

The route /joint indicator made of pre-cast RCC should have the following dimensions (see Figure '5')

- Base - 250 mm x 150 mm
- Top - 200 mm x 75 mm
- Height - 1250 mm

### 6.2. Stone based Route Indicators

The route /joint indicators made of Sand/lime Stone Should have the following dimension  
The word '**BBNL OFC**' should be engraved on the Route/Joint indicators.

- i. Stone to be used (Sand/lime Stone)
- ii. Indicator Top surface to be rounded
- iii. Base 155 mm x 100 mm
- iv. Upper 500 mm length to be Tapered width wise as shown in the drawing and homogeneously finished.
- v. Height 650mm (Straight) + 400 mm (Tapered)
- vi. The route indicators should be engraved with word 'OFC' of size 80mm length & 50mm, width.
- vii. Length 3.5 Ft., top 4"x4" dressed 1Ft. from top & tapered.

**(See figure '6' for details of Stone Route Indicators)**

The Route indicators shall painted Blue and placed at 500 to 1000 cm away from the centre of the trench towards jungle side. The Joint indicators are placed at OFC joints and placed 500 to 1000 cm

away from wall of the joint chamber facing jungle side and are painted Grey. The engraved word "BBNL OFC" should be painted in white, on route as well as joint indicators. Numbering of route indicators/joint indicators should also be done in white paint. The numbering scheme for route indicators will be Joint No./Route Indicator No. for that joint. For example, 2/6 marking on a route indicator means 6<sup>th</sup> route indicator after 2<sup>nd</sup> joint. Additional joints on account of faults at a later date should be given number of preceding joint with suffix A, B, C, and D. For example sign writing 2A on a joint indicator means, additional joint between joint No. 2 and 3. The numbering of existing route/joint indicator should not be disturbed on account of additional joints. Enamel paints of reputed brand should be used for painting and sign writing of route as well joint indicators.

The route and joint indicator shall be painted with primer before painting with oil paint. The material used should bear ISI mark. The size of each written letter should be at least 3.5 cms. The colours of painting and sign writing is as under :

- (1) For Joint Indicator: Grey colour
- (2) For Route Indicator: Blue colour
- (3) For BBNL OFC & Nos: White colour.

## 7. Documentation

The documentation, consisting of the following shall be prepared for each Block and the Panchayats connected to the Block. 4 sets of documentation shall be provided both in Electronic format on CD as well as Hard binded copy.

**7.1. Route Index Diagrams – General:** This diagram shall consist of Cable Route Details on Geographical Map drawn to scale with prominent land marks and alignment of cable with reference to road. This shall be prepared on A-3 sheets of 80 GSM.

### 7.2. Route Index Diagrams –Profile

These diagrams will contain

- Make and size of the cable.
- Offset of cable from centre of the road at every 10 meters
- Depth profile of Cable at every 10 meter;
- Details of protection with type of protection depicted on it;
- Location of culvert and bridges with their lengths and scheme of laying of PLB HDPE Ducts pipe thereon.
- Important landmarks to facilitated locating the cable in future; Location of Joints and pulling manholes.

These diagrams shall be prepared on **A-4 sheets** of 80 GSM. On one sheet profile of maximum 400 meters shall be given to ensure clarity.

### 7.3. Joint Location Diagram

This diagram will show

- Geographical location of all the joints.
- Depth of Joint Chamber covers from ground level
- Type of chamber (Brick/Pre-cast)
- Length of O.F. Cable kept inside the joint chamber from either direction.

This shall be prepared on A-4 sheets of 80 GSM.

All the diagrams (i), (ii) & (iii) shall bear the signatures of the contractor, the Engineer-in-charge as a proof of accuracy of the details. The diagrams shall be bound in A-4 size book with cover.

The cover sheets shall be of 110 GSM and laminated. The front cover shall have the following details.

1. Name of the State/District/Block
2. Name of the Panchayats connected
3. Name of the BBNL with logo
4. Name of the CPSU executing the work
5. Name of the Contractor
6. Date of commencement of work
7. Date of completion of work

For each Block 1 sets of above mentioned document shall be submitted to BBNL.

## **8. SAFETY PRECAUTIONS**

### **8.1. Safety Precautions when excavating or working in excavations close to electric cables**

The Engineer- in-charge of the work should get full information from Electricity undertaking regarding any electric cables, which are known or suspected to exist near the proposed excavation and unless this is done, excavation should not be carried out in the section concerned. The electricity undertaking should be asked to send a representative and work should be preceded with close consultation with them.

Only wooden handled hand tools should be used until the electric cables have been completely exposed. Power Cables, not laid in conduits, are usually protected from above by a cover slab of concrete, brick or stone. They may or may not be protected on the sides. It is safer, therefore, always to drive the point of the pickaxe downwards then uncovering a cable, so that there is less chance of missing such warning slabs. No workman should be permitted to work alone where there are electric cables involved. At least one more man should be working near by so that help can be given quickly in case of an accident. If disconnection of power could be arranged in that section it will be better. No electric cables shall be moved or altered without the consent of the Electric Authority and they should be contacted to do the needful. If an electric cable is damaged even slightly, it should be reported to the Electric Authority and any warning bricks disturbed during excavation should be replaced while back filling the trench. Before driving a spike into the ground, the presence of other underground properties should be checked. Information on plans regarding the location of power cables need not to be assumed as wholly accurate. Full precautions should be taken in the vicinity until the power cable is uncovered. All electric cables should be regarded as being live and consequently dangerous. Any power is generally dangerous, even low voltage proving fatal in several cases.

### **8.2. Electric shock-Action and treatment :**

Free the victim from the contact as quickly as possible. He should be jerked away from the live conductors by dry timber, dry rope or dry clothing. Care should be taken not to touch with bare hands as his body may be energized while in contact. Artificial respiration should begin immediately to restore breathing even if life appears to be extinct. Every moment of delay is serious, so, in the meanwhile, a doctor should be called for.

**8.3. Safety Precautions while working in public street and along railway lines :**

Where a road or footpath is to be opened up in the course of work, special care should be taken to see that proper protection is provided to prevent any accidents from occurring. Excavation work should be done in such a manner that it will not unduly cause inconvenience to pedestrians or occupants of buildings or obstruct road traffic. Suitable bridges over open trenches should be so planned that these are required for the minimum possible time. Where bridges are constructed to accommodate vehicular traffic and is done near or on railway property, it should be with the full consent and knowledge of the competent railway authorities.

**8.4. Danger from falling material**

Care should be taken to see that apparatus, tools or other excavating implements or excavated materials are not left in a dangerous or insecure position so as to fall or be knocked into the trench thereby injuring any workman who may be working inside the trench.

**8.5. Care when working in Excavations**

Jumping into a trench is dangerous. If it is deep, workmen should be encouraged to lower themselves. Workers should work at safe distance so as to avoid striking each other accidentally with tools. If the walls of the trench contain glass bits, corroded wire or sharp objects they should be removed carefully. If an obstruction is encountered, it should be carefully uncovered and protected if necessary. Care must be taken to see that excavated material is not left in such a position that it is likely to cause any accident or obstruction to a roadway or waterway. If possible the excavated material should be put between the workmen and the traffic without encroaching too much on the road.

**8.6. Danger of cave in**

When working in deep trenches in loose soil, timbering up/shoring the sides will prevent soil subsidence. The excavated material should be kept at sufficient distance from the edge of the trench or pit. Vehicles or heavy equipment must not be permitted to approach too close to the excavation.

When making tunneled opening, it should be ensured that the soil is compact enough to prevent cave in even under adverse conditions of traffic. Extra care should be taken while excavating near the foundations of buildings or retaining walls. In such cases, excavation should be done gradually and as far as possible in the presence of the owners of the property.

**8.7. Protection of Excavations :**

Excavations in populated areas, which are not likely to be filled up on the same day should be protected by barriers or other effective means of preventing accidents and the location of all such openings must in any event be indicated by red flags or other suitable warning signs. During the hours from dusk to dawn, adequate number of red warning lamps should be displayed. Supervisory officers should ensure that all excavations are adequately protected in this manner as serious risk and responsibility is involved. Notwithstanding adoption of the above mentioned precautions, works involving excavations should be so arranged as to keep the extent of opened ground and the time to open it to a minimum.

**8.8. Precautions while working on roads**

The period between half an hour after sun-set and half an hour before sunrise, and any period of fog or abnormal darkness may also be considered as night for the purpose of these instructions, for the purpose of providing the warning signs. Excavation liable to cause danger to vehicles or the public must at all times be protected with fencing of rope tied to strong uprights or bamboo poles at a suitable height or by some other effective means. Any such temporary erection which is likely to cause obstructions and which is not readily visible should be marked by posts carrying red flags or boards with a red background by day and by continuously lighted lamps at night.

The flags and the lamps should be placed in conspicuous positions so as to indicate the pedestrians and drivers of vehicles the full expanse i.e. both width and length of the obstruction. The distance between lamps or between flags should not generally exceed 1.25 m along the width and 6m along length of the obstruction in non congested areas, but 4 meters along the length in congested areas.

If the excavation is extensive, sufficient notice to give adequate warning of the danger, should be displayed conspicuously not less than 1.25 m above the ground and close to the excavation. Where any excavation is not clearly visible for a distance of 25m to traffic approaching from any direction or any part of the carriage way of the road in which the excavation exists, a warning notice should be placed on the kerb or edge of all such roads from which the excavation or as near the distance as is practicable but not less than 10 m from the junction of an entering or intersecting road in which the excavation exists. All warnings, in these should have a red background and should be clearly visible and legible. All warning lamps should exhibit a red light, but white lights may be used in addition to facilitate working at night. Wherever required a passage for pedestrians with footbridge should be provided. At excavations, cable drums, tools and all materials likely to offer obstructions should be properly folded round and protected. This applies to jointer's tents as well. Leads, hoses etc. stretched across the carriageway should be guarded adequately for their own protection and also that of the public.

#### **8.9. Traffic Control**

The police authorities are normally responsible for the control of traffic and may require the setting up of traffic controls to reduce the inconvenience occasioned by establishment of a single line of traffic due to restriction in road width or any other form of obstruction caused by the work. As far as possible, such arrangements should be settled in advance. If there are any specific regulations imposed by the local authorities, these should be followed.

#### **8.10. Work along Railway Lines**

Normally all works at Railway crossing is to be done under supervision of the railway authorities concerned, but it is to be borne in mind that use of white, red or green flags by the Departmental staff is positively forbidden to be used when working along a railway line as this practice may cause an accident through engine drivers mistaking them for railway signals. When working along a double line of railway, the men should be warned to keep a sharp look on both the "UP" and "DOWN" lines to avoid the possibility of any accident when trains pass or happen to cross one another near the work spot.

#### **8.11. Procedure and Safety Precautions for use of explosives during blasting for trenching :**

In areas where the cable trench cannot be done manually on account of boulders and rocks, it is necessary to blast the rocks by using suitable explosives. The quality of explosive to be used depends on the nature of the rocks and the kind of boulders. A few types of explosive fuses and detonators normally used for making trenches for cable works are detailed below:

- i) Gun powder

- ii) Nitrate Mixture
- iii) Gilatine
- iv) Safety fuse
- v) Electric Detonator
- vi) Ordinary Detonator

#### **8.11.1. Procedure**

A detailed survey of the route is to be done to assess the length of the section where trenching is to be done with the help of blasting. A route diagram of the rocky section may be prepared indicating the length of the route where the explosives are to be used. For the purpose of obtaining license, a longer length of route should be given in the application as in many cases, after digging, rocks appear which was not initially anticipated.

Next a license will have to be obtained for use and storing of explosive in that section. If the area falls under a police commissioner, the authority for granting such license is the police commissioner of the concerned area. When the route does not fall in the jurisdiction of a police commissioner, the authority for issuing license is the District Magistrate.

The concerned authority should be applied in prescribed form with a route map. The concerned authority will make an enquiry and issue license for using/storing explosives for cables trenching work. Such license will be valid for 15 days only. The license should be got renewed if the blasting operation needs to be extended. Once the license is granted, it is the responsibility of the holders of the license for the proper use of explosives, its transportation and storing.

#### **8.11.2. Method of using**

The safest explosive is the Gilatine and electric detonator. Gilatine is in the form of a stick. Electric detonator is a type of fuse used for firing the explosive electrically. Holes are made at suitable intervals on rocky terrain or boulders either by air compressor or by manual chipping. The depth of the holes should be 2 to 3 ft. Fill up the holes with small quantity of sand for about 6". First the electric detonator is to be inserted into the Gilatine and the Gilatine is to be inserted into the holes keeping the + ve and- ve wirings of electric detonators outside the holes. Again refill the holes with sand. These +ve and-ve insulated wires of detonator are than extended and finally connected to an EXPLODER kept at a distance of not less than 100 m.

Now the explosive is ready for blasting. But, before connecting wires to exploder for blasting, all necessary precautions for stopping the traffic, use of red flags, exchange of caution signals, etc. should be completed and only then Exploder should be connected and operated.

#### **8.11.3. Operation of exploder (IDL schaffler type 350 type exploder )**

The type 350 blasting machine consists of a bearing block with blasting machine system and the explosion proof light- alloy injection molded housing. The exploder is held with the left hand. The twist handle is applied to the drive pin, clapped with the right hand turned in the clock wise direction in continuous measurements at the highest speed from the initial position until it reached to a stop. At this stage an indication lamp will glow. When the indication lamp glows, " press button switch" should be pressed. This will extend the electric current to detonator and Gilatine will be detonated. The rock will be blasted out of the trench. Number of holes can be blasted in a single stroke by connecting all such detonators in series connection and finally to the exploder. After blasting, again mazdoors are engaged on the work to clear the debris. It the result of the first blasting is not satisfactory, it should be repeated again on the same place.

#### **8.11.4. Warning**

There may be two reasons for unsatisfactory results of the blasting

- a) Misfire of Gilatine due to leakage of current from detonator.
- b) Over loading because of overburdens.

Never pull the broken wire pieces form the holes in such cases. Attempt should not be made to reblast the misfired Gilatine. The safest way is to make a fresh hole by its side and put fresh Gilatine in that hole and blast it.

#### **8.11.5. Precautions**

The abstract of Explosives Rules 1983 which are relevant to our work is given below :

#### **8.12. Restriction of delivery and dispatch of explosives**

No person shall deliver or dispatch any explosives to anyone other than a person who.

- a) is the holder of a license to possess the explosives or the agent of a holder of such a license duly authorized by him in writing on his behalf.

OR

- b) is entitled under these rules to possess the explosives without a license.

The explosives so delivered or dispatched shall in no case exceed the quantity, which the person to whom they are delivered or dispatched is authorized to possess with or without a license under these rules.

No person shall receive explosives form any person other than the holder of a license granted under these rules. No person shall receive from or transfer explosives to any person for a temporary storage or safe custody in a licensed premise unless prior approval is obtained from the Chief Controller.

A person holding license for possession of explosives granted under these rules shall store the explosives only in premised specified in the license.

#### **8.13. Protection from Lightening During Storing**

Every magazine shall have attached there to one or more efficient lightening conductors designed and erected in accordance with the specification laid down in Indian Standard Specifications No. 2309 as amended from time to time. The connections to various parts of earth resistance of the lightening conductor terminal on the building to the earth shall be tested at least once in every year by a qualified electrical engineer or any other competent person holding a certificate of competency in this behalf from the State Electricity Department. A certificate showing the results of such tests and the date of the last test shall be hung up in conspicuous place in the building.

#### **8.14. Precautions during thunder-storm**

When a thunder- storm appears to be imminent in the vicinity of a magazine or store house every person engaged in or a round such magazine and store house shall be withdrawn to a safe distance from such magazine or store house and the magazine and store house shall be kept closed and locked until the thunder storm has ceased or the threat of it has passed.

#### **8.15. Maintenance of records**

Every person holding a license granted under these rules for possession, sale or use of explosives shall maintain records in the prescribed form and shall produce such record on demand to an Inspection Officer.

**8.16. Explosives not to be kept in damaged boxes**

The licensee of every magazine or store house shall ensure that, the explosives are always kept in their original outer package. In case, the outer package gets damaged so that the explosive contained therein cannot be stored or transported, such explosives shall be repacked only after the same are examined by controller of explosives.

**8.17. Storage of explosives in excess of the licensed quantity**

The quantity of any kind of explosives kept in any licensed magazine or store house shall not exceed the quantity entered in the license against such kind of explosives. No explosives in excess of the licensed quantity shall be stored in the magazine or store house unless a permit in this behalf is obtained from the licensing authority by a letter or telegram.

**8.18. Precautions to be observed at Site**

The electric power at the blasting site shall be discontinued as far as practicable before charging the explosives. No work other than that associated with the charging operations shall be carried out within 10 meters of the holes unless otherwise specified to the contrary by the licensing authority.

When charging is completed, any surplus explosive detonators and fuses shall be removed from the vicinity of the hole and stored at a distance which should prevent accidental detonation in the event of a charge detonating prematurely in any hole. The holes which have been charged with explosive shall not be left unattended till the blasting is completed. Care shall be taken to ensure that fuse or wires connected to the detonation are not damaged during the placing of stemming materials and tamping.

**8.19. Suitable warning procedure to be maintained**

The licensee or a person appointed by the licensee to be in charge of the use of explosives at the site shall lay down a clear warning procedure consisting of warning signs and suitable signals and all persons employed in the area shall be made fully conversant with such signs and signals.

**8.20. Precautions to be observed while firing**

The end of the safety fuse (if used in place of a detonator should be freshly cut before being lighted. The exploders shall be regularly tested and maintained in a fit condition for use in firing. An exploder shall not be used for firing a circuit above its rated capacity. The electric circuits shall be tested for continuity before firing. All persons other than the shot-firer and his assistant, if any, shall be withdrawn from the site before testing the continuity.

For the purpose of jointing, the ends of all wires and cables should have the insulation removed for a maximum length of 5 cms. and should, then be made clear and bright for a minimum length of 2.5 cms. and the ends to be joined should be twisted together so as to have a positive metal contact.

Then these should be taped with insulation to avoid leakage when in contact with earth. In case of blasting with dynamite or any other high explosive, the position of all the bore holes to be drilled shall be marked in circles with white paint. These shall be inspected by the Contractor's agent. Bore holes shall be of a size that the cartridge can easily pass down. After the drilling operation, the agent shall inspect the holes to ensure that drilling has been done only at the marked locations and no extra hole has been drilled. The agent shall then prepare the necessary

charge separately for each bore hole. The bore holes shall be thoroughly cleaned before a cartridge is inserted. Only cylindrical wooden tamping rods shall be used for tamping. Metal rods or rods having pointed end shall never be used for tamping. One cartridge shall be placed in the bore hole and gently pressed but not rammed down. Other cartridges shall then be added as may be required to make up the necessary charge for the bore hole. The top most cartridge shall be connected to the detonator which shall in turn be connected to the safety fuses of required length. All fuses shall be cut to the length required before being inserted into the holes. Joints in fuses shall be avoided.

Where joints are unavoidable, a semi-circular niche shall be cut in one piece inserted into the niche. The two pieces shall then be wrapped together with string. All joints exposed to dampness shall be wrapped with rubber tape.

The maximum of eight bore holes shall be loaded and fired at one occasion. The charges shall be fired successively and not simultaneously. Immediately before firing, warning shall be given and the agent shall see that all persons have retired to a place of safety. The fuses of the charged holes shall be ignited in the presence of the agent, who shall see that all the fuses are properly ignited.

Careful count shall be kept by the agent and other of each blast as it explodes. In case all the charged bore holes have exploded, the agent shall inspect the site soon after the blast but in case of misfire the agent shall inspect the site after half an hour and mark red crosses (X) over the holes which have not exploded. During this interval of half an hour, nobody shall approach the misfired holes. No driller shall work near such bore until either of the following operations has been done by the agent for the misfired boreholes.

- i. The contractor's agent shall very carefully (when the tamping is a damp clay) extract the tamping with a wooden scraper and withdraw the primer and detonator.
- ii. The holes shall be cleaned for 30 cm of tamping and its direction ascertained by placing a stick in the hole. Another hole shall then be drilled 15 cm away and parallel to it. This hole shall be charged and fired. The misfired holes shall also explode along with the new one.

Before leaving the site of work, the agent of one shift shall inform the another agent relieving him for the next shift, of any case of misfire and each such location shall be jointly inspected and the action to be taken in the matter shall be explained to the relieving agent.

The Engineer-in-charge shall also be informed by the agent of all cases of misfire, their cause and steps taken in that connection.

### **8.21. General Precautions**

For the safety of persons red flags shall be prominently displayed around the area where blasting operations are to be carried out. All the workers at site, except those who actually ignite the fuse, shall withdraw to a safe distance of at least 200 meters from the blasting site. Audio warning by blowing whistle shall be given before igniting the fuse.

Blasting work shall be done under careful supervision and trained personnel shall be employed. Blasting shall not be done within 200 meters of an existing structure, unless specifically permitted by the Engineer-in-Charge in writing.

**8.22. Precautions against misfire**

The safety fuse shall be cut in an oblique direction with a knife. All saw dust shall be cleared form inside of the detonator. This can be done by blowing down the detonator and tapping the open end. No tools shall be inserted into the detonator for this purpose. If there is water present or if the borehole is damp, the junction of the fuse and detonator shall be made water tight by means of tough grease or any other suitable material. The detonator shall be inserted into the cartridge so that about one-third of the copper tube is left exposed outside the explosive. The safety fuse just above the detonator shall be securely tied in position in the cartridge. Waster proof fuse only shall be used in the damp borehole or when water is present in the borehole. If a misfire has been found to be due to defective fuse, detonator or dynamite, the entire consignment from which the fuse, detonator or dynamite was taken shall be got inspected by the Engineer-in-Charge or his authorized representative before resuming the blasting or returning the consignment.

**8.23. Precaution against stray currents :**

Where electrically operated equipments is used in locations having conductive ground or continuous metal objects, tests shall be made for stray current to ensure that electrical firing can proceed safely.

**9. ALLIED ACTIVITIES**

**9.1. Transportation of Materials :** The materials required for executing the work entrusted to the contractors against a work order shall be made available at Project Store Depot. In some cases the materials may be available at sub divisional store godown. The contractor shall be responsible for transporting the materials, to be supplied by the BBNL or otherwise to execute the work under the contract, to site at his/ their own cost. The costs of transportation are subsumed in the standard Schedule Rates and therefore no separate charges are payable on this account.

**9.2. Disposal of Empty Cable Drums :** The contractor shall be responsible to dispose of the empty cable drums after laying of the cables. The cost of various sizes of empty cable drums recoverable from the contractor has been fixed taking into account the prevailing market rates as mentioned in this document.

**9.3.** It shall be obligatory on part of the contractor to dispose of the empty cable drums at his/their level and the amount fixed for various empty cable drums shall be recovered from the bill for the work for which the drum (s) was/were issued or from any other amount due to the contractor or the Security Deposit.

**9.4.** The contractor shall not be allowed to dump the empty cable drums in Govt./Public place which may cause inconvenience to the BBNL / public. If the contractor does not dispose of the empty cable drums within 3 days of becoming it empty, the BBNL shall be at liberty to dispose off the drums in any manner deemed fit and also recover the amount fixed in this contract from the bill/security deposit/ any other amount due to the contractor.

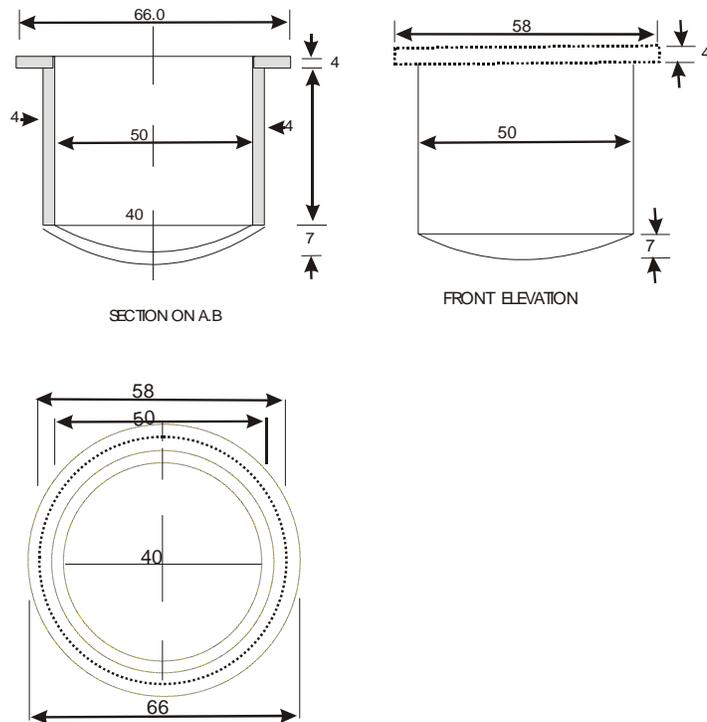
**9.5. Supply Of Materials :** There are some materials required to be supplied by the contractor for execution of work under this contract like Bricks, Cement, Wire Mesh and Steel for protection, etc., besides using other consumables which do/don't become the part of the asset. The contractor shall ensure that the materials supplied are of best quality and workmanship and shall be strictly in a accordance with the specifications .

**9.6. Social auditing:** While carrying out the execution work of cable/Eqpt. ,photography/videography may be carried out on sample basis for duration of 15 to 30 minutes per Gram Panchayat which may also involve the local people of the Gram Panchayats and villages including the Gram Panchayat Pradhan (If possible) and same may be submitted in a form of CD along with the documentation sets for information.

**Note:** All the materials as above have to be TSEC/Type approved by BSNL QA/TEC against mentioned TEC GR or as per the approval procedure of executing CPSUs for which TEC GR not there.

**Figure 1**

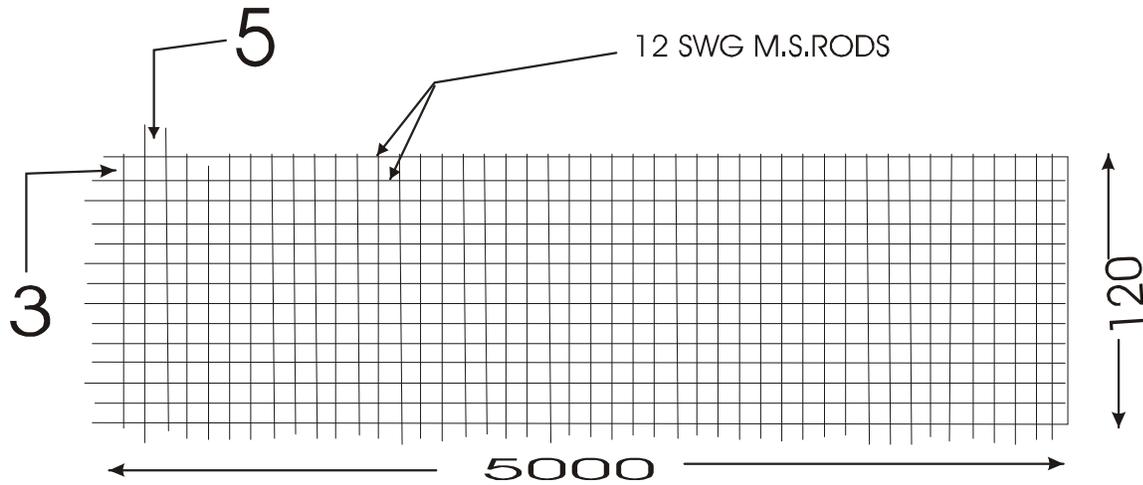
**HDPE END CAPS**



**Figure 2**

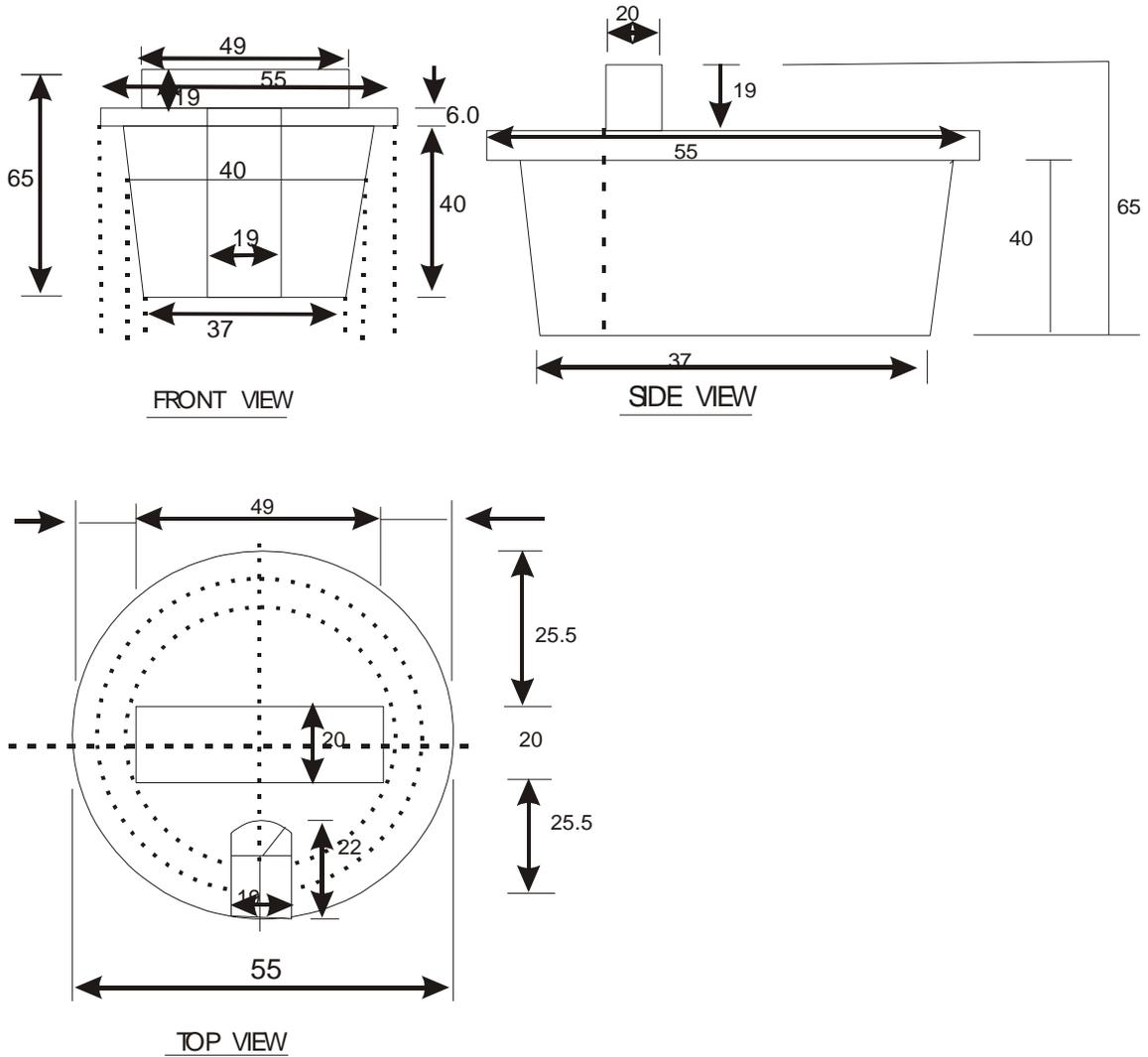
**M.S. WELDMESH**

DETAILS OF 100 MM X 50 MM, 12 SWG MILD STEEL WELD MESH HAVING WIDTH OF 120 CM.



Note : All measurements are in centimeters.

**Figure 3**  
**Rubber Cork**

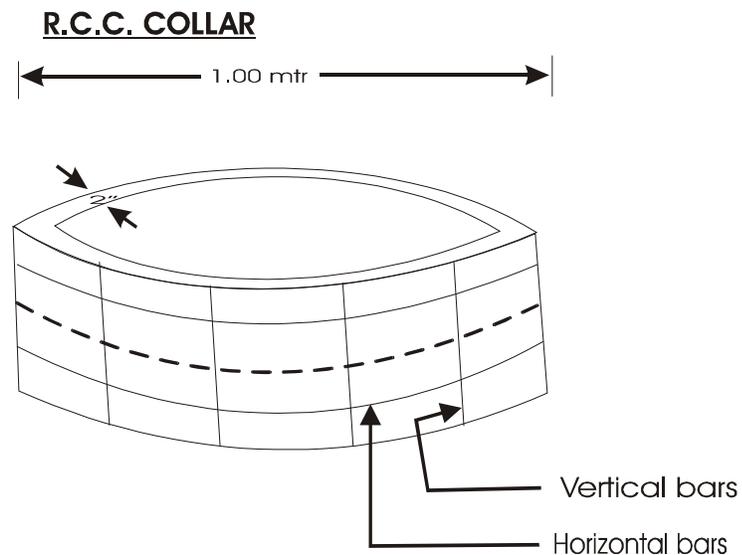


**NOTE:**

1. ALL DIMENSIONS ARE IN MM.
2. DIMENSIONS ARE ONLY FOR GUIDENCE. TAPPER SHOULD BE SUCH THAT IT SHOULD TIGHTLY FIX. INTO TYPE A & TYPE B HOPE 50 mm OO PIPES.

**Figure 4**

**SPECIFICATION AND REINFORCEMENT DETAILS OF R.C.C. JOINT PROTECTION CHAMBERS**



**Specification :**

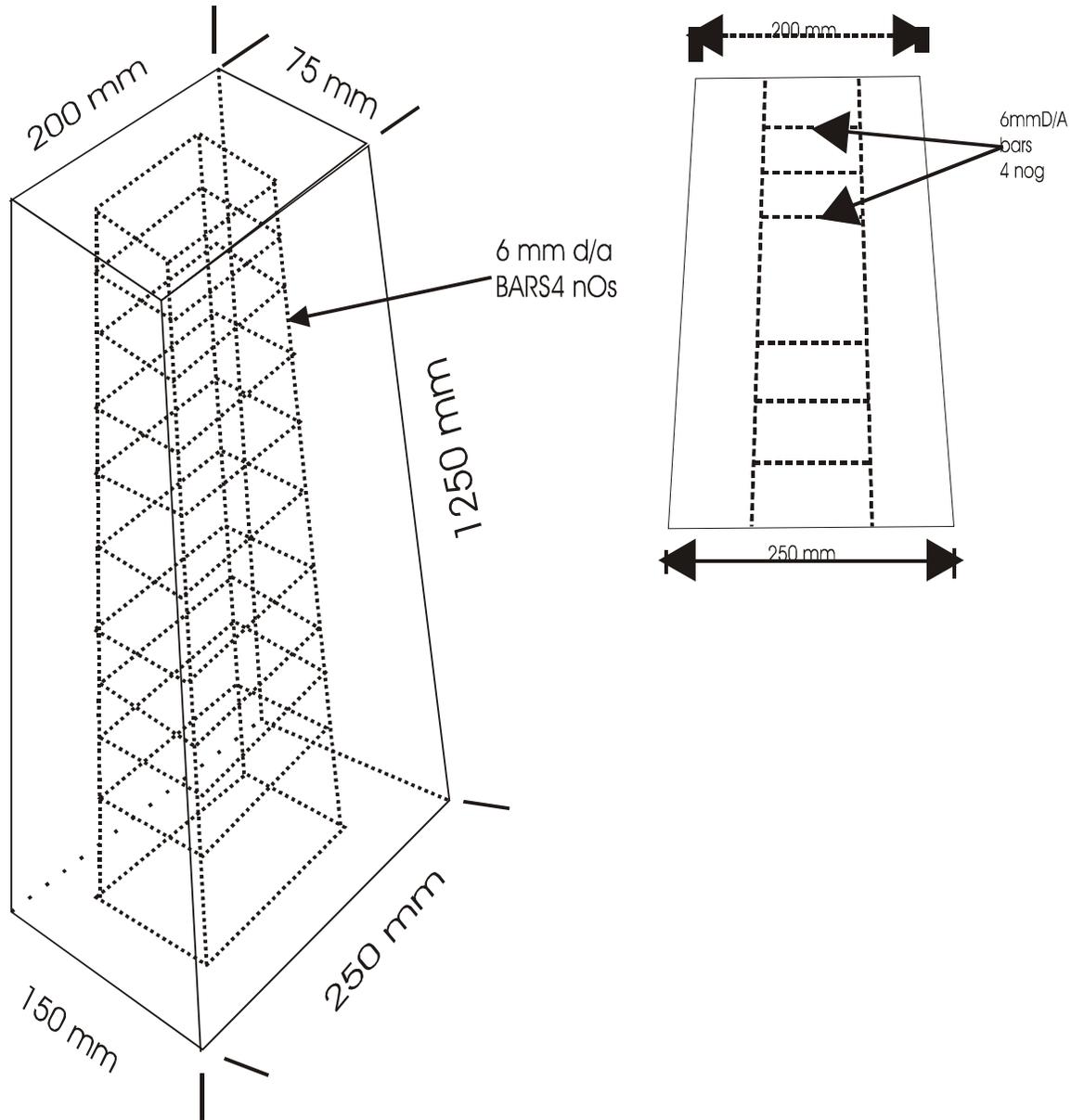
1. Diameter : 1.00 Mtr.(inner side)
2. Thickness : 5 cm.
3. Height : 50 cm.
4. 6 mm Horizontal Iron round rings – 4 Nos.
5. 6 mm vertical bars Iron – 12 mm Nos.
6. 12 gauge GI wire mesh to be wrapped before reinforcing the concrete.

**Note :**

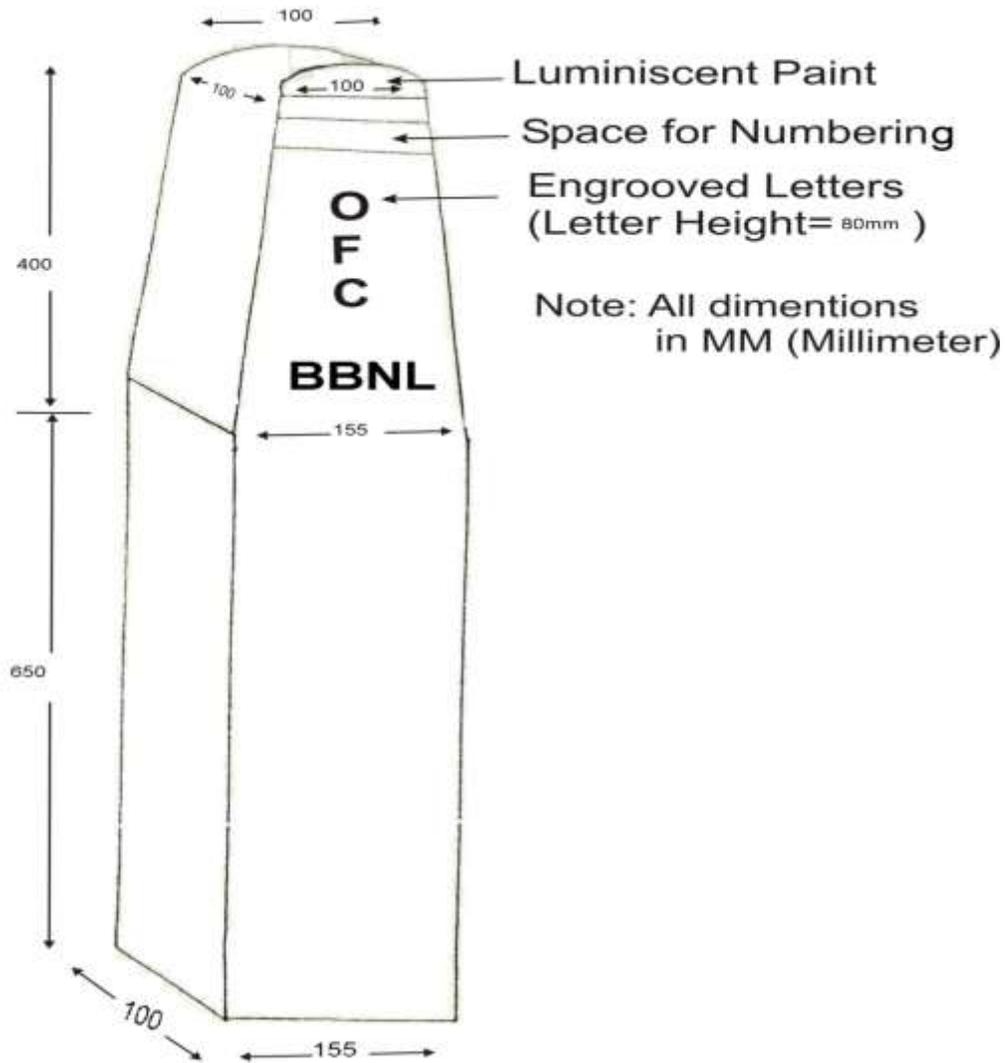
- a) Concrete 'Mix. 1: 2:3 ( 1 Cement : 2 Sand : 3 graded Stone aggregate 20 mm nominal size.
- b) Finishing : Smooth

**Figure 5**

**RCC Route Indicator**



# 1. Stone OFC Route Indicator



**Figure 6**

**Abbreviations**

1. DOT : Department of Telecom
2. BBNL : Bharat Broadband Network Limited
3. BSNL : Bharat Sanchar Nigam Limited
4. TEC : Telecom Engineering Centre
5. HDPE : High Density Polyethelene
6. DWC Ducts : Double Walled Corrugated Ducts
7. GI pipe : Galvanized Iron Pipe
8. ASTM : American Society for Testing and materials
9. GR : Generic Requirement
10. CACT : Component Approval Centre for Telecom
11. RCC : Reinforced Cement concrete