ETHEKWINI MUNICIPALITY

FIBRE OPTIC STANDARDS

Part 1

INSTALLATION OF COMMUNICATION TUBING FOR UNDERGROUND FIBRE OPTIC CABLE

Part 2

INSTALLATION OF UNDERGROUND FIBRE OPTIC CABLE INTO COMMUNICATION TUBING
1. INTRODUCTION

1.1 Scope

This document details the requirements for the installation of underground communication tubes to house fibre optic communication cables.

This includes the installation of the manholes along the route, which are required to facilitate the future pulling-in of fibre optic cable and for future fault finding and maintenance.

1.2 Order of Description

This order of description for this part of the standard is as follows:

- Definitions
- Specification of Materials
- Laying Communication Tubes for Underground Fibre Optic Links
- Handover Requirements After Laying of Communication Tubes

Specifications for these components of the Fibre Optic System follows:

2. DEFINITIONS

**Communication Tubes:** The underground tubing, as specified by the MetroConnect Engineer, through which fibre optic cable is pulled for the establishment of communication links between two points.

**Communication Manholes:** The manholes, which are either designed for use within a pavement area or for use within the roadway itself, which are situated along a route and connected by communication tubes.

**Fibre Communication Panel (FCP):** The panel within a substation where the fibre optic cable is terminated into a patch tray, and made available for optical connection to various optical
Manhole Ball Markers: A device which is attached to the inside of a manhole cover, which together with a sensor carried by an operator, is used to pinpoint the exact location of the manhole beneath the surface of the ground.

3. SPECIFICATION OF MATERIALS

The materials include Tubing, Manholes and Manhole Ball markers. Details of the materials to be used are as follows:

3.1. Specification of Communication Tubes

Communication Tubing installed between the last manhole positions on each side of an underground communication route must be 110mm, cream, hard drawn polyetherlene (HDPE) tubing with rodent repellent additives (DN110).

Sections of HDPE tubing must be joined using water-tight pipe couplers.

3.2. Specification of Communication Manholes

Manholes within roadways are to be of precast concrete or brick, and are to be located, constructed and installed according to the City Engineering Unit’s requirements and specification.

Manhole covers must be polymer in construction and be lockable.

3.3. Specification of Manhole Ball Markers to Pinpoint Communication Manholes

New technology location devices/ antennae /ball markers (3M code 14014 orange) are to be hung inside each manhole and used to locate manholes after construction has been completed.
4. INSTALLATION OF COMMUNICATION TUBING ROUTES

This includes the installation of the communication tubing itself, the communication manholes and the ball markers.
Please read **ANNEXURE A: EXCAVATION CODE OF PRACTICE** carefully.

4.1. Excavation and laying of Communication Tubing

The Contractor shall be responsible for all trenching excavations unless specified to the contrary.

The Contractor shall, before trenching commences, familiarize himself with the routes and site conditions. The procedure and order of doing the work shall be planned in conjunction with the general construction program for other services and building requirements.

The Contractor shall acquaint himself with the position of all the existing services such as storm water pipes, water mains, sewer mains, gas pipes, telephone cables and obtain the necessary Wayleaves etc. before any excavations are commenced. For this purpose he shall approach the appropriate Municipal authority and any other authority which may be involved. Special attention is drawn to GAS and PETROL pipelines that does not belong to Ethekwin Municipality.

The Contractor will be held responsible for damage to any existing services brought to his attention by the MetroConnect Engineer and shall be responsible for the cost of repairs.

The Contractor shall take all the necessary precautions in terms of the OHS Act and Construction Regulations. The contractor shall provide the necessary warning signs and/or lights in accordance with the City Engineers specification for signage at roadworks to ensure that the public and/or employees on site are not endangered. Provision must also be made for reasonable, continuous and all weather pedestrian access with due regard for pedestrian safety.

The Contractor shall ensure that the excavations will not endanger existing structures, roads, railways, other site constructions or other property. Excavations should also not endanger motorists or pedestrians.

In such instances where it is proposed to use an existing bridge structure to carry ducting, approval in writing shall be sought by the Contractor with the Roads Provision Department, Structures Branch. Under no circumstance shall the structure be cut, cored, or modified in any way without prior approval from the Roads Provision Department.
Trenches shall connect the points in a straight line. Any deviations due to obstructions or existing services will need the prior approval of the MetroConnect Engineer.

The MetroConnect Engineer reserves the right to alter any cable route or portion thereof in advance of cable laying. The removal of obstructions along the cable routes shall be subject to the approval of the MetroConnect Engineer.

Cable trenches for one or two 110 mm Sleeves shall not be less than 300 mm wide and need not be more than 450 mm wide. These dimensions must be maintained for the entire trench depth.

The width shall be increased where more sleeves are installed to allow for spacing of 50 mm between sleeves.

*Sleeves will be installed at a minimum depth of 600 mm on sidewalks and verges, and 1 metre in roadways, measured from surface level to the most upper surface of the laid sleeve. The Contractor may need to adjust trench depths to accommodate bedding where required. Trench depths below the minimum specification shall require written permission from the Roads Department which shall be acquired by the Contractor.*

The padding and bedding materials will be sieved to a maximum aggregate size of 10 mm.

The backfill will be excavated material, large objects may not be dumped and compacted into the trench.

Removal of rubble is the responsibility of the Contractor.

*Re-instatement of asphalted and paved areas will be done by Roads Department & Stormwater Maintenance, unless otherwise agreed. Submission of the necessary documentation by the Contractor for permanent road reinstatement must be prompt to ensure that trenches are repaired timeously.*

All trench depth measurements shall be made to the top of the sleeve when laid, ready for backfill.

The MetroConnect Engineer reserves the right to inspect the installation at any stage during the course of construction. Such inspections will, however, not deem the portions inspected as being complete or accepted and the Contractor shall remain responsible for completing the installation fully in accordance with the Contract Documents.

### 4.2. Laying of Communication Tubes within Electricity Substation Perimeters
Two tubes as specified in Section 3.1 are to be laid unless otherwise specified by the MetroConnect Project Engineer.

Where communication tubes are to be installed into the same trenches opened for the laying of supply cables, the tubes must be laid at the same depth as the supply cables. There should be some spacing between the tubes and the cables to prevent excessive heating of the communication tubes in the event of a fault occurring in the supply cable. Tubes may be laid together with copper pilot cables.

Where trenching is specifically for the installation of communication tubes, the two tubes as specified in Section 3.1 must be buried not less than 0.8m deep (preferably 1m) for the entire route.

Tubes laid within substations must be laid within the substation trenches, where practical. Where large bending radii permit, the above HDPE tubing may also be installed from the last manhole position into the trench inside a substation building. If the required bends into the substation building are too tight for the HDPE, or where the route terminates into an FCP, then corrugated 50mm diameter DN50 Kabelflex conduit mentioned in Section 3.1 must be used for the last section of the link. (Stock Code 101048 available from Electricity stores).

Correct water-tight pipe couplers between sections of communication tubing (Stock code 105171 available from Electricity stores) must be used to prevent ingress of moisture and mud. Connections between HDPE and DN50 Kabelflex must also be water-tight.

4.3. Laying of Communication Tubes into same Trenches opened for other Utility services

Where communication tubes are to be installed into the same trenches opened for the laying of other utility services (new water pipes/new electrical cables), the tubes must be laid at the same depth as the other utility services. There should be some spacing between the tubes and the existing cables to prevent excessive heating of the communication tubes in the event of a fault occurring in the electrical cable. Tubes may be laid together with copper pilot cables.

4.4. Installation of Communication Manholes

Communication manholes, as specified in Section 3.2 are to be placed at 200m intervals or less. Manholes are also to be installed where the cable bends beyond 30 degrees.

Communication tubes must be well sealed at entry/exit points of the manhole. All tubing
ends within the manhole must be sealed with the proper supplier's endcaps.

4.5. Installation of Ball Markers

Communication Ball Markers as specified in Section 3.3 must be hung from the inside of the manhole cover to facilitate the future location of all joints and manholes. The Communication Ball Marker must be attached close to the lid where it may be detected, with rot resistant nylon fibre string. Alternatively it may be attached via a cable tie onto a short loop of galvanised wire made to protrude into the manhole and secured at the time when the lids are filled with cemented.

4.6. Joining between Communication Tubing and overhead Optical ground Wire (OPGW).

There may be instances where the route requires a sections or sections which are overhead. This requires a joint between communication tubes and overhead Optical Ground Wire (OPGW).

In these instances the approved stainless steel dome jointboxes must be mounted onto the top of a vertically installed 2m high, 50mm diameter stainless steel pipe buried 0,8m into the ground. The pipe must be secured to the inside of the tower leg/ just off the gantry or pylon leg, using an approved stainless steel bracket.

Sufficient additional OPGW slack is to be coiled and secured above the Anti-climbing gear on the OPGW side of the joint prior to splicing, to enable the joint to be worked on at least 5m from the base of the tower/ gantry.

Where HDPE is run to the joint position and not DN kabelflex, a length of DN50 Kabelflex tubing must be joined to the HDPE tubing, which will be inserted into the base of the stainless steel pipe during the splicing process. Joints must be taped with self amalgamating rubber tape to prevent the ingress of moisture and sand. Approximately 5m of DN50 Kabelflex slack must be retained at the base of the stainless steel tube.

5. HANDOVER REQUIREMENTS AND PROCEDURES

The following paperwork must be completed and handed over to the MetroConnect Project Engineer before handover and before payment may be authorized. Careful attention must be made to Annexure C, which outlines the format of the GIS data.
that needs to be submitted to the MetroConnect Project Engineer. This needs to form part of the 'as-built' documentation.

5.1 Documentation of Route

The entire tubing route, all manholes and all joint positions must be properly surveyed and co-ordinates marked on the associated Drawing Plans and forwarded to the MetroConnect Office for capture into the drawing office database, to facilitate future fault location.

A copy of the final ‘as-built’ drawing and the completed "Communication Tubing Handover Form" form detailed in ANNEXURE B must be forwarded by the MetroConnect Project Engineer/ Supervisor overseeing the installation and to the Deputy Head: Networks and Telecommunications.

5.2 Completion of Communication Tubing Handover Form

The contractor/ cable layer is to ensure and confirm that the tubes have been laid according to the specifications and any additional requirements stipulated by the MetroConnect Office/Project Engineer.

The "Communication Tubing Handover Form" detailed in ANNEXURE B shall be completed and returned to the appointed Clerk of Works/ Project leader of MetroConnect after completion and at handover of the work.
ANNEXURE A: EXCAVATION CODE OF PRACTICE

1. Excavation, Backfilling and Reinstatement of Trenches within Road Reserve Areas
   1.1 Excavation of Trenches
   1.2 Suitable backfill material
   1.3 Use of the “Dynamic Core Penetrometer” (D.C.P) and Test Requirements
   1.4 Compacting the trench bottom
   1.5 Initial backfill (Blinding)
   1.5.1 Initial Test using D.C.P
   1.6 Final Backfilling
   1.6.1 Final Test using D.C.P
   1.7 Trenches in verge areas
   1.8 Responsibility for maintenance of the trench and final reinstatement
   1.9 Surplus material
   1.10 Service Related structures
EXCAVATION, BACKFILLING AND REINSTATEMENT OF TRENCHES WITHIN ROAD RESERVE AREA

The procedures outlined are to be followed whenever trenches within road reserve areas are reinstated, irrespective of the work being carried out by contract labour or by department personnel.

1.1 Excavation of trenches within road reserve

(a) Trench-less technology methods for road crossings shall be explored by the Contractor prior to trenching. This must be considered only as a last resort and permission must be sought by the Contractor from the Roads & Stormwater Maintenance Department before proceeding with any work.

(b) Prior to any excavation taking place through hardened surfaces, the proposed trench width shall be marked and saw cut by mechanical means by the Contractor.

(c) The minimum depth of any trench should be not less than 600 mm on sidewalks and verges, and 1 metre in roadways. Any deviation from this requirement must first be authorised by the Roads & Stormwater Maintenance Department by the Contractor.

(d) In areas covered with special pavers through which trenching is required, the existing paving shall be carefully removed and stored safely and securely for re-use. This will minimize the need for obtaining new materials to match the existing.

(e) In areas where the proposed trench falls within existing works that are being undertaken by any other service provider, it shall be necessary for the responsible official from eThekwini Municipality and the Contractor to liaise and interact with such service providers for co-ordination and reinstatement purposes.

(f) In areas where the proposed trench traverses through established flowerbeds, gardens and grassed sections, it shall be necessary for the responsible official from eThekwini Municipality and the Contractor to liaise and interact with the owners or relevant authority, prior to any work commencing.

(g) In developed and CBD areas, all property owners and businesses shall be informed by the Contractor of the proposed works prior to any work
commencing.

(h) All road/lane closures must first be authorised by the Ethekwini Transport Authority & the Durban Metro Police by the Contractor.

Correct reinstatement by the Contractor of all trench work is necessary to prevent subsidence, but in the case of trenches within hardened surfaces i.e. (Roadways, Footpaths etc..) extra special attention must be paid by the Contractor to the correct method of “compacted layered” backfill.

Strict adherence to the procedures given in this Section will ensure the satisfactory temporary reinstatement of the trench, leading to early permanent reinstatement by the appropriate authority.

2 Suitable Backfill Material

(a) General backfill can be carried out by using the material excavated from the trench, provided that:
   (i) it is easily workable and compactable
   (ii) it is free from organic material (roots, grass etc) rubbish, clay lumps and aggregates larger than 50 mm stones in diameter.
   (iii) the material is suitable, is not water saturated or too dry. Should the material be too dry, it will be moistened prior to placing and compacting.

(b) In the immediate vicinity of the duct or cable both below and up to a height of 300mm above, stone-free material must be used. (Beach and river sand are not suitable due to their high thermal resistivity).

(c) If the site materials cannot meet these requirements suitable material must be imported.

1.3 Use of “Dynamic Core Penetrometer” (D.C.P)

(a) To ensure that the required compaction of the trench has been achieved, tests must be carried out by the Contractor at various levels.

(b) The tests are carried out using a D.C.P which consists of a metal rod with a cone-shaped end with an anvil onto which a fixed weight falls through a set distance. (Drawing No.:1)

(c) The cone-shaped end of the rod is placed on the area to be tested, the weight is raised to the pre-set height and then dropped through the set distance onto
the anvil. The force of the weight will cause the rod to penetrate the soil.

(d) The number of blows required for the rod to penetrate to a distance of 100 mm into the soil indicates the degree of compaction of the soil.

(e) The following test results are deemed to be acceptable, as minimum requirements for compaction of trench backfill using D.C.P test method:

   (i) in roadways – 5 blows per 100 mm penetration
   (ii) in footpaths, driveways and medians – 3 blows per 100 mm penetration
   (iii) in verges – 2 blows per 100 mm penetration

**NOTE:** The greater the number of blows required to penetrate the 100 mm the better the soil compaction at the point of the test.

1.4 **Compacting the Trench Bottom**

(a) Compaction of suitable bedding material can be achieved by making two passes over the whole trench bed, preferably using a Power Vibrating Rammer or a 5 kg hand rammer as an alternative.

(b) The cable or duct can then be laid on the prepared bed.

1.5 **Initial Blinding (Backfilling)**

(a) After the duct(s) or cable(s) have been laid, suitable blinding material should be placed around them, and the blinding material should be brought up to a level not exceeding 150 mm.

(b) The material should be equally placed on both sides of the duct(s) or cable(s) and each layer should then be well and carefully compacted by making five complete passes over the length of the trench, using a 5 kg hand rammer.

**NOTE:** Do NOT use a vibrating rammer at this stage as the ducts(s) or cable(s) could easily be damaged.

(c) Further layers, each not exceeding 150 mm thickness should now be spread, leveled and compacted by making five complete passes over the layer, still using the hand rammer, until the duct or cable is covered by well compacted blinding material to a height of 300 mm above the top of the duct(s) or cable(s).
NOTE: If ducts are laid in a cluster the blinding material must be brought up in layers of 150 mm until a cover of 300 mm above the top duct is obtained.

1.5.1 Initial Test using D.C.P

Tests carried out at this stage, i.e. 300 mm above duct(s) or cable(s), using D.C.P, would be considered satisfactory if at least two blows are required to penetrate 100mm.

NOTE: Tests must be carried out to one side of the duct or cable, and not immediately above.

1.6 Final Backfilling and Temporary Capping

(a) From the level of 300 mm above the duct or cable to the top of the trench, backfilling should proceed using suitable material (Section 1.2), with layer thickness now being increased to 200 mm (before compaction).

(b) Each layer should be thoroughly compacted by making four complete passes over the whole trench area with a Power Vibrating Rammer.

(c) Trenches located in roadways shall be finished off with capping of either cold asphalt (50 mm thick) or 10 MPa strength concrete mix (100 mm thick), placed and compacted to serve as a temporary riding surface.

1.7 Trenches in Verge Areas

(a) The final 75 mm -100 mm of trench backfill shall comprise of an organic/topsoil type material, placed and leveled off flush with the surrounding ground level. No humps and bumps shall be permitted.

(b) All loose stones and other obstructions shall be removed to spoil.

(c) A suitable ground cover shall be established over the trench width.

1.8 Responsibility for Maintenance of the Trench and Final Reinstatement
(a) On completion of the backfilling a requisition must be created by the Contractor. A service order will be then generated by Buying Department and forwarded to the appropriate Local Authority, for permanent reinstatement of the trench surface.

(b) As the responsibility for the maintenance of the trench in the period between the initial backfilling and final reinstatement is that of the Department, failure by the Contractor to meet the compaction standards could lead to unnecessarily long periods where a trench would be open to traffic. This could give rise to dangerous conditions particularly where the trench surface is exposed to the attrition of heavily vehicular or pedestrian traffic.

(c) Trench Reinstatement by Contractors – where trench reinstatements are undertaken by contractors, requirements of Part S of the City of Durban Civil Engineering Specifications shall be complied with.

NOTE: Where the excavation is carried out within the eThekwini Municipal area, these additional clauses are applicable:

(i) The Roads and Stormwater Maintenance Department reserves the right to test the trench using a D.C.P to check the compaction of differing depths below ground level.

(ii) If the D.C.P indicates that the number of blows required to penetrate 100 mm into the soil at any zone in the trench profile is less than that specified in Clause 1.3(e), the trench will not be reinstated and the Department will be notified to take the necessary remedial action. Only after the trench has been tested and passed shall the final reinstatement be carried out.

1.9 Surplus Material

All surplus material from trench excavation must be removed by the Contractor to a designated spoil site. Should excavated material remain on site for backfill purposes, it shall be adequately barricaded. Should excavated material end up in the Municipality’s storm water infrastructure, it will be removed at the responsible party’s expense.
1.10 **Service Related Structures**

(a) All structures such as manholes, chambers, earth retainers and connecting junction boxes shall be constructed to a design approved by the relevant department.

(b) All exposed vertical surfaces above ground shall be either of a face brick or concrete off shutter finish.

(c) Where earth retainers such as loffelstein blocks are used, it shall be erected to the manufacturer’s guidelines and specifications.

(d) The finish level on manhole covers shall be true horizontal with the surrounding levels modified to tie in.

**ACKNOWLEDGEMENT**

The contents of “A Practical Guide to Trench Backfilling and Compaction”, issued by the Construction Division, City Engineer’s Department, have been used extensively in compiling this Code of Practice.
DYNAMIC CONE PENETROMETER FOR TESTING REINSTATEMENT OF TRENCHES WITHIN HARDENED SURFACES

HAMMER FALLS ONTO ANVIL

ANVIL

CONE

HAMMER (MILD STEEL)
MASS 9.0 KG

<table>
<thead>
<tr>
<th>DRN : D.J.P.</th>
<th>Drawing 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHK</td>
<td>CP 2.051</td>
</tr>
<tr>
<td>APP NPA</td>
<td>Rev 0</td>
</tr>
</tbody>
</table>
ETHEKWINI MUNICIPALITY

FIBRE OPTIC STANDARDS

ANNEXURE B: COMMUNICATION TUBING HANOVER FORM

Preamble

This checklist is to completed and signed in sequence by the Contractor/ Consultant or installer, once installation of the tubing has been completed, and handed to the appointed MetroConnect Clerk of Works/ Supervisor.

<table>
<thead>
<tr>
<th>LINK DESCRIPTION: Contract No./ Order No.: .................................</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>End A</strong></td>
</tr>
<tr>
<td>Total Length of Route</td>
</tr>
<tr>
<td>Average length between manholes</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Complies (Y/N)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>Manholes are positioned within 200m of each other.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b.</td>
<td>Manholes are positioned at bends greater than 30° in the route to facilitate the pulling of the fibre cable.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c.</td>
<td>GPS coordinates of all Manholes and ducts to be supplied with as built documents</td>
<td></td>
<td></td>
</tr>
<tr>
<td>d.</td>
<td>New technology 3M code 14014” orange location devices/ antennae have been correctly installed and attached to the inside of the manhole cover with nylon string or suitable alternative.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>e.</td>
<td>The tubing used has been approved by MetroConnect Engineer.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>f.</td>
<td>All tubing into the manhole has been sealed with proper supplier’s end-caps.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>g.</td>
<td>An ‘as-built’ diagram of the entire tubing route, showing the surveyed position of all manholes, and the manholes which accommodate joints has been submitted to the MetroConnect Engineer.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Completed By:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>--------------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Name</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Company</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Date</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Annexure C
GIS Data Specification

1. Introduction

This document, together with other referenced documents, defines the responsibilities and procedures to be adopted to ensure that the data and information produced as part of Project No........................................ are reliable, fit for purpose and consistent with documented objectives and deliverables. It provides the details regarding the structure and specifications for all Geographic Information Systems (GIS) data supplied as part of the project deliverables.

2. Deliverables

Complete and verified Spatial Data for Fibre Installation projects shall be delivered via CD-ROM or DVD or any other method approved by the MetroConnect project manager. CD/DVD should be in - R format, so that it cannot be modified. The deliverables must include the following:-

a) Descriptive document

b) Geospatial (GIS) data with relevant attributes

c) Associated data table(s) or relational Microsoft Access database

d) Federal Geographic Data Committee (FGDC) compliant metadata

a) Descriptive Document

A Microsoft Word document (and/or ASCII text file if specified) describing the CD/DVD contents shall accompany any submission and provide all necessary information for understanding the submittal. The document should include, but is not limited to, the following:

i. Project information including Project name, Project Number, Date of Project commencement and completion, Internal Project Manager (MetroConnect Official), Service provider’s project leader and contact details, Other relevant team members include the GIS technical person.

ii. Contents of the CD/DVD and/or .zip file;

iii. Description of the project, including all related deliverables, any project codes and drawings;

iv. Version and date of the data and reports;

v. Information on the use of data or data issues to note;(if any exist or as appropriate)

vi. Contact information for those responsible for creating the data and who have the responsibility for maintaining the master version of the data

vii. A short description of data themes or layers, reports, tables (limited to one to two sentences for each)
viii. Linking fields to documents, a Microsoft Access database, and/or digital photographs)

b) Geospatial (GIS) Data

All Geospatial (GIS) data shall be supplied in shapefile format. The shapefile format should include, at a minimum, the .SHP, .DBF, .SHX, and .PRJ files. The following projection parameters shall be used for all Geospatial data supplied:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spheroid</td>
<td>GRS 1980</td>
</tr>
<tr>
<td>False Easting</td>
<td>0</td>
</tr>
<tr>
<td>False Northing</td>
<td>0</td>
</tr>
<tr>
<td>Central Meridian</td>
<td>31.0</td>
</tr>
<tr>
<td>Scale Factor</td>
<td>1.0</td>
</tr>
<tr>
<td>Latitude of Origin</td>
<td>0.0</td>
</tr>
<tr>
<td>Units</td>
<td>Meters</td>
</tr>
</tbody>
</table>

In general, the standard projection for GIS layers is Universal Transverse Mercator with the parameters for the WGS84 ellipsoid.

c) Attribute Data

All related attribute data specified below shall be contained in the .dbf file.

**Dataset_Cables**

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Type</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>CableID</td>
<td>Text</td>
<td>14</td>
</tr>
<tr>
<td>LinkID</td>
<td>Text</td>
<td>12</td>
</tr>
<tr>
<td>CableType</td>
<td>Text</td>
<td>8</td>
</tr>
<tr>
<td>FibreType</td>
<td>Text</td>
<td>8</td>
</tr>
<tr>
<td>NoOffFibres</td>
<td>Long</td>
<td>8</td>
</tr>
</tbody>
</table>

**Dataset_Links**

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Type</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>LinkID</td>
<td>Text</td>
<td>12</td>
</tr>
<tr>
<td>CPCCodeFrom</td>
<td>Text</td>
<td>6</td>
</tr>
<tr>
<td>CPCCodeTo</td>
<td>Text</td>
<td>6</td>
</tr>
<tr>
<td>Length</td>
<td>Double</td>
<td>19</td>
</tr>
</tbody>
</table>

**Dataset_Fibres**

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Type</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>CableID</td>
<td>Text</td>
<td>14</td>
</tr>
</tbody>
</table>
All other additional attributes shall be delivered in a well-structured **Microsoft Access** database format (.MDB file) using the latest version of Microsoft Access. Map features and database records shall share a common unique identifier or primary key that relates the map feature to the database record.

### d) Metadata

All data submitted shall include metadata that meets the minimum content standard for metadata. The metadata must be located in the same directory as the data, share the same naming prefix, and when appropriate, be attached to that data. The metadata should be delivered in extensible markup language with an .XML extension.

### 3. Conclusion

For any additional information regarding the specifications for GIS data, the contractor is free to consult the GIS Database Administration Manager

Mr Dennis Bodeker on bodekerd@durban.gov.za or 031 311 4058
PART 2

TECHNICAL SPECIFICATION FOR
INSTALLATION OF UNDERGROUND FIBRE OPTIC CABLE INTO COMMUNICATION TUBING

6. INTRODUCTION

1.1 Scope

The purpose of this document is to detail the requirements for the pulling of underground fibre optic cable into existing communication tubes, and the handing over of the completed link.

1.2 Order of Description

This order of description for this part of the standard is as follows:

- Definitions
- Testing of Cable prior to delivery.
- Pulling in of underground fibre optic cable
- Splicing
- Handover Requirements After Laying of Communication Tubes

Specifications for these components of the Fibre Optic System follows:

7. DEFINITIONS

Communication Tubes: The underground tubing, as specified by the Engineer, through which fibre optic cable is pulled for the establishment of communication links between two points.

Communication Manholes: The manholes, which are either designed for use within a pavement area or for use within the roadway itself, which are situated along a route and connected by communication tubes.
Fibre Communication Panel (FCP): The panel within a substation where the fibre optic cable is terminated into a patch tray, and made available for optical connection to various optical equipment.

Manhole Ball Markers: A device which is attached to the inside of a manhole cover, which together with a sensor carried by an operator, is used to pinpoint the exact location of the manhole beneath the surface of the ground.

Jointbox: An approved sealed enclosure used to secure and accommodate splices made between two sections of fibre. In the case of an enclosure contained within a manhole, this will be of high density polyethylene, (eg. Tank Technologies TFO B30000/0B Fibre Optic Dome. In the case of a jointbox to be positioned in the air, this is made of stainless steel (eg. Nokia Dome Joint).

8. PULLING OF UNDERGROUND FIBRE OPTIC CABLE

The pulling of cable proceeds after the installation of the communication tubes. This process may begin only once it has been confirmed that the communication tubing, including installation of communication manholes and manhole ball markers, and documentation, has been completed according to the standard set by eThekwini Municipality.

3.1. Attenuation Tests prior to Pulling

Attenuation tests shall be carried out on every fibre of the cable while still on the drum to confirm that the fibre drums are in good order after delivery and have been received by the contractor/installer, prior to pulling.

Cables with an average attenuation at 1550nm above 0.25dB/km, or above 0.35dB/km at 1300nm, shall not be accepted. In addition, fibres with any points or steps of discontinuity greater than 0.04dB shall also be unacceptable.

The form used to confirm the results of the attenuation test is provided in Annexure B.

3.2. Pulling of Sections

One underground fibre cable is to be used per tube. Fibre cable is to be pulled from communication manhole to communication manhole.

Utmost care must be taken to ensure against over-bending and over-tensioning the cable in the process of pulling. It should be noted that the drawer wires/fibre supplied in the communication tubing must not be used to pull through the actual fibre cable. Instead a
rope, or a more robust drawer wire which must be used to pull the actual cable. A pulling lubricant may be used provided this has no detrimental effect on the cable or PVC pipes/ducts.

The cables must be hand pulled, mechanical pulling devices may only be used with explicit approval and under direct supervision of the Engineer.

Every care must be taken to prevent damage to existing cables/services whilst installing new cables.

The cable must be manhandled at every manhole along the way to prevent unnecessary drag on existing services.

Cable lubrication may be necessary when installing in occupied ducts provided this has no detrimental effect on the cable or PVC pipes/ducts.

The cable should be pulled with a continuous rhythmic motion, sharp jerks must be avoided.

At least 5 metres of slack must be looped and retained within each communication manhole.

At least 5 metres of slack should be looped at the base of the tower/gantry leg where Underground fibre optic cables need to join onto Optical Ground Wire (OPGW).

Self-expanding polystyrene type foam shall be injected into the communication tube openings after the cable has been pulled to seal the ends of the tubes and to stop the ingress of sand, rodents, etc.

3.3. Splicing

Splicing must only be carried out using equipment that has been approved by eThekwini Municipality.

The identification of cores is according to an international numbering convention as detailed in ANNEXURE A (Part 2).

Descriptions of the various splicing scenarios follow:

3.3.1 JOINTING AND SPLICING BETWEEN SECTIONS OF UNDERGROUND FIBRE OPTIC CABLE

Fibres must be fusion spliced, and must have a loss equal or less than 0.05dB.
An approved fibre optic jointbox (eg. Tank’s TFOB30000/0B Fibre Optic Dome Jointbox) must be used to contain the splices between two sections of underground fibre optic cable. The jointbox must be accommodated within a communication manhole.

Jointing within the box must be carried out strictly according to the suppliers specification. Joint boxes must be suitably sealed to prevent ingress of moisture, and waterproof to a submerged depth of 2 metres.

At least 4 metres of slack from each end should be coiled neatly into the manhole to allow staff to work on the joint above the ground within an enclosure or vehicle.

### 3.3.2 JOINTING AND SPLICING BETWEEN SECTIONS OF UNDERGROUND FIBRE OPTIC CABLE AND OVERHEAD OPTICAL GROUND WIRE (OPGW)

Joints between OPGW and Underground fibre optic cable sections must be housed within a stainless steel jointbox approved by eThekwini Electricity.

The approved stainless steel jointbox must be mounted onto the top of a vertically installed, 2 metres high, 50mm diameter stainless steel pipe buried 0.8 metres into the ground. The pipe must be secured to the inside of the tower leg/ just off the gantry leg or pylon using the approved stainless steel bracket supplied by eThekwini Electricity.

DN50 Kabelflex tubing for the underground fibre cable must be inserted into the base of the stainless steel pipe. Where the communication tubing is hard drawn polyetherlene (HDPE), the DN50 Kabelflex and the HDPE tubing must be watertight and taped with self amalgamating rubber tape to prevent the ingress of moisture and sand.

The top of the pipe must be sealed with self expanding polystyrene type foam, (‘Sista’), to prevent ingress of water.

Jointing within the box must be carried out strictly according to the suppliers specification. The correct cable clamping ferrules and half shells at the base of the joint must be used. Jointboxes must be suitably sealed to prevent ingress of moisture.

### 3.3.3 TERMINATION OF UNDERGROUND FIBRE OPTIC CABLE INTO FIBRE OPTIC STANDARDS
COMMUNICATION PANEL (FCP)

Both the underground fibre optic cable and the communication tubing in which the cable runs must be properly terminated at the FCP into designated locations at either end of the link.

The individually coloured fibre cores must be numbered according to international numbering convention as detailed in the physical specifications of eThekwini Municipality.

The optic fibres of the fibre transmission link must be fusion spliced to the pigtails provided in the patching tray/ drawer of the Fibre Communication Panel (FCP) at the termination point, using a core aligning machine. The attenuation across splices must not be greater than 0,05dB.

The connectors at the front of the patch tray must be labelled with the name of the source, or source substation, and the cores numbered. This label must be black lettering on a white background.

Singlemode fibre ends will terminated using LX.5 APC connectors and midcouplers.

4. HANDOVER REQUIREMENTS AND PROCEDURES

Handover occurs once the contractor/installer of a link has completed the installation, when all splices have been completed and when the contractor has fully tested and proved the fibre link, from termination point to termination point. A termination point is a patch panel within the Fibre Communication Panel (FCP) at a substation, unless otherwise specified by eThekwini Electricity.

4.1 Test Equipment

The test instrument used for the testing of fibre transmission links must be an Optical Time Domain Reflectometer (OTDR), approved by eThekwini Electricity.

4.2 Red Light-source test

A red light source must be used to check for basic continuity and to ensure that there are no cross-overs between termination points.
4.3 Attenuation Tests

Attenuation tests and tests shall be carried out from end to end on every fibre after pulling and splicing.

At handover the average attenuation for the link, at 1300nm, shall not be greater than 0.4dB/km. At 1550nm the average attenuation shall not be greater than 0.25dB/km.

4.4 Optical Time Domain Reflectometer Tests

Each core must be tested using the approved OTDR from each side of the link, at 1550nm and at 1310nm. The report shall also include labels describing the physical location of any events of the route.

Losses and reflectances shall proved to have been minimized.

4.4 Handover Documentation

The documentation required at handover and prior to payment are as follows:

- The completed “Completion Form for Underground Optical Fibre Link” as detailed in ANNEXURE C
- Copies of the results of the OTDR tests on CD and on hard copy
- Details of the helix factor, the index of refraction, and the Rayleigh backscatter factor of the fibre cable used.
- Complete GIS drawing of all new fibre installed (SEE Part 1: ANNEXURE C, for GIS specification).

Copies of this documentation shall be provided to Clerk of Works/ Project leader of MetroConnect after completion and at handover of the work.
ANNEXURE A: FIBRE NUMBERING CONVENTION

The standard colours of fibres in each bundle or tube shall be as follows:

<table>
<thead>
<tr>
<th>Core</th>
<th>Colour</th>
<th>Core</th>
<th>Colour</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Blue</td>
<td>7</td>
<td>Red</td>
</tr>
<tr>
<td>2</td>
<td>Orange</td>
<td>8</td>
<td>Black</td>
</tr>
<tr>
<td>3</td>
<td>Green</td>
<td>9</td>
<td>Yellow</td>
</tr>
<tr>
<td>4</td>
<td>Brown</td>
<td>10</td>
<td>Purple</td>
</tr>
<tr>
<td>5</td>
<td>Grey</td>
<td>11</td>
<td>Turquoise</td>
</tr>
<tr>
<td>6</td>
<td>White</td>
<td>12</td>
<td>Pink</td>
</tr>
</tbody>
</table>

**Example 1. 12 fibre core systems**

Two conventions are prevalent:

- In 3 tube/bundle systems:
  - Red tube - cores 1 to 4,
  - White tube - cores 5 to 8, and
  - Green tube - cores 9 to 12.

  There are 4 fibres per tube/bundle. The individual fibre cores in each tube/bundle are in order Blue, Orange, Green and Brown ie. Cores 1,5 & 9 are Blue, cores 2,6 & 10 are Orange, etc.

- In 4 tube/bundle systems:
  - Red tube/bundle - cores 1 to 3
  - White tube/bundle - cores 4 to 6
  - White tube/bundle - cores 7 to 9
  - Green tube/bundle - cores 10 to 12

  There are 3 fibres per tube/bundle. The individual fibre cores in each tube/bundle are in order Blue, Orange and Green ie. Cores 1,4,7 & 10 are Blue, cores 2,5,8 & 11 are Orange, etc.

**Example 2. 24 fibre core systems**

- In 4 tube/bundle systems:
  - Red tube/bundle - cores 1 to 6
  - White tube/bundle - cores 7 to 12
  - White tube/bundle - cores 13 to 18
• Green tube/ bundle - cores 19 to 24

There are 6 fibres per tube/bundle. The individual fibre cores in each tube/bundle are in order Blue, Orange, Green, Brown, Grey and White i.e. Cores 1, 7, 13 & 19 are Blue, cores 2, 8, 14 & 20 are Orange, etc.
ANNEXURE B: ATTENUATION TESTING ON FIBRE OPTIC CABLE/ OPGW PRIOR TO PULLING OR STRINGING

Preamble

This form is to completed and signed by the Contractor/ Consultant or installer, prior to the pulling of fibre optic cable or the stringing of Optical Ground Wire (OPGW). Once completed it must be handed to the appointed Clerk of Works/ Project leader of MetroConnect.

<table>
<thead>
<tr>
<th>LINK DESCRIPTION: Contract No./ Order No.:</th>
<th>...............................................................</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>End A</th>
<th>End B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drum Manufacturer</td>
<td>Drum No.</td>
</tr>
<tr>
<td>No. Of fibres</td>
<td>Make &amp; Model of Equipment used:</td>
</tr>
</tbody>
</table>

Test Results: average dB/km

<table>
<thead>
<tr>
<th>Core</th>
<th>Average dB/km</th>
<th>Core</th>
<th>Average dB/km</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>13.</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>14.</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>15.</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>16.</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td></td>
<td>17.</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td></td>
<td>18.</td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td></td>
<td>19.</td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td></td>
<td>20.</td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td></td>
<td>21.</td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td></td>
<td>22.</td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td></td>
<td>23.</td>
<td></td>
</tr>
<tr>
<td>12.</td>
<td></td>
<td>24.</td>
<td></td>
</tr>
</tbody>
</table>
I hereby confirm that the fibre optic cable/OPGW has been received by me in good working order.

Completed By:

<table>
<thead>
<tr>
<th>Name</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Company</td>
<td></td>
</tr>
<tr>
<td>Date</td>
<td></td>
</tr>
</tbody>
</table>
ETHEKWINI MUNICIPALITY
FIBRE OPTIC STANDARDS

ANNEXURE C: COMPLETION FORM FOR UNDERGROUND OPTICAL FIBRE LINK

Preamble

This form is to completed and signed by the Contractor/ Consultant or installer, once installation of the underground fibre optic cable is completed and fully tested. It is to be and handed to the appointed Clerk of Works/ Project leader of MetroConnect.

<table>
<thead>
<tr>
<th>LINK DESCRIPTION: Contract No./ Order No.: .......................................................</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Complied(Y/N)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Pulling of cable between, and splicing at communication manholes:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a.</td>
<td>Precautions were taken to ensure that there was no damage to the cable during the pulling process and that there was no over-bending or excessive strain placed on it.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b.</td>
<td>5m of cable slack has been retained in each manhole.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c.</td>
<td>The ends of the tubes at the manholes have been filled with self expanding polystyrene type foam.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>d.</td>
<td>Approved joint boxes have been used, and been fitted according to the manufacturer's instruction.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>e.</td>
<td>5m of cable slack has been retained on each side of a joint box at the manhole.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>g.</td>
<td>The standard fibre numbering system applied during splicing.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>h.</td>
<td>'Sista' expanding foam was used to seal top of stainless steel tube, beneath Nokia Dome Joint.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Jointing of fibre cables within the FCP in the Computer Room NOTE: FCP will have been equipped by DME with a splicing tray, fitted with mid-couplers, compression glands and pigtails for each fibre</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a.</td>
<td>NEX tubing is secured to the gland plate at the base of the FCP with a 50mm male adaptor, (provided by DME).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Item</td>
<td>Description</td>
<td>Complied(Y/N)</td>
<td>Remarks</td>
</tr>
<tr>
<td>------</td>
<td>-------------</td>
<td>---------------</td>
<td>---------</td>
</tr>
<tr>
<td>b.</td>
<td>All fibres spliced onto pigtails, and fibres on splicing tray neatly made off</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c.</td>
<td>Standard Fibre Numbering system adopted</td>
<td></td>
<td></td>
</tr>
<tr>
<td>f.</td>
<td>The loss for all splices is below 0.05dB</td>
<td></td>
<td></td>
</tr>
<tr>
<td>g.</td>
<td>The connectors at the front of the patch tray at the terminations have been labelled, and checked for crossovers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>h.</td>
<td>The average dB/km for all cores is less than 0.4dB/km at 1310nm and 0.25dB/km at 1550nm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>i.</td>
<td>All losses and reflectances on the link have been minimised</td>
<td></td>
<td></td>
</tr>
<tr>
<td>j.</td>
<td>Helix Factor: Index of refraction: Rayleigh backscatter factor:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>j.</td>
<td>All the events on the OTDR traces have been labeled/ position described</td>
<td></td>
<td></td>
</tr>
<tr>
<td>k.</td>
<td>The results of the OTDR tests, from both ends, and at both 1550nm and at 1310nm, have been provided on CD and on hard copy</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Completed By:

<table>
<thead>
<tr>
<th>Name</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Company</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Date</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Adopted at the End of December 2008:

Signature:

1. Information Technology:

2. ETA

3. Roads

4. Water

5. Electricity

6. City Police
A hardcopy customer file must be completed for each purchase order issued. Below is the index list of all information that must be supplied. Please ensure that all information is supplied to expedite job completion and payments.

1. Original RFQ document and map.
2. Bill of quantities and official quotation.
3. Site layout plan or map of completed route (as built route).
4. All email correspondence from MetroConnect Planning or MetroConnect Procurement.
5. Official purchase order number from Ethekwini.
6. Additional maps that could relate to the area of the job.
7. Additional work instructions.
8. Work instruction/variation order for additional work.
9. Quotes for any Variation work – NOT part of initial quote
10. Invoices for each purchase order.
11. Evidentiary photos for any work/cost variance.
12. Progress reports on additional work.
13. Contact people on site that was involved in the job.
14. Contact people in charge of customer buildings or sites.
15. Contact numbers and names of persons/companies that will do the job if required.
16. Progress reports from site inspections.
17. Splice tray labeling diagram.
18. Photographs of cabinet, patch panel and splice tray.
19. OTDR test results.
20. GPS co-ordinates for all service points. (New Manholes, Strategic Junction Points, etc)
21. Copy of Wayleaves from all service providers.
22. All email correspondence with Ethekwini Roads Department.
CONDITIONS PERTAINING TO APPROVAL OF WAYLEAVES

1. No obstructions to sidewalks and roadways are permitted. In this regard, Pedestrians and motorists should be accommodated for at all times.

2. The proving of underground services and the relocation thereof, if necessary, will be their responsibility of your organisation.

3. All re-instatements, including backfilling, compaction and testing of excavations to be to departmental specifications.
   The Road and Stormwater Maintenance Department will carry out the final road re-instatement and requisitions for such work must be forwarded by your organization timeously.

4. Temporary re-instatements to be maintained by the excavator until completion of final re-instatements. Claims arising during the construction of the proposed works and prior to any final reinstatements being carried out by this department will be for your organization to resolve.

5. Finish cover levels of manholes to suit the surrounding surface levels.

6. All excavations and allied works must be suitably barricaded and maintained until final completion or works.

7. Saw cutting of the existing surfaced layers will be required, prior to any excavations taking place.

8. Mixing of concrete or mortar on the road or sidewalk surface is not permitted.

9. Construction materials are not to be left haphazardly on the road, sidewalk or verge at any time during construction.

10. All rubble and other spoil generated by the proposed works to be removed off site as soon as the works in particular vicinity is complete.

11. Contractors carrying out work on your behalf to be adequately supervised at all times. Due cognisance must be taken of the gazetted Occupational Health and Safety Act 85/1993: Construction Regulations: 2003

12. The Unit reserves the right to halt progress at any time during the project should the above requirements not be satisfactorily adhered to.

13. Adequate notice of intention to commence work must be given to prior to the actual commencement of the work. All work within the Council road reserve will be monitored by
14. The Engineering Unit is to be included in any progress meetings held by yourselves.

15. This unit reserves the right to have it’s Materials Testing Laboratory carry out acceptance testing of any or all road layer densities. Control testing will be your responsibility with test results being made available to this Unit on request.

16. With regard to road markings that will be affected due to the proposed works, your organisation is to make arrangements with the Ethekwini Transport Authority’s Traffic Operations Branch on telephone 031 311 7093 or 031 311 7334 prior to commencement of the works.

17. A joint final inspection of the completed works forms part of this agreement.
ENGINEERING UNIT
ROADS AND STORMWATER MAINTENANCE DEPARTMENT
EXCAVATION AND REINSTATEMENT OF TRENCHES IN ROADS AND SIDEWALKS IN THE EMA AREA

PROJECT SPECIFICATIONS AND REQUIREMENTS

EXCAVATION OF TRENCHES

- Trenches that are excavated for service provisions and upgrading purposes on roads or sidewalks will be done so in compliance to Departmental requirements pertaining to accommodating traffic. Both vehicular and pedestrian, thereby ensuring their safety. All other Health and Safety requirements to both the public and the contractors own personnel needs to be complied with.

- The Roads Department will be kept informed in advance of all proposed excavations in roads and sidewalks. The option of trenchless technology will be explored and only when all avenues to auger bore have been exhausted, will trenching be permitted and in writing by the Roads Department.

- Where the proposed excavation falls within existing works being undertaken by any department or service provider, the Excavation Department/Contractor will liaise accordingly for ease of implementation and re-instatement purposes.

- Spoil emanating from the trench excavation will be removed to a designated spoil site soon after the trench has been excavated. Should such spoil remain on site for reuse, same will be adequately barricaded. Where the spoil is dumped on private properties by agreement, the Municipality will be indemnified in writing, against any future claims or queries.

- Where the trench traverses through gardens, flower beds and neat grassed areas, the contractor needs to liaise with the relevant authority or owner prior to the work commencing.

- In developed and CBD areas all property owners and businesses will be informed of the intended work prior to same commencing.

BACKFILLING OF TRENCHES

- All trenches will be backfilled with suitable material that is easily workable and compactable, in layers not exceeding 200mm (loose) thickness. The backfill material will be free of grass, roots, rubbish, clay and aggregates greater than 50mm. Where the backfill material is too dry, it will be moistened prior to placing and compacting.
DCP TESTING OF BACKFILLING

- Each layer of 150mm thick compacted backfill shall be tested to the following requirements using the standard 5kg DCP test method:
  - Road Trenches: Minimum of 5 blows per 100mm penetration
  - Sidewalk, driveways and median trenches: minimum of 3 blows per 100 mm penetration
  - Verge trenches: minimum of 2 blows per 100mm penetration

- Trenches in the verge (unhardened areas) may be backfilled and compacted in 300mm loose layers.

- All test results will be recorded and handed to the Engineer on a weekly basis.

- The Engineer reserves the right to carry out his/her own DCP testing and should the minimum requirements not be achieved on completed work, the contractor will be required to remove and redo the operation to ensure compliance.

ROAD CATEGORIES/ASPHALT TRENCH REINSTatement

- The city’s network comprises of the following road categories with the corresponding upper layer constructions:
  - CATEGORY A: 150mm G2 Crusher run and 240mm mix D Asphalt
  - CATEGORY B: 150mm G2 Crusher run and 160mm mix D Asphalt
  - CATEGORY C: 150mm G2 Crusher run and 80mm mix D Asphalt
  - CATEGORY D: 150mm G2 Crusher run and 50mm mix D Asphalt
  - CATEGORY E: 100mm G2 Crusher run and 25mm mix A Asphalt (driveway & sidewalks)

The onus is on the excavator department/contractor to ascertain from the Roads Department as to what category a certain road falls under.

- Asphalt will be compacted in layers not exceeding 800mm thick (after compaction)
- G2 Crusher run will be adequately moistened and mixed prior to placing and compacting.
- The DCP test requirements on the G2 crushed stone layer is a minimum of 15 blows per 100mm penetration.
- All loose material will be swept off prior to the placing and compacting of Asphalt.
ETHEKWINI MUNICIPALITY

FIBRE OPTIC STANDARDS

- All liquid emulsion will be brush applied at 0.3 l/m² to the vertical sides of the existing trench.

- The finish levels will be true to the surrounding existing road/sidewalk levels.

CONCRETE AND BRICK PAVED AREAS

- The CBD sidewalks are generally brick or concrete paved and therefore the reinstatement of trenches in these areas will be undertaken to match existing.

- Areas covered in special type pavers where trench excavation is to take place, the pavers will be carefully removed and stored for reuse as the availability of new materials for reinstating these areas are minimum. The Contractor will take full responsibility for removing, storing and safekeeping of the removed materials for reuse.

- The following mix proportions are to be used when undertaking trench reinstatement work.

  - Bedding for brick paved and concrete slabbed areas: Minimum 500mm thick river-sand mixed with cement at a ratio of 10:1 i.e 5 wheelbarrows of river sand to 1 pocket of cement.

  - Joints to precast slabs will comprise of a 3:1 plaster sand/cement mix i.e 1 ½ wheelbarrows of plaster sand to 1 pocket of cement.

  - Cast insitu concrete slabs will comprise of a full depth of 100mm, 75mm of which is concrete and 25mm Umgeni/cement topping. Both layers are required to be constructed simultaneously.

  - Should ready blend be used to mix the 75mm thick concrete, a mix ratio of 6:1 will be used i.e. 3 wheelbarrows of ready blend to 1 pocket of cement. For the 25mm topping, a mix proportion of 2:1 will be used i.e. 1 wheelbarrow of river-sand to 1 pocket of cement.

Cast insitu slabs in non CBD areas may be constructed with a full depth of 100mm concrete using a 6:1 ready blend/cement mix.

Either option requires that the concrete be wood floated and joints formed to match existing.

Should stone, sand and cement be used as separate mix materials for mixing concrete, then a mix proportion of 3:3:1 will be used i.e 3 wheelbarrows of stone, 3 wheelbarrows of river-sand and 2 pockets of cement.
ETHEKWINI MUNICIPALITY
FIBRE OPTIC STANDARDS

TRENCHES IN VERGE AREAS

- Where trenches are excavated and required to be reinstated in unhardened or grassed areas, the following will apply.
  
  - The final 75-100mm of backfill will comprise of organic topsoil material, placed and leveled off flush with the surrounding ground level. No humps or bumps will be permitted.
  - All loose stones and other obstructions will be moved to spoil.
  - The establishment of suitable ground cover over the trench width will be the responsibility of the Excavator Department/Contractor.

SERVICE RELATED STRUCTURES

- Where minor structures such as chambers, manholes, earth retainers and connecting junction boxes are to be erected, the following requirements shall apply.
  
  - All structures are to be constructed in accordance with an approved design detail, provided by the Excavator Department and passed through the Roads Department.
  - All exposed vertical surfaces above ground will either be of face brick (satin red) or reinforced concrete with an off shutter class 1 finish.
  - Where earth retainers such as loffestein blocks are used, same shall be erected to the manufactures guidelines, specifications and recommendations.
  - Generally manhole covers will comprise of a reinforced concrete slab which incorporates a standard access cover and lid. The finish on the concrete covers will be to a wood floated finish. In asphalt, brick and other special paved areas, the finish on the cover slabs will be such that it matches the existing surface finish. The finish level on manhole covers shall be horizontal with the surrounding surface modified to suit, so as to avoid sudden change in levels.
  - The mixing of mortar and concrete on existing paved surfaces will be avoided and where same is unavoidable, the affected area will be properly cleaned and washed off on completion of the day’s operations.

SPECIAL REQUIREMENTS

- The main contractor/project manager is required to ensure that effective and timeous communication and interaction takes place between the civils contractor and the re-instating contractor
  
  - Where excavated trench material has ended up in the stormwater inlet and catchpit, the contractor will be required to remove, ensuring that the incoming and outgoing pipes are
free of same. Should pressure jetting be required to clean same, this must be arranged.

- Where trench reinstatements are undertaken by resources employed by the Excavator/Civils Contractor, the trenches are required to be permanently reinstated within a period of not exceeding 7 days from date of final backfill.

- All reinstatements undertaken will carry a maintenance guarantee period of 12 months from the date of completion of the works being handed over to the Roads Department.

- Should the contract not comply with the Departmental requirements and continue to ignore the instructions from the Municipal Official to make good or comply, then the Municipality reserves the right of requesting that such contractor be removed off site.
REGIONAL CONTRACT

- Should the need arise to make contact with a Roads Department official for any reason or clarity, the following shall apply:

<table>
<thead>
<tr>
<th>Road Maintenance HQ</th>
<th>Barlla Munsamy (Admin Officer)</th>
<th>Tel: 031 311 7893</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Fax: 031 311 7691</td>
</tr>
<tr>
<td></td>
<td></td>
<td>E-mail: <a href="mailto:munsamyb@durban.gov.za">munsamyb@durban.gov.za</a></td>
</tr>
</tbody>
</table>

### REGIONAL SUBURBS

<table>
<thead>
<tr>
<th>1.) North Region</th>
<th>2.) North Central Region</th>
<th>3.) South Central Region</th>
</tr>
</thead>
<tbody>
<tr>
<td>Verulam, Tongaat, Phoenix, Inanda and Ntunzuma</td>
<td>Umhlanga, Durban North, KwaMashu, Newlands, Springfield, Durban, CBD, Berea, Maydon Wharf</td>
<td>Bellair, Catomanor, Clairwood, Bluff, Yellowood Park, Chatsworth, Umlazi, Isipingo and Prospecton</td>
</tr>
<tr>
<td>Kevin Govender</td>
<td>Shan Govender</td>
<td>Thomas Govender</td>
</tr>
<tr>
<td>Tel: 031</td>
<td>Tel: 031 311 74 27</td>
<td>Tel: 031 466 8666</td>
</tr>
<tr>
<td>Cell: 083 637 9266</td>
<td>Cell: 083 270 0234</td>
<td>Cell: 083 270 0234</td>
</tr>
<tr>
<td>E-mail: <a href="mailto:govenderkevin@durban.gov.za">govenderkevin@durban.gov.za</a></td>
<td>E-mail: govenderv@</td>
<td>E-mail: <a href="mailto:govederthomas@durban.gov.za">govederthomas@durban.gov.za</a></td>
</tr>
</tbody>
</table>

South Region

<table>
<thead>
<tr>
<th>Toti, Kingsburgh, Illovo, Folweni, Umkomaas</th>
<th>Peter Dally</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tel: 031 311 5955</td>
<td>Tel: 031 311 6403</td>
</tr>
<tr>
<td>Cell: 083 256 4412</td>
<td>Cell: 083 256 4412</td>
</tr>
<tr>
<td>E-mail: <a href="mailto:dallyp@durban.gov.za">dallyp@durban.gov.za</a></td>
<td>E-mail: <a href="mailto:mullers@durban.gov.za">mullers@durban.gov.za</a></td>
</tr>
</tbody>
</table>

West Central Region:

<table>
<thead>
<tr>
<th>Pinetown, Westville, Reservoir Hills, Westmeath, Shall cross, Marianhill, Kwadengezi, Clemont, Kwadabeka</th>
<th>Siggie Miller</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tel: 031 311 6403</td>
<td>Tel: 031 311 2736</td>
</tr>
<tr>
<td>Cell: 083 287 8582</td>
<td>Cell: 072 112 5030</td>
</tr>
<tr>
<td>E-mail: <a href="mailto:mullers@durban.gov.za">mullers@durban.gov.za</a></td>
<td>E-mail: <a href="mailto:mngomar@durban.gov.za">mngomar@durban.gov.za</a></td>
</tr>
</tbody>
</table>

West Region

<table>
<thead>
<tr>
<th>Hillcrest, Kloof, Hammarsdale, Cateridge, Molweni</th>
<th>Richard Mngoma</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tel: 031 311 2736</td>
<td>Tel: 031 311 2736</td>
</tr>
<tr>
<td>Cell: 072 112 5030</td>
<td>Cell: 072 112 5030</td>
</tr>
<tr>
<td>E-mail: <a href="mailto:mngomar@durban.gov.za">mngomar@durban.gov.za</a></td>
<td>E-mail: <a href="mailto:mngomar@durban.gov.za">mngomar@durban.gov.za</a></td>
</tr>
</tbody>
</table>
ETHEKWINI MUNICIPALITY
FIBRE OPTIC STANDARDS

Additional Comments.

Instructions To Contractors - 28 October 2009

1. Only 48 core LC patch panels must be used for any new install at a PoP site i.e. where the MetroConnect equipment is located such as UMH fire station.

2. Use any existing patch panel that is at the PoP sites first before installing a new one. We will run out of space if every contractor uses a new patch panel and not make use of existing splice trays.

3. Any new cabinet on site must be recessed 6 or 7 holes before the fibre splice trays are mounted in the cabinet.

4. When a new splice tray is installed make sure enough slack is left so that future work in the splice trays is not difficult.

5. At subscriber sites 24 core LC patch panels must be used.

6. Only 4-way dome joints must be used on any new dome joint installation.

7. When submitting an RFQ response, no maps are to be submitted unless your proposed route deviates from MC planned route.

8. Manholes are to be created 200m apart unless change in route direction is required or at 30 to 90 degree bend.

9. Manhole Spec (include locking mechanism) : Proposed manhole is the Maverick round lid, drop-in

10. Fibre Spec : Proposed fibre is Systimax

11. As built map to be submitted on CAD and on Topographical Map.

12. GPS co-ordinates to be provided in this format only : Long 30.123456  Lat -29.123456

13. Completion file to be submitted as per MC template/sample