

Technical Code Programme 2020

Awareness & Adoption of Technical Codes

Basic Civil Works

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Basic Civil Works



Part 1: General Requirements
- consist of all common requirements related to civil works.



Part 2: Open Trench
- specifies the requirements for open trench works for the installation and maintenance of communications network facilities



Part 3: Micro Trench
- specifies the requirements for micro trench works for the installation and maintenance of communications network facilities



Part 4: HDD
- specifies the requirements for HDD works for the installation and maintenance of communications network facilities

Outline

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Background and Introduction

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Rationale of the Revision

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Benefits

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Conclusion/Challenges



1

Background and Introduction

Background

- The Technical Codes for Basic Civil Works serve to assist the **relevant parties** to meet the requirements **of end users or relevant authorities** to lay their communication network to offer the communications services.
- This is important in view of the communication infrastructure is used as a **conduit for laying the fiber optic cable** as a medium to deliver higher speed of broadband services to the public/customers.

Introduction

This technical code for Basic Civil Works - General Requirements ('this Technical Code') was developed pursuant to Section 185 of the Act 588 by the Malaysian Technical Standards Forum Bhd (MTSFB) via its Network and Broadcast Infrastructure and Facilities Working Group (NBIF WG).

The **Basic Civil Work** consists of 4 main modules:

Part 1: General Requirements

Part 2: Open Trench

Part 3: Micro Trench

Part 4: Horizontal Directional Drilling

These series of Technical Codes **shall replace** SKMM/G/01/09, *Guideline on the Provision of Basic Civil Works for Communications Infrastructure in New Development Areas*.

The Technical Code shall be **read together** with the rest of the other series of Basic Civil Works depending on specific method of civil work.

The Experts

- This Technical Code was developed by representatives from the following organisations:



2

Rationale of the Revision

Why are the codes developed?

- Revision of Current Civil Work Document - *Guideline on the provision of basic civil works for communications infrastructure in new development areas (skmm/g/01/09), Version: February 2008*
- To define the **requirements** for Basic Civil Works via various methods and requirements for communications infrastructure development.
- To support the NFCP initiative – expedite and smooth approval process
- Minimize the damages due to construction work

Guideline on the provision of basic civil works for communications infrastructure in new development areas (skmm/g/01/09), Version: February 2008,

- Mainly focus on new development area
- Limited to open trench method only



**GUIDELINE ON
THE PROVISION OF BASIC CIVIL WORKS FOR COMMUNICATIONS
INFRASTRUCTURE IN NEW DEVELOPMENT AREAS**

(SKMM/G/01/09)

Version: February 2008

NFCP Requirements

- Update existing or develop new Codes/SOP on **sites improvement**, use of **other utilities, street furniture**, in building installations (including brownfield and greenfield)
- New industry SOP/guideline on process/steps/standards to be used on **State/Federal buildings/land/ROW** etc.
- Awareness and engagement programs with building managers/owners, operators, contractors, town planners, etc.

3

Benefits

3 - What are the benefits of the codes?

- Standard SOP of civil work
- Minimize the road/surface damage due to the civil works
- Expedite approval permit and deployment time
- Minimize cable cut incident due to construction work



4

Technical Code Requirements



Malaysian Technical Standards Forum Bhd

MCMC MTSFB TC G025-1:2020

TECHNICAL CODE

BASIC CIVIL WORKS - PART 1: GENERAL REQUIREMENTS

Developed by



Registered by



Registered date:

20 May 2020

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1. Scope

This Technical Code specifies the **general requirements for earthwork** for the purpose of installation and maintenance of fixed network facilities which covers:

- a) safety and precautions;
- b) processes and procedures;
- c) material specifications;
- d) testing and acceptance;
- e) milling and reinstatement; and
- f) procedure for project completion.

4. Term & Definitions

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5. Planning Of Civil Work

- Shall be carried out **before starting** of any civil work.
- To determine the suitable of **construction method** during the civil work planning stage.
- includes selection of the **route, tools, materials and approval** from relevant government agencies, local authorities and land owner.

Civil Work Construction Methods

- Open Trench;
- Micro Trench and
- Horizontal Directional Drilling (HDD).



determined s by the **land owner**

5. Planning Of Civil Works

5.2 Work Specification

- determine the **number** of duct-ways,
- **duct size** and
- **distance** of the construction.

- shortest route
 - optimise cost
 - continuous length
- The guidance:**
- future requirement & expansion.

5. Planning Of Civil Work

5.3 Duct Routing

- **starting and the end point** of the civil work.
- **minimize damages** to trees, landscape, carriageway or structure. Route planning should consider future expansion and development.
- long-term stability of the routes.



6. Safety Precautions



Safety equipment

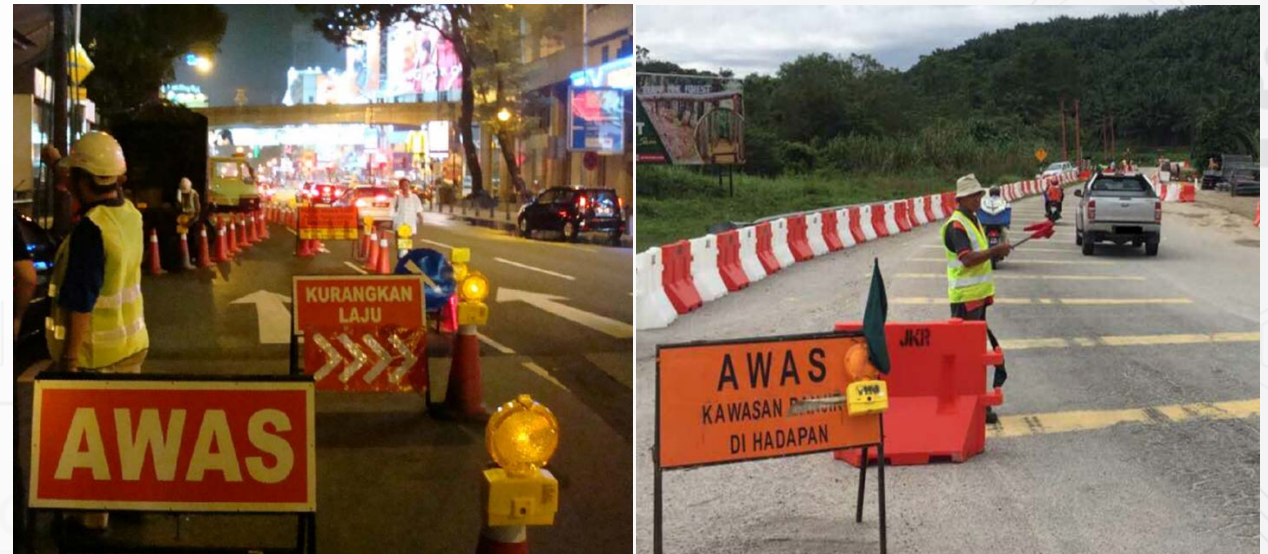
- strictly adhere to the guidelines and standards issued by the relevant authorities.
- All workers shall be equipped with personal protective equipment (PPE)

Safety elements

- effective fire-fighting apparatus and material;
- power supply identification;
- Forbidden of hazardous goods
- safety misadventure in communication construction.
- etc

Working at road side

- Barrier and warning signage - to provide ample response time for road users or traffics
- A flagman



7. Civil Work Process and Procedure

Wayleave and permit

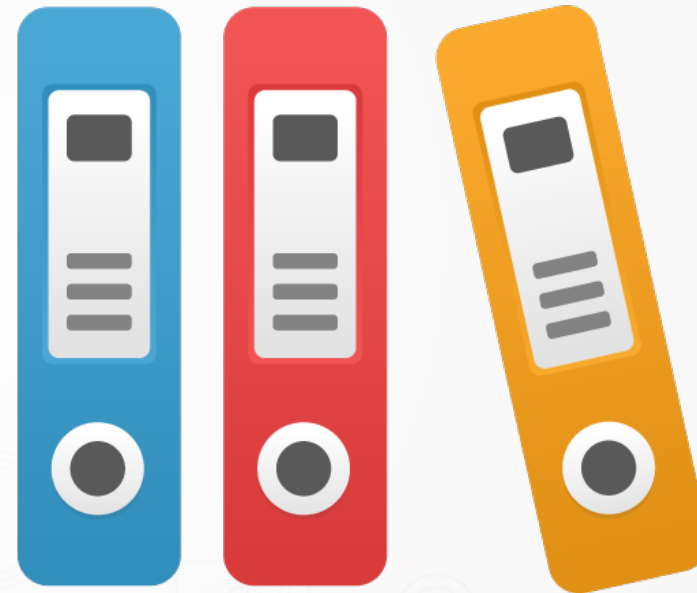
- the relevant standards and guidelines by the authorities such as *Prosedur Permohonan Syarikat Utiliti Kepada JKR* shall be complied;
- the relevant permits shall be obtained (*External Trenching Permit (ETP)* from the relevant authorities and *Internal Trenching Permit (ITP)* from landowner or Building Management (BM)); and
- joint inspection with the authorities may be required to be conducted upon the completion in order to obtain "*Sijil Siap Kerja*" or "*Pengesahan Siap Kerja*".



7. Civil Work Process and Procedure

7.2 Documentation

- application letter/form;
- detailed technical proposal or drawing;
- contractor's information;
- Utility Detection Mapping (UDM);
- joint site survey report (if required);
- copy of insurance;
- work schedule;
- Traffic Management Plan (TMP);
- method of statement;
- security deposit; and
- sites photos (before and after).



7. Civil Work Process and Procedure

7.3 Rules and regulations

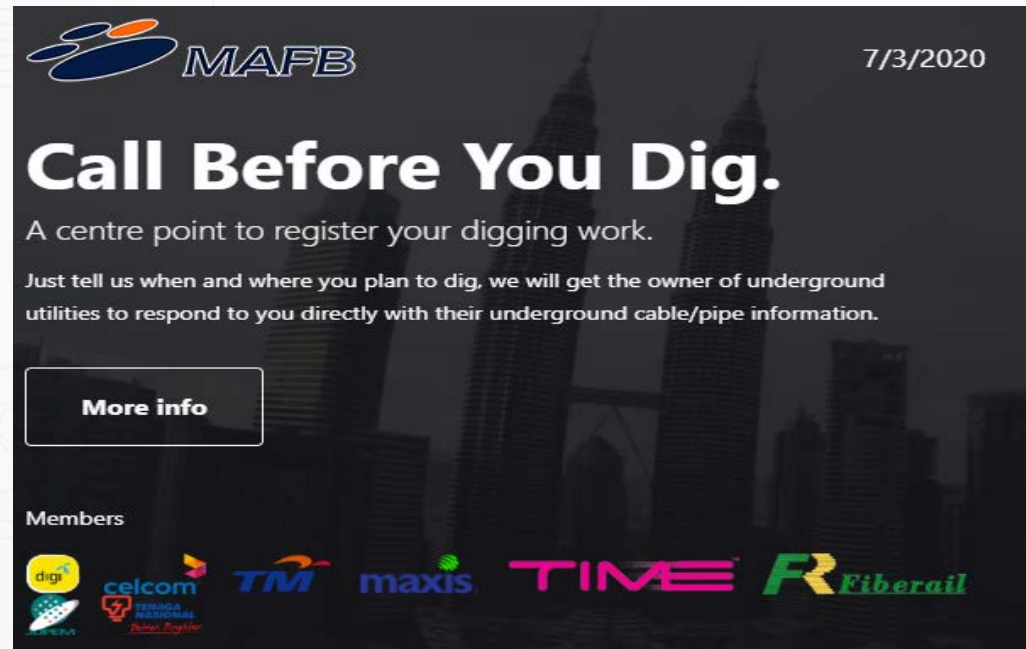
- a. appointment **OSHE** and Construction Industry Development Board (**CIDB**) certified civil works contractor
- b. project manager and the civil work contractor shall adhere to the **agreed acceptance procedure**;
- c. prepare all the **documentation** required for the acceptance procedure;
- d. prepare all the necessary **tools and test gears**;
- e. **acceptance procedures** should be performed and completed on the same day to minimize traffic obstruction;
- f. ensure all relevant **permits** are obtained and in compliance with all the relevant rules and regulations; and
- g. **Certification of Acceptance (COA)** upon completion of acceptance procedure.



7. Civil Work Process and Procedure

7.4 Call Before You Dig (CBYD) registration

- To minimize damages to underground utility facilities
- Project manager to register at CBYD portal (www.cbyd.com.my).



MAFB 7/3/2020


Call Before You Dig.

A centre point to register your digging work.

Just tell us when and where you plan to dig, we will get the owner of underground utilities to respond to you directly with their underground cable/pipe information.

[More info](#)

Members



7. Civil Work Process and Procedure

7.4 Utility Detection & Mapping (UDM)

- It is a **compulsory** for all underground civil works.
- Shall be done before underground civil works started.
- To avoid unnecessary damages to other underground utilities e.g. water, gas or power cable.
- UDM report must be **endorsed** by **qualified Land Surveyor**.
- Underground civil works shall only commence upon confirmation on the underground accessibility; otherwise the route shall be relocated.

7. Civil Work Process and Procedure

7.4 Utility Detection Mapping (UDM)

- To manage **certain risks** associated with utility mapping
- Before excavation work involving **open trench and HDD**
- UDM will provide the information as below:
 - a. **Existing** available records, plans, and maps;
 - b. **field staking** to avoid conflict with existing utilities;
 - c. **formal report** and inventory, detailing all ground proofs, subsurface features, and utilities found;
 - d. Computer-Aided Design (CAD) drawings;
- the following items shall be indicated in the utility mapping report;
 - i. **X, Y and Z view** direction along the trenching route.
 - ii. **trenching route** including the depth;
 - iii. location of existing **manhole** and proposed manhole;
 - iv. proposed location of **pilot holes**;
 - v. **all utilities** in the ground and distance and depth between each utility; and
 - vi. **cross section** of the trenching route (Y-Z view) at 3 point of scanning.



7.4 UDM Tools

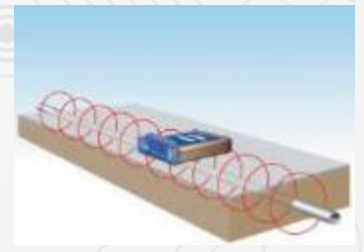
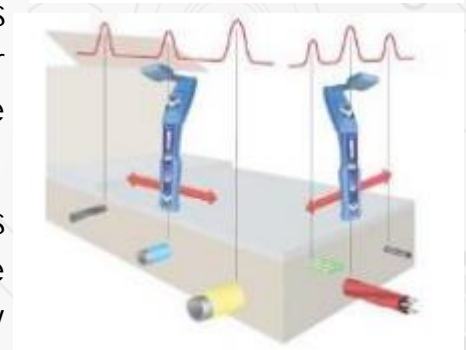
1 Ground Penetrating Radar (GPR)

- A geophysical method that uses radar pulses to image the underground utilities.
- Uses electromagnetic radiation in the microwave band of the radio spectrum (10MHz to 2.6GHz) and detects the reflected signals from underground structures.
- **Max Depth: 8m**



2 Cable Locator Radio Detection

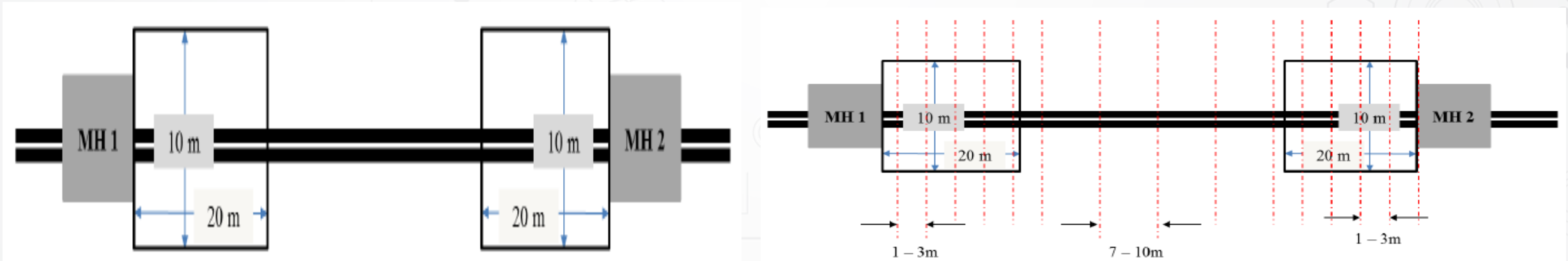
- Three method of detections:
 - **Induction** - the transmitter is placed on the ground over or near the survey area. The transmitter will induce the signal indiscriminately to any nearby metallic conductor.
 - **Direct connection** - the transmitter is connected directly to the related pipe or cable and will transmit the signal along the line.
 - **Sonde** - a battery operated transmitter is placed inside the required duct. The sonde will transmit signal and to be detected by the detector.
- **Max Depth: 6m (Induction & Direct connection) / 15m (Sonde)**



7. Civil Work Process and Procedure

7.5 Utility Detection Mapping (UDM)

- determine the area of scanning size and interval distance of scanning by considering the following requirements.
 - a. **The width of scanning is 10 m** along the route from a manhole to another manhole.
 - b. High risk area, the **scanning interval** for distance within 20 m from the manhole shall 1 m - 3 m.
 - c. The area > 20 m from manhole is categorized as **low risk area**: 7 m -10 m interval.

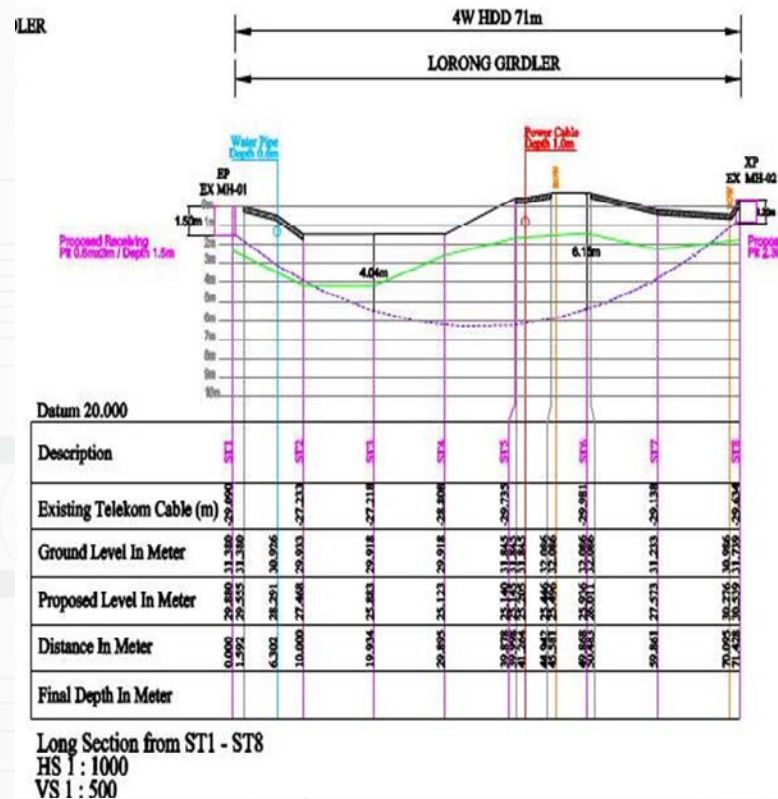


7. Civil Work Process and Procedure

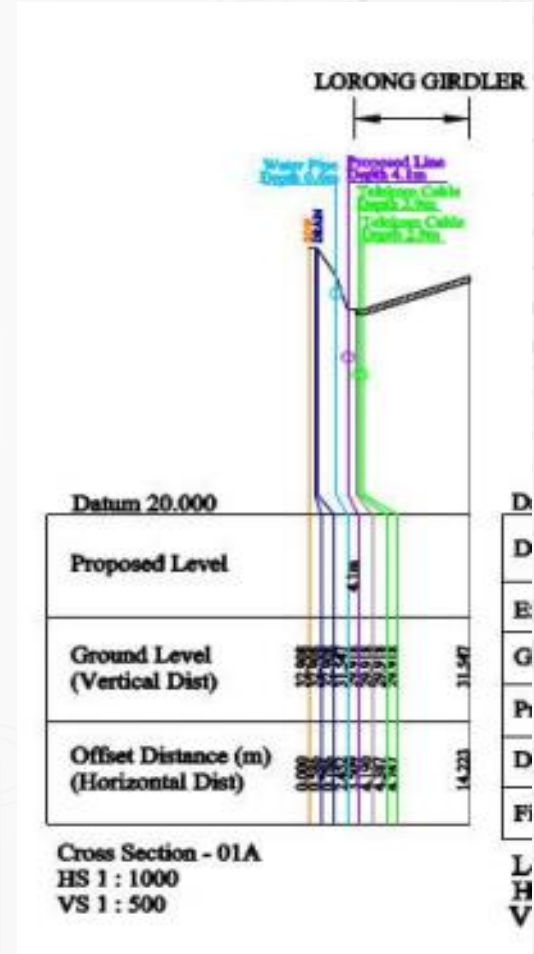
7.5 Utility Detection Mapping (UDM)



X-Z view of UDM



X-Y view of UDM



Y-Z view of UDM

7. Civil Work Process and Procedure

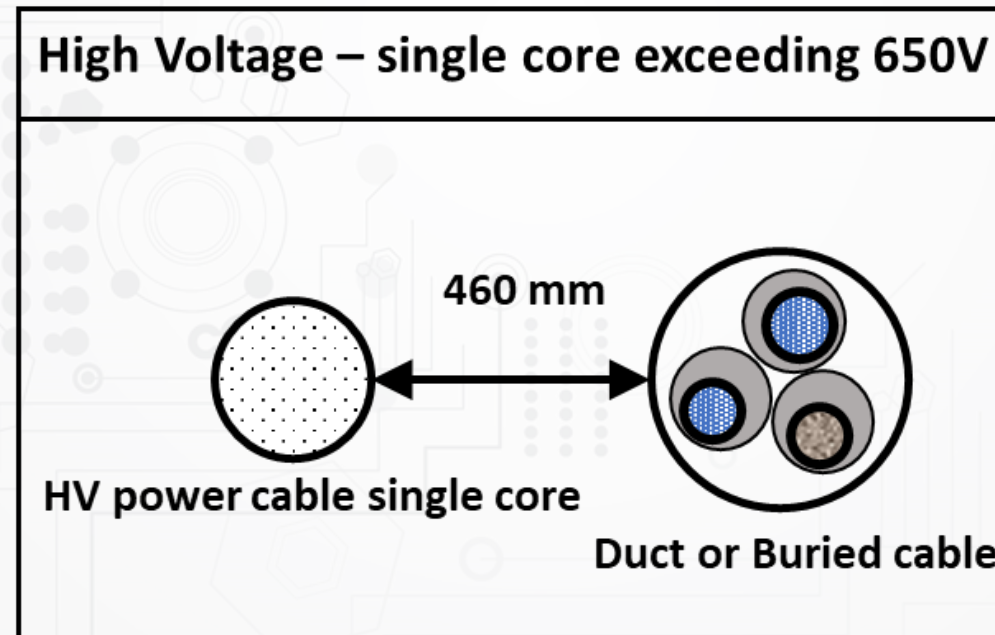
7.6 Clearance

Clearance from electricity supplies

- As much clearance as is **practicable**
- If < 150 mm & cross each other
 - ❑ to provide concrete Quality B < 50 mm thick

Set of plant (exceeding 650 V)	Minimum clearance (mm)	Description
High-voltage single-core cables	460	No exception to this requirement will be permitted
High-voltage multi-core cables	300	In difficult cases a reduced clearance will be permitted

Clearance from electrical cable



7. Civil Work Process and Procedure

7.6 Clearance

Clearance from gas pipe

- All ducts shall be kept at **min 1 m** clearance, if not < **50 mm Quality B concrete** as separation

Clearance from other services

- water mains and service pipe, sewers and subways, and manholes and joint boxes belonging to other undertakers.
- **Min of 150 mm** clearance
- If cross each other, min vertical clearance = 50 mm

8. Traffic Management Plan

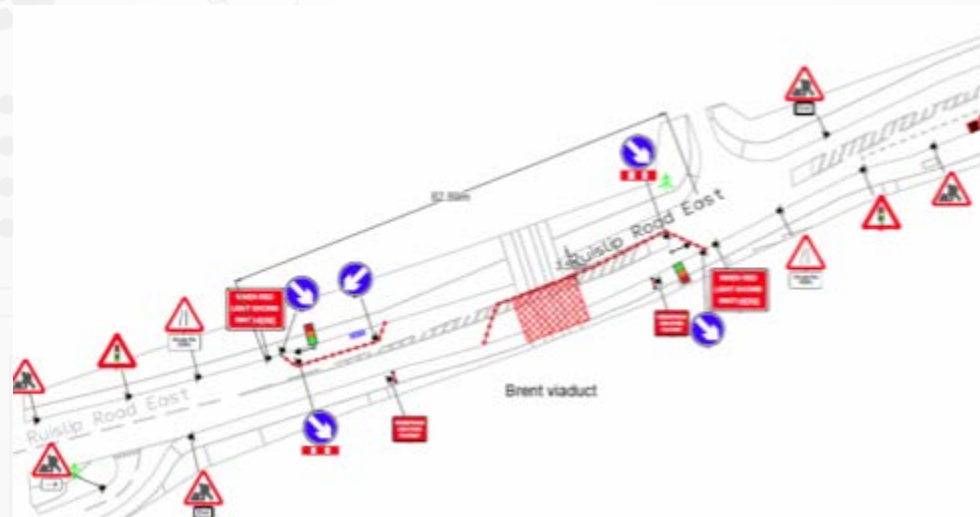
as specified in *ATJ 2C/85*, Manual on Traffic Control Devices Temporary Signs and Work Zones Control.

8.1 Type of road

- To determine type of road – federal road, state road, residential area road, village road; and highway.

8.2 Apply work permit from authorities

- to obtain work permit from the authorities or road owners, and observe all conditions for the approved work permit.



8. Traffic Management Plan

8.3 Site arrangement as per layouts of traffic control

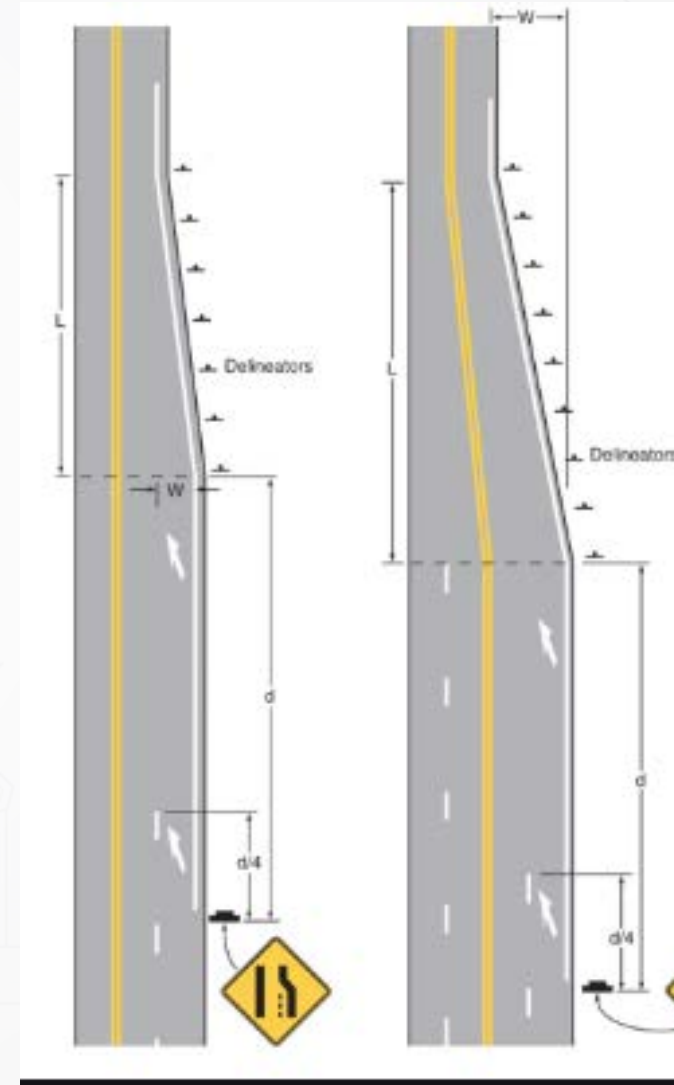
- to ensure the site arrangement is done according to the following:
 - traffic control zone;
 - layout for work on the road; and
 - sign and traffic control devices.
- Determine the specific traffic control zone
- **Traffic control zone** -distance between the **first advance** warning sign and **the point beyond** the work area advance warning area
 - a. The first temporary signboard. The length should be:
 - 2 km to 1 km for expressways;
 - 500 m for most rural roadways or open highways conditions; and
 - at least 100 m for urban roadways.
 - b. transition area
 - Tapers to close lanes.
 - Length of taper
 - c. Buffer space
 - open or unoccupied space between the transition and work areas

8. Traffic Management Plan

8.3 Site arrangement as per layouts of traffic control

Speed limit (km/h)	Taper length			Number of channelizing	Spacing (m)
	Lane width (m)				
	3	3.5	3.75		
30	17	20	22	5	6
40	30	35	40	6	7
50	50	55	60	7	9
55	60	70	75	8	10
65	80	95	100	9	12
70	130	155	165	13	13
80	150	175	190	13	15
90	170	195	210	13	16

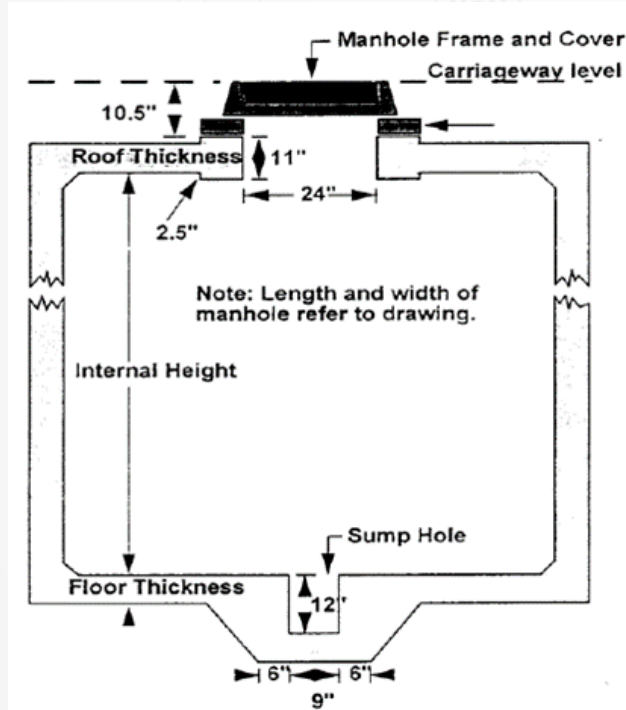
Taper length specification



9. Manhole

- For new development area, shall be provided by **property developer** for connection with NFP infrastructure.
- to consult with NFP on the **appropriate selection** of the location and size of manhole
- For public or **common area**, the manhole normally builds by NFP, local authority or land owner.

9.1 Size of manhole



Typical manhole design and specifications

Manhole type code	Internal dimension (L x W x H) (mm)	Number of 100 mm duct ways	PVC socket 100 mm	Loading weight (t)
R1B	1 980 x 1 370 x 1 830	6	12	22.5
R2A	3 280 x 1 500 x 1 830	12	24	22.5
R2A(M)	3 740 x 1 640 x 2 000	16	32	22.5
JC9C	1 960 x 1 260 x 1 020	4	16	22.5
JC9	1 810 x 890 x 1 150	4	8	22.5
JRC7	1 160 x 855 x 850	2	4	22.5
JB30	850 x 850 x 650	2	4	22.5
Handhole	300 x 300 x 300	2	4	5.0

NOTE: Other sizes deployment may defer and subjected to approval from qualified Professional Engineer.

Manhole size

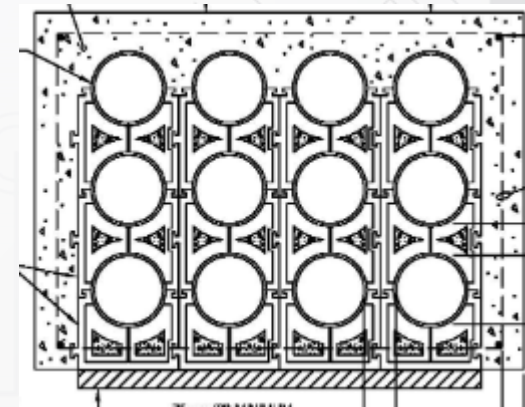
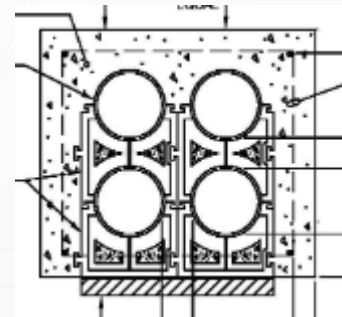
9. Manhole

9.2 Manhole Planning

- To ensure the layout plan or manhole route **meets the objective** and to **avoid any changes** during installation work.
- The planning shall include the following items:
 - a. Determine the **location** of the manhole to be installed - preferable in grass and installation of manhole at intersection or heavy traffic road shall be avoided
 - b. Determine the **type** of manhole to be used based on the following criteria:
 - i. the requirement of **duct capacity** - number of potential subscribers and future demand growth; and
 - ii. the manhole **location** to be installed.
- The recommended manhole span is between 50 m to 250 m depending on the location and suitability

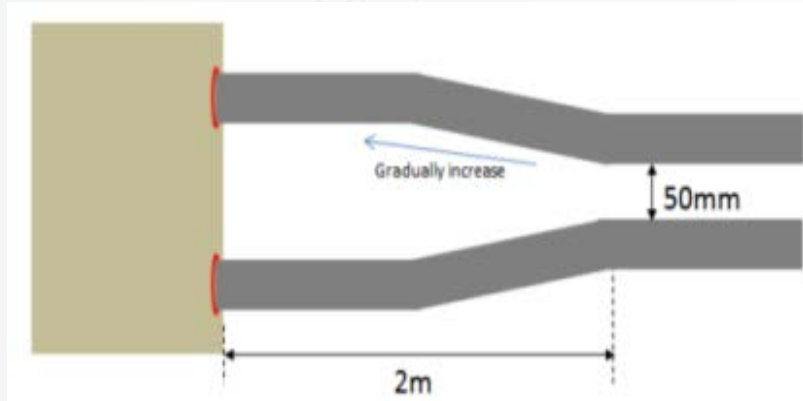
9.3 Type of Manhole

- Concrete – Pre-fabricated & In-Situ
- non-concrete type – Prefabricated



9. Manhole

9.7 Lead-in duct to manhole



- the duct shall be adjusted to **fitted** into the manhole.
- the duct shall be **gradually** positioned by increasing or decreasing the duct way level within a distance of 1 m to 2 m.
- **no sharp bending** took a form during the work

9.8 Fitting the manhole cover

- the manhole cover shall be lifted by **using a crane** and put onto the manhole.
- Measure the **horizontal level** of the manhole using appropriate tool to ensure that the cover has being put properly and evenly horizontal
- Failure to put the manhole cover evenly horizontal will jeopardized the **overall strength** of the manhole structure.



9. Manhole

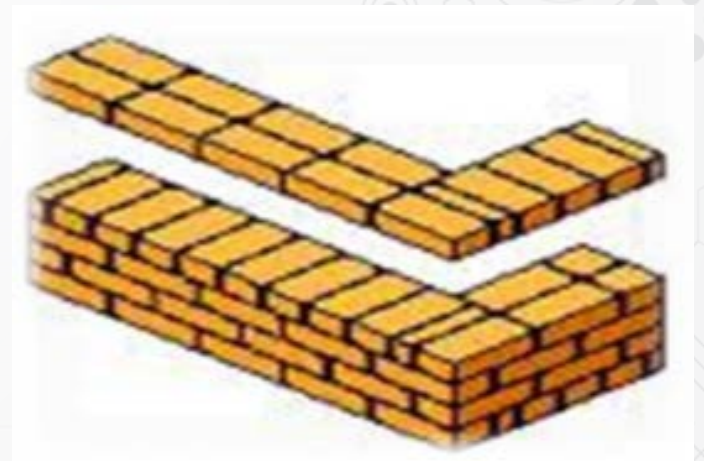
9.9 Backfilling around manhole



- The spaces outside the walls of manhole and surrounding area dug up shall be completely **filled with sand** free from stones and rammed
- Precautions shall be taken during ramming that not disturbs any work which already completed

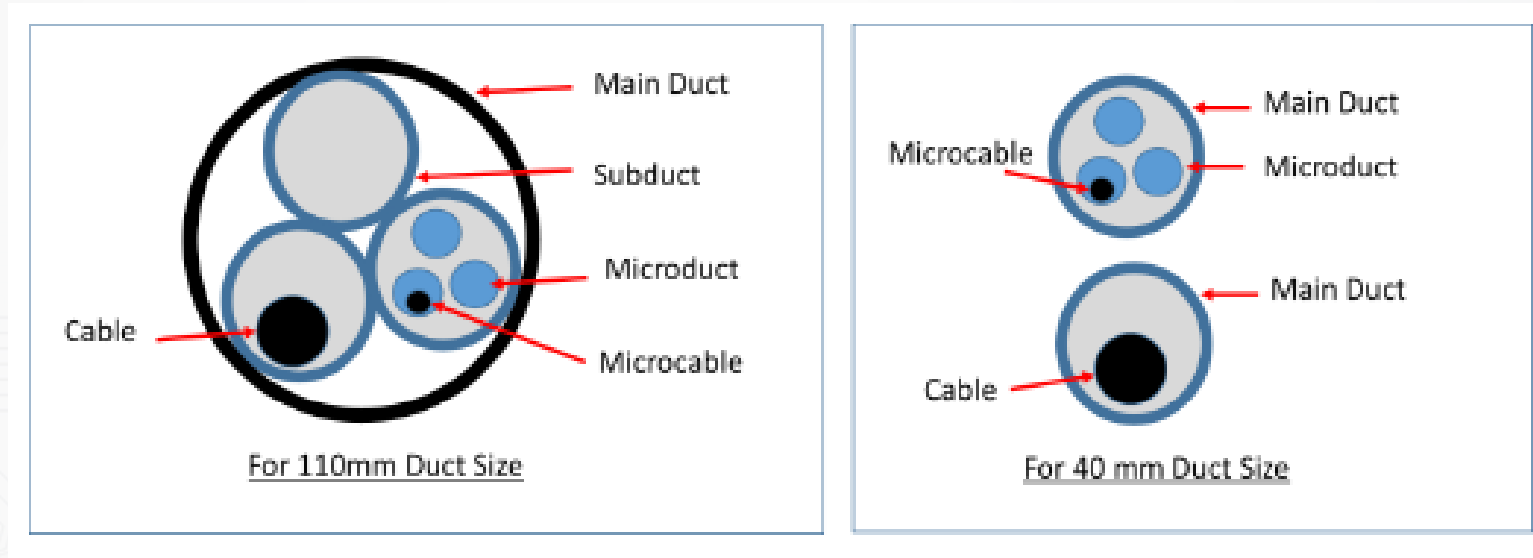
9.10 Raise up manhole

- Raise-up of the manhole's neck shall be done when the **ground level** around the chamber **was lifted**
- Through English bond bricks arrangement with the 9 inches thickness
- Inside of the raise-up shall be plastered with Portland cement



10. Duct

10.1 Duct Category



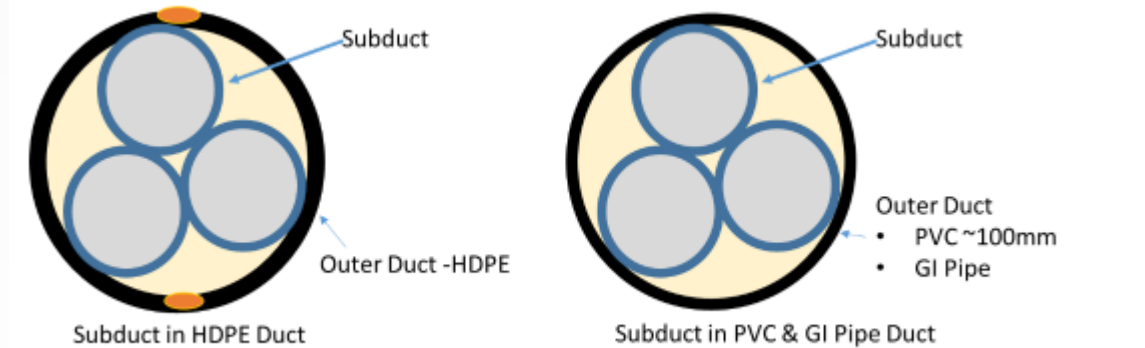
Main duct

- For **Open cut** - PVC duct or GI Pipe
- For **HDD** - only HDPE type is allowed due to flexibility, high pulling strength and tensile requirement.
- The duct size = **110 mm or 40 mm** depend on the application.

10. Duct

Subduct

- To maximize the duct space, subduct is used to lay multiple cables inside the main duct.
- Number of subducts is normally between 3 and 5 depending on subduct size and usage cable size.
- No. of subduct in 110 main duct
 - 40 mm subduct size -> 3 subducts
 - 32 mm subduct size -> max 5 subducts
- maximum of 70 % cable filled ratio.
- 2 types of subduct
 - smooth wall type - mostly for blowing technique
 - corrugated type - for standard pulling method



Corrugated

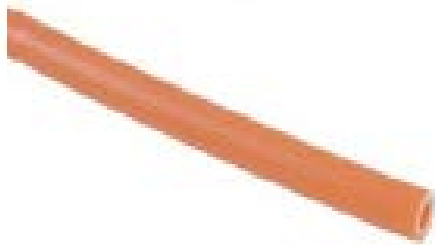


Smooth HDPE

10. Duct

Microduct

- normally use for cable blowing method for **microcable** type installation.
- can be installed in sub-duct or directly in main duct.
- Number of duct way also depends on the **application and capacity** of cable.
- **Size of microduct** will depend on duct and cable size.
- Microduct can be installed individually or in a bundle



Single Microduct



Bundle Microduct



10. Duct

10.2 Duct Specification

Specifications	Description
Material Type	HDPE, PVC, GI
Diameter	32 mm, 40 mm or 110 mm
Duct Colour	Black
Stripe Colour (if any - optional)	Yellow
Stripe Width	a) 32 mm and 40 mm duct: 4 mm - 6 mm b) 110 mm duct: 5 mm - 8 mm
Outer Marking Colour	Yellow
Outer Marking Size	Font size 20 pt

High-density Polyethylene (HDPE) duct

- **polyethylene thermoplastic** made from petroleum high pressure pipelines.
- normally used for construction via **HDD method**,
- also can be used for open trench application especially for area that require **extra protection**
- The minimum grade - equivalent or greater than **SDR13.5** grade.
- The **diameter** size can be 32 mm, 40 mm or 110 mm.



10. Duct

High-density Polyethylene (HDPE) smooth duct

- normally used for blowing application.
- provides the less friction between duct surface and cable during cable installation.
- The smooth duct is made from HDPE and the outer diameter is 40 mm.



PVC Pipe

- recommended for open cut method.
- suitable for conventional cable pulling method
- diameter size of PVC conduit is nominal 107 mm with 6 m length for every piece.



10. Duct

Galvanize Iron (GI) pipe type

- For area that require **extra protection** -road, drain or bridge crossing
- Diameter size of GI pipe is minimum 50 mm
- Min grade shall **BS EN 10255**
- The application as below:
 - Road crossing
 - ✓ Min Grade A for non-heavy traffic and
 - ✓ Min Grade B for heavy traffic road.
 - Pole riser - min Grade A.
 - Connection to customer premise - mini Grade A.



10. Duct

Draw Rope

- shall be installed in every of the new duct or subduct way.
- will be used to pull the subduct.



11. Quality of Material

All materials not otherwise specified to be used for the civil works construction are to be in accordance with the specifications of the **Malaysian Standards** or its equivalent

Concrete ratio mixer

Concrete	Parts by measure			Usage
	Cement	Sand	Aggregate	
Quality A	1	2	4	All jointing chambers, filling in covers manhole, plinth, concrete trough.
Quality B	1	3	6	For supporting, protecting or filling in purposes.
Quality C	1	4	3	Encasement of conduits. The maximum size of the aggregate shall be 6 mm.
Cement mortar	1	3	0	Plastering, sealing dummy ducts in jointing chamber, repairing damage or split ducts.

11. Quality of Material

Sand Grade

Sieve test (mm)	Passing (%)
10	100
5	95 - 100
2.36	70 - 95
1.18	45 - 95
0.6	25 - 60
0.3	5 - 30
0.15	0 - 10

Sand grade limit for cement mortar

Sieve test (mm)	Passing (%)	
	Sand for general purpose mortars	Sand for reinforced work mortars
4.75	100	100
2.36	90 - 100	90 - 100
1.18	70 - 100	70 - 100
0.6	40 - 100	40 - 80
0.3	5 - 70	5 - 40
0.15	0 - 15	0 - 10

Aggregator Size

Sieve test (mm)	Passing (%)
20	100
10	22 - 55
5	≤ 10

Steel Size

Imperial size (inch)	Metric size (mm)
1/4	6
5/16	8
3/8	10
1/2	12
5/8	16
3/4	20
7/8	22
1	25
1 1/8	28
1 1/4	32
1 1/2	40

12. Testing

12.1 Mandrel Test

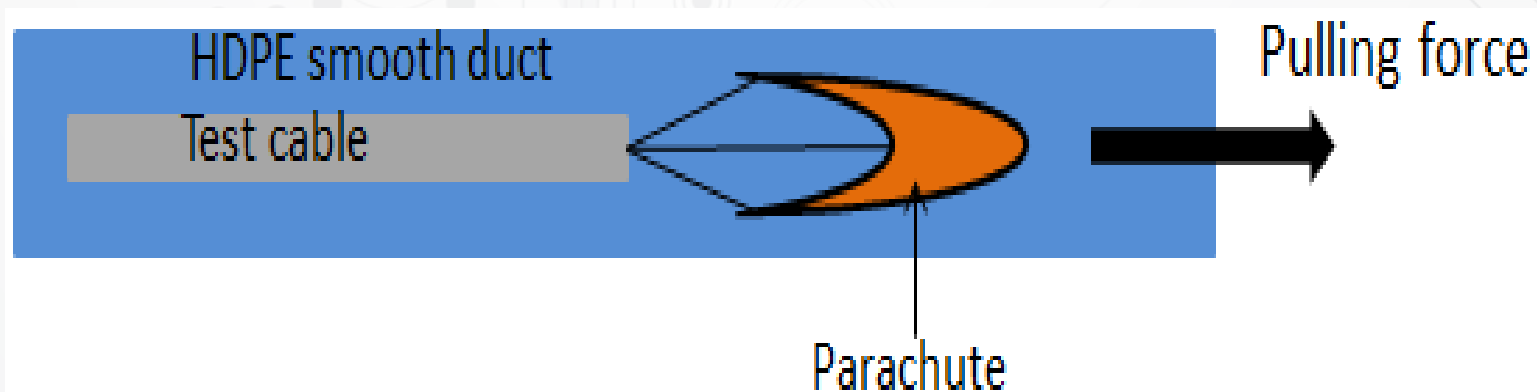
- to perform **after completion** of duct installation
- using **cylindrical brush mandrel** 457 mm in length and 83 mm in diameter
- the last joint of each duct shall be tested on completion of the manhole.
- passed twice through each 'way' to clean the duct
- to remove any foreign material which may have entered.



12. Testing

12.3 Blowing Test

- for HDPE duct smooth wall installation to ensure the duct is suitable to be used for cable blowing later.
- The blowing test shall be as follows:
 - a. **pressurizing** the duct and **monitoring air loss** - to ensure no damaged duct and couplers are properly installed.
 - b. **Attach 1-2m** cable to the cable carrier or parachute to the end of the fibre.
 - c. **Feed the cable** through the cable blower and into the duct.
 - d. **Apply a silicone-based** lubricant into the duct.
 - e. Connect the cable blower to the system and **inject air** into the duct behind the cable carrier.
 - f. The blower will exert a pulling force and the cable will begin to move through the duct.
 - g. The test is **successful** when the cable reaches to the **end** of the duct line.



13. Milling

13.1 Scrape existing road surface

- a process of removing a part of a paved area surface to receive a new wearing course.
- To follow relevant authorities instruction.



13.2 Road paving process

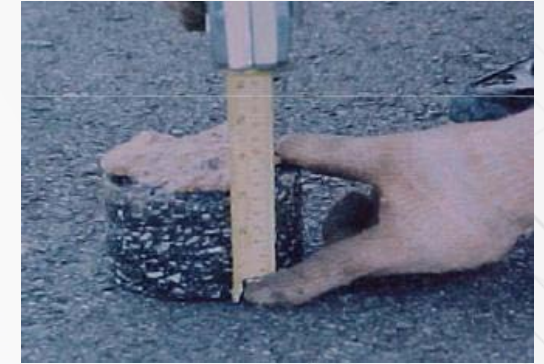
- Road paving shall be done as per specification JKR/SPJ/2008 or by the relevant authorities.



13. Milling

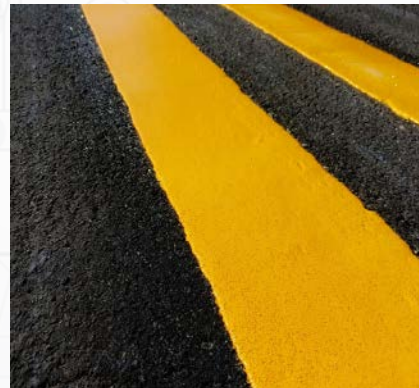
13.3 Coring test

- The purpose - to check the **thickness** of the asphalt premix
- by drilling a **cylindrical sample** of paved surfaced
- To carry out **within 24 h** of laying and compacting the asphalt premix
- diameter of core sample shall be **< 100 mm**
- thickness are **150 mm**.
- sampling **one sample per 500 m²** of premix laid.



13.4 Road painting

- as instructed by the relevant authorities.
- Prepare and apply 2 coats of approved road line paint (width of 100 mm) on the road to restore the existing road line which was removed during milling process.



14. Reinstatement

Reinstatement shall be applicable as per specification by JKR/SPJ/2008 or any requirements by the relevant authorities.

14.1 Reinstatement of excavated area in grass

- by re-planting the grass and plants which were removed during excavation.

14.2 Reinstatement of excavated area in carriageway

The procedures are as follows:

- a. Spread evenly and compact the 250 mm thickness
- b. Pour the asphalt premix with the thickness of 50 mm
- c. Compact the layer of the asphalt premix by using rammer machine
- d. to ensure that there are no changes in the level of surface at the excavated area after the road reinstatement work is complete.
- e. Repair all damages like curb, finishing (tiles) and etc.
- f. Road milling shall commence only after the road reinstatement on the excavated area has stabilized



15. Completion of Work

15.1 Site restoration

- All the signage, equipment and tools shall be removed and cleaned.
- All excavated work areas shall be backfilled and returned to the initial condition as required.
- Recover all valuable plants such as trees, landscape, carriageway according to the requirements of landowners or the relevant authorities.

15.2 Project handover

To retain and keep the following :

- a. as-built drawing;
- b. permits from relevant authorities;
- c. UDM report;
- d. duct-way space record information; and
- e. cross sectional diagram of the completed work with the following information:
 - i. the depth of the duct-way (vertical alignment) for every 6 m interval; and
 - ii. the setback distances.



TECHNICAL CODE

BASIC CIVIL WORKS - PART 2: OPEN TRENCH

Developed by



Registered by



Registered date:

20 May 2020

4

Technical Code Requirements

Stage 1

Planning

1. Planning for Open Trench Work
2. Utility Detection Mapping (UDM)

Stage 2

Specification

3. Depth & Width of Trench
4. Material

Stage 3

Installation

5. Road Cutting & Pilot Hole
6. Trench Excavation
7. Duct Laying
8. Duct Jointing
9. Duct Termination
10. Concrete Encasement
11. Backfilling

Stage 4

Completion

12. Testing
13. Safety Precaution

4 Technical Code Requirements

Stage 2
Specification

3. Depth & Width of Trench
4. Material

Depth & Width of Trench

- The width of trench **shall not be greater** than necessary for satisfactory execution of the work.
- The excavated trench shall be **as straight as possible**, and any bends or curves shall be of the maximum radius possible.
- The **depth of trench** shall follow according to the respective specification and as required by relevant government agencies, Local Authorities and Network Facilities Provider (NFP).

No of Ductway	Depth (mm)	Layer	Duct Formation
1	1500	1-Layer	○
2	1500	1-Layer	○○
4	1530	2-Layer	⊗⊗
6	1530	2-Layer	⊗⊗⊗
8	1680	2-Layer	⊗⊗⊗⊗
9	1680	3-Layer	⊗⊗⊗ ⊗⊗⊗
12	1680	3-Layer	⊗⊗⊗⊗ ⊗⊗⊗⊗
16	1830	4-Layer	⊗⊗⊗⊗ ⊗⊗⊗⊗ ⊗⊗⊗⊗
20	1830	4-Layer	⊗⊗⊗⊗ ⊗⊗⊗⊗ ⊗⊗⊗⊗ ⊗⊗⊗⊗
24	1980	4-Layer	⊗⊗⊗⊗ ⊗⊗⊗⊗ ⊗⊗⊗⊗ ⊗⊗⊗⊗

Materials for Duct Way

1

PVC Duct 107mm

- Type: PVC Duct
- Diameter: 107mm
- Color: Black
- Length per unit: 6m



2

HDPE Smooth Wall Duct 40mm

- Type: HDPE Smooth Wall Duct
- Diameter: 40mm
- Color: Black
- Length per drum: 500m
- Stripe Color: Yellow



4

Technical Code Requirements

Stage 3

Installation

5. Road Cutting & Pilot Hole
6. Trench Excavation
7. Duct Laying
8. Duct Jointing
9. Duct Termination
10. Concrete Encasement
11. Backfilling

Road Cutting & Pilot Hole

1

Asphalt Cutting Layer

Asphalt cutting using road cutter for two purposes;

- i. To ensure smooth excavation on the surface of carriageway.
- ii. To reduce the over-break at the excavation stage and to keep the upper road pavement layers adjacent to the trench intact.

The procedures of asphalt cutting are as follows:

- i. Mark two lines on the road with the average width of 750mm between the lines.
- ii. Cut along the lines by using road cutter to the full depth of the bituminous or concrete material (50mm).

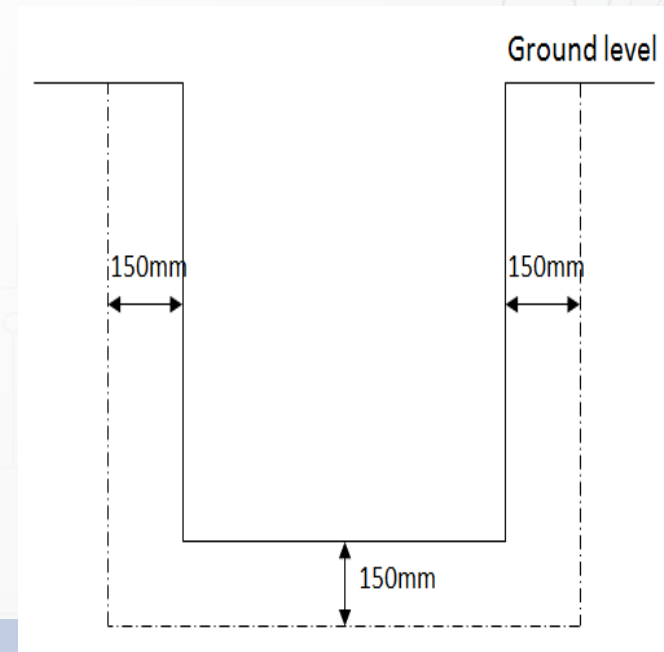


Cutting of asphalt layer using road cutter

2

Pilot Hole

- Pilot holes is an excavated holes along the identified route alignment to check possibility of existing utilities underground or other obstacles.
- Location & number of pilot holes shall be determined by the Project Supervisor.
- Size of the pilot hole is an additional of 150mm width & depth than the required trench dimension.

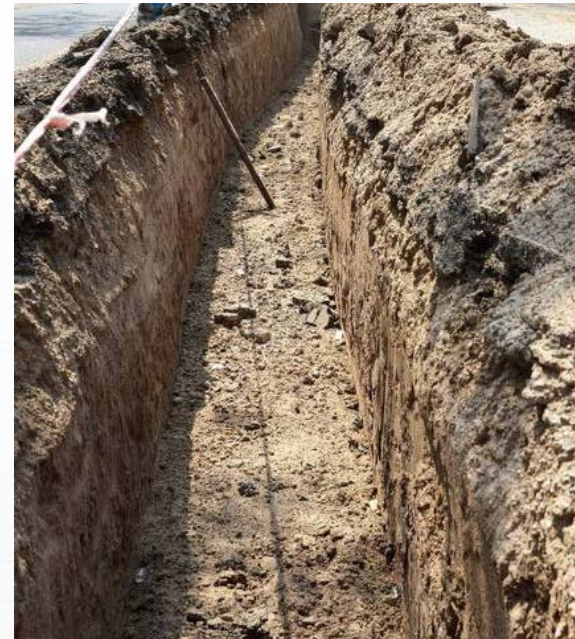


Trench Excavation

- Project Supervisor shall monitor and **measure depth & width** of the trench as specified in the project plan.
- At **every 20-meter interval** along the route alignment, depth of the trench shall be measured and recorded.
- The width of the trench shall be able to fix the number of ducts according to duct formation.
- The **bed of the trench** shall be leveled and clear from any obstacles which may obstruct duct laying process.



Measurement the
depth of trench
excavation

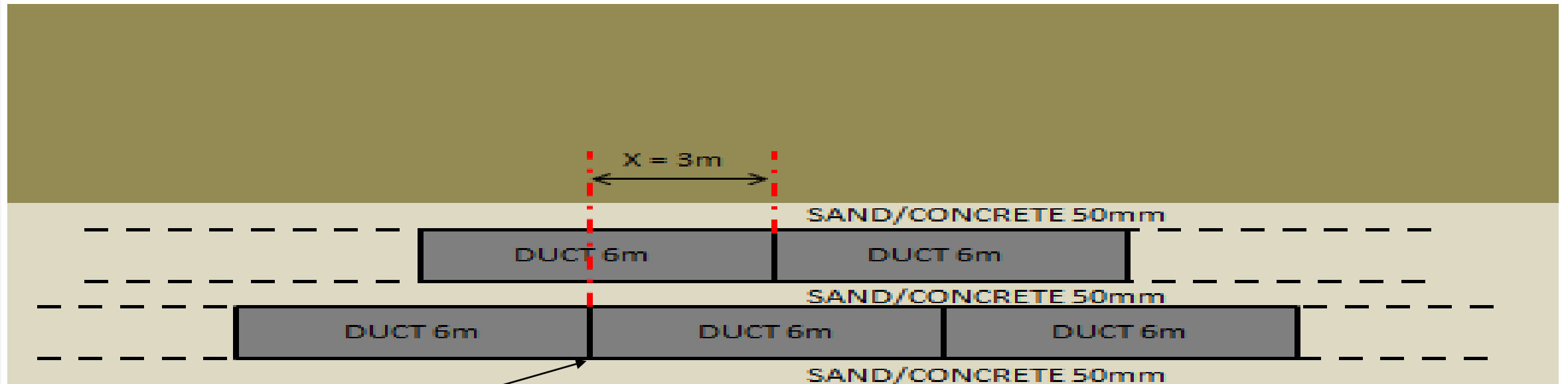


The bed of the trench
shall be leveled and
clear from any obstacles

Duct Laying

- This is the most important step in the construction of open trench civil work. During this process, Project Supervisor must ensure:
 - The line of ducts shall be kept as **straight** as possible.
 - In the case of 4-way ducts or more, the **break joint** line shall be arranged by approximately half the duct length in alternate lines, horizontally and vertically. X is break joint between duct layers.

GROUND LEVEL

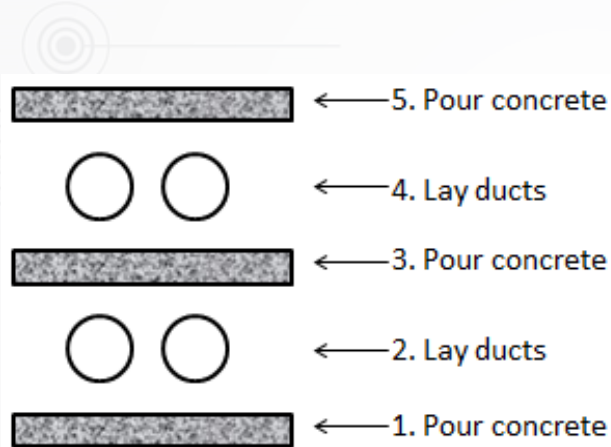
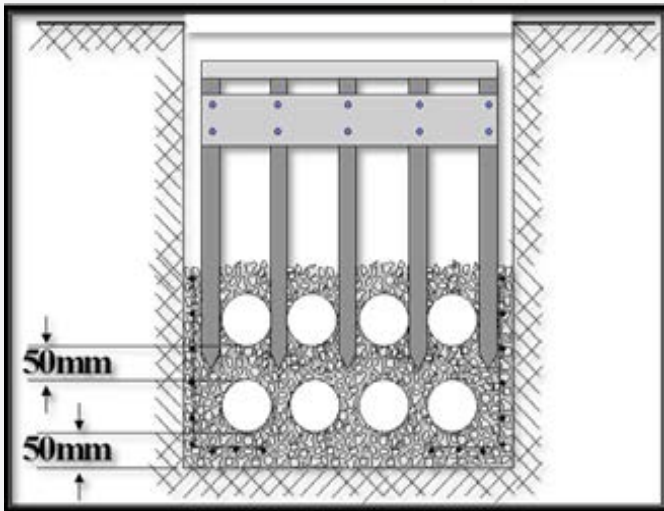


PVC duct break joint

Stage 3
Installation

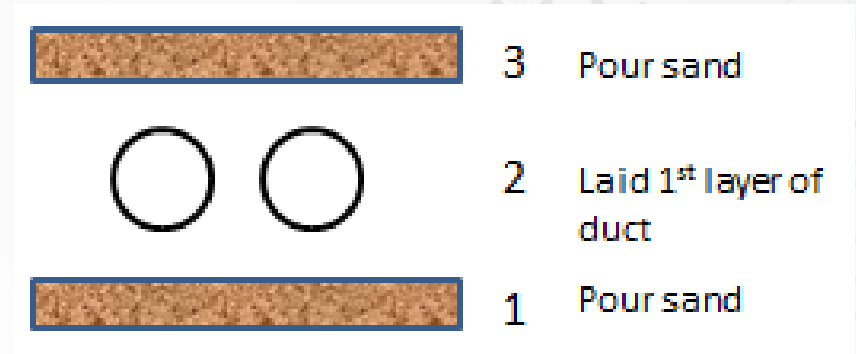
Duct Laying

1 With Concrete Encasement



- Step of duct laying with concrete encasement.
- Wooden comb is used to keep the ducts evenly spaced.

2 Without Concrete Encasement



- Steps of duct laying without concrete encasement

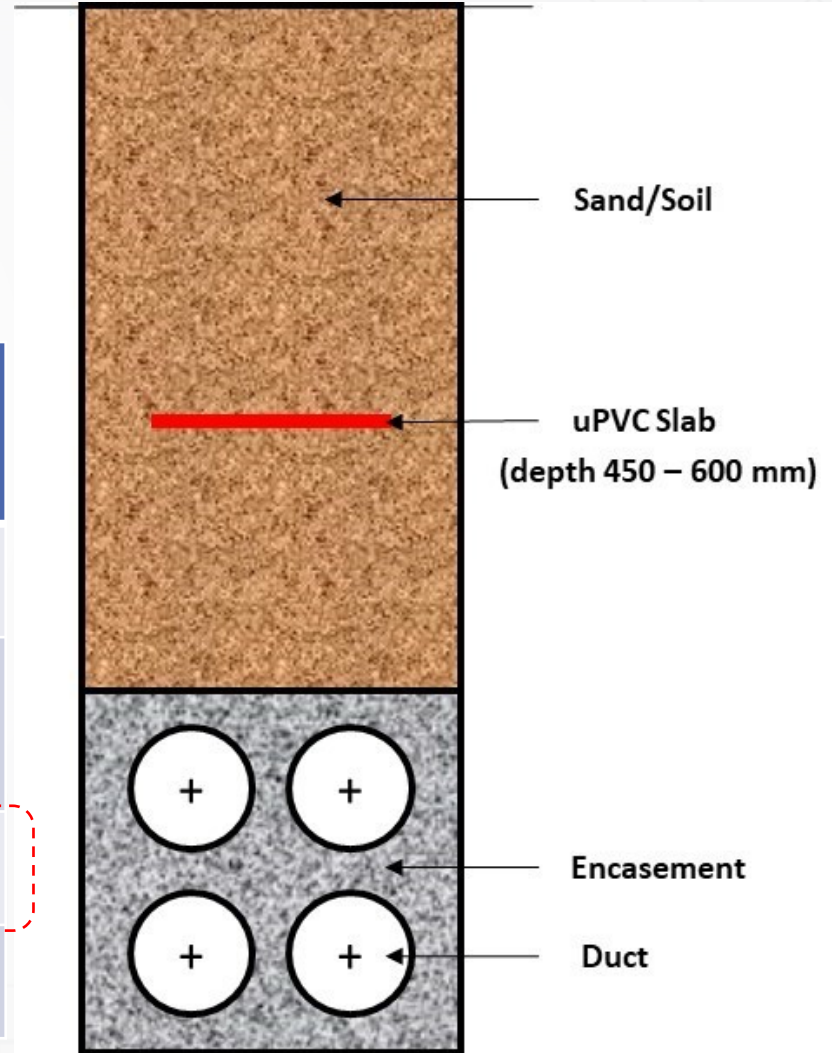
3 GI Pipe for Road Crossing

- Whenever the infra has to cross the road or the depth of trench is less than 300mm, GI Pipe is recommended as replacement of PVC duct.
- GI pipe is stronger than PVC duct to withstand the load of vehicles.

Concrete Encasement

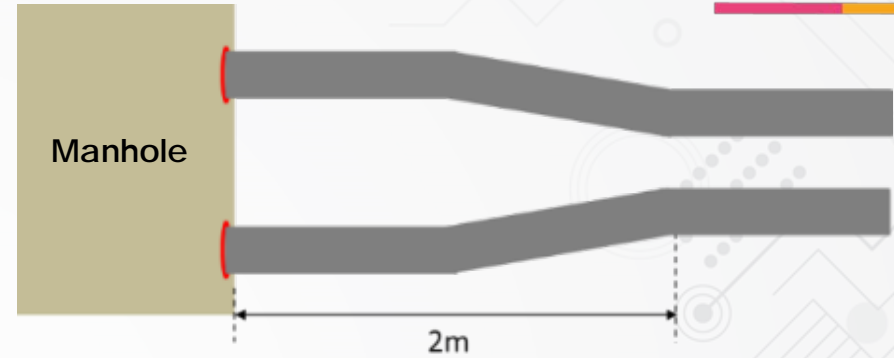
- In view of the criticality of the services riding on each cable, it is recommended that all duct route of **4 ways and above** to be concrete encased.
- The method of encasing the ducts in concrete is layer by layer method where each conduit shall completely surrounded by the concrete.
- The concrete used for the encasement shall be a **Quality C** type.

Concrete	Parts by Measure			Usage
	Cement	Sand	Aggregate	
Quality A	1	2	4	All jointing chambers, filling in covers manhole 3E and 7E, plinth, concrete trough.
Quality B	1	3	6	Placed between two set of plant if separate clearance is 152mm or less; For supporting, protecting or filling in purposes.
Quality C	1	4	3	Encasement of conduits
Cement mortar	1	3	0	Plastering, sealing dummy ducts in jointing chamber, repairing damage or split ducts.

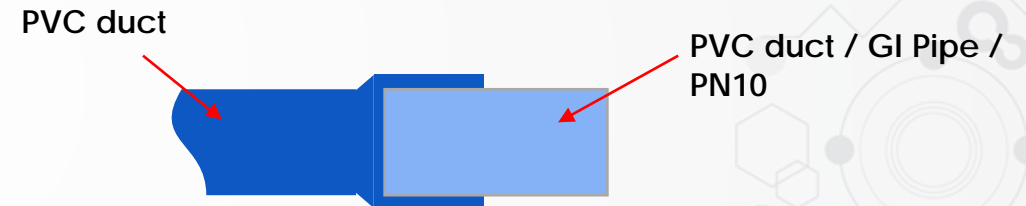


Duct Jointing

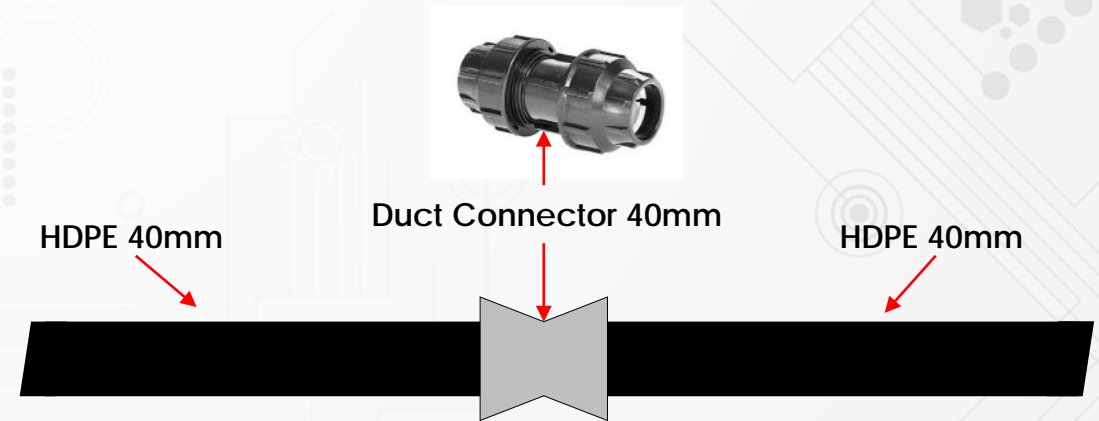
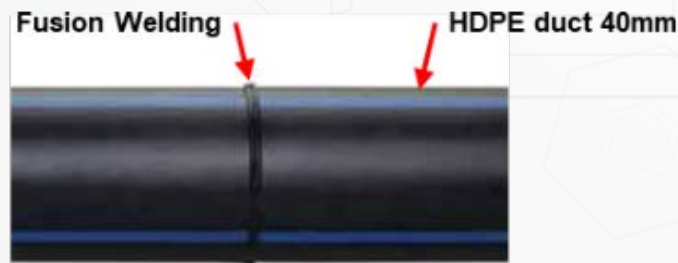
- Lead-in duct to manhole or jointing the ducts.
- Position by increasing or decreasing the duct way level within a minimum distance of 2m.
- No sharp bending.



- Jointing of 2 PVC ducts or PVC duct to GI pipe / PN10 duct can be done using Butt-Fusion method.



- Jointing the HDPE smooth wall duct 40mm can be done using Butt-Fusion Welding method or Duct Connector 40mm.



Duct Termination at Manhole

1

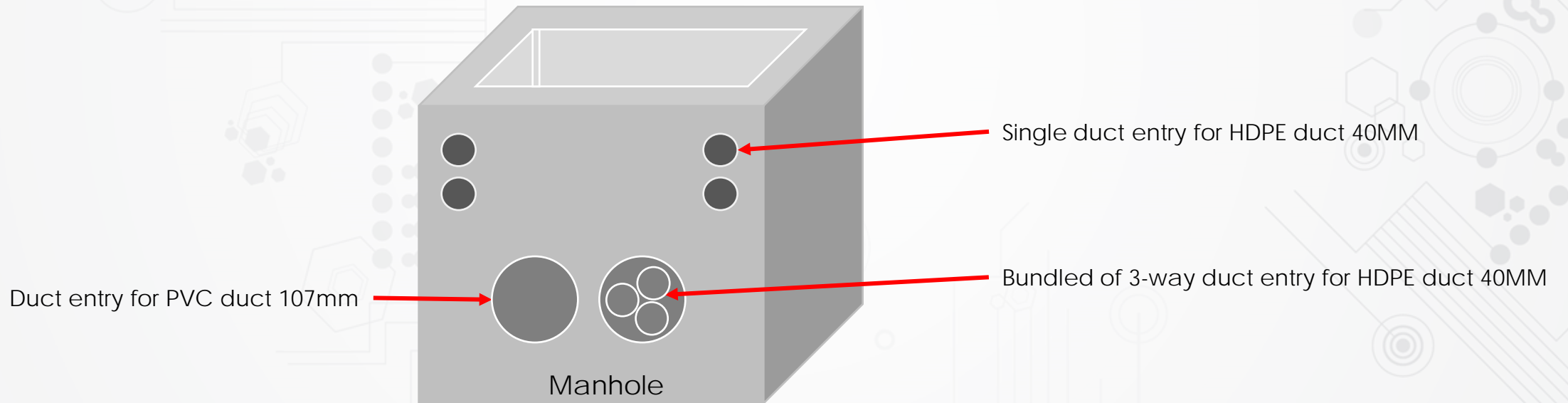
PVC Duct 107mm

- Termination of duct or Lead-in duct at manhole shall be done at the PVC duct entries

2

HDPE Duct 40mm

- The HDPE duct 40mm can be terminated at special duct entries for HDPE duct 40mm or at the normal PVC duct entries with bundled of 3-way HDPE duct 40mm per entry.

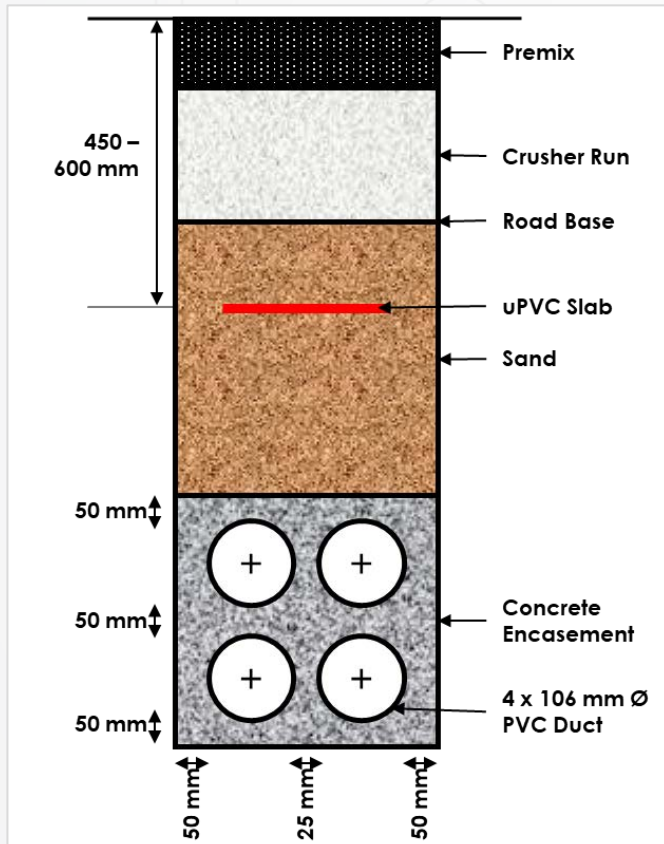


Backfilling

- It is important that the correct backfill materials is used. The compaction shall be done on layer-by-layer basis.
- Lay the uPVC slabs or warning tapes along the route alignment at the depth range of 450 mm to 600 mm from the ground level.

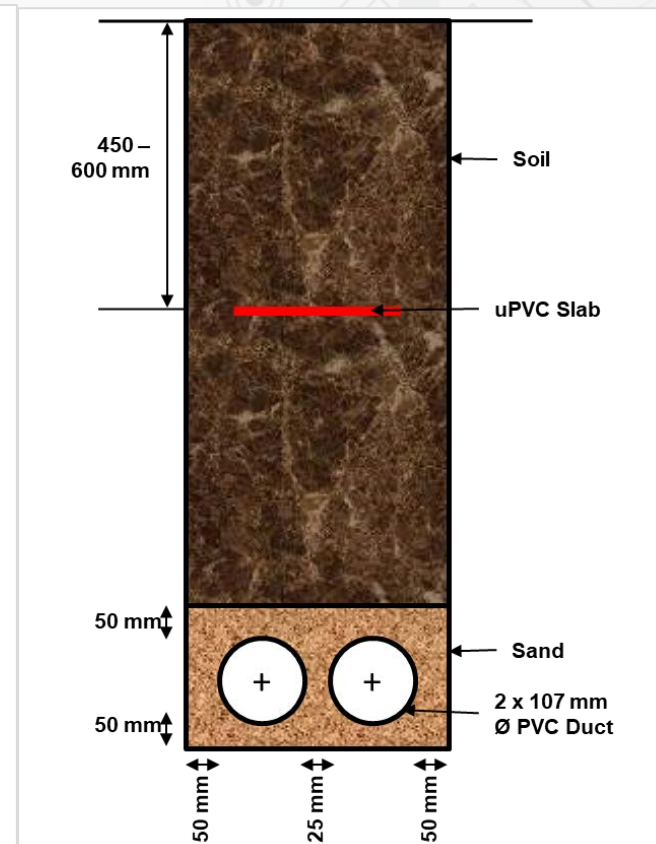
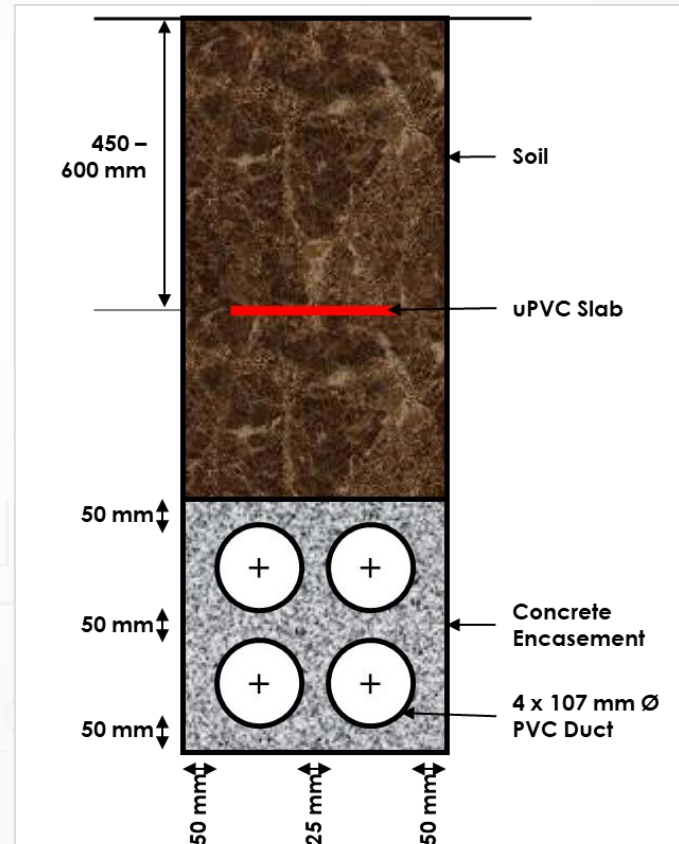
1 Backfilling in Carriageway

- Backfilling in carriageway shall be done by using clean sand but subject to approval from relevant government agencies or Local Authorities.



2 Backfilling in Grass

- Backfilling in grass shall be done by using clean sand and soil.



4 Technical Code Requirements

Stage 4
Completion

3. Testing
4. Safety Precaution

1

Mandrel Test

- The purpose of the test is to clean and test the duct condition.
- A Mandrel is a device that is pulled through the duct for the testing.



Wooden type

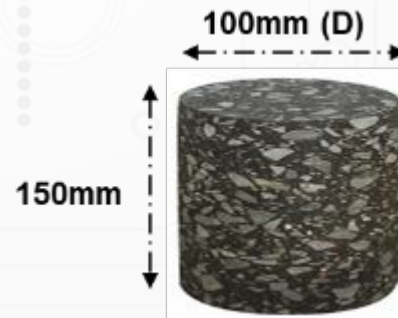


Brush type

2

Coring Test

- The purpose of the test is to check the thickness of the asphalt premix.
- Drilling a cylindrical sample of paved surfaced when requested.
- Generally, the test is carried out within 24 hours of laying and compacting the asphalt premix or as instructed by relevant authorities.
- The diameter of core sample shall be less than 100mm and the thickness is 150mm. The rate of sampling shall be one sample per 500 m² of premix laid.



Shoring System

- Shoring apparatus is a tool which is used specially to maintain the stability of the side walls of an excavation and provide protection to workers who may enter the excavated trench for duct laying etc.
- Shoring equipment shall be used for the trench of more than 1.5m in depth by using the mechanical digger.



Deeper trench must be shored



Challenges

- a) High deposit & permit cost
- b) Limited area
- c) Stringent and non standard procedure by the authorities.
- d) High cost for road milling process.
- e) 12 months liability period for rework process on any defect.

Conclusion

- a) Open Trench civil work method is the best way to offer **up to 24-way of underground ducting** which equivalent to a minimum 72 fiber optic cables can be installed.
- b) It also offer **a lower cost** compare to Horizontal Direct Drilling (HDD) method for the same number of duct ways.
- c) Support from all relevant authorities and agencies are highly required.



Malaysian Technical Standards Forum Bhd

MCMC MTSFB TC G025-3:2020

TECHNICAL CODE

BASIC CIVIL WORKS - PART 3: MICRO TRENCH

Developed by



Registered by



Registered date:

20 May 2020

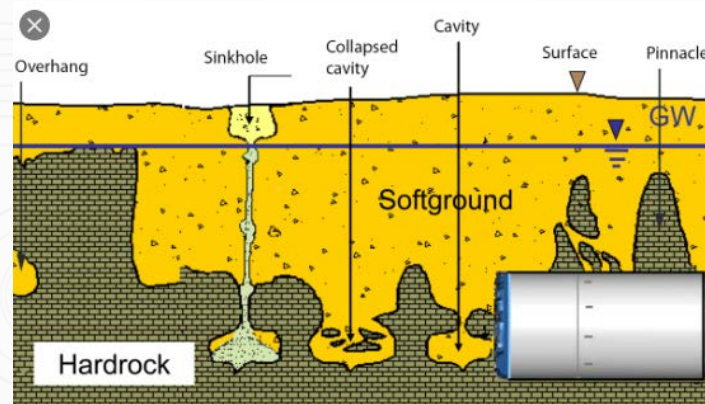
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Application

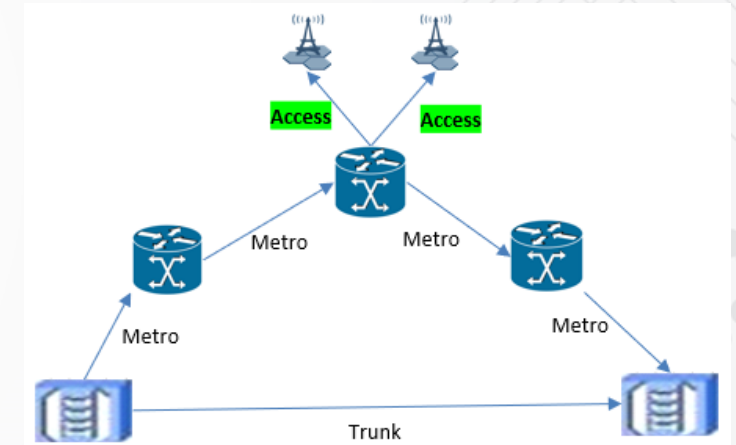
- Micro trench work is considered as an alternative civil works method. This method is suitable for certain conditions:



Congest road



Ground conditions
With hard rock



Micro Trenching for
access site

- Minimum road impact
- Micro trench size

- 300 mm depth
- Micro trench opening

- Low capacity duct/cable

1. Scope

This Technical Code specifies requirements for micro trench works for the installation and maintenance of communications network facilities which covers:

- a) planning for micro trench works;
- b) technical specifications; and
- c) installation procedures.

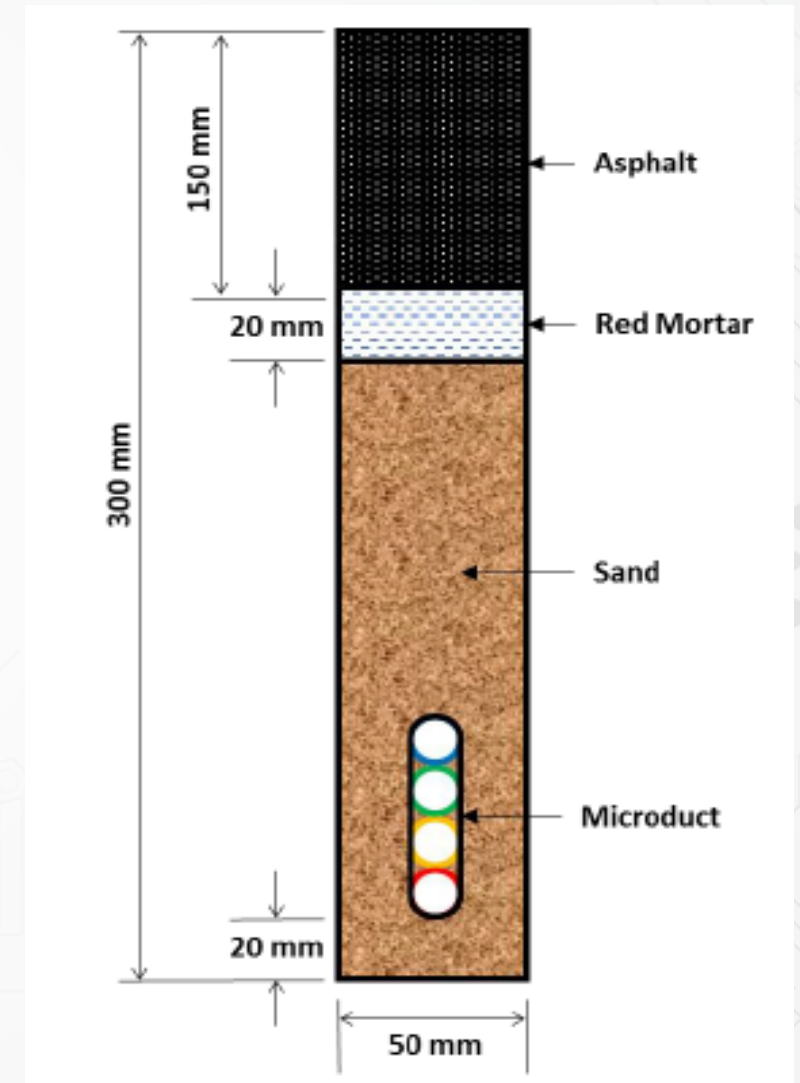
2. Planning Of Civil Work

- To follow as specified in *Basic civil works - part 1: general requirements*
- To plan **after confirmation** from relevant government agencies, local authorities and land owner
- To determine the suitability of **Micro Trench method** – road surface and surrounding condition
- Number of **duct ways and capacity** of the cable to be laid later

3. Technical Specifications

Trenching

- Only applied on routes that involve surfaces such as
 - ✓ roads (asphalt),
 - ✓ sidewalks (pavement) and
 - ✓ other concrete-based surface.
- carried out by cutting a groove at
 - a depth of 300 mm and
 - width of 50 mm



4. Technical Specifications

Duct

- The maximum diameter of duct allowed shall be **50 mm**.
- An insulated or metal-based wire shall be built-in inside the HDPE duct for precise route detection.
- There are various types of duct to be used for micro trench as follows:

a) High Density Polyethylene (HDPE) type duct;

- i) smooth wall duct with direct installed microducts
- ii) bundled microducts
- iii) individual microduct



b) Galvanised Iron (GI) pipe



5. Technical Specifications

End Cap

- End caps shall always be used during the laying, storing and transporting of microducts to prevent the penetration of water or dust
- removable and reusable
- diameter matched to the microducts size



6. Technical Specifications

Connector

- Connectors are used as sleeves for connecting 2 microducts
- removable and reusable
- should not affect the tensile strength and pressure of the microducts
- Straight connectors are used to join 2 microducts that are similar in diameter
- "reducers" are used for different diameter



7. Installation Procedure

7.1 Road Cutting

- asphalt cutting machine
- cutting speed may depend on the type of machine used.
- avoid any sharp turns in direction.
- angled cutting - to comply with the minimum bending radius required for the microducts



Cutting Machine



Angled cutting



7. Installation Procedure

7.1 Road Cutting

- on the road marker line.
- Upon reinstatement, the road marker line should be repainted
- cut in a straight line
- trenching line using suitably marked to guide the cutting.



Reinstatement



Road marker line



Road painting

7. Installation Procedure

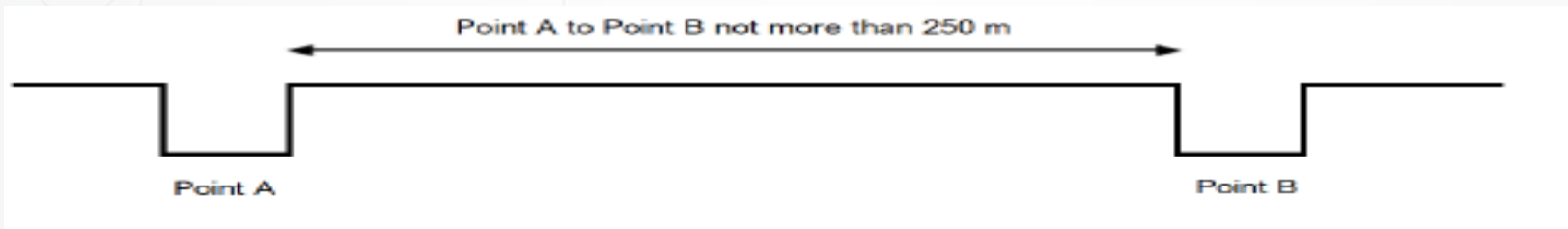
7.2 Groove cleaning and drying

- After trenching, the bottom of the trench **shall be cleaned**.
- Cleared from any loose stones or pebbles which could exert **undue pressure** and **force** on the wall of the microducts, causing damage and deformation to microducts.
- The following procedures shall be carried out after cutting the groove:
 - a) remove debris from the sides of the excavation;
 - b) remove adjacent paving materials which were damaged as a result of excavation; and
 - c) clean the bottom of the trench.

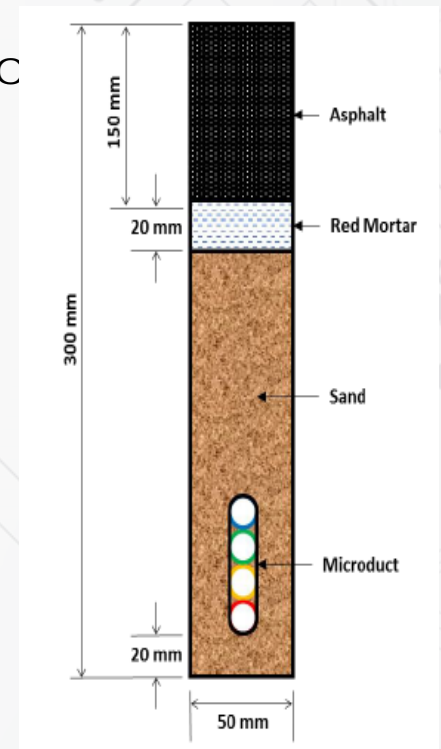
7. Installation Procedure

7.3 Laying duct

- The duct comes in various sizes with very low friction level.
- The duct is a direct-buried type with high tensile strength and crush resistance.
- The recommended distance between 2 points should not exceed 250 m



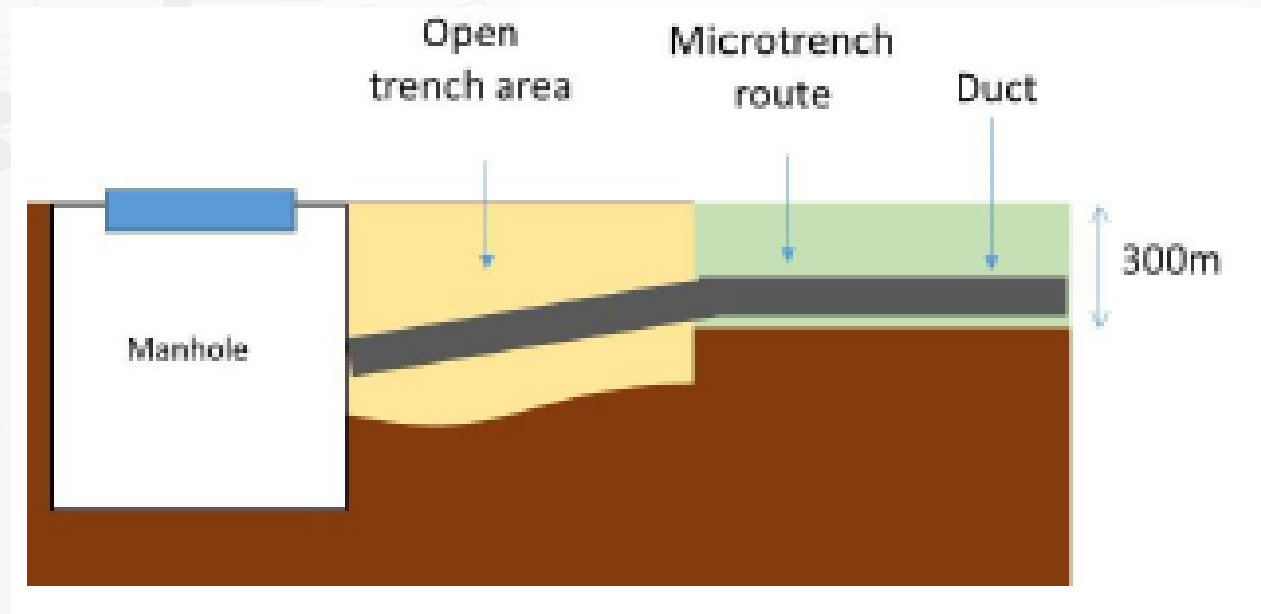
- Before laying duct into the bottom of the trench, to fill with **20 mm sand bedding** to provide cushion or absorption mechanism for the ducts.
- After laying the duct, a further topping using sand up to **60 mm of thickness** shall be done to absorb mechanical shock forces from the top of road surface.



7. Installation Procedure

7.3 Lead in manhole

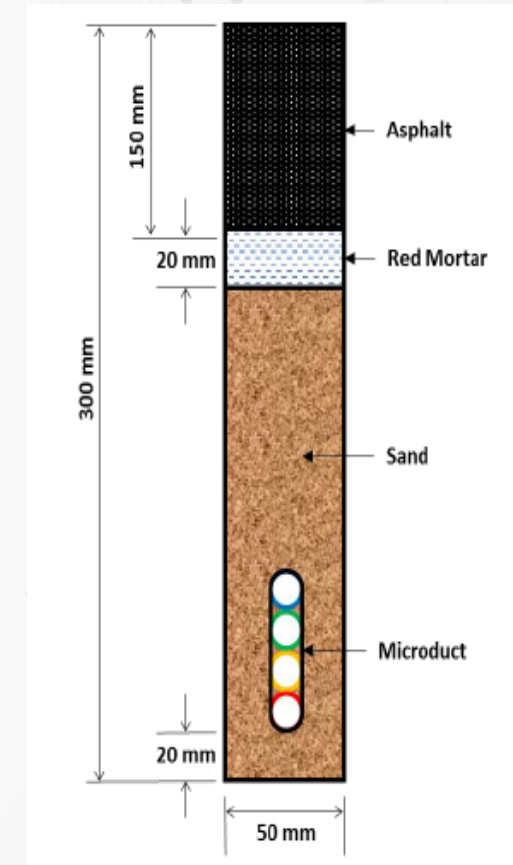
- Using **conventional excavation** with appropriate length.
- The dropping of the trench should be **gradual** from the access point to the manhole
- Individual duct shall be **separated and located at a suitable horizontal distance** inside the manhole



7. Installation Procedure

7.4 Backfilling

- Backfilling shall satisfy the following performance requirements:
 - a) volumetric stability;
 - b) bond and adhere to the walls of the trench;
 - c) the entire excavation shall be fully filled and without different settling; and
 - d) the backfilling material shall be readily removable for future maintenance works
- A suitable measure shall be taken to maintain the cable geometry and avoid undesired **floating of the ducts** during backfilling process.
- The properties of the asphalt shall be similar to the **existing surface** for reinstatement.



Challenges

This method may not be suitable for certain types of areas based on the ground conditions, surrounding utilities and shall always consider the aspect of safety and environmental.



Ground conditions



Congest Utility



Safety and environmental

Conclusion

- Micro Trenching is an **alternative solution** that only requires minimum trenching width
- Provide a **lower cost solution** and **fast deployment**
- Only **limited for low impact** and **low density of cable**



Malaysian Technical Standards Forum Bhd

MCMC MTSFB TC G025-4:2020

TECHNICAL CODE

BASIC CIVIL WORKS - PART 4: HORIZONTAL DIRECTIONAL DRILLING

Developed by



Registered by



Registered date:

20 May 2020

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LET'S COLLABORATE @ MTSFB!

1. Scope

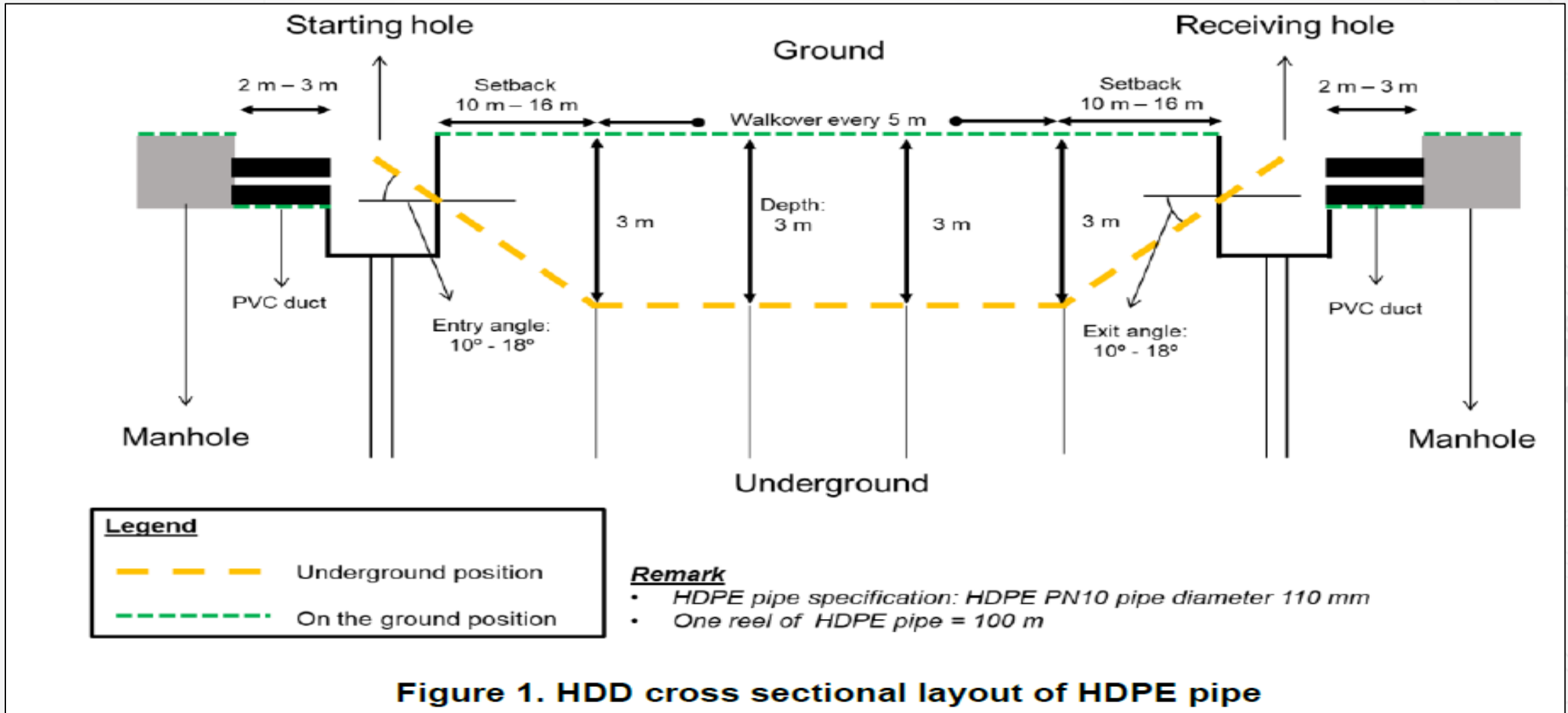
- This Technical Code specifies the requirements for HDD works for the installation and maintenance of communications network facilities which cover: -
 - a) Planning of horizontal directional drilling works;
 - b) Technical specifications; and
 - c) Installation procedures.

2. Planning for HDD

- Planning of HDD works shall be done as described in Basic Civil Works – Part 1 (MCMC MTSFB TC G025-1:2020).
- The potential areas that may require for HDD works are as follows:

<p>a) crossing river;</p> 	<p>b) crossing highway;</p> 
<p>c) crossing railway;</p> 	<p>d) Carriageway / grass verge</p> <p><i>*instructed by the relevant authorities</i></p> 

3. Technical Specifications for HDD – 2/2



- Starting and Receiving holes shall be kept as minimum as possible to minimise the surface damage. Recommended size is 1.5 m (W) x 2.5 m (L) x 1.5 m (D)

3. Technical Specifications for HDD – Crossing River

- A proper mapping shall be done to measure the river bed to determine the minimum HDD depth.
- For river crossing, the depth and distance from riverside is subject to the relevant authorities

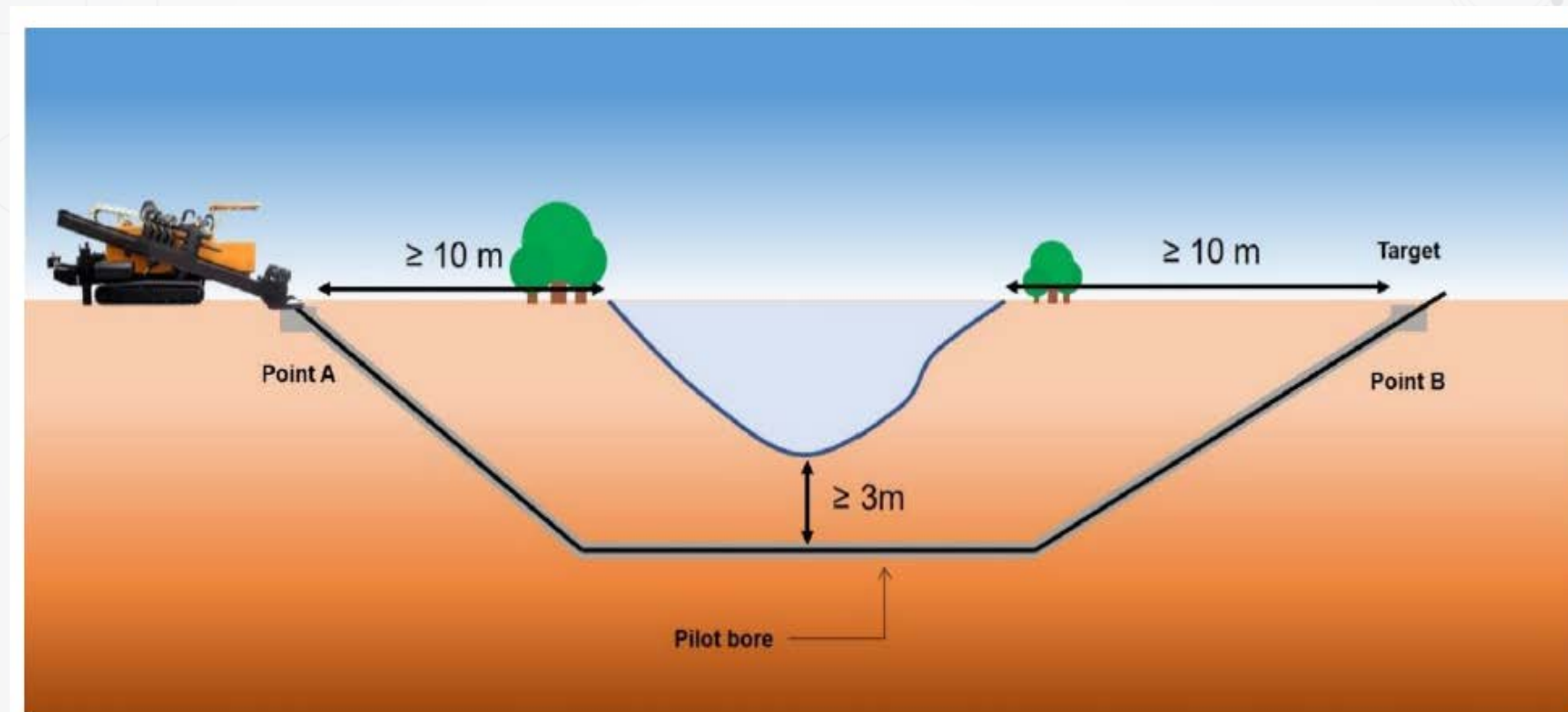


Figure 2. HDD cross sectional layout for river crossing

3. Technical Specifications for HDD – Machine

Type of distance	Machine weight (kg)	Machine size (m)	Thrust (kN)	Pullback (kN)	Remarks
Short range (< 100 m)	< 2 000	2 - 4	20	22	Limited work space to place the machine or the newly constructed manhole (e.g. beneath roads, driveways, sidewalks, sensitive landscaping, and other surface obstacles).
Medium range (100 m - 500 m)	3 000 - 5 000	3 - 5	40	40	Ideal HDD construction work.
Long range (> 500 m)	> 8 000	> 5	> 100	> 100	HDD construction which requires a special machinery and requirement (e.g. wide river crossing > 500 m)

3. Technical Specifications for HDD – HDPE Duct

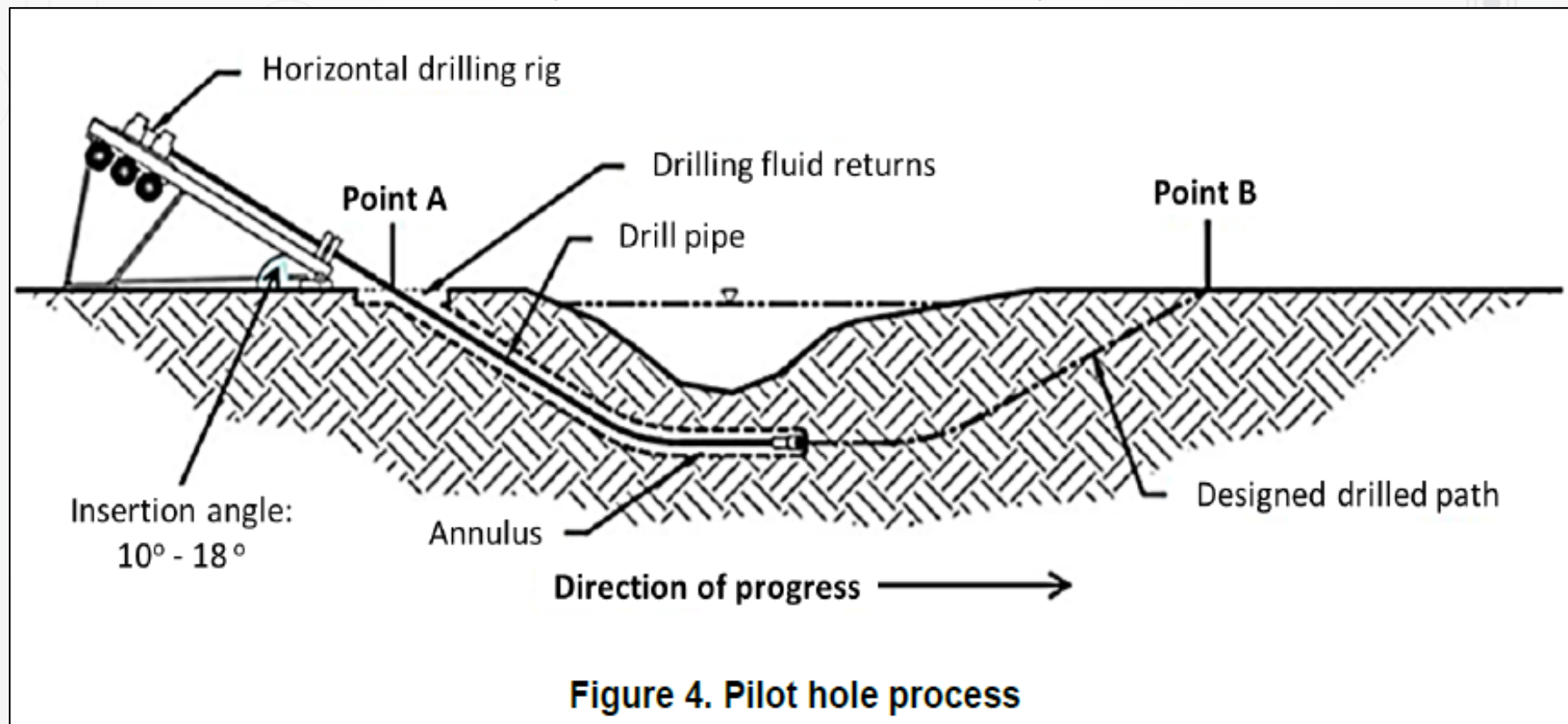
- The diameter of HDPE pipe can be 32 mm, 40 mm or 110 mm

Table 3. HDPE pipe ratio

RESIN	PE80									
SDR	21		17		13.6		11		9	
PN	6		8		10		12.5		16	
Minimum wall thickness (mm)										
OD (mm)	(mm)	(kg/m)	(mm)	(kg/m)	(mm)	(kg/m)	(mm)	(kg/m)	(mm)	(kg/m)
40	2.0	0.245	2.4	0.292	3.0	0.359	3.7	0.428	4.5	0.508
50	2.4	0.370	3.0	0.450	3.7	0.546	4.6	0.664	5.6	0.787
63	3.0	0.574	3.8	0.716	4.7	0.870	5.8	1.049	7.1	1.257
75	3.6	0.822	4.5	1.011	5.6	1.233	6.8	1.465	8.4	1.766
90	4.3	1.179	5.4	1.454	6.7	1.767	8.2	2.123	10.1	2.547
110	5.3	1.769	6.6	2.164	8.1	2.617	10.0	3.149	12.3	3.785
125	6.0	2.261	7.4	2.760	9.2	3.372	11.4	4.085	14.0	4.896

4. Installation Procedures for HDD – 1/2

- **Pilot hole** - At least 2 pilot holes shall be excavated along the HDD route
- **Pilot Drilling** - Pilot drilling is done from point A (starting hole) to point B (receiving hole)
- **Work area shall be confined with safety barricade** to avoid any hazard



4. Installation Procedures for HDD – 2/2

- The contractor shall monitor and record the depth of the drilling.
- **Walk-over tracking system** - to determine the depth, location and direction of the bore head during the pilot hole process
- In walk-over system, a **sonde** (transmitter) is installed inside the bore head



Figure 6. Sonde (transmitter)

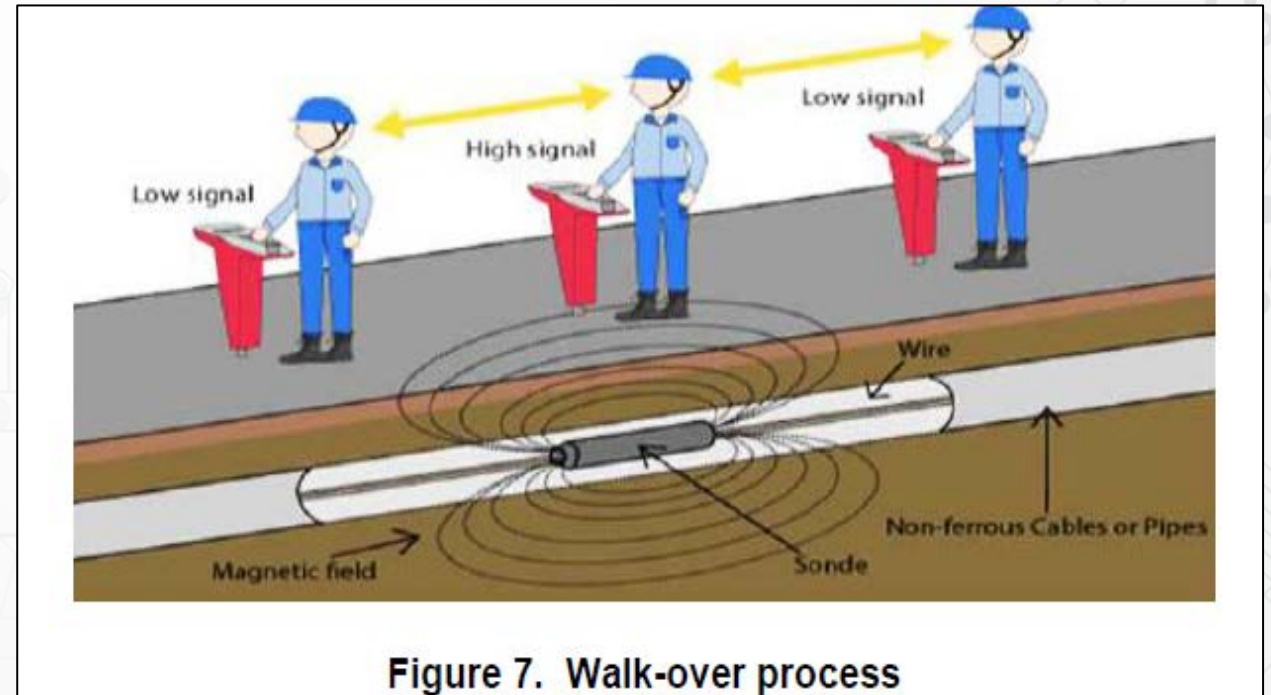
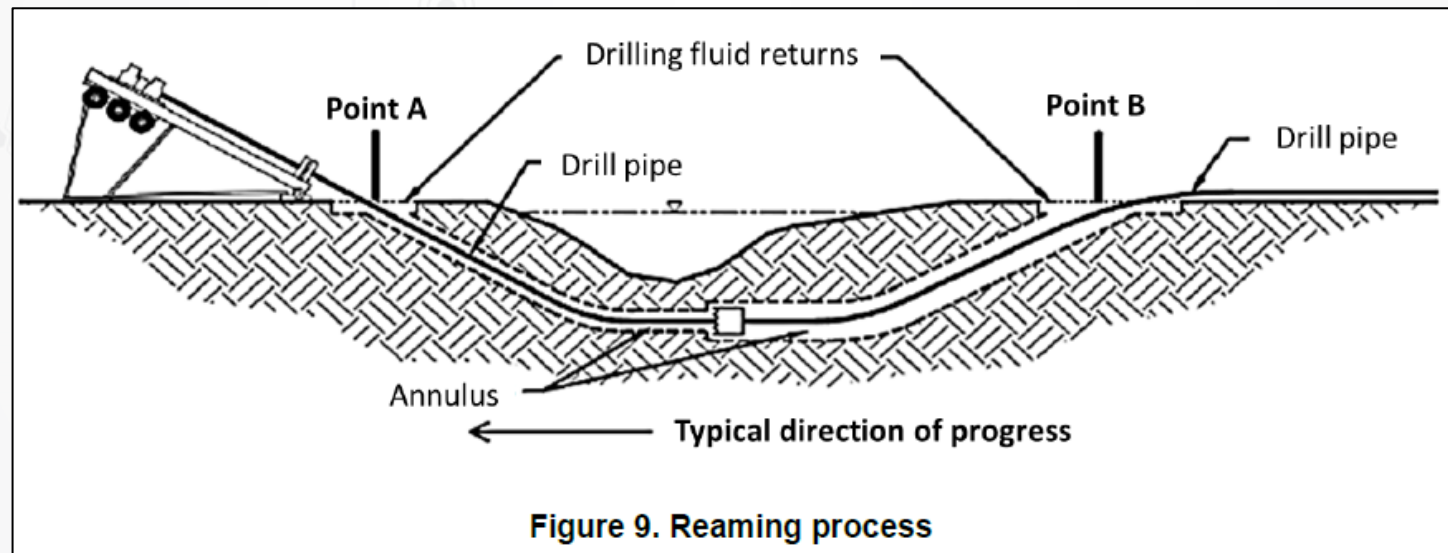


Figure 7. Walk-over process

4. Installation Procedures for HDD – Reaming

- Reaming is a **process of enlarging the bore hole** after drilling process
- The **steps of reaming process** are as follows:
 - a) Upon reaching at point B, the reaming process will start
 - b) Replace the angle bit at the end of the drill pipe with a reamer size 16 inch to enlarge the bore hole (4 ductways)
 - c) Pull back the reamer from point B
 - d) Add drill pipe behind the reamer so that there is always drill pipe in the bore hole



4. Installation Procedures for HDD – Size of Reamer

- Use swivel to prevent the rotation of drill pipe behind the reamer during the reaming process. The **suitable reamer size depends on the number of ductway** as shown in Table 4

- The reaming tools for reaming process are shown in Figure 10

Table 4. The size of reamer for HDD work

No	Size of reamer (inch)	Number of ductway
1	12	2
2	16	4
3	20	6
4	24	8
5	36	12

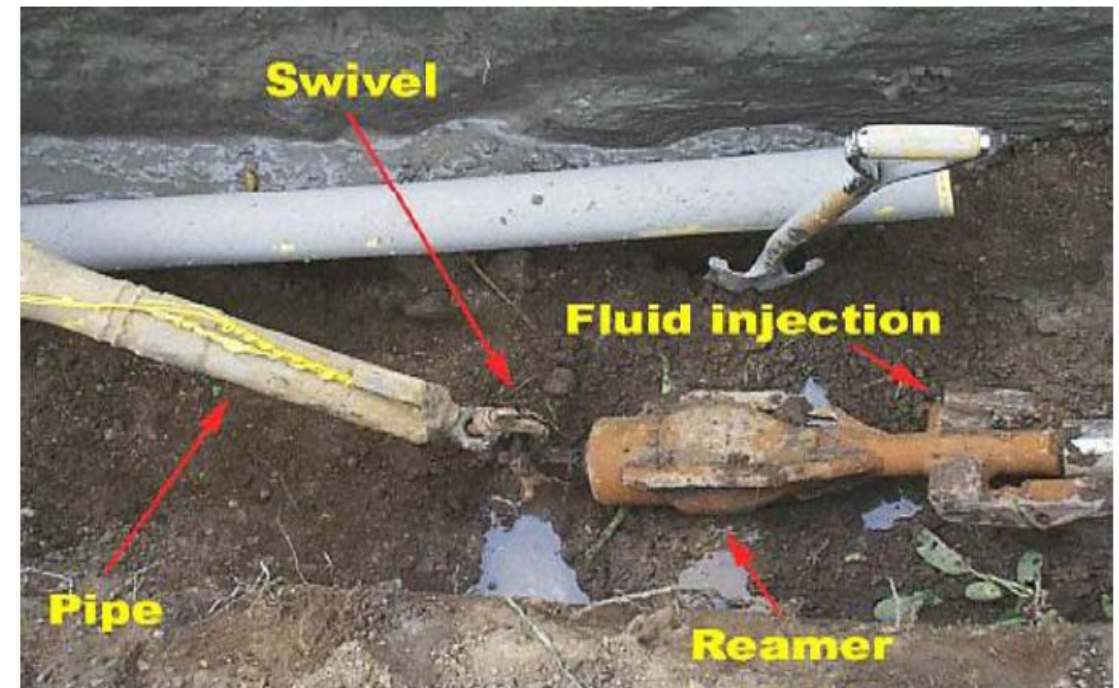


Figure 10. Tools for reaming process

4. Installation Procedures for HDD – Laying of HDPE

- The **HDPE duct shall be pulled back into the reamed hole** from point B to point A upon reaming process completed as shown in Figure 11
 - a) Using a pull head and a swivel, connect the HDPE duct to the drill pipe
 - b) To ensure the hole remain open, locate a reamer between the pull head and HDPE duct. It is also to allow lubricating fluid to be pumped into the hole during the laying process
 - c) The **laying process** will continue until the HDPE duct reach at the point A
 - d) Once the laying process of HDPE is complete, disconnect the pull head
 - e) Then, remove the drill and start the **clean-up process** as shown in Figure 12

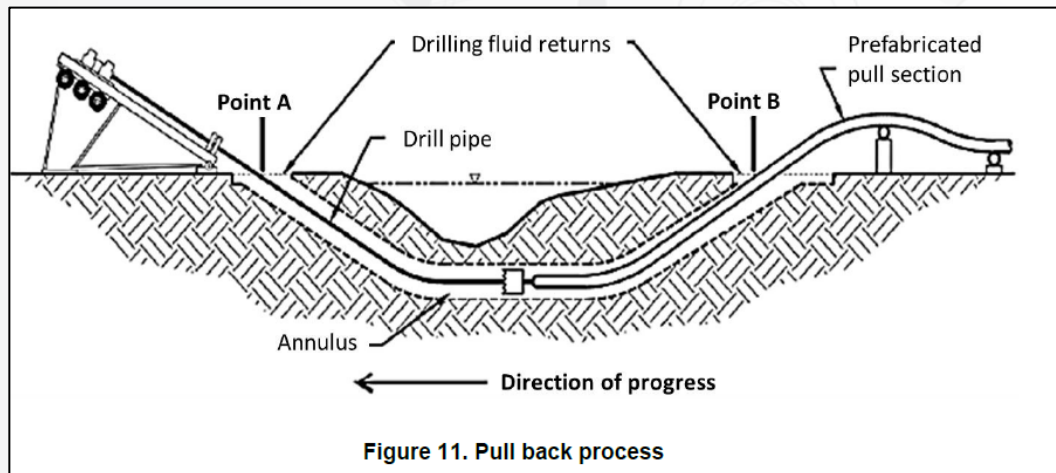
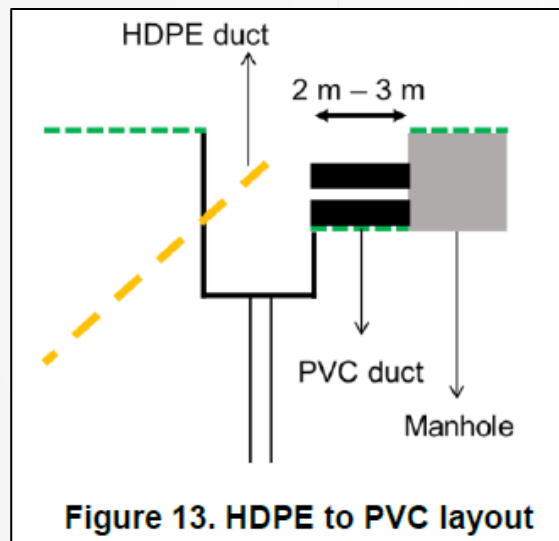


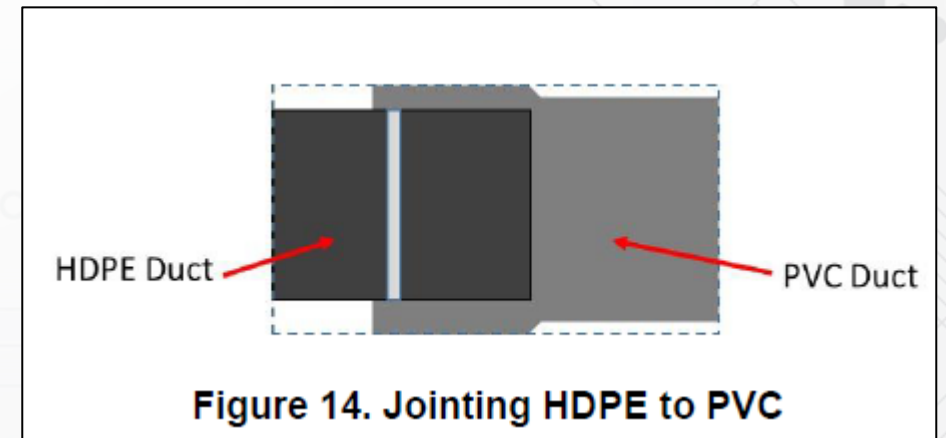
Figure 12. Reamer during completion of pullback process

4. Installation Procedures for HDD – Jointing HDPE to Manhole

- **Jointing of HDPE ducts to the existing manhole shall be done by connecting existing HDPE to PVC duct which has connection to the existing manhole.** The process is illustrated in Figure 13



- **Excavate a new trench with suitable depth to allow connection between existing PVC and HDPE duct as illustrated in Figure 14**
 - a) Wipe and clean both end of the ducts.
 - b) The outer surface of the HDPE duct shall be smoothed by using sand paper.
 - c) The inner surface of HDPE shall be trimmed by using grinder.
 - d) The end of the PVC duct shall be heated to expand the diameter of the ducts.
 - e) The HDPE duct is inserted into the PVC duct where PVC glue is applied to join the ducts.



Challenges / Conclusion

- **HDD specification** was developed to **minimize the impact** of construction work and **expedite the installation process**
- **HDD** bring advantages by **minimize road cutting** and **simplify the process** (no major road milling require)
- With the proper SOP may expedite the permit approval and installation work to meet **NFCP / JENDELA aspiration**
- High deployment cost compared to other construction method
- **Site limitation** such as limited space due to area full of underground utilities infrastructure and no space for HDD machineries work may be a challenges for this method
- Existing **utilities mapping database** in major city shall be updated to ensure minimal risk
- **Support** by all the relevant authorities and agency is required



5

Conclusion/Challenges

Q&A

*Thank
You*

Let's Collaborate



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