



Energy for
generations

ESBN Under Ground Construction Standards



This Presentation will cover

1. Documentation associated with Developments
2. Ducting
3. Substations
4. Minipillars

- **Responsibility – Set the Standards and Policies for the Under Ground Network.**
- **E.g. The duct is the prime asset in the ground / Substation Minipillar prime asset over ground.**
- **Our Function – To design, implement and maintain Safe and Reliable Assets over their life cycle.**
- **Life cycle = 80 years of safe and reliable operation**
- **To achieve safe and reliable operation, we specify**
 - Approved materials for above lifetime
 - Construction standards
 - Ducting , Precast chambers, Depths, clearances ; protective materials ,backfill materials etc..
- **ESB incorporate safety legislation / international specifications & guidelines into our standards.**
- **Standards are in place to protect installers / operators and members of the public and all other utility and construction workers**

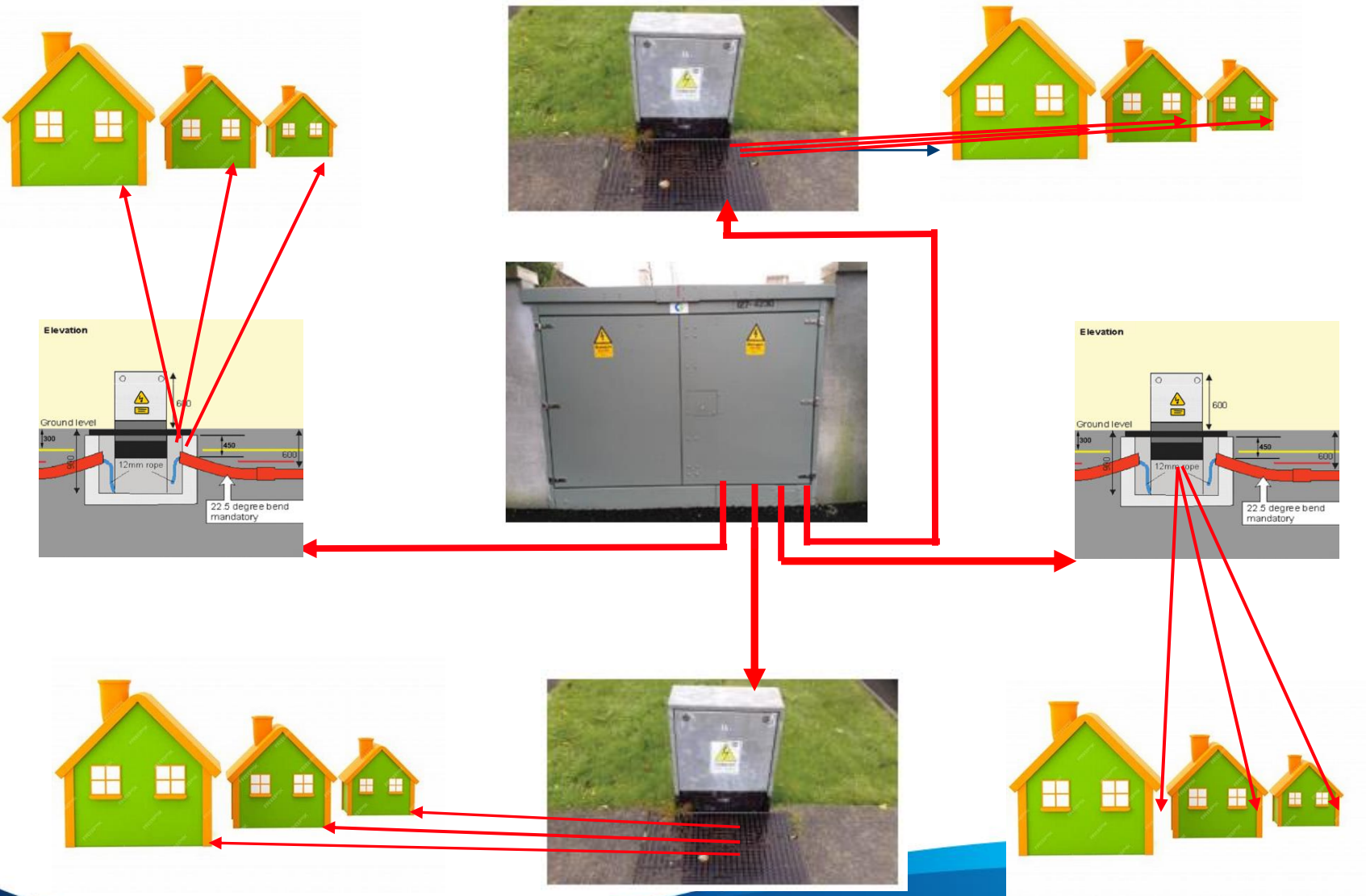
Section 1 Documentation

James O'Shaughnessy

- Documentation can be found on ESB website
- **Housing Scheme Book “Blue Book”**
 - [electrical-services-guidebook-for-housing-schemes96bf505f-4d12-4287-9c6d-ce0fa35a5b46.pdf \(esbnetworks.ie\)](https://www.esb.ie/assets/energy/96bf505f-4d12-4287-9c6d-ce0fa35a5b46.pdf)
- **Indoor Substations Standard**
 - [Construction Standards for MV Substation Buildings \(esbnetworks.ie\)](https://www.esb.ie/assets/energy/Construction%20Standards%20for%20MV%20Substation%20Buildings.pdf)
- **Trench Cross Section Drawings**
 - [mv- amp -lv-cable-installation-drawings.pdf \(esbnetworks.ie\)](https://www.esb.ie/assets/energy/mv-amp-lv-cable-installation-drawings.pdf)
- **4 Page Ducting Summary for LV/MV, 38kV, 110kV**
 - [summary-of-standard-specification-for-esb-networks-mv-lv-ducting.pdf \(esbnetworks.ie\)](https://www.esb.ie/assets/energy/summary-of-standard-specification-for-esb-networks-mv-lv-ducting.pdf)

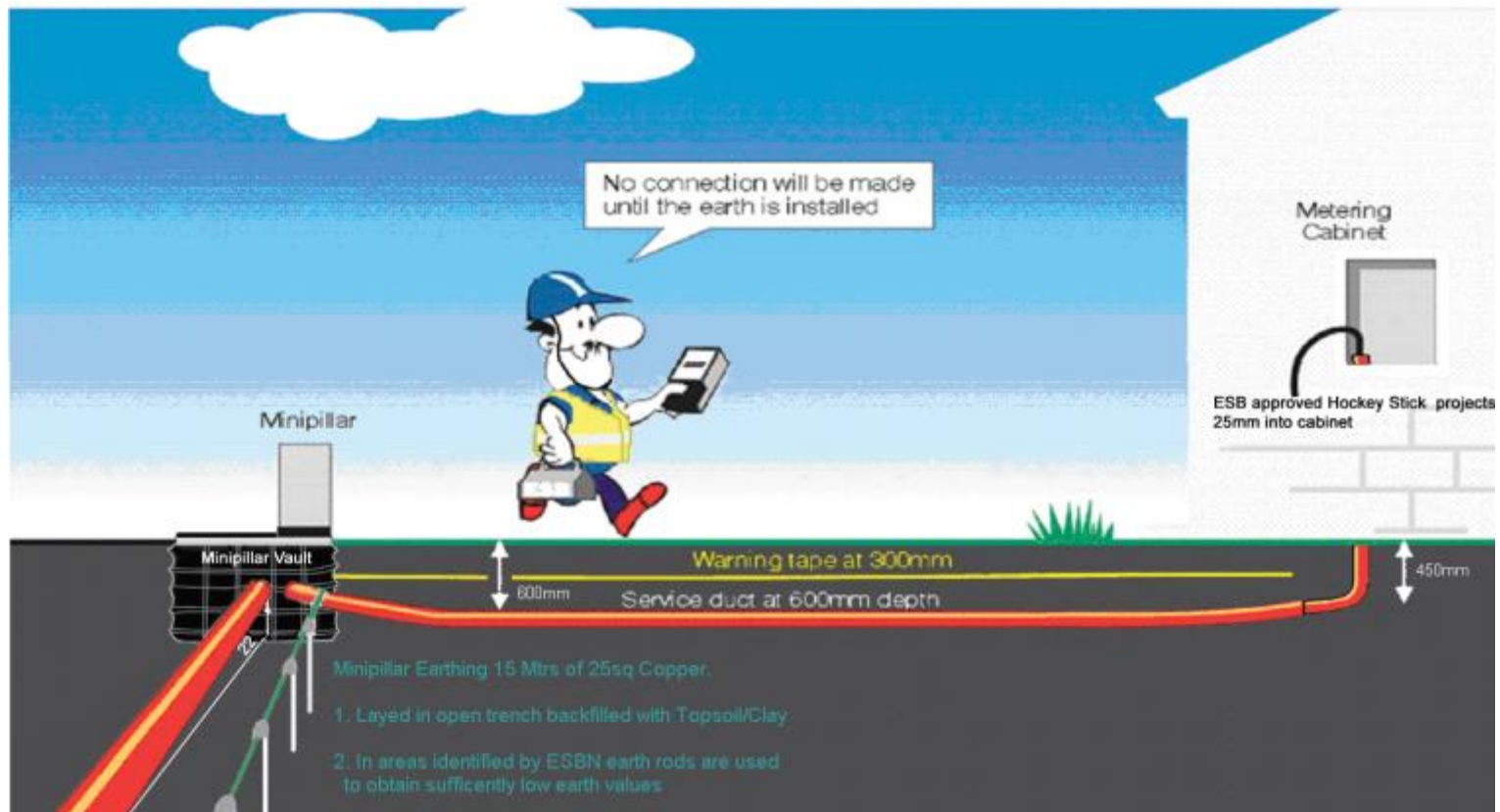
- **Approved Material Suppliers List**
 - [Substation Doors \(esbnetworks.ie\)](http://esbnetworks.ie)
- **Metering Cabinet Standard**
 - [your-meter-cabinet \(esbnetworks.ie\)](http://esbnetworks.ie)
- **Customer Interface Book**
 - [ESB Networks – National Code of Practice for the Customer Interface – Version No. 5 April 2021](#)

System Overview



MP House Connection

- Service Ducting / Minipillar Location / Meter Cabinet





NETWORKS

HOUSING SCHEMES: GUIDEBOOK FOR ESB NETWORKS STANDARDS FOR ELECTRICAL SERVICES

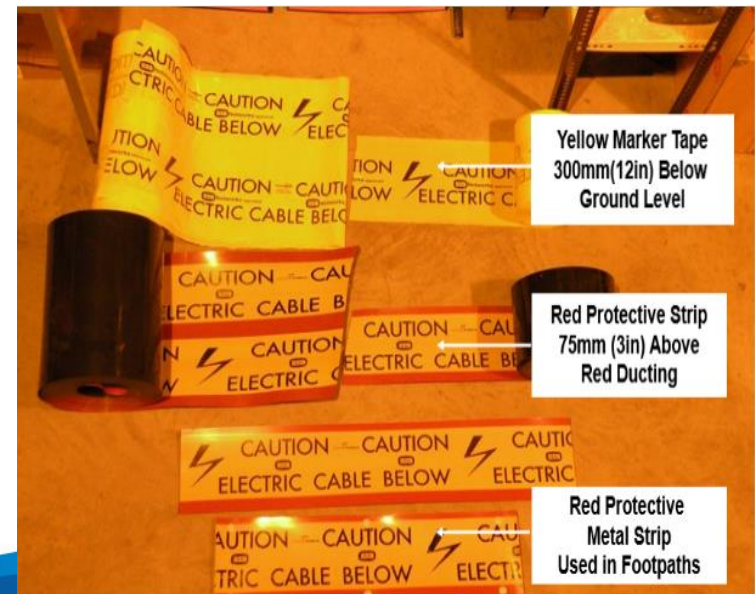
- Covers ESN minimum standard requirements for ESB N Electrical infrastructure installation on Site.
- Ducting
- Substation / Plinth
- Minipillar & Minipillar Vault cover , Minipillar Chamber.
- Meter cabinets
- Earthing of Plant – MP, Substations

Section 2 Ducting

James O'Shaughnessy

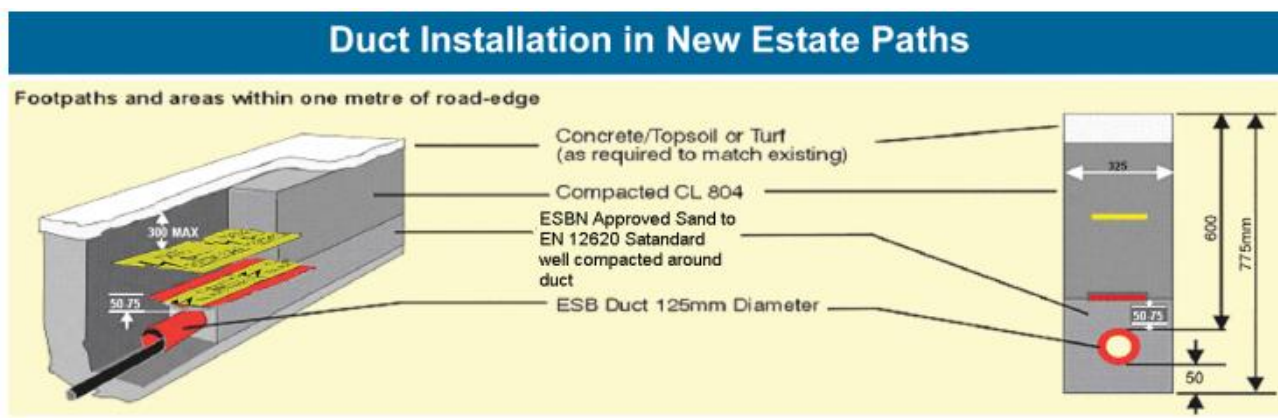
LV & MV Standards Ducting

- **Ducting**
 - Approved duct = red uPVC 125mm OD for LV & MV
 - NB!! Corrugated / Twin wall ducting is NOT approved.
 - Backfill is dependent on the location of the ducting
- **Approved Yellow Warning Tape**
 - Installed Max 300mm from Finished Ground Level
- **Approved red Marker Strip**
 - 75mm above Duct
- **Approved Ducting / Yellow Warning Tape / Red Marker Strip is available from our Approved Material Suppliers and Builders providers**



Ducting Standard

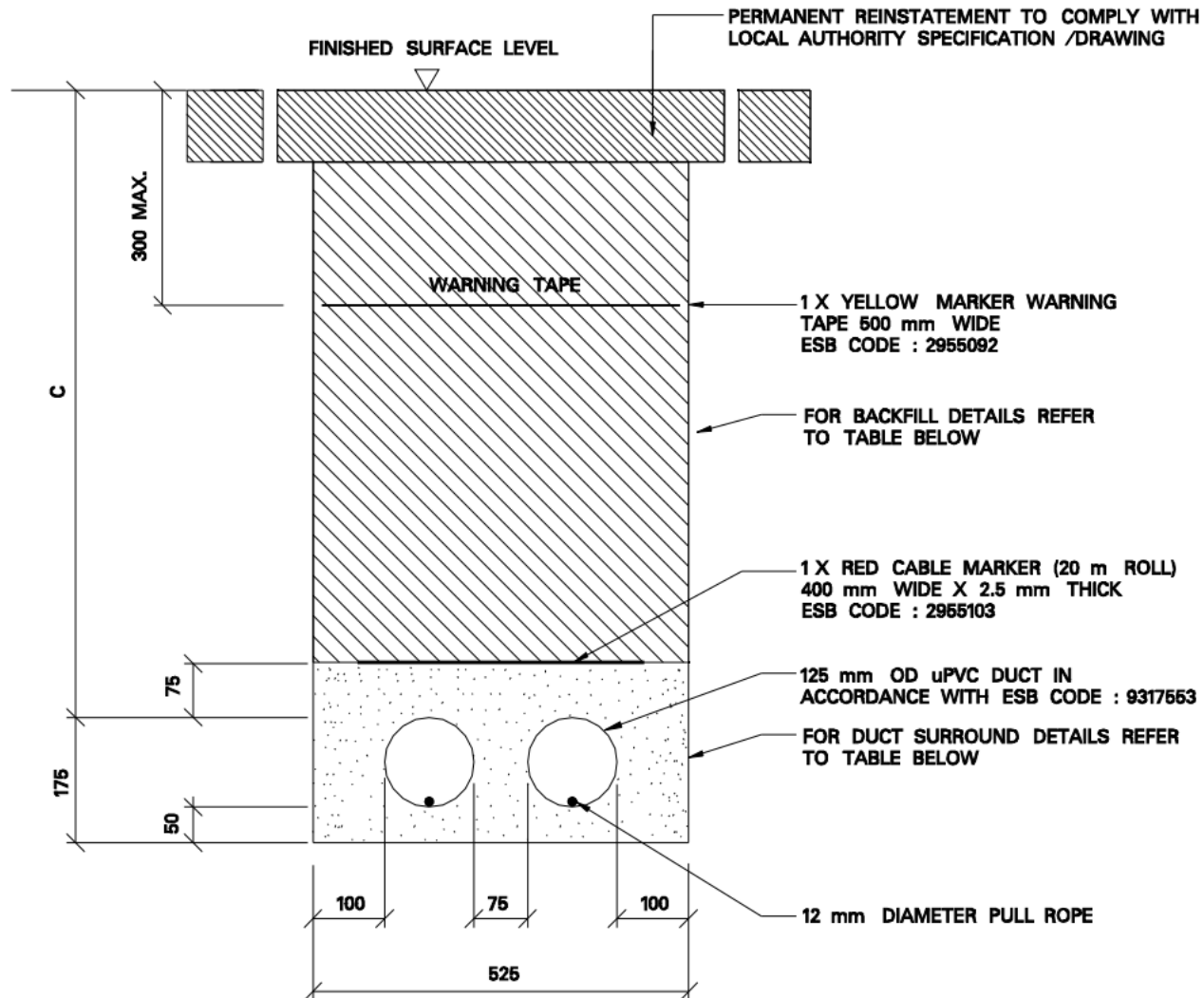
TRENCH LOCATION	MIN. DEPTH OF COVER TO TOP OF DUCTS (C)	TRENCH BACKFILL DETAILS	DUCT SURROUND MATERIAL
EXISTING FOOTPATH (NON HOUSING ESTATE)	450 mm	CL 804	ESB N APPROVED SAND
NEW ESTATE & NON ESTATE FOOTPATH	600 mm	CL 804	ESB N APPROVED SAND
NEW & EXISTING ESTATE ROADS, ESTATE GRASS VERGES & ADJOINING ROADS	600 mm	CL 804	ESB N APPROVED SAND
ESTATE OPEN GRASSED AREAS	600 mm	SUITABLE BACKFILL MATERIAL	CBGM B
NEW & EXISTING NON ESTATE ROADS	750 mm	CL 804	ESB N APPROVED SAND
FARM LAND, FOREST TRACK, BOG LAND, PUBLIC OPEN GRASSED AREAS & PRIVATE PROPERTY	750 mm	CL 804	CBGM B



Normal standard clearance = 300mm.

Clearance from High Pressure pipes = 600mm

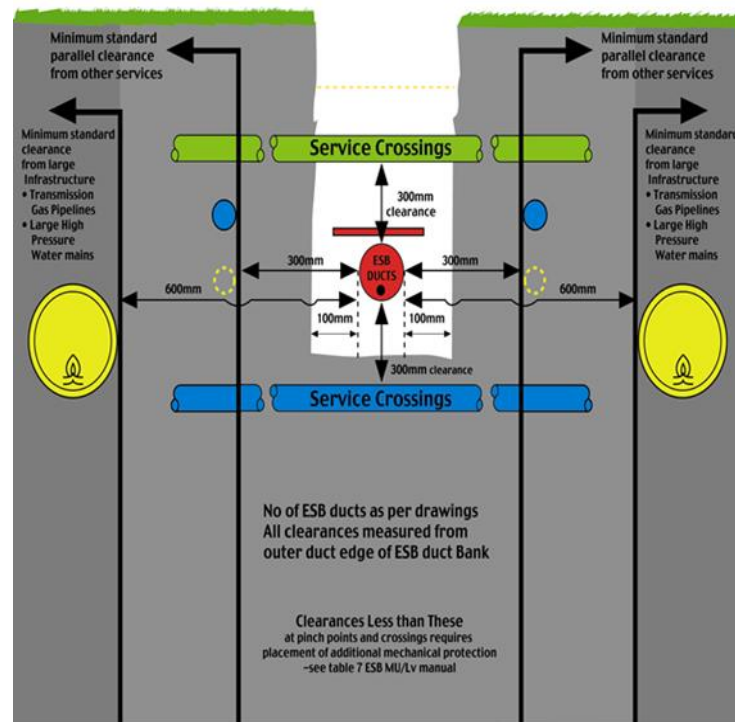
- Duct Separation



- **Approved Quarries**
http://www.esb.ie/esbnetworks/en/download_documents/builders_developers/approved_material.jsp
- **Test Requirements**
 1. It shall have no sharp stones or flints (may damage the cable sheath during compaction).
 2. At least 95% shall pass a 4 mm sieve and 100% shall pass a 8 mm sieve.
 3. The fully dried sample @ 0% moisture shall have a maximum thermal resistivity of 2.7 K.m/W. This test must be completed by the thermal needle probe method as outlined in ASTM D5334. The thermal resistivity @ 2% moisture shall also be recorded.

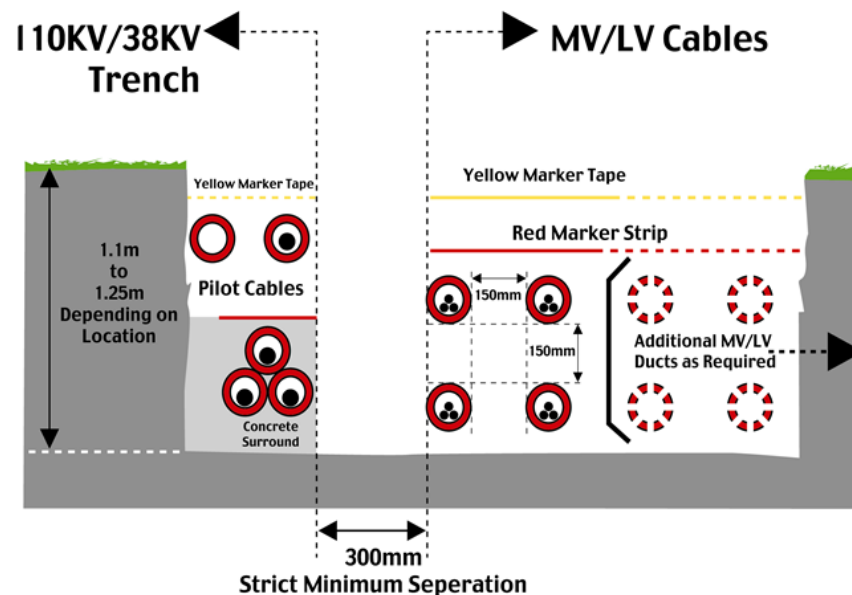
Trench Separation to other Services

- ESB Circuit to HP Water / Gas Main 600mm
- ESB Circuit to LP Water / Gas Service 300mm
- District Heating, detailed discussion required per location.



Trench Separation between ESB circuits

Layout of a Combined MV/LV & HV Trench

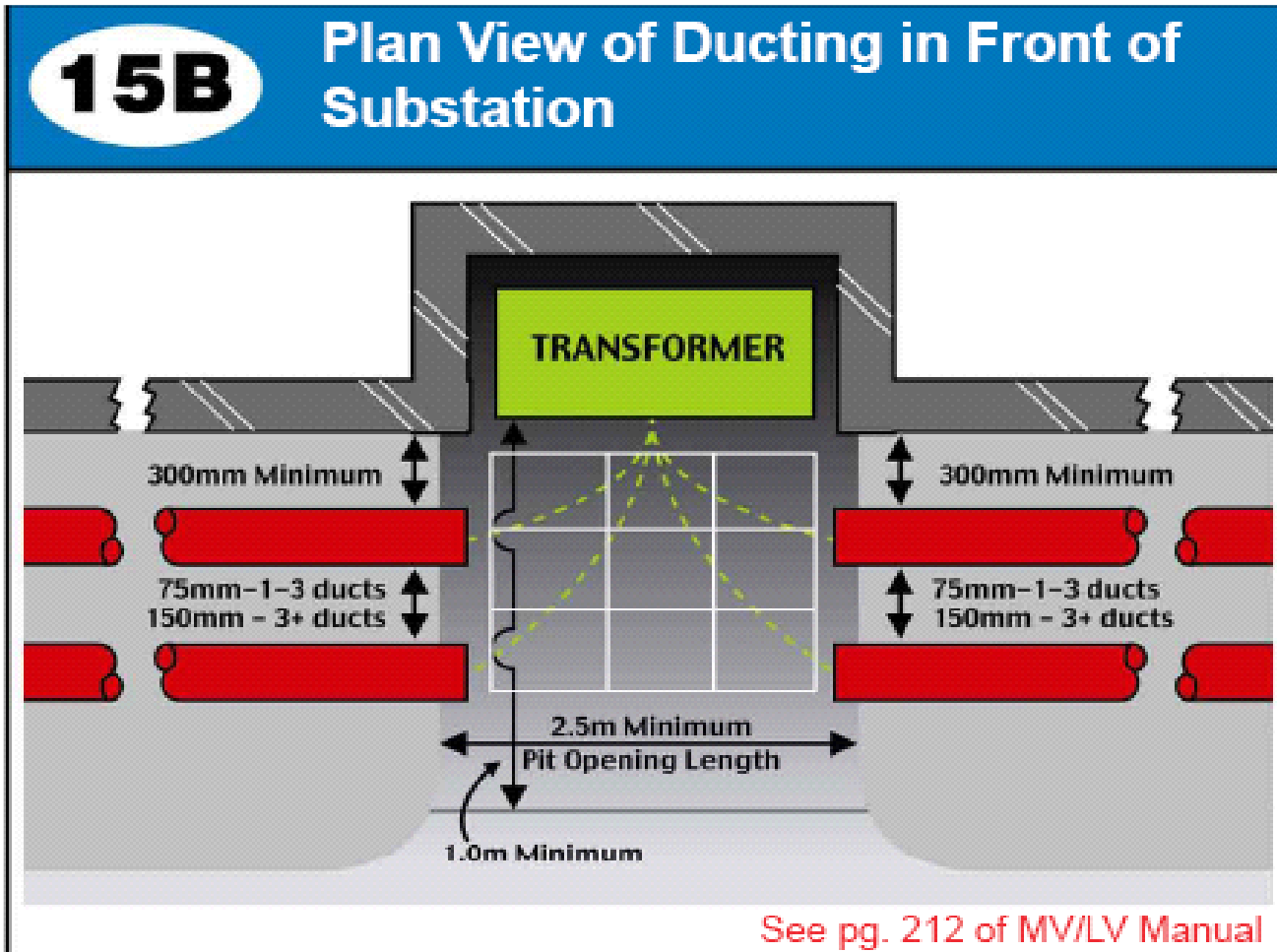


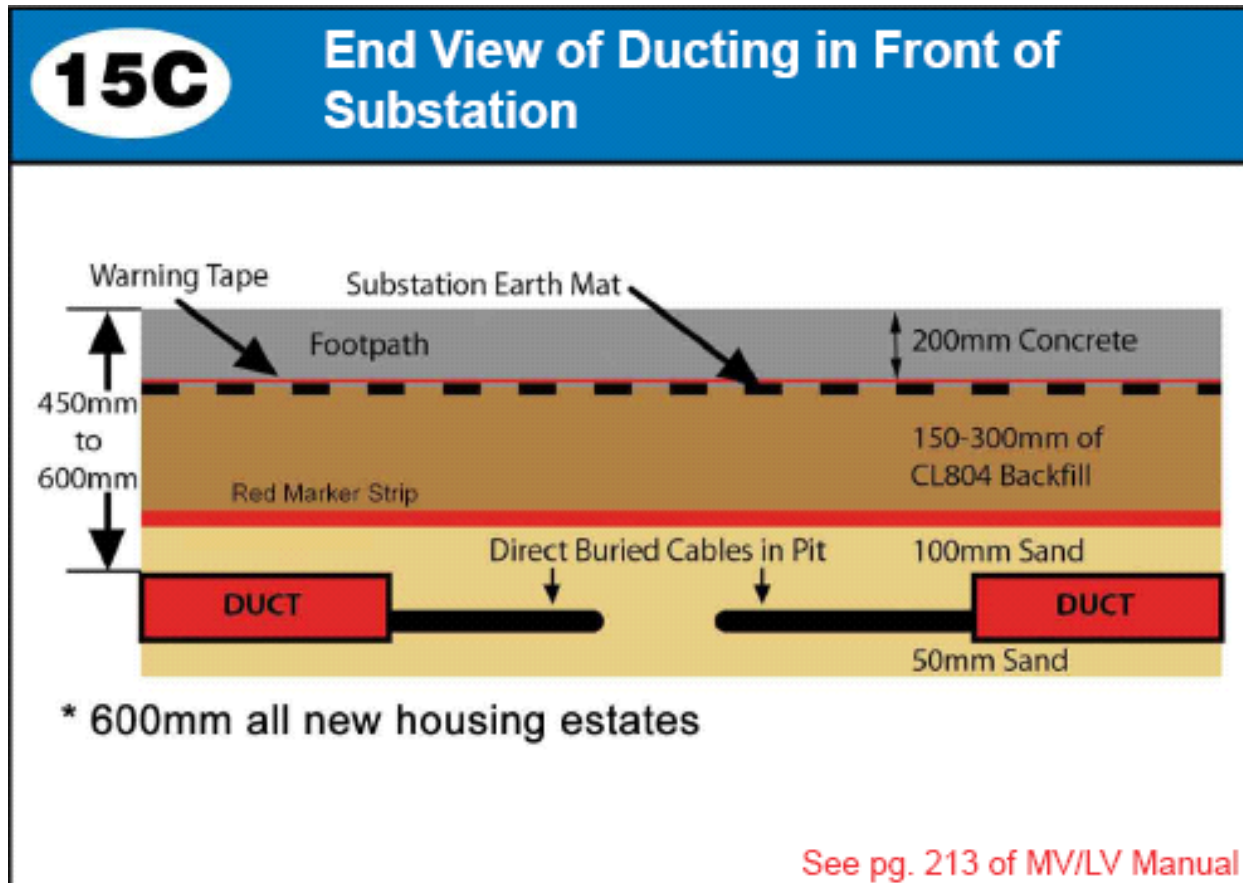
NOTES:

Due to mutual derating effects, it is generally necessary to increase the HV cable Size From:

- 400sq Cu to 630 sq Cu in the case of 110KV cables
- 630 sq Aluminium to 630 Sq mm Cu in the case of 38KV cables.

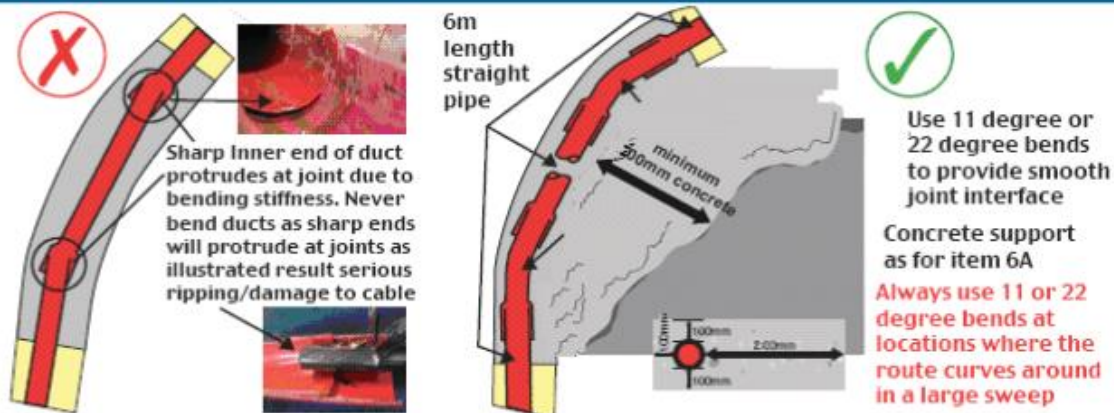
- The MV cable size should be 400 sq Al even if 185 sq mm Al would suffice, in order to keep the derating effect on the HV cables as low as possible.
- Strict Quality control is essential throughout the installation of combined trench so as to insure that critical duct spacings and trench backfill is installed as required.





DUCT BENDS

Gentle Sweep Bends



Sharp Bends

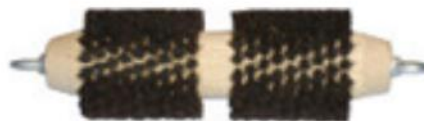


Duct Proving Requirement

Duct dimensions			Minimum mandrel diameter	Minimum brush diameter
OD (mm)	Maximum ID (mm)	Duct Type		
110	97	HDPE, SDR 17.6	90 mm code: 8783226	110mm code: 8783250
110	90	HDPE, SDR 11 HDD duct	85 mm code: 8783225	95mm
125	117	uPVC rigid – standard ducting	105 mm code: 8783229	120mm code: 8783254
125	103	HDPE, SDR 11 HDD duct	90 mm code: 8783226	110mm code: 8783250
125	111	HDPE, SDR 17.6	105 mm code: 8783229	120mm code: 8783254
140	113	HDPE, SDR 11 HDD duct	105 mm code: 8783229	120mm code: 8783254
160	145	HDPE, SDR 21	135 mm code: 8783230	155mm code: 8783251
180	147	HDPE, SDR 11 HDD duct	135 mm code: 8783230	155 mm code: 8783251
200	177	HDPE, SDR 17.6	165 mm code: 8783231	187mm code: 8783256
200	181	HDPE, SDR 21	170 mm code: 8783259	187mm code: 8783256
225	183	HDPE, SDR 11 HDD duct	170 mm code: 8783259	187mm code: 8783256
250	225	HDPE, SDR 21	210 mm code: 8783258	230mm code: 8783257

Approved Brush

- **IS Varian, Greenhills Industrial Estate, Walkinstown, Dublin 12 Ph. 01-4501150**



Approved Mandrel

- **IS Varian, Greenhills Industrial Estate, Walkinstown, Dublin 12 Ph. 01-4501150**
- **Brandon Agencies, Rathnew, Co. Wicklow. Ph. 0404-20500**
- **Midland Site Supplies, Roscrea, Co. Tipperary 087 358 7208**



Duct Proving Requirement



Note:

The proving of the ducts will be deemed as failed if:

- The pulling tension exceeds 1 tonne (10 kN)
- Mandrel is stuck
- Mandrel is moving with sudden bursts even if the pulling tension is less than maximum specified
- If a sudden spike is recorded in excess of 2kN
- Rope shoots suddenly up the duct
- Ducts do not maintain the same formation as at the start of the pull

Duct Proving Cert



Ducts Cleaning/Proving Report

Project: _____

Duct ID	Duct Diameter(s) (mm)	Sponge Diameter (mm)	Brush Diameter (mm)	Mandrel Diameter (mm)

Winch Serial No. _____ Calibration date _____

Direction of proving from _____ to _____

Typical circuit cross section
& Ducts ID

Ducts formation & ID at
the start of the pull

Ducts formation & ID at the
end of pull

Pre-Taking Over

Duct ID	Duct Designation	Max Pulling Tension (tonnes)	Comments
1			
2			
3			
4			
5			



Have the ducts maintained the correct formation?

Yes ☐ No ☐

Rubber bungs fitted after ducts proving?

Yes ☐ No ☐

Have the ducts been cleaned and proved successfully?

Yes ☐ No ☐

Signed for Contractor:

_____ signature

_____ date

Name of Contractor:

ESB Representative who
witnessed the tests:

_____ signature

_____ date

Note:

The proving of the ducts will be deemed as failed if:

- The pulling tension exceeds 1 tonne (10 kN)
- Mandrel is stuck
- Mandrel is moving with sudden bursts even if the pulling tension is less than maximum specified
- If a sudden spike is recorded in excess of 2kN
- Rope shoots suddenly up the duct
- Ducts do not maintain the same formation as at the start of the pull

- Most difficult to rectify.
- Carries big costs and disruption to rectify.
- Duct proving required to verify integrity of installed ducting.
- Witnessed duct proving where possible.

Section 3 Substations

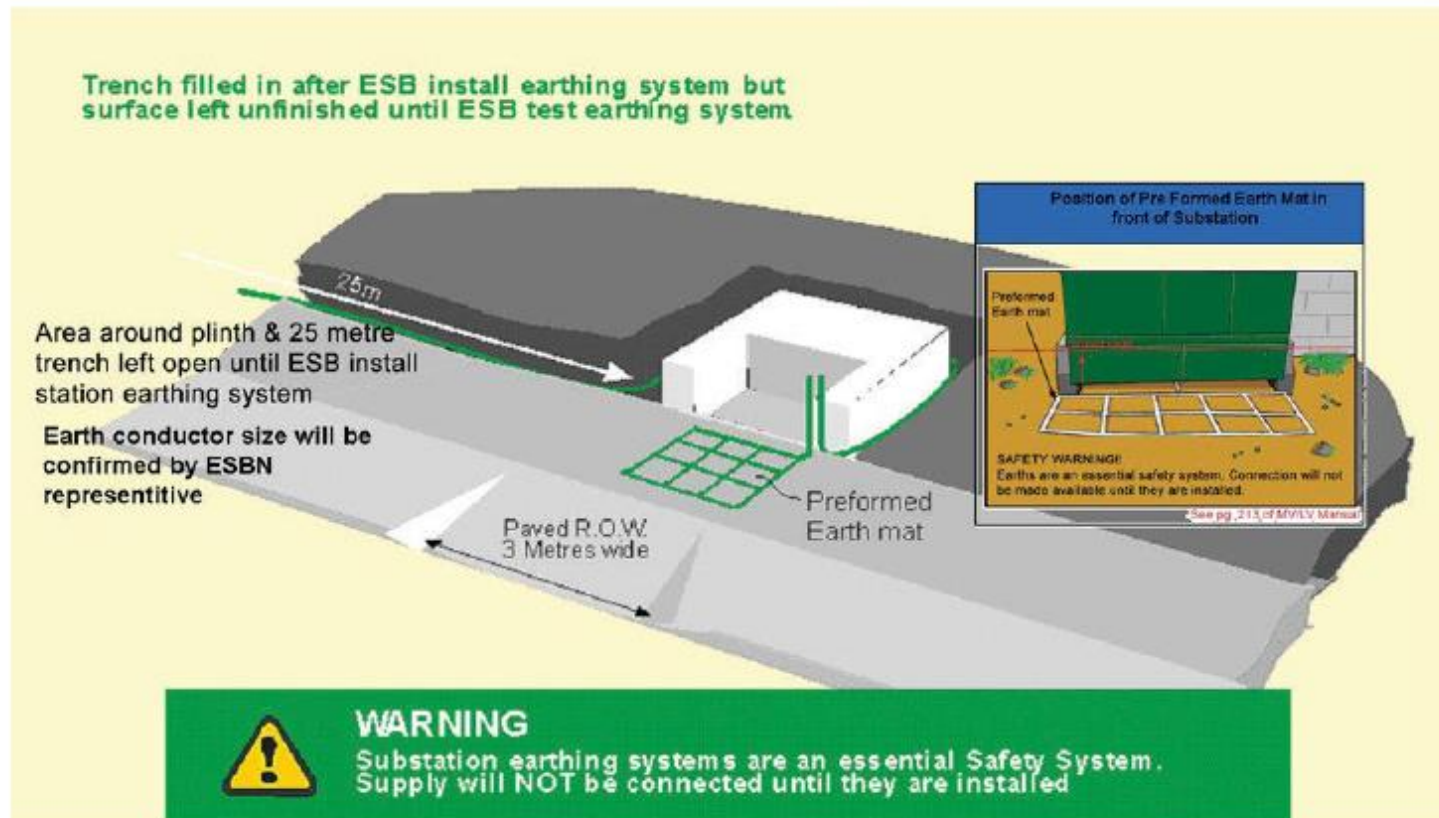
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Unit Subs / Kiosk Location

- Centre of Electrical load
- Not a hazard to traffic
- Built into walls
- 3mtr wide access all year round – Emergency operation and repair
- Legally transferred to ESN
- Covered in detail in the Housing scheme booklet



Substation Kiosk Earth



- **Consult ESB Networks**
- **Main Earth 25 Mtrs long (speak with ESNB)**
- **Earth Mat in front of Sub Door (Unit and Block Built)**
 - 200mm depth from Finished ground level
- **Perimeter Earths**
 - For standalone Unit Substation & Kiosks there is a requirement for copper earth wire to be run around the perimeter of the substation.
 - NB !! This covers electrical safety of the public.
- **Unit Sub Earth mat included**

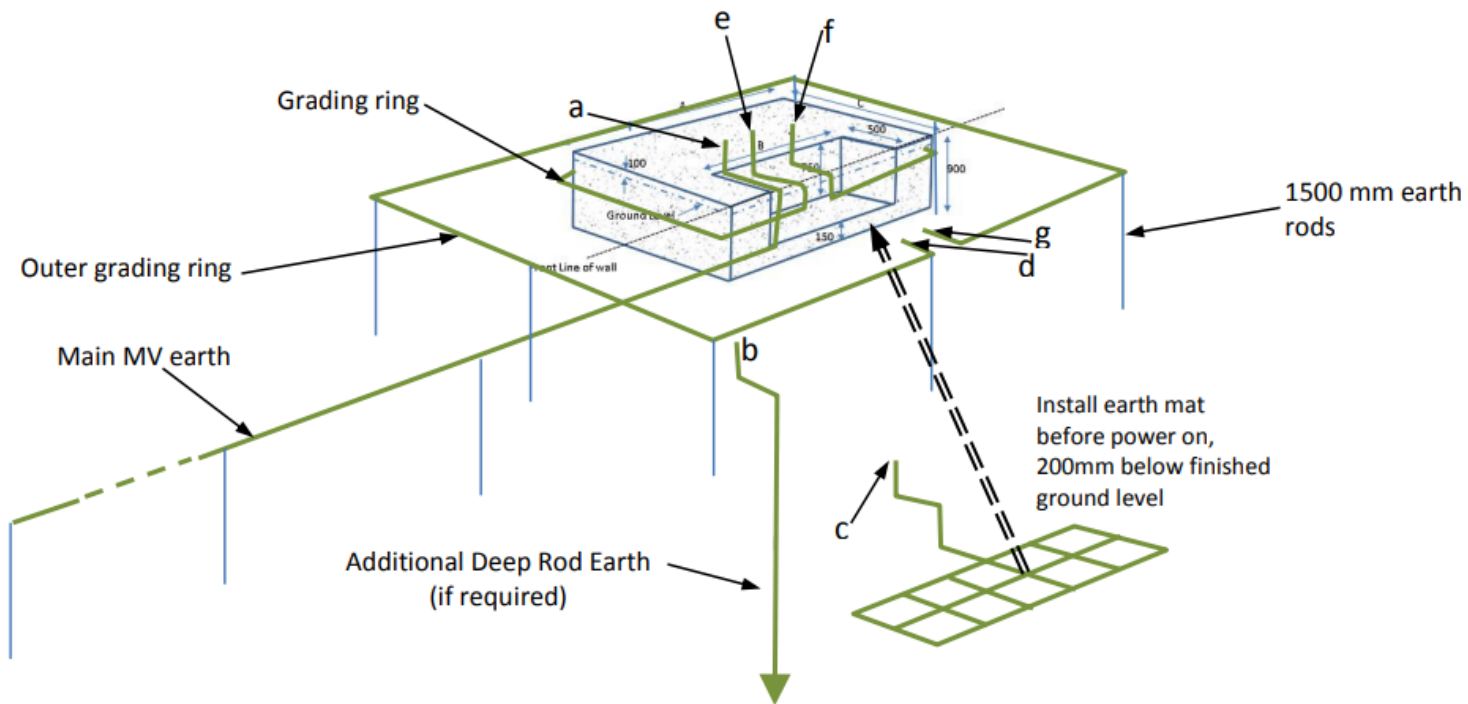


Figure 8 Installation of earths

Unit Substation / Kiosk Poor Location



Unit Sub Good Location



Construction Standard for MV Substations



Company standard Construction Standards for MV Substation Buildings

(Not Generator Connection)

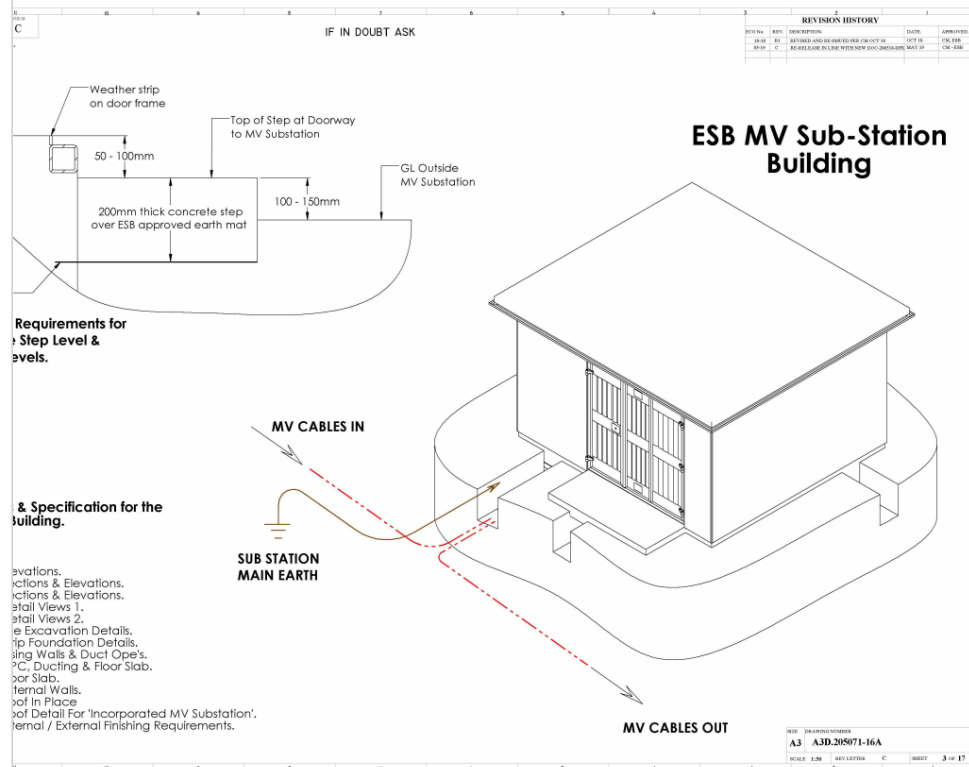
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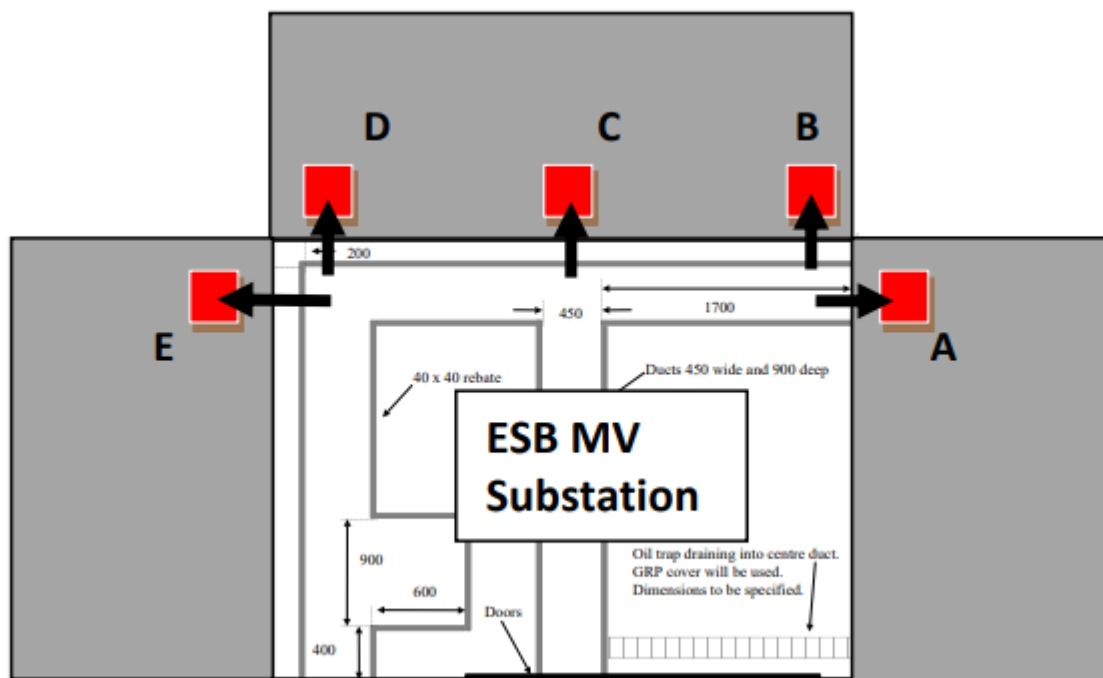
Substation Block / Concrete Built

- Customer adjacent

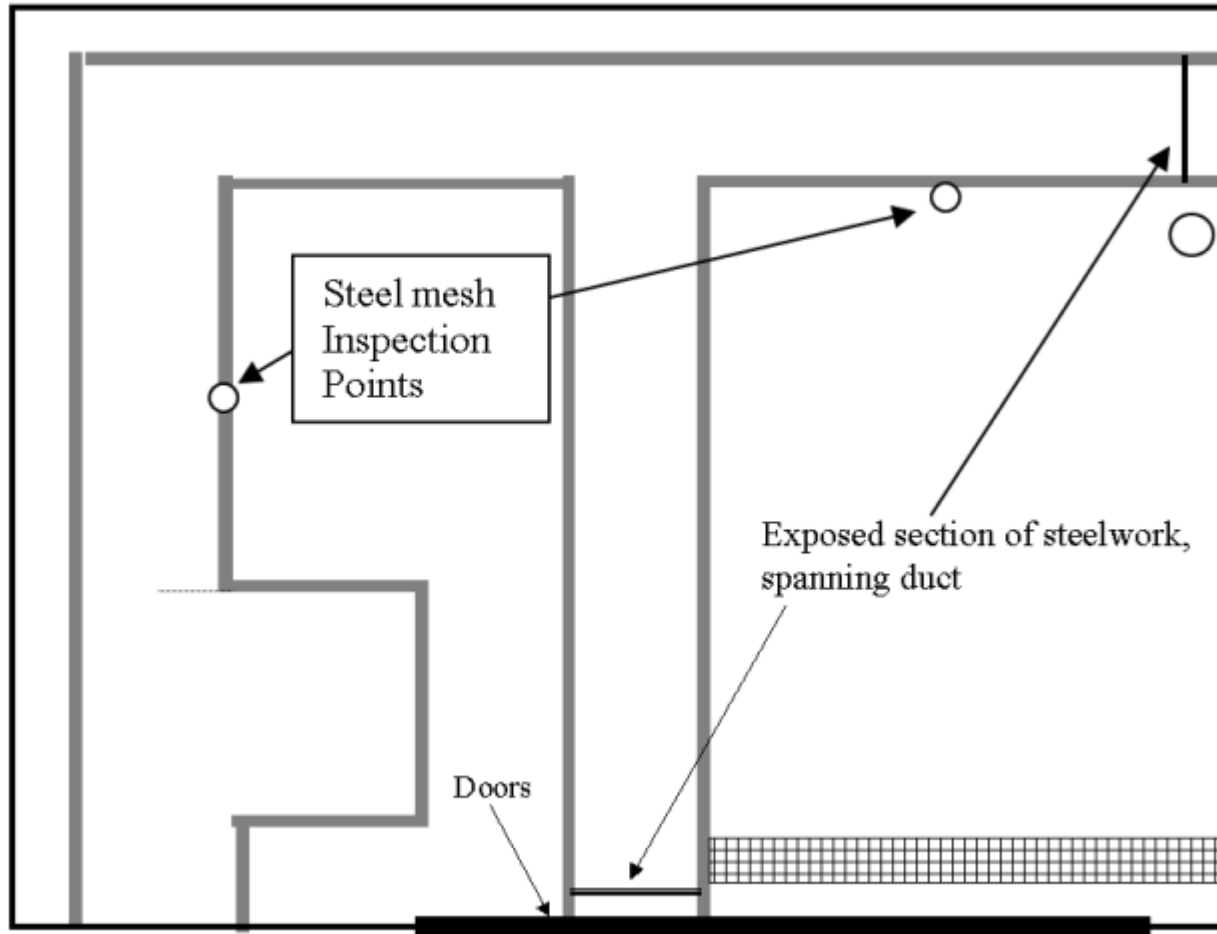


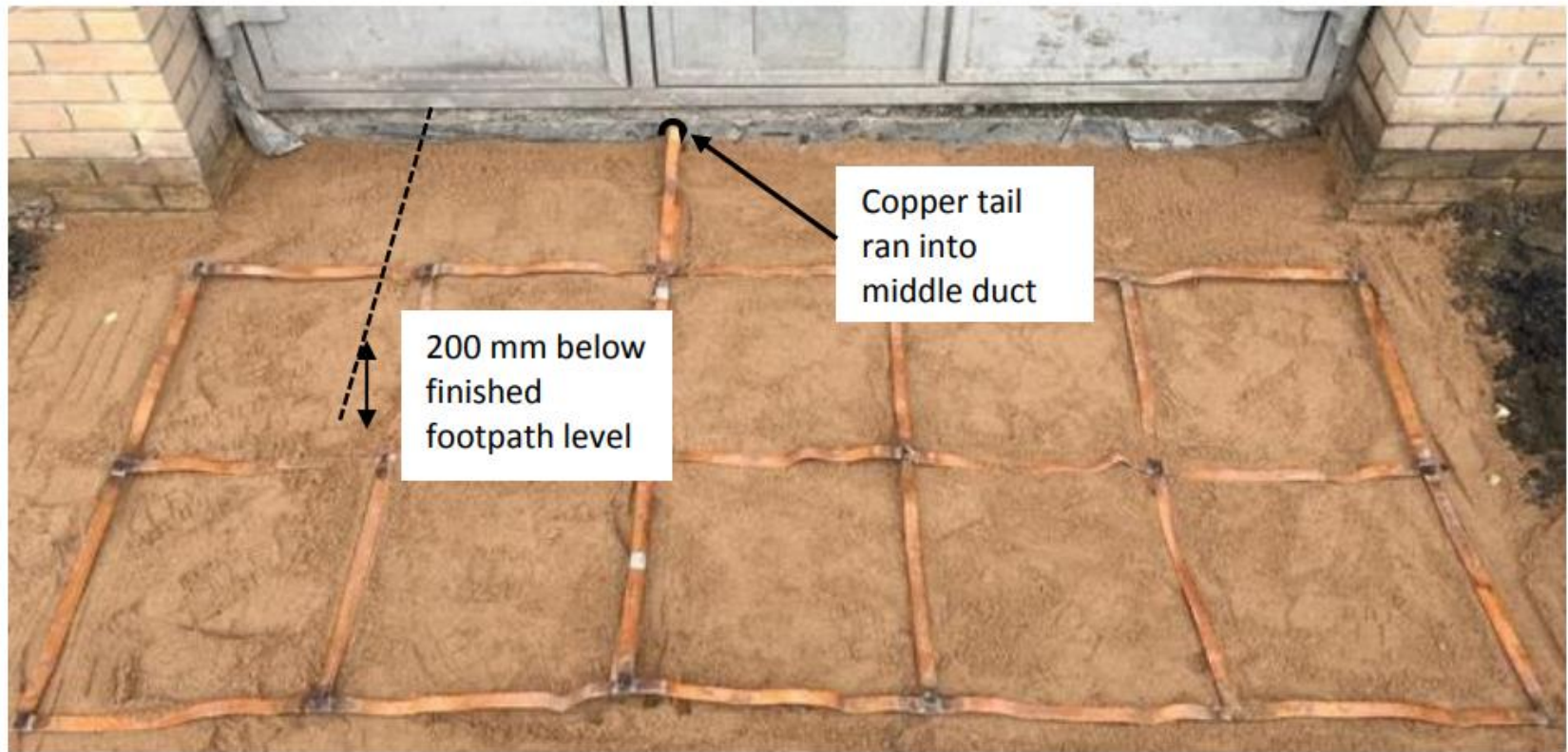
- Integrated





- Consult ESB Networks
- Indoor Substation (Concrete Built)
 - Floor Mesh
 - Floor Mesh electrically separated (physically separated) from all other steelwork /rebar in the building.
 - NB!! This covers electrical safety of ESB staff.
 - Primary function of this floor mesh is for electrical safety.
 - Main Earth – 25 Mtr required Consult Local ESB N representative
 - Earth Mat
 - Available from Door supplier
 - 200mm depth from Finished ground level





Substation Common Mistakes

Number	Error
1	Incorrect substation type selected, find out at the design stage if it is: • Single substation, double substation, dual radial feed, or another type of substation. • Will the substation be incorporated or freestanding?
2	Specification DOC-280518-DFK (this specification) type substation is built where a generation plant substation is required. Generation plants include windfarms, solar farms, landfill gas, biogas or hydro plants which are being connected to the medium voltage (MV) system.
3	Substation not at ground or street level. The substation must be at ground level unless there is specific agreement between ESB Networks and the customer. See section 3.01.
4	Inadequate vehicular access to the substation. The substation must have 3 m wide and 4 m high vehicular access.
5	Limited access to substation where it is constructed behind locked gates or fences. Full unrestricted vehicular access to the substation is required at any time of the day or night without the need for site safety or security inductions. See section 2.3.
6	External walls of substation are not a cavity type design. See drawing A3D.205071-16A Sheet 5 and sheet 16.
7	Cavity left open or poorly fire sealed around the door. See drawing A3D.205071-16A Sheet 7.
8	Steel mesh not present in the floor slab. See Drawing A3D.205071-16A.
9	Steel in the floor slab not brought out for earthing at two points and two test points. See Drawing A3D.205071-16A Sheet 2.
10	Steel in the floor slab interconnected with other steel in a larger building. It should be electrically isolated.
11	Earth mat in front of door not installed correctly or not of an approved type. See Drawing A3D.205071-16A Sheet 5.
12	Structural steel stanchions within the substation room, or exposed in the walls.
13	Precast or permanent formwork ceiling or roof used instead on poured concrete.

• Sub Type

• Location and Access

• Construction

• Earthing

• Construction

Substation Common Mistakes

14	Insulation (thermal or acoustic) present inside the substation beneath the substation roof/ceiling
15	Floor slab orientation incorrect. Do not mirror image the floor plan. Keep to the floor plan layout as specified unless specifically requested to change it by ESB Networks.
16	Customer's main switch not adjacent to the dividing wall between the ESB MV substation and the customer's switchroom. See section 3.02.
17	Cable opening to customer's switchroom too large. It should be 450 mm x 215 mm at a maximum.
18	Customer's switchroom and access to equipment not conforming to the National Rules for Electrical Installations.
19	Groundworks completed without the installation of the required earth wires. See section 2.06.
20	Exits, fire escapes or air conditioning intakes within 3 m of substation door.
21	No smoke detector fitted to substation door incorporated into larger building.
22	Windows within a 3 m of the substation door frame do not have 30 minute fire rated glass or can be opened

- Construction

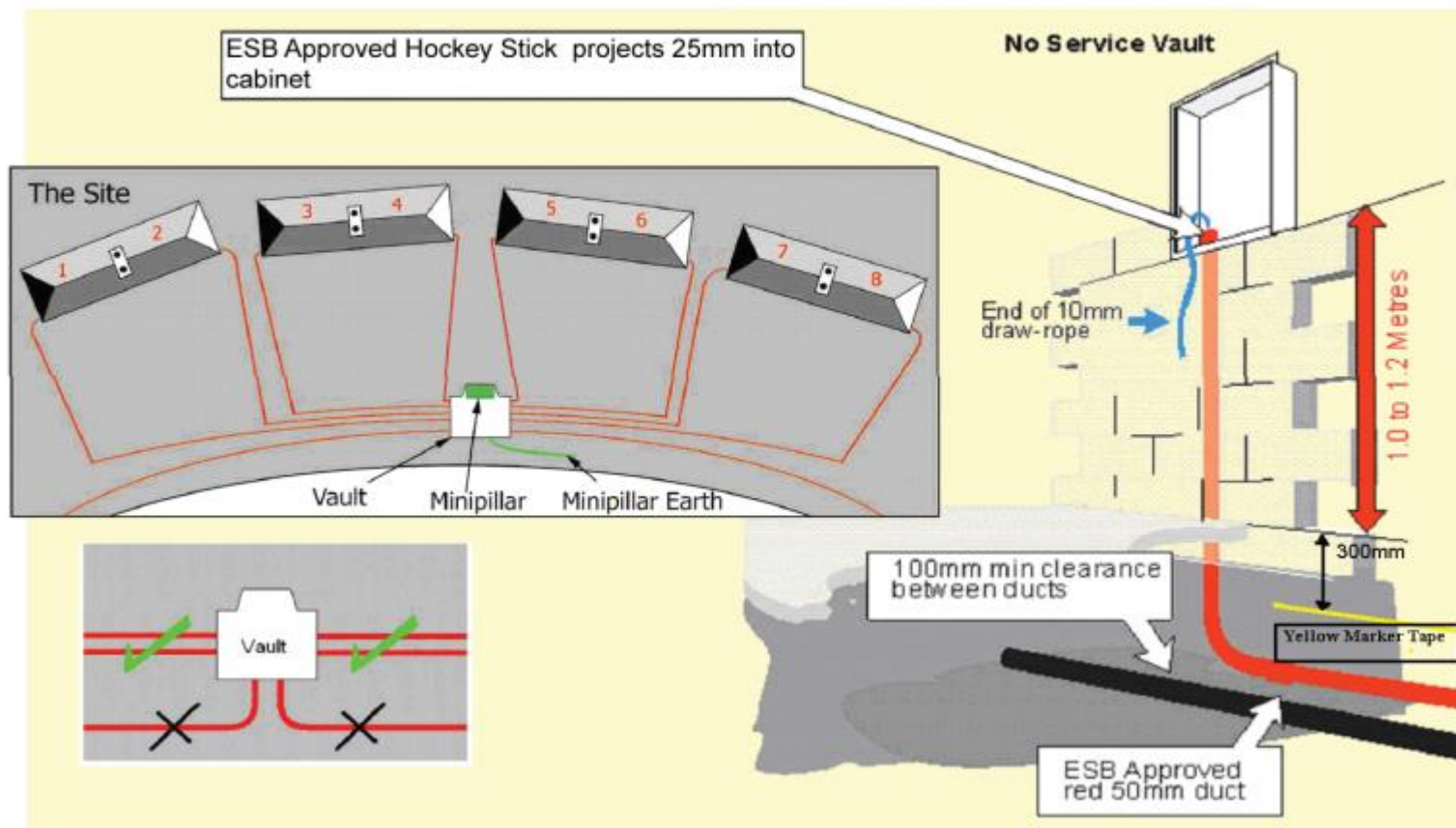
- Interface

- Earthing
- Fire Safety

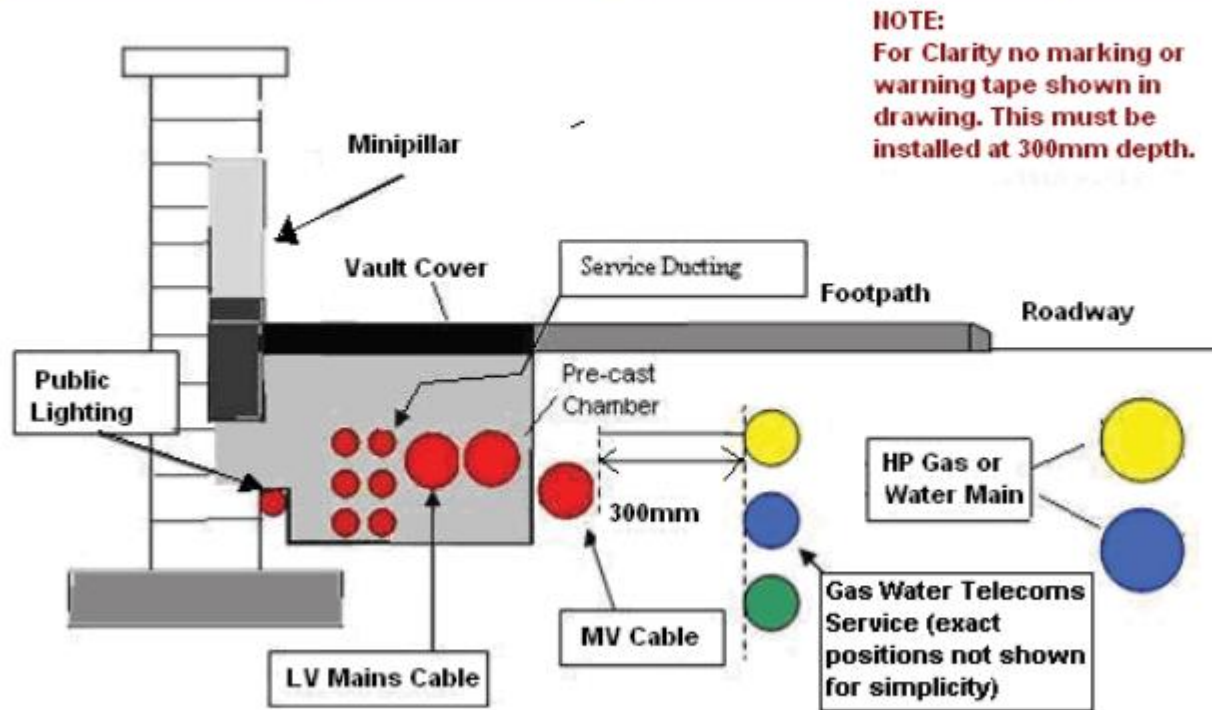
Section 4 Minipillars

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STANDARD HOUSE SERVICE



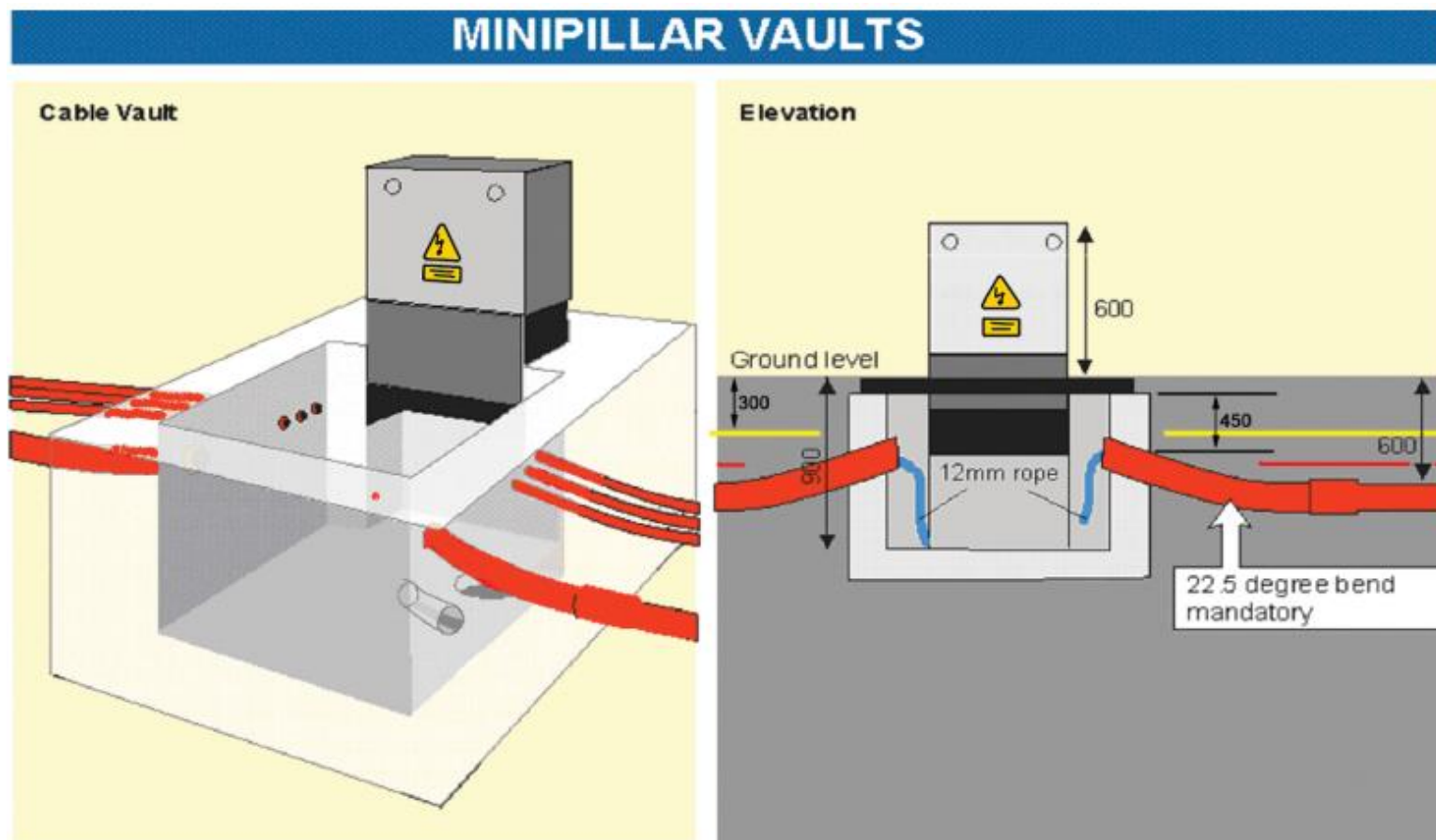
Position and Spacing of ESB Networks Ducting in relation to other Utility Ducts and Pipes in Housing Schemes/Developments



Normal standard clearance = 300mm.

Clearance from High Pressure pipes = 600mm

Minipillar Duct Approach

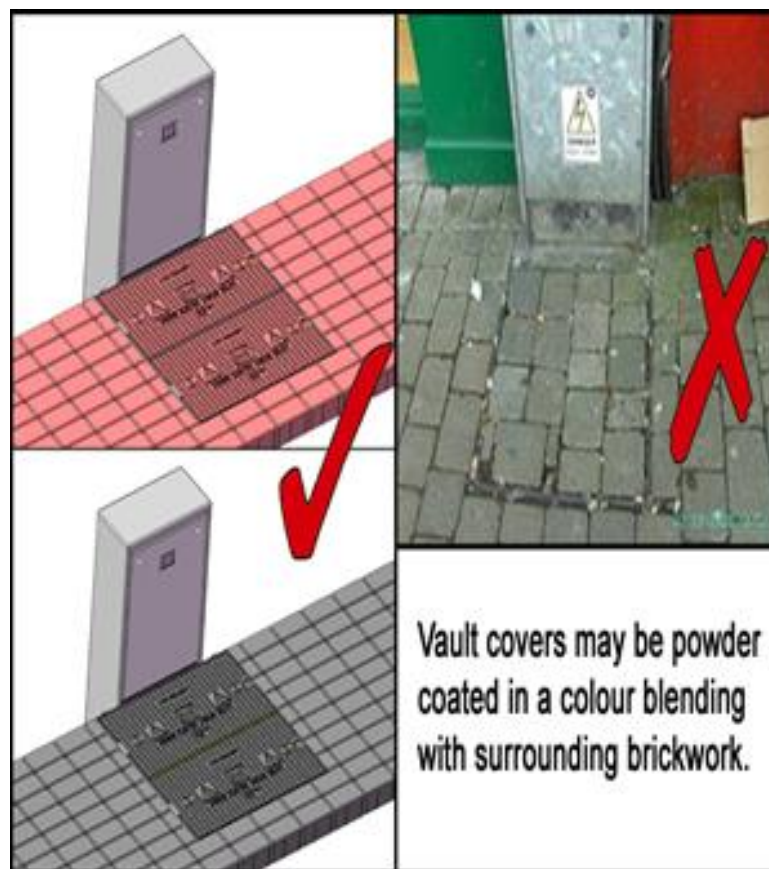


Block built Minipillar vaults are not acceptable

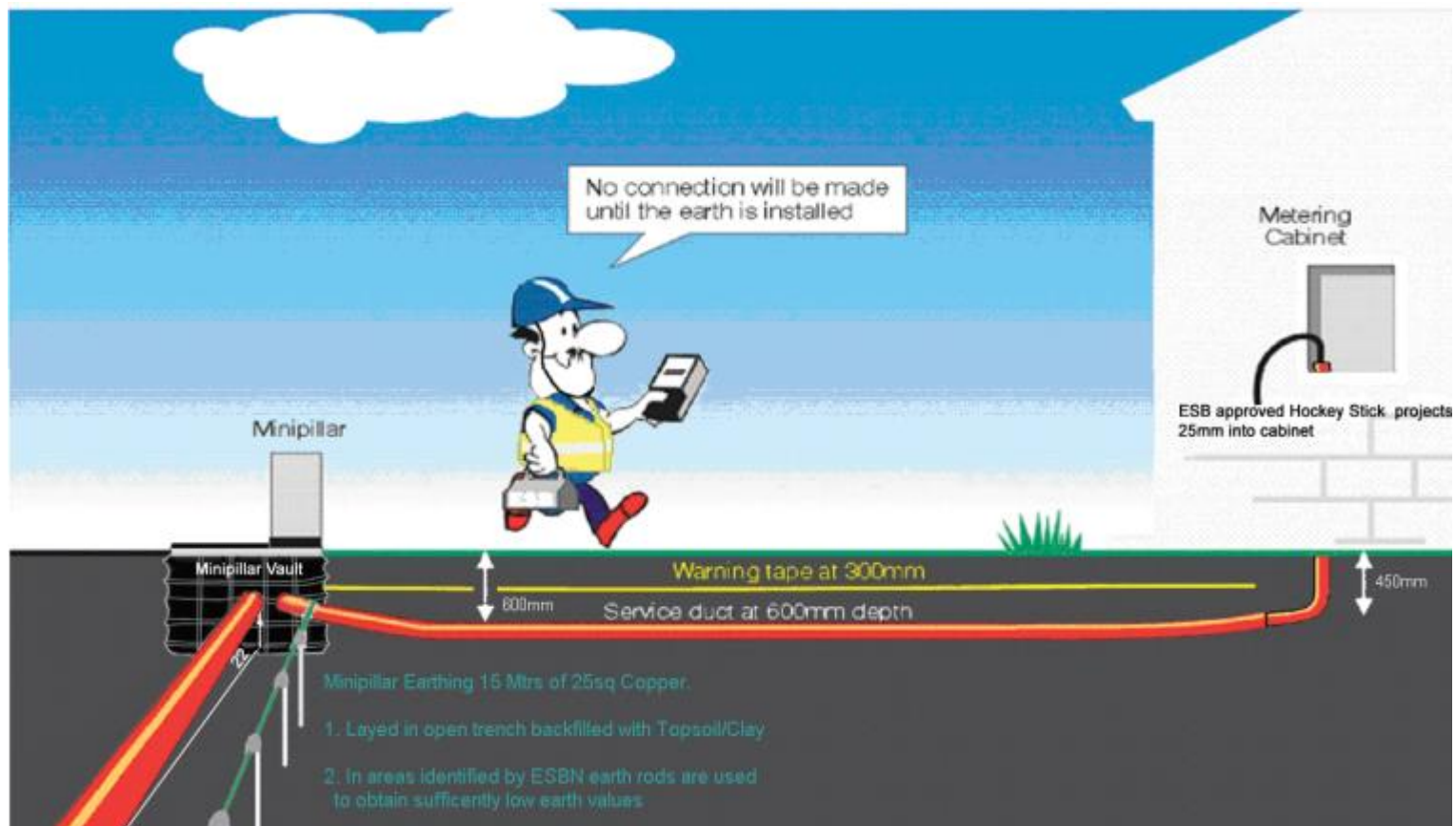
- **Cable Vaults / Covers in Roadways**
 - Policy is to avoid leaving cable vault covers in roadways long term . They may be used as a short-term measure to install cable (e.g. the Local Authority ducts and paves a street- ESB installs cables later) but once the cable is installed , the ducts in the vault must be sealed and the vault backfilled to a high standard to avoid differential settlement. Any vaults in roadways must be approved by ESB and must be designed for roadway loading i.e. EN 124/5 D400 i.e. 40-ton loading.
- **VC2 cover flush with ground level.**
 - Vault covers cannot be raised from the precast chamber they are positioned on. The VC2 cover must finish flush with finished ground level.

LV MP Vault Covers

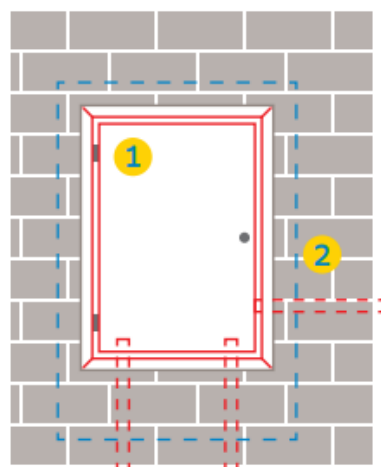
- Coloured vault covers supplied from EJ



Earthing of Each MP



INSTALLATION

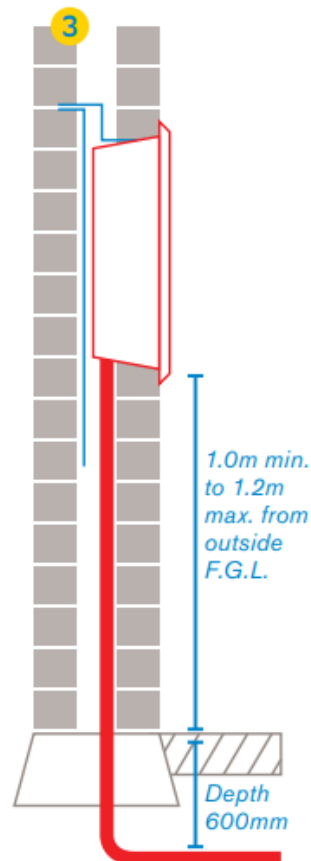


1 Only ESB Networks equipment to be fitted in outside meter box, except in the case of temporary builder's supplies where the customer's protection equipment must be fitted within the box on the right hand side.

2 Flange of cabinet to be water sealed and polythene damp proof course to be fitted by builder.



3 Side profile.



LOCATION

- An outdoor meter cabinet must be provided for the ESB Networks (ESBN) electricity meter(s).
- The meter cabinet must be directly accessible from the main entrance driveway. A position on the house wall facing the driveway, or within 2m of either corner of this wall is normally acceptable subject to proper access.
- If any further queries remain in relation to the location of the cabinet, please discuss them with your local ESB Networks representative.



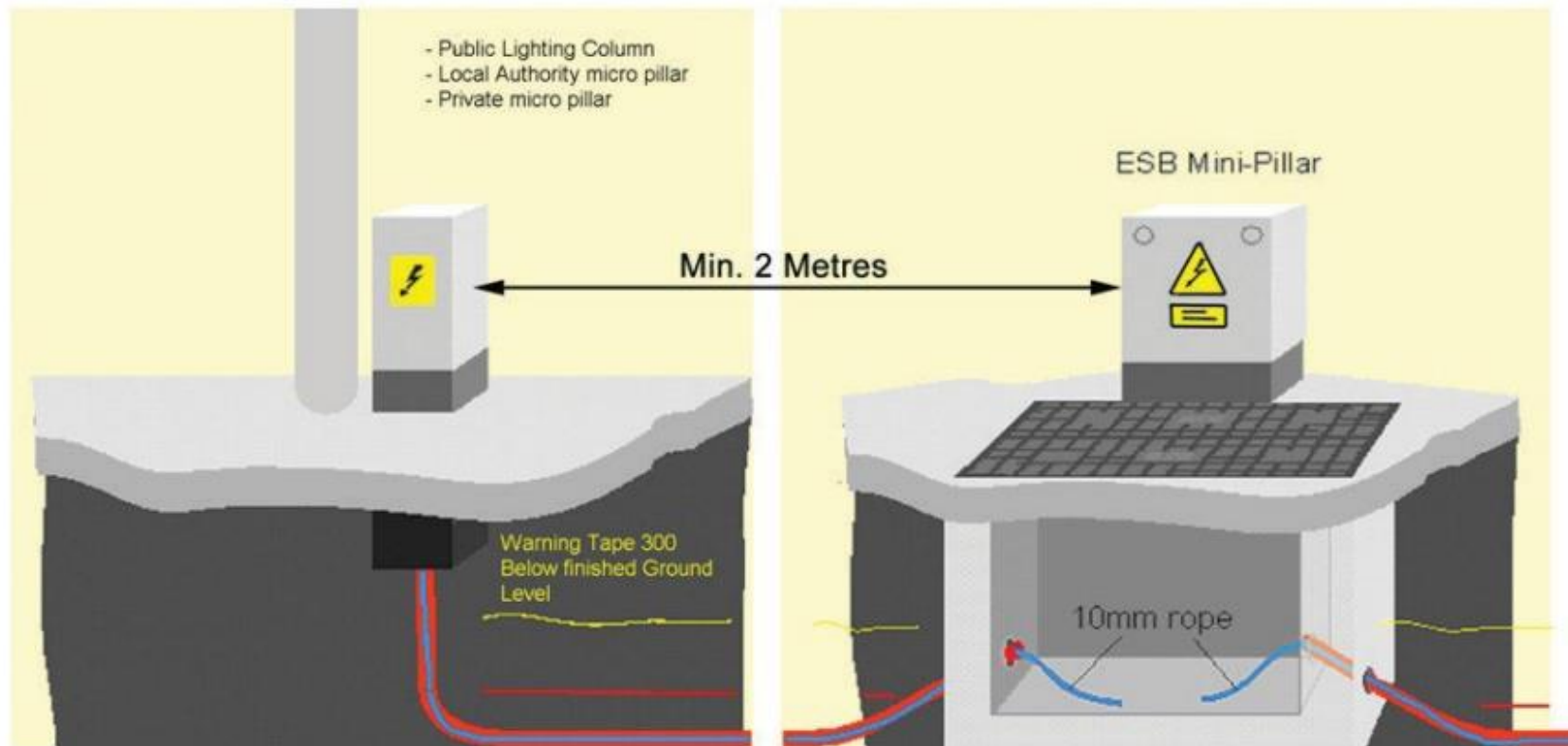
PLEASE NOTE:

- **Unacceptable positions will not be connected (these include behind security walls/gates or in porches)**
- **Damaged cabinets will not be connected**
- **Meter cabinet must comply with ESB Networks specifications**

If you need a meter cabinet key to access your outdoor meter cabinet please call us at **1800 372 757 OR 021 2386555**

Separation to other Electrical Equipment

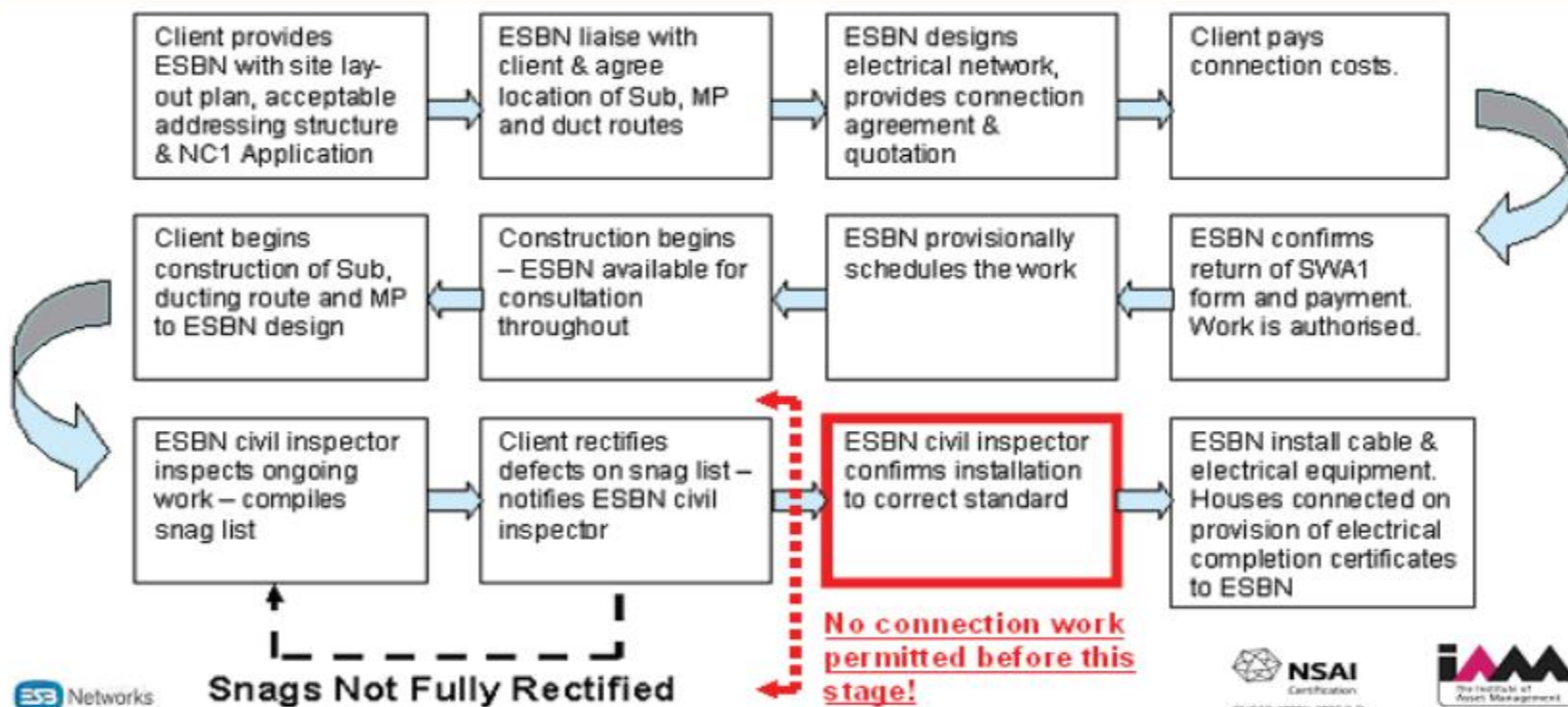
PUBLIC LIGHTING



Connection Process

- EO Issues design / Civil Inspector Site Contact / Supervisor issues works after sign off from Civil Inspector.

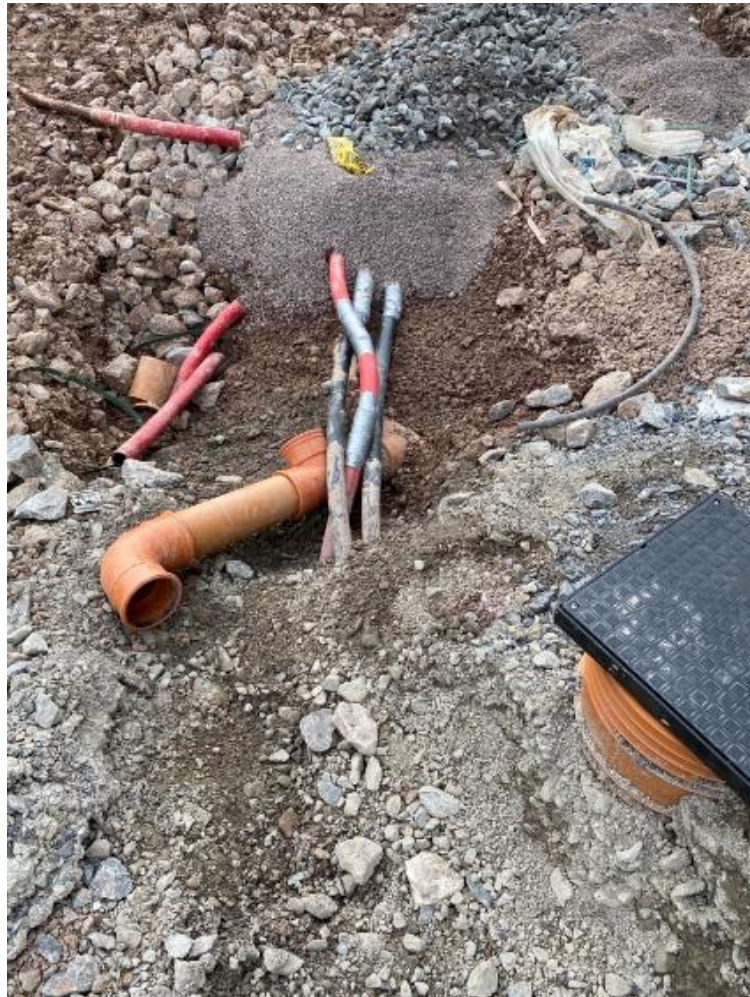
ESBN Electrical Connection Process for Housing Schemes



Interpretation of ESB Standards



What we Have Found



What we have Found



What we have Found



What we have Found



What we have found



- **Meter cabinets**
 - Too High / Low
 - Non accessible.
- **Duct not to standard.**
 - Incorrect separation
 - Fail duct proving / cable pulling
 - Not entering the Minipillar vault in correct orientation
 - Corrugated duct
 - Incorrect Backfill
- **Vault covers finished level.**
 - Built up frame and covers
 - Incorrect Heights not to finished ground level
- **Substations covered earlier**

Impact of non-Conformance

- Delay to Developer and ESB
- Re visit fees, by Civil Inspectors and crews.
- Outage cancellation
- House connections delayed.

- **Communication with ESB is Key from an early stage.**
- **Maintain a continuous link to customers on ESB standards**
 - Area Manager / Engineering Officer / Civil Inspector / Network Assets support this process
- **Issues on Standards will get direct technical back up from Network Assets**
- **Network Assets help in carrying out Ducting Workshops**

Thank You Questions ?