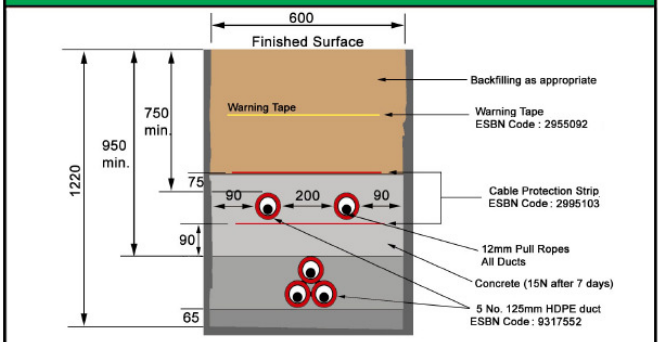
Standard Specification for ESB 110kV Networks Ducting/Cabling (Minimum Standards)

Note 1 : ESB Networks reserves the right not to accept ducting which does not conform to these standards and dimensions
Note 2 : Refer to ESB Networks for Specific job Specification. These instructions do not apply to LV/MV/38kV/220kV cable
Note 3 : All materials (ducts, marker tapes/strips, duct surrounds, mandrels and brushes) must be ESB approved materials

ESB Networks
Rev 0: Date 09-10
Approved:

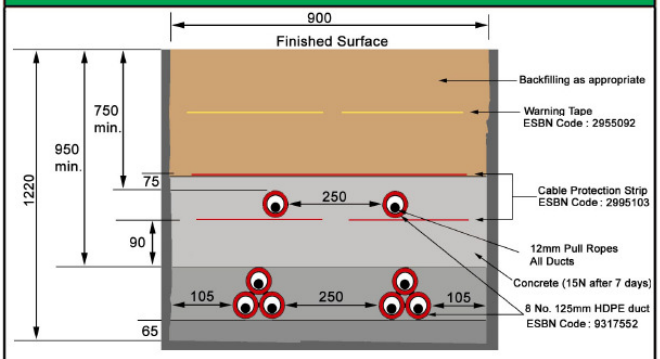
Document No:DTIS-230908-BUV

1A 110kV Single Circuit Standard Trench Cross-Section

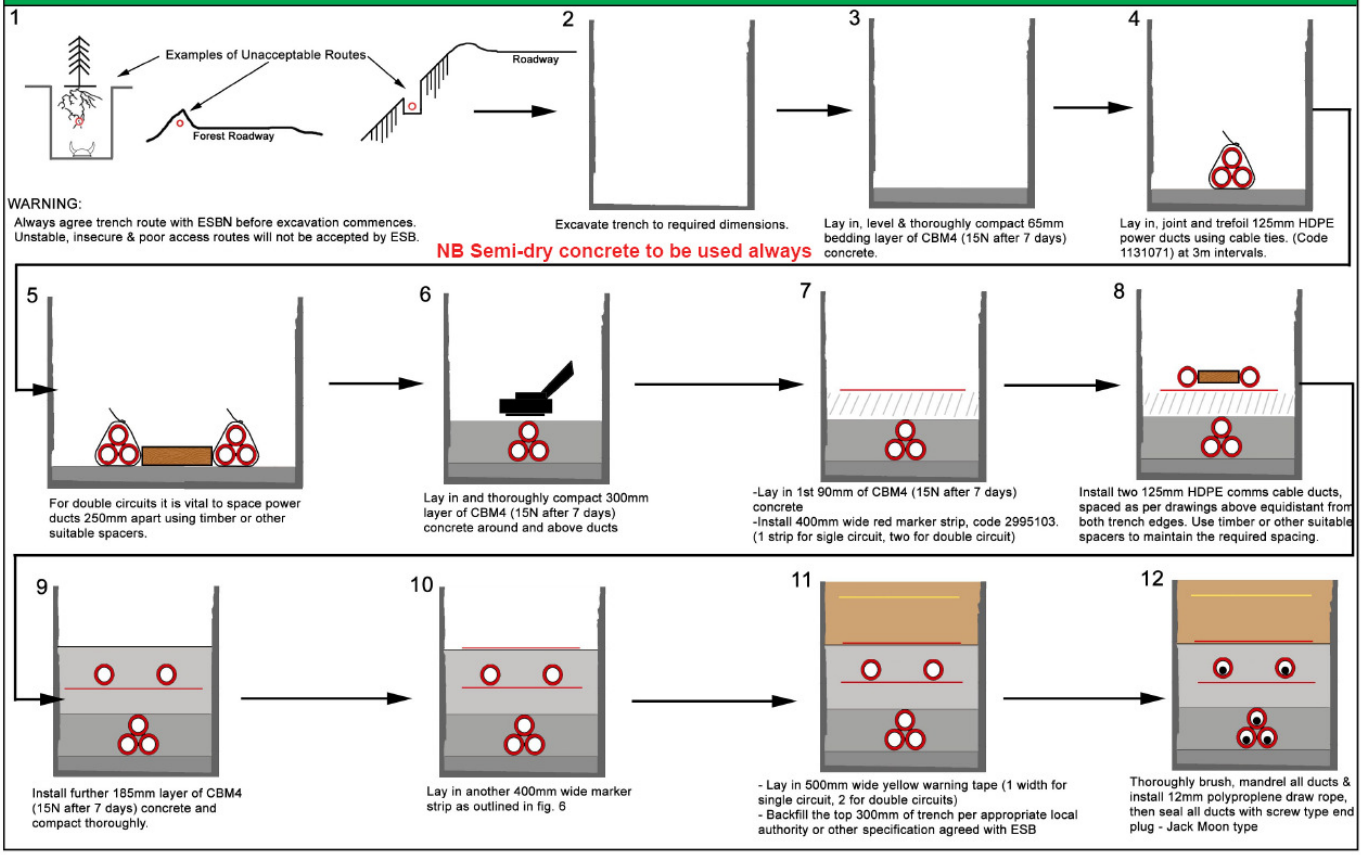


Note : Only 1ESBN comms duct maybe required if ESBN specify
Note : Maximum duct depth ≤ 1.5m to top of trefoil group

1B 110kV Double Circuit Standard Trench Cross-Section



1C Trench Installation Sequence



WARNING:
Always agree trench route with ESBN before excavation commences.
Unstable, insecure & poor access routes will not be accepted by ESB.

Excavate trench to required dimensions.

NB Semi-dry concrete to be used always

Lay in, level & thoroughly compact 65mm bedding layer of CBM4 (15N after 7 days) concrete.

Lay in, joint and trefoil 125mm HDPE power ducts using cable ties. (Code 1131071) at 3m intervals.

For double circuits it is vital to space power ducts 250mm apart using timber or other suitable spacers.

Lay in and thoroughly compact 300mm layer of CBM4 (15N after 7 days) concrete around and above ducts

-Lay in 1st 90mm of CBM4 (15N after 7 days) concrete
-Install 400mm wide red marker strip, code 2995103. (1 strip for sigle circuit, two for double circuit)

Install two 125mm HDPE comms cable ducts, spaced as per drawings above equidistant from both trench edges. Use timber or other suitable spacers to maintain the required spacing.

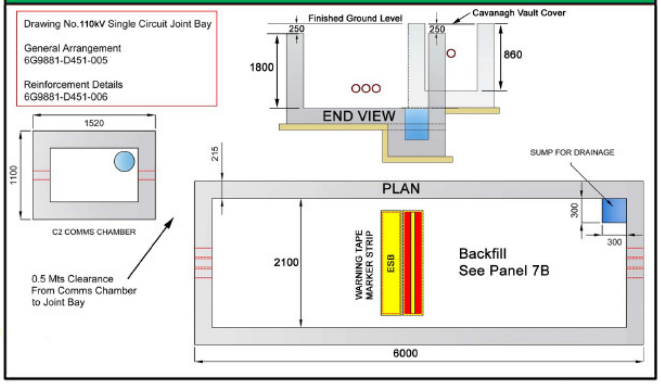
Install further 185mm layer of CBM4 (15N after 7 days) concrete and compact thoroughly.

Lay in another 400mm wide marker strip as outlined in fig. 6

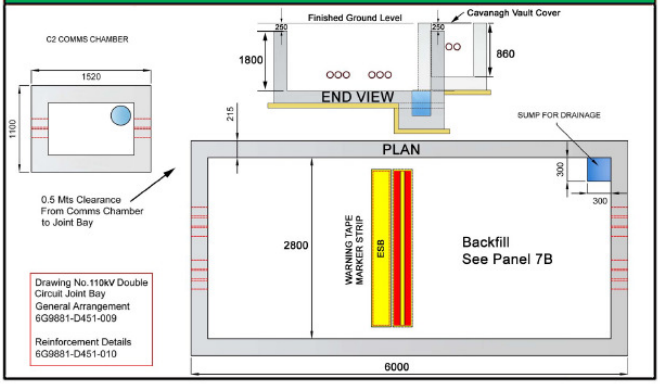
- Lay in 500mm wide yellow warning tape (1 width for single circuit, 2 for double circuits)
- Backfill the top 300mm of trench per appropriate local authority or other specification agreed with ESB

Thoroughly brush, mandrel all ducts & install 12mm polyproplene draw rope, then seal all ducts with screw type end plug - Jack Moon type

2A 110kV Single Circuit Joint Bay



2B 110kV Double Circuit Joint Bay



Standard Specification for ESB 110kV Networks Ducting/Cabling (Minimum Standards)

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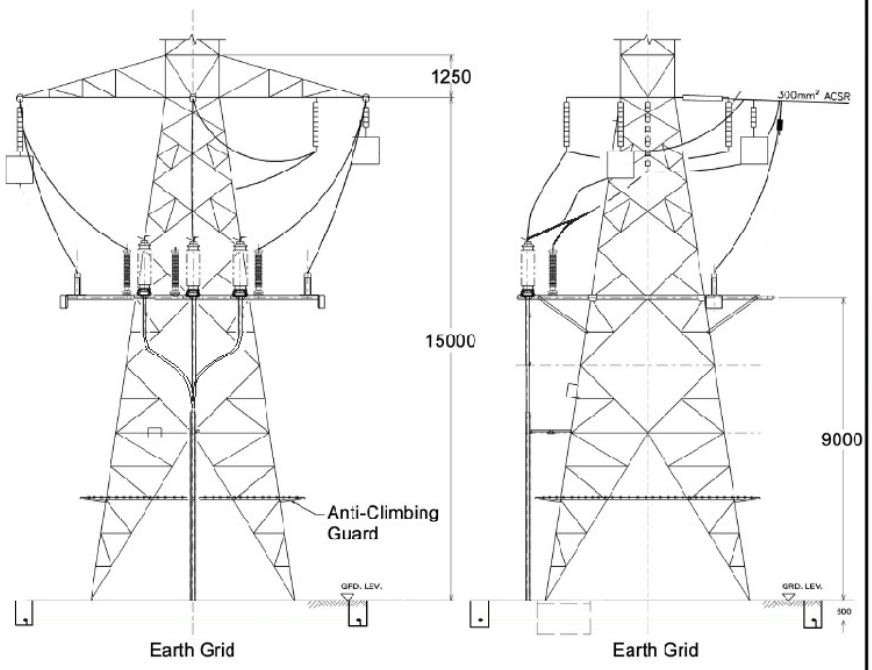
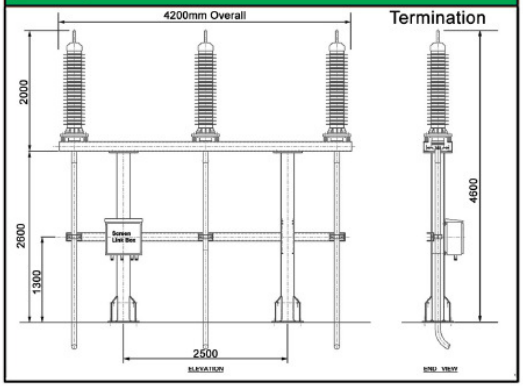
ESB Networks
Rev 0: Date 09-10
Approved:

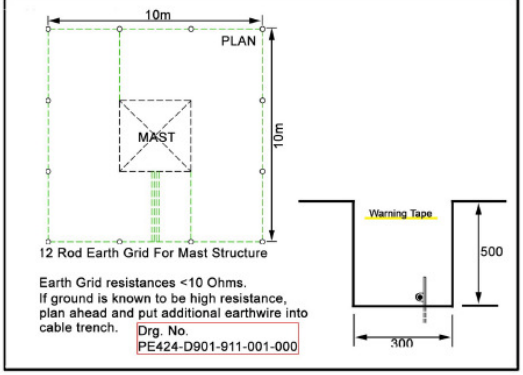
3A 110kV Cable End Mast Termination



3B Typical 110kV Termiantion Arrangement for Substations



3C Earth Grids

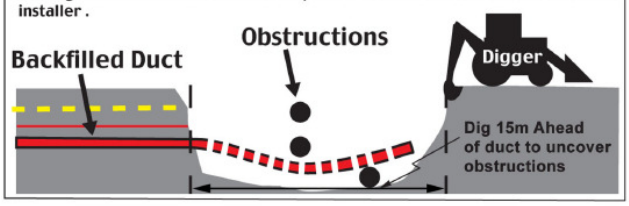


Earth Grid resistances <10 Ohms.
If ground is known to be high resistance, plan ahead and put additional earthwire into cable trench.

Drg. No.
PE424-D901-911-001-000

4A Obligation of Duct Installer to Minimise the Number and Severity of Duct Bends

The duct installer must minimise the number and severity of preformed bends in ground with obstructions and other utility service crossings by opening ground 15m ahead of backfilled duct, wherever practical to do so. This safety obligation, which may require use of steel plating, allows the duct installer to pick the least bendy duct route through utility crossings and obstructions . Otherwise, numerous sharp unrecorded duct route deviations will be present making cable installation considerably more difficult and less safe for the cable installer .

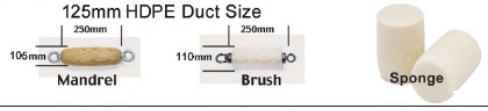


4B Standard for Brushing, Mandrelling, Roping and End-Capping of 110kV Ducts

All Ducts must be:
- Thoroughly brushed and mandrelled to prove ducts against debris /excessive deflection
- Roped using 12mm polyproplene rope with certified safe breaking load of 1.5 tons -- all rope joints to be properly spliced and PVC taped over. Approved Supplier Silver Strand Bunclana Donegal, ph (074) 9382503 - 500m drum lengths available to minimise splicing/coil handling
- Sealed using endcaps against grit and water getting into them
  NB: Replace mandrels once mandrel wear indicators or grooves are worn down
  Replace brushes once brush diameter falls 5mm below dimensions in table below
- Approved endcaps, both disposable and reusable types, are available from suppliers of approved ESBN ducting
- Approved ESBN Mandrel and brush suppliers :

Brandon Agencies, Rathnew, Co Wicklow: Phone 0404 20500 (Brushes & Mandrels)
IS Varian, Greenhills Industrial Estate, Walkinstown, Dublin 12 Phone: 01-4501150 (Brushes Only)
Clydesdale UK Phone 0044 1234 855 855 (Brushes & Mandrels)
Tynagh Network Systems, Loughrea, Co Galway. Phone: 091 842206 (Brushes & Mandrels)

125mm HDPE Duct Size

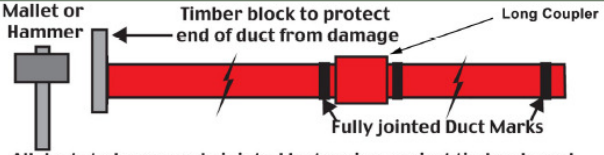


4C Approved ESBN ducting for 110kV cables

- Use only solid wall high impact resistance ESBN approved HDPE red ducting to IS 370colour standard and ESBN specification 16113 (7.1mm minimum wall thickness) Discoloured or unidentified ducting not acceptable. All duct material must be approved by ESB Networks.
- Lightweight flexible corrugated twinwall ducting is not acceptable to ESBN irrespective of manufacturer

- Current approved HDPE Duct and duct bend manufacturers are:
  Lynplast (bend fittings only), Uponor-Radius Systems, Wavin, Quality Plastics, Emtelle

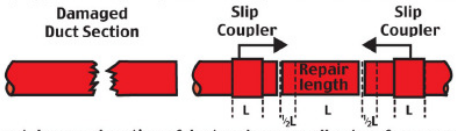
4D Specification for Duct Jointing for 110kV Cables



All ducts to be securely jointed by tapping against timber board on each duct until the black depth insertion mark is reached
Always smear duct lubricant on coupler rubber ring

4E Repair of Existing Ducts

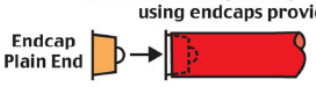
Use only approved slip couplers from approved manufacturers in section 4C



- **Cut out damaged section of duct and ensure all cut surfaces are square and free from sharp edges**
- **Slide, position and centre the repair couplers on the centering marks**

4F Sealing of Ducts

All ducts to be permanently sealed at both ends of duct run
Ducts to be temporarily sealed during installation using endcaps provided with each bale



ESBN Code 125mm: 9317583

Standard Specification for ESB 110kV Networks Ducting/Cabling (Minimum Standards)

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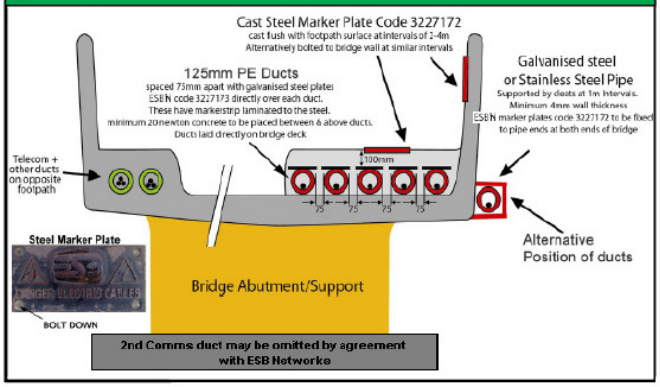
Note 3 : All materials (ducts, marker tapes/strips, duct surrounds, mandrels and brushes) must be ESB approved materials

ESB Networks
Rev 0: Date 09-10
Approved:

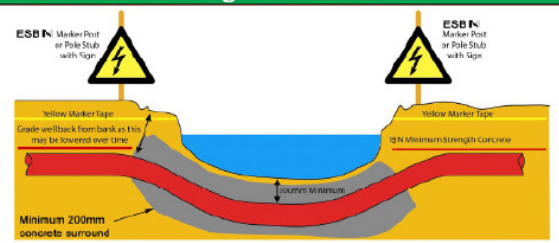
5A Bridge Crossings: Restricted Footpath Designs



5B Bridge Crossings: Restricted Footpath Designs

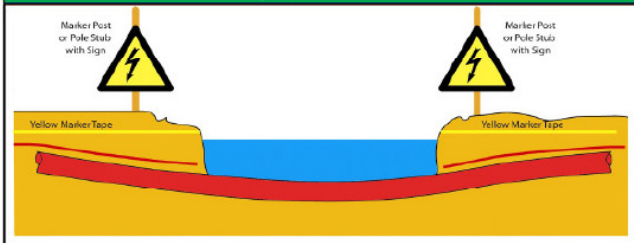
1. The design must be agreed with the bridge authority. Position in footpath is preferred.
2. Minimum cover over ducts on footpath 100mm.
3. **Where duct cover is >600mm, marker strip 75mm above ducts and marker tape (300mm below surface) + steel surface markers suffice**
4. Red ducting is not suitable for cable run external to bridges.
5. Where possible galvanised steel/stainless steel piping should be used, all joints must be free of weld burrs on inside. Alternatively heavy duty 10mm wall thickness black HDPE material with cast steel marker plates attached must be used to permanently warn of presence of electric cable.

6A River/Stream Crossings: Standard Where Burial/Drilling IS Possible



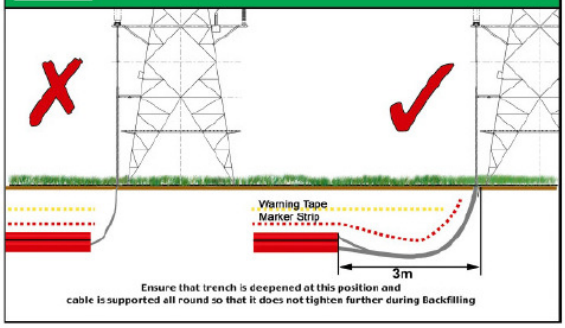
1. Depth of burial below bottom of river or stream to be agreed with relevant authority (if applicable)
2. If normal red ducting is installed by trenching, it must be encased in CBM4 (15N after 7 days) concrete to prevent uplift and to provide mechanical protection. Seal any joints to prevent concrete entering duct.
3. If drilled crossing is practical, use heavy red wall coiled HDPE duct (**sections 2.2 & 2.9 in MV/LV manual**)
4. Install an ESBN marker post on both sides of the crossing - ESBN code 8327355 or use stub pole minimum 2.0m above ground level & warning sign 8238339.
5. Where circumstances require it a large steel pipe can be installed into which a number of standard ESBN duct sizes are pulled in (**see section 2.9.4 of MV/LV manual for guidance**)
6. If crossing a tidal section of a river or stream a foreshore licence will be required

6B River/Stream Crossings: Standard Where Burial/Drilling IS NOT Possible



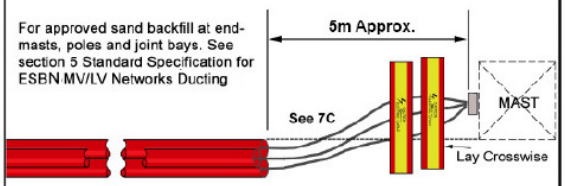
1. Installation on base of river or stream to be agreed with relevant authority (if applicable)
2. Heavy wall steel pipe to be used free of weld beads/swarf. Minimum 8mm steel wall thickness to be used. Encase in CBM4 (15N after 7 days) concrete for corrosion protection, minimum 100mm surround
3. Install an ESBN marker post on both sides of the crossing. ESBN code 8327355 or use stub pole minimum 2.0m above ground level & warning sign 8238339.
4. Ensure a smooth connection using rubber coupler between crossing pipe size and ESBN standard duct as the steel pipe size will usually differ from the standard ESBN ducting. Alternatively run ESBN ducting right through the steel pipe
5. If crossing a tidal section of a river or stream a foreshore licence will be required

7A Cable End Mast Position



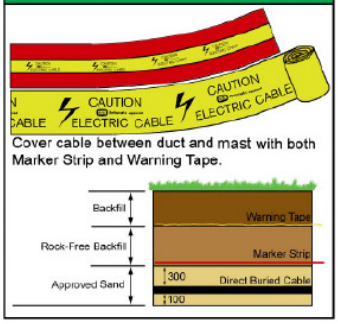
Ensure that trench is deepened at this position and cable is supported all round so that it does not tighten further during Backfilling

7B Cable End Mast Position



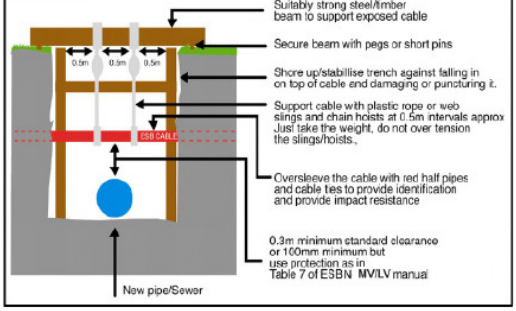
Offset trefoil to line up with edge of mast for ease of cable pulling.
Never install ducting right up to mast with long radius bend attached.
Both marker strip and warning tape to be used between duct and mast (laying the marker strip crosswise as shown above).

7C Cable End Mast - Marker Strip/Tape

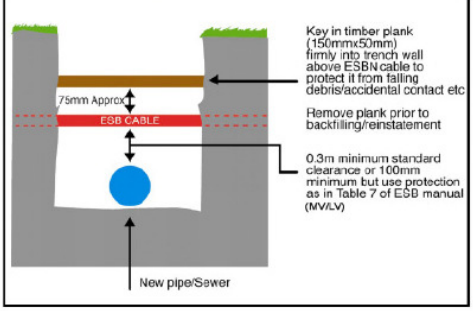


Cover cable between duct and mast with both Marker Strip and Warning Tape.

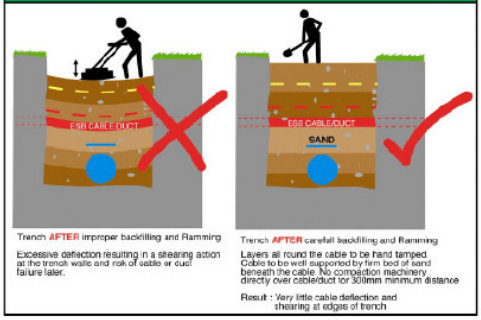
8A Supporting ESBN Cables/Ducts During Trenching Works



8B Supporting ESBN Cables/Ducts During Trenching Works



9 Avoidance of Cable Damage Due to Improper Backfilling at Cable Crossings



Trench **AFTER** improper backfilling and Ramming

Excessive deflection resulting in a shearing action at the trench walls and risk of cable or duct failure later.

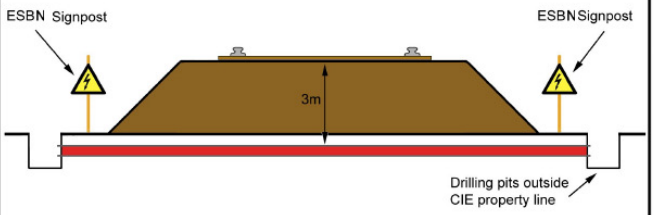
Trench **AFTER** carefull backfilling and Ramming

Layers all round the cable to be hand tamped. Cable to be well supported by firm bed of sand beneath the cable. No compaction machinery directly over cable/duct for 300mm minimum distance

Result : Very little cable deflection and shearing at edges of trench

Standard Specification for ESB 110kV Networks Ducting/Cabling

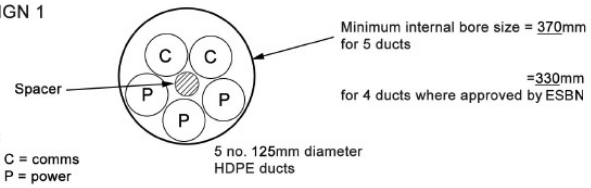
10A 110kV Railway Crossing Details



Formal licence for crossing and approval required from Iarnrod Eireann
Accurately record crossing location & erect marker posts.

10B TypicalDirectional Drill/Thrust Bore Duct Bore Details

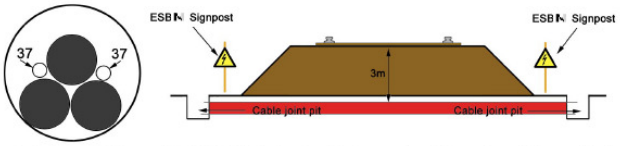
DESIGN 1



Alternatively use 2 x 37mm HDPE ducts for comms cables with C2 chamber on each side of the crossing to permit pulling along entire route. (See 10C)
All interstitial space to be bentonited thoroughly to maintain cable rating.
Accurately record crossing location & erect marker posts.

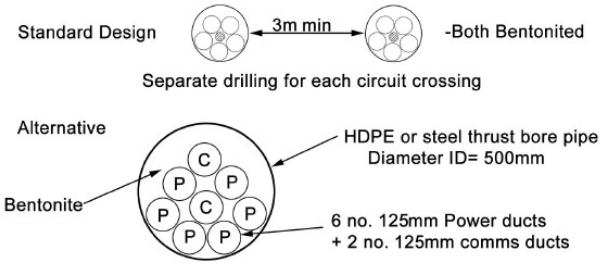
10C Typical Directional Drill/Thrust Bore Duct Bore Details

ALTERNATIVE DESIGN



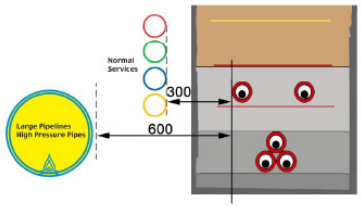
Install 1 no. 300mm ID SDR 17.6 duct with 3 no. short length cables pulled into this pipe along with 2 x 37mm comms ducts.
Full cable joint bays are required on either side of crossing along with C2 chambers for this design .
This method is used where it is not not practical to install large diameter pipe -eg. risk of ground upheaval or presence of obstructions.
All interstitial space to be thoroughly bentonited to maintain cable rating.
Accurately record crossing location & erect marker posts.

10D Typical Double Circuit Bore Crossing



All crossings to be accurately recorded and signposts erected given impracticality of marker tape.

11 Minimum Standard Clearances to Other Services

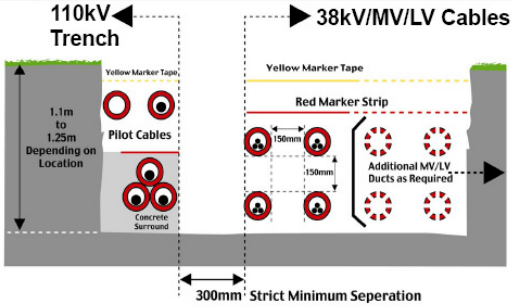


Clearances less than the above at pinch points and crossings requires placement of additional mechanical protection (concrete slab/brick) and agreement of ESBN

ESBN ducts must never be laid over other services on parallel runs, except with the written prior agreement of the other utilities and ESBN

Other services must never be laid directly over ESBN ducts on parallel runs

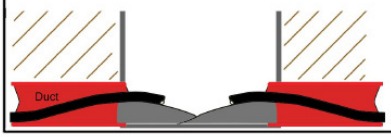
12 Combined 110kV & 38kV Cable Runs



NB. Where it is necessary to employ this formation, the seperation distance of 300mm should be strictly controlled and monitored to minimise derating (see MV/LV manual page 180)
Detailed calculations and design to be agreed between ESBN / ESBI

13 Sealing and Protection of 110kV Cables Once they Exit Ducts

Ducts to be thoroughly sealed using ESBN tyco approved water sealant and 4hr fire rating approved for firestop.
NB - All joint bay entries to be thoroughly sealed to prevent sand washout and subsidence.

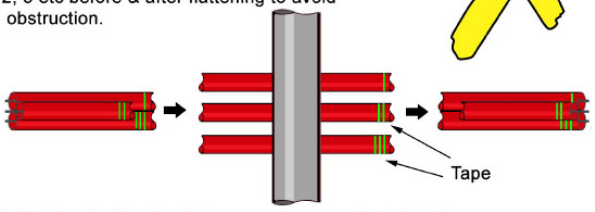


Sandbags or other durable support for cable as it exits ducts to prevent damage to cable sheath

14 Duct Crossovers Are Not Allowed

Be especially careful when going from flat to trefoil formation in vicinity of services

Eliminate this possibility by marking ducts 1, 2, 3 etc before & after flattening to avoid an obstruction.



NB. If using double circuit, tape mark power ducts 1 to 6

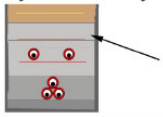
15 Crossing Dumps/Contaminated Ground

Thoroughly seal all joints with adhesive water-tight duct jointing compound and pressure test for airtightness.
Gasketed couplers alone are inadequate.

Fusion welded couplers are also acceptable but require red over-taping.

NB. Avoid whenever possible due to: Subsidence, methane gas & severe thermal derating risks.
Seek advice from ug networks section to ensure rating of cable is adequate (derating of 50% can occur)
NB. Waste oils and chemicals can also seriously damage cables

Seal all duct joints with duct adhesive compound or use continuous duct lengths & seal all duct ends in joint bays. Alternatively weld pipes.



Concrete is continued up to 300mm of final surface to offset derating (CBM4 - 15N after 7 days)