



The National Joint Utilities Group

NJUG Guidelines on the Positioning and Colour Coding of Underground Utilities' Apparatus

Volume 1

NJUG GUIDELINES ON THE POSITIONING AND COLOUR CODING OF UNDERGROUND UTILITIES' APPARATUS

PLEASE ENSURE THAT YOU READ THE LEGAL NOTICE AND DISCLAIMER WHICH APPEARS IN APPENDIX A OF THIS PUBLICATION

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NJUG has a vision for street works, this vision is simply:

- **Safety is the number one priority**
- **Utilities deliver consistent high quality**
- **Utilities work together and in partnership with local authorities and contractors to minimise disruption**
- **Utilities keep the public fully informed on all aspects of works**
- **Utilities maximise the use of sustainable methods and materials**
- **Damage to underground assets is avoided**

This document forms part of that vision.

**Mark Ostheimer
Operations Director**



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The following volumes constitute the NJUG Publications. They are living documents and may be amended from time to time. There is no attempt to describe any specific industry process as each utility has its own specifications and procedures. Not all the publications will necessarily be available at one time as individual volumes will be published when available.

NJUG PUBLICATIONS	
<i>Current</i>	<i>Previous</i>
VOLUME 1	
NJUG Guidelines on the Positioning and Colour Coding of Underground Utilities' Apparatus	NJUG 4 & 7
VOLUME 2	
NJUG Guidelines on the Positioning of Underground Utilities Apparatus for New Development Sites	NJUG 2, 5 & 6
VOLUME 3	
NJUG Guidelines on the Management of Third Party Cable Ducting	New
VOLUME 4	
NJUG Guidelines for the Planning, Installation and Maintenance of Utility Apparatus in Proximity to Trees	NJUG 10
VOLUME 5	
NJUG On-Site Environmental Good Practice Guidelines	New
VOLUME 6	
NJUG Guidelines on Co-ordination, Co-operation and Communication	New

The following NJUG publications have not been reviewed and have been completely withdrawn:

- NJUG 3 – Cable Locating Devices
- NJUG 8 – Performance Guide for the Assessment of Metallic Pipe and Cable Locators
- NJUG 9 – Recommendations for the Exchange of Records of Apparatus between Utilities
- NJUG 11 – Proposed Data Exchange Format for Utility Map Data
- NJUG 12 – NJUG Specification for the Digitisation of Large Scale OS Maps
- NJUG 13 – Quality Control Procedure for Large Scale OS Maps Digitised to OS 1988
- NJUG 15 – NJUG/Ordnance Survey Service Level Agreement (Technical) for Digital Map Products and Services



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NJUG Guidelines on the Positioning and Colour Coding of Underground Utilities' Apparatus

These guidelines describe utility industry practice. However, it should not be assumed that all mains or services will conform to the recommendations for positioning or colour coding contained in this publication.

This volume supersedes NJUG 4 'The Identification of Small Buried Mains and Services', NJUG 7 'Recommended Positioning of Utilities' Apparatus for New Works on New Developments and in Existing Streets' and the NJUG revision 'Utilities' Guidelines on the Positioning and Colour Coding of Apparatus'.

Background

The statutory right of undertakers (utilities) to carry out works within the public highway in order to provide and maintain their apparatus dates from the mid-19th century. There are no statutory obligations governing the position or depth at which apparatus should be laid within the highway. The following guidelines should therefore be adhered to wherever practicable.

The New Roads and Street Works Act 1991, as amended by the Transport Act 2000, the Traffic Management Act 2004, the Transport (Scotland) Act 2005 together with the Street Works (Northern Ireland) Order 1995, sets down the legislative requirements to be adopted during the installation, repair and maintenance of apparatus in roads and streets.

Scope

- (i) Utility apparatus can be vulnerable to damage from works carried out in the highway. The safety of operatives and the public is of paramount importance. It is therefore in the interests of all parties to make every effort to minimise both the occurrence and effect of damage (see Volume 3).
- (ii) Early consultation between highway authorities, planners, architects, developers and utilities is important to ensure that engineering and planning requirements for the installation of infrastructure are agreed.
- (iii) These guidelines apply to utility apparatus placed beneath:
 - a) Footways
 - b) Carriageways
 - c) Cycle tracks
 - d) Verges
 - e) Service strips
 - f) Footpaths



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- (iv) These recommendations are based upon a two metre wide footway, which is the minimum width required to accommodate the full range of utility services. Due to the complexity of layout and size of utility and other apparatus only guidance can be given on their actual positioning. However, utilities and others should always endeavour to comply with the recommended positioning of their apparatus.
- (v) In the case of innovative street designs, such as Home Zones, the emphasis must be on early consultation between all involved to ensure that the utility services are positioned so as to allow safe access for maintenance and repair.
- (vi) On new development sites where utility apparatus is installed by the Developer or a third party, the guidelines contained within this section for the positioning and colour coding of underground apparatus should be followed. Any deviation from these guidelines should only be conducted with the agreement of the prospective asset owner. Any variation to depth of cover must permit access to all utility apparatus. For further detail see **Volume 2 – 'NJUG Guidelines on the Positioning of Underground Utilities Apparatus for New Development Sites'**.
- (vii) These guidelines include a recommended colour coding scheme facilitating the identification of apparatus within the highway in order to create a safer working environment.
- (viii) In addition to formal notification requirements specialist advice should also be obtained when works are undertaken over, under or near to the following:
 - bridges, subways, culverts, cellars, manholes, trees and railway level crossings.

In these situations the appropriate authority or asset owner should be able to offer advice and assistance.

1. IDENTIFICATION

1.1 Pipe / Duct Identification and Recommended Depths

Tables 1 and 2 below give the recommended industry and other underground apparatus depths and colour identification for ducts, pipes and cables.



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TABLE 1 – Recommended Colour Coding of Underground Utilities Apparatus

All depths are from the surface level to the crown of the apparatus

Utility	Duct	Pipe	Cable	Marker Systems	Recommended Minimum Depths	
					Footway/Verge	Carriageway
Electricity HV (High Voltage)	Black or red duct or tile	N/A	Red or black	Yellow with black and red legend or concrete tiles	450-1200mm	750-1200mm
Electricity LV (Low Voltage)	Black or red duct or tile	N/A	Black or red	Yellow with black legend	450mm	600mm
Gas	Yellow	*** See row below	N/A	Black legend on PE pipes every linear metre.	600mm footway 750mm verge	750mm
	<p>*** PE - up to 2 bar - yellow or yellow with brown stripes (removable skin revealing white or black core pipe). - between 2 to 7 bar -orange. Steel pipes may have yellow wrap or black tar coating or no coating. Ductile Iron may have plastic wrapping Asbestos & Pit / Spun Cast Iron – No distinguishable colour</p>					
Water non Potable & Grey Water	N/A	Black with green stripes	N/A	N/A	600 – 750mm	600 – 750mm
Water - Firefighting	N/A	Black with red stripes or bands	N/A	N/A	600 – 750mm	600 – 750mm
Oil / fuel pipelines	N/A	Black	N/A	Various surface markers Marker tape or tiles above red concrete	900mm <i>All work within 3 metres of oil fuel pipelines must receive prior approval</i>	900mm <i>All work within 3 metres of oil fuel pipelines must receive prior approval</i>
	Sewerage	Black	No distinguishing colour / material (eg: Ductile Iron may be red; PVC may be brown)	N/A	N/A	Variable
Communications 	Grey, white, green, Black, purple	N/A	Black or light grey	Various	250 – 350mm	450 - 600mm
Water	Blue or Grey	Blue polymer or blue or uncoated Iron / GRP. Blue polymer with brown stripe (removable skin revealing white or black pipe)	N/A	Blue or Blue/black	750mm	750mm minimum
Water pipes for special purposes (e.g. contaminated ground) 	N/A	Blue polymer with brown stripes (non-removable skin)	N/A	Blue or blue/black	750mm	750mm minimum

These guidelines describe utility industry practice. However, it should not be assumed that all apparatus will conform to the recommendations for positioning and colour coding contained in this publication.



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TABLE 2 – Recommended Colour Coding of Other Underground Apparatus

All depths are from the surface level to the crown of the apparatus

Asset Owner	Duct	Pipe	Cable	Marker Systems	Recommended Minimum Depths	
					Footway	Carriageway
Highway Authority Services						
At the time of publication the following were current examples of known highway authority apparatus colour coding but local variations may occur						
Street Lighting						
England and Wales	Orange	N/A	Black	Yellow with black legend	450mm	600mm
Scotland	Purple	N/A	Purple	Yellow with black legend	450mm	450mm
Northern Ireland	Orange	N/A	Black or orange	Various	450mm	450mm
Other						
Traffic Control	Orange		Orange	Yellow with black legend		
Street Furniture	Black or orange	N/A	Black	Yellow with black legend	450mm	600mm
Communications	Light grey	N/A	Light grey or black	Yellow with black legend		
CCTV	Purple	N/A				
Motorways and Trunk Roads						
England and Wales						
Communications	Purple	N/A	Grey	Yellow with black legend	450mm	
Communications Power	Purple	N/A	Black	Yellow with black legend		
Road Lighting	Orange	N/A	Black	Yellow with black legend		
Scotland						
Communications ● ○	Black or grey	N/A	Black	Yellow with black legend		
Road Lighting	Purple	N/A	Purple	Yellow with black legend		

These guidelines describe utility industry practice. However, it should not be assumed that all apparatus will conform to the recommendations for positioning and colour coding contained in this publication.



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Note: The above tables do not represent an exhaustive list of underground apparatus. Utilities and local authorities do not own all the apparatus that may be found underground. Privately owned pipes and cables exist and their records may not be widely available.

- All apparatus must be treated with caution until a positive identification has been made. The pipe or duct may have the asset owner's name and contact details stamped upon it. Every effort must be made to avoid damage to all apparatus as the consequences are costly and dangerous.
- The recommended primary method of identification of small buried mains and services and their associated ducts is by colour coding (see Table 1 – 'Recommended Colour Coding of Underground Utilities Apparatus' and Table 2 – 'Recommended Colour Coding of Other Underground Apparatus'. In addition to colour coding, other methods of identification may be used (see sub-section 1.3 – 'Marker / Warning Systems'.
- Reference should also be made to HSE Publication HSG 47, 'Avoiding Danger from Underground Services'

1.2 Colour

1.2.1 New Services

It is recommended that utilities and other parties use the colour coding shown in Tables 1 and 2 of this document. Where, for example, an electricity company lays gas plant the colour should be that for the service not the owner i.e. all gas pipes should be yellow in colour.

1.2.2 Older Existing Apparatus

It is important to remember that:

- Older services or other pipelines may not conform to these recommendations.
- Colours may look different under poor or artificial lighting.
- An older pipe or duct could contain apparatus not specifically indicated by its colour coding.
- Aggressive soils may discolour pigments in duct, pipe and cable colourings over time.



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1.3 Marker / Warning Systems

1.3.1 Laying New Marker Systems

It is recommended that when installing new apparatus appropriate marker systems are laid some distance above the plant. Insulated wire or tapes incorporating a metal strip or passive electronic marker systems may be laid as an aid to the location of non-metallic pipes and ducts. Protection tapes or tiles made out of concrete, clay or plastic may be used and provide an additional means of identification.

1.3.2 Exposing Existing Marker Systems

When exposing existing marker systems care should be taken that they are not disturbed, damaged or removed. Any displaced marker system should be replaced. Whilst marker systems may have value in warning an operator of the presence of buried plant, they are of strictly limited value as a means of identification. Marker systems should not be taken as an accurate indication of buried plant.

2. POSITIONING OF APPARATUS IN A TWO METRE WIDE FOOTWAY

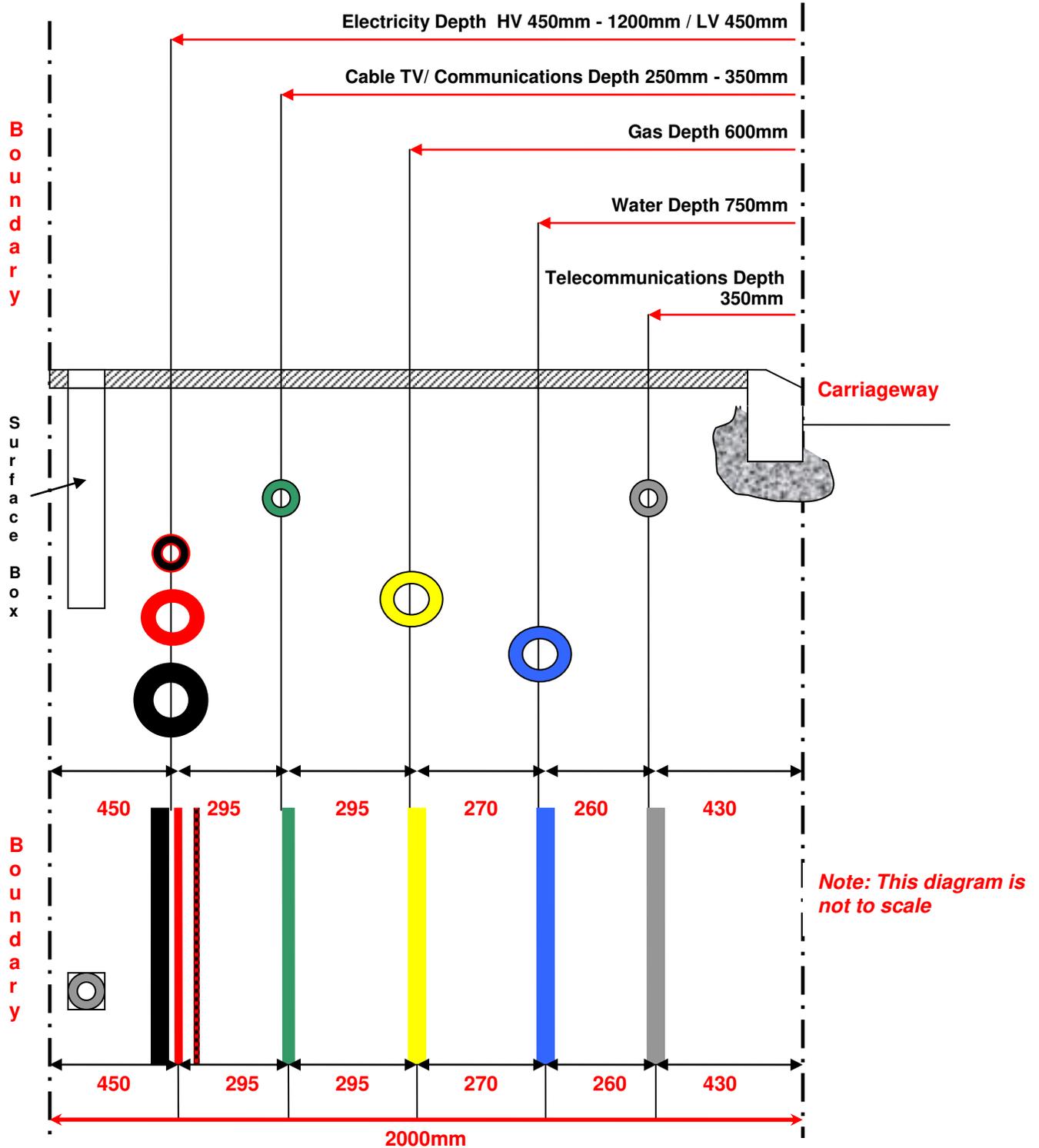
Figure 1 below illustrates the industry recommended minimum depths of cover to the crown of the apparatus. If in doubt contact the utility apparatus owner for clarification of specific requirements.



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FIGURE 1 - Recommended Positioning of Utility Apparatus in a 2 metre Footway

Note – the same positioning should apply in the carriageway/service strip (if safe and practical to do so) where a development has no footway(s) available for services and/or the boundary of the property is on the carriageway (please refer to minimum depths in carriageways). For further advice please contact the asset owner.





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The position of pipes and cables shown in Figure 1 is for illustrative purposes only.

For service connections refer to industry specific by-laws.

Note: Each utility sector may have its own asset standard in respect to the positioning and depth of apparatus.

3. INSTALLING APPARATUS IN THE CARRIAGEWAY

In the event of congestion of apparatus in the footway / verge (e.g. where less than 2 metres wide) or where a development has no footway, normal distribution mains, pipes, cables and ducts may have to be sited and positioned within the carriageway. Transmission and trunk main pipes and cable ducts are invariably of larger dimensions and as a consequence may also need to be located in the carriageway.

3.1 Specification for the Reinstatement of Openings in Highways code of practice (SROH)

Apparatus must be installed below the carriageway construction layers unless special arrangements are made with the relevant authority. Apparatus installed within the carriageway construction is significantly more at risk of damage from traffic loads and excavation and this practice should be avoided whenever possible.

Section 1.8.1 states that undertakers' apparatus greater than 20mm external diameter will not normally be permitted within the road structures.

Section 1.8.2 states that apparatus of 20mm external diameter or less shall not be permitted above or within 20mm of the following levels within a road structure:

- The base (roadbase) / binder course interface in a flexible road.
- The underside of the concrete road slab in a rigid road.
- The underside of modules in a modular road.

In exceptional circumstances, where plant can only be laid within the construction layers of the carriageway, adequate protection should be provided. This should only be considered following consultation and agreement with the relevant authority.

3.2 Ducts

Where practicable pipes and cables which cross the carriageway should be laid in ducts for ease of future maintenance and the avoidance of congestion.



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3.3 Motorways

Motorways are protected streets and undertakers should avoid laying apparatus under them unless the apparatus is directly associated with the motorway itself (e.g. lighting, communication and signal cables, etc.). Where apparatus does have to be laid under a motorway this is usually accomplished by means of a duct or service tunnel. For procedures regarding protected streets see the code of practice for the Co-ordination of Street Works and Works for Road Purposes and Related Matters.

4. INSTALLING APPARATUS OFF THE PUBLIC HIGHWAY

Industry Recommended Minimum Depths of Cables, Ducts & Mains

The minimum depths to the top of cables / ducts / mains for the various laying conditions are shown in the following tables:

4.1 Electricity

Voltage	Good agricultural land	Footpaths, verges, uncultivated land, pasture agreed to be permanent and land not open to vehicular traffic	
	All situations	Rural	Urban
132kV	910 mm	900 mm	900 mm
66kV	910 mm	750 mm	750 mm
33kV	910 mm	750 mm	750 mm
20kV	910 mm	600 mm	600 mm
11kV	910 mm	450 mm	450 mm
LV & Services	910 mm	450 mm	450 mm

4.2 Water and Waste Water

	Good agricultural land	Footpaths, verges, uncultivated land, pasture agreed to be permanent and land not open to vehicular traffic	
	All situations	Rural	Urban
Minimum Deep ploughing	900 mm As agreed	900 mm As agreed	900 mm As agreed



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4.3 Communications

	Good agricultural land	Footpaths, verges, uncultivated land, pasture agreed to be permanent and land not open to vehicular traffic	
	All situations	Rural	Urban
Minimum	350 mm	350 mm	350 mm
Deep ploughing	As agreed	As agreed	As agreed

4.4 Gas

		Service Diameters ≤63 mm / 2"	All Other Pipes			
			2 bar or below	> 2 bar to 7 bar	> 7 bar to 16 bar	> 16 bar
Open fields and agricultural land	Min.	1100 mm	1100 mm	1100 mm	1100 mm	1100 mm
	Deep ploughing	By agreement	By agreement	By agreement	By agreement	By agreement
Rural & urban locations	Paved footways	450 mm	600 mm	600 mm	1100 mm	1100 mm
	Verges & private roads	By agreement	750 mm	750 mm	1100 mm	1100 mm
	Uncultivated land, pasture agreed to be permanent and land not open to vehicular traffic	1100 mm	1100 mm	1100 mm	1100 mm	1100 mm

Contact must be made with the Gas Network Operator before any installation or excavation work is undertaken

5. FACTORS INFLUENCING THE POSITIONING OF UNDERGROUND APPARATUS

Due to technical, engineering or legal constraints there may be occasions where these recommendations cannot be adhered to. Examples include:

- (a) Width restrictions
- (b) Depth restrictions
- (c) Environmental reasons e.g. trees and planted areas



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- (d) Restrictions imposed by legislation
- (e) Safe access to apparatus e.g. heavily trafficked roads
- (f) Clustering of utilities' apparatus typically caused by:
 - Jointing chambers or valve installations in footways which may reduce the available space for additional apparatus.
 - Apparatus exiting from or entering buildings or chambers e.g. electricity substations and telephone exchanges.
 - Surface apparatus e.g. kiosks, street lighting columns and cabinets.

In such circumstances apparatus may be forced to encroach into adjacent private property providing the necessary permissions have been obtained.

6. TRENCH SHARING

Trench sharing may be beneficial in reducing disruption to both vehicular and pedestrian traffic, as well as offering cost savings in construction methods and reinstatement liability for utilities. Trench sharing can also be useful in maximising the limited available space in the highway.

Wherever practical and appropriate trench sharing should be considered.

When trench sharing is an option it is essential that early consultation takes place with representatives from relevant authorities and all other interested parties.

Agreement on the positioning of apparatus within a shared trench together with the reinstatement specification should be made between all interested parties (including the relevant authority) as early as possible as part of the planning process.

A primary promoter should be identified to take overall responsibility as the agreed point of contact with the relevant authority. The primary promoter would normally excavate the trench and install its own apparatus. The secondary promoter/s would then install their apparatus in the same trench. The primary promoter would then backfill the trench and reinstate unless an alternative agreement has been made.

With regard to statutory noticing and permit requirements it is the responsibility of each party to individually notify their own works.

For further guidance see the Code of Practice for the Co-ordination of Street Works and Works for Road Purposes and Related Matters.



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7. COMBINED SERVICE DUCTS, SUBWAYS AND TUNNELS

There are circumstances where utilities may be required to install their apparatus in designated service ducts, subways and tunnels. When considering these options the following should be taken into account:

- Accessibility - when considering the positioning of apparatus, access and maintenance.
- Positioning of apparatus – as directed by the asset owner.

8. USE OF ABANDONED AND SURPLUS APPARATUS

Abandoned or surplus apparatus is occasionally used by other utilities. While this avoids unnecessary excavation and potential damage to third party apparatus it is essential that both the original and new owners record the change of utility use and plant records are updated accordingly.

Any new apparatus installed should be colour coded in accordance with Table 1 – 'Recommended Colour Coding of Underground Utilities Apparatus'.

Arrangements for the use of such apparatus between asset owners will be unique to each utility and can only be made by mutual agreement.

9. DISTRICT HEATING

A district heating installation typically consists of a highly insulated "heat main" of flow and return pipes distributing hot water (or steam) to buildings which are connected via junction points.

The proximity of district heating apparatus may affect the efficiency and operation of other underground apparatus. Before such apparatus is laid contact must be made with all appropriate existing apparatus owners.

Installers of district heating should consider the location, spacing and depth of cover to avoid potential conflict with other existing underground apparatus.

Owners of other underground apparatus should be aware of the potential safety issues and dangers of working in proximity to district heating apparatus and should make contact with the existing owners of such apparatus. The local authority may be able to advise as to the ownership of the district heating network.



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GLOSSARY

Apparatus	Equipment such as valves, stopcocks, chambers, cabinets, transformer chambers etc and includes any structure for the lodging of apparatus.
Carriageway	A way constituting or comprised in a highway, being a way (other than a cycle track) over which the public have a right of way for the passage of vehicles.
Cycle track	A way constituting or comprised in a highway over which the public have a right of way on pedal cycles with or without a right of way on foot.
District heating	District heating utilizes a centralized boiler installation to provide heat for a number of buildings such as individual houses, blocks of social housing, local council offices, schools etc.
Duct / ducting	Structure (usually cylindrical) used to convey and protect apparatus
Fibre optic	The use of very thin glass or plastic fibres through which light can be transmitted to carry information from a source to a receiver, especially for telecommunication, television and information technology systems.
Footpath	A highway over which the public have a right of way on foot only, not being a footway.
Footway	A way comprised in a highway which also comprises a carriageway, being a way over which the public have a right of way on foot only.
GRP	Glass Reinforced Plastic
High Voltage	Electricity cables over 1000 volts (>1kV)
Low Voltage	Electricity cables up to and including 1000 volts (1kV)
Main	Structure (usually cylindrical) used to convey water or gas or oil generally greater than 50mm diameter.
NJUG	National Joint Utilities Group Limited.
Pipe	Longitudinal structure (usually cylindrical) used to convey water, gas or oil.
Service strip	A strip of designated land alongside a carriageway or footway used to convey services.
Sub-duct	Longitudinal structure (usually cylindrical) laid inside ducts used to carry smaller diameter cables such as fibre optic.



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Tiles	Impact resistant cover constructed of earthenware, concrete or polyethylene for protecting underground cables
Utility	An undertaker by statute that has a legal right to provide customer services (e.g. communications, electricity, gas, water)
Verge	A strip of land which may form part of the public highway alongside a carriageway or footway, which may contain services.



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APPENDIX A

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