

PAS 256:2017

Buried assets – Capturing, recording, maintaining and sharing of location information and data – Code of practice



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Foreword

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This PAS is not to be regarded as a British Standard. It will be withdrawn upon publication of its content in, or as, a British Standard.



Hazard warning

WARNING. This PAS calls for the use of procedures that can be injurious to health if adequate precautions are not taken. It refers only to technical suitability and does not absolve the user from legal obligations relating to health and safety at any stage.

Use of this document

It has been assumed in the preparation of this PAS that the execution of its provisions will be entrusted to appropriately qualified, and experienced people, for whose use it has been produced.

This PAS is not intended to be used retrospectively and therefore only applies to those assets that are:

- newly-installed and newly-replaced (after the publication of this PAS);
- surveyed in line with the PAS 128 methodology (survey type A); or
- exposed whilst other work is being undertaken.

Presentational conventions

The provisions of this standard are presented in roman (i.e. upright) type. Its methods are expressed as a set of instructions, a description, or in sentences in which the principal auxiliary verb is “should”.

Commentary, explanation and general informative material is presented in smaller italic type, and does not constitute a normative element.

Where words have alternative spellings, the preferred spelling of the Shorter Oxford English Dictionary is used (e.g. “organization” rather than “organisation”).

Where reference is made to English regulations and terminology, (e.g. highway authority) then the equivalent also needs to be considered for Scotland, Wales and Northern Ireland (e.g. roads authority).

Related documents

This PAS is intended to be used alongside PAS 128, *Specification for underground utility detection, verification and location*. PAS 128 specifies requirements for the detection, verification and location of existing and new underground utilities. PAS 128 applies to active, abandoned, redundant or unknown underground utilities and the location of their associated surface features and sets out:

- the accuracy to which the data are captured;
- the quality expected of these data; and
- a means by which to assess and indicate the confidence that can be placed in such data.

This PAS is also intended to be used alongside HSG47, *Avoiding danger from underground services*. HSG47 outlines the potential dangers of working near underground services and gives advice on how to reduce any direct risks to people’s health and safety, as well as the indirect risks arising through damage to services.

Contractual and legal considerations

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a PAS cannot confer immunity from legal obligations.

Particular attention is drawn to the following specific regulations:

- Highways Act 1980 [1]
- New Roads and Street Works Act 1991 (NRSWA) [2]
- Roads (Scotland) Act 1984 [3]
- The Street Works (Northern Ireland) Order 1995 [4]
- Traffic Management Act 2004 (TMA) [5]
- Transport (Scotland) Act 2005 [6]

0 Introduction

0.1 Background

There is a vast network of buried assets owned by utility companies, local authorities and other organizations across the UK. Access to accurate mapping of this critical national infrastructure is vital for those undertaking excavations to maintain service, minimize costs and comply with health and safety legislation.

It is estimated that there are in excess of 3 million excavations in the highway each year; 2.53 million works were estimated to have been carried out by utility companies in England and Wales in 2015 ¹⁾ and around 95,000 utility openings in Scotland ²⁾. In addition, a similar number of works and openings are estimated to have been carried out by highway authorities and others each year, and other excavations are made outside of the highway network by various stakeholders.

The quality, accuracy and reliability of asset owners' records are variable as there are limited established industry standards to which they are to adhere. Asset owners also provide access to their plans in many different formats and on many different platforms to a highly variable timescale.

This has the following implications:

- a) confusion and delays for those needing the information to be able to work safely; and
- b) higher risk of asset strikes causing:
 - 1) safety risks to the public;
 - 2) higher costs to the project, customers, general public, local businesses, etc.;
 - 3) delays to the project, customers, general public, local businesses, etc.; and
 - 4) risks of environmental damage.

Active involvement of key industry players and their agreement through consensus around the capturing, recording, maintaining and sharing of location information and data related to buried assets is likely to provide the lowest overall cost to all. Organizations wishing to abstain from the consensus might miss out on the benefits of early involvement, and the cost to align in the future might significantly increase.

A key benefit of improved asset records is improved safety whilst working in the vicinity of utility assets. However, this does not remove the responsibility of anyone working in the immediate vicinity of utility services, and any employer, to ensure that their employees work safely, at least to the level set out in HSE guidance HSG47, *Avoiding danger from underground services* [NR1].

Additional benefits arising from improved data quality are expected to support:

- i) long-term asset management objectives;
- ii) enhanced design and planning; and
- iii) multi-organizational societal improvements such as future/smart cities and building information modelling (BIM).

0.2 Aims of this PAS

This PAS builds on existing legislation of the New Roads and Street Works Act 1991 [2], the Traffic Management Act 2004 [5], the equivalent street and roads works legislation in Scotland, Wales and Northern Ireland ³⁾, and the requirements set out in PAS 128. It aims to provide the framework for those owning buried assets to:

- a) drive towards improved accuracy when capturing and recording information;
- b) share more accurate records collaboratively, with those working in the vicinity of their buried assets; and

¹⁾ See ALARM survey 2016, http://www.asphaltuk.org/wp-content/uploads/ALARM_survey_2016.pdf [7]

²⁾ See <http://www.roadworksscotland.gov.uk/nmsruntime/saveasdialog.aspx?IID=1728&SID=99> [8]

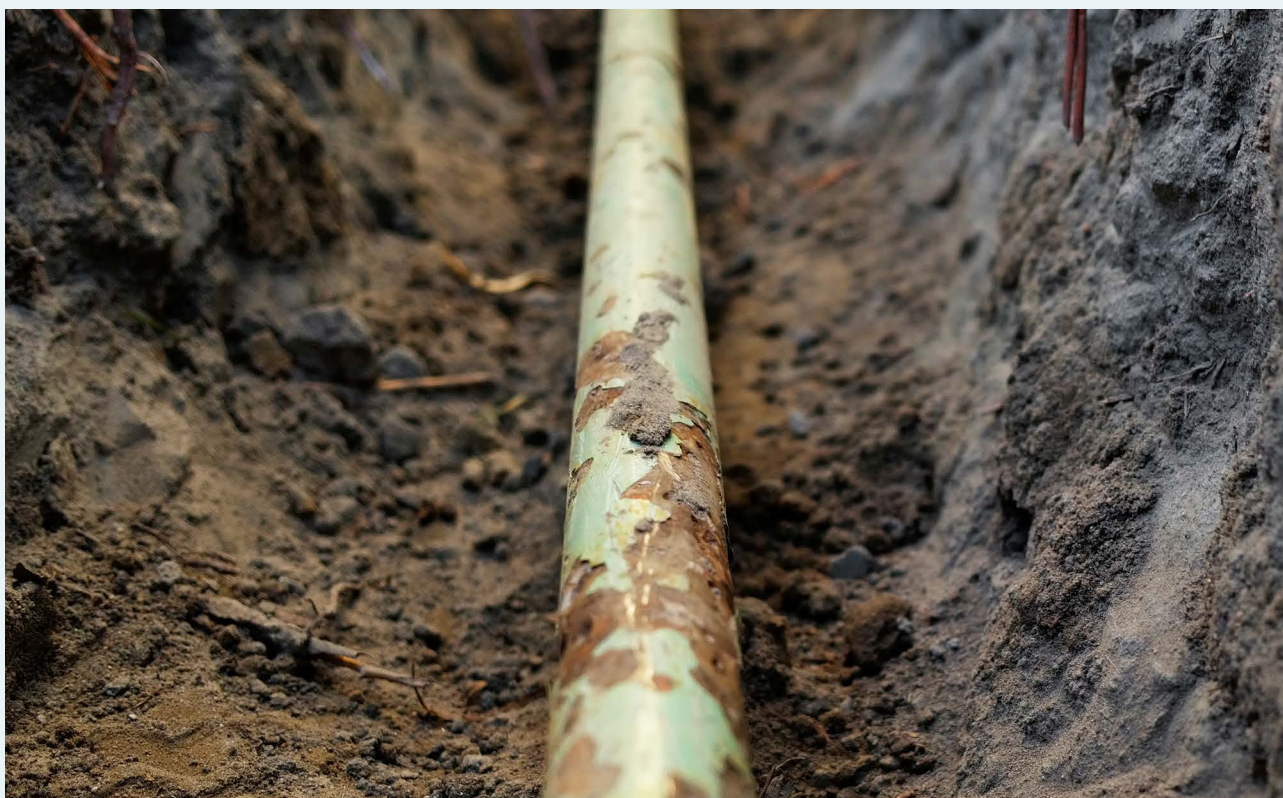
³⁾ For example, The Street Works (Northern Ireland) Order 1995 [4].

- c) improve the linkage between assets that are part of the critical national infrastructure with initiatives such as Smart Cities, and building information modelling (BIM).

NOTE Further information on BIM is given in the PAS 1192 suite of standardization documents. In particular, PAS 1192-2 provides the framework for collaborative working, information exchange and information management in a BIM Level 2 environment.

This PAS aims to enable:

- 1) an improvement in planning, together with more certainty of the location of assets, in order to reduce excavation and reinstatement costs, and encourage more use of trenchless or minimum dig technology;
- 2) provide a standard format for asset data that is recognized by industry as being more resilient, in order to allow smoother interchange into future and emerging technologies and innovations, for example, Smart Cities and BIM;
- 3) the sharing of more consistent and more accurate asset information, including the warning and physical protection devices afforded to buried assets, where known;
- 4) better visibility of records for survey practitioners in order to reduce the number of unknowns and allow better-targeted survey work;
- 5) increased knowledge of the underground network for those designing or excavating, thereby reducing the risk of injury, damage or disruption;
- 6) increased efficiency of street works and a reduction in the associated delays to the public;
- 7) a reduction in the environmental impact and environmental costs of works;
- 8) a long-term reduction in the cost, effort and time it takes for utilities and highway or roads authorities to share asset records;
- 9) a reduction in the time taken to update records in order to enable timely sharing of more current data;
- 10) improved knowledge of all asset owners of the spatial relationship of their asset with respect to those of other asset owners, in order to improve future planning and further improve co-ordination;
- 11) the development of a feedback mechanism from those undertaking works around the positional accuracy of their asset in relation to their asset plans; and
- 12) improved ease of access towards a complete set of records by facilitating a move towards electronic data exchange over time taking into consideration individual organizations' operational, financial, commercial and security concerns.



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1 Scope

This PAS gives recommendations for improving the capturing, recording and maintaining of data related to buried assets (and associated above-ground assets) together with the sharing, in a security-minded manner, of asset information relating to utilities, local authorities and other providers' infrastructure.

This PAS is not intended to be used retrospectively and therefore only applies to those assets that are:

- a) newly-installed and newly-replaced (after the publication of this PAS);
- b) surveyed in line with the PAS 128 methodology (survey type A); or
- c) exposed whilst other work is being undertaken.

This PAS applies to buried assets located in public and private land.

This PAS covers:

- 1) a data glossary;
- 2) data formats, such as geography markup language (GML);
- 3) transition of spatial data, using relative accuracy as a minimum and moving towards absolute accuracy (including depth), together with supporting evidence such as photographs or tagging;
- 4) the inclusion of decommissioned or abandoned assets when sharing data;
- 5) a target number of days to make data available for sharing from installation;
- 6) the capture of data emanating from works carried out under a s50 licence or equivalent;
- 7) the inclusion of local authority and other organizations' buried assets;
- 8) movement from paper or microfiche records to a structured, accessible digital format;
- 9) the capture and sharing of measurable deviations from straight line installations;
- 10) the use of warning and protection devices to aid the final location of the buried asset; and

- 11) symbology, typology, colour coding and layering.

NOTE 1 *At the time of publication, efforts to standardize symbology are being undertaken by The Survey Association and these are expected to be introduced as best practice when published. In the interim, this PAS directs users towards the NJUG publication, Guidance on the Positioning and Colour-Coding of Underground Utilities Apparatus [NR2] (see Clause 17). Each organization is advised to share the symbology used in its records whenever data is shared.*

NOTE 2 *Scotland already has a centralized Scottish electronic records system ⁴⁾ which makes underground pipe and cable information accessible via the Scottish Road Works Register (SRWR).*

NOTE 3 *Attention is drawn to The INSPIRE Regulations 2009 [9], The INSPIRE (Scotland) Regulations 2009 [10], The INSPIRE (Amendment) Regulations 2012 [11] and The INSPIRE (Scotland) Amendment Regulations 2012 [12].*

This PAS does not cover:

- i) how or where data are stored or how the integrity of storage is assured;
- ii) mines and quarries, with the exception of the buried assets associated with these types of undertaking;
- iii) asset owners' policies, processes, procedures and systems for maintaining and providing data to ensure legal compliance; or

NOTE 4 *Information on data and file retention is given in PAS 128, 11.7.*

NOTE 5 *This PAS is cognizant of the need to maintain commerciality and security. Further information on adopting a security-minded approach to open data is given in PAS 1192-5 and the guidance notes on the CPNI website ⁵⁾.*

⁴⁾ See <http://www.roadworksscotland.gov.uk/LegislationGuidance/Guidance/Vault.aspx>.

⁵⁾ See <http://www.cpmi.gov.uk>.

- iv) service pipes and cables supplying individual premises, only the main networks.

NOTE 6 *Future revisions of this PAS might address assets attached and related to main networks.*

NOTE 7 *Where information is held on service pipes and cables supplying individual premises, it is useful to share this information with operators. Organizations which do not currently capture service connections are encouraged to begin doing so. Where an organization has knowledge of other buried structures (cellars, bridge decks, fleets, tunnels, London Wall, etc.) it is important that these are also highlighted.*

This PAS is for use by organizations owning buried assets and organizations who require the asset records for planning and designing purposes or carrying out work in the vicinity of those buried assets.

This PAS applies to England, Scotland, Wales and Northern Ireland.

NOTE 8 *Attention is drawn to devolved legislation and terminology as described in the foreword.*

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

[NR2] NJUG. *NJUG Guidelines on the Positioning and Colour Coding of Underground Utilities' Apparatus*. Volume 1, Issue 8. London: NJUG, October 2013. Available at: <http://www.njug.org.uk/wp-content/uploads/V1-Positioning-Colour-Coding-Issue-8.pdf> [viewed March 2017]

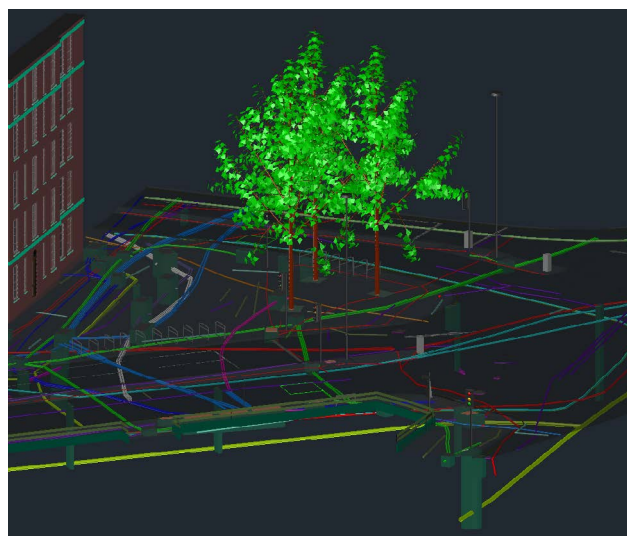
Standards publications

BS EN 12613, *Plastics warning devices for underground cables and pipelines with visual characteristics*

PAS 128, *Specification for underground utility detection, verification and location*

Other publications

[NR1] HEALTH AND SAFETY EXECUTIVE. *HSG47: Avoiding Danger from Underground Services*. Crown Copyright. 2014. Available at: <http://www.hse.gov.uk/pubns/priced/hsg47.pdf> [viewed March 2017]



3 Terms, definitions and abbreviations

3.1 Terms and definitions

For the purposes of this PAS, the following terms and definitions apply.

3.1.1 abandoned asset

pipe, cable or asset that has been decommissioned by an organization and it has been confirmed in writing that it will not be re-used or re-energized in the future

NOTE 1 *The structure of these assets (either intact or otherwise) might remain in the ground.*

NOTE 2 *All buried plant need to be treated as live until proven otherwise by safe testing by the asset owner.*

3.1.2 absolute accuracy

degree to which the position of an object on a map conforms to its true or accepted location on the earth, according to an accepted coordinate system

NOTE *Examples of accepted coordinate systems include geographical coordinate systems such as the European Terrestrial Reference System 1989 (ETRS-89), and Cartesian coordinate systems such as the British National Grid.*

3.1.3 absolute coordinates

easting, northing and height that define the absolute spatial location in a specified reference (coordinate) system

3.1.4 absolute technologies

technology that allows the capture of location information and data to absolute accuracy

3.1.5 asset owner

any owner of an asset

NOTE *This can include utility companies, local authorities, private owners and legally delegated operators.*

3.1.6 buried asset

pipe, cable or any other asset located beneath ground level

NOTE 1 *In other publications, this might also be referred to as buried apparatus, underground apparatus, buried or underground infrastructure, buried or underground services or buried or underground utilities.*

NOTE 2 *Buried assets do not include services as defined in 3.1.19, however, future revisions of this PAS may address this.*

3.1.7 coordinate

sequence of two or three numbers that designate a position in two- or three-dimensional space

NOTE 1 *With a terrestrial coordinate reference system, this unambiguously describes a position in relation to the Earth.*

NOTE 2 *This covers ETRS89 and the British National Grid (or Irish Grid, where appropriate) ⁶⁾.*

3.1.8 data

facts and statistics collected together for reference or analysis

3.1.9 decommissioned asset

pipe, cable or asset which is no longer in use, but might be re-used or re-energized in the future

3.1.10 depth

actual elevation in relation to above ordnance datum (AOD)

3.1.11 highway authority

statutory body empowered in accordance with various Acts (including the Greater London Authority Act 1999 [13]) to manage and maintain highway networks in England and Wales

NOTE *In Scotland and Northern Ireland, the authority responsible for maintaining and managing the roads is the roads authority. Attention is drawn to the Roads (Scotland) Act 1984 [3] for further information on roads authorities.*

⁶⁾ See <https://www.ordnancesurvey.co.uk/business-and-government/help-and-support/navigation-technology/os-net/surveying.html>.

3.1.12 information

processed, interpreted, organized, structured or presented data, which makes that data more meaningful or useful

3.1.13 local authority

administrative body in local government

NOTE A highway or roads authority may be part of a local authority. For the purposes of this PAS, reference to local authorities and highway authorities also includes other statutory bodies and transport authorities such as Transport for London (TfL) and airports.

3.1.14 relative accuracy

measure of positional consistency between data points

NOTE 1 Relative accuracy compares the scaled distance of objects on a map with the same measured distance on the ground.

NOTE 2 Relative accuracy descriptions on plans can also be helpful to locate buried assets in the absence of technology to locate by global navigation satellite system (GNSS), for example, global positioning system (GPS).

3.1.15 requestor

utility, authority, contractor or any other body requesting details of asset records in order to plan, design, maintain or excavate safely

3.1.16 s50 licence

licence granted under a section 50 licence of the New Roads and Street Works Act 1991 [2] (NRSWA) allowing those, other than a highway authority or undertaker, to repair and/or place apparatus/services across the road

NOTE 1 In some instances, a s50 licence also permits the repair and/or placement of apparatus/services along the highway.

NOTE 2 In Scotland, the equivalent of s50 is s109 permission (NRSWA [2]) and in Northern Ireland, it is Article 11 of the 1995 Order [4].

3.1.17 s74 closure of works notice

notice submitted by an undertaker to the highway authority on completion of all works in a street to indicate that works have stopped

NOTE 1 This notice is a requirement under NRSWA [2] and therefore an indication of when works in the highway have been completed.

NOTE 2 In Scotland and Northern Ireland, s74 charges are not enacted. The s129 (3) notice might be used in Scotland as the start of the period.

3.1.18 security-minded

the understanding and routine application of appropriate and proportionate security measures in any business situation so as to deter and/or disrupt hostile, malicious, fraudulent and criminal behaviours or activities

[SOURCE: PAS 1192-5:2015, 3.1.26]

NOTE Further information on adopting a security-minded approach to open data can be found on the CPNI website ⁷⁾.

3.1.19 service

pipe or cable feeding properties, as defined by individual utilities.

NOTE Service pipes or cables generally run at approximately 90 ° from the main network and might enter private land rather than continuing along the highway. These might deviate to accommodate surroundings.

3.1.20 spatial data

information about the location and shape of geographic features and the spatial relationships between them

NOTE Spatial data is usually stored as coordinates or topology, along with the attribution of the assets. Object locations are normally captured using x,y,z coordinates in the Ordnance Survey Great Britain 1936 (OSGB36) grid reference and, where possible, the data collector is advised to build topological relationships between the asset captured and surrounding objects.

3.1.21 street works

works of any of the following kinds (other than works for road purposes) executed in a street in pursuance of a statutory right or a street works licence:

- placing apparatus; or
- inspecting, maintaining, adjusting, repairing, altering or renewing apparatus, changing the position of apparatus or removing it;

or works required for or incidental to any such works (including, in particular, breaking up or opening the street, or any sewer, drain or tunnel under it, or tunnelling or boring under the street)

[SOURCE: NRSWA 1991 [2], section 48]

NOTE In Scotland this is s107 of NRSWA [2] and refers to road works.

⁷⁾ See <http://www.cpni.gov.uk/>.

3.1.22 undertaker

person by whom the relevant statutory right is exercisable (in the capacity in which it is exercisable by him) or the licensee under the relevant street works licence, as the case may be

[SOURCE: NRSWA 1991 [2], section 48]

NOTE *Generally speaking, these are utilities and telecommunications companies or nationalized companies such as Network Rail.*

3.1.23 unidentified buried object (UBO)

buried asset at a given location, which is not recorded on any plans supplied by undertaker, local highway or roads authority or any other asset owner

3.1.24 works for road purposes

works of any of the following descriptions executed in relation to a highway:

- e) works for the maintenance of the highway,
- f) any works under powers conferred by Part V of the Highways Act 1980 [1] (improvement),
- g) the erection, maintenance, alteration or removal of traffic signs on or near the highway, or
- h) the construction of a crossing for vehicles across a footway or grass verge or the strengthening or adaptation of a footway for use as a crossing for vehicles,

or works of any corresponding description executed in relation to a street which is not a highway

[SOURCE: New Roads and Street Works Act 1991 [2], section 86]

3.1.25 wrongly recorded object (WRO)

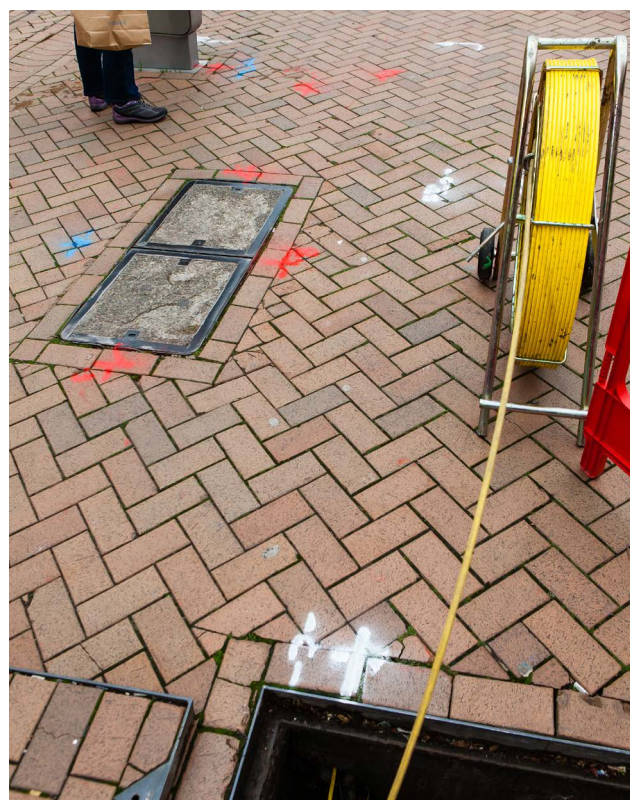
object recorded in the plans supplied by the asset owner that does not match the location or description of the asset

NOTE *WROs could be, for example, pipes or cables for which the depth, location or materials differ from the information provided in the supplied plans.*

3.2 Abbreviations

For the purposes of this PAS, the following abbreviations apply.

AOD	above ordnance datum
CAD	computer-aided design
ETRS-89	European Terrestrial Reference System 1989
GIS	geographic information system
GML	geography markup language
GNSS	global navigation satellite system
GPS	global positioning system
OSGB36	Ordnance Survey Great Britain 1936
RFID	radio-frequency identification
UBO	unidentified buried object
WGS84	World Geodetic System 1984
WRO	wrongly recorded object
XML	extensible markup language



4 Data

COMMENTARY ON 4

Advances in spatial technology have grown exponentially in recent times with many industries now describing areas in which spatial technology has delivered significant efficiency gains and driven business to new levels. It is important that spatial data is stored effectively and to understand the consequences if spatial data is stored incorrectly.

The most basic component of any geographic information system (GIS) is the spatial data that specifies the location of the features. This spatial data cannot exist without the coordinate systems which are used to specify the location information. In order to maximize the value of the data, accurate capture of measurements (i.e. position) is key, and certain metadata (such as date of collection, coordinate reference system) are to be retained with the measurement. It is important that processing and storage does not degrade the accuracy and that coordinate precision does not imply greater accuracy than was obtained.

Further information on accuracy and conversion is given in Annex A.

4.1 Data glossary

COMMENTARY ON 4.1

Currently, most records are exchanged by providing plans with assets drawn on these plans. However, as the demand for the electronic sharing of asset record information increases, and the technology becomes more common, the provision of asset record information is expected to move towards data exchange rather than the sharing of plans. Data can be recorded using any coordinate system but it needs to be capable of being shared.

Database users and application developers from organizations that hold buried asset records or that receive information from such organizations could benefit from an authoritative data dictionary document that catalogues and defines the minimum information that could be shared swiftly through electronic exchange. The data dictionary is not included in this PAS, however the glossary in Table 1 indicates the minimum data necessary for data exchange. Table 2 gives examples of optional data that can be provided.

The agreed data dictionary would typically include the names and descriptions of various tables (records or entities) and their contents (fields) plus additional details, like the type and length of each data element. Another important piece of information that a data dictionary can provide is the relationship between tables.

A complete data dictionary and data model can only be designed once the protocol has been fully defined and accepted.

4.1.1 For the purposes of electronic data exchange of record information between organizations, the minimum data set out in Table 1 should be made available for sharing by asset owners or their agents.

4.1.2 Data can only be shared where it has been previously captured and held by an asset owner. Users of this PAS should begin capturing the data listed in Table 1 for newly-installed or replaced assets as soon as possible, so that data can begin to be shared.

NOTE 1 Table 2 gives examples of optional data that can be provided, although this list is not exhaustive. Beginning to capture and share such optional data can help provide useful additional information.

NOTE 2 Attention is drawn to the importance of adopting a security-minded approach to data sharing. Further information on adopting a security-minded approach to open data is given in PAS 1192-5 and the guidance notes on the CPNI website ⁸⁾.

NOTE 3 The UK could benefit from introducing a central administration to deal with buried asset issues and provide a complete view of all underground assets, whether utility, authority or other. Scotland may choose to continue to operate independently with its centralized electronic records system until the rest of the UK is able to reach this level of record capture. Information on what this central administration could comprise for the rest of the UK is given in Annex C.

⁸⁾ See <http://www.cpni.gov.uk>.