SCSI
Chartered property, land and construction surveyors

MEASURED SURVEYS OF UNDERGROUND UTILITIES

1st edition, SCSI Guidance Note

RICS

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Measured Surveys of Underground Utilities
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SCSI guidance note 1st edition

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Contents

SCSI guidance notes

This is a guidance note. Where recommendations are made for specific professional tasks, these are intended to represent 'best practice', i.e. recommendations that in the opinion of SCSI meet a high standard of professional competence. Although members are not required to follow the recommendations contained in the note, they should take into account the following:

When an allegation of professional negligence is made against a surveyor, a court or tribunal may take account of the contents of any relevant guidance notes published by SCSI in deciding whether or not the member had acted with reasonable competence.

In the opinion of SCSI, a member conforming to the practices recommended in this note should have at least a partial defence to an allegation of negligence if they have followed those practices. However, members have the responsibility of deciding when it is inappropriate to follow the guidance.

It is for each surveyor to decide on the appropriate procedure to follow in any professional task. However, where members do not comply with the practice recommended in this note, they should do so only for a good reason. In the event of a legal dispute, a court or tribunal may require them to explain why they decided not to adopt the recommended practice. Also, if members have not followed this guidance, and their actions are questioned in an SCSI disciplinary case, they will be asked to explain the actions they did take, and this may be taken into account by the panel.

In addition, guidance notes are relevant to professional competence in that each member should be up to date and should have knowledge of guidance notes within a reasonable time of their coming into effect.

Document status defined

SCSI and RICS produces a range of standards . These have been defined in the table below. This document is a guidance note.

Document status defined

Type of document	Definition	Status
Standard International standard	An international high level principle based standard developed in collaboration with other relevant bodies	Mandatory
Professional statement SCSI/RICS professional statement (PS)	A document that provides members with mandatory requirements or a rule that a member or firm is expected to adhere to. This term also encompasses practice statements, Red Book professional standards, global valuation practice statements, regulatory rules, SCSI/RICS Rules of Conduct and government codes of practice.	Mandatory
Guidance and information SCSI/RICS code of practice	Document approved by SCSI/RICS, and endorsed by another professional body/ stakeholder, that provides users with recommendations for accepted good practice as followed by conscientious practitioners.	Mandatory or recommended good practice (will be confirmed in the document itself). Usual principles apply in cases of negligence if best practice is not followed.
SCSI/RICS guidance note (GN)	Document that provides users with recommendations or approach for accepted good practice as followed by competent and conscientious practitioners.	Recommended best practice. Usual principles apply in cases of negligence if best practice is not followed.
SCSI/RICS information paper (IP)	Practice-based information that provides users with the latest technical information, knowledge or common findings from regulatory reviews.	Information and/or recommended best practice. Usual principles apply in cases of negligence if technical information is known in the market.
SCSI/RICS insight	Issues-based input that provides users with the latest information. This term encompasses thought leadership papers, market updates, topical items of interest, white papers, futures, reports and news alerts.	Information only.
SCSI/RICS economic/ market report	A document usually based on a survey of members, or a document highlighting economic trends.	Information only.
SCSI/RICS consumer guide	A document designed solely for use by consumers, providing some limited technical advice.	Information only.
Research	An independent peer-reviewed arm's length research document designed to inform members, market professionals, end users and other stakeholders.	Information only.

Preface

This first edition of ***Measured Surveys of Underground Utilities*** is published by SCSI and prepared by the SCSI Geomatics Professional Group and a specialist Practice Standards and Specifications Working Group. This publication forms part of a series of specifications and guidelines intended to assist those connected with the requesting, purchasing and production of surveys and mapping material at large scales and high accuracies, by promoting good practice and avoiding the duplication of effort.

SCSI would like to thank the following main authors and reviewers of this first edition:

- Philip Mulreid MSCSI, Apex Surveys
- Niamh O' Reilly FSCSI, Technological University Dublin
- Ray Murphy MSCSI, Murphy Geospatial
- David Graham MSCSI MRICS FRGS, Murphy Geospatial
- Ben King FSCSI, Department of Communications
- Eugen Niculae, FSCSI FRICS, Technological University Dublin
- RICS Mapping and Positioning Practice Panel (MAPPP)
- SCSI Geomatics Professional Group
- James Kavanagh MRICS, Director Land Group
- All participants in the extensive consultation process

The primary intention of this guidance note is to place the relationship and understanding between chartered surveyor and client at the core of any survey project. It is also hoped that it provides a reference document that supports downstream survey data users as well as enhanced collaboration processes such as BIM.

Unlike many survey specifications, this document is intended to provide guidance only and is not intended to be incorporated verbatim into the text of individual contracts. In particular, it requires choices to be selected throughout, thus making alternative choices inapplicable. Specification users are free to select the parts of the specification that are relevant to them to incorporate into their own specifications. However, the value of this specification is its structure, which will become familiar to clients and surveyors. Users should therefore ensure that they retain the order of clauses within their documents and acknowledge the SCSI/RICS as source where used.

The specification sets out to improve the standard of the industry by creating a level playing field and high standard of work. It is written in a way to enable a client to compare quotes and results based upon the same initial requirements.

Any comments or feedback on this document should be sent to info@scsi.ie and marked for the attention of the Geomatics Professional Group.

Measured Survey of Underground Utilities – Introduction

This measured survey specification is designed for use by geospatial, land, engineering and measured building surveyors who are acting in an advisory capacity, and by survey-knowledgeable clients who specify their own surveys. This document should help clients communicate what they require and expect to receive in terms of survey detail, accuracy, grid, types of survey, formats and final deliverables. It will help both parties to clarify related project information issues such as contacts, timescales, data management systems, site access, omissions and supply of existing information. It will assist in having a well-defined set of goals and expectations from a survey for all concerned.

It is recommended that the client and surveyor's initial meeting(s) or discussions in relation to completion of this specification are recognised as being of critical importance to the success of a survey project, and that if uncertainty exists on either side it is highlighted and resolved before finalisation.

The first question should always be: What is the purpose of this survey?

A complete measured survey project specification is contained within this guidance note, and particular attention should be paid to the survey detail accuracy band table. The client can choose which features to include in the proposed survey in the relevant section.

Clients and surveyors should pay attention to the notes and recommended good practice highlighted in boxes throughout this specification. These should be followed unless both parties have agreed it is not appropriate to do so.

Not all measured surveys may require a full specification, and where the client–surveyor relationships and expectations are mature, the shorter 'quick specification' may be sufficient. However, when specifying surveys all parties are expected to have sufficient competence in the land survey (geomatics) field.

1. Project information

The information given in the following clauses provides essential information needed for the project.

1.1 Project designation

The following are the main client references for this project:

Project name:	
Project reference no:	

1.2 Purpose of project

The project objective is to provide survey information to enable the following work to be carried out by the client:

1.3 Client/agent responsible for payment of works

On completion of the works payment shall be made by:	
Contact name:	
Position:	
Address:	
Phone no:	
Email:	

1.4 Survey location/extent of survey

The location and extent of the survey is shown:

The location and extent of the survey is shown on the following map(s) attached to this specification:	
The site contact name and contact details are:	

Should contact be made with the site contact prior to visiting site for tendering purposes? (Y/N)	

Recommended good practice

It is recommended that the client provides a digital map or plan of the survey extents in PDF, Google Earth (KMZ/ KML) and source computer-aided design (CAD) format which allows the surveyor to measure areas, distances, etc.

1.5 Survey schedule dates

The following are the proposed/key survey schedule dates as known at the time of specification issue (if not known, insert 'to be confirmed'):

Tender submission: (also include in cover letter or email)	
Award project:	
Lead time from award of contract to start date (weeks):	
Programme for delivery of the survey (weeks from start date):	
Other (please specify any interim deliverables etc.):	

1.6 Project contacts

1.6.1 Client

Client organisation name:	
Contact name:	
Position:	
Address:	
Phone no:	
Email:	

1.6.2 Client representative for matters concerning the project

Rep. organisation name:	
Contact name:	
Position:	
Address:	
Phone no:	
Email:	

1.6.3 Other (known local and statutory authorities, etc.)

Rep. organisation name:	
Contact name:	
Position:	
Address:	
Phone no:	
Email:	

1.7 Site access principles

The following site access principles apply to these works (select one of the following):

(a)	There is no specific limitation on site access and the surveyor need make no special arrangements.	
(b)	The surveyor shall inform the client in advance of the proposed access dates required, so that the client may make arrangements with the owners/occupiers.	
(c)	Other (specify)	

Recommended good practice

In all cases the client should provide a letter of introduction on request from the surveyor to facilitate site access and enquiries from land owners, including authorities. Should the surveyor encounter land owners/occupiers who deny access, he/she should retire politely and inform the client immediately. The client should ensure that confidential matters, and to whom letters of introduction cannot be shown, are clarified.

1.8 Site access requirements

Responsibility for the following site access requirements is as follows (NA if not applicable, some items are pre- selected, replace Y with N if not applicable).

Default requirements

It is the client's responsibility to ensure clear site access prior to the survey commencement. Clear site access includes relevant Local/Road Authority notifications, third-party notifications (e.g. householders), and removal of vehicles or obstacles from the survey area.

Requirement	By client	By surveyor	Comments
Keys to buildings/ gates	Y		
Industry safety cards, i.e. Safe Pass/ CSCS/SLG/PTS		Y	
Personal photo ID cards		Y	
Letters of appointment (which surveyors can produce to members of the public if required)	Y		

Non-typical requirements

Note
Will only be completed if specifically selected by the client and may add to the cost.

Requirement	By client	By surveyor	Comments
Garda clearance certificates*			
Security clearance certificates			
Site-specific permits			
Other (specify)			

**Such as criminal records certificates.*

1.9 Survey facilities

The surveyor shall liaise with and comply with all requirements of Eir, Irish Water, Gas Networks Ireland, ESB Networks, the Local Authority, Gardai and any other persons or authorities with regard to gaining access to and occupation of the proposed inspection chambers/investigation points and occupying the site for the execution of the survey works.

The surveyor shall also obtain all necessary permits, information and records from such persons or authorities to enable the works to proceed.

Services providers may charge for supervision of utility survey works. It is not possible for the surveyor to establish and include third-party costs at the tender stage. Surveyor should seek costing from third-party providers at the award or contract and advice client of same. The client should pay third-party costs directly to the service provider.

Third-party costs should be paid as follows (select one option):

Surveyor should not inspect chambers that will incur third-party costs.	
Client will pay third-party costs directly to the provider.	

1.10 Access to locked, broken or otherwise inaccessible chambers

In the event of locked manhole covers, it is the client's responsibility to obtain any necessary permits or access keys. Where permits or access keys are not provided prior to survey commencement, it may not be possible to verify the survey results and thus the accuracy of the completed survey may be compromised.

Where it is not possible to lift a manhole cover because it is stuck, obstructed or locked, this should be reported to the client at the earliest opportunity or noted appropriately on the drawing. It is best practice not to attempt to lift damaged covers but to report the damage to the client.

The client should note that additional costs may apply to revisiting site to lift manholes that have been unstuck, unobstructed or unlocked.

1.11 Survey Facilities

Responsibility for the following survey facilities are: (NA if not applicable, some items are pre-selected, replace Y with N if not applicable).

Default requirements

Requirement	By client	By surveyor	Comments
Site inductions (site procedures and health and safety)	Y		
Appropriate equipment and software to carry out the works		Y	
Traffic management		Y	

Note
It is mandatory that survey works on roads are carried out as per Chapter 8 of the Traffic Signs Manual.

Non-typical requirements

Note
Will only be completed if specifically selected by the client and may add to the cost.

Requirement	By client	By surveyor	Comments
Office space/ co-location			
Security personnel			
On site welfare (on site toilets etc.)			
Temporary access equipment (MEWPS etc.)			
Temporary lighting/power			
Training courses (specify)			

1.12 Information to support project execution

Default requirements

Requirement	By client	Comments
Know site-specific hazards	Y	

Client to confirm known utilities present on site: (input Y or unknown)

Service	Known to be present
Foul drainage	
Surface water drainage	
Combined drainage	
Watermains	
ESB – high/med/low voltage	
Gas – high & low pressure	
UPC/Virgin Media	
Public lighting	
Traffic	
CCTV cabling	
Telecommunications including fibre optic	
Other (specify)	

Recommended good practice

Any existing record or historic drawings along with any other information known by the client should be made available to the surveyor at the tender stage to assist with pricing/scoping of works.

Non-typical requirements

Note
Will only be completed if specifically selected by the client and may add to the cost.

1.13 Competency of survey staff

The surveyor is responsible for ensuring that his/her staff are qualified, competent, appropriately insured and trained to do the tasks for which they are engaged. Relevant qualifications can include professional and technical membership of SCSI and third-level qualification in surveying, geomatics or similar.

Surveyors responsible for setup of traffic management must hold valid CSCS Signing Lighting and Guarding Card.

For locating underground utilities, all survey staff most hold a valid Location of Underground Services (LUGS) card.

1.14 Calibration and checking of equipment

The surveyor is responsible for ensuring that all equipment is calibrated/verified and checked prior to use, and maintained as such throughout the period of survey works, as well as ensuring it is fit for the survey purpose required.

Calibration certs of all equipment/instrumentation should be supplied to the client on request. Survey equipment should be calibrated as per the manufacturer's instructions, which is generally yearly for total station but varies for other survey equipment.

1.15 Protection of property

The client should notify the surveyor of any restrictions in relation to the marking of survey control, vegetation clearance and security requirements. Surveyors should be aware of the potential damage that survey marking can cause to structures, underground utilities and the environment, and take appropriate steps to mitigate this.

Road marking spray	Y/N
Are there any restrictions with regard to using road marking spray etc. to mark up location of underground utilities and survey control points in outdoor locations on the site?	

1.16 Risk assessment and safety briefing

Document	Supply for info	Submit for client approval	Comments
Method statement			
Health and safety risk assessments			
Traffic management plans			
Photographic evidence of daily traffic management setup			
Permission from asset owner to open service covers			
Other (please specify)			

The client is to provide the surveyor with any templates to be used for the above documents if required. Where client approval is specified, this shall be provided within one week. If no response is received within that time, the document will, by default, be deemed approved by the client.

Recommended good practice

Notwithstanding legal requirements, the client should notify the surveyor of any hazards known to him/her prior to the preparation of the risk assessment (e.g. asbestos, confined spaces, site works).

1.17 Traffic management

The requirements of the survey investigation may necessitate the works to be carried out on existing road networks and streets, and therefore require the preparation of a traffic management plan. The preparation of this plan must take cognisance of the Department of the Environment's *Traffic Signs Manual* (2021).

Minimum traffic management requirements as follows:

a) Traffic management plans to be submitted to the client prior to commencement of works on site.

b) Traffic management plans must be developed by a qualified person who has taken the Traffic Management Design Course (two-day course).

c) Implementation, supervision and removal of TM on site to be provided by a Signing Lighting and Guarding certified person (three-day course).

d) in urban and city environments, traffic management plans need to be submitted to the local authority for approval, upon which the local authority will issue the surveying company with permits to proceed with the survey works

1.18 Obscured features

The following specific client constraints (e.g. working hours) will apply to the work carried out under this project (NA if not applicable):

Where constraints are identified by the client after commissioning of works, these shall be communicated as soon as practicable to the surveyor and agreement sought on resolution/cost/impact.

1.19 Surveyor-identified project constraints

Any constraints identified by the surveyor must be raised in writing to the client during the tender period. Where constraints are identified after commissioning of works, these shall be communicated as soon as practicable to the client and agreement sought on resolution/impact/cost.

1.20 Obscured features

The surveyor will not be responsible for omission of details obscured during site survey dates unless action for clearance in advance has been agreed. This may include:

a) Features obscured by vegetation, debris, snow, sand, earth, when working outside and plaster, cladding, carpet, etc. when working inside buildings

b) Features obscured by vehicles, trailers, temporary covers, stacked materials

c) Features inside buildings obscured by coverings, furniture, fixtures and fittings

d) Features inside inspection covers/manholes/chambers obscured by debris, blockages (where internal chamber survey details are requested in the scope)

e) Features obscured by flooding when undertaking non-hydrographic surveys

f) Features omitted due to lack of adequate lighting or physical access (i.e. at height)

g) Setting out of points where the placement of appropriate markers is restricted due to obscuration, lack of permission, impermeable or unmarkable surfaces

h) Other (specify)

1.21 Action to reduce/remove obscured features

Actions for reducing or removing obscured items are:

	Y/N
Should be identified by the surveyor and shall be communicated as soon as practical to the client and agreement sought on resolution/impact/cost:	
Other (specify)	

1.22 Access issues

The surveyor shall advise the client of any access restrictions or related issues that could have an impact on the survey requirements or deliverables. The surveyor should notify the client as soon as practical of such issues and ensure that all reasonable steps are taken to reduce adverse impacts.

Additional cost may apply for unforeseeable factors such as:

a) Any change in site conditions from previously advised

b) Any delays on site through no fault of the surveyor.

c) Access restrictions or limitations

d) Revisits to survey areas that were inaccessible at the time of survey

e) Lost time due to site induction requirements.

f) Previously unknown features that require more detailed investigation

g) Locally requested changes to the survey extents or additional or amended works requested while on site

1.23 Survey records retention

The surveyor shall retain survey records for this number of years: (recommended seven)	

Recommended good practice

It is recommended that surveyors keep copies of all survey records, including those obtained from other parties, for a period of no less than seven years. Surveyors and clients should take note of any legal or quality management system requirements to retain records when deciding on this option.

1.24 Data ownership

Recommended good practice

Surveyors shall observe any legal requirements for records preservation, client confidentiality and protection and ensure that adequate storage and security systems are in place to avoid loss or unauthorised access to records.

1.25 Cost for supply of records

Where the surveyor is requested by the client to make accessible all or part of his/her survey records, which are not included as deliverables, the surveyor shall make these available at an agreed cost.

Once it is agreed, the surveyor shall confirm the access lead time by agreement with the client no more than one week after formal request, with information to be provided within one month of request date.

2. Survey type and accuracy

2.1 Survey standard

The following documents are referred to in the text in such a way that some or all of their content constitutes provisions of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document applies.

The work shall be carried out in accordance with the best accepted current practice and with the requirements of ***PAS 128:2014 – Specification for underground utility detection, verification and location***.

BS EN ISO 19650-1:2018, Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM) – Information management using building information modelling – Part 1: Concepts and Principles & Part 2: Delivery phase of the assets.

BS EN ISO 19650-2:2018, Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM) -- Information management using building information modelling -- Part 2: Delivery phase of the assets

BS EN ISO 19115-1:2014 +A1:2018, Geographic information. Metadata. Fundamentals

Other publications
[NR1] RICS. Guidelines for the use of GNSS in land surveying and mapping. RICS Business Services Limited: London, 2010.

Attention is drawn to HSE's publication, *Avoiding danger from underground services* (HSG47:2014)
The survey type shall be as defined in ***section 3***.

2.2 Accuracy

2.2.1 Accuracy of geophysical techniques

The quality level required should have a positional accuracy of the following for PAS 128, survey type B surveys:

a) Horizontal + 150mm or 15% of detected depth (whichever is greater)

b) Vertical + 15% of detected depth

Note
In good ground conditions and within the depth range of 2 metres the ability to detect an underground utility (applies to all material types) will reduce in diameter by 1mm for each 10mm of depth, i.e. a 200mm pipe can be detected at 2m and a 50mm pipe at 0.5m but a 25mm plastic water service pipe cannot be detected at 1.2m with radar. Furthermore, small-diameter plastic gas and water pipes laid at a depth of 1 metre or more may be undetectable.

Poor geophysical/ground conditions, builder's rubble, overgrowth and other surface obstructions may limit accuracy of the survey.

2.2.2 Accuracy of above-ground features and services

Please tick the following:

The accuracy of above-ground utility-related features and services such as inspection covers and street furniture shall be +/- 20mm in height and plan:	

or

The accuracy of above-ground utility-related features and services such as inspection covers and street furniture shall be: (please specify)	

2.3 Above-ground features and detail

If a topographic survey is also required, this should be specified separately using the SCSI ***Measured Surveys of Land*** guidance notes.

If topographic survey is not required, then as a minimum the survey should include any surface indications of buried utilities such as street furniture, inspection covers, valve covers, manholes, gullies, reinstatement scars and inspection pits.

Where a topographic survey is provided by the client to be used as background mapping for the utility survey, the surveyor should perform adequate checks to ensure the utility data ties into the survey (although it should be noted that the utility surveyor cannot take responsibility for the accuracy of a survey carried out by others).

2.4 Survey coordinate reference system

The survey shall use the following coordinate reference system in plan (select one of the following):

Irish Transverse Mercator (ITM)	
Irish Grid (IG)	
An existing local grid for which there are existing survey control points	
A site grid based on existing site features (e.g. a building grid). Give details:	
An arbitrary grid proposed by the surveyor.	
Other (specify)	

Recommended good practice

The selection of grids, height datum and transformation of coordinates is often a complex matter that may have serious technical and financial implications for a project. The client should seek advice from a chartered land surveyor if necessary.

SCSI recommends the use of the ITM coordinate system where possible as this is the most accurate and consistent national coordinate system.

Clients should be aware of scale factor and its possible impact on the survey. If in doubt consult a chartered geomatics surveyor.

Where a survey control network is tied into or based on pre-existing survey control points, the source of the coordinate values, expected accuracy, hierarchy and reference grid and height datum shall be confirmed by the client and verified by the surveyor. The surveyor shall notify the client of any discrepancies in supplied control or transformation values that exceed required accuracies and provide advice on potential implications or solutions to resolve them.

The survey shall use the following height (vertical) datum (select one of the following):

Surveyed heights (levels) shall be orthometric and quoted in metres above Malin Head (OGM15).	
Surveyed heights (levels) shall be orthometric and quoted in metres above a datum defined by the client.	
Surveyed heights (levels) shall be orthometric and quoted in metres above a datum defined by the surveyor (this could apply, for example, to a building, where the datum might be a floor level).	

Recommended good practice

It is recommended that all surveys should be related to the national height datum (Malin Head).

From 26 August 2016, the geoid model on which onshore mapping in Ireland is based has changed from OSGM02 to OSGM15, therefore all heights related to Malin Head datum have changed.

Malin Head levels from surveys prior to 26 August 2016 (using OSGM02) will not coincide with levels surveyed using the new OSGM15.

You should be aware that there was a crossover period of approx. 6 months when both OSGM02 and OSGM15 were in use.

OSGM15 is now the geoid for Ireland and should be used for all future surveys.

2.5 Connection of chosen survey grid to other coordinate reference systems (where applicable)

This section only applies where there is a requirement to connect an existing legacy coordinate system to ITM, IG or other specific coordinate system.

The client requires that (select one of the following):

The surveyor shall use transformation formulae provided by the client when converting between the survey grid specified and other specified coordinate system.	
The surveyor shall observe and compute transformations between the survey grid specified and other specified coordinate system.	

2.6 Survey control network

The surveyor shall establish survey control points that shall be linked together by a network of observations to realise the survey grid on the ground. This network shall include all types of observations required to establish plan and height control and provide sufficient redundancy in observations to allow proof of accuracy.

Background information
A network can include conventional traversing but should also include cross-bracing and self-checking geometry to ensure that geometric weaknesses are mitigated and required accuracy is maintained throughout the network. These observations can include links to national or global survey control networks, allowing a coordinated survey control point to be geospatially linked or transformed to national or global coordinate systems

All survey control point network observations, regardless of observation method, shall be computed and adjusted rigorously using the most appropriate technique to ensure that the survey control accuracy is achieved, and supports the detail accuracy as defined in the accuracy band table and survey detail specification.

Recommended good practice

Where national grid control is relied on for dynamic survey capture (i.e. mobile surveying systems), specific survey control points local to the survey extents shall be established to verify the accuracy of the surveyed detail and/or control the trajectory of the survey sensor.

2.7 PAS 128, Survey Type B (applies to Survey Type B only)

2.7.1 Existing record drawings)

Up-to-date utility records for all possible utilities shall be obtained prior to undertaking the survey using geophysical techniques.

A copy of all utilities records obtained shall be submitted to the employer's representative.

2.7.2 Utilisation of existing information

Survey Type B (using geophysical techniques) shall be carried out only in conjunction with a site reconnaissance and desktop study by the surveyor. This desktop study shall include, but shall not be limited to, a review of all available utilities record drawings, historic drawings, geotechnical reports and topographical survey drawings.

All information obtained from the desktop studies, manhole surveys and any other investigation techniques adopted shall be fully utilised by the surveyor to process data obtained from the geophysical techniques.

2.7.3 Detection equipment and techniques to be used for compliance with PAS 128 (Survey Type B)

2.7.3.1 Ground penetrating radar (GPR)

It is a requirement that the entire study area will be surveyed by GPR scanning.

GPR equipment must be either dual frequency or high-density array system. Where multi-polarisation antennas are not used, the surveyor must ensure that adequate GPR grid-spacings are observed along with lateral GPR scanning.

Dual frequency receivers (200 to 600 MHz)
The multiple frequency antennas will allow detection of shallow, small diameter services, but also services buried at depth.

High density arrays
For high density arrays the following requirements shall be met:

a) Full coverage of the survey area shall be carried out using smaller arrays to infill areas not accessible to the main array.

b) The collection regime for the main array shall be maintained throughout the survey area, ensuring a minimum 10% overlap between swaths.

c) Survey speed shall allow scans to be collected where the centres do not exceed the antenna separation.

d) Positioning of the array shall be continuously monitored and recorded using either GNSS or total station and at an absolute accuracy of ≤100 mm.

GPR, Ground Penetrating Radar (sometimes referred to as ground probing radar): The use of radar waves from a surface transmitter that can penetrate through ground materials and are reflected back to the instrument at a change of ground material or other buried objects. GPR systems allow the data acquired in grids and recorded to be post-processed and interpreted off-site. This increases the confidence in the data and in congested areas is likely the only way to achieve high accuracy and confidence. Accurate survey grids are established so that detected features found during post-processing and interpretation can be retrospectively located on the interpretative drawings.

Geophysical data by itself does not allow identification of the utility detected. The identification of the utility is achieved through a combination of on-site interpretation from both GPR and EML surveys together with on-site reconnaissance and correlation with utility records, and therefore a QLC visual inspection of the site, by an experienced surveyor who understands utilities and is responsible for the final identification of utilities and sign off of the survey, is a necessary part of a QLB detection survey.

It is recognized that post-processing via recognized GPR post processing software generally improves the interpretation of GPR data by resolving weak and intermittent signals or analysing multiple targets in order to gain a better understanding of areas of complex or more obscure utility networks. The use of post-processing is reflected in the method statement and also in the quality level determined and assigned to the results.

NOTE 1 The accuracy with which depth assessment can be made depends on the technique being used and depth of utility (see Note 3). However, other factors, such as ground conditions, proximity of other utilities, material and method of construction, have an influence on the quality of depth data. Some techniques, such as ground conductivity, allow no depth assessment to be made; others might only provide indicative depth estimates.

NOTE 2 The accuracy with which horizontal and vertical position of the utility can be estimated depends on the depth of burial of the utility so that accuracies are expressed, in part, as a percentage of depth. The deeper the target utility the less accurately both the horizontal and vertical position can be assessed. The accuracy also depends on the confidence with which signals can be interpreted, which can depend on the ground materials, presence of heterogeneity and other features in the ground including the presence of multiple buried services.

NOTE 3 No detection technique can detect every type of underground utility in every location. In addition to EML and GPR, a range of other techniques can be deployed in consultation with the client based on the client's requirements/risk appetite.

Recommended good practice

In areas with medium to high density of buried utilities, it is recommended that GPR field data should be recorded and saved for offsite post-processing.

In areas with a low density of utilities, live GPR mark-ups may be carried out on site. This should only be carried out by an experienced GPR technician.

2.7.3.2 Electromagnetic locator (EML)

It is a requirement of this contract that passive EML is deployed over the whole survey area and that where an active EML method can be used. A signal generator shall be used to attempt to induce a signal onto buried services from the surface or directly where accessible. Where a tracing cable or sonde can be used, it shall be used , EML methods to be used as per the following minimum standards:

a) Accessible earth connections shall be used in order to trace electric lines.

b) An active signal shall be applied to the utility once its presence has been established.

c) Where an active signal cannot be made, passive EML methods shall be used.

d) Pits and manholes shall be accessed to allow line tracers and/or sondes to be used for active tracing of accessible ducts and pipes.

e) EML shall as a minimum conform to BS 50249 2002.

WARNING. This refers to physical entry into confined spaces, which is not to be attempted without suitably trained operatives and safety equipment.

Attention is drawn to HSE's publication, Confined space – A brief guide to working safely (INDG258) [2].

EML, Electromagnetic Location Detection of buried utilities via a hand-held receiver using electromagnetic and radio frequency signals that are present in metallic utilities as a result of current flow or re-transmitted low frequency radio signals (passive EML). Signals can also be induced from a transmitter at ground surface, by direct connection from a signal generator or from a sonde or tracing wire introduced into a pipe or duct (active EML). Most EML systems do not have the capability of recording what was detected on-site so it relies on the detected position and depth being marked on the ground surface as the survey progresses. This has the advantage of providing quick results but does not allow post-processing and retrospective interpretation of the data to be undertaken and has the disadvantage that no digital record is made for most equipment on the market. However, some modern equipment now has the ability to keep a record for audit at a later date. For quality it is recommended practitioners use such equipment to enable verification of field shape when assigning confidence levels in post processing.

Note on Detection Techniques:
The following shall be recorded as a minimum as evidence of work carried out:

a) site name and location;
b) time and date of the site interpretation;
c) detection techniques used including the model and serial number of equipment;
d) weather conditions;
e) the names, qualification and experience of the operator(s);
f) calibration method and calibration data obtained;
g) modes of detection for each geophysical survey instrument used;
h) photographs of the site (e.g. of on-site mark out, obstructions);
i) notes on site limitations (e.g. overgrown);
j) utility records available at time of the survey;
k) a polygon representing where any search sweep has been undertaken;
l) all GPR data together with the accurate georeferenced location of data (lines or grids as appropriate to the survey design);
m) where post-processing is not employed, the coordinate at any point where a utility has been detected and marked on the ground; and
n) EML data and locations where the instrumentation used has this capability.

2.7.3.3 Other techniques

It is the responsibility of the surveyor to select an appropriate suite of additional investigation techniques to meet the survey quality level required by the client.

These may include:

- Gyro based pipe location logging: Used for tracing the line of pipes where two access points allow the instrument to be deployed and recovered such as inverted siphons.
- Magnetometry: Used for detecting subsurface features, in particular ferrous based and fired clayware pipelines. Often used to obtain information over large areas (≥0.5 hectare). It is of limited use in urban and congested areas.
- Electromagnetic (EM) ground conductivity: Used for detecting subsurface features. Often used to obtain information over large areas (≥0.5 hectare).
- Earth resistance: Used for detecting variations in earth resistance caused by shallow variations in soil, e.g. trench backfill.
- Metal detectors: Used for detecting shallow ferrous objects.
- Infrared (thermal) imaging: Used for detecting thermal anomalies at the surface associated with underground features.
- Acoustic transmission (sounding): Used to demonstrate connectivity of open drains only.
- Hum detectors
- Radio frequency detectors: Used to relocate utilities that have been previously tagged with an RFID device. Only relevant where a check can be made against a record of its original placement.
- Vibration acoustic: . Used to detect the horizontal position (not depth) of pipework where a vibration signal can be induced along the pipe.

The above are not a requirement and may incur additional charges. Surveyor should make suggestions/recommendations.

2.7.4 Geology of the site

Any detection or verification methodologies to be used should take due consideration of the geology beneath the site when known, such as soil type and likely moisture content.

When selecting the geophysical technique, the resolution as well as depth of penetration expected in the prevailing geology should be considered.

When selecting the method of verification, the composition and physical properties of the geology should be considered.

3. Underground utility survey

This section of the specification refers to the survey of underground utilities. The term refers to the detection, location, positioning and identification of buried pipes and cables beneath the ground.

In June 2014 the British Standards Institution published in conjunction with the Institution of Civil Engineers a specification on underground utility surveys. ***PAS 128:2014 Specification for underground utility detection, verification and location*** provides clear and explicit requirements that a survey practitioner is to follow in executing utility surveys.

This section advises the client in selecting what specific requirements and methodologies the practitioner should follow.

3.1 Survey type

Tick the appropriate boxes below to confirm the survey types to be applied to the survey:

Survey type	Required (Y or N)
Survey Type D: The lowest level of survey, being essentially a utility record search.	Y
Survey Type C: A reconnaissance survey correlating, where possible, the results of the record drawings with surface features related to the buried utilities, thus improving the quality of the record data.	
Survey Type B: A detection survey of utilities carried out using, as a minimum, the two techniques of electromagnetic location and ground probing radar (GPR). There are four accuracy bands within Quality Level (QL) B, which the surveyor allots to each utility detected. These reflect the accuracy and confidence of the detection results.	
Survey Type A: The highest level, being a verification survey where critical utilities are exposed using slit trench or similar so that their precise position and depth can be verified. (Slit trench locations/quantity of slit trenches should be specified for pricing purposes.)	

Recommended good practice

Survey Type B is the most common survey type and should be selected if underground utility survey is required.

Survey Type A includes Survey Type B but with additional ground investigation techniques such as slit trenches to confirm utility positions at critical locations.

3.2 Utility survey outputs

The following table confirms the utility survey outputs required. The delivery type column is to be used to define the generic output format: CAD, point cloud, report, hard copy, image file, video file, spreadsheet, textual data, database, GIS database, etc.

Section 4 deliverables shall be used to confirm the specific client requirements for each delivery output.

Typical outputs

Output	Required (Y or N)	Delivery type/ comments
2D utility survey (line drawing)		
3D utility survey (line drawing)		
3D Solid Model		
3D BIM Model		
Survey report including: Photos of chambers Sketches of contents of chambers		

Non-typical outputs

Output	Required (Y or N)	Delivery type/ comments
Cross-sections (specify)		
Other (specify)		

Recommended good practice

Utility survey technical report should contain the following as minimum:

a) A description of the survey project requirements and defined survey area

b) A list of the detection methodologies used during the survey

c) Planimetric information

d) Photos of inspection chambers

e) Sketches of inspection chambers

f) A description of how successful each detection methodology proved to be and a plan showing any areas where these detection methodologies were not successful

g) A list of any utilities that would have been expected to be present that were not detectable using the detection methodologies

h) Areas of conflict between record information, site information and detected utilities

i) For a verification survey, the verification deliverable

j) Appendices with site-specific documentation such as TM plans and photos .

3.3 Utility survey features

Recommended good practice

The following tables provide a listing of features to be surveyed. This is not intended to be exhaustive, and the client should add additional features and comments if required.

Some features have been pre-selected as 'default features'. These are considered by SCSI to be features that, if present on site, should be surveyed and presented on a standard topographic survey, irrespective of the accuracy band selected by the client. However, features not required for a specific survey can be identified by the client by replacing the Y with an N in the relevant box.

'Non-typical' features are not typically surveyed/required at all accuracy bands, and will not be surveyed unless specifically selected by inserting Y in the relevant box.

3.3.1 Survey water drainage

Default features

The following features to be included as standard; if any features are not required, please specify in comments.

Feature	Comments
Position and cover level of inspection covers within the survey area	
Pipe line routes and connections	
Invert level of pipes (observed from the surface without entering confined space)	
Invert level of inspection chambers	
Incoming and outfall pipes at inspection chambers	
Diameter of pipework (observed from the surface without entering confined space)	
Connections to storm/foul and combined water sewers	
Culverts, manholes, access pits, headwalls	

Non-typical outputs

Note

Features below will only be surveyed if specifically selected by the client. These are not typically surveyed/required at all survey types and may add cost to the survey.

Feature	Required (Y or N)	Comments
Position, cover level and invert levels of immediate upstream or downstream manholes outside the survey area		
Connections to immediate upstream or downstream manholes outside the survey area		

Diameter of pipework and incoming and outfall pipes at immediate upstream or downstream manholes outside the survey area (observed from the surface without entering confined space)		
Connections of pipes to buildings (where possible)		
Dimensions and levels of concrete surrounding inspection covers (if possible)		
Material type of pipes (where possible)		
Manhole chamber dimensions (observed from the surface without entering confined space)		
Confined space entry Surveyors are to enter inspection chambers to measure pipe dimensions, chamber dimensions and invert levels *(NB NOT RECOMMENDED: severe impact on cost and safety)*		
Other (specify)		

3.3.2 Foul sewer

Default features

The following features to be included as standard; if any features are not required, please specify in comments.

Feature	Comments
Position and cover level of inspection covers within the survey area	
Pipe line routes and connections	
Invert level of pipes (observed from the surface without entering confined space)	
Invert level of inspection chambers	
Incoming and outfall pipes at inspection chambers	
Diameter of pipework (observed from the surface without entering confined space)	
Connections to storm/foul and combined water sewers	
Culverts, manholes, access pits, headwalls	

Non-typical outputs

> **Note**
> Features below will only be surveyed if specifically selected by the client. These are not typically surveyed/required at all survey types and may add cost to the survey.

Feature	Required (Y or N)	Comments
Position, cover level and invert levels of immediate upstream or downstream manholes outside the survey area Connections to immediate upstream or downstream manholes outside the survey area		
Connections to immediate upstream or downstream manholes outside the survey area Diameter of pipework and incoming and outfall pipes at immediate upstream or downstream manholes outside the survey area (observed from the surface without entering confined space)		
Connections of pipes to buildings (where possible)		

Dimensions and levels of concrete surrounding inspection covers (if possible)		
Material type of pipes (where possible)		
Manhole chamber dimensions (observed from the surface without entering confined space)		
Confined space entry Surveyors are to enter inspection chambers to measure pipe dimensions, chamber dimensions and invert levels *(NB NOT RECOMMENDED: severe impact on cost and safety)*		
Other (specify)		

3.3.3 Watermains

Default features

The following features to be included as standard; if any features are not required, please specify in comments.

Feature	Comments
Position of stop cocks, sluice valves, meter pits and inspection covers within the survey area	
Watermain routes and connections	
Fire main routes and connections	
Depth of pipes (from ground level to top of pipe) (annotated at each surface feature, change of direction and significant change of depth)	
Diameter of pipework (where possible) (observed from the surface without entering confined space)	

Non-typical features

Note

Features below will only be surveyed if specifically selected by the client. These are not typically surveyed/required at all survey types and may add cost to the survey.

Feature	Required (Y or N)	Comments
Position, cover level and invert levels of immediate upstream or downstream connections outside the survey area		
Connections to immediate upstream or downstream connections outside the survey area		
Diameter of pipework and incoming and outfall pipes at immediate upstream or downstream connections outside the survey area (observed from the surface without entering confined space)		
Connections of pipes to buildings (where possible)		
Material type of pipes (where possible)		
Internal dimensions of valve and meter pits (observed from the surface without entering confined space)		
Dimensions and levels of the thrust blocks and concrete surrounds (if possible)		
Other (specify)		

3.3.4 Gas

Default features

The following features to be included as standard; if any features are not required, please specify in comments.

Feature	Comments
Position of gas valves and inspection covers within the survey area	
Gas routes and connections	
Depth of pipes (from ground level to top of pipe) (annotated at each surface feature, change of direction and significant change of depth)	
Diameter of pipework (where possible) (observed from the surface without entering confined space)	

Non-typical features

Note
Features below will only be surveyed if specifically selected by the client. These are not typically surveyed/required at all survey types and may add cost to the survey.

Feature	Required (Y or N)	Comments
Position, cover level and invert levels of immediate upstream or downstream connections outside the survey area		
Connections to immediate upstream or downstream connections outside the survey area		
Diameter of pipework and incoming and outfall pipes at immediate upstream or downstream connections outside the survey area (observed from the surface without entering confined space)		
Connections of pipes to buildings (where possible)		
Material type of pipes (where possible)		
Internal dimensions of valve and meter pits (observed from the surface without entering confined space)		
Dimensions and levels of the thrust blocks and concrete surrounds (if possible)		
Other (specify)		

3.3.5 Telecommunications

Default features

The following features to be included as standard; if any features are not required, please specify in comments.

Feature	Comments
Details of utility owner/operator	
Position of above-ground assets such as overhead utility lines, utility poles, utility boxes	
Position and cover level of utility inspection covers within the survey area	
Cable routes with levels, numbers and sizes of ducts	
Depth of ducts/cables (from ground level to top of duct (annotated at each surface feature and significant change of depth)	
Invert level of inspection chambers	
Diameter of ducts (observed from the surface without entering confined space)	
Fibre-optics (where possible: often not possible to trace)	

Non-typical features

> **Note**
> Features below will only be surveyed if specifically selected by the client. These are not typically surveyed/required at all survey types and may add cost to the survey.

Feature	Required (Y or N)	Comments
Each individual duct to be represented where bands of cables ducts are present		
Position, cover level and invert levels of immediate upstream or downstream manholes outside the survey area		
Connections to immediate upstream or downstream manholes outside the survey area		
Diameter of pipework and incoming and outfall pipes at immediate upstream or downstream manholes outside the survey area (observed from the surface without entering confined space)		
Connections of pipes to buildings (where possible)		
Dimensions and levels of concrete surrounding inspection covers (if possible)		
Material type of pipes (where possible)		
Manhole chamber dimensions (observed from the surface without entering confined space)		
Confined space entry Surveyors are to enter inspection chambers to measure pipe dimensions, chamber dimensions and invert levels *(NB NOT RECOMMENDED: severe impact on cost and safety)*		
Other (specify)		

3.3.6 Electricity and street lighting

Default features

The following features to be included as standard; if any features are not required, please specify in comments.

Feature	Comments
Details of utility owner/operator	
Position of above-ground assets such as overhead utility lines, utility poles, utility boxes	
Position and cover level of utility inspection covers within the survey area	
Cable routes with levels, numbers and sizes of ducts	
Depth of ducts/cables (from ground level to top of duct (annotated at each surface feature and significant change of depth)	
Invert level of inspection chambers	
Diameter of ducts (observed from the surface without entering confined space)	
Fibre-optics (where possible: often not possible to trace)	

Non-typical features

> **Note**
> Features below will only be surveyed if specifically selected by the client. These are not typically surveyed/required at all survey types and may add cost to the survey.

Feature	Required (Y or N)	Comments
Voltages classified as: Low (0–11kv) High (11–66kv) Transmission (66kv or over) (where possible)		
Each individual duct to be represented where bands of cables ducts are present		
Position, cover level and invert levels of immediate upstream or downstream manholes outside the survey area		
Connections to immediate upstream or downstream manholes outside the survey area		
Diameter of pipework and incoming and outfall pipes at immediate upstream or downstream manholes outside the survey area (observed from the surface without entering confined space)		
Connections of pipes to buildings (where possible)		
Dimensions and levels of concrete surrounding inspection covers (if possible)		
Material type of pipes (where possible)		
Manhole chamber dimensions (observed from the surface without entering confined space)		
Confined space entry Surveyors are to enter inspection chambers to measure pipe dimensions, chamber dimensions and invert levels *(NB NOT RECOMMENDED: severe impact on cost and safety)*		
Other (specify)		

3.3.7 Ventilation

Default features

The following features to be included as standard; if any features are not required, please specify in comments.

Feature	Comments
Details of utility owner/operator	
Position of above-ground assets such as overhead utility lines, utility poles, utility boxes	
Position and cover level of utility inspection covers within the survey area	
Cable routes with levels, numbers and sizes of ducts	
Depth of ducts/cables (from ground level to top of duct (annotated at each surface feature and significant change of depth)	
Invert level of inspection chambers	
Diameter of ducts (observed from the surface without entering confined space)	
Fibre-optics (where possible: often not possible to trace)	

Non-typical features

Note

Features below will only be surveyed if specifically selected by the client. These are not typically surveyed/required at all survey types and may add cost to the survey.

Feature	Required (Y or N)	Comments
Each individual duct to be represented where bands of cables ducts are present		
Position, cover level and invert levels of immediate upstream or downstream manholes outside the survey area		
Connections to immediate upstream or downstream manholes outside the survey area		
Diameter of pipework and incoming and outfall pipes at immediate upstream or downstream manholes outside the survey area (observed from the surface without entering confined space)		
Connections of pipes to buildings (where possible)		
Dimensions and levels of concrete surrounding inspection covers (if possible)		
Material type of pipes (where possible)		
Manhole chamber dimensions (observed from the surface without entering confined space)		
Confined space entry Surveyors are to enter inspection chambers to measure pipe dimensions, chamber dimensions and invert levels *(NB NOT RECOMMENDED: severe impact on cost and safety)*		
Other (specify)		

3.3.8 Heating

Default features

The following features to be included as standard; if any features are not required, please specify in comments.

Feature	Comments
Details of utility owner/operator	
Position of above-ground assets such as overhead utility lines, utility poles, utility boxes	
Position and cover level of utility inspection covers within the survey area	
Cable routes with levels, numbers and sizes of ducts	
Depth of ducts/cables (from ground level to top of duct (annotated at each surface feature and significant change of depth)	
Invert level of inspection chambers	
Diameter of ducts (observed from the surface without entering confined space)	
Fibre-optics (where possible: often not possible to trace)	

Non-typical features

Note

Features below will only be surveyed if specifically selected by the client. These are not typically surveyed/required at all survey types and may add cost to the survey.

Feature	Required (Y or N)	Comments
Each individual duct to be represented where bands of cables ducts are present		
Position, cover level and invert levels of immediate upstream or downstream manholes outside the survey area		
Connections to immediate upstream or downstream manholes outside the survey area		
Diameter of pipework and incoming and outfall pipes at immediate upstream or downstream manholes outside the survey area (observed from the surface without entering confined space)		
Connections of pipes to buildings (where possible)		
Dimensions and levels of concrete surrounding inspection covers (if possible)		
Material type of pipes (where possible)		
Manhole chamber dimensions (observed from the surface without entering confined space)		
Confined space entry Surveyors are to enter inspection chambers to measure pipe dimensions, chamber dimensions and invert levels *(NB NOT RECOMMENDED: severe impact on cost and safety)*		
Other (specify)		

3.3.9 Cable TV

Default features

The following features to be included as standard; if any features are not required, please specify in comments.

Feature	Comments
Details of utility owner/operator	
Position of above-ground assets such as overhead utility lines, utility poles, utility boxes	
Position and cover level of utility inspection covers within the survey area	
Cable routes with levels, numbers and sizes of ducts	
Depth of ducts/cables (from ground level to top of duct (annotated at each surface feature and significant change of depth)	
Invert level of inspection chambers	
Diameter of ducts (observed from the surface without entering confined space)	
Fibre-optics (where possible: often not possible to trace)	

Non-typical features

Note
Features below will only be surveyed if specifically selected by the client. These are not typically surveyed/required at all survey types and may add cost to the survey.

Feature	Required (Y or N)	Comments
Each individual duct to be represented where bands of cables ducts are present		
Position, cover level and invert levels of immediate upstream or downstream manholes outside the survey area		

Connections to immediate upstream or downstream manholes outside the survey area		
Diameter of pipework and incoming and outfall pipes at immediate upstream or downstream manholes outside the survey area (observed from the surface without entering confined space)		
Connections of pipes to buildings (where possible)		
Dimensions and levels of concrete surrounding inspection covers (if possible)		
Material type of pipes (where possible)		
Manhole chamber dimensions (observed from the surface without entering confined space)		
Confined space entry Surveyors are to enter inspection chambers to measure pipe dimensions, chamber dimensions and invert levels *(NB NOT RECOMMENDED: severe impact on cost and safety)*		
Other (specify)		

3.3.10 Combined Services and Ducts

Default features

The following features to be included as standard; if any features are not required, please specify in comments.

Feature	Comments
Details of utility owner/operator	
Position of above-ground assets such as overhead utility lines, utility poles, utility boxes	
Position and cover level of utility inspection covers within the survey area	
Cable routes with levels, numbers and sizes of ducts	
Depth of ducts/cables (from ground level to top of duct (annotated at each surface feature and significant change of depth)	
Invert level of inspection chambers	
Diameter of ducts (observed from the surface without entering confined space)	
Fibre-optics (where possible: often not possible to trace)	

Non-typical features

Note

Features below will only be surveyed if specifically selected by the client. These are not typically surveyed/required at all survey types and may add cost to the survey.

Feature	Required (Y or N)	Comments
Each individual duct to be represented where bands of cables ducts are present		
Position, cover level and invert levels of immediate upstream or downstream manholes outside the survey area		
Connections to immediate upstream or downstream manholes outside the survey area		

Diameter of pipework and incoming and outfall pipes at immediate upstream or downstream manholes outside the survey area (observed from the surface without entering confined space)		
Connections of pipes to buildings (where possible)		
Dimensions and levels of concrete surrounding inspection covers (if possible)		
Material type of pipes (where possible)		
Manhole chamber dimensions (observed from the surface without entering confined space)		
Confined space entry Surveyors are to enter inspection chambers to measure pipe dimensions, chamber dimensions and invert levels *(NB NOT RECOMMENDED: severe impact on cost and safety)*		
Other (specify)		

3.3.11 Abandoned services and ducts

Default features

Following features to be included as standard, if any features are not required please specify in comments.

Feature	Comments
Details of utility owner/operator	
Position of above-ground assets such as overhead utility lines, utility poles, utility boxes	
Position and cover level of utility inspection covers within the survey area	
Cable routes with levels, numbers and sizes of ducts	
Depth of ducts/cables (from ground level to top of duct (annotated at each surface feature and significant change of depth)	
Invert level of inspection chambers	
Diameter of ducts (observed from the surface without entering confined space)	
Fibre-optics (where possible: often not possible to trace)	

Non-typical features

Note

Features below will only be surveyed if specifically selected by the client. These are not typically surveyed/required at all survey types and may add cost to the survey.

Feature	Required (Y or N)	Comments
Each individual duct to be represented where bands of cables ducts are present		
Position, cover level and invert levels of immediate upstream or downstream manholes outside the survey area		
Connections to immediate upstream or downstream manholes outside the survey area		
Diameter of pipework and incoming and outfall pipes at immediate upstream or downstream manholes outside the survey area (observed from the surface without entering confined space)		

Connections of pipes to buildings (where possible)		
Dimensions and levels of concrete surrounding inspection covers (if possible)		
Material type of pipes (where possible)		
Manhole chamber dimensions (observed from the surface without entering confined space)		
Confined space entry Surveyors are to enter inspection chambers to measure pipe dimensions, chamber dimensions and invert levels *(NB NOT RECOMMENDED: severe impact on cost and safety)*		
Other (specify)		

3.4 Site verification (applies to Survey Type A only)

Verification is the process of exposing a utility and subsequently measuring and recording its accurate location as well as other relevant attributes, either externally through excavation and/or manhole accessor internally using Gyroscopic mapping.

Verification of a utility that does not have access via a manhole or inspection chamber can be performed using one excavation technique or a combination of excavation techniques that protect the integrity of the utility. Such techniques include, for example, vacuum excavation (air only), hydro or dual (air and hydro) and safe hand-digging techniques. For guidance on potential dangers of working near underground services and on how to reduce any direct risks to people's health and safety, as well as the indirect risks arising through damage to services, see the HSE's ***Avoiding danger from underground services*** (HSG47).

3.4.1 Site investigation techniques

For Survey Type A, the data shall be obtained through visual inspection of the utility:

a) at access points such as in a manhole or inspection chamber; and
b) by its excavation and exposure.

Damage to the utility and the surrounding infrastructure should be avoided when exposing the utility and also in undertaking the reinstatement of any excavations. Exposing the utility could be by any number of standard of care techniques, including:

a) vacuum excavation with pressurised air and/or water to expose the utility;
b) hand-digging techniques to expose the utility;
c) other conventional mechanical excavation technologies used in conjunction with a) and/or b).

The exact quantity of non-destructive verifications is project-dependent and should be specified by the client.

Warning
For all excavations, assume that underground utilities are present and act accordingly. Attention is drawn to laws, rules and regulations applicable to vacuum excavating or hand digging near or atop dangerous utilities such as electric, gas, fuel or petroleum.

3.4.2 Verification techniques

Visual inspections

Data gathered from visual inspection at access points shall include as a minimum:

a) for foul, surface and combined water drainage systems access points (manholes and inspection chambers):
   1) pipe positions and orientation at ground surface;
   2) visible pipe diameters;
   3) material type;
   4) pipe depths (invert levels related to a common datum);
   5) directions of flow;
   6) manhole/inspection chamber size;
   7) manhole/inspection chamber soffit depth and depth to base;
   8) connectivity diagram;
   9) manhole/inspection chamber layout and/or photographs;

b) for telecoms/electrical utility manholes and inspection chambers:
   1) ducts position and orientation at ground surface;
   2) number and size of ducts on each face;
   3) material type;
   4) depth to top of ducts;
   5) manhole/inspection chamber size;
   6) depth to base;
   7) manhole/inspection chamber layout and/or photographs;

c) for gas/water utility manholes and inspection chambers:
   1) depths and diameter of the utility, when visible in manhole/inspection chamber;
   2) valve connectivity;
   3) material type;
   4) manhole/inspection chamber layout and/or photographs.

Excavations shall be:

a) a single spot excavation (commonly known as an inspection pit, test hole or pothole) for the verification of an individual utility; and/or
b) a trench excavation for the verification of multiple utilities.

The verification measurements should only be attributed to the utility at the exact point of excavation. Further test holes might be required along the same utility route.

Verification might not be achievable at all locations within a survey area due to ground conditions or construction methods.

The thrust block should not be disturbed, e.g. no vacuum or hand excavation behind or around the thrust block.

Suitable safe systems of work should be planned and applied, including consideration of the installation of shoring equipment or stepped battered excavations when site conditions warrant it.

3.4.3 Determining location of utility to be exposed

The location of the utility to be exposed shall be determined by:

a) utility detection; and/or
b) on-site utility features obtained through site reconnaissance; and/or
c) utility records.

Excavation verification work should be undertaken using utility detection data undertaken in accordance with PAS.

However, it can be undertaken using data from site reconnaissance or a desktop utility records search.

3.4.4 Reporting

The information gathered once the utility has been exposed shall include, as a minimum, depth from top of utility to a reference point installed on the surface level.

Where safe working practices allow, the information gathered should also include:

a) nature of utility (i.e. pipe, cable or other);
b) configuration of multiple utility layout;
c) diameter of utility (external diameter only);
d) material type;
e) backfill materials used;
f) observation of the condition of utility;
g) prevailing ground conditions.

Attention is drawn to the HSE's ***Avoiding danger from underground services*** (HSG47) [3] and in particular to guidance on confined space entry.

Where information on subsurface ground conditions (i.e. soil/rock type) is requested, it should be in accordance with BS EN ISO 14688-1 and BS EN ISO 14689-1.

4. Deliverables

The following defines the client requirements for specific deliverable formats and method of delivery. It is designed to allow a client to refer to his/her existing formats and templates where appropriate.

Due to a lack of convention in relation to digital formatting and standards, this section does not incorporate a default specification for formats, and it is the client's responsibility to ensure that sufficient information is supplied to the surveyor. Where the client does not provide sufficient detail the surveyor shall confirm to the client the proposed format of deliverables.

Recommended good practice

Clients should note that software versions and formats supported change rapidly over time. It is recommended that along with a client system-compatible format, a standard exchange format should be specified. For certain agencies that have long archiving periods, this can be a prerequisite for acceptance of survey data (heritage).

The list given here is by way of suggestion and not exhaustive, nor does it guarantee that all information in one format can be consistently exchanged into another.

The formats applicable to the deliverables shall be based on the requirements selected in ***Section 3***.

Deliverable type	Relevant output(s) (specified at section 3)	Software system	Version	Exchange format (file type)	Suggested exchange formats	Info
CAD					*.dxf, .DWG	4.1
Digital terrain model (DTM)					*.dxf, .DWG	4.2
Building information modelling (BIM)					Revit®,AutoCAD, MicroStation and Navisworks	4.3
Point cloud					*.LAS; E57	4.4
Point cloud viewer						4.5
GIS					*.dxf, *. SHP fgdb (Geodata-base)	4.6
Survey reports					*.pdf, *.docx	4.7
Imagery/ photography					*.jpeg ; *.TIF, *.ECW	4.8
Video					*.mpeg, *.avi	4.9
Spreadsheet					*.csv, *.txt	4.10
Textual data						4.11
Hard copy						4.12
Other						

Method of delivery

The surveyor shall send the survey deliverables to the client via:

Method	Required
Via FTP site	
Upload to client's system	
Email attachment	
Delivered portable hard drive, USB or CD/DVD	
Delivered hard copy	
Other (specify)	

It is assumed that any method of delivery (e.g. hand/post/courier) to the client's specified address is acceptable.

Presentation standards

The following presentation standards shall be used:

Client-supplied standards	
Surveyor-defined standards	
CAD layers and presentation to be as per the ***Topographic Specification for Urban Projects***	
Other (specify)	

Non-typical features related to CAD (where applicable)

Note
Features below will only be surveyed if specifically selected by the client. These are not typically surveyed/required at all accuracy bands and may add cost to the survey.

Item	Required (Y or N)	Comments
Client-specified colours (please specify)		
Pre-fix level layer naming		
Suffix-fix level layer naming		

4.1 CAD deliverables

4.1.1 Presentation of CAD deliverables

Recommended good practice for layering

Feature descriptive level/layer naming
(Trees, walls, road markings, roads, buildings, walls, windows, etc.)
Detail segregation (groups/classification, i.e. BIM, utility groups, entity types (3D surfaces, strings, points))
Legend
Key/location plan
North arrow

4.1.2 Format of CAD Deliverables

Recommended good practice

The client should ensure that CAD-deliverable formats and presentation standards are well specified and compatible with his/her own or intended users' systems. Consideration should also be given to the contents of drawing title blocks. These should include:

- survey reference number
- survey date
- filename
- project/drawing title
- survey company
- client name
- legend (all used symbols, abbreviations, line styles, etc.)
- north point/arrow
- annotated map grid
- scale bar
- plot scale and applicable paper size
- key plan
- grid and datum
- location data referred to elsewhere (cross-sections).

Clients should also note that developing conventions in relation to BIM are designed to increase collaboration and sharing of data in a consistent manner and this can lead to significant efficiencies in data management and decision making. Clients should therefore keep abreast of BIM guidance and overlapping specifications (e.g. BIM execution plan) when completing this section.

Due to the move away from hard copy plans/drawings, it is good practice that all digital drawings with title blocks be output as *.pdf as a proof copy. The *.pdf copy serves as a record of the digital deliverable.

4.2 Digital terrain model (DTM)

Recommended good practice

When specifying a grid format, clients should be aware of the increase in data file sizes with increasing density of points, particularly over large areas. It may be suitable in such circumstances to specify multiple densities or test data sets in consultation with the surveyor. It is important to specify the grid cell size and the position of the centre of cells.

4.3 Building information modelling (BIM)

4.3.1 Presentation of BIM model

Recommended good practice

Should surveys be required for BIM, it is recommended that a BIM deliverable shall be provided in accordance with the employer's information requirements (EIR) and the BIM execution plan (BEP) as specified in BS EN ISO 19650-1:2018, 3.3.6 and BS EN ISO 19650-2:2018, 3.1.3.1 respectively.

4.3.2 Format of BIM deliverables

Recommended good practice

Some BIM software packages use an internal coordinate system that is then referenced to real-world coordinates. It is important that surveyors engaging in surveys to BIM projects read **section 2** and correctly set project coordinate systems to enable integration with real-world coordinate systems.

4.4 Point cloud

Recommended good practice

Clients should specify cleaning of spurious data from moving objects captured during the creation of point clouds (i.e. people, moving vehicles, false reflections from car mirrors, etc.).

The client should take care to ensure point cloud deliverable formats including generic formats that will serve as future archive of data as well as formats compatible with their own or their intended users' systems.

Clients should also note that developing conventions in relation to BIM are designed to increase collaboration and sharing of data in a consistent manner and this can lead to significant efficiencies in data management and decision making. Clients should therefore keep abreast of BIM guidance and overlapping specifications (i.e. BIM execution plan).

4.5 Point cloud viewer

Recommended good practice

Where clients have requested point cloud data, they should consider specifying a point cloud viewer output.

When specifying colour image overlaid point cloud viewing formats, clients should also seek delivery of light intensity only formats to ensure changes in capture between scanning and image does not result in misinterpreted survey data (i.e. moving vehicles).

Recommended good practice

The client should take care to ensure that point cloud viewer formats specified are compatible with his/her own or intended user's systems. Where a client does not have a point cloud viewer, he/she may be able to download one online as many manufacturers provide free downloadable viewers. Clients should also note that point cloud viewers can work on lower performance PCs and generally rely on smaller files that can be shared over online hosting systems.

4.6 GIS

Recommended good practice

The client should take care to ensure that GIS deliverable formats and presentation standards are well specified and compatible with their own or their intended users' systems.

GIS data requires detailed format specification in terms of the data topology, rules for feature code snaps, nodes, creation of polygons, dark links, etc. This is not a trivial consideration in large datasets, and it will have a significant effect on the cost of the data capture and processing.

4.7 Report

Recommended good practice

It is considered good practice to produce a survey report for various types of surveys. It can provide proof of provenance, methodology and agreed specification and can act as an important historical reference document in case of dispute. It can also aid future use of survey deliverables (particularly survey control) and enhance the future value of the surveyed data.

The client should specify the following as a minimum for topographic and utility survey reports where requested: date of survey, details of the specification being followed, outline methodology, computing and presentation of the survey, equipment used, site photography, details of quality control for site and processing work, survey issues or difficulties encountered on site (omissions, access, etc.).

For survey control reports in addition to the above, the client should also specify survey control network diagram, list of supplied survey control, numerical results (loop closures, residuals, etc.), network adjustment files, details of survey control points (including location information sufficient to find control stations).

4.8 Imagery/photos

Recommended good practice

The client should note that file sizes can vary dramatically with different file formats. Clients, where appropriate, should consider multiple formats that preserve the original data capture but also provide lighter file format for ease of handling and sharing.

Clients should consider specifying geo-location attribute capture of imagery to ensure that location and direction of view can be verified.

4.9 Video deliverables

Recommended good practice

The client should note that file sizes can vary dramatically with different file formats. Where appropriate, clients should consider multiple formats that preserve the original data capture but also provide lighter file format for ease of handling and sharing.

Where clients require CCTV or fly-through video files they should consider specifying supply of a flight path and video trajectory with time, distance correlation. This is particularly important for condition surveys of sewers.

4.10 Spreadsheets

Recommended good practice

The client should consider carefully spreadsheet output requirements for monitoring or macro-driven spreadsheet outputs. This can include validation tools and coordinate conversions where reporting requires change of system from site capture to output analysis.

4.11 Textual data

Recommended good practice

The client should consider carefully specific textual data formats if they are system dependent. In particular, sample data and trial inputs should be included in the specification if submissions are likely to be used in critical operations that require high reliability in data sequencing.

4.12 Hard copy

Recommended good practice

Due to the move away from hard copy plans/drawings to digital deliverables, the client should specifically state if hard copy deliverables are required. These could be paper/ film plots, photographic negatives, etc.

Clients should be aware that it is not advisable to scale from paper plots.

Appendix A: Quick specifications

This quick reference specification sheet, summarising the full SCSI guidance, is intended for use on small or straightforward schemes and assumes that the first option clause (where appropriate) is used throughout. Margin numbers indicate the relevant main guidance sections or clauses.

The client should tick the requirement(s) needed in each subject category. Where no item is selected for a particular category the surveyor will assume that there is no requirement. Additional information, where necessary, should be provided in a covering letter.

If this sheet does not provide adequate opportunity to specify the survey then the main guidance document should be used to prepare the survey specification.

Quick specifications for utility surveys

Clause	Subject	Details					
1	Project information						
1.8	Client						
1.8	Contact and telephone						
1.5	Survey extent	Location plan attached		Textual description		Proposals plan	
2.3	Band and/or scale	1:50/D		1:100/E		1:200/F	
2.4.1	Plan control grid and datum	All PAS 128 surveys should be referenced to National Grid					
		GNSS derived datum (recommended)		Benchmark derived datum			
5.2	QL D desktop utility records search (required for levels C-A)			QL C site reconnaissance			
5.2	QL B detection survey			QL A verification survey			
5.2	QL B detection methods	M1	M2	M3		M4	
		Post-processing of GPR data		Yes		No	
5.2	QL A verification methods	Inspection chamber survey		Machine/hand dug trial holes		Vacuum excavation	
		Number of inspection chambers		Soft dig (number)		Hard dig (number)	
5.5	Deliverables and delivery medium	CAD	PDF	BIM		GIS	
		Email	DVD	Paper		Other	

Appendix B: Definitions

Absolute accuracy
Absolute accuracy is the measurement of RMSE of normally distributed error vectors relative to a defined grid and/or height datum. This is typically measured from the nearest survey control marker which was used as part of the primary grid establishment. (See the Ordnance Survey table overleaf.)

Accuracy
In general, when accuracies (or tolerances) have been specified, they refer to vector errors and are defined statistically as root mean square errors (RMSE) or standard deviation. The RMSE or standard deviation is equivalent to 68% of normal distribution of random errors and is often used to express tolerance or confidence in measurements. The standardised normal distribution table determines the ratio of RMSE to different confidence or measurement error tolerances. A 90% tolerance or confidence in a set of measurements is equal to 1.65 times the RMSE or standard deviation when a representative sample of points is tested. Thus a RMSE of ± 0.1m indicates that in a representative sample of 100 points, not less than 68 shall be correct to better than ± 0.1m, and not less than 90 points shall be correct to better than ± 0.165m. Any errors exceeding three times the RMSE (outside of 99.7% of confidence or tolerance in the normal distribution of errors) in this case ± 0.3m, may be regarded as gross errors or mistakes.

Datum
The starting point or source of a grid (horizontal datum), height (vertical datum) or projected coordinate system (map datum). It is commonly referred to in relation to vertical heighting or levelling but can be applicable to a grid origin, global spheroid shape and origin, and origin of a true bearing or rotation and scale factor in a map projection.

Georeferencing
To georeference something means to define its existence in physical space. That is, establishing its location in terms of a map projection and/or coordinate system.

Grid
Generally an orthogonal and planar (flat) coordinate system used to define locations on a map. A grid can have an arbitrary or local origin, or be geospatially related to an earth based datum. Grids can have a 1:1 true-scale factor or be projected from curved surfaces to have non uniform or nonunity scale factors.

Projection
Projections contain the parameters by which measurements on the ground or in space have been scaled, rotated or shifted to present them on a map coordinate system. They are typically used for large areas, country wide or global mapping systems to overcome representing earth curvature on a plan.

Relative accuracy
Relative accuracy is the measurement of RMSE of normally distributed vector errors between proximate features shown in survey or setting out on the ground. The calculation can be made independently of the absolute accuracy of features shown on a grid (i.e. the distance between a two buildings measured from the same survey). (See the Ordnance Survey table overleaf.)

Survey control
The physical markers or point features that are used to realise coordinate grids on the ground, often referred to as permanent ground markers or PGMs where specifically installed for that purpose. Survey control is typically made up of a number of points observed along interconnected baselines. They are used for setting out or mapping all other features to the established grid. Survey control is generally classified as primary, secondary or tertiary depending on its importance in defining a grid and/or its accuracy for use in surveying or setting out.

Survey traverse or survey control network

The complete set of baselines measured between survey control points is called a survey traverse or control network where the baselines exceed more than 1 (i.e. more than 2 points). Where the set of baselines closes back on itself it is typically called a traverse loop. A closed traverse is one that starts and ends on a known baseline, even where the baseline is the original start of the traverse (i.e. as in a closed loop traverse). Where a traverse includes cross-bracing of multiple baselines (more than 2 baselines observed from one survey control point) it is typically referred to as a network. Where a baseline does not close back it can be called a flying traverse or in the case of a single baseline a traverse leg. As with survey control, survey traverses or survey control networks can also be classified as primary, secondary or tertiary depending on its importance in defining a grid and/or its accuracy for use in surveying or setting out. Traverses can include angle, distance, height and co-ordinate measurement.

The following table, based on more than 40 years of accuracy testing, represents the absolute and relative accuracy of UK Ordnance Survey large scale topographic mapping data:

Original survey scale	99% confidence level	95% confidence level	RMSE*
1:1250			
Absolute accuracy	0.9m	0.8m	0.5m
Relative accuracy	+/- 1.1m (up to 60m)	+/- 0.9m (up to 60m)	+/- 0.5m (up to 60m)
1:2500			
Absolute accuracy	2.4m	1.9m	1.1m
Relative accuracy	+/- 2.5m (up to 100m)	+/- 1.9m (up to 100m)	+/- 1.0m (up to 100m)
1:10 000			
Absolute accuracy	8.8m	7.1m	4.1m
Relative accuracy	+/- 10.1m (up to 500m)	+/- 7.7m (up to 500m)	+/- 4.0m (up to 500m)

Table 1: Ordnance Survey mapping accuracies of large scale topographic mapping data

(Confidence level is how frequently a parameter falls within the quoted limits.)
*RMSE (root mean square error) is the square root of the mean of the squares of the errors between the observations.
Source: www.ordnancesurvey.co.uk/oswebsite/support/products-services.html

Appendix C –References

Bannister, A., and Raymond, S., *Surveying* (7th edition), Pearson, 1998

Beach, M., and Schofield, M. *Engineering Surveying* (6th edition), A Butterworth-Heinemann, 2007

Bomford, G. *Geodesy* (4th edition), Clarendon Press, Oxford, 1980

Hofmann-Wellenhof, B., Lichtenegger, H., Wasle, H. *GNSS – Global Navigation Satellite Systems: GPS, GLONASS, Galileo and More*, Springer-Verlag, New York, 2007

Iliffe, J.C. and Lott, R. *Datums and Map Projections for Remote Sensing, GIS and Surveying* (2nd edition), Whittles Publishing, Dunbeath, 2008

Kaula, W. *Theory of Satellite Geodesy: Applications of Satellites to Geodesy*, Dover Publications Inc, Mineola, NY, 2003

Leick, A. *GPS Satellite Surveying* (3rd edition), John Wiley & Sons, Chichester, 2004

Metric Survey Specifications for Cultural Heritage 2009 English Heritage (available to download at www.englishheritage.org.uk/publications/metric-survey-specification/)

Seeber, G. *Satellite Geodesy, Foundations, Methods and Applications* (2nd edition), Walter de Gruyter, Berlin, 2003

Survey4BIM task group – www.bimtaskgroup.org/survey4bim/

Uren, J. *Surveying for Engineers* (5th edition), Palgrave Macmillan, 2010

Van Sickle, J. *GPS for Land Surveyors* (3rd edition), CRC Press, Lincoln, US, 2008

The International Standards Organisation (ISO)

ISO produces several suites of standards related to many of the surveying and measurement topics contained within the guidance note. This listing is by no means exhaustive and all ISO standards can be sourced at www.iso.org/iso/home.htm

ISO 17123-1:2010 gives guidance to provide general rules for evaluating and expressing uncertainty in measurement for use in the specifications of the test procedures of ISO 17123-2, ISO 17123-3, ISO 17123-4, ISO 17123-5, ISO 17123-6, ISO 17123-7 and ISO 17123-8.

ISO 17123-2, ISO 17123-3, ISO 17123-4, ISO 17123-5, ISO 17123-6, ISO 17123-7 and ISO 17123-8 specify only field test procedures for geodetic instruments without ensuring traceability in accordance with ISO/IEC Guide 99. For the purpose of ensuring traceability, it is intended that the instrument be calibrated in the testing laboratory in advance.

ISO 17123-1:2010 is a simplified version based on ISO/IEC Guide 98-3 and deals with the problems related to the specific field of geodetic test measurements.

ISO 4463-3:1995 – Measurement methods for building – Setting-out and measurement

ISO/TS 12911:2012 – Establishes a framework for providing specifications for the commissioning of building information modelling (BIM).

ISO 9849:2000 – Optics and optical instruments – Geodetic and surveying instruments – Vocabulary

ISO 19152:2012 – Geographic information – Land Administration Domain Model (LADM)

British Standards Institute (BSI)

BSI also produces suites of standards and Publically Available Standards (PAS) which can be sourced at http://shop.bsigroup.com/

British Standards Institute (BSI) PAS 128:2014 – Specification for underground utility detection, verification and location

British Standards Institute (BSI) PAS 1192-2:2013 – Specification for information management for the capital/delivery phase of construction projects using building information modelling, PAS 1192-3:2014 (when available)

The International Federation of Surveyors (FIG)

FIG produces a series of best practice documents of measurement subjects. A full suite of FIG publications can be sourced at www.fig.net/pub/figpub/index.htm

No. 49 Cost Effective GNSS Positioning Techniques. FIG Commission 5 Publication. FIG Report, 2010

The Survey Association (TSA)

TSA also produces a suite of geomatics and surveying related client guides and guidance notes many of which are cross-endorsed by RICS. These can be sourced at www.tsa-uk.org.uk/

Network RTK GNSS Best Practice (2012)

The Essential Guide to Utility Surveys (2009)

Detailed guidance notes for specifying a utility survey (2009)

RICS professional guidance

EDM calibration, 2nd edition (2008)

Guidelines for the use of GNSS in land surveying and mapping, 2nd edition (2010)

Vertical aerial photography and digital imagery, 5th edition (2010)

Terms and Conditions of Contract for Land Surveying Services, 3rd edition (2009)

Code of Measuring Practice, 6th edition (2007)

Boundaries: procedures for boundary identification, demarcation and dispute resolution, 3rd edition (2014)

Party wall legislation and procedure, 6th edition (2011)

Rights of light, 1st edition (2010)

Daylighting and sunlighting, 1st edition (2012)

Chartered property, land and construction surveyors

Dating back to 1895, the Society of Chartered Surveyors Ireland is the independent professional body for Chartered Surveyors working and practicing in Ireland.

Working in partnership with RICS, the pre-eminent Chartered professional body for the construction, land and property sectors around the world, the Society and RICS act in the public interest: setting and maintaining the highest standards of competence and integrity among the profession; and providing impartial, authoritative advice on key issues for business, society and governments worldwide.

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Members of the profession are typically employed in the construction, land and property markets through private practice, in central and local government, in state agencies, in academic institutions, in business organisations and in non-governmental organisations.

Members' services are diverse and can include offering strategic advice on the economics, valuation, law, technology, finance and management in all aspects of the construction, land and property industry.

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