Section 2: Ordnance Survey Large Scales Map Data

The Quality of Ordnance Survey Large Scales Data

How good is an Ordnance Survey map? How much can it be relied upon to show what is really on the ground? These are of course subjective questions; the answers depend on so many factors, and the intended use of the map data. The term "quality" can mean different things to different users but a generally-accepted definition which can be used in the context of geographic information is that it is "a measure of performance against a pre-determined specification". In other words Ordnance Survey describe a specification – which includes, for example, what will be shown, to what accuracy it will be shown, how it will be depicted, how often change will be collected, and then provides measures to describe how performance can be assessed against this defined specification.

Ordnance Survey produces data at the three basic scales which are then stored in the Ordnance Survey National Topographic Database. This is then used to produce data products – Land Line, and since 2001 OS MasterMap. Both of these are based on the same raw data, but OS MasterMap has been engineered to form unique map objects (over 430 million) rather than the previous "spaghetti" data of Land Line. The quality of Ordnance Survey large scale (Land Line and OS MasterMap) data is described in the User Guides[1] as a statement of performance against specification. Some metrics are given and more will be added in the future. The User Guide(s) provides a statement of lineage – information about the data source, particularly about the original scale and accuracy.

Lineage

As described in the introductory sections, Great Britain was completely remapped between the years 1946 and 1983, and this mapping continues to be updated and upgraded. Since 1946 surveying and mapping techniques have developed and the specifications for capture and maintenance of the mapping have changed to meet new user requirements. Consequently, maps have been produced by a number of different methods, producing a range of accuracies and content within the overall tolerances appropriate to the scale of the published map.

Graphic (paper) mapping has been digitised using published Ordnance Survey topographic maps created from ground or photogrammetrlc surveys. Large-scale topographic maps were traditionally published at scales of 1:1250 (urban areas), 1:2500 (rural areas) and 1:10,000 (mountain and moorland areas). This latter scale is a metric version of the old 1:10560 (6") scale. The survey practices and quality

[1] Ordnance Survey, 2004, OS MasterMap User Guide V5.1, Product Specification ©Crown Copyright.

control procedures adopted during their production were designed to ensure that the resulting maps were true cartographic representations of the landscape, commensurate with the scale of publication. These maps were not intended to represent surveys of engineering quality or precision but are a multipurpose series of general topographic maps.

The digitising programme began in May 1971, and was aimed at the automation of graphic map production. The increasing demand for digital data in the 1980s led to an acceleration in the digitising programme and coverage of Great Britain was completed in 1995. These digital maps, now known as the Land-Line product, have been constantly revised within a digital environment since their initial capture and were digitised using quality procedures formulated in collaboration with the National Joint Utilities Group (NJUG).

In April 2000 Ordnance Survey commenced a programme to convert the unstructured, tile-based data, into an object-based, seamless dataset to form the basis of OS MasterMap. The resultant data was further improved in a manual editing programme finishing in October 2002. There have been small changes to elements of the content specification (now the OS MasterMap real-world object catalogue) since the initial digitising programme commenced in 1971.

Such changes have not normally been implemented retrospectively. This means that within the data there are features that do not fully comply with the current OS MasterMap real-world object catalogue. For example, Ordnance Survey historically captured all buildings greater then 8.0 m² in private gardens. This minimum size was increased to 12.0 m² in 1988. Buildings now considered undersized, but captured before that date, could remain in the data.

Ordnance Survey assesses the quality of Land Line and OS MasterMap data by five quantifiable components:

- completeness;
- positional accuracy;
- temporal accuracy;
- logical consistency; and
- attribute accuracy.

Within the OS MasterMap User Guide the various layers of data (e.g. topography, Integrated Transport, Imagery etc) are described according to these criteria, with some exceptions.

Each component is described by the following parameters.

- definition - the description of the particular quality parameter,
- measurables - the set of one or more measures against which the parameter is assessed;
- conformity - the limiting value for each measure that any metric is not expected to exceed;
- correction - the protocol for correcting non-conformance;
- improvement - the protocol for improving data that is within the limiting values.

Going through these quantifiable components of quality in turn:

Completeness

This is a measure of the correspondence between the real world and the specified data content. In other words, data represents the real world and certain real world objects are included in the mapping representation of the real world – some aren't. Completeness is a measure of how much of the real world is represented in data form in a standard, catalogued manner. At initial digitising stage, all Land-Line tiles were rigorously checked to ensure that no features included on the source map were omitted with reference to the product specification. Subsequent revision of the Land-Line tiles included local quality control procedures to ensure that all captured data conformed to the current specifications. Data 'cleaning and enhancement' processes have also been carried out to enhance the geometric fidelity of the data, e.g. closing 'closed' polygons, removing 'spikes' and redundant points in the data.

According to the latest OS MasterMap User Guide completeness is a measure of the correspondence between the real world and the specified data content for OS MasterMap as reflected in the OS MasterMap real-world object catalogue. The User Guide specifies how completeness is measured – e.g. measurables / omissions, and describes how Ordnance Survey manages this measure - by monitoring the data to ensure that only features representing real objects in the OS MasterMap real-world object catalogue are captured as part of revision and that features representing no longer extant real-world objects are deleted. Ordnance Survey does not capture metrics on completeness because of the difficulty in establishing numerical baselines for the real world and the data. Capture of change is described under Temporal consistency.

Positional accuracy

Positional accuracy has three main components: geometric fidelity, relative accuracy and absolute accuracy.

Geometric fidelity / accuracy

Geometric fidelity is the trueness of features to the shapes and alignments of the real-world objects they represent. Normally geometric fidelity takes priority over relative and absolute accuracy. This is measured by the degree to which:

- detail that is square on the ground is represented as square in the data, and shapes must be accurate;
- alignments that are straight in the real world are represented as straight lines within the data;
- lines of sight that pass through ground points should, when plotted at the scale of the original survey, pass through the plan positions of the corresponding points; and
- adjacent features are in sympathy with each other as regards alignment and orientation.

The test for geometric fidelity for OS MasterMap is defined by Ordnance Survey as being applicable when data is plotted or displayed at the source scale of the mapping from which the data was originally digitised (see Lineage). It reflects the real-world object(s') geometry.

The following figures, reproduced from the current Ordnance Survey Land-Line User Guide show two representations of the same features.

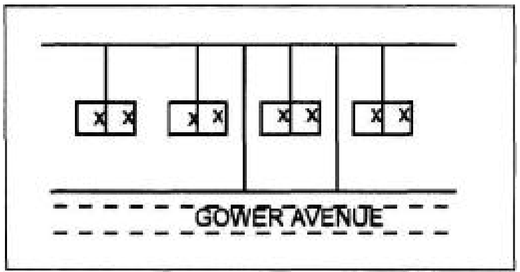

Fig 1. This is a true representation of the real world. It shows how the features look in reality – with one straight back fence and a number of parallel house divisions and boundaries.

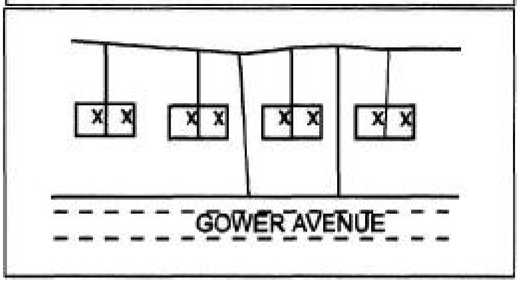

Fig 2. This depiction may meet the relative and absolute accuracy requirement level but does not meet the accuracy of shape criteria. The guideline is that map detail must form a cartographically acceptable representation of real-world detail when plotted or displayed at a scale no larger than the source survey scale.

There is a danger here however, because the map shown in Fig 1 is how we expect to see features. Particularly in new developments, features tend to be parallel and divide buildings equally. Digitising software can use these characteristics to automatically divide buildings and generate 90° angles, for example – but this might not be the case in reality!

Relative accuracy

Relative accuracy is a measure of the positional consistency of a data point in relation to other local points of detail. Relative accuracy compares the scaled distance between features measured from the map data with distances measured between features on the ground.

Ordnance Survey is continually sampling data and testing the accuracy of well defined points of detail. Random samples are taken in different geographical areas for the various source survey scales and survey methods. The aggregated average results of this testing over the last 40 years show:

Scale	Relative error	95% confidence limit	99% confidence limit	Maximum measured distance
1:1250 (urban)	< ± 0.4 m	< ± 0.8 m	< ± 1.0 m	60.0 m
1:2500 resurvey or reformed (urban and rural)	< ± 0.9 m	< ± 1.8 m	< ± 2.3 m	100.0 m
1:2500 overhaul (urban and rural)	<± 1.2 m	< ± 2.3 m	< ± 3.0 m	200.0 m
1:10 000 (mountain and moorland)	< ± 3.5 m	< ± 6.7 m	< ± 8.8 m	500.0 m

NOTE: Certain types of feature such as public road network lines, vegetation and landform limits, tide lines and underground features are surveyed to a lesser degree of accuracy due to the nature of the feature..

The relative accuracy criteria are best understood by using some examples:

Map Type	Criteria
Land-Line urban map (1:1250 source scale and some large rural towns at 1:2500 source scale)	If the distances between two well defined points of detail 60.0 m apart were measured in the real world, there would be an expectation that 95% would be represented in Land-Line by a scaled distance of between 59.2 m and 60.8 m.
Land-Line rural map (1:2500 source scale) - resurvey or reformed survey methods	If the distances between two well defined points of detail 100.0 m apart were measured in the real world, there would be an expectation that 95% would be represented in Land-Line by a scaled distance of between 98.2 m and 101.8 m.
Land-Line rural map (1:2500 source scale) overhaul survey method	If the distances between two well defined points of detail 200.0 m apart were measured in the real world, there would be an expectation that 95% would be represented in Land-Line by a scaled distance of between 197.7 m and 202.3 m.
Land-Line mountain and moorland map (1:10 000 source scale)	If the distances between two well defined points of detail 500.0 m apart were measured in the real world, there would be an expectation that 95% would be represented in Land-Line by a scaled

	distance of between 493.3 m and 506.7 m.

Absolute accuracy

Absolute accuracy is a measure that indicates how closely the coordinates of a point in the dataset agree with the true coordinates of the same point on the ground in the British National Grid reference system. It is measured by comparing the position recorded in the data and the true position of the feature on the ground. Coordinates in different reference systems can only be compared when the necessary transformation parameters to convert between the two systems are known to a certain level of precision. Ordnance Survey Land-Line is provided in the National Grid coordinate reference system, which is defined by the OSGB36® triangulation. Comparison with coordinates given by GPS, which are in the WGS84 system, must take into account the necessary differences between the two reference systems. This issue is discussed further in the section “Ordnance Survey – Current Issues”, under the section describing GPS. Ordnance Survey statistics for absolute accuracy refer only to the National Grid. Ordnance Survey is continually sampling data and testing the accuracy of well defined points of detail. Random samples are taken in different geographical areas for the various source survey scales and survey methods. The aggregated average results of this testing over the last 40 years show:

Scale	RMSE*	95% confidence level	99% confidence level
1:1250 (urban)	< ± 0.5 m	< ± 0.8 m	<± 1.0 m
1:2500 (rural) (resurvey or reformed)	<± 1.1 m	<± 1.9 m	< ± 2.4 m
1:2500 (rural)	< ± 2.8 m	< ± 4.8 m	< ± 6.0 m
1:10 000 (mountain and moorland)	< ±4.1 m	<±7.1 m	< ± 8.8 m

* RMSE (root mean squared error) is the square root of the mean of the sum of the squares of the errors between the observations.

NOTE: Certain types of feature, for example, public road centrelines, underground features, and vegetation and land form limits, are surveyed to a lesser degree of accuracy..

<u>It is also important to note that that the positional accuracy improvement programme will cause this table will change. The 1:2500 rural accuracy level (±2.8 m) will not exist by the end of the programme as most rural mapping will meet the resurvey/reformed accuracy level (±1.1 m). There will be an addition to the table of 1:2500 selected rural towns which will have an accuracy of ±0.4m.</u>

Temporal Accuracy

Within the OS MasterMap User Guide the two components of temporal accuracy (this can be thought of as its "up to dateness") are described as consistency and validity:

- Temporal consistency – not really significant until the release of OS MasterMap in which objects are given attributes to show dates. Temporal consistency shows how time related events are recorded. For example TOID (Topographic Identifier – the unique id for each map object) version numbers for change-only update will only increase with time for updated features, TOID version dates for change-only update will only increase with time for updated features, and version dates and history dates will relate to the date of update.
- Temporal validity - is defined as the amount of real-world change that has been incorporated into OS MasterMap data that is scheduled for capture under current specifications - the amount of real-world change that has been incorporated into OS MasterMap within the published timescales. This is slightly more complex than at first seems apparent – map features are categorised by Ordnance Survey according to their importance, and according to the scale at which they are captured - both affect how frequently the change is updated.

The capture of real-world change is seen as such an important aspect of Ordnance Survey's performance that it has become one of its key performance targets – in 2003 a figure of 99.6% of significant real-world features was set as a target for being represented in the national topographic database within six months of completion. In other words as new features become added to the GB landscape – houses, roads etc, 99.6% of them should be added to the Ordnance Survey National Topographic Database within 6 months of their completion.

This target refers to "*known category A change*" (types of map feature are categorised according to their perceived importance to the map user – see the list later in this section). Category A change, for example new housing and roads, will be captured and made available as Land Line / OS MasterMap data within six months of the change occurring, subject to the following:

- isolated houses, traffic-calming measures and mobile/park homes will only need to meet this requirement once an area has been subject to a national sweep, unless they form an integral part of a new development.
- for the rural and moorland areas yet to undergo any form of cyclic revision, only category A change exceeding one hectare in extent, or one km for linear features, will be captured.

The Ordnance Survey Land Line User Guide describes temporal validity under the heading of "currency" - a category it uses to identify how up to date the Land-Line data is. The timescales for surveying and for incorporating change into Land-Line (and OS MasterMap) products are derived from assessing different categories of real-world features and whether the change occurs in areas described as urban, rural or mountain and moorland. The policy for revision of Ordnance Survey basic scales is a significant factor affecting currency and is explained further later in this section – under Ordnance Survey revision policy for basic scale products".

Ordnance Survey clearly sees the currency of its data as a key issue for its customers – and recognises this importance by making it one of its key performance targets. It is continually seeking to improve currency, and is now using developers' plans to make pre-build information available at the earliest opportunity. This will be discussed later in the course notes.

Logical Consistency

The logical consistency of Ordnance Survey Land-Line is a measure of how well the tiles supplied match the specification laid down, regardless of the content. This covers the logic within the data and the syntax of the files supplied. The data is checked for conformance to the specification laid down in the user guide to ensure that syntax, referential integrity and feature code ranges are correct. No variation against the specification is permitted. However, the specification itself may allow for some variation in the way that particular features are represented. Land-Line is usually distributed in either BS 7567 (NTF v2.0, Level 2) transfer format or DXF (AutoCAD release 12 compatible) format. All Land-Line data created and supplied by Ordnance Survey undergoes rigorous testing by software to ensure that the syntax of the files supplied conforms entirely to that defined for the format. It is important to remember that the checks performed by Ordnance Survey test how well the data conforms logically to the specifications of these formats - not the actual content. Files are tested to ensure that valid data is present within the file.

The logical consistency of OS MasterMap is again a measure of how well the data supplied matches the specification. The data is checked for conformance to the specification laid down in the user guide. As with Land Line, the checks performed by Ordnance Survey test how well the data conforms logically to the specifications, not the content. The OS MasterMap logical consistency components are fully checked by software, but Ordnance Survey acknowledges that there are some inconsistencies. There are four components of logical consistency that can be measured against the current OS MasterMap specifications:

- conceptual - the data maintenance rules in the overview and life cycle specifications. The life cycle of a feature is a subjective measure relying on the interpretation of those updating the data. Ordnance Survey is testing revision activity and will publish metrics when they become available;
- value domains - the values given in the attribute and classification specification. Ordnance Survey state that for OS MasterMap 100% will meet the specification;
- physical structure - of the stored and delivered datasets - the database schema and GML formats. Ordnance Survey state that for OS MasterMap 100% will be valid as per the specification;
- topologlcal - the explicit topological references between features - the values given in the geometry and topology specification. Ordnance Survey state that for OS MasterMap 100% will be valid as per the specification.

Attribute Accuracy

Attribute accuracy measures the correct interpretation and representation of the metadata elements within the data structures (i.e that the correct value of an attribute has been recorded). For example, attribute accuracy will identify that all buildings which should be feature code 0001 have the correct feature code, and that feature code 0001 has not been applied to a feature that it should not apply to. In the case of OS MasterMap attribute accuracy is used to describe how accurately the attributes within OS MasterMap record the information about a real-world object.
The three components of attribute accuracy that can be measured (for OS MasterMap) are:

- Feature descriptive groups and descriptive terms - do they correctly represent the attributes of the real-world objects?
- Change through time attributes – do they correctly reflect the reasons for change of OS MasterMap features?
- CartographicText - does it correctly represent the real-world object that it refers to via an OS MasterMap feature?

Accuracy is dependent on a number of factors. The area concerned – urban, rural, and mountain/moorland, and the type of features (categories) can dictate the data capture methods employed and so the resultant accuracy which can be expected.

Ordnance Survey revision policy for basic scale products

Ordnance Survey's policy for updating its large-scale data, and therefore its basic scale products has been a constantly changing one as national policy, corporate policy, and technology have changed. Currently, the products directly affected by the revision policy are OS MasterMap™, Land-Line®, Superplan® and Siteplan®. Revision activity is split into two processes: continuous revision and cyclic revision:

- Continuous revision is undertaken for those features of most importance to the majority of customers - mainly urban developments - or where capture is in the national interest. Ordnance Survey aims to capture these features within six months of building being completed on the ground. As already mentioned, pre-build data (Pre-BuiW™) is also available for some sites, giving customers advance plans of developments before they are built.
- Cyclic revision is undertaken periodically for changes to the natural environment, which tend to be slower and less evident than additions to the built environment. Capture can be most economically achieved using systematic revision at fixed intervals, typically through aerial photography. Great Britain is subject to a National sweep programme for revision of category B change. In urban and rural areas the target for completion of this cycle is five years, and ten years in moorland areas. This is undertaken using primarily photogrammetric survey methods. The National sweep aims to collect any remaining category A change and at least 85% of category B change. When the National sweep is completed it will be followed by a policy of continuous revision of rural and remote areas. In September 2003 only approximately 1.5% of rural areas had not been revised under the first cycle of the National Sweep programme, this is scheduled for completion in 2004.

Revision applies to areas classified as:

- urban - all areas covered by 1:1250 scale mapping, and other areas of development greater than 20 hectares on 1:2500 scale mapping and having a population greater than 1 000 at the 1991 census;
- rural - all areas covered by 1:2500 scale mapping which are not classified as urban; and
- mountain and moorland - all areas covered by 1:10 000 basic scale mapping, that is those remote parts of GB not supplied at 1:1250 or 1:2500 scales.

Priorities when capturing new detail are based on the following categories:

Category A - Change captured as part of a continuous revision process within six months of completion.

This includes those features of significant business benefit to customers where information about change is essential. All change within category A will be captured within six months of construction:

- housing and associated features, including demolition but excluding extensions to private dwellings (isolated houses are currently exempt but Ordnance Survey will capture within three months if notified by a customer);

- commercial, industrial, community and public sector buildings and associated features, including extensions to existing buildings greater than 0.25 ha and any demolitions;
- communications networks (roads - including carriageway alterations due to traffic calming schemes - railways, airports, transmission lines and so on) and associated features, including demolition;
- distinctive names associated with the above;
- major coastal defences designed to reduce the risk of flooding; and
- property boundary fences forming part of major refurbishment programmes and which make a significant impact on map data.

Within the last two years additional detail has been included in this category, reflecting modern features that have become increasingly significant to Ordnance Survey customers:

- major non-coastal defences designed to reduce the risk of flooding*;
- traffic-calming measures*; and
- permanent mobile or park homes with postal addresses*.

*New features of these types have been captured from November 2002. The aim has been to complete any retrospective capture by April 2004 for mobile homes and by April 2005 for traffic calming and non-coastal flood defences.

Category B - Change captured as part of a cyclic revision process known as *national sweep*

This will include features of important business benefit to Ordnance Survey customers, but of a lower priority than the elements included in category A. All detail within this category will be captured as part of a national sweep programme. The current target for completion of the national sweep is five years in rural areas and ten years in moorland areas, and includes:

- agricultural and horticultural buildings;
- quarries and other surface workings;
- field boundaries;
- water features (ponds, lakes and similar; rivers; canals; landing stages and jetties);
- forestry and other vegetation;
- tracks and paths;
- extensions to commercial, industrial, community and public sector buildings less than 0.25 ha in extent;
- apparent property boundary features not in category A, that is, those erected since the initial development and not part of refurbishment programmes;

- mean high and low water when affected by change to other features in category A and B; and
- significant changes to tidelines - when evident either from photography used in the national sweep programme or when highlighted by a customer - will be incorporated into OS data within twelve months.

Category C - This will include features that currently have a low business benefit for customers

These features will remain within the National Topographic Database specification and will therefore continue to be visible to customers, but changes will not be captured. Changes to the following detail will be captured as necessary to complete any revision of categories A and B:

- extensions to existing private residential buildings;
- private garages;
- street furniture such as guide posts, mile stones and water taps; and
- archaeological information*.

* Ordnance Survey has been investigating ways of updating archaeological features in consultation with the relevant bodies.

Data will be updated by Ordnance Survey according to revision policy which takes into account the change category and the type of area. This can be summarised as:

Change Category	Area classification	Revision category	Revision period
A	Urban and rural	Continuous	6 months
A	Mountain and moorland	Continuous	6 months
B	Rural	Cyclic	5 years
B	Mountain and moorland	Cyclic	10 years
C	Urban, rural, and mountain and moorland	Continuous and cyclic	Only revised when required for sensible cat A and B completion

Revision controlled by Graphic Survey

Ordnance Survey staff still use graphic survey for a considerable amount of data capture. Data is input directly into field data computers (PRISM) in which bespoke software provides graphic functions to construct and store the new data. The process of graphic survey can only position new detail with respect to existing detail. Therefore, the process can only control the relative accuracy of the final map. Absolute accuracy is controlled by GPS and/or instrumental detail survey (IDS) processes. It is essential therefore, if absolute accuracy is to be maintained, that positions provided by IDS and GPS are not changed. In cases where this is thought to be necessary Ordnance Surveyor field surveyors will contact specialist Geodetic Surveys & Computations staff to ensure that more serious survey control problems do not exist in that area. Overall, within the area of revision, all features must be in sympathy with each other as regards alignment, distance apart and orientation. The completed revision should fall within the following tolerances to ensure that the required quality standards are achieved.

Maximum permitted tolerances between measured and scaled distances

1:1250	Resurvey and subsequent revision	up to 60 m then >60 m	0.2 m 1:1000
1:2500	Resurvey and subsequent NG-controlled revision	up to 100m then >100m	0.5m 1:1000
1:2500	Overhaul and subsequent NG-controlled revision	up to 50m then 50m-200m then >200m	0.5m 1:150 1:850
1:2500	Overhaul and subsequent uncontrolle revision	up to 50m then 50m-200m then >200m	0.5m 1:100 1:700
1:10000	Resurvey and subsequent revision	up to 1400 m then >1400 m	4.0m 1:1500

NOTE: These tolerances are cumulative. For example revision of 1:2500 resurvey distance measured = 800 m maximum permitted tolerance = [(800 m -100 m) x (1:1000)] + 0.5m = 1.2m.

Specification

Positional accuracy of a feature can be effected by the rules that are applied to the survey. To add to the clarity of the map some features are enlarged to a minimum size, others are omitted if too small and some are generalised. It follows therefore that there are a set of features which are not show in true position due to one or more rules, and cannot be relied upon to take measurements from.

Methods of Survey

One of the biggest influences in achieving accuracy standards is in the method of survey. For many years Ordnance Survey followed a convention that no piece of work would be published without some form of examination. Today the surveyors are solely responsible for their own work, and what is surveyed one day can be available to a user the following day, with no external check other than software validation. It is likely that the chance of introducing error into the data has increased through this lack of examination. Increasingly survey is completed by remote methods, principally by plotting from aerial photography. To ensure that accurate results are achieved by this method, there needs to be strict controls in place to monitor the photo model set up, the plotting methods, and the interpretation of the operator. In best practice a field check would be applied to ensure the ground reflects the map representation.

As programmes become bigger and resources more stretched, it has been estimated that perhaps 5% of the recent rural revision has been field examined for anything other than completeness. The aim in aerial survey is to capture on average 85% of the detail, and only show that which can be taken to a logical conclusion. This may lead to inferring survey detail in order to achieve the statistical threshold. Added to this, accuracy may not be the concern of some users as they use the map as a planning tool, rather than for survey.

In many ways the methods of survey currently used are superior to those used in the original survey, particularly with the introduction of direct survey digitising, and the emergence of GPS. Used wisely these can and do enhance the data which form the current map, but the skill required to make proper use of these tools needs to be understood and practised if the results are to reflect the desired standards.

All mapping represents a snapshot of what exists on the ground at the time of survey, and depicts detail that is within the rules, and meets the revision policy at that time. Maintaining a map is an important process in user perception of the map, and if the user is to have confidence in the information provided. Of course all users have different requirements but, as already stated, currency is for most a key factor in assessing the usefulness of the map. In the past, particularly in rural areas and moorland areas full revisions have been infrequent, and inconsistent.
Ordnance Survey revision is now based on a set of criteria, either the amount of change, or by time. The revision process is also determined by categories of change as seen earlier in this section. In exceptional circumstances, revision may be completed due to sub-standard accuracy in specific areas, or through user request. The two main types of revision that Ordnance Survey currently uses, continuous and cyclic, have also been described earlier in this section. Added to these principal methods we can add re-survey and ad hoc revision.

Re-survey
Whilst not part of the revision policy, re-survey may in fact provide a full revision of an area, not necessarily a full map at an enlarged scale, and if completed by aerial survey, may include other categories of change outside the normal criteria.

Ad Hoc revision
It is sometimes the case that a change in Government policy will see a full revision of particular areas that don't fall under any of the above criteria. This happened a few

years ago with the de-classification of security sensitive sites, previously unmapped on the basic scales. Other ad hoc revisions may also occur through the incorporation of surveys commissioned and completed for clients under contract.

Data Quality - Maps and Plans fit for purpose

Ordnance Survey large scale maps represents real world features that exist at ground level at the time of survey, and depict general boundaries. They do not attempt to depict property ownership boundaries, although in many cases these boundaries may coincide. For example the hedge depicted on the map may have been planted on a bank, dug from the ditch which forms the property boundary. The ditch may over time disappear, and the hedge may become overgrown. The surveyor will show the features evident at the time of survey, to the specification current at that time. The resulting fine line on the map, depicting the root of hedge, bears little resemblance to the rambling feature as seen on the ground, and is not the actual property boundary. A map user has to know that the measurement from point to point on the map may not necessarily be representative of what can be physically measured on the ground. Depending on the type of feature, precise measurement may not be achievable.

Ordnance Survey surveys do not attempt to be a cadastre (legal property survey), and therefore a great deal of the detail has not been fixed by instrumentation, but supplied graphically relative to the original framework of map detail. The aim of the surveyor is to produce a consistent map using a framework of control within acceptable limits of error. All maps contain error, be it relative to other detail or in absolute position. The aim is to reduce these errors to acceptable limits, and to eliminate gross error, i.e. that outside the stated limits. Great effort has been made throughout the history of Ordnance Survey to maintain high levels of quality, but no method, policy of individual can ensure that a map is error free.

Perception and user expectations are important factors when assessing the quality of a map. The user must be satisfied that the map is fit for the purpose it is to be used for, i.e. that the detail and specification meet these needs, and that the published standards of accuracy will meet the rigour of the application. The user also has to know the rules of the map, to be able to interpret the conventions, depiction and rules employed by the cartographers. When all this is understood, the quality of a map can be understood, and assessed.

In the case of land registration there will be many occasions where the Ordnance Survey map does not agree with the deed plan supplied. This can be for many reasons, which will be discussed during the Introduction to Survey Practice course. Some of these reasons are concerned with the specification of the map, some result from scale differences, and some from limitations of the data capture method.

The information in this section will give the reader a good understanding of what to expect from Ordnance Survey large scale map data – and what not to expect. This, combined with the information in the other sections of this reference guide should help to build up a comprehensive picture of how Ordnance Survey data has been derived, and what can be reasonably expected of it when it is applied to land registration work.

Key points from this section

- Ordnance Survey large scales data is generally of high quality, although the definition of quality depends on the user, and the purpose for which the data is being used;

- The data is described by Ordnance Survey in the user guides, according to its lineage – its history, and the following definitions of quality:
  - completeness;
  - positional accuracy;
  - temporal accuracy;
  - logical consistency; and
  - attribute accuracy.

- Each of these is defined, and then Ordnance Survey describes how each item can be measured, the limits within which each item must remain to conform to the standard, how the items will be corrected if they fall outside of the normal parameters, and methods for improvement;

- Features are categorised by Ordnance Survey according to their perceived importance to map users;

- Ordnance Survey maintains its data by continuous revision for items of major importance and by cyclic revision at regular intervals for the rest;

- Most "small areas of "infill" survey will be done by graphic survey – in which it is impossible to improve on the accuracy of the existing surrounding data. Large rural areas will be "swept" by photogrammetric means – not all areas will have a thorough field check;