



Section 6: Potential Problems in the use of OS mapping

Registration Survey Case Examples

Introduction

This section will list the main problems encountered when comparing deed plans and Ordnance Survey maps, and try to explain the most common reasons behind the difference. A better understanding of how the map data was derived will make these apparent anomalies much clearer. Some differences might just be due to the Ordnance Survey map and the deed plan being drawn at different times – both were right when they were compiled but they are showing the same thing at different snapshots of time. Some differences are due to the specifications used to compile the Ordnance Survey map and the deed plan. The deed plan might have been drawn to 1:500 scale and shows a lot of intricate detail; the Ordnance Survey map might have been drawn at 1:2500 scale, omits features under a certain size altogether, and has some features generalised. Most map users have problems learning the cartographic rules and interpreting the detail depicted on different maps. Once aware of what these rules are and how detail is depicted, acquiring the skill of interpretation becomes much easier.

Real Errors

First of all, is it really an error? or does the specification require the feature to be shown in a particular way? Is a feature omitted or is it not shown due to its size or character? Is the planimetric position in error or is it within the accepted tolerance levels for the scale of survey? Is the shape of the building really different or is it that the juts and recesses are not large enough to show? Is the feature shown the one you think it is or are there parallel features that have been generalised for clarity?

We need to consider all of these questions before judging the representation provided by the map of the real world. In some cases there are errors, as no surveyor can complete work that is error free. Many of the errors on a map owe more to history than current poor survey practice, and are a legacy that has yet to be resolved. Identifying errors in the past has been difficult; putting them right has been an even greater challenge, as it often requires moving large areas of existing detail to achieve consistency. Increasingly new technology is showing the limitations of the basic rural maps, and there is a continual review of accuracy in light of new findings. However, shifting data is understandably not popular, particularly with existing users who have based their own records on an established base map assumed to be accurate. In most cases, if errors are identified, Ordnance Survey will try to resolve them, ensuring that the best interest of most users is satisfied. Other more extensive problems in the mapping may need more long term and radical solutions, such as



resurvey or reforming. It is likely that, on occasion, examples of poor drawing by the OS will be discovered by RoS caseworkers. Any such examples should be referred to the MBM manager. The MBM manager will correspond with Ordnance Survey with a view to resolving the problem. It is possible that, although the drawing is poor, it might fall within Ordnance Survey's published tolerances, particularly at 1/2500 mapping.

Historical background

Remember (from the introduction section – Ordnance Survey, Background Information) that around 70% of Ordnance Survey mapping covers rural areas at 1:2500 and that the source of a great deal of that mapping goes back to the “overhauled” County Series mapping and may have a long history of errors introduced over decades of scale changes, reformatting, distortion of materials, replotting, and digitising. Considering this, one should immediately be cautious if dealing with rural mapping (and mountain/moorland), unless it is known to be from a recent re-survey. Even then there are points that users need to be wary of, as discussed below.

Positional Accuracy

The issue of positional accuracy improvement (PAI) is currently a key one for Ordnance Survey and its customers. It is dealt with more thoroughly later in this reference guide under "Ordnance Survey, current issues". Ordnance Survey is currently embarked upon a programme of positional accuracy improvement to bring all geographic areas of Great Britain up to a consistently higher level of mapping accuracy. The reasons for undertaking such a programme are that the majority of 1:2500 scale mapping, as seen in the historical background section of this reference guide, is based on overhaul mapping from the 1950s. The overhaul process took the existing County Series mapping, each based on an individual projection, and converted it to the National Grid. There were limitations in that conversion process that resulted in $\pm 2.8\text{m}$ RMSE absolute accuracy. However, the relative accuracy of features (distances between features close to each other) was very good, $\pm 1.2\text{m}$ RMSE, and was deemed acceptable.

Since the overhaul process has been completed PAI has happened on a local level whenever new map detail has been incorporated. But with the advent of new technology such as GIS and GPS, and customers integrating their data with Ordnance Survey data, it was recognised that it was no longer right for Ordnance Survey to supply discreet pockets of data which had been "shifted" to fit in new developments without informing its customers. A further complication is that the shift in co-ordinates of the re-positioned data is not systematic - it could vary in size and direction. With both Ordnance Survey and the GI community embracing and using advances in data capture technology, there is increased demand for a more homogenous and improved accuracy across all of Great Britain.



Both Ordnance Survey and its customers were aware of the accuracy limitations of the overhaul mapping, and regular consultation confirmed that both Ordnance Survey and its customers would benefit from improving accuracy levels. After seven consultation and information papers (1997-2000) and a PAI seminar held in February 2000 there was consensus that a national programme of PAI in areas mapped at 1:2500 scale should proceed. The need was recognised in the context of:

- ensuring that Ordnance Survey large scale map data was future proofed to accommodate ongoing development and change;
- providing higher-quality data to customers; and
- providing better relationships with customers' GPS-positioned assets.

The conclusions were that Ordnance Survey should:

- publish a national programme of PAI activity to provide customers with details of when, where and how the changes will be implemented;
- complete PAI in one pass per 1km by 1km area. PAI activities must not introduce any new errors in content detail.

This sounds very good, but what is the impact on RoS? Ordnance Survey readjusts the position of the map detail to its 'true' national grid position. As mentioned above however, the shift is often random, rather than, say, the position of all the features moving 2m to the north. Ordnance Survey informs MBM of the affected areas and map tiles and the proposed time scale for the re-survey of the area. (aerial photography is likely to be used). When MBM receive the revised map tiles for an area/town, it is likely that updating the affected Titles/Indexes will be treated as a project. MBM will liaise with the relevant production area to discuss the best options to ensure that any disruption is kept to a minimum.

Dates of Revision

Do the Ordnance Survey map and the deed plan share similar dates of survey? Depending on the difference in date they may depict quite different versions of the same area. The date of revision for an Ordnance Survey map may tell the user when it was last updated, but does not define which individual features were updated at that revision (this will be the case with OS MasterMap however in which individual features have specific attributes that include data of revision). In Land-Line data it may have been that Address-Point seeds were added or a name was changed, rather than new detail survey having taken place. On past maps, unless there was a full revision of all detail, it is likely that a proportion of the map will not reflect all the change evident at that time. The current rural revision process, for example, will endeavour to revise all buildings and roads, but may not include all the current property or field boundaries, names and vegetation change. In continuous revision areas, unless associated to the new detail, no change is being recorded to existing



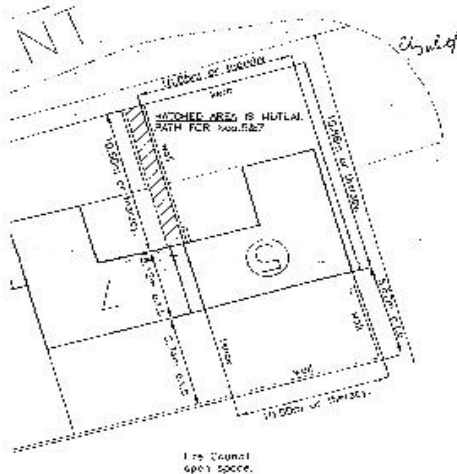
property boundaries, unless these are part of an organised programme of property division changes, mainly in urban housing estates.

Another significant point relating to the date of the Ordnance Survey map revision is the affect of specification changes. These happen rarely fortunately but need to be born in mind. As described already permanent buildings and other objects whose plan outline covers an area of 8 m² or more are shown, unless they are within a private garden, when the minimum criteria is 12 m². This is a change of rule dating from the late 1980's though; before this time buildings over 8 m² were shown in private gardens. Change of specification also accounts for some anomalies in minimum size for juts and porches – currently 2m at 1:10,000 but this has been 5.0m in the past. Another example is the capture of mobile or park homes that are permanent, residential and have a postal address. These are relatively recent additions to the specification, and although they are being retrospectively captured, it is unlikely that there will be national coverage of such features for another 5 years or so (i.e. 2009). These examples can lead to some confusing inconsistencies - even within the same map.

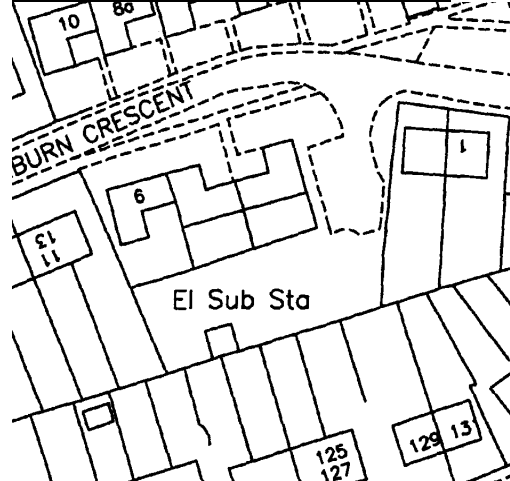
Specification

Generalisation and minimum sizes - It is important to be aware that some features, for example parallel features, will be generalised due to scale and minimum size rules. Measurement from these features may not give accurate results.

Deed Plan – 1:200



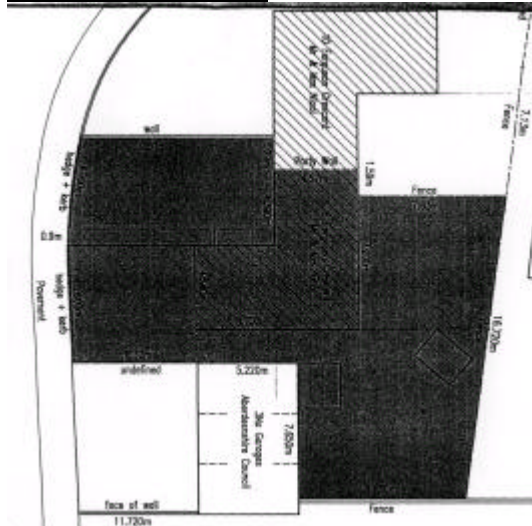
Ordnance Survey Map – 1:2500



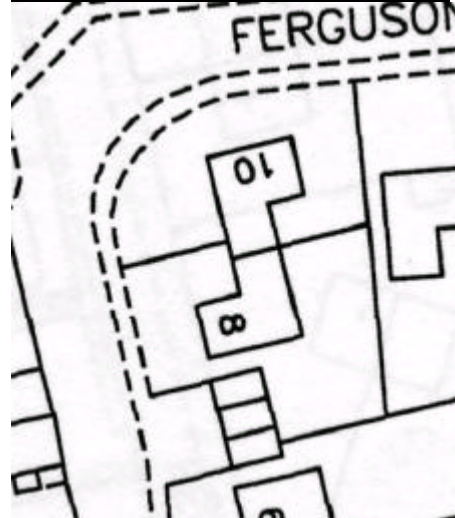
In the example above the deed plan (left) shows an area of shared path (hatched) to the front of the properties N°5 and N°7 Lynburn Crescent. It also shows a pend between the properties, which scales about 1.0m width. This is below minimum size for the 1:2500 Ordnance Survey map. The dividing features appear to have been generalised on the Ordnance Survey map to show a simple single dividing

line, and no shared path.

Deed Plan – 1:200



Ordnance Survey Map – 1:2500



Unfortunately the deed plan image above is not very clear, but in this example a jut (change of boundary direction) is not shown at the rear of N°8 Ferguson Crescent on the Ordnance Survey map (right), but the one at the front is. According to the deed plan the features are offset from the central dividing wall by 1.59m and 1.29m respectively. The minimum distance for separating features at 1:2500 is 2.0m and so there is just too much to show in the space available - the resulting generalisation has created the inconsistency. In this case the solution was found by inspecting the deeds to the adjoining property and confirming the deed plan measurements.

Boundary features.

The Ordnance Survey map shows topographic features – it does not attempt to show the property boundary, although in many cases these will be the same. The topographic features used by the owner to show the extent of a property, e.g. fence, wall, hedge, may be out of date, have moved or be intentionally positioned within the true extent of the property to allow for maintenance. Some property boundaries are defined by water features. These of course move! and if near the coast may be tidal. For example, how do you define the precise line of Mean High Water Ordinary Spring Tide on the river Forth that is tidal to Stirling? How do you register a property that is defined to this variable line - one that is not bounded by any other permanent general line feature? For Ordnance Survey this is quite a problem and clearly involves careful timing and often the use of infra-red aerial photography. Understanding the difficulties related to this particular type of boundary will help



avoid some of the potential problems that are likely to arise in this type of case work.

Hierarchy of features

Remember that there is a hierarchy for features; where a fence, hedge or wall runs approximately parallel to another feature and so close that they cannot both be plotted correctly at scale of survey then only one feature is surveyed. In determining which feature to include, the following hierarchy is used by the surveyor:

1. include if the feature is used to mere an administrative boundary;
2. include if the feature *appears* to define the extent of a property;
3. include if the feature appears more important, for example, a hedge next to a cattle protection fence, show the hedge.

Building divisions

These are only shown where there is a different construction, or the division is evident from ground to roof and can be surveyed from the outside. This means, for example, that shops at ground level will not be divided, as the division does not extend to the floors above. In many cases, no attempt is made to show a division, as it cannot be guaranteed to extend from ground level to roof level. If you were to walk any High Street with an Ordnance Survey map, you are almost certain to question what is really been shown in many cases, and the value to the more demanding user. It is worth remembering the basic principles of the specification however before being too critical of the standard of the map.

Ommissions

Remember that not everything is shown on the map, not all detail is shown if it does not meet the minimum size rule for example (e.g. permanent buildings under 8 m², or under 12 m² in private gardens; driveways under 100m in private gardens). Conversely if of significant importance and to be consistent, some features will be shown larger to meet the minimum size criteria. For example smaller buildings and objects covering an area of 4 m² or more and whose smallest dimension is 1 m or more are shown when they are in such a detached position as to be a relatively important topographical feature and features are shown regardless of size when used to identify the alignment of or mere an administrative boundary or as a site for a bench mark.

Justs¹ and recesses

The ability to survey juts and recesses depends on their minimum size, method of survey and whether the jut forms an obstruction or the corner of the building.

¹ Beware of differences in terminology used by RoS / Ordnance Survey. In RoS a jut is a change in direction of a boundary feature. For Ordnance Survey a jut is a projection from the main building line of a building – for example a bay window.



Roof projections

The ability to capture detail at ground surface level is more difficult when aerial photography is used as the principle means of data capture. In areas of “over throw” (where the angle of photography is such that ground surface level cannot be seen) only the roof line may be seen. Awareness of this limitation and the subsequent differences in building size, compared to ground survey, may be important – although well within stated tolerance there may be inconsistency and differences between the distances on the ground and those scaled from the map.

Naming Conventions.

Names are a continuing point of discussion; the spelling, authorisation and revision are all factors in the debate. Whilst every care is usually taken in their collection, errors in spelling do occur, but the biggest introduction of error was seen during initial digitisation, where all the names were copied in a rapid programme of conversion. Unfortunately this was a great opportunity for further mis-spelling to occur. This is perhaps a frustration rather than a major issue, and can quickly be rectified without great impact on the users. Scottish names and Gaelic names are particularly prone to debate, and because most of the surveyors do not understand the meaning, they are prone to some more obvious errors. For example, how many house names do you know that when translated mean, “beware of the dog”, “no parking” or “please shut the gate”.

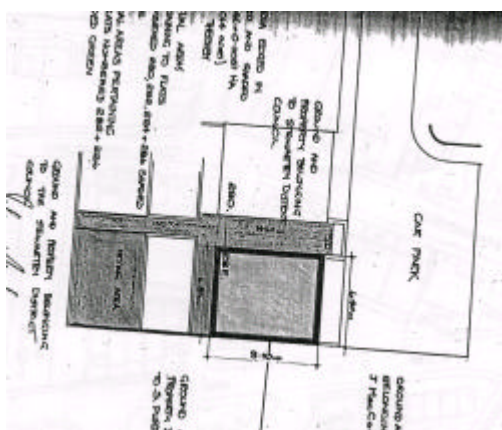
Vegetation

No vegetation will be shown in private gardens unless it is a continuous feature. Also the minimum size rules may mean that small strips of shelter belt, and areas in the corners of fields where there are clearly trees planted and fenced, may not be shown. Reliance on measurements from indefinite extents of vegetation should be treated with caution.

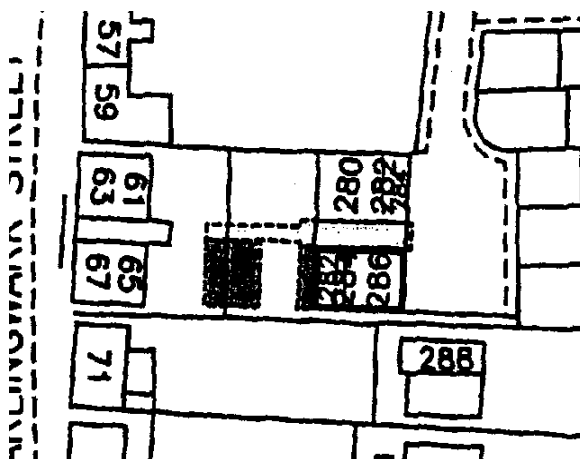
Natural Relief - Slope

The lack of natural relief on an Ordnance Survey map can give a user, unfamiliar with the area, a fairly false understanding of the area, with no appreciation of the difficulties of the terrain and its survey. The difficulty of surveying detail on steeply sloping wooded sites for example provides an excellent opportunity for error to be introduced. On submitted deed plans that have been ground measured, was the extent of slope distance incorporated correctly? How was it measured in the first place? It is unlikely that much of the detail could have been captured by stereo plotting methods, as it would have been difficult to see.

Deed Plan – 1:200

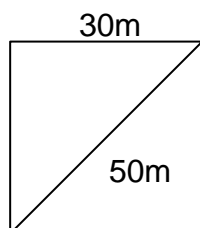


Ordnance Survey Map – 1:2500



In the example above there are, not unusually, big differences in the scales of the documents used. It looks as though this is very likely to be a slope problem - the true ground measurement has been taken from the 1:200 scale deed plan and applied to the Ordnance Survey map, which of course depicts horizontal distance – hence the anomaly.

Measurements on deeds quoted to inches and sub-metre should be treated with care, as in most traditional surveys it would have been difficult to achieve accuracy standards to these levels of precision. Look for Bench Marks and spot heights which give an indication of height change. Remember that detail is not shown in private gardens and the blank space on the plan may in fact be impenetrable jungle, particularly in mature Victorian gardens. Those precise measurements you see may raise an eyebrow if you were to try and measure them on the ground. In this exaggerated example, a boundary fence shown on both an Ordnance Survey map and a deed plan scales 50m on the deed plan but



only 30m on the Ordnance Survey map. Clearly the two features are the same but there is a 20m difference in their mapped dimensions. Slopes are unlikely to be so severe in practice of course but this example does illustrate the problem of slope measurement when the Ordnance Survey map and the deed plan are drawn to different specifications.



Scale – and survey accuracies

As mentioned earlier in the revision guide, Ordnance Survey classifies areas of Great Britain as urban, rural and mountain/moorland. Each is surveyed to an appropriate level of accuracy which is deemed to be “fit for purpose”. It would be uneconomic and wasteful to survey mountainous areas to the same level of accuracy as urban areas for example. Problems arise however when a very accurate “divorced” survey (i.e. completely independent of any surrounding features), at say 1:200 scale, is submitted as a deed plan in an area that has been surveyed to a much lower level of accuracy and precision by Ordnance Survey – say 1:2500. This is one of the more common reasons for discrepancy between the Ordnance Survey map and the deed plan, and with experience, should be easy to recognise. Linked to this issue of scale is the survey method – i.e. the survey method appropriate to the scale will have been used, as described earlier in the reference guide. Some examples of potential problems relating to survey methods are:

Photogrammetric revision -This is by far the most effective and efficient method of completing rural and moorland revision. However the operators are limited in what they can see, and particularly what they can see at ground level. On the majority of plans being revised no field check is applied, as it has been proved statistically that the errors introduced are within the stated standards for that mapping.



It is easy to identify common errors made by the plotter, if you know where to look and the type of feature that they have difficulty interpreting. This is usually where there are trees, and where roofs obscure the ground level features. Currency is the biggest driver in the revision programme, and in some cases there may be pressure to put detail on the map without the normal rigorous checking that in the past has been a key factor in establishing the Ordnance Survey quality image. Initially, to meet the challenging target of capturing 85% of the total change in rural revision, a feature might be shown to a 'logical conclusion' where it was not really possible to see it clearly along its entire length, rather than not show the feature at all. Increasingly, these types of features are being flagged for field checking.

Photogrammetric methods - A mixture of methods will be used to improve the mapping and these are **resurvey**, **reform** or **improvement**.

- *Resurvey*

As its name suggests, this involves resurveying an area from scratch. Although resurveying provides good quality results, it is an expensive way to improve accuracy and may also make some unnecessary changes in areas



where the existing mapping is already generally acceptable. It is, however, the most appropriate method when areas such as whole towns are affected.

- *Reform*

In contrast, reform will be used when a more systematic approach is needed, for example, when objects are correctly situated in relation to one another but need improvement in terms of absolute accuracy. In these cases such objects need to be realigned to position them correctly with the National Grid, but not changed in relationship to each other. This is the normal method used by Ordnance Survey to improve current positional accuracy inconsistencies.

- *Improvement*

Only those specific features found to be greater than the specified tolerance will be resurveyed using the improvement method. This means that the position of objects such as hedges or fences will be corrected individually to reduce costs. In doing this the surveyor may improve surrounding local detail to retain geometric fidelity and relative accuracy. This particular type of surveying is more cost-effective and particularly suitable for improving accuracy in small pockets of land.

Photogrammetric update of all types suffers from roof overhang, shadow and vegetation cover. The main problem with resurvey is that existing building seeds may fall outside the building, the shape and extent of boundaries may change, and the relativity of detail may be significantly different. Dealing with this change is not easy for existing users and can create considerable retrospective work. Resurveys have been used extensively as part of the PAI programme.

1:1250 pockets

Current policy is for development of over 4 hectares outside the 1:1250 urban areas to be controlled to the accuracy standard of 1:1250. These then become pockets within the rural overhaul areas. Much of this development is in green field sites, either on the periphery of the 1:2500 minor town, or as redevelopment sited in the middle of it. Both are difficult to resolve, but in-fill is perhaps the worst to deal with. It is likely that more cases will be seen where new detail is being shoehorned into spaces that are not relative to a local framework.

Edge match/poor-drawing problems on the DMS

MBM's policy is to keep a seamless up-to-date database. In reality however, this is nearly impossible due to the Agency's threshold for receiving new data through the maintenance contract agreement. When new data straddles two map tiles, the adjoining map tile will not automatically be ordered unless a registered or pending registration is affected. If the new data is deemed to be important, i.e. buildings, property boundaries, roads, etc., then the adjoining map tile will be ordered. If a caseworker encounters an example of an edge match problem, they should contact the MBM manager who will then investigate and resolve the discrepancy.



Key Points from this section

- many of the differences between Ordnance Survey maps and deed plans are not necessarily errors – but they might be;
- caseworkers need to be particularly wary of old Ordnance Survey 1:2500 mapping;
- different dates of survey may show a completely different picture of what is on the ground;
- caseworkers need to understand Ordnance Survey basic scales specification, especially generalisation, minimum sizes, building divisions, detail in private gardens, vegetation and hierarchy of features;
- slope distances shown on deed plans can be significantly different to horizontal distances shown on Ordnance Survey maps;
- different areas of Great Britain are mapped to different scales and with different map accuracies and specification 1:1250 pockets in rural areas can cause problems with overall “fit”; data changed on one plan may not be available on the adjoining plan