

# www.surveyplot.co.uk

## – a free web-based application for displaying survey data

A web-based application, developed at Loughborough University is capable of transforming and displaying OS grid coordinates onto a range of freely available mapping resources, including: Google Earth/Bing/ OS maps and OpenStreetMap.

**D**eveloped to fulfil Loughborough's MEng degree in Civil Engineering under the guidance of Prof **Jim Chandler**, the web application [surveyplot.co.uk](http://surveyplot.co.uk) is available free of charge and is ideal for displaying detailed land surveys, or any other geometric information, without the need for expensive specialist software. Although this can currently clearly be achieved using commercial GIS software, users often don't require the full functionality of a GIS for simple visualisation. In addition, the application allows sharing of the visualisation link, easily enabling others to view.

### Adding data

Survey coordinates are in a simple CSV file format (Point Identifier, +3 ordinates) to be uploaded, in either the UK National Grid or WGS84/ETRS89 coordinate systems. The OSTN02 transformation is used, enabling display on maps using both systems. Google, Bing, Ordnance Survey and OpenStreet maps and imagery can all be used as a backdrop. KML files can also be downloaded for subsequent use in either Google Earth or other GIS systems. When plotting points they can be displayed either individually or optionally as a 'group'. Grouping enables lines or shaded areas to be shown, which is ideal for visualising and distinguishing buildings or roads.

The OS National Grid system (OSGB36) contains inherent accuracies arising from the

re-triangulation of the UK, which was undertaken between 1936 and 1953, before the introduction of electromagnetic distance measurement or GPS surveying equipment. These inherent errors in OSGB36 cause issues when using survey grade GPS technology and when transforming coordinates between WGS84/ETRS89 coordinate systems and OSGB36. OSTN02 was introduced to 'correct', or more strictly distort, transformed data back to the original and slightly distorted OSGB36 framework. Ordnance Survey provides a detailed description of the OSTN02 transform, which was used to write the program code for [surveyplot.co.uk](http://surveyplot.co.uk).

### Testing

[Surveyplot.co.uk](http://Surveyplot.co.uk)'s components have been tested individually to confirm accuracy. Firstly, the OSTN02 conversion implementation was checked against a range of values provided by OS, confirming it produced the same values to 3 decimal places. Secondly, 44 visible OS trig pillars were measured in both Google and Bing imagery, comparing observed against actual pillar locations. Overall, this revealed an accuracy of  $\pm 2.1\text{m}$  relative to the Google imagery and  $\pm 1.7\text{m}$  with the Bing imagery, at the 95% confidence interval.

Finally, both mapping services were directly compared to a full photogrammetric quality orthophoto covering Loughborough University campus and surrounding area. A GPS survey of easily identifiable ground

*"... users often don't require the full functionality of a GIS for simple visualisation."*



**Left:** A simple example survey with a road and buildings.



## About the author



**Matt Harrison** graduated this summer with a Civil Engineering MEng degree (1st class) from Loughborough University. He currently works as a research and development engineer for SAS International, a building interior designer and manufacturer based in London.

control was used, again comparing observed against actual ground coordinates. The results demonstrated the importance of relief displacement, as the orthophoto yielded a far higher accuracy, additionally validating the accuracy of the Google/Bing imagery in the previous test.

The discrepancies between transformed positions and their apparent image locations can be attributed to two sources, of increasing significance:

- Separation between the ETRS89 and WGS84 terrestrial reference frameworks. ETRS89 is essentially WGS84 frozen to the Eurasian plate in 1989, as small movements in the tectonic plates cause the two systems to diverge at a rate of approximately 2.5 cm per annum. Ordnance Survey therefore recommend usage of ETRS89 coordinates, by linking surveys directly to either active or passive OS points.
- The remaining error can be attributed to the Google/Bing imagery not being fully corrected for relief displacement. Bing imagery was found to have a higher positional accuracy, which is thought to be due to homogenous collection methods as part of project 'global ortho'. In contrast, Google procures its imagery from a number

of suppliers with perhaps a wider quality range. Google's imagery appears to be generally of a higher resolution and contains less shadowing, grain and artefacts across the UK, giving an impression of higher quality. However, this does not appear to be fully justified in a positional sense.

In summary, surveyplot.co.uk provides a simple visualisation tool for surveyors, providing a quick way to overlay UK National Grid information on a variety of web mapping services. The site is now live and all feedback is welcome.

Note: Although detailed testing has demonstrated accuracy of the web-based application, it should be noted that accuracy can't be guaranteed.

## References:

Ordnance Survey, "A guide to coordinate systems in Great Britain An introduction to mapping coordinate systems and the use of GPS datasets with Ordnance Survey mapping," pp. 1-46, 2008.

W. Walcher, F. Leberl, and M. Gruber, "The Microsoft Global Ortho Program," ISPRS Ann. Photogramm., vol. 1, no. September, pp. 53-58, 2012.



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