Ordnance Survey Benchmarks: Their very limited use for civil engineering survey work

Prepared by ICE/ICES Geospatial Engineering Panel

Information note

Geospatial engineering and topographic surveys have traditionally used Ordnance Survey benchmarks (BMs) as reference points for establishing ground heights. There are three classes of these; first-order marks of high accuracy, usually anchored to solid rock and securely protected (fundamental benchmarks: FBMs), second-order marks established on stable structures and the more familiar third-order marks cut into walls and houses.

In the past Ordnance Survey maintained a dense network of these, ensuring that there would be one per square km in rural areas, denser in built-up areas. The BM network of some 500,000 BMs (generally 1912–56) was regularly checked and maintained. In 1972, however, Ordnance Survey effectively abandoned the network as too expensive to maintain and the BMs have been steadily disappearing and becoming increasingly less reliable ever since. There has been no resurvey since the mid-1980s. Many BMs since this time have therefore disappeared and monumental subsidence in mining areas has made many values unreliable.

The Fundamental BM network (190 stations approximately) is still retained and maintained by Ordnance Survey and BM information is still readily available where needed and for historical comparison.

In 2000, the Ordnance Survey formally announced that it was abandoning the traditional BMs in favour of global positioning systems (GPS) plus a datum conversion model.

With the national mapping agency of Great Britain no longer recognising BMs, their use ceases to be best practice for height referencing for general geospatial engineering and civil engineering work.

An exception could be for very minor surveys that have limited extent, are self contained and have no impact on other projects.

Best practice since 2000 is that site-survey ground heights should be obtained by using survey-quality GPS equipment to bring one or more Ordnance Survey datum height(s) into a job. The GPS position is then combined with a height correction modal (geoid model) to derive the final Ordnance Survey datum height. Spirit levelling is then usually used to promulgate that height around the site.

GPS, combined with a geoid model, has developed sufficiently to provide more consistent and accurate heighting across the country than spirit levelling. That is not to say that, over short distances, relative heights can be determined to a much higher accuracy with spirit levelling; it is a combination of approaches.

To obtain levelling measurements using GPS, two pieces of information need to be combined:

- A GPS coordinate in the European Terrestrial Reference Frame 1989 (ETRF89). This is easily achieved either instantaneously through using a real-time GPS technique (such as real-time kinematic: RTK) or through post-processing GPS data collected at the point to be heighted and at known base stations in the ETRS89 coordinate system. Examples of base stations are the freely available active or passive stations from the Ordnance Survey. RTK and active stations are generally monitored daily unlike BMs, which were usually only observed once in their lifetime.

- Secondly, a transformation (currently OSGM02™) is needed to convert the GPS altitude to a height above either Ordnance Survey Datum Newlyn for mainland Great Britain or one of the local Ordnance Survey datums.