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Styles, significance and heritage value of Ordnance Survey artefacts: examples from northwest England

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Abstract

A variety of artefacts linked to the map-making activities of the Ordnance Survey can be found throughout northwest England. These were created at various times from the early- to mid-19th century through to the late-20th century. Most are no longer used for their original purpose and with the passage of time many have been damaged or destroyed, largely as a consequence of ignorance as to their former use and significance. The artefacts range in scale from a stone hut and related structures on Scafell Pike in the Lake District, to cut bench-marks (aka crow's feet) that were inscribed on walls in both urban and rural settings. The decay and/or loss of these artefacts, which played a pivotal role in mapping the nation, is regrettable.

Keywords

Ordnance Survey, stone structures, bench-marks, flush brackets, triangulation pillars

Introduction

The year 1791 is usually given as that in which the Ordnance Survey (OS) was established in Great Britain, although that name was not used initially. In the early years the organisation was referred to as either the Trigonometrical Survey, the General Survey, the British Survey, or variations thereon (Close, 1969; Hewitt, 2011). However, for several decades prior to 1791 the British military had been engaged in surveying the country. This had been prompted by events leading up to and culminating in the defeat of the Jacobites at Culloden in 1746. Reliable maps of the Highlands of Scotland did not exist but were regarded as extremely important in case of a future rebellion. Later, in the 1750s and 1770s, conflicts with France persuaded the British that greater detail of the geography of southern England would provide them with considerable advantages should the French attempt to invade. Much of this early work, north and south, was directed by Major-General William Roy, who is widely regarded as the founder of the OS even though he died in July 1790, almost exactly one year before the OS was formally constituted.

Of course, maps of different areas, at a variety of scales, and displaying various types of information existed before the events of the mid- to late-18th century mentioned above. However, many of these maps were the results of regional or local surveys and were somewhat selective in the information they portrayed. This was often due to the underlying purpose of the map and by whom it had been commissioned, and surveyed. However, maps were not used by the majority of the population due either to: (1) their costs, (2) a lack of education necessary to understand the information as presented, or (3) simply because they were not seen as necessary items in everyday life. Nevertheless, maps had been drawn up and printed for several centuries for use by landowners and Government. For Cumbria, a valuable compilation charting the progress of maps and mapping is that by Shannon (2024).

With the establishment of the OS, the mapping of Great Britain, and also of Ireland from 1824, was put on a more structured footing by being a distinct branch of the military, and thus funded by and accountable to Government, and with the aim of covering the entire country in uniform detail at a scale of one inch to one mile. Major (later Lieutenant-Colonel) Edward Williams was the OS director from 1791 until his death in 1798 when he was succeeded by his colleague Captain William Mudge (later Major-General). Mudge died in 1820 and was succeeded as director by his assistant Captain Thomas Colby (later Major-General). Colby remained in post until his retirement in 1846. In 1824 Colby was also tasked with establishing and directing an OS for Ireland and, again, he remained in that position until 1846 (Portlock, 1869). It was during the tenures of Mudge and Colby that the OS in Great Britain began the surveying and mapping of northwest England (Mudge & Colby, 1811).

The early years and the Principal Triangulation

The historic counties of Lancashire, Cumberland, and Westmorland, along with parts of northwest Yorkshire and north Cheshire were the focus of OS attention in 1807-08. Mudge and Colby, along with a team of several men passed through the region, ascended several summits and obtained high-precision angular bearings to other summits, flag-staffs and church towers. Figure 1 shows the locations of some of the sites selected for obtaining this trigonometrical data from, along with other sites used in the 1840s, and Table 1 gives details of the observations recorded from the top of Billinge Hill in southwest Lancashire (Clarke & James, 1858). The OS party were stationed there from 15th-21st June 1807 and recorded multiple observations on ten prominent landmarks. Their visit to the summit of Black Combe, in southwest Cumbria, in the summer of 1808 was celebrated in poems written by William Wordsworth and published in 1815: '*Written with a slate pencil on a stone, on the side of the mountain of Black Combe'* and '*View from the top of Black Combe*'. Apparently Mudge had claimed that Black Combe has a more extensive view than any point in Britain, and Wordsworth was clearly impressed with the work being undertaken by the men from the OS. Clarke & James (1858) also provide details of these trigonometrical stations; details for Black Combe are given in Table 2.

The survey data gathered in northwest England in 1807-08 was used in the Principal Triangulation of Great Britain. This exercise had begun under William Roy's supervision in 1783, before the OS was formally established, and was completed in 1853. It incorporated new observations taken at several summits in northwest England in the 1840s (Figure 1). Triangulation refers to the process of dividing an area into triangles. If the length of one side of a triangle (the base line) is known by precise measurement then by measurement of the internal angles at each point of the triangle, the lengths of the other two sides of the triangle can be determined by trigonometry. From this, other triangles can be measured and the locations of places correctly positioned in space, rather than being estimated. Hence, use of the name Trigonometrical Survey in these early days (Owen & Pilbeam, 1992). The base line for the Survey, measured across Hounslow Heath in southern England, was 5.19 miles (8.35 km) in length. Later, additional baselines in other parts of the country were measured to provide a check on the accuracy of the expanding network of triangles.

In preparation for the triangulation measurements, cairns of stone or peat, often supporting long wooden poles, were usually constructed on the selected hills or mountain tops. These acted as *conspicuous objects* and enabled the surveyors to obtain accurate bearings between summits. Today, these cairns and poles no longer exist, having been dismantled or allowed to degrade over time and, from the 1930s on, replaced as survey locations by triangulation pillars (see below). However, some extant summit cairns probably consist of the same stones that were collected together by OS personnel in the 19th century for that initial triangulation work.

Figure 1. *Outline map of northwest England showing locations of sites from which triangulation observations were made in 1807-08 and the 1840s and used in the Principal Triangulation of Great Britain.*

Summit camps

Because it was necessary for the OS to spend time (a few days to perhaps several weeks) on each summit, in order to obtain trigonometrical observations on a range of distant features, this invariably meant camping. In most cases canvas tents of different sizes were used to accommodate the officers and men, to serve as a cook-house and mess, and to protect the theodolite and other instruments from inclement weather. On Scafell Pike (978 m above sea level), the highest English mountain, the abundance of boulders allowed the survey party to construct at least one stone hut. This hut is situated ~60 m east-southeast of the summit cairn and, although now roofless, consists of walls to 1.7 m in height and has a floor space of 3.5x2.7 m. The floor is paved with angular slabs; there is a stone bench alongside three of the walls and a fireplace in the south wall (Figures 2A

Table 1. *Trigonometrical data obtained by the Ordnance Survey from Billinge Hill, southwest Lancashire in June 1807 (from Clarke & James, 1858). Note that all bearings are 'referred to a South Meridian Line' (Clarke & James, 1858, p. 71) rather than north, as is conventional today.*

BILLINGE.

3-ft. Theodolite, B.O.

From 15th to 21st June 1807. Observer: Major-Gen. COLBY, R.E.

Objects.	Bearings.	No. of Obs.	Range.	Recip. of Weight.	Objects.	Bearings.	No. of Obs.	Range.	Recip. of Weight.
	° ′ ″		″			° ′ ″		″	
Cyrn-y-Brain	30 29 57·39	3	3·24	1·29	Go Hill	115 57 33·48	13	7·71	0·70
Heswell Hill	53 3 15·27	3	6·62	5·04	Rivington	224 13 46·87	15	7·23	0·58
Everton Flagstaff	61 29 35·32	3	4·61	2·87	Mowcopt	322 14 58·07	5	4·03	0·87
Snowdon	62 14 30·04	1	—	18·46	Bellefield	332 10 49·66	5	2·58	0·41
Great Ormes Head	76 4 1·90	2	0·72	0·13	Delamere, Old[1]	356 16 8·02	10	9·17	1·69

[1] A correction of + 3″.05 to be applied to this bearing to reduce it to the new station.

and B). Adjacent to this hut are several sub-circular stone structures. These comprise low stone walls that resemble crude shelters like those often fashioned by hill walkers, but it is also possible that they were originally constructed by the OS and have since been considerably modified. However, there is no evidence that they previously had paved floors, stone benches or fireplaces.

There are also a few sub-circular stone structures ~75-100 m north of the summit cairn. These consist of low stone walls less than 0.4 m in height and with internal dimensions not exceeding 3.5 m. The limited quantity of boulders both outside and inside of the walls indicates that they were unlikely to have ever stood any higher (Figure 2C). These walls probably served as protective surrounds for large tents used by the non-officer ranks; the stone hut was likely to have been accommodation for the officers in command of the survey party.

It is believed that these structures relate to the period 8th July–20th September 1841 when the OS were stationed at the summit and obtained triangulation data on 31 other summits (Clarke & James, 1858). Further details of the Scafell Pike structures are provided by Wilson & Wilson (2025a) and similar stone structures attributed to OS activity have been described from Wales and Scotland (Lilley, 2018) and the north of Ireland (Wilson & Wilson, 2025b, c).

Spirit levelling and bench-mark placement

In addition to the Principal Triangulation, spirit levelling was undertaken by the OS along the road network in order to determine surface heights. This 1st (Primary) Geodetic Levelling (aka 1GL) began in 1841, was completed in 1859, and involved 10,000 miles of double (i.e. forward and backward) levelling throughout Great Britain (Seymour, 1980; Owen & Pilbeam, 1992). The datum or zero level for this work was eventually settled in 1844 from observations of high and low water at Liverpool's Victoria Dock, although the datum was later found to be slightly lower than mean sea-level; this entailed adding a small amount (0.65 ft) to each height determined.

Table 3 lists the lines of 1GL that are either wholly or partly in northwest England, along with their start and end dates. Several of these lines included short side spurs such as the Thurnham Bridge to Glasson Dock spur of the Preston to Lancaster line. On the ground, semi-permanent marks were created by the surveyors as a record of their work and as points of reference for any subsequent surveys. These marks, termed 'cut-marks' 'bench-marks' (sometimes 'cut bench-marks') and colloquially as 'crow's feet', were usually chiselled into the stonework of roadside walls, bridges, churches and various other public and non-public buildings at intervals of ~0.5 mile (~0.8 km). Similar marks were cut into wooden posts where stonework was not available.

On vertical stonework the commonest form of mark consists of an incised horizontal line below which an incised broad arrow points upwards (Figure 3A and B). The line defines the height of that location above the datum and presumably the arrow draws attention to it, making it easier for surveyors to find.

Table 2. *Description of the trigonometrical station at the summit of Black Combe, southern Lake District (from Clarke & James, 1858).*

BLACK COMB, 1841, is a large rocky hill in the parish of Whitbeck, in the county of Cumberland. The station is on the top of the hill, and is marked by a pile of stones 14·5 feet high and 50 feet in circumference, erected above a centre stone with a hole in it 4 inches deep and an inch in diameter. The station was restored in 1852.

An arrow symbol had been in use for several centuries to indicate Government property. These marks were usually placed ~12-36 inches (~30-100 cm) above the ground surface. On stonework, some cut bench-marks were augmented by a brass bolt. This was either inserted into the middle of the horizontal cut or it was placed to one side or other of the cut (Figure 3C and D). Bench-marks were also made on quasi-horizontal stone surfaces such as kerbstones, bridge parapets, earth-fast boulders and exposed bedrock. In such cases a bolt or rivet was usually paired with an incised broad arrow (Figure 3E), alternatively a shallow indentation was made in the stone at the apex of the arrow (Figure 3F). This indentation, termed a pivot bench-mark, was designed to hold a small steel ball-bearing on which a survey staff could stand and freely pivot. Bench-marks from this phase of surveying are listed by Clarke & James (1861).

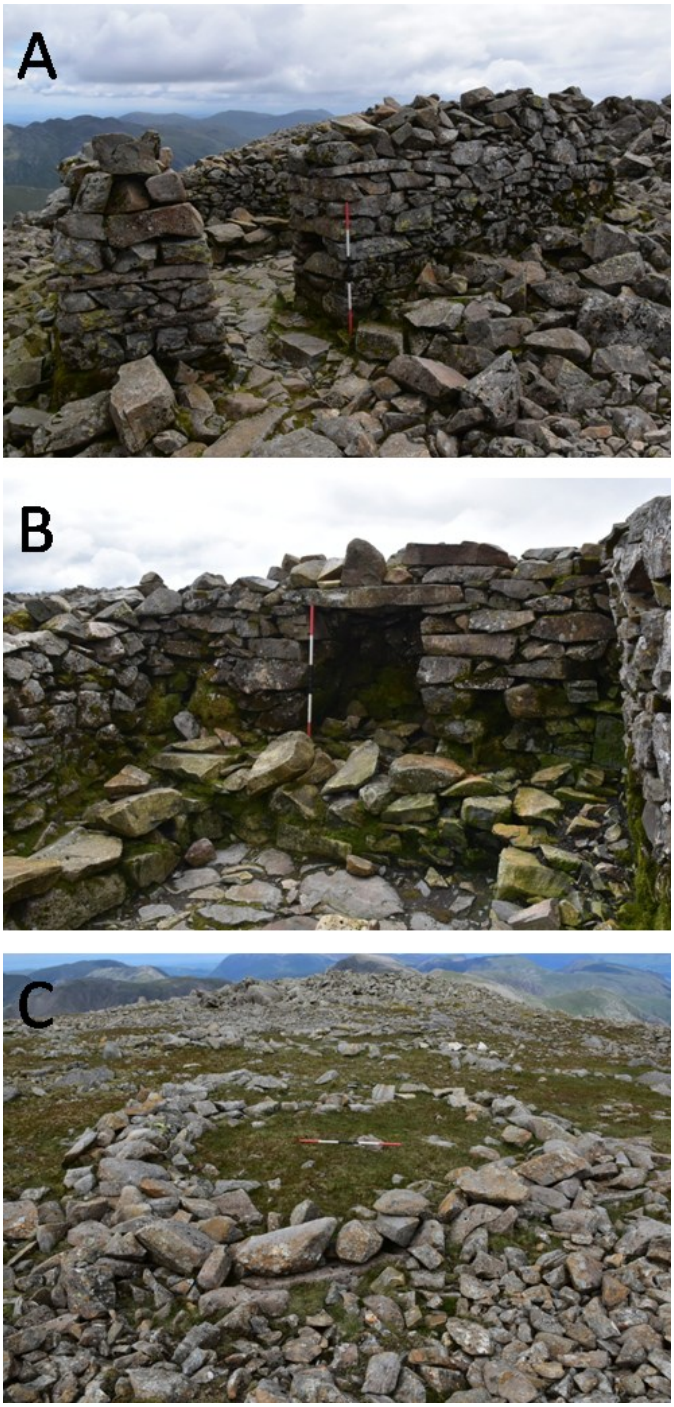

Figure 2. A: *Walls and entrance way of the Scafell Pike stone hut.* ***B:*** *The fireplace, bench and paved floor in the Scafell Pike stone hut.* ***C:*** *Sub-circular low stone wall that served as a protective surround to a large tent. In each image the survey pole is 1 m in length.*

Bench-marks of the types described and illustrated do not only occur in association with lines of levelling; they continued to be added to the network of survey points as mapping was extended into areas between the lines and are indicated on the 1:10,560 scale OS maps by a small arrow symbol, the letters BM and the height above sea-level.Within relatively small urban and rural areas it is usually possible to find bench-marks of different styles and ages (Wilson & Smith, 2022). However, with the passage of time many of the early bench-marks have been destroyed as a consequence of re-development. Bench-mark locations are no longer indicated on the latest 1:10,000 scale maps.

Table 3. *Lines of the 1st (Primary) Geodetic Levelling (1GL) 1841-59 either wholly or partly in northwest England, with their start and end dates (from www.bench-marks.org.uk).*

Line	Start date	End date
Carlisle to North Shields	Jan 1844	Feb 1845
Carlisle to Sark Bridge	July 1844	Sept 1845
Keswick to Ambleside	Dec 1855	Jan 1856
Kendal to Broughton-in-Furness	Feb 1844	Dec 1844
Kendal to Carlisle	July 1843	Dec 1844
Kendal to Thirsk	June 1845	Nov 1845
Liverpool to Port Carlisle	Dec 1841	Jan 1844
Liverpool to Spurn Head	Jan 1842	Oct 1846
Manchester to Gloucester	Dec 1843	Aug 1844
Manchester to Halifax	Mar 1843	June 1845
Milner's Bridge to Bradford	Sept 1842	Nov 1845
Penrith to Darlington	Apr 1844	Nov 1844
Penrith to Workington	Oct 1855	Mar 1856
Preston to Halifax	Oct 1843	Mar 1844
Preston to Lancaster	May 1842	Nov 1843
Preston to Manchester	Nov 1841	Nov 1843
Warrington to Adlington	Jan 1843	Apr 1844
Warrington to Pembroke Docks	Sept 1851	July 1852

The 2nd Geodetic Levelling (2GL)

A second phase of levelling was conducted by the OS between 1912 and 1921 and again several of the lines were either wholly or partly in northwest England (Table 4). This levelling was required because many of the old bench-marks had disappeared due to re-development or they had been disturbed and could no longer be regarded as reliable indicators of height. The 2GL, using modern instruments and methods, was associated with the creation of some new forms of bench-mark, although on side spurs to the main lines of levelling cut-marks and bolts. continued to be used as height reference points. The new bench-marks consisted of Fundamental Bench Marks,

Projecting Brackets and Flush Brackets. A new datum was also adopted in conjunction with 2GL; mean sea-level at Newlyn in Cornwall derived from hourly tide-gauge readings from 1st May 1915 to 30th April 1921 was approved, and this continues to be the OS datum.

Fundamental Bench Marks (FBMs) – These bench-marks were established on solid rock in order to minimise any subsequent natural disturbance and are high-accuracy marks. They consist of above and below ground components (Figure 4). Above ground, the mark is a short pillar of granite or concrete with a brass bolt set into the top. The pillars usually also have two plaques on the vertical sides. One of these states Ordnance Survey BM (or Bench Mark on some). The other is a more recently added plate informing that the structure is part of the national GPS network (Figure 5A). Below ground, a concrete chamber contains the precisely measured reference point. Some 115 FBMs were constructed but financial constraints following the First World War resulted in some parts of the country being excluded and only 86 of the FBMs were eventually used (Seymour, 1980).

FBMs were placed at the terminal points of each of the lines of levelling listed in Table 4, but the FBM at Kirkby Stephen has since been destroyed and the Wetheral one has suffered some damaged. Thus, five FBMs dating from the 2GL are present in northwest England, i.e. Daresbury, Liverpool, Penrith, Ribblesdale and Wetheral.

Projecting Brackets (PBs) – These small metal brackets were in use for only a short period before being superseded by Flush Brackets (see below). They consist of wall-mounted metal plates that carry the letters OSBM and an arrow symbol. Projecting from the plate is a small platform with a raised stud that represents the height reference point (Figure 5B). Unlike Flush Brackets they have no unique identifying number. Only two such brackets occur in northwest England. Both are to be found on the Skipton to Ribblesdale line of levelling: one in Hellifield, the other in Horton-in-Ribblesdale.

Flush Brackets (FBs) – As their name implies these brackets were intended to be flush with the wall surface on which they were mounted. To achieve this, a shallow recess was cut in the stonework to take the bracket. However, this was often not done and therefore some brackets stand proud of the surface. FBs measure ~18x9 cm, are embossed with the letters OSBM and a small arrow, and have a horizontal slot directly above the arrow that is the height reference point. In addition they carry a unique identifying number (Figure 5C). All FBs associated with 2GL lines in northwest England are of the basic variety, i.e. they have an up-to four-figure number. Originally 19 FBs were placed along the Ribblesdale to Kirkby Stephen line, 23 FBs along the Kirkby Stephen to Penrith line, and 25 along the Penrith to Wetheral line. However, not all these FBs exist today; several have disappeared probably as a consequence of re-development or refurbishment of the structures on which they were placed. A small number of 2GL FBs were used on triangulation pillars (see below).

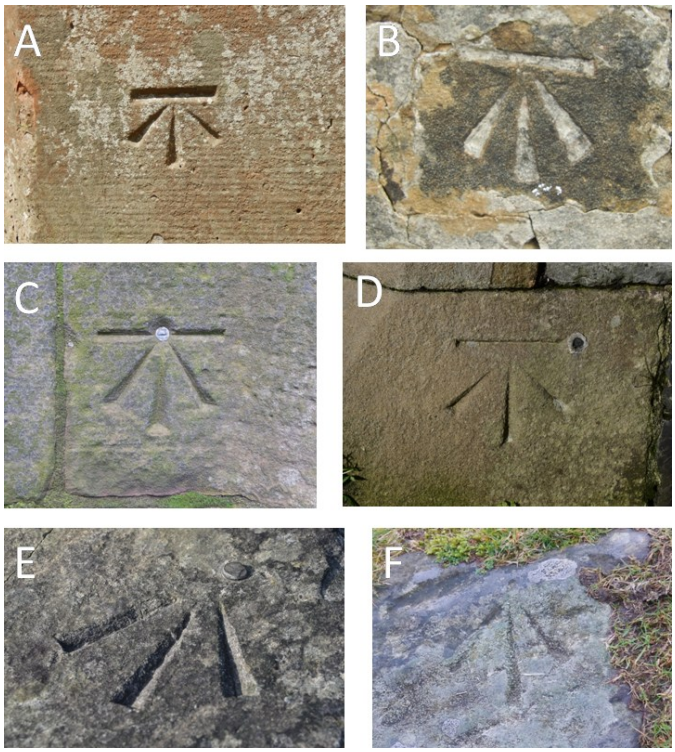

Figure 3. ***A:*** *Cut bench-mark on gatepost, Orton Road, Carlisle.* ***B:*** *Cut bench-mark on derelict shooting hut, Simon Fell, Ribblesdale.* ***C:*** *Cut bench-mark with centred bolt, St. Andrew's Church, Penrith.* ***D:*** *Cut bench-mark with offset bolt, St. Mary's Church, Ambleside.* ***E:*** *Horizontal arrow and flat-head bolt on top of bridge parapet, Springs Farm, Keswick.* ***F:*** *Horizontal arrow and pivot depression (above tip of arrow) on earth-fast boulder, Howgill Fells.*

The 3rd Geodetic Levelling (3GL)

A third phase of levelling took place between 1950 and 1956. This was deemed necessary due to deficiencies with the 2GL, one of which was its rather sparse coverage of northern England. In addition it was hoped that 3GL would detect any vertical crustal movements that had occurred since 2GL due to continuing isostatic re-adjustments associated with the demise of the last British Ice Sheet. All 115 FBMs constructed for 2GL were used and some new ones created at terminal points of the new lines of levelling, e.g. Hoghton to Lancaster, and Ulverston to Wasdale. Thus, more lines of levelling were added to the network (Seymour, 1980; Owen & Pilbeam, 1992). The lines that were wholly or partly in northwest England are listed in Table 5. Some of these lines are the same as used for 2GL although apparently levelled in the opposite direction, e.g. Liverpool to Daresbury (2GL), Daresbury to Liverpool (3GL). Existing FBs were re-levelled and some additional brackets were placed along these lines but differed from the earlier ones

by being of either S-series or G-series types. S-series brackets were introduced in the 1920s and can be found on walls and most triangulation pillars (see below), and there are a few distinct styles: from S01 to S1134 the S is found below the number (Figure 6A), from S3200 to S3677 the S is above the number, all other brackets have S as a prefix to the number (Figure 6B); FB numbers S01 to S0999 all have zero before the number. G-series brackets first appeared for the 2GL in Scotland from 1936 but were also used for the 3GL in England and Wales. On the majority of G-series brackets the letter is as a prefix to the number (Figure 6C), but it was placed above the number on some others. Numbers below 1000 do not have a leading zero. G-series brackets are only found on walls, never on triangulation pillars. The only 3GL line in northwest England to have all FBs of G-series type is the Hoghton to Lancaster line, along which 28 such brackets were used.

Table 4. *Lines of the 2nd Geodetic Levelling (2GL) 1912-21 either wholly or partly in northwest England, with their start and end dates (from www.bench-marks.org.uk).*

Line	Start date	End date
Daresbury to Wrexham	Mar 1920	July 1920
Kirkby Stephen to Penrith	Apr 1914	July 1914
Liverpool FBM[1] to Liverpool Tide Gauge	Sept 1919	Oct 1919
Liverpool to Daresbury	Oct 1919	Feb 1920
Macclesfield to Daresbury	Dec 1919	Mar 1920
Penrith to Wetheral	Dec 1914	Mar 1915
Ribblesdale to Kirkby Stephen	July 1914	Oct 1914
Skipton to Ribblesdale	Aug 1914	Dec 1914
Wetheral to Newcastleton	Aug 1914	Dec 1914
Wolsingham to Kirkby Stephen	June 1918	Oct 1918

[1]FBM: Fundamental Bench Mark

Retriangulation and Triangulation Pillars

Great Britain underwent a primary retriangulation in the years 1935-39. This was deemed necessary in order to facilitate a new secondary triangulation which had previously been conducted on a county basis. However, the secondary data had proved difficult to tie together nationally, and the expansion in urban development required that this be rectified in order to support new large-scale surveys. Although the accuracy of the Principal Triangulation of the nineteenth century would have sufficed as the basic framework for the new secondary triangulation, it was doubted if many of the original station markers (usually stones with holes drilled into them, and buried) could be located (Hotine, 1937a; Seymour, 1980). A retriangulation was therefore required, and was duly conducted.

To permanently mark the stations used for the retriangulation, a standard pillar was designed and built on-site (Hotine, 1937b; Officers of the Ordnance Survey, 1967). Today, these structures are the familiar triangulation pillars (TPs) that adorn some hilltops and occupy other prominent landscape positions. They take the form of a truncated pyramid of concrete or local stone, stand to a height of 4 feet (1.2 m) and are 2 feet (0.61 m) square at base. The top of each pillar has a brass 'spider' with three grooved legs 120º apart designed to hold a theodolite or beacon (light) during surveying. Adjacent to the spider are three brass loops by which that equipment can be secured by cords. Low down on one side of the pillar is a brass FB of similar size and design to those mentioned above (Figure 7A-C). Each TP FB has a unique serial number.

A small number of the 2GL FBs were used on TPs, such as that on Whernside in the Yorkshire Dales (Figure 8A). Other TPs carry S-series brackets with the letter S as a prefix (Figure 8B), except for brackets with numbers exceeding 10,000 (Figure 8C) on which the S is absent.

Table 5. *Lines of the 3rd Geodetic Levelling (3GL) 1951-1956 either wholly or partly in northwest England; start and end dates unknown (from www.bench-marks.org.uk).*

Line
Cockermouth to Wetheral
Daresbury to Liverpool
Hoghton to Lancaster
Kirkby Stephen to Ribblesdale
Lancaster to Ulverston
Liverpool to Dyserth
Liverpool to Hoghton
Macclesfield to Daresbury
Newcastleton to Wetheral
Oswestry to Daresbury
Penrith to Kirkby Stephen
Ribblesdale to Skipton
Skipton to Hoghton
Ulverston to Wasdale
Wasdale to Cockermouth
Wetheral to Hexham
Wetheral to Penrith

The structure of TPs is more complex than the exterior view suggests. Figure 9 shows the anatomy of a TP, in particular the lower centre mark and the upper centre mark. These consist of brass bolts firmly fixed in position. The former mark, usually set into bedrock, defines the location of the station and is independent of the pillar. Should the pillar be toppled or destroyed, this mark allows the precise re-positioning of a replacement. The latter mark, usually set in concrete, is aligned exactly above the former and is the surveyed mark. In addition, pillars have sighting/drainage tubes towards the base and a centre tube covered by a screw cap in the middle of the spider (Figure 7B). The spider acts as a 'forced centring' fitting that ensures a theodolite, when mounted on the spider, is centred over the centre marks at the base of the pillar.

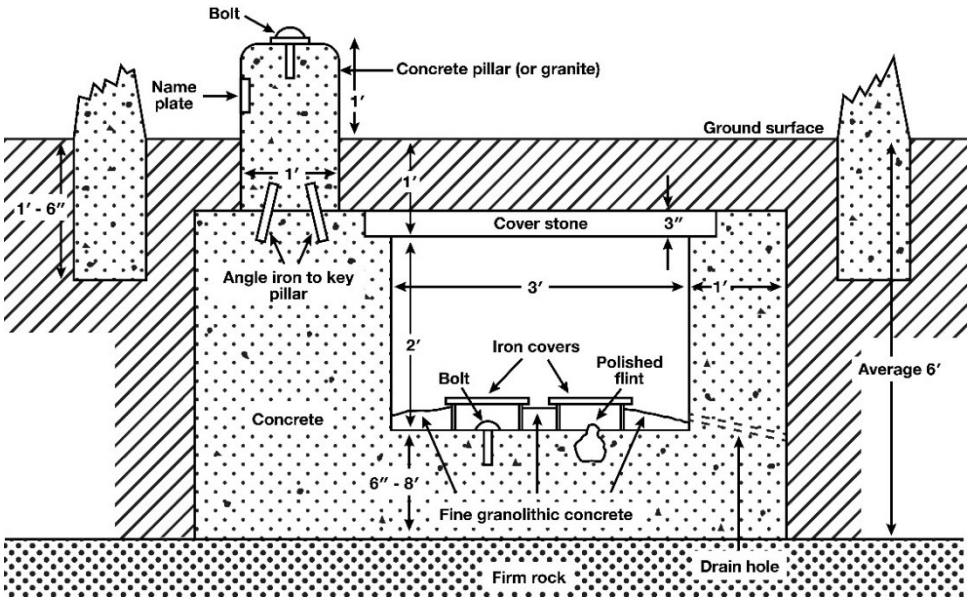

Figure 4. *Sketch of Fundamental Bench Mark showing above and below ground components. Redrawn with amendments from Seymour (1980).*

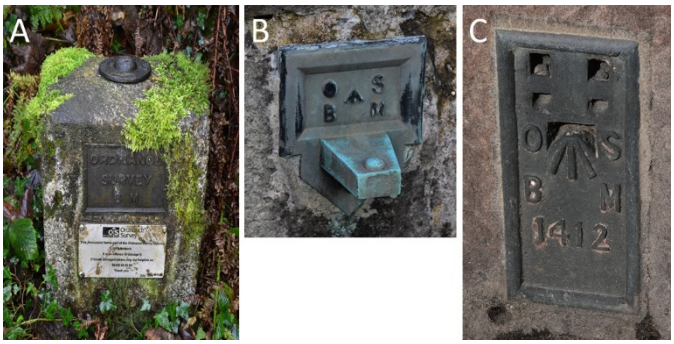

Figure 5. A: *Fundamental Bench Mark. This FBM occurs near Ulverston and was constructed for the 3rd Geodetic Levelling along the Ulverston to Wasdale line. The brass bolt (top) and metal plates (side) are clearly visible. The stainless-steel plate states 'This monument forms part of the Ordnance Survey National GPS Network'.* ***B:*** *Projecting Bracket on St. Oswald's Church, Horton-in-Ribblesdale. The bracket was fixed in position during levelling along the Skipton to Ribblesdale line between August and December 1914 for the 2nd Geodetic Levelling.* ***C:*** *Flush Bracket (no. 1412) on front of former Grey Bull Inn (now a private residence), Scotland Road, Penrith. The bracket was fixed in position during levelling along the Penrith to Wetheral line between December 1914 and March 1915 for the 2nd Geodetic Levelling.*

Approximately 6500 TPs were constructed in Great Britain between 1936 and 1962. In 2021 it was estimated that 6190 pillars were still present, the others having been deliberately removed because of industrial or urban development, or they had succumbed to weather-related factors or vandalism. A slightly damaged pillar exists on Scafell Pike. Some badly damaged pillars have been repaired; the pillar on Crag Hill/Eel Crags (839 m above sea level) in the northwestern fells of the Lake District spent the years 2015-18 lying on its side having been pushed over. It has since been re-erected but no longer carries a flush bracket.

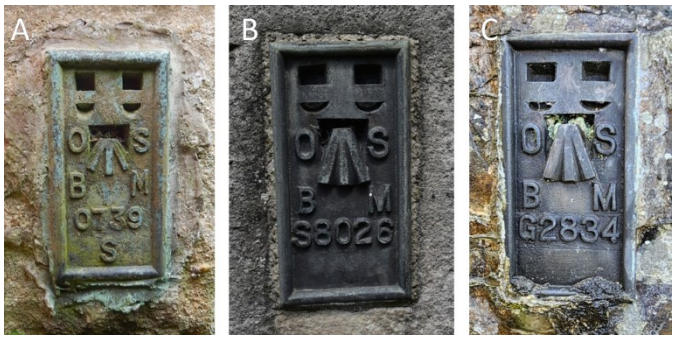

Figure 6. A: *S-series Flush Bracket (no. 0739/S) on wall of St. James' Church, Clapham, Yorkshire Dales.* ***B:*** *S-series Flush Bracket (no. S8026) at Bassenthwaite Lake Station, northern Lake District.* ***C:*** *G-series Flush Bracket (no. G2834) on bridge near Broughton-in-Furness, southern Lake District.*

Significance and Heritage Value

With the exception of TPs, which are prominent features in their local landscapes, other OS marks are small and inconspicuous and are sometimes obscured by dense vegetation or various types of domestic and industrial 'debris'. Consequently, their locations are unknown to most people and they usually go unnoticed. Over many years there has been a sharp decline in their numbers because some of the structures on which they were placed have been demolished or refurbished. The marks themselves have no legal protection unless their host structures have protected status. But even on listed buildings, weathered stonework that carries a cut-mark, brass bolt or flush bracket may be replaced, resulting in the loss

of the artefact. In the case of the Lake District – a UNESCO World Heritage Site – it is pertinent to ask if all OS artefacts therein have protected status except for FBMs, and some TPs, which are still used by the OS and carry a small stainless-steel plate that informs of such (Figures 5A and 7A), other bench-marks are no longer maintained for surveying purposes. Map making is now largely a digital process and elevation data is gathered by satellite ground receivers, and computers can do in seconds-to-minutes what previously took several days of field survey and deskwork to achieve. Bench-mark placement ended ~35 years ago.

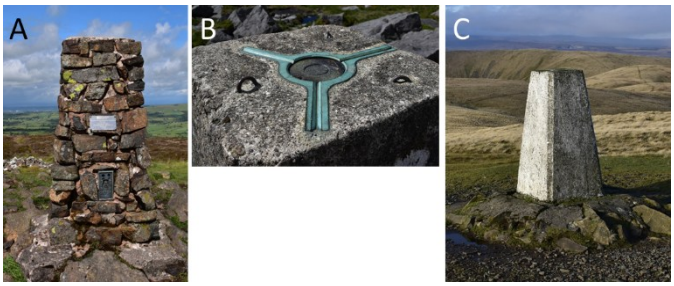

Figure 7. A: *Triangulation pillar on Binsey, northern Lake District, constructed of local stone and showing the Flush Bracket (no. S5707) towards base. The stainless-steel plate carries the same wording as that in Figure* ***5A****.* ***B****: Brass spider and loops on top of a concrete triangulation pillar.* ***C:*** *White-painted concrete triangulation pillar, The Calf, Howgill Fells. The FB (no. S5676) is on the far side of the pillar.*

The erasure of bench-marks, either through ignorance or intention, represents the loss of a resource that played a significant role in mapping the nation. They are important physical and temporal markers of the OS remit to produce accurate maps, and are heritage features (albeit of small-scale) that deserve to be protected and conserved.

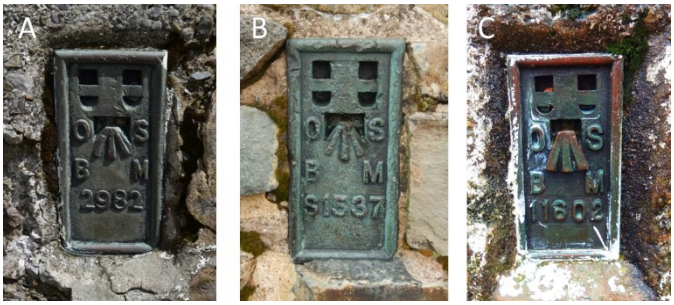

Figure 8. A: *Flush Bracket (no. 2982) on triangulation pillar on Whernside, Yorkshire Dales. This is one of the small number of 2nd Geodetic Levelling FBs to be placed on triangulation pillars.* ***B:*** *S-series Flush Bracket (no. S1537) on triangulation pillar on Scafell Pike (Lake District) – England's highest mountain and FB.* ***C:*** *S-series Flush Bracket (no. 11602) on the Black Combe triangulation pillar, southern Lake District. The extant pillar replaced an earlier one with bracket no. S2593 sometime after 1973-74 (Wainwright, 1974).*

To this end, local Geographical/Historical/Heritage groups can play a part. The bench-mark database at www.bench-marks.org.uk is available for use by everyone. By selecting the *Search* tab and entering a postcode and a radius distance around that location, the site will generate a list of all known bench-marks of all ages within that radius. For the postcode of BB9 7LG (the Town Hall in Nelson, Lancs.) and a radius of 3 km, a list of 370 bench-marks will appear along with details of their locations (National grid references and nature of their host structures) and, in most cases, their ages, and physical condition. However, such lists are not necessarily complete; unrecorded bench-marks may exist and await discovery. Also, some bench-marks in these lists no longer exist, having been removed for reasons mentioned above.

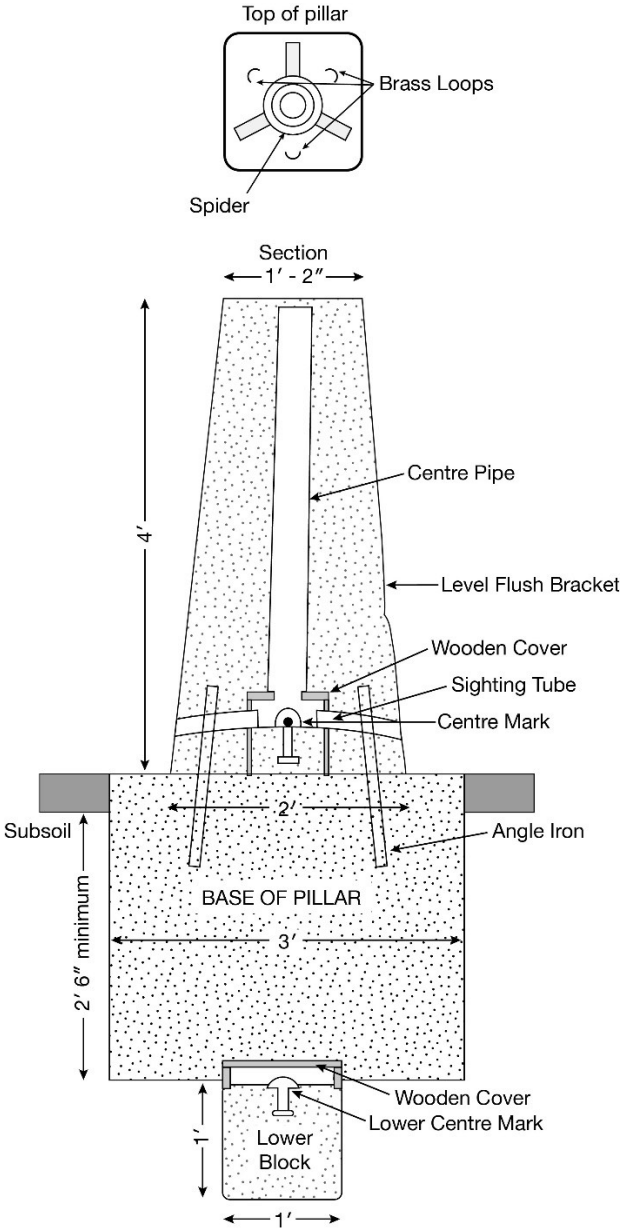

Figure 9. *Structure of a triangulation pillar (adapted from https://Trigpointing.UK).*

Local societies can assist with the retention of bench-marks within their areas by field recording of extant marks and making representations against proposals that would lead to their removal. The refurbishment of a bench-mark-bearing

structure need not result in the loss of the mark. In some circumstances, cut-marked stones have been retained within the fabric of refurbished structures, although not always in their original position. In some of these cases the stones have been inverted to signify that they no longer indicate an accurately levelled elevation.

Further exploration of the bench-mark database can provide lists of marks placed along lines of survey associated with the 1GL, 2GL and 3GL phases (Tables 3-5). Again, some of the marks listed may have been destroyed but the remaining ones are deserving of protection.

Conclusions

Different styles of OS artefacts that were created to facilitate the map-making process can be found throughout northwest England. However, over the years since they were placed many have been lost or seriously damaged. Most of the extant survey marks are no longer used by the OS and they lack statutory protection. This has resulted in a rapid decline in their numbers and the loss of a significant heritage resource. Likewise the stone structures on Scafell Pike have been slowly deteriorating over many years.

OS maps have been part of the British consciousness since they were first published in the 19th century, and they continue to serve the interests of geographers (both physical and human), geologists, historians, archaeologists, motorists, and walkers alike. Although surveying and map-making no longer rely entirely on bench-marks, some effort to record and retain such marks is a worthy aim; they represent a tangible link with the past but their redundant status threatens their very survival.

Acknowledgements

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