

# Survey of Bram Rigg Top

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The Team:

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## **1) Introduction**

Bram Rigg Top (Hill Number 2739, Section 35A, OS 1:50000 Map 98, OS 1:25000 Map OL19S, Grid Ref. SD668964) is listed as a Nuttall (a hill in England and Wales at or over 2000ft in height and with 15m or more of drop) in the Database of British and Irish Hills (DoBIH) with just 15m of drop. It is situated in the Howgill Fells and lies between The Calf and Calders. It is separated from The Calf by a drop of over 30m but the drop of just 15m that separates it from Calders means that it is on the borderline of eligibility for a Nuttall. It was surveyed in October 2015 by Myrddyn Phillips who used a Trimble GeoXH 6000 receiver and found the summit to be 672.7m and the col 658.0m thereby giving a drop of just 14.7m. However, the summit and col positions were estimated by eye and the measurement uncertainty of the receiver is +/-0.3m. Consequently, the list authors, John and Anne Nuttall, decided at that time to await further survey work before removing Bram Rigg Top from their list. An added uncertainty lies in whether Calders really is higher than Bram Rigg Top. It has a height of 674m on the 1:50k map with Bram Rigg Top being 672m. Given the measurement uncertainty of +/-3m for map heights it is possible that Calders is actually lower than Bram Rigg Top, in which case it would be the candidate for removal from the Nuttall's list. This is unlikely, since Calders has been measured as 675.4m by Alan Dawson who used a Leica RX1250 receiver and 40 minutes data collection time. The measurement uncertainty associated with this instrument and collection time is within 0.1m assuming the summit position has been identified. This means that the height difference between Bram Rigg Top and Calders as measured by Myrddyn Phillips and Alan Dawson is 2.7m in favour of Calders.

The purpose of this survey was to measure accurately the drop of Bram Rigg Top in order establish whether it meets the 15m criterion to belong to the Nuttall's list of hills. A line survey with level and staff was considered the most convenient method of doing so.

## **2) Equipment used and Conditions for Survey**

The surveying was carried out using a Leica NA730 Professional Automatic level (X30 telescopic system)/tripod system and a "1m" E-staff extendable to 5m.

Positions were recorded using Garmin Etrex 20, Garmin Montana 600 and Garmin Oregon 450 receivers. The instruments were allowed to "stabilise" for at least five minutes before any readings were taken. All grid refs are recorded to 10 figures, but we acknowledge that the 5<sup>th</sup> figure in each direction is probably only accurate to the nearest 5m.

Conditions were good for the survey. The weather was warm, 15 degrees Celsius, with sunny intervals and a very light wind.

## **3) Character of Hill**

The Howgill Fells lie just North of Sedburgh and are well seen by travellers on the M6, which passes immediately below the hills between junctions 37 and 38. They are predominately grassy and rounded in character, although Cautley Crag is an exception and together with its accompanying waterfall of Cautley Spout is a magnificent sight for walkers approaching the fells

from the East and for travellers on the A683. The highest point of The Howgills is The Calf (676m) which is just over a kilometre West of Cautley Crag and Bram Rigg Top lies just over 500m South of it. Our route began from The Cross Keys Hotel on the A683 where a bridge crosses the River Rawthey and then a well-made path leads to the foot of Cautley Spout. The path bifurcates here with one branch heading North, while the other rises very steeply by the waterfall. This latter path appears daunting from below, but is, in fact, a well-engineered staircase of stone slabs which allows fast progress. After crossing a tributary of the main stream at 460m, the gradient eases and the path then continues to follow the stream to a sheepfold. A right fork is taken here which leads directly to the col between Bram Rigg Top and The Calf. It is then just a short walk up a well-constructed path between the Calf and Calders. This path is left as it passes over the shoulder of Bram Rigg Top and finally it is a short stroll of 150m East its summit. This comprises rough grass with a convenient ATV track that descends to join the main Calf-Calders path near the col between this summit and Calders. This track made a convenient route for the line survey.

#### **4) The Survey**

The first task was to locate the true summit position using the level which was set up at a convenient position near the remains of a cairn. The summit area comprises two broad high areas about 100m apart with a shallow dip between them. By taking staff measurements it was quickly established that the further of these high areas was about 2m lower than that upon which the level was situated. Further work in this higher area near the old cairn quickly identified the summit to be on the North side of the ATV track and a few metres from it. This position was marked with a flag.

Next our attention turned to the col. This is complicated by the presence of the Calf-Calders path which is about 2m wide. On the SW side of it there is a shallow ditch and in the col area this joins a runnel that drains East. This runnel is probably partly natural, but it does not run completely across the col. On the East side of the path there is also evidence of spoil deposited there from the construction of the path. Although initially the cause of confusion, this spoil was seen not to lie over the natural col. Use of the level and staff, soon showed this to be a few metres SW of the path. This position was marked with a flag.

Having identified the summit and col positions we next carried out the line survey using the standard procedure for line surveying. The staff was held vertically on the summit position and the level set up in a convenient position lower on the hill. Once a set of readings had been taken (Backsight Reading), the staff was then moved to a position further down the hill towards the col, but the level was not moved apart from a rotation through "180 degrees" to take another set of readings (Foresight Readings). Each set comprised a reading of the central level line and the upper and lower stadia lines. The average of these three readings was then calculated and, provided this average was within 1mm of the central line reading, then the set was accepted and the line survey continued. The process of alternately moving the staff and level was repeated until the final reading was taken with the staff positioned at col.

The line survey was then repeated from col to summit and this provided a check on the accuracy of the survey. The details of the survey are given in the Appendix.

Lastly, ten figure grid references of summit and col positions were taken with the hand-held GNSS receivers.

Finally, a semi-quantitative survey from the summit of Bram Rigg Top to the col separating it from The Calf was carried out. The result is also shown in the Appendix.

#### **5) Results**

Details of the line survey are shown in the Appendix. It is seen that the drop between Bram Rigg Top and Calders is 14.68m and the closing error is just 1mm.

Ten figure grid references for the summit were recorded as:-

Garmin Oregon 450	SD 66834 96464	Accuracy 3m	Height = 683m
Garmin Montana 600	SD 66835 96457	Averaged	Height = 668m
Garmin Etrex 20	SD 66834 96463	Averaged	Height = 676m

Ten figure grid references for the remains of the cairn, which is 10m SW of the summit, were recorded as:-

Garmin Oregon 450	SD 66824 96458	Accuracy 3m	Height = 679m
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Ten figure grid references for the col were recorded as:-

Garmin Montana 600	SD 67035 96278	Averaged	Height = 656m
Garmin Etrex 20	SD 67035 96279	Averaged	Height = 658m

Ten figure grid references for the col between Bram Rigg Top and The Calf were recorded as:-

Garmin Oregon 450	SD 66869 96769	Accuracy 3m	Height = 645m
Garmin Montana 600	SD 66869 96768	Averaged	Height = 643m
Garmin Etrex 20	SD 66869 96768	Averaged	Height = 645m

The drop between Bram Rigg Top and The Calf is 31.8m

## **6) Discussion of Results and Errors**

The closing error for the line survey between Bram Rigg Top and Calders is 0.001m. To this must be added the measurement uncertainty in height in locating the summit. The ground in the summit area is quite flat and only gently falls away, so we estimate that this was achieved to better than +/- 0.05m. As discussed above the col is area is crossed by a wide and well-engineered path which at first sight complicates the identification of the col itself. This is not helped by the presence of a shallow ditch on its SW side, which terminates in a runnel that passes beneath the path. The remains of spoil, now grassed over, on its NE side also confuses. However, natural ground on the SW side of the path is slightly higher. While the col is slightly complicated in topography, we nevertheless estimate the measurement uncertainty in height associated with locating its correct position is no more than +/-0.05m. This gives an overall measurement uncertainty of 0.07m for the measurement of the drop.

The height difference between the summit and the remains of the cairn is 0.19m.

The summit position measured by Myrddyn Phillips is SD 66828 96450 (converted to a Garmin reading) which is about 15m South of the position we found. We estimate this is about 0.1m lower than the true summit and illustrates the wisdom of employing a level and staff for this purpose.

The col position measured by Myrddyn Phillips is at SD 67035 96275 (converted to a Garmin reading). Within the error of Garmin measurements this col position, confirmed by photographs, is the same as identified in this survey.

While there is very good agreement between the drop measured in this survey and that measured by Myrddyn Phillips, this is somewhat serendipitous since our respective summit positions are several metres apart and of the order of 0.1m metres in height different, but his col position was the same.

We would conclude that the measurement uncertainty of the GNSS receiver employed by Myrddyn Phillips compensated for this.

Finally, the drop between Bram Rigg Top and The Calf is 31.8m. This was only a semi-quantitative determination and we estimate the associated measurement uncertainty is +/-0.5m.

### **7) Summary and Conclusions**

The **summit** of **Bram Rigg Top** is at grid reference SD 66834 96461 and is the highest point of grass and has no feature marking it. It is 0.19m higher than the remnants of the cairn. The col is at SD 67035 96279 and is ground on the SW side of the path.

The **ascent from col to summit** of **Bram Rigg Top** is **14.68+/-0.07m**

**Bram Rigg Top does not have sufficient drop to be included in the list of 2000ft hills for England and Wales.**

John Barnard and Graham Jackson, 06 October 2016.

## Appendix



Summit position marked with flags as seen from remnants of cairn



Position of col marked with flags: ditch on right hand side of path terminates in runnel (left of picture) which goes under path

Title:- Bram Rigg Top

Instrument:- Leica NA730

02-Oct-16

Point Number	Horizontal Line		Lower Stadia Line		Upper Stadia Line		Mean BS metres	Mean FS metres	Ht Difference metres	BS Distance metres	FS Distance metres
	Backsight R metres	Foresight F metres	Backsight R metres	Foresight F metres	Backsight R metres	Foresight F metres					
<b>Summit to Col ( JB Staff and GJ Level)</b>											
1	0.552	2.962	0.469	2.611	0.635	3.318	0.552	2.964		16.600	70.700
2	0.220	4.464	0.148	4.182	0.293	4.747	0.220	4.464		14.500	56.500
3	0.235	4.671	0.191	4.395	0.279	4.948	0.235	4.671		8.800	55.300
4	0.304	3.892	0.243	3.608	0.367	4.175	0.305	3.892		12.400	56.700
						Sum =	1.312	15.991	-14.679	52.300	239.200
<b>Col to Summit (GJ Staff and JB level)</b>											
1	3.962	0.392	3.689	0.355	4.239	0.429	3.963	0.392		55.000	7.400
2	4.652	0.252	4.352	0.210	4.953	0.295	4.652	0.252		60.100	8.500
3	4.421	0.345	4.152	0.285	4.690	0.404	4.421	0.345		53.800	11.900
4	3.025	0.396	2.662	0.294	3.393	0.499	3.027	0.396		73.100	20.500
						Sum =	16.063	1.385	14.678	242.000	48.300
<b>Bram Rigg Summit to Col between The Calf (JB Staff and GJ Level)</b>											
1	0.0	5.0									
2	0.1	5.0									
3	0.0	5.0									
4	0.2	5.0									
5	0.1	5.0									
6	0.1	5.0									
7	0.1	2.4									
	0.6	32.4							31.8		