Defining the Summits and Cols of Hills

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Contributors

The following have received a copy of this document and many have responded with useful comments that have contributed towards its evolution. We thank everyone for their input.

John Barnard, Myrddyn Phillips, Graham Jackson

Chris Bienowski

Jim Bloomer

Alan Castle

Chris Crocker

Clem Clements

Alan Dawson

Michael Dewey

Simon Edwardes

Jonathan de Ferranti

Jon Foote

Alun Fisher

George Gradwell

Dave Hewitt

Mark Jackson

Dewi Jones

John Kirk

Stewart Logan

Brent Lynham

Henry Marston

John & Anne Nuttall

Jeff Parr

David Purchase

Rick Salter

Simon Stewart

Mark Trengrove

Chris Watson

Rob Woodall

Jonathan Woods

Summary

This is a very brief summary of the conclusions drawn from the document.

Summit

The Summit of a hill is a single point that is the highest point above sea level (Ordnance Datum Newlyn in mainland Britain or Malin Head for all Ireland) on that hill. The exceptions to this are where the highest point of any hill is a tree or fallen tree trunk, or built of metal, wood, concrete or other man made material, including stone buildings, covered reservoirs, cairns and walls. In such circumstances the Summit shall be deemed to be the highest other point. Where a summit is covered with heather or other living vegetation then the highest point is deemed to be the ground immediately below the vegetation.

Not included in the list of exceptions above are past vegetation such as peat, and man made structures that are grass covered, including tumuli or permanent earthen mounds of any era or hill fort structures. Where the highest point is a rock or boulder that cannot be moved by a typical single adult person without tools the topmost point of that rock or boulder will be deemed the Summit. Where such a rock or boulder can be moved, the Summit will be deemed to be the next highest point not included in the exception criteria above.

If the one time summit has been removed the Summit is that which exists now.

Col

A Col is a pass or saddle situated between two hills. If progressing from one hill to a higher hill, always maintaining the highest possible line between the two hills, the Col is the lowest point through which one is obliged to pass, and the route is called the Critical Hill Traverse (CHT). Similarly, if progressing from one valley to another, always maintaining the lowest possible line between them, the Col is the highest point through which one is obliged to pass, and the route is called the Critical Valley Traverse (CVT). The exact point at which the CHT crosses the CVT is the Col.

As is the case for summits, man-made structures are also encountered sometimes in the area of a Col. Where the Col has been in-filled permanently with material or it has been over-deepened by the digging of a cutting then the current day base of the Col (be this artificial) shall be the depth (or height) of the Col. Where a Col has been bridged over a void, then the low point of the Col under that bridge shall be still regarded as the Col. Where there is a known man-made cutting near a Col that creates a new lower artificial Col in a nearby location, then this shall be ignored for the purposes of calculating the Relative Height of hills, provided the original Col is identifiable.

Useful Definitions of Terms Used in the Document

Critical Hill Traverse

The route or line maintaining the highest possible line between two summits is the Critical Hill Traverse (CHT). This line is unaffected by obstacles and is therefore the theoretical highest possible line irrespective of practical considerations.

Critical Valley Traverse

The route or line maintaining the lowest possible line between two valleys is the Critical Valley Traverse (CVT). This line is unaffected by obstacles and is therefore the theoretical lowest possible line irrespective of practical considerations.

Key Col

Each summit has only one Key Col (sometimes referred to as Critical Col, Relative Col, Prominence Col or more often simply Col) which lies in line between this summit and another higher summit. This second summit is the one which delivers the highest possible route to the subject summit. The Key Col is the lowest point on the CHT between these summits.

Each Col can only be the Key Col for any one summit. A Key Col can be a long way from a summit. For example, The Key Col for Snowdon (Yr Wyddfa) is actually in Scotland! To create a picture, if sea level were to rise gradually until the summit just becomes the highest point on a new island, then the Col flooded to create this is the Key Col for that summit.

Relative Height (Drop or Prominence)

This is the difference between the height of the Summit and the height of the Key Col.

Generally, Relative Height is equal to or less than the height of the Summit above sea level. For a Col lying beneath the sea, its height is regarded as sea level i.e. 0m. However, should a Col exist in low-lying land below sea level, the Col height would be negative. In the UK such land is largely restricted to an area SW of The Wash in Lincolnshire.

Defining the Summits and Cols of Hills

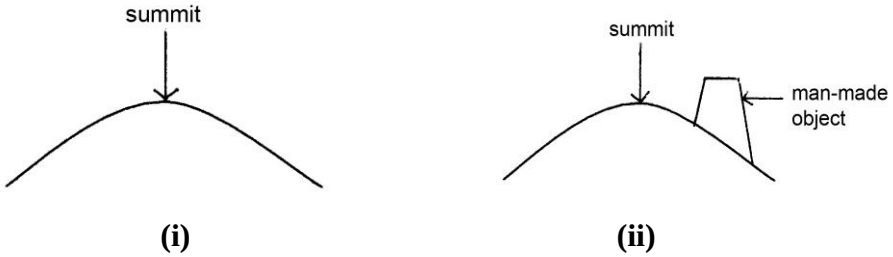
Introduction

Surveying techniques give hill-list compilers a new dimension in accuracy with techniques such as differential GPS and line surveying with automatic level & staff enabling us to measure absolute height and drop to within a few centimetres. Previously, the compiler had to rely on map features, for example spot heights, which are accurate to only 3m and not necessarily positioned at the true summit or col. However this increase in accuracy brings with it a new challenge, namely the reliable definition of a summit and a col. We are finding increasingly that the limitation on a measurement depends on definition rather than the equipment used. For example, consider the case of Penycloddiau (SJ127678 LR116) where recently Denbigh council has built a 'tumulus' on the top of the hill which completely obliterates the natural summit. This is a permanent feature, so for anyone wishing to measure the height of Penycloddiau where should the GPS be placed? Alternatively, consider the col of Milk Hill (SU235632 LR173) which has a railway cutting running through it. Should the surveyor measure to the railway line or some alternative point? While list compilers have tackled problems such as these in the past, it has been done on an ad hoc basis, as and when the need has arisen. As the ability to make more precise measurements is now at hand, this issue will become increasingly common. Consequently, in this document we attempt to set out a protocol that will enable the positions of summits and cols to be defined for any situation in the UK, thus giving surveyors, cartographers and future hill-list compilers a clear set of guidelines to follow.

Defining Summits

1. Is the natural summit identifiable?

Our first proposed rule is if the natural summit can be identified, irrespective of whether other higher man-made features are present in the vicinity, then this is the point from which absolute height or drop is measured. This will be the case for the majority of hills.



(i) **(ii)**

Example: Sgurr Alasdair (NG450207 LR32)

This rule applies equally to both modern and ancient man-made objects.

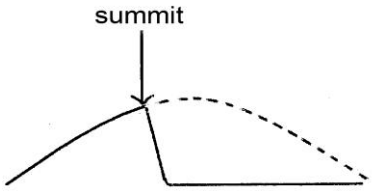
Occasionally, situations may be encountered where there is a landscaped man-made feature (eg old colliery tip) of similar bulk to the hill in question, but distinct from it and

not obscuring the natural summit. In these situations we propose that the man-made feature, if higher, should be the point from which height and drop are measured.

Examples: Hensbarrow Beacon (SW996575 LR200) (but see General Comments)

2. Has the natural summit been removed?

This may have happened, for example, through quarrying or through other activities such as levelling of the ground for various purposes. It is impossible to survey the original summit in this circumstance and therefore we propose that the highest remaining ground should be surveyed, even though the new summit may have been created through human disturbance.



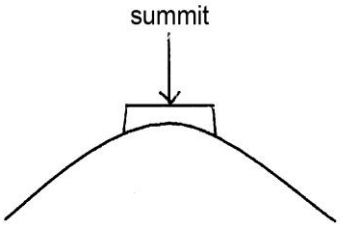
Examples: Cairngryffe Hill (NS941411 LR71, 72), Cefn Mawr (SJ200634 LR116), Craig y Bwlch (SN717694 LR147)

3. Is the natural summit covered by a man-made feature comprising earth or unworked stone?

This category covers several types of feature found in the summit area of many of our lower hills and we shall consider some of these in turn.

Tumulus

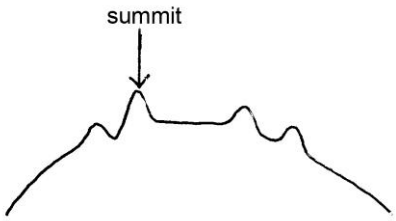
These usually ancient features comprise stones that have been covered by earth and sometimes they have a central hollow. If the tumulus covers the natural summit then we propose that the highest point of the tumulus becomes the recognised summit.



Examples: Domen-ddu (SO016782 LR136,147), Pegwn Mawr (SO023812 LR136), Bache Hill (SO213636 LR137,148), Swyre Head (SY934784 LR195)

Hill Fort

Hill forts are built round the summits of hills and enclose a relatively flat, levelled area upon which dwellings were originally built. The natural summit has therefore usually been removed and the earthen ramparts often form the highest point. In these situations we propose that the highest point of the fortification, assuming it to be earthen and not worked stone, should be regarded as the summit. If the natural summit can be shown to exist then Rule 1 applies irrespective of whether the ramparts of the hill fort are higher.



Examples: Burrow (SO381830 LR137), Wapley Hill (SO347624 LR137,148,149), Bryn Dinas (SJ172248 LR125), Long Mountain/Beacon Ring (SJ264058 LR126)

Petrified Fort

The wall of the fort comprises rocks fused by heat to form a coherent structure which encompasses the summit area of the hill. The land enclosed by the fortification has usually been levelled and probably contained buildings when the settlement was in use. Usually, the natural summit has thus been obliterated and consequently the highest point of the wall should be regarded as the summit. Once again should the natural summit be identifiable then Rule 1 applies and should be used.

Example: Tap O'Noth (NJ484293 LR37)

Small Summit Mounds

Many summit cairns and trig points are built on small mounds of earth or rock. In most cases it is impossible to be certain whether these mounds are natural or have been constructed prior to the cairn or trig point having been built upon them. We propose that the top of the mound (or base of the cairn/trig point) be defined as the summit.

Example: Cuilags (HY209033 LR7)

Huge Ancient Cairns

A few hills have these features. The cairn might be ten metres wide and several metres high. The dilemma here is that the cairn comprises loose stones which are mobile and therefore the height measurement cannot usefully be made from the top of the cairn. We propose that in these cases the positional measurement is made from the top of the cairn, but the height measurement is made from the highest ground on the periphery of the cairn (see also General Comments).

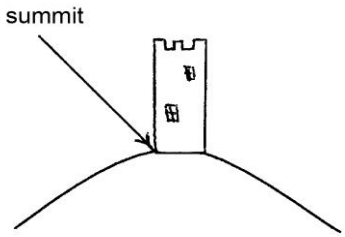
Examples: Tinto (NS953343 LR72), Grey Nag (NY664476 LR86)

Dry-stone Walls

A few summits have dry-stone walls passing over their summits. The ground at the base of the structure should be taken as the summit, but refer also to the discussion of cairns under General Comments.

Examples: north top of Housedon Hill (NT902329), Drummond Hill (NN749454 LR51,52)

4. Is the summit occupied by a metal mast, wind turbine, stone tower, building, wall of stone and mortar, or covered reservoir?

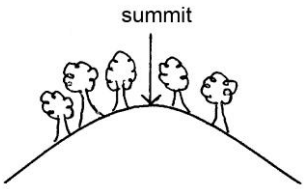


These features are usually constructed from or contain man-made materials and are often relatively recent in origin. We propose that the highest ground adjacent to the structure is measured for position and height. It is also acknowledged that the ground may have been levelled or worked in preparation for the construction of the structure. Of course, if the building does not occupy the summit then Rule 1 applies and the natural summit should be used.

Examples: Moel Famau (SJ161626 LR116) stone tower, South Stack (SH202822 LR114) lighthouse, Pale Heights (SJ543696) covered reservoir

5. Is the summit covered by trees?

Few people would disagree with the statement that trees don't count! Consequently, the highest natural ground should be identified for measurement.



Examples: Banc Dolwen (SN792787 LR135,147), Drummond Hill (NN749454 LR51,52), Knock of Crieff (NN873233 LR52,58), Croes y Forwyn (SJ029210 LR125), Long Mountain/Beacon Ring (SJ264058 LR126)

General Comments

There are a few general comments that apply to most of the above categories.

First, our definition of natural ground does not mean ground that has remained completely untouched by man. Little or no ground in the UK has escaped human disturbance at some time or other since the last ice age. It does mean ground where the general contour of the land has not been changed. Thus, ploughing, to take but one example, may change the appearance of the land, but it does not change the general contour, so ploughed land would count as natural in this context.

Secondly, many summits are marked by a cairn. The cairn should be checked as carefully as possible (we do not advocate its destruction) to ascertain whether it has been built over an embedded rock or boulder. If so, then is this rock or boulder higher than any other feature that is a contender for the highest point? If it is, then the boulder in the cairn marks the highest point and should be used for the height measurement. An example of this is Harter Fell (NY459093 LR90). If there are no hidden fixed rocks or boulders in the cairn then the base of the cairn is the summit position as given in Section 3. Occasionally, a summit contains a very large well-built cairn which is impossible to probe and in this case there is no option but to measure from the base of the cairn and report this height with the caveat that there may just be higher ground within the cairn. An example of this is Drygarn Fawr (SN862584 LR147).

A similar situation may arise when dense vegetation covers a summit. Again the only option is to measure and report the highest identifiable point with the caveat that the dense vegetation may just hide higher ground. An example is Brighstone Down (SZ432847 LR196).

Thirdly, many summits are made not of smooth ground, but of ground adorned with embedded rocks. In this case the rocks should be tested to give confidence that they are truly embedded and part of the hill and not just lying loose on the surface. If the rock cannot be removed from its position by reasonable and unaided human effort, then it is deemed to be part of the hill and the height measurement is taken from the top of the rock. There are many examples of this situation; Geal-charn (NN596782 LR42) which was surveyed by us is but one. Occasionally, a summit may be crowned by a large boulder sitting on the surface of the ground (for example an erratic) which cannot be moved by unaided human effort. In this situation we would propose measurement be made to the summit of the boulder. An example is Pen y Castell (SH721688 LR115).

Fourthly, many summits are covered in heather or other thick ground cover. In these circumstances there is a gradation between living plant, plant detritus and the soil underneath. This may only be of the order of 5cm – 10cm, but the technique of differential GPS is capable of resolving these small differences. As far as possible plant matter should be removed before a measurement is taken. The one exception is peat. Our uplands are covered by a few metres of peat in many areas and, although strictly plant detritus, it is both impractical and in our view wrong not to include the peat layer in the measurement. Once again there are many examples, an obvious one being Kinder Scout (SK084875 LR110).

It should also be mentioned that, if there were ever a case of a UK summit with permanent snow, the height would be measured from the underlying ground.

Lastly, several hills have covered reservoirs on their summits and these features have been the cause of much controversy. We are advised that all are constructions of concrete, some of which are partly covered or completely covered by grass. Moreover, on a long time-scale of many decades they are temporary, in that they will be demolished when no longer used.

Consequently, we have classed them along with other structures built of man-made materials (Section 4) and therefore they do not count as part of the hill. The highest ground adjacent to the structure is measured for position and height. If, when demolished the area is landscaped and the earthen remnants of the reservoir remain as a mound, then in these cases the top of the mound would be used for measurement of position and height. Of course, if the natural summit is identifiable then this should always be taken in precedence.

Note that summit and col heights for a few hills may change by several centimetres with time where they are, for example, arable land (eg Milk Hill summit SU104643 LR173) or where there is an unstable peat layer (eg Kinder Scout summit SK084875 LR110 or the col of Meall Cala NN501137 LR57). Indeed in the case of Meall Cala's col, which contains a network of peat hags, the col height may vary with season as the peat swells and shrinks. In a very few critical cases this could require the summit or col to be re-measured if there is reason to believe that change has occurred. It is a list author's prerogative to accept or reject a hill for their list. However, we would recommend that for a candidate hill where drop or height frequently fluctuated in and out of qualification, then such a hill would be deemed not to qualify for that list.

In Section 1 Hensbarrow Beacon was given as an example of a hill where spoil heaps in the near vicinity are considerably higher than the natural hill. This example serves to illustrate the potential complexity of reassigning the summit from the original natural position to a new one. In this case the spoil heaps are in the process of being landscaped. The highest of these has been landscaped on its lower slopes, but the summit area remains very much a spoil heap. However, some of the lower spoil heaps have been landscaped and are higher than the natural summit. In cases such as this one, where the landscape is undergoing relatively rapid change, we would retain the old summit position until the process of stabilising and landscaping the highest feature has been completed.

We would not condone the deliberate addition of material to a summit, just in order to change the status of the hill.

Mention should also be made of County Tops where the highest point lies on a ridge or slope and not a summit. The challenge here is clearly not in locating a summit or a col, but being able to transfer the line of the boundary from the map to the ground. If it is assumed that a 1:10k map can be read accurately to 0.5mm, then the accuracy with which the boundary can be mapped on the ground is to within about 5m. The procedure we successfully adopted for Hail Storm Hill was to transfer the grid references of points along the boundary into a hand-held GPS and then, using the GPS, mark out these points on the ground with small flags. Note that a small systematic error is introduced when transferring map grid references to most hand-held GPS instruments and this needs to be taken into account, see

http://www.hills-database.co.uk/database_notes.html#GR10 .

The highest point was then determined with level and staff and the survey-grade GPS set up on this point. Since the accuracy of the hand-held GPS is about 5m for position and that of a1:10k map also 5m, then the overall error in this method of about +/-7m for position is the best that is achievable. The height difference between the two points 7m up the ridge and 7m down the ridge then likely determines the uncertainty of the height measurement.

Appendix 3: Flow Chart for Summits summarises the process for determining the summit of a hill.

Defining Cols

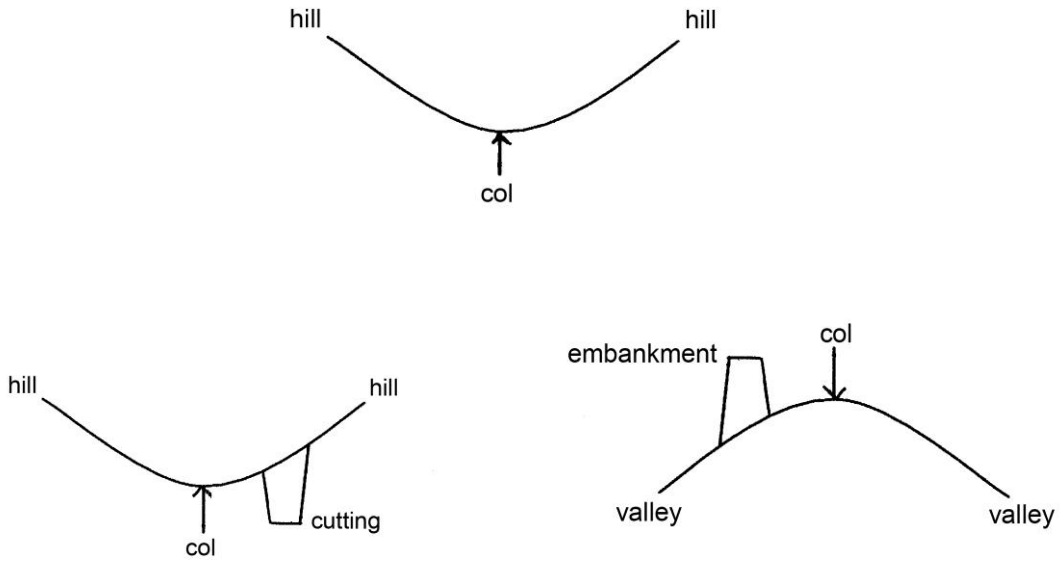
First, it is appropriate to describe how we go about finding the position of cols as these are usually of more complex shape than a summit and therefore less easy to locate. The first task is to find its approximate position (say to within 100m of distance) and this is fairly easily accomplished with a level and staff. Next a grid of flags is laid out around this point with individual lines being parallel to the hill to hill direction and perpendicular to the valley to valley direction, as shown in Appendix 2: Surveying a col. The spacing chosen depends on how well defined the col is, but it is usually either 5m or 10m. With the level then set up at some convenient point (this may be either inside or outside the grid) the height of each point is measured relative to the level. For the valley to valley direction, the points rise in height to a maximum and then fall again as each line of flags is traversed. The flag with the maximum height in each line is identified and the line of resulting maxima represents the line of the col in the hill to hill direction. The flag with the lowest height in this line then represents the position of the col. If required a second small grid may be constructed around this point in order to locate the col position more precisely.

Often cols are of more complicated structure than the classic shape, for example there may be two cols of very similar height (Bell Crags NY296137 & NY296140 LR89,90) or the col may contain a network of peat hags (Meall Cala NN501137 LR57). In these situations the location of the col may become very time-consuming. For a classic col it takes about 2 hours to carry out this procedure.

The process for defining cols is very similar to that for defining summits, although the issues may be slightly different and so we will treat them separately.

1. Is the natural col identifiable?

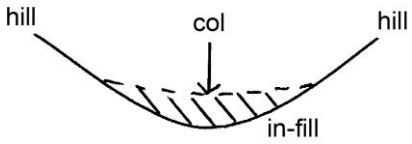
If the col is clearly identifiable, despite there being a man-made feature, such as a road or railway cutting close by, then the natural position and height of the col is used. Note that this rule is comparable with the first rule for summits.



Example: Most cols fall into this category

2. Has the col been covered by debris comprising earth and unworked stone?

In this situation the new surface should be used to locate the position of the col as it is impossible to determine the original position and height of the col.

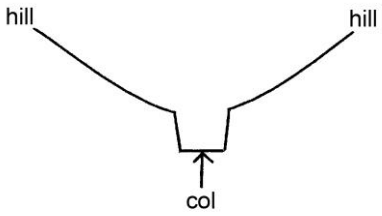


Example: Carreg y Foel Gron col (SH745428 LR124)

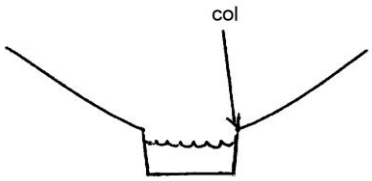
3. Has the original col been removed by a cutting?

Cutting running in valley to valley direction

In this situation it is impossible to determine the position and height of the original col and therefore the col position within cutting should be used.



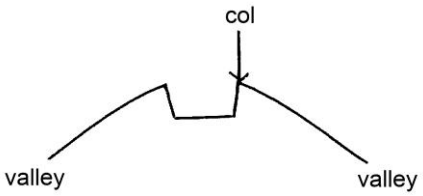
A special case occurs where the cutting is a canal. We propose that the bank of the canal at the critical hill – hill traverse is chosen as the col and not the water's surface or the bed of the canal. If the two banks are of different height then the lower one is chosen. The alternative of taking the surface of the water is impractical as water levels may change with season. Where it is the case that one embankment simply merges with the water then an attempt will be made to ascertain the water height when the canal is just overflowing (via an overflow point). Only if the canal were permanently drained would the bed become the point of measurement, as the situation would then revert to a conventional cutting as discussed above.



Examples: Milk Hill col (SU235632 LR174) railway cutting over canal tunnel; Raw Head col (SJ528439 LR117) canal

Cutting running in hill to hill direction

If the cutting runs in the hill to hill direction, then the col cannot be in the base of the cutting, because in the perpendicular valley to valley direction the location of the col is the highest point of the critical traverse. Consequently, the col is located at the top of the embankment on this critical traverse (see survey of col).

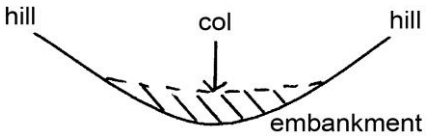


Example: none known

4. Is the natural col covered by an embankment?

Embankment running in hill to hill direction

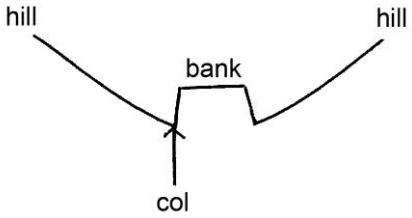
If the embankment covers the natural col and it is impossible therefore to determine the col's original height, then the summit of the embankment should be used for the measurement of col height. This is similar to the case of in-fill as discussed above.



Examples: Y Blaen Llym [Craig Nythygigfran] col (SH683466 LR115); Kinder Scout col (SD894486 LR103)

Embankment running in valley to valley direction

If the embankment runs in the valley to valley direction, the base of the embankment represents the low-point in the hill to hill direction (see survey of col) and therefore this point should be taken as the col.

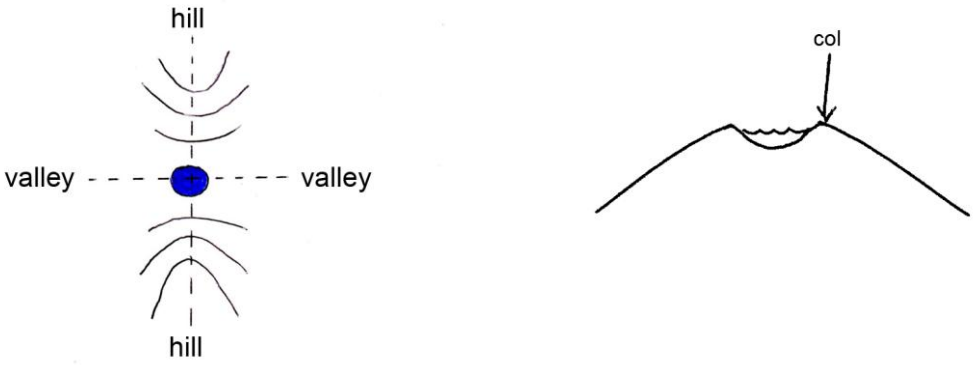


Example: none known

5. Small Lakes (lochans, llynnau and tarns) and Reservoirs

Although this document has concentrated on the treatment of man-made features, pools of water are commonly found in cols and can cause confusion. Reference to the sketches below shows that it is the highest point of the valley – valley traverse that lies on the critical hill – hill traverse that is the col. It is not the water's surface.

Occasionally, the pool is the source of two streams each issuing into a separate valley and



therefore one has to be crossed in a critical hill-hill traverse. In this situation the water's edge is taken as the col position, as for a canal (see above).

Example: Bryn Brith col (SH658144 or SH663144 LR124)

Large reservoirs offer a unique problem as these are usually retained by large concrete dams which, being constructed from man-made materials, are not taken into consideration directly when determining the height of a col. The majority of reservoirs are constructed in valleys and do not cover a col and in these situations the natural col can still be identified and used. Very occasionally however, a reservoir is constructed over a col with dams retaining the water at either end. This situation may again be treated in the same way as a canal traversing a col and the height measured on the bank of the reservoir at the water's surface. Note that water levels in reservoirs can rise and fall. We would propose that the maximum water level height be used which can be ascertained from the tide line, if the water level is low at the time of survey. It should also be noted that the col

occupies an area (that of the reservoir) and not a point and so cannot be represented by a unique six-figure grid reference. The grid reference of one or both of the dams might be used as a convention in this situation.

Should the reservoir ever be decommissioned and the natural col exposed once more then the natural col should be once again be used.

Example: Stronend col (NS676857 or NS717838 LR57)

General Comment

Cols are generally lower lying than summits and as a result tend more often to suffer from human disturbance. A classic example is the col of Abberley Hill (SO701746 LR138). A railway cutting passed through the col in a valley to valley direction and it was this that gave Abberley Hill (SO751672 LR138, 150) sufficient drop to enter the list of Marilyns. The cutting was crossed by a road bridge at or very near the position of the col. Then the railway line was closed and several years later the cutting was filled and the road now crosses this area on an embankment. Abberley Hill is no longer a Marilyn and this case serves to illustrate just how much human disturbance can occur in cols.

The flow chart in **Appendix 4: Flow Chart for Cols** summarises the process for determining the position of a col.

Appendix 1: Alternative treatments

While compiling this document we have found alternative approaches for treating the features found on summits and on cols and we thought it useful to describe these in this section and explain why we have not adopted them. Our motivation in writing this document has been the development of a protocol that can be interpreted in the field when man-made objects are encountered during a survey. We have also aspired to treat summits in the same way as we would treat cols. For example, if the natural summit is identifiable, then it is used in preference to any man-made object for the height measurement and if the natural col is identifiable, then that too is used in preference to any man-made object for measurement purposes. In the case of man-made objects, a summit that has been quarried away is treated in the same way as a col that has been quarried to produce a cutting for a road or railway line. However, it must be acknowledged that a col is a more complex three-dimensional object than is a summit and this uniformity of treatment is not always attainable.

Sorting man-made objects by date

One method of treating man-made objects is by date, the rationale being to group these objects into ancient and modern structures. The precise date of transition may be different according to author. Modern structures are then discounted and cannot be used in the determination of summit height and position, but ancient objects are used for this purpose. For example, an ancient tumulus near, but not on, and higher than the natural summit of a hill would count as the summit, even though the natural summit were identifiable. We have not followed this approach for two reasons. First, there is the difficulty of determining the date of construction of a mound (without investigating archaeological archives), when it is encountered during a survey. Secondly, if no written record exists that allows the object to be dated, the summit height and position of the hill cannot be determined. If the tumulus is situated over the natural summit then both approaches are consistent in taking the summit of the tumulus as the summit of the hill. This document tries to be consistent in its treatment of summits and of cols. Recently constructed cuttings would have to be discounted on a date rule even when they destroy the original position and height of a col. In this situation the col can never be determined by survey. The same dilemma would apply to summits that have been quarried away in recent times. The date approach also requires exceptions to be made for some summit objects, in the same way as the protocol described in this document. For example, buildings pre-dating the cut-off have to be treated as exceptions.

Covered reservoirs

The treatment of covered reservoirs is a controversial subject. One such treatment rejects all, while we have found proponents who would include all such constructions as part of the hill. Clearly, there is no correct or incorrect treatment of covered reservoirs and we have adopted the position of not counting them for the reasons given in the General Comments section of Summits. From the correspondence we have received, this is the view adopted by a significant majority of reviewers. However, we recognise that this view is not unanimous.

Canals

The treatment in this document of canals that cross a col from valley to valley is not that followed by all, although we believe it to be a majority view. Some authors believe the bottom of the canal should be used for measurement of drop.

Appendix 2: Surveying a col

valley ↑

1	▲ 0	▲ -1	▲ -2	▲ -3	▲ **-4**	▲ -3	▲ -2	▲ -1	▲ 0	▲ 1
2	▲ 1	▲ 0	▲ -1	▲ -2	▲ **-3**	▲ -2	▲ -1	▲ 0	▲ 1	▲ 2
3	▲ 2	▲ 1	▲ 0	▲ -1	▲ **-2**	▲ -1	▲ 0	▲ 1	▲ 2	▲ 3
4	▲ 3	▲ 2	▲ 1	▲ 0	▲ **-1**	▲ 0	▲ 1	▲ 2	▲ 3	▲ 4
5	▲ **4**	▲ **3**	▲ **2**	▲ **1**	▲ **0**	▲ **1**	▲ **2**	▲ **3**	▲ **4**	▲ **5**
6	▲ 3	▲ 2	▲ 1	▲ 0	▲ **-1**	▲ 0	▲ 1	▲ 2	▲ 3	▲ 4
7	▲ 2	▲ 1	▲ 0	▲ -1	▲ **-2**	▲ -1	▲ 0	▲ 1	▲ 2	▲ 3
8	▲ 2	▲ 1	▲ -1	▲ -2	▲ **-3**	▲ -2	▲ -1	▲ 0	▲ 1	▲ 2
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**

hill ←

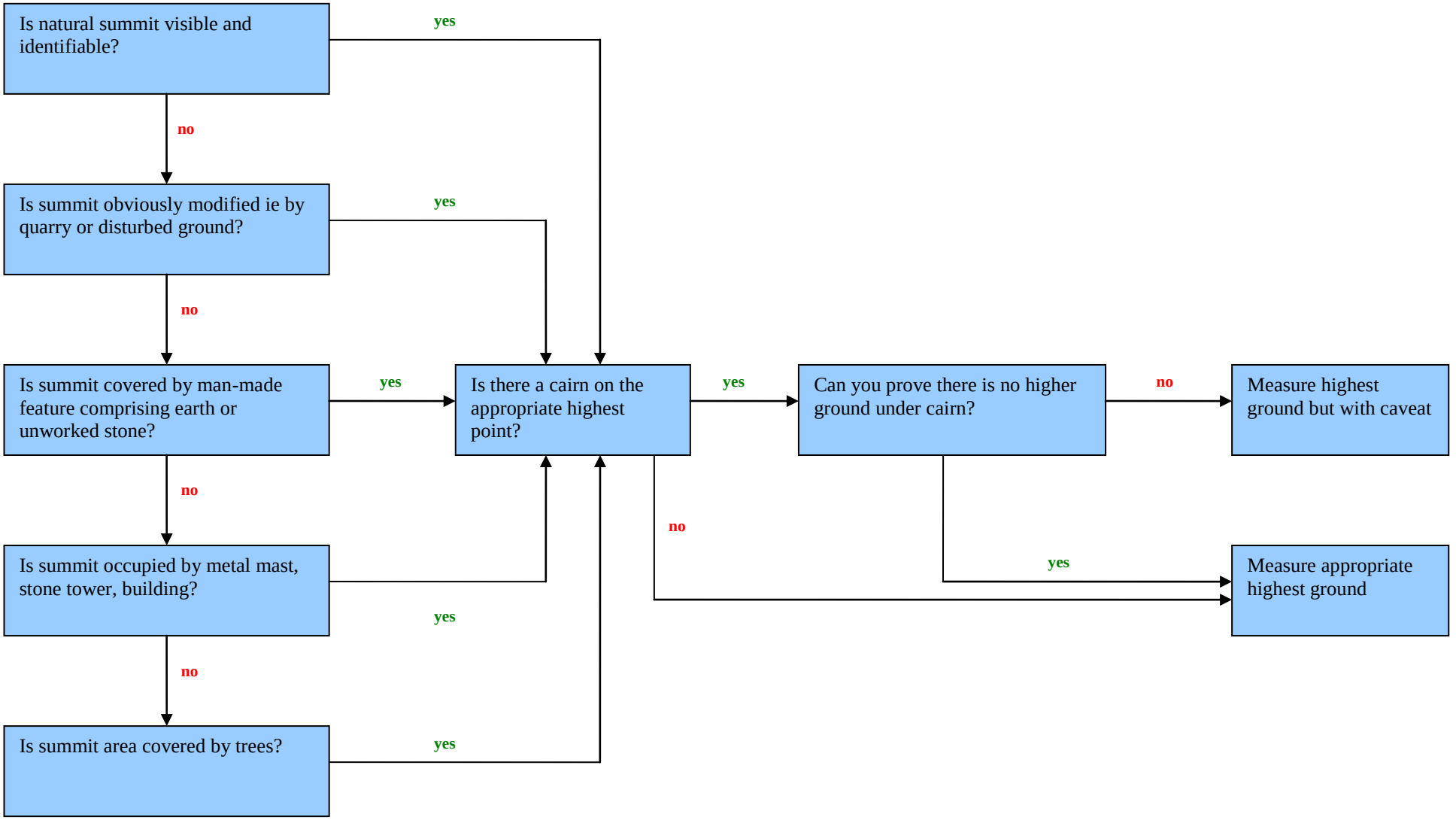
Critical hill – hill traverse

→ **hill**

Critical valley – valley traverse

valley ↓

Appendix 3: Flow Chart for Summits



Appendix 4: Flow Chart for Cols