

LINE AND BATTER: Part 2

If I had a pound for every time a person asked “what should the batter of a wall be”... I’d probably still be broke, but it is not an unfamiliar question. As with much of walling the answer is perhaps a little indeterminate.

DSWA’s “Walling Techniques and Traditions” states: “*over the generations it has been found that the base width should be twice the width of the wall measured immediately beneath the copestones. By adding these two widths together you can get an approximate measure of the height of the wall before the cope is put on.*”ⁱ To put it another way the top width is a third the height (before cope) of the wall, foundations are twice top width and batter equates to 1 in 6.

Meanwhile BTCV’s “Dry Stone Walling” comes up with “*as a general rule of thumb, the base width of a wall should be half its height, measured from the bottom of the trench to the top of the coping. The top width, below the coping, should be half the base width.*”ⁱⁱ This is a very messy formula as coping size can vary for any given height of wall and so will affect the batter calculation. Better perhaps, (maybe it’s a misquote?), to measure before cope when it will consistently give a batter of 1 in 8. It would of course be battered more than 1 in 8, i.e. nearer 1 in 6 if coping enters the equation, - depending on the actual height of the wall and the relative proportion made up by coping... I’ll leave you to work that one out for yourselves!

Well last time I hinted that this instalment would have more of a theoretical bent... It will be a little heavier than normal, so here we go again...

Batter is the slope of a wall (face) in narrowing from the width of the footing to that below the cope. Slopes such as this are measured as ratios 1:6 (one in six), 1:7, 1:8 etc. They can also be stated as percentages and of course as degrees. For walling, ratios tend to be more useful. To clarify: for a batter of 1:6 the wall batters in 1 unit for every 6 units in height; for a wall 1.2m high that has a base width 80cm and top width of 40cm, the wall batters in from

80 to 40 which is 40cm in total, so it batters in 20cm on each side, or 20cm in 120cm (height) which is 1 in 6 (120 divided by 20); for a wall of the same height with a base of say 75cm and top width of 45cm, the wall batters in 30cm, or 15cm per side, and 15cm in 120 or 1:8 (120/15). Enough of the math (for now).

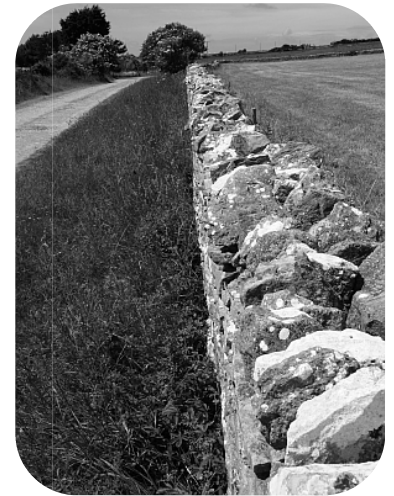
Interestingly most `modern` writers seem to put batter at around 1:6, or would do if they actually put it into words. You have to follow the dimensions, as they give them, through and calculate it yourself. Few of these cite sources, although Raistrick looks at a series of Enclosure Awards and Acts, from the end of the 18th and beginning of the 19th centuries. From these we can deduce a batter of around 1:6 as the norm in the Penninesⁱⁱⁱ (in one instance 1:7). Scottish Master Craftsman Nick Aitken, has carried out some research into wall dimensions, and I am indebted to him for indicating two 19th Century references which point at batters of 1:9 and 1:10.^{iv}

The BTCV formula only appears from the 1999 revision onwards. It is an un-referenced formula and Sean Adcock cannot find his original source for it and now thinks it might just have been some form of Welsh Urban (Rural?) myth. It is predated by a year or two in a small North Welsh publication, and seems likely that it is an idea that was prevalent in this part of the country.^v Nick Aitken has a credible theory suggesting when I asked, that it all started “*off as a specification for a particular wall and got repeated and simplified with each telling. It has become part of walling folklore, an easily remembered ‘factoid’*”.

The doyen of dry stone research, Richard Tufnell, believes that walls are battered around 1:6 virtually everywhere, and has measured walls in Minorca, Majorca, India, a number of US States, Croatia, France, Greece, Switzerland and a fair number of other destinations. He tells me that “*most were at or around the 1:6 mark. Appearances can be deceptive - I was told that Kentucky rock fences had almost no batter for example, but measuring sound foundations against the width under the copes showed that most of these too were battered at around 1:6.*”

There is written, and empirical, evidence that many walls are battered

(much) less than 1:6. In the original BTCV book Brooks refers to a batter of 1:12 in the Cotswolds. The DSWA’s own “Specifications for Cotswold Oolitic Limestone Walls”, puts batter at 1:9 to 1:12. The south of England does appear to be a world apart, Purbeck walls would appear to have a similar batter. Wall ends can be good indicators of batter, finding old ones not crumbling seems to be a problem in Purbeck, but those I have seen seemed to show a marked verticality. The problem with empirical evidence though is the danger that we only see what we want to see, and “exaggerate” the verticality.



A typical Purbeck wall with very little batter.

From a recent Mendip publication’s cross sectional diagram, the walls of that area can be imputed to have a batter of only 1:24 to 1:27.^{vi} Of the 2 diagrams, as actually drawn rather than the attached notes, one has a batter of around 1:7 the other about 1:10. The diagrams according to the text are based on those in “*Dry Stone Walling*” (they originated in the first edition by Brooks). Whilst the text notes they are less battered than the norm for the rest of the country, I worry as to the accuracy of the notion of 1:24. Could the diagrams have been lifted without further investigation/justification? If you can label a wall drawn at 1:10 as 1:24, then why not the real thing? I stand to be corrected, having only just realised the import and not having time to try and find out. I do however feel it could well be the case with many written versions of batter, more Nick ‘factoids’, and ‘rural myths’ perhaps.

Have you come across old specifications from the 19th Century? Any information on ‘old’ batters/ dimensions would be appreciated by Nick (stonedyker@

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Richard also suggests that people are not good at judging true vertical without a level. I would agree as I for one have problems. Is it the case that if something is only a degree or two off of vertical, then we just assume that it is indeed vertical? 19th century lime and mortar stone built houses in Wales, (at least the one I live in) can have very slightly battered walls, and having just checked the internal batter of my bathroom it comes out at 1:25. You assume these things are vertical until you try and fit a shower unit!

1:24 is only 2 degrees off of vertical, to all intents and purposes it might as well be vertical (talking dry stone walls not showers), the slightest error and it will be vertical.

As to measuring old walls this can be problematic, you need to find a bit that doesn't appear to have moved. Following Richard's observations I thought I'd have a look around here, finding old walls which do not lean or bulge is a problem. One wall on bedrock was nearer 1:7 to 1:8 than 1:6 but wasn't that even. Another even wall end in a wood was definitely 1:8, then I realised that whilst it looked very old it was in fact an old repair, further along the line the original batter was indeterminate. Anyway who's to say a wall end exactly mirrors the wall. If it's built of large hard to dress stone its quite possibly been built to fit the stone rather than a theoretical measurement. Another wall actually measured around 1:6, but I suspect the footing had spread a few of inches in the top, and so in reality the original batter could easily have been nearer 1:8. This would match my gut feeling as to what a typical batter would be in this area, but that is dangerously empirical, and anyway my survey is hardly representative.

So what should batter be? Well personally I think it is largely indeterminate, but I think that there is more than a nugget of truth in Richard's observations and that by and large most walls are going to tend towards 1:6, and there is not going to be as much variation as we might assume.

With thousands of miles of wall in the UK, you would not expect uniformity. Practicalities enter the equation; for example you need to be wide enough to fit whatever big stone you have in the footing, and theoretically then get down to a suitable width for the available coping. With smaller and thinner/flatter stone this is usually not a problem, so you can get a reasonable amount of batter on these walls. Big boulders require a wider wall, blockier stone (Aberdeenshire for example) might not lend itself to much of a batter and you can end up with more vertical walls. Larger stone with good length into the wall might require a more vertical wall if they are to fit higher up, without the footing becoming ridiculously wide. You might actually require a batter of more than 1:6 to get from a wide footing to a narrow top.



intermediate test in Purbeck, walls battered at 1:12 and built of relatively flat/regular stone

But if the stone is that large achieving more batter can be difficult. In some places you find a stepped batter where regularly large stone is stepped in, okay for cattle but arguably not for sheep.

Flat stone is actually more stable than rounded stone and so can be built more vertical (you can make a vertical pile of cream crackers, potatoes offer a different challenge). By the same token larger, slabber, stone can be built more vertical which in turn means that the length of stone into the wall does not have to decrease that much as height increases, and there is relatively less 'tracing' as a result (assuming there are reasons not to increase foundation width). Long stone can be used to corbel a wall or even overhang it as exemplified by North Wales' "Wailing Wall" in Cwm Ystraddlyn, built in the 1860s.

Looking at it from a physics/engineering viewpoint the most important thing is that the batter is

consistent, which in turn means the forces are evenly dispersed downwards. There is a useful introductory article as to how this aspect of walling works in "Stonechat 10" which can be viewed at www.dswales.org.uk/stonechat.html.

In practice most field walling/gapping has to essentially copy the wall dimensions (more on that next time). As we have seen, 2 of the leading practical guides come up with (different) rigid definitions. Nick suggested "*batter is another place where the amateur looks for a formula. Stone and local traditions dictate how most walls should be built and experience gives the professional more options*"

Whatever the arguments batter it is still important. Mortared walls can be vertical because of the mortar (to rather simplify matters!). This doesn't actually glue the stones together, rather it ensures forces are transferred evenly across the joints and ensures a stable fit. As such there is so much friction across the joints that sliding will not take place and so walls generally fail as a unit.^{vii} In dry stone walls you get settlement, movement, sliding and failure. Batter helps prevent this, and whilst more batter might not necessarily mean more stable, the more vertical the more likely it is that problems will develop (stone size/shape notwithstanding).

My thinking is that a batter, however slight, is more structural than no batter. Essentially if you build plumb then any small error is an overhang. Also 1 or 2 cm off of the desired batter in a metre and a bit is hardly going to be noticeable by eye, but can reduce the batter to a potentially less stable one. Most stone can be fitted to a batter of 1:6, (all if you cant the footing, but that's a whole new can of worms) only rarely should you go below 1:8, and the more vertical you do, the greater the potential for a serious error. Above all keep it consistent, no point having a general batter of 1:6 full of dips and bulges.

Next time more on the actual practicalities!

With thanks to Nick Aitken and Richard Tufnell for their thoughts.

Craig Arbennigol

ⁱ DSWA. "Dry Stone Walling Techniques and Traditions". 2004. p.15

ⁱⁱ Brooks.A., Adcock.S., Agate.L., “*Dry Stone Walling*” BTCV. 1999. p.58

ⁱⁱⁱ Raistrick. A. “*The Pennine Walls*”. Dalesman. 1973 pp 9-17

^{iv} Rev John M. Wilson. “*The Rural Cyclopaedia, or a General Dictionary of Agriculture etc*”, Vol. IV, (1849) and Henry Stephens. “*The Book of the Farm*”, (1891)

^v P. N. Jarvis; *Adeiladu Muriau Cerrig Sych - dry stone walling on the Ffestiniog Railway*, 1993, revised edn 1995

^{vi} Hardcastle. J & Nisbet M. “*Lifelines; The Vital Dry Stone Walls of the Mendip AONB*” Mendip Hills AONB Service. 2008. p.9

^{vii} See Gordon JE “*Structures: or why things don't fall down*” Penguin (1991) Chapter 9 for further explanations.

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