

Masterclass: Assessing Stonework

This edition's Masterclass looks at what you should be looking for when trying to assess whether or not a wall has faults. As a basis it uses the photo competition from *Stonechat* 15, Shirley Addy's Winning entry was as follows:

1. Copes very unevenly sized
2. Running joints – left and right of spirit level (and elsewhere).
3. Small stones at base (right of level).
4. Larger stones are being used above smaller ones
5. Several stones are placed vertically (white one right of level and third from right in second row)
6. Base of cope is too wide at 40cm relative to total height of wall (100cm.)
7. Fourth cope right of level not supported underneath hence gap, and should be placed on a horizontal side
8. Height of wall drops to right
9. Too many small stones at left of picture
10. Courses placed in wall too wavy: slopes downwards towards both sides of picture.
11. Too many gaps filled in with small stones at base especially 1st course right of level.
12. There does not appear to be any sloping batter in wall
13. Some copes are too large especially those in middle.
14. Unsightly gaps, such as at white 'thistle' stone right of spirit level.
15. Middle of base is overhung by second course
16. Largest stones should be at base
17. No throughs and appears to be built as brick wall.



Photo © S.Adcock

A good starting point as to what to look for are 8 principles I identified in *"Dry Stone Walling"* (BTCV, 1999) which you should aim to meet with the placement of each stone (p.51) (some of which I shall paraphrase here), it follows if you can identify where these principles are badly broken then there is a fault in the wall.

- i Largest stones at bottom
- ii Length into wall, avoiding tracing (ie running long axis along the wall)
- iii Place each stone so that it is touching its neighbours, below and to the sides for as much of its surface as possible
- iv Place each stone in a way that does not make it overly difficult to build alongside and on top of it.
- v Taper the wall to the correct batter
- vi Break/cross joints
- vii Sit stones solidly with a minimum of wedging
- viii Set stones to the true horizontal.

Some of these principles cannot necessarily be assessed once the wall is completed and as much of the strength of a wall is internal there is only so much you can see from the outside.

It is beyond the scope of this article to deal with all the technical aspect in great detail. If you are interested in finding out more, many are dealt with in the "Standards" section of www.dry-stone.co.uk, particularly if you follow the link in the first paragraph to the technical appendix of a report I compiled for to the Gwynedd Council Environment Directorate acting as Department's Representative for the Welsh Assembly Government Transport Directorate. It covers the most common aspects of poor workmanship, with plenty of photos (many of which have appeared in previous *Stonechat's* "Rogues Gallery" and "Masterclasses".

So to the eight points (Figures in parentheses relate to Shirley's entry)

(i) Largest stone at bottom (3,4,15,16)

You are unlikely to be able to say very much about the foundations after a wall has been built (although I have when inspecting walls seen footings narrower than the actual wall). At least 1 entry suggested the larger stones should have been in the footings. This is very likely right, but you are unlikely to be that certain that the footings are not even bigger.

Which brings us to grading that is generally placing larger stones towards the bottom of the wall. Here there are obviously a number which should have been placed lower. There are however other implications with these stones size which can be ascertained from relative dimensions. Given that you know how high the wall is you can work out the rough dimensions of a stone's face. In this instance the 2 large stones highest up the wall have faces of around 25-30cm high and about twice as long, they are virtually below the coping so the wall is only a little over 40cm wide, hence. Assuming they are not throughstones (if they are that would open another can of worms) they are obviously traced. Then there are two possibilities, they are either stood on edge (i.e. their base depth into the wall is less than their height) and therefore highly unstable (especially given they are traced) or they leave relatively little space (much less than 15cm) for building the second skin which will consequently be weak, and likely to peel away. As with all things walling setting stone on edge can be regionally acceptable – in some areas they are known as "shiners" although this can refer to any stone with a large (reflective, sun glinting, I suspect) surface- although generally within fairly well prescribed limits and highly specific reasons.

Shirley's answer recognised the need for stone grading although I considered 3,4 and 16 to be tautological. It's possible that 4 related to some pinning (discussed below) but then this would have been the same as 11. I didn't feel it was possible to infer 15 from the photo and it wasn't actually the case. Only one entrant recognised the possibility that the large stones were set on edge.

(ii) Length into wall (17)

The analysis above effectively deals with "length into wall". You can normally tell from the general dimensions of the wall and the relative visible dimensions of a stone whether many are traced, especially extreme examples. In the wall in question all 5 large stones are obviously traced, compounding the problem as where tracing is unavoidable it is best to avoid tracing stones next to each other, or on top of each other, as far as possible. In addition there is a very long traced stone immediately below the coping. This is not as serious as it would be lower in the wall since it has little weight acting on it, and it is tied by the coping.

Single 'excessively' traced stone.
A5/A55 Anglesey © S.Adcock





However it is more serious than it would otherwise be given the prevalence of other traced stones.

No-one really got the tracing problems, although 'appears to be built as brick wall' does just about cover it. Technical aspects of tracing were dealt with in detail in *Stonechat* 11 which can be found on the North Wales Branch Section of the DSWA website. The article can also be found in the books section of www.dry-stone.co.uk

Left: Section of wall where most of the stones are traced. A5/A55 Anglesey. © S.Adcock

(iii) Contact (14)

That is tightness (see this edition's rogues gallery) whilst not universally good was I felt not disastrous (compare it to the rogues gallery) although you could make the argument that with more regular stone you can build a tighter wall you have to be careful not to assume that stone is flatter than it actually is. Black Anglesey Limestone flatters to deceive, if you'll pardon the pun. Other considerations would be the creation of "letterboxes" or "floaters", that is where a gap exists so that a stone is not sitting properly on those below it. In the most serious of cases the lower stones can be easily pulled out.

(iv) Subsequent building

Not really part of assessment as cannot really see although sometimes pinning indicates that a stone was badly placed and difficult to build on.

(v) Batter (12)

It is not possible to assess the batter from the photo. However batter and the related 'line' are two important aspects of assessing a wall. Competitions, and examinations often include separate marks for line and batter, sometimes one mark encompassing both. These two aspects of walling are often inter-related but they are also distinct. As a concept this difference does not appear to be widely understood so I shall dwell on it a while here.

A wall might have two perfect straight and flat faces, if one side slopes more than the other it is likely that the batter is wrong on one side – or both! (there are some regional and technical exceptions beyond the scope of this article), or if both sides have the same batter but the wall is wider at one end than the other the line is wrong. This is the sort of thing that those familiar with competitions are likely to have noticed. A line is run out competitors put their line bars/frames against this 'master line' then lean them, this effectively moves them and the line, the end result are a series of slightly zigzagging walls they might have the right batter but the line is wrong. Even though the resulting section of wall is perfectly flat and straight it doesn't necessarily mean that one or both of the line and batter are actually right. Conversely two adjacent sections will often be relatively straight but one is more vertical than the other. Rarely do competitors (especially in, but not confined to, the amateur and novice classes) manage to batter both sides the same. Essentially line is along and batter is up. When a wall bulges or dips then this is a serious localised fault in both line and batter. There are also instances when a wall might be built with a ledge or a long dip/bulge, in such instances the batter is generally more at fault than the line. A wall might also be built with a different batter at either end on one side. It is likely then that the batter is wrong, it also has implications on the line, but I shall leave you to mull them over yourself as they give me a headache!

It is also important to remember that part of the strength of the wall lies in its 'A' shape. Hence line and batter are important structural aspects and not just cosmetic. When assessing walls bad dips or bulges should be obvious. Whilst they would lead you to questioning the integrity of the wall and closely scrutinising the work of the builder they do not mean it will fall down. In many respects having a good line and batter is important in the long run rather than the short run. I have recently been re-surveying sections of the A5/A55 Anglesey side roads, having first looked at them 4 years ago. My original report frequently mentions poor line and/or batter. As the walls were so poorly built in the first place assessing them now can be problematic as a wall might not be leaning, it might have been built like that, a bulge might have always existed. Hence it can be very difficult to tell if a wall is on the move. (Interestingly the competition photo wall appears to be leaning into the field i.e. away from the side seen than it was originally). In terms of maintaining a wall it is very important that it is built well in terms of line and batter in the first place, then you can accurately assess if a problem is developing and if so, how severely.

(vi) Crossing joints (2)

This wall is riddled with 2 stone joints, not unusual with this type of stone where in effect every second course is levelled to avoid lots of thin levelling stones. This is in fact a common practice in Central and Southern Scotland, although not North Wales. Consequently it might not be a serious fault with this type of stone, however it implies subsequent good crossing of joints, and not having 2 stone joints every other stone! In an ideal world beyond sitting one stone on 2 and 2 on 1 you should aim for 1/2 on 1 and 1/2 on another. Crossing a whole series of joints by a centimetre or two doesn't give much strength to a wall and can create virtual running joints either vertically or diagonally. In addition



Complete running joint (centre). A5/A55 Anglesey



within this section of wall there are obvious running joints either side of the spirit level (ie joints of 3 or more stones vertically). A complete running joint as seen left takes an impressive degree of incompetence. With the 'competition wall', the running joints are only a stone apart exacerbating the fault. This is known as "stacking" and has no structural integrity, and is a particularly serious fault, as outlined in *Stonechat* 11's Rogues gallery (left).

"Stacking". A5/A55 Anglesey

(vii) **Wedging**

This refers to internal wedging which you cannot tell from outside.

(viii) **Set to true horizontal (10)**



Shirley was correct in noting that the coursing bent down at the end. It is a fault but perhaps not that severe, this criticism relates more to this extract from the wall featured in *Stonechat* 14's Rogues gallery. If it wasn't within a 'normal' layered wall this could almost pass for polygonal walling! It can of course also apply to where a whole layer or course slopes either down or up (depends which way you're looking at it I suppose and what it is doing relative to the actual slope of the ground)

Ty'n y Fynnon, Betws yn Rhos

In addition to the 8 criteria above there are a number of other faults/factors which can be reasonably assessed from the outside.

Pinning (11)

See this edition's rogues gallery for more of an explanation. There are a number of pins under the lowest of the large stone (immediately to right of spirit level), more serious is a small pin under large central stone, even worse given it is traced and probably on edge.

Stone distribution (9)

In a well structured wall not only is stone graded according to height it should have an even distribution along a wall. This tends to apply more to random walls where stone size generally decreases with height rather than every stone being smaller than those lower in the wall. This aspect of walling can get highly technical dealing as it does with differential settlement (ie factors which make one piece of wall settle at a different rate to another) and so I shall only introduce the idea. For example if you are rebuilding a 5 metre section of wall and have five large boulders it is often tempting to group them but structurally it is likely to be better to spread them along the length. Similarly filling a gap between a couple of large stones is better done with 2 or 3 medium size stones rather than half a dozen small ones.

Shirley's observation here is quite astute as the stone could have been ordered so much better. The reality is even starker as outside of the photo the stone size decreases quite considerably on either side.

Vertical stones (5)

One entrant referred to the vertical stones, i.e. essentially narrow stones stood upright to fill a gap between two large stones (2nd course up 3rd stone from right, and immediately above it fourth stone from right) as "soldiers" a term I had not previously come across, but will endeavour to use as standard in future. Whilst our North Welsh Cloddiau are essentially built from these "soldiers" that is once again a case specific regional variation with its own technical niceties. Within dry stone walling it is a practice that is generally frowned upon. I'm not entirely convinced as to how bad a practice it is IF the stone is the right height and a very tight fit. There are however considerations with stone type (grain), and frequency - twice in a few square centimetres should be excessive by anyone's definition. I will admit to doing it, but generally only on farm walls and literally once or twice a year, not every half hour! Generally it can be easily avoided just by ordering the stone better, and just points to bad technique. Here the builder cannot even argue it facilitates better crossing of joints given that it actually creates them.

Coping (1, 6, 7, 13)

I'm not going to dwell on coping here as we've just had two epic 'Masterclasses' dealing with this aspect of walling in *Stonechats* 13 & 14.

As to Shirley's answers; point 13 is essentially just explaining/expanding 1, which is of course in itself correct. Point 6 is not strictly true, or only if a strict formula for wall dimensions is applied without recourse to stone type or local tradition, which in both instances would be more likely to point to this wall being on the narrow side. So all things considered it isn't a silly width given that it needs to be wide enough to facilitate building stone size whilst trying to be narrow enough to cope with a single stone. Point 7 is probably mostly correct. It could be a stone with a bit missing, assuming it isn't then it should not be set on this surface, as to whether or not it should be set horizontally is a whole different ball game as it would then be lower than everything else.

Hearting

Being able to see daylight through a wall generally indicates that it is poorly hearted. It is worth bearing in mind that not being able to see daylight does not necessarily mean a wall is well hearted especially if the face stones are reasonably tight and of smaller stone. After all for daylight to show you need to have two gaps opposite each other (i.e. lining up) and then no hearting between them. However sometimes (and dependant on stone type, notably larger and/or squarer) a wall's inside can be so well built in places in terms of stone contact and interlocking of faces that it is difficult to fit hearting in (well it's the excuse I use!). Whilst still a fault it is would not then be criminal, but only if sporadic and only if the wall is obviously otherwise well built.

Throughs (17)

Generally there is little that you can tell from a photo about throughstones from the outside, unless they project too much, create a joint, or do not sit on stone below. Then you can only tell because they poke out. In North Wales they should not project so not being able to see them is not really a problem. It seems unlikely that any of the stones in this wall are throughs but you cannot be sure. The fact that stones protrude from a face of course is not a guarantee that they are actually throughstones, as it is not unknown for building stones to be poked out to maintain a pattern of throughs.

Even height (8)

Shirley specifically mentions this so I better had. The overall height does vary, but it is more notable as a problem with coping than the height *per se*. The height of the stonework below the coping might vary marginally, but difficult to tell from the photo given the grass.

Well that's about it, as usual I could go further but I'm sure we've all had enough. One of the keys to inspecting walls is not to miss really bad faults. When you identify these you look more closely for smaller faults. The occasional fault is not a problem but lots of faults compounding each other is a cause for concern. It is likely that the wall in the photo represents the join between two different contractors. This is likely to explain a number of the problems, but it does not of course excuse them. Perhaps more alarming than someone building this wall is the fact that it was signed off and the main contractors and sub-contractors paid. It can be difficult to see problems in a wall, but a section such as this is literally eye catching given the grouping of "shiners" and should stick out like a sore thumb to even a semi competent 'inspector'.

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