Masterclass: Problems and planning part 3

Sean Adcock. All photos © the author.

In part one (*Stonechat 26*: Summer 2012) I suggested that *"poor grading can become what is in effect a self-fuelled inevitability"* . This was developed in part 2 when we looked at the tendency to place large stones alongside and on top of each other leading to grouping. This however does not just apply to large stone. If we are not careful similar size stones can tend to flock together – both along and up. Small stones can lead to a 'mushrooming', especially if we are concentrating on sitting one on two and half on half and levelling ready for the next stone.
If you wall with thin stone then most of the following is probably not for you although as ever the basic principles will apply.

In the following analyses small stone means much smaller (generally a narrower face) than you would otherwise expect at that point in the grading, and not necessarily physically small per se.

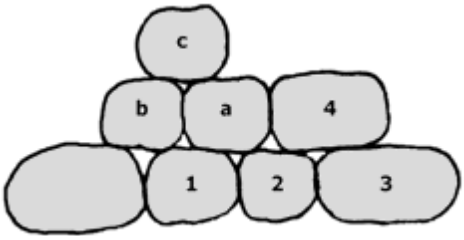

Fig.1

If you are going to sit a stone half on a small stone then you are already restricting how big a stone can be used. With regular stone it ought to be easy to lap onto the adjacent stone with a degree of choice as to how much this overlap is, with less regular stone it is often easier (or only possible) to lap just a small amount, an idea we'll return to later. Basically it is often easier to fit two small stones (Fig.1:a & b) on top of a small stone (Fig.1:1), then you have two small stones to deal with and if you're not careful the problem 'mushrooms'.

A similar problem can occur where two similar size stones are set next to each other (Fig.1:1,2) , then the next one up often the same size too (Fig.1: a). Essentially this is the same as the large 'alongside and on top' problem outlined in part 2. It is not necessarily a weakness if all the stones are 'small' (again relative to grading) - but can easily become one. It is possible that 'mushrooming' is often only prevented by accident through using stones which create poor joints or by setting 1 stone on 3 (which is generally regarded as a weakness). People then see these faults and correct (or criticise) them, rather than recognising the initial problem. The true fault is in having created the situation in the first place, and this often comes down to not being aware that its happening and not planning ahead. The end result is often either an increase in joint problems, or if you're concentrating on avoiding these (because it is drummed in from early training as 'a', if not 'the', cardinal rule), it can easily 'mushroom'. A corollary to this problem can be that such grouping uses up similar sizes very quickly, which somewhat inconvenient if that is the size you need to sort out a problem elsewhere.

In Fig.1, if 'a' is set around half on stones 1 and 2 then it will necessarily be of a similar size to 1 or 2. The smaller the stone the more of a problem this becomes if you are trying to avoid sitting it on the outside ¼ of the stone (as detailed in part 2, Fig.4). Stone 4 is also likely to be smaller than you would otherwise expect at this point, unless you are able to extend it well onto 3. It will often still be smaller than you would ideally want (i.e. relative to the available stone) - but if you use a larger stone it is likely to lead to jointing issues at the right end of 3. So even if it is bigger than a or b, it is still essentially just adding another undersized stone to a section . Much of this is relative, to a certain extent hypothetical, and certainly schematic, but it does help explain why you often see groups of smaller stone in poorly graded walls, how poor grading itself becomes self perpetuating and/or leads to the knock on problems with jointing outlined here and in parts 1 and 2. As was noted in part 1 (*Stonechat 26*) grading/stone distribution is not only up but also along.

To summarise, if you put two small similar sized next to each other then the 'best' that tends to happen is that the next stone up is of a very similar size, or smaller. If it gets larger then there is more likely to be a joint problem on far side of adjacent stone. Small stones are naturally very difficult to form the next joint on simply because there is a lack of space to sit on. A problem exacerbated if the stone does not have very square edges.

This problem can also arise if (or be exacerbated by) the stones are not sat level, as it tends to be more difficult to cross a joint well in these instances. This is especially true with regular stone, but also with less

regular stone unless have a conveniently shaped stone to get over it. If you are not careful it can be the start of a bad joint. It can be possible when sitting a larger stone on smaller ones to avoid the jointing issue by choosing to set it on 3, bridging the centre stone and hopefully sitting it around half on the outer two. This is usually ill advised as it leads to the weakness, mentioned a couple of times already in this mini-series, known as '1 on 3'. A weakness which is exacerbated if the bridging stone is traced, which when the 'smaller' stone is not that physically small it frequently is. Of course it should be able to place a one on three with adequate length into the wall, if the wall is wide enough relative to the length of stone needed, however the practicalities of leaving sufficient space for building stones on the other face, plus problems with overlapping less regular stone, often results in a limited overlap.

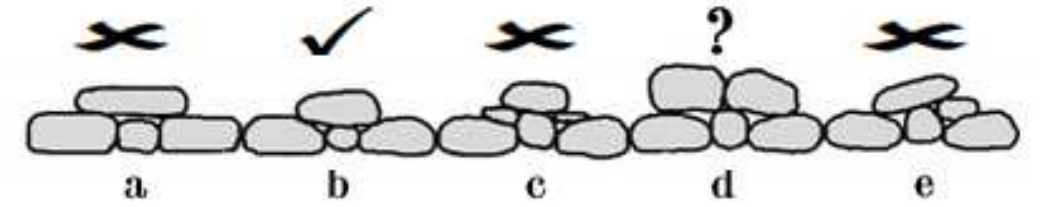

Fig.2

In *Stonechat 18* (Summer 2009), Masterclass (*Random walling part 2*) looked at this problem in terms of actually managing to hold the centre stone, 'nipping' it with the bridging stone. Fig.2 is based on the diagram used then. A number of the principles looked at here were looked at in that article. Stonechat 18 can be viewed online at www.dswales.org.uk, all previous Masterclasses can be found at Mark Jurus' 'Dry Stone Resource' blog site http://drystoneresource.blogspot.co.uk/.

It can be very difficult to successfully get a 1 on 3 stone to sit on and hold all three stones underneath. The bridging stone tends to miss the middle stone completely (Fig.2: a) or rock on it (Fig.2: c & e). Often the best we can achieve is for it to sit on the middle and one of the outer stones, whilst missing the other (not dissimilar to Fig.2: e, except that often the stones are set more level, with a pin/plate at one end). Even if we somehow manage to get the bridging stone to sit on all three more or less evenly then it is still a weakness. We have to assume that over time walls will settle, where a 1 on 3 stone is present any movement in the wall below will result in one of the three no longer being securely held, unless all three move by the same amount, which is extremely unlikely.

As noted *'Random Walling part 2'* also looked at problem of 'nipping' the smaller stone. I think it is worth repeating the advice I offered then... *"with regular stone you need to ensure everything is very level otherwise the stone will remain loose or just act as a pivot. With less regular stone if you cannot get it flat then it is probably best to allow a slight dip then you can find a suitable shape to nip it. If it is proud the chances are (unless you are very lucky with stone shape) you cannot bridge it and nip it. Unless you use absolute slivers compounding the problem, you have to have two stones sat on it. This will mean a very limited (if any) overlap, and often the start of a stepped joint."*

If you do manage to accomplish 'b' in Fig.2, it is often only with a stone which does not stretch far onto either one or both of the outer stones (Fig.3: x) as stones which stretch further rarely sit well (Fig.3: z), unless you have very flat stone and are able to sit all three very level. With less regular stone you are extremely lucky if you find a stone which can contour onto the outer stones (a gap at c is more likely). As well as creating potential jointing problems here, it can also have the knock on effect of finding a stone (Fig.3: y) with sufficient

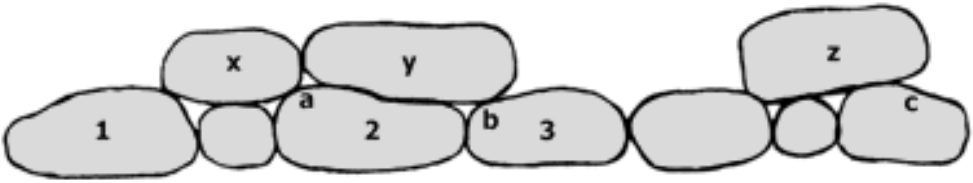

Fig.3

face width to bridge the next joint. Stone y is quite wide compared to other stones in order to get any significant overlap onto '3' if it were much shorter the jointing at both a and b would be poor. If a shorter y is shunted to the right to increase the overlap then another relatively small filler is needed between x and y (as it

Fig. 4

would be if y itself left sufficient space for another to cross joint b), and the initial problem is recreated, as can be seen in Fig.4. Here limited overlaps in the one on three just below centre right, has necessitated another one on next layer - centre of picture.

If you do not avoid this problem then tracing is more often than not the only viable alternative to creating a joint(s). Remember with most stone types tracing is okay, (as an exception rather than a rule), as long as it solves a problem and on balance leads to a better overall structure. Traced stones should be relatively flat based, sit very well and subsequently tied in. Slightly rounded stone does not trace at all well as it rarely sits well and tends to have an innate tendency to want to tip off, at very best relatively easily. You should always bear in mind that tracing to solve a problem is usually solving the problem with a potential weakness, and really only a last resort solution.

A corollary to this problem, especially with less regular stone, is getting a stone to sit far enough onto the next stone with without rocking (Fig.3: z). In poorer built walls you often see limited overlapping of joints as this avoids rocking, however it frequently leads to jointing issues (Fig.5).

Fig.5

It can be easier to sit flat stone on flat stone with minimal crossing of joints maintaining good contact and avoiding rocking as a result of slight irregularities in stone shape or level. However this creates poor jointing and in the case in Fig.5 running diagonal joints. This problem tends to exacerbate when flatter stone is mixed in with more irregular stone. When walls are composed of a variety of stone type/shapes, it tends to be easier to wall similar types/shapes together than to mix them up, which theoretically (all other things being equal) tends to have a detrimental effect on the structure (see also Figs.7a&b).

This overlap problem can also apply to d in Fig.2. It is usually the case that the narrower the face width you use to sit on the small stone, the easier it is to sit them – the wider the face width, the more likely they are to rock. Once more there is potential for 'mushrooming'.

Essentially whether or not using a small stone (to create the dip suggested in *Stonechat 18*) works is down to a combination of the shapes of the adjacent stones and the stone used to bridge the small stone. All four need to be chosen to accommodate each other, to maximise the potential for a good fit of the bridging stone. For example in Fig.4 the upper one on three works well. The smaller stone is relatively very small and so easier to bridge, the slopes of the outer stones have created a smooth dip, a wide slightly complimentary curved stone completes the set. A similar configuration can be seen at the top of Fig.7b.

1 on 3 can rarely be completely avoided, especially with more irregular or rounded stone, however the practice should be kept to a minimum. If they occur frequently in a wall it tends to be indicative of a poor building process, which suggests other faults might be present too. In *Stonework*[1] I suggested a guideline that, on average, you should have fewer than one per square metre of wall face. This is of course highly arbitrary as it will be hugely influenced by stone type and circumstance, but whatever the case if you keep finding you are having to sit one on three on a regular basis (several times a day) then you probably need to reassess your overall process and how you are planning ahead.

Given that 1 on 3 can rarely be avoided, then you should try to mitigate the problem where it occurs: good length into the wall on the bridging stone; smaller middle stones are more easily bridged without tracing; with less regular stone make the small stone the lowest point of a dip; ensure good wedging of any internal voids between the bridging stone and the smaller stone.

This is probably a good point to briefly return to the formation 'a' in Fig.2. The gap between the bridging stone and the centre stone is known as a "letterbox", and the small stone is relatively easily displaced (Fig.6). The formation tends to be particularly problematic with regular stone, but is often seen with less regular stone too. Walls move with settlement and the bridged stones are prone to become displaced. This creates more

Fig.6

scope for movement of the adjacent stones and complete collapse is more likely. It is possible to argue that that this is not a criminal fault in certain circumstances, as the greater potential for collapse might be deemed a little theoretical. Hence where the letterbox is very thin good pinning behind will hold the middle stone, at least in the medium term. If it has good length into the wall and can't fall out, and if the bridging stone is sufficiently strong so that it does not crack (this will depend on stone type and thickness, how much wall there is above and possible pressure points which will depend on subsequent construction) then it might not be a huge problem. However as is always the case, 'all other things being equal' it is a weaker structure and as such an error which you should try to avoid.

We have not completely finished with the idea that like sized stones group together.

Levelling stones also have a tendency of grouping but in this case along a length. Fig.7a shows a random wall Fig.7 b is a close up section from this. It highlights a few of the problems I have touched upon, sitting larger stones on smaller and consequent jointing problems, dealing with steps etc. Given the complexities the problems are actually quite well dealt with - tightness and a lack of pins usually indicates competence rather than incompetence. Always remember there is probably no such thing as the perfect wall, and the less regular the stone the more imperfect the wall tends to be. But generally in Fig.7b, maybe one diagonal joint notwithstanding, the good overlaps and jointing suggest a more than competently built wall. It does however illustrate how grouping can work along.

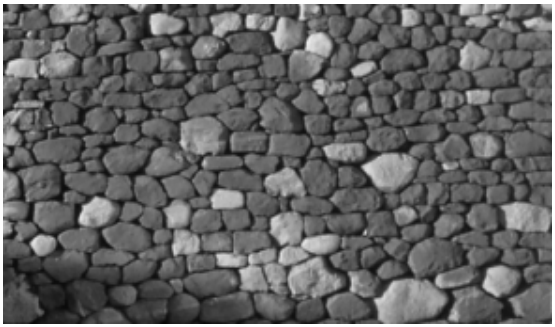

Fig.7a

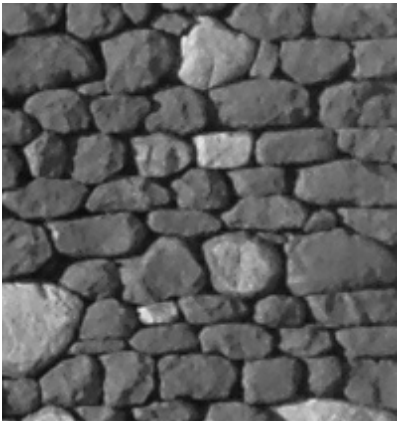

Fig.7b

Despite the overall randomness seen in Fig.7a there is a lot of grouping of similar sizes in 7b. This illustrates the issue raised when looking at Fig.5., that just as with sizes stone types/shapes can also 'flock' together, and here the flatter stones are of a different type to the lighter coloured lumps. As with the already noted temptation with large footings/ building stones (parts 1 and 2) it should be clear that with any size stone once you have placed one it is tempting to build level with that in order to facilitate building the next layer, and then next to that with another and so on. This often leads to strings of thinner stones or rows of larger stones higher in the wall (if you have two or three left it is always tempting to place one next to another...). Whilst often more a visual problem (and that can be in the eye of the beholder) than structural it does have the usual jointing implications. The key is when and how to use 'jumpers' which was dealt with in some detail in *Random Walling part 2*, and as this episode is dragging on I shall not re-visit it here.

Last time I suggested one of the keys to walling is to create problems which are smaller than the ones you are trying to solve. To extend this idea, there is little wrong with creating a problem (within reason), as long as you have the potential solution(s) in mind as you do it, even identifying stones to facilitate this. Planning. You also need to be aware of what happens alongside and above the solution too. More Planning. In all such cases the circumstances relate to 'this' wall, with 'this' stone, at 'this' point. In one set of circumstances a fault might not be that much of a problem but the self same identical fault (exactly the same stones sat in the same way) might create a massive problem because the stones alongside are different. For example if you are going to set two stones with a gap and then fill that with a 'small' stone then don't have an awkward step only

a stone away (or vice versa) which will necessitate some sort of compromise. If you create small problems close to each other you are likely to end up creating a more difficult problem to solve rather than having reduced the problem. Just as you should distribute stone evenly along a wall, and/or place throughs at regular intervals, you should perhaps aim to spread the problems around. Walls which fail as a result of poor building generally do so because a number of faults are combined, or in very close proximity to each other.

Not sure exactly where I'll be headed next time. Planning and forethought....

NOTE

[1] Adcock.S. (2012) *Stonework*, North Wales Branch DSWA . p.11.