

An Illustrated Guide to Dry Stone Walling



by Norman Hadow

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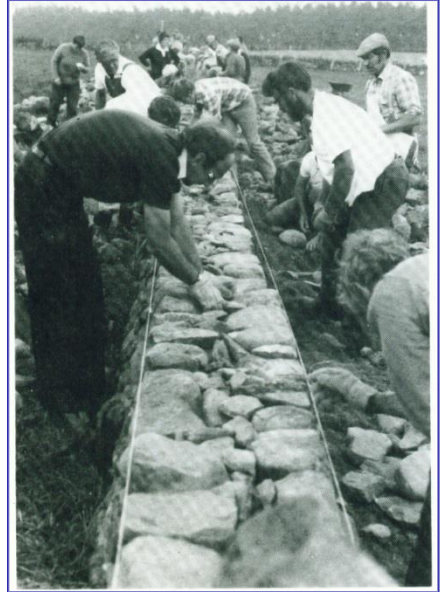
Norman has been a master craftsman with the Dry Stone Walling Association of Great Britain for around 30 years. He has a degree in Botany from Edinburgh University and worked for many years in the Food and Oil industries. This booklet is a personal account of his experiences since he started building with rocks and reflects mostly his own views in a profession where every waller has their own ideas about the best way to do the work.

Getting Started

I attended a two day training course and learnt the technique from an inspiring master called Eric Boyce. He could make the rocks sing.

Eric said the technique is simple, you can learn it quickly then you are a dyker. The art takes a bit longer:

5% Theory and 95% Practice.



I was told that all you needed to start walling was a hammer and a horse (or in my case a car). I already had a hammer which had been the one that my parents had used to break coal.

I closed our small Craft shop and started the best job I have ever had. I soon discovered that the work was challenging for the mind and the body. Just what was needed to enjoy fulfilling employment.

Types of Stone

Much of the final look of the wall will depend on the type of rock which is available.

At the beginning I found that I had to find work where there was a need for repairs and no wallers in the area who could take on the jobs. As a result I had to move around the country and deal with several different types of stone and styles. In Scotland the most common rocks are sandstone, granite and basalt. Now that I travel more widely, I often encounter limestone. I shall explain how each type presented different qualities and how I learned to deal with these.

Granite

This igneous rock varies considerably depending on how slowly it cooled and thus the size of the crystals. It can be very hard and heavy when the grain is fine, but quite crumbly when the crystals are large. I call this porridge stone which is easy to break. In the Scottish Highland Massif many of the walls built in Victorian times used stones dressed in quarries as the bulk of the structure, although often these were placed on top of large erratic boulders dropped off by the retreating ice 10,000 years ago.



The colour in granite varies from white, grey, yellow and red depending on the content of the original minerals in it.

When dressed granite is not available, then field stone is used. The typical grey rock of Deeside is very heavy and rough to handle.

However there is very little slip when building and this alters the style of the walls in this area – aspects which I discuss later.

Sandstone

This sedimentary material is probably the easiest rock to use. The advantages are that it is light to lift, normally easy to break and shape and there are many delightful colours in different parts of the country.



Limestone



Although I have not used limestone much in Scotland I frequently come across it in other countries especially Canada and Switzerland. There are many types with varying qualities. The flat bedded varieties are very useful in a coursed wall. Some limestone erodes dramatically in wet weather.



The English Cotswold stone is most attractive and often contains fossils. The colour changes from white grey to yellow depending on the amount of weathering.



Another feature of certain limestone is that many plants will survive in and on the walls.

Slate

Slate can be a very durable stone. The quarries in the Lake District of England produced huge quantities of brilliant walling and roofing material.



It also makes an ideal surface for illustrations.



Foundations and Starting to Build

Sorting the Stone

When building a new or rebuilding an old wall, it is important to select certain types of rock before work starts. Upright copes (the top stones) should be laid on the higher side of the job, roughly three strides from the work. Throughs and coverbands (the connecting stones) should be laid along in front of the copes. The building stones are set out with the largest nearest the wall on both sides. However it is important to allow a walking distance between the future wall and all of the rocks. This prevents tripping later on. Every few metres piles of hearting (the infill) are created from any rubble, but be careful not to include any soil or vegetation which will retain water.

Foundations

Prepare a trench along the proposed line of the wall. The width will be governed by the height of the wall and the type of rock. Normally there is a slope from ground level to the top. Where the stones are very flat bedded, then a slightly steeper slope is possible. When the rocks are very rounded the bottom should be wider to help to prevent slippage. Depth of the trench has to be deep enough to reach reasonably solid sub soil. For a 4 foot (120cms) wall the typical depth is around 4 inches (10cms.), for 6 foot (180cms.) I normally dig down 6 inches (15cms.) to 9 inches (23cms.) The trench can be filled with small rubble, or very large rocks can be placed in the hole with the top surface as flat as possible, handy for a family picnic!



The A Frame

The next thing is to set up a profile (An A frame) of the proposed wall. I normally build this in wood at the start of each job, allowing the cross pieces to protrude slightly. This is for attaching stings later.



An A frame is also very useful when building a curve to give the builder a rough idea of how to place the stones.

Strings can be attached to the A frame then to a post further down the work as a guide to the height and to help to maintain the batter.

Batter is a slope from the base to the top. Normally it is around 10% but this varies with the material used:

steeper for flat stones and more sloping for round stones.

Bottom Layer ...

This is where the largest rocks in the pile will be used. Ideally each should go half way through the wall with their length into the wall. Clearly each stone is stronger this way whereas laying them along the way can be a weakness.

... and Upwards

After the bottom layer, I tend to build up in courses about 3 metres long then I level off on each side. The purpose of this is to create a flat surface so that the next layer will be much easier to lay. I can still remember Eric Boyce telling us that "you can lay an egg on kitchen table".

There are several ways to proceed above the first layer, which this depend on geology and geography. When the rock is flat bedded, the normal practice is to build in level courses.



Where there is no obvious strata as with basalt or river washed material, various different styles are adopted.



Sometimes both round and flat rocks are on-site then the layers can be alternated.

A common fault in walling is to create running joints. What I mean by this is well understood, even by my six year old grandson who is a lego fiend. This photograph shows the danger of not crossing joints and I am glad that he understands that a cup of coffee is also quite important for me when I'm working!



Hearthing



During a training course the students look sceptical when I tell them that I spend half my working time doing hearthing. It is essential, as with poor hearthing the wall will collapse in or fall out. The spaces underneath and between the building stones should be filled first with the largest non-building rocks which fit.

Subsequently smaller, preferable broken material should be used to fill any small spaces. Broken bricks are ideal for this job. On some jobs the client has provided 50 mm. road stone which was ideal. However small hearthing should never be used without first filling with larger pieces, this can result in a serious weakness. Earth or anything which can hold moisture should be avoided as frost can affect the wall as the water expands and contracts.



Throughs

The two walls have to be joined together otherwise they will move independently. On a 4 foot 6 inch (140cm) wall, throughs are put on as a bridge. These are normally at 1½ feet (45-60 cm) from the ground. For easy measuring I put them on at knee height. It is important that these reach at least to the outside edge of both sides. They should be as level as possible and can be sticking out if there is no problem with



animals climbing or scratching on them. In addition they must be well supported underneath to prevent them cracking later with the weight on top of them. Occasionally they can be used ornamentally.



A second layer of throughs is required if the wall is around 6 feet (180 cm). The same advice given above applies to them.

Once the throughs are firmly in place the double wall is continued up to a stage below the required full height.

Cover Band and Copes

From the layout at the start of the work, the builder will already know what is available for the top. There are many ways to finish off depending on the function of the build. Where there is no pressure from stock or human activity, it is possible to do without cover bands or individual copes, as is common in areas like vineyards or olive groves.

In farms which have cows or sheep it is important to have a strong high wall to prevent jumping, climbing or scratching.



In gardens the client often decides what top they want. In Scotland the tradition is for upright copes. . .



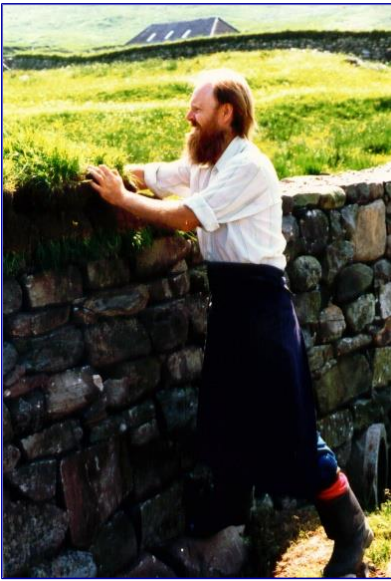
. . . whereas in Yorkshire (England) they tend to specialise in sloping copes.



Different Systems of Coping

One variety of top stones is called castellation also called cock and hen or buck and doe and, in one part of Scotland, Ben Vorlich's.





Other materials used are grass which requires a high rainfall as in the West of Scotland and in Canada I have seen sedum mats used successfully.

Building on a Slope

This Victorian wall in Glen Lyon Scotland is a fine example of how to deal with a steep slope. The courses are running roughly horizontally.



The copes are placed carefully on steps created as the wall is constructed.

The Swiss are experts at making tracks up the mountains for access to pastures for sheep, goats and cattle.



Wall Ends and Corners

There is no doubt in my mind that a single massive rock is the best thing for the end of a wall. However such rocks are seldom available.

The general principle using normal stones is one across the width of the wall and two back along the length of the wall. It is also important to make sure that the ones along the length of the wall extend past the cross stones as shown in the picture. This reduces the danger of the end falling down. Where there is a wooden post the normal practice is to leave a very small gap between the wall and the post, on the assumption that the stone will last longer than the wood.

On a corner, just as on the wall of a stone built house, the rocks should alternate. I have to admire the quality of this Swiss structure. You can see that the builder has chosen the largest rocks they could find for this part of the job.



Stiles, Steps and Styles

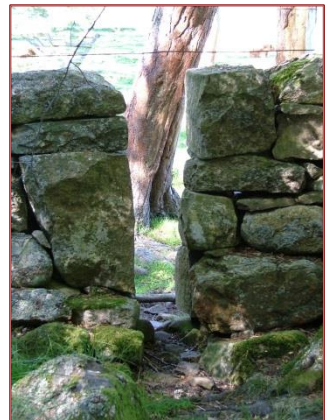
Steps

How you climb over the wall depends on the length of flat stones available. With a suitable size, at each level the rock can go right through to protrude on both sides. This results in going up one side of the climb, then turning to go down the other. Where this is not possible or desirable then one goes up and down on steps which continue in the same direction. It is customary to have the same lift at each level and the step surface should be wide and long enough to be able to climb over safely without having to use hands for support.



Slip Stiles

This is used where cattle or horses are in a field. The shape is important, so that a person is able to go through the gap which is narrow at the base for their legs and widens at shoulder height. This prevents the entry of large animals.



Styles

After a while, with regular practice, each waller develops their own style. Like wine it is possible to recognise characteristics in the builders work, it is always a balance between strength and beauty.

Bridges

Trees can be a problem when growing beside a wall. A single long stone can solve this without affecting the tree, at least for a decade or so!

Finally once a single stone is not long enough it may be necessary to allow the tree to win.



Clapper bridges are useful over water – or it is possible to use a simple arch.

A Larger Bridge



For your first attempt, it is wise to get experience with someone who is an expert in the field.

Foundations

The best possible foundation is to use bedrock.

Where bedrock is not present then the largest flat top rocks available should be used. These should be set on solid material below the bed of the river. The pillars for the arch is also built with the heaviest rocks available. While it may be tempting to use mortar on these supports, the advantage of dry build is that flood water flows through the gaps whereas a solid mortared block forms a dam which holds back the receding excess from the surrounding area.

The Wings

Ideally the wings of a bridge should also be laid on bedrock or at least onto solid hard stand. It is important that the wings are not built up above the height of the the arch at each stage. It is aesthetically pleasing for the rock used for the wings to be the same as the arch stones. However when rough irregular rocks are used for the wings

it may be necessary to use a different type of material for the arch which is more suitable for chiselling into the required shapes.

Former

Nowadays it is common to cut the required shape on at least two boards then to cover these with strong cross pieces or with bendable strong materials such as marine ply. It is essential that the former of whatever type is strong enough to bear the weight of not just the arch rocks, but also any material which will be built on top before the former is removed.

The support for the former should be resting on a solid base. Bricks or blocks are ideal for the support as they can be easily knocked away when require

With a half moon former it is possible and useful when placing the arch stones, to mark lines on the outside to indicate the required slope of the builders and especially the risers.



When the desired arch is not a half circle, the lines should be drawn from the theoretical centre.



Features

Apart from walls themselves there are many ways of using drystone techniques to build interesting variations. For example adding a ramp to a set of steps.



Creating an alcove within a wall adds a touch of colour or a site for a plant pot in a garden.

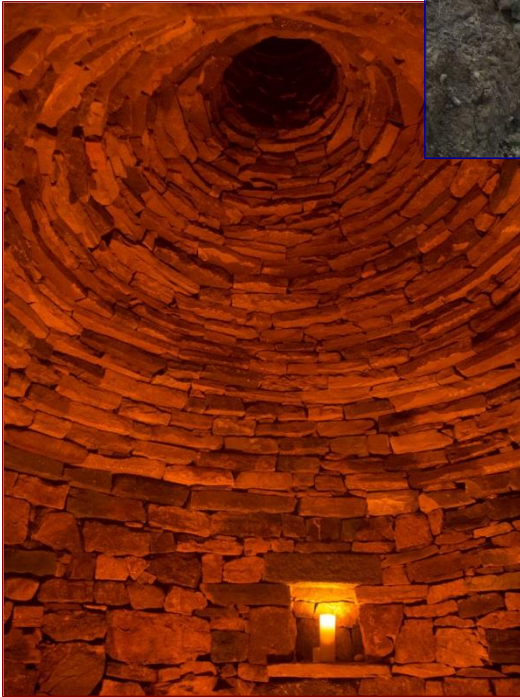


The West of Scotland Branch of the Drystone Walling Association built this thistle at a garden festival. It demonstrates how attractive different types and colours of rocks can be used along with planting.

This small shelter was built in the Botanic gardens in Edinburgh as a memorial.



This partly underground storage area was covered over with soil and then seeded. The inside was corbelled to create a large dome.



Here again alcoves were built into the walls, this time to allow for lighting.

In 2012 this cairn was constructed to commemorate the 60th Jubilee of Her Majesty the Queen's accession to the British throne.



Safety

The most common injuries are squashed fingers, grit in the eyes, bruising of the legs and pulled muscles. Tiredness, lack of concentration and rushing are the main reasons for mishaps.

There are several ways of preventing accidents from happening:

- 1 Wear safety boots.
- 2 Wear goggles when using hammer and chisel.
- 3 Leave a walking space on both sides of the wall between the work and the material which is to be used.
- 4 Lift carefully using the thigh muscles for heavy rocks. Keep the spine straight.
- 5 Be aware of your limitations: **Get help when you need it.**



I use a couple of ways to lift heavy rocks. The first is to roll them up fence posts.

When other people are available a hessian sack can be employed in the same way as a stretcher.



Glossary

A Frame:	Normally a wooden structure in the shape of a capital A.
Batter:	The slope from the ground to the top of the wall.
Copes:	Rocks or other material which cover the top of a wall.
Corbelled:	Stones built in concentric circles to create a dome without the need for a supporting structure.
Foundations:	The lowest part of a wall, mainly below ground.
Cover Band:	Normally flat stones used on top of the wall below the copes. This is useful when the cope stones are too small.
Dyke (Dyking):	Scottish terms for a wall and the operation of building.
Former:	Structure used to support the rocks to be used in an arch.
Hearting:	Infill between the building stones.
Lines:	The strings used to guide the builder.
Riser:	The stones at the bottom of an arch going from horizontal to sloping on each side.
Throughs:	Rocks used across the wall to join the two sides together.
Waller:	The builder.
Wings:	The parts of a bridge which go from the arch onto the banks.

Rules and Guidelines

Rules

- 1 For a double wall there must be a solid foundation and
- 2 it must be well hearted.

Guidelines

- a Each stone should be placed with the long axis into the wall.
- b Largest rocks at the base.
- c Use lines to ensure straightness.
- d The batter should be about 10°.
- e Throughs should be built in every 3 feet along the wall.
- f Avoid running joints.
- g Leave a walking space between the work and a pile of stones.
- h Stand back and look at the job regularly.
- i Before starting a repair, assess what has caused the damage. It could be a vehicle, people, livestock, trees, floods or even undermining by rabbits!



Thank You

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