

The Art and Craft of Stone and Boulder Construction

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john@devoreslandandwater.com

Stone is the original building material of the human race. After thousands of years, why is it that the art of stone is nearly lost? Thankfully, there is a renaissance occurring in many areas of the world to restore the ancient crafts. In the Midwest the majority of stone being installed is done by landscapers rather than stone masons. If landscapers are going to do the work, how about we start doing it really well?

We are going to focus on the basic landscape applications of primarily unmortared stone installation used in the Midwest.

I. Function and Design with stone

A. *Retaining Walls: Grade changes* for function and/or effect

1. **Dry laid walls:** flat stone or boulder

- Less formal appearance
- Allow plant growth through the wall, good for naturalized looks
- No extensive footers required—minimal disturbance of root zone
 - ◇ Walls are able to flex with soil movement
- Permeable...water passes through

2. **Wet Laid (Mortared) walls**

- More formal appearance, usually sterile (however, planting channels can be installed through the wall)
- Require frost depth footers (significant root zone disturbance)
 - ◇ Walls are rigid and will crack over time if the soil beneath or behind moves them
 - Require pass-through drainage holes in the wall or drain lines behind the wall

B. *Paving: Walks, patios, stepping stones*

1. **Wet laid**

- Horizontally laid surfaces with mortared joints
- Smoother surfaces for snow clearance, wheel chairs, walkers, etc.
- “sterile” joints no weed issues
- More formal in feel whether patterned or “crazy” paving (random shaped stones)
- Require more significant bases: concrete or compacted aggregate
- Shed water

2. Dry laid

- Horizontally laid surfaces with aggregate filled joints
 - ◊ *Pea gravel, rock dust, large gravel, sand (not recommended)*
 - ◊ *Joint fillers affect use of the surface*
- Smooth surfaces are still good for most uses, but not perfectly flat
- Will allow some plant growth...great for creeping groundcovers
- Less formal, mostly natural/random shapes. Patterned stone needs to be large pieces.
- Extensive base prep not as crucial
- Allows water to soak into soil (more so with non compacting joint material)

3. Joinery (joints between stones)

- → **Parallel sides!** ←
 - ◊ This is true for both vertical joints in a wall and joints in paving stones
 - ◊ If the joints are sloppy, the visual aesthetic is lost even if the wall or paving is structurally sound

C. Naturalizing Using Boulders/fieldstone, indigenous stone

1. **Accomplishing grade changes** to “mostly” hold back soil
2. **“Steppers”**, walking paths
3. **Boulder arrangements** to reflect indigenous geologic terrain

D. Water features

1. **Most common use of stone**, frequently the most predictable look
 - “ring around the collar” to hide the liner edge
 - *“Hmm, I wonder where the liner is”*
1. Greatest **opportunity to naturalize** because waterways in nature expose the most stone
2. **Fountains**, whether drilled rocks, formal constructions, etc.

E. Sculptural

3. **Oriental style** boulder arrangements
4. **Boulders take the place of evergreens** in design when well placed
 - Anchor perennial beds beautifully for winter dormancy
2. **Focal points** *when the rocks are large*
3. **Literal sculpture pieces**
 - Bird baths (depressions in natural boulder)
 - Formal, contemporary, abstract

II. Pitfalls to Avoid (How to be smarter than the rock)

A. Movement

1. The soil beneath and behind walls and/or boulders moves
 - Freezing and thawing
 - Wet and dry soils
2. A properly built wall or placed boulder moves with the soil and does not settle significantly or fall over

B. Drainage

1. Unless there is focused water entering behind a wall, normal water movement should pass right through these walls
2. If there is a spring, downspout, swale, etc....anything that causes concentrated water movement, this should be alleviated by surface contours, drain lines, or other appropriate measures.

C. Settling

1. You cannot build a wall or place boulders on unstable soil and expect it to stand. Always excavate to undisturbed soil. If you need to raise the base, use compacted aggregate or use standard masonry with frost appropriate footers.

III. Physics you can't ignore (Behavioral modification for rocks)

A. Mass

1. For retention of soil, adequate mass is essential
2. This is the reason for most block wall failures

B. Friction (for stacked walls, rounded, angular, or flat stone)

1. The stones must have good contact with the stones above and below. These points of contact combined with the weight of the stone keep them in place
 - Stabilize every stone before moving to the next.
 - Chisel off high peaks to avoid pivot points and facilitate mating faces.
 - Shims of small pieces of stone stabilize each stone and increase friction points. Too many shims means you are choosing the wrong stones.
2. Rule number one
 - *One stone over two*
 - ◇ Do not stack your joints (one joint directly above another)
 - ◇ When using random thicknesses of stone, you will have to stack joints at times, but you must account for that in the wall.

C. Center of gravity

1. The center of gravity **must be behind the center of the base of the wall.**
 - If not, when the wall moves out due to frost heave or saturated soils, it will tend to continue to move out over time
2. **Batter.** The face of the wall or boulder should be angled back towards the retained soil ever so slightly. *This angle is the batter of the wall.*

D. Hearting (a stoner's word for gravel)

1. **Hearting** is aggregate that fills the voids between stones
 - All voids should be filled. Larger voids should have stone pieces to support any weight from above and increase friction points. The hearting fills all the remaining voids. Otherwise settling will occur over time.
 - In a retaining wall, we use washed gravel with no fines. This is free draining. We also fill between the wall and the soil with this gravel.
 - If your gravel is angular, you will need to pack it into the voids with a rod or chisel. Angular gravel needs to be consolidated.
 - Round gravel needs to be consolidated somewhat, but it usually does not need compacting. It settles into about 95% consolidation on its own. You get to coax it the rest of the way

E. Toe (the part above and in front of the foot(er))

1. Make sure your bottom course of stone is held in from the front (soil, aggregate, pavement, etc.)
2. This simply keeps the bottom of the wall from sliding over the surface of the ground

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I am now offering design, project management, and landscape construction training to the landscape industry.

Call or email for further enquiries

Reference Books/Recommended reading:

"Natural Stonescapes;" Richard Dubé, Frederick Campbell ISBN 3703800092

"Secret Teachings in the art of Japanese Gardens;" David Slawson, ISBN 4-7700-1541-0