Technical Bulletin

Stacked Stone Headwalls

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Center for Dirt and Gravel Road Studies

Headwall or Endwall– An integrated wall located at either end of drainage pipe or a stream crossing structure. A wall built at a pipe inlet is a **headwall**. A wall built at a pipe outlet is an **endwall**.

Stable headwall with bankwall

Stable stacked stone endwall

PURPOSE – Headwalls and Endwalls protect vulnerable pipe ends and support the road edge. I addition, these walls also serve to direct flow, to reduce erosion, and to visually identify pipes along the road. When properly constructed, a headwall can improve pipe efficiency and an endwall can stabilize a steep road bank.

BENEFITS – Properly installed headwalls and endwalls provide multiple maintenance and environmental benefits which are explained in the Center's separate "Headwalls and Endwalls" technical bulletin. This bulletin focuses on the construction of these walls with the most common building material, natural stone.

WHERE TO USE

- Use with all road drainage pipes, including crosspipes, through-pipes, bank pipes and driveway pipes.
- Use with all stream crossing structures, including pipes, box culverts, and bridges.

CONSIDERATIONS

- Headwalls and Endwalls are an integral part of drainage pipes and road stream crossings.
- Natural stone headwalls and endwalls often combine both cost effectiveness and durability.
- The strength of a rock wall comes from the weight and friction of the interwoven stacked stones.
- The stability of a stacked wall results from tightly fitting stones, staggered joints, proper canter, and the use of sufficient "tie-ins" to compacted soil (multiple deadman anchors).

Typical Requirements for headwalls and Endwalls constructed of stone

Materials: Any size and shape stone can be used. However, construction will be easier with rocks of a uniform thickness, flat on at least two sides, that can be handled by one person. Where native stone is unavailable in or near the road corridor, headwalls and endwalls can be constructed using purchased landscape stone or retaining wall blocks. Whether your stones are rectangular or irregularly shaped, the key to a durable dry-laid stone wall is to interlock the stones and to tie the stones to the soil behind the wall. Attention to detail during construction separates a good wall from a poor wall. Many of the stone walls constructed by the Civilian Conservation Corps (CCC) in the 1930s are still functioning today.

Equipment: Gloves, a shovel, a hand tamper and an eye for detail are all that is needed. A pick or a prybar are handy to have. A sledgehammer may help to adjust embedded stones. However, a backhoe and a skilled operator can save time and labor when large rocks are available. Don't forget your safety equipment.

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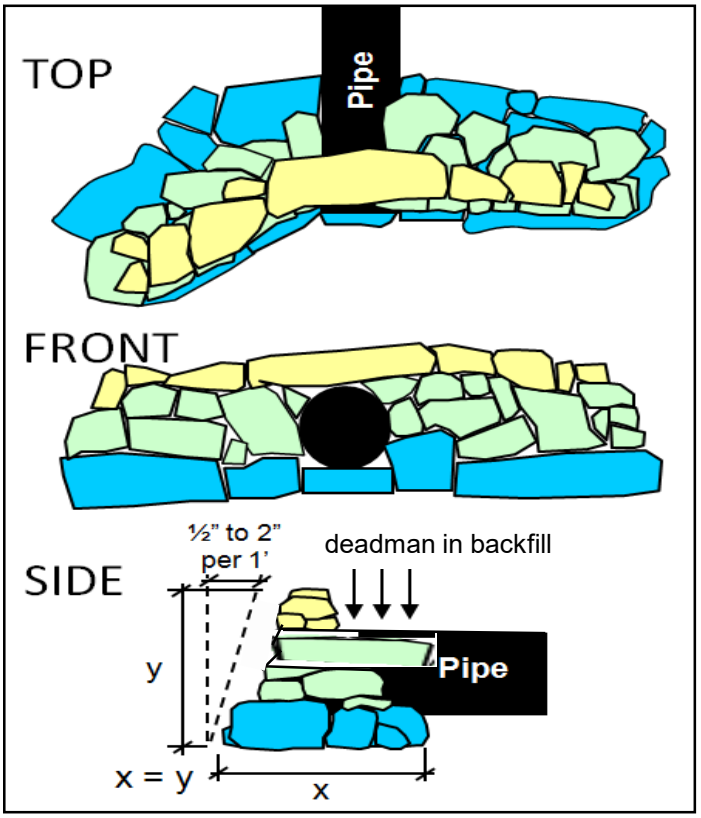
Stone Headwall Construction

1. If necessary, excavate around the pipe end to make room for the wall. Walls typically extend 2-3 times the diameter of the pipe on each side of the pipe. The base of the wall should be level with, or lower than, the bottom of the pipe inlet.
2. Use rocks with flat sides in the face of the wall. Use the largest available stones for the base course and slightly smaller stones in consecutive courses. Take care to stagger the joints and slightly cant the wall toward the road in each successive course. Periodically install a longer stone into the wall face with the long axis perpendicular to the face of the wall. Compact this "deadman" stone into the wall backfill.
3. Backfill and compact behind the wall in layers as it is built. Use material that is damp enough for compaction and free of large roots and clumps of organic material.
4. Build the wall to the top of the pipe. Place a large capstone over the top of the pipe to bridge the two halves of the wall together and protect the pipe. If a large stone is unavailable, continue to build the wall to attain a stable span of smaller stone over the pipe, alternating the joints in the rock.

Important Considerations

- Be aware that the size and shape of headwalls will vary based on pipe size, road and pipe alignment, stream or ditch alignment, and approach velocities.
- On roads with linear grade, construct headwalls to "plug" the inboard ditch and to turn flow into the pipe.
- Integrate a bankwall into the headwall design where unstable slopes exist at the pipe inlet.
- Be sure that the wall backfill is sufficiently compacted behind the wall and around the "deadman" anchors.
- Headwalls can be reinforced by placing fabric between successive layers of rock, and tying the fabric into the backfill, creating a geosynthetic "deadman." This technique may be especially useful when working with rounded stone or landscape block.
- Consider identifying pipe ends with a reflective post or similar marker.



Plan views of a stone headwall. Note that the base width should be equal to the height, the face should be sloped or canted back, seams should be overlapped like bricks, and "deadman" anchors should be mixed throughout.

A properly constructed natural stone headwall can last for decades.