

Reline Procedure Using Corrugated Steel Pipe and Corrugated Steel Pipe Arch (Liners 1000 mm Diameter and larger)

Replacing a deteriorated culvert, storm sewer or small bridges under a roadway can be an expensive and disruptive operation. High costs are associated with demolition and removal of the existing structure. The disruption of traffic required for conventional reconstruction can create significant costs and inconvenience. Relining with corrugated steel pipe will minimize project cost and time.



Procedure

The following are suggestions only to assist qualified engineers and contractors in developing a construction plan. Each project is unique and will benefit from local experience and expertise.

1. Survey the existing or host structure noting unusual inward projections and damage. Take measurements to determine the largest liner size that will fit inside the host allowing room for pipe walls and bolts, skid rails and approximately 50 mm. minimum all around for grout. Survey the external working area, noting obstructions that may limit pipe lengths, equipment size and material storage.
2. Dewater and clear the host pipe of debris removing any obvious obstructions. Water needs to be controlled with cofferdams, pumps, and piping as appropriate. Insure that all environmental requirements are met.

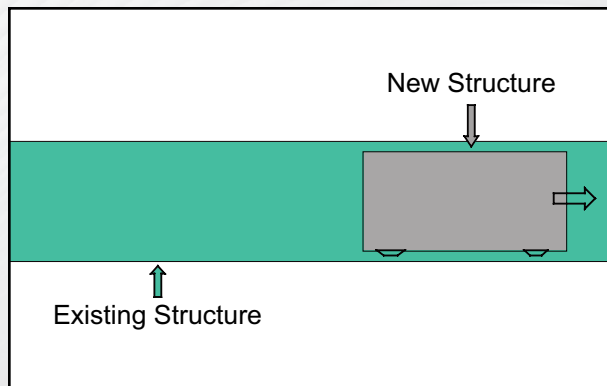
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3. The corrugated steel liner pipe should be ordered and fabricated with the appropriate number of grout fittings, threaded rod adjusters and jack openings. All welds are to be painted with a zinc rich paint and damaged Polymer Coating should be repaired with appropriate coating.
4. Skid shoes or rails should be attached to the invert of the host pipe or may be attached to the external bottom of the liner pipe. These can be steel or recycled plastic lumber and must be of sufficient section to allow the liner to slide without obstruction due to bolt heads, corrugations, exposed reinforcing steel etc.
5. Liners are generally pulled, pushed or carried into the pipe one piece at a time. Longer lengths can reduce labour time however shorter lengths provide greater flexibility and maneuverability around curves and obstructions. The most common method of sliding pipe is to establish an anchor beam across the host pipe entrance and then pull the liner sections using cables and come along.
6. Adjustment rods should be removed or threaded inside the liner prior to insertion to avoid catching and damage. Grout plugs can be adapted with cable anchors for pulling.
7. When the first liner is in position along the host pipe it should be adjusted to proper line and grade using adjustment screws. It should then be blocked against the host pipe at both ends using wood to restrict movement in any direction.
8. The second liner is then pulled into place, stopping approx: 20 mm from the first pipe to allow for proper seating of the internal coupler. Removable spacers are useful here. Once in place the adjustment screws are used to establish line and grade. The trailing end is blocked to prevent movement.
9. The gap between pipes should be filled with a gasket material and first and second liner pipes should now be coupled together using internal coupling bands.
10. These steps are repeated until all liner pipes are in place, blocked and coupled. On long projects such as storm sewers it may be appropriate to complete the grouting operation in sections to secure and minimize exposure to flooding and other issues.
11. To prevent flotation during grouting, timbers should be placed along the invert of the liner. Scaffold jacks should be set on the timbers and extended through top grout ports and locked in full contact with the host pipe.
12. Small diameter plastic vent pipes should be set at the top of the grout cavity through the headwall forms. These will allow air to escape and will indicate when grouting is complete.

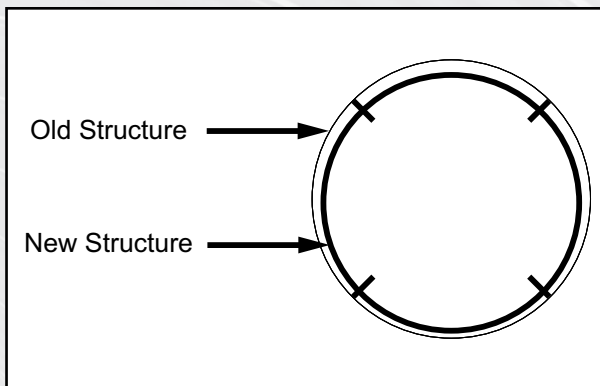
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13. The space between the host pipe and the liner is blocked off at both ends of the run to contain grout. This can be done with gunnite, formed concrete or carefully placed sand bags. It is important that the host pipe be structurally adequate at the ends to support grouting pressure. This may require an external band, cables, concrete headwalls or additional placement of fill if the host pipe is badly deteriorated.
14. Grouting is completed by pumping a properly designed grout through the grout fittings. It is important to grout in stages to ensure proper flow and complete fill of voids and to minimize flotation pressures. Typically grout is placed in at least three stages allowing each stage a day to cure between pours. It is important to monitor the liner for uplift and buckling during the pour and to stop if movement occurs or when fill levels are indicated by grout in the vents or fittings.
15. The scaffold jacks should be removed prior to the last pour of grout. This assumes that the grout has set and is at an elevation above the spring line of the liner preventing flotation. Grout holes should be capped and adjustment screws removed or cut off as grouting is completed.
16. Internal coupling bands can be left in place or removed once the grout is set.

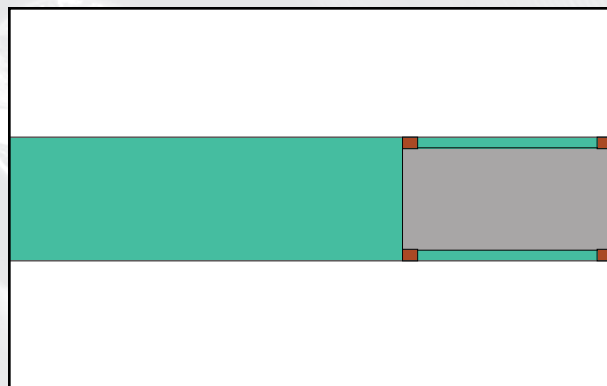
Reline Procedure Using Corrugated Steel Pipe and Corrugated Steel Pipe Arch (Liners 1000 mm Diameter and larger) Pictorial Walk-Through



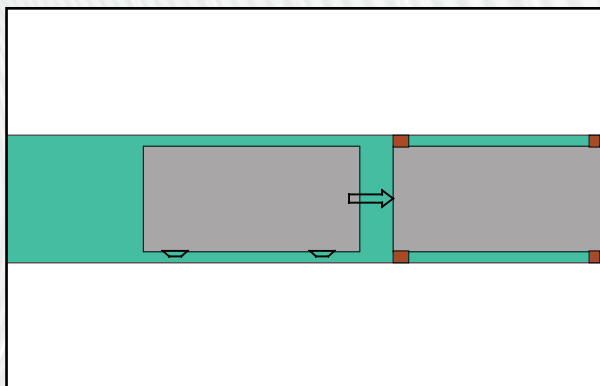
INSERT 1ST SECTION – PROFILE VIEW



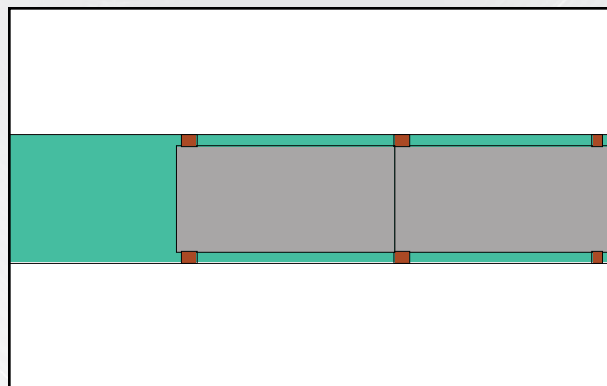
SET TO LINE & GRADE USING ADJUSTING RODS ON BOTH ENDS – END VIEW



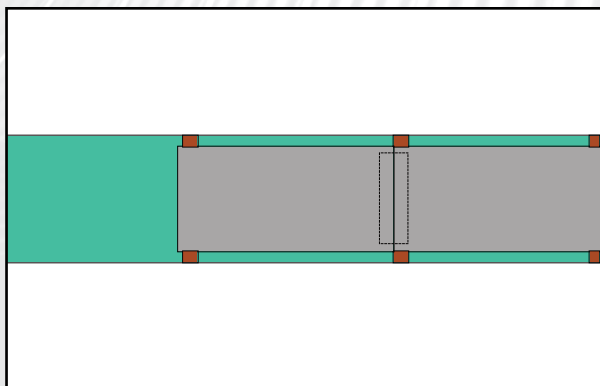
BLOCK THE 1ST SECTION – PROFILE VIEW



PLACE THE NEXT SECTION – PROFILE VIEW



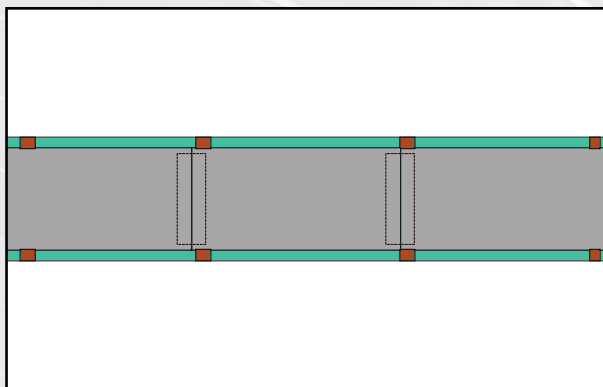
BLOCK THE TAIL END – PROFILE VIEW



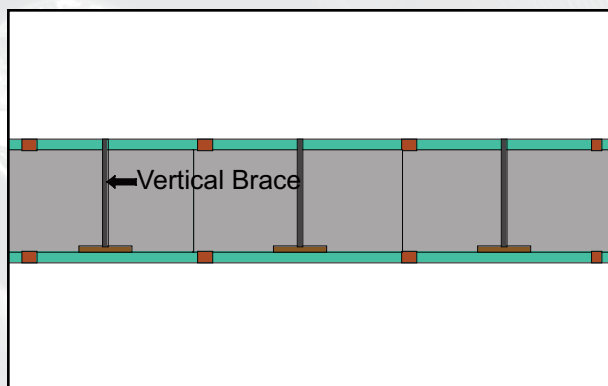
PLACE INTERNAL EXPANDING BAND & GASKET – PROFILE VIEW

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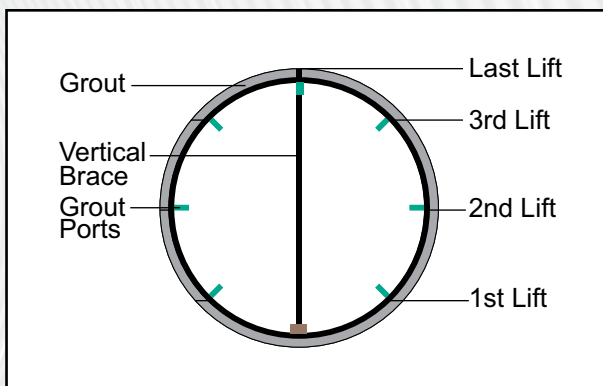
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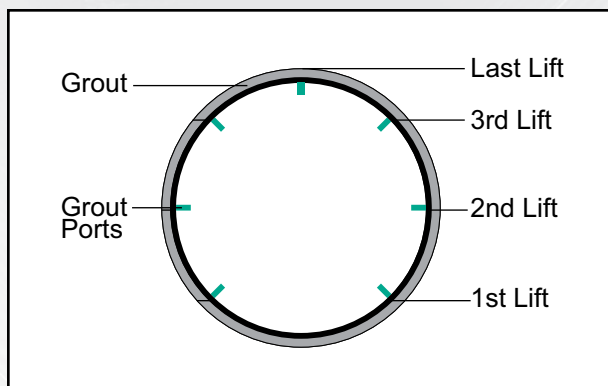
REPEAT UNTIL ALL SECTIONS ARE INSTALLED – PROFILE VIEW



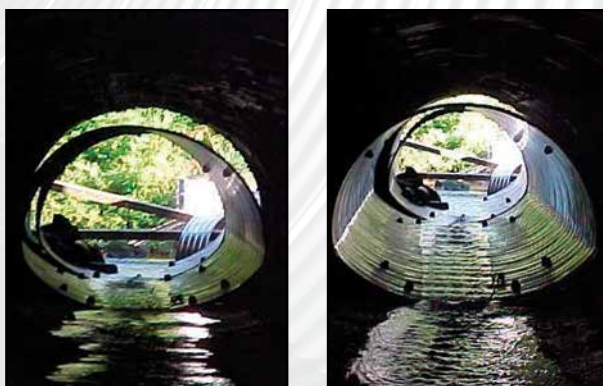
INSTALL BRACING TO PREVENT FLOTATION DURING GROUTING – PROFILE VIEW



GROUT IN STAGES – END VIEW



WHAT IS THE BUOYANT FORCE? – BUOYANT FORCE = WEIGHT OF DISPLACED GROUT



ONE PIECE AT A TIME

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FLOATATION BRACING



BYPASS PIPING AND END BRACING



VENT THROUGH HEADWALL



HEADWALL GUNITE INSTALL



GROUT PORT – LAST LIFT



GROUT THROUGH VENT

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