

## Methods and Benefits of Spincasting Cements on Corrugated Metal Pipes

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No-dig pipe rehabilitation technologies for sanitary sewer systems have been popular for over 30 years. No-dig technologies for storm sewer systems have been adopted at a much slower pace. With the benefits of no-dig technologies well documented to include less disruption, less collateral damage, lower cost, and in many instances, better long term reliability, interest in no-dig solutions for storm water systems is on the rise. A recent emphasis has been placed upon the spin-cast application of engineered high strength cements to monolithically line corrugated metal and reinforced concrete pipes. Many companies experienced in the design, formulation, and production of engineered, high-strength cements have begun to offer spin-cast cementitious lining solutions for storm-water pipe rehabilitation.

The need for repairs or replacement of storm pipe is well illustrated with corrugated metal pipes (CMP). CMP is used extensively throughout the United States with benefits including low material costs, relative lighter weight, and fewer joints than the popular alternative reinforced concrete pipe (RCP). That's the good news. The bad news is, based on numerous State Highway Department and various engineering agency studies, galvanized CMP has a 10 to 35 year life span before perforation<sup>1</sup>. Empirical observation suggests that rusted inverts are the most common cause of perforation. Once the inverts fail, undercutting occurs and the loading above the CMP causes the CMP to shift and sag. Pipe deflections and gaps in joints are sometimes observed. Ultimately, erosion begins to occur. When the CMP is placed under a street or highway, roadbed failure follows and/or potholes appear. At this point, repair or replace operations become critically necessary.



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<sup>1</sup> Rinker Info Series " Corrugated Metal Pipe, dated 01/94

The standard practice is to replace the compromised CMP. With dig and replacement, the street or highway is excavated, the CMP and headwalls removed, new bedding materials laid, new pipe and headwalls placed, flowable fill or compacted base stone installed, and then, typically, asphaltic binder and topping paved and rolled. Heavy machinery and dump trucks are required. Other collateral tasks may also be required, especially if other utilities are in conflict or nearby. The end result should be a structurally sound end product at a premium price.

Conversely, with spin-cast cementitious linings, tasks are quite different. Any pipe with a pipe diameter of 12" or more is a candidate for rehabilitation via spin-cast engineered cements. First the CMP must be cleared of larger obstacles. (As a first qualifying note, it should be understood that, if obstacles within the pipe are too large to remove, rehabilitating the CMP may be impossible and dig and replace become the sole option. Fortunately, this is seldom the case.) After large obstacle removal, the pipe requires hydro blasting to drag sediment/debris out of the pipe and to clean the CMP substrate upon which the cements will be placed.

Once the pipe is properly cleaned, then invert degradation, pipe deflections, and joint offsets may be analyzed, either with man entry or with a sewer inspection camera. It is most important to repair the CMP invert first. Flowable grouts may be used with special pumps and hoses to pump the grout into, under, and around compromised or missing CMP inverts. The Strong Company Grout 12,000 is a 12,000 psi compressive strength grout that has excellent flow characteristics. Once Strong Grout 12,000 has been placed, the CMP invert bottom is re-established and incorporated into the high strength grout while undercutting is eliminated.



Once the invert is re-established, joint offsets and pipe deflections can be addressed. If possible, joints should be sealed with quick setting repair mortars such as The Strong Company's QSR quick set repair mortar. This mortar will set up in 5 to 20 minutes while providing a 3,000 psi compressive strength. If joints are exposed, but they cannot be sealed by hand application, the spin-cast cement can seal off the open joints adequately. (It might be wise to add another ¼" pass with the spin-caster in these situations.) Next pipe deflections are identified and rectified as needed with the use of hand digging implements, hammers and jacks. If pipe deflections are significant, and man entry cannot be executed, (ie CMP with less than 24" in the minor pipe axis) the CMP pipe deflection repair may require a point repair by digging methods. (In rare circumstances, it may be required that pipe rehabilitation be abandoned and the CMP be replaced.)

Once the pipe is cleaned, the invert repaired, joints sealed, and point deflections addressed, the CMP is ready for the lining operation using a spincaster and engineered high strength cements. The Strong Company's fiber-reinforced, 9,000 psi compressive strength Storm Seal Mix is specially designed to pump through a spincaster down to 12" with the use of a cement spray rig that incorporates a diesel power plant, hydraulic pumps, water tank, counter-rotating mixer, hopper, rotor/stator pump, electrical panel, variable speed winch, and spincaster.



In the case of the Strong Storm Seal System, the Storm Seal Mix is metered to guarantee a certain thickness as the Storm Seal Mix is pumped through the

spincaster and the spincaster is pulled back to the rig at a predefined speed. In theory, the materials can be sprayed up 1" per pass and more. In practice, it is best to apply the materials to ensure excellent bonding to the substrate. Especially at the crown of the CMP, mortar weight can pull the mortar away from the substrate if applied too heavily. After applying a coat, the cements will need 2 to 3 hours to tack up before applying a second coating. The size and shape of the pipe and the desired thickness of the engineered cements will determine the number of passes made at a certain application rate. Usually, filling the CMP webbing and applying another ½" to 1" of the high strength Storm Seal Mix will be sufficient to rehabilitate the CMP to a point where it may actually outperform dig and replacement solutions. For reasonably round pipes, three to four passes will fill the webbing and add 1" of the Storm Seal Mix lining to the CMP. For elliptically shaped CMP, it is best to apply the mix at a rate that does not cause the material to sag on the minor axis so that axis becomes the axis that defines the rate that the material is applied. However, additional passes most likely will be required as the major axis will need more passes to gain the required thickness. Once the required number of passes are completed, it is best-practices to spray a concrete sealer on the liner to retard water loss while the cement cures. Once accomplished, the rehabilitated pipe liner will be structural, monolithic (no joints), hydraulically improved, and chemically resistant.



With spin-cast cementitious linings, there will be no digging, no utility conflicts, minimal collateral damage, and typically lower total costs. The rehabilitation usually will take two to three days from start to finish. As for as costs are concerned, our experiences have suggested that relining the various diameter pipes that we have lined have cost 33% to 60% of what a dig and replacement alternative would cost, and it can be applied to various shaped pipes with diameters from 12 inches to 120 inches and lengths up to 125 feet and more based on spray rig access.