Is CIPP (Cured-in-Place Pipe) a suitable method for rehabilitating a gravity sewer that has previously been rehabilitated with a plastic product?

For a more general discussion, let's expand this question to cover a wider topic: "Is CIPP a suitable method for rehabilitation of plastic host gravity sewers?"

Whether a plastic host sewer or a sewer that has previously been rehabilitated with a plastic product, the answer is, "Yes, a CIPP solution can be used, but there can be complications." There are three principal issues to consider when rehabilitating plastic sewers with CIPP.

1) Plastic pipes are smooth with fewer joints than rigid pipe materials, which could inhibit a CIPP solution from physically "locking into" the plastic host sewer. In sewers constructed of rigid pipe materials, joints are typically only a few feet apart, and there is often a scattering of structural defects, yielding a chance for the CIPP to physically lock into the host sewer preventing unwanted CIPP movement.

Curing of CIPP is an exothermic process; the chemical reaction produces heat. This exothermic temperature can be much higher than the hot water or steam temperature used for heat cure processes. As the CIPP cools it wants to decrease in length, which is a function of the material's coefficient of thermal expansion/contraction and the cooling temperature range. If the cooled CIPP is locked into or has a good friction fit along the length of the host sewer and cannot decrease in length, it develops tensile stresses, much like a stretched rubber band. This is the case with most CIPP installations in gravity sewers with few, if any, issues of concern.

If the cooled CIPP is not locked into or does not have a good friction fit with the host sewer, which may be the case when rehabilitating plastic sewers, then the CIPP may contract in length, causing the CIPP to draw back into the plastic sewer at the manholes. Another scenario is when the CIPP is locked into or has a good friction fit with the host sewer at various locations along the length of the sewer, such as when a sewer constructed of rigid pipe materials is repaired with plastic pipe through an excavated point repair. In this case the CIPP is typically well locked into the host sewer on each side of the point repair, but not locked in through the point repair. Depending upon the tensile strength and other characteristics of the CIPP laminate and the site conditions present, a circumferential fracture (visible gap) in the CIPP can develop within the plastic point repair.

This discussion is based on municipal sewers. In industrial sewers, high temperature effluents and effluents carrying corrosive chemicals will intensify any effects leading to circumferential CIPP cracking.

2) Uncontrolled overheating of the CIPP and the plastic host pipe from the exothermic heat generated is an issue of concern with plastic sewers rehabilitated with CIPP with heat cure. This heat typically dissipates into the host pipe, surrounding soil and the curing medium inside the CIPP (air, steam or water). Installing CIPP inside an existing plastic host pipe is like wrapping a blanket of insulation around the curing CIPP, where overheating can be an issue. This can lead to coating damage for those CIPP types that have a permanent thermoplastic coating on the inner CIPP surface when installed. Excessive overheating may also lead to CIPP laminate damage.

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3) Service connections reinstatement may be problematic using remotely controlled robotics for CIPP in plastic host pipes. Some plastic pipe factory wyes can produce large CIPP dimples that are not well-defined which can lead to host pipe damage when the robot operator tries to establish the perimeter of the service opening. Even with well-defined CIPP dimples, at the perimeter of the dimple the robot operator may not be able to determine if he/she is cutting through just the CIPP or the CIPP and the plastic host pipe; thus, creating another defect that should be repaired. This is more of an issue with well-established robots with router-type bits, whereas the newer robots with articulating arms and ball-type bits can lower the risk of damaging the plastic host pipe. When reinstating service connections in rigid host pipes, there are audible and possible visual indicators (dust) that the robot bit is up against the host pipe material, which is not the case with plastic host pipes.

This article cannot cover all scenarios when installing CIPP in plastic sewers, but there are approaches to manage the issues described above. The first and probably the most crucial step is to hire a CIPP installer that is experienced in CIPP projects with plastic sewers. For plastic sewers with service connections, this includes an experienced robot operator. Contractors experienced in these matters have the knowledge to plan for these projects and lower the risk of CIPP defects.

Following are some approaches that have been taken to mitigate the risks of installing CIPP in plastic sewers. These are not recommendations, merely some techniques that have been used, and any specific project may call for none, some or all of the following techniques.

- As stated above, hire a CIPP installer experienced in plastic sewer installations.
- Use a higher tensile strength, higher elongation resin instead of the more brittle resins typically used for sewers. Candidate resins are those used for pressure pipe CIPP.
- Use a fabric tube with axial fiber reinforcement to increase axial tensile strength.
- Install and cure the CIPP with high enough pressures to ensure a tight fit thus leading to a good friction fit and any available lock in between the CIPP and plastic host sewer.
- Use the cure schedule as recommended by the CIPP technology provider. This may include a modified initiator package and cure schedule to lower the peak exotherm temperature. This most likely will call for a longer cure cycle.
- Use a gradual cool down phase at the end of the cure cycle as recommended by the CIPP technology provider. Hold the installation and cure pressures until the end of the cool down phase.

One final thought: It's hard to predict the results of installing CIPP in plastic sewers. On one project excellent results may be achieved with little advanced planning, while on another project there may be defects even if several precautions are taken. Or vice versa. It's always a good idea to alert the owner to the possibility of defects and how any defects that may arise will be repaired.

Have a technical question? Email **TAC@NASSCO.org**