how to: pipe defect detection

As the world’s infrastructure continues to age, municipal agencies and engineers are working harder than ever to preserve, repair and rehabilitate sewer systems. Oftentimes, the most cost-effective and efficient way to repair sewer main is by inserting a cured-in-place pipe (CIPP) liner into the existing problematic pipe. When properly installed, CIPP liners can be the answer to aging buried infrastructure, but studies are finding they often are improperly installed.

For example, a U.S. Environmental Protection Agency study conducted in January 2012, “A Retrospective Evaluation of Cured-In-Place-Pipe Used in Municipal Gravity Sewers,” found that defects missed during closed-circuit television (CCTV) inspections in poorly installed CIPP liners later became the cause of infiltration and root intrusion. Much of the pipe inspected during the study was not expected to last the estimated useful life. Proper certification of newly installed CIPP liners is essential for eliminating infiltration, reducing maintenance costs, estimating useful life and ensuring responsible capital spending. The following should serve as a guide to using CIPP liner certification based on defect flow results from Electro Scan, a technology that locates and measures defect size and flow in gallons per minute.

Locating Defects

The technology simulates the performance of sewer main in wet-weather conditions, when pipe is full of water. It releases a focused, low-voltage, high-frequency electrical current of 40 mA to locate and quantify all defects in non-conductive (e.g., CIPP, asbestos, vitrified clay, etc.) pipe. Non-conductive materials naturally prevent electricity from passing through, or along, the wall of a pipe. As a result, no electrical current should ever be able to “leak” or escape from the inside of a pipe unless there is a crack or break present.

The technology’s testing is carried out by pulling an electrically charged probe through a pipe and measuring the variation of the electric current. Middle: The truck should be positioned to minimize safety risks and maximize production. Bottom: The equipment is set up in the upstream manhole, with the jet truck positioned at the downstream manhole.

8 steps to proper installation of cured-in-place pipe liners

By Mark Grabowski & Carissa Boudwin
jet truck at the downstream manhole. The jet truck operator will jet up the pipe to the upstream manhole, where the hose will be hooked and brought to the surface. The nozzle then will be removed and the Electro Scan Sliding Funnel Plug installed on it. Attached to the Sliding Funnel Plug is the ES-620 probe, which is wired to the truck via a standard CCTV cable reel. After everything is connected, the assembly can be lowered back into the upstream manhole.

While the probe is being attached to the jet hose, another operator can begin setting up the Electro Scan Mainline Application on the PC in the truck, and also attaching the grounding cable to either the provided ground stake or another electrical ground source (fence post, street sign, etc.), so any AC being put out by the probe that escapes the pipe through a defect can be measured as it completes the circuit.

With the probe in the upstream manhole’s flow line and the Funnel Cone seated just inside the pipe’s invert, sealing off the flow, the jet truck operator can turn on the water and create a small surcharged area to surround the probe. Once the water is high enough to fill the entire diameter of the pipe, the jet truck operator can begin to retrieve the hose while pulling the ES-620 probe through the pipe at 30 to 60 ft per minute.

While the probe is moving through the pipe, it is feeding data through the CCTV coaxial cable and back to the onboard PC every 14 milliseconds or faster. It is feeding back data on the speed of the probe, water height and distance; most importantly, it is feeding back data on electrical readings within the pipe. With CIPP having such a high electrical resistance, any small defect within the liner or the coating can be detected automatically.

After the scan is complete (five to 10 minutes per pipe), the data automatically are saved on the PC, then uploaded, via Wi-Fi, to a cloud-based processor, which performs a post-processing analysis on it, before uploading it to www.criticalsewers.com, a Web-based viewing platform, for the engineer or manager to view within minutes of the scan’s completion.

Engineers and managers can assess which defects, if any, exist within the liner, then make a determination to move on to other actions, such as further investigate, repair immediately, add lateral connection liners, keep an eye on for future potential failures or approve for payment.

Certification of CIPP Installations
Electro Scan substantively changes the acceptance criteria for rehabilitated pipe, especially CIPP liners. The main objective of most sewer pipeline rehabilitation is to ensure groundwater cannot infiltrate through the pipe wall and into the sanitary sewer system. When a properly installed CIPP liner is electro scanned, the electrical current will not be able to escape the pipe wall, so the electrical current will remain unchanged, resulting in no defects being recorded. When a CIPP liner is not properly installed, there are variations in the electrical current, resulting in distinct defects being recorded and measured. Most defects are detected at service reconnections, where either there was no lateral connection liner installed, the robotic cutter has damaged the liner, or the lateral connection liner was not properly sealed.

Defective liners can be repaired or re-installed under warranty by the contractors, avoiding prematurely deteriorating pipe.

Measuring the Reduction in Defect Flows & Analyzing Data
Testing before and after rehabilitation provides a snapshot of data for each sewer main that can be compared to further enhance rehabilitation plans. Calculating the reduction in estimated daily flow provides valuable decision-making data on where and how to spend capital to continue to improve the sewer system. For example, the difference between the estimated defect flow from the initial scan and the CIPP certification scan provide an estimate flow reduction total. The owner then can decide if further rehabilitation is necessary, and will have the locations of the largest defects, allowing the engineers to address the largest remaining defects first.

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