You Should Know

American Concrete Pipe Association

A Message from the American Concrete Pipe Association Bulletin No. 140

Should Laser Video Inspection Be Required? Find Out More...

In 2002, a report entitled *"Condition Investigations of HDPE Pipe In-Service In the United States (Six States)"* was issued by Wiss, Janney, Elstener Associates, Inc. This report was based upon the performance evaluation of installed high density polyethylene (HDPE) pipe in six states.

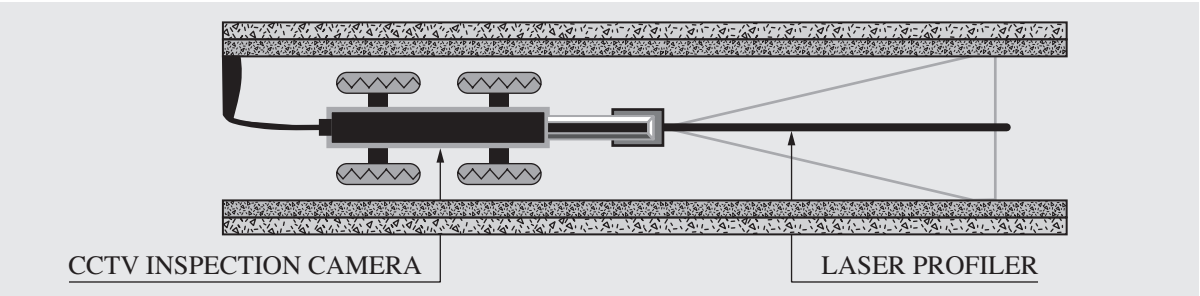
In the fall of 2005, Pipe Drainage Consultants conducted a follow up performance study including 11 of the 13 original Ohio sites with 672 feet of pipe from the 2002 report.

In May 2005, the Kentucky Department of Transportation formed a task group to evaluate current specifications and the use of HDPE pipe on future KY DOT projects. It was decided to first evaluate the long-term performance of seven of the origianl 2002 HDPE pipe sites for which 3,892 feet of pipe were inspected. Field evaluations were performed in July, 2005 by the KY Transportation Center and Pipe Drainage Consultants.

Field Testing and Equipment:

At both the Kentucky and Ohio test sites, detailed laser video inspections of the pipe were conducted utilizing a Cues OZ II pipe line inspection camera. The Cues OZ II camera was utilized due to its optics, which has little to no barrel distortion that could be misled for pipe deflection.

The laser video inspection is designed to provide the contractor, owner, or consulting engineer with the ability to determine internal pipeline conditions after the initial installation. The Laser Profiler is a stand-alone tool for use with a closed circuit television video (CCTV) survey system to collect survey data and create pipeline reports using innovative machine vision software to obtain the measurements of faults and features inside the pipeline. This includes measurements of pipe size, water levels, cracking, and hydraulic capacity. Analysis of pipe ovality is available showing pipe distortion such as crown flattening and vertical and horizontal deflection up to 30 times per second.



continued on back

The concept - simple and easy:

1. A ring of laser light is projected onto the internal pipe surface.
2. The laser image is in the field of view of the camera while the camera moves through the pipe.
3. Analysis is performed on the ring of light using the Laser Video software to build a digital pipe profile.

The Software -

- o Manual Measurements - Precise measurements (accurate to 1 mm) can be taken from a single frame captured from the video. This includes pipe size verification, size of laterals, water levels, holes, and off-set joints.
- o Automated Analysis - The software uses machine vision. Machine vision is used to find the video image of the laser profile (red laser line). Each frame of the inspection video is analyzed to build a digital profile of the pipe. From this profile, the Video built-in functions display the following:
  - Ovality - calculates the "q", the total external pressure on the pipe (as per ASTM F 1216, the internationally recognized standard for CIPP rehabilitation).
  - Capacity - calculates the cross-sectional area for each profile and normalizes the results against the expected internal pipe area.
  - Delta - finds the maximum and minimum pipe radius for each profile.
- o 3D Modeling - Using the digital profile, the Laser Video creates a fully interactive 3D model of the pipe. This allows the user to navigate through the selected pipe within its local environment.

The Evidence:

Camera and laser systems utilized on both the Ohio and Kentucky projects provided significant information about pipe performance.

The cross drains inspected in Ohio show that cracking has increased by 4 to 7 times since 2001. In Kentucky, radial cracking is documented in approximately 20% of the pipe sections with sagging and ponding occurring in 26% of the pipe. Corrugation growth was found on average at about 0.4 inches in "smooth wall pipe", equating a Mannings "n" value much higher than the manufacturers' design recommendations. The majority of the pipe investigated would not pass a 5% deflection test and most of the sites had pipe sections that would not pass a 10% deflection test.

These studies clearly demonstrate the difficulty in achieving a problem free installation of HDPE pipe and that the pipe does not always perform in accordance with theory. It also brings into question the long-term properties of the HDPE material and current material tests used to verify future performance. These problems are an indicator of future failure.

Studies such as the Kentucky and Ohio DOT projects clearly show the benefits of using Laser-Video testing to ensure the proper installation and performance of the pipe installed on their projects.

References:

1. *Cues Laser Profiler*, retrieved from www.cuesinc.com
2. *Evaluation of HDPE Pipe Performance on Kentucky DOT and Ohio DOT Construction Projects*, Pipe Drainage Consultants, September, 2005.

