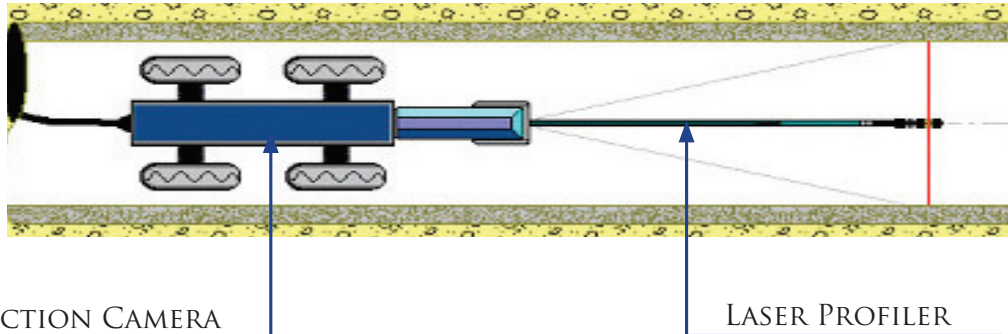


# Laser Profiler System

The Laser Profiler is designed to provide the contractor, municipality, or consulting engineer with the ability to determine internal pipeline conditions prior to and/or after rehabilitation. The Laser Profiler is a stand-alone, snap-on tool for use with a CUES CCTV survey system and CUES camera to collect survey data and create pipeline reports containing the measurement of faults and other features inside the pipeline. This includes measurements of pipe size, laterals, water levels and other features, as well as automatic analysis of pipe ovality and capacity up to 30 times per second. The Laser Profiler simply attaches to your existing CCTV Camera and the resulting CCTV images are analyzed using innovative machine vision software.



## *The concept - simple and easy:*

- A ring of laser light is projected onto the internal pipe surface
- Laser image is in the field of view of the camera while the camera moves through the pipe
- Analysis is performed on the ring of light using the Laser Profiler software to build a digital pipe profile
- For use with live or pre-recorded to video (tape, CD, or DVD)

## The Laser Profiler Base System includes the following:

- For 6"-15" pipe: Camera mounting assembly, single laser head, battery charger, 3-D measuring software, rod extension for 10", 12", 15", barrel distortion target, calibrator target, AC adapter, and hardware case.
- For 8"- 42" pipe: Laser wand, triple laser head, battery charger, 3-D measurement software, barrel distortion target, calibrator target, AC adapter, camera skid assembly 8"-30", skid plate assemblies for 36" and 42", skid adapter plate, and hardware case.

## FEATURES & BENEFITS:

- Can operate in pipe sizes ranging from 6" through 72"
- Internally battery powered (rechargeable); no electrical connections are required; no moving parts
- Software can be used on a TV inspection vehicle or on a remote computer
- Can capture a single frame of video from videotape, previously stored file, CD, DVD, etc, when utilized on a remote computer
- Designed to project a laser light in a radial plane perpendicular to the CCTV camera's line of sight and create a red line on the inside wall of the pipe; laser is designed to provide sufficient intensity to view the video image with normal CCTV camera lighting
- Easily attaches to your existing CUES CCTV Camera or Transporter
- Designed to capture and display a single frame on the data monitor for measurement and analysis in industry standard formats to include JPEG, BMP, or TIFF formats
- Text can be placed anywhere within the captured video image
- A line graph displays the cross-sectional amplitude over the entire length of the pipe run from entry to exit access
- High-strength carbon fiber and aluminum construction
- Designed to obtain the actual degradation of the pipe by utilizing the laser profiling and measurement tools
- Certified by WRc

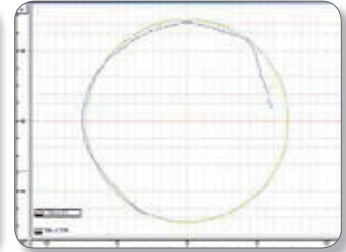
## The Software

Manual Measurements - Precise measurements can be taken from a single frame captured from the prerecorded or live video. This includes pipe size verification, size of laterals, water levels, holes, and off-set joints. The captured frame, with its measurement data, can then be stored as a JPEG or BMP file. Manual measurements can be performed on the captured digital profile to an accuracy of 1mm\*.

Examples of quantifying lift in liner using both the manual and the automated digital measurement methods. The 3-D model can be seen below.



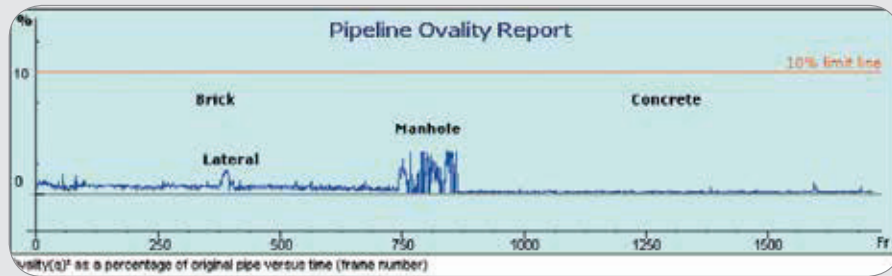
Manual



Automated

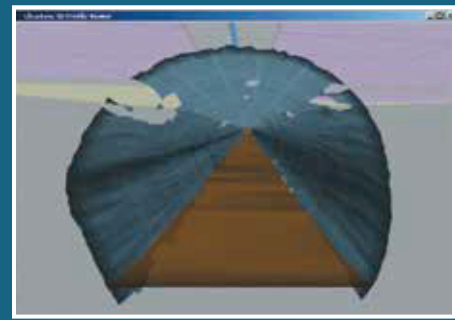
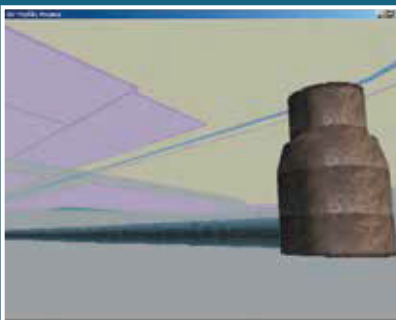
Automated Analysis- The software uses machine vision. Machine vision is used to find the video image of the laser profile (red laser line). Each frame of the inspection video is analyzed to build a digital profile of the pipe. From this profile, the Laser Profiler built-in functions display the following:

Ovality analysis in a 30" brick and concrete pipe



- Ovality - The Ovality function calculates the "q" (as per ASTM F 1216, the internationally recognized standard for CIPP rehabilitation).
- Capacity - The Capacity (X-sectional Area) function calculates the cross-sectional area for each profile and normalizes the results against the expected internal pipe area.
- Interfaces with CUES software
- Delta - The Delta calculation finds the maximum and minimum pipe radius for each profile.

## THE LASER PROFILER 3D DEVELOPMENTS:



3D Modeling- Using the digital profile, the Laser Profiler creates a fully interactive 3D model of the pipe. This allows the user to navigate through the selected pipe within its local environment, thereby providing a new perspective to traditional CCTV inspections.