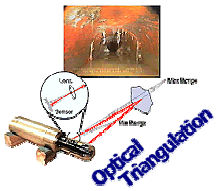
OMC Project Description – Sewer Profiling



Measurement of pipes is difficult especially when they are underground and are in an unfriendly environment. A profiling instrument was developed to address this task in a project that was funded by government and Thames Water.

Overview

The OMC pipe profiler was designed, built and tested in this project for the purposes or remotely monitoring the condition of sewers or undertaking any measurement related to the water/waste industry. The instrument uses the optical triangulation technique to estimate the distance to the surface of the pipe without touching it. An optical encoder measures the angle at which the measurement is taken and this information is then used to create a cross-sectional measurement of a pipe like structure. The instrument is controlled from up to 200 metres away and also has a small video camera to enable the user to see where the instrument is. The pre-production prototype was extensively tested by Thames Water Research and Technology team and also by Subterra who are experts in the area of sewer inspection.

Industrial partners

UK Government, Thames Water, Subterra

Project duration

Approximately 1 year to develop the instrument

Project value

Approx. £100k

Intended beneficiaries

Any industry that requires the internal dimensions of a pipe-like structure

Current status

Discussions are taking place with an interested party regarding licensing and OMC are able to provide instruments to the end users requirements on request.

Project Highlights

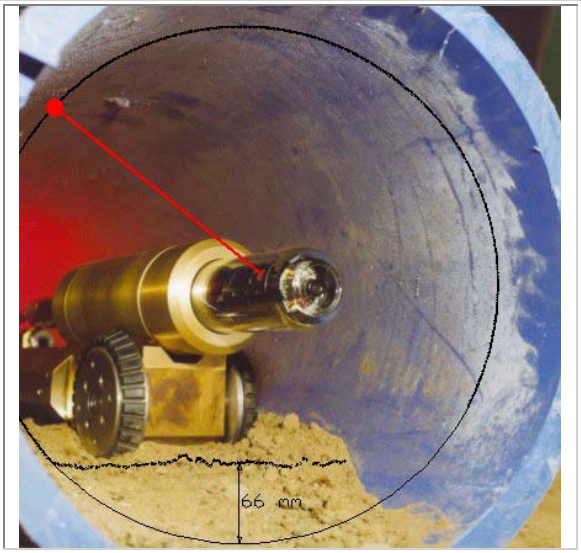
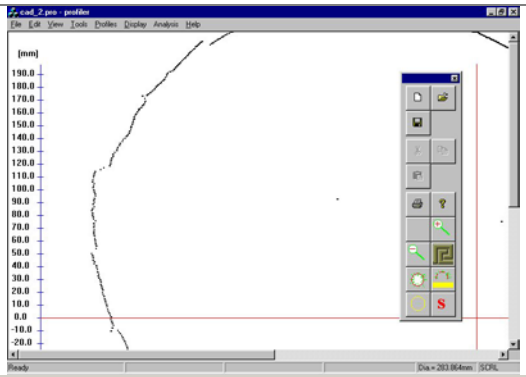
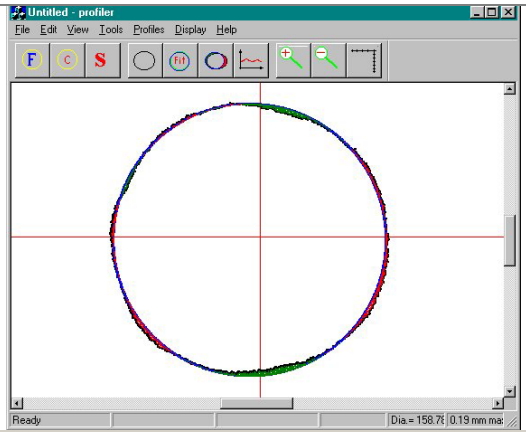
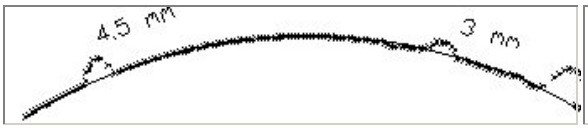
- Winner of a Metrology for World Class Manufacturing award in 1997
- Extensive field trials during 1999-2001
- Featured on the BBC's Tomorrows World programme in 2000

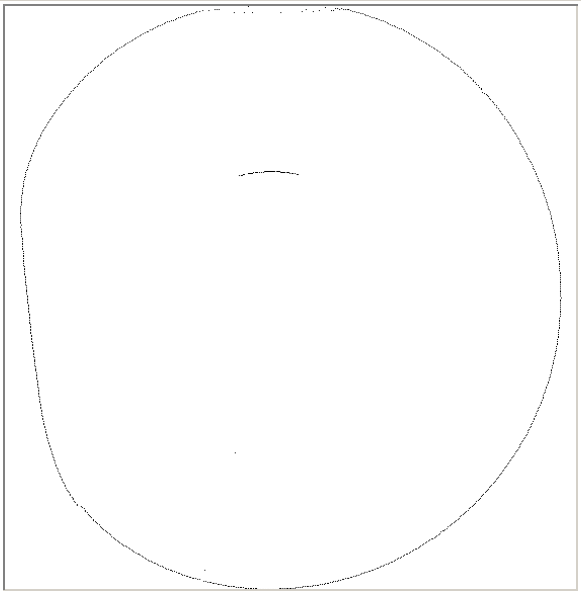
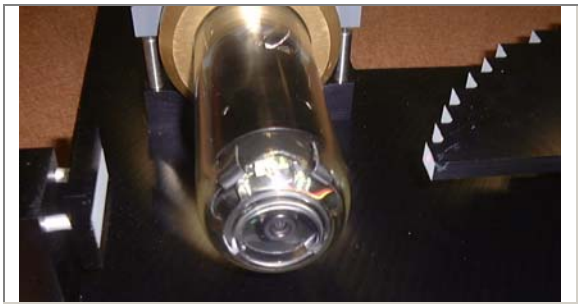
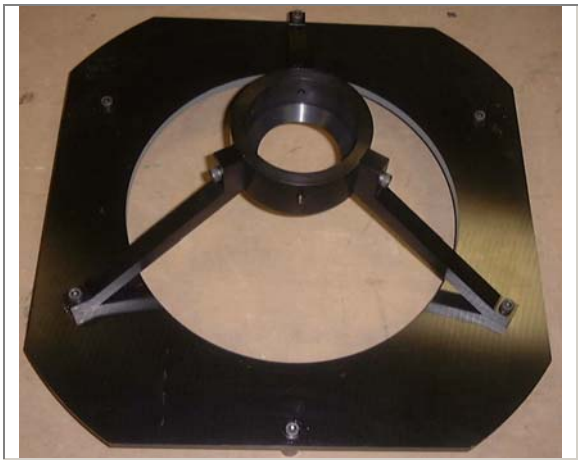
Background

OMC has been involved in profiling of structures for many years. Initially profiles were measured by taking pictures of a rotating laser beam. After developing the plates were measured manually to obtain the shape of a tunnel or canal. Several commercial contracts were undertaken to prove the concept. The on-line measurement step was the next development that started in 1987. Various prototypes were developed from one that was capable of measuring the Channel Tunnel to the sewer profiling devices. The on-line profiler uses the principle of optical triangulation to measure distance. This is achieved using a linear CCD array that detects where the reflection of a laser spot is. By calibrating the system it is possible to convert the pixel location into distance. This technique is optimal for relatively close range measurements that have to be undertaken very quickly. The Thames Water profiler, for instance, can take more than 200 measurements per second. A critical part of the development of the system was not just that the instrument would be robust and reliable but also that the software and calibration and verification infrastructure would be in place. An important element of the project was also the close collaboration between the end user (Subterra) and the development team.

Pictorial highlights

The Thames Water version of the profiler built upon experience developing and testing a previous prototype for North West Water. This device was able to measure 400 points in few seconds and function up to 95 metres from the operator.

	The process of pipe measurement is illustrated in this figure where the measurement data is superimposed onto a picture of the profiler in action.
	The software allows the user to visually assess the condition of the pipe being measured. In this figure the position of bricks and joints can clearly be seen.
	The ovality of a pipe can be estimated by a circle fitting process to allow the user to visualise the shape of the pipe through an exaggerated difference profile plot.
	The size and shape of defects can be measured using the system. In this case gouges in a plastic pipe.

	Gross deformation of pipes can easily be seen visually.
	A sophisticated calibration apparatus allows the instrument to be calibrated quickly and easily.
	A system verification rig allows the user to determine whether the system is operating correctly. The inner hole of the plate has been manufactured to a high level of accuracy so both the scale of the system and its distance measurement accuracy can be assessed.