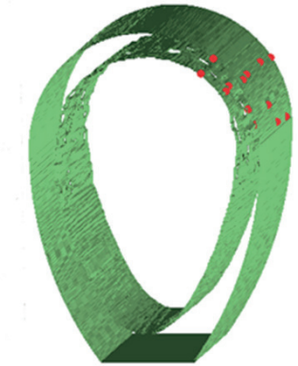
Contact

francois.clemens@deltares.nl
t +31(0)6 5241 4021

Aging pipes in underground networks



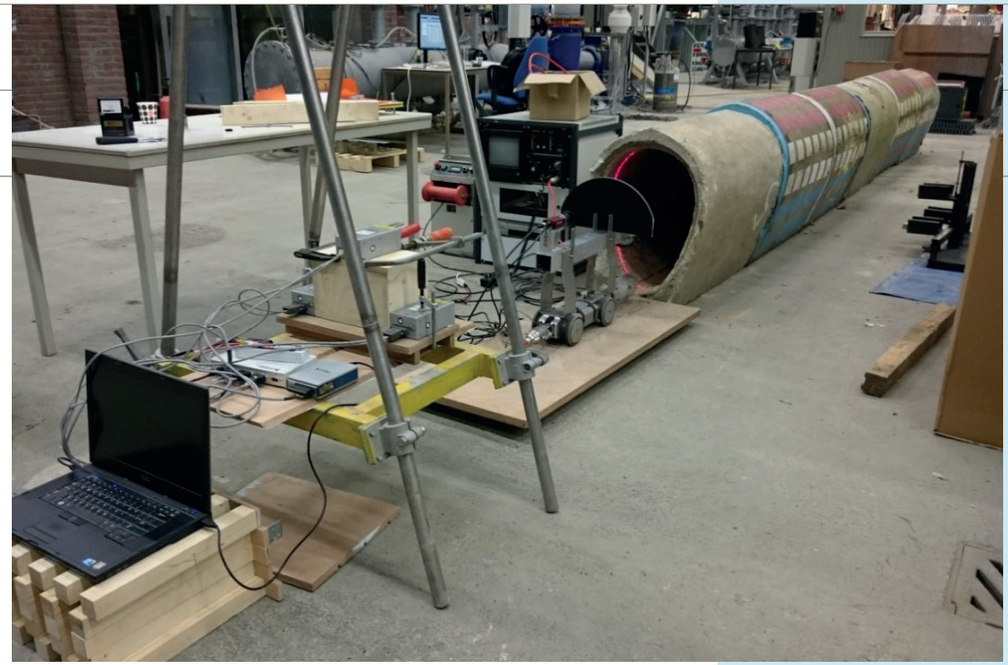
Output of the 3D laser scanning. Red dots indicate loss of material.

Lab testing at Eindhoven University of Technology

Underground networks for wastewater and drinking water are aging and effective asset management is required. This means quantifying the actual functionality and structural condition of the pipes, preferably using non-destructive methods. With this goal in mind, a group of companies, water authorities, municipalities, Deltares, Delft University of Technology, STOWA and RIONED joined forces in the Urban Drainage Knowledge Programme and set up an STW-funded research programme TISCA: Technology Innovation for *Sewer Condition Assessment*. A major aim of TISCA is to obtain information about hydraulic capacity and structural strength using non-invasive methods for existing infrastructure.

Before the development of the TISCA programme, 3D laser scanning technology was introduced for a new tool that accurately scans the interior geometry of old pipes. The resulting data are essential for the assessment of the structural strength of pipes and hydraulic roughness. For example, old pipes can contain irregularities such as small cracks and accretions of material that affect pipe strength and the flows of water and other fluids. Corrosion results in more hydraulic roughness (reducing the hydraulic capacity) and also reduces the thickness of the wall and makes the pipe weaker. A laser scan shows that material is lost at the top of the pipe (red dots) and this is seen as increased roughness on the inner wall at the top relative to the bottom.

The assessment of the condition and behaviour of aging pipes can be determined not only with measurements but also with models. One TISCA project is the *Condition Assessment of Sewer Pipes by means of Finite Element Modelling* (CASPFEM). The aim is to quantify the interaction between the pipe and the surrounding soil. This is a step forwards since it allows for a more realistic representation of the soil mechanics. In the CASPFEM model, the laser scan measurements serve as input for advanced structural modelling. Delft University of Technology is involved on the modelling side in the mixed-mode FEM analysis of concrete. The results of the modelling show that, counter-intuitively, egg-shaped pipes tend to crack first at the bottom (the thin end). This is difficult to observe in practice. Deltares will conduct experiments in the GeoCentrifuge to study the interaction of pipes with the soil. The GeoCentrifuge experiments are planned for the near future.



Prototype of the laser scan device in the experimental set-up at Deltares

The intermediate results are already being used in further research by the Universities of Technology in Delft and Eindhoven, and by Deltares. Ultimately, the project will result in a method that will allow practitioners to make accurate assessments of the actual strength of aging underground pipes.