UNIVERSITY OF TWENTE.

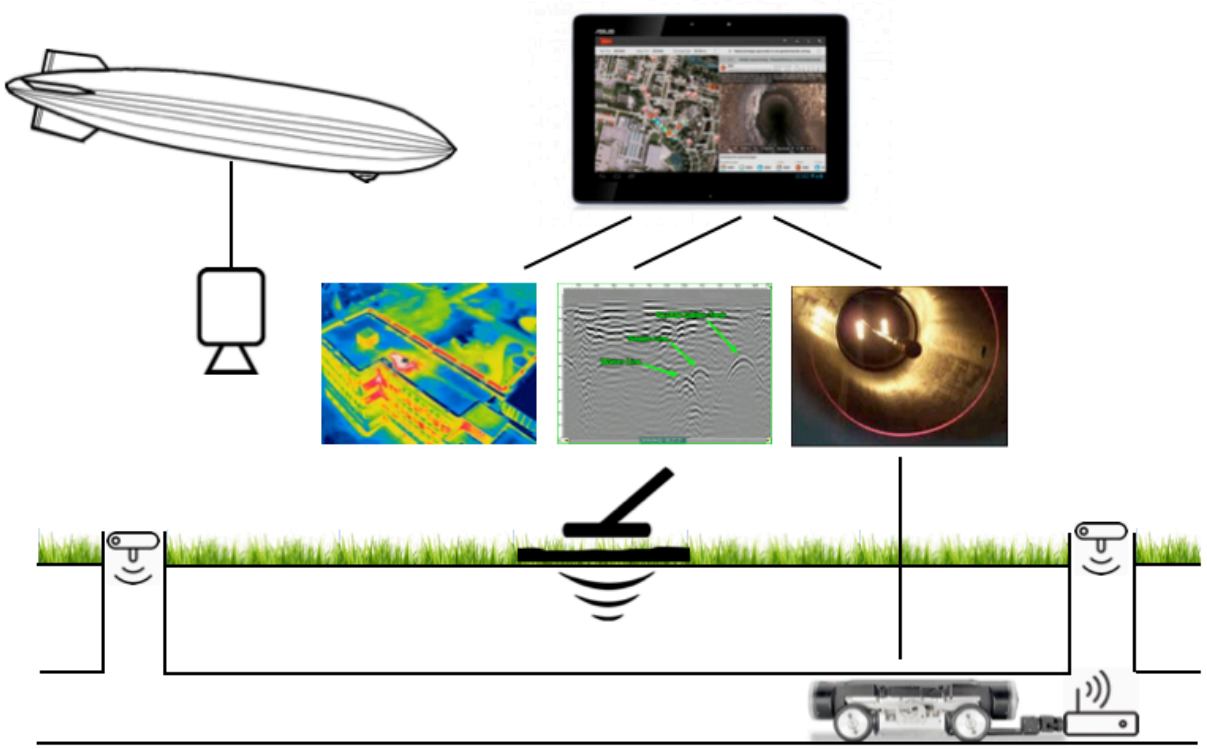
TECHNOLOGY INNOVATION FOR SEWER CONDITION ASSESSMENT – LONG-DISTANCE INFORMATION-SYSTEM (TISCALI)

University of Twente

ITC FACULTY OF GEO-INFORMATION SCIENCE AND EARTH OBSERVATION

TISCALI

- Who are we:



- **Technology Innovation for Sewer Condition Assessment – Long-distance Information-system (TISCALI)**

TISCALI

- **Who are we: University of Twente**

Faculty of Engineering Technology (CTW), Dept. of Construction Management and Engineering (CME)

Andre Doree

Leon Olde Scholtenhuis

Faculty of Electrical Engineering, Mathematics and Computer Science (EWI) , Dept. of Robotics and Mechatronics (RaM)

Edwin Dertien

Hengameh Noshahri (**PhD Candidate**)

Faculty of Geo-Information Science and Earth Observation (ITC), Dept. of Earth Systems Analysis (ESA) & Dept. of Water Resources (WRS)

Wim Timmermans

Mark van der Meijde

Jonathan Franco (**PhD Candidate**)

ITC

UNIVERSITY OF TWENTE.

USERS

BRANDWEER TWENTE

- Initiated the Safety Campus Twente (unique safety fieldlab).
- It has a unique location which can be used for **several safety experiments** and product tests.
- Have **experience** in testing new concepts with **drone- and robot technology** for the emergency services.
- Have the **right network** to facilitate the specific tests.
- Can contribute to the project, especially in the **testing phase** where science meets practice.
- Estimated time input around **30 mandays**

USERS

- They believe that the outcome of this project can help significantly in the objective detection and quantification of defects in sewers.
- Id-tec will invest **time** and **equipment** for all these projects.
- Id-tec **develops** sophisticated **machines** and **equipment** for the wastewater, oil and gas industry.
- Can contribute by offering experience on **translating the research results**.
- Can contribute **equipment** to the four-years project, by means of one sewer **robotic unit**.

USERS

- They specialize themselves in **Ground Penetrating Radar and mobile mapping.**
- They strongly believe that the integrated use of remote sensing, ground radar, and robotics techniques into a dedicated subsurface information system contribute to an improved asset management of the existing sewer infrastructure.
- Contribute by offering access to their **24 Channel GPR**, available **scan data** for at least **two sites**, and contribute in surveying and assistance.
- The contributions to the four year project will be in **working hours** and **equipment**.

USERS

M.J. Oomen
riool- en betontechniek B.V.

- Their **pipeline ground penetrating radar technique** may deliver data that can be used to assess **pipeline material conditions and the conditions of its surrounding soil**.
- Interested in the aim of TISCALI to **evaluate & automate** the use of these technologies to improve condition assessment of **concrete sewer pipelines**.
- They serve as **user/expert** to the research team and will provide anonymized **pipeline scan data from our in-pipe GPR**.
- They will further support the project in kind through **assisting** in the user meetings for 30 hours.

USERS

OPEN INNOVATIE CENTRUM ADVANCED MATERIALS **(OICAM)**

- Believe that the outcome of this project can help significantly in the objective detection and quantification of defects in sewers and in determining the constructive strength and stability of sewers in the Netherlands.
- Provide **knowledge** regarding **advanced materials**.
- Can contribute by offering our **experience on translating** the research results.
- Their contribution will be in for 310 working hours by a **Senior Researcher** & 146 working hours by a **Junior Researcher**.

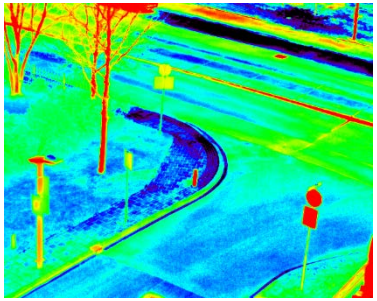
USERS

Rolsch Assetmanagement

- They are a **software development** and consultancy company in the field of water pipes, sewer pipes and related assets.
- Specifically our software tool **Rasmariant** can calculate the **optimal replacement moment** of assets using risk-based **algorithms**.
- Can contribute by offering our **experience** on **analysing** the measured results and in the **development of software** to automate the analysis.
- Their contribution will be in kind in the form of **assistance** for **256 hours** over 4 years.

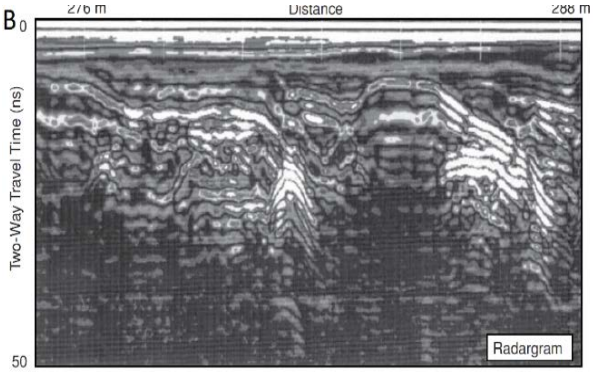
WHAT DO WE OFFER

REMOTE SENSING SEWER CONDITION (PHD1)



TIR imagery

Detection and evaluation of potential “problem” locations in sewer pipes by analysing the environment surrounding it.



GPR measurements

WHICH FACILITIES CAN WE SHARE

REMOTE SENSING SEWER CONDITION (PHD1)

TIR camera FLIR x6570sc

- **Image size: 640x512**
- **Max frame rate 234Hz**
- Weight: 5kg
- Power supply: 24 V
- Spectral band: Long-wave infrared
- Spectral range: 7.7–9.3 µm
- **Thermal sensitivity: <25 mK**
- **Temperature measurement accuracy : ±1°C (1.8°F) or ±1%**
- 100mm, 50mm and 25mm lenses

WHICH FACILITIES CAN WE SHARE

REMOTE SENSING SEWER CONDITION (PHD1)

- GPR

- **Three** frequency antennas: 500, 100, and 50 Mhz,
- **Automatic** logging and **GPS** controlled location system.

WHAT WILL BE DONE

REMOTE SENSING SEWER CONDITION (PHD1)

- Two approaches will be done throughout the research:

1. Establish the best conditions for TIR and GPR through **simulations** or **numerical analysis**.

2. Establish the best condition for TIR and GPR through **experiments** under controlled condition and **real-life** scenarios.

WHAT WE NEED & WHAT DATA CAN WE SHARE

REMOTE SENSING SEWER CONDITION (PHD1)

Data collection/processing

Data input

- TIR images from different scenarios.
- GPR measurements parallel and perpendicular to the sewer pipe done under the different scenarios.

- **Outputs**
  - Graphs of **daily** and **yearly** temperature **variations** for **pixels** located on leakage and non-leakage.
  - GPR **radargrams** and interpretation of **cross sections** showing the **different radar facies**.

WHAT WE NEED & WHAT DATA CAN WE SHARE

REMOTE SENSING SEWER CONDITION (PHD1)

Data analysis

Determination of best condition for data acquisition and data integration

- TIR imagery + temp. variation graphs + radargram interpretations

Determining the applicability of the methodology on real-life scenarios

1. **Direct comparison**
   - TIR imagery from experiments+ TIR imagery from real life scenarios
   - Temp. variation graphs from experiments + temp. variation graphs from real life scenarios
   - radargram interpretations from experiments + radargram interpretations from experiments.

2. **Data integration from data collected on real-life scenarios**
   - TIR imagery + temp. variation graphs + radargram interpretations

WHAT DO WE OFFER

ASSESSING OF SEWER CONDITION (PHD2)

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Modular Sewer Rehabilitation System ID-TEC

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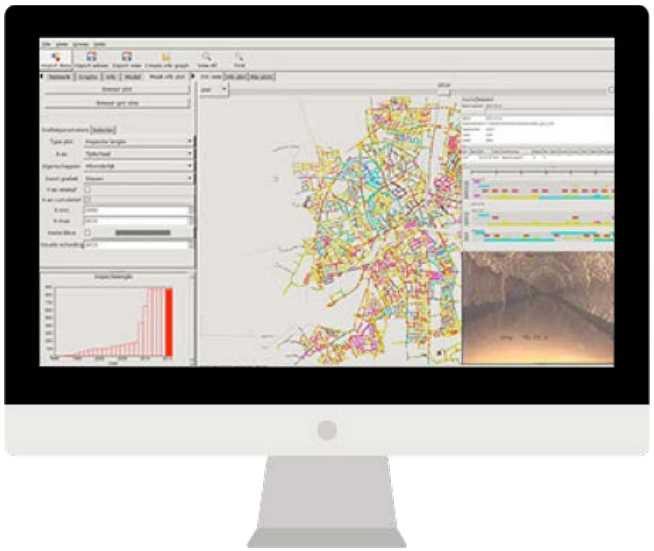

Rasmariant - A product of Rolsch Assetmanagement

WHAT WILL BE DONE

ASSESSING OF SEWER CONDITION (PHD2)

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Contact-based Inspection

Contact-less Inspection

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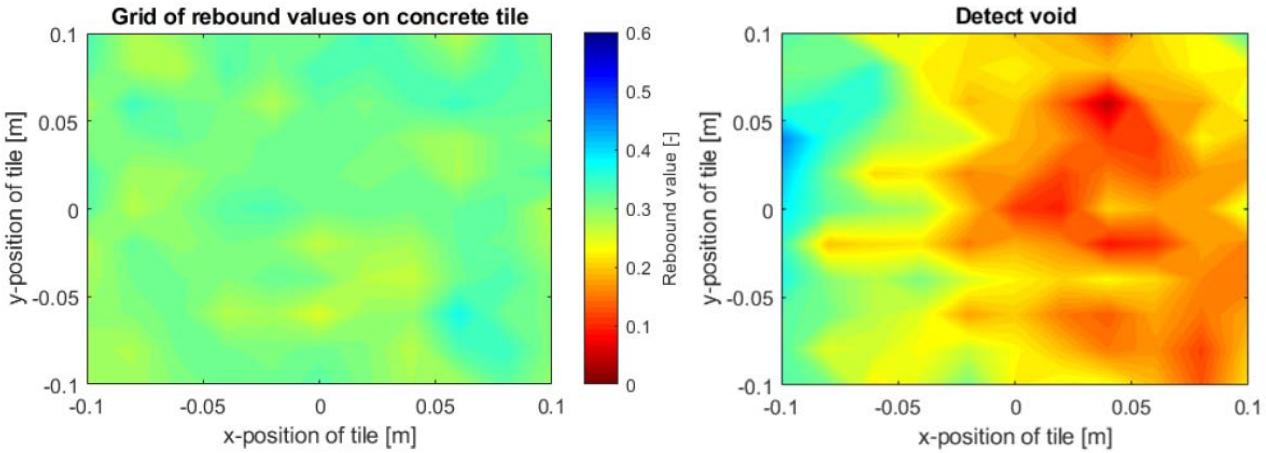

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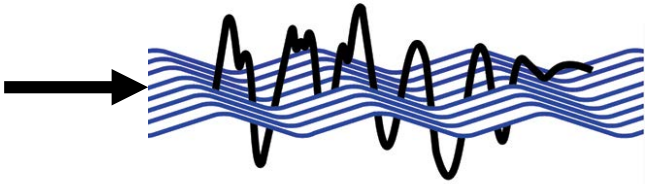

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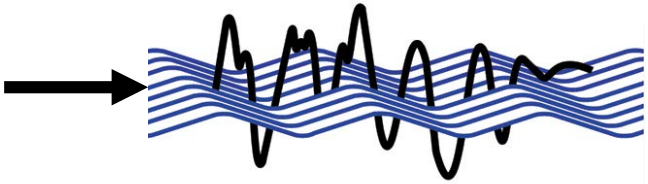

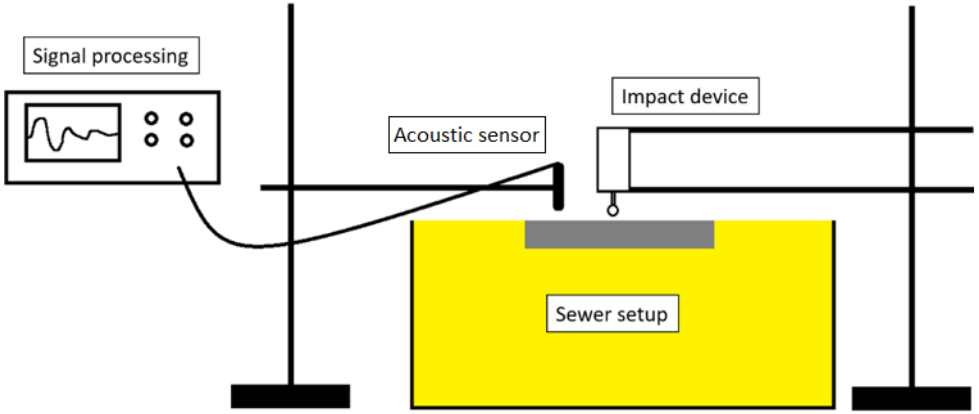

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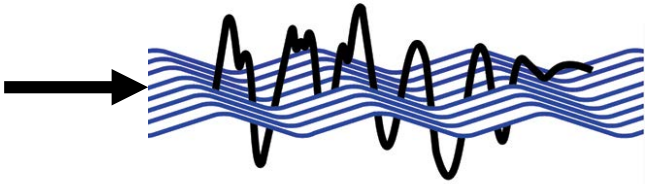

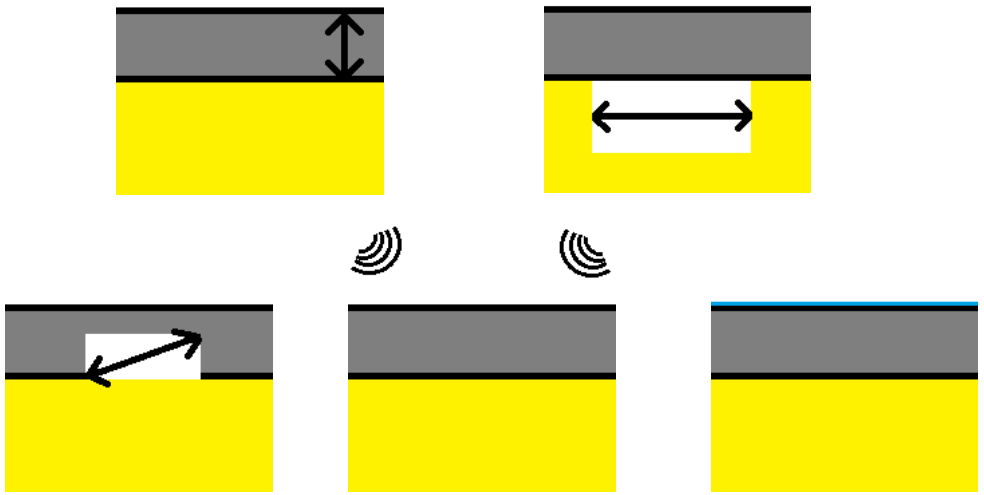

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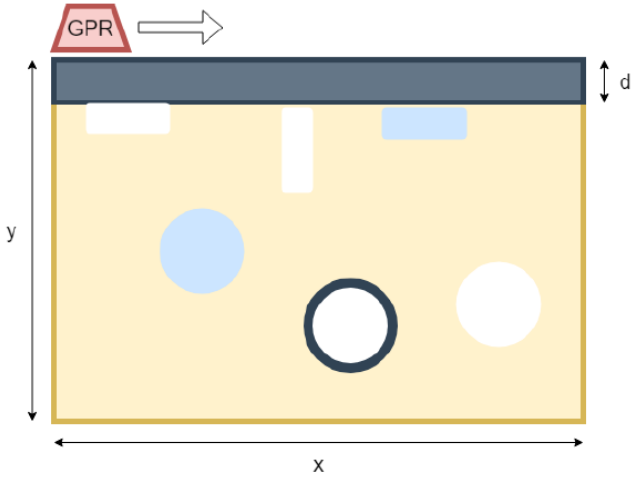

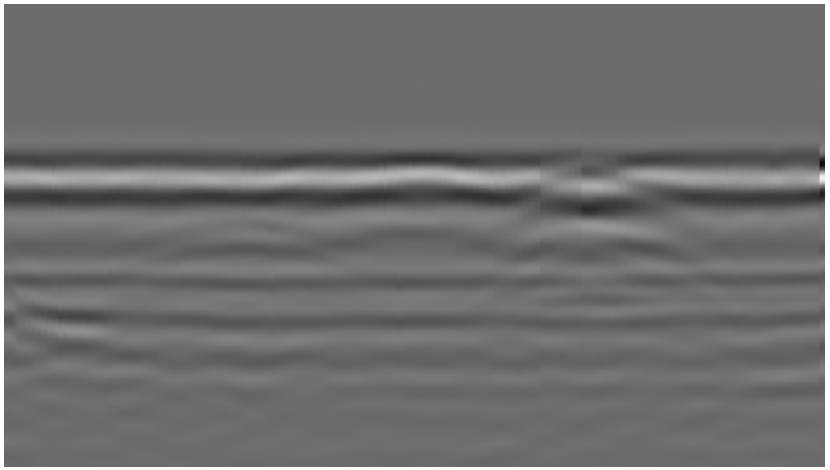

WHAT DO WE NEED

ASSESSING OF SEWER CONDITION (PHD2)

- Labeled in-pipe GPR radargrams
- Test facility for in-situ experiments
  - Concrete sewer pipes of various dimensions
  - Defined defects: voids in the supporting ground, cracks, delamination, etc.
- Knowledge on information system
  - User wishes, visualization

WHAT CAN WE SHARE

ASSESSING OF SEWER CONDITION (PHD2)

- Data / research findings
- On campus test facility (end of 2019)
- Robotic lab facilities

SPACE53

TERRINet
The European Robotics Research Infrastucture Network