UNIVERSITEIT TWENTE.

ZOARG ... WAT VOORAF GING

UNIVERSITEIT TWENTE

19 JUNI 2025, THE GALLERY, ENSCHEDE

Kickoff

zoarg 2.0

graafschade reductie

ZoARG Team en Alumni

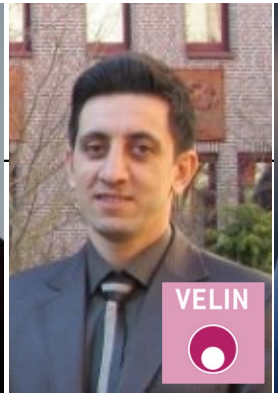
Prof. Dr. Ir. André Dorée

Dr. Farid Vahdatikhaki

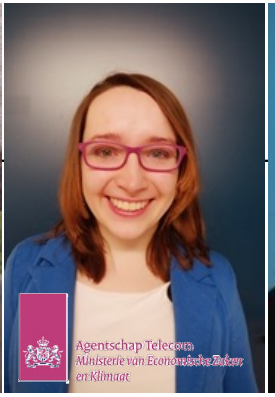
Dr. Ir. Léon olde Scholtenhuis

Dr. Ramon ter Huurne

Dieuwertje ten Berg EngD.



Saeid Asadollahi EngD



Paulina Racz. EngD

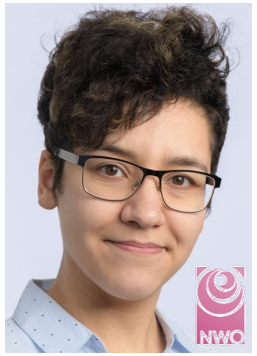
Fatemeh Mahmoudi EngD

Jitske Posthumus EngD

Azin Karimzad EngD

Dr. Nima Zarrinpanjeh EngD

Jiarong Li EngD



Dr. Hengameh Noshahri

Dr. Kai Chen Goh

Faith Tangara MSc

3 new candidates

Onderwerp	Naam EngD	Voltooid	Co-financier
Opleiding veilig raketboren	Fatemeh Mahmoudi	2015	Allinq
Proefsleufplaatsbepalingalgoritme	Paulina Racz	2016	RDI
Feedback support system graafmachine	Armin Langroodi	2020	SOMA College
Datamodel beheer nutswerken	Ramon ter Huurne	2019	Campus Mngt UT
E-learning grondradar voor MBO	Dieuwertje ten Berg	2021	ROC van Twente
Geofencing systeem minikraan	Saeid Asadollahi	2019	VELIN
Simulatie van FttH-aanlegproces	Jitske Posthumus	2021	Allinq
Ontwerp grondradarvalidatie	Azin Karimzad	2023	MapXAct
3D sleufscanner	Nima Zarrinpanjeh	2025	Siers
KLIC-Graafschadevoorspeller	Jiarong Li	2025	Kadaster

ENKELE FAST FACTS

DE AFGELOPEN ELF JAAR …

Enkele themas

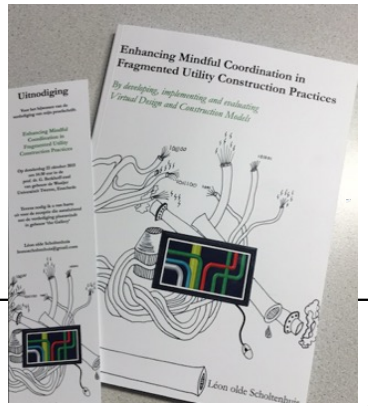
… bouwprocesvisualisaties
… modellen van ondergrond-data
… graafveiligheidsystemen
… opleidingsmateriaal grondscanning
… proefsleuf-algoritme
… raketboor-trainingsmateriaal
… FttH-simulatie toolkit
… 3D Scanner
… grondradarvalidatie
… ordening ondergrondse netten
… meerwaarde 3D
… challenge Based Learning
… learning communities

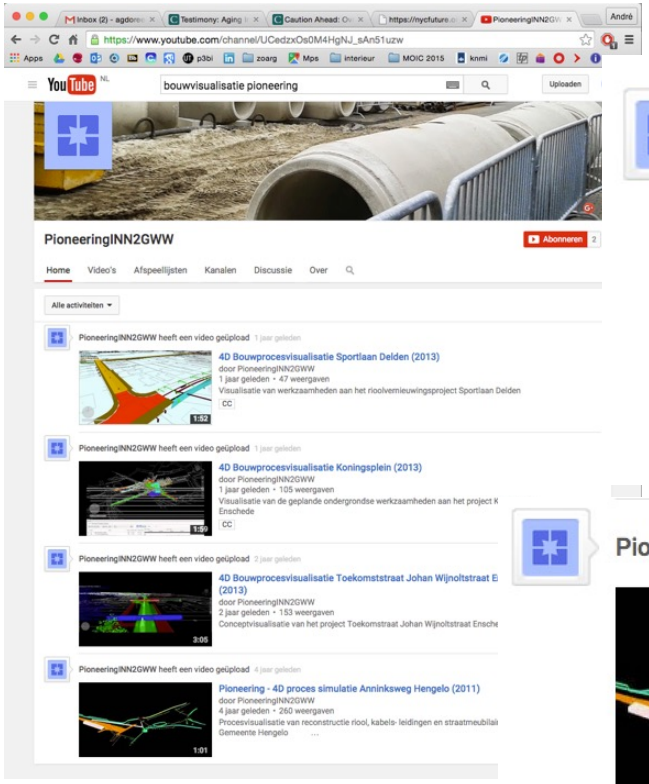
Feiten en cijfers

… 2014, 2017, 2019, 2023 symposia
… 9 EngD projecten afgerond
… 1 EngD projecten gaande
… 2 EngD project in opstart
… 2 PhD projecten afgerond
… tientallen afstudeerders
… twee vakken over ondergrond
… MSc alumni in de sector
… NL, UK, Australië, India

2D --> 4D BENADERING NUTSWERKEN

PROEFSCHRIFT LEON OLDE SCHOLTENHUIS





Glasvezel als ‘recht’ ,
maar ook een maatschappelijke ‘schadepost’

Europa 2020-strategie (2010)
streefdoelen breedband:
1. alle Europeanen tegen 2013 van basisbreedband voorzien 2.alle Europeanen tegen 2020
snel breedband
3. ten minste 50 % van de Europese huishoudens ultrasnelle breedband (dan 100 Mbps) tegen 2020.

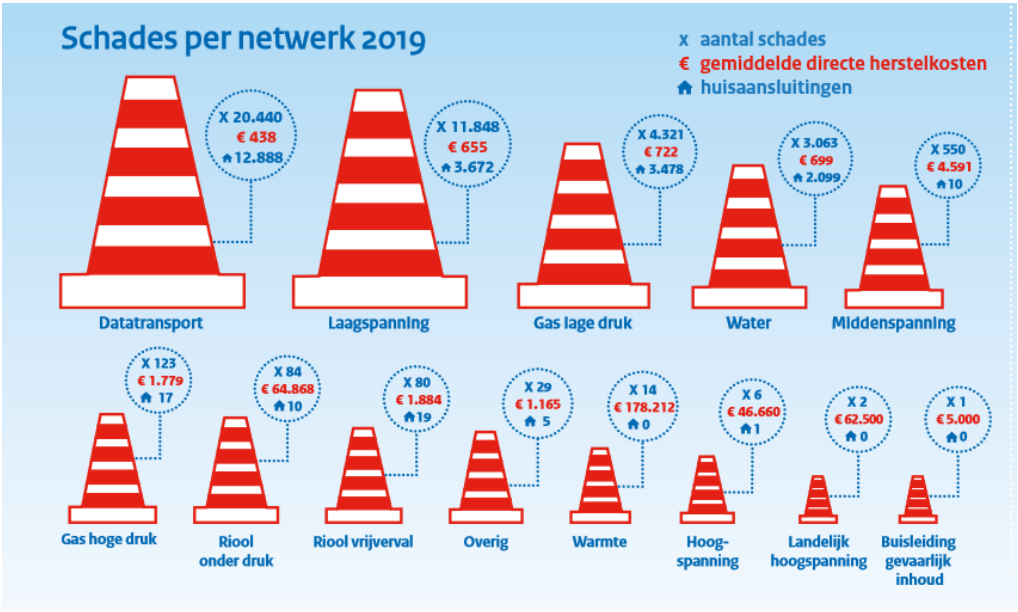
https://www.eca.europa.eu/Lists/ECADocuments/SR18_12/SR_BROADBAND_NL.pdf

30.000-40.000 graafschades jaarlijks (bron: Kadaster)

Letsel, verstoring, meerwerk, vertraging …

38,4 mln. EUR/jr herstelkosten

200-290 EUR/jaar gevolgschade



Figuur: Agentschap Telecom (2019)

Schade-impact & Reggefiber's ZoARG-fonds

Reggefiber 'verglaasde' in 2017 jaarlijks ~7000km.

Stimuleringsfonds voor R&D projecten digitalisering ondergrond & veilig graven

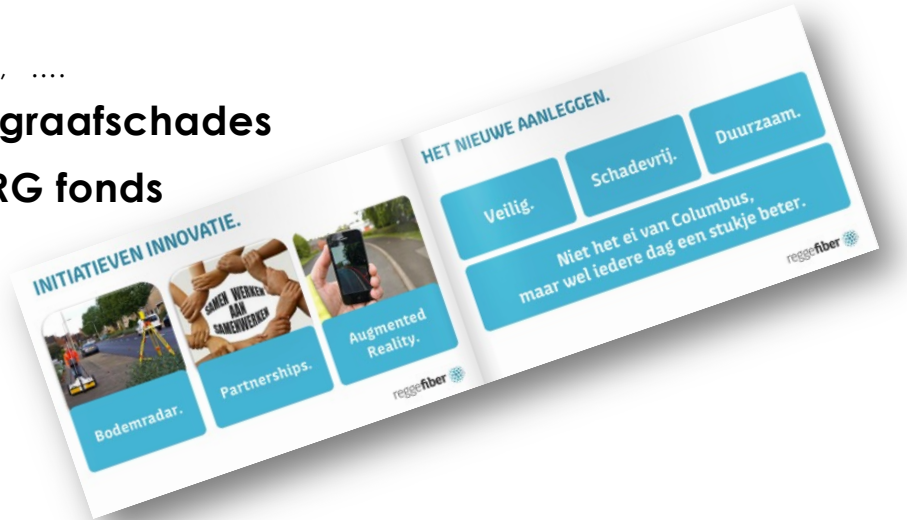
Coalitie van RF en UT, aangevuld met 4O-partners

<u>Onderzoek, ontwikkeling gericht op graafschadereductie en zorgvuldige aanleg</u>

Rijksinspectie Digitale Infrastructuur
Ministerie van Economische Zaken en Klimaat
kadaster UNIVER
roc van twente
UNIVERSITY OF TWENTE.
Liander
gasunie crossing borders in energy
VELIN
siers
alliq
MAPXACT
SOMA COLLEGE

HET ZoARG PROGRAMMA

- samenwerking van Reggefiber en UT
- beoogt professionalisering van de sector K&L
- door sponsoring van **10 PDEng projecten** (Professional Doctorate in Engineering)
- i.s.m. ketenpartners
  - zoals VWT, Spie, Fiber4all, AT, Geostruct, Mapxact, Kadaster, Bam, ….)
- i.s.m. onderzoeksgroepen
  - zoals CM&E, ITC, 3TU Bouw, Robotica, ….
- met focus op **reductie van graafschades**
- **gestimuleerd door het ZoARG fonds**
- link naar PDEng website



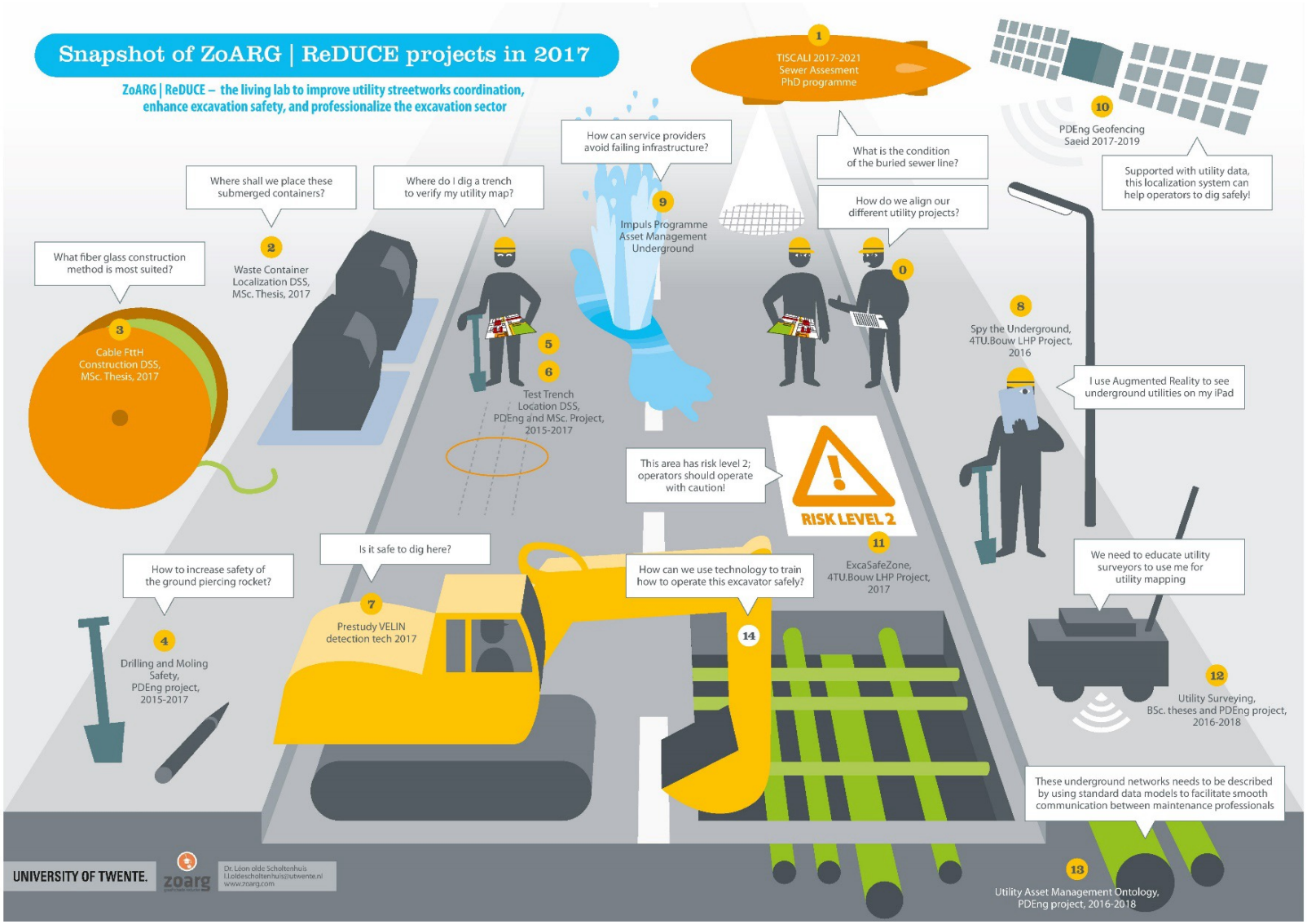
Wat is een *PDEng* ?

- PDEng = ***Professional Doctorate in Engineering***
- gericht op ontwerp en innovatie
- post master opleiding
- tot technologisch ontwerper
- duur = twee jaar
- opdracht van een organisatie
- 50% onderwijs ; 50% project
- geaccrediteerd door de KIVI
- kandidaat veelal in dienst UT
- gevraagde financiering/kosten: 65k euro.

32.5k uit **ZoARG** fonds !!

Snapshot of ZoARG | ReDUCE projects in 2017

ZoARG | ReDUCE – the living lab to improve utility streetworks coordination, enhance excavation safety, and professionalize the excavation sector



0

Problem | Different utility owners reconstruct their infrastructure at different moments
Title | Enhancing mindful coordination in fragmented utility construction practices
Author | Léon olde Scholtenhuis @ Stichting Pioneering Inn2GWW

1

Problem | Can we efficiently assess conditi-ons of large sewer networks by integrating above-ground, ground-level, and in-pipe sensing techniques?
Title | Technology Innovation for Sewer Condition Assessment Long-range Informati-on system (TISCALI) – Project 2/2
Author | Hengameh Noshahri @ NWO Applied and Engineering Sciences

2

Problem | Lack of structure and clarity in determining waste container locations
Title | Development of a Support System for Waste Container Location Selection
Authors | Reinier Umker @ Twentse Weg en Waterbouw

3

Problem | Difficulty in selecting optimal methods for fiber glass network construction
Title | Support System for Fiber Glass Construction Method Selection
Author | Rob Slöetjes @ Volker Wessels Telecom

4

Problem | Damage and safety risks exist when installing fiber glass house service lines
Title | Increasing Safety of Ground Piercing Methods
Author | Fatemeh Mahmoudi @ Fiber4All/Allinq

5 6

Problem | Experts' implicit logic leads to selection of different utility test trenches locations
Title | Development of a Support System for Choosing Utility Test Trench Locations
Authors | Paulina Racz @ Agentschap Telecom & Lars Syfuss @ University of Münster

7

Problem | It is unclear what sensing technologies can be applied to support safe excavation
Title | Review of Detection and Monitoring Systems for Buried High Pressure Pipelines
Author | Saeid Asadollahi @ VELIN

8

Problem | No methods exist to visualize utility location uncertainty in 3D.
Title | Spy the Underground
Projectleader | Léon olde Scholtenhuis, Sisi Zlatanova @ 4TU.Bouw

9

Problem | Life cycle management of buried assets is diverse and suboptimal
Title | Underground Asset Management
Type | Collaboration with GasUnie and Alliander

10

Problem | Non-professional excavator operators cause most damage to high-pressure transportation pipelines
Title | Developing an affordable and user-friendly geofencing system for excavator operators
Author | Saeid Asadollahi @ VELIN

11

Problem | Excavator operators need to collect and interpret various data sources to analyse safety risks
Title | ExcaSafeZone; link data on a risk heat map for excavators operators
Authors | Léon olde Scholtenhuis, Farid Vahdatikhaki, Jakob Beets, Pieter Pauwels, Sisi Zlatanova @ 4TU.Bouw

12

Problem | Industry limitedly adopts ground radar technology for utility surveying
Title | Developing a manual, guideline and educational method for utility mapping
Authors | Thom Brand @ Geofoxx, Peter Schakel @ Facilitair Bedrijf, Dieuwertje ten Berg @ ROC van Twente

13

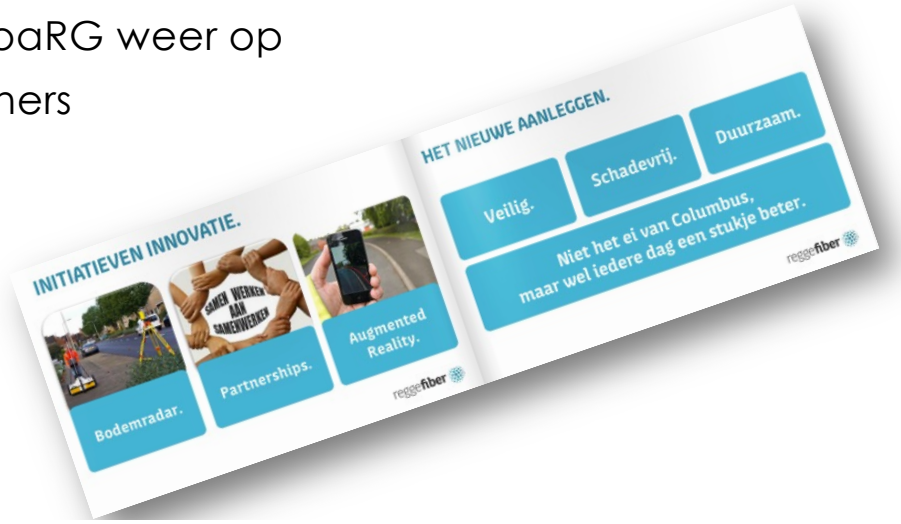
Problem | Different standards and approaches exist to store utility network data
Title | Developing a domain-ontology for the life cycle management of utility networks
Author | Ramon ter Huurne @ Facilitair Bedrijf UTwente

14

Problem | Difficult to train operators about safety hazards on real-life construction sites
Title | Educating the next generation training operators with modern sensing and localiza-tion technologies
Author | Farid Vahdatikhaki & SOMA college

HET ZoARG PROGRAMMA

- Reggefiber wordt overgenomen door KPN
- KPN verlegt de prioriteit schaalt FttH af
- raakt de netwerkpartners (vd Donk, Allinq, VWT)
- raakt tempo in ZoARG programma
- na 2-3 jr pakt KPN FttH en ZoaRG weer op
- verbreding naar meer partners
- ZoARG 2.0



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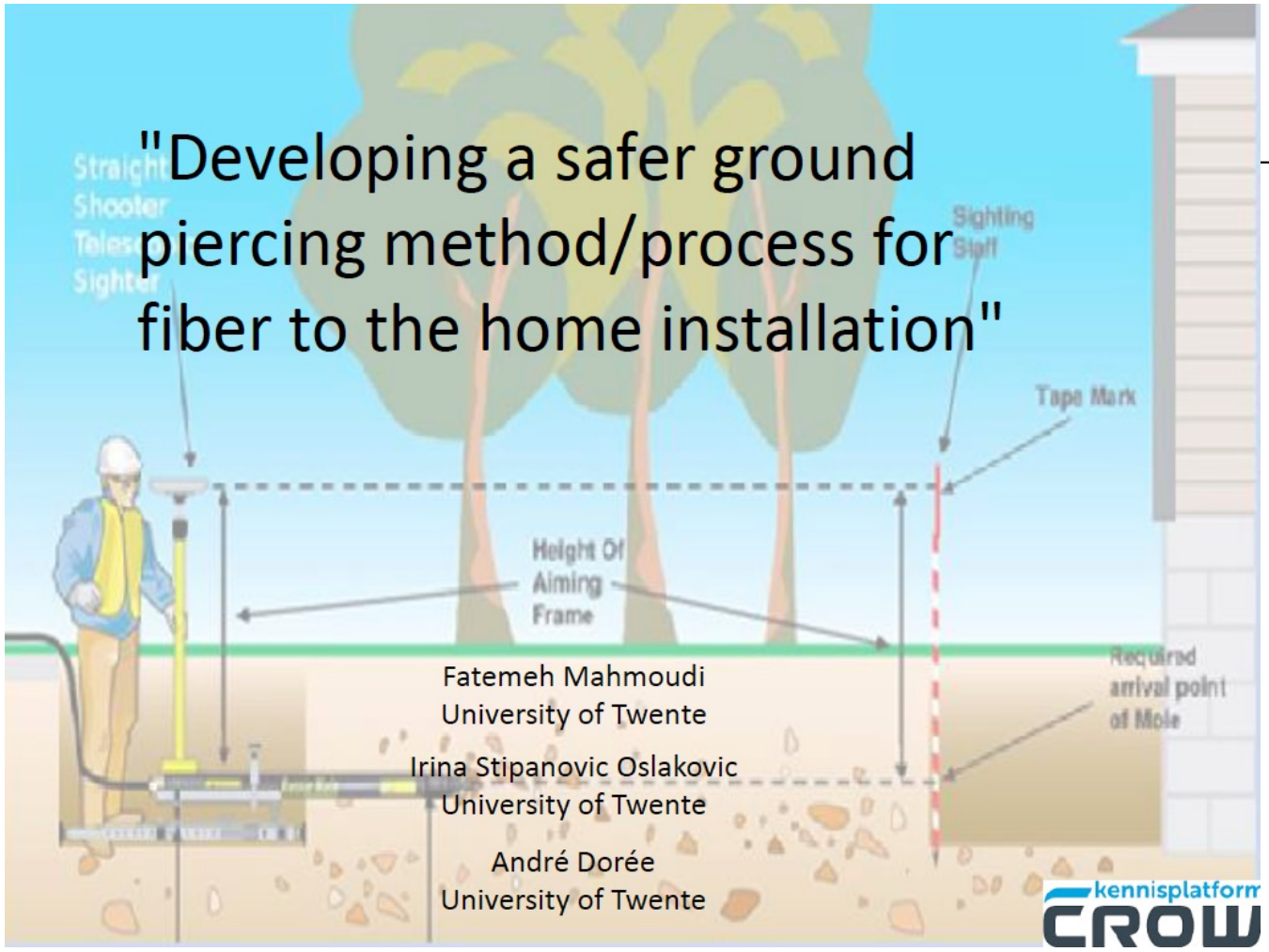
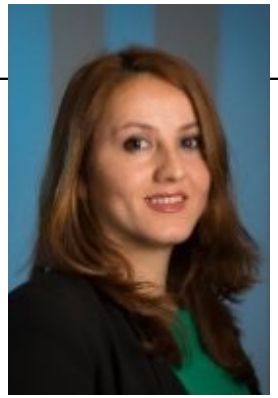


FATEMEH MAHMOUDI



alling

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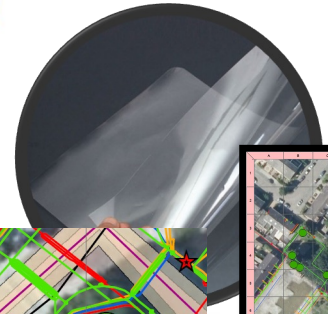
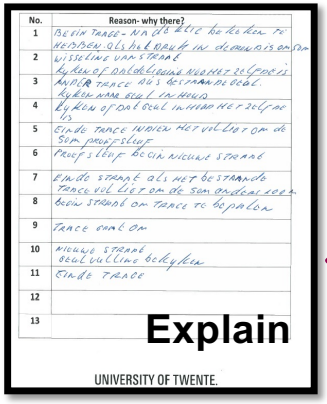
Proefsleuven DSS-traject

Paulina Racz

Place foil on the map



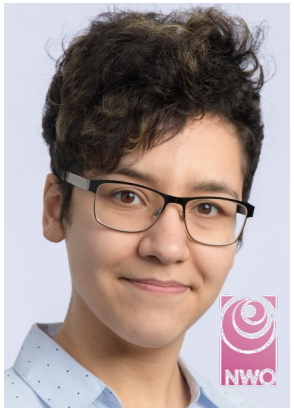
Locate Test Trenches



Sewer condition assessment

Stichting RIONED

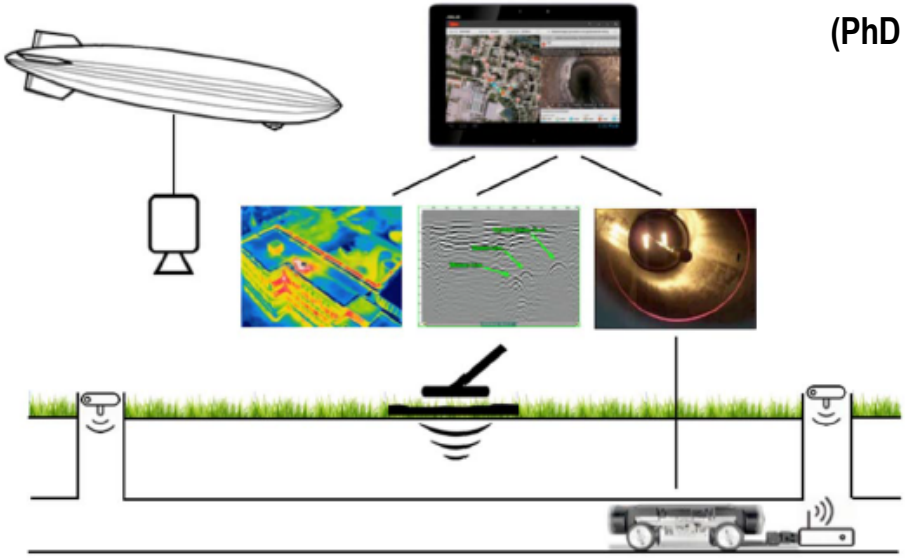
NWO Netherlands Organisation for Scientific Research



Hengemeh Noshari

(PhD Student)

- Current assessments are laborious and costly, not automated
- Developing a converging three-stage approach & **Information System** for sewer condition assessment.
  - Macro (Thermal Infrared Camera)
  - Meso (Ground Penetrating Radar)
  - **Micro (In-pipe multi sensor system)**



- Questions:
  - Which properties to detect?
  - How to measure these? (visual, acoustic etc.)
  - How to quantify?
  - How to automate (reliance on expert?)

Bringing technologies to vocational schools

roc van twente

Dieuwertje ten Berg

- Utility surveying is not trained in the Dutch Civil Engineering vocational schools
- No national professional qualification for SUE/Utility Surveying
- Goal:
  - Eliciting the required skill set & competences for utility surveying with GPR
  - Developing a training / e-learning module for GPR
  - Outlining how to integrate this with other technologies in vocational schools (*roadmap*)

zoarg
Dieuwertje ten Berg
d.m.j.s.tenberg@utwente.nl

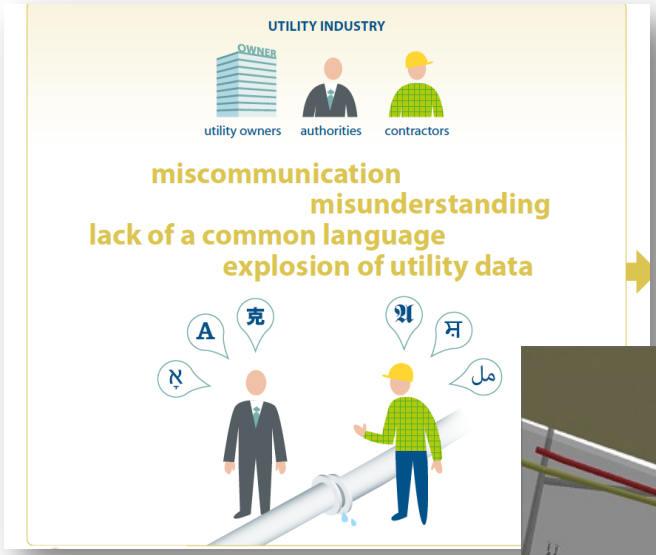
Ontology for Life Cycle Management of Buried Utilities

UNIVERSITEIT TWENTE.
FACILITAIR BEDRIJF
WWW.UTWENTE.NL/FB

Ramon ter Huurne

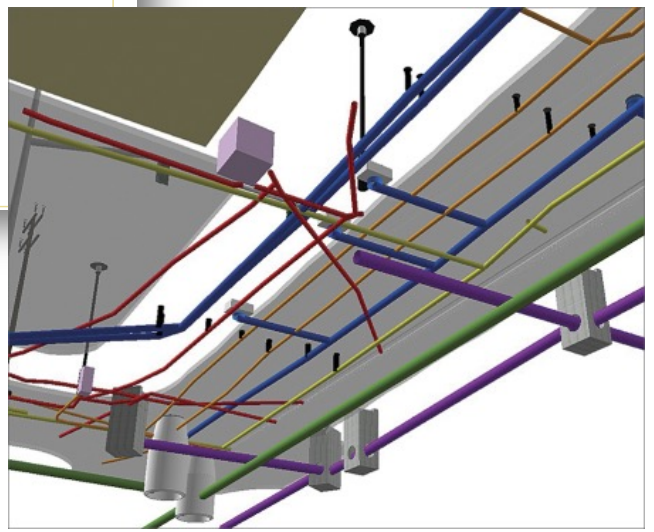
Among existing standards (INSPIRE, WION):

- Focus on geometry and visualization, less on attributes
- Little focus on operations & maintenance
- Practice does not agree on attributes/relations/semantics;

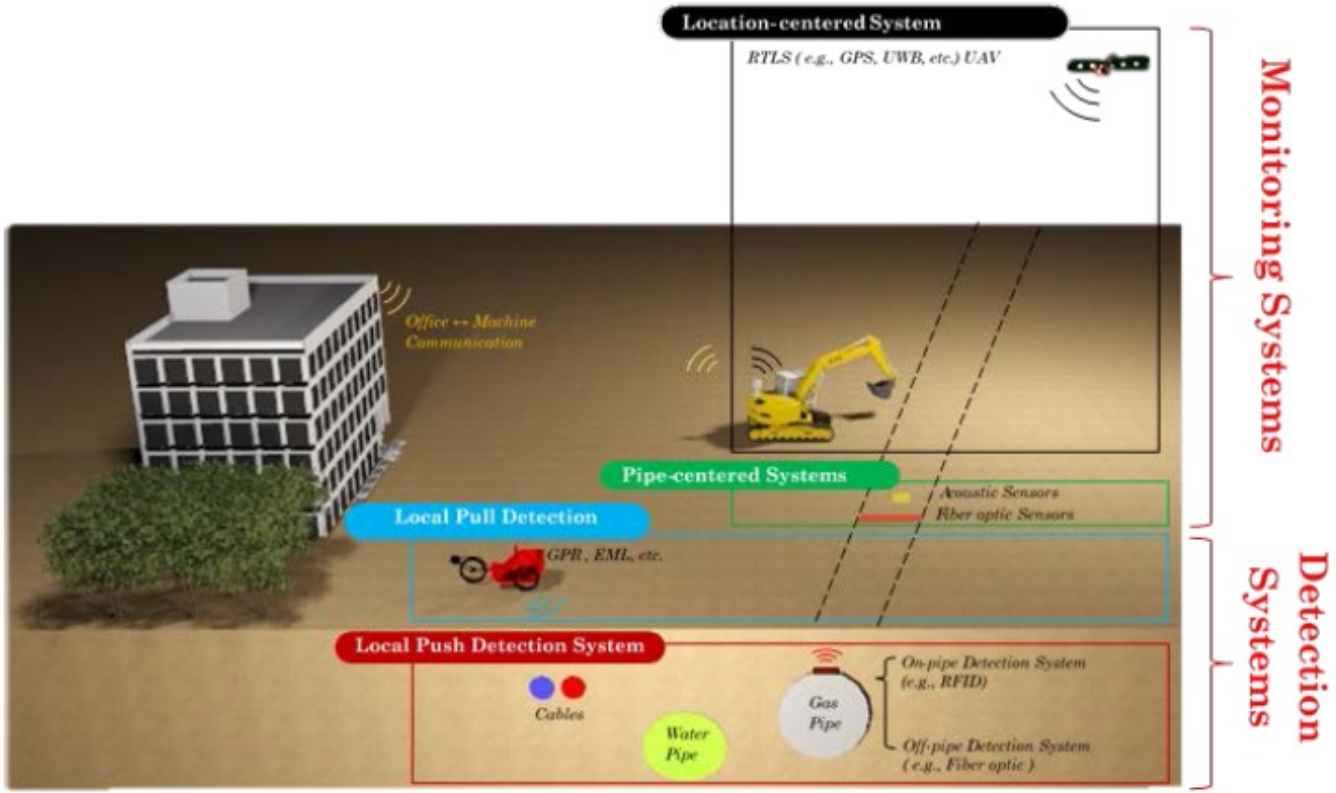


Approach:

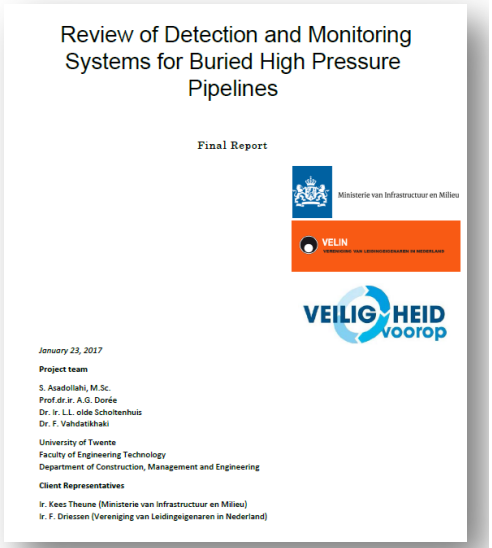
- Field study in utility engineering company
- Development of the ontology in UML (Unified Modelling Language)
- Implementation in CityGML open standard



Detection and Monitoring Systems for enhancing pipeline safety



Saeid Asadollahi



Review of Detection and Monitoring Systems for Buried High Pressure Pipelines

Final Report

Ministerie van Infrastructuur en Milieu

VELIN

VEILIGHEID voorop

January 23, 2017

Project team

S. Asadollahi, M.Sc.
Prof.dr.ir. A.G. Dorée
Dr. ir. L.L. olde Scholtenhuis
Dr. F. Vahdatikhaki

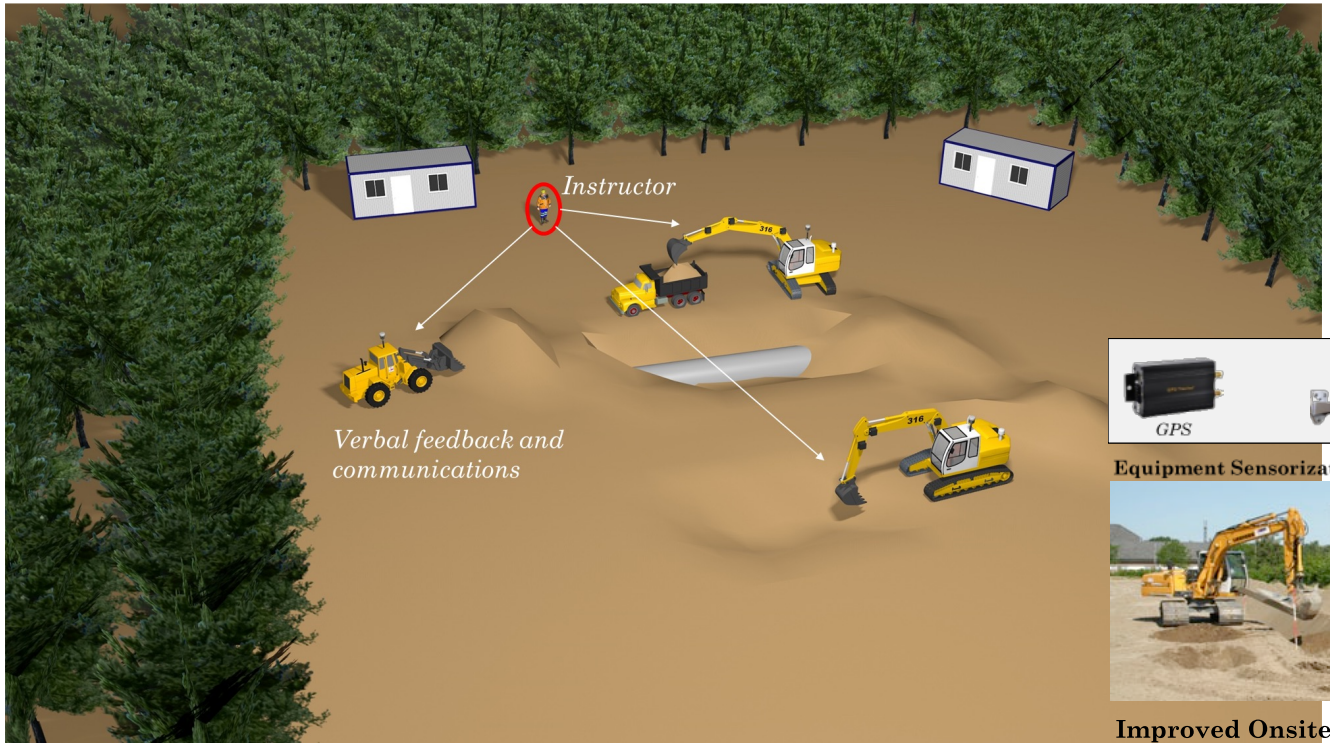
University of Twente
Faculty of Engineering Technology
Department of Construction, Management and Engineering

Client Representatives

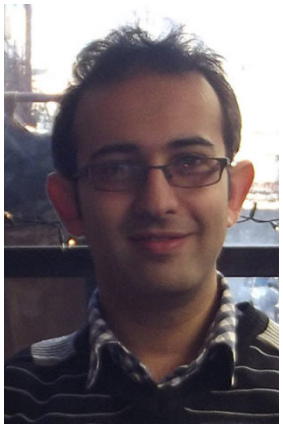
Ir. Kees Theune (Ministerie van Infrastructuur en Milieu)
Ir. F. Driessen (Vereniging van Leidingeigenaren in Nederland)

Asadollahi Dolatabad, S., Doree, A. G., olde Scholtenhuis, L. L., & Vahdatikhaki, F. (2017). Review of Detection and Monitoring Systems for Buried High Pressure Pipelines. University of Twente.

Feedback support system voor graafmachinebedienden



SOMA COLLFGE



Armin Kassemi Langroodi

Equipment Sensorization

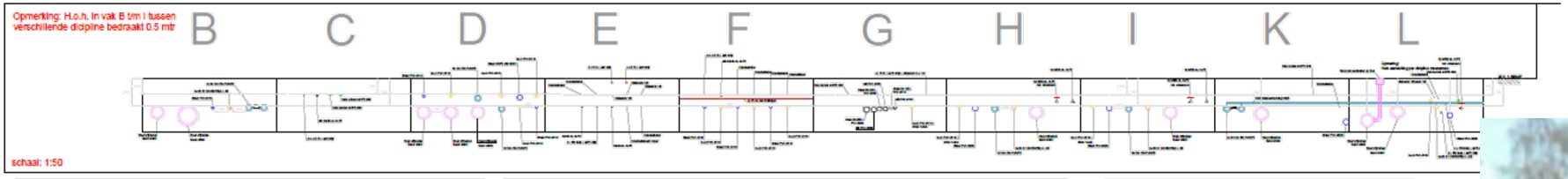
Scene Reconstruction

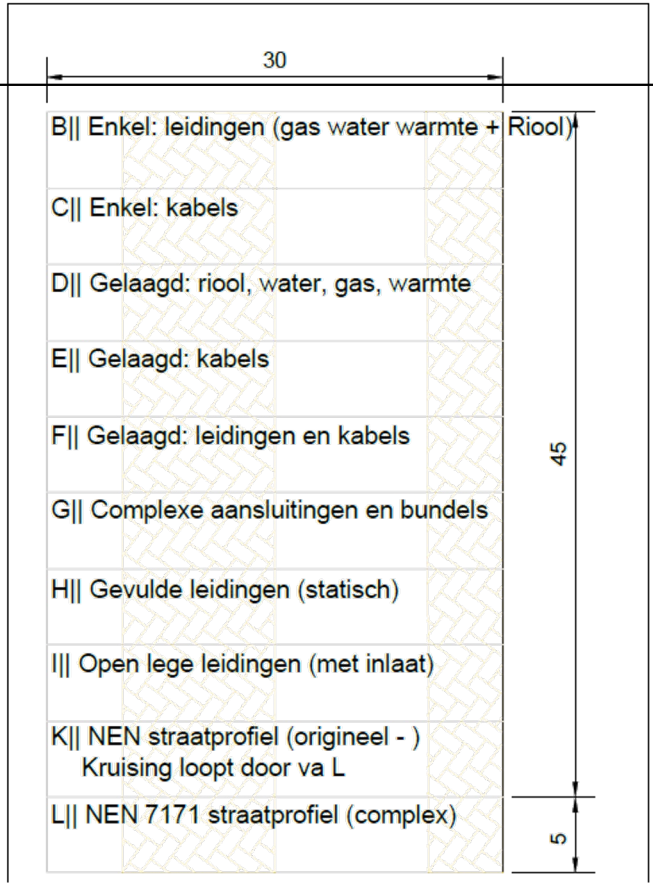
Practice on Realistic Simulation

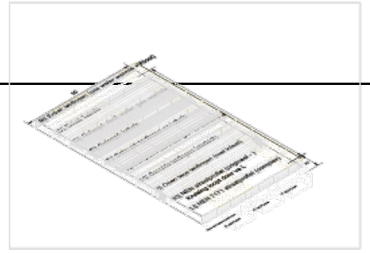
Improved Onsite Training

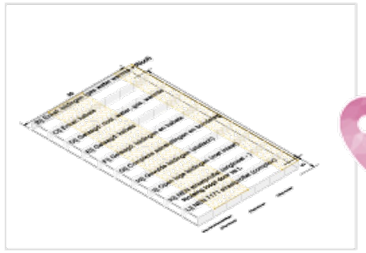
Feedback Support System

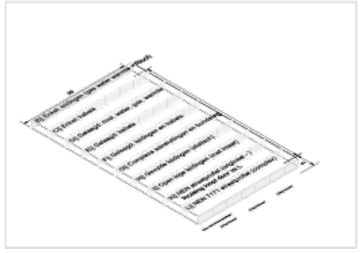
UNIVERSITY OF TWENTE. *Faculty of Engineering Technology || Department of Construction Management & Engineering*











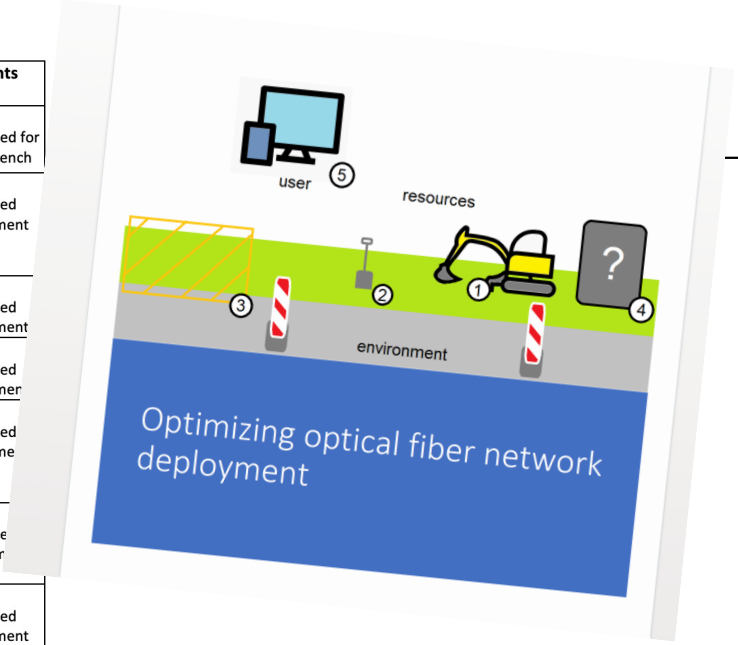
Azin Karimzad

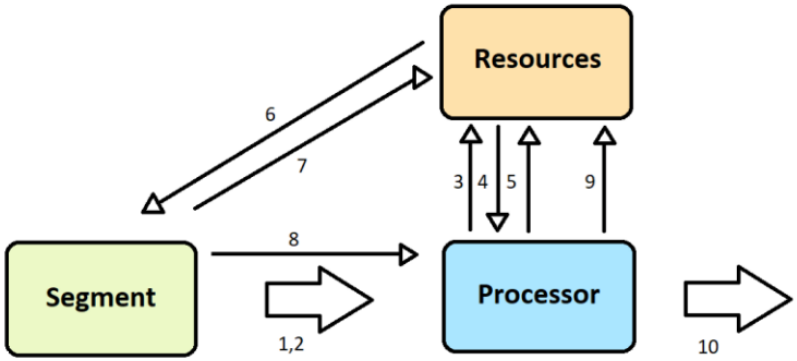
MAPXACT

UNIVERSITY OF TWENTE.

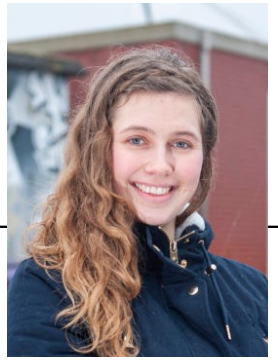
Table 6: Overview of processing steps, their required resources and other constraints.

Processing step	Required resources	Processing time	Constraints
Putting up traffic signs	• Workers • No limit to the number of workers who can perform this process simultaneously	• Depends on the length of the segment	• Always performed for entire trench
Removing cover	• Workers • Performed by specialized workers • Sub-team of three specialized workers for removing cover, compacting, and restoring cover	• Depends on the length of the segment • Depends on type of cover (from shortest time required to largest time required): no cover > standard 30x30 tiles > clinker bricks > patterned paving	• Usually performed per segment
Trenching	• Workers (2) + excavator • Two workers at a time, one in the excavator, one checking for obstacles	• Depends on the dimensions (length, width, depth) of the segment	• Usually performed per segment
Duct-laying	• Workers • Preferably performed by at least two workers, no upper limit	• Depends on the length of the segment • Depends on the duct-type and number	• Usually performed per segmer
Coupling	• Worker + Coupling toolkit • Performed by specialized worker • Only one worker at a time, due to one coupling toolkit available as well as small scale of the task and limited space	• Depends on the length of the segment • Depends on the location (urban, rural)	• Usually performed per segme
Refilling	• Workers (2) + excavator • Two workers at a time, one in the excavator, one assisting	• Depends on the volume of the segment • For trenches less than 60 cm deep, performed once. Otherwise, performed twice	• Usually performe per segm
Compacting	• Worker (1) + compacting machine • Performed by specialized workers • Sub-team of three specialized workers for removing cover, compacting, and restoring cover • Only one worker at a time, due to one compacting machine available	• Depends on the length of the segment • For trenches less than 60 cm deep, performed once. Otherwise, performed twice	• Usually performed per segment
Restoring cover	• Workers • Performed by specialized workers • Sub-team of three specialized workers for removing cover, compacting, and restoring cover	• Depends on the length of the segment	• Usually performed per segment
Removing traffic signs	• Workers • No limit to the number of workers who can perform this process simultaneously	• Depends on the length of the segment	• Always performed for entire trench





1. Segment enters processor
2. Processor delays segment
3. Resources available?
4. Yes
5. Processor seizes resources
6. Start task
7. Task finished
8. Segment finished
9. Processor releases resources
10. Processor releases segment



Jitske Postumus

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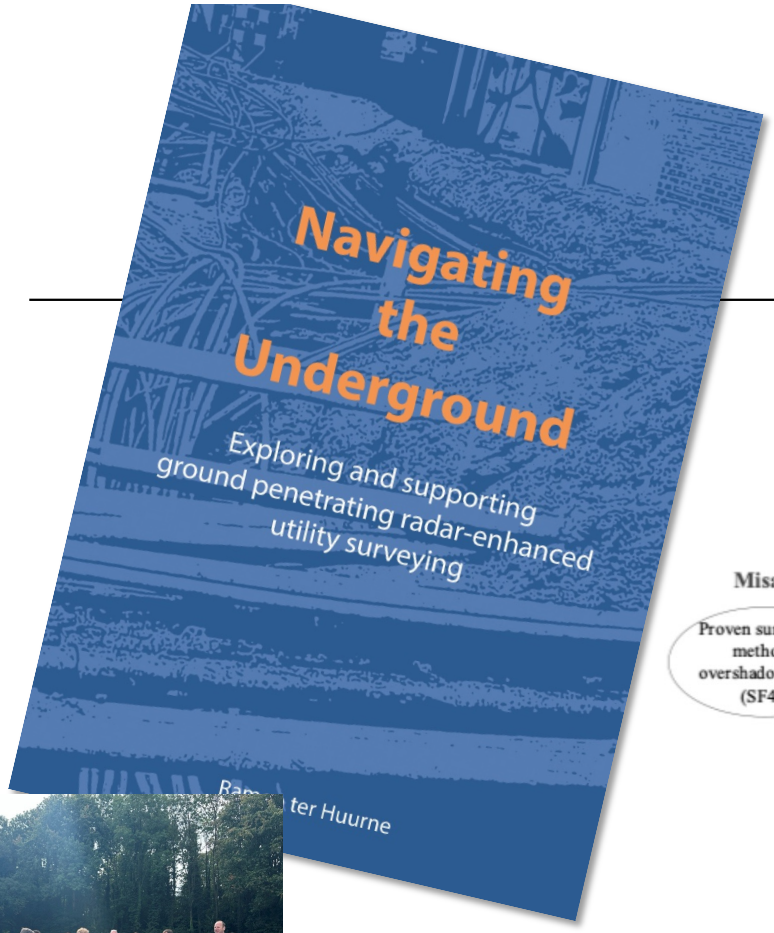
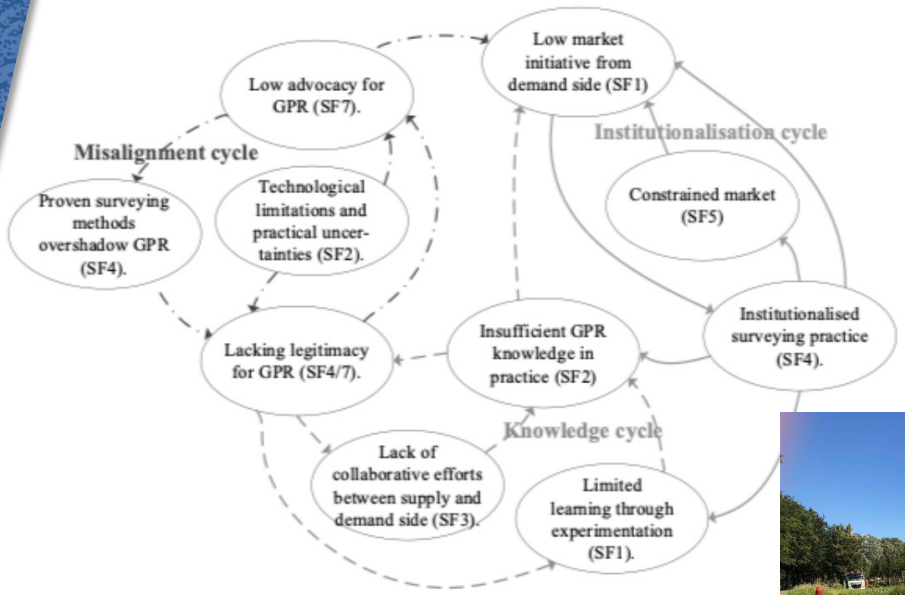


gasunie
crossing borders in energy

MAPXACT

Liander



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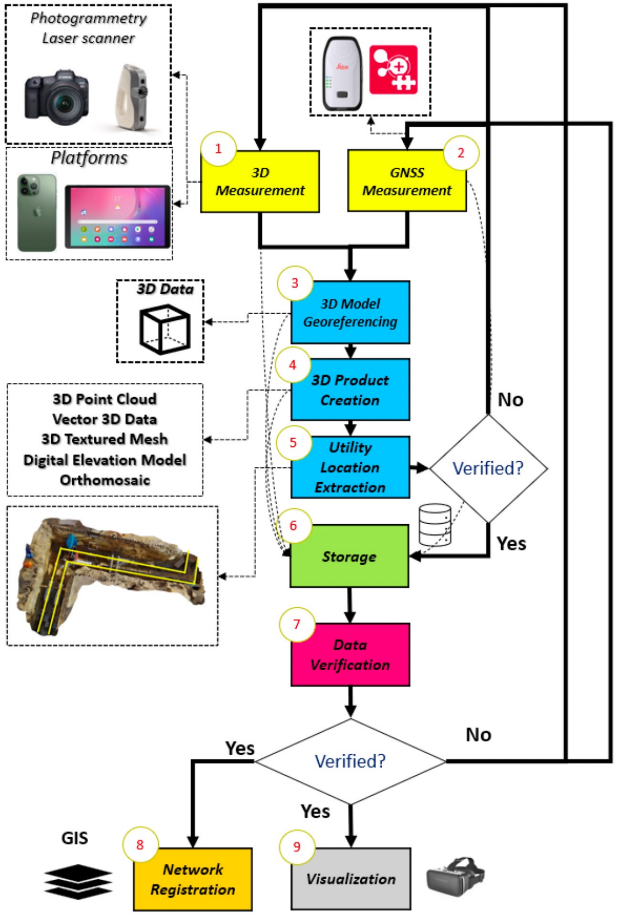
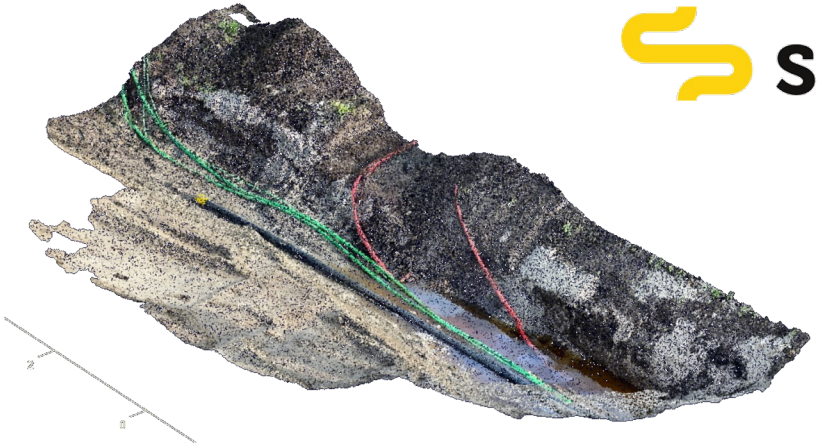
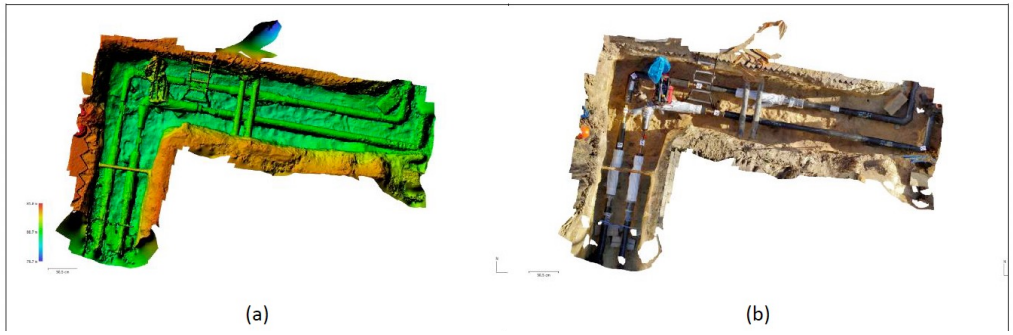
3D GPS + met LiDAR ingemeten





siers

Nima Zarrinpanjeh



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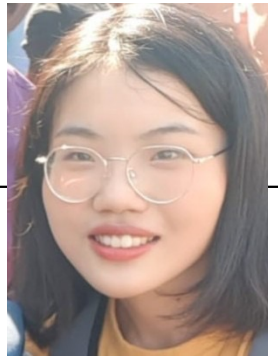
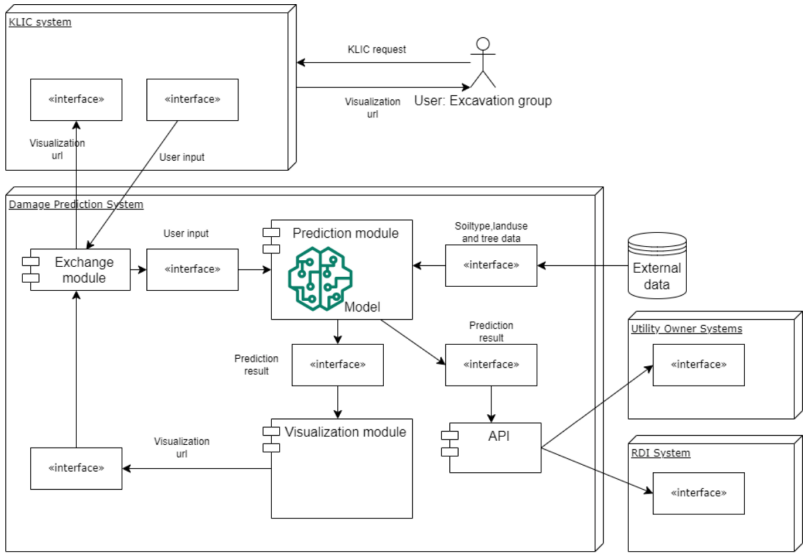
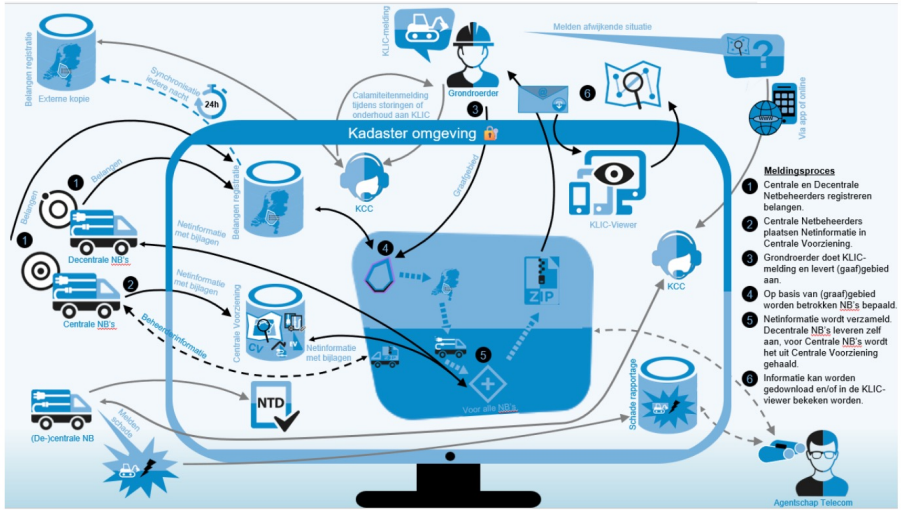
DATA-DRIVEN PREDICTION AND REDUCTION OF EXCAVATION DAMAGES



jiarong li





data model voor proefsleuven

Faith Tangara

What is a Test Trench?

Definition:
A test trench is a small excavation made to physically verify the location and depth of underground utilities before construction begins.

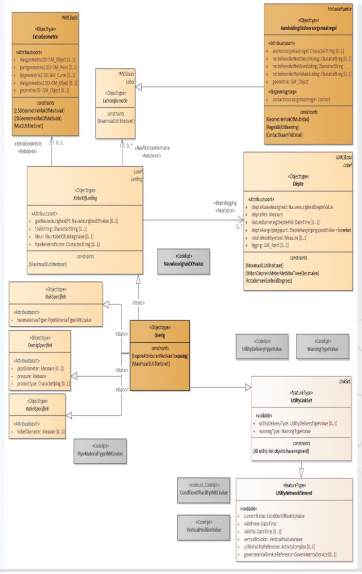
Test Trench Data Characteristics:

Heterogeneous formats: Photos, sketches, CAD files, 3D scans, point clouds

Varying quality: Different accuracy levels and collection methods

Inconsistent metadata: Different recording standards and contextual information

Temporal validity: Underground conditions change over time



Building on existing stan… …ile addressing test trench-specific needs

Onderwerp	Naam EngD	Voltooid	Co-financier
Opleiding veilig raketboren	Fatemeh Mahmoudi	2015	Allinq
Proefsleufplaatsbepalingalgoritme	Paulina Racz	2016	RDI
Feedback support system graafmachine	Armin Langroodi	2020	SOMA College
Datamodel beheer nutswerken	Ramon ter Huurne	2019	Campus Mngt UT
E-learning grondradar voor MBO	Dieuwertje ten Berg	2021	ROC van Twente
Geofencing systeem minikraan	Saeid Asadollahi	2019	VELIN
Simulatie van FttH-aanlegproces	Jitske Posthumus	2021	Allinq
Ontwerp grondradarvalidatie	Azin Karimzad	2023	MapXAct
3D sleufscanner	Nima Zarrinpanjeh	2025	Siers
KLIC-Graafschadevoorspeller	Jiarong Li	2025	Kadaster

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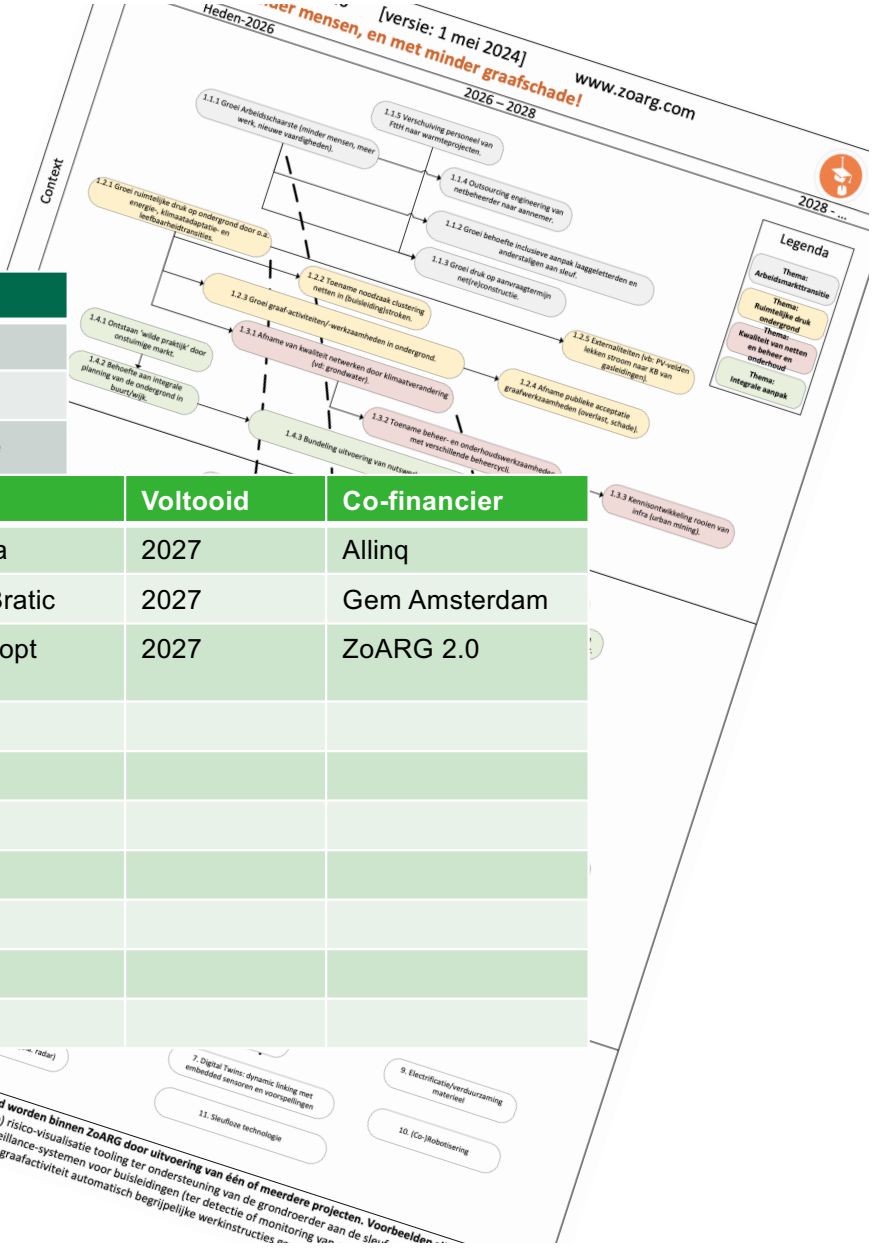
Feedback support system graafmachine	Armin Langroodi	2020	SOMA College
Datamodel beheer nutswerken	R		
E-learning grondradar voor MBO	D		
Geofencing systeem minikraan	S		
Simulatie van FttH-aanlegproces	Ji		
Ontwerp grondradarvalidatie	A		
3D sleufscanner	N		
KLIC-Graafschadevoorspeller	Ji		

Onderwerp	Naam EngD	Voltooid	Co-financier
Datamodel proefsleuven	Faith Tangara	2027	Allinq
GIS en DSS voor ontwerp ligging	Aleksandra Bratic	2027	Gem Amsterdam
Detectiemethoden	… werving loopt	2027	ZoARG 2.0
…			



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