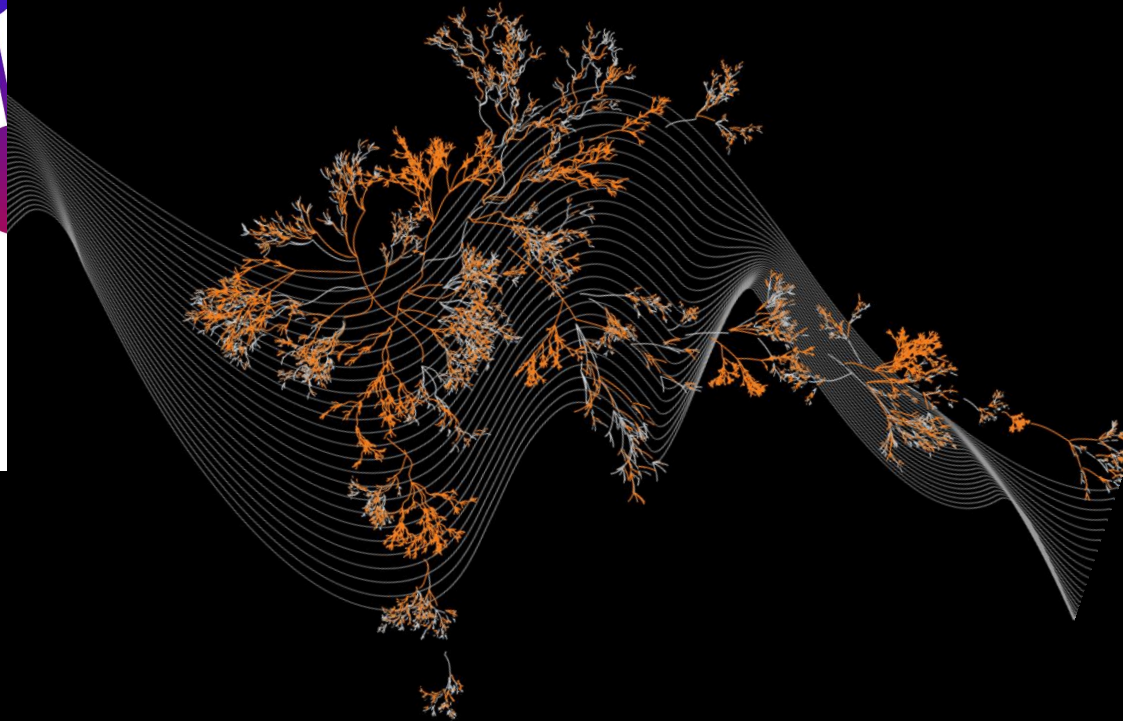




National  
Interdisciplinary  
Education  
Conference

02.02.2017 Amsterdam



# Integration bottlenecks in the Smart Cities module

**Dr. ir. Marjolein Dohmen-Janssen, Programme Director Civil Engineering**

**Dr. ir. Léon Olde Scholtenhuis, Assistant Professor Civil Engineering**

**Drs. Lisa Gommer, Educational Scientist Engineering Technology**

**UNIVERSITY  
OF TWENTE.**

# CONTENT

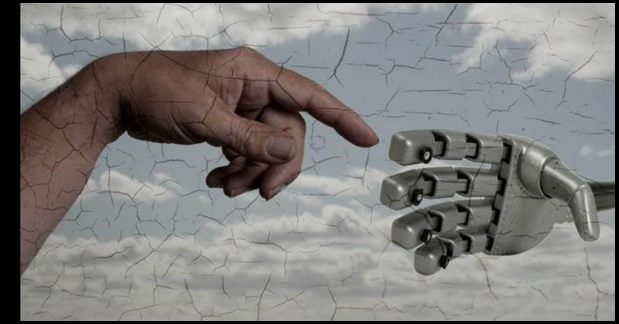
- Short overview Twente Educational Model (TOM) 3 min
- BSc- and MSc-curriculum Civil Engineering 5 min  
*Interdisciplinarity + Smart Cities*
- Particular interdisciplinary BSc-module 7 min  
*Smart ways to make smart cities smarter*
- Reflection + questions for discussion 40 min
- Closure 5 min

# TWENTE EDUCATIONAL MODEL

## OBJECTIVES

- Better preparation of students for the future  
*(learn to acquire deep knowledge; to find solutions for new, complex problems)*
- Increasing pace of study and success rate
- Enhancing the profile of UT graduates:
  - T-shaped professional
  - Entrepreneurial attitude:  
full of innovation, creative, bold
  - Researcher, Designer and Organiser

HIGH TECH HUMAN TOUCH



BREADTH

DEPTH



# TWENTE EDUCATIONAL MODEL

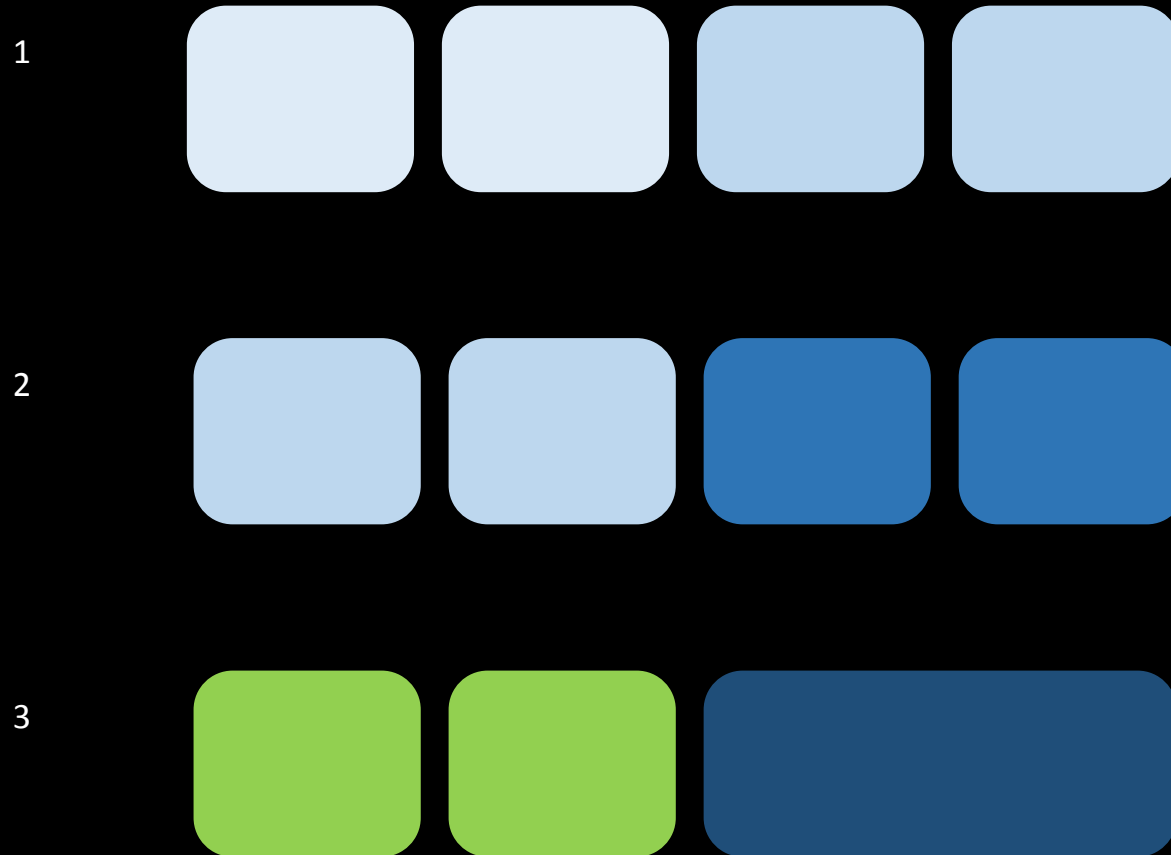
WHY: WHAT DID WE LEARN FROM RESEARCH?

- Steady pressure
- Frequent feedback
- Different teaching modes /  
limit passive listening
- Create community
- Be clear about high ambition  
and expectations
- Teachers perform best in teams



# TWENTE EDUCATIONAL MODEL

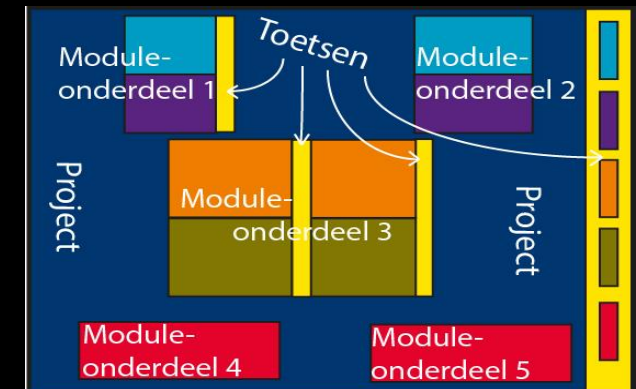
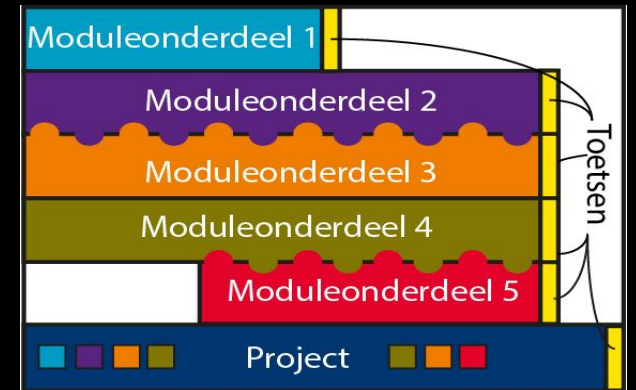
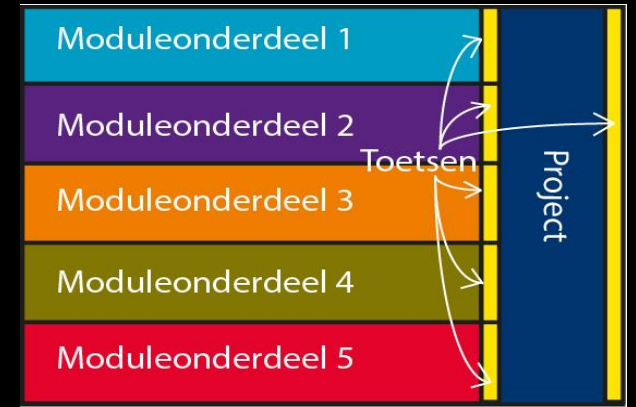
## STRUCTURE OF THE BSC-CURRICULA



# TWENTE EDUCATIONAL MODEL

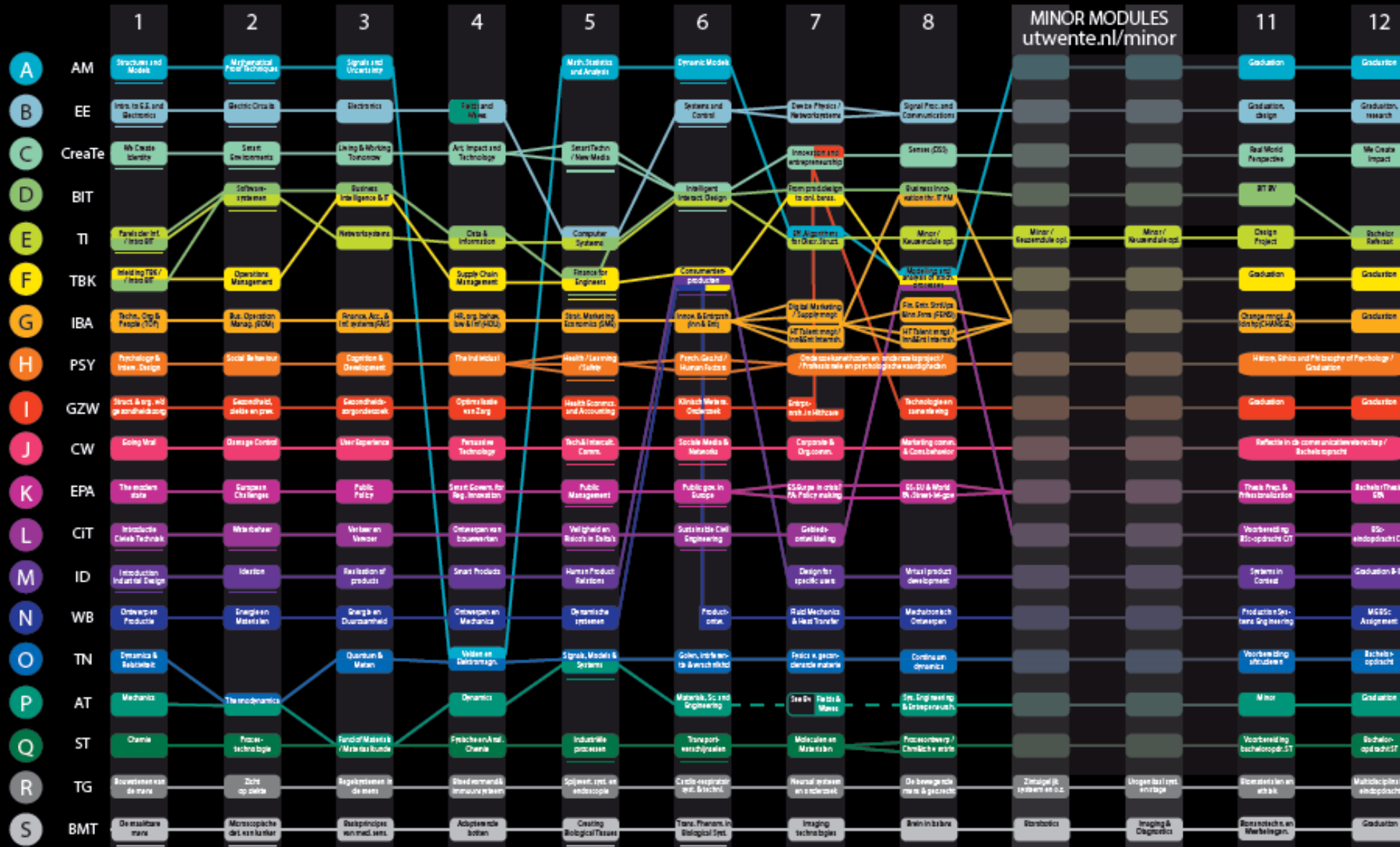
## CHARACTERISTICS

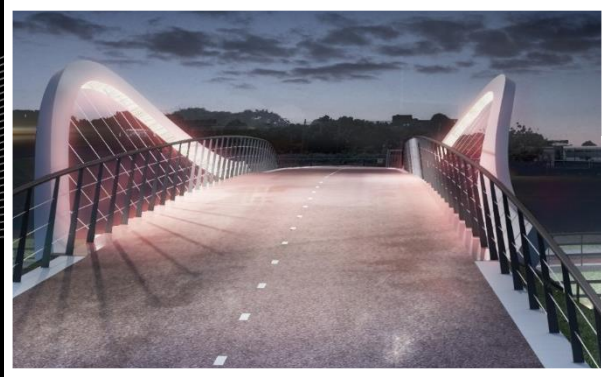
- 4 full time thematic modules per year (10 weeks, 15 EC per module)
- Project-Led Education
- Individual and group work
- Tests for parts of the modules ↔ integral assessment
- Pass or fail module as a whole (0 or 15 EC)





# MODULE MAP 2016-2017





1. INTRODUCTION TO CIVIL ENGINEERING

2. WATER MANAGEMENT



3. TRAFFIC & TRANSPORT

4. DESIGNING BUILDINGS AND STRUCTURES



# CIVIL ENGINEERING MODULES YEAR 1





5. SAFETY AND RISKS  
IN DELTAS

6. SUSTAINABLE CIVIL  
ENGINEERING

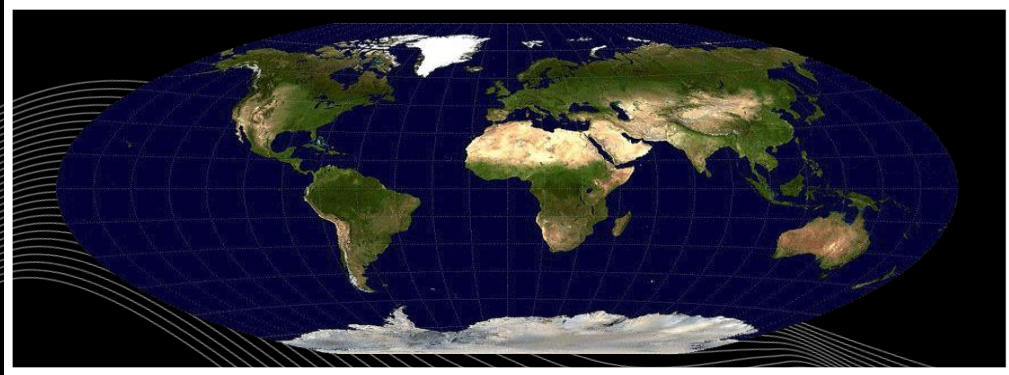


7. AREA DEVELOPMENT

8. OPTIMIZING TRANSPORT  
PROCESSES



# CIVIL ENGINEERING MODULES YEAR 2



9. & 10. ELECTIVE MODULES (MINOR)  
In-depth  
Broader-based

11. PREPARING FOR  
GRADUATION



12. BSC GRADUATION PROJECT

# CIVIL ENGINEERING MODULES YEAR 3



## 11. PREPARING FOR GRADUATION



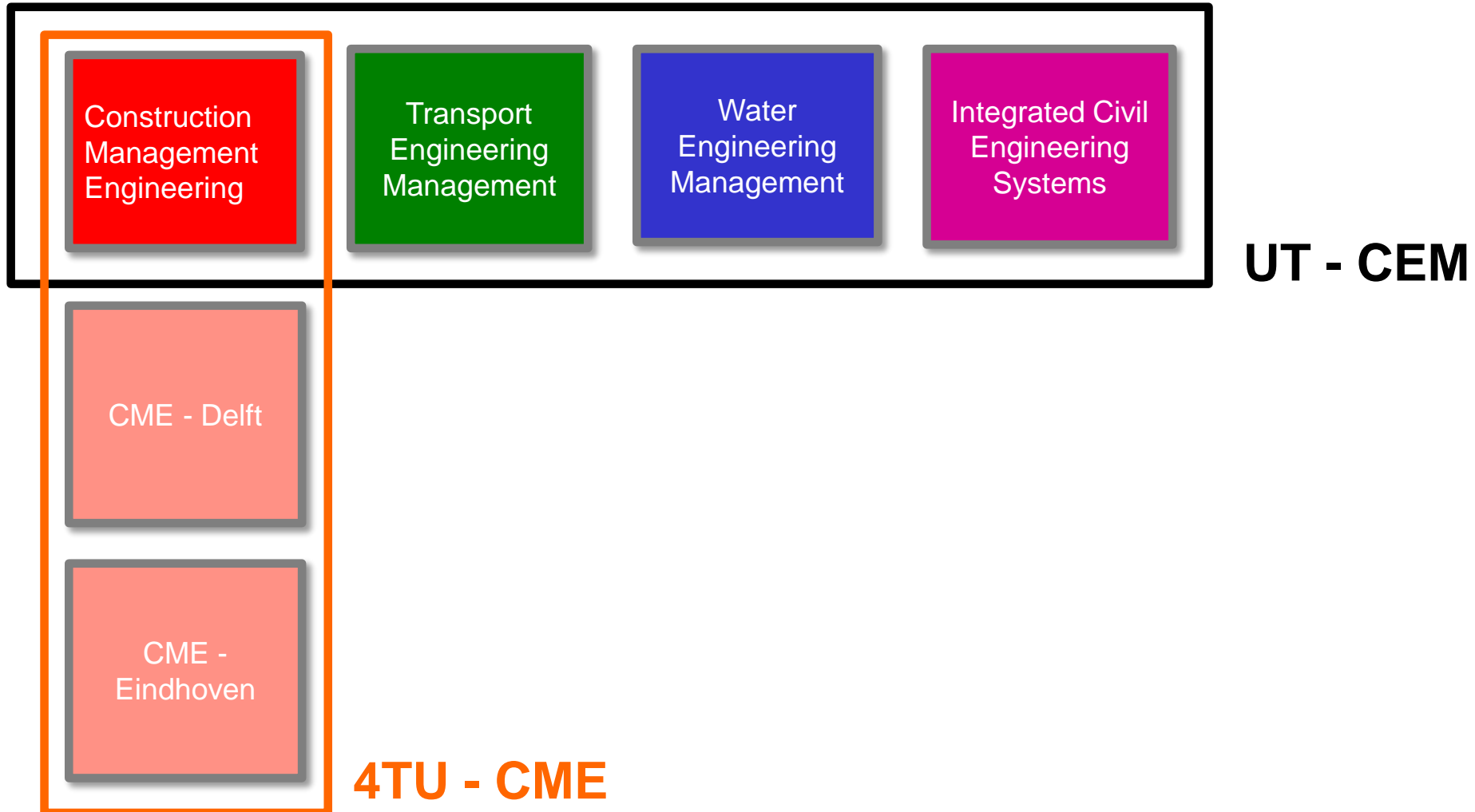
## 12. BSC GRADUATION PROJECT

# CIVIL ENGINEERING MODULES YEAR 3

# MSc Civil Engineering and Management (UT-CEM)

## Construction Management and Engineering (4TU-CME)

---



# CIVIL ENGINEERING AND MANAGEMENT (CEM)

3 SPECIALIZATIONS ON A SPECIFIC *DISCIPLINE*

4TU.

- Construction Management and Engineering
  - Profile: Markets and Organizations in Construction
  - Profile: Design Management in Construction



This will change

- Transport Engineering and Management
  - Profile: Transport planning and modelling
  - Profile: Smart Transport Systems



- Water Engineering and Management
  - Profile: Integrated Water Management
  - Profile: River and Coastal Engineering

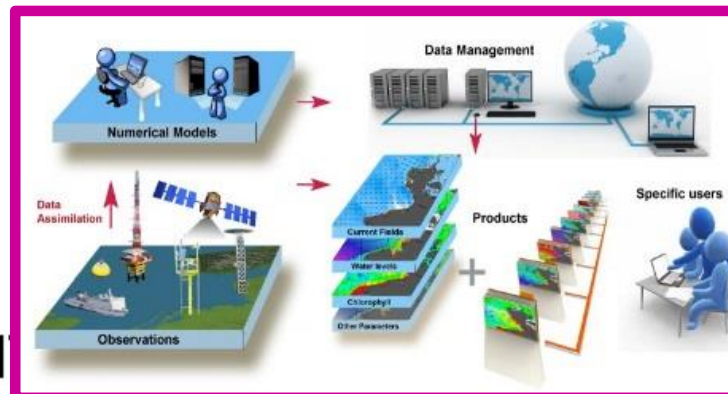


# CIVIL ENGINEERING AND MANAGEMENT (CEM)

ONE SPECIALISATION ON A SPECIFIC *THEME*

- Integrated Civil Engineering Systems
  - Profile: Sustainability
  - Profile: Modelling and Forecasting
  - Profile: Civil Engineering Structures

➔ Profile: Smart Cities



# INTEGRATED CIVIL ENGINEERING SYSTEMS

## Smart Cities

---

### Profile Courses:

- Planning and Process Management
- Land Use and Transport Interactions
- Integrated Water Management
- Research Methodology and Academic Skills



# INTEGRATED CIVIL ENGINEERING SYSTEMS

## Smart Cities

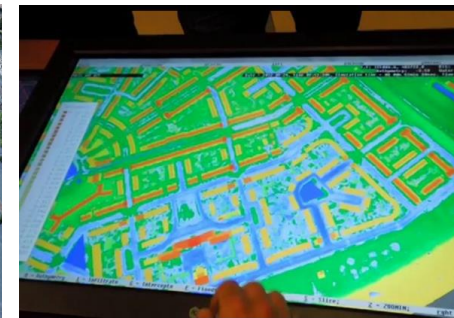
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### Examples of Profile Electives:

- Sustainable Building
- Intelligent Transport Systems
- Electric Vehicle Systems Design (IDE)
- Virtual Reality (IDE)
- Solar Energy (SET)

### Example of MSc-thesis project:

- The introduction of interactive modelling by 3Di in flood resilient urban spatial planning





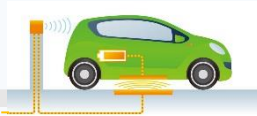
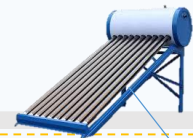


# Smart Ways to get Smart Cities Smarter

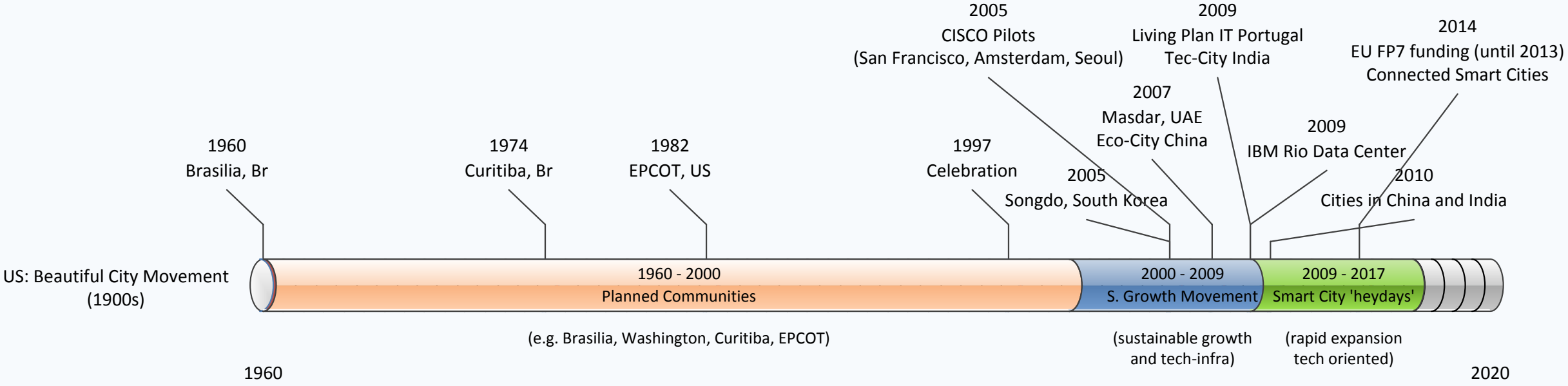
Dr. Ir. Léon olde Scholtenhuis



# City planners' wet dreams ...

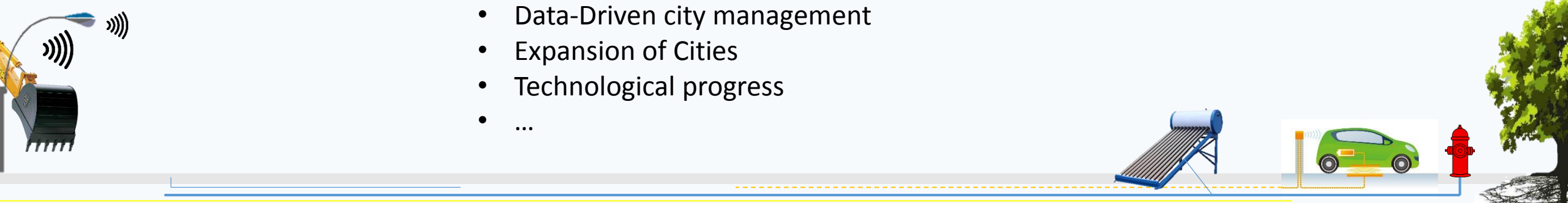


# Want to be the odd one out?



- Urban sprawl (planning)
- Utopia fantasy
- Rapid transport
- Sustainable, CO<sub>2</sub> reduction
- Data-Driven city management
- Expansion of Cities
- Technological progress
- ...

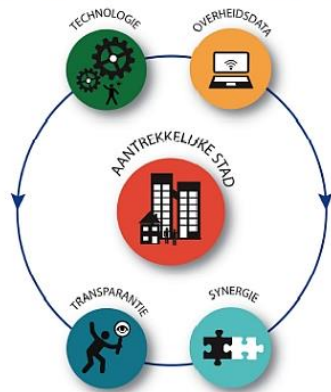
*After Hatch (2012), Swabey (2012), and Fitzgerald (2016)*



# Global and local initiatives

WHERE (NOT?)

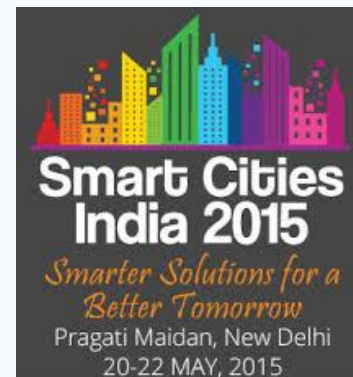
Wat is SMART CITY DORDRECHT?



am smart erdam  
city



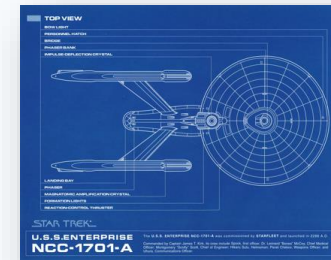
0 3 0 Utrecht



# Some patterns

Defining key characteristics of Smart Cities

- urgency and sensitizing by: [1] demographics, [2] sustainability & energy and [3] digital revolution, [4] liveability & security, [5] citizen participation
- technology discussed mostly refers to the high tech side of the technology spectrum (big data, sensing, e-participation, livable)
- it is about 'designing the future': it works towards a blueprint for city at a higher level.
- Utopian characteristics



# So, what is a Smart City?

In Shelton paper:

- apply the **massive amounts of digital data** collected about society as a means to rationalize the planning and management of cities (cf. Townsend 2013).
- cities as a “**complex network of interconnected systems**” (IBM 2010), constantly creating new data that can be used to “monitor, measure and manage” urban life by “leveraging information to make better decisions...anticipating and resolving problems proactively... [and] coordinating resources to operate more efficiently”
- smart city interventions bears **little resemblance to the marketing rhetoric and planning documents** of emblematic, greenfield smart cities, such as Masdar in the United Arab Emirates, Songdo in South Korea, and Living PlanIT Valley in Portugal.



Is there consensus on the definition?

what is a smart city - Google

https://www.google.nl/webhp?sourceid=chrome-instant&ion=1&espv=2&ie=UTF-8

what is a smart city

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**What is a Smart City? - comarch.com**  
[Ad smartcity.comarch.com/](https://www.comarch.com/smartcity/)  
 Learn about intelligent platform for the entire city life. More!  
 Smart mobility · Smart entertainment · Smart services · Smart retail  
 Highlights: Flexible Modular Structure, Scalable Systems, Improve Urban Space...

**Smart Cities Challenge - nextenergy.org**  
[Ad www.nextenergy.org/nextchallenge/](https://www.nextenergy.org/nextchallenge/)  
 \$100k Available to Commercialize Technologies in Urban Areas  
 Smart Parking · Smart Infrastructure · Smart Transportation · Smart Buildings  
 Highlights: Smart Parking, Smart Infrastructure, Smart Transportation, Smart Buildings...

A **smart city** is an urban development vision to integrate multiple information and communication technology (ICT) and Internet of Things (IoT) solutions in a secure fashion to manage a city's assets – the city's assets include, but are not limited to, local departments' information systems, schools, libraries, ...

**Smart city - Wikipedia**  
[https://en.wikipedia.org/wiki/Smart\\_city](https://en.wikipedia.org/wiki/Smart_city)

About this result · Feedback

**Smart city - Wikipedia**  
[https://en.wikipedia.org/wiki/Smart\\_city](https://en.wikipedia.org/wiki/Smart_city)  
 A smart city is an urban development vision to integrate multiple information and communication technology (ICT) and Internet of Things (IoT) solutions in a secure fashion to manage a city's assets – the city's assets include, but are not limited to, local departments' information systems, schools, libraries, ...

**What is a 'smart city' and how it will work- The Times of India**  
[timesofindia.indiatimes.com/What-is-a-smart-city-and-how-it-will-.../47128930.cms](https://timesofindia.indiatimes.com/What-is-a-smart-city-and-how-it-will-.../47128930.cms)  
 May 2, 2015 - PM Modi had announced his vision to set up 100 smart cities across the country soon after his government was sworn into power mid last year.

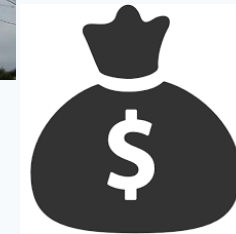
**What is a Smart City? | India Smart Cities - India Smart Cities Challenge**  
[www.smartcitieschallenge.in/what-is-a-smart-city/](https://www.smartcitieschallenge.in/what-is-a-smart-city/)  
 Smart cities focus on the most pressing needs and the greatest opportunities to improve quality of life for residents.

**PDF | What is Smart City - Smart Cities**  
[smartcities.gov.in/writeradddata/What%20is%20Smart%20City.pdf](https://smartcities.gov.in/writeradddata/What%20is%20Smart%20City.pdf)  
 The core infrastructure elements in a smart city would include: i. adequate water supply, ii. assured electricity supply, iii. sanitation, including solid waste management, iv. efficient urban mobility and public transport, v. affordable housing, especially for the poor, vi. robust IT connectivity and digitalization, ...

**Just what IS a smart city? | Computerworld**

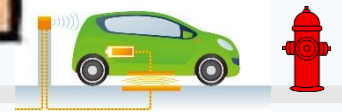
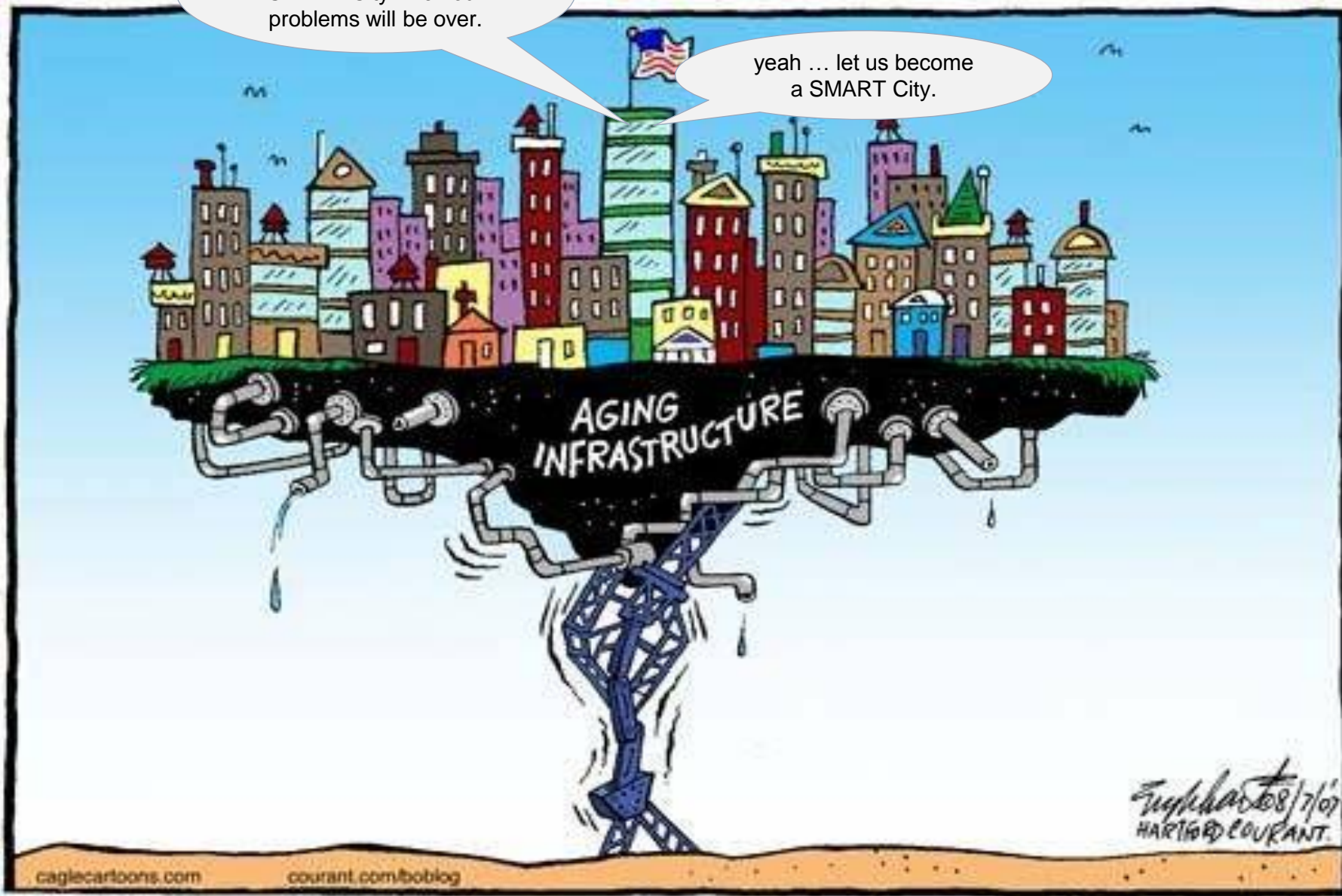
## Despite their popularity ...

- Smart Cities are not built on greenfields
- Often on brown or greyfields
- Existing constraints:
  - Physical constraints
  - Insufficient funds for large-scale development plans
  - Existing rules & regulations
  - Commercial interests
  - Privacy issues



trust me... once we are a SMART City ... all our problems will be over.

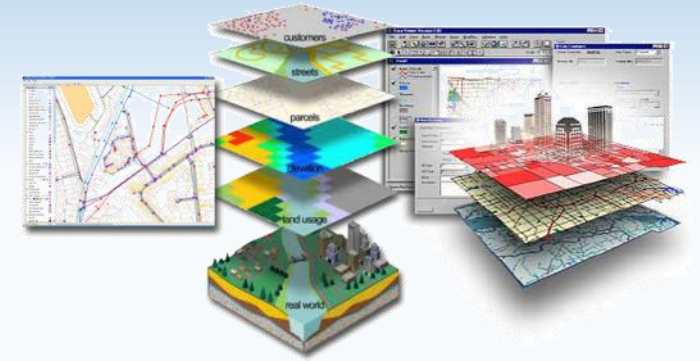
yeah ... let us become a SMART City.







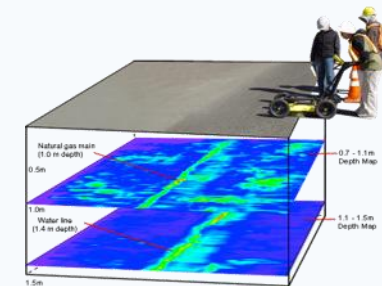
# This module focuses on **developing SC's**



- Smart technologies
- Focus on 'city engineering'
  - Construction
  - Traffic
  - Robotics & sensors
  - Geophysics
- Design project using systems engineering



***How to maintain and renew the city infrastructures?***



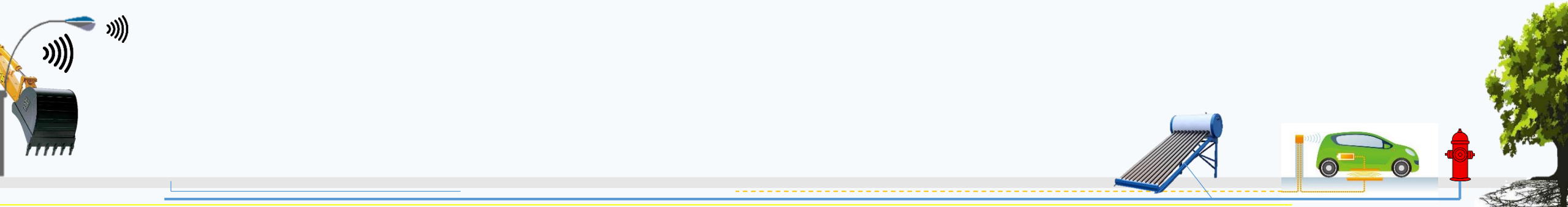
# Learning goals

1. At the end of the module's first block, students are able to recall ten **types of urban infrastructures**, their state, purpose, and vulnerability.
2. At the end of the module's first block, students can express five **targets**, five **barriers**, and two distinct **trajectories** of smart city engineering.
3. At the end of the module's first block, students can explain the barriers of smart city realization, criticize the smart city **rhetoric**, and state why few Smart Cities **examples exist in practice**.
4. At the end of the module, students can explain how **Robotics**, **Geophysics**, and **Traffic solutions** support construction of Smart urban life & mobility improvements.
5. At the end of the module's first block, students can explain the key steps of the **Systems Engineering** process model and relate the model to the V-model, and demonstrate how it can be applied to a design project.
6. At the end of the module, students are able to **implement** technical knowledge (from Robotics, Geophysics, and Traffic Engineering), and **apply** principles of Systems Engineering to design a solution for a **smart city development problem** (design project).
7. At the end of the module, students are able to **present their smart city engineering design** to peers and practitioners by means of a A3A0-poster and presentation.
8. At the end of the module, students are able to integrate their domain knowledge with that of fellow students from other fields (**peer-learning**) into an integrated design report.




# Structure of this module

- **Block 1: Introduction to Smart City Engineering (Week 46-49)**
  - Smart City introduction (46-47)
  - Basics robotics, traffic, geophysics, systems engineering – pressure cooker (48-49)
- **Block 2: Design Projects (Week 50-5)**
  - Real life problems from industry (SOMA, Geofoxx, Fiber4All, FB)



# Examples of design project work (delivered last week)

Smart Learning at SOMA College




Group 5  
 M. Frankema (+1578234)  
 G. Lijkk (+1378783)  
 E. Luiken (+1561022)  
 S. Smil (+1567187)  
 L. van der Woep (+1598813)

Smart ways to make smart cities smarter  
 27-1-2017

2017


Smart Campus: Real-time Noise Warning



Rogier Bongers +1600699  
 Danny Boes +1543792  
 Teun Berghuis +1594079  
 Dimity Bruns +1469447  
 Douwe Hut +1603573  
 University of Twente  
 26-1-2017


UNDERGROUND ENTERTAINMENT FACILITY - GROUP 1

Timon Daniels +1384317  
 Kevin Voetizang +1466380  
 Melke Frolitage +1538888  
 Thomas Derks +1565575  
 Ka Hei Feng +1833138



27 januari 2017

Smart Ways To Make Smart Cities Smarter:  
 Development of a safe and lightweight digging tool

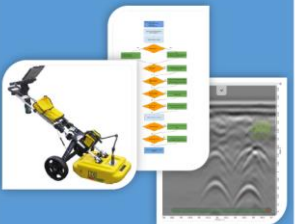


Projectgroep 8:  
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 Koen Boonk WB +1384104  
 Nick Linnen WB +1340890  
 Thijs van der Linden ID +1582742  
 Thijs ten Siethof CT +1592289

Tutor: dr.ir. L.L. oude Scholtenhuis  
 Versie: 1.0  
 Pagina's: 25

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IMAGING THE UNDERGROUND



Group 2:  
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 Casper Broekers +1241803  
 Joep Rawee +1590138  
 Wytse Roosjen +1574981  
 Sam Westerhof +1588249

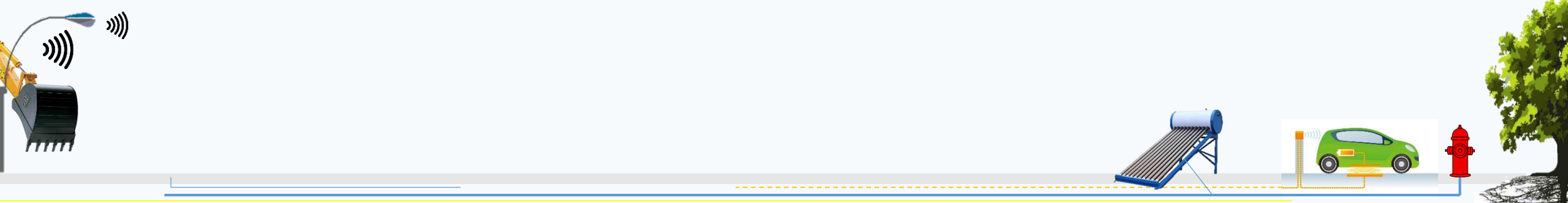
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Unravelling Bike Myths

Bart Jansen +1590928  
 Paul Kemper +1589717  
 Amarins Kroes +1548840  
 Floris Nijland +1592246  
 Bram van den Pol +1579843

27th of January 2017



# Reflection and observations

1. Participants: about 50 students with an engineering, math, chemistry, or physics major
2. Students with different qualities (qualitative, quantitative, analyzing, designing, writing, modelling) experience the work and work load differently
  1. 'we need to read a lot, I'm not used to that'
  2. 'this part of class is easy'
  3. 'how can we possibly cover all the course material?'
3. Embracing diversity in the projects types creates difficulty when achieving 'unbiased' grading
4. The common 'divide and conquer' approach still exists during project work
  1. "he is good at writing, so he should make the report"
  2. "she is a good programmer, we are not, so he almost had to do all the work"



# Discussion

1. Can we open up the module for social science and business students while keep challenging the engineering students? (and vice versa)
2. How can we shift from a mere multi-disciplinary to a trans/interdisciplinary collaboration of the students?
3. How can we truly stimulate the peer-learning? And how do we test this as a learning objective?
4. How can we make the grading process more unbiased when we have different specialized project groups & project tutors?

