

# Applied research on BIM



Guest lecture at TU Delft (AR2R016)

Date: 27 May 2015  
Presenter: Dr. Rizal Sebastian (Director of Research)  
Version: 1.0

# CONTENT

- Introduction
- Proposition
- Applied research in NL and EU collaborative projects
- Discussions



# INTRODUCTION



# DEMO PROFESSIONALS



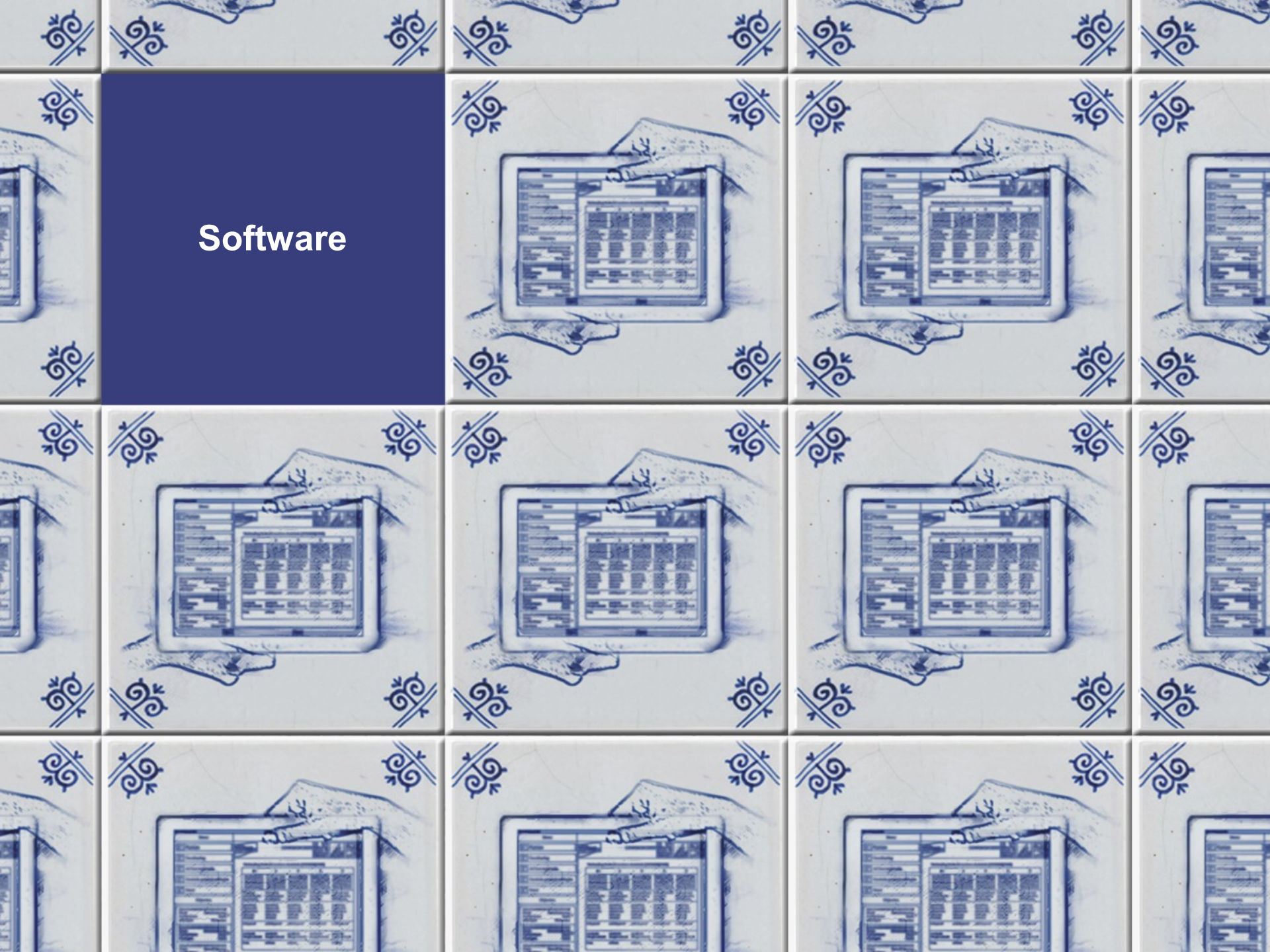
# KEY TO PERFORMANCE

To optimize social, public and economic benefits by collecting, structuring, analyzing and disclosing real estate information.





Software



**Consultancy**



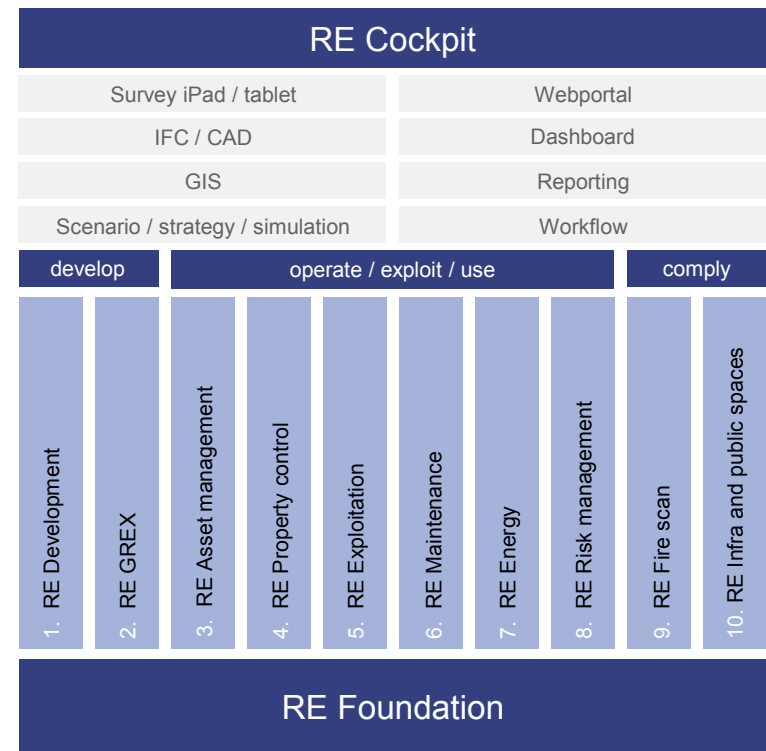
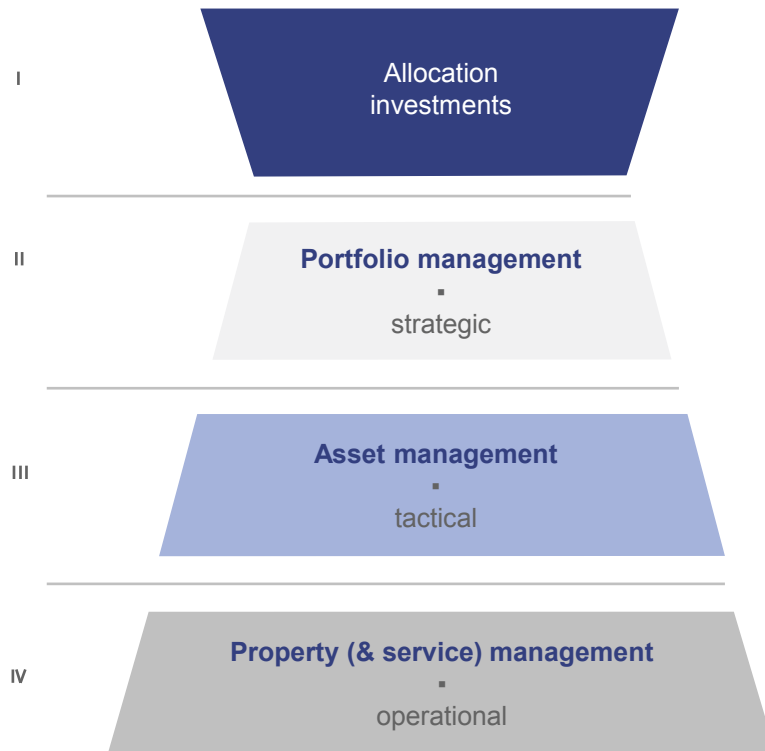


**Research**





# DEMO = RE + IM



# WHAT DOES DEMO OFFER?

## ■ Software

- Delivery
- Generic development
- Tailor made development
- Implementation

## ■ Consultancy services

- Survey (NEN 2767, energy, fire scan, safety, holistic)
- Consultancy
- Research
- Training, courses, interim chores, audits

## *Aspects*

- Financial analysis
- Technical administration
- Maintenance policy (MYMP, NEN 2767)
- Energy policy
- (Fire) safety
- Rules and regulations
- Sustainability
- Risk analysis and management



# CLIENTS





# RESEARCH PROJECTS



**INSITER** INTUITIVE SELF-INSPECTION TECHNIQUES

INTUITIVE SELF-INSPECTION TECHNIQUES using Augmented Reality for construction, refurbishment and maintenance of energy-efficient buildings made of prefabricated components

HOME | PROJECT | BACKGROUND | PARTNERS | DISSEMINATION | RESEARCH RESULTS

Coordinator:  
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Login Consortium  
Login Webmaster

**INSITER - Intuitive Self-Inspection Techniques using Augmented Reality for construction, refurbishment and maintenance of energy-efficient buildings made of prefabricated components.**  
Energy-efficient buildings (EeB) have become a priority of the European Commission (EC) to promote and maintain sustainability in the construction sector. Within the recently launched EU research programme "Horizon 2020" (<http://ec.europa.eu/programmes/horizon2020/>), a particular attention is given to quality-gap and performance-loss between design and realization both in new construction as well as refurbishment of EeB. The construction sector is characterized by a segmented approach involving a variety of skills

**PROJECT MEETINGS**  
Pre kick-off October 2014  
Kick-off December 2014  
Consortium Meeting

**PARTICIPATION IN EVENTS**

**CROSS RELATED PROJECTS**

**Streamer**  
European research on energy-efficient healthcare districts

HOME | PROJECT | BACKGROUND | PARTNERS | IMPLEMENTERS COMMUNITY | RESEARCH RESULTS

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**STREAMER**  
Healthcare-related buildings are among the top EU priorities since they play a key role for a sustainable community, but their energy use and carbon emission are among the highest of all building types. Take for instance a typical hospital building that is part of the healthcare district. It uses 2.3 times more energy than an office. In the EU there are some 15,000 hospitals producing 250 million tonnes of carbon per annum. The energy use of 1 healthcare district could exceed that of 20,000 dwellings. In almost every European city there is at least one healthcare district making a huge impact on the whole city's energy performance.

**PROJECT MEETINGS**  
Consortium Meeting Florence September 2014  
Consortium Meeting Paris March 2014  
Kick-off September 2014  
Pre kick-off May 2013

**PARTICIPATION IN EVENTS**  
Linked Data in Architecture and Construction (LDAC 2014)

**PANTURA** Low-disturbance sustainable urban construction

Home | Project | Background | Partners | Stakeholders | Research Results

Coordinator:  
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**PANTURA**  
More than 50% of bridges in European cities are older than 40 years. Bridges in cities are often key objects and landmarks of the urban architecture and are a vital part of a city's infrastructure. Bridge owners and managers are currently dealing with a large number of structurally deficient, obsolete bridges. The need to maintain, renew, strengthen and upgrade this part of the infrastructure will increase dramatically in the near future.

PANTURA has bridges as its focal point. It is, however, important to stress that the approach proposed here can be applied to all infrastructure projects. The aims are to improve highly flexible off-site production processes, create resource-efficient construction sites, improve technologies and tools for bridge construction, repair and renovation in densely populated areas and enhance communication between stakeholders, local authorities and construction companies.

PANTURA is a research project that is co-financed by the European Commission under the Seventh Framework Programme for Research and Technological Development. This website is the retrieval mechanism for all public information about the project. It gives a description of the research work and the partners and stakeholders involved. In the course of the project also research results will be published. The final results will be available in 2014.

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**Proficient**

HOME | PROJECT | PARTNERS | COMMUNITY OF PRACTICE | RESEARCH RESULTS

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**PROFICIENT**  
Proficient aims to create large business opportunities for SMEs in the construction sector by exploiting the newly emerging process of Collective Self-Organised (CSO) housing for constructing and retrofitting energy-efficient residential districts.

Proficient responds to the EU-wide trend of self-organising housing process in order to boost the quality and the scale of energy-efficient buildings. Self-organised housing process -through which a group of homeowners carries out new construction and retrofitting projects on a district scale- reflects a raising awareness towards sustainability and the increasing self-managing capability of European society.

**NEWS**  
Proficient and current development in de CSO housing market in Germany- parallel 3L activities to Proficient and intermediate results

**ARCHIVE**



# PROPOSITION



# BIM is *not* smart

It is the user that makes BIM smart  
by creating and applying it in a smart way

\* BIM = Building Information Model





- 3D BIM: geometry and visualisation



4D BIM: time scheduling

The screenshot shows the Autodesk Navisworks Manage interface. The main 3D view displays a construction site with a yellow tower crane labeled 'AUTODESK' and a red steel structure under construction. The TimeLiner window is open at the bottom, showing a Gantt chart for construction tasks. The tasks are listed in a table below.

Active	Name	Status	Start	End	Planned St	March 2010	April 2010	May 2010						
						W13	W14	W15	W16	W17	W18	W19	W20	W21
<input checked="" type="checkbox"/>	3 STRUCTURAL FRAM...		3/19/2010 8:00:00 AM	4/1/2010 5:00:00 PM	1/28/2010 8:00	[Gantt bar spanning W13 to W14]								
<input checked="" type="checkbox"/>	3 STRUCTURAL FRAM...		4/2/2010 8:00:00 AM	4/6/2010 5:00:00 PM	2/11/2010 8:00	[Gantt bar spanning W14 to W15]								
<input checked="" type="checkbox"/>	3 STAIRS		4/7/2010 8:00:00 AM	4/7/2010 5:00:00 PM	2/16/2010 8:00	[Gantt bar spanning W15 to W15]								
<input checked="" type="checkbox"/>	ROOF LEVEL		4/8/2010 8:00:00 AM	6/16/2010 5:00:00 PM	4/8/2010 8:00:0	[Gantt bar spanning W15 to W18]								
<input checked="" type="checkbox"/>	ROOF SLAB PHASE 1		4/8/2010 8:00:00 AM	4/12/2010 5:00:00 PM	4/26/2010 8:00	[Gantt bar spanning W15 to W16]								
<input checked="" type="checkbox"/>	ROOF SLAB PHASE 2		4/13/2010 8:00:00 AM	4/15/2010 5:00:00 PM	4/29/2010 8:00	[Gantt bar spanning W16 to W17]								
<input checked="" type="checkbox"/>	ROOF SLAB PHASE 3		4/16/2010 8:00:00 AM	4/20/2010 5:00:00 PM	5/4/2010 8:00:0	[Gantt bar spanning W17 to W18]								
<input checked="" type="checkbox"/>	ROOF SLAB PHASE 4		4/21/2010 8:00:00 AM	4/23/2010 5:00:00 PM	5/7/2010 8:00:0	[Gantt bar spanning W18 to W19]								
<input checked="" type="checkbox"/>	ROOF SLAB PHASE 5		4/26/2010 8:00:00 AM	4/28/2010 5:00:00 PM	5/12/2010 8:00	[Gantt bar spanning W19 to W20]								



# 5D BIM: cost estimation

The screenshot displays the Innovaya Design Estimating software interface. On the left, a tree view shows building sections including 'Default (2104)', 'CEME extension-2008.rvt - Demo (0)', 'CEME extension-2008.rvt - Phase 0 (411)', 'CEME extension-2008.rvt - Phase 1 (1688)', and various levels and roofs. The central 3D view shows a building model with a blue sky and green ground. On the right, a 'Component Types' list includes ARCHITECTURAL, Walls (313), Curtain Walls (548), Curtain Wall Mullions (88), Doors (62), Windows (37), Window Door Assemblies (0), Ceilings (7), Floors (12), Roofs (9), Fascias (0), Gutters (0), and Stairs (7). Below the 3D view is an 'Estimate' window with tabs for Estimate Info, Takeoff, Object Costs, and Estimate Reports. It shows a table with columns for Assembly, Description, Lab, Mat, Equip, and Total. The table lists various construction items like Substructure, Basement Walls, Walls CIP, Foundation walls, Slab on Grade, Shell, Floor Construction, CIP Slab, CIP Column, Exterior Walls, Partitions, and Wall, with their respective costs. The total list cost is \$6,151,167.

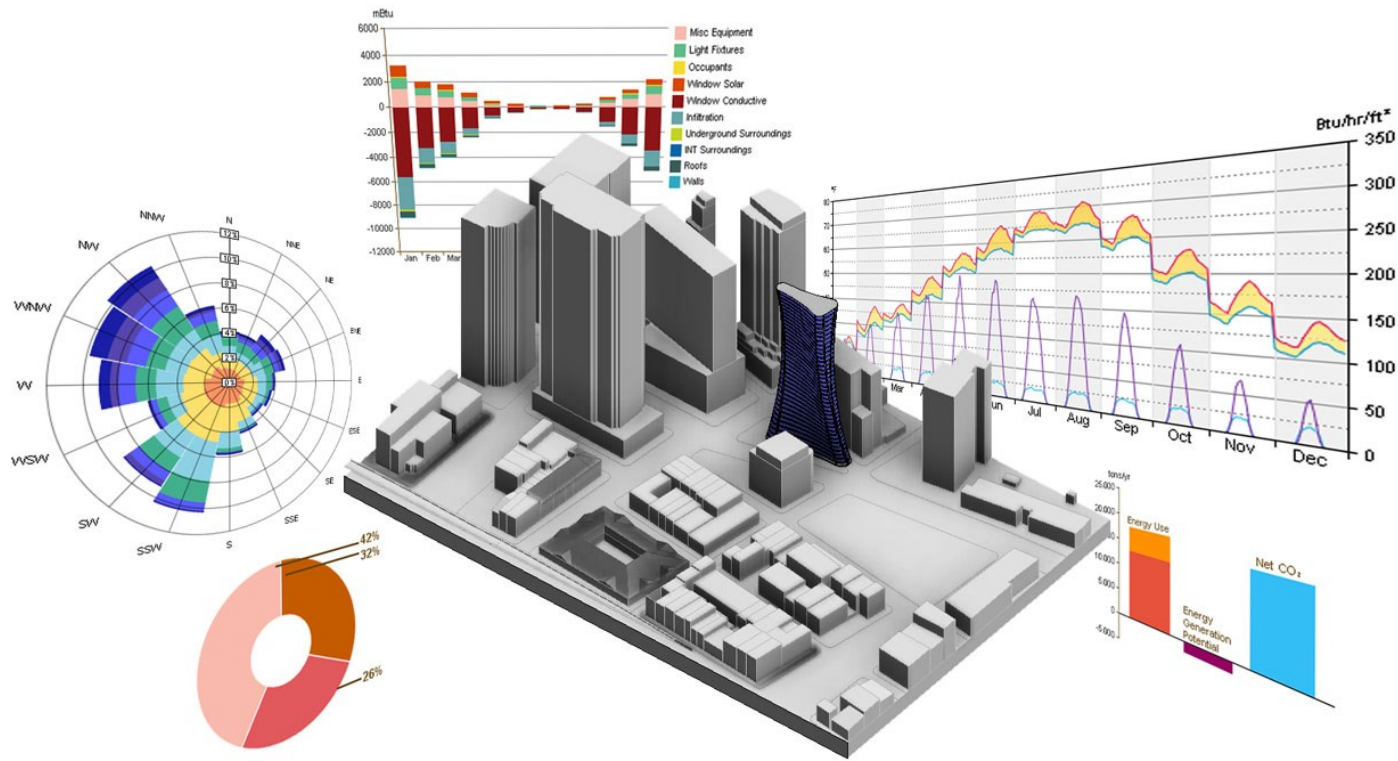
Assembly	Description	Lab	Mat	Equip	Total
<b>A</b>	Substructure				
	Substructure	\$1,409,642	\$809,403	\$42,253	\$2,261,298
<b>A2020</b>	Basement Walls	\$1,378,496	\$769,241	\$39,593	\$2,187,330
	Walls CIP	\$1,378,496	\$769,241	\$39,593	\$2,187,330
<b>A2020 110 7262</b>	Foundatn wall,cip,12'wall height,pu...	\$226,686	\$155,443	\$7,944	\$390,073
<b>A2020 110 9260</b>	Foundatn wall,cip,16'wall height,pu...	\$100,765	\$69,167	\$3,537	\$173,468
<b>A2020 110 7220</b>	Foundation wall,cip,12'wall height,p...	\$1,051,045	\$544,631	\$28,113	\$1,623,789
<b>A1030</b>	Slab on Grade	\$31,147	\$40,161	\$2,660	\$73,968
<b>A1030 120</b>	SOG	\$31,147	\$40,161	\$2,660	\$73,968
<b>A1030 120 3400</b>	Slab grade, 5" thick, light industrial, ...	\$31,147	\$40,161	\$2,660	\$73,968
<b>B</b>	Shell	\$1,971,932	\$1,537,292	\$50,555	\$3,559,779
<b>B1010</b>	Floor Construction	\$742,079	\$920,677	\$21,957	\$1,684,712
<b>B1010 219</b>	CIP Slab	\$258,712	\$239,735	\$6,612	\$505,060
<b>B1010 219 7500</b>	Cipcbm and slb,8's,one way,16",30'...	\$258,712	\$239,735	\$6,612	\$505,060
<b>B1010 227</b>	CIP Slab	\$477,843	\$677,991	\$15,261	\$1,171,095
<b>B1010 227 4100</b>	Wslb,cst-in-plc cnc,8'd rib,16",20'20'...	\$477,843	\$677,991	\$15,261	\$1,171,095
<b>B1010 203</b>	CIP Column	\$5,523	\$2,950	\$83	\$8,557
<b>B1010 203 1200</b>	Cast-in-place cnrct col,18"sq,tied,50...	\$5,523	\$2,950	\$83	\$8,557
<b>B2010</b>	Exterior Walls	\$1,229,853	\$616,615	\$28,598	\$1,875,067
<b>B2010 101</b>	Walls	\$1,229,853	\$616,615	\$28,598	\$1,875,067
<b>B2010 101 4750</b>	Concret wall,rnfrcd,8'high,8"thick,lig...	\$163,571	\$74,601	\$5,185	\$243,357
<b>B2010 101 4100</b>	Concrete wall, reinforced, 8' high, 8'...	\$220,558	\$106,870	\$4,048	\$331,476
<b>B2010 101 8900</b>	Concrete wall, reinforced, 8'high,12"thic...	\$845,724	\$435,144	\$19,365	\$1,300,233
<b>C</b>	Interiors	\$208,952	\$112,915	\$8,223	\$330,090
<b>C1010</b>	Partitions	\$208,952	\$112,915	\$8,223	\$330,090
<b>C1010 140</b>	Wall	\$160,057	\$74,217	\$8,223	\$242,496
<b>C1010 140 2030</b>	Mtl prt, std,3 ct gypls plst,2-1/2"@ 1...	\$160,057	\$74,217	\$8,223	\$242,496
<b>C1010 126</b>	Wall	\$48,896	\$38,698	\$0	\$87,594
<b>C1010 126 6000</b>	Mp58"rgyp brd fac, 5/8" rtd gyp brd ...	\$48,896	\$38,698	\$0	\$87,594

Total List Cost: \$6,151,167

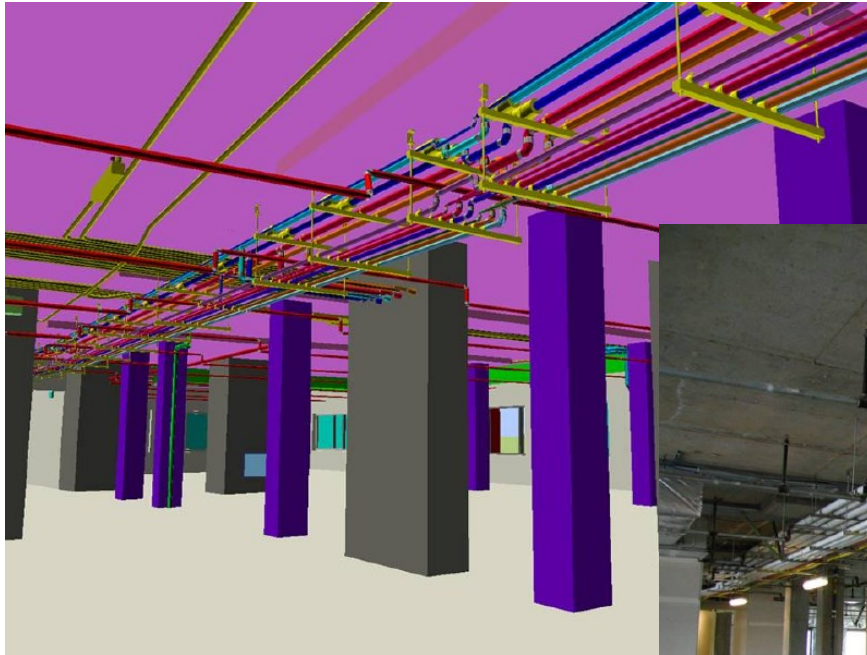




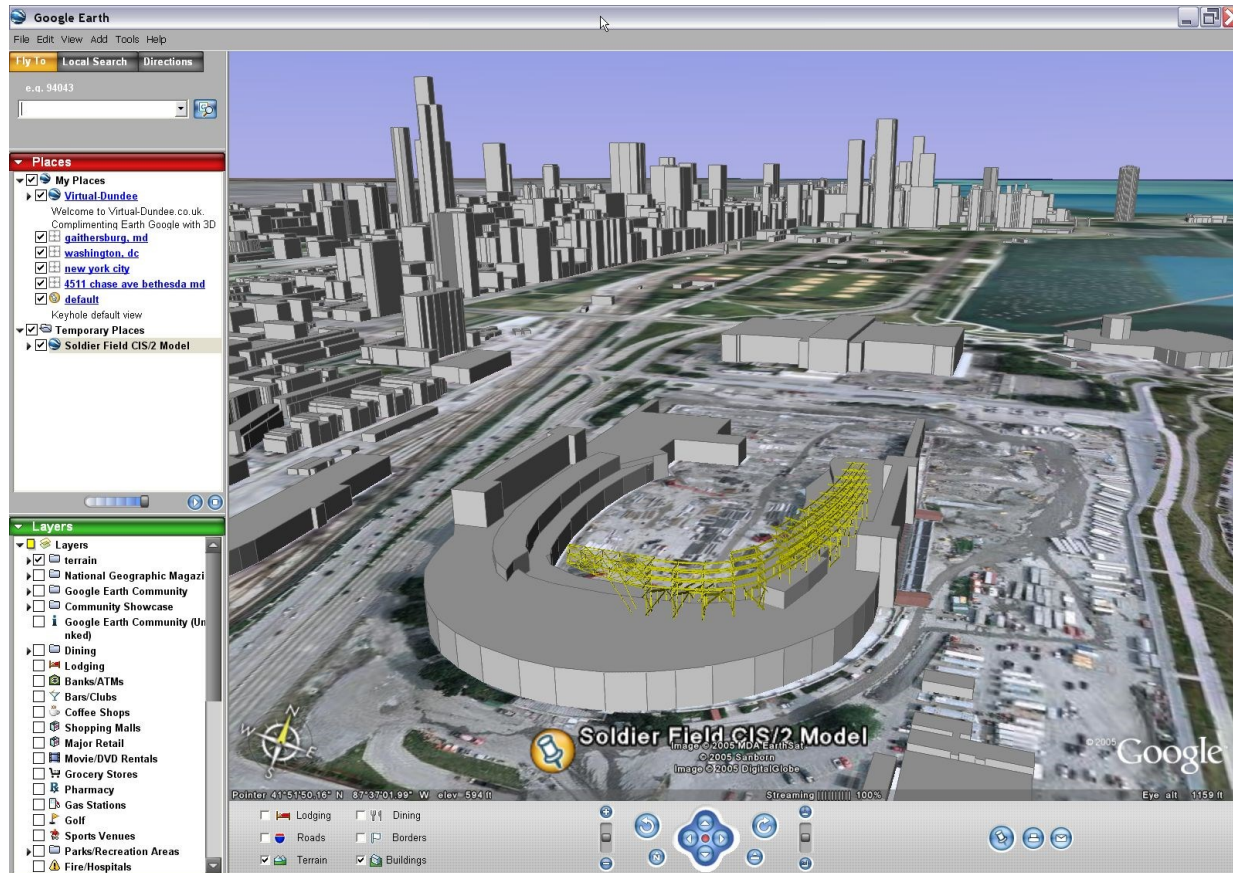
6D BIM: energy analysis



- 7D BIM: facility management

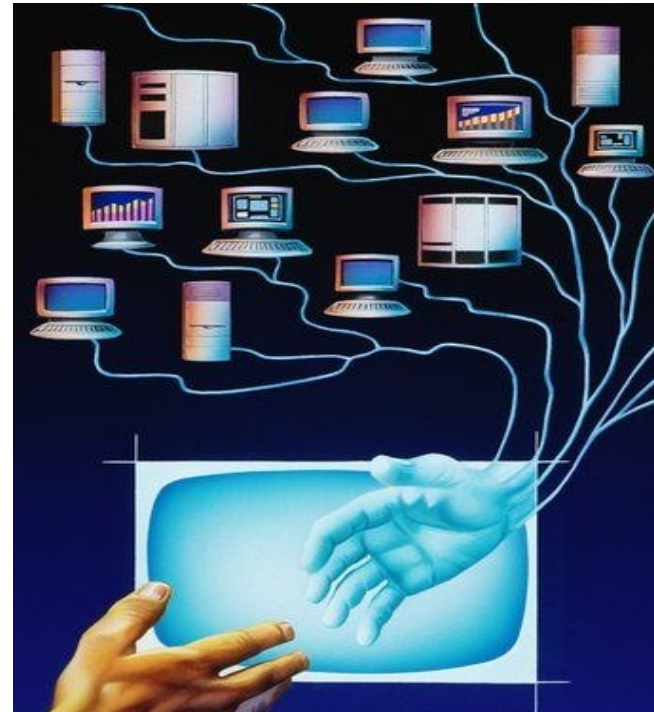


■ 8D BIM: post-occupancy





- ...D BIM: ??





# APPLIED RESEARCH



# BIM APPLIED RESEARCH IN NL AND EU



Low-disturbance  
construction



Digital cultural  
heritage



Energy-efficient  
buildings



Self-instruction  
& self-inspection



# BIM FOR ENERGY-EFFICIENT HOSPITALS

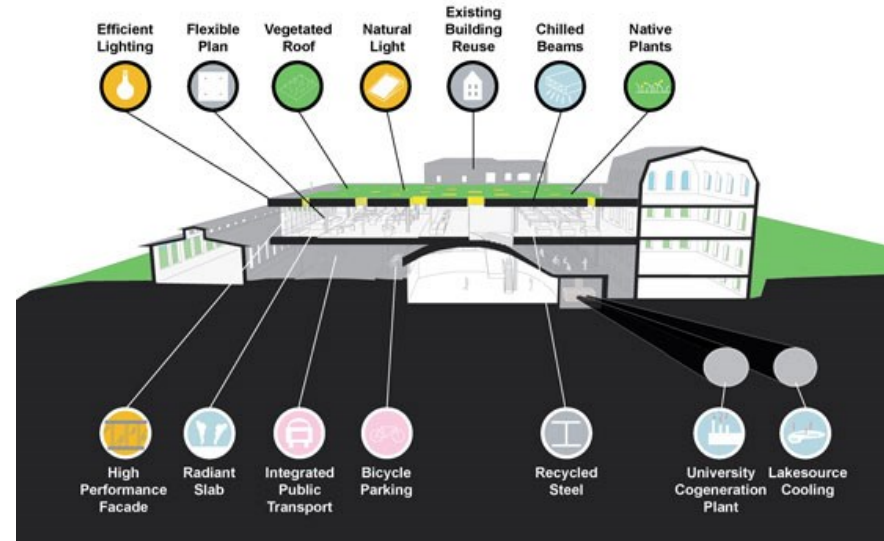


- Overall research goal

Development of customizable semantic BIM:  
a design template for new and retrofitted hospitals

BIM enriched with semantic guidelines:

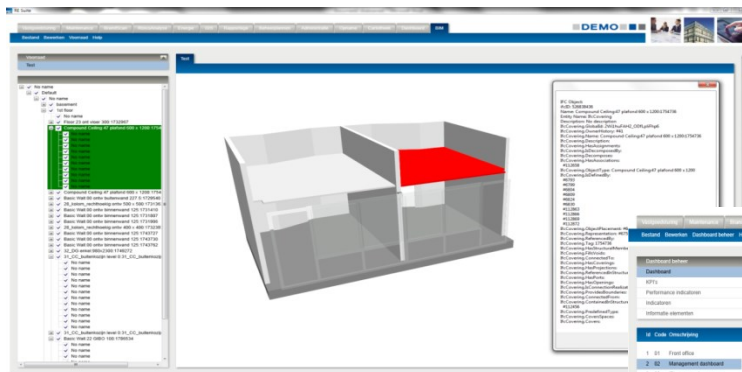
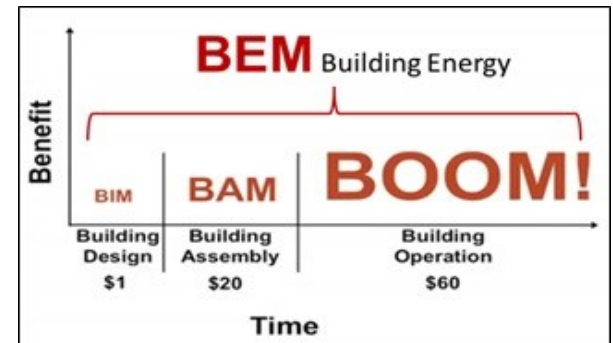
- Object models + process models
- Regulations + experience
- Specifications + performance



# BIM FOR ENERGY-EFFICIENT HOSPITALS

- Key achievement for DEMO

Framework for hospital BEM (Building Energy Model): a lifecycle model inter-connecting “BIM, BAM, BOOM”



IFC BIM with energy properties



A dashboard incorporating KPIs, algorithm, and MCDA (multi-actor decision analysis)



User mobile apps





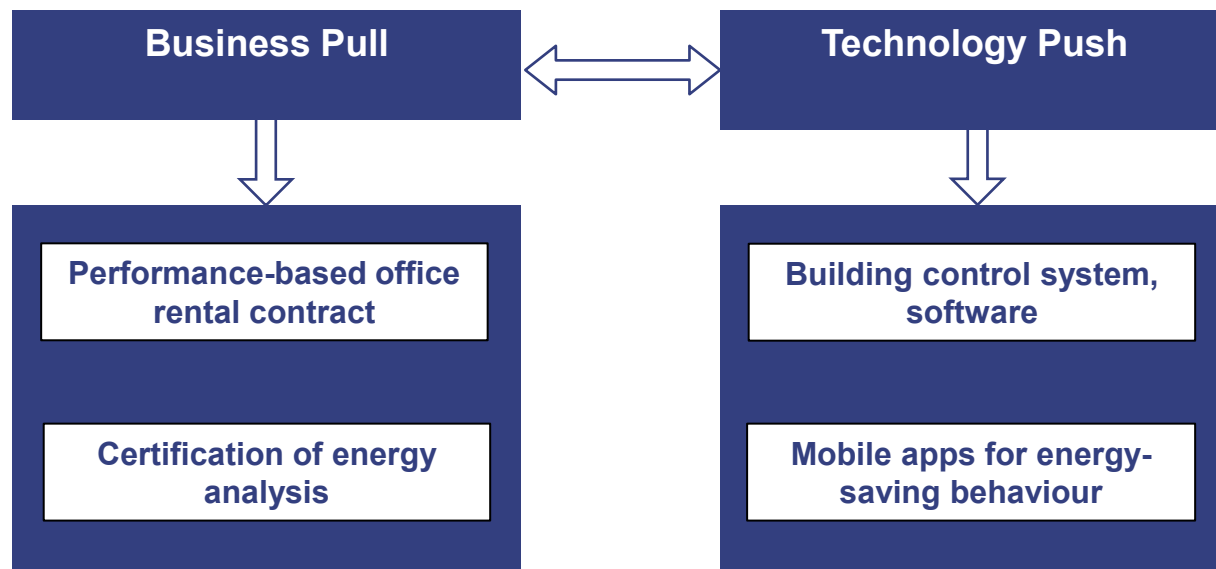
# BIM FOR ENERGY-EFFICIENT OFFICES



## TRECO-Office

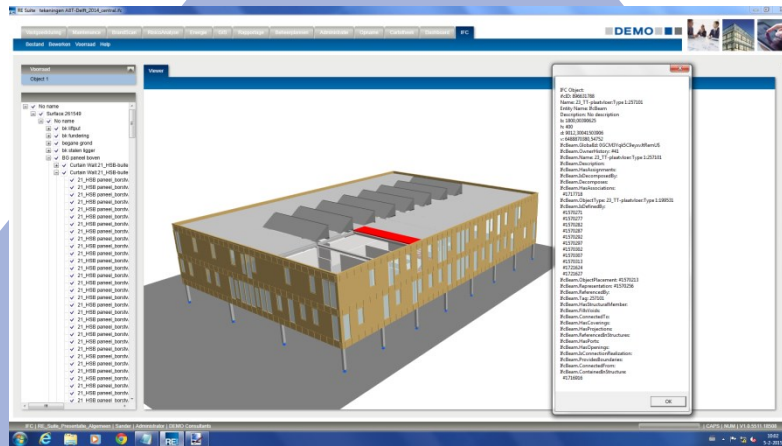
- Overall research goal

Real energy performance and control for offices and public buildings

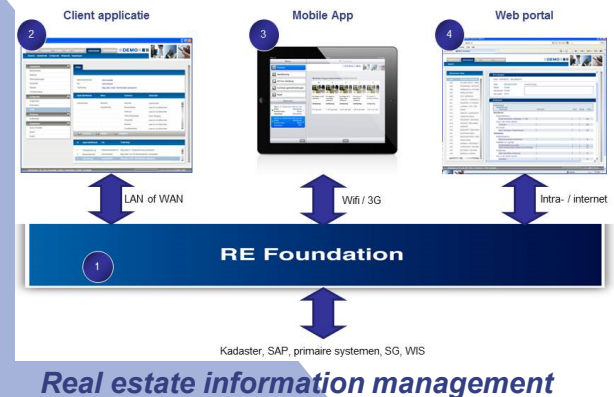


# BIM FOR ENERGY-EFFICIENT OFFICES

- Key achievement for DEMO



## IT architectuur RE Suite



# BIM FOR ENERGY-EFFICIENT NEIGHBOURHOODS

- Overall research goal

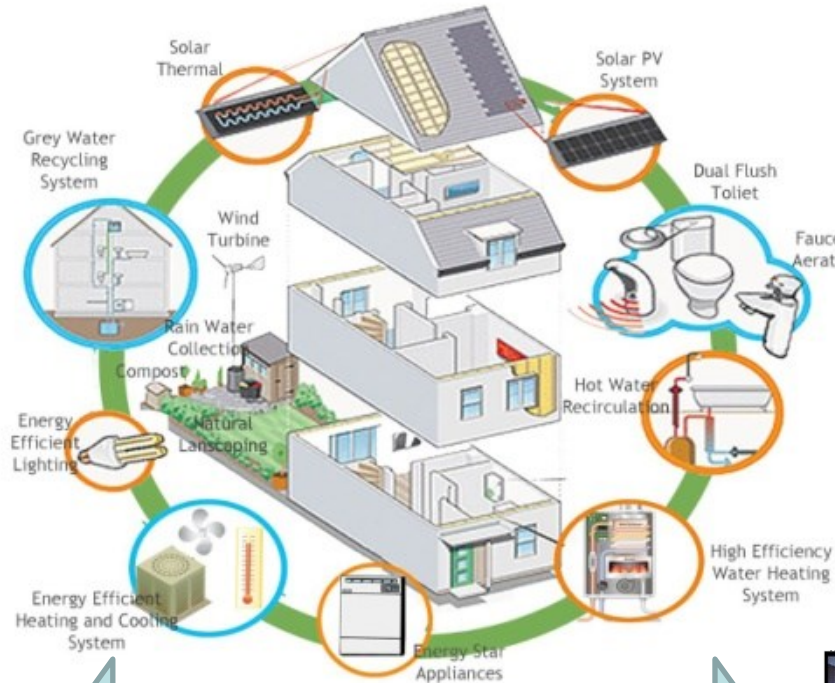


Facilitating the development of energy-efficient neighbourhoods based on Collective Self-Organised (CSO) housing approach supported by an e-Marketplace platform for Small & Medium-size Enterprises (SMEs)



# BIM FOR ENERGY-EFFICIENT NEIGHBOURHOODS

- Key achievement for DEMO



Collective home owners

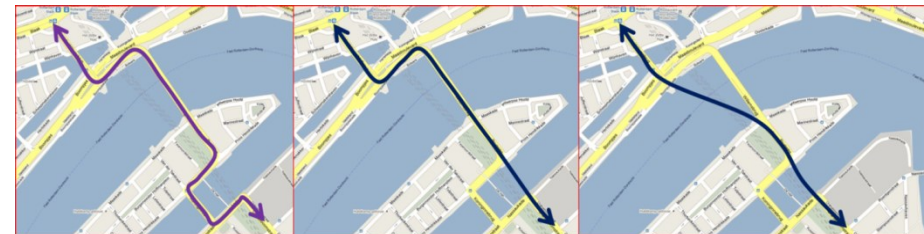




# BIM FOR LOW-DISTURBANCE URBAN PROJECTS

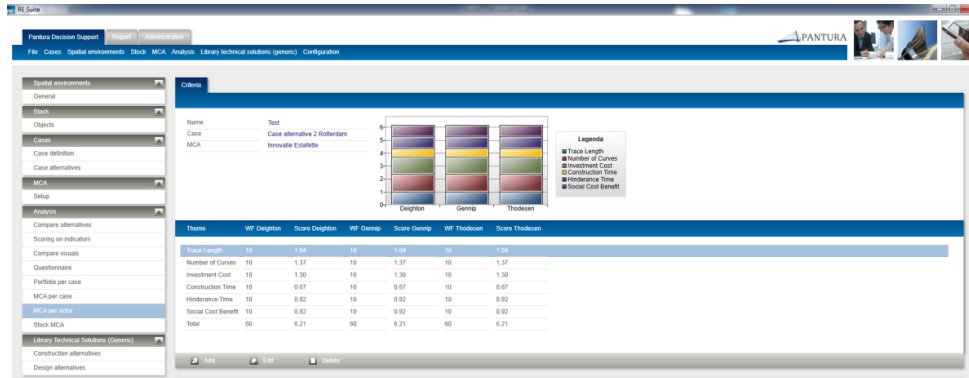
- Overall research goal

Development of construction management methods and ICT tools for low-disturbance construction, refurbishment and maintenance of bridges in the cities.

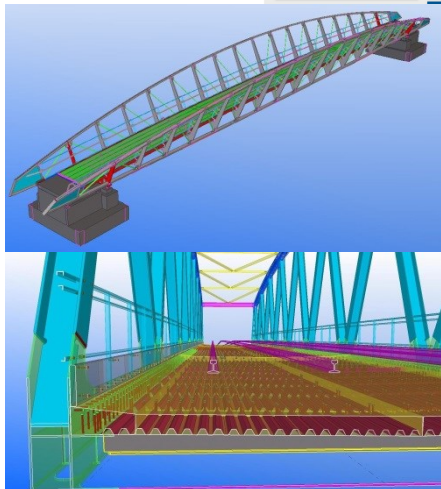


# BIM FOR LOW-DISTURBANCE URBAN PROJECTS

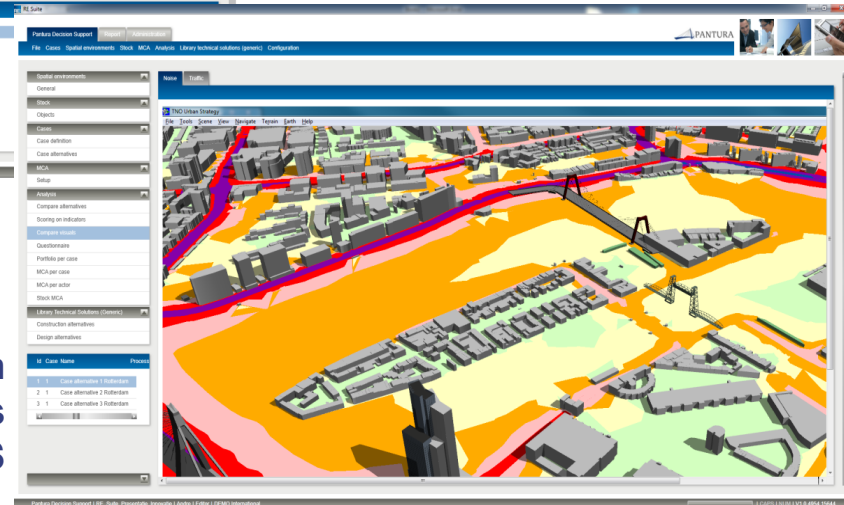
- Key achievement for DEMO



Multi-actor & multi-criteria decision-support tool



Bridge engineering in BIM



Urban impacts in 3D GIS



# BIM FOR SELF-INSTRUCTION & SELF-INSPECTION

- Overall research goal

Development of intuitive and cost-effective BIM-based Augmented Reality for self-instruction and self-inspection at real time during the construction process

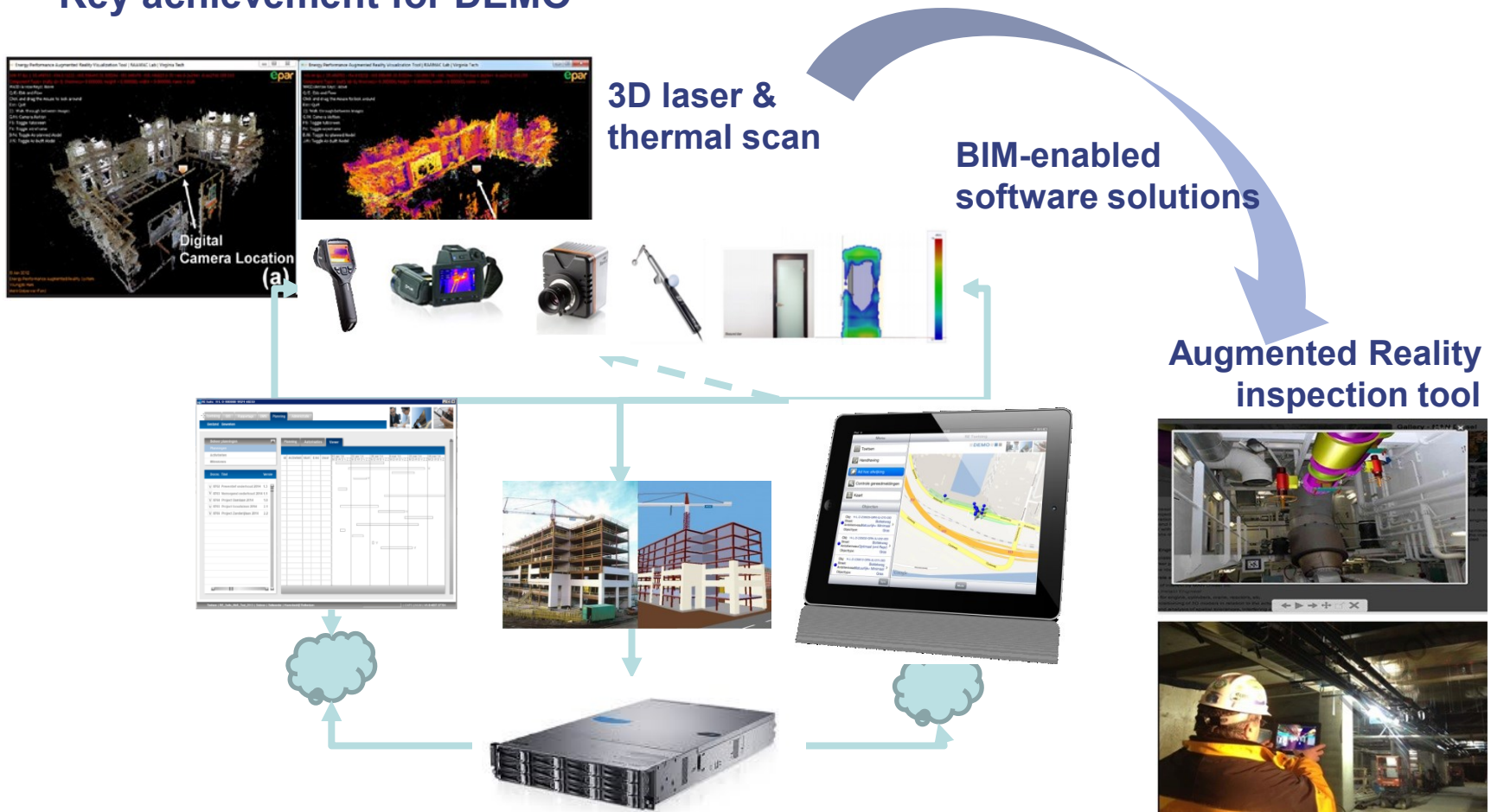
INSITER INTUITIVE  
SELF-INSPECTION  
TECHNIQUES





# BIM FOR SELF-INSTRUCTION & SELF-INSPECTION

- Key achievement for DEMO

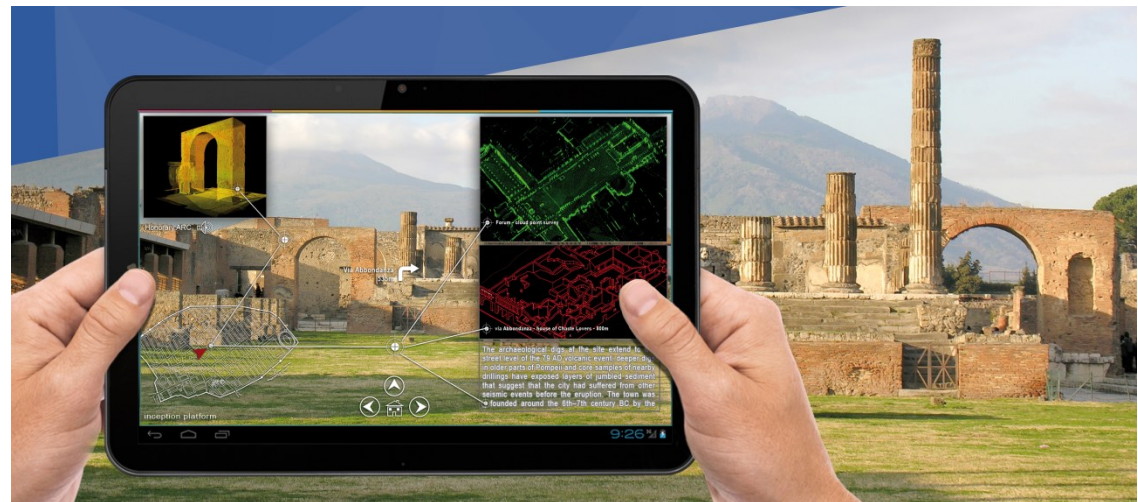




# BIM FOR TIME-DYNAMIC CULTURAL HERITAGE

- Overall research goal

Development of BIM-based methods and instruments for time-dynamic 3D reconstruction of cultural heritage for scholars, building engineers, tourists and governments



# BIM FOR TIME-DYNAMIC CULTURAL HERITAGE

- Key achievement for DEMO



Semantic software platform and mobile apps for Heritage-BIM (H-BIM)



# DISCUSSIONS



## MORE INFORMATION

- [www.insiter-project.eu](http://www.insiter-project.eu)
- [www.inception-project.eu](http://www.inception-project.eu)
- [www.streamer-project.eu](http://www.streamer-project.eu)
- [www.proficient-project.eu](http://www.proficient-project.eu)
- [www.pantura-project.eu](http://www.pantura-project.eu)
- [www.tki-energo.nl/treco-office/](http://www.tki-energo.nl/treco-office/)







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