



INSITER: Intuitive Self-Inspection Techniques

Dr Rizal Sebastian

Sustainable Places Conference 2018, 27th– 29th June 2018

(27 June 2018, second afternoon session at 15:00 – 17:30)

www.built2spec-project.eu





Agenda





1. Brief introduction of the presenter: Dr Rizal Sebastian
2. INSITER project summary
3. Integration of measurement output data into BIM
4. BIM-based Augmented Reality with Clash Cubes
5. ICT toolset and mobile app
6. Conclusion and discussion





1. Brief introduction of the presenter: Dr Rizal Sebastian



Background and affiliation

-  Education in architecture, design and construction management
-  Present: Director of Research at DEMO (NL). Past: TNO (NL) and ARCADIS (NL)

Project Coordinator roles

-  H2020 INSITER (presented in this workshop)
-  H2020 P2ENDURE (Plug-and-Play deep renovation)

Scientific Coordinator roles


-  H2020 SAFEWAY (Big Data for resilience of transport infrastructure)
-  H2020 BIM-SPEED (BIM for deep renovation)

Former project & scientific coordinator of FP6 and FP7 projects in BIM, EEB, urban infrastructure



2. INSITER project summary



 Programme : H2020-EEB-3-2014-RIA

 Period : 1 December 2014 – 30 November 2018

 Partners :

Large construction firms	Architectural, engineering, ICT firms	University, research institutes, knowledge platform
Dragados (Spain) Hochtief ViCon (Germany)	Ipostudio (Italy) 3L (Germany) AICE (Italy) DWA (Netherlands) RDF (Bulgaria) Siemens SW (Belgium) DEMO (Netherlands) --Coordinator--	UNIVPM (Italy) Fraunhofer IPA (Germany) CARTIF (Spain) ISSO (Netherlands)



2. INSITER project summary



Overview:

Real Problems	Research challenges	Developed results	Achieved objectives
As-built ≠ As-designed	Improving reliability & time-efficiency of measurement during construction	Optimised laser, thermal and acoustic scanning procedures with BIM interoperability	Enabled professionals (blue & white collars)
Actual performance ≠ Energy simulation	Developing user-friendly & cost-effective IT tools	BIM-based Augmented Reality and mobile applications for construction stage	Prevented or minimised performance gap
Delays and budget overruns	Generating practical method for high-quality construction process	INSITER 8-step guidelines for construction workers & technical specialists	Resolved fragmentation in value-chain



3. Integration of measurement output data into BIM

INSITER DLL to integrate measurement output data to BIM models in Revit

Geometry

Heat Map

Humidity

True Color



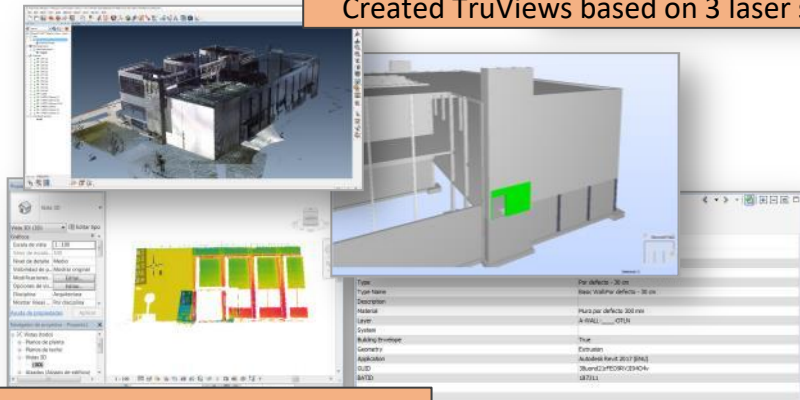
3. Integration of measurement output data into BIM

BIM enrichment with static data



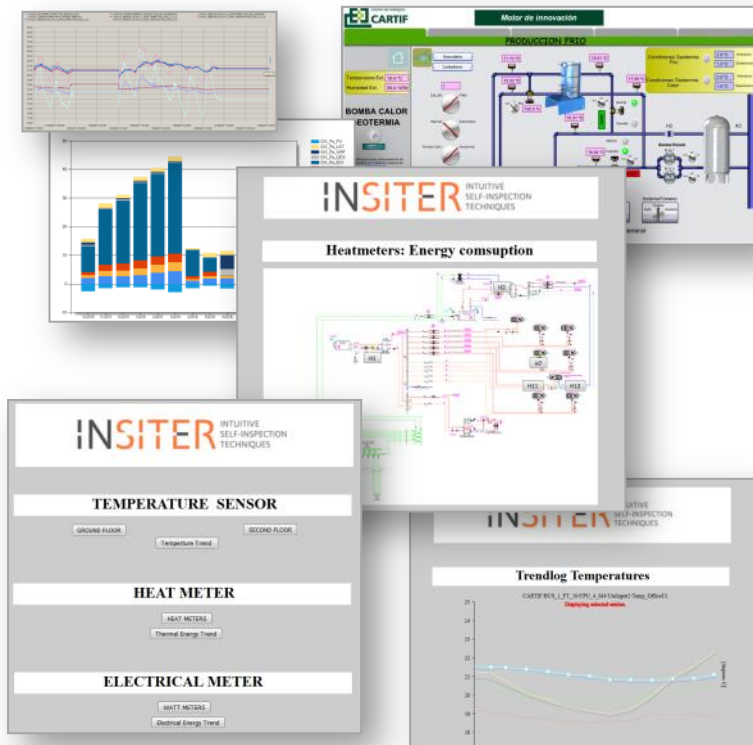
Humidity Detection based on Reflectivity

Created TruViews based on 3 laser scans



Overlay of Thermal Image and BIM.

BIM enrichment with dynamic data



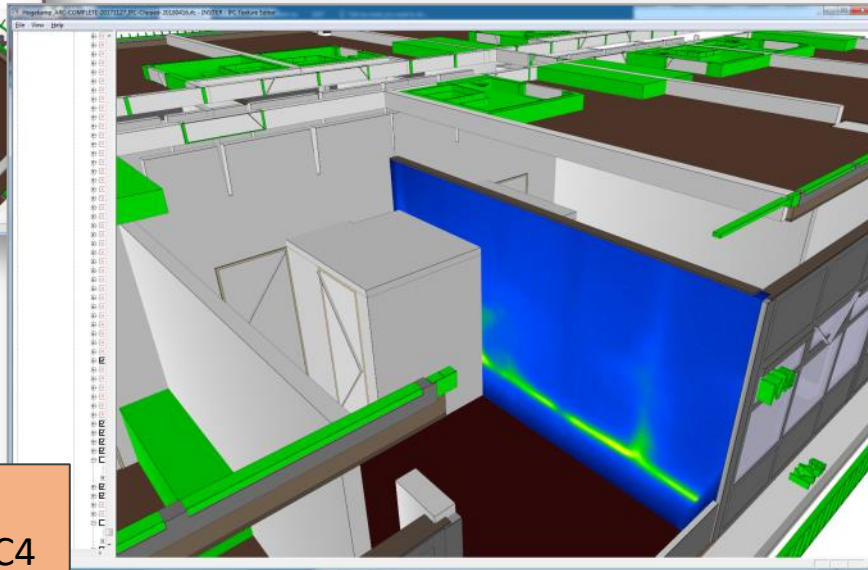
Building Monitoring System (BMS)



3. Integration of measurement output data into BIM



Thermal scan directly applied onto specific IFC building component



Add texture information to IFC4



3. Integration of measurement output data into BIM

Building Monitoring System (BMS) data to enable comparison of energy efficiency before and after refurbishment/maintenance

INSITER INTUITIVE SELF-INSPECTION TECHNIQUES

Temperatures Second Floor

Trendlog Temperatures

Heatmeters: Energy consumption

	Energy (Wk)	Flow (m ³ /s)	Mass (kg/s)	Volume (m ³ /s)
H1: Outlet Biomass Boiler	5.656724e+10	0	2.704264e+11	3.02635e+08
H2: Geothermal HP	1.746047e+10	0	8.30296e+10	9.29217e+07
H7: AHU Industrial Area Heating	2.4903e+07	0	4.5301e+08	453690
H11: AHU Office Heating	2.58478e+09	0	1.228942e+10	1.375546e+07
H12: AHU Office Cooling	1.702741e+10	1.41	8.163555e+10	9.135826e+07

DATABASE DLL



4. BIM-based Augmented Reality with Clash Cubes

INSITER BIM AR Vision

Complex BIM Models,
Planning and
Instrumentation Data

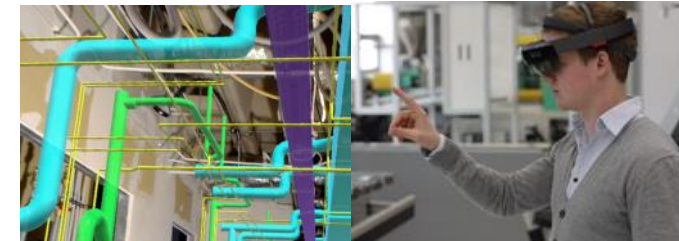
AR Solution for extensive and complex IFC BIM models for on-site self-inspection with referenced planning, self-instruction documentation and instrumentation data (with tablet computers)



INSITER HoloLens BIM-based Mixed Reality

Detailed BIM-based
3D scenes, including
e.g. MEP systems etc.

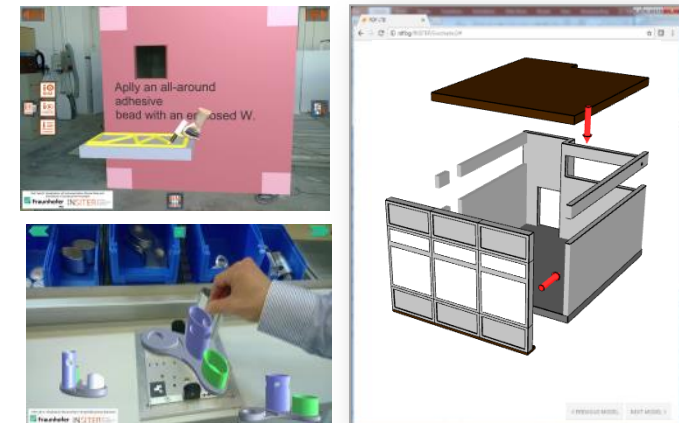
Detailed 3D scenes and BIM model evaluation for on-site self-inspection or self-instruction (with MS HoloLens)



INSITER BIM-based Self-Instruction AR

Detailed BIM-based
Process Guidance
and Simulation

Detailed self-instruction simulation and visualization (with tablet computers, smart glasses or MS HoloLens)

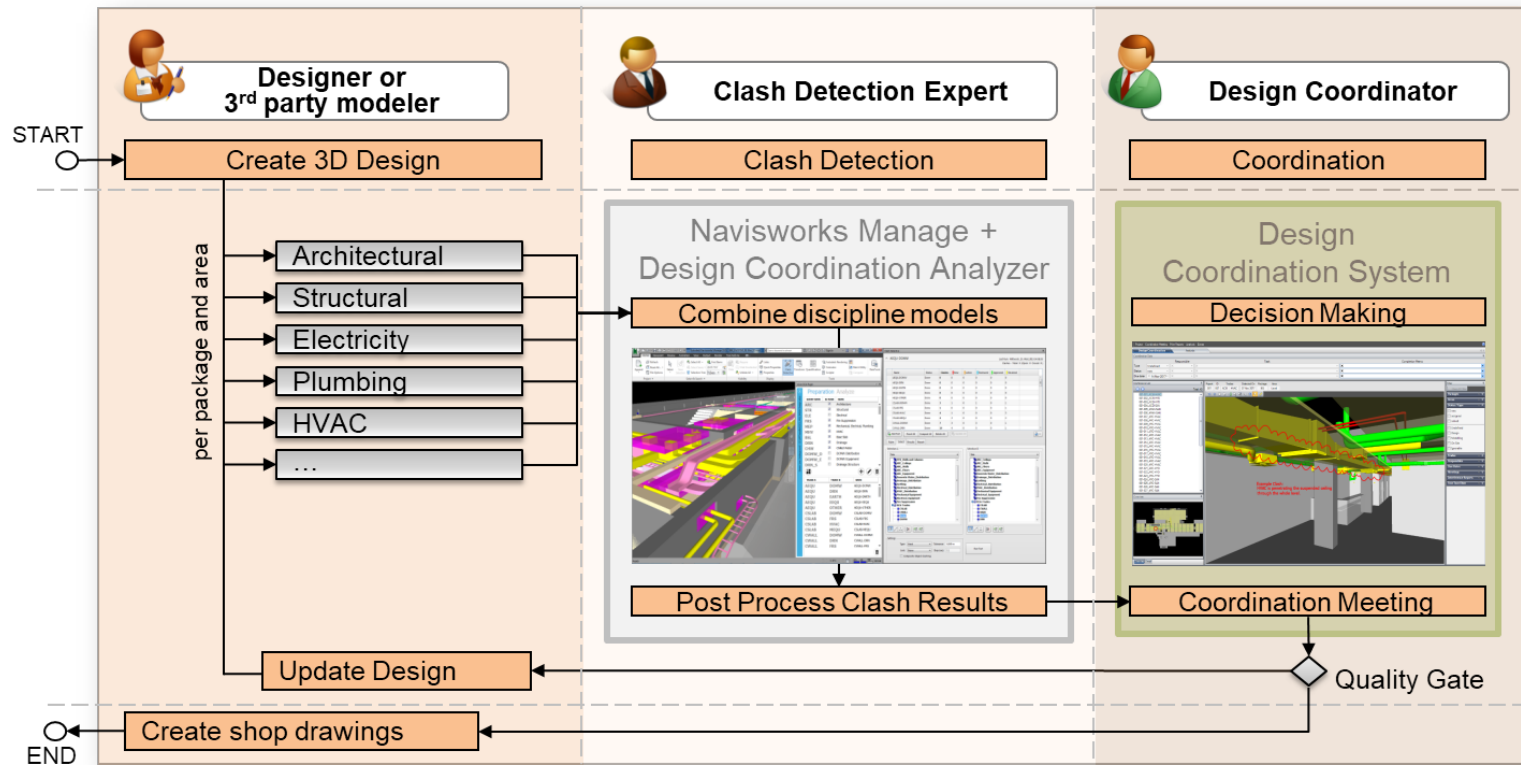




4. BIM-based Augmented Reality with Clash Cubes

Processing BIM clash detection and displaying Clash Cubes in AR

Process overview



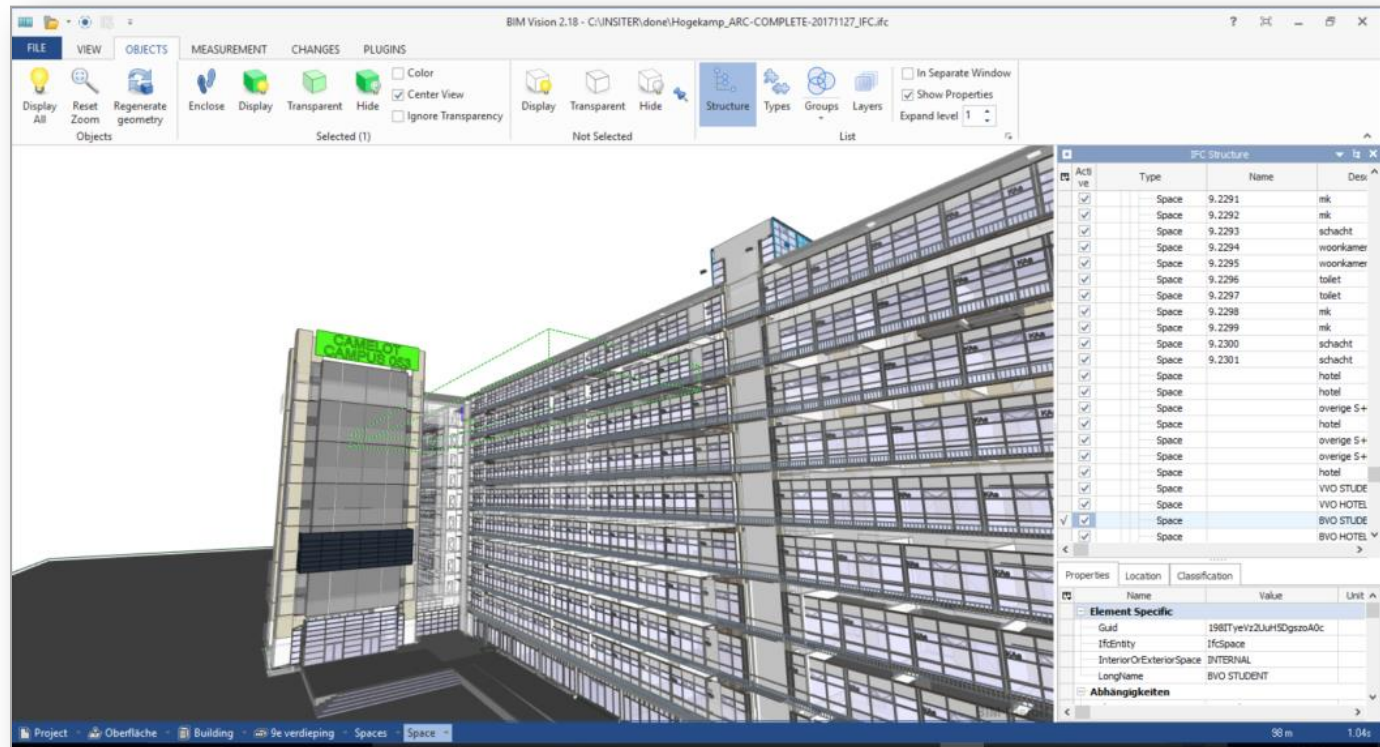


4. BIM-based Augmented Reality with Clash Cubes

Processing BIM clash detection and displaying Clash Cubes in AR

INSITER challenge

- How to provide input data in a most effective way to perform a clash detection, **when only a consolidated IFC model is available?**
- How to make Big Data available to be used on **mobile devices on construction site?**

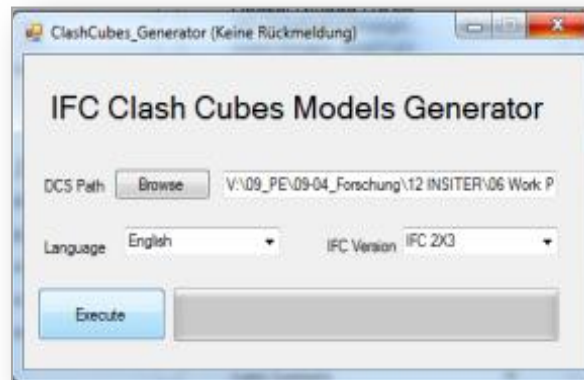




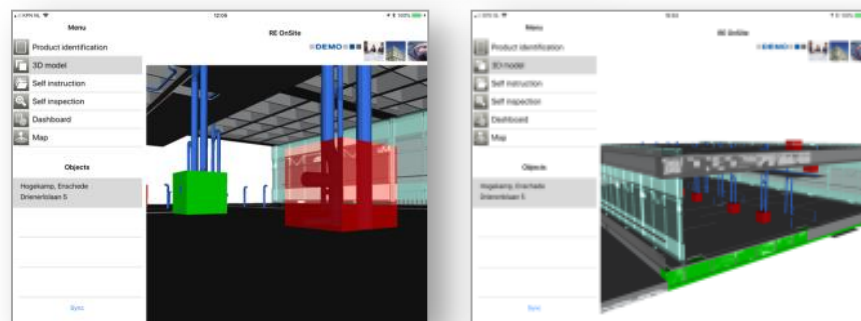
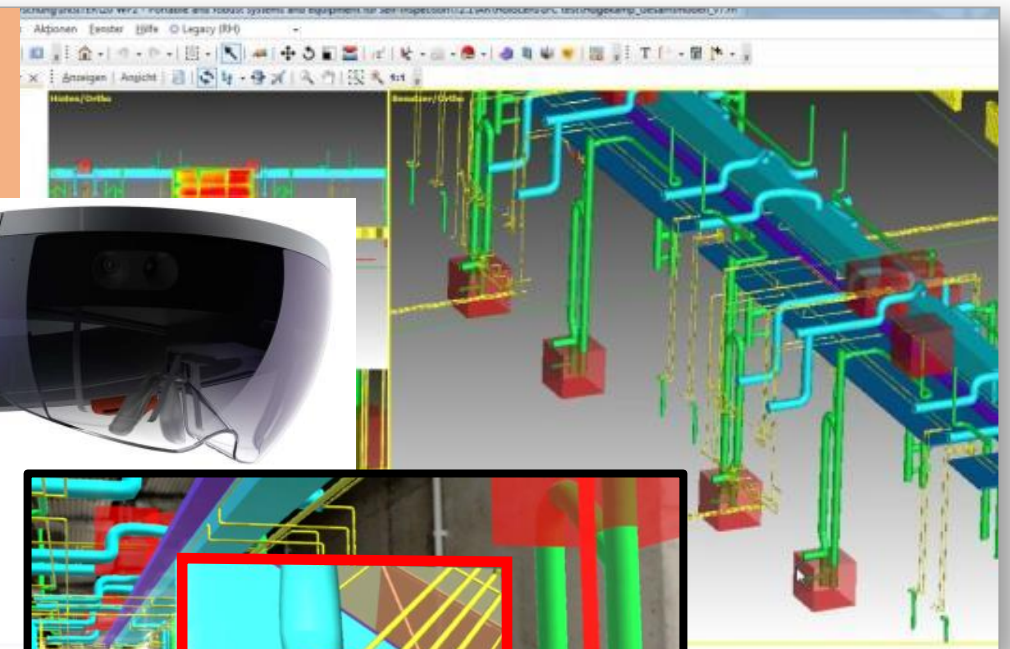
4. BIM-based Augmented Reality with Clash Cubes

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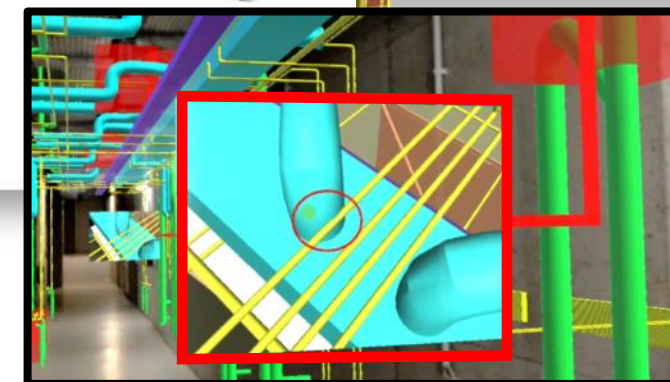
 Creating Clash Cubes to forward coordination information to AR for on-site construction



Clash Cubes for visualization in AR environment

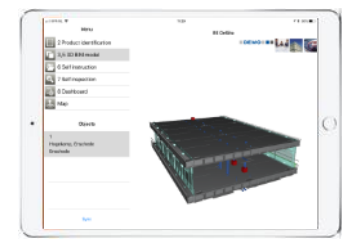
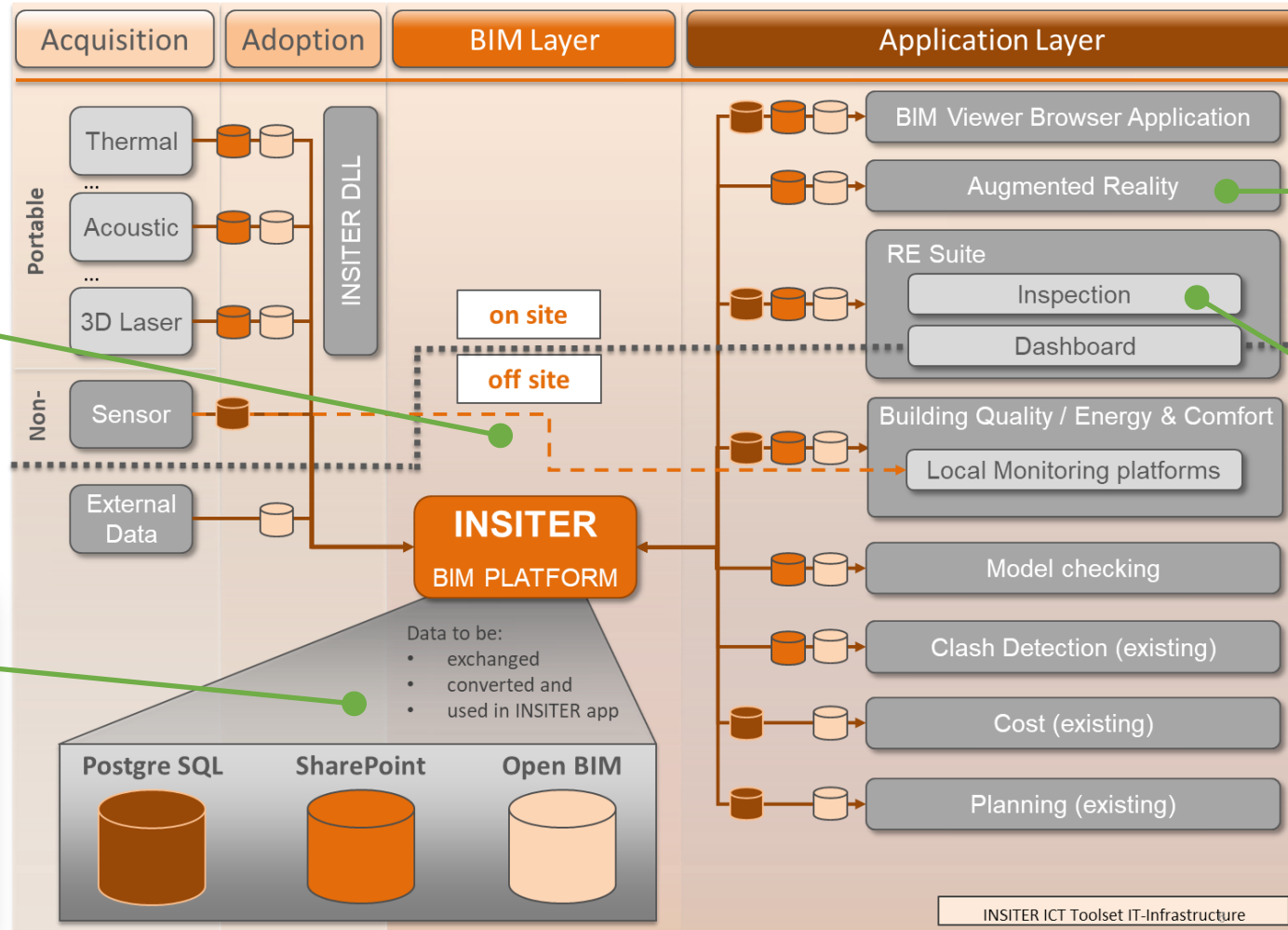
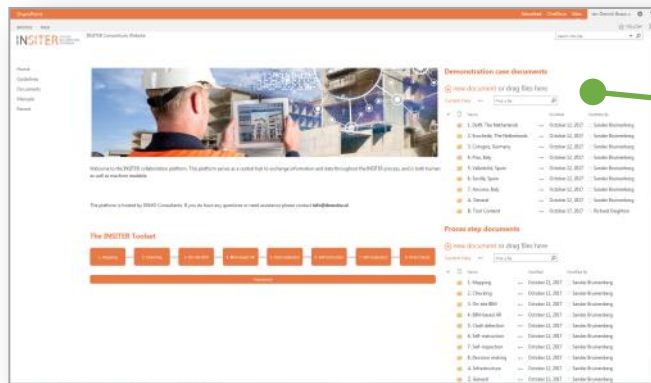


Clash Cubes in INSITER Mobile App





5. ICT toolset and mobile app





5. ICT toolset and mobile app

Mapping STEP 1:

Identify the real environment on-site, where the work should be performed

BIM on site STEP 3:

Deploying BIM on construction site

Clash Detection STEP 5:

Verification of the current site situation

Self-Inspection STEP 7:

Verify the current installation and fill in checklists for further processing



STEP 2: Checking

Check delivered MEP components against design by using QR-Code for identification and verification

STEP 4: BIM based AR

Validate delivered HVAC elements against design requirements

STEP 6: Self-Instruction

Guiding the construction process using a mobile device

STEP 8: Final Check

Quality, time and cost evaluation by the Construction Managers



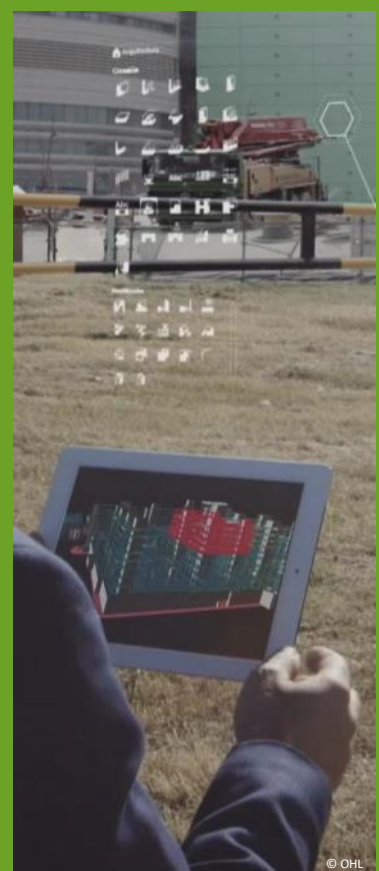
6. Conclusion and discussion

- 📱 Most INSITER solutions are at Technology Readiness Level (TRL) 6.
What is the most effective approach to bring these solutions towards TRL 8-9?
- 📱 What is the acceptance for self-instruction & self-inspection during construction?
What are the barriers?
- 📱 Who are the potential partners for further development and market exploitation?
Who are the competitors?



INSITER INTUITIVE SELF-INSPECTION TECHNIQUES

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Tools for the 21st Century Construction Worksite

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