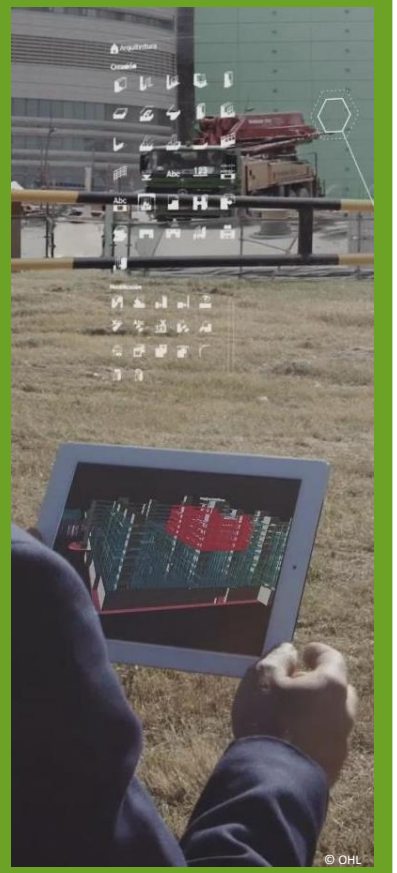

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Tools for the 21st Century Construction Worksite

DRONES, AUGMENTED REALITY AND POINT CLOUDS FOR ASSESSING CONSTRUCTION QUALITY AND PROGRESS

R2M SOLUTION

June 27, 2018 | Aix Les Bains | Sustainable Places 2018

www.built2spec-project.eu

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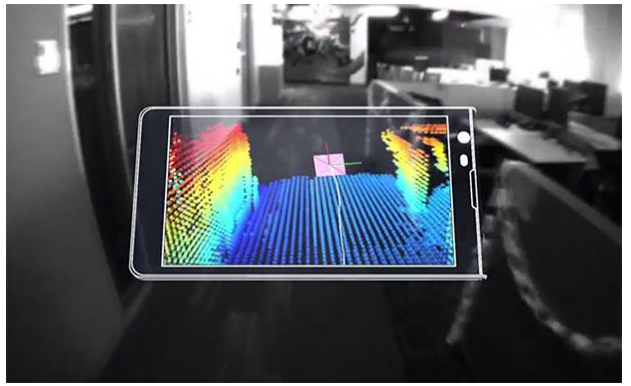
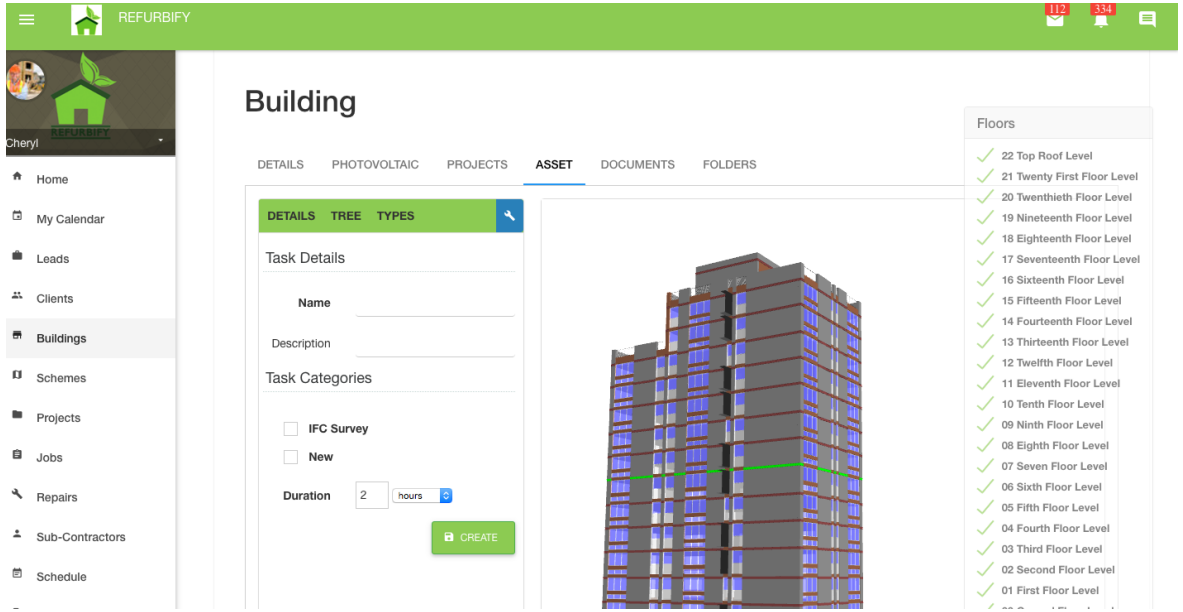
DRONES, AR & POINT CLOUDS

OUTLINE:

- B2S 3D reconstruction
- B2S Demo Sites
- Future developments
- Conclusions





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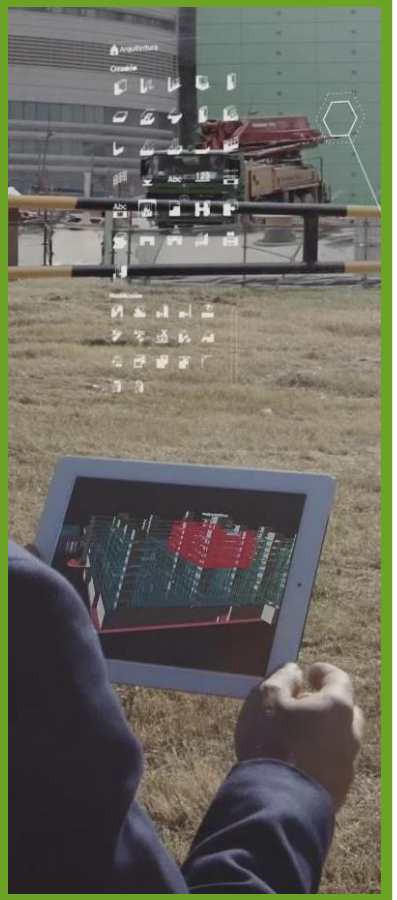
B2S – Innovative tools



- Building
- Acoustic
- Airtightn
- Thermal

Cheaper
Easier
More portable
Faster to apply

ency quality checks

uality tools

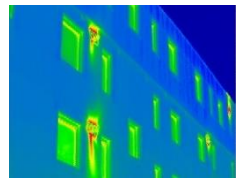
ery tools

ng components









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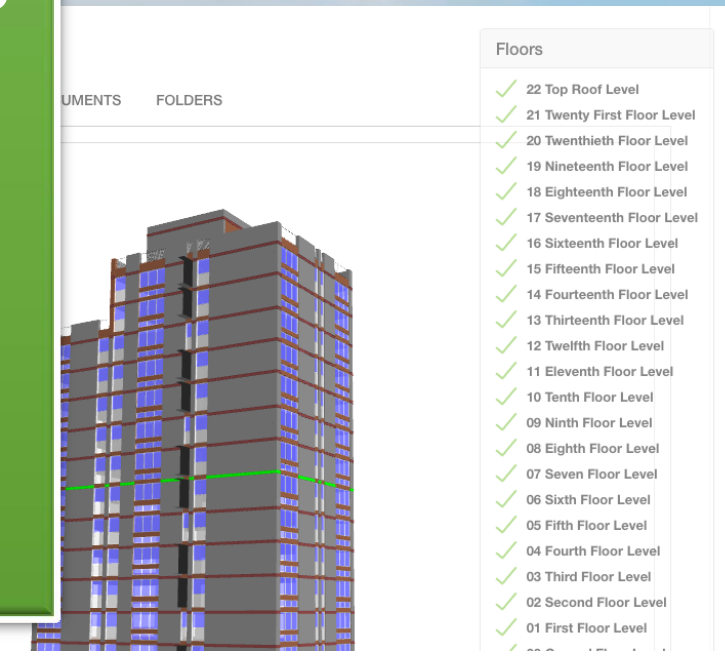
3D imagery tools

Point cloud to BIM
3D scanning
Google tango Drones

ASSESS PROGRESS
ASSESS QUALITY



BUILT2SPEC DEMO SITES

- Goal >> to test on site different technologies and procedure developed within WP4 in a real environment (3D reconstruction and construction progress)
- Technologies >> Scan and 3D reconstruction:
  - INDOOR: 3D scanner (**NUIG**); HoloLens (**ETH**); Google Tango (**ETH**) and GoPro (**ETH**)… Matterport (**R2M**)
  - OUTDOOR: Drone (**R2M**)**;** 3D Scanner (**NUIG**) and GoPro (**ETH**)
- Site management and coordination >> **DE5** (in cooperation with **R2M**)

RIGOLIZIA - PILOT SITE DESCRIPTION

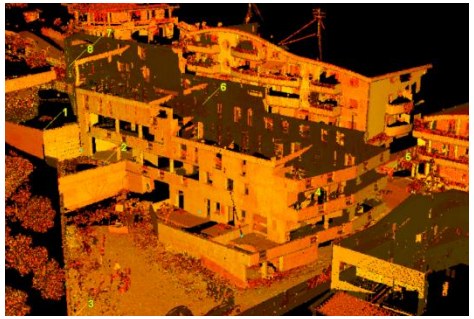
- Full scale testing and technologies comparison
- New technology available >> MATTERPORT
- Reconstruction applied to:
  - Compare works with design (BIM) and identify/quantify deviations
  - Quantify/monitor works progress
  - Support BIM development before reconstruction

RIGOLIZIA - TECHNOLOGY COMPARISON

OUTDOOR reconstruction

3D Point Cloud from Drone

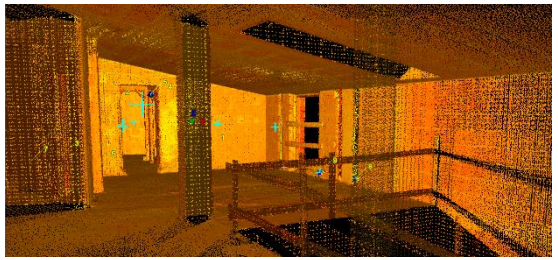
3D Point Cloud from GoPro



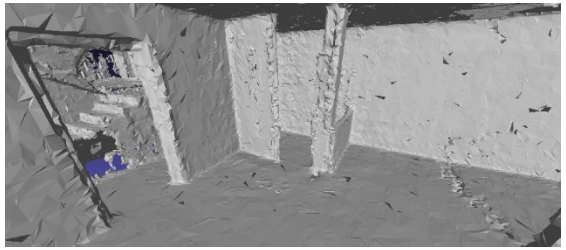
3D Point Cloud from 3D scanner or Matterport

INDOOR reconstruction

3D Point Cloud from Google Tango



3D Point Cloud from 3D scanner or Matterport



3D Point Cloud from HoloLens

3D Point Cloud from GoPro

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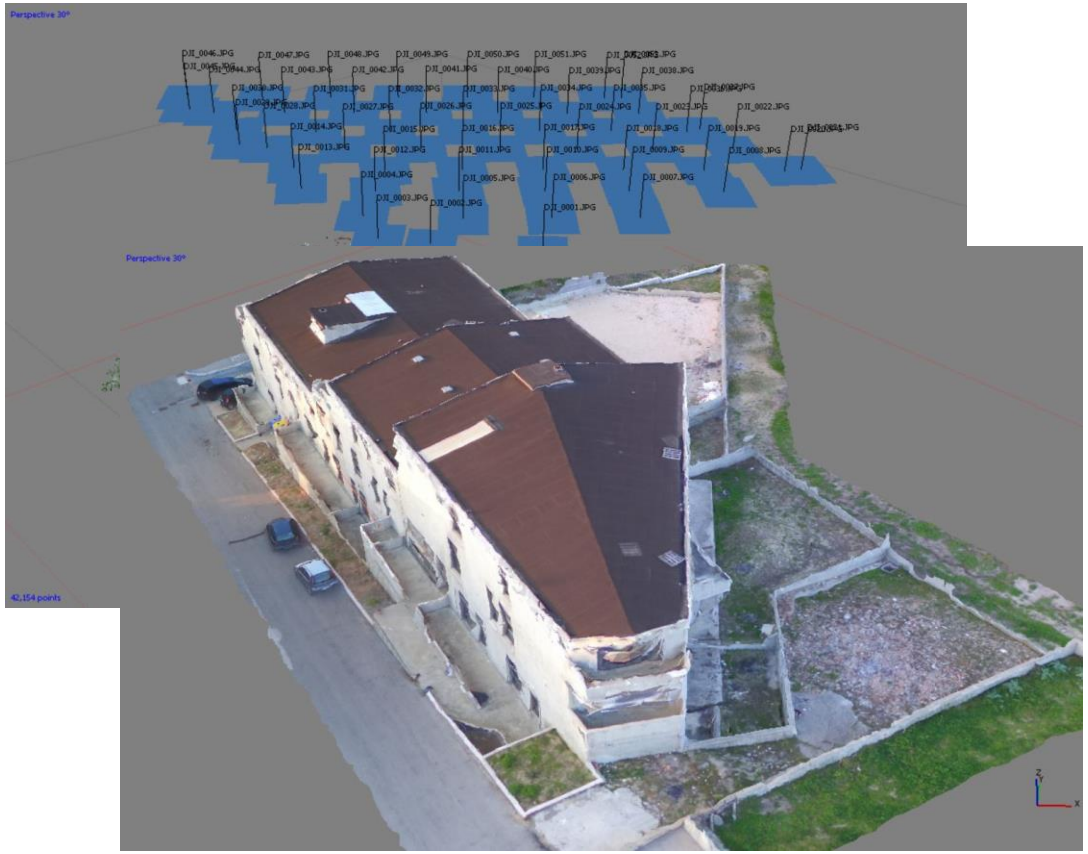
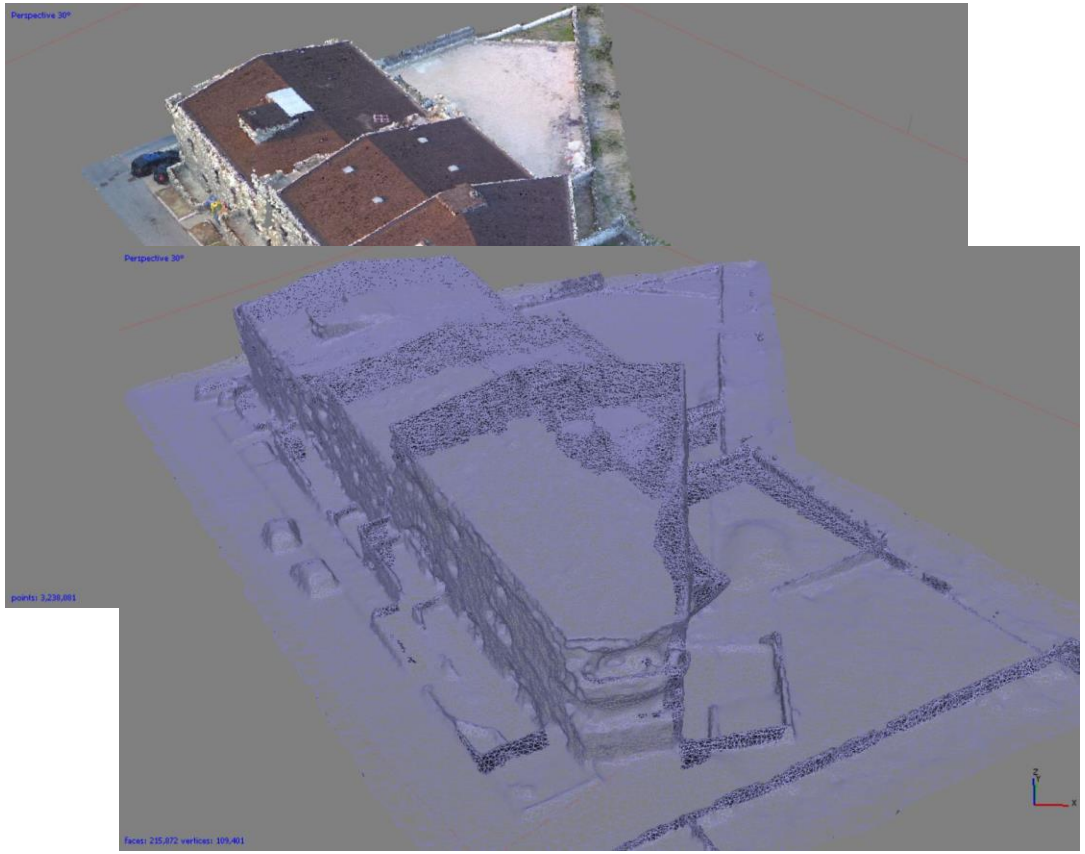
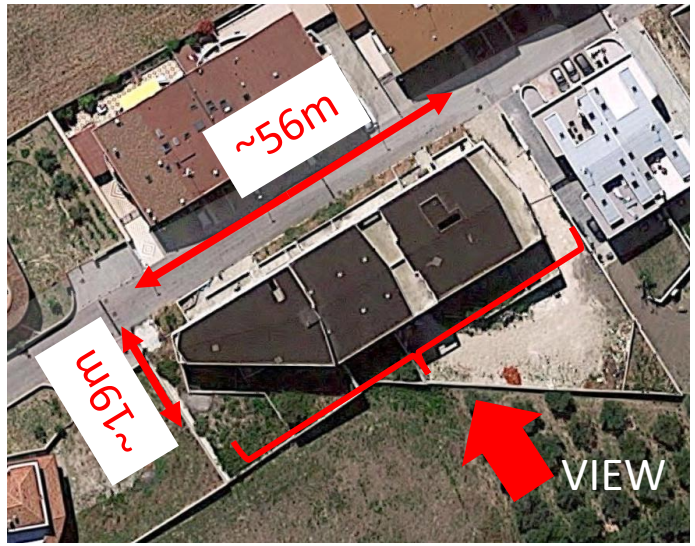
RIGOLIZIA - 3D RECONSTRUCTION (UAV)

UAV Outdoor Reconstruction: **RIGOLIZIA (SAN SALVO)**





RIGOLIZIA – INDOOR RECONSTRUCTION

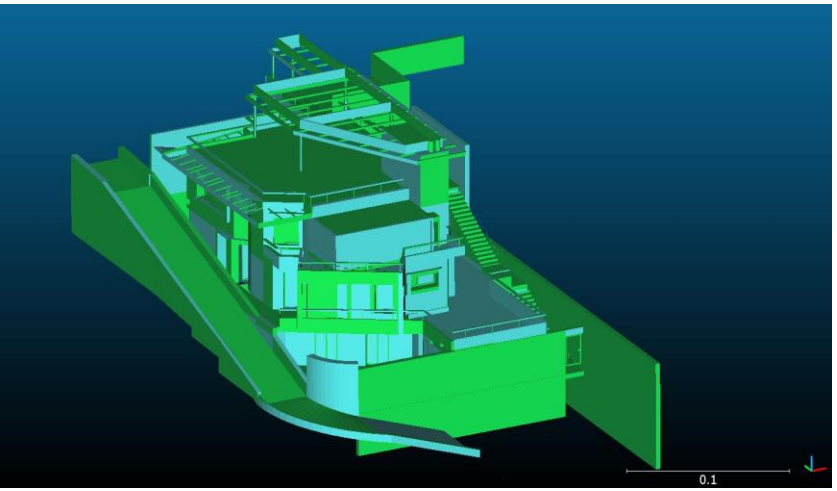


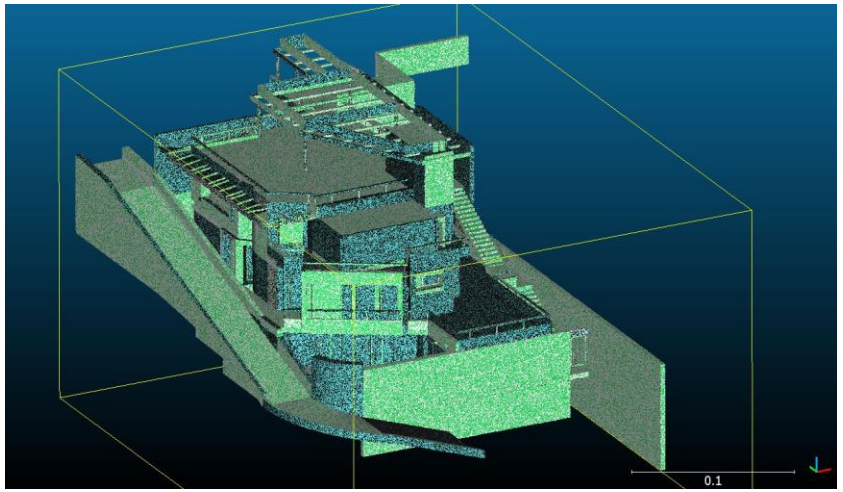
HoloLens in action (video)

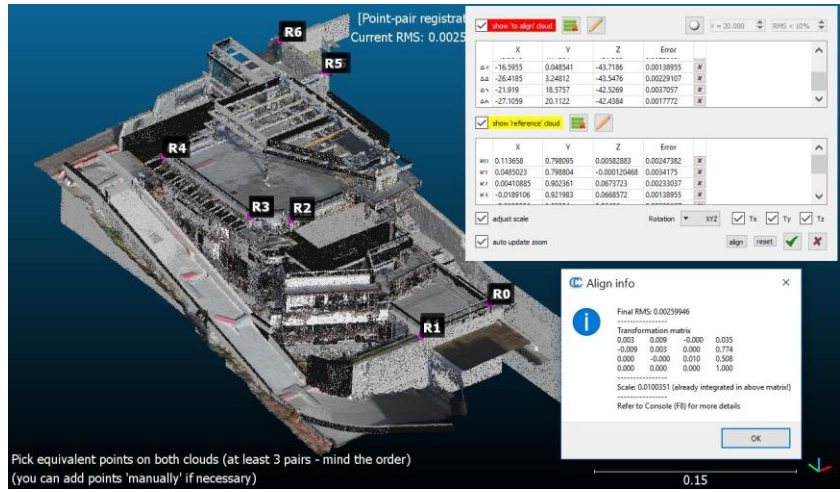
CANALE - PILOT SITE DESCRIPTION

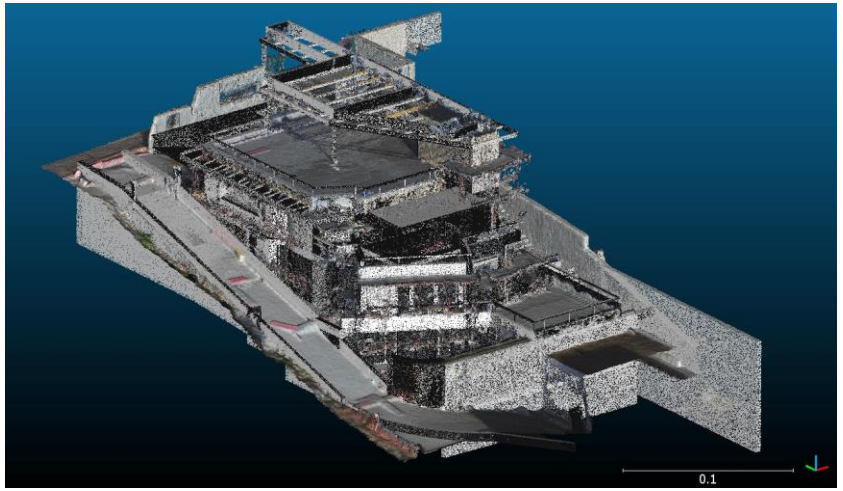
- Residential Building
- 4 floors
- Ongoing retrofitting works
- Reconstruction applied to:
  - Compare works with design (BIM) and identify/quantify deviations
  - Quantify/monitor works progress
  - Support BIM development before reconstruction

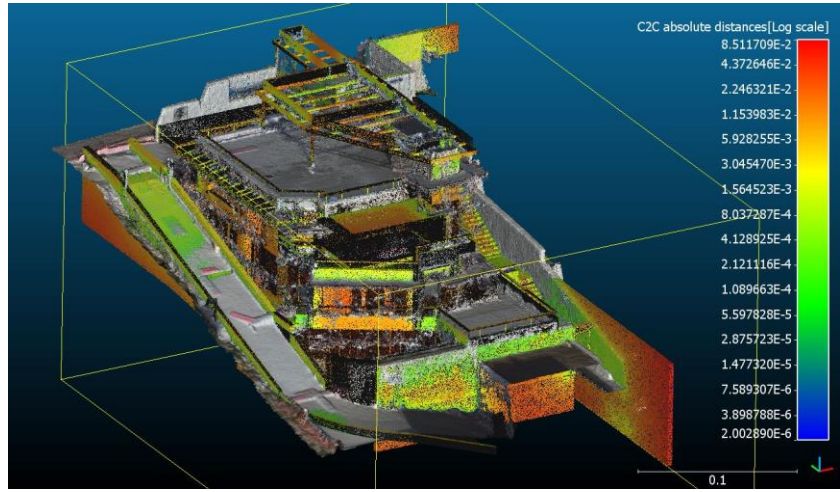
CANALE - POINT CLOUDS COMPARISON





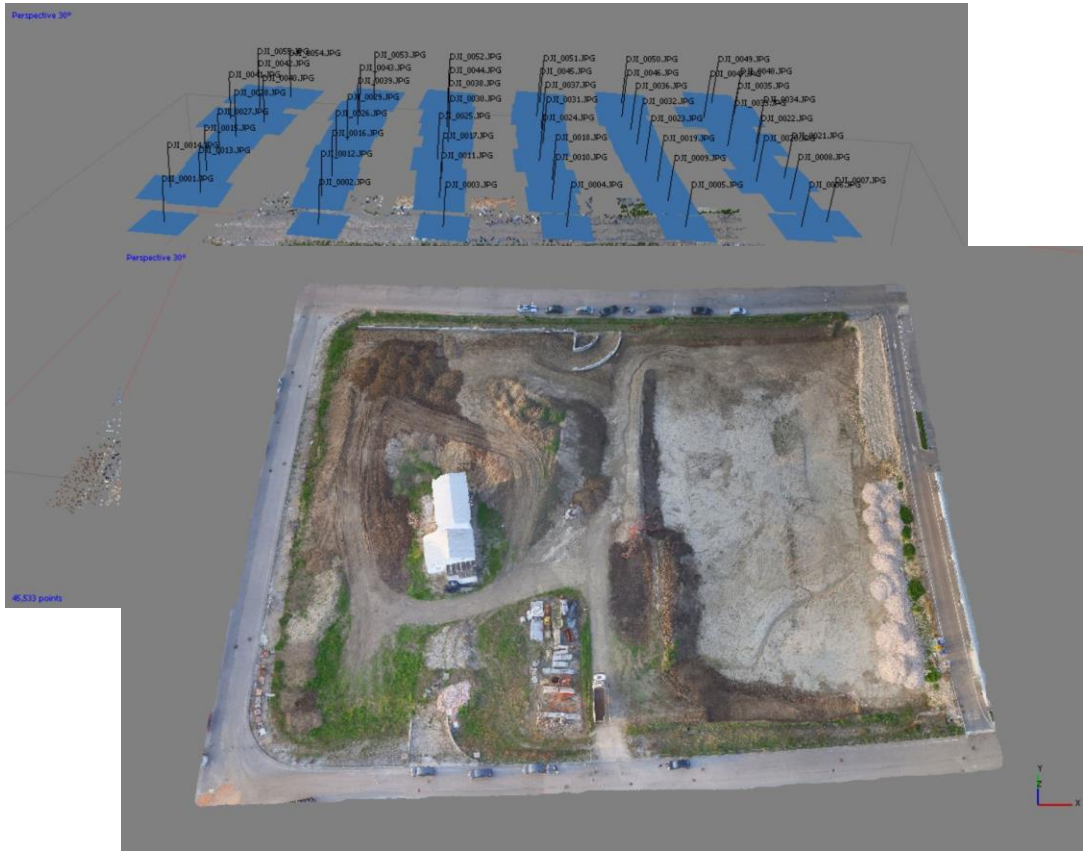






LOTTO 8 - 3D RECONSTRUCTION (UAV)

Outdoor Construction Site Progress: **LOTTO 8 (SAN SALVO) – START OF WORKS**



RESIDENTIAL BUILDING – 3D RECONSTRUCTION

VIA CADORE (PAVIA)

OUTDOOR: **UAV**

INDOOR: **MATTERPORT**

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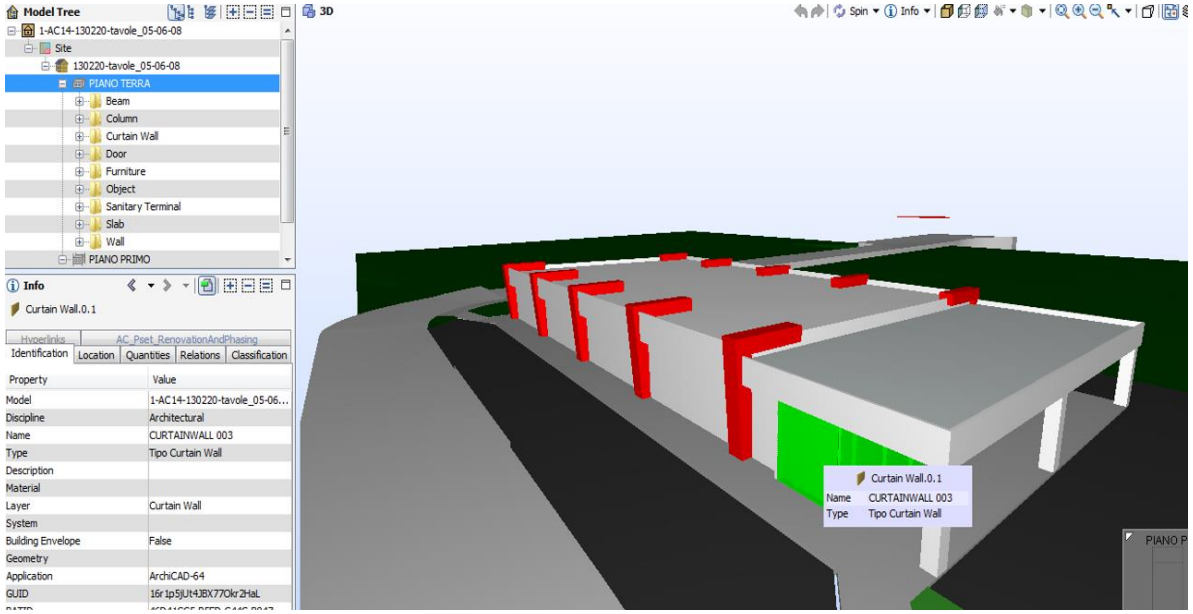
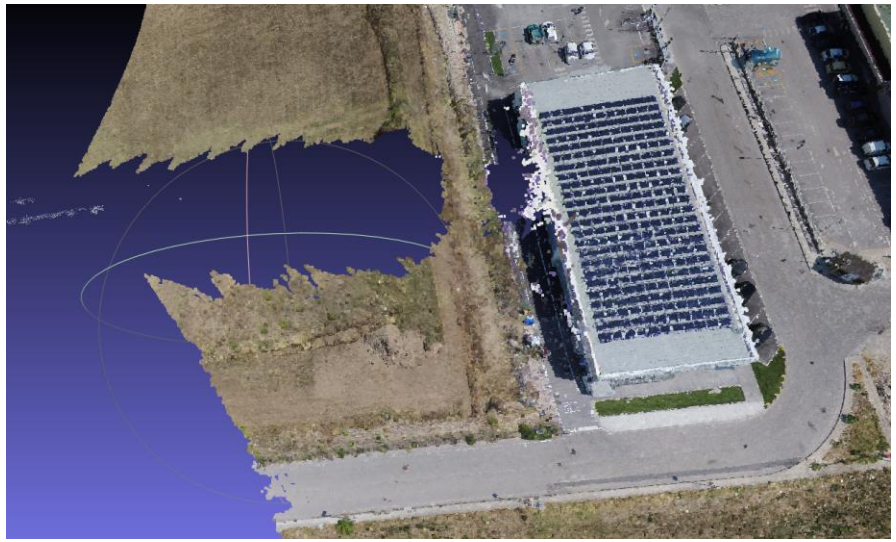
LOTTO 8 - COMPARISON (BIM vs POINT CLOUD)

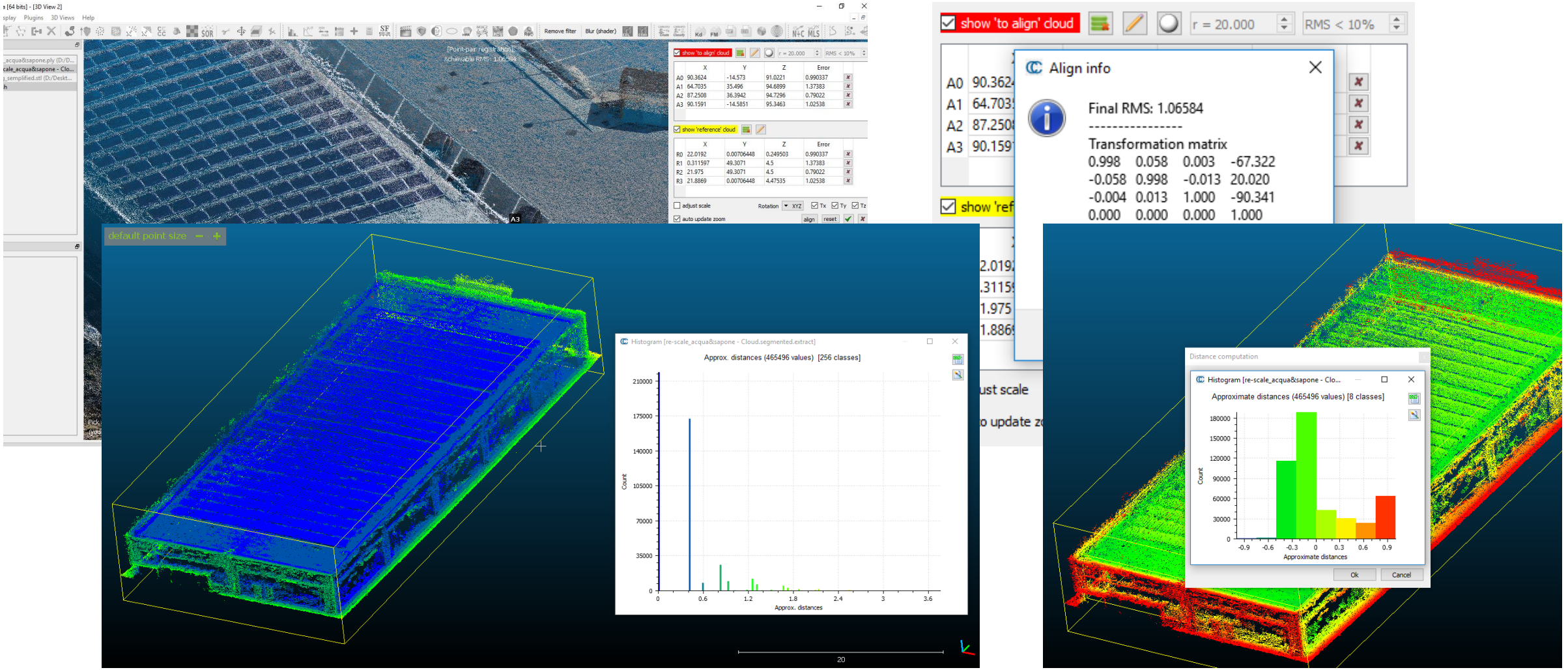
Building Model:

- “ACQUA & SAPONE” - Commercial building
- BIM vs Point Cloud (UAV) – Scope: ***progress checks***





LOTTO 8 - COMPARISON (BIM vs POINT CLOUD)



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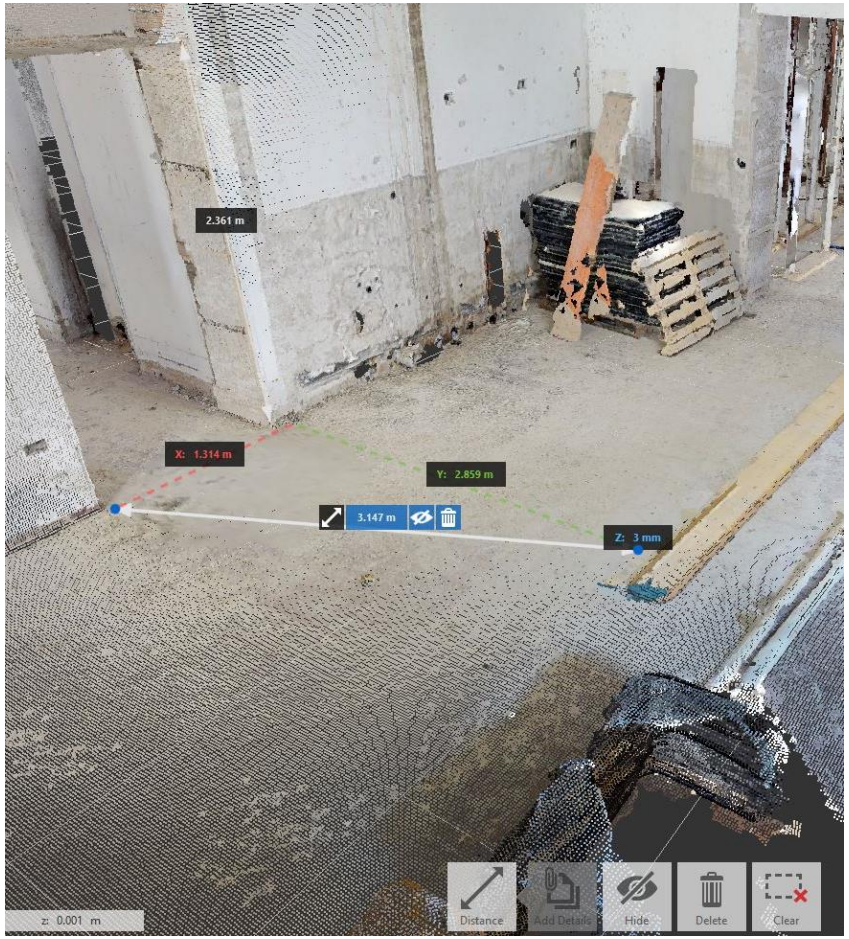
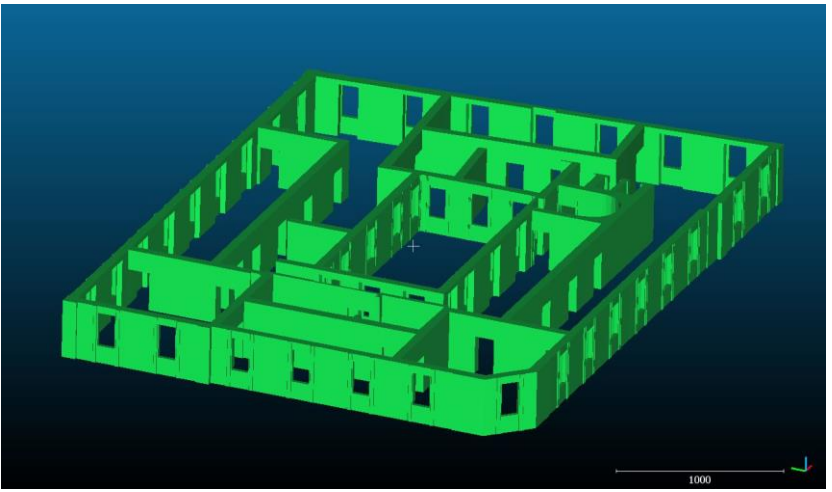
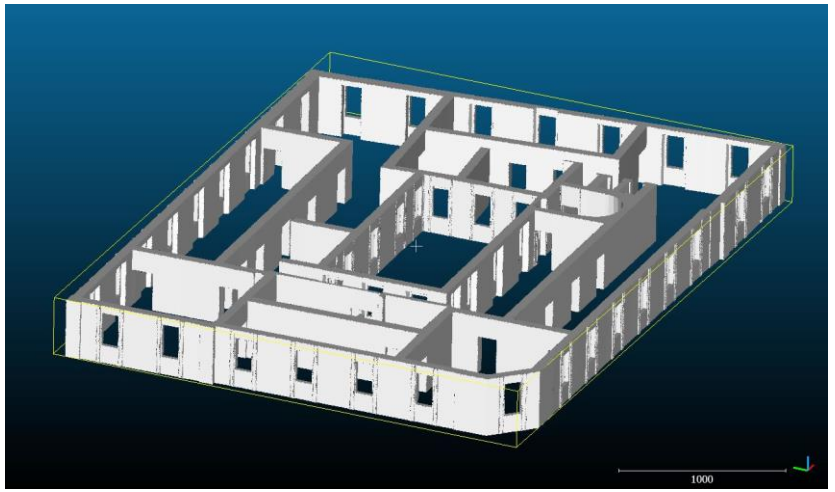
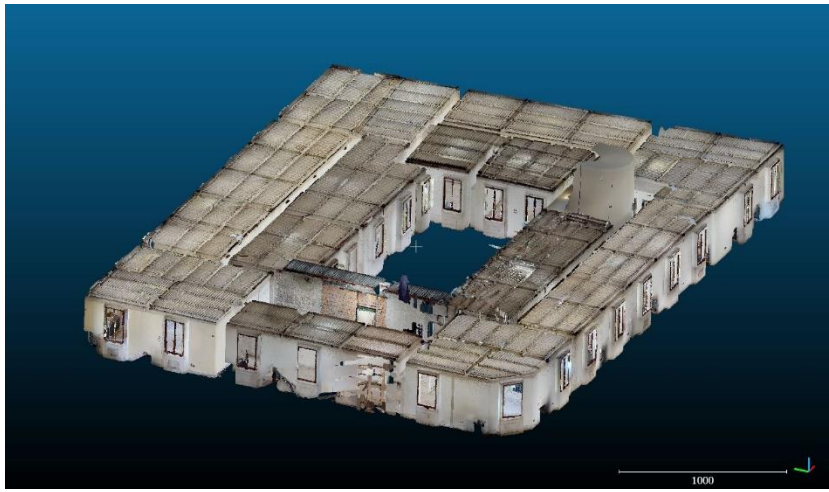
CNT - INDOOR RECONSTRUCTION

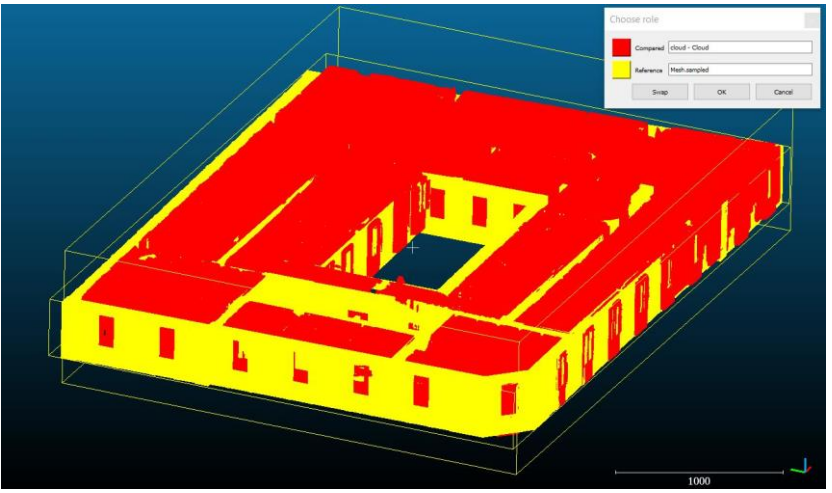


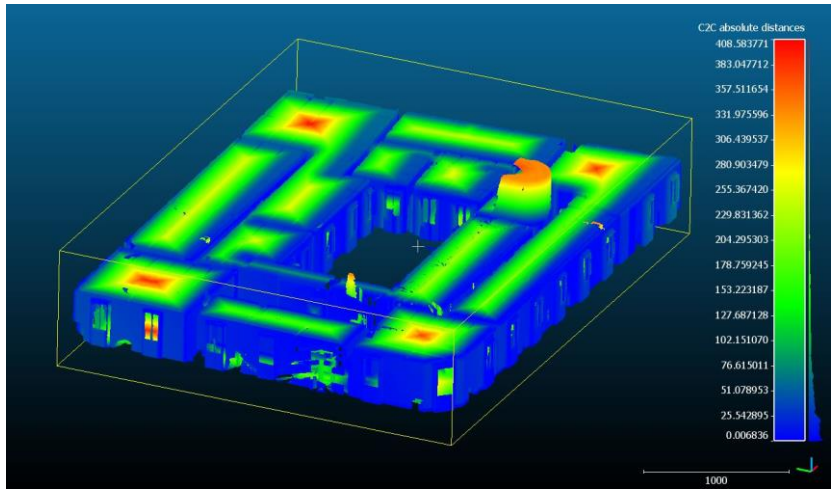
CNT - COMPARISON (BIM vs POINT CLOUD)

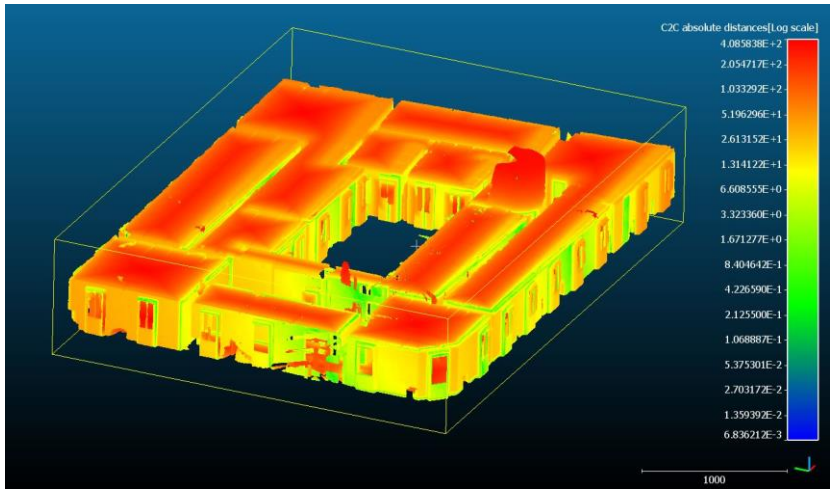




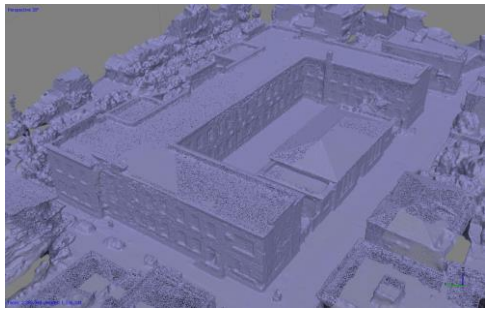








3D SURVEY – OTHER CASE STUDIES



CONCLUSIONS… waiting for matterport

Main results: 3D Point Clouds obtained from all the technologies tested (Drone, GoPro, 3D scanner, HoloLens and Google Tango):

	3D scanner	Drone	GoPro	HoloLens	Google Tango
Data acquiring time on site	Time consuming (< 1 cm)	Great (~10/20 mins)	Great (~10-20 mins) – depends on building dimensions	Real time 3D re-construction enabling the End User to gather a lot of geometrical information just "looking at" the screen.	
Post-processing time consuming	Depends on the amount of data to be processed from 1 hrs or less up to 1-2 days.				
Reconstruction accuracy	Very good (< 1 cm)	Great (~10 cm)		Good (~15-20 cm)	
User-friendliness	Special training needed (>1 day)	Little experience needed when using software (excluding Drone piloting).		Very easy to use	

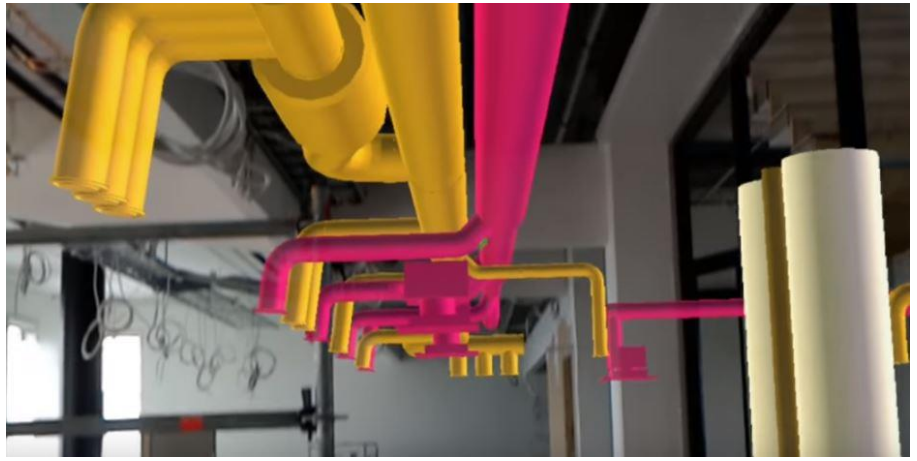
Conclusions and perspectives:

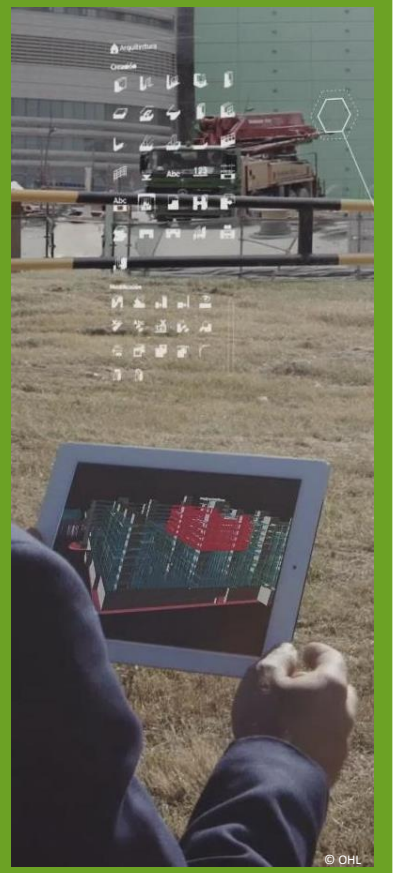
- Tests confirm the procedure / methodologies under development in WP4. Some improvements needed: more detailed flight/path plan when using Drone / GoPro techs.
- Tested device / technologies are different with respect to acquisition time, post processing time and output quality and hardware costs. The particular choice should be adapted to requirements of a particular task and the final purpose of the acquired 3D data.

3D SURVEY – MATTERPORT

matterport®

3D SURVEY – FUTURE DEVELOPMENTS





Thanks for the attention

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