

FIG

FIG WORKING WEEK 2017

Helsinki Finland

29 May - 2 June 2017

Presented at the FIG Working Week 2017,
May 29 - June 2, 2017 in Helsinki, Finland

3d model of underground canal "Aposa" Bologna

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Surveying the world of tomorrow -
From digitalisation to augmented reality

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Bologna's overview

- Wider Historical City Centre in the World
- Longest Arcade in the World
- Towers
- Oldest University in the World
- Great cuisine
- Waterways



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Aposa

- The only natural waterway running underneath city centre
- Covered mainly with masonry vault
- Open public sewer till 1990s
Now the public sewer is a closed system
- After maintenance works was opened to Tourism visits
- Now is closed to public



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Municipality main needs on Aposa

- Knowing where are the private insertions in public sewer and whom belong
- Tourism office wants to open to visits again
- Security sector needs to verify structure before open to public again



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Which solution to their problems?

- GIS for sewer private insertion
- Virtual Tour
- Cross sections of tunnel and above surroundings

Georeferenced 3d virtual environment?



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Environment Analysis

- Mainly masonry built vaults
- Some arches along the path
- No regular tunnel section
- Different water level and risk of its sudden growth
- Only some sectors a adequately illuminated



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Methodologies Analysis

- **Close Range Photogrammetry**
 - Near 200 camera positions
 - 8-10 pictures from every positions
 - Water level
 - Low illumination
 - Drift



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Methodologies Analysis

- **Terrestrial Laser Scanner**
 - Near 100 stations (2-10 mins per scan)
 - Hi relative accuracy
 - Water level
 - Low illumination
 - Drift



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Methodologies Analysis

- **Mobile Laser Scanner**
 - Very rapid data acquisition
 - Concern about relative accuracy
 - Water level
 - Low illumination
 - Drift



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Methodologies Analysis

- **Common issues to face**
 - Low Illumination
 - Water Level
 - Drift



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Preliminary tasks

- **Georeferencing survey markers and checkboards**
 - Two polygonal with Total Station
 - Static GNSS positioning of starting and ending survey markers on ETRF2000



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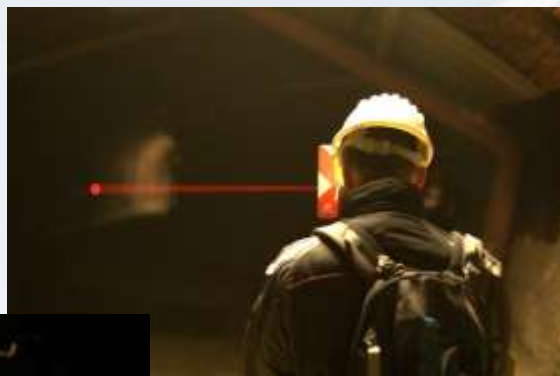
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TLS survey

- Topcon GLS-2000
- Z+F 5010
- Leica P30



MLS survey

- Gexcel Heron
- 3d Target Scanfly backpack



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Trimble



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First results

- TLS
 - a complete underground reflectance only point cloud
 - small full RGB point cloud zones
- MLS
 - only partial data was delivered
 - some fly trough video



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Bologna's city centre



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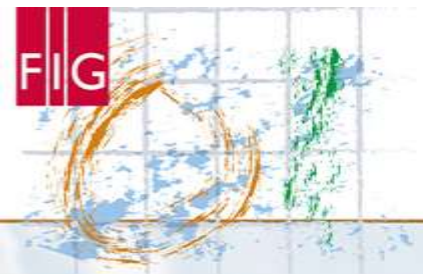


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Private insertion

Closed system sewer



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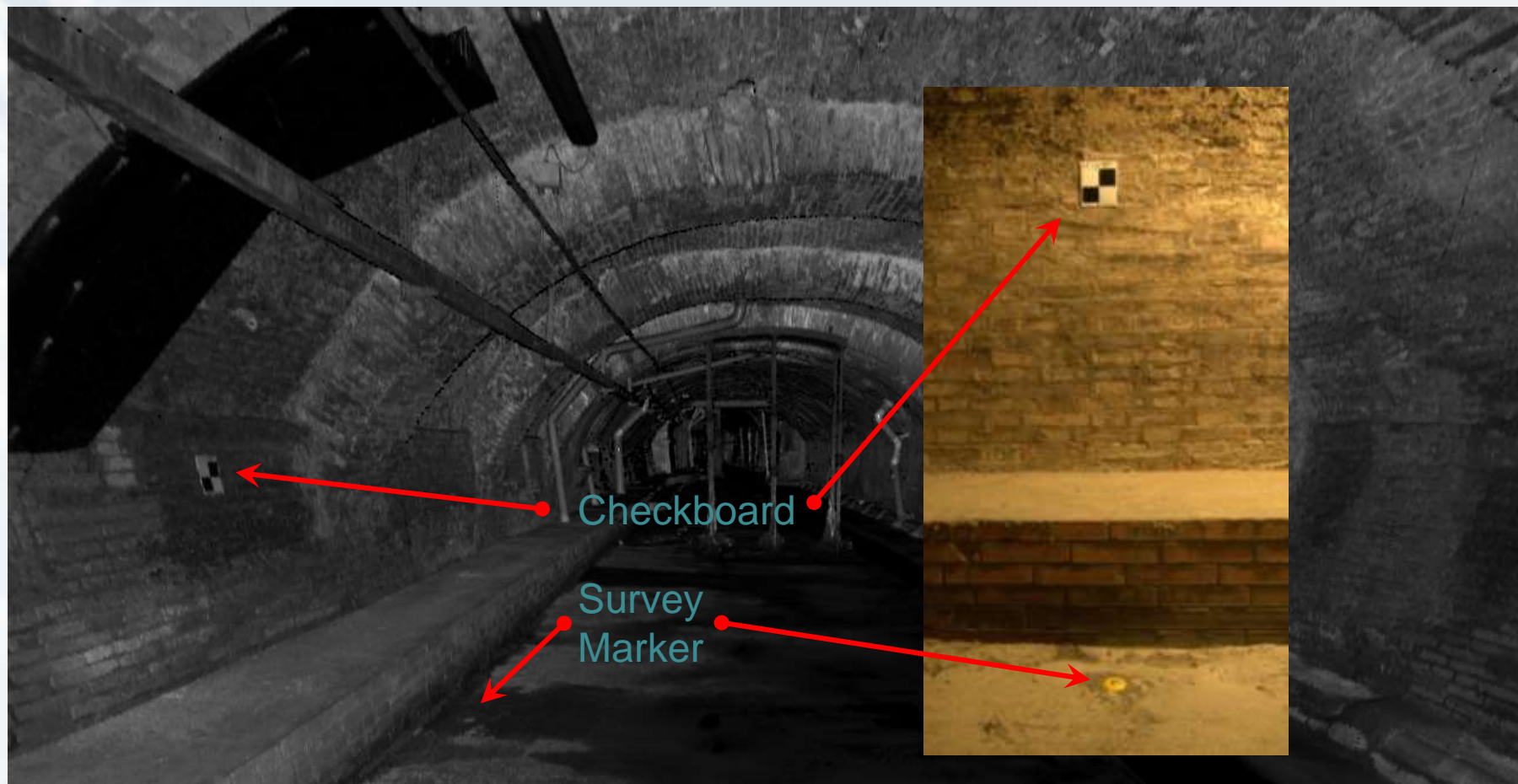


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Compliance with aims of project

- Georeferenced 3d environment ✓
- GIS for sewer private insertion (*Work in Progress*)
- Virtual Tour (*Work in Progress*)
- Cross sections of tunnel and above surroundings (*Work in Progress*)



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Conclusions

- A correct illumination is mandatory to reach our goals
- Drift correction successful due to reference points trough the path
- At the moment TLS fits better the purpose
- Water is still a problem for data losses and security reasons



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Next steps

- Acquire a full RGB point cloud (linked to lighting solution)
- Plan the scanning of above environment
- Augmented reality environment creation
- *learn how to stop water!*



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Geometri e Geometri Laureati



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di Bologna



Thanks for your attention!



Many thanks to Geomatics Commission of Collegio Geometri e Geometri Laureati di Bologna

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