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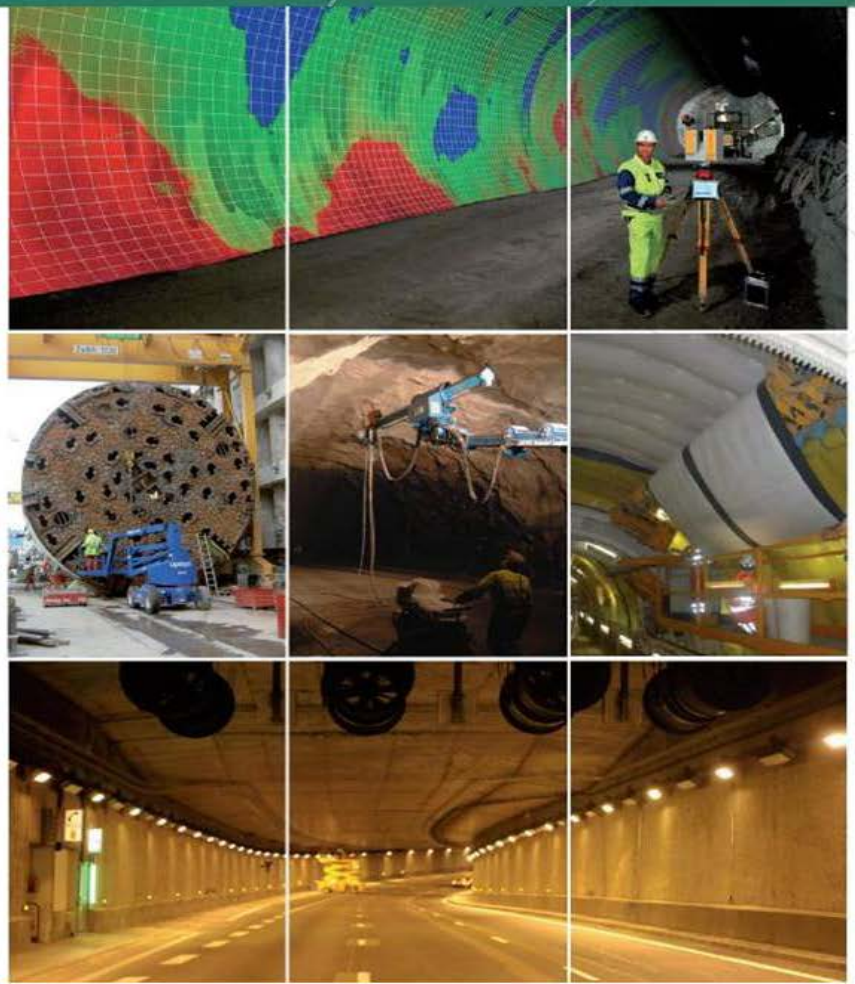
MONITORING



AG Monitoring – Current Members

Currently the following companies are members of the AG ‘Monitoring’

- itmsoil, France
- Soldata, France
- Geodata, Austria
- Amberg Technologies, Switzerland
- Babendererde Engineers, Germany
- Astrium Services, Germany
- Seli s.p.a, Italy
- Tre , Italy

Further members are welcome.

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AG MONIORING – SELECTED TOPICS

Sub AG1: frequency of measurements (urban tunnels, soil) / TBM parameters

- typical specifications for designers

Sub AG 2: Information and communication systems

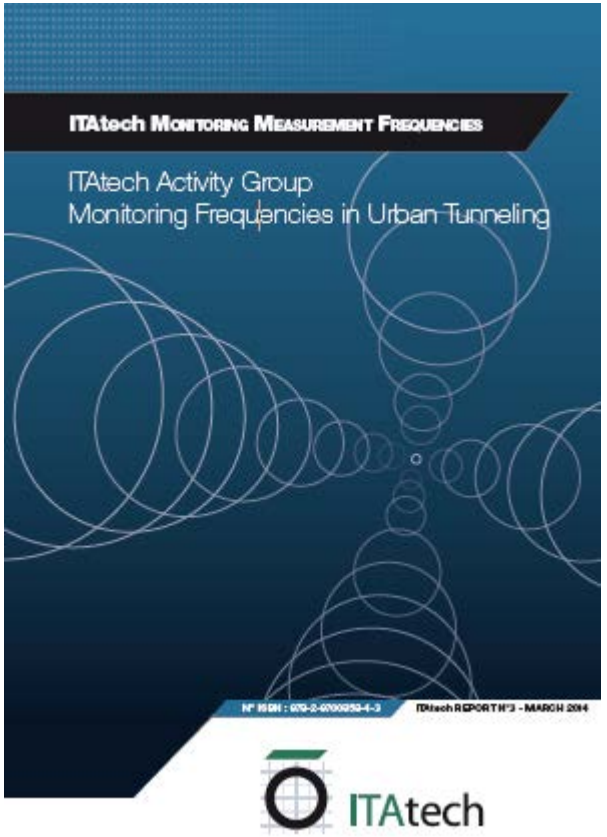
- plug and play system for all data on a site: basic vision

Sub AG 3: remote measurements (air borne measurements / scanning)

- state of the art, recommendations for application…

Sub Group 1: Frequencies of Measurements

- Guideline finalised and printed



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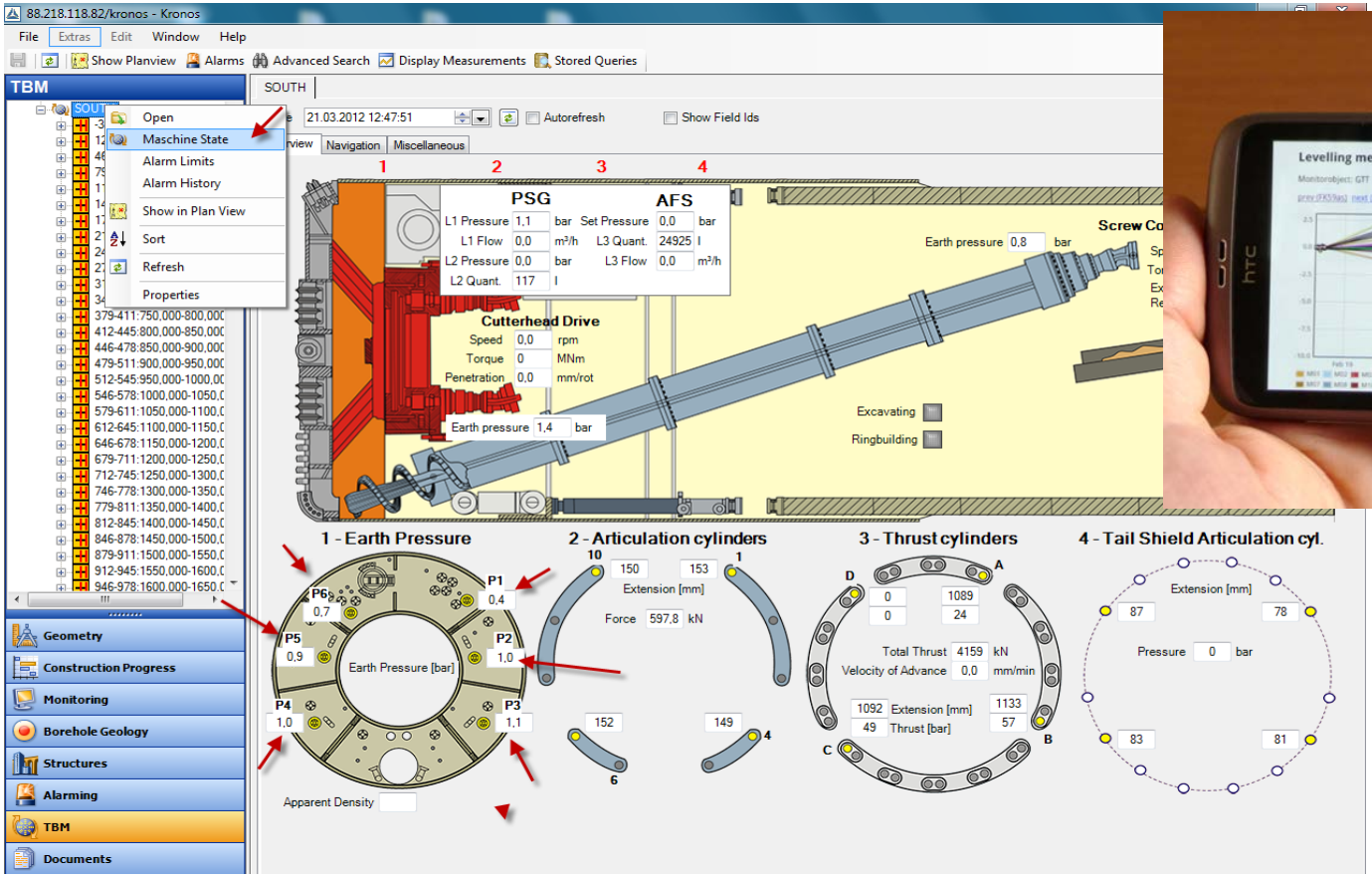
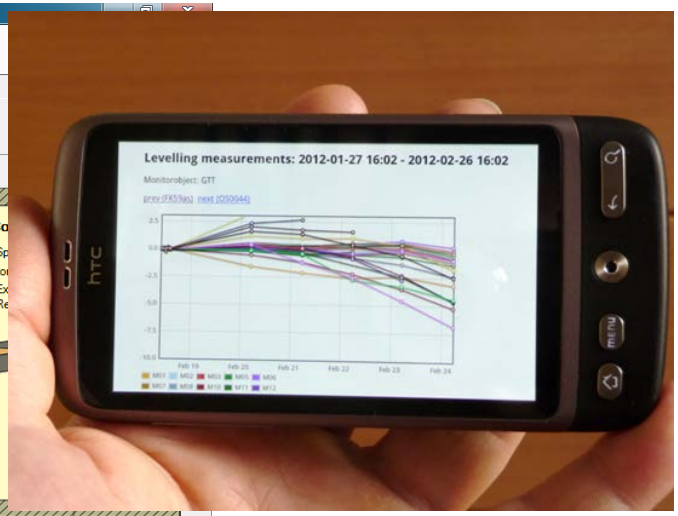
AG MONITORING – SUB GROUP 2





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AG MONITORING - SUB GROUP 2

Work done

- Preparation of a first draft report
- Input from other AG members expected

Activities have been put on hold due to lack of interest from the AG members

Topics

- Report of ITA WG 2 on Monitoring (2011) is a valuable state of the art report on monitoring during construction infrastructures
- Not covered topics in the reports
  - New innovative technologies which are today already in use
- Topic of the subgroup: Remote Measurements
  - Todays misunderstanding of the benefits of these ‘new’ Technologies
  - Guidelines and project examples
  - Possible combination of the ‘new’ Technologies with traditional methods
  - Guidelines of the possible accuracy of these systems
  - Lesson learnt from todays project

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AG MONITORING – SUB GROUP 3

System	Specifications/discussions	Decision for paper	
InSAR (Interferometric synthetica aperture radar), PSInSAR	▪ Satellite based or terrestrial SAR (Synthetic Aperture Radar)	▪ Analysed in stage one	
Laser Scanning	▪ Complete area based settlement analysis with laser scanner ▪ Laser beams followed by a distance and angle measurements (up to 1Mio. points/sec.)	▪ Analysed in stage one	
Reflectorless Measurements	▪ Low cost laser scanner or total station systems ▪ Measuring cross section or a fix raster without placing any targets on the surface	▪ Analysed in stage one	
Photogrammetry	▪ Close range photogrammetry ▪ Often used in metrology today	▪ Not analysed in phase one	

Optical surface measurements methods	▪ Different technologies available
	  ▪ Bar projection (triangulation)
	  ▪ Multiple point projection
		▪ Not analysed in phase one	

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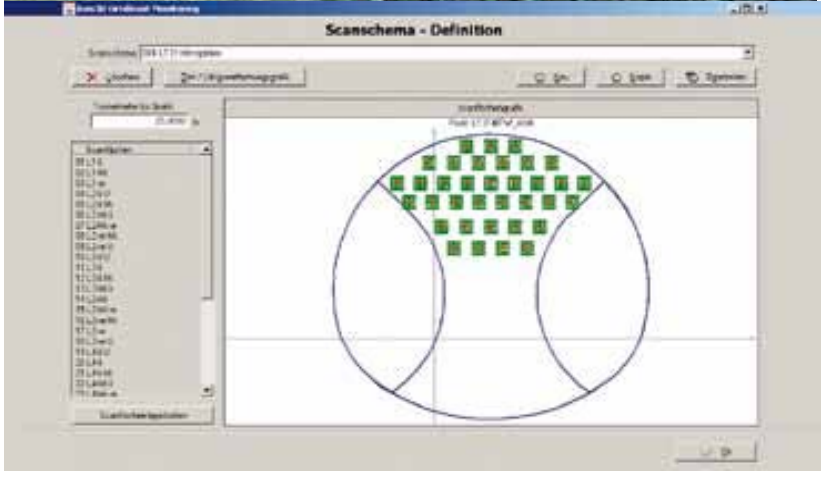
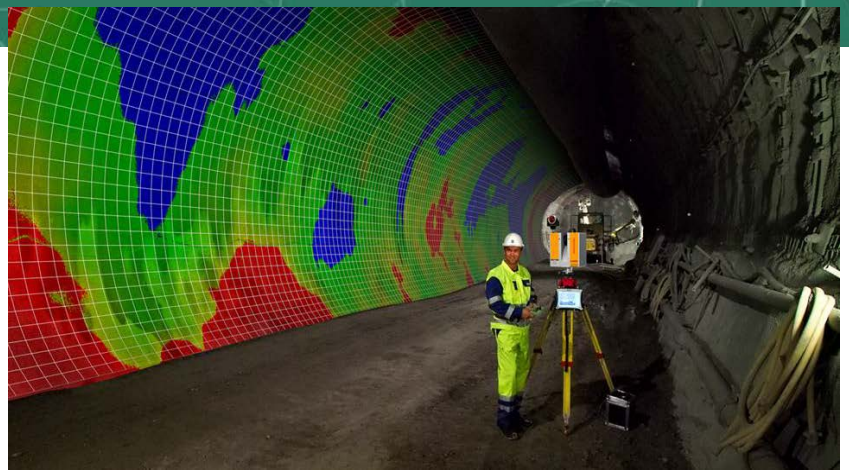
AG MONITORING – SUB GROUP 3

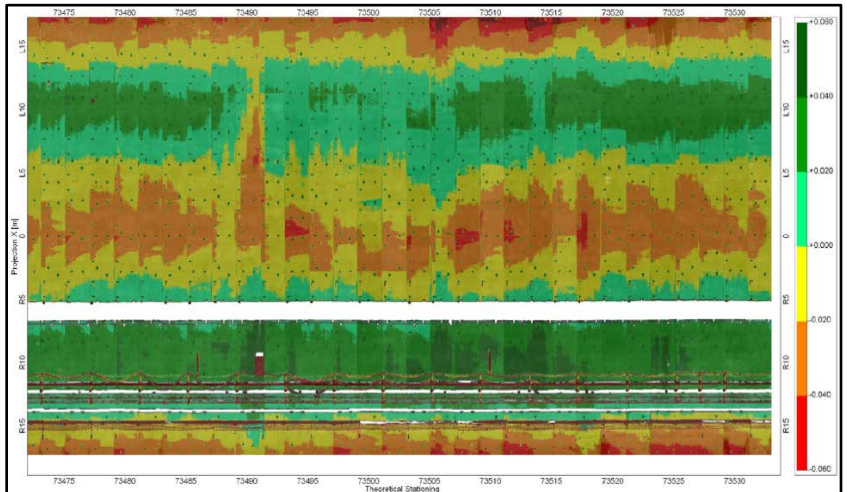
- Reflectorless Measurements
  - A remote monitoring system able to measure surface deformation 24 hours/day
  - Robotic Total station equipped with a reflectorless distance meter
  - Data logger, communication box, processing SW for comp.
- Main advantages
  - Uninterrupted traffic, neither for installation nor for taking readings
  - Very cost effective for high frequency of readings



AG MONITORING – SUB GROUP 3

- Laser Scanning
  - Deflection of laser beams (reflectorless measurements)
  - Rotating mirror ends up to 1 Mio points/sec.
  - No installation on the monitored object/area
- Main advantages
  - Complete deformation analysis of the structure
  - Laser scanning technologies gets more affordable
  - Little interruption of the heading process





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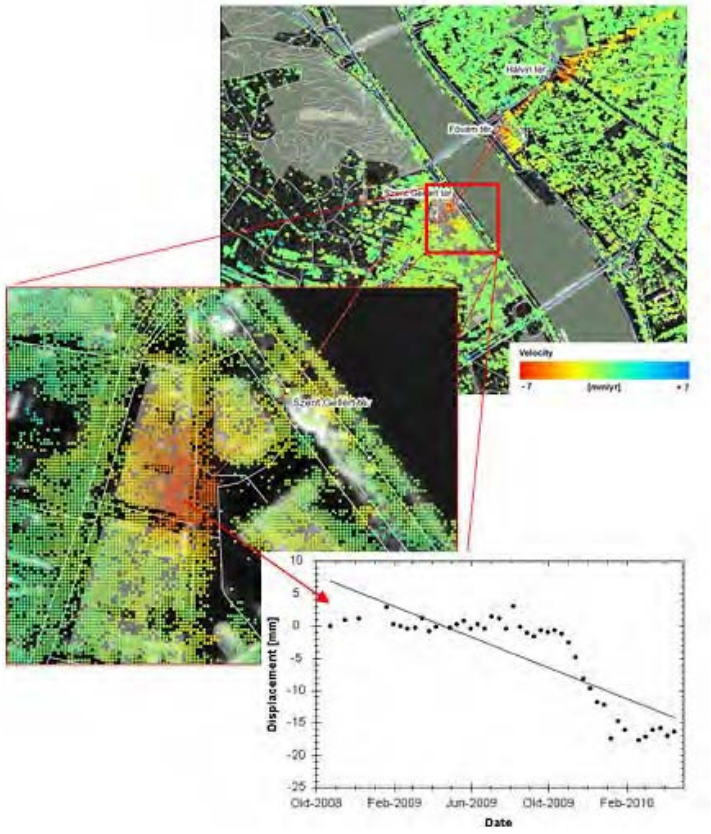
AG MONITORING – SUB GROUP 3

- InSAR
  - Satellite based or terrestrial SAR (Synthetic Aperture Radar)
  - Covers a big area of an underground project
  - Remote Monitoring system which measures in a time frame of weeks
- Main advantages
  - Complete deformation analysis of a bigger perimeter than just the active zone
  - Precision reached in millimetres



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AG MONITORING – SUB GROUP 3

Work Done

- Daft Guideline ready
- Review of guideline within AG Group
- Sent to ITA WG 2
- Peer review to be defined at WTC 2014 ITA Tech SB meeting
- Publication of Guideline (4. quarter 2014)