

COST Action TU1202
Impact of climate change on engineered slopes for infrastructure



3rd WG2 Meeting
 London, United Kingdom
 13 May 2014

In attendance: Nichos Michas, Harry Saraglou (HS), Chris Wooff, Joel Smethurst (JAS), Razvan Gheorghe, Stanislav Lenart, Brendan O’Kelly, Paul Callender, John Van-Esch, David Gunn, Jamie Standing

Apologies: Paul Hughes, David Hughes, Neil Dixon, Sarah Springman, Gilles Grandjean, Hjordis Lofroth.

<p>Introductions from new members, and presentation</p> <p>As a number attending the meeting were new to the Action, and others had not been at the opening meeting in Newcastle, those members were asked to give a short PowerPoint presentation about their work. Brendan O’Kelly, Paul Callender, Stanislav Lenart, and Razvan Gheorghe gave brief (10 minute) presentations.</p> <p>Chris Wooff from Network Rail gave a 30-minute presentation providing an asset owners perspective on instrumentation and monitoring.</p>	
<p>Outputs from the WG</p> <p>1. Monitoring forms</p> <p>Joel Smethurst (JAS) circulated the monitoring forms that had been received before 09 May 2014. In total, and including those received just before the meeting, monitoring forms for 12 no. sites have been received, covering France, United Kingdom, Sweden, Greece and Slovenia. JAS encouraged further completed forms – details of site and references will be helpful in writing the SOTA review paper.</p> <p>2. SOTA Review</p> <p>Joel Smethurst gave a short presentation covering the decisions that had been made at the recent Management Committee (MC) meeting in Paris on the SOTA review papers, and the history and current thoughts on the WG2 paper. This included the draft paper structure, which had been circulated prior to the meeting.</p> <p>Comments were invited on the proposed paper structure. The following points were discussed:</p> <ul style="list-style-type: none"> • A paper title of: ‘A review of the role of instrumentation and monitoring in 	<p>All</p>

<p>the performance of infrastructure slopes' was agreed</p> <ul style="list-style-type: none"> • JAS said that Hjordis Lofroth had suggested prior to the meeting that Section 2 within the paper ('Applications for instrumentation and what to monitor') could be divided into two clear sections, rather than being merged (one on applications for instrumentation, and a second section on what to monitor). It was generally agreed this seemed sensible. JAS to change proposed structure. (Note: the structure presented is given in appendix to these minutes). • JAS pointed out that decision making and communication strategies are mentioned in the Memorandum of Understanding (MoU), but not currently included explicitly in the paper structure. It was felt that this could be included in Section 4. Paul Callender asked whether Sections 3 and 4 could be merged, as handling large volumes of data is a fairly recent issue caused by better instrumentation and datalogging. JAS to consider these changes and update proposed paper structure. • Building Information Management (BIM) was discussed. This framework for managing and modelling information could be included as a brief discussion point in the paper. Stanislav Lenart offered to consider and write a short section on this, as appropriate. • Links should be made in the paper to models and modelling – for example, comparing monitoring results with initial conceptual and numerical models. It was agreed that this was a good idea, and should provide links to other WG papers (WG 1 and 3, in particular). JAS to incorporate into the paper structure and discuss with WG 1 and WG3 leaders. • The paper should include a discussion of the aims of the monitoring from an asset management perspective. Climate change is also important, and monitoring approaches and aims need to be placed in the context of climatic change. The extremes of climate (from dry and fairly arid, to permafrost) should also be incorporated – these present a different range of problems and mechanisms. Can we include a brief discussion of data, and who owns the information, and how it may be shared? JAS to consider how all of these can be incorporated. 	<p>JAS</p> <p>JAS</p> <p>JAS</p> <p>JAS</p>
<p>Discussion on who would be prepared to contribute parts of the review paper.</p> <ul style="list-style-type: none"> • Paul Callender agreed to lead on new instruments and innovation (the current Sections 3 and 4, which could be merged). • Stanislav Lenart to consider a part on BIM and technology. • Chris Wooff agreed to take on Section 5. • Joel Smethurst to write Introduction (Section 1). • Still looking for people to lead on Sections 2 (Applications for monitoring, and what to monitor); and Section 6 (Summary, Conclusions). We are also looking for other volunteers within WG2 to contribute smaller parts to all above sections of paper. JAS to ask for further volunteers from the members of the WG not at the meeting in London. 	<p>JAS</p>
<p>3. Brainstorming session for SOTA Review</p> <p>Two questions were considered:</p>	

- What are the novel instrumentation/new monitoring technology that we should incorporate in Section 3 ?
- The future – where does instrumentation and monitoring go next (Section 5.)?

A brief summary of the main points from the group sessions on these are given below:

What are the novel instrumentation/new monitoring technology that we should incorporate in Section 3?

Innovative/novel sensors:

- 3D scanning of the ground (e.g. ERT)
- MEMS based sensors (e.g. Shape Array)
- Micro-strains acoustics (ALARMS project)
- Wireless sensor networks (in meshes or grids)
- Distributed fibre optic sensors
- Satellite (ESA-Gallileo, and passive radar systems)
- RFID tag systems
- Modular multi-sensor systems (e.g. ARDUINO).

Novel features that sensors should/could incorporate:

- Rapid data output (high bandwidth)
- Non-contact (wireless)
- High resolution
- Inclusion of spatial and temporal information
- Higher on-board processing
- Small (use of micro-/nano-technology)
- Provision of real time information
- Measurement of smaller/larger sample volume
- Low energy/long battery life
- Reliable (1. Robust for use/environment; 2. Provide accurate data with low errors)
- Event activation

The future – where does instrumentation and monitoring go next (Section 5.)? The trends could be:

- Cheaper, smaller, more discrete points (or less discrete points, such as fibre monitoring)
- Better reliability
- Reducing use of expensive holes via other techniques (satellite techniques, laser scanning, other non-destructive techniques)
- Can we do better on difficult parameters – soil stiffness, permeability (links to model), evapotranspiration
- Can we do better with some techniques (such a difficulties encountered with GPR)?

Short-term scientific meetings

<p>John Van Esch from Deltares gave a presentation outlining the STSM in which John was hosted by David Gunn from BGS in late September 2013. A written report on the STSM has been received and will be added to the website.</p> <p>Three potential further STSMs were considered. Harry Saraglou would like to visit Sarah Springman and her colleagues at ETH Zurich. Chris Wooff would like to visit Kristine Flesjo's team in Norway. And a reverse of the completed STSM above, seeing the BGS visit Deltares, was also suggested. None of these have resulted in firm proposals yet, and JAS and HS to encourage further development of ideas to firm proposals.</p>	<p>JAS and HS</p>
<p>Next workshop</p> <p>To be held in Lisbon in October. A Doodle poll has been circulated by PH with a range of possible dates in October, and the final dates should be announced shortly. (Note, dates now agreed – 22nd to 24th of October).</p> <p>The possibility of meeting again as a working group before Lisbon to progress the SOTA review was discussed. It was decided to see how contributions and the paper progressed before considering a further meeting.</p>	<p>JAS</p>

Joel Smethurst 22/07/2014

Appendix 1: Proposed SOTA Review paper structure presented at the meeting

Paper structure:

1. Introduction

- Introduction to the problem (paragraphs to set the scene: type of slopes, impact of failure, need for monitoring)
- Applications for monitoring (to introduce the range of applications that monitoring may be used for – research, condition monitoring, early warning, risk management)
- The current challenges for monitoring (cost, reliability, data handling, knowing what to monitor and how to do it)

2. Applications for instrumentation and what to monitor

- Applications (a more in depth discussion of the differing applications/uses for instrumentation in slopes)
- What to monitor (some comments on advantages and disadvantages of monitoring common parameters for differing applications)

3. New instruments and innovation

- To describe recent advances in instrumentation and monitoring, and some of the new technologies being developed. Comments on how these may be starting to reduce cost and provide greater quality of data.

- Comments on acceptance of new technology
4. Managing and handling data
- Advances due to better datalogging, IT and web-based technologies
 - Current challenges (automation, reliability, can we do real time?)
5. The future – where do we go next?
- Comments on how new technology described in 3. above may influence our ability to monitor slopes, and brief discussion of the challenges and difficulties that will be forthcoming from new technology (e.g. ever greater amounts of data)
 - Futuregazing – where do we want to get to?
6. Summary/conclusions
- Recommendations for monitoring
 - Thoughts on future technology

Appendix 2: Current list of participants in WG2 – updated 18 March 2014

Participant	Affiliation	Email	Country	Research
Brencic, Mihael	Department of Geology	mihael.brencic@geo.ntf.uni-lj.si	Slovenia	Slope monitoring Landslide hazard Climate change
Dixon, Neil	Loughborough University	N.Dixon@lboro.ac.uk	United kingdom	Monitored slopes Acoustic monitoring
Gheorghe, Razvan		Razvan_25_ageo@yahoo.com	Romania	
Grandjean, Gilles	BGRM	g.grandjean@brgm.fr	France	Geophysics. Monitored slopes including long datasets
Gunn, David	British Geological Survey	dgu@bgs.ac.uk	United Kingdom	Resistivity monitoring Asset management
Hughes, David	Queens University Belfast	d.hughes@qub.ac.uk	United Kingdom	Monitored slopes Embankments on peat Laser scanning
Hughes, Paul	Newcastle University	paul.hughes@ncl.ac.uk	United Kingdom	BIONICS embankment Laser Scanning Wireless systems
Länsivaara, Tim	TUT	tim.lansivaara@tut.fi	Finland	Full scale testing Limit equilibrium Eurocodes

Participant	Affiliation	Email	Country	Research
Lenart, Stanislav	Slovenian National Building and Civil Engineering Institute (ZAG)	Stanislav.lenart@zag.se	Slovenia	Slope and dam monitoring
Libric, Lovorka	University of Zagreb	llibric@grad.hr	Croatia	Resistivity measurements
Lofroth, Hjordis	Swedish Geotechnical Institute	hjordis.lofroth@swedgeo.se	Sweden	Monitoring, TC431
Lu, Chi Wei	Research Centre for Advanced Engineering Construction	cwlu@nkfust.edu.tw	Taiwan	Landslide monitoring
Lucas, Daisy	ETH Zurich	Daisy.lucas@igt.baug.ethz.ch	Switzerland	Field instrumentation for monitored slopes
Mafti, Raluca	Geological Institute of Romania	mafteir@yahoo.com	Romania	Geo-hazards and mapping
Michas, Nichos	Athens University	michas@tee.gr	Greece	Rockfalls and rock hazards
Neata, Gheorghe		office@geo-serv.ro	Romania	
O'Kelly, Brendan	Trinity College Dublin	bokelly@tcd.ie	Ireland	Monitoring and pile stabilisation of slopes
Saroglou, Harry	NTU Athens	saroglou@central.ntua.gr; c.saroglou@imperial.ac.uk	Greece	Monitored slopes Optical fibres
Smethurst, Joel	University of Southampton	J.A.Smethurst@soton.ac.uk	United Kingdom	Monitored slopes Instrument development
Springman, Sarah	ETH Zurich	sarah.springman@igt.baug.ethz.ch	Switzerland	Monitored sites Full-scale testing Centrifuge modelling Prevention measures
Van Esch, John	Deltares	John.vanesch@deltares.nl	Netherlands	Monitoring of engineered slopes
Wooff, Chris	Network Rail	Chris.Woof@networkrail.co.uk	United Kingdom	Large number of monitored sites Site repair Alarm levels