COST
Domain Committee TUD

COST Action TU1202
Start Date 04/10/2012

Impact of climate change on engineered slopes for infrastructure

MONITORING PROGRESS REPORT

Reporting Period: *from 04/10/12-25/05/13*

This Report is presented to the relevant Domain Committee.
It contains three parts:

I. Management Report *prepared by the COST Office/Grant Holder*
II. Scientific Report *prepared by the Chair of the Management Committee of the Action*
III. Previous versions of the Scientific Report*; i.e., part II of past reporting periods*

The report is a "cumulative" report, i.e. it is updated annually and covers the entire period of the Action.

Confidentiality: the documents will be made available to the public via the COST Action web page except for chapter *II.D. Self evaluation*.

Based on the monitoring results, the COST Office will decide on the following year's budget allocation.

Executive summary (max.250 words)

TU1202 started on the 4th of October 2012. Since then it has expanded to a current total membership of over 60 from 17 COST countries. Membership is still expanding and recently we have added representatives from the US and we are in negotiations for further international members to join from Taiwan and Hong Kong.
The first official management committee took place on the 7th of March 2013 at which the final working group leader roles were filled as was the position of website co-coordinator and vice chair. The management committee added to the detail of the overall Action workplan (as detailed in the MoU) with destinations and theme for forthcoming workshops agreed. A core group of chair/vice chair/working group leaders has been firmed to help push the agenda along and guarantee Action objectives are met.
The first workshop was held on the 8th of March 2013 at which all working groups were present. The workshop provided an opportunity for Action members to get to know one another and to begin to build collaborative partnerships. Output/activities agreed at the workshop included the creation of a register of landslide datasets and a number of STSMs were scoped out to be carried out later in the year.
The next Action workshop will take place in Romania in October 2013 the planning of which is now well underway – it is hoped that by this point the first two STSMs will be complete and will be ready to report back to the Action.

I. Management Report *prepared by the COST Office/Grant Holder*

I.C. Overview activities and expenditure

(year) Budget

Total Action Budget:
Remaining Action Commitment:

Meetings

Meeting Type	Date	Place		travel	Local organiser			Cost	Total
Steering meeting	7/03/12	Newcastle		19240					19240
workshop	8/03/12	Newcastle		23400	1800				**25200**
Core group	12/07/12	Paris		7000					**7000**
Steering meeting	21/08/12	Romania		19240					**19240**
workshop	22/08/12-23/08/12	Romania		25200	1800				**25200**

95880

STSM

Beneficiary	Date	Place					Cost	Total
K Martinovic	TBC	Dublin					2500	**2500**
J Van Esch	TBC	Keyworth					2500	**2500**
TBC	TBC	TBC					2500	**2500**
TBC	TBC	TBC					2500	**2500**

10000

Current projected spend
105880

II. Scientific Report

II.A. Innovative networking

The first workshop for TU1202 was held on March 8th in Newcastle upon Tyne, United Kingdom. All 4 working groups attended. Reports from each of the working groups are attached in the Annex and outputs from the workshop are summarised below

- *Innovative knowledge resulting from COST networking through the Action.*
    - At the first workshop systems for sharing of valuable datasets has been agreed, these are;
        - Full scale monitored slope datasets
        - Laboratory/soil/climate/vegetation data.
    - Plans were made for the definition of 2 benchmark slopes to be studied with different numerical approaches in order to identify the limits and benefits of each technique.

- *Significant scientific breakthroughs as part of the COST Action.*
    - The Action has been fully active since March 2013 and whilst we have not made "scientific breakthroughs" in the following 3 months we have initiated 2 STSMs targeted at improving slope monitoring technology and numerical analysis.
- *Tangible medium term socio-economic impacts achieved or expected.*
    - *The workshop was attended by a number of asset owner/stakeholders who have engaged in the planning process and will be helping ensure the Actions have relevant socio economic outputs.*

- *Spin off of new EC RTD Framework Programme proposals/projects.*
    - *Potential new framework proposals will be an Agenda item at the next workshop to be held in Romania in October 2013.*

- *Spin off of new National Programme proposals/projects.*
    - Two national projects led by or involving members of the Action MC will be starting in July 2013.
        - Infrastructure slopes: Sustainable management and resilience assessment (iSMART) EPSRC UK funded project - grant value £2m.
        - Assessing the Underground (ATU) EPSRC UK funded project - grant value £5m.

    - A further project proposal has been submitted in May 2013 for a potential start date of September 2013.
        - Assessing Critical Infrastructure Vulnerability: earth structure degradation due to extreme weather events (ACTIV) Royal Society UK – grant application value £20k

II.B. Inter-disciplinary networking

TU1202 has only been fully active since March 2013 and as yet no workshops have been co-hosted with other Actions. However, within TU1202 a number of different scientific disciplines are represented and have taken part in the initial workshop, these include Geologists, Geotechnical engineers, civil engineers, geophysicists, industry asset owners, biologists, ecologists and geographers. Representatives from other disciplines have been invited to join and it is expected that participation at the next workshop will include urban planners and climate scientists.

II.C. New networking

- Since the Action started a total of 80 participants have joined. The gender balance of the Action is currently 70% male, 30% female. The management committee is engaged in trying to get this figure to closer to a 50:50 ratio.
- 3 of the four working groups are led by early stage researchers, the chair and vice chair are early stage researchers, overall action membership is 50% ESRs.
- 2 STSMs have been planned and approved, a further 2 STSMs are planned for 2013, all involved ESRs.
- 1 US representative has joined the management committee of the Action. A proposal is being written for a reciprocal agreement with the National Science Council of Taiwan to enable 3 potential Taiwanese members to join the Action. Further international members have been contacted and we hope to have an even wider international participation as the Action progresses.
- 2 abstracts have been submitted to conference proceedings – it is intended that each STSM will result in at least 1 journal publication.
- Action members have begun to apply for further research funding through national research funding bodies (see section 11.A above). Further research projects are planned and will be scoped out at future Action workshops.

II.D. Self evaluation

The Action held its first workshop on the 8th of March and first Management committee meeting (after the kickstart meeting) on the 7th of March.

The primary success has been in building the membership to 80 in a relatively short space of time, these members have actively participated in the workshop and through online discussions. It is also a very positive sign that membership includes a broad range of age, seniority and experience – with some very senior researchers engaging actively with the Action.

At national level there has been some success already in gaining further funding for research and some publication outputs are in progress. The management committee and in particular the working group leaders will be working very hard to make sure these outputs are maintained and increased over the next three and a half years.

The drawbacks experienced so far have mainly concerned the use of e-COST. Whilst the system has many good points for organising an Action as a whole it is less capable at managing activities at working group level. It would be of great benefit if the system could enable working group leaders to manage their subgroups through e-COST.

III. Previous scientific report(s)

This is the first report.

Annex

Working Group Notes

COST TU1202 – Impacts of climate change on engineered slopes for infrastructure

Working Group 1 – Numerical modelling capabilities

Gaetano Elia, Federica Cotecchia

During this first meeting, the chair has briefly outlined the aim and objectives of the working group (WG1), identifying a general framework for the numerical activities and possible overlaps with the work of the other WGs. This has been followed by a short introduction of the 11 working group participants in terms of numerical techniques adopted to model slope-atmosphere interaction and its effects on infrastructures. In general, the research work of all participants can be related to the analysis of the stability of natural and artificial slopes and their interaction with infrastructures.

The discussion between the participants has been focused on the following aspects:

1. A wide range of numerical approaches, with different level of complexity, can be employed to study the same boundary value problem. Each numerical technique has specific limitations and benefits and requires different input data. At the same time, the numerical approach adopted depends on the available input data.
2. The main input data for the analysis of slope failures triggered or reactivated by climate factors should come from the hydrological modelling of infiltration, evapo-transpiration and run-off effects (interaction with WG3).
3. In some cases, the most advanced simulations may try to couple the hydrological and mechanical models of the slope.
4. The importance and necessity to derive site specific climate data.
5. The importance of slope monitoring data (interaction with WG2).

The outcomes of this first discussion are:

1. Potential additional members (specifically climatologists and biologists) have been identified and will be contacted/invited by the different participants.
2. A possible long term output would be the definition of one or two benchmark slopes to be studied with different numerical approaches in order to identify the limits and benefits of each technique. This could lead to the publication of a report/guidance note on the performance of the available stability models.
3. Related to the previous point, a first STSM could be devoted to the identification of suitable case histories/datasets available between the partners of the Action.

COST ACTION Workshop, Newcastle UK, 08 March 2013

Minutes of Workgroup 2 meetings

Morning session: JAS reminded members of the WG objectives (also appended below). Members of the working group gave presentations detailing their work, including showing data sets from a number of instrumented sites. A list of participants in the group is provided over the page.	Actions
Afternoon Session: **Potential outputs from the WG** A planned output from the WG is a catalogue of sets of instrumentation data. It is intended that this will be web-based. In the first instance, it will describe the site and data available and contact details for the person(s) who hold the data. A discussion was held over the size and type of slope failures that fall into the Action. PH advised that any type of slope failure, including large natural landslides, which threaten transport infrastructure should be included. A standard form (template) will be produced to capture information about sites. The nature and form of the website, and who will implement it is currently being discussed. A second planned output from the WG is a journal paper describing the state of the art and future challenges for instrumentation. It was felt that much existing conventional instrumentation had already been described well in outputs from other projects, e.g. SAFELANDS (www.safeland-fp7.eu), and the focus should be on future challenges and new instrumentation development in response to asset owner's needs. A first draft of a paper plan to be produced for circulation and comment by the WG.	JAS, HS JAS, HS
Additional members The make-up of the WG is mainly academic. It was felt that further representation particularly from asset owners would be helpful, to further	

define the need for new instrumentation and monitoring systems. The UK Asset Owners Forum Chair could be invited to give a presentation at a future COST meeting. Other ideas for representation in the Action for asset owners were put forward (to be pursued by JAS in consultation with WG members); a wider representation by asset owners is encouraged and any ideas should be forwarded to the WP Chair.	JAS, PH JAS, All
Short-term scientific meetings Some ideas for STSM's were suggested, although these were not particularly well developed (particularly who might go on the missions). The WG to give further consideration to STSM's and any ideas should be put forward to the WG Chair – note that the COST Chair Paul Hughes has set an initial deadline of mid-April 2013 for initial proposals to be considered by the Management Committee.	All
PH = Paul Hughes; JAS = Joel Smethurst, HS = Haris Saroglou	

WG2 Objectives

Aim: The aim of this task is to bring together researchers, practitioners and asset owners to review the state of the art in slope instrumentation so that recommendations can be made about the equipment, monitoring, decision making and communication strategies that will be required to protect our slope infrastructure into the future.

Objectives:

1. Evaluation of the strengths and weaknesses of different types of geotechnical and slope monitoring instrumentation to deliver high quality research data relevant to efficient and effective operation
2. Recommendations on decision making and communication strategies [relating to monitoring results]
3. Recommendations on future instrumentation needs for research and practice
4. Web-based catalogue of slope monitoring data

List of participants in WG2

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
David Gunn	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
Libric, Lovorka	University of Zagreb	llibric@grad.hr	Croatia	Resistivity measurements
Saroglou, Harry	NTU Athens	saroglou@central.ntua.gr	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
Wooff, Chris	Network Rail	Chris.Woof@networkrail.co.uk	United Kingdom	Large number of monitored sites Site repair Alarm levels

TU1202 Working Group 3 Workshop
March 8, 2013

Minutes

1) Introduction of participants

Each participant gives a brief presentation about his research related to the theme of the WG3 (Climate - Vegetation - Soil interactions). The full list of the participants and some key-words related to their research are shown in the Table.

The research fields of the participants cover both Soil mechanics (unsaturated soils, slope stability) and the role of Vegetation on soil behaviour. Even if the studies presented focus on Climate -Vegetation -Soil interactions, other researchers who work on the field of Climate will be welcomed to join the WG.

About the approaches used, all the studies presented are mainly based on experimental observations (in laboratory or in field). The works aim to better understand the mechanism and to provide experimental data for numerical modelling. Further interactions with others WGs are necessary.

Several topics are of interest for several participants in the WG3 and can be identified for further actions: large-scale laboratory test, vegetation, desiccation cracking, etc.

2) Objectives
The expected outputs of the WG3 can be reminded below:
"- Improved simulation of the long-term geotechnical behaviour of engineered slopes by providing the key parameters that will need to be incorporated in coupled models for classic geotechnical numerical tools to consider the impact of climate change on engineered slopes for infrastructure.
- *Suggested adaptation measures that aim to increase the resilience of existing geotechnical infrastructures and to improve future slope design. Results of these analyses will aim at selecting more resilient vegetation species, to both water stress and abundance, and for different climatic situations in Europe (Mediterranean, North Europe), as well more adequate slope properties as a function of soil type, aiming to increase slope stability."*

3) Actions
Some potential additional members are identified to fulfil the gaps concerning the topics of vegetation and climate change. They will be contacted to join the WG for the next WG Workshops.
- Institute for crop research (Dundee University)
- Roger Street (UK Climate Impacts Programme)
- Chris Kilsby (Climate scientist, Newcastle University).

For the first year (2013), two actions were identified for which STSMs and Publications can be expected:
- Develop a framework to contain data involving systematization of laboratory and field available data of the partners.
- Select experimental data from large-scale laboratory tests for numerical modelling benchmark.

4) List of participants

Participant	Affiliation	Email	Country	Research
CUI Yu-Jun	Ecole des Ponts ParisTech	yujun.cui@enpc.fr	France	Geotechnics, Unsaturated soils, Environmental Chamber
GENTILE Francesco	University of Bari	francesco.gentile@uniba.it	Italy	Vegetation, Slope stability
GOWING John	Newcastle University	john.gowing@newcastle.ac.uk	United Kingdom	Water management in agriculture, root zone salinity, lysimeter experiments
JOMMI Cristina	Delft Univ. of Technology	C.Jommi@tudelft.nl	Netherlands	Soil/atmosphere water exchanges, Experiments & Numerical modelling
KEHAGIA Fotini	Aristotle University of Thessaloniki	fkehagia@civil.auth.fr	Greece	Road design and construction, measures for stabilization of motorway
LOURENCO Sergio	Cardiff University	LourencoSD@cardiff.ac.uk	United Kingdom	Slopes, Wetability
OLIVEIRA Manuel	National Laboratory for Civil Engineering	moliveira@lnec.pt	Portugal	Modelling soil water content as a function of climate change and vegetation
SPRINGMAN Sarah	Swiss Federal Institute of Technology Zurich (ETH)	sarah.springman@igt.baug.ethz.ch	Switzerland	Experiments on role of vegetation on slope stability
STIRLING Ross	Newcastle University	r.a.stirling1@newcastle.ac.uk	United Kingdom	Cracks development, Experiments and modelling
TANG Anh Minh	Ecole des Ponts ParisTech	anhminh.tang@enpc.fr	France	Experiments in Environmental Chamber, Cracks
TOLL David	Durham University	d.g.toll@durham.ac.uk	United Kingdom	Experiments on suction and water content measurement, lysimeter

Working Group 4 meeting summary

Working Group 4 meeting took place on March 8th, 2013, as part of 1st TU1202 Working Groups workshops.

WG4 members present at the meeting were:
Kenneth Gavin (WG leader, University College Dublin, IE), Karlo Martinovic (WG co-leader, University of Zagreb, HR), Tom Dijkstra (British Geological Survey, UK), Timo Schweckendiek (Deltares, NL), Irina Stipanovic-Oslakovic (University of Twente, NL), Meho Sasa Kovacevic (University of Zagreb, HR), Jean Hall (Newcastle University, UK), Fernando Rodriguez Lopez (Technical University of Madrid, ES), Claudia Vitone (Politecnico di Bari, IT), Stephanie Glendinning (Newcastle University, UK), David Hutchinson (Network Rail, UK), Vlatko Sheshov (University "Ss Cyril and Methodius" Skopje, MK), Kristine Flesjo (Norwegian Public Roads Administration, NO).

At the start of the meeting, WG leader welcomed the participants and made a short briefing regarding WG rules and procedures, as well as WG4 (Hazard/risk) aims.

Following members presented short PPT presentations about their background, related research and possible contribution to WG goals:

WG member	*presentation topic*
Kenneth Gavin	reliability-based design approaches to slope stability analysis, maintenance of rail transport infrastructure, infiltration in unsaturated soil slopes
Karlo Martinovic	rockfall hazard in Croatian karst, preparation of joint research projects regarding needed risk assessment methodologies
Irina Stipanovic-Oslakovic	sustainable maintenance of transport infrastructure from climate change perspective, asset management
Timo Schweckendiek	flood defence risk management and numerical modeling, risk based optimisation
Fernando Rodriguez Lopez	risk management, infrastructure sustainability, insurance schemes
Claudia Vitone	new methodologies for landslide hazard assessment,

	geotechnical laboratory research
Kristine Flesjo	asset management from owner's point of view, risk analyses, datasets
Tom Dijkstra	landslide databases, daily landslide prediction, joint projects on resilient transport networks, modeling groundwater behaviour

Open discussion ensued, on which following actions were made:

- risk assessment methods being used by WG members are to be collected, analyzed and listed. Case studies from all members are also to be obtained. Karlo Martinovic is assigned for collecting the data.
- data mentioned is about to be set on the Action's new website. Tom Dijkstra offered Action website to be made as an extension of CLIFFS (Climate Impacts Forecasting for Slopes) programme website. It was discussed whether the website should take form of service-point for useful links or the form of fully rounded unit. Other WGs also have to be contacted in order to set it up.
- database of slope failures and rail/road network delays was proposed to be set, with data provided by asset managers, in first place Network Rail (David Hutchinson) and Norwegian Public Roads Administration (Kristine Flesjo)
- it is concluded that among first steps, exact parameters for general risk analyses must be identified. This will be important for asset managers as a general minimum list of actions they should execute in order to avoid hazard. Vulnerabilities are also to be listed, and current over-relying on visual inspections was clearly defined as one. Future aim of increased usage of monitoring equipment was also stated.
- guideline for risk management: 3-step approach as used in Norwegian and British infrastructure administration
- establishing state-of-the-art of risk assessment was set as primary current WG aim for purpose of subsequent defining of most pragmatic and realistic method
- idea of providing a case study, on which different risk assessment methods would then be applied by WG members in order to compare the outcomes, was set and is to be developed
- additional members that will be needed for further WG work were identified as climate modelers or similar type of meteorological office researchers. Internal invitations will be sent by WG members where applicable.
- STSM calls are invited, one of applications expected: from Croatia to Ireland
- further arrangements and data sharing will be made via mailing list

The composition of WG showed fine balance of academics, non-academic researchers and asset managers, as well as balance between senior researchers and ESRs, and proper gender distribution.

WG Leader thanked all the participants for their attendance and officially closed the meeting, after which he shortly presented the minutes from the session at the common

meeting for all four WGs.