

BIONICS

BIOLOGICAL AND ENGINEERING IMPACTS OF CLIMATE CHANGE ON SLOPES

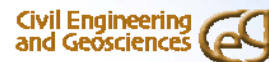
Background

Stakeholders and collaborators

Aims and objectives

Results to date

Future of the facility



BACKGROUND

**Earthworks slopes constitute major part
of the infrastructure asset**

(£20B of a total £60B for highways alone)

Failures cost significant £

(£50m for highway maintenance in 1988/9)

**Maintenance costs a fraction of
emergency repairs**

(£emergency = 10 x maintenance)



BACKGROUND 2

Water is a key factor controlling the stability of slopes

Climate change predicts:

Hotter, drier summers –

- shrinkage, cracking, loss of vegetation

Followed by:

More intense periods of rainfall –

- swelling, infiltration, increased water pressure, erosion, (flooding)

THE PROBLEM!



Last Updated: Saturday, 13 January 2007, 16:57 GMT
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Landslide
More than 100
passengers
to safety
tracks
onto a
caused
derailed

Last Updated: Friday, 20 July 2007, 14:38 GMT 15
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Motorway
A landslide
caused
led to the
floodin
carriage

Last Updated: Wednesday, 25 July 2007, 17:59 GMT
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Landslide
Six
evacuated
landslide
attractions

Last Updated: Wednesday, 29 August 2007, 06:09
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£1m to fix flood landslide route
The cost of repairing
Gloucestershire's flood-
damaged A46 will be
£1m, county highways
bosses have said.





Damage to the county's roads is estimated to be £2.5m.

Deep water
 collapsed

Nor
 Nor
 Wor

The road was closed at Salmon Springs earlier this month, after a landslide caused by July's severe floods.

 Newcastle University

Civil Engineering and Geosciences 

STAKEHOLDERS AND COLLABORATORS

EPSRC £900k

11 industrial partners, including

- Network Rail
- Railway Safety and Standards Board
- London Underground
- Highways Agency
- British Waterways

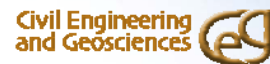
6 Universities

 Newcastle University

Civil Engineering and Geosciences 

RESEARCH AIMS

1. Establish a unique facility for engineering and biological research
2. Improve basic understanding of the effects of climate on slopes
3. Improve modelling capability to examine long-term impacts



STAKEHOLDER REQUIREMENTS

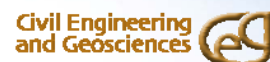
Improved asset management tools

Prediction, planning and preparation


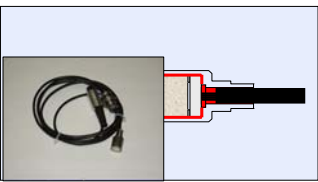
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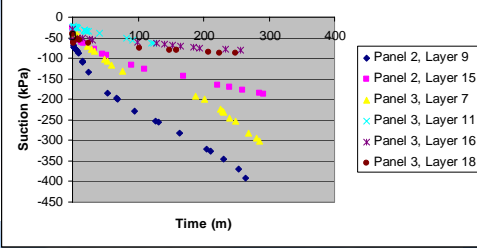
What, when and how?

Cost





RESEARCH FACILITY

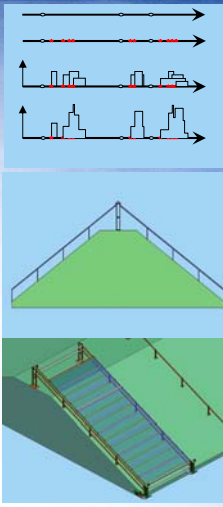



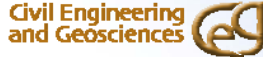
Symbol	Panel	Layer
Blue diamond	Panel 2	Layer 9
Magenta square	Panel 2	Layer 15
Yellow triangle	Panel 3	Layer 7
Cyan cross	Panel 3	Layer 11
Pink asterisk	Panel 3	Layer 16
Red circle	Panel 3	Layer 18

BIONICS - climate interactions

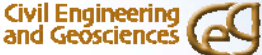

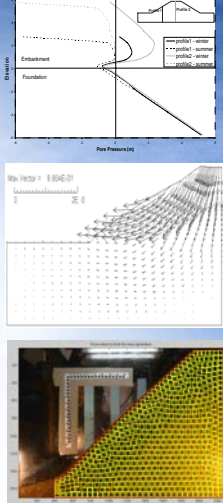
- Informed by UKCIP02 Climate scenarios
- Rainfall informed by BETWIXT
- Cover system to be installed
- Coupled with sprinkler system
- Creates controlled rainfall
- Covers prevent infiltration and create warming



BIONICS-modelling interactions

- Two-phase flow model links rainfall and vegetation with pore pressure
- Models pore pressures within the embankment
- FLAC used to determine geotechnical behaviour
- Partially saturated constitutive model being developed
- Further physical data being provided by centrifuge
- Uses soil from embankment
- Climate chamber developed at appropriate scale



FUTURE OF THE FACILITY

2 EPSRC-funded projects using the facility

1 Collaboration grant associated with the facility

2 EPSRC funding applications in progress

Part of a Platform bid in Earth Systems Science Engineering and Management

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