Condition monitoring for earthworks

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Earthworks – ultimate failure

Watford, September 2016
Cutting slope wash-out failure

Pictures from Rail Magazine and Daily Mail
Earthworks – ultimate failure

Stonegate, Kent, February 2014
Deep-seated embankment failure

Pictures from Twitter
Earthworks – ultimate failure

- Network Rail earthworks failures and resulting derailments (From Transport Resilience Review, July 2014)
Network Rail ‘alert system’

- Wirelessly connected tiltmeters on posts, coupled with remote camera systems. Is an alert system, and not condition monitoring.
Can we condition monitor?

**Track monitoring train**

**LiDAR surveys**

**Optical fibres**

**Slope surface sensors**

Tilt

Soil water pressures or content
Challenges

• The ground is vary variable
• Surface monitoring doesn’t necessarily tell you what is going on at depth, and surface movement may not be a reliable predictor in all cases
• Long lengths of earthwork: Big data
• Smart sensors or smart cloud is required to interpret data
Forecast risk of failure/derailment

Monitored slope condition

Deterioration and stability model
Based on slope geometry and properties

Weather forecast
And other forecast products such as SMI

RSSB train derailment risk model