Advances in design and management of engineered slopes

Dr Adam Fisher
What changes/advances have I seen over 24 years as a geotechnical professional?
I will do this from:

- A quick look at geotechnical risk management and the framework it provides for the design and management of slopes

- Considering a few projects delivered, methods used and the subsequent advances that may have changed the approach

- Discussing how the concepts of ‘Geotechnical BIM’ could perhaps add some real value going forward
‘Effective design offers one of the best ways of minimising geotechnical risk’

- Be systematic, phased so that key stages are not missed
- Determine essential project requirements
- Use conceptual design to identify construction methods least at risk from ground conditions and provide the optimum solution
- Use analytical techniques that recognise that ground conditions are uncertain
- Compare the design with current or previous cases in similar ground
Soil slope - 1994

Soper’s Wood Landslide – Bath
Jurassic Fuller’s Earth
## Current Project

<table>
<thead>
<tr>
<th>Fundamental Approach</th>
<th>Systematic/phased - unchanged</th>
</tr>
</thead>
<tbody>
<tr>
<td>Desk based research</td>
<td>GIS, Google, BGS, historical maps etc</td>
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<tr>
<td>Geomorphology/Terrain</td>
<td>Drone, 3D terrain model, aerial photo</td>
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<tr>
<td>Investigation / monitoring</td>
<td>BS5930, Advances in methods and data handling (AGS)</td>
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<tr>
<td>Analyses</td>
<td>3D ground model, software, EC7, Finite Element analyses</td>
</tr>
<tr>
<td>Engineering Solutions</td>
<td>Methods have evolved and some new options could be given consideration – Electro Kinetic</td>
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</tbody>
</table>
Anchored rock slope
Western Australia

- Nailing
- Anchors
- Spaced piles
- Geomembranes
- Cut off walls

- Risk based evaluations
- Drones
- 3D models
- Remote sensing

2014
Western Australia

- Reinforced earth
- Gabion facing system (Health & Safety)
- Material classification
NO DRAIN NO GAIN

Innovative geogrids aid highway earthworks in Hastings

2017/18
BUILDING INFORMATION MODELLING/MANAGEMENT

Process for generating and managing design, construction and operations data. It’s an approach not a product you can buy off the shelf.

Agreed procedures, methods - data quickly captured, processed and shared

Assessing data in context of all disciplines (organisations). Informed decisions.

Retaining and building on data for projects life – doesn’t get lost.
Anchored retaining wall

Site Model
CONCLUSIONS

◆ The concept of geotechnical risk management underpins all elements of design and management of engineered slopes. THIS HAS NOT AND SHOULD NOT CHANGE

◆ Key advances in slope design and management have been from technical advances in data capture, speed of analyses and communication of results.

◆ BIM is totally aligned to the geotechnical risk management process and can further improve efficiencies, knowledge sharing and communication.