Modern Methods of Excavation Support

Presented by

Duncan Pearson – Technical Services Manager
Helen Aird – Technical Sales Engineer
1. Company Introduction / Technical Services
2. Introduction to proprietary shoring
3. Why excavations fail
4. SiteSafe Solutions
5. Load monitoring of hydraulic struts / case studies
6. Bad practice slides
7. Questions
Company Introduction
Established 1954

Annual turnover of £147m

Circa 1500 employees
Strategic depot network

Comprehensive equipment portfolio

Dedicated sales & operational support
Technical Services
Twelve Experienced Design Engineers
Specialist Major Projects Team
Dedicated Technical Sales Support
ISO 9001 accreditation
P.I. Cover - £5m
Documented design and checking procedure
Training Options

- Office based appreciation courses
- Practical site training
- Toolbox Talk DVD - produced in conjunction with the National Construction College, Bircham Newton
Introduction to Proprietary Shoring

a) What is proprietary shoring?
b) Why do we shore excavations?
c) What are its advantages?
Examples of “Traditional” methods of support
Examples of “Proprietary systems”
Proprietary systems
Why Support Excavations?

- Avoid death and injury
- Protect colleagues and Public outside the dig
- Avoid damage to Existing services
- Protect adjacent structures
- Comply with Health And Safety Legislation
- Time and Cost savings
Why Support Excavations?

- Average of 7 fatal accidents each year.
Advantages of proprietary shoring

1. Rapid installation and removal
2. No on-site welding
3. On-site adjustment and versatility
4. The ability for pre-load to limit deflections
5. Re-use of components
6. Improved safety
Why do excavations fail?

Causes of failure in excavations and how we can prevent them
...a near miss!!
...small water leak in cofferdam leads to..
Examples of Failure

- Pile toe failure due to over digging

- Over loading of frame
Surcharges (Additional external loadings not taken into account)
Groundwater – Loss of fines
## Causes of Failure

<table>
<thead>
<tr>
<th>SITE ISSUES</th>
<th>DESIGN ISSUES</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Design Brief</strong></td>
<td><strong>Design</strong></td>
</tr>
<tr>
<td>- Inadequate or poor quality information</td>
<td>- Lack of consideration of limit states</td>
</tr>
<tr>
<td>- Verbal soil information</td>
<td>- Lack of adequate design risk assessment</td>
</tr>
<tr>
<td>- Missing surcharges</td>
<td>- Poor interpretation of SI</td>
</tr>
<tr>
<td>- Incomplete assessment of site conditions</td>
<td>- Underestimation of surcharges</td>
</tr>
<tr>
<td></td>
<td>- Underestimation of effects of groundwater</td>
</tr>
<tr>
<td><strong>Execution</strong></td>
<td>- Over reliance on software</td>
</tr>
<tr>
<td>- Lack of communication</td>
<td></td>
</tr>
</tbody>
</table>
Causes of Failure / Accidents

“HUMAN” ISSUES

• Ignorance
• Bullying
• Idleness
• Neglect
• Irresponsibility
• Complacency
• Forgetfulness
Collapse of unsupported or inadequately supported excavation walls.

Often with disastrous consequences

This was the aftermath scene of a recent trench collapse recent fatality
Modes of Failure

- Wedge Failure
- Rotational Failure
- Soft Zone Failure
- Soft Pockets
- Layered Soils
- Effects of Water
Failure due to “boiling”
Modes of Failure

Slope failure of Battered Excavation
Modes of Failure

Cross-strut removal / frame overload
Warning Signs

- Deflection
- Tension cracks
- Soil movement
SiteSafe Solutions
Sitesafe Solutions

**Systems include**
- Box Handrail System
- Laddersafe Range
- Stepsafe
- Edgesafe
- Endsafe
- Surroundsafe
- Fallsafe
On board load monitoring of proprietary struts
Wireless Load Monitoring Overview

- Calibrated load / swivel pin
- Wireless telemetry unit and transmitter
- Hydraulic strut assembly
Wireless Load Monitoring Overview
Typical results graph

Trigger levels
Load Monitoring - Site 22412 | V12406 Network Rail

From: 27/09/2010 To: 30/09/2010

Load Charts

Pin Load

Temperature

Pin Load

External Temp

Internal Temp

0 10 20 30 40 50 60 70 80 90

10:00:00 12:00:00 14:00:00 16:00:00


Temperature

Pin Load

External Temp

Internal Temp

0 10 20 30 40 50 60 70 80 90

10:00:00 12:00:00 14:00:00 16:00:00

This £260m project was one of the largest infrastructure projects in the UK.

The main Contractor was Bouygues Travaux Publics (UK)
Design Challenges

• High design axial prop loads ranging from $1,500kN – 13,000kN$
• Design specification included:
  – Loss of prop condition
  – 50kN accidental loading
  – $35^\circ$ temperature range (60% restraint)
• Overcome a reluctance to use hydraulic props
• Huge amount of bespoke fabrication
• Provide a cost effective solution over long rental period
The Solution
Installation of Struts
Bad Practice

or.......
......why men die early!
Working in unsupported excavations
Poor workmanship
Incorrect use of equipment
Bad Practise
Stupidity!
Stupidity!
…and finally a cautionary tale!!

…inspect your equipment before using it!
End of Presentation

.... Any Questions?