Some trends from recent ground investigation contracts and geotechnical projects in Ireland

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This talk will discuss...

• Risk and the role of geotechnical engineering
• Ground investigation in Ireland
• Commercial out-turn from GI contracts
• Trends from the data
• Some comments and discussion
Previous papers and presentations

• Internal paper at Arup (2011)
Ground related risks

From Tim Chapman (2008), ‘The relevance of developer costs in Geotechnical risk management’.
Road construction

Risk management

Percentage fee scales

- Some clients link fees to percentage of the capital costs

<table>
<thead>
<tr>
<th>Scheme</th>
<th>Civil Fee scale – detailed design</th>
<th>Geotech proportion of overall design fee</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buildings</td>
<td>2 – 4%</td>
<td>2 – 10%</td>
</tr>
<tr>
<td>Roads</td>
<td>3 – 5%</td>
<td>10 – 20%</td>
</tr>
<tr>
<td>Flood defence</td>
<td>3 – 5%</td>
<td>25 – 70%</td>
</tr>
<tr>
<td>Ports and harbours</td>
<td>3 – 6%</td>
<td>25 – 70%</td>
</tr>
</tbody>
</table>

- This incentivises reducing effort spent on geotechnical engineering in competitive tenders. Some clients do not include geotechnical engineering in quality assessments.

- This can result in excessively conservative design to account for the lack of geotechnical engineering input. The works usually take longer to implement which has significant costs. Worse case is that the structure fails to meet performance criteria.
Irish ground conditions

Glacial landscape

- Peat covers 17% of country
- Very soft silts adjacent to rivers, estuaries, inter-drumlin areas, etc.

Unsorted nature of glacial till

Image taken from University of Sheffield
Ground investigations

Motorway development 2000 - 2010

Basement and deep excavations
Techniques

Plus trial pits, geophysics, CPT (infrastructure / civil), dynamic probes....

Numerous contracts: Remeasureable, Lump sum, Public Works Contract, etc.
Authors and assistance from:
Before we have a look at the data....... 

Each project is different and requires an individual assessment. But........................

“No man ever steps in the same river twice, for it’s not the same river and he’s not the same man.”
—Heraclitus
How much of the tender sum is paid out?

[Graph showing relationship between tender price and final contract value, with annotations indicating tender price exceeded and project under budget.]
When the data is presented in a histogram....
Is there a trend with project value?

€10K-€20K, N = 219
€20K-€50K, N = 77
>€50K, N = 89
Does it matter who designs the GI?

Contrib. N = 106
Non contrib. N = 119
How much of the contract is based on fieldwork?
What proportion of the construction budget is spent on GI?

**Building projects**

**Road and Bridge projects**
How many explorations on a typical site?

**Building area**

- Square root of (building area/number of boreholes) vs Building area (m²)
- Upper and lower bound trends?
- Range suggested by EC7

**Construction cost**

- Square root of (building area/number of boreholes) vs Construction cost (€)
- Range suggested by EC7
Tender award based on price only.....
AGS BDA taskforce in UK
The two lines are speculative, subjective, unquantified and unsubstantiated but useful for stimulating debate.
Conclusions and Recommendations

• Poor ground investigation and geotechnical design is frequently an issue in project cost and programme overruns.

• Early intervention produces greater opportunity to provide developers with certainty and guidance.

• Ground investigations frequently cost less than the tender cost. This suggests the presence of a conservative bias when competent geotechnical engineers design ground investigations.

• A remeasurable contract is ideally suited for most ground investigations. Please use the Engineers Ireland Specification and Related Documents for Ground Investigation 2nd Edition 2016 (Green Book)
Conclusions and Recommendations

• The proportion of the construction budget spent on ground investigations tends to decrease with increasing project value.

• There is a need to record data and improve decision making. The cause of failures or losses on projects would be worthwhile sharing.

• Is there a need to introduce quality requirements for Ground Investigation Contractors by the State to promote best practice?
Thanks to: