Typical Geotechnical Risks in the Middle East
By Tayo Roberts
Introduction

• What is Geotechnical Risk

• Typical Geotechnical Risks

• Mitigation and Managing Geotechnical Risks

• Conclusions
What is Geotechnical Risk?

All construction projects interact with the ground at some point - without appropriate investigation and assessment the ground is a RISK
Typical Geotechnical Risks in the Middle East

**Typical Geotechnical Risks**

- Karst features – cavities and solution features
- Variable ground conditions
- Sabkha
- Liquefaction of superficial materials
- Bearing Capacity (e.g. loose sand or soft clay) – differential settlement
- Slope stability (excavations, shafts, shoring / retention systems)
- Shallow groundwater table & Nuisance water
- Quality of ground investigation
- Geotechnical design (e.g. wrong assumptions, wrong geotechnical models)
Geotechnical Risks

• Karst Features

Deep cavity encountered within sandstone (Abu Dhabi)

Cavity encountered within sandstone (Al Falah area, Abu Dhabi)
Geotechnical Risks

• Karst Features

Deep cavity encountered within Limestone (Doha, Qatar)

In-filled Cavity encountered within Limestone (Riyadh, KSA)
Typical Geotechnical Risks in the Middle East

- Sabkha Deposits

Coastal Sabkha

Sabkha Matti

Inland Sabkha
Geotechnical Risks in the Middle East

Geotechnical Risks

- Liquefaction
- Bearing Capacity Failure
Typical Geotechnical Risks in the Middle East

Geotechnical Risks

- Slope stability
Geotechnical Risks

• Shallow Groundwater
Geotechnical Risks

- Nuisance water
Geotechnical Risks

- Quality of ground investigation
Geotechnical Risks

- Quality of ground investigation
Geotechnical Risks

- Quality of ground investigation

Cavity encountered under bridge abutment – not shown on BH log, no GI supervision

Total core recovery 80mm core diameter v 63mm core diameter
Typical Geotechnical Risks in the Middle East

Geotechnical Risks

- Incorrect Assumptions in Geotechnical design
Mitigation and Managing Geotechnical Risks

- Desk Study & Walkover
- Geotechnical and Geophysical Investigation
- Site Supervision
- Geotechnical Design
- Construction Supervision/Inspections
Mitigating and Managing Geotechnical Risks

Site Supervision - GI

• Quality of GI data impacts confidence in design

• Full-time supervision required to detect non-compliances

• Without adequate supervision & in absence of properly defined specifications & standards quality of work unpredictable

• Identify potential engineering concerns early on site

• Optimization of scope through supervision
Mitigating and Managing Geotechnical Risks

Geophysical Testing

- Appropriate techniques for ground conditions
- Confirmation boreholes to confirm identified anomalies
Mitigating and Managing Geotechnical Risks

Identify, assess, mitigate and manage the risk...

- Develop a conceptual model of ground and groundwater conditions
- Create a register of ground related risks
- Revise and refine through the progression of the project with increasingly detailed data from investigation and construction phases
Mitigating and Managing Geotechnical Risks

Geotechnical Interpretative Report

• Checking of contractors Factual Report i.e. exploratory hole logs (material descriptions), laboratory and in-situ testing results

• Develop ground model based on site specific geological profiles

• Establish geotechnical parameters for the materials encountered from in-situ, laboratory testing results and experience of performance

• Identify feasible foundation solutions, ground treatment requirements
Mitigating and Managing Geotechnical Risks

Geotechnical Design

- Foundations – bearing capacity & settlement
- Earthworks – excavation, filling, compaction
- Cut/ embankment – slope stability
- Retaining structures – embedment, loading
- Infrastructure – pavement design, foundations, utilities
- Ground improvement – design & verification
Mitigating and Managing Geotechnical Risks

Construction Supervision

- Supervision of piling, shoring, excavation, earthworks, road formations, ground improvement & reinforcement, anchoring systems
- Monitor slope construction to assess stability of excavations
- Specification & execution of monitoring programmes for shoring systems, slope stability, dewatering impacts
Mitigating and Managing Geotechnical Risks

Construction Supervision

- Review contractors method statements & submittals
- Monitor contractors work against design, specification & method statement
- Confirm material arising from excavations are what’s expected
- Prepare site daily records & maintain QA/QC register
- Issue non-conformances & consultant advise notices
Conclusions

- Appreciation of geotechnical risk at design & construction stages
- Early involvement and allowance in projects for geotechnical inputs – design & supervision
- Ensure the right people supervise the works
- Assessment of risk and mitigation measures in risk registers and ownership of risk assigned - ground risk is best managed by a ground professional
- Provide a high standard of full time targeted site supervision (during ground investigation and construction) adopting the right person in the right place principal

Finally, value for our clients (ground related) comes from quality ground investigation, management of ground risks, strong geotechnical design and construction supervision
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Questions?
11:30 – 11:45
Morning Break

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