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Industry Update

Managing Risks in Underground Works: Evolving Approaches Across Middle East Projects

By [Ibaad Hakim](#), [Habeeb Rahman](#) and [Elliot Hunt](#)

While site and ground-related risks are important considerations for all construction projects, tunnelling and underground works are inherently more complex and significantly more sensitive to these risks than above-ground construction works. In the Middle East, where ambitious infrastructure projects frequently involve extensive underground components, effective management of site and ground-related risks is critical to ensuring successful project delivery.

Across the region, large-scale developments incorporating significant subsurface works include:

- metro expansions in Dubai, Doha and Riyadh and rail projects such as Etihad Rail;
- road tunnels, such as those on large urban roads like Sheikh Zayed Road, and Mecca's Hajj-related tunnels;
- deep utility infrastructure supporting stormwater, wastewater and district cooling networks such as Dubai's Strategic Sewerage Tunnels;
- subterranean oil and gas facilities and infrastructure, including pipelines and storage caverns;
- multi-level underground parking for luxury commercial and residential developments, including large development projects such as Rua al Madinah and Diriyah Square; and
- mega-projects such as NEOM's *The Line*, featuring *The Spine* (an underground logistics, pedestrian and subway network) and *Aquellum* (a skyscraper-sized subterranean community).

These projects demand a sophisticated and flexible approach to risk allocation, incorporating both careful planning and contractual flexibility. This is especially important given the traditional dominance of inflexible contracting strategies such as lump-sum pricing and insistence on EPC-style risk allocations, which seek to confer site risk on the contractor.

Unique Underground Characteristics

Underground works present several unique and interrelated risks, including:

- increased uncertainty from limited knowledge about subsurface physical conditions and how surrounding ground mass will respond to excavation;
- physical limitations to site access, complicating logistics, materials handling, waste removal and emergency response;
- complex multiparty ownership and stakeholder arrangements affecting the land around the subsurface works;
- dependance on specialist and high-value equipment, often with long lead times; and
- linear sequencing for works, heightening the risk of critical delays and limiting the contractor's ability to re-sequence works to recover lost time.

These factors are further complicated by the Middle East's distinct ground conditions, including collapsible soft sand deposits, high groundwater table resulting in water accumulation, high groundwater salinity and soil chloride content posing corrosion risks to subterranean structures and equipment, inadequate drainage during seasonal rains and hard rock (limestone, dolomite and basalt) in certain locations requiring specialist heavy machinery and blasting.

How Can These Risks Be Mitigated?

Sound risk allocation is based on assigning risk to the party best able to manage it. Traditionally, employers in the region have sought to transfer all site risk to the contractor. However, given the inherent uncertainties involved in subsurface works and potential for risks that are beyond a contractor's reasonable ability to foresee and control, such a traditional EPC risk allocation is typically unattractive to contractors and results in inflated bid prices and a significant number of time and cost claims.

Given the significant inherent risks in subsurface works, a more balanced risk allocation model is emerging, which attempts to require:

- the employer to carry out comprehensive site-related surveys, providing more comfort and certainty to the parties;
- contractors to assume foreseeable risks in design and execution based on the site-related surveys carried out by the employer;
- employers to retain the risk of unforeseeable conditions, i.e., those not captured in the contractual documents prepared based on the site-related surveys carried out by the employer;
- the use of shared-risk frameworks whereby the contractor and employer share the "pain and gain" of conditions; and
- the use of flexible pricing models, including target cost and remeasurement portions and provisional sums, to better reflect the on-the-ground realities.

Such mechanisms provide equitable compensation and align commercial outcomes with actual site conditions.

Pre-Construction Mitigation and GBRs

As stated above, comprehensive site data is the foundation of effective risk management for underground works. Employers should invest in thorough investigations, producing:

- geotechnical data reports (GDRs) and geotechnical interpretative reports (GIRs) to capture known conditions; and
- geotechnical baseline reports (GBRs) based on the GDRs and the GIRs to clearly define contractual assumptions and identify measurable baselines, including for ground and subsurface conditions; geological, geotechnical, hydrogeological and environmental conditions; and utility mapping.

A well-prepared GBR contains baseline statements in objective terms, addressing both physical and behavioral conditions, taking into account the employer's planned construction methods, design philosophy and sequence of the works for the planned method of construction. It should also specify the methods of measurement to evaluate the material properties and ground behavior to be assessed against these baselines and should be detailed, realistic and prepared as late as possible — after the majority of the site investigations and reference designs have been completed. For these reasons, GBRs have been widely endorsed by both tunnelling professionals and legal experts and are increasingly used in the UAE and Saudi Arabia.

The more accurate and detailed the site data and baselines are, the greater the chances are for the works and project to be successful, reducing the chances of disputes, claims and cost/scheduling overruns.

Early Contractor Involvement

While comprehensive site data is one way to mitigate the risk of site conditions, another is to involve the contractor in the design process early. Rather than engaging the contractor after design has been finalized, a collaborative procurement and delivery model called early contractor involvement (ECI) engages the contractor during the design and planning stages, enabling employers to benefit from contractor expertise on constructability, choice of tunnelling methods, sequencing and mitigation of ground movement in planning and designing the works. In the Middle East, where projects are often first-of-a-kind and face complex ground and site conditions, ECI is particularly valuable and is being increasingly adopted by major regional project developers.

Planning, Early Warning and Monitoring

In addition to the procurement strategy and risk allocation, managing emerging risks during construction is important. Therefore, contracts involving subsurface works benefit from including:

- a detailed and regularly updated risk register supported by clear management plans to identify, allocate and track existing and emerging risks based on probability, severity and overall risk rating;
- early-warning mechanisms to enable proactive notification and timely mitigation of events that could affect performance or worker safety;
- real-time monitoring systems to track ground movements, water ingress and structural stability; and
- flexibility in design and planning allowing methodologies to adapt as site conditions evolve (see below).

Disputes and Conflict Avoidance

The complexity of underground projects demands close collaboration between contractors, designers, geotechnical engineers and geologists, and requires clear communication and structured dispute resolution mechanisms. While DABs have historically been uncommon in the Middle East, they are beginning to gain traction. The scale and complexity of high-profile megaprojects are driving expectation that DABs will feature more prominently in future contracts and should be carefully considered for all underground works.

Contractual Mitigation

Use of Appropriate Contract Form — FIDIC Emerald Book

The use of an appropriate contract form is fundamental to effectively managing the site and ground-related risks in subsurface works. The chosen form should include balanced risk allocation and sharing mechanisms while reflecting best practices developed and used in the tunnelling and underground works industry.

There is no global uniform approach to contracting for subsurface works as practices vary greatly across industries, jurisdictions and project types. Historically, subsurface works contracts in different jurisdictions have adopted a patchwork of standards, including ICE and NEC forms as well as adaptations of FIDIC. In 2019, however, the introduction of the FIDIC Conditions of Contract for Underground Works (the Emerald Book) provided, for the first time, an international standard form specifically designed for tunnelling and underground projects.

The Emerald Book adopts a design-build approach and includes:

- a generally more balanced and “fairer” risk allocation than FIDIC Yellow or Silver Books;
- a hybrid pricing mechanism that combines elements of lump-sum and measurement pricing;
- a GBR-based risk allocation and baseline-based assessments (by reference to a “schedule of baselines”); and
- enhanced disclosure provisions requiring the employer to provide site data — including geological, geotechnical and hydrogeological data — supported by a GDR.

The schedule of baselines is tied to production rates, such as expected rates for progressing the subsurface works, which reflect what the contractor should reasonably achieve if conditions match the assumptions. During construction, if actual site conditions are consistent with the schedule of baselines, the contractor carries the risk; however, if the conditions prove materially more adverse (or more favorable), the contract provides a mechanism for adjusting time and cost entitlements. This system creates a fairer allocation of subsurface risk, improves the realism of tender pricing and reduces disputes by replacing vague foreseeability tests with a clear contractual benchmark.

In the Middle East, FIDIC contracts are widely used as the standard construction market, positioning the region to be progressive in adopting pilot applications of the Emerald Book.

Conclusion and Key Takeaways

Underground works involve elevated site risk and demand a tailored, flexible and considered approach to contracting. The importance of accurate ground investigation data, supported by contractual baselines such as GBRs, is vital to minimize uncertainty and fairly allocate risk. Alternative procurement strategies, such as ECI, allow for more effective planning and lower tender risk premiums while real-time monitoring and effective dispute avoidance processes help to ensure successful project delivery.

The FIDIC Emerald Book also offers a strong contractual framework, with built-in flexibility, risk-sharing mechanisms and detailed provisions for managing unforeseeable ground conditions. However, the Emerald Book still requires careful tailoring to reflect on-the-ground specifics and project nuances.

As the Middle East continues to promise groundbreaking underground infrastructure, its approach to contracting and risk management must evolve in tandem.



If you have any questions concerning these developing issues, please do not hesitate to contact any of the following Paul Hastings Abu Dhabi lawyers:

Ibaad Hakim
+972-2-403-2816

ibaadhakim@paulhastings.com

Habeeb Rahman
+972-2-403-2807

habeebrahman@paulhastings.com

Elliott Hunt
+972-2-403-2809

elliottthunt@paulhastings.com

Paul Hastings LLP

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