The ITA Contractual Practices Checklist of Subsurface Construction Contracts

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Introduction

In an ideal world there would be no need for contracts for hydroelectric projects. The good intentions of the participants would be enough to guarantee success. The reality is that contracts are essential for encouraging good behaviour in the face of the challenges and uncertainties present in all projects. Even with contracts and the best of intentions, projects still run into trouble. The problems are further aggravated by bad contracts, which have the potential to ruin otherwise good projects. Businesses and lives have been lost to bad contracts.

Writing a construction contract is difficult. There are countless aspects that must be considered. Once signed, it is difficult to change a contract, therefore every significant outcome must be anticipated and considered for inclusion. Contracts for hydroelectric projects are further complicated by the uncertainties of the ground conditions associated with their tunnelling and excavation works, which are major project components. Globalization raises additional issues, with companies operating in regions where they are unfamiliar with local business practices and legal systems.

In 2010, in response to these challenges, the International Tunnelling Association's (ITA) Working Group 3 on Contractual Practices (WG3) wrote the document:

> *The ITA Contractual Framework Checklist for Subsurface Construction Contracts* [3]

Written for projects involving significant subsurface works, the ITA Framework Checklist explains the major contractual areas that must be considered to ensure a successful project. The goal is not to specify how each area should be resolved, but rather to highlight the importance and tradeoffs involved in its resolution. The Checklist is compatible with, and provides guidance for reviewing, standard contracts such as FIDIC and NEC.

The Checklist's main focus is to help practitioners ensure their contracts:

1. Take into account the highly technical issues and uncertainties associated with subsurface works
2. Make a clear and fair balance of risks and responsibilities
3. Have payment mechanisms and schedules that allow for their inherent unpredictability
4. Define resolution processes appropriate for resolving minor defects up to major disagreements

1. Background

Projects including a substantial element of underground works face the usual difficulties associated with the design and delivery of large infrastructure projects, but with an added complication in that the properties of the predominant material that the Engineer needs to work with, the ground conditions, are most often only partially known. Even a thorough geotechnical investigation will only sample a small fraction of the material that the project will be constructed in. This inherent uncertainty needs to be adequately catered for in the contractual framework to allow a rapid response to differing ground conditions. This invariably means that the construction cost and anticipated duration can only be defined within a range dependent on the range of potential conditions that may be encountered. This uncertainty does not sit well with Employers, particularly private developers reliant on project finance.

Other aspects of underground work that need to be considered in the design and contracts for hydropower projects are:

- Design adaptation. While the Designer can and should provide a range of excavation and support classes that cover the anticipated ground conditions, agreeing on the most appropriate support class for a particular

situation and responding to differing conditions will always require more continuous input from the Designer than most other construction projects

- Limited access. Another aspect of underground works projects that needs to be considered in the contract documents is the limited access to working areas, which can have a significant impact on the Contractor's efficiency, and thus the construction time, if not planned for
- Use of specialised and often bespoke construction equipment with the concomitant long procurement lead times, high up-front costs and specialist teams
- Design changes, design adaptation and unforeseeable ground conditions cause delays and can impact construction interfaces. Scheduling buffers and contractual provisions can be included as contingencies
- Subsurface works often fall under different legal regimes than other types of construction and Employers can be faced with unexpected legal obligations and liabilities. In some jurisdictions subsurface works are governed by mining law. Legal issues can be further complicated by the long delivery times for these projects requiring all parties to continuously monitor applicable changes in legislation
- Standard forms of contract are often unsuitable for subsurface works. Experience is required to adapt them

2. Risk Allocation

All underground works are subject to unknown ground conditions. In spite of site investigations, project cost and schedule impacts only evolve as excavation proceeds and the actual ground conditions become known. Therefore, in projects with major subsurface components, there are significant risks, which must be recognized and explicitly allocated in the contract. Limited access to tunnels and caverns further compound risks. Seemingly minor issues can cause knock-on effects that hinder the completion of other work, for example, by causing scheduling problems for specialist equipment and teams. Relatively small project components can represent a significant proportion of the total project risk.

With underground works, the traditional methods used for allocating risk are generally not adequate because the parties that can best mitigate the risks many not be able bear them. Stated bluntly, the money and resources required to address some risks may be beyond the party's capabilities. The Checklist recommends that each party's exposure be commensurate to their financial participation in the project. It further states that:

> *..unfair allocation of risk in contracts will inevitably complicate the delivery of a subsurface construction project because an unfair bargain inevitably leads to conflict and disputes, as one or more of the parties struggle to survive unfair contractual burdens. In most subsurface construction projects disputes usually involve some aspect of unknown ground conditions or logistics. This is why focusing upon contractual aspects of ground conditions and logistics warrants such attention.* [3]

Employers are encouraged to use differing site conditions clauses (DSCs) and Geotechnical Baseline Reports (GBRs, see section 3), which separate the risk associated with unknown ground conditions from the Contractor's performance. Simply trying to shift the risk to the Contractor can backfire. An Employer tendering a fixed price must either expect to pay a premium for 'certainty of price', or face disputes about differing ground conditions from a low bidder, intending to make their profits through poor quality work and claims. In extreme cases, the Contractor can walk away from the contract or go bankrupt.

In addition to risk allocation, methods for dealing with variations and disputes must be defined in the contract. Differences from the forecast conditions can be managed by adjusting remunerations according to the actual conditions encountered. The use of excavation classes and unit prices is a common technique (see section 4). Methods for resolving non-performance, by either party, must also be defined in the contract. Failure to define a dispute resolution process will result in project delays, increased costs and expensive litigation. Dispute resolution methods, including use of experts, familiar with underground works, are strongly recommended (see section 5).

Hydropower projects also face administrative risks related to third party approvals, permits, environmental issues and re-settlement. Provisions for changes in law and regulations between writing the contract and completing the work must also be considered.

Finally, formal risk management procedures, including a project risk register are highly encouraged. Risk management improves the project's capacity to indentify risks before they have an impact on the project. The procedures should include provisions for monitoring, communicating and contractually allocating risks. All parties involved in the project should participate in the process. Project financiers, insurers and authorities are increasingly

mandating the use of formal risk management procedures. An example 'code of practice' for risk management is presented in [4].

3. GBR and Site Investigations

A key document for allocating risks between the contracting parties involved in projects including underground excavation is the Geotechnical Baseline Report (GBR).

> *The primary purpose of the GBR is to establish a single source document where contractual statements describe the geotechnical conditions anticipated (or to be assumed) to be encountered during underground and subsurface construction*. [9]

Although geotechnical data has traditionally been included in contract documents for subsurface works, the importance of a baseline interpretation of the data, including experience and local knowledge of expected conditions not identified in the data, has increasingly been recognized as of benefit to both the Employer and the Contractor.

The GBR, when accurately worded with specific parameters and definitions, allows the Employer to define the conditions the Contractor must price for and so assess what residual risk remains and make provision for it. The Contractor is better able to price the work and plan his work methods, resulting in a more competitive price for the Employer. The underlying premise being that a thorough geotechnical investigation has been completed and sufficiently skilled and experienced engineers prepared the report.

The GBR does not provide a mechanism to deal with the consequences of actual ground conditions differing from those given as the baseline. This mechanism needs to be provided in the contract documents in the form of a Differing Site Conditions (DSC) clause to facilitate price and schedule adjustment as a process within the construction management [5].

It is important to note that a Site Data clause, such as clause 4.10 in the FIDIC Red Book 1999 Edition leaves the Employer at risk for:

1. Errors in the site data
2. Site data that may be reasonably interpreted in more than one way
3. Misleading or insufficient site data, contributing to the Contractor choosing unsuitable or inefficient construction methods

Rather than limiting the Employer's risk, the provision of data only can substantially increase his risk if it is not representative of the expected conditions. For this reason it is wise to include the interpretation and augmentation of the data with the experience and knowledge of a competent professional team. Even the use of a turnkey contract, such as the FIDIC Silver Book, does not exclude the Employer from all risks. This is described in more detail in section 6.

The obvious corollary to the above is that a comprehensive geotechnical investigation is vital to provide the basis for the GBR. Although it is difficult to accurately measure the benefits in relation to the costs, these are significant in terms of design optimisation and risk reduction. More important than the amount of data collected is ensuring that representative locations and parameters are chosen. It is dangerous to include information on conditions that have no bearing on the design or construction method, but which might be used by a wily Contractor to claim compensation for against a DSC. There are many reference books and papers available on what constitutes an effective site investigation, for example [6]. The purpose here is to emphasise the importance of site investigations for projects with significant subsurface works.

The applicability to hydropower projects is not just that many of these projects include underground works, but that the same principles can be applied to other aspects of hydropower projects, e.g. dam foundations, open channel cuts and fills, access roads and large structure foundations. This is discussed in more detail in section 6.

4. Payment Mechanisms

All construction contacts require clear payment mechanisms. The challenge for subsurface contracts is to balance the Employer's desire for price certainty against the uncertain ground conditions and cash flow requirements of the other parties. Generally the more geotechnical data, and interpretation thereof, available when the contract is being negotiated the better chance for a fair contract and the meeting of budgets and schedules.

The Employer must therefore take into account that the ground conditions are likely to be different than expected, and define a payment mechanism that takes into account the variations that will inevitably occur. The Checklist counsels that Employers should not try to hold parties responsible for things they cannot control:

> *Appropriately compensating Contractors for work necessarily and reasonably done as a result of circumstances beyond their control is generally regarded by the ITA as highly desirable. In many countries, despite technically falling out side the contract conditions, courts will award compensation for works necessarily completed for the benefit of the contract.* [3]

In other words, in spite of contractual allocation of risk, an Employer may still be obliged to pay for all the reasonably done work required to complete the project. Therefore the Employer is better off dealing with variations up-front in the contract, than taking on the risk of costs and delays caused by dispute resolution procedures and litigation.

Payment mechanisms should be well defined and based on clearly stated criteria. Ideally, they should separate the ground conditions from the Contractor's performance. Payment mechanisms based on unit cost, making use of objective criteria (e.g. clearly defined inspection regimes) for measurement and assessment of actual ground conditions are recommended. Suitable systems include having the Contractor bid on price and performance for specific ground conditions and then making payments via 'automatic' variations based on the actual conditions encountered. Such mechanisms typically are based on expected unit costs and quantities for specific combinations of pre-defined excavation and support classes. During the work, the Employer and Contractor agree, via joint inspections, which classes were present, the result of which is used to calculate the exact payments. (This is common practice in Switzerland and Austria, and details are elaborated in [1], [7] and [8].) Use of such mechanisms assures the Employer that the Contractor has incentives to perform, and the Contractor is assured that they will be paid fairly.

Underground works require expensive equipment with long lead times and high start-up costs. Adequate consideration must be made in the contract for the cash flow required for the start-up costs and mobilisation of specialist teams. The Employer must be aware that uncertainty of cash flow can lead to 'manufactured' and counter productive claims and disputes in an attempt to ensure adequate cash flow. The linear nature of tunnelling projects means that such disruptions frequently lead to serious and costly delays.

5. Dispute Resolution

Disputes have the potential to cause serious delays in projects with underground works. The cost of delays caused by a dispute can quickly exceed the amount at stake. It is therefore critical that disputes are recognized and dealt with in a timely manner, making use of clearly defined and efficient procedures. Likewise, the presence of minor defects in completed work should not be a cause of disputes. The contract should clearly define what constitutes substantive completion, despite the existence of minor defects, and further define mechanisms for resolving them. The Checklist encourages the definition of a series of escalating mechanisms for resolving disputes, with litigation as the last resort.

Many disputes can be avoided or amicably settled by clearly defining what is expected of all parties in the contract. The Checklist states that it is of fundamental importance that the contract explicitly defines the work to be performed, including clear statements of the obligations and responsibilities of all parties. The definitions can include a combination of prescriptive and performance terms, but they must be explicitly expressed. The clear contractual allocation of risk, commensurate with each party's commercial participation in the project, as described in section 2, is critical.

The use of DSCs and GBRs, described in section 3, are encouraged. Together they provide a baseline for managing expectations and a mechanism for resolving differences. Flexible payment mechanisms, described in section 4, are an important mechanism for avoiding disputes. By using a clearly defined payment system based on unit costs and measurements systems, minor variations are accounted for and resolved automatically.

Because many activities are on the project's critical path, tunnel projects demand quick resolution of disputes. One technique for reducing the consequences of disputes is to separate the technical effort to resolve a dispute from the financial aspects. The project organization should allow for the technical resolution of problems, without regard to, or having to wait for, the commercial resolution. This allows technical experts to begin their work immediately, which helps reduce delays.

The checklist recommends further mechanisms for resolving disputes, including the use of external independent experts, Dispute Resolution Boards (DRBs) and arbitration (both binding and on-binding). When using such

mechanisms, care must be exercised to ensure that the experts involved are accustomed to the unique issues of subsurface construction projects.

6. Trends

A major trend in contracts for hydropower projects is that of Employers increasingly adopting a turnkey procurement approach, typically using the FIDIC Silver Book. This is partly due to Employers wanting to reduce their risk, but also due to pressure from external funders also insisting on a fixed capital cost, particularly where project specific finance is required. This apparent shifting of risk to the Contractor can have unintended consequences and needs to be carefully managed in the contract.

Quality is the first aspect of a project that may suffer when risk is shifted to the Contractor. If the Contractor carries significant risk and is further responsible for the design and required to deliver to a performance specification then there is no incentive to design or build for operating efficiency, robustness or longevity. The Employer must understand that in a competitive bidding environment where the Contractor carries significant risk, the Contractor's incentive is to provide only the bare minimum necessary to satisfy the performance specification.

Another issue is the project schedule. If the Contractor's overheads are low, which is often the case in developing countries where labour intensive construction methods are used, there is little incentive to complete the project on time. This conflicts with the Employer who faces additional finance costs and lost revenue in the event of delays. If completion is scheduled immediately prior to a wet or winter season then a short delay can quickly escalate into a half-year or more, with disastrous consequences for the Employer. This situation may even be exploited by a Contractor who has significant negotiating power over the Employer, in spite of anything written in the contract, as the end of the construction period approaches. It is recommended to align the Contractor's motivations with those of the Employer by providing incentives in the contract for timely completion.

A Contractor will normally include a risk premium in his price when bidding for a turnkey project. That said, many factors such as a dearth of work, strategic entry into a new market or availability of plant and personnel from a project coming to an end, may motivate a Contractor to price low and take on significant risk. This does not protect the Employer from poor quality work or having to renegotiate to achieve a milestone if risks materialise and the Contractor is unable to respond effectively.

7. Applicability to Hydro

The ITA Contractual Framework Checklist, while developed specifically for subsurface contracts, is applicable to other aspects of hydropower construction, in particular those that require excavation. The principles of clearly allocating risk, identifying geotechnical conditions (and providing payment and schedule management provisions in the contract to manage variations in these conditions), implementing risk management procedures and including an effective dispute resolution process also apply to dam foundations and surface excavations for open channels, access roads, switch yards, etc.

Significantly different geotechnical conditions from those expected can impact both the foundation level and grouting requirements for a dam, both of which have major impacts on the Contractor's schedule and costs. It is feasible to define a concept similar to rock classification systems for tunnelling to enable geological risk sharing in the excavations for large dams.

In remote locations access roads often need to be built in difficult, mountainous terrain and surface channels feeding head ponds that lead into the penstocks are often components of smaller schemes. These both require substantial excavation and fill activities, which may benefit from the principles of risk allocation and contractual structure advocated by the Checklist.

8. Conclusion

The International Tunnelling Association's *Contractual Framework Checklist for Subsurface Construction Contracts*, produced by Working Group 3 of the ITA is a useful reference document when planning and preparing procurement strategies and documents for projects including underground works or other elements of work requiring significant surface excavation. This is true for many hydropower projects and the principles described in the Checklist can be applied across the range of procurement methods typically used.

The Checklist is not prescriptive and does not mandate particular contract forms or clauses. It is intended to alert those responsible for procurement to the best contractual practices and lessons learned from numerous underground

excavation projects constructed across the globe. In particular the principle of balancing risk between the Employer and Contractor is emphasised; a viewpoint that goes against the current trend of shifting more risk onto Contractors.

The various ITA Working Groups have produced publications on a broad range of topics related to underground excavation, which can be accessed through the ITA website [2]. While not produced specifically for hydropower projects many of these publications would also be useful reference documents on hydropower projects, which require a large amount of surface and sub-surface excavation.

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