The ITA Contractual Framework Checklist for Subsurface Construction Contracts (2nd Edition / 2020)

ITA - Working Group n°3 "Contractual Practices"

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1 >> About this document

This 2nd edition of the Contractual Framework Checklist builds upon the 1st edition by identifying and clarifying key contractual practice subject areas that ITA believes are fundamental for the success of subsurface construction projects independently of the form of contract and risk apportionment used. This 2nd edition also endorses third party documents that ITA considers to have special subject matter or geographic significance and will further assist formulation of contractual practices for improved project performance.

On May 7th, 2019, ITA and the International Federation of Consulting Engineers (FIDIC) jointly issued a "Form of Contract for Underground Works": the "Emerald Book". It takes into account all the subjects raised in this checklist. The use of the FIDIC-ITA Emerald Book is endorsed.

ITA believes most existing standard forms of construction guidelines and contracts could deal better with the variabilities inherent in subsurface environments, and the impact of those variabilities when an Employer seeks to have an underground facility constructed in this variable environment. Application of this Contractual Framework Checklist will help all parties achieve the ultimate objectives of on-time, on-budget and fitness for purpose delivery of the subsurface (below the surface of the earth, be it water or land) infrastructure.

The Contractual Framework Checklist does not specify exactly how each topic should be addressed, because each project is different. Items considered to be minimum requirements for successful subsurface project implementation and delivery are recommended in order to provide the most favorable legal basis for the construction process in the specific circumstances of any project.

This document presumes that the reader has decided to proceed with the design and construction of subsurface works and seeks to optimize project delivery by developing and using the most appropriate contractual arrangements. Optimizing the contractual arrangements for subsurface works is considered highly advantageous because subsurface projects are inherently risky and prone to cascading time and cost overruns if risks are not properly addressed physically and contractually.

This document is based on a fundamental principle that the employer should expect to pay a fair price for the construction a facility that it wants, to provide a desired function in a desired location. As it is, and in particular in underground construction, the parties must rely on incomplete sources of information when completing a design and commencing construction. While in most of the project's true costs will be determinable by time of tender, a portion may only be understood when the construction is underway or completed. The goal of this document is to provide guidance on how the parties can work together to (1) achieve the employer's facility objectives and (2) ensure that the Contractor is paid the fair price that would have been known had x-ray vision been available.

This document outlines some thoughts relating to the application of information management systems to help manage contractual information on subsurface infrastructure projects.

This document includes a list of ITA-endorsed publications which express opinions on technical matters or regional contractual and risk apportionment approaches that could be incorporated into contractual arrangements, or which may provide useful detailed advice on contractual practices within a geographic area. Endorsed documents at the time of publication are noted in Section 10. The latest schedule of these recommended documents is hosted at www.ITAWG3-endorseddocs.com .

This document supersedes all previous documents issued by ITA Working Group 3 – Contractual Practices. See note under Section 11: Conclusions.

2 >> Introduction

Subsurface construction projects pose special risks in contrast to most other works and have unique features that warrant special attention. In particular, the design and contracting of these projects should address that:

- The inherent uncertainties of geological, geotechnical, hydrogeological and structural performance of the subsurface space are properly dealt with in the contract;
- The rule of law is maintained over all stages of the project. The risk that a government or regulatory authority changes the legal environment of the project (sovereign risk) must be minimized given the time frames and financial implications of subsurface projects. Retrospective alteration of the rights of parties under a contract must be resisted as it constitutes an undermining of the rule of law;
- The impacts on time and cost resulting from geotechnical uncertainties are managed by performing an appropriate level of geotechnical investigation and analysis prior to contracting for construction;
- Specialized personnel and equipment that may be required to efficiently and effectively construct the works are considered in advance. In some circumstances these may have long lead times and high start-up costs;
- In areas without a strong history of tunnelling, industry-recommended contractual practices discussed in this document are adapted to account for the special risks in subsurface construction;
- Because of the subsurface uncertainties, the contract includes a Geotechnical Baseline Report (GBR). The GBR describes, for the purposes of tendering and for administering disputes, the subsurface conditions anticipated to be encountered during the construction process, and which party carries the risks associated with the anticipated conditions;
- The contract includes proactive procedures for the timely identification and resolution of issues between the parties, such as dispute resolution processes that involve independent persons expert in the anticipated subsurface conditions and construction methods to be employed;
- The quality and performance required for all elements of the project are described including how they will be assessed;
- Provisions are made for the programme and cost consequences of any contractually unforeseeable circumstances. These may be substantial due to the nature of subsurface construction. Careful consideration should be given to prescribing mechanisms which acknowledge and manage these uncertainties in the contract;
- Capital is efficiently and effectively distributed in the project in accordance with costs incurred (e.g. mobilization) and work performed;
- Time and resources are allocated to test and commission installed electrical and mechanical systems taking into account the limited access typical of subsurface works;
- Due regard is given to the intended use, operational performance, maintenance and sustainability of the constructed infrastructure.

All major projects demand specialized contractual frameworks. Subsurface construction projects demand special attention in the areas noted above. Failure to address these issues in a contract will adversely impact effective delivery of subsurface construction projects.

The procurement process should include: a solicitation stage that is fair and transparent, a tender phase that allows sufficient time for tender preparation and an evaluation phase that allows sufficient time to ask questions of the tenderers and to select the contractor. Tenderers should be pre-qualified to perform the works, following a prequalification processes that is project specific, transparent, auditable, and not overly burdensome. A well-planned procurement process can help attract the interest of the most qualified and experienced firms.

Tenderers have to consider site information, terms of contract, and scope of work in establishing their proposals. Therefore, the procurement process should ensure that the successful contracting team has enough time and money in the proposal to satisfactorily complete the project.

Allocation of un-assumable risk in contracts should be avoided. Unbalanced allocation of risk in contracts will inevitably complicate the delivery of a subsurface construction project because an unfair bargain increases the likelihood of highly variable pricing in the tender stage, and conflicts and disputes during construction.

The specific arrangements used in each project will depend upon its unique characteristics including financial, geological, hydrogeological and archaeological context, third party constraints, excavation methodology, risk sharing arrangements, local contractual practices and political demands.

With particular project delivery schemes, employers may seek to "lock in" a contractor for a fixed end date at a fixed price. While simple and expedient for the employer, its project cost will be greater because the tenderers will price the risk. The cost may raise higher still because subsurface-related disputes will still occur. Risk sharing, rather than risk shedding, has proven to reduce overall costs, and is therefore the more effective approach.

Employers who solicit a fixed price will pay a premium for "certainty of price" whether the priced risks materialize or not, thereby raising the cost of projects unnecessarily. There may be circumstances where this practice is appropriate – but they are considered exceptional.

Employers who seek to assign all risks to the contracting party may not appreciate that while commercial risks may be able to be captured in the transaction, political risk cannot. Simply allocating all commercial risks to the other party may leave the employer less able to manage the political consequences of a circumstance or impact, notwithstanding the commercial risk transfer.

Contracts which include a mechanism for adjusting remuneration according to the conditions encountered will only oblige the employer to pay for the risks that do occur. While such contracts require ongoing expertise and documentation to exercise the remuneration mechanism effectively, the

additional administration will be a fraction of the fixed price premiums.

At the heart of effective subsurface risk management is (1) the degree of understanding of the range of subsurface conditions that may be encountered, and (2) the ability of the construction contract to anticipate and compensate for the impacts of the encountered conditions on project programme, cost, and third party risk.

Unit price measurement and payment methods facilitate the management of risks associated with variable conditions encountered and are commonly used in a range of contract forms for subsurface construction projects. These measurement and payment methods are best suited for high risk construction projects with limited information on ground conditions and construction certainty.

The ultimate goal of a successful contract (no matter what form) is to achieve the project objectives of function, quality, environmental compliance, safety, time and cost.

3 >> Responsibilities and Procedures

3.1 CLEAR SPLIT AND BALANCE OF RESPONSIBILITIES IN CASE OF UNFORESEEABLE SITUATIONS

In subsurface construction projects there is a range of interdependent activities which must be undertaken for the benefit of all parties. The challenge is to articulate who is responsible for those activities, including items such as geological investigations, geological interpretation, safety, environmental issues, third-party risks, insurance, systems integration, testing and commissioning, and other matters (i.e. archaeologic). Failure to assign these responsibilities will inevitably lead to delays, disputes, and increased costs. Even where responsibilities are clearly articulated, it is likely that problems will still arise. Procedures should be in place to deal with such issues.

The split of responsibilities in such circumstances should be specified within the contract including, for instance, the procedures to determine where the burden for the supply of resources and payment for such activities will lie.

3.2 DISPUTE RESOLUTION PROCESS

An appropriate and effective dispute resolution process will help to avoid delays, increased costs and expensive litigation.

ITA recommends that alternative dispute mechanisms be investigated rather than defer to the traditional legal systems. Traditional court procedures will only lengthen the time required for resolution which will cause both parties to incur significant legal fees and associated personnel costs as a result. A range of alternative mechanisms for the resolution of such disputes exists, including dispute resolution boards, mediation, arbitration, and mini-trials. Each mechanism has its strengths and weaknesses.

ITA also recommends that whatever dispute mechanism is chosen, it should respect and account for the highly technical nature of issues manifested in subsurface construction disputes. In ITA's experience, disputes often relate not to legal tenants, but to the interpretation of contractual documents, programme requirements, engineering design, subsurface ground and groundwater conditions both physical and behavioural, contractual performance, and quality issues.

Maintaining good relationships between the parties will only aid in the expedient resolution of construction disputes. The maintenance of such ongoing relationships through partnering mechanisms should be considered.

The impact of a dispute or claim may be magnified if the claim is not evaluated or processed promptly. It is in the interest of all parties to resolve disputes and seek claim resolution at the lowest possible working level. There should be a mechanism which identifies the rights, responsibilities and consequences for initiation and duration of the claims process.

Early identification of issues in need of resolution coupled with clear procedures to resolve disputes is considered at the heart of all effective construction project dispute resolution processes.

3.3 CONSEQUENCES OF NON-PERFORMANCE

Non-performance by either party as well as subcontractors, suppliers and consultants can lead to greater damages and, in the worst case, termination of the contractor or contract.

Subsurface construction contracts must not only define what is required in terms of works to be provided, measurement and payment mechanisms, and dispute resolution processes, but also provide the mechanisms for timely resolution of such matters including, where necessary, directing a party to take an action, the award of damages, and termination. Such provisions are essential in order to avoid or at least minimize ambiguities with respect to the consequences of a party's decisions, behaviour or adverse circumstances which may arise during construction.

Such provisions should deal with issues ranging from disputes with respect to: adequacy of the detailed design; the assessment, review and ultimate acceptance or rejection of completed work; and payments. These procedures should also extend to administrative matters such as permits, facilities, standard of professional conduct, warranties and guarantees, standards of works and equipment, and changes in legislation and regulations.

Ultimately, it is the attention to these matters which provides the framework for the most efficient delivery of the project and, on occasions, the modification, the extension/reduction or even the removal of parties from a project. Subsurface projects (especially those involving tunnels, caverns and shafts) demand decisions to be made rapidly, capital to flow and the mobilization and demobilization of specialist teams and equipment.

3.4 RISK MANAGEMENT PROCEDURES

The implementation of formal risk management procedures in subsurface projects is highly encouraged, irrespective of the form of contract utilised. Formal risk management procedures should employ well maintained and frequently updated risk registers and risk management systems to improve the capacity to identify, control, monitor, communicate, and contractually allocate risks.

It is recommended that the employer initiate and define in an early phase the risk management process of the project.

All parties involved should participate in a formalized and documented risk management process to identify risks, identify and assign risk mitigation measures, and maintain team communications throughout construction, all of which will improve the effectiveness and efficiency of implemented controls to further reduce residual risks. Therefore, an open-minded communication policy and unrestricted sharing of all risk-related information between all stakeholders is recommended.

All success-critical factors for the project should be identified and managed by a project risk management system. Expected versus real Total Cost of Ownership and Time (substantial dates of completion) should be controlled by an integrated cost and time risk analysis.

Particular emphasis should be given to certain "High Impact & Low Probability" risks, which frequently tend to be ignored or overlooked, but could have a substantial impact on both on a financial and/or programme level.

4 >> Major Elements and Issues for Subsurface Projects

As with all construction projects, subsurface contracts demand rigorous attention to the scope of works to clearly define issues critical for a project's success. Examples for subsurface projects include the following:

- Spatial variability of subsurface ground and groundwater conditions;
- Influence of such conditions on construction means, methods, and cost;
- Configuration of subsurface spaces;
- Environmental impacts during construction and operation;
- Archaeological significance;
- Limited access to the working faces;
- Contract interfaces;
- Technical interfaces;
- Adjoining surface uses and structures;
- Long term useful life;
- Other subsurface services including existing and future infrastructure;
- Ultimate use / operation after commissioning and maintenance of the works;
- Servicing of equipment and systems during their useful life; and
- Renewal of equipment and systems after their useful life.

In subsurface projects, the geotechnical, geological and hydrogeological contexts are never fully revealed until the excavation is in process, and consequently the potential requirement for special equipment and expertise needs to be understood at the beginning of the work to mitigate the impacts of such variability.

There are also unique challenges of delivering the infrastructure fit for the intended purpose, due to the often-demanding interfaces between surface and subsurface conditions and due to challenging health, safety and environmental considerations.

All subsurface construction involves the employment of capital-intensive equipment and frequently this is designed to suit the particular circumstances of the project. It is recommended that all contracts provide mechanisms to establish which equipment and corresponding technical details are provided for in the contract to serve as a basis if a dispute arises.

To enable the assessment of construction methods, time, risks and costs in a controlled manner, it is recommended that an outline of the construction methods envisaged is developed at an early stage in the project development which corresponds with the contents of the GBR and works as a feasible solution from which a reference design and/or final design can be established.

All underground equipment must be designed to operate under unique, confined space conditions. Furthermore, work forces capable of working safely in subsurface conditions and using such equipment are often organized into specialist "teams". The ability of securing such teams for a project can be problematic and can represent a clear basis for contractor prequalification discussed in Item 2.

During the preparation of the tender documents, the employer should carefully consider which key equipment (particular, critical and/or long lead items) is required and provide outline schedules accordingly.

Due regard should be given to the special character of the works, which should be reflected in the:

- Project scope;
- Construction methodology and required special equipment;
- Manner in which fitness for purpose is to be assessed;
- Specific allocation of contractual risks;
- Obligations of parties with respect to the terms and conditions of payment.

It is of fundamental importance for all forms of contract delivery to clearly state the obligations and responsibilities of the parties. This applies irrespective of who is responsible for the project design (e.g. the employer for design-bid-build or the contractor for design-build) and whatever the combination of prescriptive or performance terms.

It is also of fundamental importance that mechanisms for dealing with disagreements associated with programmatic issues which arise from time-to-time be explicitly addressed. Early resolution should be a priority. Failure to resolve such issues may impact all parties due to long project durations and the potential impacts to the project's critical path. The manner in which such disagreements are to be resolved should be explained in detail including actions, outcomes, payments, and completion of all or part of the contract.

In each project there should be a clear definition of what constitutes substantial completion, despite the existence of defects. The manner and basis for determining what constitutes substantive completion, defects, and minor defects should be described.

5 >> Programme

While all construction projects may require consideration of the scheduling and timing, subsurface construction projects demand rigorous scrutiny of scheduling and yet must also be able to accommodate unforeseeable events. This apparent contradiction, between certainty and taking into account unforeseeable events, is at the heart of successful subsurface construction contracting. This is why the ITA considers it essential that subsurface construction contracts be geared to anticipate variations from the anticipated subsurface conditions, as well as constraints such as limited access. Robust contracts and construction programmes can anticipate variations and impacts to the planned approach. There is a range of contractual mechanisms, tools and provisions available to achieve this outcome. The exact blend should be tailored to the special circumstances of each project.

Subsurface projects also utilize specialist excavation and support installation equipment, such as road headers and tunnel boring machines, rock bolting and shotcreting equipment, slurry wall, secant pile wall, and grouting equipment, and cast-in-place concrete traveling forms. These types of equipment will have lead times for design and procurement ranging from several months to more than a year.

In addition, the programme provides an objective way of sequencing a range of inter-dependent activities. These activities range from the provision of land and site access suitable for construction staging and spoils removal, to obtaining the necessary permits and approvals for land use and around-the-clock construction activity. Time scheduling and careful work sequencing are often more critical than in traditional construction projects due to the inherent limited access conditions and the linear nature of most tunnelling activities.

Subsurface projects often require not only administrative permissions but also complex enabling works such as the diversion of existing sewers or traffic, and relocation of electrical and telecommunication lines, gas lines, and other pre-existing subsurface utilities. There is normally a requirement to conduct detailed ground and structure surveys along the alignment and adjacent properties at the surface or subsurface as well as geological, hydrogeological and geotechnical analysis of the subsurface. Frequently, the subsurface utilities are poorly identified and documented leading to potential delays. Specific consideration should be given to effecting required relocations under separate, advance contractors to avoid delays of the main construction work. Also advisable is apportioning such risks appropriately within the contract, taking into account the different types of uses in subsurface projects, such as railway, metro, road services, drainage, mine exploitation, hydropower and many others.

The potential impact and delay caused by external certifying authorities responsible for granting operational approvals (such as emergency services, environmental impact and security) during a project must be identified as part of the programme of activities to manage the risk of approval delays. It is becoming increasingly more difficult to secure such approvals at late stages of projects. Such approvals are often not dealt with as a strategic risk during the precontractual phase of a project because they are not a major civil engineering works activity. There can be significant benefits if advance works, approvals and agreements are secured prior to the commencements of the main works. All should be listed in a comprehensive risk register.

As part of scheduling of activities it is essential that in the end phase, sufficient time and access to the works is provided for testing and commissioning and third-party approvals as well as final acceptance.

For complex uses such as metro, high speed railway, roadway, drainage and sewer projects, it is essential that operational requirements are responsibly addressed in the design development. A good strategy is to allow sufficient time and budget for maintenance and operational personnel to contribute at all stages of the project and to be closely involved (participate) in commissioning and testing activities, as well as operational training where appropriate.

Although electro-mechanical/railway systems often represent a small proportion of project cost, they may account for a very significant proportion of testing and commissioning risk, particularly in projects with complex signalling, communications, traction power, and operational risks. This is especially true for metros, high speed railways, road, and hydro projects. Provisions should be made for appropriate testing and commissioning arrangements of such systems, within the project programme.

It is recommended that a project programme should indicate the critical paths, dependencies, milestones and productivities and be presented in an appropriate time line/location format as part of the contract documents.

The contractor must plan and schedule its work in advance of doing it and provide such documentation of the plan to the employer so that appropriate arrangements can be made for all the employer's contract responsibilities to be accomplished: e.g., inspection and testing, permits and approvals, payment, and others.

Specific provisions to adjust the contractual time of the project should be considered.

Therefore, ITA urges all those engaged in establishing subsurface construction projects to provide appropriate time for project completion bearing in mind the range of time critical issues such as significant uncertainty of ground conditions and location, often long lead times for personnel, capital, permits and agency approvals, insurance and equipment for securing the efficient and effective construction of subsurface infrastructure.

6 >> Allocation and Sharing of Risk

In subsurface construction projects the risks for unforeseeable geological, geotechnical, hydrogeological and other factors can be significant. Therefore, due regard to the contractual allocation of risks is especially important due to their potential impact. Effective contracts should promote risk-sharing mechanisms that are fair and equitable, following the primary principle of risk management: The risk should be allocated to the party in the best position to manage it (that, in subsurface projects, may not be the one who better understands the risks).

The desire to identify and pre-price subsurface risk prior to construction for the purposes of efficient contracting and single-point risk allocation, while sometimes viable for surface works, is fraught with difficulties when applied to subsurface construction. It is for this reason that wholesale reassignment of ground condition risks to the contractor should be strongly avoided. The challenge of identifying, allocating, sharing, and resolving subsurface risks should be considered as a continuing activity, independent of the project delivery method and contracting approach.

Based on a review of projects around the world, it is the opinion of the ITA that if the employer predetermines the project footprint, the employer should own the risk associated with the subsurface conditions, including unforeseeable geotechnical/geo-mechanical/hydrological conditions encountered within the employer's anticipated scope of work. On the other hand, the contractor should own the risk of performance with respect to: i) advance rates; ii) excavation and support methods for a defined type of ground; iii) equipment and manpower; and iv) quality and workmanship, according to the prescribed and referenced ground conditions as expressed in the contract documents and in particular, the GBR.

Risks should be more carefully addressed in subsurface construction projects than in other types of projects, because they may exceed the economical capacity of the project. It is essential that all parties are aware of the nature of the risks they bear, and which risks they are responsible for managing and mitigating to the extent possible.

Administrative risks related to third party approvals, permits and changes to laws and regulation should be allocated to the employer as an agent of the sovereign where ever possible. It is often the case that none of the parties have ultimate power with respect to such approvals, permits, laws and regulations. This is because subsurface construction projects necessarily and often require the approval of third parties, who may or may not be supportive of the project and are usually subject to changes in the law and regulations.

Subsurface projects often take longer to complete than the term of any leader, politician or political authority. The risk of changes in the rule of law should be assigned to the employer.

Furthermore, these projects often require extensive (local and international) capital and expertise. In this context, maintaining consistent lawful support for projects through their entire life (from concept through to design, construction and operation) is essential for project delivery and maintaining confidence in the world's technical, financial and insurance markets. This is especially important in transnational projects where harmonization of regulatory and operational requirements must be agreed between countries and inter- and intra-governmental support for the project must be nurtured and maintained.

In subsurface construction projects there are often changes which result in significant modifications to the programme and cost which may or may not be related to unforeseeable subsurface conditions. It is desirable that mechanisms be put in place to address time and cost variations. Sometimes, conditions are less onerous than expected and significant cost savings can be achieved. Provision for both increases and reductions in time for completion and corresponding costs should be included in the contract.

The use of a differing site conditions clause or its equivalent, e.g. an unforeseeable physical conditions clause, combined with a GBR, is recommended as best practice to effectively allocate risks and facilitate dispute avoidance and resolution.

ITA recommends that the GBR approach be used to administer such clauses in the following manner: the risks of the anticipated subsurface conditions as described in the GBR are allocated to the contractor; and any additional time and costs attributable to encountered conditions more adverse than those portrayed in the GBR are the responsibility of the employer.

It is also common that subsurface construction projects encounter issues associated with utilities and other third parties which are not foreseen at the time of contracting. Clearly specifying a mechanism to deal with such matters is considered prudent to minimizing overall impacts to project costs and programme.

Due care should be given to force majeure events which have the potential to significantly interfere with all subsurface development. Accordingly, they should be dealt with within the framework of the contract.

7 >> Terms and Conditions for Payment

Subsurface construction projects demand clear mechanisms for payment, with the ability to be flexible and adapt to changing geological conditions and associated changes in constructions methods. Balancing the legitimate needs of price certainty of the employer and financier with the cash flow requirements of other parties demands a detailed pre-construction analysis. As a general rule, the more geotechnical data and interpretation that is available to parties in the early stages of a project, the greater the certainty will be for meeting budgets, making timely payments, and achieving programme goals.

Due to the long lead times, high start-up costs, the range of specialist equipment, and the personnel required to design and construct such projects, certainty of cash flow is essential for the effective delivery of such infrastructure. Uncertainty in the mechanism or unreliability of payment jeopardizes such projects as a disruption to any sub-component frequently leads to a serious interruption to the critical path for project delivery. In some cases this may contribute to the termination of the contract or bankruptcy of the contractor.

Clearly stipulating the terms of payment, mechanisms for interim payment and the processes to certify that the works meet the acceptance criteria is essential. Where measurements or other analysis is required (often via a clearly defined inspection regime) in order to quantify payment, it is desirable that such procedures and mechanisms are clearly articulated in advance in the contract.

When the employer receives a well–substantiated claim for additional costs and/or time, this should be acknowledged at an early stage.

Compensating the contractor for additional work that resulted from circumstances beyond its control is generally regarded by ITA as highly appropriate.

Without such contract mechanisms and certainty that they will be followed and respected, it is inevitable that the delivery time and price for the infrastructure will be adversely affected.

8 >> Terms and Conditions for Insurance Policies, Guarantees and Penalties

Clearly stipulating the terms and conditions for insurance policies is essential in the preparation of tender documents. The amount and definition of insurance coverages, required for the different types of liability (general, professional, third parties, etc.), as well as the duration of the coverage must be an integral part of the contract. The relative contractual provisions must be verified and clarified with the insurer, who (after the clarification) will be bound to a specific insurance policy aligned with the contract particulars. This should be an integral part of the contract documents, eventually as annexes to the contract.

Clearly stipulating the terms and conditions for guarantees (Performance Guarantee / Performance Bond, Advance Payment Guarantee (if applicable), Guarantee for Defects Remedial, Warranty Bond, etc.) is essential. The amount and definition of the required guarantees, as well as their duration and the conditions for their release must be an integral part of the contract. The guarantee certificates, issued from a bank, an insurance company or other type of institutions, should be an integral part of the contract documents.

Clearly stipulating the terms and conditions for premiums and for penalties, if applicable, is essential. The amount and definition of the mechanisms /rules for the determination of premiums and penalties, including the maximum aggregate amount (for the case of cumulated penalties) must be an integral part of the contract.

The management of large amounts of complex changing data in subsurface construction projects is a critical part of successful project control and delivery. There are various demonstrated and proven methodologies for managing the planning, design, and construction phases of a project that may later also serves as a base for efficient long-term information-based maintenance.

The implementation success of information management systems requires that, whatever system is used, it meets the technical and administrative constraints and requirements of a project.

When implementing such a system in a project, consideration is needed to ensure a successful completion. Existing processes and deliverables are proven and accepted, but when implementing new technology and processes or new ways of work this is usually not the case. Therefore, some developments and possible changes may have to be considered.

The main considerations for successfully implementing any information management strategy from a contractual perspective are:

- Identifying the challenges, needs and benefits, apportioning responsibility and rights to each party and phase (design, construction and maintenance), to enable correct adaptation and optimization of data and processes, information models and structures;
- Formulating the rules for creating, using, editing, distributing and exchanging digital information is the foundation of any information technology. Consider especially the terms of liability, security and control;
- Mastering the exchange of information in order to specify what information is valid, relevant and what is the right of use of the information during the different phases and by different parties;
- Specifying the priority of information legally in any marking and visualizing uncertainties in geological data correctly;
- Specifying if and if so how concurrent design and review will be managed to avoid accelerated change iterations;
- Using standardization of new deliveries, terms, definitions, processes and routines to avoid misunderstandings, and to achieve increased clarity;
- Clarifying security classification, access rights, copyrights and reusing digital information within and outside the project, to avoid unauthorized use;
- Ensure that whatever method of information management is adopted the likelihood of multiple or contradictory information is minimized;
- If applicable, providing digital models that can be used to replace or complement drawings and other documents, considering that this might result in multiple or contradictory information;
- Adopting standard contract clauses that need to be modified with an order of precedence to accommodate the digital model complemented by procedures and regulations about usage rights related to data and models, where applicable.

10 >> Endorsements

The Contractual Practices Working Group 3 of ITA (WG3) has considered and reviewed a range of contractual and technical publications from around the world. The following documents are considered useful for the management of subsurface works contracts (December 2019) and are offered for further information :

- FIDIC-ITA Form of Contract for Underground Works, designed by the Contractor according to the reference design by the Employer and the Geotechnical Baseline Report (FIDIC-ITA, 1st Edition, 2019).
  https://fidic.org
- A Code of Practice for Risk Management of Tunnel Works (ITIG, 2nd edition, 2012, UK);
  https://www.imia.com/wp-content/uploads/2013/08/ITIG-TCOP-01_05_2012.pdf
- Swiss Standard Series for underground Works (2004, SIA, Switzerland):
  - SIA 197 “Design of Tunnels. Basic Principles”
  http://www.webnorm.ch/4f3ac0f0-8e65-4652-85ee-351416ed9c34/D/DownloadAnhang
  - SIA 198 “Underground Structures. Execution”
  http://www.webnorm.ch/f7c6fc15-d0f5-4bcb-92fc-5435e256eee2/D/DownloadAnhang
- Gold Book - Geotechnical Baseline Report for Construction (Randall Essex, P.E., 2nd Edition, 2007, USA), ISBN 978-0-7844-0930-5
  https://sp360.asce.org/PersonifyEbusiness/Merchandise/Product-Details/productId/232148866
- AFTES Guidelines « Cost control and forms of contract» GT25R3A1 - 2016-TOS n°254.
  http://www.aftes.asso.fr/commande-recommandation.html
- Recommended Contract Practices for Underground Constructions - 2nd Edition, SME, 2019; ISBN 978-0873354592
  https://smemi.personifycloud.com/PersonifyEbusiness/Store/Product-Details/productId/3239421

Details of endorsed documents are hosted at the ITA Web site at
https://about.ita-aites.org/publications/wg-publications/content/214-endorsed-documents-by-working-group-3

11 >> Conclusions

The relationship between parties in all subsurface construction projects is primarily governed by the written "contract".

Contracts are as variable as the demands of the global projects and as creative as those who draft them. From standard form contracts, such as SIA, FIDIC, NEC and other public and private institutions, to uniquely drafted legal frameworks, which may even include special laws to expedite arrangements, the possibilities are almost boundless. This is why it is essential that special attention be given to the factors regarded by ITA to be critical to the success of subsurface construction projects.

Effective risk allocation and management is of paramount importance for the successful completion of underground projects. The practices recommended in this document could improve the predictability of time, costs and the budgetary requirements of underground projects. It is essential that these special subsurface construction issues and the manner in which they are dealt with be considered in all subsurface project contracts.

The FIDIC-ITA Form of Contract for Underground Works (the Emerald Book) contains general conditions of contract as well as guidance for the preparation of particular conditions and of tender documents related to design-build project delivery. The Emerald Book is the first in FIDIC's family of contract forms to be adapted for application to underground construction. It is anticipated that over time, similar revisions of other FIDIC documents will be developed.

Risk sharing concepts are an essential element to "fair" contracting for underground works. While the tools to use are understood, how risk sharing provisions are best incorporated into different forms of contract used around the world is less well understood. One of ITA's WG3 goals is to provide additional guidance on this subject.

12 >> Appendix – Checklist Table

CONTRACTUAL FRAMEWORK CHECKLIST FOR SUBSURFACE CONSTRUCTION	CHECK
Decision to proceed with the design and construction of subsurface works	
Sufficient time for preparation of the tender documents, the tendering phase and the selection of the contractor through a transparent prequalification process	
Timely and appropriately scoped geotechnical investigations prior to tender rather than following	
Consideration of how to unforeseeable geological, geotechnical and hydrogeological risks, as well as archaeologic and administrative risks related to third parties	
Investigation of pre-existing subsurface utilities and their impact on the works	
Consideration of advance works contracts to remove or relocate subsurface utilities that would impact the work, prior to engaging the tunnel contractor	
Effective subsurface risk management: understanding of the range of most probable subsurface conditions; how to compensate for known conditions that cannot be quantified at time of tender; and how to compensate for the impacts of unforeseeable conditions on project time and cost	
Preparation of a Geotechnical Baseline Report that portrays the anticipated physical conditions to be encountered, how the ground is expected to react when subjected to certain construction means and methods, and what measures will need to be implemented to mitigate adverse behaviours.	
Implementation of formal risk management procedures, from the early phases of design through construction completion, with all parties involved in the identification, management, and mitigation of the major risks.	
In the case of design-build delivery, clear Employer's Requirements that include an appropriate reference design	
Mechanism for adjusting remuneration according to the conditions encountered	
Clear split and balance of responsibilities in case of unforeseeable situations	
Mechanisms for clear and timely resolution of matters related to works, delays, cost, payments and disputes	
Involvement of suitably qualified experts experienced in subsurface construction in the dispute resolution process	
Project programme should indicate the critical paths, dependencies, milestones and productivities and be presented in an appropriate format	
Sufficient time and access to the works should be provided for testing, commissioning and third-party approvals	
Specific provisions to adjust the contractual time of the project	
Clear mechanisms for payment, with the ability to adapt to changes in geological conditions and their impacts to construction methods and sequences	
Clear stipulation of the terms and conditions for insurance policies, for guarantees and for premiums and penalties	
Implementation of an effective construction inspection and monitoring program that provides information able to facilitate a comparison with the anticipated subsurface conditions indicated in the GBR	
Implementation of an effective information management strategy	

>> Notes for the User

The applicability of specific contractual provisions to any project can only be determined by detailed analysis of the unique circumstances of a project. Previously published ITA contractual propositions must not be adopted on a project without obtaining expert advice as to their applicability.

This document is an adjunct to, and not a substitute for, expert legal advice.

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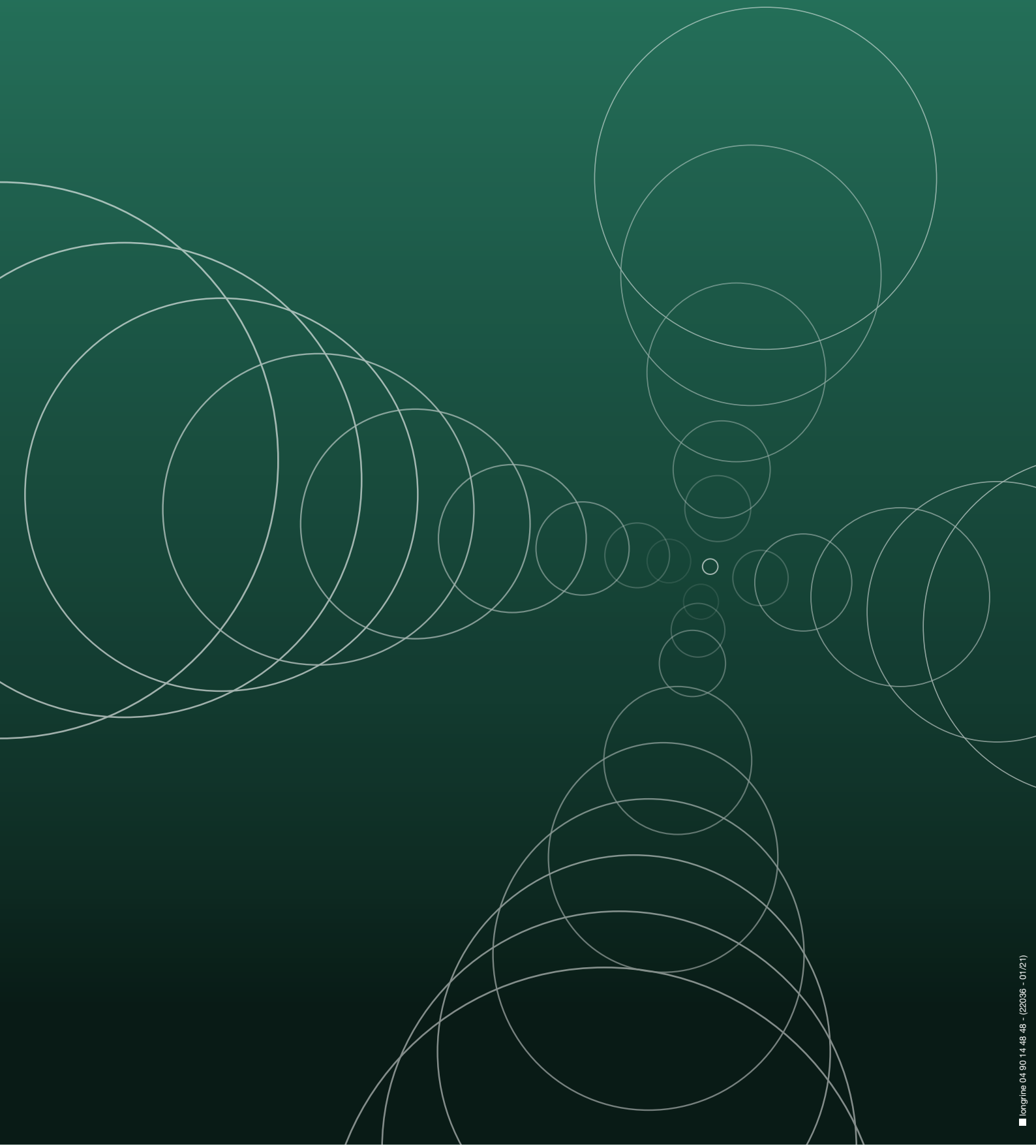

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