

FIDIC Middle East Contract Users' Conference

**Dubai,
24-27 February 2020**

James Maclure

FIDIC Task Group 10



International Federation of Consulting Engineers
The Global Voice of Consulting Engineers



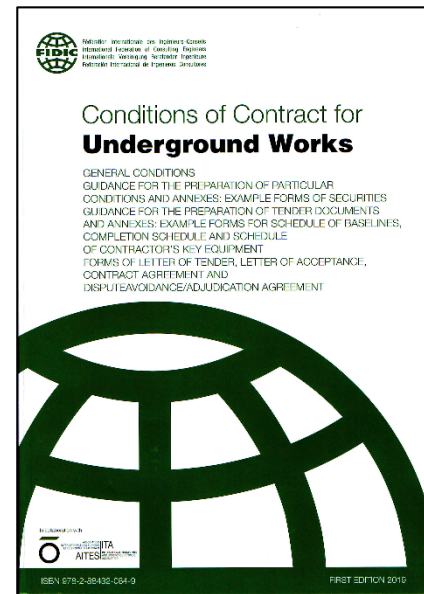


FIDIC Middle East Contract Users' Conference

Dubai, 24-27 February 2020

Agenda :The FIDIC Emerald Book. 1st Ed. 2019

1. Introduction
2. Underground Works and Risk Allocation
3. Key Concepts
4. The Role of the Engineer
5. A Simplified Example – Adjustment of Time
6. Concluding Remarks





1. Introduction

Underground Works – a growing demand

Over 50% of the world's population now live in cities - two thirds will by 2050.

Cities will face great challenges over water supply, waste water disposal, pedestrian links to shopping malls. protected storage of bulk commodities such as fuel and water, high speed rail networks.

Transport routes will need to cross hills and mountains, Energy production will need water transfer tunnels, Nuclear power stations will need huge sub-surface storage facilities for nuclear waste.





What's the problem?

A look at tunnelling contracts....

'You have a 90% certainty of an average 33% cost overrun and a 23% time overrun, regardless of the risk assessments made by the project protagonists' *

Will Siganto

in 'Tunnels & Tunnelling' Sept 2019

***based on analysis from a database of 11,000 projects.**

A distinction between the 'foreseeable' and the 'unforeseeable'

' Construction time and remuneration can change within the foreseen circumstances, and this can account for roughly 75% of the Contractor's disputes' *

Kurt Hechenblaickner, Strabag,

*** FIDIC Conference London Dec 2019**





Underground Works and Risk Allocation

What's special about Underground Construction?

The principle material affecting underground works is the ground – provided by nature and not necessarily to our specification.

1. The choice of the method of excavation and lining has a strong influence on the successful project outcome.
2. Access to the Works is often limited to a few points or even a single point.
3. Land, below which the Works are carried out, usually belongs to different third parties, who may be impacted by un-desired consequences (e.g. settlement!).





What's special (cont'd)

In addition Underground Works:-

- 1. Require very extensive investment in specialized contractor's Equipment**
 - 2. Are time consuming to carry out - requiring lengthy planning, procurement, advance works and, once started, lost time may be difficult to recover.**
-
- ❖ The Emerald Book is based on the FIDIC Yellow Book 2nd. Ed. 2017, but with a unique risk/reward allocation.**
 - ❖ The Emerald Book is recommended for any project where: “a significant proportion of the Works are carried out beneath the natural or man-made surface of the earth”.**





Risk Allocation

Risk Allocation principles

- The general principle in FIDIC is that the contract must be essentially fair and balanced in character and any unbalanced risk allocation should be clearly stated.
- In the FIDIC Red and Yellow Books “unforeseeable physical conditions” are a neutral risk – giving the Contractor entitlement to EOT & Additional Cost, but not profit!
- However when encountered in underground works “adverse” unforeseen conditions have a major impact on Costs (and time) – Contractors argue that it is “not essentially fair” that they are denied profit on such a big element of the final outturn Costs!





Employer's Risk and Reward in the Emerald Book

- The Employer selects the site (or makes it available), and is best placed to carry out comprehensive ground investigations
- In the Emerald Book the Employer sets out his “take” on foreseeable conditions in a Geotechnical Baseline Report (GBR), which represents his preferred prediction of the subsurface physical conditions and behaviour under excavation and support. The Contractor must take these conditions into account when preparing his tender.
- The Employer pays more only if the conditions are worse than anticipated.
- The Employer pays less and enjoys earlier completion if the conditions are better than anticipated (his reward).





Key Concept: The GBR defines the 'foreseeable' subsurface physical conditions

Since the GBR defines what subsurface physical conditions (including behavioural conditions) are foreseen, then subsurface physical conditions which are outside the predictions of the GBR are defined as 'unforeseeable'!

Risk arising out of performance under foreseen conditions still lies with the Contractor and is deemed to be covered by his rates and prices. However re-measurement applies - so he is paid at his quoted rates for actual work done.

It follows:

- Contractor will gain if he performs better than expected under foreseen conditions.
- Employer should gain if conditions are better than foreseen in the GBR!
- And Contractor may claim if he encounters 'unforeseeable' conditions.





Contractor's Risk and Reward in the Emerald Book

The Emerald Book is a design-build contract - the Employer defines the 'intended purpose' in order to rely on the Contractor's specialised resources and experience to ensure that the Works, when completed, will be fit for that 'intended purpose'.

- **The Contractor examines the Contract Documents carefully before submitting his Letter of Tender and then scrutinises the Employer's Requirements in detail after Contract award, (SC 5.1) drawing attention to any errors or faults etc. he may discover.**
- **The Contractor must provide firm production rates or durations against each activity or item of Excavation or Lining work (now defined terms) set out in the Baseline corresponding to the work zone or tunnel drive.**
- **The Contractor is rewarded if he achieves better than anticipated production rates!**





Key Concept: Schedule of Baselines

- The Employer provides a Schedule of Baselines based on the GBR
- Each baseline contains quantified estimates of the different ground conditions, excavation and support activities required to complete a particular excavation drive or zone.
- The Contractor enters corresponding production rates against the activities in the Schedule of Baselines - the Schedule of Baselines is about quantities and time not money!.
- The Contractor's production rates will be binding, and are relied on to provide a mechanism for the adjustment of the time for completion of the excavation drive or zone.





Schedule of Baselines (cont'd)

A typical Schedule of Baselines contains a list of works that the contractor has to allow, say in a specific tunnel drive or zone. For example a Baseline Schedule might include:

- *Excavate and secure tunnel in a ground Class A (GBR para. X1 drg.D1) - 2,500 m.*
- *Ditto in ground Class B (GBR para X2 and drg.D2) - 1,500 meters.*
- *In ground Class B, allow for total water inflow at face >15 ltrs/s for a length of 100 m of tunnel*
- *Allow for probe drilling at the tunnel face - total length of drilling - 500 m.*
- *Allow for interruptions for investigations instructed by the Engineer - 200 hours.*





Key Concept: The Completion Schedule

- **The Completion Schedule is a Schedule (provided by the Employer in the Contract Data) setting out the Milestones, Sections and Works, consistent with the Milestones and/or Sections given in the Schedule of Baselines.**
- **The Contractor completes the Schedule by computing the Time for Completion of each Milestone or Section, based on the quantities and production rates in the Baseline Schedule, taking account of the logical sequential links between each Milestone and/or Section.**
- **Times for Completion in the Completion Schedule will be subject to adjustments through re-measurement and calculation, and the Programme, once accepted, will incorporate and supersede the Completion Schedule.**





Key Concept: BOQ & Measurement

- Although the Emerald Book is 'Design-Build' based on the 2017 Yellow Book, the Excavation and Lining Works are to be paid according to quantity of work done.
- Accordingly a Bill of Quantities must be included in the Schedule of Rates and Prices, for pricing by the Contractor, for each Section of the Excavation and Lining Works.
- This Schedule of Rates and Prices should be structured to include Preliminary and General Items *and* Method-related charge Items *i.e. fixed rate items, time-related items and quantity-related items* as applicable to the whole of the Works and/or individual Sections or Milestones.





Key Concept : Monitoring Ground Conditions

Monitoring and Recording actual ground conditions is of key importance!

- **The Contractor's unit cost and production rates (or activity durations) are based on agreed measures in response to described geotechnical baseline conditions.**
- **The Employer pays the Contractor to achieve the performance he promised, and therefore needs to know when conditions differ from the described baselines.**
- **The Engineer acts for the Employer, so will monitor the actual ground conditions, and agree and/or determine the records with the Contractor.**
- **The Engineer also records the measures that the Contractor takes to determine that they were necessarily carried out and in accordance with the Contract.**





Key Concept: Adjustment of Time and Contract Price

Time for Completion - The Engineer will, following measurement of Excavation and Lining Works, adjust (reduce or extend) the time allowed in the Completion Schedule by

- applying the production rates provided by the Contractor
- to the measured quantity of each item necessarily carried out (as agreed and/or confirmed by the Engineer).

The Contract Price - Now include three components:

- i) Lump sum items - all works not subject to remeasurement
- ii) Payment for Excavation and Lining work - based on the measured quantities.
- ii) Payment of time-related items - taking into account the adjustments of time.





The Roles of The Engineer

In keeping with other FIDIC forms of contract, the Engineer has a double role in the Emerald Book:

- **On the one hand he/she is engaged by the Employer, defined as ‘Employer’s Personnel’ and entrusted with the responsibility of administering the Contract.**
- **On the other hand he/she is required to act ‘neutrally’ between the Parties when it comes to agreeing or determining any matter or Claim under Sub-Clause 3.7.**
- **The Guidance for the Preparation of Particular conditions at S/C 3.7 suggests that acting “neutrally” means that “the Engineer treats both Parties even-handedly, in a fair minded and unbiased manner”**





Engineer's Specific Duties and Authority for Excavation and Lining Works

Sub-Clause 3.2.2 provides that *“The Engineer shall monitor and record progress of the execution of the Excavation and Lining, for compliance with the Contractor’s obligations under Sub-Clause 4.24 [Excavation and Lining].”*

Such records shall state whether the measures taken under Sub-Clause 4.24 [Excavation and Lining Works] were jointly agreed between the Engineer and the Contractor, and if not, the Engineer’s reasons for disagreement.

Ideally the decisions on the required support are taken jointly (Contractor to suggest, Engineer to agree)

If there are different opinions, the Contractor decides, since he is primarily responsible for the safety of the Works, and the Engineer will then follow SC 3.7 to determine or determine entitlement to adjustment of time or Cost.





Adjustment of Time -Simplified Example -1

Project

4,000m of tunnel, GBR anticipated between 40% and 70% in ground Class A, rest in Class B with one major fault with a possibility of significant water inflow. In the Baseline Schedule the Employer selects 60%(2400m) in Class A, 40%(1600m) in Class B, 20 metres of class B with water inflow above 15ltr/sec and 500m of instructed probe drilling/grouting .

Contractor plans to excavate 10m/day in Class A, 5m/day in Class B, 2m/d when water inflow above 15ltr/s, Probe drilling 100m/d

Programmed time

Class A tunnelling	2400m at 10m/day	=	240-days
Class B tunnelling	1580m at 5m/day	=	316-days
Class B tunnelling	20m at 2m/day	=	10-days
Instructed probe drilling	500m/100m/dy	=	<u>5-days</u>
<u>Total programmed time</u>		=	<u>571-days</u>

Scenario 1 – actual 20%(800m) Class A; 80% (3200m) in Class B; 50-metres of faults water inflow $\geq 15\text{ltr/s}$. 20dys probe drilling

SO the Allowable time is calculated

Class A tunnelling 800m at 10m/day	=	80-days
Class B tunnelling 3150m at 5m/day	=	630-days
Class B tunnelling 50m at 2m/day	=	25-days
Instructed probe drilling	=	<u>20-days</u>
<u>Total allowable time</u>	=	<u>755-days</u>

Time adjustment (EOT)

755days - 571days = **184-days EXTENSION OF TIME**





Example (Cont'd)

Project - Scenario 2

Conditions are better than expected with 3000m of class A and only 1000m of Class B, and in the fault zone the water inflow was always less than 15ltr/s. However 5-days were still spent probe drilling

The programmed time is still 571-days

Scenario 2 – actual conditions 2400m in Class A and 1600m in Class B and no water inflow $\geq 10\text{ltr/s}$

Again the Allowable time is calculated

Class A tunnelling 3000m at 10m/day = 300-days

Class B tunnelling 1000m at 5m/day = 200-days

Class B tunnelling at 2m/day = 0-days

Instructed probe drilling = 5-days

Total allowable time = 505-days

Time adjustment (EOT) 505days - 571days = - 66-days REDUCTION IN TIME





Example (Cont'd)

Scenario 3 – The actual conditions were exactly as the Employer had anticipated in the Baseline Schedule, but the Contractor failed to maintain his promised production rates and finished 30-days late.

The programmed time is still 571-days

Assuming the tunnel was on the critical path and there were no qualifying grounds for an EOT - the Contractor would be liable to 30 days Liquidated Damages!

Conclusions from the example!

For the Employer to get the project finished on time and to budget, he needs to be able to accurately describe the subsurface physical conditions and ground behavior in the GBR. In this way he only pays the Contractor at his quoted rates for work necessarily performed according to the conditions encountered.

The Contractor would be rewarded by bettering his own production rates and prices.

A true 'win-win' situation!





Concluding Remarks

Emerald Book - the job is not yet finished yet!

Outstanding tasks include:

- Preparation of a detailed clause-by-clause “Guide”
- Listening to feed back, correcting errors, taking on board improvements.
- Preparation and rolling out of training courses on various aspects of the use of this form of contract, including
 - ❖ Preparation of tender documents and the GBR.
 - ❖ The management and administration of an underground works contract using the Emerald Book



THANK YOU!

