Fair and Transparent Payment for Excavation and Lining Works / How Bill of Quantities are Utilized According to The FIDIC Emerald Book

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Note – Defined terms (capitalized terms) in this paper shall, unless stated otherwise, have the meaning given in the Emerald Book, 2019

ABSTRACT: The FIDIC Emerald Book has been drafted with the aim of providing fair and balanced contracts for the underground industry. The excavation and lining works of a tunnel depend on the geological/geotechnical situation, which will be encountered during the execution. It is not possible to estimate the required quantities for the support beforehand and remuneration of the Contractor needs to be flexible to account for these uncertainties. In many tunnel contracts, it is a problem how cost for extension of time due to changed geology (or other circumstances not in the sphere of the Contractor) is compensated. It is a fact that the Contractor has higher costs when the execution of the project takes longer than indicated in the Contract and these costs should be paid to the Contractor. To facilitate these concepts the Emerald Book foresees different BoQ items for the excavation and lining works only, which cover Fixed-rate items, Time-related items and Quantity-related items. All other parts shall be covered in lump sums.

KEYWORDS: FIDIC, Emerald Book, Fair compensation, Bill of Quantities, Time related cost

1. INTRODUCTION

FIDIC contract forms are drafted with the background of establishing a fair and balanced risk allocation between the parties. In the past, when FIDIC documents (Red or Yellow Book) were used as the basis of contracts for underground projects there were often problems/disputes when it came to ground conditions that were different from those anticipated/described. These problems relate to the compensation for excavation and lining works as well as problems how the Contractor is compensated for extensions of time (compensation of time related cost).

The Emerald Book is very explicit in the allocation of risk in regard to the Excavation and Lining, where the geotechnical risk is attributed to the Employer including the risk of increased quantities of support. The Emerald Book addresses this situation by compensating the Excavation and Lining Works by measurement of the actual encountered ground conditions in accordance to a Bill of Quantities prepared by the Employer and priced by the Contractor.

2. MEASUREMENT OF EXCAVATION AND LINING WORKS AND ADJUSTMENT OF TIME FOR COMPLETION AND CONTRACT PRICE (CLAUSE 13.8)

The introduction to the relevant clause in the Emerald Book provides that unless otherwise stated in the Contract, only the Excavation and Lining Works shall be subject to measurement, and the Accepted Contract Amount shall be deemed to cover all other Underground Works and all things necessary for the proper execution and completion thereof in accordance with the Contract.

The Contract Price and Time for Completion shall be adjusted following such measurement, and the Parties shall be entitled to such adjustments without the need to submit a Statement or any formal Notice (including any requirement to comply with Sub-Clause 20.2 [Claims For Payment and/or Extension of Time]).

2.1 Adjustment of Contract Price

The cost of the Excavation and Lining Works will largely depend on the subsurface physical conditions and/or ground reaction(s) to such works. The conditions of the Emerald Book provide that the Excavation and Lining Works are to be measured and paid for using rates and prices set out in the Bill of Quantities. Under these conditions, it is the Contractor that measures the as-built quantities, which are then agreed or determined by the Engineer. All the other Works (for example, ancillary surface works) are to be paid on a lump sum basis.

Due to the typically long duration of underground works and to the high cost of investment in equipment, an important portion of the cost to the Contractor, such as for example, depreciation of and interest for equipment, overhead charges etc., is time-related, whilst the remainder of the cost depends on the volume or quantity of the performed works. Hence, the adjustment of Time for Completion (if any) due to the difference between the contractually agreed and the encountered subsurface physical conditions should also lead to an adjustment of the Contractor’s remuneration for time-related charges. The Bill of Quantities for Excavation and Lining Works should therefore distinguish between time-related rate items, quantity-related rate items and fixed rate items for the performance of the Works (Sub-Clauses 13.8.2 and 13.8.3).

2.2 Adjustment of Time for Completion

The Time for Completion of the Works, of a Section or any Milestone may largely depend on the subsurface physical conditions that are encountered during excavation. As the risk related to these conditions is allocated to the Employer under the provisions of the Emerald Book, Time for Completion should be adjusted by the variation of these conditions within the limits defined by the GBR, insofar as this variation affects the critical path of the Works, of a Section or any Milestone.

In the case that the amount of a more onerous condition encountered is higher than described in the GBR, the Time for Completion should be extended, while in the case that the amount of less onerous conditions is higher than described in the GBR, the Time for Completion should be reduced.

Accordingly, the Contractor’s Tender shall include production rates for each excavation drive or zone, based upon the conditions described in the GBR. The estimated quantities of the excavation, ground support, ancillary measures and lining, as well as the corresponding production rates shall be included in the Schedule of Baselines (Sub-Clause 8.2.2), and the corresponding sequential logical links between Milestones shall be included in the Completion Schedule (Sub-Clause 8.2.1).

3. PROVISIONS IN THE EMERALD BOOK FOR BILL OF QUANTITIES

Clause 13.8.2 Bill of Quantities for Excavation and Lining Works provides:
The Bill of Quantities sets out the quantities, units of measurement and applicable unit rates and prices for all Excavation and Lining Works.

Unless provided otherwise in the Employer’s Requirements, (a) initial quantities shall be determined by the Employer, consistent with the Employer’s reference design, the Geotechnical Baseline Report and the Schedule of Baselines, at a level of detail sufficient to enable the Contractor to establish unit rates or prices for each activity or, if agreed, group of activities, and (b) the Bill of Quantities shall be completed by the Contractor with his tendered unit rates and prices.

For the purposes of this Sub-Clause:
- a “fixed-rate item” or “fixed charge” or similar term used in the Bill of Quantities shall be taken to refer to a rate or price which is not subject to adjustment for any change in quantity;
- a “time-related item” shall be taken to refer to a rate or price for an item of work which is proportional to the length of time taken to execute the work not the quantity of that (or other items of) work;
- a “quantity-related item” shall be a rate or price for a unit quantity of the item of work; and
- a “value-related item” or “value-related charge” shall refer to a rate or price considered proportional to the value of the item of work.

4. HOW IS THE BILL OF QUANTITIES ESTABLISHED ACCORDING TO THE EMERALD BOOK?

The answer to this question takes us way into the early stages of a project and the guidance for preparation tender documents, which is part of the Emerald Book.

The nature of underground projects require substantial preparation before floating a tender, which are to be conducted by the Employer and/or his consultants.

A minimum of following tasks are expected to be carried out by the Employer and his consultants:

a) Execution of a site investigation:
   - The Site Investigation should provide sufficient range of information, considering the size, nature and complexity of the project and cover at least:
     i. Adjacent property and relations with 3rd parties
     ii. Access to site and working areas
     iii. Geology, hydrogeology, hydrology and geotechnics
     iv. Disposal of excavated material and waste material
   
   b) Preparation of a Geotechnical Data (GDR) based on the information gained from the site investigation
   
   c) Preparation of Employer’s Requirements
   
   d) Preparation of a Geotechnical Baseline Report (GBR)

The GBR contains the only contractual definition of what is assumed to be encountered in defining the contractual allocation of the risks for subsurface physical conditions between the Parties. The risk allocation in the GBR depends on the Employer’s preferred risk acceptance. The design concept chosen by the Employer and the GBR is thus an interpretation of the expected subsurface physical conditions, adapted to the preferred risk allocation by the Employer.

e) Preparation of an Employer’s Reference Design

The Employer’s reference design should:

i. be compatible with the Employer’s Requirements, and the Employer’s preferred assessment of acceptable physical risks;
ii. be based on and consistent with the conclusions of the preliminary investigations in the GDR,
iii. cover the Permanent Works and the excavation and support procedure for the Underground Excavation and Lining Works; and
iv. be consistent with the GBR and the various relevant Schedules.

The Employer’s reference design should be produced by a qualified and experienced designer and peer reviewed prior to issue.

Based on the GBR and the Employer’s Reference Design, which is in turn based on the excavation method preferred by the Employer, the Bill of Quantities and the Schedule of Baselines (“BoQ for time”, which is covered by another article at this conference – see references) are derived.

5. DIFFERENT ITEMS OF THE BILL OF QUANTITIES

As outlined above the preparation of the BoQs is the duty of the Employer, respectively the Employer’s consultant. When deriving the BoQs from the Reference Design it is important to consider the detail of site investigation, the reliability of the data obtained, the complexity of the project and other factors relevant. Based on this the Employer can choose the level of detail of the BoQs.

The more detailed the BoQs are developed the more scenarios of required support can be covered and if the geotechnical conditions are outside the GBR relevant prices of items for claims might be available. However, on the other side the higher the detail of the BoQs the more complicated the evaluation of the tenders and the execution during the implementation of the project.

The Bill of Quantities for the Excavation and Lining Works shall include fixed rate items, time-related rate items and quantity-related rate items for the Excavation and Lining Works, as follows:

5.1 Fixed rate items

Fixed rate items are for, as appropriate, the provision of Contractor’s Equipment, facilities, and supervision, facilities and services required by the Employer’s Personnel, fees for relevant Contractor’s overhead charges, and the maintenance of such provisions for the relevant section of the Excavation and Lining Works for the period necessary according to the Completion Schedule.

5.2 Time related rate items

Time-related rate items are for, as appropriate, the extended or reduced availability and maintenance of the fixed rate items in sub-paragraph (5.1) above, all expressed, unless otherwise specified, in units for an extension or reduction for a calendar day.

5.3 Quantity-related rate items

Quantity-related rate items are for the Excavation and Lining Works, and Plant supply and installation for the relevant portion of the Works.

For the Excavation and Lining, the BoQ for quantity related items as a minimum can contain only several support classes, as per the GBR and the reference design, which cover all measures needed to stabilize the cavity. However on the other hand the BoQ can contain hundreds of items detailing each and every individual support measure, drainage drilling and rebar that might be required. To find the right level of detail to make the project administrable is the task of the Employer and Employer’s consultant.

5.4 Value-related charges/items

Unless provided otherwise in the Particular Conditions, value-related charges for compliance with contractual provisions such as, without limitation, insurance, securities, permits and levies for the relevant portion of the Excavation and Lining Works, shall be included as percentage additions in the rates described in (5.1), (5.2) and/or (5.3) above.

6. BOQ IN CASE OF AN ALTERNATIVE DESIGN FORM THE TENDERER

The Emerald Book is open to alternative proposals from the tenderers and leaves this for the Employer to decide. In case there is an alternative proposal the tenderer is required to provide supporting documentation to the level of detail stated for a compliant tender and in particular details of the proposed alternatives for:

- the preliminary design and

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• the alternate methods of construction for excavation and support; and
• all relevant supporting Schedules to enable the Employer to evaluate the Tender and in particular any changes in the risk allocation between the Parties.

Any alternative proposals shall therefore contain a fully developed set of supporting tender documents, including in particular a GBR, a Schedule of Baselines, a Completion Schedule and a Bill of Quantities that are applicable to the proposal.

The acceptance or refusal of the alternative proposal shall be at the sole discretion of the Employer.

7. RESPONSIBILITY FOR MEASUREMENT

Contractor is responsible for the measurement and shall submit relevant measurements with full supporting records to the Engineer at the intervals stated in the Contract Data (if not stated then at monthly intervals). The method of measurement for the Bill of Quantities needs to be defined and shall be as stated in the Contract Data.

After receiving the measurement records, the Engineer shall proceed under Sub-Clause 3.7 [Agreement or Determination] to agree or determine the measurement.

If the Engineer finds the measurement in order he will agree on the same, however if the Engineer for example does not share the understanding of the Contractor, what was justified to be installed as support, the Engineer will determine the quantities deemed appropriate by the Engineer.

8. HOW IS THE CONTRACTOR PAID FOR EXCAVATION AND LINING ACCORDING THE EMERALD BOOK?

8.1 Payment for quantity related items

After the measurement and agreement or determination by the Engineer the question is, how the Contractor is going to be paid and what is the procedure to change the overall Contract Price. The relevant clause that deals with the determination of the compensation for excavation and lining is clause 13.8.4 Adjustment of the Contract Price, which reads:

The Engineer shall adjust the Contract Price:
(a) by valuing each item of the Excavation and Lining Works by applying the measurement agreed or determined in accordance with Sub-Clause 13.8.1 [Responsibility for Measurement], and the appropriate rate or price for the item in the Bill of Quantities; and
(b) by applying the rates for time-related rate items in the Bill of Quantities to the adjusted Time for Completion under Sub-Clause 13.8.3 [Adjustment of Time for Completion].

The meaning of that clause is that lining and excavation will be paid as per the actual measured BoQ items, which were required to excavate and line the tunnel multiplied by the unit rates contractually agreed on.

There is no need for any notices or claims as long the ground conditions are as described in the GBR. That clause is an automatic mechanism to adjust (up or down) the contract price, depending on the encountered situation.

8.2 Payment for time related items

The Emerald Book distinguishes between fixed rate items and time related rate items, which both cover “time related cost”. The fixed rate items are for the compensation of the Contractor for investments and mobilization as well as of time related cost, which cover the period of construction according to the Completion Schedule (Time for Completion for Excavation and Lining according to the anticipated ground conditions and the production rates of the Contractor). In the end, this can be a lump sum amount, payable as an advance payment for mobilization and in instalments over the period of constructions.

When there are deviations to the anticipated ground conditions, which are however within the limits specified in the GBR (e.g. changes in percentage of support classes) the Contractor is entitled to an adjustment of the Time for Completion (positive or negative).

This has an effect on the compensation of the Contractor in the time related rate items. The Contractor is entitled to compensation for the extended availability and maintenance of the fixed rate items by e.g. daily rates offered by the Contractor. However if the ground conditions are more favourable and the adjustment of Time for Completion is negative the reduced required availability and maintenance of the fixed rate items shall reduce the Contract Price by e.g. daily rates offered by the Contractor.

9. CONCLUSION

The Emerald Book addresses the risk of the subsurface physical conditions not corresponding to the expectations before tenders are submitted by allocating these risks to the Employer. Based on this principle it was necessary to find a mechanism that will allow to compensate the Contractor for the work done to excavate and stabilize the actual encountered ground conditions.

By implementing a Bill of Quantities for the Excavation and Lining Works and an automated adjustment of the Contract Price there is no need for notices and claims, if ground conditions other than anticipated (but inside the limits of the GBR) are encountered during the execution of the works.

This straightforward principle will lead to easier project implementations and overall lower project costs as there is no need to fight for the fair compensation of excavation and support. The imminent problem of time related cost, which is not addressed in that detail in the Red and Yellow Book, is tackled by the implementation of separate BoQ items and is related to the adjustment of Time for Completion, which again is a fair solution for the Contractor and the Employer.

10. REFERENCES