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BALANCED BASELINES
A FAIRER ALLOCATION OF UNCERTAIN RISKS

Author
Jim Doyle, Dip. CE, MIE (Aust) BEc (Hons), LLB (Hons),
Partner Doyles Construction Lawyers

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What are Geotechnical Baseline Reports?

A Geotechnical Baseline Report (GBR) is a document included in the construction contract, which provides the parties to the contract with a mutual understanding of the subsurface site conditions (the baseline). The actual conditions then encountered are measured against this baseline. If the contractor comes across a more adverse condition than that of the baseline, then the owner pays the contractor more to complete the work under those adverse conditions, and if the conditions are less adverse than the baseline, then the contractor is paid no more than that tendered.

The philosophy surrounding this interpretation to the baseline is that the owner owns the ground, and therefore should pay any additional costs associated with ground conditions being more adverse than anticipated.

By including these baselines in the contract documents, the parties are less likely to have arguments because it is more likely that the conditions are going to be agreed as unexpected or not as and when encountered. Essentially the GBR clarifies the what, in the question "conditions materially different to what?" contained in the latent conditions clause in most standard construction contracts.

Whilst the primary purpose of the GBR is to document statements as to the anticipated geotechnical conditions to be encountered in the construction project as part of the contract, secondary purposes of the GBR include:

(a) presentation of geotechnical and construction conditions that formed the basis of design of underground components;

(b) enhancement of the contractor's understanding of the key project constraints and selected requirements in the contract plans and specifications;

(c) identification of important considerations and constraints that need to be addressed during the bid preparation and construction;

(d) assistance to the contractor in evaluating the requirements for excavating and supporting the ground; and

(e) guidance to the construction manager in administrating the contract and monitoring contract performance, for both time and cost.

History of the GBR

An important development in the use of the GBR was in 1972, when Washington Metropolitan Area Transit Authority addressed subsurface conditions in a separate report which was made part of the contract documents.

In 1974, the US National Committee of Tunnelling Technology (USNCTT) published a report entitled *Better Contracting for Underground Construction*, which identified the fundamental need to improve the overall approach to contracting for underground construction projects. In particular making the statement that:

> *"...if all bidders can base their estimate on a well defined set of site conditions with assistance that equitable reimbursement will be made when changed conditions are encountered, the owner will receive the lowest reasonable bids with a minimum of contingency for unknowns."*

A further report was published in 1984 by the USNCTT entitled *Geotechnical Site Investigations for Underground Projects* which set out conclusions and recommendations reached after partial review of 200 heavy construction projects and a thorough review of 87 of these projects. The main points made in the report were that where there was a large investment in exploring, clearly communicating and disclosing subsurface conditions, the lower was the actual cost of the project, and the report also provided a recommended outline for interpretive geotechnical reports and a checklist of items to be addressed.

The objectives and contents of geotechnical reports were further clarified in a booklet published by the Underground Technology Research Council (UTRC) in 1989 outlined *Avoiding and Resolving Disputes in Underground Construction*.

The American Society of Civil Engineers published *Geotechnical Baseline Reports for Underground Construction* by Randall Essex in 1997 presents guidelines, practices and recommendations developed by the UTRC Technical Committee on Geotechnical Reports, which have been based on feedback received from industry forums. It represents an important milestone in the use of baselines in the geotechnical field.

What is included in a GBR?

The aim of a GBR is to provide a set of relatively simple statements about the facts and opinions relating to the subsurface conditions to be encountered in the construction project. Examples of some of the items that are addressed in a GBR are:

(a) the estimated amounts and distribution of different materials along the alignment;

(b) a description, strength, permeability, grain size, and mineralogy of the intact materials;

(c) a description, strength, permeability of the ground mass as a whole;

(d) groundwater levels and groundwater conditions expected, including baseline estimates of pumping rates;

(e) the anticipated behaviour of the ground and the impact of groundwater, with regard to applicable methods of excavation and installation of ground support;

(f) construction impacts of adjacent facilities;

(g) potential or known faults and fault zones; and

(h) other geotechnical and man-made sources of potential difficulty or hazard that could impact on the construction process, such as boulders, high or low top of bedrock, gas, contaminated ground, contaminated groundwater and subsurface obstructions. [1]

The above statements should be expressed in quantitative terms, and the baseline may be expressed as a maximum value, a minimum value or an average or a typical value.

The GBR is prepared by experienced and qualified consultants, so that the document identifies the factors that are most important to the particular project and contract in question. The completion a GBR is usually programmed to occur after most of the design has been completed and should involve both design team representatives and the project owner in its preparation.

Where a baseline is set it will, with the contract conditions, determine the risk allocation in respect of geotechnical conditions, and consequently has an effect on things such as bid prices, and the final price of the project. The way that the GBR is designed means that a reasonably adverse baseline will usually have the effect of increasing the bid price, and possibly cost the owner more due to the fact that they will be paying for the contingency of encountering the adverse condition whether or not the adverse condition is actually

[1] Essex, R, *Geotechnical Baseline Reports for Underground Construction*, 1997, page 15-16

encountered or not but there is less risk to the owner of a cost or time over run. On the other hand, a less adverse baseline, has the effect of decreasing the bid price costing the owner less if adverse conditions are not encountered but allocating more risk to the owner of time and cost over runs if more adverse conditions are actually encountered.

It has been suggested by Essex that in order for an owner to reduce their risk in relation to subsurface site conditions, they can take the following measures:

1. provide an adequate budget to explore the subsurface conditions, not only for the designer's purposes, but for bid preparation and construction purposes;
2. retain suitably qualified and experienced design consultant to investigate the subsurface conditions to evaluate the potential risks and to prepare drawings, specifications and a GBR consistent with those risks;
3. allocate sufficient budget and sufficient time to allow the design team to complete the design, drawings and specifications and then the iterative process required to prepare a clear, integrated and consistent GBR;
4. develop unit price payment provisions that can adjust to the encountered conditions;
5. minimise misunderstandings as to what is indicated by the GBR, by encouraging review and candid discussion of the baselines with the bidders before bids are received; and
6. maintain reserve funds apart from the construction contract until all potential design and geotechnical risks have been handled.

Benefits of the GBR

The GBR is certainly a major breakthrough in terms of managing risk and reducing the incidence of disputes in relation to construction contracts that involve subsurface site conditions. They are a welcome improvement on the latent conditions clauses in construction contracts, which result in time consuming and expensive dispute resolution, often ending up in court or arbitration.

In summary, the benefits of including a GBR in the contract documents are:

(a) the GBR offers the opportunity to provide an overview of the project risk, so that what is contained in other documents is easier to understand, allowing all participants involved in the project to have an understanding of the key project issues and constraints ;

(b) by establishing clear baselines as part of the contract documents, the parties are more likely to agree on conditions indicated in the contract without time consuming and costly arguments;

(c) the parties are clear about their allocation of the risk involved in the project;

(d) baselines clarify the what in the question "conditions materially different to what?" commonly used in latent conditions clauses in construction contracts;

(e) the GBR aids in pricing projects on a realistic basis.

Going Further – Balanced Baselines

Whilst the GBR has been a positive step in the right direction for underground construction projects, it is submitted that the concept could be applied further. In addition to the contractor receiving extra payment if the conditions are more adverse than those in the baseline, it is suggested that the owner should receive a reduction in the contract price, for any less adverse site conditions that are encountered. This change would see the introduction of balanced baselines, where both contractor and owner have balanced risks in regards to subsurface site conditions.

The major philosophy of the GBR in its present form, where the owner is not entitled to a reduction if site conditions are less adverse is that in order to be as competitive as possible, contractors do bid on a view of conditions more favourable than the baselines stated in the GBR. It is said that this has an economic benefit for the owner who receives a lower bid, which reflects the economic consequences of the better conditions assumed in the contractors bid. If balanced baselines were introduced, the contractor would receive a downward adjustment in the contract price for less adverse conditions than those of the baseline, then bidding contractors would have no incentive to bid on conditions more favourable than the baseline, and this would have the effect of concentrating the differences in the bids on efficiencies in dealing with the various conditions and as well as reducing debates as to what the contractor did or did not assume in his bid.

It is submitted that the contractor bidding the works should not be encouraged or permitted to build into his bid an expectation that it is better or worse than the baseline, and instead he should bid the cost of doing the work according to the categorisation set out in the contract with rates for each of the conditions. In a competitive environment a balanced baseline discourages contractors to take risks as to the condition of the ground, where there whole philosophy of the GBR is to remove that risk and deal with technically based assessments of the ground conditions.

It is sometimes said that if the contractor has estimated the ground condition to be better than the baseline, he has taken the risk and therefore should be paid any savings actually achieved. However this it is submitted is the wrong philosophy as it encourages the contractor to guess at the ground conditions. If he has been paid under a balanced baselines approach, then he has to develop and profit from his skill in dealing with the defined conditions and to quote the best competitive rate. This rewards him for the selection of equipment, selection of men and development of techniques which deal with the defined conditions involved rather than a profit the result of a lucky guess.

Benefits of Balanced Baselines

There are numerous benefits involved in adopting a balanced baselines approach over the "one sided" GBR approach currently used.

The first of these benefits is that it is more attractive to market this technique as fair to owners, if the owner will pay more if the ground is more adverse, but less if the ground is less adverse. Owners are going to be more willing to adopt an approach where there is a possibility that the contract price will be reduced, and only increased if the site conditions are more adverse than the conditions stated in a well researched and thought-out baseline that has been developed by experienced and qualified consultants.

Linked to this benefit is the avoidance of a situation where the contractor can be paid more for small parts of the work which are more adverse, despite the fact that a great majority of the work was much better than the baseline predicted. If the owners had the opportunity to claim back similarly to the contractor there is likely to be fewer claims and more agreements on claims and counterclaims between the parties, therefore reducing the likelihood of expensive and time-consuming dispute resolution procedures. The closer settlement is to the "coal face" the better prospect of the contract remaining on time and on budget and a co-operative relationship being maintained. The current one sided practice whereby the contractor gets paid more if the conditions are adverse but never less inevitably encourages claims.

The fact that the contractor might have to give money back to the owner, may have the outcome of the project coming in at the estimated cost, rather than the present situation which sees a significant number of contracts coming in at a much higher price than predicted.

Another benefit of balanced baselines is that the contractor would be paid fairly for the actual conditions encountered based on expert in situ mapping of the driven tunnel rather than to have to have a claim able to be mounted on the basis that in some way his assessments were influenced by the contract and the information (including the baseline itself) it contains. This would reduce reliance on latent condition claims which are presently prevalent in the industry.

Another reason why the balanced baseline should be adopted is it would enable the GBR to be easily used for design and construct contracts because there would be a fairer balance of the net cost to the contractor for actual ground conditions and less guesswork in competitive bids.

The present practice of relying on latent conditions claims to fairly re-price the works is fraught with problems. Latent conditions clauses in their present state are awkward impractical to apply, encourage gamesmanship and lead to many costly and time-consuming disputes. They rely on the contractor being able to show that the conditions that they have encountered are materially different to those which it ***should have anticipated***, being a competent contractor. The inevitable arguments in relation to these

clauses rests on what a competent contractor should have anticipated, and whether or not the conditions encountered are materially different to those that they did anticipate.

Where there is no common framework for recording expectations and actual conditions confusion is promoted.

The introduction of balanced baselines, takes away that confusion and provides a document that includes all a common and competitive basis for pricing and planning, and therefore the room for argument is reduced significantly and prospects of agreement on site is maximised and empowered.

Providing for the Totally Unexpected Conditions

It is suggested that there will always be those sites that will give rise to totally unexpected conditions well outside the range set out in the baseline. The appropriate provision to be introduced in relation to the conditions that fall well outside of those anticipated conditions, is that the contractor would recover his increased direct costs, but not profit from the encountering of such unanticipated conditions.

Bullet Proof and Bankable Contracts

The aim of a drafter of a construction contract should be to ensure that contracts are

1 bullet proof ie have properly identified the risks and developed that risk allocation which most efficiently and fairly promotes the management and treatment of the risk, and

2 bankable ie that provide for the maximum certainty of outcomes to both parties in all but catastrophic events and allows both to arrange their affairs and importantly their financing of the project on an economically efficient basis.

Under the balanced baselines approach, banks, insurance companies and bondsmen would be able to calculate their risks. In partnership with the owner they would have a better opportunity to take a conservative baseline in order that he had a choice between:

(a) a higher probability of achieving on budget performance or alternatively receiving some small amount in credit; and

(b) an aggressive budget with more chance of over run.

Under the balanced baseline's approach, contract and performance monitoring reports are generated more quickly, and precise reports to the contractor on whether or not he is winning or losing on the project are available on a daily basis, as opposed to end of the project when a claim is finally resolved. This reporting also helps the contractor to correctly predict and implement the correct technical approach by the contractor to the conditions as found thereby producing a better final result for all involved.

An Australian Example

An example of the use of balanced baseline approach to ground conditions is demonstrated by amending the terms of the contract for the design and construction of a tunnel in Sydney recently on which the author was briefed to settle the contract terms.

This contract contained a clause under the latent conditions section of the contract that dealt with Baseline Ground Conditions. The relevant parts of the clause read as follows:

> ***12.10 Q Values and Baseline Ground Conditions***
>
> *Q Values shall be the fundamental criteria to determine the support type to be used in the tunnel.*
>
> *The Q values and the total lengths of each support type as expected by the Principal have been included in Table below representing the Principal's Baseline Ground Conditions ("PBGC")*
>
> ***Table 1 – Principal's Baseline Ground Conditions***

Schedule No.	***Q Value***	***Schedule Item No.***	***Length (m) (1) (2)***
2.1A	*Q > 2.5*	*4.1.1*	*353*
	0.75 < Q <2.5	*4.1.2*	*134 [3]*
	0.16 < Q < 0.75	*4.1.3*	*29*
	Q < 0.16	*4.1.4*	*20*
	0.75 < Q c 2.5	*4.1.5*	*10 [3]*
		Total Length Schedule 2.1A	*546*
2.1B	*Q>2.5 if no blocks*		*1187*
	0.75 c Q < 2.5 Q > 2.5 if blocks		*1215*
	0.16 < Q < 0.75		*423*
	Q c 0.16		*64*
		Total Length Schedule 2.1 B	*2889*

> *Notes*
>
> *(1) Local enlargements of the tunnel for construction purposes are included in the lengths in Table 1 above. No adjustments to Rates for Support will be allowed for these enlargements.*
>
> *(2) These lengths in Table 1 above assume that 10m of the Walter Support Type 9 is in rock with Q values between 0.75 and 2.5.*
>
> *Notwithstanding the PBGC, the Contractor shall prepare its own support design and make its own assessment of the expected ground conditions.*

To the extent that the Contractor chose to provide in its tender for less support than the PBGC, it did so at its own risk and the Principal shall have no liability upon claims for any extra cost or any extension of time incurred by the Contractor in providing support equal to the support required for the PBGC.

12.11 Progress Payments

Progress payments for Tunnel Excavation and Support will be made by paying pro-rata to the length of the tunnel excavated the appropriate proportion of the lump sum for the Tunnel Excavation and Support shown in the Pricing Schedules.

No additional payments for any additional support required by the ground conditions or latent condition will be made until the end of the tunnel drive. The Contractor has allowed for any cash flow risks associated with additional support or latent conditions required in their tendered rates.

12.12 Ground Support Payment Adjustment

At the end of excavation of each tunnel drive, the sum of the lengths of each support type installed shall be measured and the cost of as-installed support shall then be calculated using the rates in the Pricing Schedules.

Similarly, the expected cost shall be calculated on the basis of the PBGC using the Contractor's prices in the Pricing Schedules.

If the cost of the as-installed support is equal to or less than the total cost calculated from the PBGC, then no further amount shall be paid to the Contractor.

If the cost of the as installed support is less than the cost calculated from the PBGC, then the amount of the difference shall be deducted from the contract sum paid to the Contractor.

If the cost of the as installed support is more than the cost calculated from the PBGC, then the amount of the excess shall be paid to the Contractor.

12.13 Ground Support Completion Date Adjustment

At the end of excavation of each tunnel drive, the sum of the lengths of each support type installed shall be measured and the total time for as-installed support shall then be calculated using the Advance rates in the Pricing Schedules.

Similarly the total time expected from the PBGC shall be calculated using the Advanced rates in the Pricing Schedules.

If the total time of the as installed support is less than the total time expected for the PBGC, the Date for Practical Completion of the Separable Part shall brought forward by the amount of the difference.

If the total time of the as installed support is more than the total time expected for the PBGC, the Date for Practical Completion of the Separable Part shall be extended by the amount of the excess.

At the end of excavation of the tunnel, the Contractor may claim an extension of time calculated in accordance with this clause. The extension of time calculated in accordance with this clause shall be the only entitlement to an extension of time associated with the tunnel excavation and support.

The contractor shall be entitled to a payment of the sum set out in the Pricing Schedules ("the Ground Support Delay Payment") for each day by which the Date for Practical Completion is extended by reason that the total time of the as installed support is more than the total time derived from the PBGC.

By including this clause in a contract under latent conditions, both Principal and Contractor would be aware of exactly what the risks were regarding differing ground conditions. The basis for dispute would be limited and measurability of the result progressively available.

Expansion to Other Applications

Balanced baselines have wide potential application outside geotechnical conditions to provide for a fair and efficient allocation of risks and to promote efficient and experienced contractors rather than those who have guessed wisely as to uncertain risks on unsatisfactory data. Examples include service load conditions, site conditions including access and traffic management conditions, exchange rate variations and insurance premiums and excesses, wet weather and industrial conditions, regulatory approval delays.

Conclusion

The GBR has made a substantial progress in providing solutions to some of the problems associated with latent conditions when it comes to construction contracts that involve subsurface conditions. The GBR has helped to reduce time consuming and expensive dispute resolution common in the industry which often ends up in court, by providing clear expectations for both parties.

Whilst the GBR are a major step forward when it comes to managing risk and reducing the incidence of disputes in relation to such contracts, by taking it a step further and introducing balanced baselines, in major projects more benefits can be achieved leading to substantial promotion of best contracting and technical practice, and a further reduction in the time and money spent on dispute resolution. They are an essential part of managing and maintaining a partnership between principal and contractor on difficult and challenging projects.

Jim Doyle, Partner, Doyles Construction Lawyers
Tel: (02) 9283 5388
doyles@doylesconstructionlawyers.com

Sydney - Melbourne - Brisbane