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Early Contractor Involvement: Rethinking and Recalibrating Delivery Methods for Subsurface Projects[1]

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Introduction

For more than half a century, the underground design and construction industry has been challenged to develop and successfully implement approaches to improve delivery and risk allocation, and minimization of disputes, on major subsurface projects. In the last two decades, intensified efforts to address those challenges have concentrated and resulted in increased utilization of delivery methods alternate to the long-dominant and pervasive traditional design-bid-build ("DBB") method. Design-Build ("DB") has emerged as the preferred delivery method for many project sponsors of major subsurface projects.

In the last several years, problematic trends have been identified and serious questions raised about whether conventional DB is meeting the challenge of improving project delivery and achieving realistic procurement pricing and balanced risk allocation on heavy civil and major subsurface projects.[2] Reports abound regarding claims and disputes among project participants; unrealistic pricing and contingencies; imbalanced risk allocation; substantial financial losses experienced by Design-Builders; and the concerning increase in professional liability claims by the latter against their Consulting Engineer subconsultants.[3] These losses and claims have resulted in the significantly diminished availability and capacity of bonds and project-specific professional liability insurance required to support principal project participants in the delivery of those projects.[4]

The megaproject characteristics of major subsurface projects – complexities; substantial construction values; varied and fragmented design and construction scope distributions; critical design and construction interfaces and interdependencies; and diverse roles and responsibilities of multiple participants – elevate and intensify the risks and stakes for project participants.[5]

The recent industry critical spotlight on conventional DB fairly raises a basic question: Is conventional DB **intrinsically** the problem, or is that delivery approach simply a manifestation and symptomatic of more dysfunctional characteristics and fundamentally flawed premises and expectations underlying the assignment of project participant roles and responsibilities and risk allocation inherent in all delivery methods for subsurface projects?

This paper will examine that question and analyze whether Early Contractor Involvement ("ECI") methods , such as Progressive Design-Build ("PDB") and Construction Manager/ General Contractor ("CM/GC"), are prudent approaches that may provide more sensible and successful procurement and contractual strategies and mechanisms to improve and inform pricing realism and the balance of risk allocation on subsurface projects by providing and facilitating increased opportunities for synchronized, holistic, and timely collaboration of the Owner, Contractor, and Consulting Engineer in the development and evolution of design and construction approaches from preliminary stages and through construction; and thereby be more likely to enhance the availability and capacity of bonding and project-specific insurance coverages on those projects.

Subsurface Projects: Effective, Efficient, and Balanced Risk Allocation

The root causes of most problems and disputes on major subsurface projects stem from ineffective, inefficient, and imbalanced

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[2] In general terms, *conventional* DB involves procurement and contractual approaches in which the Design-Builder is required to contractually commit to a fixed price and risk allocation terms based on preliminary levels of design development.

[3] R. Korman, *Will Claims By Contractors on Big Design-Build Projects Ever End?*, Eng. News-Rec. (Feb. 8, 2023); T. Schleifer, *Seeking A Fix to the Fixed-Price Conundrum*, Eng. News-Rec. (Nov. 18, 2019); T. Schleifer, *Commentary: Contractors and Design-Build: Let's End Risk-Shift Madness*, Eng. News-Rec. (Mar. 4, 2020); J. Peterson, *What is Wrong with Design-Build Contracting?*, Under Constr. Vol. 21 No. 2 (Winter 2019); D.J. Hatem, *Project-Specific Professional Liability Insurance on Design-Build and Public-Private Partnership Projects in North America: A Path Forward*, Donovan Hatem LLP (May 3, 2022).

[4] D.J. Hatem, *Recalibrating and Improving Design-Build on Public Infrastructure Projects*, American Bar Assoc. Forum on Constr. Law (Sept. 2022). A study by Travelers highlights these concerns specific to bonding experience and Contractor losses. See R. Korman, *Study Finds Design-Builder Profit Shortfall on Big Infrastructure Projects*, Eng. News-Rec. (Aug. 24, 2021); D.J. Hatem, *Project-Specific Professional Liability Insurance on Design-Build and Public-Private Partnership Projects in North America: A Path Forward*, Donovan Hatem LLP (May 3, 2022).

The cause of, and potential solutions to, the Project-Specific Professional Liability (PSPL) crisis on DB public infrastructure projects is discussed in greater detail in D.J. Hatem, *Project-Specific Professional Liability Insurance on Design-Build and Public-Private Partnership Projects in North America: A Path Forward*, Donovan Hatem LLP (May 3, 2022). The effective and long-term solution to the surety and project-specific insurance capacity and availability concerns depends upon correction of the underlying procurement and contractual root causes, as well as the implementation of improved, correlative underwriting practices. There is constructive and encouraging precedent for the development and implementation of improved and balanced risk allocation in procurement and contractual practices as a predicate and foundation mechanism to address serious reservations and withdrawals in insurance capacity on subsurface projects. That precedent resulted from a collaborative effort among owners, contractors, consulting engineers, and insurers, culminating in the promulgation of *A Code of Tunnel Practice for Risk Management of Tunnel Works* International Tunnelling and Underground Space Association, International Association of Engineering, Insurers (3d ed., Feb. 2023) (the "Code"). The Code is intended to achieve alignment between effective and balanced risk allocation, management practices, and insurance underwriting. Prior editions of the Code are discussed in more detail in §12.6.2, pp. 670-71 (and accompanying footnote 389, pp. 672-74), in D.J. Hatem & P. Gary, eds., *Public-Private Partnerships and Design-Build: Opportunities and Risks for Consulting Engineers*, ch. 12, Washington: American Council of Engineering Companies (3d ed. 2020). For further discussion of the Code, see D.J. Hatem & D. Corkum, eds., *Megaprojects: Challenges and Recommended Practices*, ch. 18, ¶2.0, 597-602 (American Council of Engineering Cos., 2010). As to similar discussion relating to availability of adequate surety bonding capacity, see D. Mast & P. Nicholas, *Alternative Delivery for Tunnels*, TUNNEL BUSINESS MAGAZINE (Dec. 2020). The potential applicability of a Code approach to addressing the current PSPL crisis in PIPs is discussed in D.J. Hatem, *Project-Specific Professional Liability Insurance on Design-Build and Public-Private Partnership Projects in North America: A Path Forward*, Donovan Hatem LLP (May 3, 2022).

[5] For discussion of megaprojects and professional liability risk, see D.J. Hatem & D. Corkum, eds., *Megaprojects: Challenges and Recommended Practices*, ch. 18 (American Council of Engineering Cos., 2010); and D.J. Hatem & P. Gary eds., *Public-Private Partnerships and Design-Build: Opportunities and Risks for Consulting Engineers*, ch. 12, ¶12.5, Washington: American Council of Engineering Companies (3d ed. 2020); D.J. Hatem, *Megaprojects: Professional Liability Risk and Project-Specific Professional Liability Insurance*, ABA Forum on the Construction Industry (American Bar Association, 2012).

risk allocation. Effective and efficient risk allocation requires an identification and realistic assessment of relevant risks, as well as the prudent assignment of appropriate roles and responsibilities to project participants in a manner that correlates and aligns with their reasonable ability to control and manage the variables likely to cause the occurrence of the identified risks and mitigate the consequences.[6] Balanced risk allocation involves the allocation of risks in a manner that is fair, realistic, and sensible given the assigned respective roles and responsibilities of the project participants.[7]

Subsurface Conditions Risk Allocation: Critical and Inherent Factors and Characteristics

Effective, efficient, and balanced risk allocation on subsurface projects depends upon the holistic consideration of the interdependencies, interrelationships, and dynamics that define critical and inherent factors and characteristics of subsurface projects. These factors and characteristics require and depend upon recognition that:

- The adequate scope and quality of subsurface investigation are essential.
- Subsurface conditions risk and assessment are especially specific to particular site conditions.
- Subsurface conditions risk allocation is significantly imprecise and often grounded in subjective and judgmental assessments.[8]
- The meaningful and timely opportunity for reasonable and realistic evaluation of available subsurface data should occur in synchronization with the development of the contemplated permanent works final design and construction means/methods approaches.
- The compatibility and suitability of those approaches in the reasonably anticipated subsurface conditions are based upon available subsurface data and related evaluations.
- The availability and opportunity to reasonably evaluate subsurface data, evaluations, final design, and construction means/methods approaches should occur **prior to** contractual commitment as to construction cost and risk allocation terms.
- Understandings as to the interactions and interdependencies among the roles and responsibilities of project participants are essential.
- There are critical dependence and interdependencies of the design and construction approaches in the context of both anticipated and encountered subsurface conditions during construction.
- The iterative, evolving, and continuous nature of the design and construction approaches is influenced by actually encountered subsurface conditions.
- The continuous and meaningful involvement and site observations by the Consulting Engineer during construction is necessary to evaluate the efficacy of the design in the context of specifically encountered subsurface conditions.[9]
- The need for a relatively flexible planning and pricing approach that recognizes the potential that (a) encountered subsurface conditions during construction may differ from those anticipated in the design approved for construction; and (b) design and construction approaches contingently may need to be modified based on subsurface conditions (i) actually encountered during construction; and (ii) that fall within reasonably anticipated probable variation parameters.

The overarching question is how these **critical and inherent factors and characteristics** can be sensibly aligned and synchronized with the assigned roles and responsibilities of project participants to achieve pricing realism and effective, efficient, and balanced risk allocation.

Subsurface Projects: Delivery Methods

The various project delivery methods are distinguished by how the roles and responsibilities of the project participants are assigned and how risks are allocated to address these **critical and inherent factors and characteristics**. The selection of a delivery method should, of course, be made on a project-specific basis, and predicated upon evaluation of appropriate considerations.[10]

[6] *See* R.J. Smith, *Risk Identification and Allocation: Saving Money by Improving Contracts and Contracting Practices*, INT'L CONSTR. LAW REV., 12(1), 40 (1995); D.J. Hatem & P. Gary, eds., *Public-Private Partnerships and Design-Build: Opportunities and Risks for Consulting Engineers*, ch. 12, ¶ 12.1.3 & 12.3.2, Washington: American Council of Engineering Cos. (3d ed. 2020); S.H. Hwang, *Mitigating Completion Risk in International Project Finance – A Comparative Law Perspective and Practice*, INT'L CONSTR. LAW REV., 231 (2023).

[7] R. Essex, D. Hatem, J. Reilly, *Alternative Delivery Drives Alternative Risk Allocation Methods,* North American Tunneling Conf., Washington, D.C., 24-27 (June 2018); N. Munfah, *Controlling Risk of Tunneling Projects Implemented by Alternative Delivery Method*, TUNNEL BUSINESS MAGAZINE (Society for Mining, Metallurgy & Exploration, 2019); Transportation Research Board, *Managing Geotechnical Risks in Design-Build Projects*, NCHRP Project No. 24-44 (D. Gransberg et al. eds., 2018); A. Ventimiglia et al., *Packaging and Contract Delivery Methods for the Horizon Lateral*, Rapid Excavation and Tunneling Conf. 2023 Proc., p. 22, eds. N. Garavelli & F. Pepe (Society for Mining, Metallurgy & Exploration, 2023); Transportation Research Board, *Guidelines for Managing Geotechnical Risks in Design-Build Projects*, NCHRP Research Report 884 (D. Gransberg et al. eds., Sept. 2018); D.J. Hatem & P. Gary, ed., *Public-Private Partnerships and Design-Build: Opportunities and Risks for Consulting Engineers*, ch. 12, Washington: American Council of Engineering Cos. (3d ed. 2020).

[8] A. Stephenson & N. Suhadolnik, *Improving Risk Allocation for Ground Conditions in Major Subsurface Projects*, SoCLA Nat'l Conf. 2022 (Society of Construction Law, 2022).

[9] A. Muir Wood, *Tunneling: Management by Design* 1, 285-88 (London: E&FN Spon, 2000); D. Charrett, *Managing Design Risk*, SoCLA Nat'l Conf. 2022, 2, 7 (Society of Construction Law, 2022).

[10] See Transportation Research Board, *A Guidebook for the Evaluation of Project Delivery Methods*, TCRP Report 131 (D. Gransberg et al. eds., 2009); For an excellent article discussing issues and concerns in the use of design-build for urban subsurface projects, see R. Drake & W. Hansmire, Getting Metro Owners the Best Value from Their Major Underground Projects, 2020 Proceedings, North American

Delivery method selections may generally be viewed as driven, distinguished, and determined by the answers to the following questions:

- What are the critical programmatic objectives, expectations, criteria, and constraints as to cost, time, design, and construction standards?
- To what extent does the Owner want or need to control design development; or prescribe or constrain construction means/methods (for example, due to third-party impacts and other considerations)?
- How will specific roles and responsibilities of each project participant be assigned?
- How will risks be allocated among the project participants?
- How will contracts be drafted to clearly and consistently define and document the roles, responsibilities, and risks of the respective project participants?

The answers to these questions will predominantly inform prudent decision-making as to the appropriate delivery method.

In all delivery methods, contracts should endeavor to clearly and consistently define and document the respective risks, roles, and responsibilities of project participants; ideally, contracts should also strive to anticipate and provide mechanisms to address modifications in design and construction approaches, as well as in commercial, risk allocation, and other terms, that may be required based on encountered subsurface conditions, within contractually defined and anticipated probable variation parameters. On complex subsurface projects, especially of a megaproject character, there are a network of contracts by and among certain project participants; conscientious efforts should be focused on the coordination and alignment among the terms of those various contracts, especially as relate to the interrelationships and assignment of roles and responsibilities and allocation of risks among the project participants.

Design-Bid-Build and Conventional Design-Build Subsurface Projects: Distinctive and Common Aspects as to Typical Roles, Responsibilities, and Risks

DBB

In DBB, the Owner directs and controls the scope and quality of the subsurface investigation, as well as the evaluation of subsurface data and analyses as relate to the design and anticipated construction approaches. The Owner also controls and is responsible, either through explicit contract terms or implied warranty obligations, for the accuracy, adequacy, suitability, and constructability of the permanent works final design in the anticipated subsurface conditions.[11] Typically, on major subsurface projects, differing site conditions ("DSC") risk is shared with the Contractor through contractual provisions that define entitlement standards, and are particularly facilitated and reinforced by a Geotechnical Baseline Report ("GBR").[12] In DBB, the Contractor typically is responsible for the design and implementation of appropriate means, methods, procedures, sequences of construction, and the selection of suitable construction equipment to be utilized in the construction process ("construction means/methods") in the reasonably anticipated subsurface conditions. Construction means/methods can significantly influence both the successful implementation of the permanent works design and the interactive behavior of subsurface conditions during construction.

In DBB, the design of permanent works is completed prior to and typically absent any involvement or input of the Contractor; and typically, the Contractor plans, designs, and implements its construction means/methods independent of Owner involvement or input. Risks, roles, and responsibilities are often assigned in DBB without due regard to (a) the relationship, interaction, and interdependencies among those assigned risks, roles, and responsibilities, or (b) the **critical and inherent factors and characteristics**. The DBB approach, with its sequential and independent design and construction demarcations, creates relatively rigid boundaries and dysfunctionality in the execution of assigned roles and responsibilities that are often irreconcilable with and subvert effective, efficient, and balanced risk allocation, and underlie many disputes during construction.[13]

Conventional DB

In conventional DB, risks, roles, and responsibilities are assigned differently than in DBB. The Design-Builder typically is responsible for the adequacy and suitability of both the permanent works final design and the construction means/methods. Additionally, subsurface conditions risks may or may not be shared in accordance with the conventional entitlement standards typically utilized in DBB.[14] The development process for the final design – more or less – involves interactions between the Owner and the Design-Builder, but, significantly, these interactions typically occur in conventional DB <u>after</u> (a) the award of the Design-Build

Tunneling, 256-262 (Society for Mining, Metallurgy and Exploration, 2020) (raising issues as to concerns as to use of DB on urban subsurface projects, such as limitations in use of performance specifications; and the premium cost to the owner of transferring substantial design, and construction and subsurface conditions risk to the design-builder).

[11] D.J. Hatem & P. Gary, eds., *Public-Private Partnerships and Design-Build: Opportunities and Risks for Consulting Engineers*, ch. 12, ¶ 12.4.3, Washington: American Council of Engineering Cos. (3d ed. 2020).

[12] D.J. Hatem, *Should Geotechnical Baseline Reports be the Universal and Exclusive Contractual Basis for Subsurface Conditions Risk Allocation?*, TUNNEL BUSINESS MAGAZINE (Jan. 2022).

[13] Most disputes on major subsurface projects involve issues as to the roles, responsibilities, and risk allocations among project participants for design adequacy, construction means/methods, and DSCs. J. Gildner et al., *The State of DRBs in the Tunnel Industry, North American Tunnelling* 326, 331-32 (Society for Mining, Metallurgy & Exploration, 2022).

[14] D.J. Hatem & P. Gary, eds., *Public-Private Partnerships and Design-Build: Opportunities and Risks for Consulting Engineers*, ch. 12, Washington: American Council of Engineering Cos. (3d ed. 2020).

Contract; and (b) the Design-Builder's commitment to (i) a fixed price based on limited design development and incomplete subsurface investigation, and (ii) relatively imbalanced risk allocation terms. In this procurement and contractual regime, these interactions often are not fairly characterized as collaborative, nor are the permanent works final design and construction means/methods developed based upon transparent and mutually-understood (a) evaluations of anticipated subsurface conditions; (b) reasonably anticipated probable parameters of subsurface conditions variations that may be encountered during construction and that may warrant modifications to the planned design or construction means/methods; (c) contingent details or other specifics of design and construction approaches involved in any such modifications; or (d) determinations of how and whether any such required modifications will be compensated or warrant adjustments in contractual risk allocation.

Despite their distinctive aspects relating to assignment of roles and responsibilities and allocation of risks among project participants, both DBB and conventional DB have in common procurement and contractual regimes that do not allow for timely, simultaneous, and transparent Owner-Contractor interactions, collaboration, or input in (a) the evaluation of subsurface conditions risk; (b) the permanent works design development process; or (c) the design and development of contemplated construction means/methods. Furthermore, neither delivery method embraces or is receptive to reasonably contemplated probable variations in subsurface conditions encountered during construction that may necessitate modifications to the planned permanent works design or construction means/methods approaches, and corresponding commercial and contractual risk allocation adjustments.

More specifically, in DBB, Owners may be less receptive to proposed modifications to the final design after the issuance of construction documents and fixed cost commitment given their perceived confidence in and responsibility for the adequacy of that design. Similarly, in conventional DB, the Design-Builder may resist modifications to the design approaches that formed the basis of its pre-award technical preliminary design and pricing proposals, as well as its contractual fixed price and risk allocation commitments.

The bottom line is that both DBB and conventional DB are conceived and structured in a manner in which roles and responsibilities are independently and inflexibly assigned in fragmented and demarcated manners that do not adequately and realistically account for the inherent interrelationships, interdependencies, and dynamics required for effective, efficient, and balanced risk allocation, considering the **critical and inherent factors and characteristics** of subsurface projects.

This fragmented and disintegrative structure during critical pre-construction phases of planning and development of design and construction approaches leads to:

- Misalignment in the assessment and pricing of anticipated risks, especially subsurface conditions risks.
- Divergence and polarization of financial and contractual interests among Owner and Contractor (or Design-Builder).
- Fixed price contracting approaches that do not reflect the realities of (a) reasonable risk assessments based on available data, or (b) contingencies in planning of modifications to design and construction approaches due to reasonably anticipated probable variations in encountered subsurface conditions.
- Constrained and inflexible design and construction approaches that are either overly-conservative in DBB or unduly optimistic in conventional DB; neither of which spectrum is responsive or receptive to the realities of necessary modifications in final design and construction approaches that may be required due to reasonably anticipated parameters of probable variations in encountered subsurface conditions.
- Aversions, intolerance, and inflexibility to such modifications resulting in the elevated occurrence of adversarial disputes and conflicts; a virtual zero-sum game environment.

As Sir Alan Muir Wood summarized:

"The principal players in a tunnelling project may be imagined to be assigned as the members of an orchestra. Each needs to be able to master his own instrument, each needs to have a good ear for the contributions of others in order to be able to engage in the counterpoint of dialogue. The conductor, the leader of the project, needs to understand how to blend the contributions by the players, requiring an appreciation of the range of pitch and tonalities – the specific element – of each instrument. Too often, the tunnelling players are each following unrelated scores, with the conductor confined to the role of the orchestral administrator, without insight into the essence of the enterprise, the manager without understanding of what is managed. No wonder if the result is too frequently cacophonous."[15]

Conventional DB: Subsurface Conditions Risk Allocation Approaches

There are significant variations in subsurface conditions risk allocation approaches in conventional DB, involving substantially more diverse approaches than in DBB.[16] Specifically, consider the following variations:

- Owners may undertake more or less subsurface investigation; and may or may not furnish sufficient subsurface data

[15] A. Muir Wood, *supra* note 9, at 3.

[16] R. Essex, D. Hatem, J. Reilly, *Alternative Delivery Drives Alternative Risk Allocation Methods*, North American Tunneling Conf., Washington, D.C., 24-27 (June 2018); Transportation Research Board, *Managing Geotechnical Risks in Design-Build Projects*, NCHRP Project No. 24-44 (D. Gransberg et al. eds., 2018); Transportation Research Board, *Guidelines for Managing Geotechnical Risks in Design-Build Projects*, NCHRP Research Report 884 (D. Gransberg et al. eds., Sept. 2018); D.J. Hatem & P. Gary, ed., *Public-Private Partnerships and Design-Build: Opportunities and Risks for Consulting Engineers*, ch. 12, Washington: American Council of Engineering Cos. (3d ed. 2020).

and evaluations.

- Owners may disclaim (wholly or partially) the Design-Builder's right to rely upon Owner-furnished subsurface data and evaluations.
- Subsurface information and reports may be classified as "Contract Documents with reliance rights" or merely as "Reference Information Documents," with non-reliance and other (more or less specific) disclaimers as to the latter.
- The Contract Documents may or may not include a Geotechnical Data Report ("GDR"), or a Geotechnical Baseline Report ("GBR"), with differing orders of precedence or priority assigned to those reports.[17]
- The Contract Documents may or may not include a DSC or other provision for sharing subsurface conditions risk.
- The scope of entitlement standards under conventional DSC contractual provisions may be substantially restricted and allow for equitable adjustments for only limited types of DSCs.
- The Contract Documents may contain a provision stating that the Owner's acceptance of the Design-Builder's alternative technical design concept may or will alter the otherwise governing risk allocation regime for subsurface conditions.

Each of the above approaches will likely have a significant impact on the extent to which risk is allocated in an effective, efficient, and balanced manner. On conventional DB projects, experience has demonstrated a greater propensity of some Owners to implement these approaches in a manner that leads to imbalanced risk allocation.

Conventional DB: Imbalanced Subsurface Conditions Risk Allocation Rationalizations

Some Owners rationalize imbalanced subsurface conditions risk allocation to the Design-Builder on some or all of the following reasons:

- The Owner's need for cost certainty at the time of contract award.
- The perceived correlation and interconnection between the Design-Builder's responsibility for design adequacy and its absolute responsibility and risk undertaking for subsurface conditions variations.
- The belief that the Design-Builder's design adequacy responsibilities would be undermined if subsurface conditions risk were shared.
- The position that the Design-Builder's responsibilities for subsurface conditions investigation and data evaluations are not consistent with a risk sharing approach to subsurface conditions risk.

Conventional DB Case Study: Ottawa Confederation Line Project – Stage 1: Subsurface Conditions Risk Allocation Procurement and Contractual Approach

The Ottawa Confederation Line Project – Stage 1 addressed subsurface conditions risk allocation as follows:

- <u>Procurement Approach</u>: The Owner's objective was to maximize risk transfer to the Design-Builder to obtain a fixed price competition during the proposal phase and in the contract award, and to allocate virtually all subsurface conditions risk to the Design-Builder. The procurement utilized a gated risk/ladder approach that provided strong incentives to proposers to assume maximum subsurface conditions risk. The "top rung" of the ladder position was granted to proposers who accepted the highest level of subsurface conditions risk with <u>no</u> reliance upon the GBR or GDR. Accordingly, the DB Contract was awarded to the Design-Builder which accepted virtually all subsurface conditions risk.
- <u>Contractual Approach</u>: The successful Design-Builder was allocated virtually all subsurface conditions risk. As a general principle, no relief was provided due to subsurface conditions expected or encountered in design or construction. The sole partial relief exception was for the "bursting or overflowing of water tanks, apparatus or pipes if such events are not attributable to the actions or omissions of [Project Co. or Design-Builder] and are not properly inferable, readily apparent or readily discoverable from the Background Information."[18]

A December 2015 Report authored by Deloitte and The Boxfish Group ("D/B Report"), commenting on the Confederation Line procurement and contractual approach, stated:

"Although the bid teams had initially indicated that they … would not assume all tunnel risk, this [procurement approach] caused each bid team to accept the risk. The driver for this acceptance was the competitive tension brought by the 'Gating' process – even though all the bid teams did not want to assume the full risk, they could not convince themselves that their competitors would not find a way to accept the risk. In the end, this 'Gating' triggered an ability to prove it possible for the teams to obtain the guaranteed financing packages required while taking on full tunnel risk."[19]

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[17] D.J. Hatem, *Should Geotechnical Baseline Reports be the Universal and Exclusive Contractual Basis for Subsurface Conditions Risk Allocation?*, TUNNEL BUSINESS MAGAZINE (Jan. 2022); D.J. Hatem & P. Gary, ed., *Public-Private Partnerships and Design-Build: Opportunities and Risks for Consulting Engineers*, ch. 12, Washington: American Council of Engineering Cos. (3d ed. 2020).

[18] W. Hourigan, *Report of the Ottawa Light Rail Transit Public Inquiry, Executive Summary and Recommendations*, Ottawa Light Rail Transit Commission (Nov. 2022). The Report is further discussed on pages 34-38 of L.A. Weintraub et al., *The P3 Experience: What They Are, How They Have Been Used, Their Successes, and Their Future*, American Bar Assoc. Forum on Constr. Law (Apr. 2023).

[19] Deloitte & The Boxfish Group, O*ttawa Light Rail Transit System – Lessons Learned from Confederation Line & Stage 2 Implementation Implications* (Dec.

The D/B Report further stated:

- The ability to transfer all subsurface risk was "novel and extremely successful" and the gated risk procurement approach "was a critical element leading to the single fixed-price for the entire project."
- The "value of this approach" was demonstrated by the Owner's ability to hold the Design-Builder contractually responsible for a $100m loss due to a sinkhole that caused a portion of the tunnel and surface level to collapse due to unanticipated subsurface conditions.
- The same procurement and contractual approach should be utilized on future Public-Private Partnership ("P3") projects.

The November 2022 Final Report of the Ottawa Light Rail ("Confederation Line") Transit Public Inquiry expressed caution and reservations about the procurement and contractual approach to subsurface conditions risk allocation utilized on Confederation Line Stage 1, in stating:

- The approach led to adversarial relationships, contentious disputes, and delays arising out of the sinkhole event.
- Private sector participants are increasingly reluctant to bid on P3 and other major DB infrastructure projects, especially subsurface megaprojects involving significant and substantial subsurface conditions risks.
- Balanced approaches to subsurface conditions risk allocation should be evaluated and, as appropriate, implemented on major DB subsurface projects.
- The P3/DB delivery method may not be appropriate for all subsurface projects.[20]

The following statements from the ASCE's *Geotechnical Baseline Reports: Suggested Guidelines* are relevant to this discussion:

> "A number of DB projects in Canada over the last decade were advertised with a GBR and a Differing Site Condition (DSC) clause in the bid documents. Bidders were advised that if they chose to bid the work with these provisions, the owner would add a financial penalty to their bid totals. Such substantial penalty could cause an otherwise low bidder to lose the competition. Bidders were also given the 'option' to avoid the bid penalty by agreeing to have the GBR and DSC clause removed from the contract, resulting in significant risk transfer to the contractor relative to subsurface conditions. Some have referred to this as a form of commercial blackmail. It is also noted that this practice would not be allowed on US federal contracts governed by the Federal Acquisition Regulations. It certainly does not represent a fair contracting doctrine on behalf of the owner.
>
> A strategy of coercing bidders into accepting all ground risks is bad for the bidder and ultimately bad for our industry. It is an unfair attempt to circumvent an owner's responsibility to pay a fair price for the risk of unknown conditions in its own property, and it tends to reward the most reckless bidders at the expense of the most prudent ones. It may also give owners a false sense of security because there are other bases for claim, such as the Implied Warranty (there may be an implied warranty that the boring log information is accurate) doctrine, failure to disclose, superior knowledge, or misrepresentation.
>
> One concern about unfair one-sided contracts is that a bad precedent may tend to perpetuate bad practice. Hopefully, these practices can be curtailed. That certain contractors are beginning to push back on all-risk-transfer contracting was the focus of an article in Engineering News Record (ENR) in November 2019 (Rubin et al. 2019). The article recounts that a number of bidders are stepping away from contracts that fail to disclose a well-defined baseline because unknown conditions can easily lead to financial losses on their balance sheets. As a result, they have taken steps to reduce the percentage of fixed-price contracts that fail to promise equitable compensation for undisclosed conditions. Project delivery methods are a focus in the ENR article, with Public-Private Partnership delivery being seen as a process of choice to achieving full risk transfer. A number of international companies were cited or quoted in the article. Although underground construction projects were not featured in the article, a number of aviation, highway, and transit programs with subsurface claims were discussed.
>
> From a balanced perspective, full-risk transfer practices common to surface-based construction are disadvantageous for underground projects. To avoid adverse trends that are affecting the underground industry, it is recommended that owners and their advisors be informed of this reality if they seek more competition, lower outturn cost, and less acrimony between the parties concerned".[21]

Subsurface Conditions Risk Allocation: Flawed and Unrealistic Premises and Expectations

Despite their fundamental differences, DBB and conventional DB share, and are predicated upon, three flawed and unrealistic premises and expectations: (1) that roles and responsibilities on subsurface projects should be compartmentalized and contractually assigned and executed independently and rigidly among project participants; (2) that procurement methods must be conceived and implemented on that basis; and (3) that consideration and implementation of potential modifications in

2015).

[20] W. Hourigan, *supra* note 18.

[21] *Geotechnical Baseline Reports: Suggested Guidelines*, American Society of Civil Engineers, ch. 10, Recent Practices and Lessons Learned (R. Essex ed., 2022).

permanent works design or construction means/methods, due to probable variations in encountered subsurface conditions, are to all extents to be minimized, or even eliminated, to avoid disrupting previously contractually defined design and construction approaches. Demarcations as to roles, responsibilities, and risks often are not as clear, definitive, and absolute as may appear in contractual terms, nor are they appropriate given the inherent factors and considerations of subsurface projects.

The need to develop and implement procurement and contractual methods, that are intended to achieve those premises and expectations, lies at the root of problems and disputes arising from ineffective and imbalanced risk allocation on subsurface projects.

As Sir Alan Muir Wood stated:

> "Good tunnelling practice demands continuity and interaction of planning, investigation, conceptual design, detailed design and construction. Each is dependent to a degree on the others. A site investigation, for example, needs to be directed to obtaining information of particular relevance to a specific form of tunnelling; where unexpected features are revealed, the tunnelling strategy may need to be reconsidered and the site investigation appropriately varied. Conceptual design and construction are particularly interdependent since the former may depend upon quite specific features of the latter for success, with the need to ensure that these are rigorously implemented.
>
> Present trends in commissioning tunnelling tend to ignore a condition for good tunnelling: the overall management of the design process. The many engineering activities of a project are subdivided and performed sequentially or separately, with only limited coordination. This ensures that interaction cannot occur and that the specific needs cannot be addressed in the early phases.
>
> The single motive appears to be to ensure fixed costs of each fragmented activity, an objective far removed from obtaining good value for money. The costs may well be fixed – up to a point – but the price for so doing will be high and good tunnelling practice suffers in consequence. The goal of economic tunnelling, which benefits all involved, is effectively prevented.
>
> Moreover there are greatly increased risks of disputes and litigation because of the attempt to unload all responsibilities into construction. This procedure is as good for the legal profession as it is disastrous for good engineering. Tunnelling methods based on the observational method (ISOM) [i.e. Informal Support based on the Observational Method] are particularly incapable of optimization where the overall project is fragmented."[22]

[22] A. Muir Wood, *Will the Newcomer Stand Up?,* Tunnels Tunnelling (Sept. 1994).

Early Contractor Involvement: A Path Forward

Early Contractor Involvement ("ECI") approaches, such as Progressive Design-Build and Construction Manager/General Contractor, allow for more sensible and successful procurement and contractual strategies to improve and inform pricing realism and the balance of risk allocation on subsurface projects by allowing for increased opportunities for more transparency, and synchronized and timely collaboration among the Owner, Contractor, and Consulting Engineer in the development and implementation of design and construction approaches; and, thereby, enhance the availability and capacity of bonding and project-specific insurance coverages on those projects.[23]

This paper will focus on two ECI approaches:

- Progressive Design-Build
- Construction Manager/General Contractor

PDB and CM/GC represent delivery methods with different and distinctive characteristics.[24] However, both methods – in contrast to DBB and conventional DB – provide opportunities for substantial and meaningful interaction, constructive collaboration, and transparency in understanding between the Owner and Contractor as to risk assessments and in the development of permanent works design and construction means/methods **prior to** final agreement on price and risk allocation terms.[25] In ad-

[23] D.J. Hatem, *Improving Risk Allocation on Design-Build Subsurface Projects*, TUNNEL BUSINESS MAGAZINE (June 2020); D.J. Hatem, *Recalibrating and Improving Design-Build on Public Infrastructure Projects*, American Bar Association Forum on Construction Law (Sept. 2022); D.J. Hatem, *Project-Specific Professional Liability Insurance on Design-Build and Public-Private Partnership Projects in North America: A Path Forward*, Donovan Hatem LLP (May 3, 2022).

[24] Transportation Research Board, *Managing Geotechnical Risks in Design-Build Projects*, NCHRP Project No. 24-44 (D. Gransberg et al. eds., 2018); Transportation Research Board, *Guidelines for Managing Geotechnical Risks in Design-Build Projects*, NCHRP Research Report 884 (D. Gransberg et al. eds., Sept. 2018); D.J. Hatem, *Improving Risk Allocation on Design-Build Subsurface Projects*, TUNNEL BUSINESS MAGAZINE (June 2020).

[25] Sources that more particularly focus on the application and advantages of PDB and CM/GC in the specific context of tunneling and other major subsurface projects include: I.G. Castro-Nova, G.M. Gad & D.D. Gransberg, *Assessment of State Agencies' Practices in Managing Geotechnical Risk in Design-Build Projects*, TRANS. RES. REC. (2017); R. Gould, J. Murray & D. Elbin, *Benefits and Challenges of Progressive Design-Build Procurement – Atlanta Plane Train Project*, North American Tunneling 2022 Proceedings, pp. 209-218; C. del Puerto, D. Gransberg & M. Loulakis, *Contractual Approaches to Address Geotechnical Uncertainty in Design-Build Public Transportation Projects*, J. LEG. AFF. DISPUTE RESOLUT. ENG. CONSTR. (2017); Transportation Research Board, *Guidelines for Managing Geotechnical Risks in Design-Build Projects*, NCHRP Research Report 884 (D. Gransberg et al. eds., Sept. 2018); R. Essex, D. Hatem & J. Reilly, *Alternative Delivery Drives Alternative Risk Allocation Methods*, North American Tunneling Conference, Washington, D.C., 24-27 (June 2018); D.J. Hatem, *Subsurface Conditions and Design Adequacy Risk Allocation in Design Build: Dynamics, Interactions and Interdependencies*, TUNNEL BUSINESS MAGAZINE (Oct. 2018); D.J. Hatem, *Rethinking and Recalibrating Design-Build*, DEC. 2020 DES. AND CONS. MNG. REP.; D.J. Hatem, *Design-Build: Recalibrating Procurement and Contractual Approaches*, George A. Fox Conference (May 10, 2022); I.G. Castro-Nova, *Geotechnical Risk Decision Tools for Alternative Project Delivery Method Selection*, Iowa St. U. (2016); D.D. Gransberg & B. Cetin, *Subsurface Risk Management Tools for Alternative Project Delivery* (ASCE

dition, both PDB and CM/GC allow for increased and enhanced utilization of the Observational Method.

Progressive Design-Build

PDB typically involves the following implementation approach:

- The Owner selects the Design-Builder based on qualifications or best value.
- The Owner and Design-Builder collaboratively conduct the subsurface investigation, subsurface conditions evaluations, and design development.
- The Owner and Design-Builder may collaborate in preparation of a joint Geotechnical Baseline Report.
- Following interaction and input from, and collaboration with, the Owner, the Design-Builder develops the design to a level of approximately 60%, or more.
- The Owner and Design-Builder agree to commercial and contractual terms.
- In the DB Contract, subsurface conditions risk is shared between the Owner and the Design-Builder, and the latter is responsible for the adequacy, suitability, and constructability of the permanent works final design and construction means/methods.

PDB seeks to align and synchronize design development and risk assessment opportunities so as to realistically and objectively inform design and construction approaches, as well as contractual price and risk allocation commitments.

Construction Manager/General Contractor

The CM/GC method is typically implemented in the following approach:

- The Owner engages a Consulting Engineer to prepare a preliminary design.
- The Owner initially contracts with a CM based on qualifications.
- The CM collaborates with the Owner and the Owner's Consulting Engineer in the subsurface investigation, the design development processes, and potentially in the preparation of the Geotechnical Baseline Report.
- There is a meaningful opportunity for particularized, negotiated, and agreed-upon contractual risk allocation for subsurface conditions, and for interactions, input, and

Geo-Congress, 2020); *I-70 Twin Tunnels Risk Assessment and Project Delivery Selection*, Colorado Dep't of Trans. Innovative Contracting Advisory Committee (2011); M. Fowler, M. Keleman, C. Fischer, M. Hogan & S. Kim, *I-70 Twin Tunnels Widening Using Drill and Blast Under CM/GC Contract*, SOC'Y FOR MINING, METALLURGY AND EXPLORATION INC (2015); J. O'Carroll, A. Thompson & T. Kwialkowski, *A Study in the Use of Design-Build for Tunnel Projects*; S.V. Stockhausen, E. L.D. Sibley and D. Penrice, *Progressive Design-Build – Is it Coming to a Project Near You?*; D. Pelletier, J. Willhite, A. Thompson, B. DiFiore & J. Wallace, *CM/GC Delivery Method For Federally-Procured Projects: A Case Study on the Independent Cost Estimating Process,* SOC'Y FOR MINING, METALLURGY & EXPLORATION, 2020 Proceedings, North American Tunneling, pp. 249-255; N. Sokol, M. Jaeger & J. Sucilsky, *Progressive Design-Build in Silicon Valley,* Society for Mining, Metallurgy & Exploration, 2020 Proceedings, North American Tunneling, pp. 273-281; C. Taragaza, *Progressive Design-Build in the Tunneling/Underground Construction Industry – Perspective from the Private Sector*, Rapid Excavation and Tunneling Conf. 2023 Proc., p. 29, eds. N. Garavelli & F. Pepe (Society for Mining, Metallurgy & Exploration, 2023); M.B. Haggerty & J. Welna, *CMGC Delivery of the I35W SSF Project – Fostering Collaboration to Meet Stormwater Resiliency Challenges*, Rapid Excavation and Tunneling Conf. 2023 Proc., p. 12, N. Garavelli & F. Pepe (Society for Mining, Metallurgy & Exploration, 2023); L. C. Weiman-Benitez et al., *A Case Study in Successful Progressive Design Build Tunneling*, Rapid Excavation and Tunneling Conf. 2023 Proc., p. 112, eds. N. Garavelli & F. Pepe (Society for Mining, Metallurgy & Exploration, 2023).

It is generally recognized that the advantages of PDB particularly on subsurface infrastructure projects, include the ability of the owner team and DB or contractor Team to be better informed and aligned as to both perceptions and realities of critical risk variables and contingencies – such as those involving evaluation of subsurface conditions and assessments as to final design feasibility and approach – prior to reaching contractual commitments on price and risk allocation terms See D.J. Hatem, *Improving Risk Allocation on Design-Build Subsurface Projects*, TUNNEL BUSINESS MAGAZINE (June. 2020); C.B. Farnsworth, R.O. Warr, J.E. Weidman, & D. M. Hutchings, *Effects of CM/GC Project Delivery on Managing Process Risk in Transportation Construction,* J. CONSTR. ENG. MANAGE. (2016); D.Q. Tran & K.R. Molenaar, *Risk-Based Project Delivery Selection Model for Highway Design and Construction*, J. CONSTR. ENG. MANAGE. (2015); I.G. Castro-Nova, G.M. Gad, A. Touran, B. Cetin and D.D. Gransberg, *Evaluating the Influence of Differing Geotechnical Risk Perceptions on Design-Build Highway Projects*, 4 ASCE-ASME J. of Risk and Uncertainty in Eng. Systems (2018); D. Gransberg, *Construction Manager – General Contractor Project Delivery*, TR NEWS 285, March-April 2013, at 10; N. Munfah, *Controlling Tunneling Project Risk Implemented by Alternative Delivery*, TUNNELING ONLINE.COM (Oct. 17, 2019), https://tunnelingonline.com/controlling-tunneling-project-risk-implemented-by-alternative-delivery/; S. R. Kramer, *Using Alternative Delivery Methods to Increase Competitiveness on Tunnel Projects* (Aug. 14, 2017); Nat'l Cooperative Highway Res. Program, *Guide for Design Management on Design-Build and Construction Manager/General Contractor Projects* (787. 2016); Nat'l Cooperative Highway Res. Program, National Cooperative of Highway Research Program Synthesis 429 Geotechnical Information Practices in Design-Build Projects (2016); NCHRP, *NCHRP Res. Rep. 884 Guidelines for Managing Geotechnical Risks in Design-Build Projects* (2019); and S. Briglia & M.C. Loulakis, *Geotechnical Risk Allocation on Design-Build Construction Projects: The Apple Doesn't Fall Far From the Tree*, 11 J. AMERICAN COLLEGE CONSTR. LAWYERS (Sept. 2017); D. Mast & P. Nicholas, *Alternative Delivery For Tunnels*, TUNNEL BUSINESS MAGAZINE, December 2020, at 16.

There are other approaches to defer final price and risk allocation commitments in DB until the design-builder has had adequate time to evaluate relevant project factors and conditions. The Virginia DOT "scope validation" approach relating to the pricing and risk for subsurface conditions work, is noteworthy in this regard. Under that approach, the design-builder has a period of time following a limited notice to proceed within which to validate its pricing and risk assessments as to subsurface conditions prior to making final contractual commitments. See *AASHTO Guide for Design-Build Procurement*, p. 33 (2008); *Guidelines for Managing Geotechnical Risks in Design-Build Projects*, National Academies Press, Appendix C. p. 8 (2018); D.J. Hatem & P. Gary eds., *Public-Private Partnerships and Design-Build: Opportunities and Risks for Consulting Engineers*, ch. 12, ¶12.2.3, p. 460, Washington: American Council of Engineering Companies (3d ed. 2020). For an excellent discussion of contractual and procurement approaches to managing risk or major subsurface projects, see M. Loulakis & D. Gransberg, *Managing the Risk of Subsurface Conditions*, NATIONAL ACADEMY OF CONSTRUCTION, February 22, 2022; K. Kelley et al., *Design-Build Project Delivery Method Selection and Implementation of a GBR-B and GBR-C for the Pawtucket Tunnel*, Rapid Excavation and Tunneling Conf. 2023 Proc., p. 335, eds. N. Garavelli & F. Pepe (Society for Mining, Metallurgy & Exploration, 2023); K. Bhattarai & D. J. Hatem, *Risk Baseline Report: An Innovative Risk Management Approach for a Complex Underground Project*, Rapid Excavation and Tunneling Conf. 2023 Proc., p. 1041, eds. N. Garavelli & F. Pepe (Society for Mining, Metallurgy & Exploration, 2023).

collaboration in the development of design and construction approaches.

- The Owner and the CM agree on a fixed price and risk allocation terms at approximately 50 – 75% progression of the design development.
- The Owner's Consulting Engineer finalizes and seals the design.
- The Owner is responsible for adequacy, suitability, and constructability of the final design, given its dominant control in the design development process.[26]

Early Contractor Involvement: More Collaborative, Interactive, and Objectively Documented Basis to Inform Realistic Pricing and Risk Allocation Decisions

At the 60+% level of design development on a major subsurface project – i.e., the minimal point at which the Contractor (in CM/GC) or the Design-Builder (in PDB) is typically expected to contractually commit to a fixed price and risk allocation terms – the following has transpired:

- The subsurface investigation and data evaluation are complete or minimally substantially complete.
- Sufficient subsurface data is available to adequately inform the permanent works design and construction means/methods design and approaches.
- The permanent works design is substantially complete.
- There has been a reasonable opportunity to address and mitigate issues that have been identified in a Risk Register during the development of both the permanent works design and construction means/methods.
- The Contractor or Design-Builder has a realistic and reliable basis upon which to plan, evaluate and allocate risk, and price (with appropriate contingencies) the design of permanent works and construction means/methods.
- An adequate, reasonably informed, and realistic basis exists to negotiate and contract on relevant and balanced risk allocation terms.
- There is an adequate contractual basis to facilitate resolution of any subsequent DSC disputes.[27]

ECI: Advantages for Subsurface Projects

ECI improves and increases opportunities for:

- Interface, interactions, collaboration, and alignment regarding:
  - Subsurface conditions evaluation.
  - Development of permanent works design and construction means/methods suitable for anticipated subsurface conditions.
  - Identification of design criteria and details for anticipated contingent modifications to permanent works design and construction means/methods due to probable parameters of subsurface conditions encountered during construction.
- Development of contractual documentation of mutual and transparent understandings as to assessment, design and construction means/methods modifications, and other contingencies, risk allocation, and compensation and time adjustments due to:
  - Subsurface conditions encountered during construction.
  - Design and construction means/method modifications required during construction due to certain parameters of encountered conditions.
- Collaboration in design development and contractual alignment of specific (and optional, contingent) permanent and temporary design approaches with particularized risk allocation and pricing.
- Reduced conservatism in design criteria, requirements, or details in initial released for construction ("RFC") Contract Documents.
- Flexibility in technical, contractual, and commercial considerations due to design modifications based on subsurface conditions not initially assumed as a basis for the design of the RFC Contract Documents.
- Increased transparency and collaboration in the risk allocation contractual terms.
- Establishing and fostering a culture that embraces and effectively/fairly manages variations in subsurface conditions, and in required modifications to design and construction approaches.

As demonstrated, ECI provides several opportunities to correct and recalibrate the flawed and unrealistic risk allocation premises and expectations underlying DBB and conventional DB. ECI constructively addresses the **critical and inherent factors**

[26] In certain CM/GC contexts, risk for defective final design may be shared depending upon the respective roles of the Owner and Contractor in the design development process. See Coghlin Elec. Contractors, Inc. v. Gilbane Bldg. Co., 36 N.E.3d 505 (Mass. 2015); D.J. Hatem, *Subsurface Conditions and Design Adequacy Risk Allocation in Design Build: Dynamics, Interactions and Interdependencies*, TUNNEL BUSINESS MAGAZINE (Oct. 2018); D. Gransberg & K. Molenaar, *Critical Comparison of Progressive Design-Build and Construction Manager/General Contractor Project Delivery Methods,* Transportation Research Record Journal of the Transportation Research Board (Jan. 2019); N.R. Sellers, *Do Construction-Manager-at-Risk Contracts Alter the Spearin Doctrine?*, Fabyanske Westra Hart & Thompson.

[27] K. Bhattarai & D.J. Hatem, *Risk Baseline Report: An Innovative Risk Management Approach for a Complex Underground Project*, Rapid Excavation and Tunneling Conf. 2023 Proc., p. 1041, eds. N. Garavelli & F. Pepe (Society for Mining, Metallurgy & Exploration, June 2023).

and characteristics, thereby promoting effective, efficient, and balanced risk allocation in subsurface projects.

In both DBB and conventional DB, the Contractor's or Design-Builder's fixed price is based on a design; in DBB, typically the Owner is explicitly or impliedly responsible for the adequacy and suitability of the final design, and in DB, the Design-Builder bears that responsibility.[28] In either and both delivery methods, contractual terms (including risk allocation and opportunities for cost and time adjustments to the fixed price) have the effect of explicitly or implicitly discouraging modifications to the final design during construction due to differing subsurface conditions. In DBB, the Owner typically will bear the additional risk or cost due to such modifications; in conventional DB, the Design-Builder typically will bear that risk and cost. Simply put, these delivery approaches produce an aversion to receptivity for design and construction modifications that may be necessary based upon reasonably anticipated parameters of conditions variations encountered during construction that, by definition, occur after contractually-defined risk allocation and cost commitments have been established.

ECI affords the Owner and the Design-Builder with meaningful and timely opportunities to identify and anticipate – through planning, design, and construction phase contingent modifications, as well as pricing contingencies – reasonable and agreed upon ranges or parameters of anticipated encountered subsurface conditions that may produce the need for such modifications, and to contractually address the risk or cost consequences for project participants.

ECI: Facilitating Utilization of the Observational Method

The observational method ("OM") has been defined as:

> "[A] continuous, managed, integrated, process of design, construction control, monitoring and review that enables previously defined modifications to be incorporated during or after construction as appropriate. All these aspects have to be demonstrably robust. The objective is to achieve greater overall economy without compromising safety."[29]

In recent years, there has been discussion within the underground design and construction industry that the traditionally perceived boundaries between permanent works design and construction means/methods considerations may not always need to be absolute and immutable. In addition to the benefits of allowing a Contractor to provide early input in the development of permanent works design under ECI, there has also been recognition that, in appropriate instances, the Owner and/or its Consulting Engineer may have valuable input, and thus should have the meaningful opportunity to be involved (to varying and appropriate degrees), in providing recommendations, criteria, and standards for the design of construction means/methods.[30]

Both DBB and conventional DB contractual pricing and risk allocation approaches have been noted to constrain the utilization of the OM.[31] In significant part, those methods lack the requisite collaborative framework that allows for more flexible, receptive, and tolerant contractual provisions to verify planned design and construction approaches and anticipate any required modifications in those approaches due to reasonably anticipated probable parameters of variations in encountered subsurface conditions. The interactive, synergistic, and collaborative characteristics of ECI foster a contractual and pragmatic environment that is more embracing of the variations and flexibilities inherent in the design and construction of subsurface projects and required to maximize OM utilization.

As previously discussed, both DBB and conventional DB – while distinct delivery methods – are based on structures that result in inflexibility in and resistance to modifications in planned design and construction approaches. As explained below, these approaches constrain OM utilization:

> "In the design-bid-build contracts, there is typically a separation between the designer and the contractor, which may create obstacles to modifying the design during construction and, consequently, a barrier to the use of the observational method. The same kind of problems may arise in a design-and-build contract if the client keeps the right to approve all modifications of the design and has no incentives to do so. This separation can lead to disputes and confrontation between the actors involved. This must be avoided when implementing the observational method, where high-quality communication and cooperation are essential."[32]

In DBB, receptivity to the OM is confronted by constraints. As stated by Powderham and O'Brien:

> "Under a conventional [DBB] contract, a contractor bids on a project based on a fixed design specified in the contract documents and on the premise that it will be built

[28] D.J. Hatem & P. Gary, ed., *Public-Private Partnerships and Design-Build: Opportunities and Risks for Consulting Engineers*, ch. 12, ¶ 12.3.2, Washington: American Council of Engineering Cos. (3d ed. 2020).

[29] D. Nicholson et al., *The Observational Method in Ground Engineering: Principles and Applications*, CIRIA Report 185, section 2.1 (Constr. Indus. Rsch. & Info. Assoc., Jan. 1, 1999) ("CIRIA Report 185").

[30] As to the latter, see J. Reilly, *TBM Procurement Within Contract Award Processes*, Tunnels and Tunneling (April 2021); D.J. Hatem & D. Corkum eds., *Megaprojects: Challenges and Recommended Practices*, ¶6.4, 520-538 (American Council of Engineering Cos., 2010); D. Del Nero, *Means and Methods of Construction: Whose Domain Is It?*, North American Soc'y for Trenchless Technology (2012); D. Del Nero, *Means and Methods – In the Engineer's Domain*, Col. Sch. of Mines (2015); G. Brierley & D.J. Hatem, *Contractor Submittals for Tunneling Projects*, TUNNEL BUSINESS MAGAZINE (Feb. 2022); V. Tirolo & G. Almeraris, *Suggested and Prescriptive Means and Methods – Are They Really in the Owner's Interest*, Rapid Excavation and Tunneling Conf. 2005 Proc., p. 20 (2005).

[31] A. Powderham & A. O'Brien, *The Observational Method in Civil Engineering*, ¶ 14.2.1 (CRC Press, 2021).

[32] M. Tidlund, *Geotechnical Risk Management Using the Observational Method*, Doctoral Thesis in Civil and Architectural Engineering (KTH Royal Institute of Technology, 2021).

> as designed. The introduction of the OM within such a contract immediately presents commercial risks from the need to allow design changes during construction. Such risks tend to fall predominantly upon the contractor who can consequently be exposed to the double disadvantage of less return but more ownership of the design. Risk allocation is reasonably well defined in a conventional [DBB] contract where most of the design risk is taken by the client and most of the construction risk is carried by the contractor."[33]

The integration and synchronization of design and construction in conventional DB improves opportunities for OM utilization:

> "Design-and-construct contracts are intrinsically more amenable than other forms to inclusion of the OM. They allow a contractor to team up with a consultant at the time of tender and to offer the client a more effective solution."[34]

However, regarding conventional DB, CIRIA Report 185 further states:

> "Design-and-construct forms of contract are not without problems. More often than not the client's adviser has prepared the feasibility study and produced an outline design for the purpose of seeking tenders. That adviser – who quite properly has an influence in assessing the tenders – might not have the wisdom, knowledge and experience to assess objectively a tender that contains an OM solution. Consequently the tender is likely to be unsuccessful. The adviser could also have an auditing role and, therefore, possibly restrict the design process.
>
> The real problem for a contractor who wishes to pursue the OM in a design-and-construct environment arises when the client has strict approval requirements on the contractor's design or an independent check is required. The client, having accepted an offer for a lump-sum price and off-loaded the risk, has no incentive to help the contractor through a prompt or sympathetic approval system. The client's approval consultant or an external checker has even less interest."[35]

Commenting on conventional DB, Powderham and O'Brien note similar limitations in facilitating OM utilization:

> "[DB] forms of contract offer greater potential to adopt the OM where design and construction are inherently more closely inter-related and the contractor has significant ownership of the design. However, intense time pressures (especially during tender phases) and fragmentation of design effort within an adversarial environment may often inhibit the adoption of the OM. Stakeholder approval, especially of the client, may be difficult to achieve. Implementation of the OM requires greater effort by the designer and the contractor, and it may not be in the commercial interests of either party to pursue the OM unless there is an appropriate financial incentive."[36]

[33] A. Powderham & A. O'Brien, *supra* note 31, at 327-29, ¶14.2.1.

[34] D. Nicholson et al., *supra* note 29, at 96, ¶ 6.2.1.4.

35 *Id.*

ECI: OM Alignment

Procurement and contractual approaches on major subsurface projects should aim to anticipate subsurface conditions risk contingencies and appropriate modifications in design and construction approaches that may be necessary to address probable and reasonable parameters of variations in conditions assumed and predicted during design development and prior to construction commencement. Delivery approaches and contract terms should both enable and embrace the potential for such variations and modifications. Success in the implementation of the OM is significantly influenced, if not determined, by such approaches and terms.

ECI improves and facilitates opportunities for OM implementation by fostering collaboration, flexibility, and joint Owner-Contractor (in CM/GC) or Owner-Design-Builder (in PDB) pre-construction, mutual understandings and decisions as to:

- The nature and extent of subsurface investigation required to support design development and constructability approaches.
- The mutually understood evaluation of subsurface conditions data.
- The collaborative identification and assessment of probable and reasonable parameters of variations in subsurface conditions that may reasonably be expected to be encountered during construction; and the development of standards or criteria for the monitoring, measurement, and evaluation of actual (physical or behavioral) encountered conditions.
- The collaborative development of modifications to permanent works design and constructability approaches (both as initially planned and any modified, contingent approaches) to be implemented based upon probable variations in actually encountered conditions.
- The contractual terms to address risk allocation and equitable adjustment/relief implications of any design and constructability modifications.[37]

[36] A. Powderham & A. O'Brien, *supra* note 31, at 329, ¶14.2.2.

[37] See A. Powderham & A. O'Brien, *The Observational Method in Civil Engineering*, 325-31 ¶ 14 (CRC Press, 2021); M. Tidlund, *Geotechnical Risk Management Using the Observational Method*, Doctoral Thesis in Civil and Architectural Engineering (KTH Royal Institute of Technology, 2021); J. Brochner et al., *Contractors and Design Risk in Major Civil Works Design/Build Projects*, Procs. of Canadian Soc'y for Civil Eng'g 1st Int'l Constr. Specialty Conf. (2006); A Kadefors & J Brochner, *The Observational Method in Rock Engineering: Contracts and Collaboration* (2008); A. Kadefors & J. Brochner, *Organization and Contract in Rock Tunnel Project – Knowledge in Collaboration*, BeFo Rapport 138 (2015); A. Muir Wood, *Tunneling: Management by Design*, ¶¶ 2.6, 2.7 (London: E&FN Spon, 2000); W. Klary et al., *Atlanta – Plain Train Tunnel West Extension Project – Progressive Design-Build*

ECI: Recalibrating Project Delivery with Cost and Risk Realities

There are multi-dimensional concerns presented by the problematic conventional DB procurement and contractual practices in heavy civil and major subsurface projects. At root, these concerns principally derive from mandates that a fixed price be contractually committed prior to sufficient clarity and comprehension of the expectations as to what is required of the DB team in the final design and construction approaches. Those concerns are exacerbated by aggressive and imbalanced risk allocation obligations of the Design-Builder and the unqualified flow down of those prime DB contract terms to the Consulting Engineer. Further, in a highly competitive procurement environment, DB proposers often engage in aggressive pricing and do not include in their proposal pricing adequate contingencies for the unknowns and risks in project final design and construction approaches.

At root, the principal concerns with conventional DB approaches on these projects primarily and predominantly arise out of unrealistic expectations of project participants as to the actual and inherent project cost ("project cost") and risks necessary to be reasonably assessed and factored in the design and construction of a project that meets the Owner's ultimate requirements. Simply put, the realistic project cost is not captured in the fixed-price award.

Many of the Design-Builder "cost overrun" claims against Consulting Engineers in conventional DB derive from failures to adequately, reasonably, and realistically estimate and assess project cost and risk during the proposal phase. Some of those failures may be attributable to strategic and competitive factors and influences in the procurement process. However, it appears that those failures are significantly due to the inability of the majority of Design-Builder proposers to adequately define and reasonably predict during procurement all of the relevant design and construction considerations, costs, and risks inherent and necessary to assess and price in order to achieve the Owner's ultimate requirements. On megaprojects, the risks of unrealistic project cost and overly optimistic risk assessments are elevated.

For the most part, Design-Builder "cost overrun" claims against Consulting Engineers are not genuinely attributable to fault, negligence, misrepresentation, or other wrongful conduct of most – and perhaps all – project participants. Rather, these claims derive and drive from the failure or inability to capture in the DB Contract a realistic fixed price basis to encompass the design and construction scope and cost, and associated risks inherent in delivering a project that meets the Owner's ultimate design and constructability requirements. Viewed in this context, the very foundation or predicate of a professional negligence claim against the Consulting Engineer for "cost overruns" is fundamentally flawed and misdirected.

In DB, there is an important intersection between (a) project cost and (b) expectations as to design adequacy. In DBB, the Owner typically owes an implied warranty obligation to the Contractor; more specifically, the Owner impliedly warrants that the final design that it provides to the Contractor is suitable and constructable for the project. The Owner, in DBB, will (should) typically budget for the cost adjustments required to compensate the Contractor as a result of the Owner's breach of that implied warranty obligation. In the latter circumstance, the Owner may be able to recover those costs from its Design Professional who prepared the defective design, but typically only if the Owner proves that the Design Professional failed to meet the professional standard of care. Put another way, not all design defects are due to standard of care departures and there are certain costs due to design defects that ultimately will be the Owner's implied warranty obligation and financial responsibility, for which Owners should prudently plan and fund contingency.

In DB, since the Design-Builder is responsible for the final design (and its constructability), the Design-Builder contractually undertakes the cost, schedule, and other risks attributable to design defects that do not result from the Design Professional's departure from the standard of care. Design-Builders, like Owners in DBB, should prudently plan and fund contingency for non-negligent design defects.

In DB, the cost and schedule impacts of defective design not resulting from the Consulting Engineer's standard of care departures are an inherent and reasonably expected component of the Design-Builder's pricing and contingencies. Perfection is not the standard reasonably expected of the Consulting Engineer; and professional liability insurance is not intended to indemnify Design-Builder claims against Consulting Engineers for the Design-Builder's commercial and contractual risks not attributable to the Consulting Engineer's standard of care departures.

The overarching question is **when** can sufficient understanding of design and construction approaches reasonably and realistically be known in a manner to adequately and realistically inform commitments as to contractual pricing and risk allocation terms.

On major complex DB subsurface projects (and especially megaprojects), it is neither realistic, reasonable, nor fair to expect that such an understanding can or should be known or knowable at the time of DB Contract execution.

The acute problems associated with procurement and con-

Risk Management Approach, Rapid Excavation and Tunneling Conf. 2023 Proc., p. 2, eds. N. Garavelli & F. Pepe, (Society for Mining, Metallurgy & Exploration, 2023). Effective utilization of the OM approach requires clear and mutual understandings in any delivery method of the respective roles, responsibilities, and risks of all project participants. The Supreme Court of New South Wales decision in Theiss Pty Ltd. & John Holland Pty Ltd. v. Parsons Brinckerhoff Australia Pty Ltd., [2016] NSWSC 173 – which involved a dispute arising out of the OM approach on a DB project – demonstrates the importance of that admonition. This aspect of the Theiss decision is discussed in M. Graham, Theiss Pty Ltd and John Holland Pty Ltd v. Parsons Brinckerhoff Australia Pty Ltd [2016] NSWSC 173, KREISSON (Mar. 2016), https://kreisson.com.au/wp-content/uploads/2016/03/Theiss-and-JH-v-Parsons-Brinckerhoff.pdf; and B.C. Burman et al., *Lane Cove Tunnel Collapse and Sinkhole a Forensic Review – 3: The Legal Aftermath,* AUSTRALIAN GEOMECHANICS, Vol. 53 No. 4: 51-57 (Dec. 2016). As discussed in this paper, ECI increases the opportunities for more transparent understandings as to roles, responsibilities, and risks that enhance OM utilization.

tractual practices in conventional DB that (a) require a fixed price at the time of initial DB Contract award and (b) mandate imbalanced risk allocation terms, need to be corrected and a more sensible path forward developed. In general, the solution should allow for deferral of contractual commitments as to final price and risk allocation terms until the Design-Builder has had a reasonable opportunity to understand the required design and construction approaches, and the site, subsurface, and other relevant conditions and constraints (physical and political) in which those approaches will materialize. ECI provides approaches to address these problems by recalibrating procurement and contractual practices to cost and risk realities.

Some Owners may perceive ECI approaches – of deferring contractual commitments as to final pricing and risk allocation terms until a point after initial DB Contract award – as exposing them to either increased project costs or cost overrun exposures, or risk allocation terms that are less favorable than what they have achieved and are achieving presently in conventional DB. Also, some Owners may contend that fixed price and aggressive risk transfer approaches in conventional DB procurement and contractual approaches have worked well for them; and, at least to this point, there is no discernable or compelling reason for any modification in those approaches.

The question is whether these or related perceptions and contentions are sound, fair, sensible, or even sustainable in the long term, as evidenced by the recent and likely continued withdrawal of major Contractors, Consulting Engineers, and their professional liability insurers from conventional DB projects due to the procurement and contractual fixed price and associated imbalanced risk allocation terms.

The experience of the past in major subsurface projects amply demonstrates the advisability of balanced risk allocation; and the promise of success in the future for the design and construction industry vitally depends upon it. Disregarding or minimizing the longer-term significance of specific Contractor, Consulting Engineer, and professional liability insurer withdrawal from the DB arena is not reflective of a sound or prudent owner programmatic approach. The underwriting of PSPL insurance on DB projects was never conceived or intended to substitute or worse, compensate or indemnify, for claims derived from primarily commercial risks associated with inherent project costs due to design deficiencies (or otherwise) unrelated to standard of care departures and motivated by either aggressive and unrealistic bid pricing and inadequate contingencies, or imprudent and imbalanced risk allocation between Owners and Design-Builders.[38]

Early Contractor Involvement: Improving Surety and Professional Liability Insurance Availability and Capacity

Unrealistic procurement pricing and imbalanced risk allocation practices on heavy civil and major subsurface projects have negatively impacted the availability and capacity for surety and project-specific professional liability insurance ("PSPL/SPPI") participation in such projects.[39]

As to PSPL/SPPI policies specifically, there is a direct correlation between those problematic practices and the frequency and severity of professional liability claims covered by those policies. The potential for significant improvement in addressing these problematic procurement and contractual practices by ECI approaches should also enhance surety and PSPL/SPPI availability and capacity.[40]

Summary: Holistic Considerations

Realistic pricing, and effective, efficient, and balanced risk allocation on major subsurface projects depend upon meaningful and timely pre-construction collaboration to address the interrelationships, interdependencies, and dynamics among permanent works design, construction means/methods, and evaluation of subsurface conditions, as well as the advisability of defining and addressing, both commercially and contractually, the consequences and the probable and reasonable parameters of anticipated subsurface variations in conditions that may be encountered during construction, which could require design and construction means/methods modifications.

Project delivery methods on major subsurface projects should realistically account for these intense interactions and interdependencies, and the necessary alignments and collaborations among the respective roles and responsibilities of all project participants and corresponding risk allocations required to address the **critical and inherent factors and characteristics** of those projects. ECI provides sensible platforms and beneficial delivery approaches to accomplish those objectives on major subsurface projects.

The discrete and diverse subjects discussed in this paper share fundamental characteristics, the holistic understanding, alignment, and balancing of which – individually and collectively – are essential to effective solutions for some of the more vexing procurement and contractual problems and challenges confronting the achievement of successful delivery of major subsurface and other heavy civil infrastructure projects. The problems and challenges are not confined to any particular delivery method. Their sources are multi-dimensional and so are the components to their effective resolution.

Subsurface projects inherently involve a number of complex,

[38] D.J. Hatem, *Recalibrating and Improving Design-Build on Public Infrastructure Projects*, American Bar Association Forum on Construction Law (Sept. 2022).

[39] This issue has been extensively discussed in the sources cited in notes 3 & 4 *supra*. The misalignment of risk allocation approaches in conventional DB and PSPL coverage is discussed in D.J. Hatem & T. Whisler, *Professional Liability Insurance and Alternative Delivery Methods: A Square in a Circle?*, in REAL ESTATE LAW AND PRACTICE COURSE HANDBOOK SERIES: BUILDING BETTER CONSTRUCTION CONTRACTS 2015 177, 177-92 (P.J. O'Connor, Jr & T.R. Twomey, 2015).

[40] *Id.*

dynamic, and evolving critical interactions and interdependencies in the planning, investigation, and evaluation of anticipated ground conditions; the selection and development of permanent works design; and the selection, design, and implementation of construction means/methods.

This *planning*, in reality, is based more on a set of reasonable assumptions and expectations rather than demonstrative of a fixed or absolute set of understandings or immutable *plans*. The critical interactions and interdependencies produce a dynamic and complex environment in which – despite the essentiality of *plans* as an initial matter – prudent and flexible *planning* depends upon reasonable expectations of contingencies and variations – sometimes material in nature – due to factors and subsurface conditions actually experienced, but reasonably anticipated, in project execution.

More specifically, subsurface conditions encountered during construction often vary from those anticipated and indicated in Contract Documents, with the consequence that modifications may be required in planned permanent works design approaches and/or construction means/methods.

In DBB and conventional DB, the relative rigidity in the demarcation of roles, responsibilities and risks of project participants defies, contradicts and subverts the dynamic, interactive and interdependent factors and characteristics inherent in design and construction approaches suitable in potentially variable anticipated subsurface conditions. Those factors and characteristics require a significantly higher degree of tolerance based on actually encountered subsurface conditions for (a) evolution and modification in design and construction approaches; (b) particularly responsive and project-specific risk allocations tailored to defined parameters of such modifications; and (c) commercial adjustments that may be warranted for cost or time impacts due to such modifications in planned approaches.

ECI provides the opportunity for embracing such modifications in a fair and balanced manner, and one that is informed by collaborative and mutual information and risk assessments exchange and design development, evaluation and exchange – i.e., transparency – that occur prior to final contractual commitment.

Subsurface conditions variations and consequent planning modifications in design and construction approaches in most instances will impact cost and/or time for project completion. Disappointed contractual and commercial expectations on major subsurface projects often produce disputes among project participants, especially when they have not adequately and reasonably anticipated potential design and construction approach modifications, and funding and pricing contingencies in initial planning, commercial, and contractual adjustment mechanisms. Those disputes are likely to negatively impact profit, the ability to achieve successful on-time and within budget project completion and involve performance issues that implicate surety and liability insurance availability, capacity, and losses, and consequently adversely impact availability and capacity of surety and insurance on infrastructure projects.

As such, all of these subjects are, in important respects, inextricably interconnected and should be evaluated cohesively and coherently in order to achieve an effective alignment and balance that maximizes the opportunities for project success for all project participants.

ECI may not be a universal or ultimate solution to the procurement and contractual problems on subsurface projects, but it certainly is a significant corrective and improvement measure.