CONSTRUCTION SUPERCONFERENCE 2020

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How To Protect Your Business From The Increased Risks Of Design-Build By Using Informed Bidding Practices, Innovative Project Management Techniques, Specialized Agreements, And Appropriate Contract Terms

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Introduction

- Design-Build (“DB”) is quickly replacing Design-Bid-Build (“DBB”) as the preferred North American construction-delivery process for large infrastructure projects

- That said, DB case law remains sparse due to the tendency for construction disputes to settle, or resolve through arbitration proceedings, which are confidential and hidden from the public

- As a result, confusion and uncertainty often exacerbate the problems/risks associated with DB

Introduction

- Today's presentation will focus on how you can protect your business from the increased risks of DB through:
  - Informed bidding practices
  - Innovative project management techniques
  - Specialized agreements; and
  - Appropriate contract terms
- To put these mitigation strategies in perspective, we begin today's presentation by addressing the history and characteristics of DB Projects
- We will then discuss how these strategies/mechanisms can help reduce the risks to Design-Builders in the DB construction-delivery process

History of DB Projects

- DB is a form of delivery method that places design, construction, and material and equipment procurement under a single contract with the project owner

- Prior to the ‘80s, the DB project delivery method ran contrary to many public procurement policies in the United States, which required the federal government and states to award projects to the lowest bidder, prioritizing cost over value

History of DB Projects

- Beginning in the mid-80s, legislation at the federal level expanded to encourage and facilitate the use of the DB delivery method

- The following federal statutes helped pave the way for modern DB laws:
  - Competition In Contracting Act of 1984 (CICA)
  - Federal Acquisition Streamlining Act of 1994 (FASA)
  - Clinger-Cohen Act of 1996 (CCA)
  - Federal Acquisition Regulation (FAR)

History of DB Projects

- According to a study by Fails Management Institute (FMI), DB construction was anticipated (prior to COVID-19) to represent up to 44% of construction spending in the accessed segments by 2021

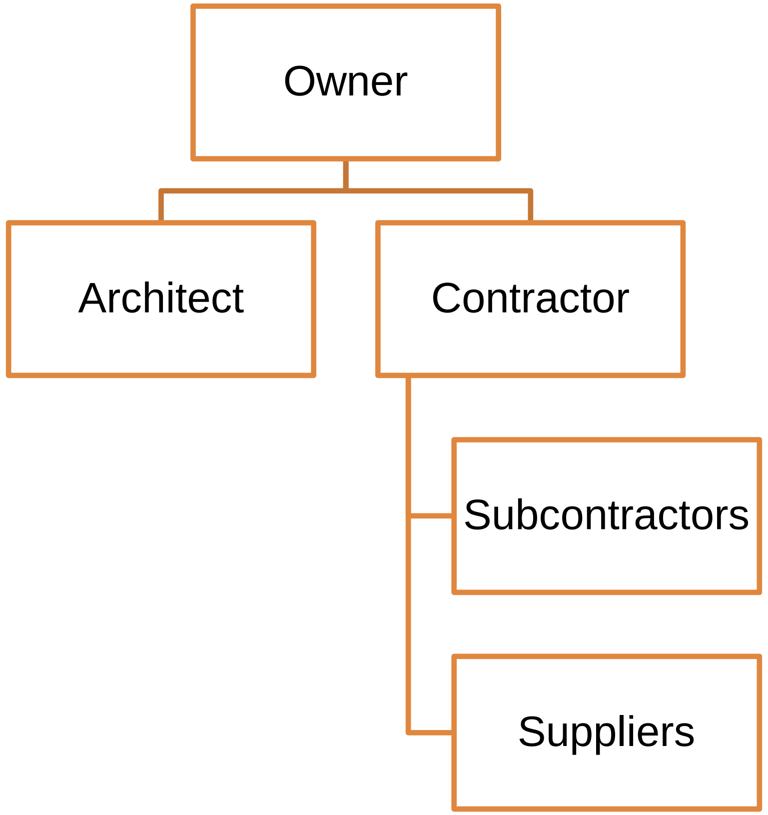
- FMI attributed the increase in DB projects to the passage of state legislation that facilitates the use of alternative delivery methods

- In 2020, forty-four (44) states have full or widely permitted authorization to utilize DB for public agency projects

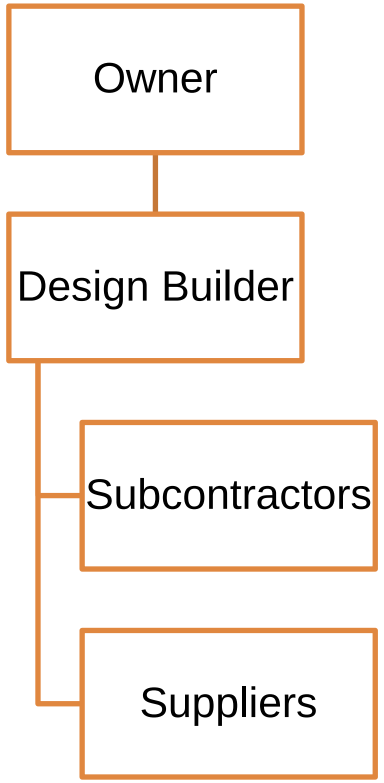
- The only six (6) states where DB currently remains a limited option are: North Dakota, Iowa, Wisconsin, Alabama, New Jersey and Pennsylvania

Characteristics of DB Projects

An obvious difference between DBB and DB projects relates to the contractual relationships among the parties



Design-Bid-Build vs. Design-Build



Characteristics of DB Projects

Another major difference between DB and DBB projects relates to project execution

DBB	Conceptual Planning	Select Architect	Preliminary Design	Final Design	Bid	Permits	Select Contractor	Construction
DB	Conceptual Planning	Select Design-Builder	Preliminary Design	Final Design/Permits	Construction			

Characteristics of DB Projects

- In the DB context, design development is the process by which pre-award schematic, conceptual or preliminary design or design criteria, parameters or standards are developed and finalized following award of the DB Contract

- Strict performance-defined DB projects in North America today are rare

- Most DB projects are defined by a combination of performance and prescriptive requirements

- As discussed in our first case study, one of the major risks of DB Projects relates to the degree of design development furnished by the Owner to the Design-Builder

Characteristics of DB Projects

A third major difference between DB and DBB relates to liability

- On DBB projects, owners are typically liable to the contractor for the design of the project

- On DB projects, however, owners are not (or believe that they are not) responsible for either the success or the failure of the project design

These, and other distinguishing characteristics, have a significant impact on project participants' roles and responsibilities, and the corresponding ability to control and manage risk

Risks of DB Projects

- At all times, DB project participants should keep in mind the Three Rs – Rules, Responsibilities and Risks
- There are many risks in DB, but two fundamental categories of risk are design-evolution risk and construction-period risks
- Common factors cited for determining how to allocate risk include:
  - Which party can best control the risk and its consequences;
  - Which party can best foresee and bear the risk; and,
  - Which party most benefits economically in controlling the risk

Risks of DB Projects:

Bridging or Conceptual Design Elements

The constructability of bridging or conceptual design elements poses a major risk to DB participants

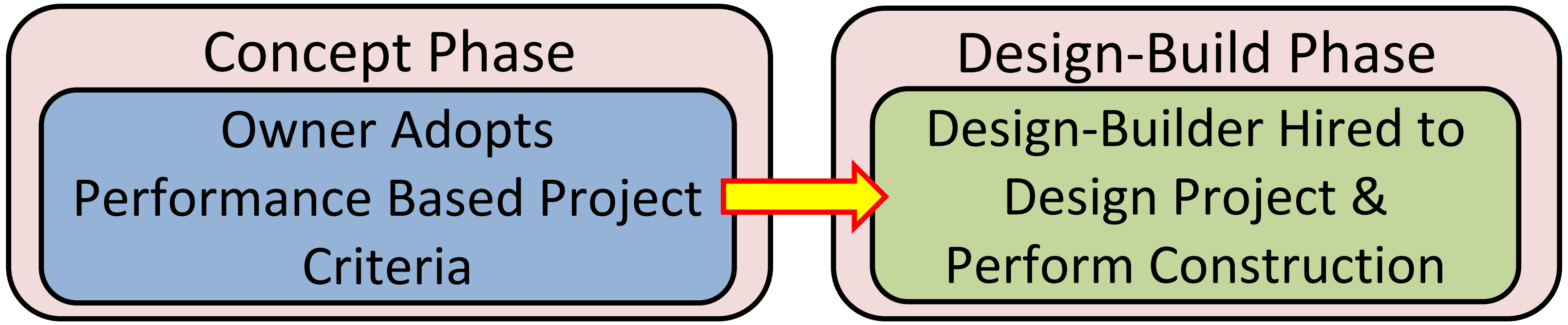
- Prescriptive specifications may transfer the risk of design adequacy back on to the owner, even where the contract disclaims such owners' responsibility

- This is a function of the *Spearin* doctrine and the idea that required design details or prescriptive specifications constitute owner control, and that, for this reason, responsibility for these design elements should lie with the owner

- This is particularly true where an owner continues to insist upon application of a prescriptive element or specification after it is questioned/identified

Risks of DB Projects:
Bridging or Conceptual Design Elements

Basic Design-Build Arrangement



Design-Build Bridging Arrangement

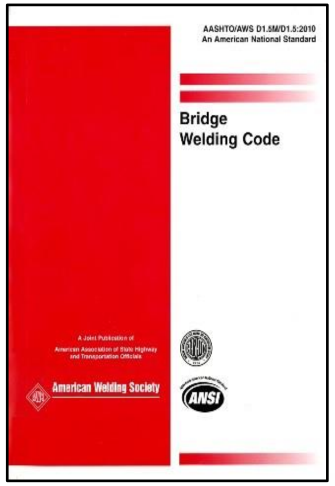
Case Study #1

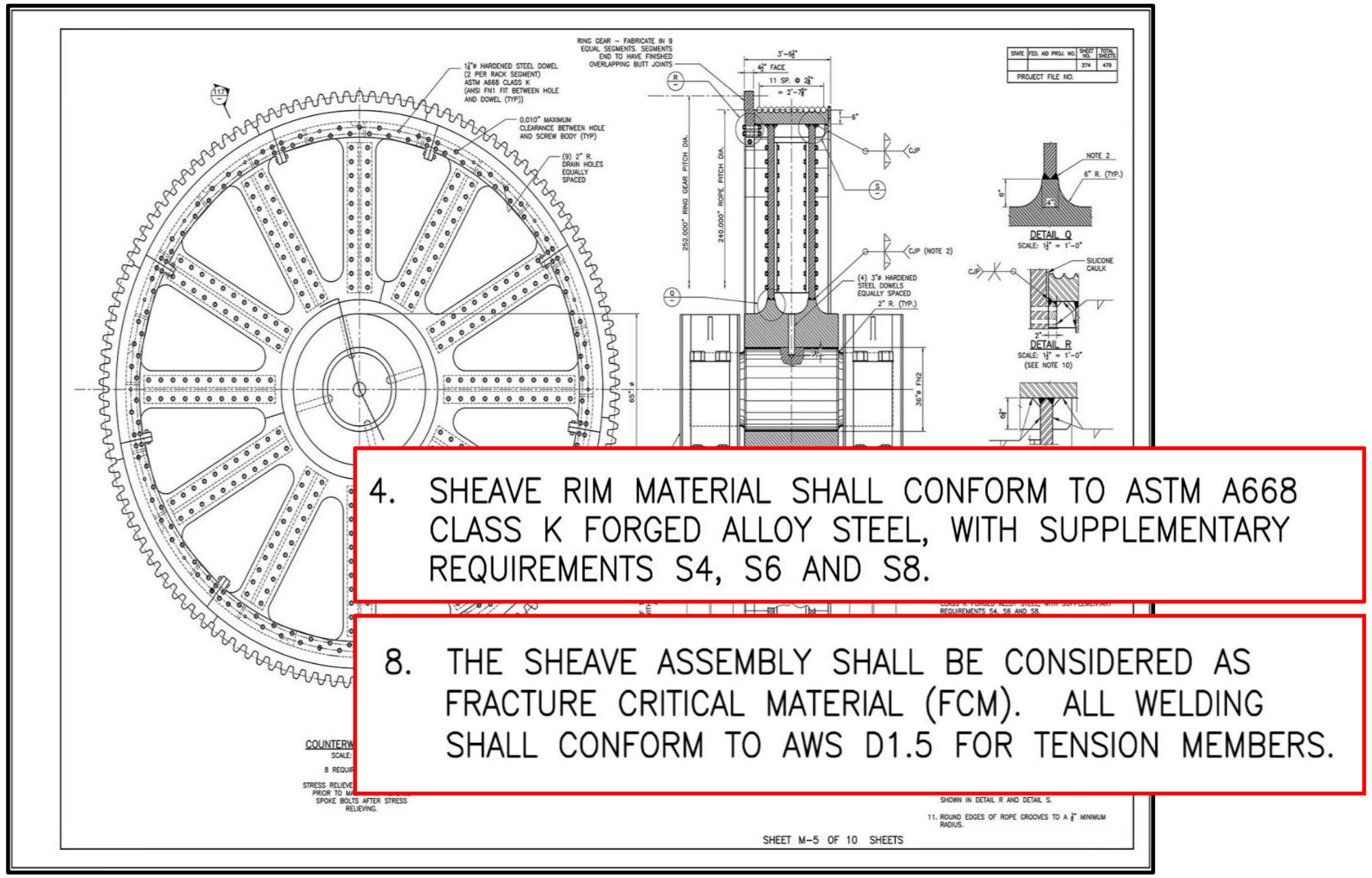
- This case study analyzes a dispute arising out of the design-builder's reliance on the owner's prescriptive requirements on a DB project in North America

- The damages in dispute included the costs incurred / time lost by the Design Builder as a result of defects in the Owner's prescriptive specifications/bridging documents

Case Study #1

Background: The Agency's RFP Drawings for Counterweight Sheaves were highly developed and prescriptive





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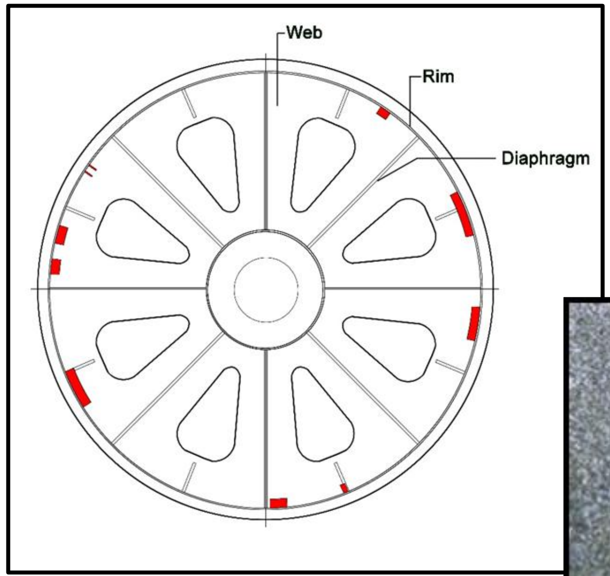
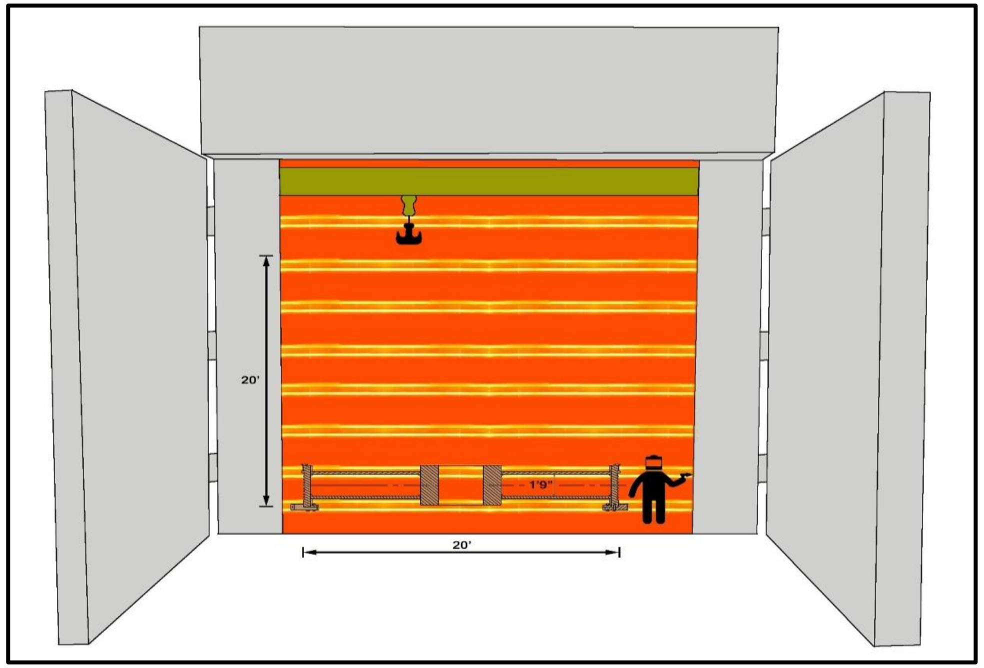
Case Study #1

The Problem: Irreparable cracking developed in the Heat Affected Zone of the Rim Base Metal… not the welds



Case Study #1

The Cause: Experts determined that it was impossible to successfully (and safely) weld the rim using the materials and welding procedures prescribed in the Agency's RFP Documents



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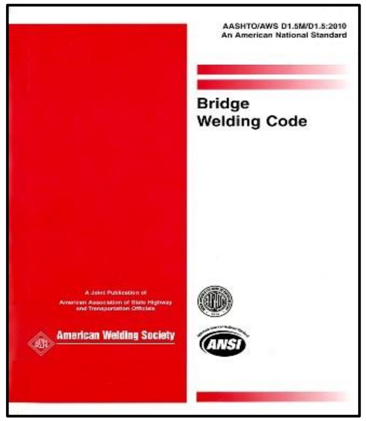
Case Study #1

Examples of prescribed due diligence when using unusual material in AWS Bridge Welding Code



5.4 Base Metal

5.4 Base Metal

cover the base metal to be used
etest, and verification tests.

lification Requirements. The
ualified by the PQR base metal
wing:

PQR Test Plate Specification and Grade	Qualified Production Base Metal Specification and Grade
M 270M/M 270 (A 709/A 709M) Gr. 250 [Gr. 36]	M 270M/M 270 (A 709/A 709M) Gr. 250 [Gr. 36]
M 270M/M 270 (A 709/A 709M) Gr. 345 [Gr. 50]	M 270M/M 270 (A 709/A 709M) Gr. 250, 345, 345S [Gr. 36, 50, 50S]
M 270M/M 270 (A 709/A 709M) Gr. 345W [Gr. 50W] (meeting requirements of 5.4.2)	M 270M/M 270 (A 709/A 709M) Gr. 250, 345, 345S, 345W, HPS 345W [Gr. 36, 50, 50S, 50W, HPS 50W]
M 270M/M 270 (A 709/A 709M) Gr. HPS 345W [Gr. HPS 50W]	M 270M/M 270 (A 709/A 709M) HPS 345W [Gr. HPS 50W]
Any steel with minimum specified yield strength >345 MPa [50 ksi]	PQR Test Plate Specification and Grade

5.4.2 M 270M/M 270 (A 709/A 709M) Grade 345W [50W] Test Plate Chemistry Requirements. When M 270M/M 270 (A 709/A 709M) Grade 345W [50W] test plate and backing steel is used to qualify all AASHTO steels having a specified minimum yield strength of 345 MPa [50 ksi], or less, the M 270M/M 270 (A 709/A 709M) Grade 345W [50W] steel shall have the following chemical composition:

Element	Composition, min, %
Carbon	0.15
Manganese	1.00
Silicon	0.25
Chromium	0.50
Vanadium	0.03

5.4.2.1 Carbon Equivalent Alternate. Test plate and backing steel that does not have a chemical composition that conforms to the above limits may be used, provided the steel has hardenability determined by the following:

The Carbon Equivalent shall be 0.45% minimum as determined by the formula

$$CE = C + \frac{(Mn + Si)}{6} + \frac{(Cr + Mo + V)}{5} + \frac{(Ni + Cu)}{15}$$

Carbon shall be 0.12% minimum.

5.4.2.2 Ideal Critical Diameter (DI) Alternate. Test plate and backing that does not meet the chemical composition or CE criterion above may be used by establishing an Ideal Critical Diameter. The hardenability shall be equal to or greater than steel meeting the requirements of 5.4.2 when established based upon an Ideal Critical Diameter (DI), whether calculated or experimental.

5.4.3 Use of Unlisted Base Metals. When a steel other than one of those described in 1.2.2 is approved under the provisions of the general specification, and such steel is proposed for welded construction under this code, WPSs shall be established by qualification in conformance with the requirements of 5.12.4. The fabricator shall have the responsibility for establishing the WPS by qualification.

5.4.3.1 The Engineer shall require evidence of adequate weldability of the steel, which as a minimum shall require the following:

(1) Acceptance by other national codes such as ASME, AWS (Offshore Applications), and ABS (Ships) of the steel for similar or stricter requirements for strength and toughness at equivalent loading rates.

(2) A minimum history of five-year use under similar conditions of loading.

(3) Records of past weld testing that would verify adequate resistance of the steel to hydrogen cracking at medium restraint levels. These tests should also establish the maximum and minimum heat input range for each welding process to be used in construction.

5.4.3.2 The responsibility for determining weldability, including the assumption of additional testing costs involved, shall be assigned to the party who either specifies a material not described in 1.2.2 or who proposes the use of a substitute material not described in 1.2.2. The party proposing the use of a substitute material not described in 1.2.2 shall assume the additional costs involved in establishing the WPS as required in 5.4.3.

5.4.3.3 When base metals not described in 1.2.2 are approved for welding to base metals of the same specification and grade or to steels described in 1.2.2, the welding procedure shall be qualified by test under the provisions of 5.12.4.

(1) In addition, when specified in the contract documents or ordered by the Engineer, CVN tests shall be made to measure the toughness of the coarse-grained area of the HAZ (see 5.4.3.5).

(2) The WPS shall list all welding variables and the minimum preheat and interpass temperature for the thicknesses listed in Table 4.3.

(a) When quenched and tempered steels are to be welded, both the minimum and maximum preheat and interpass temperatures shall be listed for each welding heat input and thickness as shown in Table 12.5.

(b) The WPS shall list any special precautions necessary to avoid weld and HAZ cracking and to ensure that the required strength, ductility, and toughness will be produced.

5.4.3.4 Unlisted Steels with $F_y \geq$ 485 MPa [70 ksi]. WPSs used to produce matching weld metal to join steels, with a minimum specified yield strength of 485 MPa [70 ksi] or greater that are not described in 1.2.2, shall be qualified by the Contractor as specified in the contract documents or ordered by the Engineer in conformance with 5.4.3. Weldability testing shall be as determined by the Engineer, or approved by AASHTO.

5.4.3.5 Charpy V-Notch (CVN) Test Requirements. WPS qualification tests for welds on steels with minimum specified yield strength of 485 MPa [70 ksi] or greater shall measure strength, ductility, toughness, and soundness of the weld metal. When specified in the contract documents, qualification tests for steels shall also measure the CVN test values of the coarse grained area of the HAZ. The minimum CVN test energy, test temperature, orientation of the notch, and other necessary details shall be specified in the contract documents when HAZ testing is required.

5.4.4 CMTRs. Copies of certified mill test reports (CMTRs) shall be furnished for all plates and backing used in testing.

5.4.5 WPS Backing. Steel backing used in weld tests shall be of the same specification and grade as the weld test plates, but CVN tests shall not be required.

5.4.6 Base Metal for Undermatched Welds. WPSs for welds that undermatch the base metal strength shall be based on PQRs that utilize undermatching filler metal and the higher strength of steel to be used in production.

5.4.7 Test Plate Base Metal for Hybrid PQRs. WPSs for joints involving two base metals of different specified yield strengths shall be qualified based on PQRs suitable for the lower strength base metal.

5.4.3 Use of Unlisted Base Metals. When a steel other than one of those described in 1.2.2 is approved under the provisions of the general specification, and such steel is proposed for welded construction under this code,

5.4.3.1 The Engineer shall require evidence of adequate weldability of the steel, which as a minimum shall require the following:

(1) Acceptance by other national codes such as ASME, AWS (Offshore Applications), and ABS (Ships) of the steel for similar or stricter requirements for strength and toughness at equivalent loading rates.

(2) A minimum history of five-year use under similar conditions of loading.

(3) Records of past weld testing that would verify adequate resistance of the steel to hydrogen cracking at medium restraint levels. These tests should also establish the maximum and minimum heat input range for each welding process to be used in construction.

5.4.3.2 The responsibility for determining weldability, including the assumption of additional testing costs involved, shall be assigned to the party who either specifies a material not described in 1.2.2 or who proposes the use of a substitute material not described in 1.2.2.

Case Study #1

- The Prime Contract included general exculpatory provisions that the Owner referenced in support of its initial denial of the Design-Builder's claim

Department Of Transportation — Highway Division

SECTION 3.0: INFORMATION SUPPLIED TO DB ENTITY/ ACKNOWLEDGEMENT BY DB ENTITY

The DB Entity shall have full responsibility to complete the formal design of all Project elements, regardless of the fact that DOT has supplied certain preliminary design work for certain portions of the Project to the DB Entity. All Design Documents shall be furnished to DOT after

- The DB Entity is responsible for correcting any errors, omissions and defects in the DOT-Supplied Design through the design and/or construction process, with the obligation to correct any errors, omissions, inconsistencies and other defects affecting therein, all at no additional cost to DOT;

the BTC Plans being provided may be necessary based on comments received during the on-going environmental permitting;

- The DB Entity is not entitled to rely on any documents or information provided by DOT other than the RFP Documents and the DB Entity's right to rely on the Reference Documents is subject to the limitations set forth herein;

- DB Entity's Warranties and indemnities hereunder cover errors, omissions and defects in the Project even though they may be related to errors, omissions and defects in the DOT-Supplied Design;

presents a feasible concept for the Project which can and shall be used as the basis for the completion of the Project, and agrees that it shall have no right to seek additional compensation or a time extension, except as specifically permitted by negotiated changes in the DB work; and

Section 3: Information Supplied to DB Entity/Acknowledgement by DB Entity — Page 35

Department Of Transportation — Highway Division

- The DB Entity acknowledges and agrees that DOT shall not be responsible or liable in any respect for any loss, damage, injury, liability, cost, expense or cause of action whatsoever suffered by DB Entity, its employees, agents, officers or Subcontractors or any other Persons for whom DB Entity may be legally or contractually responsible, by reason of any use of any information contained in the DOT-Supplied Design or any action or forbearance in reliance thereon, except to the extent that negotiated changes in the DB work provides for an increase in the DB Price and/or extensions of the

Section 3: Information Supplied to DB Entity/Acknowledgement by DB Entity — Page 36

Case Study #1

- These general exculpatory provisions, however, did not apply to the prescriptive portions of the contract
- These provisions only applied to the non-prescriptive portions of the contract

SECTION 12. INDEMNIFICATION AND RELEASES

12.1 INDEMNIFICATIONS BY THE DB ENTITY

Subject to this Section , the DB Entity shall release, defend, indemnify and hold harmless the Indemnified Parties from and against any and all claims, damages, losses, liabilities and costs, including attorneys' fees, arising out of, relating to or resulting from errors, omissions, inconsistencies or other defects in AbcDOT-Supplied Design, regardless of whether such errors, omissions, inconsistencies or defects were also included in Abc DOT-Supplied Design or RFP Documents, except as provided under Abc.L c. 30, § 39N.

12.2 RESTRICTIONS

The DB Entity's indemnity obligations hereunder shall not extend to any loss, damage or expense incurred by an Indemnified Party to the extent caused by:

b. Any defect inherent in prescriptive design or construction specifications included in the Contract Documents, provided the DB Entity complied with such standard and did not actually know of its deficiency or, if the DB Entity actually knew of its deficiency, unsuccessfully sought Abc DOT's waiver of or approval of a deviation from such standard; or

Page 44 Page 45

Case Study #1

Key Takeaways

- Request bridging documents that embody the owner's expectations and can serve as a guiding charter of the themes and goals for the project

- Seek out projects that utilize performance specifications vs. prescriptive specifications

- If the project has prescriptive design elements, design-builders should memorialize and confirm their/the Owner's interpretation of what is prescribed or warranted by the owner

Case Study #1

Questions?

Risks of DB Projects:
Scope of Work

Service scope is another major risk to the design-builder on a DB project

- Unlike DBB, where the contractor is typically only responsible for construction defects, on DB projects the design-builder is – with a few exceptions – liable to the owner for both design errors and construction defects, regardless of whether they are due to negligence, errors or omissions

- This means that the design-builder assumes the risk that it can complete the project on time and on budget and, to the extent difficulties or unexpected conditions arise on the project, it may have to absorb the impact

Risks of DB Projects:

Scope of Work

- One way to manage to identify, mitigate and manage these risks is to enter into teaming agreements, pre-bid, that assign designers the job of vetting the owners' RFPs

- Typical teaming agreement scope includes two major scope requirements for designers:

  - Development of preliminary design documents to satisfy owner's RFP requirements; and

  - Development of documents and information to support contractor's development price proposal

Risks of DB Projects: Scope of Work

- The designers' services under the teaming agreement should require the designer, amongst other things, to:
  - Verify that the owners' concept or bridging designs are sufficient to develop the preliminary design;
  - Seek clarification of ambiguities in contract documents and specifications; and
  - Identify additional information which must be provided by the owner for designer to develop and advance the preliminary design

Risks of DB Projects:

Scope of Work

Recent developments in teaming agreements reveal attempts by contractors to contractually bind designers to quantity-growth risks

Architect/Engineer shall provide Contractor with notice of the date on which the Architect/Engineer requires a response and a reasonable time to respond. Unless caused by Architect/Engineer or its Subconsultants, any unreasonable delays by Contractor shall entitle Architect/Engineer to seek an equitable adjustment of schedule as provided for in IV-B, CHANGES/ADDITIONAL SERVICES.

6. Nothing contained in this Design Agreement, the Proposal, or any other document or instrument of service prepared by the Architect/Engineer under this Design Agreement shall create any obligation or contractual relationship between any third party and either Party.

7. The Architect/Engineer shall promptly respond to requests from Contractor for information related to Architect/Engineer's scope, Contractor requires to complete the Proposal.

12. The Parties acknowledge that the Project quantity estimates shall be based upon partial design development, the RFP documents, publically available reference documents and any studies and tests performed during Proposal preparation. Prior to submittal of the Proposal, the Parties will make a mutual determination regarding quantity contingencies, additional studies and testing required for design development, and probability of substantial changes in estimated quantities, all of which shall be set forth in the Design Agreement (Phase II), Exhibit G.

include the use of techniques and methods that may be proprietary to the Contractor and its Affiliates Work.

12. The Parties acknowledge that the Project quantity estimates shall be based upon partial design development, the RFP documents, publically available reference documents and any studies and tests performed during Proposal preparation. Prior to submittal of the Proposal, the Parties will make a mutual determination regarding quantity contingencies, additional studies and testing required for design development, and probability of substantial changes in estimated

9

quantities, all of which shall be set forth in the Design Agreement (Phase II), Exhibit G.

D. **THE ARCHITECT/ENGINEER'S PROJECT REPRESENTATIVE.** The Architect/Engineer shall designate a representative ("Architect/Engineer's Representative") authorized to act on the Architect/Engineer's behalf with respect to the Project and all matters arising from or otherwise relating to the Project.

E. **ARCHITECT/ENGINEER'S STANDARD OF CARE.** The standard of care for all professional Services provided by the Architect/Engineer pursuant to this Design Agreement shall be the care and skill ordinarily exercised by members of the same profession currently practicing in United States, on projects of similar size and complexity at the time the Services are performed.

1. The Architect/Engineer shall communicate with the Owner and/or with Contractor's Separate Consultants only through or with the consent of Contractor. However, it is understood that an open line of communication between Owner, and/or with Contractor's Separate Consultants and the Architect/Engineer is in the best interest of a successful Project. Contractor agrees to involve Architect/Engineer in or promptly inform Architect/Engineer of discussions, meetings or other proceedings affecting the design portion of the Services.

10

Risks of DB Projects:
Pricing of the Work

Pricing poses another major risk to design-builders

- Unlike DBB, where the contractor submits its bid based on a complete set of design documents, DB procurements are often compressed, leaving design-builders to submit their bid based on conceptual or “bridging” design drawings (typically 30%) and usually under a tight deadline

- Since design-builders are often asked on DB projects to provide definitive pricing based upon incomplete, conceptual project definitions, pricing of the work is one of the ultimate risks for design-builders

Risks of DB Projects:

Pricing of the Work

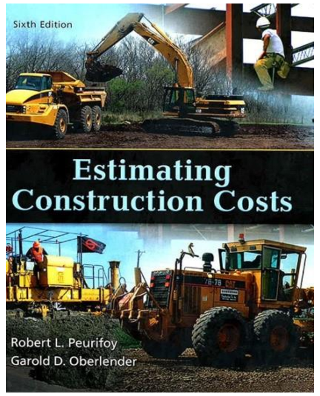
- Incomplete design documents necessitate inclusion of an allowance or contingency in the bid to account for likely development to or changes to the design, which may result in increased construction costs

- Typically, a design contingency should be carried at the conceptual estimate stage and a separate contingency should be carried for the design development phase

Risks of DB Projects:

Pricing of the Work

Estimators use contingencies to cover known unknown and unknown risks



RISK ASSESSMENT

Assessing risk and assigning contingency to the base estimate is one of the most important tasks in preparing early estimates. Risk assessment is not the sole responsibility of the estimators. Key members of the project management team must provide input on critical issues that should be addressed by the estimators in assessing risk. Risk assessment requires a participatory approach with involvement of all project stakeholders including the business unit, engineering, construction, and the estimating team.

The owner is responsible for overall project funding and for defining the purpose and intended use of the project. The design organization is responsible for producing the contract documents, the plans and specifications, to construct the project. The estimating team is responsible for preparing an estimate of the probable final cost to construct the project, including direct and indirect costs, and assessing risk and assigning contingency.

RISK ANALYSIS

Typically, risk analysis is a prerequisite to assigning contingency. Based on the acceptable risks and the expected confidence level, a contingency is established for a given estimate. Risk analysis and the resultant amount of contingency help management to determine the level of economic risk involved in pursuing a project. The purpose of risk analysis is to improve the accuracy of the estimate and to instill management's confidence in the estimate.

Numerous publications have been written to define risk analysis techniques. Generally, a formal risk analysis involves either a Monte Carlo simulation or a statistical range analysis. There are also numerous software packages for risk analysis. The lead estimator for a project must assess the uniqueness of each project and select the technique of risk analysis that is deemed most appropriate. For very early estimates, the level of scope definition and the amount of estimate detail may be inadequate for performing a meaningful cost simulation.

CONTINGENCY

Contingency is a real and necessary component of an estimate. Engineering and construction are risk endeavors with many uncertainties, particularly in the early stages of project development. Contingency is assigned based on uncertainty. Contingency may be assigned for many uncertainties, such as pricing, escalation, schedule, omissions, and errors. The practice of including contingency for possible scope expansion is highly dependent on the attitude and culture toward changes, particularly within the business unit.

In simple terms, contingency is the amount of money that should be added to the base estimate to better predict the total installed cost of the project. Contingency can be interpreted as the amount of money that must be added to the base estimate to account for work that is difficult or impossible to identify at

the time a base estimate is being prepared. In some owner or contractor organizations, contingency is intended to cover known unknowns. That is, the estimator knows there are additional costs, but the precise amount is unknown.

Risk analysis method
- Percentage of base estimate
- Expected net risk
- Simulation

FIGURE 3.3 | Risk assessment

this method. In some situations, contingency is applied as a percentage of major

CONTINGENCY

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However, sometimes an allowance is assigned for known unknowns and a contingency is assigned for unknown unknowns.

AACE International document 18R-97 defines contingency as "An amount of money or time (or other resources) added to the base estimate to: (a) achieve a specific confidence level; or (b) allow for changes that experience shows will likely be required."

Risks of DB Projects:

Pricing of the Work

Industry standards for contingency indicate a need for both design and construction contingencies

Washington State Department of Transportation

ADMINISTRATIVE MANUAL

Cost Estimating Manual for WSDOT Projects

M 3034.02

July 2009

Environmental and Engineering Programs
Strategic Analysis and Estimating Office

Cost Estimating Data

An estimator calculates the cost of work items, then applies markups such as mobilization, sales tax, preliminary engineering (PE), Miscellaneous Item Allowance in Design (only for historical bid-based, cost-based, and risk-based methods), and construction engineering (CE). Table 1 presents a summary of recommended values for various elements.

Cost Estimating Elements	Planning	Scoping	Design	PS&E
Identification of Work Items	> $50,000	> $10,000	All Items	All Items
Mobilization	Per *Plans Preparation Manual*, 830.02			
Sales Tax	Site-specific, based on Control Section. Data can be found in TRIPS or EBASE. Specific direction is found in Standard Specification 1-07.2.			
Preliminary Engineering	See Table 3		PM's Workplan + Actuals to Date	Actual
Miscellaneous Item Allowance in Design[3]	30% to 50%	20% to 30%	10% to 20%	0% (all items should be defined)
Contingency	Applies to parametric, historical bid-based and cost-based estimates only. Per *Plans Preparation Manual*, 830.03			

3. Miscellaneous Item Allowance in Design accounts for lack of scope definition and those items too small to be identified at that stage of the project. This allowance is eliminated entirely in PS&E estimates as the scope will then be fixed and all estimate items should be identified.

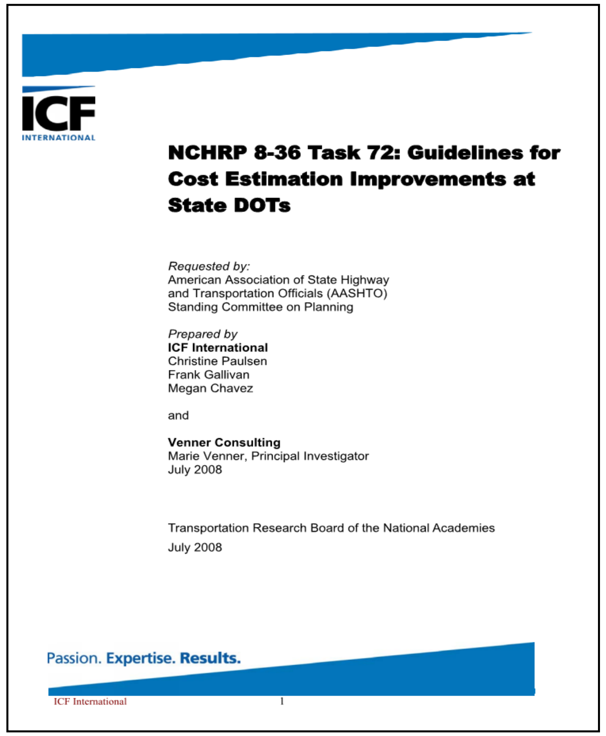
2. Report cost estimates in current dollars to program management. The Construction Cost Index (CCI) will be used to inflate the estimate to midpoint of construction by program management.

3. Miscellaneous Item Allowance in Design accounts for lack of scope definition and those items too small to be identified at that stage of the

Risks of DB Projects:

Pricing of the Work

The need for a design contingency for conceptual design is nationally recognized


ICF INTERNATIONAL

NCHRP 8-36 Task 72: Guidelines for Cost Estimation Improvements at State DOTs

Requested by:
American Association of State Highway and Transportation Officials (AASHTO)
Standing Committee on Planning

Prepared by
ICF International
Christine Paulsen
Frank Gallivan
Megan Chavez

and

Venner Consulting
Marie Venner, Principal Investigator
July 2008

Transportation Research Board of the National Academies
July 2008

Passion. Expertise. Results.

ICF International 1

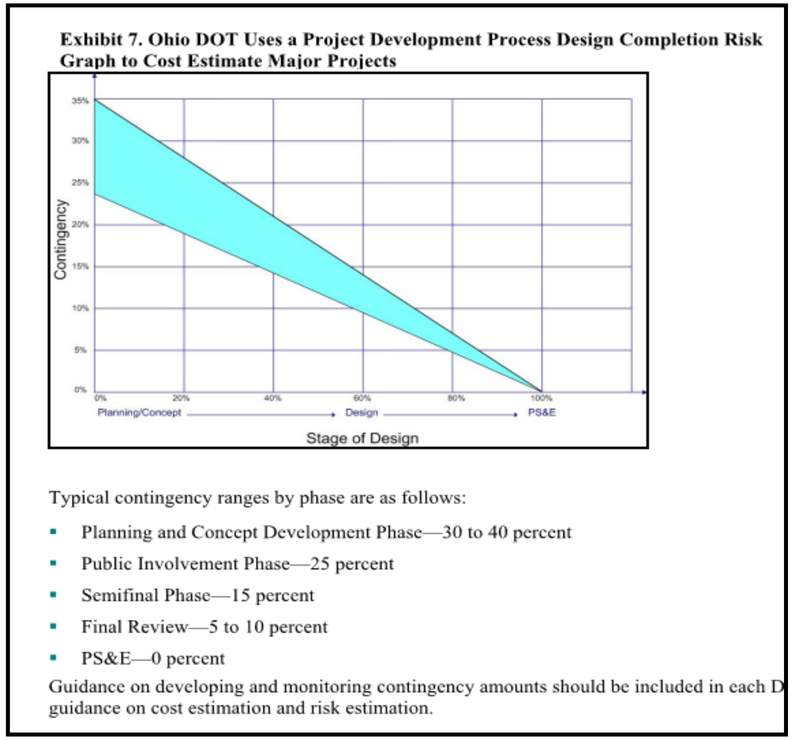


Exhibit 7. Ohio DOT Uses a Project Development Process Design Completion Risk Graph to Cost Estimate Major Projects

Typical contingency ranges by phase are as follows:

- Planning and Concept Development Phase—30 to 40 percent
- Public Involvement Phase—25 percent
- Semifinal Phase—15 percent
- Final Review—5 to 10 percent
- PS&E—0 percent

Guidance on developing and monitoring contingency amounts should be included in each D guidance on cost estimation and risk estimation.

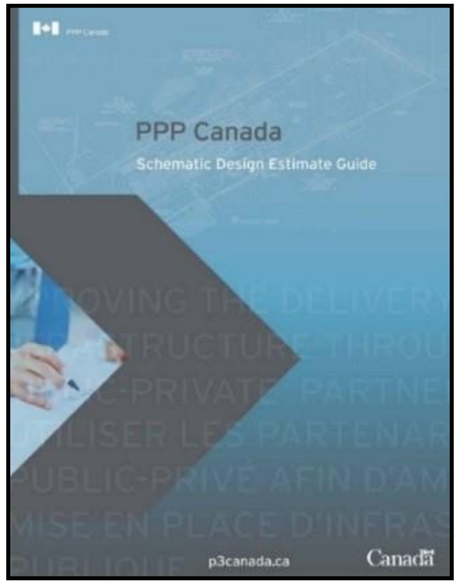
Risks of DB Projects:

Pricing of the Work

Pg. 15: Section 3.5 - Allowances

1. Design and Estimating Allowances are added to reflect the early state of the project design. The contingencies are to cover omissions and unknown project elements resulting that can be expected to be discovered over the design process.

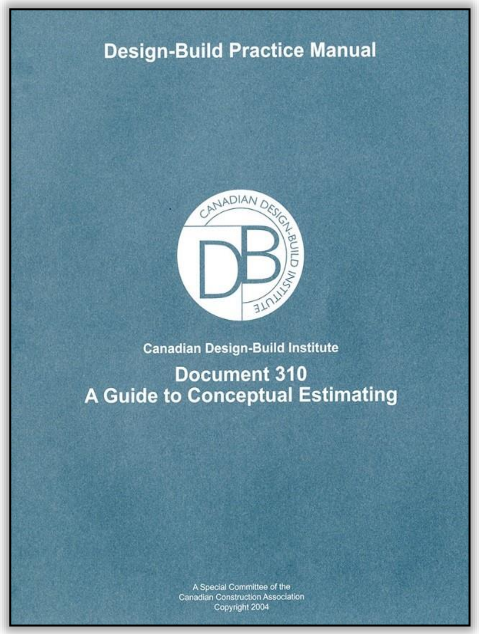
Pg. 26: Section 6 - Conclusion



For P3 projects, this Guide recommends a Cost Analysis with an accuracy of +/- 15% which is generally supported by a Schematic Design at a 30% level. The Schematic Design Estimate focuses the capital costs of the project during the construction phase. This approach allows for the development of robust cost estimates for decision-making, while minimizing any potential to impede private sector innovation and duplicate efforts in a P3. It is generally an accepted industry standard that a Schematic Design Estimate is prepared in Elemental Format, which is approved by the Canadian Institute of Quantity Surveyor. However, developing a Schematic Design Estimate varies based on the type of infrastructure being constructed. Although different classes of infrastructure will have many common features there will be departure points, therefore, the required background information, elemental categories, and final outputs will be different among infrastructure classes.

Risks of DB Projects:

Pricing of the Work



for future projects. There are a variety of ways to track these costs, by unit costs, percentage of overall project costs, cost per square meter of building area, etc., and therefore they are very useful in both single and multiple-unit costing methods.

It is recommended that the project cost should also include the management cost and project controls costs, and provide a design contingency to cover the completion of the design and to allow the design consultants some flexibility.

The amount of the design contingency will depend on what stage the owner's design or the owner's statement of requirements is at, the complexity of the building, how much consideration has been given to the details of the design, and the level of confidence in the ability to cost the scope of work accurately. Typically, a design contingency of 5 to 15% of the total costs is carried at the conceptual estimate stage; this is then reduced accordingly in subsequent cost checks, so that by the pre-tender stage, the design contingency has been eliminated.

4.0 ELEMENTAL FORMAT

The primary purpose of the elemental cost format is to generate standardized cost information that can be used to develop and control project, and, costs should the design-builder be successful, to subsequently track costs for future projects. This cost information is first used in the early stages of design, when the actual materials to be used in a building are not yet determined. This method requires a breakdown of costs by functional systems or elements, each of which performs a specific function in the building.

An element is defined as "a major component common to most buildings which usually performs the same function or functions irrespective of its design, construction or specification." There is a standardized list of elements, which follows the CSI/CSC Uniformat's system, as well as standardized rules for measuring them. The list was

developed primarily to ensure that each element that performs a readily identifiable function within the building would have a significant cost and would typic[...] measurable.

The elements are divided into fi[...]
Major Group Elements, such as[...]
enclosure, and each major grou[...]
into Group Elements, such as s[...]
structure, which are further sub[...]
basic Functional Elements, suc[...]
or walls above grade, which are[...]
most buildings. These are furth[...]
Sub-Elements, such as standar[...]
foundations, which provide mor[...]
groupings within the elements. [...]
Institute of Quantity Surveyors [...]
provide a detailed description o[...]
Cost Analysis, the related meth[...]
measurement, and the standard[...]
elements.

The following provides an exam[...]

A SHELL
A1 SUBSTRUCTURE
A11 Foundations
A111 Standard F[...]
A112 Special Fo[...]
A12 Basement Excavati[...]

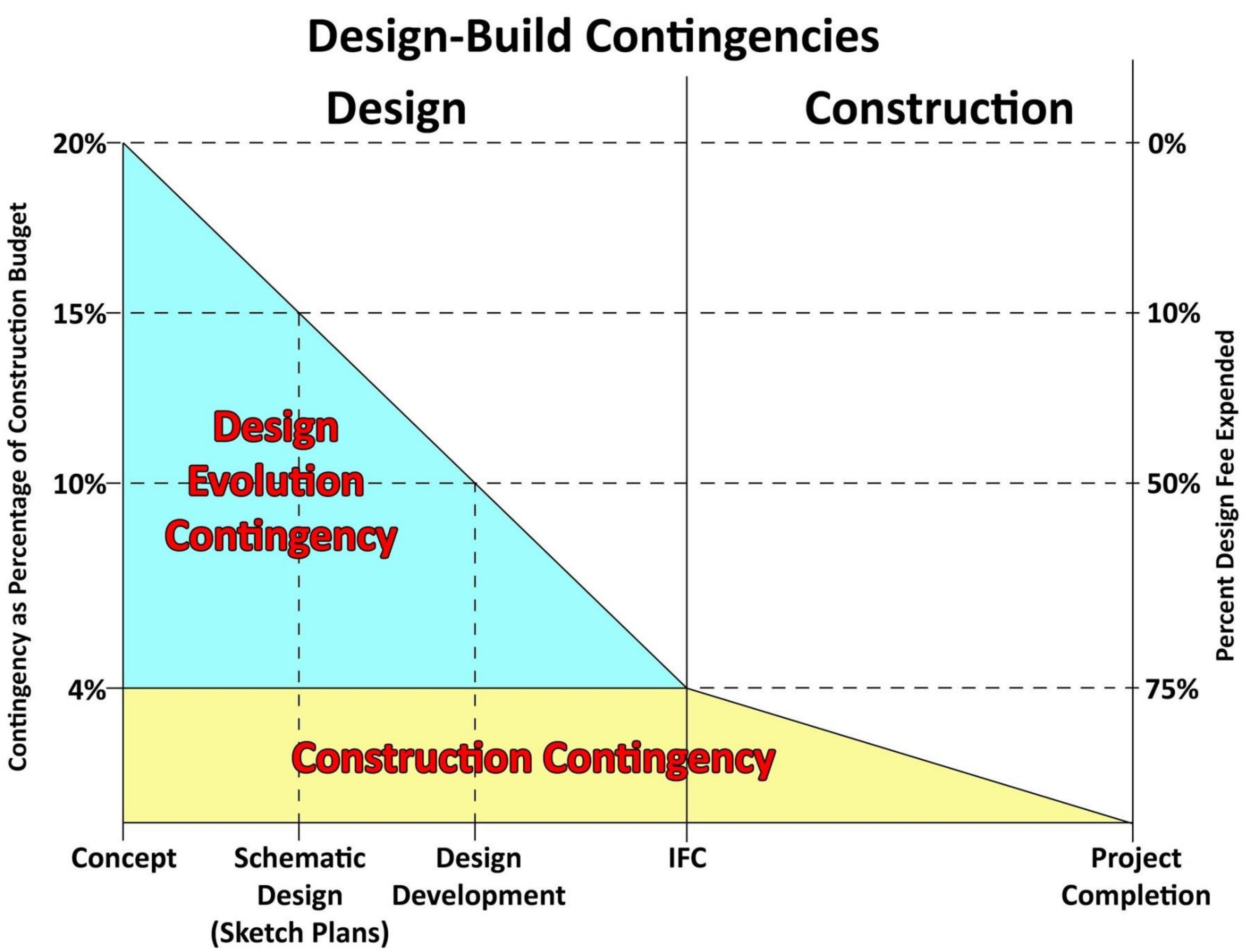
One of the main advantages of [...]
established and clearly defined [...]
measurement such as the Elem[...]
that it provides a means of track[...]
future projects, it can be used to[...]
comparisons between buildings[...]
a check to determine whether c[...]
over or under estimated. A reas[...]
estimate can be developed usin[...]
information, either in very prelim[...]
such as cost per square meter [...]
detailed format using the eleme[...]
Elemental cost analysis has sev[...]
advantages over other cost ana[...]
ensures a consistent format, pro[...]
checklist to ensure that no part [...]
overlooked, shows how the cost[...]
distributed over the building, the[...]
whether an element represents [...]

4

Canadian Design-Build Institute Practice Manual
Document 310 'Conceptual Estimating' – 2004

The amount of the design contingency will depend on what stage the owner's design or the owner's statement of requirements is at, the complexity of the building, how much consideration has been given to the details of the design, and the level of confidence in the ability to cost the scope of work accurately. Typically, a design contingency of 5 to 15% of the total costs is carried at the conceptual estimate stage; this is then reduced accordingly in subsequent cost checks, so that by the pre-tender stage, the design contingency has been eliminated.

Risks of DB Projects:
Pricing of the Work



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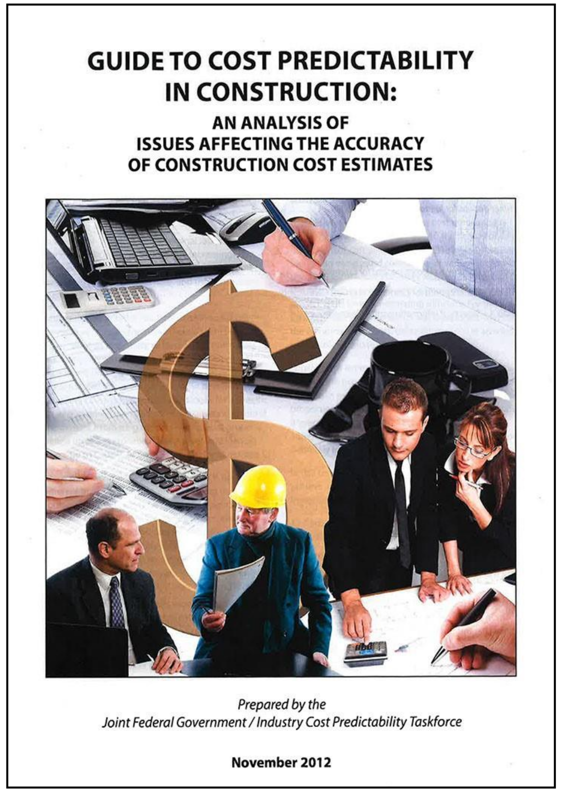
Risks of DB Projects:

Pricing of the Work

Numerous studies confirm that estimate accuracy is a function of design completeness

So, it's logical to expect a contingency sized to balance inaccuracy

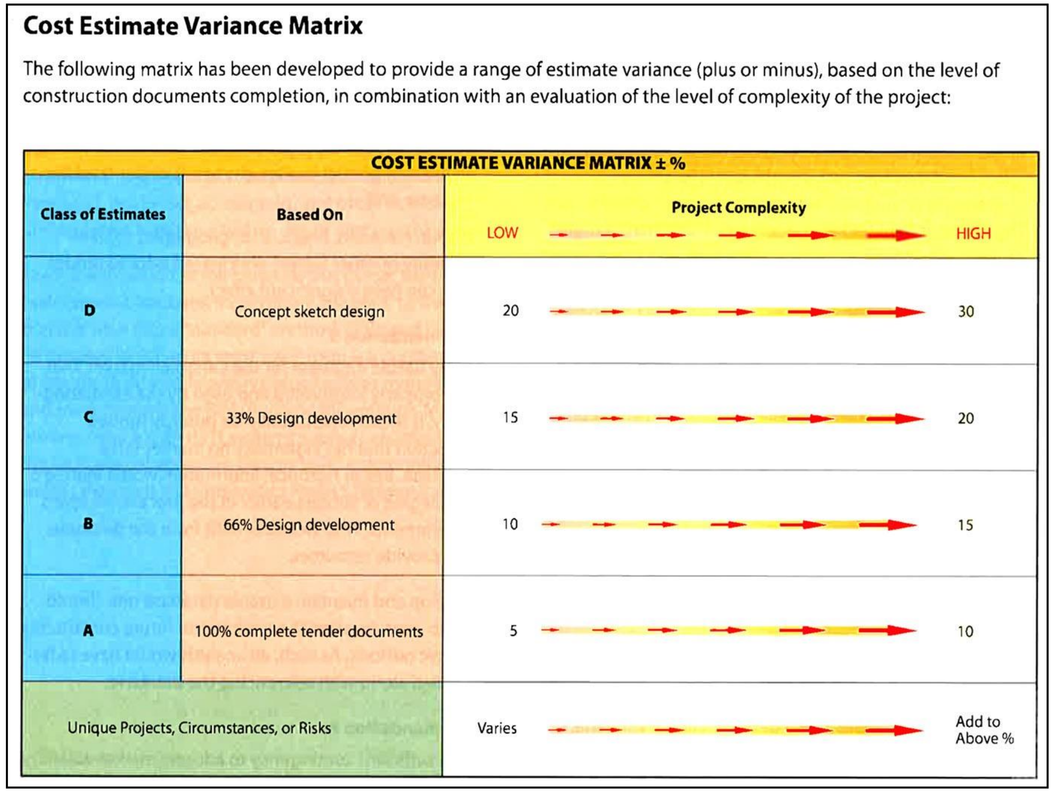


GUIDE TO COST PREDICTABILITY IN CONSTRUCTION:

AN ANALYSIS OF ISSUES AFFECTING THE ACCURACY OF CONSTRUCTION COST ESTIMATES

Prepared by the Joint Federal Government / Industry Cost Predictability Taskforce

November 2012



Cost Estimate Variance Matrix

The following matrix has been developed to provide a range of estimate variance (plus or minus), based on the level of construction documents completion, in combination with an evaluation of the level of complexity of the project:

COST ESTIMATE VARIANCE MATRIX ± %			
Class of Estimates	Based On	Project Complexity LOW	HIGH
D	Concept sketch design	20	30
C	33% Design development	15	20
B	66% Design development	10	15
A	100% complete tender documents	5	10
Unique Projects, Circumstances, or Risks		Varies	Add to Above %

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Risks of DB Projects:

Pricing of the Work

However, even when design is complete, a construction period contingency is needed for design amendments or unanticipated construction-period impacts

Washington State Department of Transportation

Plans Preparation Manual

M 22-31.05
November 2013

Engineering and Regional Operations
Development Division, Design Office

Division 8 — *Contract Estimate*

When determining mobilization for a project, consideration should be given to location, complexity, the need for specialized equipment, the type of work, and the working season if it extends over more than one construction season. Projects that would probably require a higher mobilization percentage include rural vs. urban; projects with multiple work sites; projects with numerous preparatory removal items; projects with large quantities of excavation; or projects extending over two seasons where the contractor would be expected to shut down operations and move out.

(2) Engineering and Contingency Percentages

"Contingency percentages" are set up to handle unforeseen changes in a project during construction, including additional work, quantity over-runs, and additional items. Contingencies are currently limited to 4% of the total contract amount for all WSDOT contracts. For local agency projects administered by WSDOT off the state highway system, no contingency percentage will be set up.

WSDOT Plans Preparation Manual M 22-31.04
September 2012 — *Page 8-3*

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Risks of DB Projects:

Pricing of the Work

Factors Affecting Costs

Costs can vary depending upon a number of variables. Here's a listing of some factors that affect costs and points to consider.

Quality—The prices for materials and the workmanship upon which productivity is based represent sound construction work. They are also in line with industry standard and manufacturer specifications and are frequently used by federal, state, and local governments.

Overtime—We have made no allowance for overtime. If you anticipate premium time or work beyond normal working hours, be sure to make an appropriate adjustment to your labor costs.

Productivity—The productivity, daily output, and labor-hour figures for each line item are based on an eight-hour work day in daylight hours in moderate temperatures and up to a 14' working height unless otherwise indicated. For work that extends beyond normal work hours or is performed under adverse conditions, productivity may decrease.

Size of Project—The size, scope of work, and type of construction project will have a significant impact on cost. Economies of scale can reduce costs for large projects. Unit costs can often run higher for small projects.

Location—Material prices are for metropolitan areas. However, in dense urban areas, traffic and site storage limitations may increase costs. Beyond a 20-mile radius of metropolitan areas, extra trucking or transportation charges may also increase the material costs slightly. On the other hand, lower wage rates may be in effect. Be sure to consider both of these factors when preparing an estimate, particularly if the job site is located in a central city or remote rural location. In addition, highly specialized subcontract items may require travel and per-diem expenses for mechanics.

Contingencies

The allowance for contingencies generally provides for unforeseen construction difficulties. On alterations or repair jobs, 20% is not too much. If drawings are final and only field contingencies are being considered, 2% or 3% is probably sufficient and often nothing needs to be added. Contractually, changes in plans will be covered by extras. The contractor should consider inflationary price trends and possible material shortages during the course of the job. These escalation factors are dependent upon both economic conditions and the anticipated time between the estimate and actual construction. If drawings are not complete or approved, or a budget cost is wanted, it is wise to add 5% to 10%. Contingencies, then, are a matter of judgment.

Final Checklist

Estimating can be a straightforward process provided you remember the basics. Here's a checklist of some of the steps you should remember to complete before finalizing your estimate.

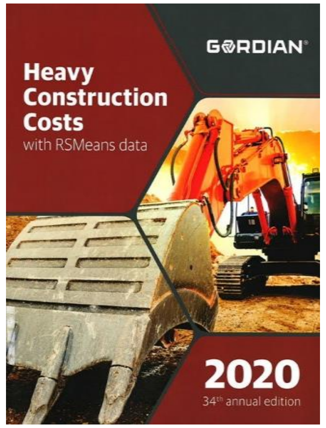
Did you remember to:

- factor in the City Cost Index for your locale?
- take into consideration which items have been marked up and by how much?
- mark up the entire estimate sufficiently for your purposes?
- read the background information on techniques and technical matters that could impact your project time span and cost?
- include all components of your project in the final estimate?
- double check your figures for accuracy?
- call RSMeans data engineers if you have any questions about your estimate or the data you've used? Remember, Gordian stands behind all of our products, including our extensive RSMeans data solutions. If you have any questions about your estimate, about the costs you've used from our data, or even about the technical aspects of the job that may affect your estimate, feel free to call the Gordian RSMeans editors at 1.800.448.8182.

Save Time. Go Online.

For access to the latest cost data, an intuitive search, and pre-calculated location costs, take advantage of the time savings available from our online application.

rsmeans.com/online



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Risks of DB Projects:
Pricing of the Work

Design Development Risk

A + B = C

A = Actual cost of design and construction

B = Design-Builder’s Bid assumption based on conceptual design

C = Difference – i.e., the foundation of a professional liability claim by the Design-Builder against the Design Professional

Risks of DB Projects:

Pricing of the Work

Risk registers or risk assessment can help reduce/control pricing risks

- Risk assessments require involvement from all project participants, including the business unit, engineering, construction, and the estimating team (who is responsible for preparing an estimate of the probable final cost to construct the project, including direct and indirect costs, so that risk may be assessed and contingencies may be appropriately assigned)

Building information modeling (BIM) can be used to detect errors/conflicts and to develop cost/time estimates

Case Study #2

- This case study analyzes a dispute arising on a DB project in North America

- The issue was whether the design evolution from the Base Technical Concept (BTC) drawings, available at the time of bid, to the Issued For Construction (IFC) drawings, used as the basis to actually detail, fabricate and erect bridge towers was within a fair and reasonable limit

- The damages in dispute included the costs incurred by the Design-Builder's steel fabrication subcontractor as a result of the subcontractor's misunderstanding and unfamiliarity with the DB construction-delivery method

Case Study #2

Background: The contract between the Design Builder and its steel fabrication subcontractor included the following scope of work provision

Supplementary Provision A – Scope

1. Scope as detailed below.

   Supply materials, fabricate, machine as indicated, shop assemble for correct fitness and deliver the bid items listed below and as defined by Oregon Iron Works Proposal to dated June 20, 2012 Proposal No. pages 1-3 and Scope of Supply sheets 1-2.

   Bridge Towers:

   Oregon Iron Works Item 1 – Tower Superstructure Steel Prime Paint
   Oregon Iron Works Item 2 – Finish Paint Interior and Exterior

   Connection details between bridge towers and the following are to be coordinated between Seller and Contractor: Access stairs, ladders, platforms; architectural mesh; rustication panels, counterweight bearings; counterweight rope terminations; aux. counterweight sheaves; span lock actuators; trolleyed hoists in machinery rooms; finger joints; utility openings. Timely coordination of the Sellers work with other scopes of Work on the project is the Contractors responsibility

Case Study #2

2. The Seller understands that this Contract is a Design Build Contract, and that all information given to him during the Pre-Construction Stage, to develop a price for the Scope of Work as noted herein, was preliminary and not complete in every detail. The Seller, being experienced in this type of work, further understands that he has included in his price the cost required to develop a complete functioning scope of work that meets all requirements of the proposal for this Project submitted by the Contractor to the Owner, within a fair and reasonable limit.

Case Study #2

3. As this is a Design Build Project the Contractor may amend the design, which might increase, or decrease the quantities (and types) of work to be performed by the Seller. Adjustments to the payment amount of this Agreement due to such increases and / or decreases shall be negotiated in good faith, and be mutually agreed to by both the Contractor and Seller. The lump sum value of $20,484,000 was based on the quantities defined in Rev. 1 dated June 20, 2012 (Appendix B), which were based on the documents of the General Contract, and Drawings prepared during the Pre-Bid Phase (Appendix C). Thus, adjustment to the payment amount of this Agreement shall be negotiated and based on the differences from these quantities and scope of work. For the purpose of adjustments to the payment amount of this Agreement, weight quantities are defined as finished weights on the shop drawings. ~~Any claims by the Seller for any other cost increases, such as but not limited to, labor or plant shall not be basis for a price change.~~ The Seller shall be responsible to submit to the Contractor, all required information with regards to any price changes to this Agreement for his review.

Case Study #2

BTC Characteristics vs. IFC Characteristics

Case Study #2

The Problem:
Design evolution caused an increase to the total number of component pieces, bolts, and holes used to build the tower steel it detailed and fabricated for Design-Builder

The REA provides the following examples of complexity change:

- "Total number of pieces to be fit welded and/or assembled **doubled**[1] (increasing by approximately 39,369 pieces)."
- "Number of bolts increased by **12%**, but the number of drilled holes **increased by 25%**. This difference illustrates the sheer magnitude of additional stiffeners, plates and plies added to the structure, all having to be assembled, fit or welded then often removed for three coats of paint, only to be reassembled again for shipping."

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- "Anchor structures originally depicted without weld symbols, thereby defaulting to fillet welds, were changed to **full penetration welds** requiring significant increase in welding and **full volumetric inspection.**"
- "Major members that remained same in outward appearance changed significantly:
  - Anchor bolt count and size remained the same but **length doubled** and the revised design required **heavy steel "cans"** resulting in both labor and material price increases.
  - Although the number of final assemblies remained the same, the number of individual component pieces required to fit, weld and assemble into those final assemblies **more than doubled**.
    1. By example, the front column is the same length and originally required 234 pieces to be assembled. The final design required 359 pieces to be assembled, with holes for other work.
    2. On top of the 359 major pieces assembled, 156 additional pieces of ladder components had to be welded or bolted to the inside of a confined space.
    3. All of this work then required finish painting in stages to allow for completion of the work."

[1] Emphasis from original document
[2] Emphasis from original document

Case Study #2

Case Study #2

The Cause: Experts determined that the final steel design for the towers was "within a fair and reasonable limit" of what an experienced DB bridge fabricator should have known or should have inferred based on the concept design available at the time of contract execution

The Subcontractor's claim ignored that the as-built structure was similar in structural concept, total weight, and number of erectable pieces to that in the documents available at the time of contract execution

Subcontractor's claim did not demonstrate that its original estimate of complexity change due to a "fair and reasonable" design evolution was properly accounted for in its bid either by reasonably experienced assumptions or appropriate contingency pricing

Case Study #2

Key Takeaways

- Manage subcontractors and fabricators regarding possible disputes/claims relating to delays caused by late approval of advanced designs or by problems with the submittal process

- When hard-dollar bid pricing is based on preliminary design, estimators must forecast final design and details based on either historical similar experiences or with contingencies and allowances

- Assign/hire personnel with deep experience building similar projects or have an engineer further develop key portions of the work based upon bridging or concept drawings to facilitate the preparation of detailed cost estimates for a successful bid

Case Study #2

Questions?

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Risks of DB Projects:
Differing Site Conditions

Differing or changed site conditions present another risk to the design-builder

- On a DBB project, the owner (through its design team) usually investigates subsurface conditions and supplies the contractor with available geotechnical information during the procurement phase, which – through a differing site conditions (DSC) clause – the contractor can usually reasonably rely upon if unknown or materially different site conditions are encountered

- By contrast, DB projects often seek to place responsibility on the design-builder to conduct – as part of the design process – its own geotechnical assessment of the site, and owners frequently disclaim liability for the [usually limited] geotechnical information provided during procurement

Risks of DB Projects: Schedule

Another major risk to the design-builder relates to the project schedule

- In DB projects, the design-builder not only bears the risk that the project may not be completed on time, but also the risk that the owner will not accept the design-builders' project schedule
- Because DB projects often seek expedited time frames before design is advanced beyond a conceptual level, contractors are at risk of schedule bust
- Design-Builders should exercise caution in contracting with owners that propose unrealistic project schedules and should negotiate provisions that contemplate the need for schedule adjustments

Risk Mitigation Strategies:

Specialized Agreements

Consider utilizing AIA Standard Form A141 or the AIA “Design-Build Amendment”, which is designed to be executed after the design has progressed enough that a price for the remaining design and construction may be determined

- Under the AIA Design-Build Amendment, the parties can agree to various price structures, including: Stipulated Sum, Cost of the Work, Cost-Plus-Fee

Risk Mitigation Strategies:

Appropriate Contract Terms

When possible, negotiate and draft DB contract to include provisions that clearly and explicitly set forth the parties' roles, responsibilities and risks

DB contracts and subcontracts should be sure to include provisions related to:

- Indemnity and/or Limitation of Liability
- Waiver of Consequential Damages
- Delay outside the Design-Builder's control
- Dispute Resolution

Risk Mitigation Strategies:

Insurance Products

DB contracts and subcontracts should further include:

- Flow-down provisions, which incorporate the terms and conditions of the DB contract so that the subcontractor assumes to the design-builder all obligations the design-builder assumes toward the owner

- An explicit provision that the subcontractor/vendor/consultant understands the DB process and acknowledges DB risks – even to the point of presenting case studies of prior similar projects – to suppress later claims that the subcontractor/vendor/consult did not understand the nature/risks of the DB delivery method

Risk Mitigation Strategies:

Insurance Products

Obtaining performance and/or payment bonds from sureties can also help reduce DB risk

BUT…

A surety’s decision to issue performance and/or payment bonds on a project is made on a case-by-case basis and takes into consideration the risks held by the design-builder

Because the surety’s risk is heightened on DB projects, it’s important to determine whether the surety has limited the scope of bond coverage as to design and/or construction risks

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