Colorado Department of Transportation
Innovative Contracting Advisory Committee

Project Delivery Selection Approach

Overview

This document provides a formal approach for CDOT highway project delivery selection. The document provides generic forms for use by CDOT staff and project team members. By using these forms, a brief project delivery selection report can be generated for each individual project. The primary objectives of this document are:

- Present a structured approach to assist CDOT in making project delivery decisions;
- Assist CDOT in determining if there is a dominant or obvious choice of project delivery methods; and
- Provide documentation of the project delivery decision in the form of a Project Delivery Decision Report.

Background

The project delivery method is the process by which a construction project is comprehensively designed and constructed including project scope definition, organization of designers, constructors and various consultants, sequencing of design and construction operations, execution of design and construction, and closeout and start-up. Thus, the different project delivery methods are distinguished by the manner in which contracts between the agency, designers and builders are formed and the technical relationships that evolve between each party inside those contracts. Currently, there are several types of project delivery systems available for publicly funded transportation projects in the Colorado. The most common systems are Design-Bid-Build (DBB), Design-Build (DB), and Construction Manager/General Contractor (CM/GC). No single project delivery method is appropriate for every project. Each project must be examined individually to determine how it aligns with the attributes of each available delivery method.

- DBB is the traditional project delivery method in which an agency designs, or retains a designer to furnish complete design services, and then advertises and awards a separate construction contract based on the designer's completed construction documents. In DBB, the agency "owns" the details of design during construction and as a result, is responsible for the cost of any errors or omissions encountered in construction.

- DB is a project delivery method in which the agency procures both design and construction services in the same contract from a single, legal entity referred to as the design-builder. The method typically uses Request for Qualifications (RFQ)/Request for Proposals (RFP) procedures rather than the DBB Invitation for Bids procedures. The design-builder controls the details of design and is responsible for the cost of any errors or omissions encountered in construction.

- CM/GC is a project delivery method in which the agency contracts separately with a designer and a construction manager. The agency can perform design or contract with an engineering firm to provide a facility design. The agency selects a construction manager to perform construction management services and construction works. The significant

characteristic of this delivery method is a contract between an agency and a construction manager who will be at risk for the final cost and time of construction. Construction industry/Contractor input into the design development and constructability of complex and innovative projects are the major reasons an agency would select the CM/GC method. Unlike DBB, CM/GC brings the builder into the design process at a stage where definitive input can have a positive impact on the project. CM/GC is particularly valuable for new non-standard types of designs where it is difficult for the owner to develop the technical requirements that would be necessary for DB procurement without industry input.

Overview of the Project Delivery Selection Process

The process is shown in the form of a flow chart below. It consists of the following activities:

A. Describe the project and set the project goals.

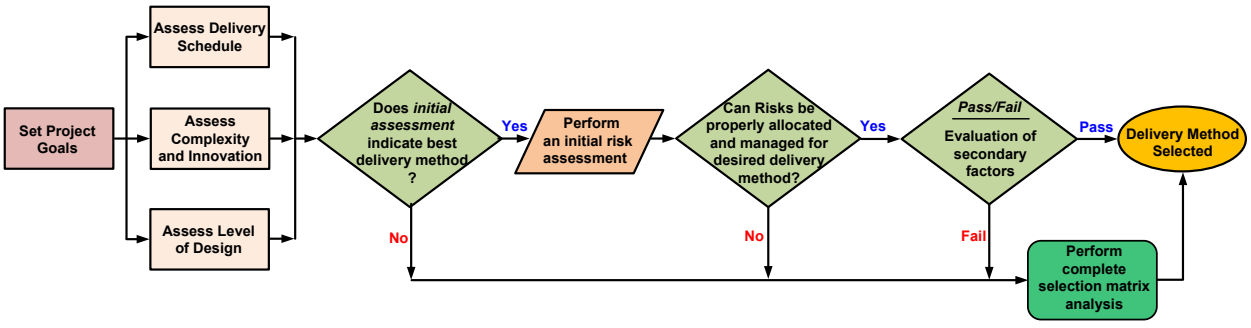
B. Assess the three primary factors (these factors most often determine the selection).
   1. Delivery Schedule
   2. Complexity & Innovation
   3. Level of Design

C. If the three primary factors indicate there is a clear choice of the delivery method, then:
   4. Perform an initial risk assessment for the desired delivery method to ensure that risks can be properly allocated and managed, and

D. Perform a brief pass/fail analysis of the secondary factors to ensure that they are not relevant to the decision.
   5. Cost
   6. Staff Experience/Availability (Owner)
   7. Level of Oversight and Control
   8. Competition and Contractor Experience

E. If steps B, C & D do not result in clear determination of the method of delivery then perform a more rigorous evaluation of all eight factors against the three potential methods of delivery (DBB, DB and CM/GC).

Typically the entire selection process can be completed by the project team in a 4 hour workshop session, if team member have individually performed assessments before the workshop.



CDOT Project Delivery Selection Flowchart

The following forms and appendices are included to facilitate this process.

Project description checklist (page 4)

Project Goals worksheet – including example project goals (page 5)

A careful determination of the project goals is an instrumental first step of the process that will guide both the selection of the appropriate method of delivery as well as the specific delivery procurement process and implementation of the project.

Project Delivery Selection Matrix Summary (page 6)

The Project Delivery Selection Matrix Summary summarizes the assessment of the eight Evaluation Factors for the three delivery methods. The form is qualitatively scored using the following notations:

+ +	Most appropriate delivery method	**X**	Fatal Flaw (discontinue evaluation of this method)
+	Appropriate delivery method	**NA**	Factor not applicable or not relevant to the selection
–	Least appropriate delivery method		

The form also includes a section for comments and conclusions. The completed **Project Delivery Selection Matrix Summary** should provide an executive summary of the key reasons for the selection of the method of delivery**.**

Workshop Blank Form (page 7)**:** This form can be used by the project team for additional documentation of the process. In particular it can be used to elaborate on Evaluation Factor 4. "Initial Project Risk Assessment".

Evaluation Factor Project Delivery Method Opportunity/Obstacle Summary Forms (pages 8 to 15)

These forms are used to summarize the assessments by the project team of the opportunities and obstacles associated with each delivery method relative to each of the eight Evaluation Factors. The bottom of each form allows for a qualitative conclusion using the same notation as described above. Those conclusions then are transferred to the **Project Delivery Selection Matrix Summary.**

Appendix – Opportunity/Obstacle Checklists: These forms provide the project team with guidance concerning typical delivery method opportunities and obstacles associated with each of the eight Evaluation Factors.

Appendix – Initial Risk Assessment Guidance: Because of the unique nature of Evaluation Factor 4. "Initial Project Risk Assessment", the Appendix provides the project team with additional guidance for evaluation of that factor including: Typical CDOT Transportation Project Risks; a General Project Risks Checklist; and a Risk Opportunities/Obstacles Checklist.

Project Description Checklist

The following items should be considered in the project description as applicable. Other items can be added if they influence the project delivery decision. Relevant documents can be added as appendices.

- ❒ Project Name
- ❒ Location
- ❒ Estimated Budget
- ❒ Estimated Project Delivery Period
- ❒ Required Delivery Date (if applicable)
- ❒ Source(s) of Project Funding
- ❒ Project Corridor
- ❒ Major Features of Work – pavement, bridge, sound barriers, etc.
- ❒ Major Schedule Milestones
- ❒ Major Project Stakeholders
- ❒ Major Challenges (as applicable)
    - o With Right of Way, Utilities, and/or Environmental Approvals
    - o During Construction Phase
- ❒ Main Identified Sources of Risk
- ❒ Safety Issues
- ❒ Sustainable Design and Construction Requirements

Project Goals

An understanding of project goals is essential to appropriate project delivery selection. Typically, the project goals can be defined in three to five items. Examples are provided below,[1] but the report should include project-specific goals. These goals should remain consistent over the life of the project.

Project-Specific Goals

1. Goal #1
2. Goal #2
3. Goal #3
4. Goal #4

[1] ***Generic Project Goals***

Schedule

- Minimize project delivery time
- Complete the project on schedule
- Accelerate start of project revenue

Cost

- Minimize project cost
- Maximize project budget
- Complete the project on budget
- Maximize the project scope and improvements within the project budget

Quality

- Meet or exceed project requirements
- Select the best team
- Provide a high quality design and construction
- Provide an aesthetically pleasing project

Functional

- Maximize the life cycle performance of the project
- Maximize capacity and mobility improvements
- Minimize inconvenience to the traveling public during construction
- Maximize safety of workers and traveling public during construction

Project Delivery Selection Matrix Summary

Determine the factors that should be considered in the project delivery selection, discuss the opportunities and obstacles related to each factor, and document the discussion on the following pages. Then complete the summary below.

PROJECT DELIVERY METHOD OPPORTUNITY/OBSTACLE SUMMARY			
	DBB	**DB**	**CM/GC**
Primary Evaluation Factors			
1. Delivery Schedule	+		+ +
2. Project Complexity & Innovation	-		+ +
3. Level of Design	+		+ +
4. Initial Project Risk Assessment	-		+ +
Secondary Evaluation Factors			
5. Cost			
6. Staff Experience/Availability (Owner)			
7.Level of Oversight and Control			
8. Competition and Contractor Experience			

Key: **+ +** Most appropriate delivery method
+ Appropriate delivery method
– Least appropriate delivery method
X Fatal Flaw (discontinue evaluation of this method)
NA Factor not applicable or not relevant to the selection of project delivery

CONCLUSIONS AND COMMENTS:

Workshop Blank Form

1) Delivery Schedule: Delivery schedule is the overall project schedule from scoping through design, construction and opening to the public. Assess time considerations in getting the project started or funding dedicated and assess project completion importance.

DESIGN-BID-BUILD *Requires time to perform sequential design and procurement, but if design time is available has the shortest procurement time after the design is complete.*	
Opportunities	**Obstacles**
▪ …… ▪ …… ▪ ……	▪ …… ▪ …… ▪ ……

DESIGN-BUILD *Can get project under construction (and meet funding obligations) before completing design. Parallel process of design and construction can accelerate project delivery schedule; however, procurement time can be lengthy due to the need for an accurate RFP.*	
Opportunities	**Obstacles**
▪ …… ▪ …… ▪ ……	▪ …… ▪ …… ▪ ……

CM/GC *Quickly gets contractor under contract and under construction to meet funding obligations before completing design. Parallel process of development of contract requirements, design, procurements, and construction can accelerate project schedule, but schedule can be slowed down by CM/GC design process and Guaranteed Maximum Price (GMP)negotiations and contracting.*	
Opportunities	**Obstacles**
▪ …… ▪ …… ▪ ……	▪ …… ▪ …… ▪ ……

Delivery Schedule Summary

	DBB	**DB**	**CM/GC**
1. Delivery Schedule			

Key: **+ +** Most appropriate delivery method **+** Appropriate delivery method
– Least appropriate delivery method **X** Fatal Flaw (discontinue evaluation of this method)
NA Factor not applicable or not relevant to the selection of project delivery

Notes and Comments: ……
……
……
……

2) Project Complexity & Innovation: Project complexity and innovation is the nature of project that seeks for the applicability of new designs or processes to resolve complex and technical issues.

DESIGN-BID-BUILD *Allows CDOT to fully resolve complex and qualitative designs before procurement. Innovation provided by CDOT/Consultant expertise and through traditional owner directed processes such as VE studies, contractor bid alternatives, and post-bid VE.*	
Opportunities	**Obstacles**
▪ …… ▪ …… ▪ ……	▪ …… ▪ …… ▪ ……

DESIGN-BUILD *Incorporates design-builder into design process through best value selection and contractor proposed Alternate Technical Concepts (ATCs) – which are a cost oriented approach to providing complex and innovative designs. Requires that desired solutions to complex projects be well defined through contract requirements.*	
Opportunities	**Obstacles**
▪ …… ▪ …… ▪ ……	▪ …… ▪ …… ▪ ……

CM/GC *Allows independent selection of designer and contractor based on qualifications to jointly address complex innovative designs through three party collaboration of CDOT, designer and Contractor. Allows for a qualitative (non price oriented) design but requires agreement on GMP.*	
Opportunities	**Obstacles**
▪ …… ▪ …… ▪ ……	▪ …… ▪ …… ▪ ……

Project Complexity & Innovation Summary

	DBB	DB	CM/GC
2. Project Complexity & Innovation			

Key: **+ +** Most appropriate delivery method **+** Appropriate delivery method
– Least appropriate delivery method **X** Fatal Flaw (discontinue evaluation of this method)
NA Factor not applicable or not relevant to the selection of project delivery

Notes and Comments: ……
……
……
……

3) Level of Design: Level of design is the percentage of design completion at the time of the project delivery procurement

DESIGN-BID-BUILD *100% design by CDOT, with CDOT having complete control over the design.*	
Opportunities	**Obstacles**
▪ …… ▪ …… ▪ ……	▪ …… ▪ …… ▪ ……

DESIGN-BUILD *Design advanced by CDOT to the level necessary to precisely define contract requirements and properly allocate risk (typically 30% or less).*	
Opportunities	**Obstacles**
▪ …… ▪ …… ▪ ……	▪ …… ▪ …… ▪ ……

CM/GC *Can utilize a lower level of design prior to contracting and joint collaboration of CDOT, designer, and contractor in the further development of the design. Iterative nature of design process risks extending the project schedule.*	
Opportunities	**Obstacles**
▪ …… ▪ …… ▪ ……	▪ …… ▪ …… ▪ ……

Level of Design Summary

	DBB	**DB**	**CM/GC**
3. Level of Design			

Key: **+ +** Most appropriate delivery method **+** Appropriate delivery method
– Least appropriate delivery method **X** Fatal Flaw (discontinue evaluation of this method)
NA Factor not applicable or not relevant to the selection of project delivery

Notes and Comments: .....
.....
.....
.....

4) Initial Risk Assessment: Risk is an uncertain event or condition that, if it occurs, has a negative effect on a project's objectives. Risk allocation is the assignment of unknown events or conditions to the party that can best manage them. An initial assessment of project risks is important to ensure the selection of the delivery method that can properly address them. An approach that focuses on a fair allocation of risk will be most successful. Refer to the risk discussion and checklists in the appendix.

DESIGN-BID-BUILD

Risk allocation for design-bid-build best is understood by the industry, but requires that most design-related risks and third party risks be resolved prior to procurement to avoid costly contractor contingency pricing and change orders and claims.

Opportunities	Obstacles
▪ …… ▪ …… ▪ ……	▪ …… ▪ …… ▪ ……

DESIGN-BUILD

Provides opportunity to properly allocate risks to the party best able to manage them, but requires risks allocated to design-builder to be well defined to minimize contractor contingency pricing of risks.

Opportunities	Obstacles
▪ …… ▪ …… ▪ ……	▪ …… ▪ …… ▪ ……

CM/GC

Provides opportunity for CDOT, designer, and contractor to collectively identify and minimize project risks, and allocate risk to appropriate party. Has potential to minimize contractor contingency pricing of risk, but can lose the element of competition in pricing.

Opportunities	Obstacles
▪ …… ▪ …… ▪ ……	▪ …… ▪ …… ▪ ……

Initial Risk Assessment Summary

	DBB	DB	CM/GC
4. Initial Risk Assessment			

Key: **+ +** Most appropriate delivery method **+** Appropriate delivery method
– Least appropriate delivery method **X** Fatal Flaw (discontinue evaluation of this method)
NA Factor not applicable or not relevant to the selection of project delivery

Notes and Comments: ……
……
……
……

5) Cost: Project cost is the financial process related to meeting budget restrictions, early and precise cost estimation, and control of project costs.

DESIGN-BID-BUILD *Competitive bidding provides a low cost construction for a fully defined scope of work. Costs accuracy limited until design is completed. More likelihood of cost change orders due to contractor having no design responsibility.*	
Opportunities	**Obstacles**
▪ …… ▪ …… ▪ ……	▪ …… ▪ …… ▪ ……

DESIGN-BUILD *Designer-builder collaboration and ATCs can provide a cost-efficient response to project goals. Costs are determined with design-build proposal, early in design process. Allows a variable scope bid to match a fixed budget. Poor risk allocation can result in high contingencies.*	
Opportunities	**Obstacles**
▪ …… ▪ …… ▪ ……	▪ …… ▪ …… ▪ ……

CM/GC *CDOT/designer/contractor collaboration to reduce risk pricing can provide a low cost project however non-competitive negotiated GMP introduces price risk. Good flexibility to design to a budget.*	
Opportunities	**Obstacles**
▪ …… ▪ …… ▪ ……	▪ …… ▪ …… ▪ ……

Cost Summary

	DBB	**DB**	**CM/GC**
5. Cost			

Key: **+ +** Most appropriate delivery method **+** Appropriate delivery method
– Least appropriate delivery method **X** Fatal Flaw (discontinue evaluation of this method)
NA Factor not applicable or not relevant to the selection of project delivery

Notes and Comments: ……
……
……
……

6) Staff Experience/Availability: Owner staff experience and availability as it relates to the project delivery methods in question.

DESIGN-BID-BUILD *Technical and management resources necessary to perform the design and plan development. Resource needs can be more spread out.*	
Opportunities	**Obstacles**
▪ …… ▪ …… ▪ ……	▪ …… ▪ …… ▪ ……

DESIGN-BUILD *Technical and management resources and expertise necessary to develop the RFQ and RFP and administrate the procurement. Concurrent need for both design and construction resources to oversee the implementation.*	
Opportunities	**Obstacles**
▪ …… ▪ …… ▪ ……	▪ …… ▪ …… ▪ ……

CM/GC *Strong, committed CDOT project management resources are important for success of the CM/GC process.*	
Opportunities	**Obstacles**
▪ …… ▪ …… ▪ ……	▪ …… ▪ …… ▪ ……

Staff Experience/Availability Summary

	DBB	DB	CM/GC
6. Staff Experience/ Availability			

Key: **+ +** Most appropriate delivery method **+** Appropriate delivery method
– Least appropriate delivery method **X** Fatal Flaw (discontinue evaluation of this method)
NA Factor not applicable or not relevant to the selection of project delivery

Notes and Comments: ……
……
……
……

7) Level of Oversight and Control: Level of oversight involves the amount of agency staff required to monitor the design or construction, and amount of agency control over the delivery process

DESIGN-BID-BUILD *Full control over a linear design and construction process*	
Opportunities	**Obstacles**
▪ …… ▪ …… ▪ ……	▪ …… ▪ …… ▪ ……

DESIGN-BUILD *Less control over the design (design desires must be written into the RFP contract requirements). Generally less control over the construction process (design-builder often has QA responsibilities)*	
Opportunities	**Obstacles**
▪ …… ▪ …… ▪ ……	▪ …… ▪ …… ▪ ……

CM/GC *Most control by CDOT over both the design, and construction, and control over a collaborative owner/designer/contractor project team*	
Opportunities	**Obstacles**
▪ …… ▪ …… ▪ ……	▪ …… ▪ …… ▪ ……

Level of Oversight and Control Summary

	DBB	**DB**	**CM/GC**
7. Level of Oversight and Control			

Key: **+ +** Most appropriate delivery method **+** Appropriate delivery method
– Least appropriate delivery method **X** Fatal Flaw (discontinue evaluation of this method)
NA Factor not applicable or not relevant to the selection of project delivery

Notes and Comments: ……
……
……
……

8) Competition and Contractor Experience: Competition and availability refers to the level of competition, experience and availability in the market place and its capacity for the project.

DESIGN-BID-BUILD *High level of competition, but limited ability to choose based on qualifications. High level of marketplace experience*	
Opportunities	**Obstacles**
▪ …… ▪ …… ▪ ……	▪ …… ▪ …… ▪ ……

DESIGN-BUILD *Allows for a balance of qualifications and price in the selection process. Medium level of marketplace experience*	
Opportunities	**Obstacles**
▪ …… ▪ …… ▪ ……	▪ …… ▪ …… ▪ ……

CM/GC *Allows for the selection of the single most qualified contractor, but GMP can limit price competition. Low level of marketplace experience*	
Opportunities	**Obstacles**
▪ …… ▪ …… ▪ ……	▪ …… ▪ …… ▪ ……

Competition and Contractor Experience Summary

	DBB	**DB**	**CM/GC**
8. Competition and Contractor Experience			

Key: **+ +** Most appropriate delivery method **+** Appropriate delivery method
– Least appropriate delivery method **X** Fatal Flaw (discontinue evaluation of this method)
NA Factor not applicable or not relevant to the selection of project delivery

Notes and Comments: ……
……
……
……

APPENDIX

Opportunity and Obstacle Checklists

(With Project Risk Assessment Discussion and Checklists)

1) Delivery Schedule

DESIGN-BID-BUILD	
Opportunities	**Obstacles**
❒ Schedule is more predictable and more manageable ❒ Milestones can be easier to define ❒ Projects can more easily be "shelved" ❒ Shortest procurement period ❒ Elements of design can be advanced prior to permitting, construction, etc. ❒ Time to communicate/discuss design with stakeholders	❒ Requires time to perform a linear design-bid-construction process ❒ Design and construction schedules can be unrealistic due to lack industry input ❒ Errors in design lead to change orders and schedule delays ❒ Low bid selection may lead to potential delays and other adverse outcomes.

CM/GC	
Opportunities	**Obstacles**
❒ Ability to start construction before entire design, ROW, etc. is complete (i.e., phased design) ❒ More efficient procurement of long-lead items ❒ Early identification and resolution of design and construction issues (e.g., utility, ROW, and earthwork) ❒ Can provide a shorter procurement schedule than DB ❒ Team involvement for schedule optimization ❒ Continuous constructability review and VE ❒ Maintenance of Traffic improves with contractor inputs	❒ Potential for not reaching GMP and substantially delaying schedule ❒ GMP negotiation can delay the schedule ❒ Schedule-driven goals may drive up cost ❒ Designer-contractor-agency disagreements can add delays ❒ Strong agency management is required to control schedule

2) Project Complexity & Innovation

DESIGN-BID-BUILD	
Opportunities	**Obstacles**
❒ CDOT can have more control of design of complex projects ❒ CDOT& consultant expertise can select innovation independently of contractor abilities ❒ Opportunities for value engineering studies during design, more time for design solutions ❒ Aids in consistency and maintainability ❒ Full control in selection of design expertise ❒ Complex design ~~can be resolved~~ and competitively bid	❒ Increased costs due to pricing of risk ❒ Innovations can add cost or time and restrain contractor's benefits ❒ No contractor input to optimize costs ❒ Limited flexibility for integrated design and construction solutions (limited to constructability) ❒ Difficult to assess construction time and cost due to innovation (or lack of efficiency)

CM/GC	
Opportunities	**Obstacles**
❒ Highly innovative process through 3 party collaboration ❒ Allows for owner control of a designer/contractor process for developing innovative solutions ❒ Allows for an independent selection ~~of the best qualified designer~~ and best qualified contractor ❒ VE inherent in process and enhanced constructability (innovative phasing, VE walls) ❒ Risk of innovation can be better defined and minimized and allocated ❒ Can take to market for bidding as contingency	❒ Process depends on designer/CM relationship ❒ No contractual relationship between designer/CM ❒ Innovations can add cost or time ❒ Scope additions can be difficult to manage ❒ Preconstruction services fees for contractor involvement ❒ Cost competitiveness – single source negotiated GMP ❒ Limited competition in design after designer is selected

3) Level of Design

DESIGN-BID-BUILD	
Opportunities	**Obstacles**
❒ 100% design by owner ❒ Agency has complete control over the design (can be beneficial when there is one specific solution for a project) ❒ Project/scope can be developed through design ❒ The scope of the project is well defined through complete plans and contract documents ❒ Well-known process to the industry	❒ Owner design errors can result in a higher number of change orders, claims, etc. ❒ Minimizes competitive innovation opportunities ❒ Can reduce the level of constructability since the contractor is not bought into the project until after the design is complete

CM/GC	
Opportunities	**Obstacles**
❒ Can utilize a lower level of design prior to selecting a contractor then collaboratively advance design with owner, designer and contractor ❒ Contractor involvement in early design improves constructability ❒ CDOT controls design (phasing) ❒ Design can be used for DBB if the price is not successfully negotiated. ❒ Design can be responsive to risk minimization	❒ Teaming and communicating concerning design can cause disputes ❒ Three party process can slow progression of design ❒ If design is too far advanced it will limit the advantages of CMGC or could require design backtracking

4) Initial Risk Assessment

Three sets of risk assessment checklists are provided to assist in an initial risk assessment relative to the selection of the delivery method:

A. Typical CDOT Transportation Project Risks
B. General Project Risks Checklist
C. Opportunities/Obstacles Checklist (relative to each delivery method)

It is important to recognize that the initial risk assessment is to only ensure the selected delivery method can properly address the project risks. A more detailed level of risk assessment should be performed concurrently with the development of the procurement documents to ensure that project risks are properly allocated, managed, and minimized through the procurement and implementation of the project.

A. TYPICAL CDOT TRANSPORTATION PROJECT RISKS

Following is a list of project risks that are frequently encountered on CDOT transportation projects and a discussion on how the risks are resolved through the different delivery methods.

A.1: Site Conditions and Investigations (How unknown site conditions are resolved)

DESIGN-BID-BUILD

Site condition risks are generally best identified and mitigated during the design process prior to procurement to minimize the potential for change orders and claims when the schedule allows.

CM/GC

CDOT, the designer, and the contractor can collectively assess site condition risks, identify the need to perform site investigations in order to reduce risks, and properly allocate risk prior to GMP.

A.2: Utilities

DESIGN-BID-BUILD

Utility risks are best allocated to CDOT, and mostly addressed prior to procurement to minimize potential for claims when the schedule allows.

DESIGN-BUILD

Utilities responsibilities need to be clearly defined in contract requirements, and appropriately allocated to both design-builder and CDOT:

Private utilities (major electrical, gas, communication transmission facilities): Need to define coordination and schedule risks as they are difficult for design-builder to price. Best to have utilities agreements before procurement. Note – by state regulation private utilities have schedule liability in design-build projects, but they need to be made aware of their responsibilities.

Public Utilities: Design and construction risks can be allocated to the design-builder, if properly incorporated into the contract requirements.

CM/GC

Can utilize a lower level of design prior to contracting and joint collaboration of CDOT, designer, and contractor in the further development of the design.

A.3: Railroads (if applicable)

DESIGN-BID-BUILD

Railroad risks are best resolved prior to procurement and relocation designs included in the project requirements when the schedule allows.

DESIGN-BUILD

Railroad coordination and schedule risks should be well understood to be properly allocated and are often best assumed by CDOT. Railroad design risks can be allocated to the designer if well defined. Best to obtain an agreement with railroad defining responsibilities prior to procurement

CM/GC

Railroad impacts and processes can be resolved collaboratively by CDOT, designer, and contractor. A lengthy resolution process can delay the GMP negotiations.

A.4: Drainage/Water Quality Best Management Practices (construction and permanent)

Both drainage and water quality often involve third party coordination that needs to be carefully assessed with regard to risk allocation. Water quality in particular is not currently well defined, complicating the development of technical requirements for projects.

Important questions to assess:

1) Do criteria exist for compatibility with third party offsite system (such as an OSP (Outfall System Plan))?
2) Is there an existing cross-drainage undersized by CDOT Criteria?
3) Can water quality requirements be precisely defined? Is right-of-way adequate?

DESIGN-BID-BUILD

Drainage and water quality risks are best designed prior to procurement to minimize potential for claims when the schedule allows.

DESIGN-BUILD

Generally, CDOT is in the best position to manage the risks associated with third party approvals regarding compatibility with offsite systems, and should pursue agreements to define requirements for the design-builder.

CM/GC

CDOT, the designer, and the contractor can collectively assess drainage risks and coordination and approval requirements, and minimize and define requirements and allocate risks prior to GMP.

A.5: Environmental: Meeting environmental document commitments, (noise, 4(f) and historic, wetlands, endangered species, etc.)

DESIGN-BID-BUILD

Risk is best mitigated through design prior to procurement when the schedule allows.

DESIGN-BUILD

Certain environmental approvals and processes that can be fully defined can be allocated to the design-builder. Agreements or MOUs with approval agencies prior to procurement is best to minimize risks.

CM/GC

Environmental risks and responsibilities can be collectively identified, minimized, and allocated by CDOT, the designer, and the contractor prior to GMP

A.6: Third Party Involvement: Timeliness and impact of third party involvement (funding partners, adjacent municipalities, adjacent property owners, project stakeholders, FHWA, PUC)

DESIGN-BID-BUILD

Third party risk is best mitigated through design process prior to procurement to minimize potential for change orders and claims when the schedule allows.

DESIGN-BUILD

Third party approvals and processes that can be fully defined can be allocated to the design-builder. Agreements or MOUs with approval agencies prior to procurement is best to minimize risks.

CM/GC

Third party approvals can be resolved collaboratively by CDOT, designer, and contractor.

B. GENERAL PROJECT RISK CHECKLIST (items to consider when assessing risk)

Environmental Risks	External Risks
❒ Delay in review of environmental documentation ❒ Challenge in appropriate environmental documentation ❒ Defined and non-defined hazardous waste ❒ Environmental regulation changes ❒ Environmental impact statement (EIS) required ❒ NEPA/ 404 Merger Process required ❒ Environmental analysis on new alignments required	❒ Stakeholders request late changes ❒ Influential stakeholders request additional needs to serve their own commercial purposes ❒ Local communities pose objections ❒ Community relations ❒ Conformance with regulations/guidelines/ design criteria ❒ Intergovernmental agreements and jurisdiction
Third-Party Risks	**Geotechnical and Hazmat Risks**
❒ Unforeseen delays due to utility owner and third-party ❒ Encounter unexpected utilities during construction ❒ Cost sharing with utilities not as planned ❒ Utility integration with project not as planned ❒ Third-party delays during construction ❒ Coordination with other projects ❒ Coordination with other government agencies	❒ Unexpected geotechnical issues ❒ Surveys late and/or in error ❒ Hazardous waste site analysis incomplete or in error ❒ Inadequate geotechnical investigations ❒ Adverse groundwater conditions ❒ Other general geotechnical risks
Right-of-Way/ Real Estate Risks	**Design Risks**
❒ Railroad involvement ❒ Objections to ROW appraisal take more time and/or money ❒ Excessive relocation or demolition ❒ Acquisition ROW problems ❒ Difficult or additional condemnation ❒ Accelerating pace of development in project corridor ❒ Additional ROW purchase due to alignment change	❒ Design is incomplete/ Design exceptions ❒ Scope definition is poor or incomplete ❒ Project purpose and need are poorly defined ❒ Communication breakdown with project team ❒ Pressure to delivery project on an accelerated schedule ❒ Constructability of design issues ❒ Project complexity (scope, schedule, objectives, cost, and deliverables are not clearly understood)
Organizational Risks	**Construction Risks**
❒ Inexperienced staff assigned ❒ Losing critical staff at crucial point of the project ❒ Functional units not available or overloaded ❒ No control over staff priorities ❒ Lack of coordination/ communication ❒ Local agency issues ❒ Internal red tape causes delay getting approvals, decisions ❒ Too many projects/ new priority project inserted into program	❒ Pressure to delivery project on an accelerated schedule. ❒ Inaccurate contract time estimates ❒ Construction QC/QA issues ❒ Unclear contract documents ❒ Problem with construction sequencing/ staging/ phasing ❒ Maintenance of Traffic/ Work Zone Traffic Control

C. RISK OPPORTUNITIES/OBSTACLES CHECKLIST (relative to each delivery method)

DESIGN-BID-BUILD	
Opportunities	**Obstacles**
❒ Risks managed separately through design, bid, build is expected easier	❒ Owner accepts risks associated with project complexity (the inability of designer to be all-knowing about construction) and project unknowns
❒ Risk allocation is most widely understood/used	❒ Low-bid related risks
❒ Opportunity to avoid or mitigate risk through complete design	❒ Potential for misplaced risk through prescriptive specifications
❒ Risks related to environmental, railroads, and third party involvement are best resolved prior to procurement	❒ Innovative risk allocation is difficult to obtain
❒ Utilities and ROW best allocated to CDOT and mostly addressed prior to procurement to minimize potential for claim	❒ Limited industry input in contract risk allocation
❒ Project can be shelved while resolving risks	❒ Change order risks can be greater
	❒ Contractor may avoid risks

CM/GC	
Opportunities	**Obstacles**
❒ Contractor can have a better understanding of the unknown conditions as design progresses	❒ Lack of motivation to manage small quantity costs
❒ Innovative opportunities to allocate risks to different parties (e.g., schedule, means and methods, phasing)	❒ Increase costs for non-proposal items
❒ Opportunities to manage costs risks through CM/GC involvement	❒ Disagreement among Designer-Contractor-Owner can put the process at risk
❒ Contractor will help identify and manage risk	❒ If GMP cannot be reached, additional low-bid risks appear
❒ Agency still has considerable involvement with third parties to deal with risks	❒ Limited to risk capabilities of CM/GC
❒ Avoids low-bid risk in procurement	❒ Designer-contractor-agency disagreements can add delays
❒ More flexibility and innovation available to deal with unknowns ~~early in design process~~ prior to completion of the contract documents.	❒ Strong agency management is required to negotiate/optimize risks
	❒ Discovery of unknown conditions can drive up GMP, which can be compounded in phased construction

5) Cost

DESIGN-BID-BUILD	
Opportunities	**Obstacles**
❒ Competitive bidding provides a low cost construction to a fully defined scope of work	❒ Cost accuracy is limited until design is completed
❒ Increase certainty about cost estimates	❒ Construction costs are not locked in until design is 100% complete.
❒ Construction costs are contractually set before construction begins	❒ Cost reductions due to contractor innovation and constructability is difficult to obtain
	❒ More potential of cost change orders due to owner design responsibility

DESIGN-BUILD	
Opportunities	**Obstacles**

❒ Contractor input into design should moderate cost ❒ Design-builder collaboration and ATCs can provide a cost-efficient response to project goals ❒ Costs are contractually set early in design process with design-build proposal ❒ Allows a variable scope bid to match a fixed budget ❒ Potential lower average cost growth	❒ Risks related to design-build, lump sum cost without 100% design complete, can compromise financial success of the project.

CM/GC	
Opportunities	**Obstacles**
❒ Owner/designer/contractor collaboration to reduce project risk can result in lowest project costs. ❒ Early contractor involvement can result in cost savings through VE and constructability ❒ Cost will be known earlier when compared to DBB ❒ Integrated design/construction process can provide a cost efficient strategies to project goals ❒ Can provide a cost efficient response to the project goals	❒ Non-competitive negotiated GMP introduces price risk ❒ Difficulty in GMP negotiation introduces some risk that GMP will not be successfully executed requiring aborting the CM/GC process. ❒ Paying for contractors involvement in the design phase may increase total cost

6) Staff Experience/Availability

DESIGN-BID-BUILD	
Opportunities	**Obstacles**
❒ Agency and consultants have high level of experience with the traditional system ❒ Designers can be more interchangeable between projects	❒ Can require a high level of agency staffing of technical resources ❒ Staff's responsibilities are spread out over a longer design period ❒ Can require staff to have full breadth of technical expertise

DESIGN-BUILD	
Opportunities	**Obstacles**
❒ Less agency staff required due to the sole source nature of DB ❒ Opportunity to grow agency staff by learning a new process	❒ Limitation of availability of staff with skills, knowledge and personality to manage DB projects ❒ Existing staff may need additional training to address their changing roles ❒ Need to "mass" agency management and technical resources at critical points in process (i.e., RFP development, design reviews, etc.)

CM/GC	
Opportunities	**Obstacles**
❒ Agency can improve efficiencies by having more project managers on staff rather than specialized experts ❒ Smaller number of technical staff required through use of consultant designer	❒ Strong committed owner project management is important to success ❒ Limitation of availability of staff with skills, knowledge and personality to manage CMGC projects ❒ Existing staff may need additional training to address their changing roles ❒ Agency must learn how to negotiate GMP projects

7) Level of Oversight and Control

DESIGN-BID-BUILD	
Opportunities	**Obstacles**
❒ Full owner control over a linear design and construction process ❒ Oversight roles are well understood ❒ Contract documents are typically completed in a single package before construction begins ❒ Multiple checking points through three linear phases: design-bid-build ❒ Maximum control over design	❒ Requires a high-level of oversight ❒ Increased likelihood of claims due to owner design responsibility ❒ Limited control over an integrated design/construction process

DESIGN-BUILD	
Opportunities	**Obstacles**
❒ A single entity responsibility during project design and construction ❒ Continuous execution of design and build ❒ Getting input from construction to enhance constructability and innovation ❒ Overall project planning and scheduling is established by one entity	❒ Can require high level of design oversight ❒ Can require high level of quality assurance oversight ❒ Limitation on staff with DB oversight experience ❒ Less owner control over design ❒ Control over design relies on proper development of technical requirements

CM/GC	
Opportunities	**Obstacles**
❒ Preconstruction services are provided by the construction manager ❒ Getting input from construction to enhance constructability and innovation ❒ Provides owner control over an integrated design/construction process	❒ Agency must have experienced staff to oversee the CM/GC ❒ Higher level of cost oversight required

8) Competition and Contractor Experience

DESIGN-BID-BUILD	
Opportunities	**Obstacles**
❒ Promotes high level of competition in the marketplace ❒ Opens construction to all reasonably qualified bidders ❒ Transparency and fairness ❒ Reduced chance of corruption and collusion ❒ Contractors are familiar with DBB process	❒ Risks associated with selecting the low bid (the best contractor is not necessary selected) ❒ No contractor input into the process ❒ Limited ability to select contractor based on qualifications

DESIGN-BUILD	
Opportunities	**Obstacles**
❒ Allows for a balance of qualifications and cost in design-builder procurement ❒ Two-phase process can promote strong teaming to obtain “Best Value” ❒ Increased opportunity for innovation possibilities due to the diverse project team	❒ Need for DB qualifications can limit competition ❒ Lack of competition with past experience with the project delivery method ❒ Reliant on DB team selected for the project ❒ The gap between owner experience and contractor experience with delivery method can create conflict

CM/GC	
Opportunities	**Obstacles**
❒ Allows for qualifications based contractor procurement ❒ Agency has control over an independent selection of best qualified designer and contractor ❒ Contractor is part of the project team early on, creating a project “team” ❒ Increased opportunity for innovation due to the diversity of the project team	❒ Currently there is not a large pool of contractors with experience in CMGC, which will reduce the competition and availability ❒ Working with only one contractor to develop GMP can limit price competition ❒ Requires a strong project manager from the agency ❒ Teamwork and communication among the project team