Project Delivery Selection Workshop Summary

Workshop Summary	
Project Name:	**US 34A MP 65 to MP 88 (Estes Park to Loveland)**
Workshop Date:	**September 23, 2014**
Workshop Location:	**CDOT Region 4 – Loveland Residency**
Facilitators:	**Mark Talvitie & Dave Poling**
Delivery Method Selected:	**CMGC**

Workshop Participants	
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Project Delivery Description

The following items should be considered in describing the specific project. Other items can be added to the bottom of the form if they influence the project delivery decision. Relevant documents can be added as appendices to the final summary report.

Project Attributes
Project Name: US 34A MP 65 to MP 88
Location: US 34 between Estes Park and Loveland
Estimated Budget: $55M to $100M, depending on final flood recovery funding eligibility and other funding participation
Estimated Project Delivery Period: September 2014 through December 2017
Required Delivery Date (if applicable):
Source(s) of Project Funding: Federal Flood Recovery funds, CDOT, Local entities and coalitions
Project Corridor: US 34 between Estes Park and Loveland
Major Features of Work – pavement, bridge, sound barriers, etc.: Rock cut and fill, HMA pavement, structure construction and repair, retaining walls, river restoration, major and minor drainage
Major Schedule Milestones: Begin construction in 2015, complete construction by end of 2017
Major Project Stakeholders: CDOT, FHWA, USFS, Larimer County, Town of Estes Park, City of Loveland, Big Thompson River Restoration Coalition
Major General Obstacles: Timely confirmation of Federal funding eligibility and magnitude Timely coordination of appropriate river restoration and private access elements to be included with highway reconstruction efforts.
Major Obstacles with Right of Way, Utilities, and/or Environmental Approvals: ROW: Determining ROW needs in private property areas far enough in advance and to limits needed to allow ROW to be delivered when needed for construction, and allow room for flexibility of slope limits. Accesses: Determination of access bridge configuration and resiliency across river Funding: Coordination and determination of funding sources and amounts related to improvements Permitting: Certain phases will be waiting for specific permitting, such as floodplain permit from County, CLOMR
Major Obstacles during Construction Phase: Maintaining traffic during major rock removal and road construction activities Accommodating and maintaining private accesses during construction Use of CR 43 during construction, coordination with construction of the CFL project
Safety Issues: Protection of the public and adjacent property during construction, especially major rock removal activities; Sub-standard shoulders, clear zones, and design speeds; high bicycle use placement of passing lanes relative to side road and property accesses.
Sustainable Design and Construction Requirements:

Project Delivery Goals

An understanding of project goals is essential to selecting an appropriate project delivery method. Therefore, project goals should be set prior to using the project delivery selection matrix. Typically, the project goals can be defined in three to five items and need to be reviewed here. Example goals are provided below, but the report should include project-specific goals. These goals should remain consistent over the life of the project.

Project-Specific Goals *(see separate US 34 Goals Evaluation Table for additional background)*
Goal #1: Build a resilient roadway that works in harmony with the river and environment
Goal #2: Build a safe system that best meets the needs of users and stakeholders
Goal #3: Meet or beat schedule to begin construction as early as possible in 2015, and achieve substantial completion by December 31, 2017.
Goal #4: Minimize inconvenience to the public and maximize safety of workers and traveling public during construction
Goal #5: Maximize scope and improvements within the project budget
Goal #6: Minimize life cycle maintenance costs and provide a quality product
Goal #7: Implement an effective public outreach and communication plan

Project Delivery Constraints

There are potential aspects of a project that can eliminate the need to evaluate one or more of the possible delivery methods. A list of general constraints can be found below the table and should be referred to after completing this worksheet. The first section below is for general constraints and the second section is for constraints specifically tied to project delivery selection.

General Constraints
Source of Funding: • Federal Flood Recovery funds: need to be determined based on refined design and estimates, and accepted by project area by FHWA. • CDOT: Potentially providing funds toward work in non-severe areas. • Local entities and coalitions: BTRRC, City of Loveland, Larimer Co may have funding to contribute to project
Schedule constraints: Begin construction in 2015, complete construction by end of 2017 Significant amount of work will involve work in river, seasonal runoff may impact construction progress
Federal, state, and local laws:
Third party agreements with railroads, ROW, etc: Need ROW from private, public, and federal (USFS) entities. ROW process is in early stages
Project Delivery Specific Constraints
Project delivery constraint #1: Determine level of roadway reconstruction eligible to be accomplished under federal funding, and through any additional funding
Project delivery constraint #2: Determine appropriate level of river restoration to be accomplished under base highway project, and through additional funding
Project delivery constraint #3: USFS approvals of preliminary and final designs
Project delivery constraint #4: 4(f) – Determination and avoidance of any historic features; clearance could take 8 months minimum
Project delivery constraint #5:

Project Risks

Use the table below to document any known risks or potential risks associated with the project being evaluated. This information will be used for selection factor five – Project Delivery Risk Assessment.

Identified Project Risks
Project Risk: Determination of Federal funding eligibility for project elements, and coordinating potential funding from other project sources in timely fashion for alternative delivery procurement documents
Project Risk: Geotechnical Investigations: Conducting a comprehensive enough investigation program of potential rock excavation areas to define ROW and for alternative delivery proposers to adequately propose solutions
Project Risk: ROW: Complicated ROW corridor with potential impact to many private parcels
Project Risk: Hydraulics/Drainage: Complicated river modeling and design with potentially many agencies and stakeholders weighing in on final solutions.
Project Risk: Storm and Spring runoff events: corridor may be subject to above-normal events during construction
Project Risk: Permitting: Floodplain modeling and redefinition based on revised highway and river configuration
Project Risk: Stakeholder, third party coordination, Bureau of Rec, FERC, local entities
Project Risk: Environmental: Specifically 4(f) schedule risk (approx. 8 months min)
Project Risk: USFS input/approval into procurement documents and design
Project Risk: Utilities: FO, water hydrants, siphon, utilities in narrows section

Project Delivery Selection 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	**CMGC**	**DB**
Primary Selection Factors			
1. Project Complexity & Innovation	-	++	+
2. Project Delivery Schedule	X- Fatal Flaw	Begin Construction ++ Const. Complete + Overall +	Begin Construction + Const. Complete ++ Overall +
3. Project Cost Considerations	NA	+	+
4. Level of Design	NA	+	+
5. Risk Assessment	NA	++	+
Secondary Selection Factors			
6. Staff Experience/Availability (Agency)	NA	+	+
7.Level of Oversight and Control	NA	++	+
8. Competition and Contractor Experience	NA	+	++

Rating 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

Project Delivery Selection Summary Conclusions and Comments

Note: *The Project Delivery Selection Method (PDSM) Workshop was conducted on September 23, 2014. Design-Bid-Build was eliminated due to fatal flaws related to schedule, which resulted in focusing on two innovative delivery methods, D-B and CMGC. Given the known information at the time, neither method stood out clearly as the preferred procurement method. Subsequent to the PDSM workshop, additional factors came to light that made using a CMGC procurement method more favorable than D-B. These factors included: updating/prioritizing the project goals, considering feedback from FHWA regarding risk mitigation concerns and scheduling measures, identifying additional key risks, and further consideration of opportunities for innovation. A White Paper was prepared in November 2014 detailing the justification for moving ahead with CMGC vs. D-B. This document is attached to this PDSM as supporting information.*

Project Complexity & Innovation: CMGC was deemed the most appropriate method since it provides the advantage of CDOT being able to control more complicated aspects of the project definition and requirements and obtaining approval of design solutions to secure funding. While DB was seen to be able to provide maximum opportunity to benefit from innovative approaches of multiple proposer teams, CMGC also provides opportunity for innovation through collaboration between the owner, designer, and contractor. DBB was the least appropriate method since did not provide opportunity for contractor input into innovative approaches.

Project Delivery Schedule: CMGC provides the opportunity to get a contractor on board the quickest, and to get an early package under construction in 2015. Due to negotiations with only a single contractor though, it may be difficult to guarantee the project would be complete by the end of 2017. DB procurement process is longer and would eliminate opportunity to begin construction in 2015; but DB method should be able to complete project by end of 2017 due to inherent efficiencies once a DB contract is underway. The result was that DB and CMGC were rated equally related to schedule. DBB was eliminated from further consideration due to long duration to completely design all aspects of the corridor and secure ROW before bidding.

Project Cost Considerations: CMGC provides opportunity to get pricing from contractor on project elements with different funding sources, allowing these aspects to be defined earlier in the process. CDOT experience on recent CMGC projects though is that negotiated costs can be higher than anticipated, resulting in additional caution being exercised in the use of this method. With the DB method, it may be more complicated to estimate and get costs for individual elements, and to ultimately get constructed what the funding was based on, but the competitive nature of DB would provide good value in the end. The result was that DB and CMGC were rated equally related to cost.

Level of Design: No clear advantage of either CMGC or DB

Risk Assessment: CMGC shares risks between CDOT and contractor, which on this corridor would be an advantage, although final cost may be higher. With DB, spending adequate time preparing the RFP technical requirements and base information would be necessary to allow proposers to adequately assess risks, but this step would also take additional time and would likely reduce opportunities for innovation. Overall, CMGC was determined to be the most appropriate method related to risk.

Secondary Selection Factors: Based on the secondary factors, DB and CMGC were equal in the Staff Availability category; CMGC provided an advantage over DB in the Level of Oversight and Control category; and DB provided an advantage over CMGC in the Contractor Competition category.

Project Delivery Selection Matrix Primary Factors

1) Project Complexity and Innovation

Project complexity and innovation is the potential applicability of new designs or processes to resolve complex technical issues.

DESIGN-BID-BUILD - Allows Agency to fully resolve complex design issues and qualitatively evaluate designs before procurement of the general contractor. Innovation is provided by Agency/Consultant expertise and through traditional agency directed processes such as VE studies and contractor bid alternatives.

Opportunities	Obstacles
Maximum control of design and project elements	Would miss out on contractor design input and innovation
CDOT obtains buy-in from USFS, and other stakeholders prior to construction	If bid in packages to expedite start schedule, multiple packages could result in lack of cohesion, and less material balance efficiencies
Would know exact impacts to environmental resources	Low bid contractor may not be the best qualified

CMGC - Allows independent selection of designer and contractor based on qualifications and other factors to jointly address complex innovative designs through three party collaboration of Agency, designer and Contractor. Allows for a qualitative (non-price oriented) design but requires agreement on CAP.

Opportunities	Obstacles
Constructability review through design process	Less experience with procurement method (CDOT and Contractor)
Control of stakeholder expectations and input	Project may not be best-fit for construction innovation or long-lead time procurement opportunity
CDOT obtains buy-in from USFS, and other stakeholders	Can require a lot of management and partnership, extra layer of communication
CDOT retains control of the design and final product	
Allows greater control over complex funding, design, and construction relationship between the roadway, accesses, and river.	

DESIGN-BUILD - Incorporates design-builder input 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
Get innovation and ideas from multiple contractor teams	Requires desired solutions to complex designs to be well defined through technical requirements.
If through the ATC process, R&R alternatives are approved, the contractor is tied to that commitment	Qualitative designs are difficult to define, (like harmonizing road and river), can increase risk perception
Can use best-value procurement to select design-builder with best qualifications for this type of work	CDOT and Stakeholders have to live with solutions that meet minimum requirements of technical requirements.

Project Complexity and Innovation Rating Summary

DBB	CMGC	DB
-	++	+

++	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		

2) Delivery Schedule

Delivery schedule is the overall project schedule from scoping through design, construction and opening to the public. Assess time considerations for starting the project or receiving dedicated funding 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
Schedule is more predictable and more manageable	Designing entire corridor and bidding as one package will likely preclude construction from starting in 2015, and may reduce possibility of completing project by December 2017.
Time to communicate/discuss design with stakeholders	Phased ROW delivery may not work as well with DBB
	FATAL FLAW: Schedule

CMGC - 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. However, schedule can be slowed down by coordinating design-related issues between the CM and designer and by the process of reaching a reasonable CAP.

Opportunities	Obstacles
Opportunity for contractor to provide input on schedule	GMP/CAP negotiation can delay the schedule
Design can continue concurrent with the procurement process, will better define where contractor input would be a benefit	No firm commitment on construction completion date at time of contractor selection
Shorter procurement schedule than D-B, so construction of an early package could potentially begin in 2015	CDOT may not be able to push designer as fast as D-B contractor can
	Need multiple stakeholder approvals if broken out into packages, can take more time

DESIGN-BUILD - Ability to get project under construction before completing design. Parallel process of design and construction can accelerate project delivery schedule; however, procurement time can be lengthy due to the time necessary to develop an adequate RFP, evaluate proposals and provide for a fair, transparent selection process.

Opportunities	Obstacles
Potential to accelerate completion schedule through parallel design-build process	Time required to get buy-in and define complex technical requirements and expectations through RFP development could delay procurement and overall schedule
Encumbers construction funds more quickly	Due to longer overall procurement (RFP prep, proposals phase, etc.) than CMGC, construction likely would not start until Spring 2016
Can prepare early packages to get work started (for instance, in an area where no new ROW is required)	Requires agency and stakeholder commitments to an expeditious review of design
Can obtain firm commitment on construction completion date	

Delivery Schedule Rating Summary		
DBB	**CMGC**	**DB**
X- Fatal Flaw	**Begin Construction ++ Construction complete + Overall +**	**Begin Construction + Construction complete ++ Overall +**

++	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		

3) Project Cost Considerations

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
Eliminated from Consideration due to Fatal Flaw	

CMGC - Agency/designer/contractor collaboration to reduce risk pricing can provide a low cost project however; non-competitive negotiated CAP introduces price risk. Good flexibility to design to a budget.

Opportunities	Obstacles
Actual costs for each project area can be broken out and tracked to ensure proper funding allocation	Need to pay for contractor input during design, and independent construction estimates
Opportunity for contractor to provide input on cost saving/efficiencies	Use of this method on this corridor may limit overall competition since fewer firms have CMGC experience, and design would not be bid competitively
Use of ICE can help validate contractor costs	Since GMP/CAP is negotiated with one contractor and not competitively bid, costs can be higher than with other methods.

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
Overall best opportunity for competition between contractors to optimize design and construction efficiencies	Due to complexity of road and river relationships, may be difficult for proposers to define proposal designs sufficiently to not build in more risk
D-B teams can propose ATCs to minimize costs	Potential for costly change orders if CDOT or stakeholders find they want additional or revised features after project awarded
Costs are set with proposals to help secure funding	Tracking proposed and actual costs for each project area or element to ensure proper funding allocation may be difficult

Project Cost Considerations Rating Summary

DBB	CMGC	DB
NA	+	+

++	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		

4) 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 Agency or contracted design team, with Agency having complete control over the design.

Opportunities	Obstacles
Eliminated from Consideration due to Fatal Flaw	

CMGC - Can utilize a lower level of design prior to procurement of the CMGC and then joint collaboration of Agency, designer, and CMGC in the further development of the design. Iterative nature of design process risks extending the project schedule.

Opportunities	Obstacles
Can select a contractor utilizing a lower level of design	Design process with 3 parties can slow schedule down
Contractor involvement in early design improves constructability	Advancing design before contractor input can limit advantages or require re-design
Design can be used for DBB if cost can't be negotiated	

DESIGN-BUILD - Design advanced by Agency to the level necessary to precisely define contract requirements and properly allocate risk (typically 30% or less).

Opportunities	Obstacles
D-B Contractor involvement in proposal and design improves constructability and innovation	Requirements need to be clearly defined in RFP, which can be a challenge with lower level design information
Some discipline design or investigation levels can be relatively low for RFP	Design and investigation level needs to be sufficient for adequate proposal level design and risk assessment
	Since the river coordination with roadway is a complex element, river design should be done to at least 30% for RFP to reduce potential risk.

Level of Design Rating Summary

DBB	CMGC	DB
NA	**+**	**+**

++	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		

5) Project Delivery Risk Assessment

Risk is an uncertain event or condition that, if it occurs, has an 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.

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, change orders, and potential claims.

Opportunities	Obstacles
Eliminated from Consideration due to Fatal Flaw	

CMGC - Provides opportunity for Agency, 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
CDOT can keep risk of elements of coordination with agencies and public	Eventual CAP may exceed available or approved funds, requiring redesign or supplemental funding
Resiliency level can be fully designed and pricing obtained to facilitate acceptance by funding agencies	
Can work with contractor to keep construction within available ROW until all is available	

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
Can shift risk of proving and providing resiliency onto D-B team	Providing enough initial data (geotech, hydraulic design) under compressed schedule to allow proposers to adequately assess risk can result in higher costs
Can phase ROW delivery, D-B team understands risk and plans accordingly	

Project Delivery Risk Assessment Rating Summary		
DBB	**CMGC**	**DB**
NA	**++**	**+**

++	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		

Project Delivery Selection Matrix Secondary Factors

6) Staff Experience and Availability

Agency 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
Eliminated from Consideration due to Fatal Flaw	

CMGC - Strong, committed Agency project management resources are important for success of the CMGC process. Resource needs are similar to DBB except Agency must coordinate CM's input with the project designer and be prepared for CAP negotiations.

Opportunities	Obstacles
Consultant team has some experience with CMGC	
CDOT overall has procured and constructed a number of recent relevant CMGC projects which could be used as a template	

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
Consultant team has strong experience with D-B on both owner-side and contractor side	
Current CDOT team has some D-B experience, can bring in staff with more direct experience	

Staff Experience and Availability Rating Summary		
DBB	**CMGC**	**DB**
NA	**+**	**+**

++	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		

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**
Eliminated from Consideration due to Fatal Flaw	

CMGC - Most control by Agency over both the design, and construction, and control over a collaborative agency/designer/contractor project team	
Opportunities	**Obstacles**
Allows most control over delivery process, design, and final product	May require more CDOT oversight and involvement to manage both design consultant and contractor

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**
	Less control over design and construction

Level of Oversight and Control Rating Summary		
DBB	**CMGC**	**DB**
NA	**++**	**+**

++	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		

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 GC selection is based solely on low price. High level of marketplace experience.

Opportunities	Obstacles
Eliminated from Consideration due to Fatal Flaw	

CMGC - Allows for the selection of the single most qualified contractor, but CAP can limit price competition. Low level of marketplace experience.

Opportunities	Obstacles
	Limited number of construction firms who have performed CMGC in CO may limit qualified pool and limit competition

DESIGN-BUILD - Allows for a balance of price and non-price factors in the selection process. Medium level of marketplace experience.

Opportunities	Obstacles
Relatively larger number of design and construction firms now have D-B experience, which should increase competition and result in best value selection.	

Competition and Contractor Experience Rating Summary		
DBB	**CMGC**	**DB**
NA	**+**	**++**

++	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		

COLORADO
Department of Transportation
Region 4
Flood Recovery Office
1901 56th Ave, Suite 110
Greeley, CO 80634

DATE: 11/18/14

FROM: Scott Ellis, PE – Resident Engineer

TO: Corey Stewart, PE – North Program Engineer

RE: US 34 Procurement Method

SUBJECT

The purpose of this SBAR is to provide an overview of some of the key risks associated with Design-Build (D-B) procurement on the US 34 Flood Recovery project and to provide documentation to support Construction Manager/General Contractor (CMGC) as the preferred procurement method. The project team is seeking concurrence from the Region 4 Executive Oversight Committee.

BACKGROUND

A crucial step in the delivery of the permanent repairs for the US 34 Flood Recovery project is to select the appropriate procurement method. A Project Delivery Selection Method (PDSM) Workshop was conducted September 23, 2014. Design-Bid-Build was eliminated due to fatal flaws related to schedule, which resulted in focusing on two innovative delivery methods, D-B and CMGC. Given the known information at the time, neither method stood out clearly as the preferred procurement method. Subsequent to the PDSM workshop, additional factors have come to light that make using a CMGC procurement method more favorable than D-B. These factors include: updating/prioritizing the project goals, considering feedback from FHWA regarding risk mitigation concerns and scheduling measures, identifying additional key risks, and further consideration of opportunities for innovation.

ANALYSIS

Below is an analysis of several elements of the project:

1. **Project Goals**

   Based on the initial PDSM evaluation and additional technical work that has been done, the project team has collectively developed seven goals for the project, along with multiple sub-goals for each. Risks, impacts, and opportunities for each sub-goal have been identified for both D-B and CMGC delivery methods. Based on this analysis, CMGC overall has fewer risks, or has risks more easily mitigated, than the D-B delivery method. Key items related to project goals included:

   a. *Build a safe system that meets the needs of users and stakeholders:* key sub-goals included maximizing resiliency of private access bridges while minimizing impacts to roadways and private properties, achieving a consistent project-wide roadway design standard, accommodating recreation, and providing rockfall protection. It would be difficult for CDOT to define required solutions and it would require a significant effort by D-B teams to analyze and commit to solutions to these items, which would be a large part of a best-value

evaluation and selection. See the following discipline sections in this Analysis section for additional discussions.

b. *Resiliency of roadway in harmony with river*: key sub-goals included maximizing percentage of roadway remaining fully usable or available for emergency access, and incorporating river resiliency. For D-B procurement, proposers would need to complete extensive hydraulic modeling and design during the proposal phase to be able to commit to meeting stated percentages. Even with this effort, high risks with significant costs associated with the potential design could still exist. With CMGC, the design team continues advancing road and hydraulic designs, while working with contractor to develop the most cost effective solution.

c. *Schedule*: Based on schedule comparisons, the amount of up-front work to develop an adequate D-B RFP, and the length of procurement and contracting would mean design would not start until early 2016, with construction projected for Summer 2016. While with D-B CDOT could still require completion by end of 2017, it would come at a financial cost. With CMGC, procurement is shorter and an early package could potentially be under construction by late 2015. Breaking up CMGC into packages can make it more difficult to bid out subsequent packages if an acceptable cost cannot be negotiated. A CMGC RFP should require commitments for timely responses and estimates to keep on schedule.

d. *Budget*: While with D-B there is more competition from a cost perspective, the degree of uncertainty and complexity of the project would likely add risk to the proposals, to the point that cost savings due to increased competition would be negated. Also, with D-B, determining and tracking eligible costs by project area would be a challenge based on the typical methods during a D-B process. Contractors will price risk into their cost, so if additional changes come up during the D-B process, it is unknown what it could cost CDOT to incorporate additional items in the project. With CMGC, costing the individual areas is cleaner. In addition, since the project will be 100% federally funded, CMGC allows for costs by segment and total costs to be accepted and approved by FHWA before construction begins. With D-B and the associated risks, there would undoubtedly be change orders during construction that would run the risks of not being funded by FHWA.

See *Attachment A - D-B and CMGC Goals Comparison* and *Attachment B - D-B vs CMGC Schedule Comparison* for additional information.

RISK: To ensure that the project goals are achieved, the project is kept on schedule, and costs are reasonable, the Project Team should require CMGC proposers to commit to a comprehensive plan for delivering the project on schedule and providing timely feedback. During design and construction, the Project Team should actively manage the overall schedule and process.

2. **<u>Geotechnical</u>**

In order to build a safe, resilient roadway that works in harmony with the river, the alignment of US 34 will be adjusted throughout the corridor. This will require large rock cuts to widen the roadway template and move the road onto bedrock.

KEY RISKS OF D-B:

- ***Due to the high cost and risk associated with constructing rock cuts and the difficulty of accessing the top of slopes, the D-B contractor may propose to avoid many of the rock slopes during construction and forego the resiliency improvements.***
- ***Most D-B contracts do require a warranty period following the substantial completion of the project, but many of the problems associated with the construction of rock slopes are not realized until several years after construction. The cost of maintenance, public safety,***

and prolonged closures of the road are some of the long-term effects of poor cut slope design and construction. Through a CMGC contract, CDOT has more control over the design and the long-term performance of the rock slopes.

- ***There are no true design standards for rock slope design and rockfall mitigation. Currently, a task force comprising CDOT, FHWA and private industry is trying to develop a means to determine the sufficiency and level of rockfall mitigation measures based on the rock slope rating system of existing cuts. The process for determining performance requirements has not yet been determined or properly vetted. Developing appropriate technical requirements will be difficult and will increase the risk of disagreement between the owner (CDOT) and the D-B contractor on the adequacy of the measures used to stabilize the new cuts and provide sufficient rockfall mitigation.***
- ***Basing a D-B contract on a 30% level of design results in significant unknown risks, which may translate into higher bid costs or change orders and less flexibility to address issues that inevitably arise during construction.***
- ***The objectives of the project from the D-B contractor's perspective are often different than those of the stakeholders. The risk is that some of the design elements requested by the stakeholders may not be implemented, due to unforeseeable time and budget constraints.***

CMGC will allow CDOT to maintain control of the design and incorporate stabilization and excavation methods that meet the department's long-term performance expectations. The D-B delivery method may not.

Additional detail and the full geotechnical analysis can be found *in Attachment C-Geotechnical SBAR*

3. **<u>Hydraulics</u>**

River hydraulics are a critical element to the US 34 project. The relationship between the roadway and the river must be coordinated, in order to protect the roadway from future flood events, provide emergency access, and build a safe system to meet the needs of stakeholders.

KEY RISKS OF D-B:

- ***Design-build based on a 30% design may take optimization of interrelated roadway and river design out of CDOT's hands and could lead to an over-emphasis of one element and a shortchanging of the other, which could be to the detriment of both the river and roadway. CDOT may not get the most benefit for the associated cost.***
- ***Turning the design and hydraulic responsibilities over to D-B teams at the 30% level will reduce the efficiency of ensuring floodplain compliance, potentially leading to major delays in obtaining the Floodplain Development Permit from the County, since a new team will be obtaining the permit.***
- ***The federally-reimbursable resiliency design standard will probably not be firmly established until well after the 30% design stage. This will create a moving target for hydraulic design, which does not fit well with the D-B design development process. The efficiency of the design process for hydraulic protection may suffer if it is turned over to D-B teams at the 30% design level.***
- ***Design, coordination, and modeling of river improvements to meet environmental goals and assure that standards are achieved for US 34 will probably not be complete at 30% design level, potentially leading to less flexibility to coordinate and implement the work during the design-build phase.***

- ***River-related work, including improvements to protect the roadway embankment, is not easily described in design-build performance criteria at the 30% level, increasing the risk that the desired final improvements will not be achieved.***
- ***Basing a D-B contract on a 30% level of design means there will be substantial project unknowns and risk, which may translate into higher bid costs or change orders and less flexibility to address developing issues.***

Because this project so tightly integrates the roadway design with the hydraulics design of the river, it is recommended to take the hydraulics well past a 30% design level to help reduce some of the risk involved with the river and its impact to the roadway design. Moving away from a D-B delivery method and selecting other project delivery systems, such as CMGC, improves the chances of achieving resilience for both the roadway and the river, accommodating stakeholder involvement regarding river enhancements, and building acceptance of the project by stakeholders and the public.

Additional detail and the full hydraulics SBAR analysis can be found *in Attachment D-Hydraulics SBAR*

4. **Stakeholder Involvement**

The work in the US 34 corridor affects many stakeholders including FHWA, U.S. Forest Service, Larimer County, the City of Loveland, and the Big Thompson River Restoration Coalition.

KEY RISKS OF D-B:

- ***Stakeholders are working on securing additional funding sources and they may not know what is available in time to be included in the D-B contract.***
- ***Stakeholders have expressed a concern with not being able to have as much say in the final design of this corridor if the project is procured using D-B.***
- ***If the D-B procurement documents can be written to include the needs of the stakeholders, the contractor will not have as much opportunity for innovation.***
- ***Coordination with stakeholders is proceeding, but if stakeholders do not provide information or provide review in a timely fashion, specific requirements may not be known in time for inclusion in the D-B procurement document.***

CMGC could result in better relationships with the corridor stakeholders and would better meet the goal to “Build a safe system that best meets the needs of users and stakeholders.”

5. **Roadway**

To create a safe, resilient roadway that works in harmony with the river, the alignment of US 34 will be adjusted throughout the corridor. Additional technical work has been completed over the last few months that provide additional insights to the risks associated with D-B procurement. There are many locations in the corridor where it is difficult or impractical to meet CDOT and AASHTO standards for roadway design.

KEY RISKS OF D-B:

- ***The 30% design is typically included only as a reference document in the D-B procurement documents, and unless specified, the contractor has the ability to adjust the roadway line and grade within the specified criteria. Because of the relationship to the river, and the sensitivity of the floodplain, any changes made to the roadway could require re-evaluation of the floodplain, resulting in schedule delays.***

- ***If a specific preferred roadway alignment is made as a requirement in the D-B procurement document, the contractor does not have the flexibility to bring innovation to the project, which is a primary goal of a D-B document***
- ***With D-B, the contractor controls the final design, which could result in a product that CDOT finds unsatisfactory.***
- ***CDOT may not get as much roadway resiliency as desired if the interests of the D-B contractor are different than those of CDOT.***
- ***It will be difficult in D-B procurement documents to specify and enforce design requirements since much of the corridor does not currently meet CDOT and AASHTO standards.***

From a roadway perspective, CMGC could result in a more satisfactory end product. As with the hydraulic analysis, it may be necessary to take the roadway design past 30% design to properly evaluate risks associated with roadway design. CMGC allows for this. With CMGC, there will also be more time to identify additional funding sources to be included as part of the US 34 Project.

6. **Environmental**

It is anticipated that a Categorical Exclusion (CE) will be required to clear improvements in the US 34 corridor.

KEY RISKS OF D-B:

- ***Based on the current design schedule, information necessary to complete the environmental studies and obtain a signed CE would become available at end of November, 2014, through February, 2015. The compliance process may take between 6 and 9 months, based on the resource studies required. If a D-B approach is selected, many of the environmental requirements would not be complete when the draft RFP is released, and some may not be finalized before contractor proposals are submitted. This could result in schedule delays or increased cost due to additional work for the contractor.***
- ***The above timeframe assumes that impacts to historic sites would not be adverse and that either a net benefit or a de minimis impact finding could be made for Section 4(f) resources. Given the number of these sites in the corridor and their proximity to the roadway, it is possible that avoiding more substantial impacts would prevent CDOT from implementing some of the resiliencies that are desired in this corridor.***
- ***Because of the accelerated delivery of the CE due to the D-B schedule, it is likely that a tighter corridor will be cleared, which could result in less design flexibility for the contractor, reducing innovation that the contractor could bring.***
- ***The USFS may demand the ability to provide input on elements of the design that would not be addressed until final design. If D-B procurement is selected, CDOT may not be able to properly accommodate USFS. Because a CMGC approach would provide CDOT with more control over the final design decisions, CDOT would have more flexibility in coordinating with USFS and addressing community and environmental concerns.***

Since the CMGC contractor would be under contract before the CE is signed, and would support the development of the final design plans, the contractor would have the opportunity to review the anticipated impacts and proposed mitigation. In prior projects, such as the Twin Tunnels, this was very beneficial. The contractor identified construction processes that avoided some of the identified impacts. They also provided input on mitigation language that was either deemed too ambiguous or too restrictive. Language was refined in some cases to achieve the necessary impact mitigation

without unnecessarily complicating construction. From an environmental perspective, CMGC would be the preferred approach.

7. **Right-of-Way**

   KEY RISKS OF D-B:

   - ***Commitments on acquisition of parcels will be required in the D-B RFP, so the contractor can develop their approach to project phasing and schedule. If commitments for acquisition cannot be met once NTP is issued to the contractor, there is potential for claims associated with schedule delays.***
   - ***If the contractor feels that there is a risk associated with the right of way commitments, they may add costs to the project during the RFP phase.***
   - ***During the D-B process, acquisitions will be defined using only 30% design. There is a serious risk that more property than necessary will be acquired, or the opposite, that not enough will be acquired, further limiting the innovation and flexibility for the contractor.***

   CMGC allows more time for the acquisitions to be defined beyond 30% design. The contractor will be working with the design team to better define what right-of-way will actually be required to make sure that they can bring innovation and efficiencies, creating a better right of way product.

8. **Innovation**

   Opportunity for innovation should be a key element in deciding to select D-B or CMGC versus the traditional method. While the US 34 corridor certainly presents some opportunities for innovation (such as increasing resiliency, access bridge design, river improvements, etc.) they come with significant risks that each D-B proposer must assess before committing to an innovative approach or solution with their proposal.

   This project has a limited number of features that would truly lend themselves to innovative approaches. The degree of innovation (balanced against risk) obtained by working with a single contractor via CMGC is not expected to be less than what CDOT would experience in receiving proposals from multiple contractors under the D-B method. CMGC provides cost-efficient approaches and innovative solutions through real time constructability reviews while closely coordinating with the owner and the stakeholders.

RECOMMENDATION

FHWA feedback, additional technical analysis, and more in depth discussions of goals and risk evaluation has resulted in the project team's recommendation of CMGC as the most appropriate delivery method for the US 34 flood recovery project.

While extensive analysis is included above, below are some of the key considerations that support the recommendation for CMGC.

- With D-B it would be difficult for CDOT to define required solutions to technical elements (hydraulics, roadway and geotechnical) without taking the design past the 30% level and it would require a significant effort by D-B teams (more than the current timeline allows) to analyze and commit to solutions to these items, which would be a large part of a best-value evaluation and selection. CMGC allows more time to define the technical requirements while incorporating contractor input on best means and methods.

- Basing a D-B contract on a 30% level of design results in significant unknown risks, which may translate into higher bid costs or change orders and less flexibility to address issues that inevitably arise during construction.
- Based on schedule comparisons (see Attachment B), the amount of up-front work to develop an adequate D-B RFP, and the length of procurement and contracting would mean design would not start until early 2016. While with D-B CDOT could still require completion by end of 2017, it would come at a financial cost. With CMGC, procurement is shorter and an early package could potentially be under construction by late 2015.
- While with D-B there is more competition from a cost perspective, the degree of uncertainty and complexity of the project would likely add risk to the proposals, to the point that cost savings due to increased competition would be negated. The degree of innovation (balanced against risk) obtained by working with a single contractor via CMGC is not expected to be less than what CDOT would experience in receiving proposals from multiple contractors under the D-B method. CMGC provides cost-efficient approaches and innovative solutions through real time constructability reviews while closely coordinating with the owner and the stakeholders.
- Since the project will be 100% federally funded, CMGC allows for costs by segment and total costs to be accepted and approved by FHWA before construction begins. With D-B and the associated risks, there would undoubtedly be change orders during construction that would run the risks of not being funded by FHWA.
- Most D-B contracts do require a warranty period following the substantial completion of the project, but many of the problems associated with the construction of rock slopes are not realized until several years after construction. The cost of maintenance, public safety, and prolonged closures of the road are some of the long-term effects of poor cut slope design and construction. Through a CMGC contract, CDOT has more control over the design and the long-term performance of the rock slopes.
- There are no true design standards for rock slope design and rockfall mitigation. Developing appropriate technical requirements will be difficult and will increase the risk of disagreement between CDOT and the D-B contractor on the adequacy of the measures used to stabilize the new cuts and provide sufficient rockfall mitigation.
- For D-B procurement, proposers would need to complete extensive hydraulic modeling and design during the proposal phase to be able to commit to meeting stated requirements. Even with this effort, high risks with significant costs associated with the potential design could still exist.
- If a D-B approach is selected, many of the environmental requirements would not be complete when the draft RFP is released, and some may not be finalized before contractor proposals are submitted. This could result in schedule delays or increased cost due to additional work for the contractor.
- Because of the accelerated delivery of the CE due to the D-B schedule, it is likely that a tighter corridor will be cleared, which could result in less design flexibility for the contractor, reducing innovation that the contractor could bring.
- The USFS may demand the ability to provide input on elements of the design that would not be addressed until final design. If D-B procurement is selected, CDOT may not be able to properly accommodate USFS. Because a CMGC approach would provide CDOT with more control over the final design decisions, CDOT would have more flexibility in coordinating with USFS and addressing community and environmental concerns.
- Since the CMGC contractor would be under contract before the CE is signed, and would support the development of the final design plans, the contractor would have the opportunity to review the anticipated impacts and proposed mitigation.

SE/ju

Attachments (4)

A: D-B and CMGC goals comparison
B: D-B vs CMGC schedule comparison
C: Geotechnical SBAR
D: Hydraulics SBAR

cc
James Usher, Steven Humphrey, Velvet Kuesel

Attachments

Potential Project Goals – Comparison Table *– Updated 11/14/14*

Priority	Proposed/Potential Overall Goal	Sub-Goals/Values (Evaluation Criteria)	D-B Risks/Impacts/Opportunities	CMGC Risks/Impacts/Opportunities
1	**Build a safe system that best meets the needs of users and stakeholders**	• Maximize resiliency of private access bridges while minimizing impacts to roadways and private properties	• Significant effort required during proposal phase for teams to commit to solutions. • CDOT will need to live with solution of successful proposer	• Allows design team to develop preliminary solutions and then work with contractor to confirm best approach
		• Bring roadway up to Project Standards in areas defined	• Reasonable risk since more easily defined and modeled during proposal phase	• Low risk, allows design team to develop preliminary design and then work with contractor to confirm best approach
		• Improve safety of US34/CR43 intersection	• Reasonable risk since more easily defined and modeled during proposal phase	• Low risk, allows design team to develop preliminary design and then work with contractor to confirm best approach
		• Provide or accommodate recreational opportunities (river access, fishing, etc.)	• Need to be able to define what this involves so proposers can quantify adequately and assess risks	• Low risk, allows design team to develop preliminary design and then work with contractor to confirm best approach
		• Improve safety for bicycles	• Achieve via the wider shoulders, any extra widening in curves? Would need to commit to extras in proposals	• Low risk, can decide with team and contractor what is worth doing
		• Provide rockfall protection for roadway users	• Proposers would need to assess and commit to achieving this	• Low risk, can work with team and contractor
2	**Build a resilient roadway that works in harmony with the river and environment**	• Maximize percentage of roadway that will remain fully usable following a 100 year storm event. (Define minimum percentage?)	• Proposers will need to do enough design and modeling during proposal phase to feel reasonably comfortable committing to this, and may still assign significant risk	• Reasonable risk, allows design team to develop preliminary solutions and then work with contractor to confirm best approach
		• Maximize percentage of roadway that will allow emergency access following a 100 year storm event (Define what is needed)	• Proposers will need to do enough design and modeling during proposal phase to feel reasonably comfortable committing to this, and may still assign significant risk	• Reasonable risk, allows design team to develop preliminary solutions and then work with contractor to confirm best approach
		• Incorporate natural river resiliency designs into project that minimizes potential damage to river and roadways in both minor and major flow scenarios.	• Only river improvements that can be shown to protect the roadway or are needed because of roadway improvements may be eligible for funding, teams must be able to prove eligibility.	• Design team works with FHWA during preliminary design, and then with contractor to finalize costs and eligibility.
		• Minimize and mitigate environmental impacts	• Need to define fully in RFP, proposers need to commit and abide by requirements. Usually a risk item for DB teams	• Reasonable risk, managed by CDOT team to work with contractor to confirm best approach
3	**Meet or beat schedule to achieve substantial completion by December 31, 2017**	• Begin construction as early as possible in 2015	• Based on complexity and uncertainties, DB contractor would likely not be able to start physical construction until early Summer 2016	• If procurement starts late 2014 or early 2015, an early package could be designed and negotiated with contractor to start some construction late 2015
		• Complete total project prior to 12/31/2017	• Continued delays will potentially affect ability to meet this with DB	• CDOT and design team will need to require timely feedback and pricing from contractor to ensure significant delays don't occur.
		• Complete significant or critical segments prior to overall project	• Can likely be accomplished with DB	• Can likely be accomplished with CMGC
4	**Maximize scope and improvements within the project budget**	• Deliver improvements within approved budget for each individual site or section	• Need to be able to define and track budgets and costs for each site, will be fairly complicated with DB method	• Can track budgets more easily with CMGC • Need comprehensive independent estimating process to confirm and negotiate CAPs, be prepared to bid out if needed
		• Maximize amount of river restoration provided within funding provided through __ (BTRRC?)	• Need to be able to define and track budgets and costs for additional improvements, will be fairly complicated with DB method	• Can track budgets more easily with CMGC
		• Maximize amount of highway brought to Project Standards.	• Can be accomplished with DB, need proposal commitment	• Can be accomplished with CMGC with minimal risk
		• Provide passing lanes to level that existed prior to the flood event as a minimum, and provide additional passing lanes where possible.	• Proposers need to be certain enough at proposal level to commit to these. • CDOT will need to live with solution of successful proposer	• Allows design team to develop preliminary solutions and then work with contractor to confirm best approach
5	**Minimize life cycle maintenance costs and provide a quality product**	• Pavement Section Design	• Provide minimums in RFP, proposers can propose more, cost vs. points risk	• Allows design team to develop preliminary solutions and then work with contractor to confirm best approach
		• Drainage and Water Quality design and maintenance features	• Proposers commit to certain features and designs	• Team works with contractor to develop/evaluate cost/benefit
6	**Implement an effective public outreach and communication plan**	• Develop an effective plan	• If allow DB contractor to lead, CDOT gives up some control	• CDOT retains total control of PI, lowest risk
		• Personnel Experience and Qualifications	• Have to live with contractor PI lead, since may not drive selection	• CDOT retains total control of PI, lowest risk
7	**Minimize inconvenience to the public and maximize safety of workers and traveling public during construction**	• Minimize impacts to traffic via lane closures, access closures, etc.	• Can be accomplished with DB, need proposal commitment	• Can be designed and coordinated with contractor
		• Incorporation of safety elements and considerations into MOT design	• Can be accomplished with DB, need proposal commitment	• Can be designed and coordinated with contractor
		• Minimize impacts to corridor property owners	• More subjective with DB, harder to enforce in practice	• Can be designed and coordinated with contractor
		• Resiliency during construction, keeping safe and open	• More subjective with DB, harder to enforce in practice	• Can be designed and coordinated with contractor

DRAFT - SUBJECT TO CHANGE

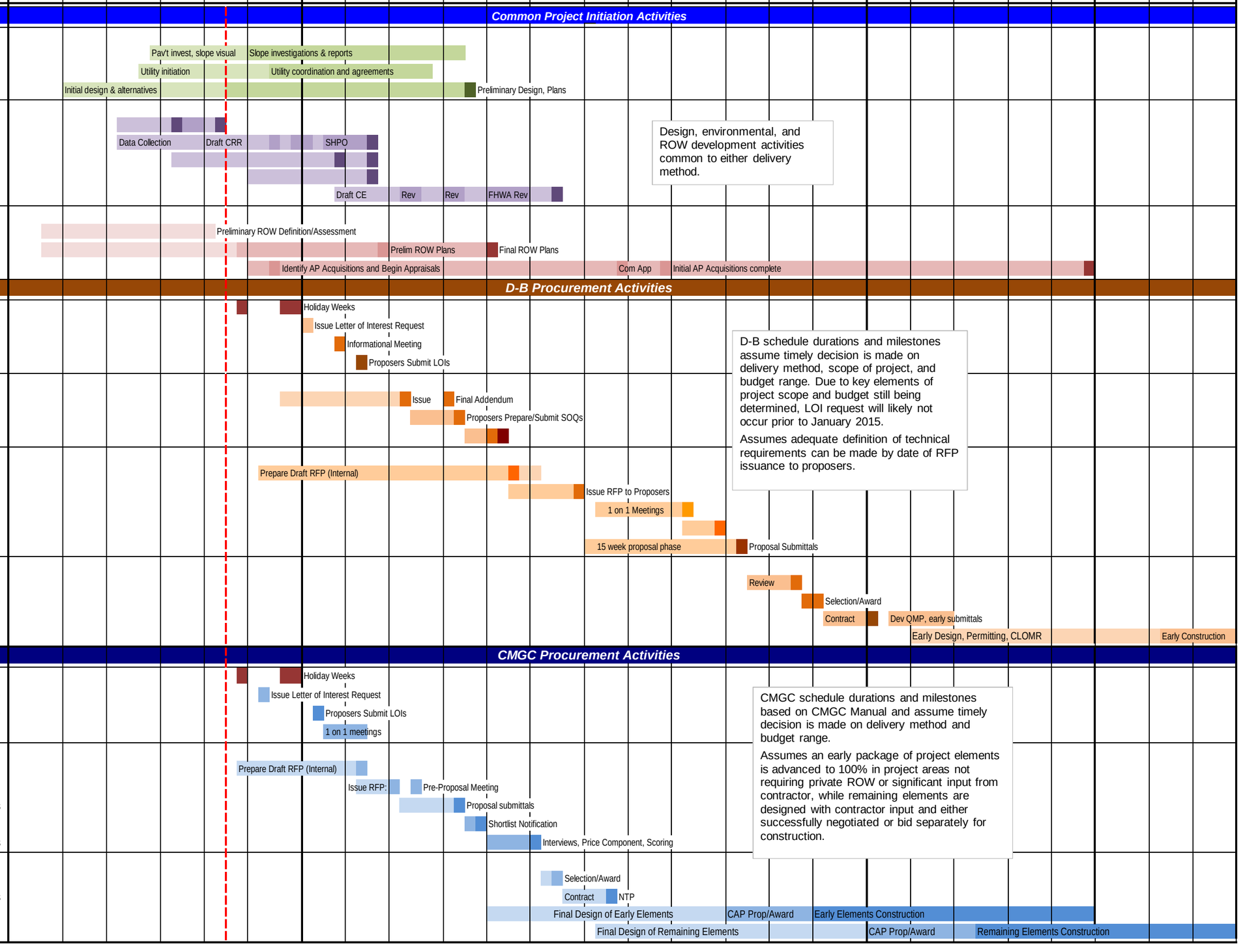
US 34 Project Delivery Schedule Comparison

Printed: 11/14/2014

Attachment B

Updated: November 13, 2014

Activity	Date/Dur
Common Project Initiation Activities	
Design Development	
Geo-technical investigation	
Utility Coordination and Agreements	
Preliminary Design, Draft Plans	
Environmental/Permitting	
ISA Checklist (Draft-Review-Final)	
Section 106 Process (Data-CRR-Reviews-SHPO Review)	
BA/BE Botanical & Wildlife	
Visual Impact Assessment, Noise Technical Report	
Categorical Exclusion/Section 4(f) Evaluation	
R.O.W. Plans and Acquisition	
Prelim ROW & Esmt Definition	
Prelim and Final ROW Plans, Approval	
ROW Appraisals/Acquisition (Estimated)	
D-B Procurement Activities	
LOI Phase	
Issue Letter of Interest Request	Milestone
Informational Meeting	
Proposers Submit LOIs	
RFQ Phase	
Prepare & Issue RFQ, Final Addendum	6 weeks
Proposers Prepare/Submit SOQs	5 weeks
Short List Selection, Notify/Debrief Submitters	4 weeks
RFP Phase	
Prepare Draft RFP (Internal) & Reviews	16 weeks
Prepare/Issue RFP to Proposers	7 weeks
1 on 1 ATC Meetings and CDOT Response	8 weeks
Prepare/Issue Final RFP Addendum	4 weeks
Prepare/Submit Proposals	15 weeks
Selection, Award, Early Activities	
Review proposals, Submit recommendation to EOC	4 weeks
Selection/Award	Milestone
Negotiate Contract, Issue NTP	5 weeks
Early Design/Construction Phase	
CMGC Procurement Activities	
LOI Phase	
Issue Letter of Interest Request	Milestone
Proposers Submit LOIs	Milestone
1 on 1 Meetings	4 weeks
RFP Phase	
Prepare Draft RFP (Internal) & Reviews	11 weeks
Finalize/Issue RFP to Proposers	4 weeks
Proposal Preparation and Submittal	4-6 weeks
Shortlisting, Approval, Notification	2 weeks
Interviews, Price Component Opening, Scoring	4-5 weeks
Selection, Award, Early Activities	
Selection Approval by FHWA/EOC	2 weeks
Negotiate Contract, Issue NTP	4-5 weeks
Early Elements Final Design / CAP Award / Const.	
Remaining Elements Final Design /CAP Award/ Const.	



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Attachment C

DATE: 11/13/14

FROM: Rick Andrew, P.G., Yeh and Associates, Inc.

TO: James Usher, US 34 Project Manager

RE: US 34 Geotechnical Design– Rock Slope Design and Performance (SBAR)

SUBJECT

As requested, Yeh and Associates, Inc. has evaluated the risks of taking the geotechnical design to a 30% level consistent with the design/build delivery method. Specifically, the rock cut design portion of the design is not a traditional geological engineering function. This memo summarizes our review of the risks of design/build from a geological engineering design perspective and provides our recommendation.

BACKGROUND

A 30% design plan set for the US 34/Big Thompson River improvements will focus on those features that help define approximate ROW needs, environmental impact limits, and portray basic design elements for budgetary purposes, such as:

- Initial rock cut slope angles
- Cut slope stabilization concepts
- Toe/top of fills and cuts for roadway
- US 34 profile and typical sections
- Bridge general layouts, plan/profile
- Basic intersection design, plan view only
- Requirements for supplemental geotechnical investigation

Specific risks associated with 30% design level for the rock slopes and rockfall mitigation (category of impact shown in parentheses):

- ROW/PE and TE may not be accurately identified based on initial cut slope angles(cost)
- Construction cost not accurately identified due to change of conditions commonly found in rock slope construction (cost)
- Long-term performance of the rock slopes (cost/roadway damage risk)
- Requirements for rock slope stabilization and rockfall mitigation not conveyed/constructed (roadway damage risk)
- Aesthetic vs. performance requirements for the rock slopes (roadway damage risk, public/stakeholders expectations)

ANALYSIS

Based on our initial understating of the project requirements, here is our summary of the risks associated with pursuing a design-build contract based on a 30% design level with respect to rock slope design and construction.

1. The approach of the current design is to improve the resiliency of US 34 by moving select locations of the alignment into the rock slopes, resulting in more of the roadway being constructed upon a stable bedrock platform.

   RISK: Due to the high cost associated with constructing rock cuts and the difficulty of accessing the tops of slopes, the design-build based on a 30% design may choose to avoid much of the rock slope construction and forego the resiliency improvements.

2. Several locations along the US 34 have experienced numerous rock slides in the past. Most of these locations did not use proper cut slope design (slope angle, ditch catchment, rock bolts) and were constructed based on speed and short-term cost, not long-term performance. Many of these locations have been repaired repeatedly.

   RISK: Most design-build contracts do require a warranty period following the substantial completion of the project. However, many of the problems associated with the construction of rock slopes are not realized until several years after construction. The cost of maintenance, public safety, and prolonged closures of the road are long-term effects of poor cut slope design and construction. Through a traditional design-bid-build or CMGC contract, CDOT has more control over the design and the long-term performance of the of the rock slopes.

   A recent example is the Central City Parkway that connects I-70 at the Hidden Valley exit to the Central City gaming district. This design-build project has experienced several slope failures in the embankments and rock slides from the cut slopes after the warranty period had expired. In September of this year, a large slide occurred at one of the rock cuts, closing the road for weeks. The cost of cleaning the road, removing the slide material, and lost revenue due to the road closure was not anticipated by Central City.

3. Whereas roadway and bridge design may lend itself to writing clear design-build performance criteria at the 30% level, geotechnical related features such as embankments and rock slopes are more difficult to develop using design and performance standards.

   RISK: There are no true design standards for rock slope design and rockfall mitigation. Currently, a task force comprising CDOT, FHWA ,and private industry is trying to develop a means to determine the sufficiency and level of rockfall mitigation measures based on the rock slope rating system of the existing cuts. The process for determining the performance requirements has not yet been determined or properly vetted. The risk is that there will be disagreement between the owner (CDOT) and the contractor on the adequacy of the measures used to stabilize the new cuts and provide sufficient rockfall mitigation.

4. The geotechnical information gathered for the 30% design submittal will be limited and the contractor will not be able to develop additional data prior to their submittal to CDOT. A higher level of unknowns on a project increases the level of risk to the contractor and owner, leading to undesirable surprises during the design-build phase. These risks may translate into higher bid costs or change orders and perhaps less flexibility to address issues that arise during construction.

RISK: Basing a design-build contract on a 30% level of design means there will be a significant degree of project unknowns and risk, which may translate into higher bid costs or change orders and less flexibility to address issues that arise during construction.

5. Effective rock slope designs that fit within the context of the setting require consideration of stakeholder concerns, particularly those involving aesthetics, safety, and cost. One of the challenges in any type of rock slope design is developing a cut slope that meets long-term stability objectives, while balancing a desire to create natural looking slopes. The designer and engineer must establish an understanding with the stakeholders to address all of the aesthetic, safety, and cost considerations of the improvements. A successful project involves gathering all stakeholders early in the scoping and design process to prevent confusion, disagreements, and delays.

   RISK: The objectives of the project from the contractor's perspective are often different than those of the stakeholders. Design elements requested by the stakeholders may not be implemented due to time and budget constraints as the project develops.

RECOMMENDATION

CDOT has completed many corridor improvement projects with extensive rock cuts, using the traditional design-bid-build method. Projects such as US 160 Wolf Creek, US 40 Berthoud Pass, SH 82 Snowmass Canyon, US 50 Bighorn Canyon, and others used a traditional approach where CDOT maintained control of the design and construction process. This resulted in corridor projects that have improved safety and mobility while decreasing maintenance of slopes and roadside ditches.

More recently, the I-70 Twin Tunnels project also required the construction of large rock cuts and followed a CMGC project delivery method. The design team was able to develop the design alongside the contractor, which helped meet the objectives of long-term performance of the slopes for CDOT, while working with the contractor's abilities and expertise. Both delivery methods have allowed CDOT to maintain control of the design and utilize stabilization and excavation methods that meet the department's long-term performance expectations. The design-build delivery method may not provide these benefits.

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Attachment D

DATE: 11/12/14

FROM: US 34 Hydraulics Design Team including Jacobs, Muller and Ayres

TO: James Usher, US 34 Project Manager

RE: US 34 Hydraulics Design (SBAR)

SUBJECT

As the decision is being contemplated for a delivery method for the US 34 Permanent Repair Project, the Hydraulics Design Team was asked to look at the risks of only taking the hydraulics design to 30% as is typical with a design/build delivery method. This memo summarizes the Hydraulics Team's review of the risks of design/build from a hydraulics design perspective and provides our recommendation.

BACKGROUND

A 30% design plan set for the US 34/Big Thompson River improvements will focus on those features that help define approximate ROW needs, environmental impact limits, and portray basic design elements for budgetary purposes, such as:

- Initial plan view layout of US 34 with major drainage cross culverts
- Toe/top of fills and cuts for roadway
- US 34 profile and typical sections
- Approximate water quality pond locations and footprints (if required)
- Bridge general layouts, plan/profile
- Basic intersection design, plan view only
- Concept layout/footprints of river design work (bank protection, grade control structures, river grading and shaping)
- Geotechnical investigation

Specific risks associated with 30% design level are described in more detail in the following sections but are outlined here (category of impact shown in parentheses:

- ROW/PE may not be accurately identified (cost)
- Impacts to private property not accurately identified (cost)
- Not all design features identified and quantified (cost)
- Proposed floodplain/floodway and associated impacts from construction not clearly identified (such as need for CLOMR, etc) (schedule and cost)
- Importance of river stability in relation to road stability not conveyed and/or constructed as envisioned (roadway damage risk)

ANALYSIS

Here are the Hydraulics Design Team's initial thoughts regarding the risks associated with pursuing a design-build contract based on a 30% design level.

1. The current design team is operating with the understanding that design for the permanent repairs of US 34 will benefit from integrating the function, stability, and health of the Big Thompson River with the requirements of the roadway. The resiliency of US 34 will benefit from increasing the overall stability of the river system, and configurations that are good for the river will tend to be good for the road.

   RISK: Design-build based on a 30% design may take this optimization of interrelated roadway and river design out of CDOT's hands and could lead to an over-emphasis one of the elements and an under-emphasis on the other, which could be to the detriment of both the river and roadway.

2. The Floodplain Development Permit from Larimer County is an essential requirement for the project. The permit will be relatively easy to obtain on a short timeline, but only if the project can be shown not to cause a rise in the 100-year flood profile. It is unlikely that the entire Permanent Repair can be designed and constructed to result in a no-rise condition, though it may be feasible to define no-rise sections of the repair for staged floodplain permitting and construction.

   An important question, and one that is complicated in the post-flood context, is what should be the baseline for no-rise comparison. Last month the CWCB issued a memo with guidance for hydrologic and hydraulic analysis in flood-affected areas. From that memo we conclude that hydraulic analysts have a choice of baseline conditions that can be used depending on the project and the situation. For the US Highway 34 project, the most likely baseline condition will be "Pre-Flood 2013" in some river reaches and "Post-Flood Pre-Repair" in others. The baseline will have to be chosen very carefully for this project, and will likely vary from one reach to another.

   Whichever baseline is chosen, the proposed project design either has to result in no rise, or it will be necessary to submit a CLOMR to FEMA, and to have it approved, before construction can begin. This requirement is derived from the federal regulations, 44CFR65.12. It is not optional for the County. Once a CLOMR package is submitted to FEMA, it can easily take 6 months or more for the approval to be issued. If the project is shown to cause a rise that will affect any existing insurable structure, the CLOMR will not be approved unless the affected structure is acquired and demolished. Clearly this requirement can be expected to impact the project schedule.

   It is our experience that the process of achieving a no-rise design and/or processing a CLOMR through FEMA is most efficient and least impactful to the schedule when the hydraulic engineers work closely and continuously with the highway designers. Design changes should be analyzed hydraulically as they are being developed and modified as necessary to achieve a no-rise condition if feasible. The engineers currently developing the HEC-RAS models and two-dimensional models will be most capable of analyzing design changes in an agile, responsive way as the design moves through its stages, because of their familiarity with the models. They will also be the most adept at frequently communicating with the County's floodplain administrator and getting his buy-in at critical junctures. It is unlikely that the design or the hydraulic analysis will be far enough at the 30% stage to ensure a compliant final design.

   Assuming that portions of the project can be feasibly designed to result in no-rise with respect to baseline conditions, it may be desirable to stage or segment the permanent repair to facilitate

project progress while obtaining permits for reaches requiring CLOMR approval. This segmentation may not be adequately defined by 30% design hydraulic analysis.

RISK: Turning the design and hydraulic responsibilities over to DB teams at the 30% level will reduce the efficiency in the process of ensuring floodplain compliance, potentially leading to major delays in obtaining the Floodplain Development Permit from the County.

3. It is our understanding that the resiliency standard for the project has not yet been firmly established. We also get the impression that the process of negotiating the reimbursable resiliency level with FEMA will be highly iterative throughout the design process. This "moving target" situation is not suitable for a DB context in which the DB teams are expected to provide a firm maximum price estimate based on the performance criteria and design parameters provided at the 30% design level.

   The two-dimensional models currently being developed will be essential tools in finalizing the design of protection for road embankments and walls once the appropriate resiliency standard has been identified. We expect, however, that this finalization will not be feasible until well after the 30% design stage. The engineers currently developing the two-dimensional models will be the most proficient at using those models to develop the final design of protection.

   RISK: The federally-reimbursable resiliency design standard will not likely be firmly established until well after the 30% design stage. This will create a moving target for hydraulic design, which is not amenable to the DB design development process. Also the efficiency of the design process for hydraulic protection may suffer if it is turned over to DB teams at the 30% design level.

4. In order to achieve design standards for US 34 such as elevating the profile above the 100-year water surface, the entire river needs to be studied and modeled, even if the river alignment is some distance away from the roadway alignment. Also, river improvements that may be necessary to mitigate fisheries impacts that occurred during the flood and emergency repair work and additional river improvements funded by other agencies to meet environmental goals need to be reflected in this modeling. This process will take time and close coordination (likely will not be complete at 30% design level); flexibility to coordinate this work may be hindered in a design-build phase that is based on 30% design.

   RISK: Design, coordination, and modeling of river improvements to meet environmental goals and assure that standards are achieved for US 34 will likely not be complete at 30% design level, potentially leading to less flexibility to coordinate and implement the work during the design-build phase.

5. Whereas the roadway and bridge design may lend itself to writing clear design-build performance criteria at the 30% level, river-related work (including improvements to help protect the roadway embankment) is not able to be as clearly described in terms of performance criteria. It is better to design improvements exactly like they need to end up looking and to even maintain control during the construction phase to make field adjustments as needed, to obtain the desired final product.

   RISK: River-related work, including improvements to protect the roadway embankment, is not easily described in design-build performance criteria at the 30% level, increasing the risk that the desired final improvements will not be achieved.

6. The level of unknowns on a project increase the level of risk which is borne by the contractor and owner, which may lead to undesirable surprises during the design-build phase – these risks may

translate into higher bid costs or change orders and perhaps less flexibility to address issues that come up. There will still be a lot of unknowns at the 30% design level associated with floodplain analyses and permitting, right-of-way and easement definition, bank protection design, private accesses, minor drainage system design, water quality and erosion control, scour protection, and cross section design.

RISK: Basing a design-build contract on a 30% level of design means there will be a significant amount of project unknowns and risk, which may translate into higher bid costs or change orders and less flexibility to address issues that come up.

RECOMMENDATION

There are other project delivery systems besides design-build that may be beneficial to consider for the construction of US 34 permanent repairs. In addition to the CDOT experience with the Construction Manager/General Contractor (CMGC) approach, variations of CMGC are being used very successfully by other project owners. For instance, Fort Collins Utilities has constructed $150 million in improvements over 15 years under its Alternative Project Delivery System (APDS) with a *negative* $4.5 million in change orders, no claims, lawsuits or late projects. The Urban Drainage and Flood Control District has implemented a Project Partners approach modelled after Ft. Collins' APDS and is finding it very beneficial. UDFCD selects contractors on large projects based on a Best Value Bid from three pre-selected contractors based on a 30% or higher level of design plus a number of other selection criteria and potentially an interview. Once on the design team, contractors provide input on constructability, risk factors, and cost so that designs are optimized and costs are known. Actual construction work can begin before the design in completed and subsequent work orders written as design phases are completed.

Using design-build based on a 30% design eliminates alternative project delivery systems that aim at a high level of owner control, reduction of unknowns and risk, and contractor input on constructability and costs. From a hydraulics design standpoint on a project such as this that so tightly integrates the roadway design with the hydraulics design of the river, it is our recommendation to take the hydraulics well past a 30% design level to help reduce some of the risk involved with the river and its impact to the roadway design. Moving away from a design-build delivery method and looking into other project delivery systems improves the chances of achieving resilience for both the roadway and the river, accommodate stakeholder involvement in regard to river enhancements, and building acceptance of the project in the eyes of the stakeholders and the general public.

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DATE: November 12, 2014

TO: James Usher, CDOT Region 4 Project Manager, Loveland Residency

FROM: Steven Griffin, Region 4 Hydraulics Unit

SUBJECT: 20279 US 34 Canyon Permanent Repair Project - Response to Hydraulics/Drainage Letter by US 34 Canyon Hydraulic Design Team

James,

I am in receipt of the letter dated November 12, 2014 from the US 34 Hydraulics Design Team of Jacobs, Muller, and Ayres addressed to you, regarding the US 34 Hydraulics Design (SBAR). Below is my response as the CDOT Region 4 Hydraulics Engineer.

ANALYSIS

The risks, numbered 1 through 6, are valid risks associated with carrying this project forward into a Design-Build project delivery method with the Hydraulics, Minor Drainage, and River Stabilization/Rehabilitation tasks at only a 30% overall level of design.

I share the Team's concern that the contract documents/technical requirements may inadequately address the hydraulic/drainage unknowns on the project at a 30% level, which very easily could translate into high bids, inconsistent work, and the lack of flexibility for CDOT to remedy undesirable/adverse design decisions on the part of the design-build Contractor (Risks # 5 and 6).

My previous experience on modified design-build hydraulic projects (i.e. 19441 SH 14 High Park Fire Response; 15548 US 34 Upper Canyon BR Replacements) was such that significant pre-bid hydraulics and drainage work (80-90%) needed to occur in-house at CDOT to assemble an adequate technical requirements package for the Contractor. Even then, the Contractors still came up with "surprises" that, while fitting within the actual content of the technical requirements, nevertheless did not reflect CDOT's desires and caused complications with environmental permitting, floodplain permitting, and overall functionality of the hydraulic structures (Risks # 2, 4, 5, and 6).

In addition to the Risks which the Team has identified in their correspondence, I would like to expand upon the Project's need to coordinate closely with individual landowners along the US 34 canyon project. As part of the Emergency Repair work, Gray Currier (Project Engineer) and Scott Ellis (Loveland Resident Engineer) did an outstanding job cataloguing areas of slope instability, erosion, and inadequate cross-drainage and side-drainage within and immediately adjacent to CDOT right-of-way. The communication with the affected landowners has almost always included the provision that these issues would be analyzed in greater detail as part of the Permanent Repair project in the canyon. However, it may not be possible to fully analyze each of these locations and provide CDOT's potential solution(s) in time to prepare the technical requirements for a design-build effort. Further, these solutions will, by their nature,

require close and repeated coordination with the individual landowners to ensure a successful result for the State of Colorado's interests as well as the landowner. A risk of the design-build process (Risk #1) is that control of this process may be removed from CDOT, and it may be difficult to ensure that the Contractor works in a positive fashion with the multiple private interests throughout the canyon to solve the drainage issues directly related to the flooding of September 2013.

RECOMMENDATIONS

I concur with the Team's recommendations. In short, the hydraulics, minor drainage, and river stabilization/rehabilitation tasks should be taken well past a 30% design effort to reduce the risk to the Contractor and to State interests. Delivery methods other than a design-build approach will likely improve the chance of success for these drainage related tasks, and lead to a more favorable outcome for CDOT's interests as well as FHWA.

OPPORTUNITIES

Over the past year, I have been able to discuss the September 2013 flood event with my counterparts in several other state DOTs, as well as hydraulic engineers at FHWA and FEMA stationed throughout the country. Many of them have expressed an eagerness to see how the Colorado Department of Transportation chooses to proceed on the Big Thompson Canyon repair work.

CDOT has an unprecedented opportunity, on a national stage, to champion a holistic approach to highway infrastructure - one which blends the safety and needs of the traveling public with a healthy river system and, at the same time, is able to minimize and mitigate any unintended adverse drainage conditions on behalf of its private and public neighbors. By choosing the delivery method which maximizes CDOT's control and discretion over the hydraulic design and construction process, this agency will be able to maximize that unique opportunity.

Regards,

Steven Griffin, P.E., CFM
CDOT Region 4 Hydraulics Engineer