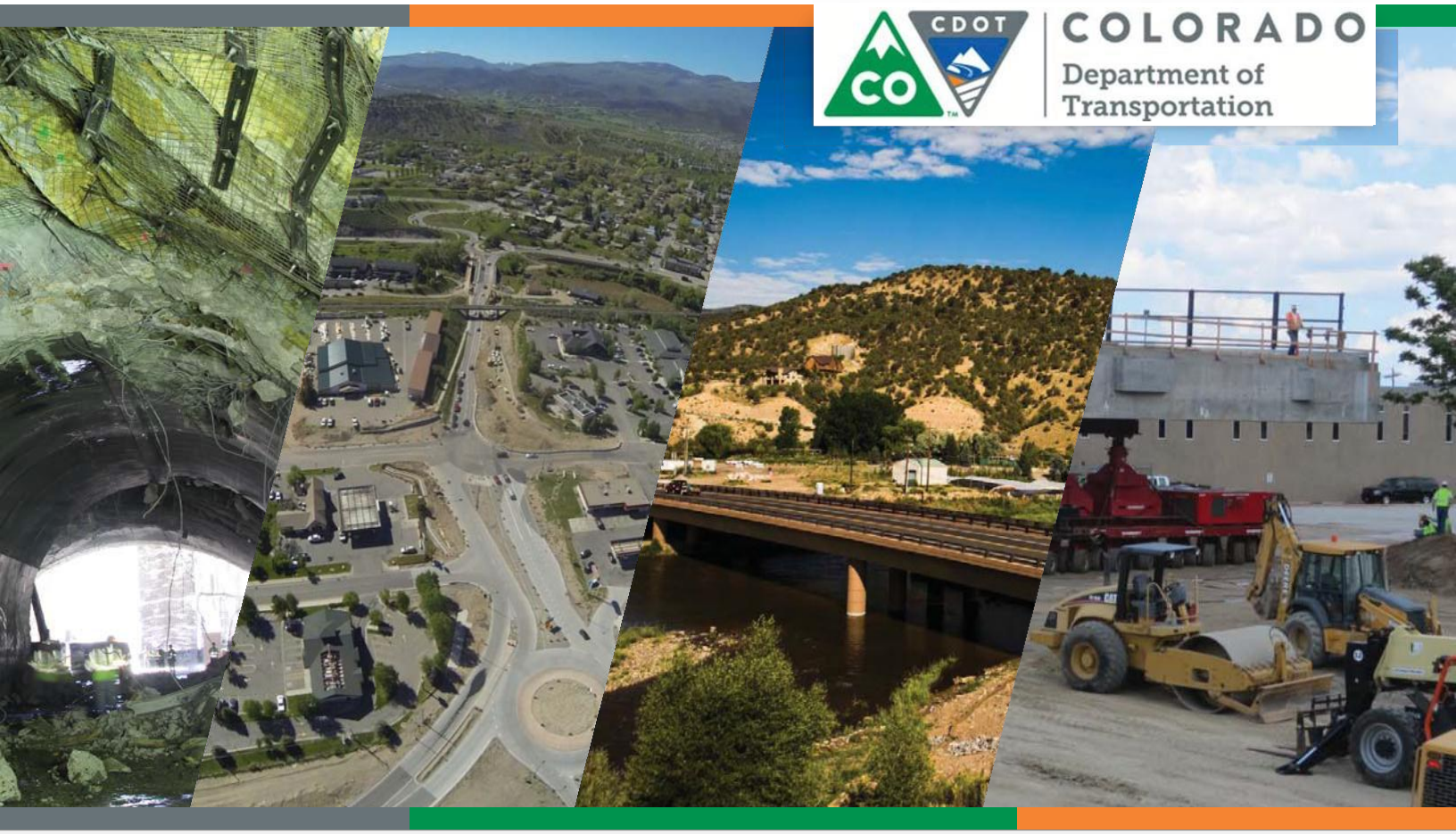

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Department of Transportation

(CMGC) Construction Manager/General Contractor

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Colorado Department of Transportation
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1 Chapter 1: CMGC Current Practice

1.1 Preface

The Construction Manager/General Contractor (CMGC) project delivery method has been used across the United States since the late 1990s. CMGC is based on a similar project delivery method called Construction Manager at Risk (CMAR or CM@Risk) used in the vertical construction industry. CMAR utilizes a Construction Manager (CM) to provide pricing, constructability reviews, and risk analysis during design development. The CM negotiates a lump sum Guaranteed Maximum Price (GMP) for the construction, and after an Owner accepts the GMP, the CM manages over the construction, hiring subcontractors to perform up to 100 percent of the work.

CMGC utilizes the same early contractor involvement as CMAR, however, during construction the Contractor becomes the prime or General Contractor and self performs a significant percentage of the work. The CMGC Contractor does not become a CM; instead the Owner supplies construction management through its own staff or a consultant. Another primary difference with CMGC is that the contract often includes both lump sum pay items, and items that will be measured and paid for on a unit price basis.

The City of Phoenix and the State of Arizona began CMGC adoption in the late 1990s and the Utah Department of Transportation followed in 2003. According to the Federal Highway Administration (FHWA), as of 2014, 16 states have passed some form of CMGC legislation and other states are exploring ways to make CMGC available for use on more projects.

CMGC in transportation projects has evolved distinct differences from the CMAR delivery used for vertical construction. The CM in transportation projects self-performs a majority of the Work as the Prime or General Contractor, whereas the CM in vertical construction manages multiple Contractors who perform the Work. For vertical construction the contract is often managed as time and materials, whereas transportation projects are most often negotiated toward a guaranteed maximum price using Independent Cost Estimates to verify competitive pricing.

The Colorado Department of Transportation (CDOT) began using CMGC in 2009 with the 2400V Switchgear Replacement Project at the Eisenhower Johnson Memorial Tunnels complex and has since used CMGC to deliver 10 more projects. These projects include tunnels, bridge replacements, advanced bridge construction methods, and complex traffic phasing. The high-risk, complex nature, and schedule-driven goals of these projects have required the early involvement of a Contractor for the successful development and construction of each project.

This manual is for use by Contractors, Consultants, and CDOT personnel to better understand the steps required to deliver a CMGC project from initial project scoping to construction completion. Chapter 1 of the manual provides a brief overview of the CMGC process, and the benefits and challenges of CMGC

project delivery. Each CMGC project has different challenges, details, risks, and goals, but the overall steps are the same for each project.

1.2 Federal Laws, State Legislation, and Regulations

The federal surface transportation bill Moving Ahead for Progress in the 21st Century Act (MAP-21) was signed into law July 6, 2012, and authorizes the use of the CMGC contracting method for delivering federal-aid projects. With the passage of MAP-21, Special Experimental Project No. 14 (SEP-14) approval is no longer required for state departments of transportation to use CMGC after October 1, 2012. Section 1303 of MAP-21 requires the FHWA to promulgate regulations as are necessary to implement the statutory provisions. FHWA anticipates issuing a Notice of Proposed Rulemaking for those regulations in 2014.

At the State level, Colorado has developed regulations for Integrated Project Delivery (IPD) that govern CMGC delivery. The key features of the regulations are that they define IPD as a project delivery method between an agency and a single entity for any combination of design and construction, and provide for the agency to select the entity that provides the best overall value to the State.

See the **Appendix** for full copies of the MAP-21 Act and the Colorado Revised Statute §24-93-101, Integrated Project Delivery Method for Public Projects Act.

1.3 Current CMGC Practice

1.3.1 Federal Practice

Every Day Counts (EDC) is the FHWA's initiative to advance a culture of innovation in the highway community in partnership with the States. Through this collaborative, State-based effort, FHWA coordinates rapid deployment of proven, market-ready strategies and technologies to shorten the project delivery.

EDC-2 Innovations, which include CMGC, are specific initiatives selected for deployment over a two-year period (2013-2014). The objective of the CMGC initiative is to increase the rapid deployment of Alternative Contracting Methods (ACMs) and harness innovation through early Contractor involvement while providing public Owners and industry with the knowledge, tools, and skills to successfully implement CMGC as a contracting method.

1.3.2 State Departments of Transportation Practice

State departments of transportation (DOTs) continue to promote CMGC as a viable project delivery method. According to the FHWA, 16 states have legislation enabling them to use CMGC project delivery and 12 states have CMGC experience including Alaska, Arizona, Colorado, Florida, Maine, Maryland, Michigan, Minnesota, Nevada , Oregon, Utah, and Vermont.[1] This is a marked increase from statistics shown in the 2010 Transportation Research Board's National Cooperative Highway Research

[1] FHWA Alternative Contracting Methods Library (2013, May) Retrieved from http://www.fhwa.dot.gov/construction/contracts/acm/cmgc.cfm

Program (NCHRP) Synthesis 402: *Construction Manager-at-Risk Project Delivery for Highway Programs: A Synthesis of Highway Practice,* which stated that only five state DOTs had experience with CMGC.[2]

Public agencies within the State of Arizona were among the early adopters of the CMGC delivery method for transportation projects. The NCHRP Synthesis 402 notes that as of 2009 the Alaska, Arizona, Florida, Oregon and Utah DOTs also had experience with CMGC, with UDOT having used CMGC for 16 projects.[3] Since the 2010 report, additional DOTs have begun to add CMGC delivery to their methods of project delivery.

The forthcoming NCHRP Project 10-85: *A Guidebook for Construction Manager/General Contractor (CMGC) Contracting for Highway Projects* is expected to provide additional guidance for state DOTs to implement CMGC project delivery.

1.3.3 CDOT Practice

CDOT began using CMGC in 2009 with the 2400V Switchgear Replacement Project at the Eisenhower Johnson Memorial Tunnels complex and has since used CMGC to deliver 10 more projects, as of February 2014. These include:

- 2400V Switchgear Replacement
- I-70 Twin Tunnels Eastbound
- I-70 Twin Tunnels Westbound
- Pecos Street over I-70 Bridge Replacement
- SH 266 and SH 71 Bridge Replacement North of Rocky Ford
- I-70 Bridge Replacement in Dotsero
- I-70/Eagle Interchange
- Grand Avenue Bridge in Glenwood Springs
- I-70 Eastbound Peak Period Shoulder Lanes
- I-25/Arapahoe Interchange

Additional Colorado local agency transportation CMGC projects include I-25/Meadows Drive Interchange in Castle Rock, the City of Arvada RTD Transit Facility, and 6th Avenue/19th Street for the City of Golden.

CDOT has developed a number of aids for CMGC that are available on the Innovative Contracting web page. The web page provides two PowerPoint presentations: "CCA CMGC 101: An Introduction to the Construction Management/General Contractor Delivery Method," dated May 18, 2012, and "CMGC 101: Construction Manager/General Contractor Delivery Method," dated November 2, 2012. Both presentations are joint documents between CDOT and the Colorado Contractors Associations (CCA) and cover the following topics:

[2] Douglas D. Gransberg and Jennifer S. Shane, *Construction Manager-at-Risk Project Delivery for Highway Programs: A Synthesis of Highway Practice,* NCHRP Synthesis 402 (Washington, DC: Transportation Research Board, 2010): 17, http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_syn_402.pdf.
[3] Ibid.

- CMGC Basics
- CDOT Project Delivery Selection Matrix
- CDOT Selection Panel
- Pre-Ad and Pre-Proposal Efforts
- CMGC Procurement
- Request for Proposals
- Interview Process
- Debriefings
- CMGC Preconstruction Phase
- CMGC Estimating and Construction Agreed Price (CAP)

The web page also provides links to CDOT's *Alternative Contracting Process – SEP-14 Construction Manager/General Contractor (CMGC) Annual Reports.* These reports summarize CDOT's CMGC activities in accordance with their established SEP-14 work plan. The reports review each of CDOT's CMGC projects on eight key evaluation factors established by CDOT's risk-based project delivery selection matrix: (1) Delivery Schedule, (2) Project Complexity and Innovation, (3) Level of Design, (4) Initial Project Risk, (5) Cost, (6) Staff Experience/Availability, (7) Level of Oversight and Control, and (8) Competition and Contractor Experience. The reports also provide project summaries that highlight lessons learned.

For a current list of CDOT's innovative projects, and the most up-to-date CMGC information, visit CDOT's Innovative Contracting web page: http://www.coloradodot.info/business/designsupport/innovative-contracting-and-design-build

1.4 Description of CMGC and Other Methods of Delivery

For all but the largest of projects, CDOT primarily employs three types of project delivery methods: (1) traditional Design-Bid-Build (DBB), (2) Design-Build (DB), and (3) CMGC. The delivery methods differ in the contractual relationship between CDOT, the contractor, and designer as represented in **Figure 1-1.**

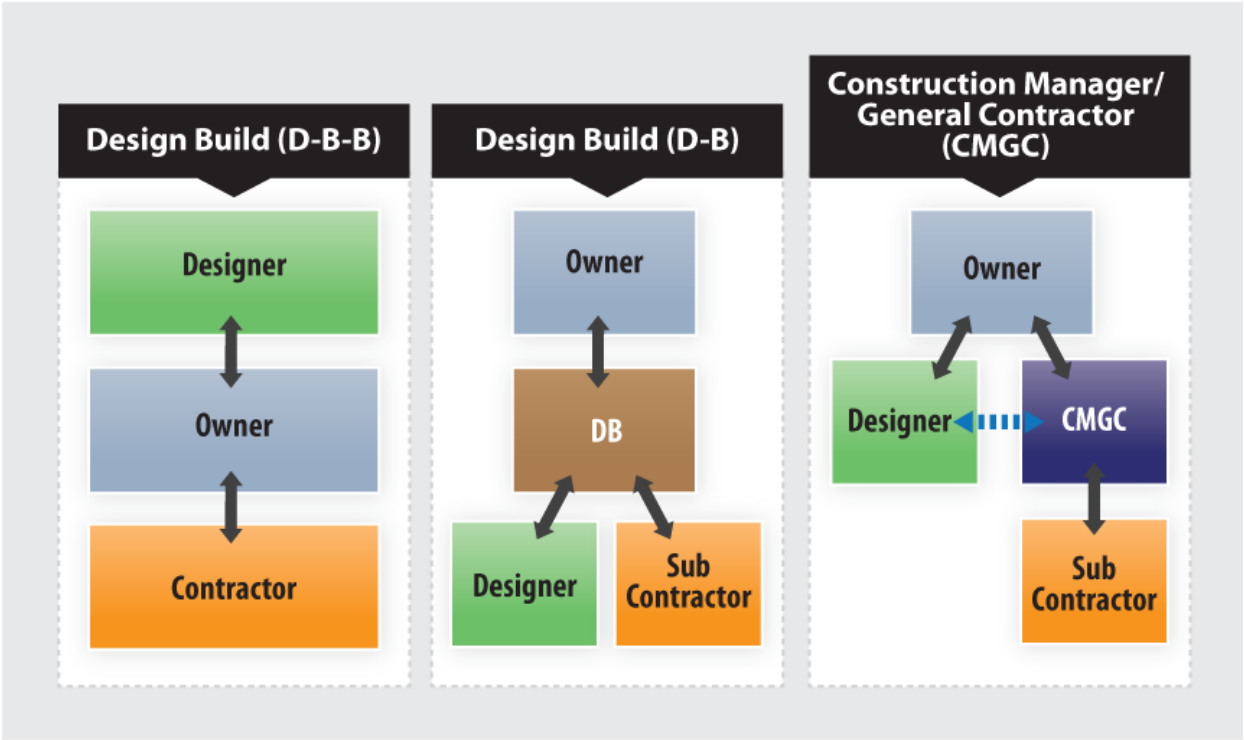


Figure 1-1. Project Delivery Methods Contractual Relationships

1.4.1 Design-Bid-Build

DBB has been the most utilized project delivery method and continues to be the method most used by CDOT. Most CDOT staff members are very comfortable with DBB and familiar with the way it works. The linear nature of planning, Preconstruction, and Construction phases is well known and practiced. In this delivery method, CDOT staff or consultant staff design a project and when construction plans are complete, the project is let for bids to the construction industry. Typically the lowest bidder wins the project and then construction occurs under CDOT oversight. Using this delivery method, CDOT allocates the majority of the responsibility for risk to itself.

1.4.2 Design-Build

DB is one of the more recent alternative project delivery methods that began in the 1990s at CDOT and has since become a highly used delivery method. In DB, the Owner procures a DB team (a paired Contractor and Design Consultant) with a GMP or best-value procurement package. The selected DB team takes the preliminary design to prepare the final design for the project. When construction packages are ready, the contractor builds the packages until the project is complete. During this delivery

method, the majority of the responsibility for the design and construction is allocated to the selected DB team. However, for it to be effective the Owner needs to recognize risks that it is better able to manage, and properly allocate all of the project risks to the party best able to manage them.

1.4.3 CMGC

In CMGC, the Owner is the primary Project Manager much like in DBB. However, with this method, the Owner takes on new roles while managing separate contracts with a selected CMGC Services Contractor and its Design Consultant team. The Owner must act as facilitator, negotiator, decision maker, collaborator, manager, and leader and must be an active participant in every step of the Preconstruction and Construction phases. Strong Project Managers are required for CMGC to work well and the majority of CDOT Project Managers have only one project assigned to them at one time.

A major factor in determining the selection of the CMGC Contractor is the ability of the Contractor to analyze the project goals, evaluate the Work elements, and formulate a proposal. This process may produce new approaches or modification to the project Work elements. Because of that, all Contractors should be aware that the final scope of Work for a project will be produced with input from CDOT, the selected Design Consultant, and the selected Contractor.

CMGC Project Managers make the final decisions on budget, design, and construction methods and must be able to make risk-based decisions on short timelines to meet project deadlines. CMGC Project Managers must also be able to question the design, estimates, and construction decisions.

The CMGC team relies on the Contractor to bring the following expertise to the project during the design phase:

- The skills and knowledge to estimate the quantities of materials, labor, and equipment needed to construct the project
- The skills and knowledge to determine the tasks needed to complete the project and to estimate the costs, duration, and sequence of these tasks
- An understanding of the availability, cost, capacities of materials, labor, and equipment
- The skills and knowledge to identify potential risks (including financial risks) and methods or solutions to mitigate them during the design process
- The skills and knowledge to review the design plans and provide suggestions and methods to improve the design for constructability, add innovative value engineering solutions, maximize scope, and optimize schedule and cost.

Once a construction contract is executed, the Contractor's role changes to that of a General Contractor (GC) during construction. This is a very traditional role and is similar to the responsibilities of a GC on a DBB. The Contractor also manages its own risk that it assumed responsibility for or is sharing with the Owner.

1.5 CMGC Frequently Asked Questions (FAQs)

i. What kind of project is optimal for using the CMGC project delivery method?

The optimal project has one or more of the following requirements: a high level of technical complexity, the need for a high level of risk management, complex phasing, the need for overall schedule acceleration, phased funding, and budget constraints requiring construction cost guarantees. Optimal projects may also require the Owner to retain project decision control over some or all of the design and construction. The CDOT Project Delivery Selection Matrix is the best available tool to use to determine the optimal project delivery method for a particular project.

ii. What are the benefits of CMGC project delivery?

The benefits of CMGC project delivery include schedule acceleration of Long Lead-Time Procurement (LLTP) phases, early Contractor involvement, cost savings through innovation and Value Engineering, team collaboration, production-based estimating, risk elimination and sharing, and improved third-party interaction.

iii. What are the challenges of CMGC project delivery?

CMGC projects can be challenging when there are schedule driven aspects of the project, cost estimating is not performed proactively, or the Owner-Project Manager does not have the experience to make quick, effective decisions or mediate disagreements between team members.

iv. What are the main similarities between DB and CMGC?

- Both DB and CMGC can accelerate the design and construction schedule.
- Both DB and CMGC foster partnerships and team building.
- Both DB and CMGC provide ways to bring innovation to the project.
- Both DB and CMGC can provide Value Engineering solutions to save on construction costs.
- Both DB and CMGC bring collaborative teams to the project.

v. What are the main differences between DB and CMGC?

- In DB there is one contract to manage with a DB team. In CMGC, there are two contracts to manage with the Design Consultant and the Contractor.
- CMGC construction packages must be biddable and severable whereas DB construction packages can be released for construction at any time.
- CMGC requires a much shorter two-step procurement process requiring a technical proposal and interview whereas DB processes can require anywhere from 4 to 12 months to prepare procurement documents and execute the procurement, depending on the characteristics of the project.
- The Owner-Manager for a CMGC must be heavily invested in the management and leadership of the Preconstruction Phase. In DB, the majority of the effort is in the procurement phase. During the preconstruction and Construction phases the Owner manages the final product and helps maintain the document system.
- In a DB procurement, an Owner can request Additional Requested Elements (AREs) and Alternative Technical Concepts (ATCs) during the procurement phase. In CMGC, the Owner

requests a list of innovations and carefully examines a Contractor's approach to CMGC and the project. During the Preconstruction Phase, the Owner gets ATCs from just one Contractor but can design to the means, methods, and strengths of that Contractor for cost and schedule savings.

- In a typical DB, more risks are allocated to the Contractor. In CMGC, the risks are discussed, negotiated, allocated, and shared as the project team collaborates on decisions to eliminate or mitigate the risk. Risk pools are used to allocate the risk.

vi. What is the CAP and LLTP CAP?

The Construction Agreed Price (CAP) is a price to complete the construction work submitted by the CMGC Services Contractor at the end of a Preconstruction Phase or when a construction package is at a high stage of completeness, typically 80 percent or greater. If the CAP and the ICE Estimate are within a percentage difference acceptable to CDOT (and the FHWA if it is a Project of Division Interest) then the Contractor will receive the opportunity to construct the project. The Long Lead Time Procurement Construction Agreed Price (LLTP CAP) is a price submitted by the CMGC Service Contractor for items that must be ordered and/or procured in advance of the construction phase for which it will be used. The CAP and LLTP CAP include the cost of the bid items with the CMGC Management Price Percentage applied to each item. The CAP and all force account items will be the maximum Contractor amount for the construction contract. The CAP process and flow chart is detailed in Chapter 4 of this manual.

vii. What are the main differences between DBB and CMGC?

- In CMGC, CAP discussions can start with the Contractor at under 100 percent PS&E. In DBB, a 100 percent PS&E package is developed and completed before a project is awarded to the lowest bidder.
- The Owner takes on most of the risk allocation in a DBB whereas in CMGC the risks are discussed, negotiated, allocated, and shared as the project team collaborates on decisions to eliminate or mitigate the risk. Risk pools are used to allocate the risk.

viii. Why are risk-based decisions a major part in a CMGC project delivery?

The CMGC delivery method allows the flexibility to assign risk to CDOT, the Contractor, and to develop a shared risk pool. The success of the project greatly depends on properly identifying risks and allocating them to the best entity that can manage them. Therefore, risk management must be involved in each stage of the project delivery and decision-making process.

1.6 CMGC Processes at CDOT

The CMGC delivery method has five major project phases:

1. Risk Assessment, Development of Project Goals, and Project Delivery Selection
2. CMGC Services Procurement
3. Preconstruction Phase
4. CAP Proposals and Construction Contract Award
5. Construction Phase

Each phase is discussed later in this manual with steps and recommendations on how to deliver a CMGC project at CDOT.

1.7 CMGC/DB Project List

Projects that have been identified by CDOT for possible DB or CMGC delivery are submitted by the regions and listed on the Innovative Contracting Program website at:
http://www.coloradodot.info/business/bidding/cmgc-other-special-projects.html

A Project Delivery Selection Matrix Report and a contact person are included for each project.

1.8 CMGC Acronyms and Definitions

See the **Appendix** for a list of common acronyms and definitions.

2 Chapter 2: Project Selection and CMGC Procurement

Not all projects can and should be delivered with the CMGC project delivery method. With the time and resource investment required during preconstruction, each project needs to be carefully scoped and scheduled, project goals set, staff and resources considered, and an initial project risk assessment completed. These initial project development tasks should be completed before the method of delivery is selected for the project.

The project team needs to consider the following questions when determining whether to use the CMGC project delivery method:

- Is the project technically complex (e.g., Accelerated Bridge Construction (ABC), tunnels, mechanical/electrical facilities, vertical construction)?
- Are the project Scope of Work and technical requirements difficult to define?
- Are there high or medium risks on the project that are hard to quantify or define?
- Is there phased funding on the project that could allow early construction for portions of the project?
- Does CDOT control which risks are allocated to CDOT and to the Contractor?
- Are there complex phasing requirements on the project?
- Is the project schedule driven?
- Are there opportunities for innovation?
- Are there opportunities to find schedule and cost savings?
- Will the project benefit from early Contractor involvement?
- Has design not advanced beyond a point where the Contractor can provide input?
- Does CDOT want to maintain design decision control?
- Are qualified Contractors interested in competing for a CMGC project?

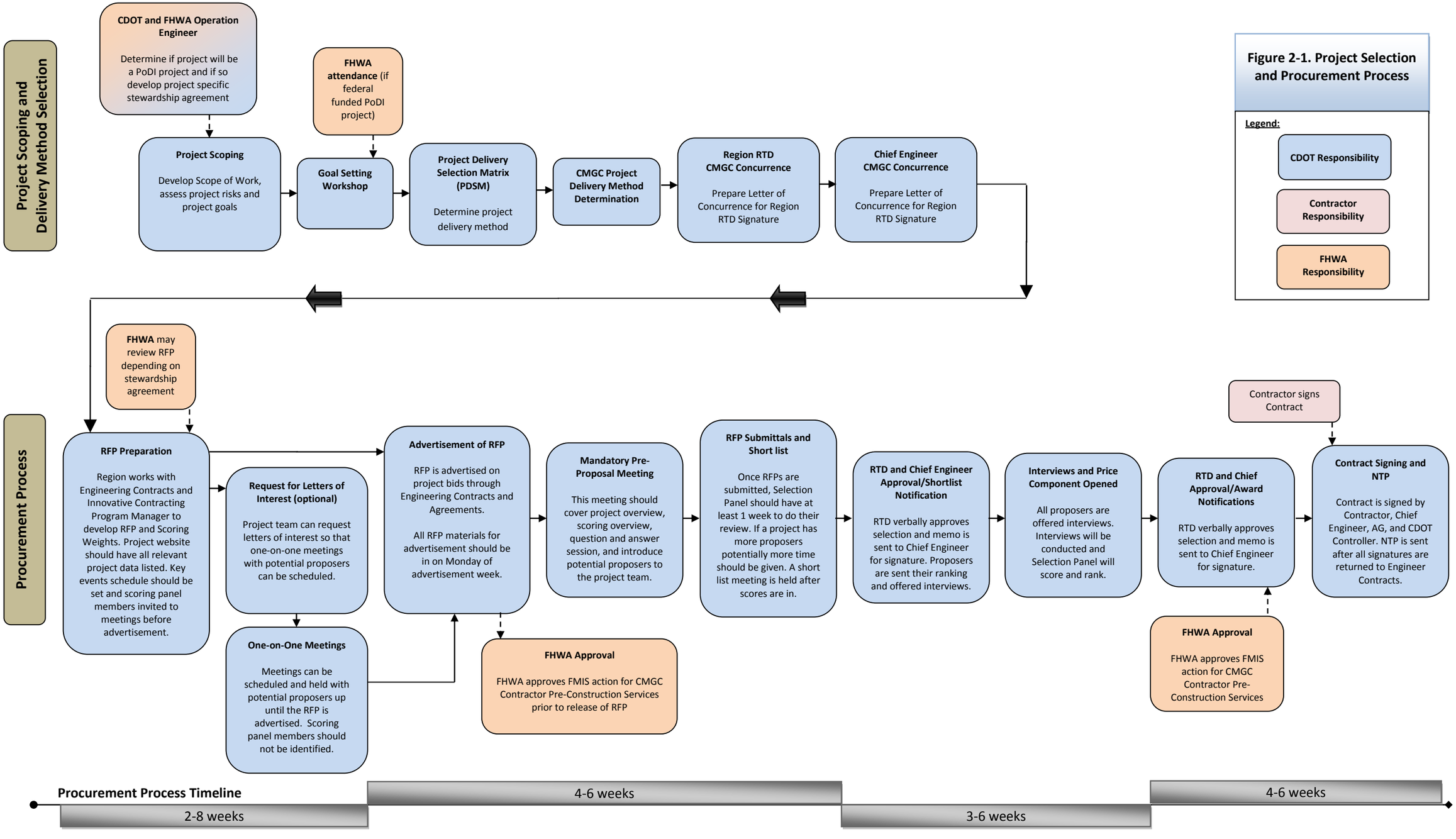
If the answers to many of these questions are yes, CMGC may be a favorable method of delivery. Regardless, a formal project delivery method selection should be performed, as discussed in Section 2.3 of this manual.

2.1 Project Selection and CMGC Procurement Schedule

The flowchart in **Figure 2-1** provides a general overview of the project selection and CMGC procurement process. The procurement process and schedule for CMGC projects are shorter than Design-Build (DB) and can be accomplished within approximately two to five months from the Request for Proposal (RFP) development to a Notice to Proceed (NTP) of CMGC Services.

Depending on the complexity of the project, the preparation of the RFP can take between two to eight weeks to get to advertisement, four to six weeks for Contractors to prepare proposals, three to six weeks for CDOT to evaluate proposals and interview short-listed Contractors, and four to six weeks to make a selection and negotiate a Contract.

Figure 2-1. Project Selection and Procurement Process



2.2 Initial Project Development

2.2.1 Identification of Funding and Schedule

CDOT prioritizes projects through the development and ongoing maintenance of the Statewide Transportation Improvement Program (STIP) as required by federal regulations. The STIP is managed by the Office of Financial Management and Budget (OFMB) and identifies budget categories and strategies for funding.

For a project to be included in the STIP it must be scoped and a total project estimate must be prepared. The Resident Engineer creates a draft baseline schedule that identifies key project Milestones and related activities, which is then reviewed by the CDOT specialty unit managers, and approved by the Region management team.

CDOT's project scoping and selection process is further described in the 2013 CDOT Project Development Manual.

http://www.coloradodot.info/business/designsupport/bulletins_manuals/project-development-manual/2013-project-development-manual/2013-project-development-manual.pdf/view

The project team should review the established project schedule and funding source (along with any associated requirements), as these may affect the project delivery method and the decision to use CMGC.

2.2.2 Scoping a CMGC Project

The scoping of a project should begin with the development and review of the project's goals and risks. The identified goals and risks can then be used to prepare the Project Delivery Selection Matrix (PDSM) and determine the best project delivery method. There are three steps in selecting a delivery method:

1. Establish project-specific goals.
2. Perform an initial project risk assessment.
3. Complete a PDSM.

When initially scoping a project for possible CMGC project delivery, the project team should consider the project schedule and resources available to manage the process. CMGC projects place a unique demand on project team members, especially at the management level, and require a high level of interaction between CDOT personnel, the Designer, and the Contractor.

The project team should review the project for elements that are most favorably managed by the CMGC project delivery method. These may include:

- complex construction elements that will benefit from Contractor input during the Design Phase of the project;
- portions of the project that can or need to be phased, or projects that require complex phasing;
- specialty skills or unique construction techniques such as ABC or tunneling;

- design decisions where project staff desires to maintain more control;
- projects that require a high level of Context Sensitive Solutions;
- expectations to have enough competition to ensure best value; and
- project risks that can be managed and reduced using CMGC.

A unique benefit of the CMGC delivery method is the ability to use the Contractor during design development to evaluate the work elements, formulate a project approach, and minimize project risks. This process may produce new approaches or modifications to the project work elements. Therefore, all contractors should be aware that the final Scope of Work for a project will be produced with input from the selected consultant and the selected Contractor.

2.2.3 Risk Identification and Analysis

"Risk" is defined as an uncertain event or condition that, if it occurs, has a negative or positive effect on a project's goals and objectives. Understanding which risks can and must be controlled by CDOT and which risks can and should be shared with the Contractor results in an efficient and effective bid package, a competitive bidding environment, and overall lower costs.

A primary benefit of alternative delivery methods such as DB and CMGC is the ability to contractually allocate risks to the party who is best able to manage that risk. A distinct advantage of the CMGC delivery method is that it provides a forum to communicate and discuss risk in the Design Phase, and to collaboratively address and reduce risk with the Owner, Contractor and Design Consultant.

Risk assessment should be a continual process throughout the project development. An initial assessment of project risks needs to be performed at the time of the initial project scoping to assist with the selection of the appropriate delivery method. Project risks also need to be continually reviewed throughout the development of the RFP, the Design Development Phase, and the Construction Phase of the project. The risk analysis and management process generally includes these five steps:

1. Identify the risk.
2. Assess and analyze the risk.
3. Mitigate and plan for the risk.
4. Allocate the risk.
5. Monitor and control the risk.

During the Preconstruction Phase of a CMGC project, the identification of risk and preparation of a risk management plan leads to the development of a Risk Register for the project, which is further explained in Chapter 3 of this manual.

2.2.4 Project Goal Setting

An understanding of project goals is essential to appropriate project delivery selection and in the successful implementation of the project. The goals influence development, negotiation, implementation, and administration of the Contract. These goals are used by contractors, consultants,

and others in preparing proposals for the project and guiding the project throughout the Design and Construction Phases.

Project goals should reflect the purpose and need of a project. Frequently, the main project goals can be divided into smaller objectives. Preferably the goals are prioritized to provide direction to the project team for making decisions relative to other goals. Following are some generic examples of transportation project goals. The goals for transportation projects are generally consistent. Nevertheless, the project goals must be considered specifically for the project and remain consistent over the life of the project.

Typical Generic Project Goals

Schedule

- Minimize the project delivery time.
- Complete the project before a specified date.
- Make the project fully operational prior to a specified date.
- Accelerate the start of project revenue.

Cost

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

Quality

- Meet and exceed the project requirements.
- Provide a design and construction that minimizes project risks.
- Provide the most highly qualified organization to perform the Work.
- Provide a high quality design and construction.
- Provide a high quality design and construction that best addresses the complexity of the project.
- Provide an aesthetically pleasing project.

Functional

- Maximize the life cycle performance of the project.
- Maximize capacity and mobility improvements.
- Provide innovative solutions to the complex project problems.
- Minimize inconvenience to the traveling public during construction.
- Maximize safety of workers and the traveling public during construction.

Significant transportation projects should include a goal setting workshop early in the project development, prior to selection of the delivery method. The workshop can be conducted by the project team or can be facilitated by an outside expert. Facilitated goal setting workshops preferably include experts in both goal setting for transportation projects and innovative contracting.

Participation in goal setting should include CDOT executive management participation. It is paramount for the selected project goals to be supported by CDOT management, as the project goals guide the project.

Oftentimes, transportation projects include significant stakeholder interests beyond the DOT project teams. In these cases, it is advantageous to include the stakeholder in goal setting. This can be accomplished either by including the stakeholders in the goal setting workshop or by soliciting their input in one-on-one meetings prior to the workshop. In projects with multiple funding sources, it is particularly vital to consider including funding partners in the development of the project goals.

Representation to consider in assembling the goal setting team includes the following:

- Executive Management (Executive Director, Deputy Director, Chief Engineer)
- Regional Transportation Director
- Regional Program Engineer
- Regional Resident Engineer or Project Manager
- Consultant Project Manager and Key Staff
- Department Specialty Area Project Staff
- Lead Agency Representation (FHWA, Federal Transit Administration [FTA], Federal Railroad Administration [FRA], Regional Transportation District [RTD])
- Entity Funding Partners (Local Government)
- Facilitator
- Other Stakeholders

2.3 Selecting the Project Delivery Method

The project delivery method is the process by which a construction project is comprehensively designed, procured, 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 as described in the Contract.

Construction industry/Contractor input into the design development and constructability of complex and innovative projects are the major reasons an agency selects the CMGC method. Unlike DBB, CMGC brings the builder into the design process at a stage where definitive input can have a positive impact on the project. CMGC is particularly valuable for new nonstandard types of designs, where it is difficult for the Owner to develop the technical requirements that would be necessary for the construction of the project. These types of projects typically present a high degree of risk using other methods of delivery such as DBB or DB. The combination of Owner-controlled design and early Contractor involvement in CMGC, provides an excellent forum for identifying and minimizing risk.

The CMGC selection is not based on a low-bid procurement. The Contractor selection is based on a best-value selection, in which the following criteria, among others, are considered: cost, qualifications, experience, and project approach, which is key to meeting the objectives of the project delivery method. Project construction cost is then negotiated on a sole source basis with the Contractor after the

collaborative design development process. A "fair" negotiated construction price can be obtained in CMGC consistent with its focus on minimizing risk and not necessarily on minimizing cost.

2.3.1 The Project Delivery Selection Matrix

The evolution of innovative contracting methods of project delivery such as DB and CMGC has made it important to evaluate projects early in their development to determine the most beneficial method of delivery. CDOT and the University of Colorado have jointly developed the PDSM tool for assessing traditional DBB, DB, and CMGC delivery for a given project in order to select the delivery method most suitable for a project. Use of the PDSM is expanding throughout the transportation industry and is increasingly being used by other state DOTs.

The PDSM manual included in **Appendix** provides the detailed methodology and worksheets to use for the delivery selection process, which is summarized in the narrative of this manual.

The PDSM provides a formal approach for CDOT highway project delivery selection. The manual 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 to:

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

The PDSM and CMGC:

The PDSM process starts by evaluating four primary factors, followed by evaluating risk assessment, which essentially constitutes a fifth primary factor. Usually, an assessment of those five primary factors determines the most advantageous method of delivery. The primary factors, as they are related to CMGC, are:

1. **Delivery Schedule**
   CMGC quickly gets the Contractor under Contract and under construction to meet funding obligations before fully completing the design. Parallel process of development of Contract requirements, design, procurements, and construction can accelerate the project schedule by developing complete, severable construction packages for different phases of the project, however, the schedule can be slowed down by coordinating design-related issues between the CM and Designer and by the process of reaching a reasonable CAP.
2. **Complexity and Innovation**
   CMGC allows independent selection of a Designer and a Contractor based on qualifications and other factors to jointly address complex innovative designs through three-party collaboration of CDOT, the Designer, and the Contractor. It also allows for a qualitative (non-price-oriented) design but requires agreement on a CAP.
3. **Level of Design**
   CMGC can utilize a lower level of design prior to procurement of the CMGC and then engage

joint collaboration of CDOT, the Designer, and the CMGC in the further development of the design. However, the iterative nature of the design process may risk extending the project schedule.

4. **Project Cost**
   With CMGC, the use of CDOT/Designer/Contractor collaboration to reduce risk pricing can provide a low-cost project. However, negotiated CAP introduces price risk and can lose the element of competition in pricing as compared with other project delivery methods that are competitively bid. CMGC allows flexibility to design to a budget.
5. **Project Risk Assessment**
   CMGC provides an opportunity for CDOT, the Designer, and the Contractor to collectively identify and minimize project risks and allocate risk to the most appropriate party. It also has the potential to minimize Contractor contingency pricing of risk. This is one of the primary advantages of CMGC when dealing with complex projects with high degrees of risk.

Three secondary factors are then assessed, primarily on a pass/fail basis to ensure they do not adversely impact the actual project delivery selection. The secondary factors are:

6. **Owner Staff Experience and Availability**
   Strong, committed CDOT project management resources are important for the success of the CMGC process. Resource needs are similar to DBB except that CDOT must coordinate the CM's input with the project Designer and then conduct CAP negotiations.
7. **Level of Oversight and Control**
   CMGC allows the most control by CDOT over both the design and construction as well as control over a collaborative Owner/Designer/Contractor project team.
8. **Competition and Contractor Experience**
   CMGC allows for the selection of the single most qualified Contractor.

A summary comparison of the first four primary factors for CMGC, DB, and DBB is provided in **Table 2-1**. **Table 2-2** provides a summary comparison of the fifth factor, outlining the project risks for these delivery methods.

The PDSM is typically prepared during a four-hour workshop with a delivery Selection Panel that should consist of the following members:

- A facilitator that is neutral toward the delivery method
- The Project Management Team
- An individual with innovative contracting experience, especially with CMGC and DB experience for complex projects
- Representatives from key technical disciplines
- Other stakeholders (local agencies, FHWA, RTD, etc.)

Table 2-1. Comparison of Primary Evaluation Factors for Delivery Methods			
Factor	**DBB**	**DB**	**CMGC**
Delivery Schedule	• Requires time to perform sequential design and procurement • If design time is available, has the shortest procurement time after the design is complete.	• Can get project under construction before completing design. • Parallel process of design and construction can accelerate project delivery schedule. • 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.	• Quickly gets Contractor under Contract. • Can expedite initial construction packages. • Parallel process of development of Contract requirements, design, procurements, and construction can accelerate project schedule. • Schedule delay can result from coordinating design between the CM and the Designer. • Schedule delay can result from CAP negotiations.
Complexity and Innovation	• Allows the Owner to fully resolve complex design issues and qualitatively evaluate designs before construction bidding. • Innovation is provided by CDOT/consultant expertise and through traditional Owner directed processes such as VE studies and Contractor bid alternatives.	• Incorporates Design-Builder input into the design process through: 1. best value selection 2. Contractor-proposed ATCs • ATCs focus on innovative, cost-efficient solutions to complex problems • Requires that desired outcomes to complex projects be well defined through Contract requirements.	• Allows independent selection of Designer and Contractor based on qualifications, experience, and project approach. • Effectively addresses complex and innovative designs through three-party collaboration by the Owner, Designer, and Contractor. • Focuses on a qualitative design approach.
Level of Design	• 100% design by Owner, with Owner having complete control over the design.	• Design advanced by Owner to the level necessary to precisely define Contract requirements and properly allocate risk (typically 30% or less).	• Can utilize a low level of design prior to procurement of the CMGC Contractor. • Then allows joint collaboration of CDOT, the Designer, and the CMGC in the further development of the design. Iterative nature of design process risks extending the project schedule.
Cost	• Competitive bidding provides a low-cost construction for a fully defined Scope of Work. • More cost change orders due to Contractor having no design responsibility.	• Designer-builder collaboration and ATC process can provide a cost-efficient project. • Allows a variable scope bid to match a fixed budget. • Poor risk allocation can reduce cost efficiency.	• Owner/Designer/Contractor collaboration to reduce risk pricing can provide a cost-efficient project. • Noncompetitive negotiated CAP introduces price risk. • Allows flexibility to design to a budget.

Table 2-2. Comparison of Project Risks for Delivery Methods			
Project Risk	**DBB**	**DB**	**CMGC**
General Characteristics	• 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.	• Provides opportunity to properly allocate well-defined and known risks to the party best able to manage them. • Risks allocated to Design-Builder must be well defined to minimize Contractor contingency pricing of risks.	• Provides opportunity for the Owner, Designer, and Contractor to collectively identify and minimize project risks and allocate risk to the appropriate party or share risk. • Has potential to minimize risks associated with innovative and complex design and construction.
Site Conditions and Investigations	• 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.	• Certain site condition responsibilities can be allocated to the Design-Builder provided they are well defined and associated third-party approval processes are well defined. • Unreasonable allocation of site condition risk results in high risk pricing. • Site investigations by Owner should include: 1. basic design surveys, 2. hazardous materials, and 3. geotechnical baseline investigations.	• 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 or share risk prior to CAP.
Utilities	• Utilities risks are best allocated to the Owner and are mostly addressed prior to bid to minimize potential for claims.	• Utilities responsibilities need to be clearly defined in the Contract requirements and appropriately allocated to both the Design-Builder and the Owner: *Private utilities*: 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 DB 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.	• Can utilize a lower level of design prior to contracting and joint collaboration of CDOT, the Designer, and the Contractor in the further development of the design.

Environmental	• Risk is best mitigated by obtaining all environmental clearances prior to bid.	• Certain environmental approvals and processes that can be fully defined can be allocated to the Design-Builder. Agreements or memorandums of understanding (MOUs) with approval agencies prior to procurement are best to minimize risks.	• Environmental risks and responsibilities can be collectively identified, minimized, and allocated by the Owner, the Designer, and the Contractor prior to the CAP. • Design can be accelerated and advanced in accordance with the *Code of Federal Regulations* (CFR), which allows preliminary design activities to proceed prior to conclusion of the National Environmental Policy Act (NEPA) process, as long as preliminary activities do not materially affect the objective consideration of alternatives in the NEPA review process.
Right of Way (ROW)	• ROW clearances are best obtained before bid.	• ROW clearance commitments can be defined to allow DB before completing all acquisition. • ROW acquisition responsibilities and risks can be shared if well defined.	• ROW risks and responsibilities can be collectively identified, minimized, and allocated by the Owner, the Designer, and the Contractor prior to the CAP.
Drainage and Water Quality	• Drainage and permanent water quality systems are designed prior to bid.	• Generally, the Owner is in the best position to manage the risks associated with third-party approvals regarding compatibility with off-site systems and should pursue agreements to define requirements for the Design-Builder.	• The Owner, the Designer, and the Contractor can collectively assess drainage risks and coordination and approval requirements, minimize and define requirements, and allocate risks prior to the CAP.
Third-Party Involvement (FHWA, Railroads, Public Utilities Commission [PUC], funding partners, adjacent jurisdictions, etc.)	• Third-party risk is best mitigated through the design process prior to bid to minimize potential for change orders and claims.	• 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 are best to minimize risks.	• Third-party approvals can be resolved collaboratively by the Owner, designer, and Contractor.

2.3.2 Approval for CMGC Delivery Method Use

Once a region has completed a PDSM and written a summary of why CMGC has been found to be appropriate or most appropriate for the project, the Resident Engineer or the Project Manager must prepare two memorandums for concurrence from the Region RTD and the Chief Engineer. These templates can be found in the **Appendix**.

2.4 CMGC Procurement

2.4.1 *CDOT Project Development Manual* Requirements for Obtaining a CMGC Contract

The 2013 *CDOT Project Development Manual* provides a comprehensive overview of the CDOT procedures entailed in developing a project. The full manual can be found here:

http://www.coloradodot.info/business/designsupport/bulletins_manuals/project-development-manual/2013-project-development-manual/2013-project-development-manual.pdf/view

Specifically for CMGC projects, the *CDOT Project Development Manual* Section 1.05.02, "Obtaining a CMGC Contract," requires the following steps to obtain an executed CMGC Contract (responsible persons are identified in parentheses after each step):

1. Ensure that the proposed CMGC service is consistent with CDOT's Long-Range Plan, Statewide Transportation Improvement Program, the CDOT budget, and the Obligation Plan (Program Engineer, Resident Engineer, and Business Office).
2. Develop scope of work (Resident Engineer).
3. Prepare a contract cost estimate (Resident Engineer).
4. Prepare CMGC selection request, including the Disadvantaged Business Enterprise (DBE) goal, for the Chief Engineer's approval for advertisement (Resident Engineer and Region ~~EEO [Equal Employment Opportunity]~~ Civil Rights Manager).
5. Establish a CMGC selection panel per CMGC guidance from the Innovative Contracting Advisory Committee (Resident Engineer).
6. Create a selection schedule (Resident Engineer and the Engineering Contracts Program Staff).
7. Advertise an Invitation for CMGC Services on the Internet and, as needed, in special journals (Contract Officer).
8. Create and distribute the selection information and instruction package to the CMGC and CCA community (Contract Officer).
9. Coordinate and facilitate selection panels to achieve consensus and make a recommendation to the Chief Engineer (Contract Officer).
10. Obtain RTD's [verbal] approval of the selection results (Resident Engineer).
11. Obtain the Chief Engineer's [written] approval of the selection results (Contract Officer).
12. Notify contractors of selection results (Contract Officer).
13. Finalize scope of work, and for project-specific funds-encumbered contracts, negotiate work-hours and the cost proposal (Resident Engineer and the contractor representative), and submit those to the Agreements Program.
    Note: For task order contracts, this step is done for each task order request.

~~14. Obtain and review the contractor's financial information, insurance information, and initial cost proposal (Contract Officer). (Only for Brooks Act CMGC Contracts.)~~

~~15. Initiate audit evaluation (Contract Officer). (Only for Brooks Act CMGC Contracts.)~~

~~16. Analyze audit evaluation report and negotiate contractor fee and final contract cost exhibit (Contract Officer). (Only for Brooks Act CMGC Contracts.)~~

17. Prepare final contract and route the contract for approval and signatures. Distribute executed contract (~~Procurement and Business Offices~~ Contract Officer).
18. Issue the Notice-to-Proceed to the contractor (~~Agreements Program Staff~~ Contract Officer).
19. Debrief contractors with CMGC Debrief Template on selection results. In-person debriefs are optional and up to the Resident Engineer. (Contract Officer and Project Manager).
20. Compile selection documentation and transmit the selection file to the CDOT Records Center (Contract Officer).

The Resident Engineer is responsible for the submittal of the Contract Certification and Contractor Evaluation forms that are part of the Colorado State Controllers Contract Management System (CMS). (p. 1-34–1-35)

Note: Items appearing above in red have been updated to reflect current practice and have been modified from the *CDOT Project Development Manual* dated January 31, 2013. Steps 14-16 are no longer required.

2.4.2 Requests for Letters of Interest

Issuing a Request for Letters of Interest (LOIs) is optional based on CDOT's desire to seek industry interest and early exchange of information with potential Proposers. The Request for LOIs also provides notice to Proposers to request one-on-one meetings.

The Request for LOIs must include the project name and description, project number, and sub-account. The project description should include a summary of the reasons the project has been selected as a CMGC project with information on the anticipated RFP process and schedule. The schedule should include the anticipated NTP and significant project Milestone dates. The Request for LOI should also include the project goals previously determined during the project scoping. Finally, it must indicate the contact information for the Project Manager or Resident Engineer with the address for LOIs, the deadline to request one-on-one meetings, and a link to the CDOT website where all project information can be found.

Once the Request for LOIs has been approved by the Region's Program Engineer, the CDOT Project Manager should email the letter to the Contract Officer to post on the project website and for advertisement in special journals, as appropriate. After the Request for LOIs has been posted to the CDOT website, the Request of LOIs should also be sent to the Colorado Contractor's Association (CCA) to distribute to their constituents.

A template for the Request for LOIs is provided in the **Appendix**.

2.4.3 Pre-Proposal Meeting

All CMGC projects shall include a mandatory Pre-Proposal Meeting during the procurement process, the purpose of which is to introduce all Contractors to the CMGC Contract delivery method, provide Contractors with an overall introduction to the project as scoped, and allow Contractors to ask questions about the project and process. The CDOT project management team for the project shall be present. The RFP shall list the date, time, and approximate duration of the meeting.

With the Pre-Proposal Meeting, it is the responsibility of the project management team to give a presentation about CMGC and the scope of the project. A template for the CMGC portion of the presentation is provided in the **Appendix**. The project portion of the presentation should match what was written in the RFP and any reference documentation. Aerials, project scope, stage of design when contracted, project goals, and an overall picture of the project helps the Contractors with their proposals.

2.4.4 Contractor One-On-One Meetings

The advertisement of the Request for LOIs initiates an industry review process. Contractors may request an informal one-on-one meeting with CDOT. These meetings provide the Contractor an opportunity to ask questions regarding the project, established goals, and the CMGC procurement process. Prime Contractors interested in an informal project briefing with CDOT must submit a LOI for the project including a request for the briefing. One-on-one meetings are not required for submitting a proposal but are no longer offered after issuance of the RFP.

2.4.5 Request for Proposals

Unlike DB projects, the procurement process for CMGC proceeds directly to the advertisement of the RFPs, without submittal of an initial Statement of Qualifications. Though only one document is submitted by interested Contractors, the RFP is a two-phase procurement consisting of an initial short-listing process followed by interviews of short-listed Proposers by a Selection Panel. Proposers are required to submit a CMGC Management Price Proposal at the interview.

Contractors interested in submitting proposal packages to CDOT are requested to submit one package that is inclusive of preconstruction CMGC Services, with the option of construction if CDOT accepts CAP proposals later on and if they are selected. Selection is determined on a best-value basis in accordance with the evaluation criteria set forth in Section 3 of the RFP, “Proposal Content and Evaluation Criteria.”

The RFP must follow federal regulations, State statues, and the *Colorado Code of Regulations* and include the following evaluation factors and sub-factors that shall be used to evaluate the proposals and capabilities of participating entities:

- Price
- Design and technical approach to the project
- Past performance and experience (not CMGC experience)
- Project management capabilities, including financial resources, equipment, management personnel, project schedule, and management plan

- Craft labor capabilities, including adequacy of craft labor supply and access to federal or state-approved apprenticeship programs, if available. See C.R.S. § 24-93-106 (Item 1).

The RFP may contain other relevant factors as determined by the Department in accordance with C.R.S. § 24-93-106 (Item 2).

The format of the RFP should generally follow the CMGC Services standard template contained in the **Appendix** on this manual, and includes:

SECTION 1 – SCOPE OF WORK AND PROJECT INFORMATION

SECTION 2 – CMGC PROPOSAL REQUIREMENTS AND INSTRUCTIONS

SECTION 3 –PROPOSAL CONTENT AND EVALUATION CRITERIA

2.5 Evaluation Team and Procedures

The evaluation phase of the selection process must be managed by a CDOT Contract Officer. CMGC proposal packages are reviewed by an evaluation team, the Selection Panel, in accordance with the evaluation criteria set forth in Section 3.2 of the RFP, "Evaluation Criteria for Proposals." Selection Panel members score the proposals, interviews, and the CMGC Management Price Percentage proposal using standard scoring forms contained in the RFP.

Standard proposal evaluation criteria include the following:

Project Management Team/Capability of the Contractor

Project Management Team
- Composition of Team/Location/Organization
- Qualifications and Experience
- Job Descriptions and Responsibilities
- Team Building and Collaboration
- Safety Performance

Project Team Capability
- Prior Experience/Performance/References
- Project Background and Success

Strategic Project Approach

Firm Approach to Attaining and Maximizing Project Goals/Strategic Project Approach
Project Innovations

Approach to Cost, Schedule, and Risk

Cost Estimating
Schedule
Risk Management

Because the CDOT RFP template contains only standard evaluation criteria, when necessary the project team is encouraged to include additional criteria that reflect the unique characteristics of the project to better help determine the submitter's overall qualifications.

2.5.1 Selection Panel Members

CMGC Selection Panel members should comprise individuals who have specific project knowledge, an understanding of the project goals, and a specialty or expertise relevant to the project. In addition, previous CMGC experience is highly desirable for as many Selection Panel members as possible. Selection Panel members typically consist of the following:

- A Program Engineer Level Manager (PEIII or higher)
- CDOT personnel only, unless another entity has a financial stake in the project
- CDOT Project Manager
- CDOT Project Development Manager or Innovative Contracting Manager, or their designee with CMGC experience
- CDOT specialty personnel, if applicable
- A maximum of five panel members

Selection Panel members should anticipate meeting at least three times during the procurement process. A Pre-Scoring Meeting is used to distribute proposals and scoring forms and to review the project goals, project scope, and project-specific CMGC Selection Panel training. After the Selection Panel has evaluated the proposals, a Short List Meeting is convened to review scoring, discuss variances in scoring, and finalize the short list for interviews. An Interview Meeting is held to review interview scoring and final scoring after the GMGC Management Price proposals are opened.

CDOT has developed the *CMGC Selection Panel Scoring Guide* to promote objectivity and transparency (see the RFP Template included in the **Appendix** of this manual). Selection Panel members are required to read and follow all scoring guidelines. All Selection Panel members must sign Non-Disclosure Agreements and Conflict of Interest Disclaimers as part of the procurement and cannot directly be contacted by or contact anyone outside of the Engineering Contracts Officer about the project until the CMGC Services Contract has been executed. A template for Non-Disclosure Agreements is provided in **Appendix**.

Selection Panel membership is confidential to maintain objectivity, prevent contact during procurement, and ensure that all Contractor communication goes through the CDOT Project Manager.

2.5.2 CMGC Selection Panel Training

All members of the Selection Panel must undergo a half-day of Selection Panel training before they receive the proposals and scoring books. The training includes a project-specific overview that includes the project goals, complexities, risks, schedule, and budget; characteristics of the Work; and proposed Scope of Work. The training also reviews the scoring books, feedback requirements, and scoring system.

2.5.3 Proposal and Review

Selection Team Panel members individually review and score each proposal category according to the criteria set forth in the RFP. Selection Panel members typically spend at least two to three hours reviewing each proposal.

Weights are assigned to each category prior to evaluation and are consistent on all scoring forms. Comments by Selection Panel members are required on all scoring forms so that all Proposers may receive constructive feedback on their proposals and performance. Scoring for the proposal and Oral Interview Criteria forms are based on the *Qualitative Assessment Guidelines* in the RFP, which are applied to all sections except the CMGC Management Price Percentage. Team members evaluate each category subfactor listed in the RFP *Evaluation Manual Scoring Form B-1* and assign those subfactors a Qualitative Assessment Value according to a scoring range from 1 to 5 (scoring values shall be in quarter-number increments only, e.g., 2.25, 3.50, 4.00), as shown in **Table 2-3**:

Table 2-3. Qualitative Assessment Values

Score	Criteria
1	The Proposer demonstrates a minimal understanding of this scoring category and the Proposer's response contains numerous weaknesses and deficiencies. The proposal demonstrates little or no level of quality or value. The Proposer's qualifications raise questions about the Proposer's ability to successfully meet the project goals.
2	The Proposer demonstrates a below-average understanding of this scoring category and the Proposer's response contains significant weaknesses and deficiencies. The proposal communicates a below-average level of quality. The Proposer's qualifications raise questions about the Proposer's ability to successfully meet the project goals.
3	The Proposer demonstrates a general understanding of the project and an approach containing some weaknesses/deficiencies regarding the stated requirements and objectives of this project. The proposal communicates an average level of quality and meets the stated requirements of the RFP.
4	The Proposer demonstrates a strong understanding and has a strong approach to the scoring category. The proposal communicates a high level of quality and the proposal exceeds the stated requirements of the RFP. The proposal shows few weaknesses or deficiencies for this scoring category.
5	The Proposer demonstrates a complete understanding of the subject and an approach that significantly exceeds the stated requirements and objectives of this scoring category. The proposal communicates an outstanding level of quality. The Proposer's qualifications are exceptional. The proposal shows no weaknesses or deficiencies for this scoring category.

2.5.4 Short-Listing

The Selection Panel shall complete a short list evaluation based on the Proposer-submitted proposal package and the criteria in Section 3.2 of the RFP, "Evaluation Criteria for Proposals." A minimum of three short-listed Proposers shall be invited to Oral Interview Meetings with the Selection Panel to be further evaluated based on criteria in Section 3.3 of the RFP, "Evaluation Criteria for Oral Interviews." If

warranted by the preliminary results, and at the discretion of the Chief Engineer, additional Proposers may be short-listed.

The Contract Officer prepares the short-list recommendation memorandum for verbal concurrence by the Regional Transportation Director and for written approval by the Chief Engineer.

2.5.5 Interviews

An oral interview is a mandatory part of the selection process after the CDOT Selection Panel notifies the short list of Proposers. Proposers that are not short-listed may request a mock scored interview to gain experience if the Proposer has never been interviewed by CDOT on prior CMGC selections. CDOT will conduct a scored mock interview for non-selected Proposers but there will be no opportunity for award or selection. Selection Panel members should anticipate spending one full day conducting interviews.

The interview not only provides an opportunity for the Proposer to present its qualifications and ideas but also allows the Selection Panel to observe the project team and see how the team members work together. Therefore, the Proposer is advised to bring all key members of its project team to the interview.

Oral interviews consist of three parts:

1. **Short Presentation**
   A 15-minute presentation summarizes the proposal and describes the Contractor's innovative ideas and unique resources. This is the part of the interview where the Proposers need to communicate to the Selection Panel the reasons they should be chosen. What strategies and abilities do the Proposers bring to this CMGC project that makes them the best candidate? Proposers are advised to limit the presentation to the most critical points of the proposal and focus on what their team can bring to the table and why.
2. **Team Challenge**
   The Proposers are given a written challenge to review and propose a course of action to address the elements in the problem.
3. **Question-and-Answer Session**
   The questions asked in this session will be standard questions for all Proposers. Although the initial questions for each Proposer are identical, the follow-up questions to clarify Proposer answers vary. The interview presentation and question/answer scoring are based on the following criteria:
   - Project Understanding
   - Project Approach
   - Project Innovation
   - Communication Skills
   - Understanding of CMGC Delivery Method

Oral interviews are assessed based on the evaluation criteria for oral interviews listed in the RFP. Selection Panel members shall use *Scoring Form B-2: Oral Interviews Standard Evaluation Form* contained in the RFP. Qualitative assessments shall be based on the Qualitative Assessment Guidelines used to evaluate the proposal.

2.5.6 The Team Challenge

The Proposers are presented with a written challenge to review, and they must propose a course of action to address the elements in the problem. The Proposer is typically given 15 minutes to prepare a response or solution, and 5 minutes to present a formal response or solution to the Selection Panel. Scoring for this challenge is based upon the following criteria:

- Challenge Understanding
- Recognition of Key Points and Ideas
- Team Collaboration
- Communication Skills
- Understanding of CMGC Delivery Method, CSS, and Environmental Commitments
- Understanding of Project Goals

Team Challenge Example 1:

The early Construction Phase CAP proposals for girder procurement and construction are within 10 percent of the Independent Cost Estimate. The initial bid on CAP #2 for the final Construction Phase of the project is more than 10 percent over the ICE Estimate and would put the total cost of the project over the Fixed Limit of Construction Cost, and it is above the aggregate of previous OPCCs. This final CAP needs to be under the project budget and must complete the remaining work on the project. Your team must present ways that the project can get back on track and include discussion on all available paths.

Team Challenge Example 2:

Your team was awarded the CMGC Services for the I-70 Bridge to Nowhere Preconstruction Phase in April 2014. The CDOT Project Manager set very challenging goals and an aggressive schedule that requires the first CAP for construction Package #1 to be proposed one week after the signing of the decision document. Package #2, delivering the Bridge to Nowhere using the ABC delivery method, and Package #3, the construction of the roadway to Nowhere, are scheduled three months after Package #1 and cannot be constructed simultaneously.

Three days before the deadline for CAP #1, the CDOT Project Manager phones your team and reports that the Suppliers that were added to the assumptions in the cost model as probable Suppliers have refused to give the ICE and CDOT any prices or quotes because they feel it would be unfair to you to release that information. The CDOT Project Manager has asked you to resolve the situation.

Your Traffic Control Subcontractor calls you that afternoon and has decided not to give you a bid, backing out of a quote that was quite competitive, and the next lowest quote represents a 20 percent

increase in traffic control prices. This changes an assumption in the cost model and past cost estimates have been close to the 10 percent limit.

2.5.7 CMGC Management Price Percentage

At the Oral Interview Meeting, short-listed Proposers are required to submit a sealed CMGC Management Price Proposal that will be evaluated based on criteria in Section 3.4 of the RFP, "Evaluation Criteria for CMGC Management Price Percentage Proposals." The CMGC Management Price Percentage Proposals must also include a summary of components used in establishing the CMGC Management Price Percentage. The CMGC Management Price Percentage remains sealed until after the qualitative scoring and is opened after the Selection Panel Interview Meetings.

Proposers shall state their proposal CMGC Management Price Percentage, identified as a percentage and carried out to four decimal points (e.g., 0.0000%), which will be applied to all Construction Phases. The CMGC Management Price Percentage shall include all profit, general and administrative (G & A) costs, regional and home office overhead, and non-reimbursable costs identified in Appendix C of the RFP. The CMGC Management Price Percentage shall not change regardless of the final, negotiated amount of the CAP for early Construction and Construction Phases.

The CMGC Management Price Percentage breakdown shall show the breakdown of all components used in establishing the percentage. The intent of the CMGC Management Fee is to define the cost and level of effort for the CMGC to deliver the project within the CAP. The CMGC Management Price Percentage shall exclude all Proposer costs for risk related to performance of the construction work. Risk is to be priced into subcontracted amounts and negotiated into self-performed work, as part of the overall direct cost of the Work.

The CMGC Management Price Percentage score is determined by comparing each firm's sealed CMGC Management Price Percentage with the lowest CMGC Management Price Percentage being equivalent to the maximum score of 15 points. To score each fee percentage, the Selection Panel will use the following example formula:

Example: Scoring of the CMGC Management Price Percentage
Assume the lowest CMGC Price Percentage is 10 percent.

FIRM A: $\frac{10\%}{10\%}$ X 15 points = 15 points

FIRM B: $\frac{10\%}{13\%}$ X 15 points = 11.5 points

FIRM C: $\frac{10\%}{16\%}$ X 15 points = 9.38 points

The scoring calculation is prepared on *Scoring Form B-3: CMGC Management Price Percentage Proposal Form* of the RFP.

2.5.8 Selection of the CMGC

The score from the qualitative evaluations (Scoring Forms B-1 and B-2) from all Selection Panel members is averaged to produce the total overall qualitative score for each Proposer. The average qualitative scores are added to the CMGC Management Price Percentage score from Scoring Form B-3. The Proposer with the highest total score in all three sections is selected.

The Contract Officer prepares the Contract Certification and Contractor Evaluation forms for the Regional Transportation Director's concurrence and for the Chief Engineer's approval and signature.

2.6 Estimating the Preconstruction Fee

The CMGC provides a variety of services during construction involving cost estimating, value engineering, constructability reviews, and construction expertise. The selected Proposer is compensated for these CMGC Services during the Preconstruction Phase. CDOT establishes a lump sum amount for these services and states the Contract amount in the RFP, along with a completed Appendix A, "Preconstruction Roles and Responsibilities Matrix," which details the Preconstruction Phase services anticipated for the project.

2.7 Procuring a Design Consultant for a CMGC Project

For CMGC projects, CDOT enters into a Contract separately with a Design Consultant who is required to work in partnership with CDOT and the Contractor. Procurement of the Design Consultant can be accomplished through CDOT's typical consultant selection methods in accordance with the *CDOT Project Development Manual*. The consultant Contract should be written to require the consultant to work together with the Contractor, and the Scope of Work should detail the unique services expected under the CMGC project delivery. The consultant should be prepared to incorporate the Contractor's ideas on phasing, materials, constructability, traffic control, and other project approaches with the goal of mitigating project risk.

2.8 Procuring a Consultant Construction Engineer for a CMGC Project

As discussed in this manual, it is highly recommended that the Construction Project Engineer/CM is actively involved in the Preconstruction Phase so that they are familiar with the details of the Construction Phase that were developed and agreed to during the design development. If the Construction Project Engineer is to be a Consultant, it is recommended that the Consultant is procured during the Preconstruction Phase. It is possible to procure Consultant Project Engineer/CM resources prior to authorization of the Construction Phase, by utilizing a Task Order driven contract, and executing a Design Phase Task Order to get the CM team up to speed for several months prior to the Contractor Construction Notice-to-Proceed.

2.9 Procuring an ICE for a CMGC Project

Hiring a qualified ICE is a key component in the CMGC process and is critical to the development of the project CAP and understanding of the Contractor's means and methods. CDOT maintains a Non-Project Specific (NPS) Contract with an ICE Consultant.

Typical consultant task orders are generated by the PM and processed through the Region Business Office. ICE consultant contracts are managed through the Innovative Contracting Program at headquarters and processed using procurement services at headquarters.

To initate an ICE consultant contract, the PM will contact the the Innovative Contracting Program Manager to discuss available ICE consultants under contract and request the outline agreement (O/L) contract or number for the ICE to be used for the project. The Innovatiave Program Manager will provide the amount remaining and the expiration date for that contract. The PM will initiate contact with the prospective ICE consultant to work through hours and amount of the services needed for the task order.

The rule of thumb for the contract amount is bewteen 0.4-0.5% of the construction budget. However the PM should substantiate this using projected number of meetings, OCIPS and GAP negotion meetings necessary. Also consider if there is specilized project work, such as tunneling, bridge moves, etc. requiring a cost estimator that is familiar with that type of work.

The following steps outline the ICE task order process:

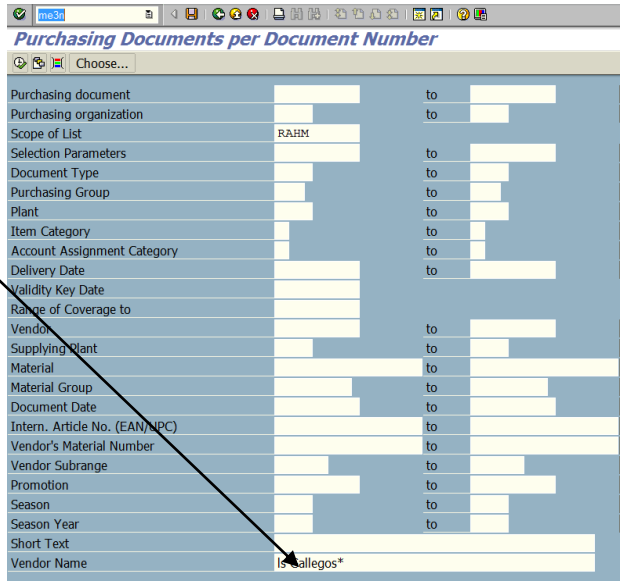
Generate a Shopping Cart for ICE Task Order

Step 1.

After the PM has contacted the Innovative Contracting Program Manager at headquarters, received a copy of the outline (O/L) agreement or the O/L agreement number for the desired ICE consultant, a SAP shopping cart will need to be generated to initiate the task order process.

To obtain information required to create the shopping cart:

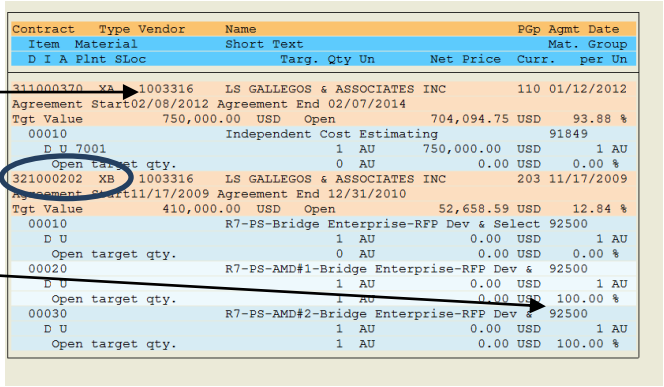
a. SAP T-Code ME3N
b. Type the consultant name field "Vender Name"* (or vender number in field "Vendor")



c. From the following screen, under the O/L agreement number gather the following information:

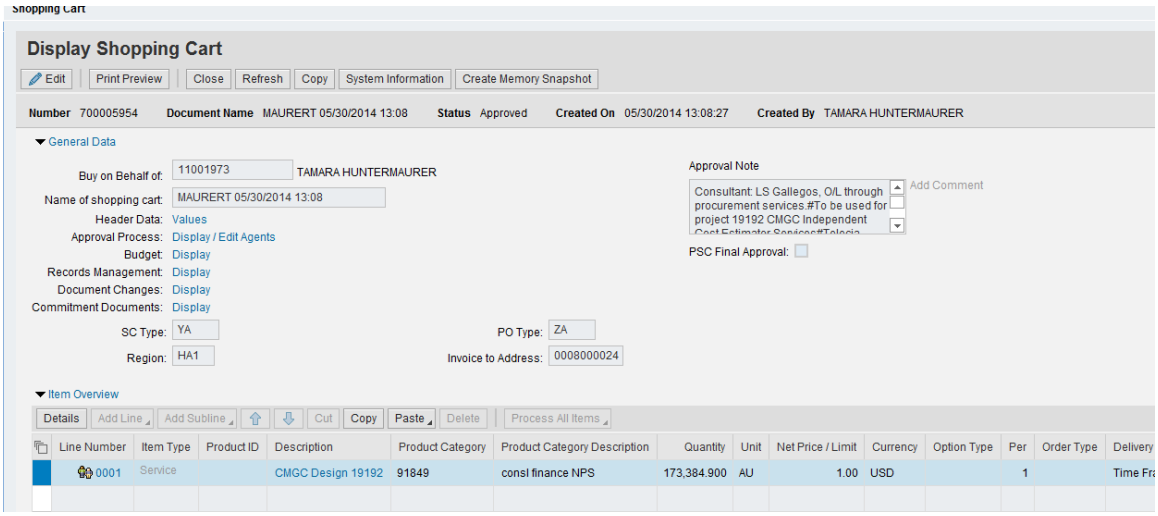
- Vendor Number
- Material Code

O/L (provided by Innovative Contracting Unit)



Step 2.

Create shopping cart using SC Type "YA", use Material Code for the "Product Code" field



Input the vendor number under the Source of Supply and the O/L number in the description at the top of the screen.

Step 3.

As this is a service type consultant contract, after the shopping cart is created by the PM and approved by the Region Business office, the Contract Administrator that handles procurement type contracts at HQ will complete the task order process. Upon completion of the shopping cart you will forward the following to the procurement Contract Administrator:

- Shopping Cart number (generated upon completion)
- Scope of Work (prepared by the consultant)
- Project Cost Worksheet-Specific Rate of Pay (prepared by the consultant)

- Request for work letter (prepared by the consultant)

2.10 CMGC Procurement for CDOT Priority Projects

On occasion, CDOT may determine an emergency or priority project that requires accelerated execution of the contract for either CMGC Pre-Construction Services or the CMGC Construction Services. For these rush projects, the contract can be executed within three business days. To facilitate this process the CDOT Project Manager must complete a *Contract Routing "Rush" Cover Sheet for CMGC Pre-Construction Services or CMGC Construction Services*, included in the **Appendix** of this Manual, and is responsible for hand delivering the document for signatures from each required signatory office. The document also requires the signature of the Chief Engineer and concurrence from the RTD, CMA Branch Manager, and Procurement Manager.

The CDOT Project Manager must include a statement of justification for using the accelerated contracting process. Typically a priority project may be defined as:

1. A project that has a management directed schedule, or critical path item, that requires contracting to be accelerated to meet the schedule.
2. A project that has a combination of the following characteristics: accelerated project schedule, deadlines for when money must be spent (FY or BE), certain parts of the scope of construction must be completed by a critical date or has long lead times procurement items that are critical in nature to the project schedule.
3. An emergency project that is critical to the mission of CDOT and the safety of the traveling public.
4. One of the top 1-5 priority projects on a state wide list determined by the Executive Management Team.
5. A project that is a result of some genuine unforeseen circumstances.

The use of the priority project contract procedure is considered the exception, and is reserved for projects that generally meet the conditions noted above. This procedure is not intended to compensate for a lack of planning for projects that can be procured using traditional time frames.

2.11 Independent Work-Hour Cost Estimates for Procurements

In accordance with federal regulations and *CDOT Project Development Manual* procedures, the Resident Engineer and Project Manager are responsible for preparing independent work-hour cost estimates for procurement of the Design Consultant for all contracts and task orders valued in excess of $100,000. However, an independent work hour estimate is not required to procure the ICE consultant. Upon completion of the Independent Cost Estimates, the CDOT and Consultant Project Managers review and negotiate the work-hours and project costs.

2.12 Concurrent Procurement Recommendations

To maximize the benefits of CMGC, concurrent procurement of the Design Consultant, CMGC Contractor, and the ICE Consultant is recommended based on CDOT's experience with CMGC projects

and industry feedback. Early selection of the CMGC Contractor maximizes the potential for team collaboration and allows the Contractor to provide early input into the design decisions. The Contractor can provide input into the risk management and offer innovative construction methods that may direct design development.

Because the ICE plays a significant role in the development of the CAP and the negotiation process, contracting the ICE Consultant and the CMGC Contractor at or near the same time is recommended. Engaging the ICE early in the process allows the ICE to develop an understanding of the project goals, risks, design decisions, and assumptions and thus more accurately prepare the Independent Cost Estimate.

2.13 CMGC Contracting and Standard CMGC Services Agreement Template

CDOT awards one CMGC Contract to the top ranked Proposer based on a best-value selection with Chief Engineer approval. The selected CMGC is awarded a Contract for Preconstruction CMGC Services. Once design of one or more construction packages is sufficient to prepare, negotiate, and accept a CAP proposal, a CDOT Construction Contract is drafted, signed, and executed.

CDOT has developed the Standard CMGC Services Agreement Template, which strives to fairly allocate risk between the parties while promoting a collaborative process that makes full use of the advantages of the CMGC Project Delivery Method. The Contract defines the scope of services that the CMGC provide during the Preconstruction Phase, provides direction on developing an Opinion of Probable Construction Cost (OPCC), defines the CAP negotiation process, and allows for award of the construction package(s).

The CDOT CMGC Contract Template can be found in the **Appendix**.

3 Chapter 3: Preconstruction Phase

The start of the Preconstruction Phase marks the beginning of the collaborative partnering between CDOT, the Design Consultant, and the Contractor. The unique roles and defined responsibilities of each member during the Preconstruction Phase of the project are described in this chapter. The project team's focus should be on partnership and open communication to minimize risk, review constructability, improve the project schedule, try new innovations, and maximize work within the budget.

3.1 Preconstruction Roles and Responsibilities

CDOT Project Manager

In CMGC, the CDOT Project Manager takes the lead role in managing and facilitating the Preconstruction Phase. CDOT Project Managers should be aware that their role in a CMGC project may require more active team coordination and direct involvement than other project delivery methods. The CDOT Project Manager is responsible for guiding design decisions while overseeing the collaborative effort between the Design Consultant and Contractor. The CDOT Project Manager is responsible for facilitating this collaborative process through active communication and project team meetings that include a Partnering Workshop, Project Scoping Workshop, Value Engineering (VE) Workshop, Design Review Meetings, and Cost Model Review Meetings. The CDOT Project Manager also leads the Cost Model and estimate review process, questioning both the Contractor and Independent Cost Estimator (ICE) estimates. The CDOT Project Manager serves as a facilitator between team members and later as the lead negotiator for CDOT during the CAP Proposal process.

Design Consultant

In CMGC, as with traditional DBB projects, the Design Consultant contracts directly with the Owner and takes direction from the Owner in development of the design. In CMGC, the role of the Design Consultant does not change as much as the role of the owner for a CMGC project. As in a DBB, the Design Consultant's main roles are to design the project, manage the design, and communicate with the CDOT Project Manager. However, the Design Consultant does give up some of the control over design decisions due to the higher involvement of an owner. On a CMGC project, the Design Consultant also is required to work with the Contractor and CDOT, manage the iterative design process that is vital to CMGC success, and expect changes in the design. The Design Consultant must keep the CDOT Project Manager informed and involved in all design reviews and risk decisions.

Independent Cost Estimator

The ICE is CDOT's primary estimator during the Preconstruction Phase of the CMGC delivery method. The ICE uses production-based estimates and solicits quotes in the same manner that a contractor estimates and bids a project. The ICE has the responsibility to question the Contractor's prices, quotes, methods, and estimate in order to ensure that CDOT is receiving a fair and open price from the Contractor. If the project has specialty work that is outside of the ICE's expertise, the ICE is required to use specialty estimators to provide accurate cost estimates. The ICE is also expected to know the local

markets and network with Subcontractors and DBEs to build a trusted network to solicit quotes. The ICE needs to work with the Contractor to understand the competitive market near the project site, regionally, nationally, and globally. The ICE is required to bring on subject matter expertise if the ICE lacks in-house knowledge of a major work item.

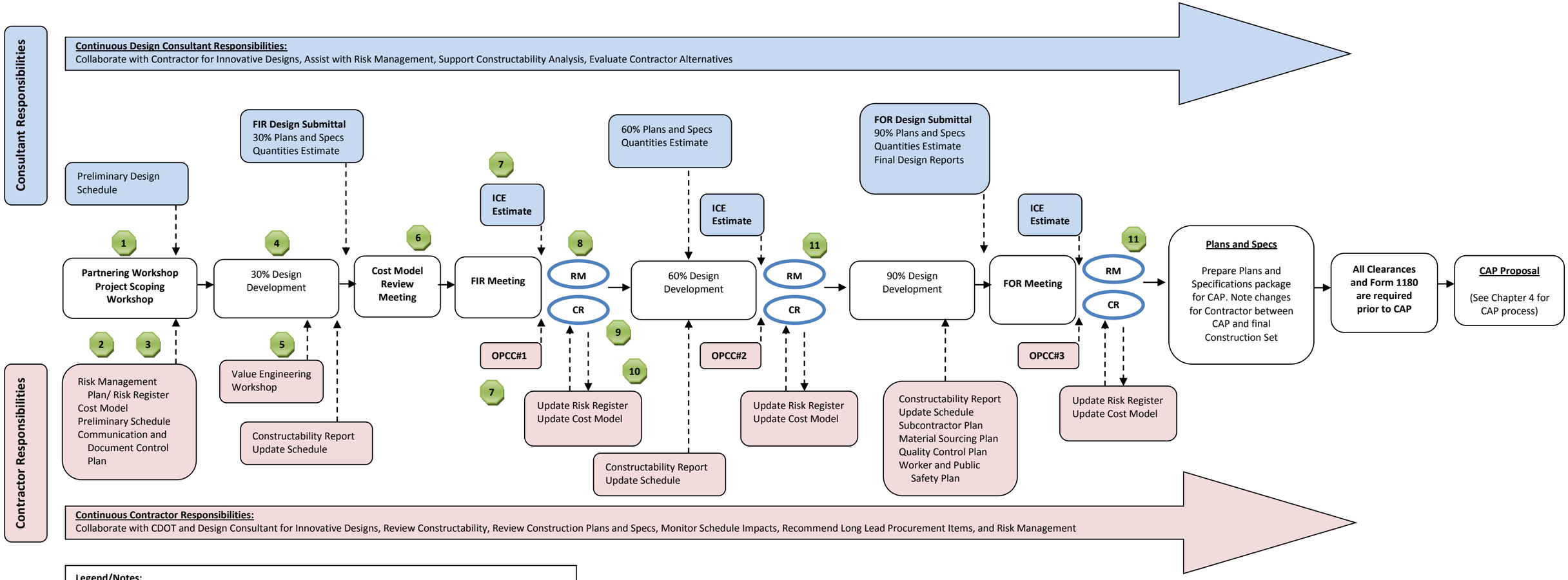
Construction Manager/General Contractor

A Contractor is selected to first serve as the Construction Manager during the Preconstruction Phase. As part of the design team, the Contractor provides input on schedule, phasing, constructability, material availability, and cost throughout the Design Phase of the project. With input from CDOT and the ICE, the Contractor is responsible for identifying project risks and providing Opinions of Probable Construction Cost (OPCC) that help guide the design development and establish project risk pools. The Contractor tasks during the Preconstruction Phase include, but are not limited to:

- reviewing construction plans to provide input on constructability, construction phasing, traffic control, materials, and design decisions.
- developing design alternatives and innovations that improve the Project Schedule and cost.
- evaluating project risks and developing a Risk Register and Risk Management Plan.
- establishing the Cost Model and OPCCs at required Milestones.
- conducting VE Workshops.
- obtaining Subcontractor quotes and coordinating with Subcontractors to meet project DBE goals.
- identifying long lead items (material, equipment, and/or utility relocations) that should be procured through the LLTP CAP process.
- preparing all reports and plans required by the Contract including: a Subcontractor Selection Plan, a Quality Control Plan, a Material Sourcing Plan, a Worker and Public Safety Plan, an Innovation Tracking and Performance Report, and a Procurement Proposal and Report for each LLTP CAP.

3.2 Preconstruction Roles and Responsibilities Matrix

The RFP and CMGC Services Agreement contain a Preconstruction Roles and Responsibilities Matrix. The matrix provides a comprehensive list of activities that are assigned to the appropriate responsible party and coordinated with all team members. CDOT project staff prepares the initial matrix as part of the RFP and assigns either primary, secondary, or collaborative responsibility roles to the Contractor, Design Consultant, and CDOT. A template matrix is presented in the Standard CMGC Services Agreement in the **Appendix** and provides suggested responsibilities for the various activities. However, because each project is unique, the matrix must be revised to meet the specific requirements of each project. The matrix is reviewed with the selected Contractor and revised accordingly, and then it becomes part of the CMGC Services Agreement.



Legend/Notes:

RM **Risk Management Meeting**

CR **Cost Estimate Review Meeting**

1 **Process Step –** described in more detail in workflow narrative on the following page

OPCC **Opinion of Probable Construction Cost**

1. The Risk Management Meeting includes the Design Consultant, Contractor, ICE and CDOT. The purpose of the meeting is to review project risks and associated costs, mitigation plans, identify the responsible party to manage the risk, and establish risk pools.
2. The Cost Estimate Review Meeting includes the Design Consultant, Contractor, ICE and CDOT. The purpose of the meeting is to review and compare the Contractor's OPCC and the ICE estimate, review pricing assumptions, review quantities, and reconcile pricing differences.
3. The Risk Management Meeting and Cost Estimate Meeting may be combined, particularly in later OPCC submittal where most project risks have already been identified.
4. This flowchart shows three typical OPCC submittals. At the option of CDOT, OPCC submittals may occur independently from FIR and FOR design submittals. More OPCC's may be required if the Contractor Estimate and ICE Estimate are not within an acceptable percentage.

Figure 3-1

PRECONSTRUCTION PHASE FLOWCHART

(Design Development to CAP Proposal)

3.3 Preconstruction Phase Work Flow

The Preconstruction Phase is shown schematically on the flowchart in Figure 3-1. The flowchart details the basic steps in the process leading from preliminary design to the development of the final Plans and Specifications that are used to develop the CAP. The following list, which corresponds to the numbered Process Steps as depicted in **Figure 3-1**, provides a brief description of the steps involved in the process. These steps are described in greater detail throughout Chapter 3 of this manual.

1. Partnering Workshop and Project Scoping Workshop

The CMGC Preconstruction Phase begins with a Partnering Workshop and Project Scoping Workshop. These can be conducted separately, but they are often combined into a multiday workshop spanning two to three days. It is often facilitated by a third party experienced in Partnering, with the goal to develop trust, respect, and cooperation among all key players. The Project Scoping Meeting is used to review the team's roles and responsibilities, preliminary schedule, project elements, and scope.

2. Prepare Risk Management Plan/Risk Register

Following initial project discussions, the Contractor prepares the project Risk Register as part of the Risk Management Plan. The Risk Register is a tool used to identify, assess, mitigate, and monitor project risks. The Risk Register includes a matrix that identifies each risk; its risk level, cost impact, schedule impact, and responsible party; approaches to minimize risk, and results of the risk mitigation. The Risk Register is continually reviewed by the project team and updated by the Contractor throughout the Preconstruction Phase to assist with key decisions on design development, risk, and project costs.

3. Prepare Cost Model

Following initial project discussions, the Contractor prepares the project Cost Model with the assistance of CDOT and the Design Consultant. The Cost Model is an open and transparent document that defines the Contractor's pricing assumptions to communicate to CDOT and the ICE. It defines the Contractor's costs related to labor, materials, equipment, subcontractor and supplier quotes, means and methods, production rates, risk, direct costs, and mobilization. The Cost Model is continually reviewed by the project team and updated by the Contractor at each pricing milestone and Opinion of Probable Construction Cost (OPCC) submittal to assist with cost reviews by CDOT and pricing by the ICE.

4. 30% Design Development

The Design Consultant proceeds with 30% design plans, collaborating with CDOT and the Contractor on key design decisions. During the 30% Design Development stage, the Contractor prepares a Project Schedule, performs constructability reviews, and offers suggestions for construction phasing and innovative design alternatives. At the end of the 30% design, the Design Consultant submits FIR Plans and Specifications for CDOT's review and comment. The Contractor also reviews the FIR Plans and Specifications and offers redline comments to improve the plans for constructability, clarify ambiguities, and provide consistency with the Contractor's proposed means and methods.

5. Value Engineering Workshop

A Value Engineering (VE) Workshop is required if the project has federal funding and is over $40 million, however CDOT may decide a VE Workshop is beneficial for smaller projects. Typically the VE Workshop occurs during the 30% design development stage and is facilitated by a third-party consultant not directly involved in the design process.

6. Cost Model Review Meeting

The Contractor updates the Cost Model based on the 30% design plans and a Cost Model Review Meeting is held with CDOT, the Contractor, the ICE, and Engineering Estimate and Marketing Analysis (EEMA) if available. The Cost Model Review Meeting may occur at the beginning of the Preconstruction Phase if preliminary design development occurred prior to procurement of the CMGC. At this meeting CDOT, the Contractor, and the ICE review the Cost Model for all pricing assumptions and means and methods that will be used to prepare the OPCC submittals.

7. OPCC #1 and ICE Submittal

The Contractor submits an Opinion of Probable Construction Cost (OPCC) to the CDOT Project Manager at the established pricing milestone, typically at 30 percent coinciding with the FIR plan submittal. The ICE prepares an independent estimate and submits it to the CDOT Project Manager. If desired by the CDOT Project Manager, and if the project schedule allows, EEMA may provide an optional unit priced project estimate that can be used for general guidance during cost estimate reviews.

8. Risk Management Meeting

A Risk Management Meeting is held following the submittal of the OPCC to review project risks, discuss mitigation and associated costs, identify the responsible party to manage the risk, and establish risk pools. During this meeting, the CDOT Project Manager and Contractor agree on how risks and contingencies are quantified and assigned. The ICE and Design Consultant participate in this discussion to assist CDOT, stay informed, and understand risk and contingency assignments. At the conclusion of the Risk Management Meeting, the Contractor updates the Risk Register for newly identified risks and risks that have been mitigated and establishes or adjusts the Risk Pools that have been agreed to by the ICE and CDOT.

9. Cost Estimate Review Meeting

A Cost Estimate Review Meeting is held following the Risk Management Meeting and includes the Design Consultant, Contractor, ICE, and CDOT. EEMA may also attend this meeting to provide guidance to the CDOT Project Manager. The purpose of the meeting is to review and compare the Contractor's OPCC and the ICE Estimate, review pricing assumptions, review quantities, and reconcile pricing differences. Prior to the meeting, the CDOT Project Manager reviews the OPCC and ICE Estimate and identifies all bid items that have significant variances. During the Cost Review Meeting, the CDOT Project Manager, ICE, and Contractor attempt to reconcile pricing differences for these identified items. The CDOT Project Manager also compares the OPCC to the ICE to determine whether they are within a

percentage difference acceptable to CDOT. The reconciliation process gives all parties the opportunity to understand each other's perspectives about pricing assumptions and risk assignment.

10. Update Risk Register, Cost Model, OPCC, and Schedule

At the conclusion of the Cost Review Meeting, the Contractor must update the OPCC, Risk Register, Cost Model, and Schedule to reflect all changes resulting from the Design Review Meeting, Risk Management Meeting, and Cost Review Meeting.

11. Subsequent OPCC Submittals

Design development continues in this cycle of design submittals, OPCC and ICE cost estimate submittals, risk assessment, and cost reviews for all established pricing milestones. Typically these coincide with the FIR, Design Office Review (DOR), and FOR Submittals at 30%, 60%, and 90% designs. However, additional OPCC submittals may be required if design refinements are required or if significant pricing variances remain. The goal, through this iterative process, is to narrow pricing differences throughout the CMGC Preconstruction Phase, such that any LLTP CAP submittals and the CAP Proposal are within a percentage of the ICE Estimate that is acceptable to CDOT.

3.4 Key Elements of the Preconstruction Phase

CMGC project delivery requires a collaborative effort between CDOT, the Design Consultant, and the Contractor. All parties must act as an integrated team working to develop innovative design solutions that incorporate the Contractor's proposed means and methods. This section describes the processes, meetings, workshops, and reports that CDOT has established to assist CDOT Project Managers in facilitating the Preconstruction Phase and provides additional details for the items introduced in the Preconstruction Phase work flow narrative.

3.4.1 Partnering

Partnering is critical to the success of a CMGC project, and the CMGC Preconstruction Phase begins with a Partnering Workshop. Partnering is a process for developing a spirit of teamwork and cooperation through shared goals, defined issue resolution procedures, clear action plans, and the monitoring of team performance to ensure that goals are achieved. Additional information on partnering can be obtained from the 2006 *CDOT Partnering Guidelines.*

Depending on the complexity of the project, the Partnering Workshop can be expected to last from a half day up to two full days. CDOT often engages with an independent third-party consultant to facilitate the workshop. The partnering consultant can also be a resource during the project if partnering and cooperation of team members starts to break down. The partnering consultant typically can be procured through Procurement Services at the same time that the CMGC Service Agreement is awarded.

A list of partnering consultants is available on CDOT's website at: http://www.coloradodot.info/business/designsupport/design-docs/partnering-on-construction-projects/2012%20Partning%20List.pdf/view

The following persons shall attend the workshop: CDOT's Resident Engineer, Project Engineer, and key project personnel; the Contractor's on-site project manager and key project supervision personnel; and the subcontractors' key project supervision personnel. The following personnel shall also be invited to attend as needed: project design engineer, construction management personnel, key local government personnel, suppliers, key CDOT specialty personnel, CDOT EEO office personnel, design consultants, CDOT maintenance superintendent, CDOT environmental manager, key railroad personnel, and key utility personnel.

3.4.2 Project Scoping Workshop

The Project Scoping Workshop initiates the design development process and is used to define project responsibilities and establish procedures and protocols to be followed during the Preconstruction Phase. At the option of the CDOT Project Manager, the Project Scoping Workshop is often combined with the Partnering Workshop into a multiday workshop spanning two to four days.

The Project Scoping Workshop should cover at least the following items:

- Introduce the project, CMGC, partnering session, and the project stakeholders.
- Discuss roles and responsibilities related to the CMGC process.
- Present project goals and objectives.
- Discuss project status, funding, and preliminary schedule.
- Present project elements and scope.
- Identify project risks and develop an initial Risk Management Plan.
- Establish OPCC pricing milestones (e.g. 30%, 60%, and 90%).
- Discuss the basic elements of the Cost Model.
- Review relevant Plans, Specifications, and reports.
- Conduct project site and equipment tour.
- Schedule progress meetings, FIR, and FOR meetings.
- Establish Communication and Document Control Plan.

The CDOT Project Manager prepares the Project Scoping Workshop agenda. A suggested format and list of agenda item is provided in the **Appendix**.

3.4.3 Collaborative Design Development

Design development is an iterative process in GMGC project delivery, where the Design Consultant and Contractor collaborate under the direction of the CDOT Project Manager. At each agreed-to milestone, typically at 30%, 60%, and 90% complete designs, the Design Consultant prepares a review set of construction Plans and Specifications. CDOT, the Design Consultant, and the Contractor participate in project design review sessions at the close of each FIR and FOR submittal and as construction documents are finalized for each CAP Package. The purposes of the project design review sessions are to (1) assure consistency with the design intent; (2) ensure complete, coordinated, constructible, and cost-

effective designs for all disciplines; (3) assure that the design documents are code compliant; (4) endeavor to confirm that all work has been included and described in sufficient detail to assure complete pricing of work; (5) allow for phased construction; and (6) identify errors and omissions.

The Contractor provides the Design Consultant written reviews and redlined hard copies of Drawings, Plans, and Specifications. The Design Consultant collects all design review comments from the various participants, provides reports to CDOT, and ensures that with the issuance of each progress set of design documents, all comments have either been incorporated or resolved to the satisfaction of CDOT.

3.4.4 Addressing Complex Construction and Developing an Innovative Approach

CMGC Project Delivery is particularly well suited to address complex construction projects and to use construction techniques that are unfamiliar to CDOT. In recent years CDOT has used the CMGC project delivery method to perform electrical switchgear improvements, Accelerated Bridge Construction (ABC), interchange projects, and tunneling projects. The advanced construction methods required by these projects were developed through the collaborative design process that incorporated the specialty contractor's expertise and experience.

The CMGC project delivery method provides the opportunity to incorporate innovative approaches into the design development. The Contractor should provide input on the design during the design process and particularly at the Design Review meetings and VE Workshop. CDOT and the Design Consultant must be open to the Contractor's suggestions and review innovative methods and materials under consideration.

To monitor and track this process, the Contractor is responsible for preparing an **Innovation Tracking and Performance Report**. This report tracks all innovations offered by the Contractor, CDOT, and Design Consultant team members from the Procurement Phase through the Preconstruction Phase. It also tracks the performance of these innovations during any Construction Phase or LLTP of the Project.

3.4.5 Assessing and Improving Constructability

As part of the collaborative design process, the Contractor provides constructability reviews for the feasibility and practicality of any proposed means and methods; selected materials, equipment, and labor; material availability; site improvements; earthwork and foundation considerations; and coordination of the Drawings and Specifications, verification of quantities, and so forth. Through this review the Contractor should provide alternatives that provide cost or schedule savings or limit impacts on the traveling public.

The Design Consultant then has the opportunity to tailor the design to the Contractor's preferred means and methods. Some of the most valuable input that the Contractor provides is a review of the actual construction phasing and traffic control that the Contractor uses during construction. By collaboratively developing construction phasing plans, the project team can be assured that construction schedules are accurate and can be accomplished during construction. Significant design decisions can be made that reduce construction impacts on the traveling public. The CMGC Project Delivery method allows CDOT to

evaluate and direct decisions regarding construction phasing, schedule, and impacts on traffic, thereby determining solutions that provide the best value to the public.

To document and facilitate this process the Contractor is responsible for developing a **Constructability Report** after review of each Milestones plan submittal, which includes a review of the cost and risks associated with the constructability of the proposed design.

3.4.6 Value Engineering Requirement

FHWA requires a formal VE analysis for each project on the National Highway System (NHS) with an estimated total project cost of $50 million or more that utilizes Federal-aid highway funding, and for each bridge project on the NHS with an estimated total project cost of $40 million or more that utilizes Federal-aid highway funding. CDOT may decide it is beneficial to conduct a VE Workshop for smaller projects. The CDOT Project Manager works with FHWA to determine the focus of the VE study, which may include cost and/or schedule improvements. Typically the VE Workshop occurs during, or prior to, the 30% design development stage. For projects delivered using the CMGC contracting method, a VE analysis is not required prior to the preparation and release of the RFP for the CMGC contract. The VE analysis is required to be completed, and approved recommendations incorporated into the project plans, prior to requesting a construction price proposal from the CMGC.

To maximize Contractor input, the CMGC is allowed to be a part of the VE analysis. FHWA agrees that the CMGC contracting method provides a greater opportunity for Contractor input during the design phase of a project. Realizing the differences in the CMGC contracting method, FHWA included VE analysis guidance for CMGC delivered projects in the Final Rule updating the VE regulations in the Federal Register on September 5, 2014. The requirement for a VE analysis provides the greatest opportunity for the Designer, Contractor, and Owner to work together to identify value improvement opportunities for the project.

Cost savings as a result of the Contractor's participation in the VE Workshop are not shared. Cost saving concepts developed through the VE Workshop during the Preconstruction Phase may be incorporated into the Contract Documents at the discretion of the CDOT Project Manager.

In CMGC, value engineering by the CMGC Contractor occurs throughout the Preconstruction Phase during the iterative design and review process. Because the Contractor is involved in the design development, Value Engineering Change Proposals (VECPs) are not accepted during the Construction Phase. CDOT Standard Specification Sections 104 is revised to state that VECP's are allowed during the construction of CMGC Projects.

3.4.7 NEPA Process and CMGC

Although project design can be accelerated and advanced through CMGC, CDOT Project Managers need to be aware that the design must progress in accordance with the Code of Federal Regulations (CFRs) which allows preliminary design activities to proceed prior to conclusion of the National Environmental Policy Act (NEPA) process, as long as preliminary activities do not materially affect the objective

consideration of alternatives in the NEPA review process. CDOT is also at risk for design alternatives that are determined not to meet previously approved environmental assessments, and written approval from the FHWA is required to advance the design past the conceptual design.

The CMGC cannot be part of, or influence, the environmental alternatives process. However, once the project has obtained environmental clearance the CMGC can provide significant value by mitigating environmental impacts identified in the environmental assessment.

3.4.8 Construction Plans and Specifications

Development of the construction plans proceeds in similar fashion to DBB except that the process is more iterative involving the Contractor for constructability reviews and design alternatives. CDOT design reviews occur at the FIR and FOR levels. CDOT specialty staff should be made aware of the limited time available for these reviews. For CMGC projects, the FOR review often requires a quick turnaround because revisions to the construction plans may affect the CMGC's CAP Proposal that is typically prepared following the FOR submittal. To ensure few changes after the CAP the plans may be advanced 100% stamped plans, if the project schedule allows.

Development of the construction specifications also proceeds in similar fashion involving the Contractor for selection of materials, equipment, and alternative methods. Modifications that are proposed by the Contractor are included in Project Special Provisions and approved by CDOT. CDOT specification reviews occur at the FIR and FOR levels. Again, CDOT specialty staff should be made aware of the review time available for these reviews so as not to adversely affect the CMGC's schedule and CAP Proposal that is typically prepared following the FOR submittal.

3.4.9 CDOT Owner Controlled Insurance Program

During the Preconstruction Phase, the project team should coordinate with CDOT Risk Management to discuss details that will affect the Owner Controlled Insurance Program (OCIP) such as schedule, unique project risks, design costs, construction costs, and the potential lines of insurance coverage that may be included in the OCIP. With project specific information, CDOT can better determine the covered and costs for the project that will affect the Contractor's insurance requirements and project cost estimates.

Typically around the 30% level, the project team should meet with CDOT Risk Management to discuss OCIP draft specifications and identify which lines of insurance coverage need to be included in the OCIP, which lines of coverage need to be provided by the Contractor and which need to be quoted by the Contractor and then analyzed By CDOT in a feasibility study. Typically around the 60% level, the Contractor will be required to provide insurance quotation documentation, along with all other applicable documentation to CDOT Risk Management for the feasibility study.

The requirements and procedures for CDOT insurance program are subject to change, therefore the Region should contact CDOT Risk Management at the beginning of the Preconstruction Pphase to obtain the most current requirements.

3.4.10 Construction Schedules

The Contractor is responsible for preparing and maintaining an overall Project Schedule, with input from the Design Consultant and CDOT. The Project Schedule must be in a Critical Path Method (CPM) format that is coordinated with the Design Consultant's design schedule, CDOT and FHWA review processes, and agreed-upon Milestone dates. The schedule must have reasonable detail to allow for assessment of potential LLTP proposals. The Project Schedule is updated following each OPCC submittal and at Milestone dates as determined at the Project Scoping Workshop.

3.4.11 Subcontracting and Supplier Plan

As part of the Cost Model, the Contractor must prepare a Subcontracting Plan**.** The Subcontracting Plan shall be started during the 30% design phase and updated and included with each OPCC prepared by the Contractor The Subcontracting Plan is also included in the CAP Proposal final package for EEO review.

As part of the Supplier and Subcontractor outreach, the Contractor is expected to solicit and obtain three or more quotes for subcontracted work and materials to ensure competitive pricing. However, if approved by the CDOT Project Manager, the project team may decide to use a Subcontractor that provides the best value if it determined to be in the best interest of the project.

3.5 Risk Management

The following section provides a summary of risk management and the tools that CDOT has developed to assist with risk management on CMGC projects. Personnel involved with CMGC contracting are encouraged to read the NCHRP Report 658, *Guidebook on Risk Analysis Tools and Management Practices to Control Transportation Project Costs* for additional guidance on risk management.

Risk management is the identification, analysis, planning, allocation, and control of project risks. It is central to CMGC project delivery. Throughout the project, the Design Consultant, Contractor, and CDOT collectively collaborate to identify project risks, propose mitigation, and actively control risks. The Contractor is primarily responsible for identifying construction risks and takes the lead in tracking project risks, preparing the associated cost and schedule impacts and monitoring and controlling risk during the Construction Phase. The ICE provides support in verifying the costs associated with the risks. The Design Consultant is responsible for advancing and refining the design to minimize or eliminate identified risks. CDOT's Project Manager is ultimately responsible for deciding which party owns and controls the risk and determines the Contract dollars assigned to the project risk pools. Understanding which risks can and must be controlled by CDOT and which risks can and are best shared with or allocated to the Contractor, results in an efficient and effective CAP Proposal and overall lower project cost.

The risk analysis and management process generally includes the following five steps, which are described in detail in subsequent sections:

1. Identify the risk.
2. Assess and analyze the risk.

3. Mitigate and plan for the risk.
4. Allocate the risk.
5. Monitor and control the risk.

Figure 3-2. Collaborative Risk Management Process

Identify the Risk

General project risks are first identified during CDOT's project delivery method selection process described in Chapter 2 of this manual. During the delivery method selection process, the PDSM likely has identified project-specific risks that would benefit from early contractor collaboration and led to the selection of the CMGC project delivery method. During the CMGC procurement phase, the Contractor further identifies the project risks and proposes methods for controlling those risks. These early identified risks become the basis of the initial project risk matrix, which is prepared by the Contractor. The project team reviews the risk matrix during the Project Scoping Workshop to reach a consensus of project risks, agree on the likelihood that the risk will occur, and discuss a general approach to mitigate the risk or maximize an opportunity to provide value to the project. Additional project risks are then identified and addressed throughout an iterative design development process, as illustrated in the Preconstruction Phase flowchart in **Figure 3-1**.

What are considered Project Risks?

A project risk is an uncertain event or condition that, if it occurs, has a negative or positive effect on a project's objectives, cost, schedule, or quality. Typical examples include unknown soil conditions, adverse groundwater conditions, hazardous materials, utility conflicts and delays, third-party processes and approvals, innovations, improved means and methods, and constructability problems.

What are not considered Project Risks?

Project risks do not include internal business risks. All of the Contractor's internal risks that are inherent in all projects, such as labor and equipment availability and failure, worker attrition, equipment failure, and capital expenditures, are completely accepted by the Contractor. Although these are real costs and risks to the Contractor, they are not common or shared project risks and must be managed solely by the Contractor as part of the Contractor's business. Similarly, CDOTs internal organizational processes, as important as they are to executing the project, are considered risks that are completely accepted by CDOT. CDOT's Resident Engineer or Program Engineer must be involved in any discussions where CDOT's Risk Pools are developed for these organizational process risks.

Access and Analyze the Risk

During the Preconstruction Phase, the project team collaboratively assesses the project risks through a series of Risk Management Meetings. These meetings are typically held at established pricing milestones following 30%, 60%, and 90% submittals, although often additional meetings are required. Initial Risk Management Meetings typically focus on identifying and assessing project risks and investigating innovative design solutions. During later meetings, the focus shifts to discussions of the cost and schedule impacts, risk allocation, and development of the risk pools, if necessary.

Mitigate and Plan for the Risk

In a traditional DBB, without the benefit of the CMGC collaborative process, project risks result in the Contractor adding contingency to the bid. In DB, there is more opportunity to properly allocate and manage risk but still the Contractor must often add contingencies to the bid to cover risk that the Contractor is not in a position to effectively manage. In CMGC, there is a unique opportunity to advance and refine the design to reduce Contractor- identified risk. Risks that have been eliminated through design changes can then be either removed from the Risk Register or noted as having been resolved. If the project risk cannot be eliminated, it remains on the Risk Register and the Contractor must prepare a mitigation plan for the risk. Mitigation can involve design changes, development of Risk Pools, Owner-accepted risk, Contractor-accepted risk, and avoidance of risk to eliminate or reduce the risk.

Some risk can be mitigated by early-stage construction packages or through the LLTP process. The Contractor should look for any material or equipment that is likely to benefit from early procurement. These items can then be procured prior to the Construction Phase through an LLTP CAP. Likewise, the project team should review the project and identify construction phases that are likely to benefit from

staged construction packages. For example, an early construction package could be procured to allow for utility construction to proceed or to allow the project schedule to advance for a phase of construction while project details are resolved on subsequent phases.

Allocate the Risk

Once a risk has been identified and quantified, it is assigned to either CDOT or the Contractor. The goal is to assign the risk to the party who is best able to control the risk. Risks can be allocated solely to the Contractor or CDOT, or they can be shared. Risk is accounted for in three ways: (1) risk that is allocated to the Contractor is included within the Contractor's bid items; (2) risk that is allocated to CDOT is accounted for in the CDOT Risk Pool; and (3) risk that is to be shared is accounted for in the Shared Risk Contingency Pool. Additionally, risk for minor overruns and Contract changes are addressed by a CDOT Risk Pool similar to DBB Force Accounts. Minor Contract Revisions (MCRs) for CMGC projects can usually be significantly less than for traditional DBB as a result of the risk mitigation process and cost allocation to risk pools.

The Contractor and CDOT develop risk pools for risks that need to be addressed through the CDOT Risk Pool or Shared Risk Contingency Pool by following four steps:

1. The CMGC Contractor submits drafts of the items, including estimates for those items, to be covered by MCRs, Overruns, CDOT Risk Pools, and Shared Risk Contingency Pools for CDOT review and acceptance.
2. The CMGC Contractor submits drafts of the definitions for Shared Risk Contingency Pools for CDOT review and acceptance.
3. The CMGC submittals are reviewed by CDOT, with technical input from the Design Consultant and cost validation from the ICE.
4. Once accepted, CDOT adds the items and definitions to the Risk Register as a Project Special Provision for team review, acceptance, and signing.

Monitor and Control the Risk

The objectives of risk monitoring and control are to systematically track the identified risks, identify any new risks, and effectively manage the contingency reserve. Risk monitoring and updating occurs after the risk mitigation and planning processes and then continues through the Preconstruction and Construction Phases. The list of risks and associated risk management strategies are likely to change as the project matures and new risks develop or anticipated risks are mitigated.

Periodic project risk reviews repeat the tasks of identification, assessment, analysis, mitigation, planning, and allocation. Regularly scheduled project risk management meetings can be used to ensure that project risk is continually reviewed. If unanticipated risks emerge, or a risk's impact is greater than expected, the planned response or risk allocation may not be adequate. At this point, the project team must perform additional planning to control the risk. Changes to project risks must be documented using the established Risk Register. During the Construction Phase, CDOT and the Contractor monitor

contingencies and the Risk Pools to ensure that the established Risk Pools are adequate for the actual realized project risks.

3.5.1 Risk Register

The Risk Register is a tool used to document the risk management process. The purpose of the Risk Register is to define the risks, document the risks, identify cost and schedules impacts associated with the risks, and produce detailed mitigation plans for the risks. Each Risk Register includes the agreement of how CDOT and the Contractor defined the risks, who is responsible for the risks, and how the risks are to be paid for during construction. The Contractor is responsible for preparing and updating the Risk Register with input from CDOT, the ICE, and the Design Consultant.

By the end of the Preconstruction Phase, the Risk Register describes all known project risks, defines the project Risk Pools, and becomes part of the Contract Documents. This Risk Register includes the agreements between CDOT and the Contractor that defines risk management for the construction package(s). The Risk Register is formalized with the Construction Agreement and is a Contract Document that is signed and agreed to by both parties so that miscommunications and disputes during construction are limited. During the Construction Phase, the Contractor is responsible for monitoring and controlling the risks that have been allocated to the Contractor through the Risk Register.

The outline and CDOT template for a typical Risk Register includes the following:

Section 1 – Project Overview, Purpose, and Procedure

a. Project overview (a full description of the project from the RFP with any changes that have occurred during the design development)
b. Project goals (as previously developed during the RFP and Project Scoping Workshop)
c. Purpose of the Risk Register
d. Risk Register procedure and methodology

Section 2 – Construction Phase Risk Categories and Definitions

a. Construction package (list the construction package(s) determined in the Preconstruction Phase)
b. Definition of the established Risk Pools and Agreements
c. A list of each identified risk specifying which Risk Pool the item will be paid from
d. Revisions to CDOT standard payment Specifications for all Shared Risk Pool items, which define how the item will be paid and shared

Section 3 – Risk Matrix

a. Identifies each risk, risk level, cost impact, schedule impact, approach to minimize risk, responsible party, and result of risk mitigation (The sample Risk Matrix in **Figure 3-3** illustrates a first level of risk identification to determine and assign potential risks. As the Preconstruction Phase advances, a second level analysis (**Figure 3-4**) is performed to further allocate and price the risk. CDOT's Risk Matrix template is included in the **Appendix**).

Section 4 – Agreement and Signature Page

LEVEL 1 - RISK REGISTER			Project Name: Example Project				Project Number: XX-XXXX			
Risk Identification				Risk Assessment			Risk Response		Allocation	
Status	ID #	Type	Identified Risk	Potential Cost Impact	Potential Schedule Impact	Risk Level	Strategy	Response Actions	Risk Owner	Updated
Active	10	Threat	Survey File	Inaccuracies or incomplete information in survey file may lead to rework of design	Design rework may delay the start of construction	Medium	Mitigate	Verify that the survey file is accurate and complete	CDOT	10/12/2012
Active	11	Threat	Lane Closure in Inclement Weather	Possible additional cost for construction equipment to support maintenance efforts	If not able to close for blasting operations, will affect the schedule critical path	Medium	Accept	Coordinate with CDOT maintenance to work within possible closures, incorporate flexibility into lane closure strategy	CDOT	11/23/2012
Active	12	Threat	Delay of ROW Acquisition	Delayed start of construction may increase costs due to price escalation	Due to the large number of parcels and businesses, may have to use the condemnation process to acquire ROW, which could delay start of construction by up to one year.	High	Accept	CDOT and Design Consultant to identify needed ROW early in design process. Project team to review potential construction phasing to allow project to proceed in phased approach	CDOT	11/23/2012
Active	13	Threat	Rock Joint Pattern Resulting in Excessive Overbreak	Increased cost for concrete, excavation, and shotcrete overruns	Additional time to construct and remove materials	High	Mitigate	Monitor during blasting to make adjustments to minimize as excavation proceeds, determine accepted amount of overbreak in CAP, consider risk pool	SHARED	12/2/2012
Active	14	Threat	Dry Utility Relocation Delays	Project delays may impact project cost if critical project elements cannot proceed and demobilization occurs	Utility conflicts may result in demobilization until resolved by third party utility owner	Medium	Mitigate	Identify flexibility in schedule to allow construction to proceed. Understand all required utility relocation during design phase and monitor utility relocations	CDOT	11/24/2012
Active	15	Threat	Nesting Birds	Nesting birds, protected from harassment under the Migratory Bird Treaty Act, may delay construction during the nesting season		Low	Mitigate	Schedule work to avoid nesting season or remove nesting habitat before starting work	CONTRACTOR	11/24/2012
Active	16	Threat	Increased Drilled Shaft Length	Increased cost for additional drilled shaft length	Increased schedule to perform additional drilling	Low	Mitigate	Review geotechnical information and obtain additional borings if necessary	CDOT	11/24/2012

Figure 3-3. Sample Level 1 Risk Matrix

LEVEL 2 - RISK REGISTER	Project Name: Example Project						Project Number: XX-XXXX				
Risk Identification	**Risk Assessment**						**Allocation**			**Monitor & Control**	
Identified Risk	**Potential Cost Impact**	**Potential Schedule Impact**	**Prob.**	**Schedule Impact (days)**	**Cost Impact**	**Factored Cost**	**Risk Owner**	**CDOT Risk Pool**	**Shared Risk Pool**	**Interval or Milestone Check**	**Status and Review Comments**
Survey File	Inaccuracies or incomplete information in survey file may lead to rework of design	Design rework may delay the start of construction	20%	10	$20,000	$4,000	CDOT	$4,000		Following completion of design survey	
Lane Closure in Inclement Weather	Possible additional cost for construction equipment to support maintenance efforts	If not able to close for blasting operations, will affect the schedule critical path	30%	20	$50,000	$15,000	CDOT	$15,000		Monitor daily during construction	
Delay of ROW Acquisition	Delayed start of construction may increase costs due to price escalation	Due to the large number of parcels and businesses, may have to use the condemnation process to acquire ROW, which could delay start of construction by up to one year.	60%	160	$250,000	$150,000	CDOT	$150,000		Review monthly during design until secured	
Rock Joint Pattern Resulting in Excessive Overbreak	Increased cost for concrete, excavation, and shotcrete overruns	Additional time to construct and remove materials	40%	15	$245,000	$98,000	SHARED		$ 245,000	Monitor daily during blasting operations	
Dry Utility Relocation Delays	Project delays may impact project cost if critical project elements cannot proceed and demobilization occurs	Utility conflicts may result in demobilization until resolved by third party utility owner	30%	30	$40,000	$12,000	CDOT	$12,000		Review monthly during design and weekly during construction	
Nesting Birds	Nesting birds, protected from harassment under the Migratory Bird Treaty Act, may delay construction during the nesting season		20%	40			CONTRACTOR			Monitor weekly to ensure habitat remains mitigated	
Increased Drilled Shaft Length	Increased cost for additional drilled shaft length	Increased schedule to perform additional drilling	10%	10	$25,000	$2,500	CDOT	$15,000		Review following geotechnical investigation. Monitor daily during Construction	

Figure 3-4. Sample Level 2 Risk Matrix
(note some columns not shown for clarity)

3.5.2 Contingency Pricing, Risk Pools, and Force Accounts

Contingency is bid into every project, regardless of contracting method, and is reflective of the risks present at the time the contact is bid. Typically, higher risk means higher contingency and lower risk means lower contingency. One of the major benefits of CMGC contracting is that it allows the owner and contractor to collaboratively work together during the design phase to better understand, manage, and reduce risks on the project, thereby lowering contingency costs.

For CDOT's CMGC projects, risk is paid for by three separate means: (1) through the Contractor's bid for risk that the Contractor has accepted, (2) through the CDOT Risk Pool for risk that CDOT has accepted, and (3) through the Shared Risk Contingency Pool for risk that has been shared.

Contractor Risk

The Contractor must include contingency in the Contractor's bid items for common construction risks, such as labor availability, material pricing fluctuations and availability, schedule delays, and Subcontractor management. CDOT and the ICE will review the Contractor's estimating assumptions to fully understand any contingency that the Contractor has assigned to the work. If the contingency is considered high, CDOT can work with the Contractor to reduce risks that are contributing to the high contingency, mitigate the risk through the Shared Contingency Risk Pool, or remove the risk from the Contractor entirely by accepting the risk in the CDOT Risk Pool.

CDOT Risk Pool

The CDOT Project Manager should consider taking ownership of the risk if CDOT has a better opportunity to manage the risk than the Contractor or if the risk is completely beyond the control of the Contractor (e.g., weather, changes in site conditions, etc.). The CDOT Project Manager may also consider taking ownership of the risk if he or she believes the probability of the risk occurring is less than the Contractor's assessed probability. For example, a Contractor is including a high contingency in a bid item to cover the cost of potential weather delays that could increase the rental costs for a specialty piece of equipment. CDOT may decide to take that risk and include this price within the CDOT Risk Pool. If the weather delay occurs, CDOT is responsible to pay the Contractor. However, if the weather delay does not occur then CDOT has saved the contingency cost without sharing the cost savings with the Contractor.

Shared Risk Contingency Pool

The Shared Risk Contingency Pool is often the best tool for managing project risks that have a high amount of uncertainty, along with a high likelihood of occurring, but still have the potential for the Contractor to control. Typically these items are identified and proposed by the Contractor who submits a plan to CDOT for review and approval. The potential amount of the shared risk is defined in the Risk Register along with a payment specification (a Project Special Provision). If the risk is encountered during construction, the Contractor is paid per the agreed-to payment specification. However, if the entire estimated risk is not recognized, CDOT and the Contractor share the savings as identified in the

Risk Register. Typically Shared Risk Contingency Pools are split equally, but the amounts could vary if either CDOT or the Contractor is assuming more risk. Ultimately this is part of the negotiation and how CDOT plans to manage the risk.

CMGC Project Special Provisions are required to contractually define shared risks. **Figure 3-5** shows a sample risk sharing Project Special Provision from a recent CDOT tunnel project. The Contractor identified a project risk associated with not knowing the amount of shotcrete that would be required to compensate for irregularities in the excavated surface. Although to some extent the Contractor could control the excavation, there was a high likelihood that additional shotcrete would be necessary beyond the neat line calculations from the construction plans. The Contractor proposed a unit price and a Shared Risk Pool, which was reviewed by the ICE, approved by CDOT, and documented in the Risk Register.

REVISION OF SECTION 641
TUNNEL SHOTCRETE

Section 641A of the Project Special Provision is hereby revised as follows:

Add the following to 641A.14:

Additional shotcrete for initial support shall be compensated through a shared risk pool as established in (e) below for structural shotcrete.

(a) The following Shared Risk Pool (shotcrete) has been established as compensation in the event that the actual volume of shotcrete to reach required thickness is increased due to irregularities in the excavated surface. The quantity will be measured based on the delivered quantity of shotcrete as defined in revision to section 641 in the special provisions. The basis of volume shall be cumulative over the length of the tunnel. In the event that the total Shared Risk Pool is not utilized, the savings will be shared between Contractor and the Owner based on percentages below

Shared Risk Contingency Pool:

Cost/Cubic Yard	Total Additional Cubic Yards	Total Risk Pool	Contractor's Share	Owner's Share
$700.00	350	$245,000	50%	50%

(b) In the event that the actual volume exceeds that as specified above the same unit rates shall apply.

Figure 3-5: Example Risk Sharing Project Special Provision

The motivation for using the Shared Contingency Risk Pool is that it provides an incentive for the Contractor to control risk and maintain good production methods during construction. Under DBB or DB project delivery methods, the savings of unrealized risks are kept entirely by the Contractor. Shared Risk Pools allows CDOT the ability to recover a share of the unrecognized risk and collaboratively assist with controlling the risk when possible. However, to ensure fair pricing, the ICE is heavily relied upon to review all unit item costs and total estimated costs associated with any Contractor-proposed shared risks. If the Contractor and CDOT cannot agree to an appropriate shared risk item price or total amount of the pool, the CDOT Project Manager may decide to accept the risk entirely into the CDOT Risk Pool.

Establishing Dollar Amounts for the Risk Pools

There is no standard formula to establish the dollar amounts to include in the risk pools for identified risks. The CDOT Project Manager must use some judgment and work collaboratively with the Contractor and the ICE to include sufficient funds to cover the likelihood of the risks occurring without overestimating the contingency such that it falsely limits the budget available for the project's intended scope of work.

To provide guidance to CDOT Project Managers, one way of viewing a simplified approach to risk allocation is to review the probability that a risk may occur. Generally, if the probability of a risk occurring is high, the entire amount of the risk should be considered for the risk pool. If both CDOT and the Contractor are in agreement that the probability of a risk is low, it is often accepted entirely by one of the parties or alternatively included in the risk pool with a reduced amount (relative to its probability of occurrence). Challenges occur, however, when CDOT and the Contractor are not in agreement on the probability of the occurrence of the risk. An approach for the CDOT Project Manager to consider is to accept the risk into the CDOT Risk Pool when the Contractor considers the probability of the risk occurring to be higher than CDOT's assessment. Otherwise, from CDOT's perspective, for shared risks, the Contractor can receive additional compensation for avoiding risks that are unlikely to occur.

The Risk Matrix can be an effective tool to assist in these discussions and in establishing appropriate amounts to include in the risk pools. The risk matrix should show the probability of the risk occurring and the total maximum cost impact if the risk does occur. To establish the contingency, a weighted average or expected value of the risk is then obtained by multiplying the probability of the risk occurring by the cost impact.

Contractors that routinely deal with risk may have more detailed methods involving complex simulations or other risk management informational systems. In these circumstances, the CDOT Project Manager must collaborate with the Contractor to understand the approach and methods used in the risk analysis.

Risk Management as it Relates to the OPCC process and CAP Proposal

Developing the Risk Register and Risk Pools is integral to the preparation of the Contractor's Opinion of Probable Construction Cost (OPCC) and the CAP Proposal. The Contractor and ICE are better able to prepare accurate estimates as project risks are identified and mitigated, and defining and establishing the Risk Pools allows the Contractor and ICE to remove contingencies from the bid items. The OPCC

becomes more accurate with each successive pricing milestone. The open-book format allows CDOT to fully understand the contingencies within the OPCC and the Risk Pools provide a tool to separate risk from discussions surrounding bid item costs. When this collaborative and open process is well executed, it leads to a CAP Proposal that does not contain any surprises and is easily agreed to by CDOT.

Force Accounts for CDOT Risk Pool and Shared Risk Contingency Pool

Once the project moves into the Construction Phase, the previously established CDOT Risk Pool and Shared Contingency Risk Pool become planned Force Accounts. The requirements for the use of Force Accounts are described further in Chapter 4 of this manual and are specified in the Revision of Section 109 - Construction Manager/General Contractor Force Accounts. The CDOT Project Manager modifies Section 109 to define project-specific requirements and definitions determined through the risk management process.

3.5.3 Risk Management Meetings

A Risk Management Meeting is typically held at each pricing milestone and includes the Design Consultant, Contractor, ICE, and CDOT. EEMA may also attend this meeting to provide guidance. The purpose of the meeting is to review project risks, discuss mitigation and associated costs, identify the responsible party to manage the risk, and establish risk pools.

During this meeting, the CDOT Project Manager and Contractor agree on how risks and contingencies are quantified and assigned. The ICE and Design Consultant participate in this discussion to assist CDOT, stay informed, and understand risk and contingency assignment. Adjustments to plans and quantities may be needed based on discussion at the Risk Management Meeting. During early risk meetings, a significant amount of time is spent identifying risks and assigning time and cost impacts for each risk. During subsequent meetings, the focus of the meetings is to identify any new risks that have been encountered. The Contractor updates the Risk Register at the conclusion of the Risk Management Meeting to include newly identified risks, risks that have been mitigated, and any necessary adjustments to the Risk Pools that have been agreed to by the ICE and CDOT.

3.6 Estimating CMGC Projects

One of the most important processes in the CMGC Preconstruction Phase is the development of interim pricing that leads toward successfully establishing an acceptable CAP. As the design progresses, the Contractor and the ICE prepare interim estimates, called Opinions of Probable Construction Cost (OPCC), at established pricing milestones. Pricing milestones allow CDOT to expose pricing disagreements early in the CMGC process, which allows time for both CDOT and the Contractor to resolve these inconsistencies prior to the final CAP commitment. Project risks and costs are reviewed through a series of Design Review Meetings, Risk Management Meetings, and Cost Estimate Review Meetings. The goal of this iterative and open process is to continually review pricing, cost assumptions, and risks in order to create a CAP proposal that is within an acceptable percentage of the ICE estimate and allow CDOT to proceed directly to awarding the Contract at the completion of the Preconstruction Phase.

3.6.1 Cost Model

Successful price justification in CMGC relies on open communication to thoroughly document the assumptions used by the Contractor to price the work. The Cost Model is an open and transparent model that the Contractor develops and uses through the Preconstruction Phase so that estimates and assumptions are communicated to CDOT, the Design Consultant, and the ICE. The Cost Model includes a Summary of Approximate Quantities (SAQ) for the Plans and Specifications at the time of the estimate, along with a list of the pricing assumptions and other notes associated with each bid item (see **Figure 3-6)**. Details include, but are not limited to, labor hours and rates, materials, equipment, subcontractor and supplier quotes, means and methods, production rates, risks, direct costs, and mobilization. The format of the Cost Model varies depending on the Contractor, but it must clearly communicate how the item costs were derived. CDOT and the ICE review the Cost Model and must concur with the assumptions made by the Contractor.

Initially, CDOT, the Contractor, ICE, and Design Consultant will need to determine and agree to the most appropriate CDOT cost data number, units of measure, and quantities for all items. As design progresses, the Contractor and ICE will reconcile quantities for major items, and will perform independent takeoffs for materials, labor, and equipment.

In an open-book process, the Contractor prepares an initial Cost Model that is reviewed by the project team at the Project Scoping Meeting. The Cost Model is further refined following completion of the 30% design and is thoroughly reviewed by CDOT and the ICE at a Cost Model Review Meeting. The Cost Model is again refined with each subsequent pricing milestone and is used as the basis for each Opinion of Probable Construction Cost (OPCC) and any LLTP CAP or any Construction CAP proposal when submitted.

When updating the Cost Model, the Contractor should review risks, market conditions, and potential challenges in the current design that could impact schedule or cost. The Contractor should propose innovations or alternative designs that minimize risk or add value to the project. The Cost Model is then used to communicate and document the history and pricing assumptions made throughout the design development.

Figure 3-6 illustrates several example bid items from a Cost Model Summary of Approximate Quantities. Each bid item contains comments that document the assumptions associated with that item. These assumptions are reviewed by the project team and are agreed to by CDOT to establish the terms for pricing the line item.

			QUANTITY	COMMENTS
ITEM NO.	ITEM	UNIT		
202-00035	REMOVAL OF PIPE	LF	53	REMOVAL OF PIPE JUST EAST OF DOGHOUSE RAIL BRIDGE, SEE SHEET 29, QUANTITIES HAVE BEEN ADJUSTED IN THIS SOAQ TO MATCH CP1A. ADDED 30 LF FOR REMOVAL OF 12" CMP AT CLEAR CREEK HOUSE DRIVEWAY.
202-00246	REMOVAL OF ASPHALT MAT (PLANING) (SPECIAL)	SY	935	1 MOBILIZATIONS FOR PROFILING CONTRACTOR. MUST GRIND OFF STRIPING.
202-00495	REMOVAL OF PORTIONS OF PRESENT STRUCTURE	LS	1	AREA 5 ALONG LENGTH OF THE WALL. REMOVE ROCKFALL FENCE ABOVE SHORING AREA 5.
202-XXXXX	REMOVAL OF GUARDRAIL (SPECIAL)	LF	1,270	TRANSPORT TO EMPIRE YARD
203-00062	EMBANKMENT MATERIAL (COMPLETE IN PLACE) (SPECIAL)	CY		EMBANKMENT VOLUME WITHIN AVERAGE END VOLUME AS SHOWN ON CLEAR CREEK CHANNEL CROSS SECTIONS.
203-02300	ROCK SCALER	HOUR	80	ADDED ITEM PER CDOT AT COST MODEL REVIEW MEETING
206-00100	STRUCTURE BACKFILL (CLASS 1)	CY	7,132	MOISTURE DENSITY CONTROL ABOVE WEST PORTAL
210-04020	MODIFY INLET	EACH	5	DECREASE QUANTITY PER CDOT/CONTRACTOR AT COST MODEL REVIEW MEETING TO MATCH FIELD CONDITIONS
210-XXXXX	MODIFY GUARDRAIL (SPECIAL)	LF	156	REQUIRES REMOVAL OF 156 LF OF GUARDRAIL (SPECIAL) AND RE-ANCHORING ROCKFALL FENCE.
217-00000	HERBICIDE TREATMENT	HOUR	100	REVISED QUANTITY DUE TO REQUEST FROM CDOT CM STAFF FOR ADDITIONAL HOURS NEEDED IN CP2
304-06000	AGGREGATE BASE COURSE (CLASS 6)	TON	1,518	REVISED QUANTITY DUE TO PARKING AREA AND CLEAR CREEK DRIVEWAY REVISION.
606-02005	END ANCHORAGE (FLARED)	EACH	2	IS REQUIRED TO BE PAINTED. AN EXISTING CDOT (SPECIAL) PAY ITEM DOES NOT EXIST, THEREFORE NEW ITEM WILL NOT BE REQUESTED. THIS IS CONSISTENT WITH PRIOR ITEM CREATION CONVERSATIONS REGARDING
626-00100	MOBILIZATION (WITHOUT AUTOPAY)	LS	1	8 MONTHS OF MANAGEMENT, 9 MONTHS OF OFFICE
700-71001	CMGC SHARED RISK CONTINGENCY POOL	FA	1	ADDED ITEM PER CDOT FOR COMMENTS
700-71002	CDOT RISK POOL	FA	1	ADDED ITEM PER CDOT FOR COMMENTS

Figure 3-6. Sample Summary of Approximate Quantities from a Cost Model

3.6.2 Pricing Milestones

The number of pricing milestones varies based on the complexity of the project; however, logical pricing milestones are built into the typical design process. For example 30%, 60%, and 90% review meetings can correspond with the design FIR, DOR, and FOR meetings. Pricing milestones are determined by the CDOT Project Manager and are established and agreed to at the Project Scoping Meeting. Ideally, the first pricing milestone occurs as soon as major project requirements are identified so that construction costs can be compared with the Fixed Limit of Construction Cost established for the project. For each pricing milestone, the Contractor submits an Opinion of Probable Construction Cost (OPCC) and the ICE submits an Independent Cost Estimate.

3.6.3 Opinion of Probable Construction Cost Submittals

The Contractor is responsible for preparing an Opinion of Probable Construction Cost (OPCC) at each agreed-to pricing milestone. Each OPCC is independently prepared but in coordination with the Design Consultant, CDOT, and the ICE. Estimates must be based on quantitative takeoffs whenever possible and must be supported in sufficient depth and organization to be used in preparing budgets, bid schedules, Specifications, and Risk Pools. The specific cost coding structure, estimating guidelines, assumptions, and contents of the cost estimates are mutually agreed to by the Contractor, CDOT, and the ICE prior to development of the first cost estimate to assure that estimates developed by all parties can be compared and reconciled. Each OPCC is produced in an open-book process through the Preconstruction Phase of the Project so that CDOT and the ICE can make accurate assumptions, calculate prices, and determine the amount of risk in the project.

Figure 3-7 is a production-based format for the Embankment bid item associated with an example project. This is the general format that will be prepared by the Contractor and ICE for OPCC submittals. The estimate contains detailed information on the labor hours and rates, equipment types, labor hours and rates, production rates, days required to complete the work, and total cost for the item.

When preparing any OPCC and in development of the Schedule of Bid Items, documents must include:

- the cost of all labor, materials, equipment, bond premiums, and actual costs of procurement or construction that the Contractor will use for the duration of such LLTP Phase or Construction Phase to complete the Work.
- the General Conditions to be incorporated in the Work.
- all indirect costs for review and approval by CDOT.
- The Subcontracting Plan

For each OPCC, the Contractor must acquire multiple quotes from potential Subcontractors and Suppliers. This information is shared in the open Cost Model and the Contractor allows potential Suppliers and Subcontractors to share their information, quotes, and product data with the ICE, CDOT, and the Design Consultant.

The Contractor must also submit a Material Sourcing Plan, a written plan that details how the Contractor intends to handle bids from material vendors for any LLTP CAP or Construction CAP proposals. The Material Sourcing Plan is started during the 30% design phase and is updated with each Opinion of Probable Construction Cost (OPCC). The Material Sourcing Plan, when fully developed, also is included in the final CAP Proposal package.

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Direct Cost Report

Activity / Resource	Desc	Quantity Pcs	Quantity Unit	Unit Cost	Perm Labor	Perm Materi	Constr Matl/Ex	Equip Ment	Sub-Contrac	Total
BID ITEM = 10										
Description = EMBANKMENT				Unit = CY	Takeoff Quan: 12,314.000		Engr Quan: 12,314.000			
A260	**PRECOMPACT SUBGRADE**			**Quan: 21,900.00 SY**	**Hrs/Shft: 10.00**		**Cal 50**	**WC UT50HW**		****Unreviewed**
FIN2	FINISH SUBGRADE		30.00 CH	**Prod: 730.0000 UH**	Lab Pcs: 6.00		Eqp Pcs: 5.00			
3STSSY	STS PER SY@106.8	1.00	21,900.00 SY	0.100			2,339			2,339
8GR140	CAT GRADER 140	1.00	30.00 HR	66.575				1,997		1,997
8LD950	CAT 950 LOADER	1.00	30.00 HR	63.470				1,904		1,904
8RLD563	CAT DIRT ROLLER	1.00	30.00 HR	48.455				1,454		1,454
8TRK4X4	FIELD PU 3/4 TON 4	1.00	30.00 HR	15.102				453		453
8TRKW4	WATER TRK 4000	1.00	30.00 HR	46.625				1,399		1,399
OBLADE	GRADER OPR	1.00	30.00 MH	23.050	1,192					1,192
OFORM	OPR FORM	1.00	30.00 MH	23.560	1,231					1,231
OGRD	GRADE CHECK	1.00	30.00 MH	23.820	1,308					1,308
OLOAD	LOADER OP	1.00	30.00 MH	24.980	1,308					1,308
OROLL	ROLLER OPR	1.00	30.00 MH	22.720	1,163					1,163
TKWT	WATER TRK DR	1.00	30.00 MH	23.050	1,085					1,085
$16,833.35	0.0082 MH/SY		180.00 MH	[0.213]	7,288		2,339	7,207		16,833
730.0000 Units/Hr*	7,300.0000 Un/Shift		121.6668 Unit/M		0.33		0.11	0.33		0.77
A280	**EXC TO EMBANK WITH TRUCKS**			**Quan: 2,500.00 CY**	**Hrs/Shft: 10.00**		**Cal 50**	**WC UT50HW**		
Shallow cuts, tight areas - slow production.										
E2EHOE	EXC TO EMB HOE AND TRUC		33.33 CH	**Prod: 75.0001 UH**	Lab Pcs: 7.00		Eqp Pcs: 6.00			
3STSCY	STS PER CY@106.8	1.00	2,500.00 CY	0.100			267			267
4ENDUMP	HOURLY SEMI EN	1.00	100.00 HR	110.000					11,000	11,000
8DZD6	CAT DOZER D6	1.00	33.33 HR	64.073				2,136		2,136
8EX325	CAT EXC 325	1.00	33.33 HR	69.150				2,305		2,305
8GR140	CAT GRADER 140	1.00	33.33 HR	66.575				2,219		2,219
8RLD563	CAT DIRT ROLLER	1.00	33.33 HR	48.455				1,615		1,615
8TRK4X4	FIELD PU 3/4 TON 4	1.00	33.33 HR	15.102				503		503
8TRKW4	WATER TRK 4000	1.00	33.33 HR	46.625				1,554		1,554
OBLADE	GRADER OPR	1.00	33.33 MH	23.050	1,324					1,324
ODOZ	DOZER OPR	1.00	33.33 MH	26.780	1,523					1,523
OEXC	EXCAVATOR OP	1.00	33.33 MH	22.560	1,319					1,319
OFORM	OPR FORM	1.00	33.33 MH	23.560	1,368					1,368
OGRD	GRADE CHECK	1.00	33.33 MH	23.820	1,453					1,453
OROLL	ROLLER OPR	1.00	33.33 MH	22.720	1,292					1,292
TKWT	WATER TRK DR	1.00	33.33 MH	23.050	1,206					1,206
$31,084.43	0.0933 MH/CY		233.31 MH	[2.428]	9,486		267	10,332	11,000	31,084
75.0075 Units/Hr*	750.0750 Un/Shift		10.7154 Unit/M		3.79		0.11	4.13	4.40	12.43
B100	**EXC TO EMBANK**			**Quan: 4,508.00 CY**	**Hrs/Shft: 10.00**		**Cal 50**	**WC UT50HW**		
E2EHOE	EXC TO EMB HOE AND TRUC		60.00 CH	**Prod: 75.1333 UH**	Lab Pcs: 7.00		Eqp Pcs: 6.00			
3STSCY	STS PER CY@106.8	1.00	4,508.00 CY	0.100			481			481

Figure 3-7. Sample Cost Item Estimate

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Direct Cost Report

Activity / Resource	Desc	Quantity Pcs	Quantity Unit	Unit Cost	Perm Labor	Constr Materi	Equip Matl/Ex	Equip Ment	Sub-Contrac	Total
BID ITEM = 10										
Description = EMBANKMENT				Unit = CY	Takeoff Quan: 12,314.000			Engr Quan: 12,314.000		
8DZD6	CAT DOZER D6	1.00	60.00 HR	64.073				3,844		3,844
8EX325	CAT EXC 325	1.00	60.00 HR	69.150				4,149		4,149
8GR140	CAT GRADER 140	1.00	60.00 HR	66.575				3,995		3,995
8RLD563	CAT DIRT ROLLER	1.00	60.00 HR	48.455				2,907		2,907
8TRK4X4	FIELD PU 3/4 TON 4	1.00	60.00 HR	15.102				906		906
8TRKW4	WATER TRK 4000	1.00	60.00 HR	46.625				2,798		2,798
OBLADE	GRADER OPR	1.00	60.00 MH	23.050	2,383					2,383
ODOZ	DOZER OPR	1.00	60.00 MH	26.780	2,742					2,742
OEXC	EXCAVATOR OP	1.00	60.00 MH	22.560	2,375					2,375
OFORM	OPR FORM	1.00	60.00 MH	23.560	2,462					2,462
OGRD	GRADE CHECK	1.00	60.00 MH	23.820	2,616					2,616
OROLL	ROLLER OPR	1.00	60.00 MH	22.720	2,327					2,327
TKWT	WATER TRK DR	1.00	60.00 MH	23.050	2,170					2,170
$36,156.56	0.0931 MH/CY		420.00 MH	[2.424]	17,076		481	18,599		36,157
75.1333 Units/Hr*	751.3333 Un/Shift		10.7333 Unit/M		3.79		0.11	4.13		8.02
B280	**IMPORT AND PLACE BALANCE**			**Quan: 2,879.00 CY**	**Hrs/Shft: 10.00**		**Cal 50**	**WC UT50HW**		
EMBANK	EXC TO EMB HOE AND TRUC		38.38 CH	**Prod: 74.9999 UH**	Lab Pcs: 5.50			Eqp Pcs: 4.50		
2CL1BFILL	CLASS 1 BACKFILL	1.00	5,326.00 TON	7.500		39,945				39,945
4ENDUMP	HOURLY SEMI EN	1.00	344.00 HR	110.000					37,840	37,840
8DZD6	CAT DOZER D6	0.50	19.19 HR	64.073				1,230		1,230
8GR140	CAT GRADER 140	1.00	38.39 HR	66.575				2,556		2,556
8RLD563	CAT DIRT ROLLER	1.00	38.39 HR	48.455				1,860		1,860
8TRK4X4	FIELD PU 3/4 TON 4	1.00	38.39 HR	15.102				580		580
8TRKW4	WATER TRK 4000	1.00	38.39 HR	46.625				1,790		1,790
OBLADE	GRADER OPR	1.00	38.39 MH	23.050	1,525					1,525
ODOZ	DOZER OPR	0.50	19.19 MH	26.780	877					877
OFORM	OPR FORM	1.00	38.39 MH	23.560	1,575					1,575
OGRD	GRADE CHECK	1.00	38.39 MH	23.820	1,674					1,674
OROLL	ROLLER OPR	1.00	38.39 MH	22.720	1,489					1,489
TKWT	WATER TRK DR	1.00	38.39 MH	23.050	1,389					1,389
$94,328.86	0.0733 MH/CY		211.14 MH	[1.901]	8,529	39,945		8,015	37,840	94,329
75.0130 Units/Hr*	750.1303 Un/Shift		13.6355 Unit/M		2.96	13.87		2.78	13.14	32.76
B340	**EMBANK STRUCTURE EXC**			**Quan: 1,993.00 CY**	**Hrs/Shft: 10.00**		**Cal 50**	**WC UT50HW**		
EMB	EMBANK		27.00 CH	**Prod: 73.8148 UH**	Lab Pcs: 6.00			Eqp Pcs: 5.00		
3STSCY	STS PER CY@106.8	1.00	1,993.00 CY	0.100			213			213
8DZD6	CAT DOZER D6	1.00	27.00 HR	64.073				1,730		1,730
8GR140	CAT GRADER 140	1.00	27.00 HR	66.575				1,798		1,798
8RLD563	CAT DIRT ROLLER	1.00	27.00 HR	48.455				1,308		1,308
8TRK4X4	FIELD PU 3/4 TON 4	1.00	27.00 HR	15.102				408		408
8TRKW4	WATER TRK 4000	1.00	27.00 HR	46.625				1,259		1,259
OBLADE	GRADER OPR	1.00	27.00 MH	23.050	1,073					1,073

Figure 3-7. Sample Cost Item Estimate

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Direct Cost Report

Activity / Resource	Desc	Quantity Pcs	Quantity Unit	Unit Cost	Perm Labor	Perm Materi	Constr Matl/Ex	Equip Ment	Sub-Contrac	Total
BID ITEM = 10										
Description = EMBANKMENT				Unit = CY	Takeoff Quan: 12,314.000			Engr Quan: 12,314.000		
ODOZ	DOZER OPR	1.00	27.00 MH	26.780	1,234					1,234
OFORM	OPR FORM	1.00	27.00 MH	23.560	1,108					1,108
OGRD	GRADE CHECK	1.00	27.00 MH	23.820	1,177					1,177
OROLL	ROLLER OPR	1.00	27.00 MH	22.720	1,047					1,047
TKWT	WATER TRK DR	1.00	27.00 MH	23.050	977					977
$13,330.76	0.0812 MH/CY		162.00 MH	[2.131]	6,616		213	6,502		13,331
73.8148 Units/Hr*	738.1481 Un/Shift		12.3025 Unit/M		3.32		0.11	3.26		6.69
C100	**FINISH SUBGRADE**			**Quan: 7,215.00 SY**	**Hrs/Shft: 10.00**		**Cal 50**	**WC UT50HW**		
FIN2	FINISH SUBGRADE		14.00 CH	**Prod: 515.3571 UH**	Lab Pcs: 6.00		Eqp Pcs: 5.00			
3STSFSY	FINISH SY@106.8%	1.00	7,215.00 SY	0.100			771			771
8GR140	CAT GRADER 140	1.00	14.00 HR	66.575				932		932
8LD950	CAT 950 LOADER	1.00	14.00 HR	63.470				889		889
8RLD563	CAT DIRT ROLLER	1.00	14.00 HR	48.455				678		678
8TRK4X4	FIELD PU 3/4 TON 4	1.00	14.00 HR	15.102				211		211
8TRKW4	WATER TRK 4000	1.00	14.00 HR	46.625				653		653
OBLADE	GRADER OPR	1.00	14.00 MH	23.050	556					556
OFORM	OPR FORM	1.00	14.00 MH	23.560	574					574
OGRD	GRADE CHECK	1.00	14.00 MH	23.820	610					610
OLOAD	LOADER OP	1.00	14.00 MH	24.980	611					611
OROLL	ROLLER OPR	1.00	14.00 MH	22.720	543					543
TKWT	WATER TRK DR	1.00	14.00 MH	23.050	506					506
$7,534.60	0.0116 MH/SY		84.00 MH	[0.301]	3,401		771	3,363		7,535
515.3571 Units/Hr*	5,153.5714 Un/Shift		85.8929 Unit/M		0.47		0.11	0.47		1.04
D280	**FINISH TIGHT AREAS**			**Quan: 12,785.00 SY**	**Hrs/Shft: 10.00**		**Cal 50**	**WC UT50HW**		
Due to chopped up nature of work, most of this will be hand work in small areas.										
HNDFIN	HAND FINISH		84.00 CH	**Prod: 152.2024 UH**	Lab Pcs: 6.00		Eqp Pcs: 4.00			
3STSSY	STS PER SY@106.8	1.00	12,785.00 SY	0.100			1,365			1,365
8A2PU3/4	FORMAN 3/4 TN PU	1.00	84.00 HR	12.330				1,036		1,036
8BH446	LG CAT 446 TRACT	1.00	84.00 HR	39.466				3,315		3,315
8RLD323	CAT DIRT ROLLER	1.00	84.00 HR	33.255				2,793		2,793
8RLVIBE	VIBE PLATE COMP	1.00	84.00 HR	6.762				568		568
LGEN	GEN LABOR	3.00	252.00 MH	12.440	5,415					5,415
OBK	BACKHOE OP	1.00	84.00 MH	22.560	3,325					3,325
OFORM	OPR FORM	1.00	84.00 MH	23.560	3,447					3,447
OROLL	ROLLER OPR	1.00	84.00 MH	22.720	3,257					3,257
$24,521.73	0.0394 MH/SY		504.00 MH	[0.767]	15,444		1,365	7,712		24,522
152.2024 Units/Hr*	1,522.0238 Un/Shift		25.3671 Unit/M		1.21		0.11	0.60		1.92
⟹ **Item Totals: 10 - EMBANKMENT**										
$223,790.29	0.1457 MH/CY		1,794.45 MH	[3.521]	67,839	39,945	5,436	61,730	48,840	**223,790**
18.174	12314 CY				5.51	3.24	0.44	5.01	3.97	18.17

Figure 3-7. Sample Cost Item Estimate

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Direct Cost Report

Activity / Resource	Desc	Quantity Pcs	Quantity Unit	Unit Cost	Labor	Perm Materi	Constr Matl/Ex	Equip Ment	Sub-Contrac	Total
BID ITEM = 10										
Description = EMBANKMENT				Unit = CY	Takeoff Quan: 12,314.000			Engr Quan: 12,314.000		
$223,790.29	***** Report Totals *****	1,794.45	MH		67,839	39,945	5,436	61,730	48,840	**223,790**

>>> **indicates Non Additive Activity**
------Report Notes:------
The estimate was prepared with TAKEOFF Quantities.
This report shows TAKEOFF Quantities with the resources.

"Unreviewed" Activities are marked.

Bid Date: Owner: Engineering Firm:
Estimator-In-Charge: JV

JOB NOTES

* on units of MH indicate average labor unit cost was used rather than base rate.
[ ] in the Unit Cost Column = Labor Unit Cost Without Labor Burdens
In equipment resources, rent % and EOE % not = 100% are represented as XXX%YYY where XXX=Rent% and YYY=EOE%
------Calendar Codes------

40	5 - 8 HOUR SHIFTS
50	**5 - 10 HOUR SHIFTS (Default Calendar)**
55	5 - 11 HOUR SHIFTS
60	6 - 10 HOUR SHIFTS
OT	OVERTIME

Figure 3-7. Sample Cost Item Estimate

3.6.4 ICE Estimate

CDOT contracts with an ICE who develops an Independent Cost Estimate for comparison with each of the Contractor's OPCC submittals. The ICE Estimate is a production-based estimate, similar to the one shown in **Figure 3-6**, that uses the same assumptions agreed to and documented in the Cost Model. This estimate serves as the official CDOT Engineer's Estimate once accepted by EEMA.

3.6.5 CDOT Engineering Estimates and Marketing Analysis Involvement

At the beginning of a CMGC project, the CDOT Project Manager should consult with Engineering Estimate and Marketing Analysis (EEMA) to inform them of the project, discuss their availability, and understand the support they can provide during the estimating process. It is recommended that EEMA attend the Cost Model Review Meeting and Cost Estimate Review Meetings. If desired by the CDOT Project Manager, and if the project schedule allows, EEMA can provide an optional unit priced project estimate that can be used for general guidance during cost estimate reviews.

It should be noted that the EEMA estimate is a unit price estimate based on historical bids and cost items. This bid format does not necessarily account for project risks, and it may not correlate with the production-based estimates of the Contractor and ICE. It can serve, however, as a starting point to identify and discuss bid items that are unique to the project and require additional assessment to understand the details of the pricing assumptions.

3.6.6 Reviewing Project Risk in OPCC Submittals

As described in Section 3.4.3, a Risk Management Meeting is held at each pricing milestone to review project risks and costs that affect the OPCC and Risk Pools. Based on the results of the Risk Management Meeting, the Contractor and ICE may also need to modify the OPCC and ICE Estimate prior to the Cost Estimate Review Meeting. As the project design development progresses, Risk Management Meetings may be combined with the Cost Estimate Review Meetings, at the option of the CDOT Project Manager.

3.6.7 Cost Estimate Review Meetings and Acceptable Pricing Differences

The Cost Estimate Review Meeting is held following each Risk Management Meeting (or optionally in combination with the Risk Management Meetings in later OPCC submittals) and includes CDOT, the Contractor, the ICE, and the Design Consultant. EEMA may also attend this meeting to provide guidance to the CDOT Project Manager. **It is highly recommended that the CDOT Project Manager request the assistance of someone with prior CMGC cost estimating experience if the CDOT Project Manager has not previously managed a CMGC project.** The purpose of the Cost Estimate Review Meeting is to review and compare the Contractor's OPCC and the ICE estimate, review pricing assumptions in the Cost Model, review quantities, and reconcile pricing differences.

Prior to the meeting, the CDOT Project Manager reviews the OPCC and ICE Estimate and identifies all bid items that have significant variances. The CDOT Project Manager also compares the OPCC with the ICE Estimate to see if they are within a total percentage difference acceptable to CDOT. If the Independent Cost Estimate and Contractor's OPCC are not within a percentage acceptable to CDOT, the Project

Manager conducts a review to determine where the cost estimates differ and what assumptions or details were used to determine each difference.

The CDOT Project Manager can implement a variety of methods to identify those items that warrant additional discussion. One method is to identify all items that have greater than a 10 percent variance. However, the CDOT Project Manager may elect to ignore bid items that exceed 10 percent if they are considered insignificant to the overall cost of the project. Another method is to review only high-dollar differences in excess of a set dollar amount and still review any item that has a very large percentage difference, as this may indicate items for which the Contractor or ICE have made incorrect pricing assumptions. For example, review all items that have a difference of $50,000 or more, along with any item that has over a 150 percent variance. Although it is important to reconcile individual bid items, the overarching objective is to reach a consensus on the entire project cost.

During the Cost Estimate Review Meeting, the CDOT Project Manager, ICE, and Contractor attempt to reconcile pricing differences for every item identified by the CDOT Project Manager as having a significant variance. The reconciliation process gives all parties the opportunity to understand each other's perspectives about pricing assumptions and risk assignment. For the integrity of the process, it is important that the CDOT Project Manager question equally the Contractor's OPCC and the ICE Estimate. The objective is to narrow pricing differences throughout the CMGC preconstruction process, with the end goal of having the CAP Proposal within a percentage of the ICE Estimate that is acceptable to CDOT. The acceptable percentage varies depending on the project size and complexity and may range from 2 to 10 percent (see Chapter 4 in this manual for additional information regarding an acceptable CAP Proposal percentage).

3.6.8 Fixed Limit of Construction Costs

The Fixed Limit of Construction Cost is the total dollar amount that CDOT makes available for the cost of performance of all Construction CAPs and LLTP CAPs to complete the work. During the preparation of each OPCC, the Contractor is responsible for notifying the CDOT Project Manager if it appears that the OPCC will exceed the applicable portion of the Fixed Limit of Construction Cost and making reasonable recommendations for corrective action consistent with the Fixed Limit of Construction Cost. The CDOT Project Manager should work with the Contractor and Design Consultant to reconcile the cost, including approving redesign; providing constructability reviews and reports, deductive alternatives; reductions in work; requesting additional value engineering; and making modifications to the Contract Documents.

3.6.9 Subsequent OPCC Submittals and Changes during an OPCC

OPCC and ICE cost estimate submittals are prepared for all established pricing milestones. Additional OPCC submittals may be required if design refinements are required, if significant pricing variances remain, or if there are significant material cost escalations. The Contractor is required to notify CDOT if any changes occur that will significantly alter a previously supplied OPCC. Through the iterative process of OPCC submittals, Risk Management Meetings, and Cost Estimate Review Meetings, the Contractor refines the Cost Model and project estimate. At the conclusion of each Cost Estimate Review Meeting,

the Contractor must update the Risk Register, Cost Model, and Schedule to reflect all changes authorized at the meetings.

The Contractor, in preparing his or her OPCC, must communicate with CDOT and the Design Consultant any proposed materials, equipment, labor, and types of construction that are to be included in the Contract Documents. The Contractor may also make reasonable adjustments in the Scope of Work and propose revisions to the Specifications for review and approval by the CDOT Project Manager. Likewise, the Design Consultant must communicate changes to the design Drawings or Specifications that affect the Contractor's and ICE's pricing assumptions.

4 Chapter 4: CAP Proposals and the Contracting Process

As the Preconstruction Phase nears completion, the focus of the CMGC process moves toward the development of a Construction Agreed Price (CAP) and award of a construction contract to perform the work. Chapter 4 describes the steps involved in developing and negotiating the CAP, and the processes required by CDOT and FHWA to execute a construction contract.

4.1 Construction Agreed Price (CAP)

The Construction Agreed Price (CAP) is the maximum amount that will be incorporated into the standard CMGC Construction Project Contract to accomplish the construction phase. The CAP is the sum of the direct cost of construction and the CMGC Management Price Percentage for a specific construction package. The total Contract Amount is the sum of the CAP and all established Risk Pools and Force Accounts. The basis for the CAP Proposal is the open book Cost Model developed during the Preconstruction Phase and refined through a series of Opinion of Probable Construction Cost (OPCC) submittals and review meetings, as described in Chapter 3 of this Manual. The Contractor will propose a CAP and, if necessary, CDOT and the Contractor negotiate the direct cost of construction for that package to agree on a final CAP. Multiple CAPs may be developed and accepted to facilitate project construction phasing or long-lead procurement items. Once a CAP Proposal is accepted by CDOT, with FHWA concurrence when required, the Contractor is awarded a construction contract to perform the work.

Payment for the construction of the project is paid through the Schedule of Bid items developed during the Preconstruction Phase and in accordance with the Standard Specifications for Road and Bridge Construction or as modified through the Project Special Provisions. The CAP is not a lump sum contract (although some bid items may be lump sum) and most items are measured and paid at actual quantities. A CAP will not be increased except for change orders, agreed overrun items, and agreed upon risk pool items approved by CDOT. Revisions to Standard Specification 109 are used to document which items are eligible for approved overruns. The Contractor assumes all risk with performance of the bid items, including management of its subcontractors, suppliers, and any associated cost impacts over and above a CAP not listed as overrun items in the construction specifications or agreed to as risk pool items in the executed Risk Register. CDOT will assume the risk and issue a Change Order for any changes to the project scope that occurs between CAP acceptance and the final 100% PS&E package.

4.2 Long Lead Time Procurement (LLTP) CAP

The Long Lead Time Procurement (LLTP) CAP is a price submitted by the CMGC Services Contractor for items which must be ordered and/or procured in advance of the Construction Phase for which it will be used. The LLTP CAP is the price of the item and the CMGC Management Price Percentage. The LLTP CAP is established through the same procedures as a CAP Proposal, depending on the cost of the item being procured and the source of funding.

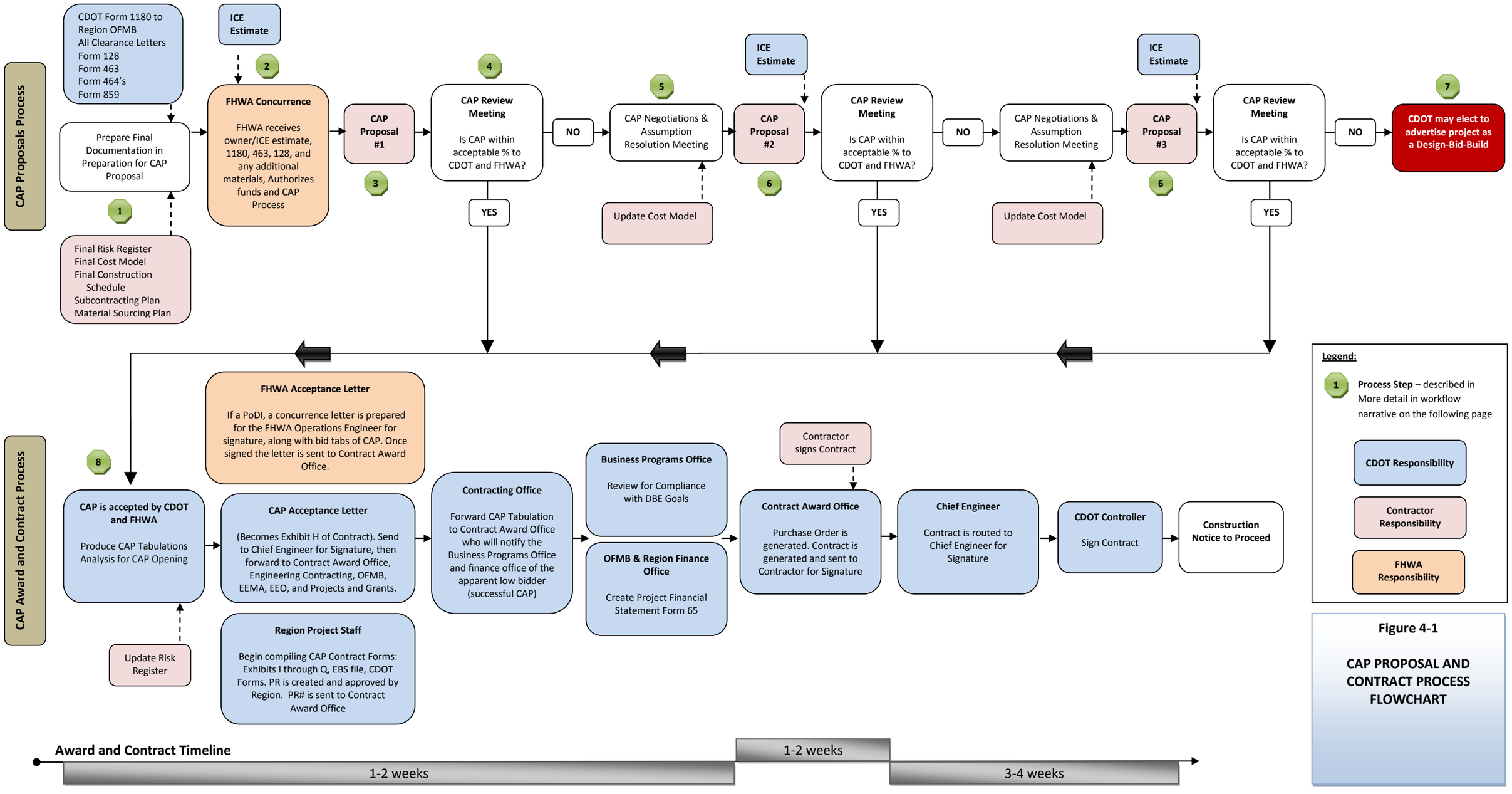


Figure 4-1

CAP PROPOSAL AND CONTRACT PROCESS FLOWCHART

4.3 CAP Proposals, Award and Contract Process Work Flow

The CAP proposal and contracting process is shown schematically on the flowchart in Figure 4-1. The flowchart details the basic steps in the process leading from the Construction Agreed Price (CAP) Proposal to award and contracting. The following narrative corresponds to the numbered Process Steps as depicted in the flowchart, and provides a brief description of the steps involved in the process. These steps are described in further detail throughout Chapter 4 of this manual.

1. Prepare Final Documentation Required for CAP Proposal

Once CDOT and the Contractor have agreed that it is appropriate to submit a CAP or LLTP CAP Proposal, the Contractor must update the Cost Model and Risk Register to reflect any changes from the last Opinion of Probable Construction Cost (OPCC) submittal. The Contractor also updates the Construction Schedule, Subcontracting Plan, and Material Sourcing Plan, and submits the documents to CDOT and the Independent Cost Estimator (ICE) to use as the basis for preparing the ICE Estimate.

CDOT is responsible for obtaining all Clearance letters for Utilities, Right-of-Way, ITS and preparing Form 1180 – STANDARDS CERTIFICATION AND PROJECT PLANS, SPECIFICATIONS & ESTIMATE APPROVAL for submittal to the Region Office of Financial Management and Budget (OFMB), along with Form 128 – CATEGORICAL EXCLUSION DETERMINATION, Form 463 – DESIGN DATA, Form 464 – DESIGN EXCEPTION VARIANCE REQUEST, and Form 859 – PROJECT CONTROL DATA.

2. FHWA Concurrence on PoDI projects

All Clearance letters and CDOT Forms are submitted to FHWA for their review and concurrence. The established CAP construction plans and specifications are also submitted to FHWA. FHWA will then authorize funds for the Construction Phase and give approval to proceed with the CAP Proposal process.

3. CAP Proposal #1

The Contractor prepares the CAP Proposal based on the issued construction plans and specifications, open book Cost Model, established Risk Register and Risk Pools, final Summary of Approximate Quantities, and all assumptions previously discussed and agreed to during the Preconstruction Phase. The ICE prepares an independent estimate using the same established criteria. The CDOT Project Manager adds the ICE Estimate and CAP Proposal unit costs into the template CAP comparison spreadsheet and sends to the review team (RE, PE III, EEMA, FHWA, ICE, etc.)

4. CAP Review Meeting

CDOT, EEMA, and the Contractor meet to review the CAP Proposal. If the CAP Proposal is within a percentage difference acceptable to CDOT, then the CAP Proposal is accepted and CDOT can move forward with the award and contracting process.

5. CAP Negotiations and Assumption Resolution Meetings

If the CAP Proposal is not within a percentage difference acceptable to CDOT, then the CDOT Project Manager and Contractor must negotiate to resolve major pricing differences. This may involve revisiting

pricing assumptions made by both the Contractor and the ICE, similarly to the Cost Estimate Review Meetings held during the OPCC process. The negotiations may take place in open forum meetings or through one-on-one discussions between CDOT and the Contractor.

6. CAP Proposals #2 and #3

The negotiation process continues if the first CAP Proposal is not accepted. To help resolve pricing differences, subsequent negotiations should be elevated to include executive level personnel from CDOT and the Contractor. Negotiation meetings may also involve additional personnel such as construction managers with specialty experience in the type of construction required for the project.

7. Failure to Reach an Agreement

A CAP proposal can be offered and negotiated up to three times. After the third and final attempt at a CAP negotiation, CDOT reserves the right to prepare the plans, specifications, and estimate package for advertisement, and the CMGC Services Contractor will not be allowed to bid.

8. Contract Award and Contracting

If a CAP Proposal is within a percentage difference acceptable to CDOT, then CDOT initiates the contracting process by preparing a CAP Acceptance Letter for the Chief Engineer's signature and a letter of concurrence for FHWA's signature. The award and contracting process generally takes between four to eight weeks to complete and issue the Notice to Proceed.

4.4 CAP Proposal and Negotiations

A Construction Agreed Price (CAP) can be prepared for the entire project, a severable phase of the project, or for long-lead procurement items. The Contractor prepares a CAP Proposal once CDOT and the Contractor have agreed that the design has advanced to a point to be able to establish a CAP. Typically, the design will be 90% complete or greater. Following the CAP, the Design Consultant is still responsible for completing a stamped set of 100% Plans, Specifications and Estimate (PS&E). CDOT is responsible for any changes that occur between the CAP and the 100% PS&E, and significant changes may require additional CAP negotiations. Therefore, all major items that affect pricing or schedule should be accounted for in the plans used to establish the CAP. If the project schedule allows, the plans may be advanced to 100% prior to establishing the CAP to reduce the risk of changes.

If a CAP Proposal is desired, the Design Consultant issues a CAP bid set of construction Plans and Specifications, along with the Summary of Approximate Quantities (SAQ) to be used by the Contractor when preparing the CAP Proposal. Alternatively, the Contractor may prepare the SAQ with CDOT's approval and confirmation of the estimated quantities. CDOT will prepare a comparison template based on the SAQ; therefore, when preparing the CAP Proposal and ICE Estimate, it is very important that the Contractor and ICE use the same SAQ and do not modify the format or reorder the bid items.

The CDOT Project Manager prepares a Bid Package to be used by the Contractor in preparing the CAP Proposal. The Bid Package consists of the Plans, Specifications, SAQ, and all required Bid Forms. The

Contractor prepares the CAP Proposal based on the Bid Package and open book Cost Model that was refined during the Preconstruction Phase and the OPCC submittal process. The ICE Estimate uses the same project documentation to prepare their independent estimate. Both the CAP Proposal and ICE Estimate are submitted to the CDOT Project Manager who prepares a CAP comparison spreadsheet. The comparison spreadsheet is used to identify price and percentage differences of the individual bid items and the total bid amount. The template comparison spreadsheet is attached in the **Appendix** of this Manual. This comparison spreadsheet is then sent to the review team which typically consists of the Resident Engineer, Program Engineer, EEMA, FHWA, and ICE.

Acceptable Estimate Differences when Negotiating the CAP

The CDOT Project Manager should review the overall project total and individual bid items for major discrepancies. CDOT may accept the CAP Proposal when it is within a percentage of the ICE Estimate that is acceptable to CDOT, with FHWA concurrence on "PoDI projects. There is no set amount for an acceptable percentage. The acceptable percentage will depend on the overall project size and complexity, but it typically ranges from 2% to 10%. The acceptable percentage is not a contractual provision, but is determined by the Region for the specific project. **The acceptable percentage shall be determined prior to entering into CAP negotiations.**

The decisions to accept a CAP Proposal is a collaborative decision between the CDOT Project Manager, EEMA, and the established review team. CDOT must decide if any price differences will be saved if the project is competitively bid, recognizing that there are additional cost and schedule impacts involved with bidding the project.

Negotiations and the Escalation Ladder

If the percentage difference between the CAP Proposal and ICE Estimate is not acceptable to CDOT, then CAP negotiations begin. The first CAP Proposal review is similar to the Cost Estimate Reviews performed during the OPCC submittal process. **If the CDOT Project Manager has not previously managed a CMGC project, it is highly recommended that the CDOT Project Manager requests the assistance of a manager with prior CMGC CAP negotiation experience.** During the initial negotiations, the CDOT Project Manager, ICE, and Contractor attempt to reconcile pricing differences that are contributing to the pricing variance. The negotiations may take place in open forum meetings or through one-on-one discussions between CDOT and the Contractor. As this stage, the CDOT Project Manager should promote open and honest discussions to help resolve discrepancies.

After the initial negotiations the Contractor prepares a second CAP Proposal based on the results of the negotiations and any revision made to the Cost Model. The ICE again prepares an independent estimate using the revised criteria and the CDOT Project Manager prepares a CAP Proposal comparison. If the CAP Proposal pricing differences have been resolved then the CAP Proposal is accepted and CDOT initiates the contracting process. If the percentage difference is not acceptable, then a second round of negotiations occurs. However, these negotiations should be elevated to a higher level of project management within the Contractor's organization and CDOT, including the involvement of the Program

Engineer and Region Transportation Director. Often a new perspective from senior management can open up new lines of communication to help resolve differences.

The second round of negotiation meetings may also benefit from the involvement of additional personnel such as construction managers with specialty experience in the type of construction required for the project. CDOT may consult with CDOT or consultant construction managers that have unique experience with the complexities of construction methods for a particular project and provide valuable insight into the Contractor's methods and means.

If a third CAP Proposal and subsequent negotiations is required the stakes become high for both CDOT and the Contractor. Failure to reach an agreement will result in significant losses to both parties. The Contractor risks losing a contract for a project that they have helped direct and for which they have significant knowledge of the project details. CDOT risks losing the Contractor's expertise and the risk management strategies incorporated into the CMGC delivery method. For these reasons, negotiations for the third CAP Proposal should be elevated to include the highest level of management, including executive level personnel from CDOT and the Contractor.

At this stage, negotiations can become very intense and it may be helpful to refer back to the partnering workshop held at the beginning of the Preconstruction Phase. The partnering session should have identified an escalation ladder to help resolve conflicts and can remind all parties of the mutual goals that were established for the project. A second partnering session can also be conducted to bring the team back together.

Revealing Pricing Differences

Typically the ICE Estimate and amount of any pricing differences are not revealed to the Contractor, however, the CDOT Project Manager has the flexibility to reveal pricing if it helps to advance negotiations. For example, if a particular bid item has a significant difference, revealing the pricing information may provide the Contractor an opportunity to explain the difference. It may be discovered that the ICE's pricing assumptions are inaccurate and that the ICE should seek out additional experts to refine the estimate. Conversely, it may convince the Contractor to re-evaluate its methods or revisit its pricing assumptions.

Expected Timeframe for Negotiations

The evaluation and negotiations for each CAP Proposal typically takes between ten days to several weeks, but will depend on the difference between the CAP Proposal and the ICE Estimate, and the number of bid items to be resolved. The use of pricing milestones and OPCC submittals during the Preconstruction Phase are implemented so that ideally the CAP Proposal process is streamlined. However, sufficient time should be allowed for the ICE Estimator to become familiar with any changes to the construction plans that have occurred since the last OPCC. Prior to CAP negotiations, the CDOT Project Manager should inform EEMA, CDOT senior management, and FHWA of the upcoming CAP schedule so that they can commit to the timeframes and meetings required for negotiations.

Failure to Reach an Agreement

The Contractor will have the opportunity to prepare and submit up to three CAP Proposals. After the third and final attempt at a CAP negotiation, CDOT reserves the right to prepare the plans, specifications, and estimate package for advertisement as a traditional bid. The Region will prepare a letter, on behalf of Region management, to the FHWA Operations Engineer (regardless of oversight) and CDOT Chief Engineer explaining that an agreement could not be reached with the CMGC Services Contractor and recommending that the project proceed as a design-bid-build. The CMGC Services Contractor will not be allowed to bid.

Contract Award and Contracting

If a CAP Proposal is within a percentage difference acceptable to CDOT then CDOT initiates the contracting process by preparing a CAP Acceptance Letter for the Chief Engineer's signature and a letter of concurrence for FHWA's signature. The CDOT Project Manager and Region Project Staff prepare all required Contract Exhibits and enter the information in Trns*port. See the "CMGC Steps after CAP Acceptance" in the **Appendix** for a list of the required exhibits and procedures.

4.5 FHWA Oversight and Requirements

FHWA may provide project oversight if the CMGC project includes federal funding. FHWA's level of involvement will depend on if FHWA determines the project to be a Project of Division Interest (PoDI) - project identified by the Division Office as having an elevated level of risk (threat or opportunity) and, therefore, warrants an increased level of Federal Oversight to ensure the successful project and/or Federal Highway Program delivery. If the project is determined to be a PoDI, CDOT must meet with the FHWA Operations Engineer assigned to the project to determine what project elements FHWA will be involved in. The FHWA Operation Engineer, along with their team leader, will then create a project specific stewardship agreement that will detail FHWA's participation.

If the CMCG project is determined to be a PoDI FHWA may:

- FHWA may participate in the evaluating the 13 criteria concerning the applicability of CMGC
- FHWA may review project level RFP procedures (specific attention to goals and selection criteria)
- FHWA will approve FMIS action for the General Contractor (this is the CMGC Preconstruction Phase services authorization and is separate from the Design Consultant)
- FHWA may review 30% plans
- FHWA may review 90% plans
- FHWA may participate in the CAP meeting(s)
- All normal FHWA oversight approvals (design variances, proprietary items, etc)
- FHWA will approve FMIS for the Construction Phase. Approval occurs prior to CAP Proposal.
    - Required:
        - Environmental clearance
        - ROW Certification Letter

    - Utility Certification Letter
    - 100% plans or approved CAP package plans and specifications which may be less than 100%
    - Value Engineering Study (if required)
    - ICE Estimate from most recent OPCC Submittal
    - Contractor estimate from most recent OPCC Submittal
- FHWA may concur in Award for construction
- FHWA may perform periodic construction inspections
- FHWA may perform a Final inspection and project acceptance

If the project is not a PoDI FHWA must still:

- Approve FMIS action for General Contractor (this is the CMGC Preconstruction Phase services authorization and is separate from the consultant designer)
- Approve FMIS construction phase. Approval occurs prior to CAP Proposal.
    - Required:
        - Environmental clearance
        - CDOT Form 1180
        - CDOT Form 463
        - Value Engineering Study (if required)
        - ICE Estimate from most recent OPCC Submittal

4.6 CDOT Processes and Strategy for Delivery

4.6.1 Single Package vs. Multiple Packages

An advantage of CMGC project delivery is that it allows the flexibility to perform construction in phases through multiple packages as project segments are identified and approved for construction. Reasons for using multiple packages could include project phasing to match funding schedules, being able to construct a phase of the project while right-of-way is secured for additional phases, or releasing a utility package in advance of roadway construction to advance the project schedule.

Each CAP package must be a severable and independent phase of the construction, such that CDOT is not obligated to have the Contractor construct any other portions of the work. Each phase of the work must obtain all required clearance, is awarded through the CAP Proposal and contracting process, and will require FHWA concurrence if the project is federally funded. Different SAP sub-account numbers may be required for each phase, depending on the number of phases, schedule, and funding sources. The CDOT Project Manager must work with FHWA to determine the account numbers. For this reason, a single package may be more efficient as the CAP Proposal and contracting process is only performed once. Using a single package also allows CDOT to evaluate the entire project CAP to ensure that the established project budget is not exceeded.

4.6.2 Long Lead Time Procurement

Another advantage of CMGC project delivery is the ability to secure construction materials and equipment during the Preconstruction Phase to reduce delays during construction. Materials may also be procured early in the design process to avoid price escalations for volatile construction materials, such as steel girders.

Items that are identified with long lead times are procured through a Long Lead Time Procurement (LLTP) CAP Proposal, similar to the CAP Proposal process, and will require federal approvals if federal funds are used to procure the LLTP materials. Therefore, it may be advantageous to use state funds for LLTP depending on the cost of the item.

4.6.3 CDOT Owner Controlled Insurance Program

The Contractor's CAP Proposal must be coordinated with CDOT Risk Management and the Owner Controlled Insurance Program (OCIP). Prior to submitting the CAP Proposal, the project team should finalize all of the details and assumptions in the cost model, including the elimination of any costs for insurance that is covered by the OCIP and set up a project planned Force Account for the incentives, if necessary. As soon as the CAP is accepted, the project team must inform Risk Management so that they can create the Project Insurance Manual. Upon award, the Contractor and all eligible subcontractors must enroll in the OCIP.

The Contractor's CAP Proposal must be coordinated with CDOT Risk Management and the Owner Controlled Insurance Program (OCIP). Prior to submitting the CAP Proposal, the project team should finalize all of the details and assumptions in the cost model, including the elimination of any costs for insurance that is covered by the OCIP and set up a project planned Force Account for the incentives if necessary. As soon as the CAP is accepted, the project team must inform CDOT Risk Management. The Contractor is required to submit OCIP Form B; OCIP Form S(1); and a signed Affidavit to be reviewed and verified by CDOT Risk Management and the OCIP Broker, before any final contract is signed. Upon award or during the review the OCIP Broker can provide an introduction to the subs of the OCIP program which would include forms, enrollment, and responsibilities of the enrolled contractors. The Contractor and all eligible subcontractors must enroll in the OCIP.

4.6.4 Posting Bid Tab Information to CDOT's Website

Following award of the Contract, the Region must send the bid tabulation to the Contract Officer so that they will be posted on the CDOT bid tabulation webpage. The approved PS&E packages should be electronically sent to the CDOT print center, for parties interested in viewing the information. In addition, the bid tabulation and approved PS&E package can also be posted to the project website, depending on the file size.

4.6.5 Construction Contract

The CDOT Project Manager and Region Project Staff are responsible for preparing and assembling the Contract Exhibits required to generate the Contract. See the "CMGC Steps after CAP Acceptance" in the **Appendix** for a list of the required exhibits and procedures.

4.6.6 CMGC Specifications - Revision of Sections 104 and 109

In addition to the project specifications developed by the project team during the Preconstruction Phase, all CMGC contracts will include revisions to Section 104 and 109 of the CDOT Standard Specifications.

Section 104 is revised to state that Value Engineering Change Proposals (VECP) will not be allowed during the construction of CMGC Projects.

CMGC contracts are not lump sum, and most items will be measured and actual quantities will be paid up to the quantity shown in the bid schedule. Section 109 is revised to specify the terms of use of the Force Accounts and Risk Pools established during the Preconstruction Phase. The CDOT Project Manager modifies this section to define project specific requirements and identify all bid items that are eligible for payment for quantity overruns. Items not identified in this specification will be paid for at original contract unit prices for the installed and accepted quantities of work up to the original quantities shown in the CAP Proposal.

4.6.7 Force Accounts

CMGC contracts typically will include at least two separate Force Accounts established during the Preconstruction Phase: the 700-71001 Shared Risk Contingency Pool F/A and the 700-71002 CDOT Risk Pool F/A. Other traditional Force Account s, such as On-the-Job Training, Incentives, and Fuel Cost Adjustments can be part of the Contract.

Using the F/A Shared Risk Contingency Pool

In CMCG, the Contractor has been involved in the design development and has prepared quantity estimates and verifications. For this reason, the Contractor is paid original contract unit prices for the installed and accepted quantities of work up to the original quantities shown in the CAP Proposal, except as defined in the CDOT Standard Specifications subsections 104.02, 104.03, and 108.11 as approved by the Engineer. However, when assessing project risks and establishing the risk pools, CDOT may decide to take the risk for overruns on certain items. Overruns approved by the Engineer on original quantities as accepted in the CAP Proposal are paid for under the existing line item and will be reconciled against the CDOT Risk Pool Force Account. The specific items for which overruns will be paid must be listed in the Revisions to Section 109.

If items and their original quantities shown in the CAP Proposal change or are modified by CDOT between acceptance of the CAP Proposal and issuance of the 100% PS&E, the Contractor is paid through the CDOT Risk Pool at the original contract unit prices for the installed and accepted quantities that have changed.

Using the F/A Shared Risk Contingency Pool

Extra work performed that the Contactor and CDOT have agreed to share risk under is paid for as stipulated in the Risk Register and compensated out of the planned Force Account Item F/A Shared Risk

Contingency Pool. The shared risk compensations, components, and total amounts for each of the items agreed upon are paid as defined in the Project Special Provisions contained in the project Risk Register. All cost savings in the Shared Risk Contingency Pool, not resulting in the reduction of work or operating performance, is shared as defined in the project Risk Register between the Contractor and CDOT.

Revisions to Section 109 should be reviewed to specify which F/A items will include the CMGC Management Price Percentage. Generally, force account work will not be eligible for the CMGC Management Price Percentage with the following exceptions: Minor Contract Revisions, Partnering, Fuel Cost Adjustment, Asphalt Cement Cost Adjustment, On the Job Training, Interim Surface Repair, Environmental Health and Safety Management and Obtain Power from Xcel Energy, or as defined through Revisions to Section 109.

4.6.8 DBE and ESB Requirements

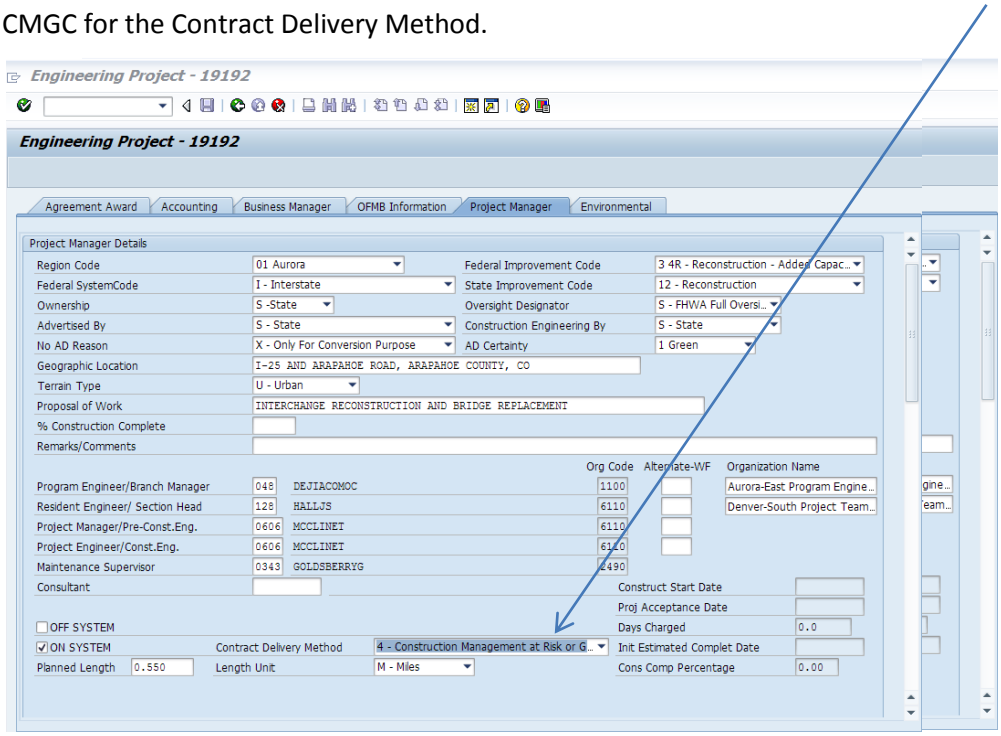
The scope of work for each LLTP and Construction Phase shall be submitted to the Regional Civil Rights Office prior to the CAP Proposal in order to determine the Contract Goal. With the CAP Proposal, the Contractor must submit a Form 1414, Anticipated DBE Participation Plan documenting its proposed DBE participation for the phase. Approval of the CAP shall be treated at selection as the lowest apparent bidder and all procedures of the then current DBE Standard Special Provision shall apply. CDOT may also establish an ESB incentive and/or goal for the construction phase of the contract and the applicable ESB Standard Special Provision shall apply.

4.6.9 OJT

The Contractor will be required to meet the on-the-job training requirements as specified by CDOT and established prior to the CAP Proposal. With the CAP Proposal, the Contractor must submit a plan detailing the Contractor's plan to meet the OJT requirements for the construction phase.

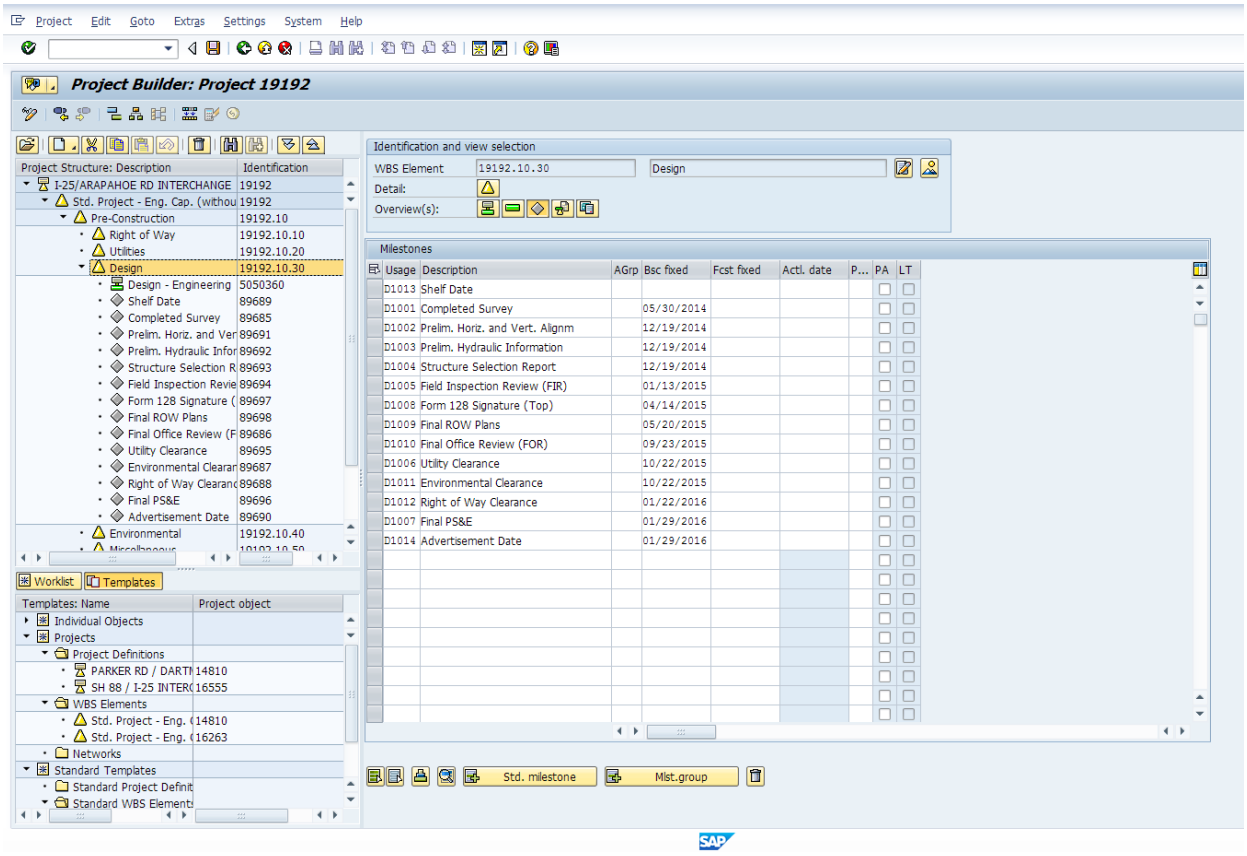
4.6.10 SAP

Using Project Builder (CJ20N) upon project set-up, the CDOT Project Manager will need to identify CMGC for the Contract Delivery Method.



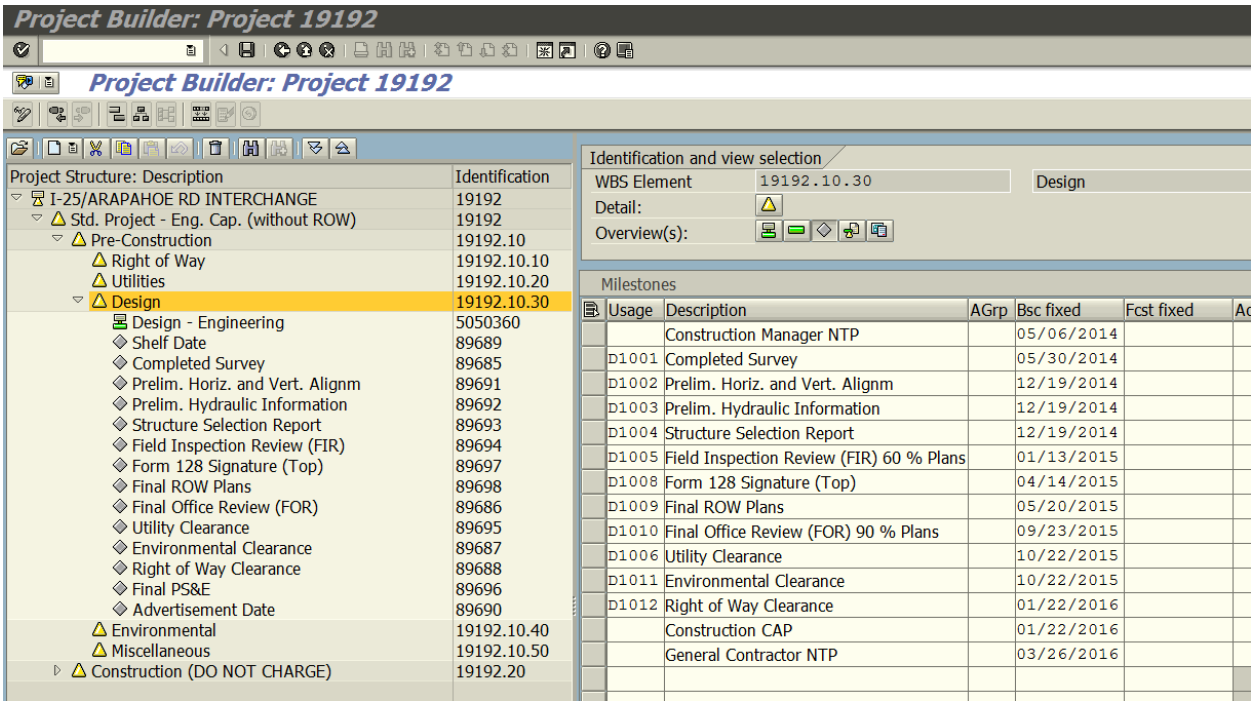
Adding Milestones Dates in SAP Project Builder (CJ20N)

When setting up your project in SAP, as with all projects, set up the template as directed in Design Bulletin 2014-3 "Milestone Dates in SAP Project Builder (CJ20N)."



Then proceed with making adjustments to the design schedule that are applicable to a CMGC delivery type project. These adjustments include, but are not limited to, the following:

- Notice to proceed for adding the selected preconstruction, (Construction Manager NTP);
- LLTP CAP and expected date of payment for item;
- Separate construction early work items CAP and expected date of payment for that work (e.g. advanced utility work)



Added milestones do not require Usage numbers. Additional information is available in the Design Bulletin "Milestone Dates in SAP Project Builder" using the embedded link "Add Milestone Dates to WBS Template.doc".

Additional milestones should be shown when other departments/approvals are included with that work and/or if a budget action will be needed with that scheduled item.

4.6.11 Funding Mechanisms

As with all projects, the source of project funding may require the project to meet certain requirements, stipulations, and reporting requirements. Funding sources are continually changing and CDOT Project Managers are encouraged to review the project funding requirements early in the CMGC process and revise the CMGC Services Contract and structure the CAP Bid Package accordingly.

4.6.11.1 RAMP Program

In December of 2012 CDOT introduced the Responsible Acceleration of Maintenance and Partnerships (RAMP) program to better coordinate project expenditures and available funding, resulting in a $300 million per year increase in construction for five years. Under the RAMP program, CDOT will fund multi-year projects based on year of expenditure, rather than saving for the full amount of a project before construction begins. A portion of the RAMP funds are proposed to leverage state transportation dollars by creating Public-Private Partnerships (P3s) with industry and Public-Public Partnerships with local governments to provide responsible improvements on corridors where partnership opportunities exist. This fund will provide an opportunity for local governments and CDOT to potentially move forward with projects that CDOT would not be able to fund alone.

Additional information regarding the RAMP program can be found here:

http://www.coloradodot.info/programs/RAMP

4.6.11.2 Colorado Bridge Enterprise

The Colorado Bridge Enterprise (CBE) was formed in 2009 as part of the FASTER (Funding Advancement for Surface Transportation and Economic Recovery) legislation. It operates as a government-owned business within the Colorado Department of Transportation. The Colorado Transportation Commission serves as the Colorado Bridge Enterprise Board. The purpose of the CBE is to finance, repair, reconstruct and replace bridges designated as structurally deficient or functionally obsolete, and rated “poor."

Additional information regarding the requirements of the CBE can be found here:

http://www.coloradodot.info/programs/BridgeEnterprise

4.6.11.3 FASTER

In 2009 the General Assembly passed Senate Bill 09-108 also known as: Funding Advancements for Surface Transportation and Economic Recovery (FASTER). This legislation changed the way that transportation funding works in Colorado. SB 09-108 established or modified a number of new operating, funding and oversight mechanisms as well as programs, including:

- Bridge Enterprise & Bridge Fund
- High Performance Transportation Enterprise
- Standing Committee on Efficiency & Accountability
- Transportation Deficit Report
- Road Safety Fund
- Tolling Existing Capacity
- Multimodal and Transit
- Transportation Planning
- Truck Weight Provisions
- Funding Provisions

Additional information regarding the requirements of the CBE can be found here:

http://www.coloradodot.info/projects/faster

5 Chapter 5: CMGC Construction Phase

During the Construction Phase of the project, the goal of CDOT, the CMGC Contractor, and the Design Consultant is to construct the project in accordance with the Contract Documents while controlling the risks that were identified in the Preconstruction Phase. The Construction Phase of a CMGC project is administered similarly to a DBB project, with slight differences related to bid item measurement and payment, risk management, and applying the Risk Pools that were established during the Preconstruction Phase. The details of these CMGC-specific Construction Phase elements are discussed in the following Chapter.

In an effective CMGC project, the Construction Phase should progress with less change orders and disputes than can be experienced with DBB. The main difference with CMGC project delivery is that the Contractor has been involved in the design development and construction plan reviews. Because the Contractor has had the opportunity to review and verify quantities, the Contractor is less likely to consider a claim for additional compensation for issues related to the design. Additionally, many of the projects risks and unknowns have been accounted for in the Risk Pools developed during the Preconstruction Phase. These planned contingencies provide a system that allows the Construction Phase to continue forward when problems are encountered.

5.1 CMGC Contractor's Role during Construction

Once a construction contract is executed, the role of the CMGC Contractor changes to that of a General Contractor during construction. This is a very traditional role, with similar responsibilities of a General Contractor on a DBB. The Contractor is responsible to ensure all environmental, safety, and permit commitments, which are specified in the Plans, Specifications, and Contract Documents, are implemented during construction. The Contractor also manages its risk by implementing the procedures defined in the Contractor's Risk Register.

The Contractor is also responsible for tracking the performance, cost and time savings of the innovative construction methods that are incorporated on the project. This is accomplished by updating the Innovative Tracking and Performance Report that was developed during the Preconstruction Phase.

5.2 Design Support during Construction

The Design Consultant should be retained during the Construction Phase to address Contractor questions or changed field conditions, and to provide consultation to the CDOT Project Manager. Continuing the spirit of partnership from the Preconstruction Phase, the Design Consultant is expected to respond in a timely and cooperative manner to inquiries from CDOT and the Contractor. To facilitate communication, it is recommended that the Design Consultant is involved in construction progress meetings and is made aware of the construction schedule.

5.3 Project Manager Support during Construction

The CDOT Project Manager is expected to have a significant role during the Construction Phase and is responsible for administering the Risk Pools developed during the Preconstruction Phase. To support

the CDOT Project Manager, the CDOT construction Project Engineer is also expected to understand the provisions within the Risk Register and the established Risk Pools. It is highly recommended that the construction Project Engineer, whether the construction Project Engineer is CDOT personnel or a Consultant, is actively involved in the Preconstruction Phase so that they are familiar with the details of the Contractor's Risk Management Plan, the Risk Pools, and the construction methods discussed during design development.

5.4 Quality Assurance/Quality Control Roles

QA/QC for CMGC projects is performed as it would be for a DBB project. Construction Management, Testing and Inspection will be through CDOT or a Consultant Project Engineer and staff. The Contractor will have developed a Quality Control Plan during the Preconstruction Phase that should be referenced during the Construction Phase.

5.5 Phasing and Packages

With CMGC projects, it can often be the case that multiple construction packages overlap or are constructed simultaneously. Each CAP package is treated as a separate construction Contract, and therefore must be tracked separately. This will require accurate tracking of pay items and construction progress to enter the required data in SAP and Site Manager.

Some construction packages may not have 100% PS&E sets prior to NTP. In this case, CDOT assumes the risk to changes between the CAP Proposal quantities and 100% PS&E quantities. Increases are paid through the CDOT Risk Pool and decreases are not paid and/or removed from the project with a change order. The CDOT Project Manager and CDOT Project Engineer work together to make sure the changes are covered and understood with all team members.

5.6 Measurement and Payment

Measurement and payment for Contract bid items is performed similar to a DBB project, except that the Contractor shall accept payment at the original contract unit prices for the installed and accepted quantities of work up to the original quantities shown in the CAP Proposal. Quantity overruns are not paid, except for items that are defined in Revision to Section 109 of the Standard Specifications.

5.7 Applying the Risk Register during Construction

The most unique element of the CMGC Construction Phase is the application of the Risk Register during construction. The Risk Register contains mitigation plans for all risks that were identified during the Preconstruction Phase, and is used by the Contractor to monitor project risks. The Contractor must immediately notify the CDOT Project Manager once a project risk is encountered. The CDOT Project Engineer must review and approve any work associated with mitigating the risk. The additional work will be paid through the CDOT Risk Pool for risks that were previously allocated to CDOT in the signed Risk Register. For risks that were shared by CDOT and the Contractor, the additional work will be paid through the Shared Risk Contingency Pool, as defined in the special provision contained in the signed Risk Register.

5.7.1 Risk Pools and Force Accounts

Once the project moves into the Construction Phase, the previously established CDOT Risk Pool and Shared Contingency Risk Pool become planned Force Accounts. As with DBB projects, Force Accounts are managed by CDOT and are applied using standard CDOT Force Account procedures and the CMGC revisions to Section 109 of the Standard Specifications. Minor Contract Revisions are still paid through the MCR Force Account item.

Both CDOT and the Contractor must continually and collaboratively monitor the Risk Pools to ensure that adequate contingency is available to complete the project.

5.8 Change Orders

One of the major advantages of CMGC projects is that the Contractor is involved during the design development, which can lead to fewer Change Orders during construction. Additionally, the Risk Pools make provisions for many of the situations that would otherwise require major Change Orders in DBB projects. However, projects may still experience change of conditions, fluctuations in market conditions, and unforeseen circumstances that will require a Change Order.

The Change Order and Contract Modification Order (CMO) processes remain the same as on DBB projects. However, for CMGC projects, the open book Cost Model that was used to develop the CAP Proposal can be a useful reference to understand what was assumed during estimating and quickly establish fair pricing for the Change Order. For Major Change Orders, the ICE Estimator should be consulted to perform an independent cost analysis.

5.9 Monitoring Environmental Commitments

Prior to Construction a tracking spreadsheet should be developed to monitor the environmental impacts and mitigation efforts identified in the environmental assessment. The tracking spreadsheet should be continually reviewed an updated throughout the Construction Phase.

5.10 Monitoring Subcontractor and DBE Participation

DBE plans and FHWA labor compliance reports are required, just as with DBB projects. These plans are developed during the Preconstruction Phase. The Contractor is responsible for monitoring the plans during construction and must make adjustments as needed to comply with project goals

5.11 Disputes and Resolutions

As with Change Orders, disputes and claims should be minimized with the CMGC project delivery due to the collaboration that is instrumental to CMGC. Should disputes and claims arise, resolution is handled in the same way as DBB projects per the Standard Specifications. The CDOT Project Manager should refer back to the partnering session and conflict escalation ladder defined during the Preconstruction Phase to facilitate discussions and confirm that the appropriate senior management is engaged in the dispute resolution.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