Alternative Contracting Process – SEP 14

Construction Manager General Contractor (CM/GC)

2012 Annual Report

**1. Introduction**

The Colorado Department of Transportation (CDOT) and the Federal Highway Administration (FHWA) have developed a Special Experimental Project Number 14 (SEP-14) work plan for the use of the Construction Manager General Contractor (CM/GC) technique on transportation projects.

As part of this work plan, CDOT is required to submit an annual report to FHWA Colorado Division each year summarizing the CM/GC activities of that particular calendar year. This report is for calendar year 2012 and addresses 5 current CDOT CM/GC Projects. It is worth mentioning that CDOT has also started procuring one other CM/GC project in late 2012 (Grand Avenue Bridge in Glenwood Springs), where the RFP was just released in December 2012.

**2. Criteria**

CDOT and FHWA identified 8 factors (5 primary and 3 secondary factors) for evaluating the applicability of the CM/GC project delivery method in order to analyze the benefits provided by the CM/GC process as it relates to these factors. These factors are:

Primary Factors:

1. Delivery Schedule
2. Project Complexity and Innovation
3. Level of Design
4. Cost
5. Initial Project Risks

Secondary Factors:

1. Staff Experience/Availability (Owner)
2. Level of Oversight and Control
3. Competition and Contractor Experience

These factors are identified in the Project Delivery Selection Matrix developed by the CDOT Innovative Contracting Advisory Committee (ICAC) and the Matrix is widely used statewide and nationwide to determine the preferred project delivery method. It is worth mentioning that all 5 CDOT CM/GC projects procured in 2012 have used the Project Delivery Selection Matrix to choose CM/GC as the preferred project delivery method.

**3. Summary of Projects**

**Project IM 0703-383 18832 (Twin Tunnels Widening Project):**

* This was CDOT’s sixth CMGC project and the largest CMGC project with a total environmental, preconstruction, and construction budget of $103 million.
* Original project risk was high because of the unknown risks of the tunnel geotech conditions, the accelerated project delivery schedule
* This project consists of five construction packages all delivered with CMGC delivery.
  + Package 0: C 0703-393 (19038) – State funded CMGC safety project that provided rockfall mitigation on the rock walls on the north side of I-70 and injecting formation grout and void filling grout into the non-project related areas of the Twin Tunnels east and west bores. This package has been completed.
  + Package 1A: IM 0703-389 (19034) – Federally and state funded CMGC project that included detour paving, Wall A construction, ATR relocation, Lab and office setup, and rockfall barrier for ped/bicycle traffic. This package is under construction.
  + Package 1B: IM 0703-390 (19035) – Federally and state funded CMGC project that included pillar stabilization, portal establishment, Doghouse Rail Bridge rehabilitation, air monitoring station installation, new bridge structure construction over Clear Creek, Retaining walls F, FF, a portion of J, and K, final detour construction, traffic and erosion control, Portal-to-Portal construction access road, and furnishing of the tunnel liner forms. This package is under construction.
  + Package 2: IM 0703-390 (19036) – This package includes the full tunnel widening excavation and liner construction, final portal construction, Chain Station reconstruction, full paving, retaining walls C, D, G, and L, removal detours and portal to portal road, and all permanent signing, striping, and water quality features. This package is currently in final design.
  + Package 3: IM 0703-391 (19037) – This package includes the wall facia on CR 314, restoration of CR 314, and all enhancements and improvement commitments. This package is in preliminary design and on hold until Package 2 is under construction.

Delivery Schedule:

* + Typical Environmental (18 to 24 months), finished in 13 months.
  + Design and Construction: 3-5 years, current schedule (on track) is 19 months from start of final design to Reopening I-70.Design to Final Restoration of County Road 314 serving as the I-70 Detour and Frontage Road, current schedule (on track) is 11 months from the date I-70 is opened.
  + Total typical schedule was 5 to 7 years from Environmental to completion; actual schedule is 3.5 years from Environmental to completion saving up to 3.5 years.

Budget Analysis:

* Overall Budget
  + Original Planning level Budget Estimate: $60million
    - This budget was established by an outside group performing a visioning study in March 2011. The project team came on board in August 2011.
    - Estimates during the environmental assessment and the initial validation estimates during preconstruction showed that project was underfunded.
    - $40 million of additional funding was added to the project in November 2012 to ensure the project could be completed.
    - The budget includes preconstruction, construction, and all CMGC related services.

Had this project used the traditional D/B/B project delivery method it would have taken twice as long, and is projected to have cost $120 M saving over $17.0 M.

Change Orders:

* Package 1A: Currently four changes orders:

1. Change Order #1 is the establishment of the Minor Contract Revisions (MCR). This is standard practice on all CDOT projects.
2. Change Order #2 is for Owner Controlled Insurance Program (OCIP). This added $1875.00 of incentives and payments that will be reconciled with MCR funds. CDOT and FHWA approved this change.
3. Change Order #3 is for revised plan sheets #1X, #60X, and 61X to add the missing fill wall rustication. This was to fix an omission in the plans. CDOT and FHWA approved this change. This was a zero cost change order.
4. Change Order #4 is to add a worker access bridge over Clear Creek and installation of a worker access concrete box culvert to get work crews under the detour traffic. This addition will save CDOT approximately $300,000 in bussing costs in Package 2. The cost of this change order was $137,185.44. CDOT and FHWA approved this change.

Lessons Learned:

* Preconstruction Lessons Learned.
  + Document everything that is addressed or resolved during preconstruction.
  + Co-location is vital to schedule driven projects. Week long work sessions are crucial to getting all the teams on one page.
  + Ensure that the ICE has the proper specialized expertise on board at the beginning of the project and has contingency resources if needed.
  + Cost Model meetings can be contentious. The owner project manager needs to be watching and listening very carefully as discussions progress so that they can stay on point.
  + Project Manager for the Owner needs to be able to question both the contractor and the ICE about their prices. The standard for both cost estimates should be the same with regard to backup, open cost model, and intent of the prices.
  + Staffing for project management on large CMGC projects needs to be appropriate for the size of the project. Standard Guidance for resident and program engineers should be developed to help staff projects due to the work loads of CMGC projects.
* Construction Lessons Learned.
  + Risk Register templates are needed to standardize the process.
  + Construction Project Engineering teams for the owner and the general superintendent should have more involvement in the Preconstruction phase.

Innovations:

* + Use of Long Stem Vegetation to improve success of re-vegetation of construction and historically impacted areas on the banks of Clear Creek.
  + Pillar Stabilization in the east bound bore walls to minimize cost of current project and possible damage to the pillar during expansion. This does not preclude any west bore expansion.
  + Portal to Portal Access Road incorporated into Package 1Bi access within the project limits, limited the areas of potential construction traffic conflict with roadway users, and provided additional emergency access.
  + Coordination with CR 314 Contractor to remove throw away work from CR314 and save on additional costs to remove and replace work.
  + Integral Pier Cap incorporated into Package 1B bridge plans will reduce structure depth to maintain clearances for wildlife and future greenway
  + Waste water treatment transported to Idaho Springs treatment plant that will improve access to not require all tunnel workers to be bussed into the work area.
  + Warm Mix Asphalt will allow for asphalt placement in winter months to avoid concrete pavement
  + Bridge Gap Architectural Details will improve wildlife habitat while improving user experience in area of bridge removal.
  + Tunnel LED Lights will decrease lifecycle cost of lighting in tunnel with higher efficiency lights.
  + Median wall architectural treatment was developed to provide additional aesthetic treatments to median wall to help with stakeholder approval for walls being shifted into the median of I-70 instead of being built on the banks of Clear Creek.
  + Employee access with temporary bridge and a concrete box culvert under the I-70 Detour that will improve access to not require all tunnel workers to be bussed into the work area.

Analysis of Performance Measures:

Performance Measures for Twin Tunnels are still being measured and will be reported in the final CM/GC Report once the project is complete.

**Project 18627: FBR R200 (18627) SH 266 & SH 71 Bridges North of Rocky Ford**

* This was one of CDOT’s first CM/GC highway projects with a total environmental, preconstruction, and construction budget of $9 million.
* The CM/GC Delivery Method was selected to help develop plans for Accelerated Bridge Construction (ABC) Project. ABC included a slide-in bridge, roll-in Bridge and GRS abutments.
* This project consists of a single CM/GC GMP for construction with LLTP items. Colorado Bridge Enterprise (CBE) funds include construction of two bridges on SH 266 and one bridge on SH 71.

This project is currently under construction.

* Original Delivery Schedule:
  + Design expected to be complete in the summer of 2012
  + Construction expected to be completed in December 2012
* Final Delivery Schedule:
  + Design was completed in August 2012.
  + Construction phase began in September 2012 and on schedule to complete in March 2013.

Budget Analysis

* Overall Budget
  + Original Design Budget Estimate: $2.0 million
    - There is currently $1.5million spent
  + Original Construction Budget: $5.1million
    - There is currently $2.8 million spent

Change Orders:

* A change order was written to install temporary rumble strips

Lessons Learned:

* + The Preconstruction services contract with CM/GC contractor was not executed until after the FIR. Earlier contractor involvement on future CM/GC projects would have been beneficial.
  + Ensure ICE is under contract when CM/GC contractor is selected.
  + Ensure that there is enough time in schedule to do 30 %, 60%, and final pricing.
  + Ensure that the ICE and EEMA are on board and prepared prior the first OPCC. Evaluation of an OPCC with a collaboratively developed cost model is much more beneficial as opposed to independent models.
  + Re-evaluate scoring standards or provide more guidance to the Review Panel prior to scoring as to what each score should represent. The proposals for this project were rated on a 1-100 rating system of which the majority of the scores were between 60-100. This resulted in a small spread between the scores of various proposers.
  + Encourage early open book sharing between the Contractor and ICE. The standard for both cost estimates should be the same with regard to backup, open cost model, and intent of the prices.
  + Earlier development of special provisions and risk pool specifications will allow more review time as GMP approaches.
  + Earlier involvement of field personnel in preconstruction will lead to a smoother transition into the construction phase

Innovations:

* + Management of on-site materials to reduce trucking costs. Balanced earthwork job to eliminate import costs.
  + Early procurement of long lead items allowed contractor to accelerate construction schedule.
  + Contractor input helped with means and methods of slide-in and roll-in Bridge and GRS abutments.

Analysis of Performance Measures:

Performance Measures for this project are still being measured and will be reported in the final CM/GC Report once the project is complete.

CDOT and the Contractor will put a lessons learned presentation together for the Colorado Construction and Consultant industry.

**Project 18162: FBR 0702-312 (18162) I-70 Frontage – Colorado River – Dotsero (F-08-F):**

* This was CDOT’s first CM/GC highway project with a total environmental, preconstruction, and construction budget of $11.8 million.
* This project consists of a single CM/GC GMP for construction with no LLTP items or early GMP packages. CBE funds include construction of a new 3-span concrete tub girder bridge across the Colorado River with roadway approaches to replace existing steel through truss on the I-70 Frontage Road (US 6) in Dotsero. The existing truss is on the National Register of Historic Places and is currently up for adoption under CDOT’s Adopt-a-Bridge program, but is slated for demolition if not adopted. The Project also includes an IGA with Eagle County for intersection improvements to construct a roundabout and partial construction of a pedestrian/bike trail within the project limits. This project is currently under construction.
* Original Delivery Schedule:
  + Design expected to be complete in summer/fall of 2012
  + Construction expected to be completed in spring 2014
* Final Delivery Schedule:
  + Design was completed in August 2012.
  + Construction phase began in September 2012 and on schedule to be completed in October 2013.

Budget Analysis:

* Overall Budget
  + Original Design Budget Estimate: $2.5 million
    - There is currently $1.9 million spent
  + Original Construction Budget: $9.3 million
    - There is currently $2.9 million spent

Change Orders:

There have been zero change orders to date

Lessons Learned:

* Preconstruction Lessons Learned.
  + Preconstruction services contract with CM/GC contractor was not executed until two weeks prior to the initially scheduled FIR date. Earlier contractor involvement on future CM/GC projects may be beneficial.
  + There are a lot of changes, resolutions, and decisions made during the design process. More deliberate tracking of progression and impacts would be useful for benchmarking.
  + Structure selection matrices incorporating critical success factors and CSS requirements were an efficient way of evaluating structure types for selection.
  + Ensure that the ICE and EEMA are on board and prepared prior the first OPCC. Evaluation of an OPCC with a collaboratively developed cost model is much more beneficial as opposed to independent models.
  + With multiple third party reviews required in project design and development, active management of those reviews is critical to meeting the project schedule. The CM/GC contractor could offer more in terms of preconstruction schedule management with a better understanding of CDOT’s contract letting and execution process. A guideline as to what environmental, historical, third party reviews are required prior to GMP and contract execution would be helpful early in preconstruction.
  + Encourage early open book sharing between the Contractor and the ICE. The standard for both cost estimates should be the same with regard to backup, open cost model, and intent of the prices.
  + Earlier development of special provisions and risk pool specifications will allow more review time as GMP approaches.
* Construction Lessons Learned.
  + Earlier involvement of owner and contractor field representatives in preconstruction will lead to a more seamless transition into the construction phase.
  + Due to drilling conditions experienced (length of time required to drill caissons), the push to install access prior to the first spawning season proved essential.

Innovations:

* + Location of west bridge pier on natural island to minimize environmental impact and limit construction costs.
  + Integral east abutment with sloped guide bank eliminated scour concerns at this location greatly reducing foundation and wall costs.
  + Unique girder erection options allowed design to consider larger clear spans with precast tub girders, meeting the CSS requirements for girder shape and reducing environmental impacts of a bridge pier in the river channel.
  + Management of on-site materials to reduce trucking costs. Balanced earthwork job to eliminate import costs. Concrete and Asphalt from existing bridge/roadway will be buried on-site to reduce export trucking costs.
  + Installation of river access prior to brown trout spawning season 2012 reduced schedule risk and allowed girders to be erected prior to high water 2013.
  + Incorporation of millings from a Glenwood Canyon resurfacing project as subbase material for the new roadway reduced trucking costs and purchasing costs for a Class 2 material
  + Design elimination of the pier cap allowed girders to rest directly on columns and reduced cost of pier cap while saving time on schedule. This innovation also provided a more aesthetically pleasing end product in line with CSS requirements.
  + Shoring area behind the east abutment allowed placement of preloading embankment prior to completion of the abutment diaphragms.
  + Early contractor start of CM/GC preconstruction services prior to executed contract allowed valuable contractor input starting with alignment selection instead of just prior to FIR.

Analysis of Performance Measures:

Performance Measures for Dotsero are still being measured and will be reported in the final CM/GC Report once the project is complete.

**Project: C 0702-278 (16594), Design, NH 0702-332 (19351) Construction Phase I, and NH 0702-335 (19459) Construction Phase II, Eagle Interchange Improvements:**

* CDOT’s first CM/GC delivery method that involves CDOT and local partner funding and phased funding with two construction phases.
* Delivery method selected primarily to develop complex phasing plans for converting conventional intersections to roundabouts while minimizing the impacts to local business accesses and traffic through the Town of Eagle’s main corridor.
* Original Delivery Schedule: 24 months
  + 7 Months Preconstruction Phase (January – July 2013)
  + 5 Months Construction Phase I (August 2013 – December 2013)
  + 12 Months Construction Phase II (January 2014 – December 2014)
* Final Delivery Schedule: Undefined at this time

Budget Analysis:

* Design Budget:
  + Original Design Budget Estimate: $2.9 M
  + Final Design Expenditures: undefined at this time
* Construction Budget:
  + Initial Engineer’s Estimate: $14.8 M
  + Final Construction Expenditures: undefined at this time

Change Orders:

N/A since construction will not start until August 2013.

Lessons Learned:

* Procurement Lessons Learned:
  + Evaluate the scoring weight percentages for each category of the proposal more closely as the Request for Proposals is prepared. The Request for Proposals for this project was written with the largest emphasis (40%) on the CM/GC design process. Most of the proposers were able to use what seemed to be boiler plate proposals and score well based on that content rather than project specific focus. In the future, the Review Panel would like to have revised the most weight percentages on project specific approaches.
  + Re-evaluate scoring standards or provide more guidance to the Review Panel prior to scoring as to what each score should represent. The proposals for this project were rated on a 1-100 rating system of which the majority of the scores were between 60-100. This resulted in a small spread between the scores of various proposers.
  + Team support and buy in is a critical factor to CMGC success.
  + Communication to contractors to provide guidance on proposals and feedback on unsuccessful applications should be performed on each project.
  + Revise the Cost Proposal Form to refine the work to be paid hourly and the work included in the lump sum items. The Cost Proposal Form was revised for clarity to include only hourly rates with estimated hours, and lump sum items were eliminated.

Innovations:

N/A at this point in the project.

Analysis of Performance Measures:

* Delivery Schedule

CDOT anticipates completing the preconstruction phase of this project by August 2013 and completing both phases of construction by December 2014.

* Project Complexity and Innovation
* Though the design is at 80%, the phasing design is at 0%. Since this heavily travelled road (22,000 ADT) is in the heart of the community with the closest I-70 interchanges at 7 miles and 10 miles, phasing is critical. The Town’s only grocery store is north of the interstate, and there is no mail delivery, so Post Office trips affect each household.
* There are opportunities for minor design changes and value engineering including flexibility of paving materials for more effective phasing, adjustment to retaining wall design, or adjustments to drainage improvements which can reduce impact to business owners.
* It is critical for the project to retain savings to meet our tight and insecure funding, or adjust the scope to meet the budget.
* CMGC would allow for seamless phasing including Utility and potential phasing of the project to meet budgetary constraints.
* The Town of Eagle has experience with CM/GC and was very interested in having this method utilized. The Town and Eagle County supplied a joint letter in support of the CM/GC delivery method.

1. Level of Design
   1. Level of design at the time of CM/GC procurement was 80%.
2. Initial Project Risk
   1. The original project risk was viewed as high. Uncertainty in the construction sequencing and phasing through a high ADT work zone (22,000 ADT), work-window restrictions due to multiple season construction and periods of no interference, ROW acquisition, and utility relocations by third party utility companies are all examples of some of the high risk items that have been identified.
   2. The Project team was working towards reducing and mitigating risks during the preconstruction phase.
3. Staff Experience/Availability (Owner)
   1. This is the first CM/GC project for the Eagle Residency project team. The construction management consultant, Stantec Consulting, has worked on a previous CM/GC project.
4. Competition and Contractor Experience
   1. Seven contractors submitted proposals for the project. The proposals, which were submitted at a high level of competition, were submitted by contractors with a range of experience with the CM/GC contracting process. The selected contractor, Flatiron Constructors, had not been awarded a CM/GC contract prior to this project.

**Project: FBR 0704-224 (18149) Pecos over I-70 (E-16-YQ):**

* This was CDOT’s Region 6 first CM/GC highway project with a total construction budget of $18.6 million. Work includes Pecos Street bridge replacement, new pedestrian bridge, and two roundabouts at the I-70/Pecos interchange.
* This project included long lead time procurement (LLTP) of fabrication of the pedestrian bridge and a variable message sign panel; which was GMP #1. GMP #2 included all work items except for the falsework work which was GMP #3.
* Colorado Bridge Enterprise funds will be used to replace the Pecos Street Bridge using Accelerated Bridge Construction (ABC) techniques in order to minimize construction impacts to traffic on I-70 and Pecos Street. The exiting 3 span bridge will be replaced with a curved deck cast-in-place post-tensioned box girders bridge that will be rolled into place. Removing the existing structure and rolling in the new bridge will be done within a 50 hour time period.
* The sidewalk will not be replaced on the Pecos Street Bridge but due to sight distance conflicts, a pedestrian structure will be constructed and installed adjacent to the roadway bridge.
* Hazard Elimination Safety funds will be used to construct the roundabouts, make modifications to ramps and pedestrian signals.
* Original Delivery Schedule:
  + Design projected completion date July 2012
  + GMP submittals and acceptance by State projected completion date August 2012
  + Construction NTP projected date October 2012
  + Construction complete projected date October 2013
* Final Delivery Schedule:
  + Design completed August 2012
  + GMP submittals and acceptance by State completed September 2012
  + Construction NTP November 2012

Budget Analysis:

* Overall Budget
  + - Design Budget (does not include indirects)

Estimate: $3.2 M

$2.8 M spent

* + - Construction Budget with Construction Engineering:

Original Estimate$17.1 M

Final $18.6M

Currently $0.6M spent

* + - Construction Engineering Budget:

Original Estimate $2.4

Final Estimate $2.4

Currently $0.23

Change Orders:

Change Order #1-the establishment of the Minor Contract Revisions (MCR).

This is standard practice on all CDOT projects.

Change Order #2-Remove Echo Testing called out in plans as it was

inadvertently left in the plan notes.

Change Order #3-Modified detour alignment. Field conditions allowed

for alternate method that reduced time.

Change Order #4-Falsework design. During design the falsework was not

complete. As the design was complete, it was found that

construction/materials was in excess of what had been planned for the

project. Contractor re-evaluated and found alternate method which

provided a savings of $330,000 over the initial design.

Change Order #5-Modifies completion time by delaying 30 days. This

was due to contracting/budgeting took 60 days delaying the start date

by 30 days.

Change Order #6-Added Shoring SF. As a part of GMP negotiations, it

was agreed between CDOT and the Contractor that CDOT would take the

risk for additional shoring. Project Special Specification allowed for

shoring item to be added at agreed price of $22.31 per sf.

Lessons Learned:

* Preconstruction Lessons Learned.
  + Expect more time for CM/GC negotiations.
  + Include contract language describing what should be included or not with indirect fees
  + Working though structure selection with owner/consultant/contractor outcome was beneficial to project
  + If design is not complete at final GMP, identify costs of items and include in force account.
  + Work with CDOT management on how much financial risk they are willing to take prior to risk discussion with contractor.
* Construction Lessons Learned.
  + Even though owner/consultant/contractor worked through the design together, expect unknowns during construction.
  + Using plans not in final design allows for changes that can lead to change orders.
  + Good working relationship between contractor/consultant due to working as a team in design

Innovations:

* ABC using a rolling bridge method
* Working though falsework design with consultant and contractor allowed for improved reduced cost and time method to be selected.
* Portions of the roadway roundabouts will be constructed as part of the bridge
* First CIP post tensioning bridge using rolling bridge method

Analysis of Performance Measures:

Performance Measures for this project are still being measured and will be reported in the final CM/GC Report once the project is complete.

**4. Conclusion**

This document details the process that CDOT and FHWA have used for implementing the CM/GC project delivery method under SEP-14. It is expected that this evaluation will enhance our understanding of the CM/GC strengths, weaknesses, and suitability of this project delivery method. In 2012, five projects were procured using the CM/GC project delivery method, and the procurement of one other project has just started in December 2012. With one CM/GC project already completed in 2011, CDOT has now used CM/GC on 7 projects, and therefore is well on its way to procure eight projects between 2011 and 2014, as described in the CDOT/FHWA SEP-14 Programmatic Agreement.