COLORADO
Department of Transportation
Division of Audit

Report Number 22-001

Construction Project Oversight

Released Report

April 2022

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June 16, 2022

The attached report presents the results of the Construction Project Oversight Audit (report number 22-001, dated April 2022). This report was reviewed and released by the CDOT Audit Review Committee (ARC) on June 15, 2022 and adds value by assisting management with improving its processes associated with construction project oversight. In addition, Audit conservatively estimates that through better construction project oversight, a 3 percent cost reduction in highway spending, approximately $19 million annually, could be achieved.

We conducted this review as part of our FY 2022 audit plan and performed this work in accordance with Government Auditing Standards. This report presents our findings, conclusions, recommendations, and the responses of CDOT management.

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Report Highlights

Background

CDOT spent an average of $648 million on highway construction during Fiscal Year (FY) 2017 through FY 2021, which represented approximately 34 percent of total CDOT expenditures. Consequently, effective project oversight is essential to delivering projects on time and within budget.

Project oversight requirements differ among project types of which CDOT uses three: Design Bid Build (DBB), Design-Build (DB), and Construction Management/ General Contractor (CM/GC).

DBB: CDOT or consultant staff design the project and bids are solicited for its construction. The construction contract is usually awarded to the lowest bidder.

DB: A design-build team is selected that works under a single contract to provide both design and construction services.

CM/GC: During design development, a construction manager provides pricing, reviews, and risk analysis. Once construction begins, the Prime Contractor performs a significant percentage of the work while CDOT or a consultant manages the project.

Highlights

The Audit Division (Audit) assessed the Colorado Department of Transportation's (CDOT) construction project oversight process by examining seven construction projects that utilize different project delivery methods and concluded that CDOT's processes were generally effective and working as intended. However, Audit found that project engineers have an excessive amount of job responsibilities, which hampers the Department's ability to further improve project oversight, resulting in occasional project delays and cost overruns. Audit identified several symptoms including: Project documentation was not always completed (e.g., project diaries, speed memos, Inspector's Reports for Force Account Work, and meeting minutes); Risk assessments were not completed properly; Significant issues were not well documented; There is a heavier reliance on consultants to provide project oversight; High project engineer turnover; ProjectWise was not being fully utilized; Projects were not always closed timely; and Funds were tied up in closed projects. We also found that the *Construction Manual* was thorough and provided clear guidance, although management should consider some minor revisions.

If CDOT could reduce project engineer responsibilities, allowing for additional time for daily project oversight and project documentation, the Department could potentially reduce highway construction expenses, the number and amount of contractor claims and disputes, improve highway construction quality, reduce the risks of adverse media attention, and improve highway and employee safety. We conservatively estimate that through better construction project oversight, a 3% cost reduction in highway spending, or approximately $19 million annually, could be achieved.

To improve construction project oversight, Audit recommends the following:

1. Develop a DBB procurement method that grants awards based upon best qualified contractor rather than solely low bid;
2. Allow for a risk-based approach in management of DBB projects;
3. Change the contactor evaluation process so that it is confidential and not automatically shared with outside parties;
4. Provide training to engineering personnel on the five risk assessment steps;
5. Develop additional training for engineers at various organizational levels and specialties; and
6. Perform a salary study for the seasoned PE I position, those with 5 to 10 years of experience, and other engineer positions if warranted.

Objective

The Audit Division (Audit) assessed the Colorado Department of Transportation's (CDOT) construction project oversight process.

Scope and Methodology

Our audit sampled seven construction projects (Projects) that were judgmentally selected, representing a mix of Design-Bid-Build (DBB), Design-Build (DB), and Construction Manager/General Contractor (CM/CG) delivery methods. Audit also analyzed and compared various trends related to our audit objective. We conducted this performance audit from October 2021 through April 2022 in accordance with the 2018 generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence that provides a reasonable basis for our findings and conclusions based on the audit objective. We believe the evidence provides a reasonable basis for our findings and conclusions based on our audit objective. We did not assess the reliability of data from SAP but, through interviews with CDOT staff, determined that the data were sufficiently reliable for the purposes of this report.

The methods that Audit used to achieve our objective were:

- Analyzing trends in expenditures, project closure timeliness, excess project funds, and consultant-related construction oversight expenditures for fiscal year (FY) 2017 through FY 2021;
- Conducting onsite observations from December 2021 through January 2022 for select projects;
- Reviewing Project documents, including project diaries, meeting minutes, Change Modification Orders (CMO) and speed memos;
- Analyzing SAP, ProjectWise, and SiteManager Project support data and documentation;
- Reviewing the following CDOT guidance:
  - *Construction Manual* (2019) for DBB,
  - *Construction Manager/General Contractor Manual* (January 2015),
  - *Design-Build Manual* (September 2016), and
  - *Standard Specifications for Road and Bridge Construction* (2021);
- Reviewing the following State of Colorado Office of the State Auditor reports:
  - *Department of Transportation Cash and Project Management Performance Audit (Feb. 2000) and*
  - *Department of Transportation Operational Risk Areas (May 2019);*
- Reviewing the following General Accountability Office (GAO) reports:
  - *Cost and Oversight Issues on Major Highway and Bridge Projects (Report Number GAO-02-702T, May 2002) and*
  - *Increased Reliance on Constructors Can Pose Oversight Challenges for Federal and State Officials (Report Number GAO-08-198, January 2008);*

- Reviewing applicable federal and state statutes; and
- Interviewing CDOT staff.

Background

CDOT currently uses three types of construction project delivery and contracting methods: Design-Bid-Build (DBB), Design-Bid (DB), and Construction Manager/General Contractor (CM/GC).

Design-Bid-Build:

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

CDOT's *Construction Manual* (CM) for DBB Projects defines the criteria and processes that are to be used in project administration. We reviewed this manual and found that it is an excellent resource, well written, and nicely coordinates with CDOT's *Standard Specifications for Road and Bridge Construction* (2021). During its review, Audit identified several characteristics of the CM, including that it:

- Is complete, offering guidance from contract award to project completion;
- Provides numerous examples of lessons learned from decades of knowledge;
- Provides many examples of completed forms and sample letters;
- Includes helpful checklists;
- Provides significant detail for construction activities;
- Provides information on how to contact specific Subject Matter Experts if further assistance is needed; and
- Contains explanations and procedures for compliance with both state and federal requirements.

While CDOT primarily uses the DBB project delivery method, characterized by established project oversight standards and conditions that CDOT staff are familiar with, the design-build and construction manager/general contractor delivery types have been growing in popularity and use. However, we found that staff were not as familiar with the DB and CM/GC delivery methods, which use a risk assessment or risk registers approach throughout the Construction phase. For example, staff did not

always follow the risk assessment steps outlined in DB and CM/GC manuals. These steps are:

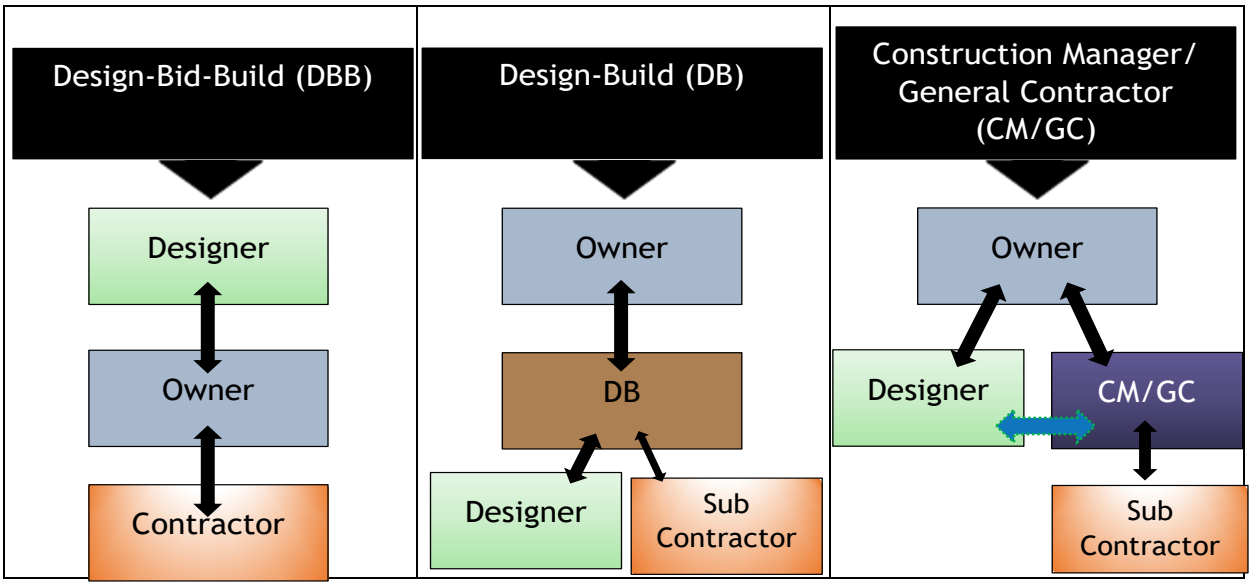
1. Identify the risk;
2. Assess and analyze the risk;
3. Mitigate and plan for the risk;
4. Allocate the risk; and
5. Monitor and control the risk.

The purpose of the risk assessments is to assist project personnel in identifying and correcting problems sooner, which could, in turn, reduce project costs. Training may be necessary to ensure staff are properly performing risk registers for DB and CM/GC projects.

Design-Build:
DB is one of the more recent alternative project delivery methods that CDOT began using in the 1990s and has since become a more frequently used delivery method. In DB projects, the Owner (CDOT) procures a DB team (a paired Contractor and Design Consultant) with a GMP or best-value procurement package. The selected DB team uses the project's preliminary design and prepares the final design. When construction packages are ready, the contractor builds the packages until the project is complete. During this delivery method, the majority of responsibility for design and construction is allocated to the DB team. However, for DB management to be effective, the Owner must recognize which risks it is better able or more suited to manage, then properly allocate each risk to the most suitable party.

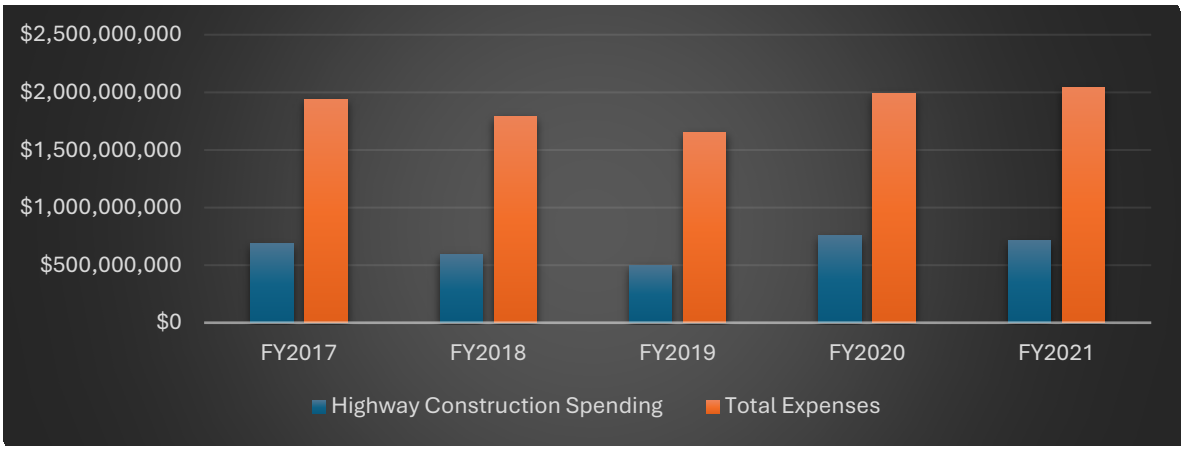
Construction Management/General Contractor:
In CM/GC projects, the Owner is the primary Project Manager, much like in DBB project delivery. However, with this method, the Owner takes on new roles while managing separate contracts with a selected CM/GC Services Contractor and its Design Consultant team. 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 CM/GC delivery to work well, and the majority of CDOT Project Managers with projects using this method have only one project assigned to them at a time. **See Figure 1** for a comparison of DBB, DB, and CM/GC project delivery methods.

Figure 1: Interaction Flow Comparison of Design-Bid-Build, Design-Build, and Construction Manager/General Contractor Delivery



As additional background, the average spent by CDOT on highway construction during FY 2017 through FY 2021 was $648 million, which represents approximately 34 percent of total CDOT expenditures (See Chart 1).[1] Highway construction spending modestly increased by 5 % in between FY 2017 and 2021. Since construction spending represents a significant portion of CDOT expenses, ensuring these monies are spent in an efficient manner is a major CDOT objective; effective project oversight is necessary to achieving this goal.

Chart 1: CDOT Highway Construction Spending and Total Expense Comparison



[1] Highway construction spending figures are based on actual contractor payments made during FY 2017 through FY 2021; these amounts do not include expenses associated with construction project design.

Findings and Conclusions

Audit assessed CDOT's construction project oversight process and concluded that CDOT's processes were mostly effective and working as intended. However, it also appears the PE I position has an excessive amount of job responsibilities, which may contribute toward oversight deficiencies Audit has identified. Audit believes some of these deficiencies have contributed towards additional project costs as well as contractor claims, delays, and/or, at times, litigation.

Audit will provide examples of these process deficiencies and their impact on the Projects we examined later in this report. These deficiencies have led Audit to develop the following six recommendations:

1. Develop a DBB procurement method that grants awards based upon best qualified contractor rather than solely low bid;
2. Allow for a risk-based approach in the management of DBB projects;
3. Make the contactor evaluation process confidential, such that information is not automatically shared with outside parties;
4. Provide training to engineering personnel on the five risk assessment steps;
5. Develop additional training for engineers at various organizational levels and specialties;
6. Perform a salary study for the seasoned PE I position, those with 5 – 10 years of experience, and other engineer positions if warranted

In our review of CDOT's construction guidance, Audit identified an extensive list of project oversight-related PE I job responsibilities. We believe that if additional daily time is available for project engineers to perform duties deemed vital to the overall success of construction project oversight and delivery, the Department could potentially reduce highway construction expenses and improve highway safety. We conservatively estimate that through better construction project oversight, a 3% cost reduction in highway spending, approximately $19 million annually, could be achieved.

Project Engineer (PE I) Workload for Design-Bid-Build:

The PE I workload directed by the *Construction Manual* (2019) (CM), one of the primary documents governing DBB projects, appears excessive. Audit identified at least 213 PE I job responsibilities within the CM. Audit then grouped these requirements by category (e.g., documentation, budget, work/materials, OJT/DBE, etc.) to develop an alternate method of reviewing engineer responsibilities (*see Table 1*). Many of these categories had entries and/or requirements located in different places within the CM.

Table 1: Project Engineer Responsibilities

Category	Number of Responsibilities
Contract completion	24
Disadvantage Business Enterprise documentation	6
Disputes and Claims	17
Support documentation	42
Force Account documentation	7
General	49
Inspections	20
On the Job Training documentation	7
Payment	18
Safety	3
Scheduling	20
Total	213

Based on Audit's observations and interviews with engineers, we found that project engineers are unable to thoroughly complete all of these tasks and provide quality project oversight in an eight-hour workday. According to our interviewees, it is necessary for project engineers to work much more than a 40-hour week to stay current with their responsibilities. Consequently, during our review of Project documentation, we identified lapses in maintaining daily dairies, Form 10s, meeting minutes, and other support documentation deemed vital to successful project delivery and/or necessary for compliance with federal and state requirements. Evaluating PE I job responsibilities and determining whether some of these responsibilities can be 1) deemed unnecessary and eliminated; 2) handled via an electronic solution; or 3) assigned to other personnel could help project engineers prioritize their time to provide better oversight of construction projects. *See Appendix A for a sample of PE I responsibilities. See also Appendix B for one responsibility outlined in the Construction Manual at Section 120.5, with additional content guidance from Section 120.6.*

Symptoms, Impact, and Recommendations:

As a result of excessive workload, Audit identified lapses in construction project oversight. The symptoms of this lack of oversight included:

- Project documentation was not always completed (e.g., project diaries, speed memos, Inspector's Reports for Force Account Work, and meeting minutes);
- Risk assessments were not completed properly;
- Significant issues were not well documented;
- There was a heavier reliance on consultants to provide project oversight;
- High project engineer turnover;
- ProjectWise was not fully utilized;
- Projects were not always closed timely; and
- Funds were tied up in closed projects.

Following is discussion of these symptoms and potential impacts by the three project types based on our sample selection:

1. **Design-Bid-Build Projects:**

A $36 million DBB Project had a design issue and an environmental concern that resulted in cost and time overruns, as well as lacked important information in various documentation and forms required by the Construction Manual. The design issue resulted in $500k in extra cost while the environmental concern cost currently stands around $3 million and the project engineer is unable to determine if additional funds will be needed.

Audit realizes that projects will always experience challenges; however, when issues do arise, the project engineer should prioritize their responsibilities using a risk-based approach. For additional context, this Project began over 20 months ago; the design issue was discovered at the start of construction and the environmental concern shortly thereafter. Although the $500k design issue was addressed over 20 months ago, the PE I has yet to complete a CMO (Form 90) to pay for the design change. The environmental concern became known over 18 months ago and remains ongoing. Audit believes the Project's information we reviewed did not appropriately document these matters. For instance:

- Over 83% of the project diaries (Form 103) were missing;
- Speed memos (Form 105) were not always prepared;
- Inspector's Report for Force Account Work (Form 10) were not prepared; and
- The Storm Water Management Plan (SWMP) was not properly maintained.

Daily Diaries and Meeting Minutes, and Form 10s:

A review of project diaries (Form 103) and meeting minutes for this Project showed few indications of the design and environmental issues this Project was facing or discussion of steps that would be taken to mitigate these issues. For example, the first indication of a potential difficulty within Project documentation, is a note accompanying the submission of a revised schedule; these challenges were not noted in the meeting minutes until a month after the submission date. and little to no information regarding either issue could be found within the diaries. In addition, as of March 2022, the Project was still active and five months past the agreed-upon construction completion date. The construction documents on file had very little discussion regarding the Project delay or comments to help the reader understand the reasons for or extent of it.

Daily Diaries: Diaries are used to document daily construction site progress. They ensure any Project issues or claims can easily be traced back to a site diary or other document and considered the memory of a Project. See Appendix B for the Diary Completion requirements.

Speed Memos: Form 105 is used to communicate with the prime contractor regarding contract changes, responses to contractor requests, reminders of required documents, etc.

Force Account Work: Form 10 is used to establish a method of payment for contract changes or extra work when there is a price dispute, price reasonableness cannot be determined, and/or the extent of the work is unknown.

The lack of Form 10s required by the *Construction Manual* took on a greater significance in this Project because of the $500k design issue/change and more so for the ongoing $3 million-plus environmental concern. This Form is used to document the number of daily labor hours, equipment, and materials for engineers to better monitor the costs and then compare to invoices for reasonableness. Through February 2022, there should be 18 months of invoices related to the environmental cleanup; however, the PE I provided 11. Supporting documentation for these 11 invoices ranged from eight pages (Oct 2021) to 67 pages (May 2021). The invoices included costs for labor, materials, administrative work, subcontractor work, rental equipment, and diesel fuel; none show evidence of review or approval by the project engineer. Without documentation for 18 months of force account work or the monitoring provided by use of the Form 10, determining the reasonableness of over $3 million of additional construction costs becomes very difficult.

Storm Water Management Plan:

The monthly SWMP inspection report for this Project had the exact same wording for each of the 17 months following identification of the water-related environmental concern:

> CDOT has conducted a water quality control inspection on [date] and recorded non-compliance findings as defined in CDOT Standard Specifications for Road and Bridge Construction, subsection 208.09(a)(3). Correct and report corrective actions to all findings in accordance to timelines noted in subsection 208.09.

Audit suggested to the PE I that the various Project documents could have more fully indicated the scope of the environmental concern, how it would be addressed to better mitigate costs, and an estimate of when the work would be completed. Even the minutes for meetings where these concerns were discussed did not identify or address the environmental concern in this manner. The PE I agreed and stated that it would have been helpful. Also, when we discussed our observations with the PE I, a couple of reasoning for the lack of some vital information, which included:

- They [inspection and engineering staff] were tired at the end of the day and
- Form 105s were just one more thing to do on top of all their other work and not always necessary.

Also, this past summer Audit performed a CDOT state-wide risk assessment and interviewed nearly 50 CDOT employees, many of which from engineering such as the

Chief and Deputy Chief Engineer, Program Managers, Resident Engineers, Project Engineers, and others, who stated the project engineer workload is excessive. See ***Table 2*** for specific project engineer workload comments:

Table 2: Project Engineer Workload Comments

Too much paperwork and things get missed.
Staff stretched too thin.
Regulation-related paperwork can be ridiculous and an overwhelming amount.
Creates a huge paperwork burden. ✓ Notes that a good project is not the same as good paperwork.
CDOT has more projects than it has the resources to manage. ✓ People without any experience are being sent out on projects.
Many requirements to wade through with new ones added every year.
Paperwork demands are very heavy.
Possible that PE is missing things due to lack of knowledge/experience, being overwhelmed, and juggling too much.
Spending majority of time handling paperwork.
Significant paperwork burden.
Required paperwork amount is cumbersome.
Cannot rely on consultants the same way as employees. ✓ May not have proper skillset (firm may send new people, skill inflation may be an issue, etc.)
Believes that many people are wearing too many hats to ensure transparency and clarity.
Need a better focus on schedule management and believes we do not do this well. ✓ Possible reasons for this are lack of time, difficulty in analyzing schedules, and/or lack of experience
Engineers/inspectors overseeing too many projects. Quality Assurance (QA) is done after the fact, not during. QA and Quality Control is lacking from consultants.
No benefit for Professional Engineer to want to do construction over design (construction has longer hours – especially in the summer, a more difficult work environment, etc.)
Technicians who may not have a degree are sent out to the field. They have experience but not enough to be comfortable and/or might be assigned to types of projects they have never done before.

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Table 2: Project Engineer Workload Comments (Continued)

The challenge is the magnitude of information, including the *Construction Manual* and contract
Amount of information in different manuals and references can be overwhelming. People do not know what information is there or how/where to access what they need.
Large amount of information can be overwhelming, causing decision paralysis or could make someone choose to ignore something. ✓ Might be too much information, too many regulations, etc. for an individual to handle.
Guidance is coming from multiple sources/divisions. ✓ Stuff/memos/information that is pushed out to staff does not always fit the core [division] mission(s) ✓ Who controls/makes decisions on what information/memos, etc., get pushed to employees? Is there quality/topic/audience control?
Subject matter expert deficiency.
Would ideally have a second person as assistant PE or similar to handle paperwork, check diaries, etc. ✓ People are promoted above their capabilities without the necessary experience.
Lack of training contributes to people not keeping necessary documentation/well-written, relevant, consistent daily diaries.

Another concern Audit identified during last summer's risk assessment interviews and this audit is the contractor evaluation process. CDOT personnel would feel a lot more comfortable if the contractor evaluations were confidential. Also, although CDOT could keep its Project contractor evaluations confidential, it would not preclude management from asking the contractors any questions that may be derived from the evaluation results. Some of the things we heard concerning the evaluation process are as follows:

- Would be better if project engineer could do confidential evaluations than current system where everyone can review and challenge
- Project staff nervous about creating written evaluations for contractors because of potential repercussions
  - ✓ PE and staff may have different ideas about how things went on a project
  - ✓ Evaluations should be more objective, supported with documentation
  - ✓ CDOT staff needs to see the value in providing evaluations – currently do not see that anything happens with or because of them and feel they are not worth the effort
- Some PEs fill out evaluations at the end of every contract (some do not), but evaluations have been in place for 10+ years and nothing has changed in terms of the process or types of bid winners

- No outcome on evaluation processes; staff often feel not worth their time to complete

Also, currently the traditional DBB Project is a low bid vs. best qualified firm winning the bid. Based upon Audit's work these last nine months, we believe CDOT could be able to obtain better efficiency and effectiveness on construction projects at an overall lower cost if the DBB bid evaluation was best qualified based rather than solely low bid. On many occasions, Audit heard the following during the risk assessment interviews last summer as well as during this audit:

- If CDOT engineers had a mechanism to boot contractors, they would use it
  - ✓ Some contractors fight CDOT every step of the way for more money
  - ✓ Bad evaluations of contractors do not do anything
  - ✓ No consequences for contractors, which is frustrating

Some metrics that an Evaluation Team can weigh for scoring that considers both a best qualified and price approach are as follows:

- Past performance from "confidential" contractor evaluations and experience
- Design and technical approach to the Project
- Project schedule capabilities, including contractor's financial resources, equipment, management personnel, etc.
- Price (should not exceed 15% of the weighted score)
- Craft labor capabilities, including adequacy of craft labor supply

In addition, the Evaluation Team should be comprised of only CDOT personnel with no more than five on the panel, with the Project Manager(s) involved in the design as one or two panel members, a Project Engineer (PE I) and Resident Engineer (PE II) from the Region in which the Project will be managed as two others, and CDOT specialty personnel, if needed. One of the Region's Program Managers and its Regional Transportation Director (RTD) should be CDOT personnel as part of the review and approval process after the Evaluation Team panel have made their selection.

CDOT could work with FHWA concerning 23 CFR 112 "Letting of Contracts" approach:

"Subsection (a)(1) states: Subject to paragraphs (2) and (3), construction of each project, subject to the provisions of subsection (a) of this section, shall be performed by contract awarded by competitive bidding, ***unless the State transportation department demonstrates***, to the satisfaction of the Secretary, ***that some other method is more cost effective*** or that an emergency exists. ***Contracts for the construction of each project shall be awarded*** only on the basis of the lowest responsive bid submitted ***by a bidder meeting established criteria of responsibility***."

The process by which FHWA reviews the methods of solicitation for both CM/GC and DB procurement methods are similar to the one suggested by Audit for DBB projects. Therefore, it is likely a change for the DBB bid solicitation process warrants a change

as well. In addition, the design of CDOT's *Construction Manual* for DBB Projects can mandate only the requirements/job responsibilities deemed vital to the overall success of a project with other defined criteria and processes being a risk-based approach.

2. Design-Build Project:

DB projects use a risk-based approach to managing project risk, in which potential risks to the project are identified during the initial phases of project scoping and reviewed throughout the project. The *Design Build Manual* (2016) identifies five risk assessment steps (pg. 2-4 – 2-5):

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 construction phase, risk registers are maintained in order to monitor the risks previously identified as well as to track any newly identified potential risks.

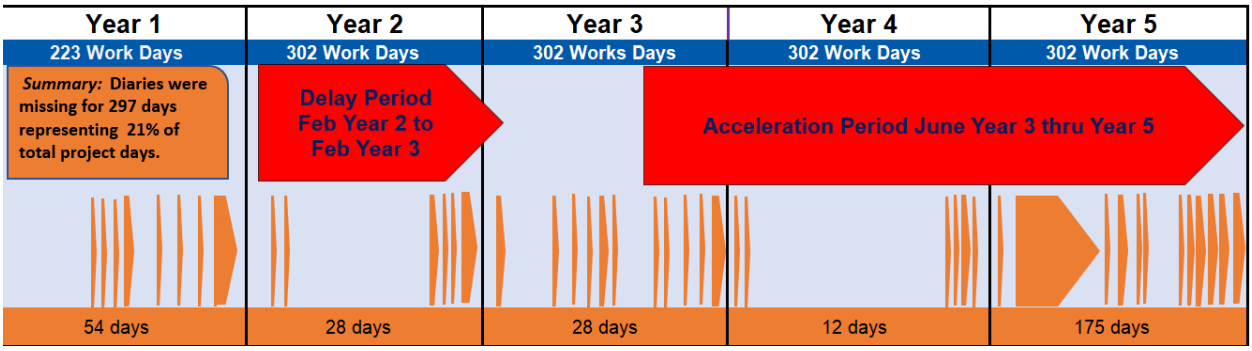
One of the DB Projects that Audit analyzed ended in litigation. This Project showed signs that CDOT personnel need additional training on the five risk assessment steps noted above. Audit review of Project documents found: 1) project diaries, although not mandated for DB projects, were not always completed; 2) there appeared to be more than the usual number of contractor issues concerning workmanship and proceeding with work without appropriate CDOT personnel present; and 3) a known significant risk and its potential consequences were not documented in the Project's risk register.

Project Diaries and Contractor Workmanship:

The project diaries for this five-year Project described numerous incidences of nonconforming work, Prime Contractor's and Subcontractors' (Contractors') questionable behavior—perhaps trying to conceal poor workmanship—and Contractors' frequent failure to adhere to approved Methods of Handling Traffic (MHTs), among other noted items that Audit considered to be concerning. Individually, or even considering some of the noted issues collectively, Audit may have considered such incidences to be typical for a project of this size. However, it was the sheer number of errors and conditions documented *(See Appendix C for issue excerpts)* compared to the other Projects we analyzed, as well as the delays, Contractor claims, litigation, and traffic fatality that has led Audit to a position of concern on this Project.

While project diaries were written most days, a significant proportion were missing. *See Figure 2* for a comparison of diaries to the five-year Project life. The diaries that were present often described nonconformance with the Project design and/or material specs, though many entries were general in nature. If CDOT can close these gaps—diaries not being prepared and/or not providing the proper information—it is possible that delays, claims, and/or litigation associated with Projects could be avoided or mitigated.

Figure 2: Diary Completion compared to Project life



When Audit discussed these matters with the construction Project team, they agreed that identifying and correcting various risks sooner could help reduce project costs. They also stated the following:

- Training may be necessary to ensure staff are properly performing risk analyses;
- With additional staff, better oversight could be provided;
    - Insufficient staff levels place CDOT in a position of relying on consultants
- The procedural and regulatory requirements of projects and project management have increased far more than the number of CDOT personnel in the last 20 years; and
- Project diaries are lacking everywhere
    - The Project team is aware of the importance in completing project diaries with relevant information, but also aware many people do not want to add diary tasks to the end of their day after spending hours on site; diary completion thus becomes an afterthought

We also discussed whether there were mechanisms to remove Contractors from a project; the Project team stated that a Prime Contractor has removed Subcontractors at times but removing a Prime Contractor is difficult. They also said that if CDOT's contractor rating tool were more effective, eliminating substandard Prime Contractors during a "best qualified" bid evaluation process would be easier.

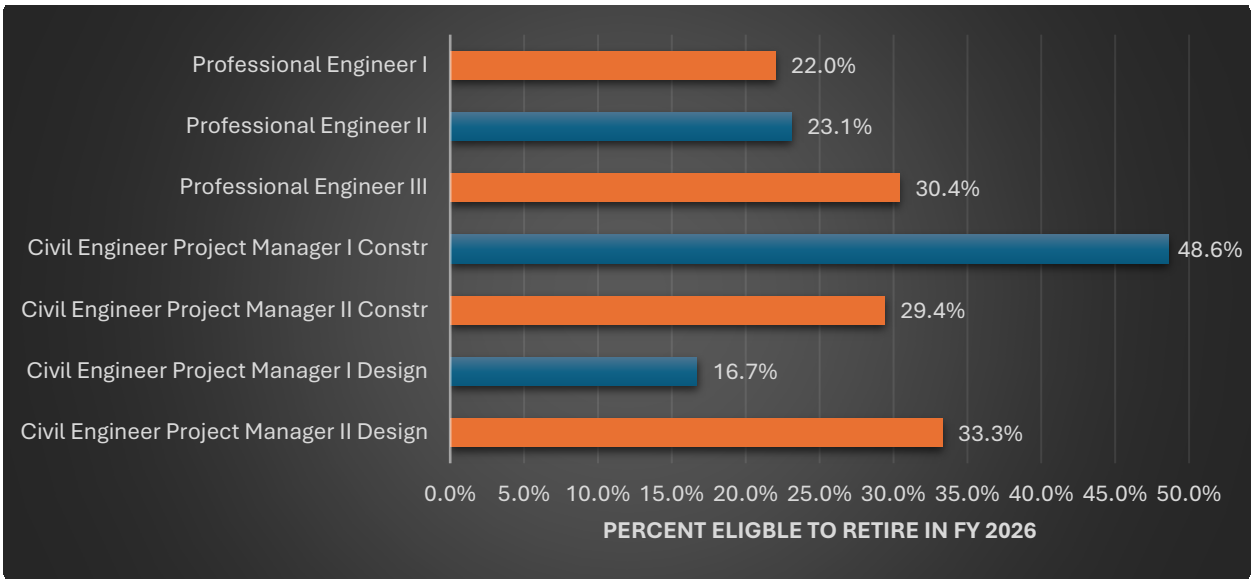
Project Risk Register:

This DB project experienced a delay, multiple claims, and litigation and although the workmanship for this Project appeared problematic, Audit was advised by the RTD that the delay was due to an easement that CDOT was unable to procure. The project engineer on this Project concurred with the RTD, stating CDOT was aware of and accepted this risk at the start of the Project. Yet neither this risk nor its potential consequences were included within the risk register. Also, prior to officially learning that the easement was not going to be obtained, management authorized construction work to progress based upon an oral agreement with the easement's owner. The easement was not obtained. In addition to millions of dollars in sunk costs, CDOT paid over $10 million via CMOs related to this matter, none of which were identified within the Project's risk register.

When Audit further discussed the risk register with the project engineer, they indicated that ongoing monitoring of potential risks via a risk register relies heavily on participation by the Prime Contractor. Contractors, however, are generally reluctant (at best) to note potential or actual issues in writing for fear of consequences. The project engineer also attributed certain process breakdowns to a lack of transparency, communication, and experience, both internally and on the Contractor's side.

The results from the second DB project Audit analyzed were very different. Project documentation was thorough, well organized, and appeared complete. However, procuring contractor engineering and administrative services for work CDOT could perform can be expensive. As the PE I for this Project said, CDOT was "paying a premium for quality." With the number of major projects being planned over the next 5 to 10 years, CDOT should consider reducing its reliance upon consultants, except when specific technical expertise is needed, by increasing its own staff. Based upon Audit's observations and discussions with CDOT personnel, the DB project approach is good but perhaps the blend between consultant personnel and CDOT staff could be weighted more towards CDOT. Also, if the runway of projects can support additional engineer personnel over the next 5 to 10 years, this approach will also help CDOT with succession planning. *See Chart 2 for engineer personnel retirement eligibility by FY 2026 (4 years away; 5 to 10-year retirement eligibility will be greater)* Lastly, based upon the results of the first DB project that Audit examined, it is recommended that CDOT personnel receive training on the five risk assessment steps.

Chart 2: CDOT Civil and Professional Engineers Eligible to Retire in FY 2026



Audit investigated certain matters discussed with engineering personnel further and found that CDOT spending for consultant's personnel to manage projects has increased more compared to both highway construction spending and the number of CDOT engineering staff. For example, from FY 2017 to FY 2021, expenditures for consultants managing projects have increased over 12% (*see Chart 3*) while highway construction spending increased just 4.7% (*see Chart 4*) and CDOT PE I staff decreased by about 2% (*see Chart 5*).

Chart 3: Consulting Spending for Construction Project Oversight FY 2017 to FY 2021

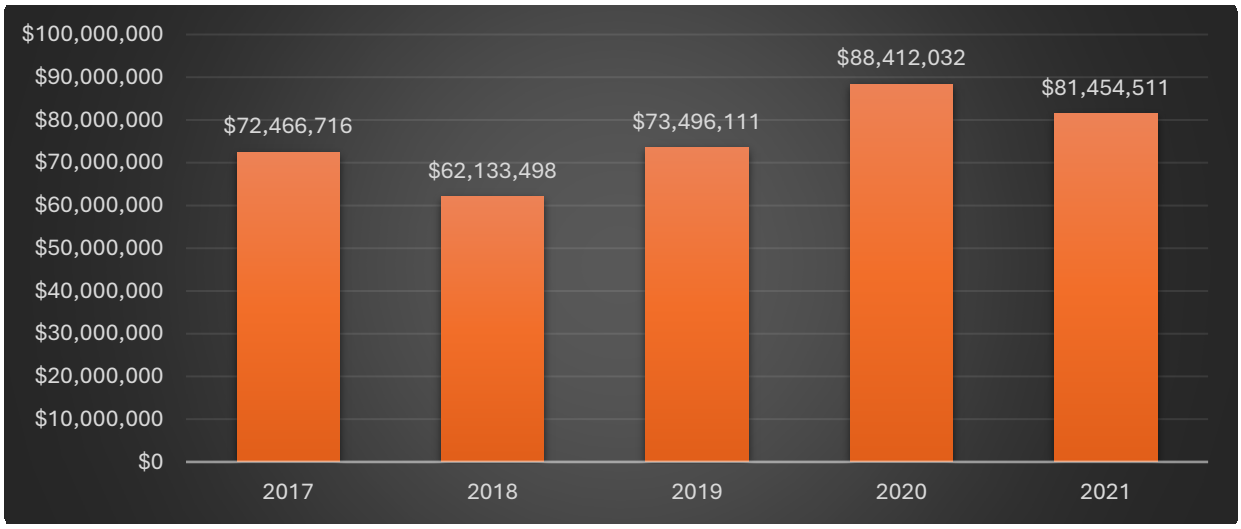


Chart 4: Highway Construction Spending

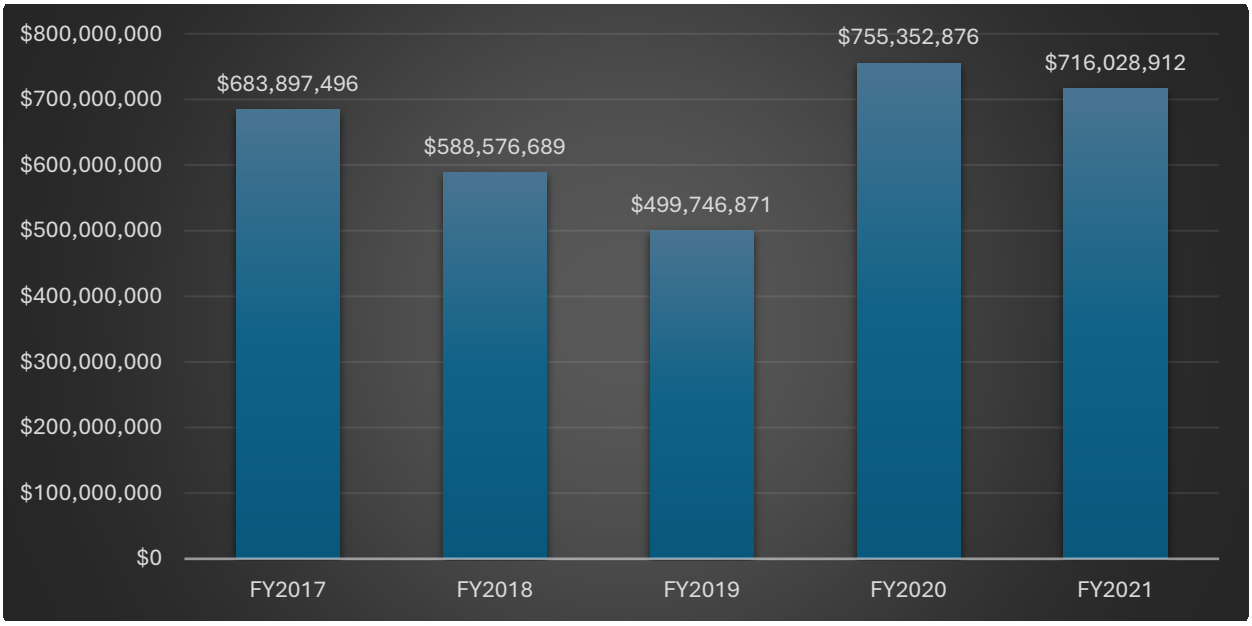
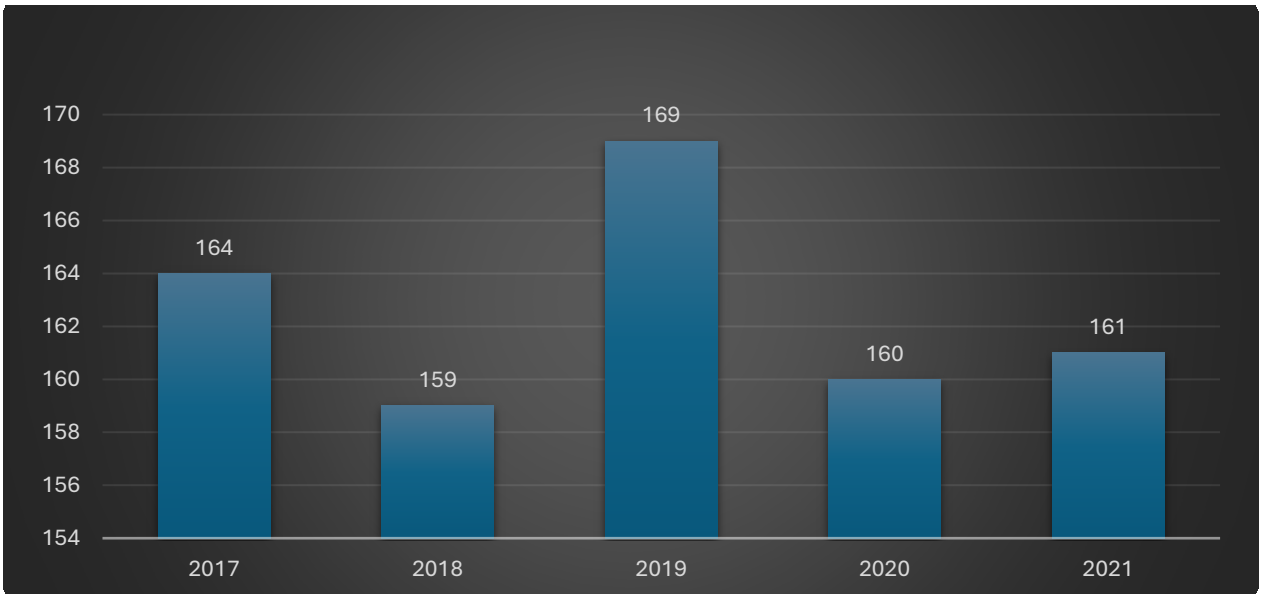


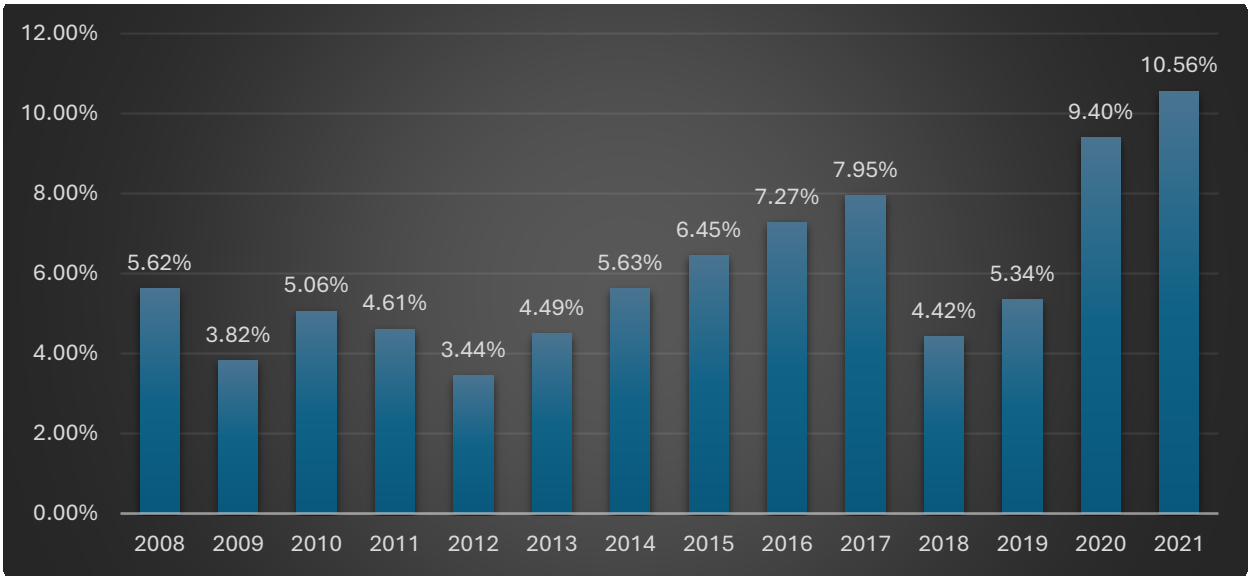
Chart 5: Number of CDOT PE I FY 2017 to FY 2021



In addition, the turnover rate for PE I staff is at its highest level of thirteen years; *see Chart 6.* This increased turnover may be due to several factors; potential explanations expressed to Audit by engineering personnel included that there were too many duties,

salaries for experienced engineers (those with 5 to 10 years of experience) were too low, and that contractors pay much better. Consequently, CDOT construction management oversight may not be as effective as it could be because new engineers must be hired and trained.

Chart 6: CDOT PE I Turnover Rate
FY 2008 to FY 2021



Comments from our 2021 risk assessments also included:

- CDOT may not have certain expertise in-house
  - Construction side hires techs who then learn on the job
  - Techs in the field might just take what consultants say at face value
- Rely on consultants because we lost a significant amount of expertise
- People promoted too quickly who lack knowledge and experience in running projects
- People are learning on the job, but may not be learning correctly
- Inexperienced/unskilled staff may be unnecessarily pushing back against contractor-requested changes/information
- Staff are missing core competencies and information
  - Overall, there is a need for a more robust training program to create a core knowledge base
  - Online training is ineffective/insufficient, does not necessarily cover needed material
- A trial by fire/sink or swim approach to personnel
  - Bring in a new person and drop them into job duties with little preparation
- Engineers in Training (EIT) put on projects before ready and drinking from a firehose is an area that seems to be repeated
  - Currently bringing in consulting teams to support EITs

- There are issues with keeping construction staff:
    - PE I makes 60% of consultant salary because of hourly and overtime pay
    - Difficult to get and keep people
    - Strongly seasonal work and CDOT recommends people use comp time during the off season rather than receive overtime pay
- Inexperienced techs sent out on projects may not observe/recognize issues
- Unable to grow and develop staff due to salary caps
- Paying consultants a lot of money to handle administrative paperwork

In addition to developing the training needed for engineers at various organizational levels and specialties, Audit also recommends that CDOT perform a salary study for a seasoned PE I, 5 to 10 years of experience, and other engineer positions if warranted.

3. Construction Management/General Contractor:

The one CM/GC Project that Audit analyzed appeared to have most of its documentation in order and appeared relatively complete. Most of the Project documentation was maintained by outside parties, which can be more expensive. As with the DB Projects, CDOT should consider reducing reliance upon consultants and weigh personnel on projects more towards CDOT. Audit also recommends that CDOT:

- Provide training to the engineering personnel on the five risk assessment steps
- Develop additional training for engineers at various organizational levels and specialties
- Perform a salary study for a seasoned PE I, 5 – 10 years of experience and other engineer positions if warranted

Other Observations:

ProjectWise Usage:

It does not appear that documentation within ProjectWise is well organized.[2] Among other observations, Audit found that project folders in ProjectWise frequently contain multiple copies of documents, are missing information, and/or contain documents from other projects. Moreover, Audit found that over 300 folders are maintained in ProjectWise with many engineers unclear as to the use of these folders and what support documentation to maintain.

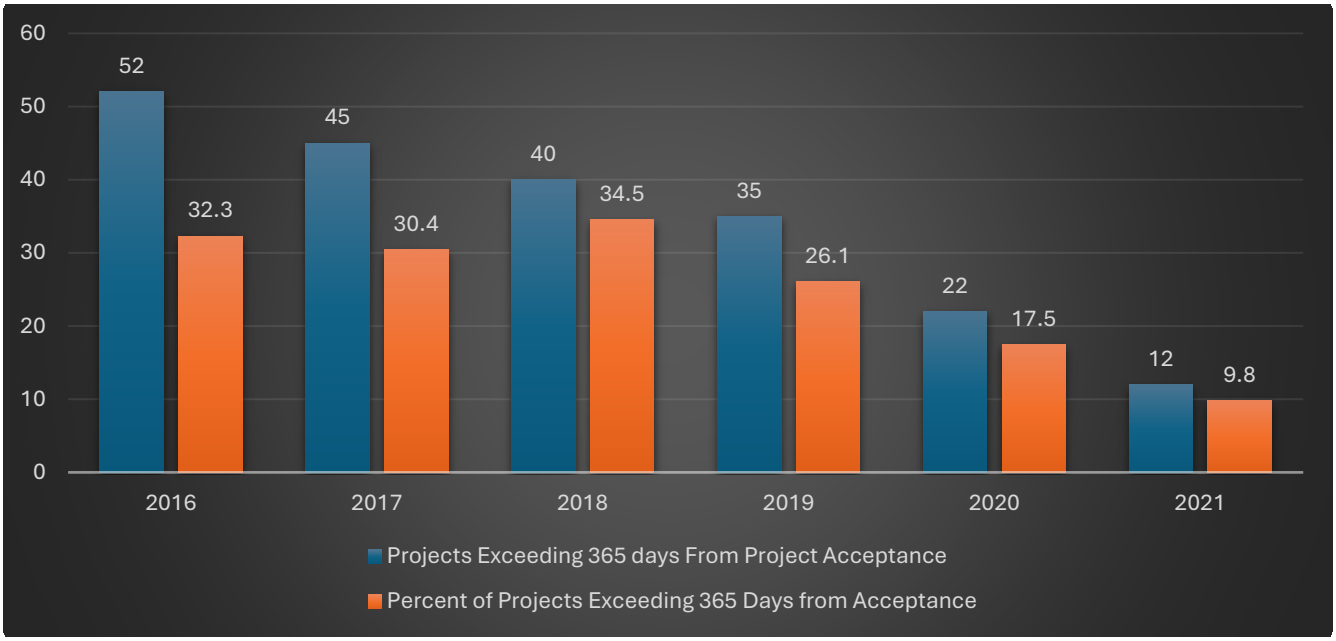
Project Closure Timeliness:

Audit found that project engineers may not have sufficient time to close projects within the 365 day timeframe following substantial completion required by statute.[3] Our

[2] CDOT uses ProjectWise to maintain project records, which is an engineering project collaboration software from Bentley Systems that allows project teams to manage, share, distribute, and review engineering project content from within a single platform.
[3] Colorado Revised Statues. (2021). § 43-1-123(1).

analysis found that CDOT has made significant improvements with closing projects within the legal timeframe from project acceptance, but improvements are still possible through better project oversight. Although their finding was based on a more stringent CDOT policy of project closure within six months, as opposed to the state requirement, not closing projects timely was also identified as an audit finding by the Office of the State Auditor.[4] In FY 2021, 12 (9.8%) of the projects were closed late based on the 365 day state requirement, although this represented a substantial improvement from FY 2016, which had 52 projects (32%) closed untimely (*see Chart 7*).

Chart 7: Projects Closed Late Based on 365 Days from Project Acceptance Date FY 2017 to FY 2021

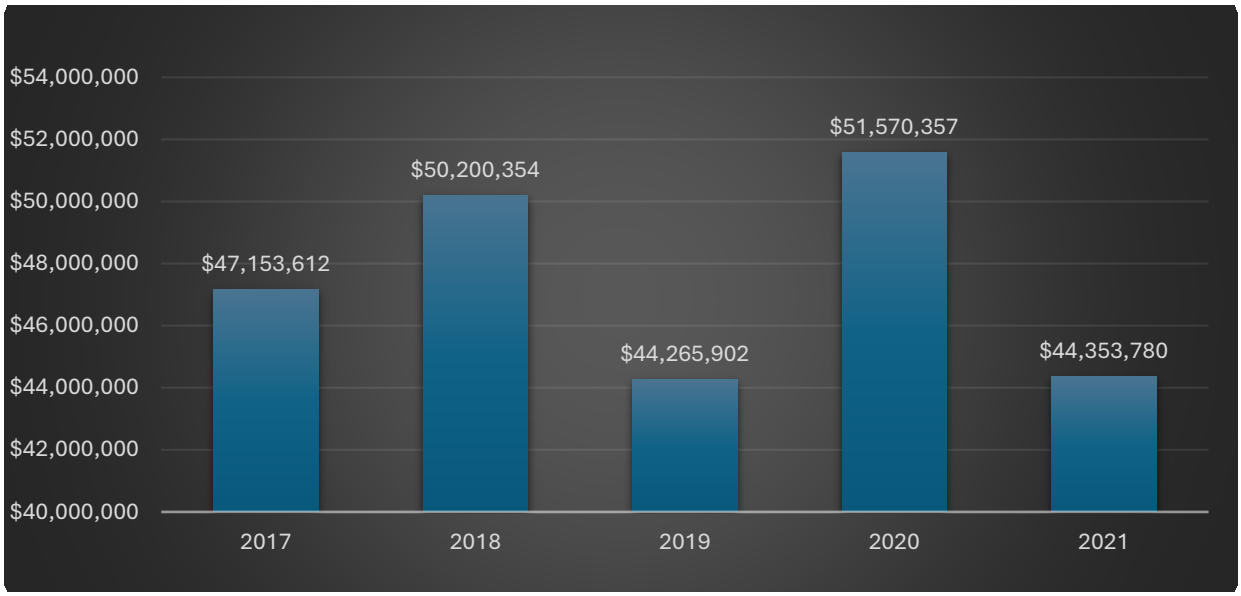


Release of Excess Construction Funds:

Our analysis of projects that were not closed within 365 days found that from FY 2017 to FY 2021, a total of $237 million—an average of over $47 million per year—in excess construction project funds could have been released sooner (*see Chart 8*). The Office of the State Auditor also identified a similar finding in their May 2019 report, finding $29.3 million in excess construction funds that could have been released sooner based on the *Construction Manual* (2019) criteria of project closure within six months within final project acceptance.

[4] State of Colorado, Office of the State Auditor. (2019). *Department of Transportation, Transportation Commission Operational Risk Areas*.
https://leg.colorado.gov/sites/default/files/documents/audits/1750p_operational_risk_areas_cdot.pdf

Chart 8: Construction Project Funds Remaining Based on 365 Days from Project Acceptance Date
FY 2017 to FY 2021



Other Matters

Although the *Construction Manual* (2019) appears thorough and provides clear guidance, management should consider the following minor revisions:

- Changing the project closure timeframe from six months from the project acceptance date to match the state requirement of 365 days (Section 121.3.4);
- Simplifying guidance on signature types for various documents (Section 120.1.1);
- Simplifying the required file format for all schedules. Section 108.3 currently requires electronic copies of all schedules in both native file format and PDF;
- Condensing multiple requirements into a single form via incorporation of multiple forms. The following forms are provided as an example of items that could be combined while providing all necessary information in a single form and using less staff time completing required forms:
    - Over and Unders report could be combined with Form 65, Project Financial Report
    - Explanation Letter could become part of the Form 90, CMO

Recommendations

To improve construction project oversight, Audit recommends the following:

1. Develop a DBB procurement method that grants awards based upon best qualified contractor rather than solely low bid.
2. Allow for a risk-based approach in the project management of DBB Projects.
3. Change the contractor evaluation process so that it is confidential and not automatically shared with outside parties.
4. Provide training to engineering personnel on the five risk assessment steps.
5. Develop additional training for engineers at various organizational levels and specialties.
6. Perform a salary study for the seasoned PE I position, those with 5 to 10 years of experience, and other engineer positions if warranted.

Management Comments

Management agrees with the findings and recommendations contained in this report. See *Appendix D for additional information* and *Appendix E for Management's Official Comments*. The Audit Division considers management's comments responsive to the recommendations and corrective actions should resolve the issues identified in this report.

Appendix A: PE I Job Responsibilities	*Construction Manual* Reference
Administers contracts according to CDOT Policies and Procedures	105.14.2
a. Reviews agreements between local agency and CDOT to ensure applicable issues are addressed in local agency projects b. Performs random project reviews and provides advice to the project engineer of the local agency	122.4 122.6
Ensures applicable project documentation conforms to contract requirements and established CDOT policies and practices	105.14.2
a. Strives to be as paperless as practical, generating and keeping all documentation in an electronic format b. Seeks approval for exceptions to electronic document requirements	120
Ensures that all documents in a project record contain the project number and project code (subaccount)	120.1
Ensures that the proper signature method is used for documents. For example, Adobe Sign for Signature Type I documents and a different method (Acrobat Pro DC certified signature, Blue Beam, login verification, scanned signature, etc.) for Signature Type 2 documents	120.1.1
Ensures that project records are accurate, complete, and easily understood.	120.1.2
Compiles and verifies project documentation and archives project records on a continuing basis	120.1.2 Figure 100-15 120.1.4 120.1.7.2 120.2
Manages the project within the approved construction budget authorization or approved budget changes	105.14.2
Monitors financial status of project (Form 65)	120.6.2.1
Maintains Overs & Unders report in AASHTOWare	120.6.2.1.1
a. Requests additional funds (if necessary) using Form 1186 at least two weeks prior to payment that will exceed project commitment amount and obtains necessary approvals - Enters SAP purchase requisition and provides a draft of Form 90 (CMO) with explanation letter and any pertinent information for funding letter requests related to CMOs b. Enters SAP purchase requisition and provides documentation, including Form 65 and Overs/Unders report, regarding project scope changes requiring increase / decrease	120.6.2.2 120.6.2.3.1 120.6.2.3.2
Notifies Area Engineer upon receipt of Value Engineering Change Proposal (VECP)	104.7

Appendix A: PE I Job Responsibilities	*Construction Manual* Reference
a. Determines if VECP qualifies for consideration and evaluation in concert with resident engineer.	104.7
b. Categorizes VECP proposal.	104.7
c. Assembles a panel of subject matter experts to evaluate VECP proposal.	104.7
d. If agreed to, processes VECP using Form 90.	104.7
Ensures that all work and materials used on the project conform to contract requirements and established CDOT policies and practices	105.14.2
a. Ensures project construction is performed in accordance with the plans	105.14.2
b. Enforces governing specifications and special provisions of the project & contract	105.14.2
c. Resolves after-the-fact discovery of inadvertent incorporation of excess foreign materials on a case-by-case basis and submits resolution to the FHWA for approval	106.11
d. Reviews & signs Form 626 submitted by project materials tester for materials outside specified limits	120.12.2
e. Evaluates materials or work for price reduction if materials, work, or finished product do not conform to the contract	120.12.3
Ensures DBE (Disadvantaged Business Enterprise), On the Job Training (OJT), and related state/federal requirements are fulfilled	105.14.2
a. Discusses federal requirements (e.g., Davis-Bacon, EEO, OSHA, etc.) incorporated via FHWA Form 1273 with contractor and subcontracting entities at preconstruction conference	107.1-107.1.1.1
b. Reminds contractor of OJT goals and status at weekly project meetings	107.1.4.2
c. Works with Civil Rights Officer (CRO) to evaluate requests for DBE or OJT waivers or modifications	107.1.4.5
Holds all necessary conferences with contractor regarding CDOT expectations and project details (e.g., preconstruction conference(s), pre-paving conference, pre-pour conference, etc.)	120.13
a. Provides complete copy of the agenda and meeting minutes to each attendee after each conference	120.13.1.4
Ensures compliance with environmental mitigation commitments	107.12
a. Conducts environmental preconstruction conference that addresses environmental requirements	107.12
b. Receives, reviews, and approves spill response plan and method statement for containing pollutant byproducts from contractor	107.25.2.20
Ensures contractor has been informed of importance of preserving protected archaeological and paleontological sites	107.23.1
a. Ensures protected sites are marked before construction begins	107.23.1

Appendix A: PE I Job Responsibilities	*Construction Manual* Reference
b. Halts construction activity and notifies CDOT Cultural Resources Staff if archaeological or paleontological resources are discovered during construction	107.23.2
Responds to Contractor requests in writing as directed by the Resident Engineer using Form 105	105.14.2
a. If Contractor refuses to sign Form 105 upon receipt, must note refusal on the form.	120.4
b. Sends Form 105 via registered mail to Contractor home office address	120.4
Ensures contract time is managed in a way that benefits the project	105.14.2
Ensures timely completion of the project based on the original project schedule and approved schedule revisions	105.14.2
a. Uses CPM scheduling and good engineering judgment to determine contract time for completing the project and documents analysis on Form 859	108.8
b. Determines and documents project time charges on Form 262 or Form 263	108.8.5.1
c. Reviews and approves/requests revision of MS Project or Primavera Critical Path Method preliminary, baseline, updated, and revised project schedules and schedule reports from contractor - Baseline schedule is required from contractor by 45th day after award - Bar chart or critical path method 90-day project schedule is required from contractor at least five working days prior to the start of work - Progress schedules & methods statement are required monthly & at least five days prior to start of work	108.3 108.3.1 Standard Special Provision 108.03(c) 108.3.2 108.3.5 120.11.1 120.11.1 120.11.2
d. Provides a written response to contractor for all schedules within 10 days of receipt	108.3.1
e. Conducts schedule review meetings for each schedule submitted as soon as feasible after receipt of schedule (with enough time to respond as required above)	108.3.1
f. Requires contractor to follow Request for Extension of Contract Time process if necessary	108.3.1
g. Determines whether an extension of contract time is warranted, and issues change order(s) as appropriate	108.8.6
h. Requires revised schedule from contractor (in writing) when there is a major contract or schedule change or when baseline schedule no longer reflects how work is being performed	108.3.1

Appendix A: PE I Job Responsibilities	*Construction Manual* Reference
i. Issues Form 105 advising contractor of liquidated damages when contractor is unlikely to complete the work within allotted time	108.9
j. Notifies Residence Engineer (RE), Contracts and Market Analysis Area Engineer, Program Engineer, and Region Transportation Director (RTD) of any significant delay or other situation that may lead to the default or termination of any construction contract, contractor, or consultant	108.10
Reviews and approves contractor's drawdown (payment) schedule. Estimates and maintains drawdown schedule for project's encumbered funds not in contractor's control	108.4.1
a. Receives and reviews payment schedule update monthly by the 1st of each month	108.4.1
b. Enters drawdown schedule information into SAP	108.4.2
Conducts safety critical element conference two weeks prior to beginning construction on each safety critical element identified by contractor in construction plan	107.6.1
a. Reviews contractor safety management plan for adequacy and compliance with specifications	107.6.3
b. Ensures safety critical work is only performed when PE is onsite	107.6.1
Documents items properly and ensures project records and other documentation are proper and current	105.14.2
Reviews contract and eliminates unnecessary items using Form 105	109.5
Generates or prints Form 110 or Form 517 project status reports	120.6.1
Prepares Form 103 (project diary) for all events that occur during construction and/or the administration of the contract	120.5
a. Documents responses, instructions, and directions to contractor, property owners, CDOT staff, and other agency personnel in the project diary (Form 103)	105.14.2 120.5 Figure 100-15
b. Documents reasons for time charges using Form 262/263	120.6
Generates Form 65 (project financial status report) monthly and submits with progress payment estimate from SiteManager	120.6.2.1.2
Completes and updates the required document checklist (monthly) to verify & document all required documents have been received from Contractor and submits to RE with each monthly pay estimate	120.1.6 Figure 100-16
Notes receipt and retains a copy of signed agreement between contractor and owner of private property in project records	106.1
Ensures that the contractor provides the appropriate project material documentation regarding steel and iron material delivered to the project which includes Buy America Certifications and all original material and certified test reports	106.11 106.12 106.13

Appendix A: PE I Job Responsibilities	*Construction Manual* Reference
Reviews contractor Certificate of Insurance for requirement compliance and monitors insurance coverage cancellations.	107.15 Standard Specifications 107.15
a. Issues a written stop work order to the contractor If insurance coverage expires.	107.15
b. Receives and reviews in-service report for any scales newly installed at location	109.1.1
c. Verifies manual weighing operations and computerized scales	109.1.2.1 109.1.2.2
Receives and documents (Form 46) concrete truck mixer inspection certification	120.12.4.1
Ensures batch plant has current scale and water meter certifications	120.12.4.2
a. Retains electronic copies of all schedules in native file format and pdf form	108.3
b. Prepares various checklists as appropriate that include: • Checklist 1: schedule completeness • Checklist 2: schedule review meeting • Checklist 3: project schedule update • Checklist 4: issues that require schedule revision & resubmission • Checklist 5: need for schedule consultant	108.3.1 Figure 100-6 Figure 100-7 Figure 100-8 Figure 100-9 Figure 100-10
Completes a change order for force account work that was not included in contract	120.15.3.4
Directs any force account work according to specified guidelines	120.15.3.4
Monitors force account work and determines if these is an opportunity to convert to an agreed price	120.15.3.3
Prepares Form 10, Inspectors Report for Force Account Work, for all force account work and ensures key information is present	109.4.2 120.15.3.5
Reviews alternative Form 10 prepared by the contractor for price disputes that the contractor believes are eligible for payment prior to starting the work in question on the next working day	109.4.2
Negotiates with contractor to determine if agreement can be reached on price	120.15.3.3
Retains Form 580 for equipment rental with all other required information	120.15.3.6
Receives and reviews Form 205 from contractor for subletting work (if applicable); required for all specialty work prior to work start	108.1 120.10
a. Consults with region EEO / Civil Rights Specialist prior to Form 205 approval	120.10.2
b. Forwards any Form 1425 (material suppliers) to Civil Rights Officer (CRO)	120.10.2

Appendix A: PE I Job Responsibilities	*Construction Manual* Reference
c. Ensures that written subcontract and certified payrolls are received from the contractor with Form 205 unless otherwise excepted	120.10.2
d. Ensures that Form 205 is prepared for leased or rented equipment on federal aid projects	120.10.3
e. Verifies partial item percentage price, unit prices, extensions, totals, and percentage calculations on Form 205 before submitting	120.10.4.1
Obtains completed and signed Form 789 if CDOT holds option to buy material as soon as practical after completion of the work in and around the pit site	120.14.1
Receives and reviews mining permit or letter from contractor using material from any source	120.14.2
Prepares change orders (Form 90) with reference to Form 65 (financial status report) for major and minor changes to contract scope, payment, or time including: • Major design changes • Differing site conditions • Additional work • Compensation for costs incurred for items eliminated from contract • Increases to OJT force account • VECP • Any overrun or extension	105.14.2 120.6.2.1.1 120.7 109.2.2 109.4.1 109.5 120.7
Obtains Resident Engineer (RE)pre-approval on any CMO	120.7.5.1
Prepares Form 90 in a clear and concise way and includes all necessary information	120.7
Ensures that the Form 90 is signed by the appropriate CDOT personnel and contractor before start of added or changed work • Provides specific & detailed written authorization to proceed to contractor if Form 90 cannot be signed before work begins	120.7
Incorporates changes into the As-Constructed Plans	120.7 121.2.3.2
Routes change order(s) and supporting documentation in electronic format whenever possible	120.7.5.2 120.7.9
Archives final executed change order in ProjectWise	120.7.5.3
Submits a copy of Minor Change Order Items summary worksheet monthly to RE and program engineer for review	120.7.3.1
Forwards any completed Form 838 from contractor to CRO	107.1.4.2

Appendix A: PE I Job Responsibilities	*Construction Manual* Reference
Sends Form 105 to contractor if contractor has not submitted Form 838 and required documentation at least 10 days prior to the progress payment	107.1.4.2
Receives, reviews, and approves Form 832 from contractor monthly including any request to waive or modify OJT goal and completes Form 1336 if the request is approved.	107.1.4.2
Issues to the contractor Form 105 requiring written explanation if OJT goal is not met and Form 105 notifying contractor of disincentive decisions	107.1.4.6
Forwards any Form 1420 or Form 1415 to CRO	120.9.1
Completes third set of questions on Form 1432 for each DBE and forwards to the CRO	120.9.2
Informs CRO of any potential commercially useful function issues	120.9.2
Tracks Form 280 for EEO and labor compliance interviews	107.1.5.2
Receives and reviews certified payrolls for all specialty work on federal aid projects	109.4.3.3
Receives and reviews Form 1391 or contractor workforce report annually for required period	107.1.5.3
a. Acquires necessary resources, if designated, for response to emergency	120.8.3
b. Procures contractor for emergency situation according to specified procedures	120.8.3 120.8.4
c. Provides for oversight of contractor activities	120.8.3
d. Updates region authority periodically regarding progress	120.8.3
e. Submits a written request for emergency contracting by the end of the next business day following the emergency	120.8.3 120.8.5
f. Submits a report to the controller no later than the end of the next business day following the emergency	120.8.3 120.8.5
g. Submits contracting information to the Agreements Unit or Procurement Office as soon as practical	120.8.3 120.8.6
Ensures the contractor is paid timely for all contract items satisfactorily completed in accordance with the contract	105.14.2
a. Prepares monthly partial payment estimates for work performed each month - Provides estimate to contractor - Notifies contractor in writing of reason for any delays - Submits required documents with payment estimate	109.6.1 120.6.2.1.2 120.1.6
b. Independently verifies work that has been completed pursuant to the specifications and determines if materials quantities are reasonable	109.1

Appendix A: PE I Job Responsibilities	*Construction Manual* Reference
c. Ensures that the Contractor has complied with the Buy America specification before paying Contractor for steel and iron products in monthly pay estimate	106.11
d. Holds payment until either complete baseline schedule or project schedule updates are approved e. Notifies and obtains concurrence from RE and program engineer	108.3.4 Standard Special Provision 108.03(d)
Documents pay items included in contract in SiteManager daily work report	120.15.1.1
Approves progress payments based on interim quantities documented and specified guidelines	120.15.1.2 120.15.5
Makes contract cost adjustments for fuel or asphalt cement costs (Form 85 must be completed as part of bid) once per month	109.6.1
Makes additional payment for inadvertent omission of pay item(s)	109.2
Denies any payment to Contractor that is not supported based on the facts and contract requirements (administrative settlement)	120.7.2
Verifies contractor recording of payments to subcontractors in B2GNow	109.6.1
Processes payments for force account work via itemized invoice or calculation and ensures all necessary documentation is present	120.15.3.9
Reviews and makes payment for stockpiled material after testing, receipt of all certificates of compliance and documentation, and acceptance by CDOT	120.15.4
Inspects, measures, and furnishes final quantities for all work listed on subcontractor Form 205 when subcontractor work is complete *All subcontractor paperwork must be submitted and complete before PE authorizes final quantities for work*	109.6.2.1
Oversees daily activities of firms and ensures DBEs are performing a commercially useful function	107.1.3.5
Monitors the condition of the traveled way with the project inspector and ensures the Contractor properly places and maintains traffic control devices in compliance with specified requirements	104.4
Performs spot checks of truck mixers throughout project and documents in project diary	120.12.4.1
Inspects and records condition of batching equipment and material storage areas	120.12.4.2
Ensures the work is inspected daily and as required to ensure reasonable conformance to the contract	105.14.2
a. Documents observations of contractor operations, equipment, and personnel	108.6.1

Appendix A: PE I Job Responsibilities	*Construction Manual* Reference
b. Requires removal of contractor or subcontractor personnel as necessary for reasons of unsafe work practices, workplace violence, etc.	107.6.1 108.6.2 108.7
c. Immediately attempts to resolve quality concerns with the Contractor Superintendent	105.14.3
d. Documents and brings to RE attention items that do not meet the contract or accepted CDOT guidelines	105.14.2
e. Seeks guidance from RE on nonconforming work	105.14.3
f. Obtains additional guidance from Region Materials Engineer, Region Program Engineer, Materials and Geotechnical Branch, and/or Area Engineer on nonconforming work	105.14.3
g. Considers potential suspension of Contractor work in nonconforming area(s)	105.14.3
h. If work has been suspended, does not allow it to resume until the problem has been corrected	105.14.3
Requires Contractor to bring nonconforming item(s) into conformance.	105.3.1- 105.3.3
a. Issues stop work order for the item(s) until the problem is satisfactorily corrected if contractor does not comply	105.3.1- 105.3.3
b. Implements a price reduction documented by a change order for nonconforming but reasonably acceptable work	105.3.1- 105.3.3
c. Ensures that unacceptable nonconforming work is removed, replaced, or otherwise corrected at no additional cost to the Department	105.3.1- 105.3.3
Notifies contractor of any maintenance problems with roadway or structure	105.20
a. Determines what restoration expenses are attributable to contractor on sections where contractor has not been granted relief from restoration expenses	107.17
b. Ensures that maintenance problems are resolved and If contractor does not take action, has the problem fixed and deducts from the money due the contractor	105.20
Monitors the status of each dispute or claim on their project(s) using Form 1318	105.22.1.2
a. Provides contractor with written acknowledgement of dispute	105.22.1.2
b. Submits Form 1318 to Area Engineer at dispute initiation and whenever the status of a dispute or claim changes	105.22.1.2
c. Reviews contractor's Request for Equitable Adjustment package to verify whether a contractual and factual basis for dispute exists	105.22.2.2
d. Requests additional information from Contractor in writing (if necessary)	105.22.2.2

Appendix A: PE I Job Responsibilities	*Construction Manual* Reference
e. Gathers supplemental data, including force account records (Form 10), records of conversations, agreements, and actions from daily dairies (Form 103), and takes photographs and video of disputed work where appropriate	105.22.1.2
f. Seeks advice and / or guidance from RE and region program engineer, as well as Area Engineer before rendering a decision	105.22.1.2
g. Provides FHWA Operations Engineer with written notification of disputes exceeding $250,000 on federal aid projects and all disputes on full oversight projects	105.22.1.2
h. Follows up written notification to FHWA with copies of all dispute information	105.22.1.2
i. Requests audit to evaluate contractor damages as soon as practical after receiving complete REA or dispute (may)	105.22.2.2
j. Seeks approval from RE to use a consultant to determine impacts of delays, dispute validity, and compensation due	105.22.2.2
k. Follows contract subsection 105.22(c) with regard the timing of rendering a decision	105.22.2.2
l. Initiates dispute review board (DRB) process according to contract subsection 105.23(a) when a dispute has not been resolved	105.23
m. Selects DRB members and informs them of project participants in order to avoid a conflict of interest	105.23
n. Notifies Area Engineer after selecting DRB members and submits Third Party Agreement to Area Engineer for signature	105.23
o. Remains involved in dispute process by maintaining the claim record and ensuring the specification is followed	105.24
p. Prepares CDOT claim package and creates, maintains, and distributes claim records, adding additional documentation as required	105.24.1
Ensures final project records are present and complete in the required format in a timely manner	121.1
a. Actively pursues completion of final documentation even if contractor has not submitted required documentation	121.1.2
b. Completes and submits final documentation to the final's administrator within 45 calendar days of issuing the acceptance letter	121.1.2
c. Ensures that final project records contain documentation supporting pay quantities, civil rights and labor compliance, surveys, as-constructed plans, materials, and anything else required by CDOT specifications, FHWA, or other regulations	121.2.6
d. Itemizes any documentation that has not been received at the time of project acceptance in the project acceptance letter	121.2.7

Appendix A: PE I Job Responsibilities	*Construction Manual* Reference
e. Follows required escalation procedure when having difficulty obtaining required documentation from contractor	121.3.1
Ensures final documentation is present based on how the contractor is to be paid (e.g., linear foot, ton, etc.)	121.2.1 121.2.2
a. Ensures all quantities have been checked before final estimate is paid	121.1.2
b. Ensures that quantities on final estimates must agree with the summary of final quantities on the as-constructed plans	121.2.4
Determines response to potential contractor request to reduce amount of retainage or securities withheld	109.6.2.2
Schedules a Final Inspection Review meeting	109.9.1
Performs a final inspection	105.21.2
a. Ensures that the contractor corrects any unacceptable work	105.21.2
b. Notifies CRO if contractor has not met OJT goal, issues Form 105 requiring written explanation from contractor, and determines whether disincentives should be imposed, also using Form 105 to notify contractor	107.1.4.6
c. Issues written final acceptance letter with required documentation regarding retainage, required documents & forms from Contractor, etc.	105.21.2 109.9.1 109.9.2 120.3.2
Begins final acceptance process by preparing Form 1212, Final Acceptance Report, and submits to RE for verification.	105.21.3 109.9.2
a. Ensures that final payment authorization is submitted to accounting within 45 calendar days after receiving all contractor submittals and resolving all contractor claims & supplier liens	121.1.1
b. Estimates and submits value of outstanding force account billings to regional finals administrator if final billings on force accounts have not been received within 90 days after final settlement advertised and final checking completed	121.2.4
Ensures that project is closed within six months after the project acceptance date	121.3.4
a. Initiates project fund escrow procedures if a lengthy extension period is anticipated	121.3.4 121.3.5

Appendix B: Diary Completion Requirements (*Construction Manual* 120.5 and 120.6)
All events that occur during construction and the administration of the Contract, including: a. work in progress, b. labor and equipment used, c. acceptability of materials used, d. details of problems encountered, and e. contacts with or directions issued to the Contractor.
Type of work performed.
All discussions with Contractor personnel, property owners, CDOT Staff, and other agency personnel regarding the project.
Location where work was performed.
Prospective bidders (company and individual's name) who looked at the project, comments made, questions asked, and CDOT response.
Visitors to the project site.
Total days charged to date, elapsed days, hours worked, approximate number of employees, and supervisory personnel.
Alteration of plans, character of work and quantities (including both anticipated and actual).
Concise description of any changed condition, anticipated effect on Contract work underway, action required, and nature of increased work to the Contractor, including estimated time and cost to correct. Continue to document activities until the impacted work is completed.
Conditions leading to extra work.
Traffic conditions, roadway conditions, signing, flagging, detours, etc.
Traffic incidents, detour shifts, etc.
Access to site or work area.
Use of materials found in the excavation. Conditions imposed on their use.
Directions or interpretations given to the Contractor.
Information leading to any decision on acceptance or rejection of work based on reasonable conformity.
Discrepancy in Contract documents and the decision as to which will be followed.
Objective comments on the competency of supervision and organization of Contractor.
Utility conflicts, status and details concerning any delay to Contract progress. Record the Contractor's effort to locate and protect utilities.
Include date and discussions of unacceptable work including remedial action or rejection and ultimate resolution.
Problems concerning legal load restrictions.
Contractor efforts to maintain Contract work
Actions of project engineer if Contractor does not perform required maintenance.
Actions taken in relation to partial or final acceptance. Include directions for completion of or correction of unsatisfactory work.
Record detail documentation covering all project activities and any impacts on the Contractor's activities when a contract claim is anticipated or has been started.

Appendix B: Diary Completion Requirements (*Construction Manual* 120.5 and 120.6)
Pit conditions before, during, and after removal of material; method of working; haul road; and any other problems noted, as well as contact with property owners.
Storage of Materials including storage locations, permissions, and the condition of the site at completion of the project.
Damage and problems caused by transportation of material including methods, production procedures, etc.
Materials delivered to the project.
Record source, quality, cost, and handling of CDOT furnished materials.
Contacts made concerning non-domestic steel and actions taken.
Compliance with applicable laws
Comments by property owners or the public.
Equipment deliveries, breakdowns, and equipment stored on the project.
Compliance with the Manual on Uniform Traffic Control Devices and the Traffic Control Plan.
Conditions and discussions related to opening portions of work to traffic, including CDOT and Contractor responsibilities.
Contractor efforts to protect work from damage.
Subcontractors working on the project.
Documentation of work progress as it relates to the Progress Schedule.
Changes in weather conditions during working hours.
Weather, temperature, and other factors related to time charges.
Any time changes and reasons for the changes.
Events leading to default or termination of the Contract.
Inspection of scales and weigher certifications.
Conformance to specifications and suitable storage conditions for materials on hand.
Daily assessment of contract time, especially when less-than-full-time charges are assessed.

APPENDIX C: Workmanship/Contractor Issues	Month
Year 1 Issues	**One**
Exploratory drilling performed without informing CDOT	***Day:*** 7
Traffic control not conforming to Method of Handling Traffic plan; standard signage not installed	20
Radar exploration performed without informing CDOT.	20
Second instance of contractor not informing CDOT of work	21
Consultant overseeing project noted numerous contractor errors	22
Certificate of Compliance not provided on anchor bolts	22
Approach slab that was not fully consolidated resulted in several voids	25
Missing diaries for 12% of the second month	**Two**
Rock socks not installed correctly upstream of existing drainage; some are damaged and need replacement. Berms not up to specifications	**Three** ***Day:*** 30
Missing diaries for 83% of the third month	
Newly installed erosion log installed incorrectly	**Four** ***Day:*** 7
Erosion control measures (BMPs) were installed incorrectly & in wrong locations.	9
Erosion control measures (BMPs) on subsequent reviews still not installed correctly, with contractor staff stating they were unaware of BMP standards.	13
Contractor crew removing fence using skid steer with chains not rated for the activity.	16
Trench box installed but a significant amount of material still exposed and protective blankets placed in a different manner than described. Contractor also damaged parts of concrete sidewalk during trench box install. Most of damage repaired but some damaged pieces left in place. Contractor crew left without sweeping sidewalk or street.	17
A flagger was suggested to contractor because construction vehicles were consistently pulling out of lane closure without knowing if there was oncoming traffic and making U-turns in a large blind spot area. Contractor declined, stating that flagger was too expensive.	20
Contractor crew blindly chipping away the abutment and began to chip below construction joint. Contractor also installed partial vehicle tracking pad near stockyard, but simply laid fabric down and covered it with rocks, not according to standards.	28
Demolition work is non-conforming. Excavation depth could cause roadway undermining. Bearing elevation at construction joint never verified. Contractor working at a site location without a Method of Handling Traffic plan in place. Contractor has also neglected to replace barrier at site on several occasions.	29
Work at abutment caused concrete chunks to roll down the sidewalk; contractor eventually set up construction fence to catch debris. Two reinforcing steel cages for caisson were missing several hoops and had hoop lap rotation issues because contractor was not following the plan.	30

APPENDIX C: Workmanship/Contractor Issues	Month
Contractor personnel working unsupervised on demolition and using wrong tool. Potholing operations on site not covered.	31
Methods of Handling Traffic issues - some commuters driving in wrong lane, going head-to-head with oncoming traffic. Contractor tied CSL tubes to steel cages incorrectly / not following plan.	**Five** ***Day:*** 4
Shaft not aligned properly and outside of allowable variation	5
Contractor used incorrect set of drawings for falsework	17
U-stirrup bars placed incorrectly resulting in clearance issues. Extra steel was also tied with incorrectly placed bars, so required length could be achieved, and some steel could be cut where clearance was an issue.	**Six** ***Day:*** 24
Protruding tie rod removed from concrete surface; patch not finished smoothly or evenly as required by specifications. Holes left by tie rod hoops not patched. Ongoing issues regarding some u-bars bent and vertical portions of unequal lengths.	29
Contractor did not make requested changes / corrections prior to concrete pour.	**Seven** ***Day:*** 6
Problem with placement of bearing device templates and bolts - pier cap steel is an obstruction to required bolt location.	9
Cylinder breaks.	13
Curb concrete at toe of slope poured without any testing.	14
Ongoing issues with groundwater in excavation. Also having trouble with steel plates sinking / falling toward existing water main. Contractor requested they level everything already placed.	27
Dowel holes drilled incorrectly	28
Wall material has to be reprocessed; deflection is too high	29
U-bars required at ends of diaphragms not delivered in steel package for deck reinforcing	**Eight** ***Day:*** 4
Improper installation of galvanic anodes, diaphragm end cap u-bars and lap bars.	9
Work on wall continues without tech rep present as required by specifications. Corner panel set incorrectly.	17
Cars passing under bridge start to merge back to right lane but swerve into left lane because closure extends across the bridge	18
Contractor improperly adding water to the surface of the footing concrete for finishing purposes against project specifications.	25
Concrete placed without any testing taking place was too stiff to effectively place or consolidate, and water could not be added. New load had to be ordered.	**Nine** ***Day:*** 7
Positioning bearing devices not correctly placed per specifications and use of grout pad was not approved	8
Form removal shows severe honeycombing as well as a visible seam at the cold joint	9
Contractor crews twice started to install cribbing without giving inspectors the opportunity to check concrete surface.	10

APPENDIX C: Workmanship/Contractor Issues	Month
Missing diaries for 64% of the ninth month	
Year 2 Issues	**Ten**
Method of Handing Traffic improperly set up; devices terminated early for north bound traffic	***Day:*** 14
Rocker setting was incorrect. Contractor was not planning on verifying thickness of existing deck before placing angle irons, thickness of existing deck is inconsistent and would have caused problems	16
Adequate equipment not onsite for dewatering	20
Dowel holes being drilled into existing deck do not achieve required embedment	**Eleven** ***Day:*** 9
Issues at abutment ends. Waterline excavation roughly 10 feet shy of elevation provided for flowline by survey but is very close to potentially compromising structure above it.	10
Contractor has been tying top mat steel of deck reinforcement without having spliced bottom mat to bottom dowels. Contractor misunderstood previous directions given.	15
Discovered a few top mat dowels embedded only about 14.5 inches; discussed with contractor about having agreed to achieve at least 16 inches of embedment.	17
Pile placed incorrectly.	23
Missing signs & sidewalk closure not implemented. Also, shift to right lane closure after coming through deck pour closure was implemented earlier than discussed, causing inadequate space for work vehicle parking and making additional warning signs necessary (but none in place). Arrow board on incorrect setting & missing advanced warning signs. Rejected concrete in first few concrete trucks; deck pour postponed.	26
Crew working to adjust the incoming invert elevation of the manhole that was placed at incorrect elevation due to discrepancy between drainage plan sheets. Manhole riser cast incorrectly.	**Twelve** ***Day:*** 7
It was originally agreed that working on the drainage line would require a partial road closure, but the entire road is closed.	15
Flared end section not placed properly according to survey stake because of Contractor beginning pipe installation in the middle of the run instead of downstream	16
Contractor crew walking across tops of girders (on trucks - 10 ft above ground) to attach shackles for life without wearing any fall protection	21
Native soil (previously excavated) not cleared for project use was placed into the trench on top of clean embankment material.	31
Steel had several issues that required corrections	**Thirteen** ***Day:*** 4
Approach slab not properly consolidated, resulting in voids. Contractor had personnel begin dry packing defective area before inspection was performed.	25

APPENDIX C: Workmanship/Contractor Issues	Month
There was a delivery of the 10M Bridge rail that was not communicated to the Contractor.	**Fourteen** ***Day:*** 5
Girder seat elevation was not in compliance with the plans.	5
Contractor working on the underdeck falsework without falsework drawing or CDOT approval.	11
Alignment of column projecting steel needed to be readjusted but concrete already in place made this more difficult	18
Crew does not have sufficient filter material to meet plan requirements for underdrain and had to complete later	20
Contractor working on the joist overhangs without shop drawings or CDOT approval.	26
Contractor continues constructing falsework decking without plans being submitted for approval by CDOT	31
Issues with bolt placement / alignment including insufficient contact with the plate and insufficient projection. Plan sheet indicated incorrect projection of the bolts, and there is a conflict between plan sheet, shop drawings, and actual fabrication	**Fifteen** ***Day:*** 13
Bolts embedded into the concrete curb were not installed according to specifications.	13
Contractor constructing scaffolding without pins/bolts at leg joints/connections as required.	16
Initial construction of cap formwork called survey into question and crew had to build the forms for the bottom of the cap differently than the plans indicate.	21
Bolts installed in locations incorrect relative to the cap	23
Surveyed points for cap corners were not square, meaning they were not built correctly.	24
Bolts were in the wrong location and pier caps were out of square.	24
Contractor was going to use 30 lb. hammers rather than the required 15 lb. hammers for potholing activity.	**Sixteen** ***Day:*** 5
Limits of repair ended up doubled from what was originally designated due to contractor's use of incorrect equipment/tools.	6
Contractor using 60lb and 90lb hammers for entire depth of removal rather than 15lb and 30lb hammers that were noted on the plan. Roughly 2/3 of removal was completed before crew switched to correct equipment.	14
Multiple loads of concrete failed testing and were rejected; remainder of concrete placement was suspended. Placement of concrete caused issues (foam block for joint pushed out of place, major voids discovered under block out, etc.).	**Seventeen** ***Day:*** 3
Concrete that did not pass air content was accepted but later was determined to be out of specification.	4
After concrete placed, some bars were omitted that were shown on plan sheet. Contractor had to be reminded of specifications.	17

APPENDIX C: Workmanship/Contractor Issues	Month
Water Department stated they were unable to get passing flushing tests and were concerned it may be due to project work	30
Contractor mistakenly applied curing compound to concrete at construction joint (violation of specifications).	**Eighteen** ***Day:*** 12
Contractor suspended header beams from bottom of deck in order to hoist without any engineered drawings depicting hoisting plan.	13
Discovered column height and decking at wrong elevation due to survey providing wrong elevation for falsework decking.	14
Contractor had to be reminded that no work could begin on proposed deck demo plan until the plan was approved	15
Contractor drilling holes at proposed anchor points corresponding to proposed deck demo plan which is still awaiting approval	16
Contractor removed formwork from Pier 3 cap in violation of specifications. Beams in overhang falsework not being installed according to engineered drawings.	19
Structure backfill exceeded maximum thickness per specification	21
Some bearing device anchor bolts and abutment / pier / intermediate diaphragms in conflict with one another causing misalignment throughout the whole system.	27
Missing diaries for 30% of the eighteenth month	
Contractor damaged some shear channels during removal and was advised to use smaller hammers to avoid further damage.	**Nineteen** ***Day:*** 7
Contractor ruptured gas line.	14
Contract unable to find proper chairs for second mat of deck reinforcing per shop drawings and instead finds chairs of different size; tells crew deck can be poured high to accommodate which is the wrong approach.	**Twenty** ***Day:*** 2
Sign structure scheduled for caisson drilling to start but survey was not provided, and underground utilities were not verified.	7
Contractor modifying construction of overhang falsework; joists did not fully support edge of deck formwork, causing issues with Bidwell support and causing the work to be out of specification.	9
All forms of Bidwell are too high and will need to be adjusted.	15
No approved roadway plans for asphalt overlay removal.	15
Inlet set at wrong elevation due to rim vs. throat plan discrepancy.	23
Contractor using adhesive not on approved products lists.	29
Concrete pour cancelled due to survey issues; improper alignment of sleeper slab. Crew notified that steel that had not yet been incorporated was fabricated too short. Survey contacted in regard to error in information provided. Survey error also resulted in sleeper slab being constructed too far from abutment. Roadway survey also had errors as well, causing bridge and roadway discrepancies.	**Twenty-One** ***Day:*** 12

APPENDIX C: Workmanship/Contractor Issues	Month
During concrete placement, low spots were observed in the approach slab. Informed contractor, who argued fixing it would not be possible.	20
Missing diaries for 29% of the twenty-first month	
Year 3 Issues	
Rail was not fabricated per plan. Both inner and outer tubes were supposed to be slotted at locations of tube splice, only inner tube was slotted.	**Twenty-Two** ***Day:*** 17
Traffic switch was not completed during overnight work as planned. There was a roll-over accident at 1 pm, and at the time of the accident, no project traffic control was in place.	**Twenty-Three** ***Day:*** 2
Contractor was using a Kobelco 50K pound excavator on the deck with abutment shoring A large excavator is prohibited while structural shoring designed for dead load is in place.	8
When removing the curb, Contractor had very limited girder delineation and was removing curb entirely to outside edge of girder flange. In addition, the curb head was to be removed first, and the remainder of curb was to be removed with slab removal operations	9
Contractor was using 30 lb. hammers rather than 15 lb. hammers for removal work, which damaged some of the existing reinforcing.	9
Contractor was using improperly sized saw blades to complete the removal by saw cutting methods, resulting in spalling past the removal limit. Consequently, a portion of backwall needed to be replaced.	22
Control was not maintained at the vertical limit of removal, resulting in a portion of the backwall needing to be reconstructed to be in accordance with the specifications.	23
Contractor was unaware that all areas of loose and delaminated concrete in the substructure were to be repaired as per the contract and plan.	27
Crew had to be reminded that there is a proper weave pattern for temp wall reinforcing straps after they had incorrectly installed several.	**Twenty-Four** ***Day:*** 3
Deck overhang bars had to be reordered after it was discovered that the bars originally delivered were not bent correctly. In addition, the new bars were offloaded without a quality inspection.	24
The survey seems to potentially be in error making it difficult to determine if work was performed correctly. The work was deemed to be AT-RISK.	28
Curing not properly performed. Curing has to take place immediately after concrete is placed, not at the end of the day or whenever the Contractor chooses to do so.	29
Missing diaries for 16% of the twenty-fourth month	
Motor vehicle accident took place at 8:30 am. Flagger was nearby (but not flagging) at the time of the accident.	**Twenty-Five** ***Day:*** 5

APPENDIX C: Workmanship/Contractor Issues	Month
Water was improperly added to concrete on truck making it non-compliant, but contractor still placed concrete that had to be later removed.	26
Crew began placing top mat reinforcing but initially placed top mat longitudinal reinforcing incorrectly to match bottom mat.	**Twenty-Six** ***Day:*** 22
Curb steel placed incorrectly. Contractor did not determine locations for 10M posts and was not spacing the reinforcing according to plans.	23
Missing diaries for 10% of the twenty-sixth month	
Contractor had no foreman or superintendent present during today's work. Crew's work had to be stopped because they were hauling material with no flagger present.	**Twenty-Seven** ***Day:*** 5
The final post on the west end of the bridge does not land where it should according to dimensions provided for the final post and its proximity to end of curb. It is discovered that layout should be done horizontally, to this point the layout was done by measuring along the bridge profile. Foreman is notified of this and agrees to lay it out horizontally.	13
Missing diaries for 32% of the twenty-eighth month	**Twenty-Eight**
Illegal lane closure: this particular method of handling traffic was no longer allowed to be utilized.	**Twenty-Nine** ***Day:*** 8
Missing diaries for 6% of the twenty-ninth month	
Crew does not match existing asphalt outside of taper correctly on south side, which is pointed out to foreman. Crew comes back to match but then matches through the taper, eliminating the taper. To correct this, the crew back drags with skid steer to create the taper, but this creates an uneven riding surface. Additionally, there are several other areas where joints were not matched properly. Crew does not have consistent rolling pattern, leaving visible lines/depressions/uneven paving throughout newly paved section north of bridge.	**Thirty** ***Day:*** 17
Contractor was informed yesterday that revision should be made to overhang falsework drawing to depict the support/formwork of sidewalk section. Current approved drawings do not specify, and Contractor has plans to construct something that is not currently detailed on approved falsework drawings.	28
Missing diaries for 16% of the thirtieth month	
No significant Issues noted	**Thirty-One**
No significant Issues noted	**Thirty-Two**
No significant Issues noted	**Thirty-Three**
Year 4 Issues	

APPENDIX C: Workmanship/Contractor Issues	Month
Concrete and pump trucks were on-site, but the pour had to be cancelled due to grade issues.	**Thirty-Four** ***Day:*** 25
Upon first install of geomembrane, crew had not graded properly and there were areas with no drainage whatsoever.	**Thirty-Five** ***Day:*** 22
Grader works to widen the area, but cuts below grade significantly and wipes out survey hubs.	**Thirty-Six** ***Day:*** 22
Contractor attempted to pull panel back with excavator; panel broke at top section and had to be removed and replaced.	**Thirty-Seven** ***Day:*** 30
Temporary wall basket built too narrow. Contractor began filling incorrectly.	**Thirty-Eight** ***Day:*** 8
Contractor began demolition on north bound pier. This is a concern because the deck dropped and is close to the basket wall.	**Thirty-Nine** ***Day:*** 5
No significant Issues noted	**Forty**
West wing wall built to wrong skew; step too close to the corner and Contractor could not set the panels as needed. Contractor reset wall footings.	**Forty-One** ***Day:*** 13
Column 3 (east) poured 2' low and column 1-3 had substantial voids.	17
West edge of sleeper positioned incorrectly (won't tie in or go over inlet correctly on approach).	23
Issue with curb & gutter; curb was not legal according to the plans to install the type 3 rail	**Forty-Two** ***Day:*** 17
No significant Issues noted	**Forty-Three**
Missing diaries for 13% of the forty-fourth month	**Forty-Four**
Missing diaries for 22% of the forty-fifth month	**Forty-Five**
Year 5 Issues	
No significant Issues noted	**Forty-Six**
No significant Issues noted	**Forty-Seven**
Missing diaries for 77% of the forty-eighth month	**Forty-Eight**
Missing diaries for 100% of the forty-ninth month	**Forty-Nine**
Missing diaries for 100% of the fiftieth month	**Fifty**
Missing diaries for 80% of the fifty-first month	**Fifty-One**
Contractor installing incorrect caps on bridge down spouts that will not work	**Fifty-Two** ***Day:*** 12
Missing diaries for 22% of the fifty-second month	**Fifty-Two**

APPENDIX C: Workmanship/Contractor Issues	Month
Missing diaries for 48% of the fifty-third month	Fifty-Three
Missing diaries for 6% of the fifty-fourth month	Fifty-Four
Contractor traffic fatality at construction site	Fifty-Five
Missing diaries for 45% of the fifty-fifth month	Fifty-Five
Missing diaries for 40% of the fifty-sixth month	Fifty-Six
Missing diaries for 58% of the fifty-seventh month	Fifty-Seven

Appendix D: Management's Comments

Construction Project Oversight Audit Report 22-001

Opportunities exist to improve oversight of construction projects	Agrees or Disagrees with Audit Finding: **Agrees**

Narrative for Findings

Audit assessed CDOT's construction project oversight process and concluded that CDOT's processes were mostly effective and working as intended. However, it also appears those in the PE I position have an excessive amount of job responsibilities, which may contribute toward the deficiencies Audit has identified. Audit believes some of these deficiencies have contributed towards additional project costs as well as contractor claims, delays, and/or, at times, litigation.

As a result of excessive workload, Audit identified lapses in construction project oversight. The symptoms of this lack of oversight included:

- Project documentation was not always completed (e.g., project diaries, speed memos, Inspector's Reports for Force Account Work, and meeting minutes);
- Risk assessments were not completed properly;
- Significant issues were not well documented;
- There is a heavier reliance on consultants to provide project oversight
- High project engineer turnover
- ProjectWise was not being fully utilized,
- Projects not always being closed timely;
- Funds being tied up in closed projects:

To improve construction management oversight, Audit recommends the following:

1) Develop a DBB procurement method that grants awards based upon best qualified contractor rather than solely low bid
2) Allow for a risk-based approach in the project management of DBB Projects
3) Change the contactor evaluation process so that it is confidential and not automatically shared with outside parties
4) Provide training to engineering personnel on the five risk assessment steps
5) Develop additional training for engineers at various organizational levels and specialties
6) Perform a salary study for the seasoned PE I position, those with 5 – 10 years of experience, and other engineer positions if warranted

Management's Response to Recommendations:

Management agrees with the recommendations. See Appendix E for Management's Official Comments.

Target Date to Complete Implementation Activities	Name of Specific Point of Contact for Implementation
1) May 2023	1) Stephen Harelson
2) May 2023	2) Stephen Harelson
3) May 2023	3) Stephen Harelson
4) May 2023	4) Stephen Harelson
5) May 2023	5) Stephen Harelson
6) December 2022	6) Kristi Graham-Gitkind

Appendix E: Management's Official Comments

COLORADO
Department of Transportation
Office of the Chief Engineer

May 6, 2022

Frank Spinelli
CDOT Audit Director
2829 W Howard Place
Denver, CO 80204

RE: Construction Project Oversight Report

Dear Frank,

CDOT Management has reviewed the Construction Project Oversight Report 22-001 and would like to thank the Audit division for a well presented and enlightening report. The audit division examined seven different construction projects of varying size and delivery methods, and based on that examination, provided six recommendations intended to improve construction project oversight. CDOT management agrees with the recommendations-so much so that efforts to address several of the issues identified were underway prior to this audit. A summary of the recommendations and CDOT management's response to each follows.

1. *Develop a Design Build Bid (DBB) procurement method that grants awards based upon best qualified contractor rather than solely low bid;*
   As the audit notes on page 11, the letting of DBB contracts is controlled by 23 CFR 112, which mandates that work be awarded on the basis of lowest responsive bid. CDOT has in place a system of prequalification for all bidding opportunities, where contractors can be prequalified for contracts of varying size based upon their capacity, assets, and bonding capability. The prequalification process does not emphasize skill or past performance on CDOT projects-or any expertise or experience on a particular project situation. Recognizing this, CDOT has experimented over the years with techniques to introduce project specific qualification-based selection in parallel with price on DBB contracts. Most recently, in 2019, a DBB project was let using a project specific qualification-based evaluation. Interested contractors were asked a series of questions regarding their

approaches to scheduling, project management and approach, subcontracting, and their experience working on similar projects in similar environments. The top scoring contractors in this process were then invited to bid on the work-and then the low bid won. CDOT is committed to continuing to experiment with this type of selection. However, it should be noted that this type of selection is not without risk. The qualification measures must remain objective, as there can be no favoritism or appearance of favoritism to any contractor or group of contractors. CDOT must balance the desire for quality contractors with the necessity of competitive bidding, and multiple bidders on all our work. We look forward to expanding our qualification-based procurement in a fair, transparent, and objective manner. Within three months, CDOT will provide to audit a summary of the qualification-based criteria that CDOT has historically used in selecting "best value" contractors, along with the pros and cons of each. Within one year, CDOT will develop and provide to audit a qualification based DBB procurement; and a recommendation for its appropriate use.

2. *Allow for a risk-based approach in management of DBB projects;*
   For the last five years, CDOT's Project Reporting and Transparency Office (formerly known as PMO) has encouraged, and then mandated the production of Project Management Plans (PMPs) for all projects in the preconstruction phase. A critical element included in the PMP is a risk register, which identifies, quantifies, and assigns project risks-as well as attempts to direct the project team to retire those risks.
   Admittedly, this PMP and risk register is focused on the preconstruction phase of project management. However, as part of the "Project First" specification, construction project engineers and contractor superintendents are directed to develop a similar risk matrix, focused on construction risks. CDOT recognizes that these two approaches to risk identification could be better integrated. As part of the PMWeb project management system deployment, now underway, the PMP for preconstruction risks is readily available to all users of the system. CDOT is working to move from the long used Sitemanager software used for construction project management to a modern PMWeb platformed system. This transformation will allow the Preconstruction PMP (and associated risk register) to easily move into the construction phase. While the shared software platform will certainly make the risk register transfer simpler, it should be noted that software solutions do not always solve systemic problems. It is recognized that CDOT must do more to work with staff to ingrain the culture of risk management into all phases of project delivery, and to make sure the risks identified are properly tracked and managed throughout the project lifecycle. The preconstruction PMWeb transformation is nearly complete-and all Preconstruction project management and portfolio management data pulls are expected to be made from the PMWeb database starting July 1, 2022. The construction PMWeb application is under development. It is expected that several pilot projects will use the system in fall of 2022, and all

projects will move to it in the summer of 2023. Work will immediately begin to ensure the risk management strategies that this software simplifies will be fully taken advantage of. While tracking the risks becomes easier with these software packages on the same platform, assigning them to the appropriate party will sometimes require changes in our construction specifications. There currently exist two major risk mitigation specifications the Asphalt Cement Cost Adjustment Spec, and the Fuel Cost Adjustment Spec. Other risks, both global and project specific, could be similarly approached. Within three months, CDOT will provide audit a report of the existing risk-based approaches used in CDOT DBB projects. Within one year, CDOT will provide audit a list of expanded use of such risk-based approaches, and how that expansion is codified in our specifications and construction guidance.

3. *Change the Contractor Evaluation Process so that it is confidential and not automatically shared with outside parties*;
   CDOT has long struggled with the Contractor Evaluation Process. It must be structured so that it is constructive, and not punitive; objective, not subjective; and transparent, yet somewhat discrete. CDOT will immediately partner with the various contractor trade groups to identify ways to improve the existing process so that it provides meaningful feedback for both contractors and project staff, who are similarly evaluated. Within three months, CDOT will provide audit with documentation of the current state of the Contractor Evaluation Process, and within one year, will provide suggested changes developed in partnership with the various contractor trade groups.

4. *Provide training to engineering personnel on the five risk assessment steps*;
   As part of developing the PMPs required in the PMWeb tool, Preconstruction Project Managers are required to identify risks, assess, and analyze the risks, mitigate, and plan for the risks, allocate the risks, and monitor and control the risks. Through our Project First program, Construction Project Engineers identify and partner with contractors to address project risks in a similar manner. CDOT recognizes that these two approaches should be more unified and will introduce more training regarding risk assessment specifically-and risk awareness throughout the project delivery process as part of our Transportation Engineering Training Program (TETP). Within three months, CDOT will provide audit documentation of our existing risk training in both the PMWeb arena and the Project First Arena; and within one year, will provide unified training materials that link risk analysis between the preconstruction and construction phases of project delivery.

5. *Develop additional training for engineers at various organizational levels and specialties*;
   CDOT has developed a weeklong engineering training program that is targeted to young engineers. It is a comprehensive, cradle to grave training for the entire CDOT project lifecycle. For more experienced engineers, CDOT has relied on specialty

training programs for materials, structural engineering, hydraulics, and traffic modeling. These trainings are delivered as demand necessitates-and are focused on specialist engineers, rather than the "jacks of all trades" that perform the bulk of our project management duties. Our project management training has been developed by the Project Reporting and Transparency Office and has been focused on the portfolio reporting needs of the department. Within three months of this audit, CDOT will provide to audit staff a catalogue of existing training opportunities, as well as a list of identified shortfalls in our training program. Within one year, CDOT will establish training courses for these identified shortfalls.

6. *Perform a salary study for the seasoned PE I position-those with 5 to 10 years of experience; and other engineer positions if warranted.*
   This effort is underway and is being undertaken by CDOT Human Resources in concert with the Colorado Department of Personnel Administration, as required by statute. Our consulting engineering partners have repeatedly told us over the last several years that the market for qualified civil engineering personnel is extremely competitive. The apparent shortage of these professionals is believed to be an industry wide problem, not isolated to CDOT. The results of the salary study will be provided to audit by December 31, 2022.

Again, CDOT management appreciates the fine quality of the work provided by the audit division and looks forward to addressing the shortcomings identified.

Sincerely,

Stephen Harelson

Digitally signed by Stephen Harelson
Date: 2022.05.06 15:40:22 -06'00'

Stephen Harelson, P.E.

Chief Engineer