Tennessee Department of Transportation
Office of Internal Audit

Government Accountability Professionals

Performance Audit
Project Change Orders and Other Contract Modifications
Part II

Final Report

Date Issued:
April 2, 2015

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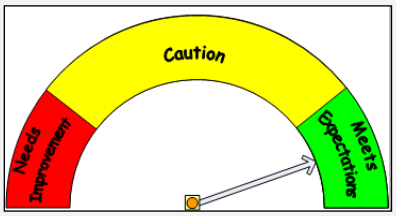
The mission of the Office of Internal Audit is to provide objective analysis and information critical to better decision making and enhancing the overall governance capability within the Tennessee Department of Transportation.

EXECUTIVE SUMMARY
April 2, 2015

Results in Brief	Recommendations
We conducted a Performance Audit of the Change Orders and other Contract Modifications. Key audit objectives were as follows: ***Are there common factors that account for project cost variances?*** **Yes**. We identified common root causes of significant project cost variances that included the following: • Quantity overruns and underruns not accounted for as change orders • Adjustments due to price indexed commodities ***Did the Construction Division process and properly execute change orders according to TDOT policy 355-01?*** **Yes**. All supporting material reviewed indicated proper classification and approval in compliance with TDOT policy; no other issues were observed	**Internal Control Evaluation**  *Indicates process stages are defined, repeatable, and managed but not fully optimized.* **Key recommendations of this report include:** • Developing a system to reduce the impact of quantity overruns • Improving transactional transparency by requiring documentation of all significant quantity differences • Optimizing the Site Manager application to improve project management of quantity variances

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INTRODUCTION

AUDIT INITIATION

We performed an *Audit of Project Change Orders and Other Contract Modifications* of the Tennessee Department of Transportation's (TDOT) highway and bridge projects to fulfill the planned annual audit plan. This audit comprises the second phase of a two-part audit report focused on providing objective, systematic, and substantive examination of project cost variances. Recommendations included herein provide pragmatic solutions to help enhance management's control of project costs and improve cost estimating on future construction projects.

The overarching goal of every performance audit engagement conducted by the Office of Internal Audit (OIA) is to assist those charged with governance by providing information to improve operational performance, reduce costs, facilitate decision-making, and contribute to public accountability.

BACKGROUND

In order to provide quality transportation infrastructure for the state of Tennessee and its 6.5 million residents, the *Construction Division*, under the *Bureau of Engineering*, enters into numerous construction contracts with private construction contractors. To facilitate the development of the transportation infrastructure, the Division prepares and establishes the scope, specifications, and the costs of highway and bridge projects. The division also pre-qualifies contractors and approves first-tier subcontractors. Upon finalization of project details, the Construction Division performs the following: (a) seeks contractor bid proposals for performing the work, (b) reviews incoming bids, (c) awards the contract, (d) manages the contract during the course of the project, and (e) oversees any necessary contract modifications and project change orders.

Change orders, sometimes referred to as *Supplemental Agreements*, are issued to accommodate additional work or project time extensions or both. Change orders are common construction industry occurrences brought about by both preventable and non-preventable events. When properly executed, change orders become part of the contract. The typical consequences of change orders are additional costs, additional time, or both. It is a common occurrence among the various state DOTs to have trouble completing construction projects within the original scope and budget. In 2004, a joint survey conducted by Purdue University's School of Civil Engineering and the Federal Highway Administration (FHWA), reported that, on average, 63.44%

of awarded contracts experienced cost increases (Bordat, McCullouch, Labi, & Sinha, 2004). While the various state DOTs use change orders regularly, the criteria for requiring a change order, documentation procedures, and approval processes vary from state to state.

Operational Information

Section 101.55 of the *Standard Specifications for Road and Bridge Construction* indicates that necessary contract items not included in the original contract must be established through a change order. Typically, in the management of a privately financed construction project, the final project cost is equivalent to the amount of the original contract plus the sum amount of all change orders.

$$\textit{Original Contract Cost} \pm \textit{Change Orders} = \textit{Final Project Cost}$$

Figure 1. Final project costs for privately financed construction.

However, in public highway construction projects, other cost factors, such as variations in actual quantities against estimated quantities and adjustments due to indexed price estimates on materials, eventually increase or decrease the final project costs but do not necessarily require the execution of a change order.

$$\textit{Original Contract Cost} \pm \textit{Change Orders} \pm \textit{Adjustments} \pm \textit{Quantity Variances} = \textit{Final Project Cost}$$

Figure 2. Final project costs for publicly financed construction.

TDOT Circular 109.03-01 requires explanations of overruns and underruns only if quantity varies by more than 10% on *Major Items*, or if the engineer extends time due to overruns. TDOT Policy 355-01 governs the change order execution and approval process. For reviewing and evaluating transactions under this audit, OIA used the version of TDOT Policy 355-01 in effect from January 2006 through August 2012, which used three distinct approval categories (see Exhibit B). On September 1, 2012, the Construction Division revised Policy 355-01. Under the revised format, change orders have four distinct approval categories based on estimated costs and/or time extensions.

Financial Information

For the period July 1 2011 through December 31, 2012, Site Manager information indicated that TDOT closed 634 projects with a cumulative bid value of $1.14 billion. Contractor payments totaled $1.25 billion. During the same period, we observed 646 change orders totaling $18.6 million associated with the various projects. We observed a project cost variance of roughly $91.4 million by deducting the bid amounts and the corresponding change orders from the total

contractor payments. On average, change orders accounted for approximately $28,909 each while other variances, not classified as change orders, accounted for approximately $144,235 each (see Exhibit A).

Exhibit A – Summary Information on Completed Projects for the period July 1, 2011 through December 31, 2012

Factor	Count or Total Value	Average Values
Number of Projects Closed	634	-
Projects by Bid Amount	$ 1,144,792,912	$ 1,805,667
Bid Amounts + Change Orders	$ 1,163,468,164	-
Contractor Payments (Final Amounts Paid)	$ 1,254,913,014	$ 2,001,488
Number of Change Orders	646	1.02
Change Orders	$ 18,675,251	$ 28,909
Project Cost Variance	$ 91,444,850	$ 144,235

Source: Internal Audit analysis of Site Manager data.

Exhibit B – Policy 355-01 January 6, 2006 through August 31, 2012

Criteria	Category 1 Major Change	Category 2 Intermediate Change	Category 3 Minor Change
Monetary Value of the Change	Alters original contract account by more than $250,000	Alters original contract account by more than $150,000 but less than or equal to $250,000 **or** alters the total original amount by more than 10% of original contract	Any change or addition other than Major Change or Intermediate Change
Completion Date Changes	Cumulative change to working time/completion date in excess of 7.5% of the original contract time	Cumulative change to working time/completion date not in excess of 7.5% of the original contract time	Any change or addition other than Major Change or Intermediate Change
Other		Any change to a unit bid price, **or** Any change to a special provision or contract provision	
Approving Authority	Regional Director, Director of Construction, Commissioner of Transportation, Director of Construction, and FHWA before work starts. In emergency, verbal approval from Construction Division and FHWA.	Regional Director, Director of Construction, Assistant Chief Engineer of Operations, Director of Construction, and FHWA before work starts. In an emergency, verbal approval from Construction Division and FHWA.	Regional Director only before work starts, Regional Director and FHWA.

Source: TDOT Construction Division

Commendable Achievements

- According to 2012 Federal Highway Administration statistics, Tennessee was ranked fourth highest among 50 states in the percentage of roads in good condition.

- Tractor trailer owner-operators named I-40 in Tennessee as the "Best Road" in the United States and ranked Tennessee highways 3rd overall in terms of quality.

- TDOT is one of only five state DOTs in the nation with no transportation debt. This enables the department to use all available revenue for transportation projects rather than using a portion of funds for debt service.

- TDOT implemented *Open-Graded Friction Course*, a new pavement preservation process, which drastically reduces the back spray on interstates with fast moving traffic thus providing a safer, more durable, and quieter riding surface.

- In 2013, TDOT invested $27 million through the State Industrial Access (SIA) program that provided highway improvements, enabling $2.7 billion in private capital investments and creating 9,100 jobs in Tennessee.

- TDOT initiated the Expedited Project Delivery (EPD) program to reduce the backlog of over 800 projects costing approximately $8 billion. By right sizing each project, TDOT's EPD review of 36 projects resulted in $171 million in savings.

- TDOT has grown its alternative contracting program in an effort to explore innovative, yet cost-effective, ways to deliver certain types of projects. To date, TDOT has delivered five Design-Build projects, all of which were completed at or below the estimated cost and on or before the scheduled completion date.

- TDOT's alternative contracting program is in the process of delivering its first project using the CM/GC (Construction Manager/General Contractor) method. This project includes a guaranteed maximum price (GMP) designed to transfer risks associated with cost overruns from TDOT to the general contractor.

- One hundred percent of all Tennessee bridges were inspected within the two-year cycle that spans from July 1, 2010 to June 30, 2012 through TDOT's bridge inspection program.

Audit Overview

The aim of the *Performance Audit of the Change Orders and other Contract Modifications* engagement was to provide TDOT's Senior Leadership and the management of the Construction Division an assessment of: (a) general accounting controls, (b) compliance with defined FHWA and TDOT policies, (c) potential areas of process improvements, and (d) cost reduction opportunities.

The audit scope covered the transactions, balances, procedures, and policies for the period July 1, 2011 through December 31, 2012. We divided the audit test work into two distinct objectives, the first of which was ascertaining sources of variances between estimated and actual project costs. The second focused on departmental compliance and testing transactional assertions for (a) existence, (b) accuracy, and (c) classification. During the period under the review, we relied on the accuracy of the data extracted from Site Manager and Edison. In assessing material variances, we used a 10% threshold to delineate significance.

Definition of Key Terms

Bid Amount – the monetary value of the original contract.
Bid Quantity – the estimated number of units needed of a line item in the original Contract.
Change Order Item – a line item added to the project through the execution of a Change Order.
Contracted Cost – the sum of all change orders added to the bid amount.
Final Payment – the final settlement made with the contractor, as reported on the Final Payment Summary for the project.
Final Project Cost – represents the cumulative contractor payments for the project as shown on the Final Payment Summary.
Indexed Payment Adjustment – are increases or decreases of contractor payments due to price fluctuations in a commodity price index.
Item (Contract, Pay, or Bid) – a specifically defined unit of work for which the price is provided as a basis for payment.
Line Item – includes any unit of work that includes material and labor arising from a bid or change order item.
Major Item – any original contract item having a value of 15% or more of the original contract amount, based on the original estimated quantity.
Materially Unbalanced Bid – a mathematically unbalanced bid that creates a reasonable doubt that, if awarded, results in the lowest cost to the government.
Mathematically Unbalanced Bid– a bid containing lump sum or unit bid items, which do not reflect reasonable actual costs plus a reasonable profit.
Non-Indexed Payment Adjustment - payment adjustments due to penalties, content variations, or price variations.
Payment Summary – a Site Manager report that details the basis of a payment to the contractor for the work performed. The payment summary includes current and cumulative payment detail.
Project Cost Variance – the computed value derived from subtracting the contracted cost from the final project cost.
Quantity Overrun – an increase in the quantity used of a line item over the estimated quantity.
Quantity Underrun - a decrease in the quantity used of a Line Item from the estimated quantity.
Site Manager - the construction management system used by TDOT for the entry, tracking, reporting, and analysis of project construction data.

OBJECTIVES AND CONCLUSIONS

1. Are there common factors that account for project cost variances?

Yes. Results of the work performed indicated that project cost variances resulted from the following:

- Variations between estimated and actual quantities from bid items.
- Variations between estimated and actual quantities from change order items.
- Variations derived from indexed and non-indexed payment adjustments.

The results of the work indicated that the Construction Division should implement process improvements to enhance the division's overall cost control practices. (See Observation A and B)

For the audit period, Site Manager data indicated that TDOT closed and made final payments for 634 construction projects. We calculated project cost variance by adding all change orders attributable to each project with the original bid amount. We then compared these values with the actual contractor payments. Variance analysis indicated that 306 of 634 (48.3%) of the closed projects had experienced cost increases while 321 of 634 (50.6%) experienced a decrease in the project costs. Seven projects exhibited no change from expected to the actual costs. Note that a positive variance resulted in actual payments exceeding estimated costs (a disadvantage to TDOT); while a negative variance indicated that actual payments were less than the estimated cost (an advantage to TDOT).

Exhibit C – Variance Statistics for the Population of Contracts

Variance Type	Number of Contracts	Project Bid Cost	Project Cost Variance	Variance	Average Variance
Positive	306	$ 836,788,273	$ 119,310,849	14.26 %	$ 389,905
Negative	321	$ 306,026,439	$ (27,865,998)	-9.11%	$ (86,810)
No Change	7	$ 1,978,200	-	-	-
Totals	634	$ 1,144,792,912	$ 91,444,850	7.99 %	$ 144,235

Source: Internal Audit data review procedures.

To ascertain the sources of the variances, we selected a judgmental sample of 31 projects for detailed testing. We extracted the top 17 projects with the greatest positive variance and the 14 projects with the greatest negative variance. For each selected project, we evaluated the line items in the *final payment summary* to ascertain where the cost differences occurred.

Exhibit D – Sources of Project Cost Variances

Variance Source	Total Amount
Number of projects evaluated	31
Bid Amount	$ 529,494,205
Change Orders	$ 7,928,026
Contracted Costs	$ 537,422,231
Final Project Costs	$ 613,944,010
Project Cost Variance	$ 76,521,779

Source: Internal Audit data review procedures.

The results of our test work indicated that the majority of the cost variance arose from quantity overruns attributable to the original bid items. Quantity overruns, regardless of whether it arises from an original bid item or a change order, occurs when estimated quantities are less than the actual quantities used; this creates a cost disparity that increases the project costs when all other factors remain constant. We observed materially significant quantity overruns totaling $102.4 million attributable to the original bid items in 18 of 31 (58.1%) selected projects.

The second largest source of variance arose from quantity underruns attributable to original bid items. We observed materially significant quantity underruns totaling -$53.6 million in 20 of 31 (64.5%) sampled projects. Quantity underruns represent a favorable project cost variance when all other factors remain constant. Quantity overruns, due to disparities between estimated and actual change order items, accounted for $7.4 million in 14 of 31 (45.2%) sampled contracts. Conversely, quantity underruns accounted for -$1.57 million for change order items; we observed this phenomenon in 11 of 31 (35.5%).

Indexed adjustments result from price fluctuations of estimated commodity items such as fuel and other minerals used during the execution of the construction project. Indexed adjustments represent relatively uncontrollable disparities because market forces drive this type of project cost variance. We observed collective indexed adjustments totaling $8.4 million for the contracts tested. We also noted that none of the project cost variances attributable to indexed adjustments exceeded the 10% materially significant threshold.

The final source of project cost variances arose from miscellaneous transactions we collectively labeled *Other Adjustments*. These cost adjustments have a project-specific variable characteristic that inhibits accurate grouping. We observed $13.4 million in other adjustments of which 1 in 31 (3.2%) had a materially significant impact on the project cost. (See Exhibit E)

Exhibit E – Sources of Project Cost Variances by Type

Variance Source	Total Amount	Materially Significant Deviations
Number of projects evaluated	31	-
Quantity Overruns - Bid Items	$ 102,426,044	18/31
Quantity Underruns - Bid Items	$ (53,647,862)	20/31
Quantity Overruns - Change Order Items	$ 7,422,550	14/31
Quantity Underruns - Change Order Items	$ (1,572,870)	11/31
Indexed Payment Adjustments	$ 8,422,325	0/31
Other Adjustments	$ 13,387,976	1/31
Unreconciled Variance	$ 83,616	-
Total Sample Variance	$ 76,521,779	-

Source: Internal Audit analysis of 31 judgmentally selected samples.

2. Were estimates for approved change orders accurate?

Generally yes. Results of the work performed indicated that the Construction Division provided accurate estimations of change order costs. However, because of exceptions noted, the division could initiate process improvements that could yield better cost controls. In ascertaining whether change orders were estimated accurately, we utilized Site Manager data and traced 45 randomly selected transactions from a population of 438 change orders approved during the period July 1, 2011 through June 30, 2012. (See Exhibit F)

Exhibit F – Population and Sample Characteristics for Approved Change Orders – July 1, 2012 through June 30, 2012

Factor	Count or Total Value	Average
Change Order Population	438	-
Value by Bid Amount (Estimate)	$ 17,928,305	$ 40,932
Test Work Sample Size	45	-
Sample Value by Bid Amount	$ 4,336,242	$ 96,361
Sample Value (Actual paid in Edison)	$ 4,467,144	$ 99,270
Variance (Actual – Estimate)	$ 130,902	$ 2,909

Source: Internal Audit analysis of 45 randomly selected samples.

The results of our work indicated that on average, estimated and actual costs incurred varied by 3.02%. Additionally, in 15 of 45 (33%) items sampled, quantity variances materially affected the actual cost paid for the change order. In one transaction, we noted that variances in the quantity of change order items significantly increased the final cost paid to the extent that the change order, if properly estimated, would have been classified in the next higher category (See Observation B)

3. Were executed change orders properly categorized and approved according to policy?

Yes. TDOT policy 355-01 provides the guidelines for the categorization of change orders and the corresponding approval levels required. We evaluated 45 randomly selected samples for compliance with existing policy and found no exceptions. No other issues noted.

OBSERVATIONS AND RECOMMENDATIONS

A – Improved accounting of quantity overruns needed.

Project cost variances arise primarily from differences between estimated quantities of line items (included in the bidding documents) and the final quantities used. We noted that one way to improve project cost control is to track the impact of quantity variations regardless of whether it results from bid items or change orders. Although TDOT Circular 109.03-01 defines the reporting requirements for overruns and underruns, the circular only addresses major items, and most items do not fall into this category.

In evaluating the details of the 31 sampled contracts, only 0.71% of the costs of overruns and 4.46% of the costs of underruns would have required an explanation. Because of the limitations imposed by the reporting requirements of the circular, accounting for quantity overruns and underruns are not as transparent, and information regarding a vast majority of cost elements affecting final project costs is not consistently evaluated. (See Exhibit G and H)

Exhibit G – Reportable vs. Non-Reportable Overruns in Bid Items

Bid Item Overruns	Value	Percentage
Reportable	$ 728,182	0.71%
Non-Reportable	$ 101,697,862	99.29%
Total Overruns	$ 102,426,044	-

Source: Internal Audit analysis of 31 judgmentally selected samples.

Exhibit H – Reportable vs. Non-Reportable Underruns in Bid Items

Bid Item Underruns	Amount	Percentage
Reportable	$ (2,390,406)	4.46%
Non-Reportable	$ (51,257,456)	95.54%
Total Underruns	$ (53,647,862)	-

Source: Internal Audit analysis of 31 judgmentally selected samples.

Current processes appear to indicate the need to improve controls for properly accounting for a majority of the unplanned increases (or decreases) in project cost. Improving controls not only helps to ensure the transparency of quantity variations that would lead to better decision-making and strategic planning but could also provide avenues for: (a) identifying high-risk bid items, (b) evaluating contractors, (c) improving the accuracy of the project estimation process (d) enhancing cash flow, (e) improving the bid process, and (f) reducing the project backlog.

Criteria:

- TDOT Circular 109.03-01 – *Overrun and Underrun Explanation*
- TDOT Circular 102.01-01 – *Contractor Performance Evaluation*
- Section 101.64 *Standard Specifications for Road and Bridge Construction*, March 1, 2006 Edition
- Prudent business practices

Risks:

- Increases in unanticipated project costs may require the use of funds committed to other or future projects.
- Increases in unanticipated project costs may cause delaying the start of other projects, potentially increasing TDOT's project backlog.
- Lack of documentation of project quantity overruns and underruns prevents TDOT from identifying the root causes and making potential process improvements to reduce future unanticipated project cost variances.
- Inadequate controls for quantity variations may allow contractors to unfairly profit by exploiting mathematically unbalanced bids.

Recommendations:

A.1 Construction Division management should develop a system to reduce the impact of quantity overruns to include:

- Analysis of data from TDOT projects to identify line items at high risk of overrun based on the frequency of occurrence and financial impact to projects.
- Use the results of current bid analysis procedures to identify and monitor mathematically unbalanced bid items for potential overruns.
- Automated notification in Site Manager for excess line item quantities based on bid quantities and construction schedules.
- Negotiation of unit pricing for overruns on any items considered mathematically unbalanced in the winning bid.

A.2 Construction Division management should require documentation of all significant quantity variations from bid estimates to include the reason for the variation and multiple approval layers.

A.3 Construction Division management should include bid quantity estimate accuracy into the evaluation of contractors and Construction Division field personnel.

B – Change order quantity overruns require monitoring.

In our test, we observed $7.4 million in quantity overruns, which accounted for 94% of the increase in the cost of the change order items for the 31 sampled projects. The overall variation between the final project cost and contracted project cost re-emphasizes the need to monitor quantity overruns because of its material impact.

Exhibit I – Impact of Quantity Overruns

Variance Source	Total Amount
Number of projects evaluated	31
Change Orders	$ 7,928,026
Quantity Overruns	$ 7,422,550
Overruns as a Percentage of Change Order Estimates	93.62%

Source: Internal Audit analysis of test results

Criteria:

- TDOT Policy 355-01 – *Approval of Construction Changes and Force Account*
- TDOT Circular 102.01-01 – *Contractor Performance Evaluation*
- Section 101.55, *Standard Specifications for Road and Bridge Construction,* March 1, 2006 Edition

Risks:

- Contractors may circumvent the approval process by intentionally underestimating quantities of change order items to avoid additional approval requirements, especially in the minor change category.
- Contractors may include minimal quantities of line items in change order estimates to avoid scrutiny of inflated unit costs for those items.
- Without the proper monitoring system in place, there are considerable risks that once a line item is established in the project quantities used can be increased, virtually unchecked, thus allowing contractors to unfairly profit to the detriment of TDOT.

Recommendations:

B.1 Construction Division management should require documentation of quantity deviations from change order estimates to include: (a) reviews of the variation, (b) documented rationale for the variation, and (c) high-level approval of significant variations.

B.2 Construction Division management should develop a process to analyze change order data to identify change order items with high risk of overruns based on the frequency of occurrence and financial impact to projects.

B.3 Construction Division management should include contractor bid item and change order estimate accuracy into the performance evaluation of contractors and Construction Division field personnel.

C – Optimizing Site Manager's capabilities will enhance internal controls and potentially help reduce project cost variances.

Current processes in place do not utilize Site Manager's early warning capabilities, especially as they pertain to significant quantity increases that materially deviate from the estimated quantities. Using Site Manager as an early warning device to provide real-time information about project activities enhances the Construction Division's ability to gain operational efficiencies and reduce project cost variances.

Criteria:

- Government Accountability Office - *Standards for Internal Control in the Federal Government* – Principle 10 – Design and Control Activities
- Government Accountability Office - *Standards for Internal Control in the Federal Government* – Principle 11 – Design Activities for the Information Systems
- Government Accountability Office - *Standards for Internal Control in the Federal Government* – Principle 16 – Perform Monitoring Activities
- Information Systems Audit and Control Association - Control Objectives for Information and Related Technology (COBIT) 5
- Prudent business practice

Risks:

- Inadequate internal controls inhibit management's ability to enforce directives that enable TDOT to achieve objectives and address related risks.
- Without the proper monitoring system in place, there are considerable risks that once a line item is established in the project, quantities used can be increased, virtually unchecked, thus allowing contractors to unfairly profit to the detriment of TDOT.

Recommendations:

C.1 Construction Division management should develop automated notifications in Site Manager for excess bid item or change order item quantities.

C.2 Construction Division management should include change order estimate accuracy into the evaluation of contractors and Construction Division field personnel.

GENERAL AUDIT INFORMATION

STATEMENT OF COMPLIANCE WITH GAGAS

We conducted this performance audit in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the work to obtain sufficient, appropriate evidence to provide a reasonable basis for our observations and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our observations based on our audit objectives.

SCOPE AND METHODOLOGY

The audit period focused primarily on change orders and project costs from Construction Division projects, accounts, and transactions within the period from July 1, 2011 through December 31, 2012. The methodology employed throughout this audit was one of objectively reviewing and evaluating various forms of documentation including accounting and financial information, written policies and procedures, contracts, and data in various forms.

CRITERIA

In conducting this audit, we evaluated the existing processes for compliance with the following:

- Tennessee Department of Transportation (TDOT), *Standard Specifications for Road and Bridge Construction*, March 1, 2006 Edition
- Government Accountability Office (GAO) - *Standards for Internal Control in the Federal Government*, September 2014
- Information Systems Audit and Control Association (ISACA) - Control Objectives for Information and Related Technology (COBIT) 5
- Federal Highway Administration Guidelines
- Tennessee Department of Transportation, Construction Division Policies and Circular Letters
- American Association of State Highway Transportation Officials (AASHTO) benchmarked information
- Prudent business practices

STAFF ACKNOWLEDGMENT

Craig Pitts, MBA, MACC – In Charge Auditor
Whitney Rogers – Staff Auditor
Mel Marcella, CPA, CMA, CIA, CISA, CFE – Quality Assurance

APPENDIX A. MANAGEMENT RESPONSES

STATE OF TENNESSEE
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COMMISSIONER

BILL HASLAM
GOVERNOR

March 26, 2015

Mel Marcella
Director of Internal Audit
James K. Polk Building, Suite 1800
Nashville, TN 37243

Dear Mr. Marcella,

This letter acknowledges that the Construction Division is in receipt of the report entitled *Performance Audit of Project Change Order and Other Contract Modifications*, conducted by the Office of Internal Audit.

We have reviewed the audit report and evaluated all of the observations raised in this report. The Construction Division will undertake the recommended actions. Attached please find our formal responses to the recommendations and the proposed plan of action. This audit will serve as a valuable instrument and management tool in helping the Tennessee Department of Transportation meet its objectives and goals.

Sincerely,

Will Reid, P.E.
Director
Construction Division

Construction Division
Management Responses to Audit Recommendations – March 2015

Report Item and Description	Responses to Recommendations / Action Plan	Assigned Responsibility	Estimated Completion
A1. The Construction Division management should develop a system to reduce the impact of quantity overruns.	***Partially Accept*** Discussions/training will be held with Regional Directors and Directors of Operations to emphasize importance of tracking overruns, (Annual Operations Symposium). Discussions will also take place with Regional Project Development staff to communicate trends related to items that frequently overrun and how it can be addressed during development phase.	Construction Director and Assistants, Regional Directors, Regional Operations Directors	June 2015
A2/ B1. The Construction Division management should require documentation of quantity deviations from change order estimates to include: (a) reviews of the variation, (b) documented rationale for the variation, and (c) high-level approval of significant variations.	***Accept*** Most of this information is required as part of the change order process however, additional justification for significant overruns will be requested prior to approval.	Asst. Directors of Const./ Regional Operations Staff (Project Supervisors)	June 2015
A3 /C1. Construction Division management should develop automated notifications in Site Manager for excess bid item or change order item quantities.	***Accept*** Currently working with IT to develop additional automated notifications	CMS Administrator	June 2015
B1/ B2. Construction Division management should develop a process to analyze change order data to identify change order items of high risk of overrun based on the frequency of occurrence and financial impact to projects.	***Accept*** We will work with CMS Manager to develop query to track this information	Asst. Directors of Const. / CMS Administrator	June 2015
A3/ B3/ C2. Construction Division management should include contractor bid item and change order estimate accuracy into the performance evaluation of contractors and Construction Division field personnel.	***Accept*** We will work with Regional Staff to track this information	Construction Division Director and Assistants, Regional Operations Directors./ Regional Operations Staff (Project Supervisors)	June 2015

APPENDIX B. HIGH RISK OVERRUN ITEMS

Top 10 Bid Estimate Overrun Items by Frequency of Occurrence and Cost Impact

Item Code	Item Description	Number of Contracts with an Overrun	Average Cost Per Occurrence	Total Overrun Amount
803-01	SODDING (NEW SOD)	19	$ 185,146	$ 3,517,780
303-10.01	MINERAL AGGREGATE (SIZE 57)	16	$ 166,873	$ 2,669,965
303-01	MINERAL AGGREGATE, TYPE A BASE, GRADING D	15	$ 731,399	$ 10,970,990
411-01.10	ACS MIX(PG64-22) GRADING D	15	$ 206,446	$ 3,096,697
709-05.06	MACHINED RIP-RAP (CLASS A-1)	15	$ 506,255	$ 7,593,824
303-01.02	GRANULAR BACKFILL (BRIDGES)	13	$ 83,164	$ 1,081,130
307-01.08	ASPHALT CONCRETE MIX (PG64-22) (BPMB-HM) GRADING B-M2	13	$ 190,525	$ 2,476,829
411-02.10	ACS MIX(PG70-22) GRADING D	13	$ 230,143	$ 2,991,862
203-01	ROAD & DRAINAGE EXCAVATION (UNCLASSIFIED)	12	$ 236,142	$ 2,833,704
805-12.02	EROSION CONTROL BLANKET (TYPE II)	11	$ 116,513	$ 1,281,641

Source: Internal Audit –Audit Command Language (ACL) analytics results.

Top 10 Bid Estimate Overrun Items by Average Cost per Occurrence

Item Code	Item Description	Number of Contracts with an Overrun	Average Cost Per Occurrence	Total Overrun Amount
203-02.01	BORROW EXCAVATION (GRADED SOLID ROCK)	10	$ 1,597,958	$ 15,979,580
209-01.31	TEMPORARY MULCH FILTER BERM	2	$ 1,270,228	$ 2,540,455
203-03	BORROW EXCAVATION (UNCLASSIFIED)	2	$ 1,170,213	$ 2,340,426
805-12.03	EROSION CONTROL BLANKET (TYPE III)	4	$ 801,090	$ 3,204,362
303-01	MINERAL AGGREGATE, TYPE A BASE, GRADING D	15	$ 731,399	$ 10,970,990
709-05.06	MACHINED RIP-RAP (CLASS A-1)	15	$ 506,255	$ 7,593,824
606-22.13	STEEL PIPE PILES (24 IN)	1	$ 472,850	$ 472,850
740-06.01	GEOMEMBRANE	1	$ 467,031	$ 467,031
411-03.09	ACS MIX(PG76-22) THIN LIFT CS ASPHALT	1	$ 383,835	$ 383,835
712M08.06	UNIFORMED POLICE OFFICER	1	$ 369,370	$ 369,370

Source: Internal Audit –Audit Command Language (ACL) analytics results.

Top 10 Bid Estimate Overrun Items by Total Cost of Overruns

Item Code	Item Description	Number of Contracts with an Overrun	Average Cost Per Occurrence	Total Overrun Amount
203-02.01	BORROW EXCAVATION (GRADED SOLID ROCK)	10	$ 1,597,958	$ 15,979,580
303-01	MINERAL AGGREGATE, TYPE A BASE, GRADING D	15	$ 731,399	$ 10,970,990
709-05.06	MACHINED RIP-RAP (CLASS A-1)	15	$ 506,255	$ 7,593,824
803-01	SODDING (NEW SOD)	19	$ 185,146	$ 3,517,780
805-12.03	EROSION CONTROL BLANKET (TYPE III)	4	$ 801,090	$ 3,204,362
411-01.10	ACS MIX(PG64-22) GRADING D	15	$ 206,446	$ 3,096,697
411-02.10	ACS MIX(PG70-22) GRADING D	13	$ 230,143	$ 2,991,862
203-01	ROAD & DRAINAGE EXCAVATION (UNCLASSIFIED)	12	$ 236,142	$ 2,833,704
303-10.01	MINERAL AGGREGATE (SIZE 57)	16	$ 166,873	$ 2,669,965
209-01.31	TEMPORARY MULCH FILTER BERM	2	$ 1,270,228	$ 2,540,455

Source: Internal Audit –Audit Command Language (ACL) analytics results.

Top Ten Change Order Overrun Items by Total Cost of Overruns

Item Code	Item Description	Number of Contracts with an Overrun	Total Overrun Amount
203-02.02	BORROW EXCAVATION (GRADED SOLID ROCK)	1	$ 3,602,133
303-02	MINERAL AGGREGATE, TYPE B BASE, GRADING (DESCRIPTION)	1	$ 304,384
740-10.04	GEOTEXTILE (TYPE IV)(STABILIZATION)	3	$ 288,171
307-01.03	AGGREGATE (BPMB-HM) GRADING A-S MIX	1	$ 254,825
104-03.31	ADDITIONAL WORK (DESCRIPTION)	1	$ 172,544
777-24.84	8IN PVC SDR 35 GRAVITY SEWER (8-10 FT)	1	$ 165,650
604-01.08	CLASS A CONCRETE (BRIDGE) (FOUNDATION LEVELING)	1	$ 146,753
705-02.02	SINGLE GUARDRAIL (TYPE 2)	3	$ 146,517
805-12.02	EROSION CONTROL BLANKET (TYPE II)	1	$ 142,238
604-03.09	CLASS D CONCRETE (BRIDGE DECK)	2	$ 135,405

Source: Internal Audit –Audit Command Language (ACL) analytics results.

APPENDIX C. REFERENCES

Bordat, C., McCullouch, B.C., Labi, S., & Sinha, K.C. (2004). An analysis of cost overruns and time delays of INDOT projects. *Joint Transportation Research Program, Indiana Department of Transportation and Purdue University*, *West Lafayette, Indiana, 2004*. doi: 10.5703/1288284313134.

Crossett, J and Hines, L. (2007). Comparing state DOTs' construction project cost and schedule performance. *TransTech Management, Inc.* Retrieved from http://www. mydotperformance.org/docs/final_report _aashto_version.pdf

Kvidera, M. (2010). Road poll: The good, the bad, the better. *Overdrive Magazine (55)* 2. Retrieved from, http://www.overdriveonline.com/the-good-the-bad-the-better/

Mattson, S. and Potts, K. (2015), Tennessee transportation funding: Challenges and options. *Tennessee, Comptroller's Office of Research and Education Accountability (OREA).* Retrieved from http://www. comptroller.tn.gov/Repository/RE/TransportationReportFinal.pdf

Oklahoma Department of Transportation. (2014). Guidance for preparing change orders, making additions to contract time, & reviewing cost breakdowns supporting supplemental agreements. Retrieved from http://www.okladot.state.ok.us/c_manuals/ccdirectives/con_ccd_20000225_Att_1.pdf

Tennessee Department of Transportation. (2012). *FY 2012 TDOT Measurement report.* Retrieved from http://www.tdot.state.tn. us/osp/pdfs/TMRFY2012.pdf

Tennessee Department of Transportation. (n.d.). *TDOT Driving to be the best, keys to success 2011 – 2013.* Retrieved from http://www.tdot. state.tn.us/ documents/TDOT-ProgressReport2011-2013.pdf