Commonwealth of Massachusetts
Office of the State Auditor
Suzanne M. Bump
Making government work better

Official Audit Report – Issued September 28, 2018

Massachusetts Bay Transportation Authority—Review of Contract Management Process

For the period July 1, 2014 through December 31, 2016

Commonwealth of Massachusetts
Office of the State Auditor
Suzanne M. Bump
Making government work better

September 28, 2018

Ms. Stephanie Pollack, Secretary and Chief Executive Officer
Massachusetts Department of Transportation
State Transportation Building
10 Park Plaza, Suite 4160
Boston, MA 02116

Dear Secretary Pollack:

I am pleased to provide this performance audit of the Massachusetts Bay Transportation Authority (MBTA). This report details the audit objectives, scope, methodology, findings, and recommendations for the audit period, July 1, 2014 through December 31, 2016. My audit staff discussed the contents of this report with management of the agency, whose comments are reflected in this report.

I would also like to express my appreciation to the MBTA for the cooperation and assistance provided to my staff during the audit.

Sincerely,

Suzanne M. Bump
Auditor of the Commonwealth

cc: Luis Manuel Ramirez, General Manager and Chief Executive Officer, MBTA
Michael Abramo, Chief Financial Officer, MBTA
Beth Larkin, Assistant General Manager, Capital Delivery Department, MBTA
James Conley, Director of Administration, Capital Delivery Department, MBTA

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APPENDIX 25

LIST OF ABBREVIATIONS

AACE	Association for the Advancement of Cost Engineering
CDD	Capital Delivery Department
DBB	design-bid-build
EON	Explanation of Necessity
FMCB	fiscal and management control board
GLX	Green Line Extension
ICE	Independent Cost Estimate
MassDOT	Massachusetts Department of Transportation
MBTA	Massachusetts Bay Transportation Authority
OSA	Office of the State Auditor
PM	project manager
RON	Record of Negotiation

EXECUTIVE SUMMARY

In accordance with Section 12 of Chapter 11 of the Massachusetts General Laws, the Office of the State Auditor has conducted a performance audit of the Massachusetts Bay Transportation Authority (MBTA) for the period July 1, 2014 through December 31, 2016.

The scope of our audit was to determine whether the MBTA had taken measures to adequately address the management action items that were identified by an external auditor. These action items were in the areas of the MBTA's bid and award, change order, and cost estimation processes.

Below is a summary of our findings and recommendations, with links to each page listed.

Finding 1 **Page 9**	The MBTA did not ensure that its own staff, as well as its contracted design engineers and their estimators, properly conducted periodic cost estimates and risk analyses.
Recommendation **Page 11**	MBTA management should establish effective monitoring controls to ensure that periodic project estimates and risk analyses are properly conducted by MBTA personnel, its contracted design engineers, and their estimators.
Finding 2 **Page 13**	The MBTA did not maintain an accurate Disinterested Bidders Database or investigate all prospective bidders.
Recommendation **Page 14**	The MBTA should develop written policies and procedures for updating information in the database and identifying and researching disinterested bidders, and it should establish monitoring controls to ensure that these policies and procedures are followed.
Finding 3 **Page 16**	The MBTA processed change orders without adequate documentation.
Recommendation **Page 18**	The MBTA should codify its Contractor's Change Order / Risk Reallocation Check-Off List as a required piece of supporting documentation for all change orders and should implement monitoring controls to ensure that its contractors complete this document.
Finding 4a **Page 20**	The MBTA did not ensure that information in its Bid Comparison to Cost Estimate Database was accurate.
Finding 4b **Page 21**	The MBTA did not ensure that contracted design engineers performed a root cause analysis on each bid that varied from the engineer's estimate by more than 10%.
Recommendation **Page 22**	MBTA management should establish effective monitoring controls to ensure that information is accurately recorded in the Bid Comparison to Cost Estimate Database and that a root cause analysis is performed for each bid received that varies from the engineer's estimate by more than 10%.

OVERVIEW OF AUDITED ENTITY

The Massachusetts Bay Transportation Authority (MBTA) was created in 1964 pursuant to Chapter 161A of the Massachusetts General Laws. The agency provides services via its rapid transit system, commuter rail service, bus service, ferry routes, and transit service for people with disabilities. According to its Capital Investment Program for fiscal year 2016, the MBTA system is the fifth-largest mass-transit system in the country in terms of ridership, serving 4.7 million people over an area of 3,200 square miles, with about 1.3 million passengers each day.

Chapter 25 of the Acts of 2009, "An Act Modernizing the Transportation Systems of the Commonwealth," as amended by Chapter 26 of the Acts of 2009, required the integration of various state transportation agencies, including the MBTA, into the newly created Massachusetts Department of Transportation (MassDOT). MassDOT is administered by the Secretary of Transportation, who is appointed by the Governor to serve as its chief executive officer. During our audit period, a seven-member board of directors (including the Secretary) with expertise in transportation, finance, and engineering, appointed by the Governor, oversaw MassDOT.[1] The Secretary appoints an administrator for each division. The MBTA general manager, appointed by the MassDOT board, directs daily operations and oversees all administrative functions and management policies and practices.

Section 200 of the Commonwealth's fiscal year 2016 budget authorized the establishment of a five-member fiscal and management control board (FMCB) at the MBTA consisting of one member with experience in transportation finance, one member with experience in mass-transit operations, and three members of the MassDOT board. Members of the FMCB are appointed by the Governor, and the chair is chosen by the Secretary of Transportation. As stated in the fiscal year 2016 budget, the FMCB is charged with "the implementation of appropriate measures to secure the fiscal, operational and managerial stability of the [MBTA]."

Construction Contract Management

The MBTA Capital Delivery Department (CDD) is responsible for the administration of construction contracts awarded by the MBTA as well as professional service contracts (e.g., contracts for design services) related to construction projects; projects include various costs, including but not limited to those for design and construction contracts, real estate, project administration, and inspections, as well

1. During fiscal year 2016, the Legislature expanded the board to 11 members.

as indirect costs. During our audit period, the CDD awarded 39 construction contracts, totaling $464 million.

In 2011, the MBTA engaged an outside accounting firm to perform a review that focused on assessing various project management activities that affected MBTA construction. During this review, the audit firm identified six MBTA design and construction project management activities for review:

- bid and award
- change orders
- cost estimation and budget development
- invoice review and approval
- schedule development
- construction monitoring and reporting

As a result of its review, the accounting firm identified 56 action items, which were intended to improve the MBTA's construction process. The MBTA agreed to implement a management action plan to implement the changes. The accounting firm performed follow-up reviews in 2013 and 2014 to assess the status of the MBTA's implementation of the plan. During both of these reviews, the accounting firm noted that the MBTA had made significant progress but had not yet fully implemented all of the suggested changes.

AUDIT OBJECTIVES, SCOPE, AND METHODOLOGY

In accordance with Section 12 of Chapter 11 of the Massachusetts General Laws, the Office of the State Auditor has conducted a performance audit of certain activities of the Massachusetts Bay Transportation Authority (MBTA) for the period July 1, 2014 through December 31, 2016.

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

The scope of our audit was to determine whether the MBTA had taken measures to adequately address the management action items identified by an external auditor. These action items were in the areas of the MBTA's bid and award, change order,[2] and cost estimation processes.

Below is a list of our audit objectives, indicating each question we intended our audit to answer; the conclusion we reached regarding each objective; and, if applicable, where each objective is discussed in the audit findings.

Objective	Conclusion
1. Has the MBTA performed market research to increase the number of contractors to bid on proposed MBTA work?	**Yes**
2. Has the research on disinterested bidders been captured and recorded accurately in the Disinterested Bidders Database?	**No; see Finding 2**
3. Does the MBTA approve and sign off on the statement of compliance for all change order costs?	**Yes**
4. Does the MBTA ensure that each change order adheres to the terms and conditions of the contract?	**Yes**
5. Does the MBTA administer the change order process in compliance with its Construction Contract Change Order Guidelines?	**No; see Finding 3**

2. A change order is a document requesting, acknowledging, and approving (or disapproving) work that is either added to or deleted from the project scope, altering the original guaranteed maximum price in the contract, the planned completion date, or both.

Objective	Conclusion
6. Does the MBTA use the Association for the Advancement of Cost Engineering (AACE) methodology for determining estimating accuracy?	**Yes**
7. Has the MBTA adhered to its project controls regarding estimates and risk analysis?	**No; see Finding 1**
8. Does the MBTA maintain an accurate and reliable Bid Comparison to Cost Estimate Database?[3]	**No; see Finding 4a**
9. Does the MBTA perform a root cause analysis[4] for each project bid that varies from the engineer's estimate[5] by more than 10%?	**No; see Finding 4b**

To achieve our audit objectives, we gained an understanding of the internal controls we determined to be relevant to our audit objectives and tested the operating effectiveness of those controls over the bid and award process, the change order process, and the cost estimation process. We conducted further audit testing as described in the following subsections.

Bid and Award—Disinterested Bidders Database

There were 39 construction contracts awarded during the audit period, which had 170 prequalified bidders (contractors that have been evaluated by the MBTA and found to be qualified to bid on MBTA projects). Of those 170, 139 submitted bids, according to the MBTA Bidders Database. The other 31 were "disinterested bidders," which the MBTA defines as bidders who were prequalified and submitted proposals but elected not to submit bids. We determined whether information about the 31 disinterested bidders was entered in the MBTA's Disinterested Bidders Database.

- We examined the Disinterested Bidders Database to determine whether market research was performed during the audit period.
- Twenty-nine of the 39 awarded construction contracts were design-bid-build (DBB)[6] projects. We inspected the Planholders[7] Lists for the 29 DBB projects and identified 883 Other Planholders that the MBTA did not review to identify potential new prequalified bidders.

3. The MBTA maintains this database to compare engineers' estimates to all project bids for all DBB projects and identify all bids varying from the engineer's estimate by more than 10% for each DBB project.
4. This analysis is MBTA's process for determining the reasons for variances between the engineer's estimate and bids received.
5. This is the final construction cost estimate for a project and is prepared by a design engineer's cost estimator.
6. In a DBB project, the MBTA hires a contractor to create design specifications for a project and then uses those specifications to solicit bids for the construction of the project.
7. A planholder is a person or company that requests a copy of an MBTA project plan.

- For the 34 of the 39 construction contracts that were competitively awarded during the audit period,[8] we determined the number of bids submitted for each contract to determine whether the average number of bids received increased or decreased during the audit period.

- We identified the winning bidders on the 39 contracts awarded to determine how many different contractors received contract awards during the audit period.

Change Orders

- From a total population of 356 change orders executed during the audit period, we tested a nonstatistical, random sample of 40, with a total value of $4.3 million, to obtain reasonable assurance that proper approval and signatures were obtained. We inspected the sample to determine whether follow-up reviews and signoffs of MBTA Construction Form 3C[9] were performed in accordance with Section 39I of Chapter 30 of the General Laws and within the authorization limitations of contract authority provided by the regulations of the MBTA board of directors before payment.

- From a total population of 356 change orders executed during the audit period, we tested a nonstatistical, random sample of 40, with a total value of $4.3 million, to determine whether the final change order packages contained the supporting documentation needed in order to complete the change order process, including the contractor's proposal cover letter, recapitulation chart, Record of Negotiation, Independent Cost Estimate, Explanation of Necessity, and Contractor's Change Order / Risk Reallocation Check-Off List.

- We reviewed all the documentation for these 40 change orders and calculated the dollar value of change order costs paid without adequate supporting documentation.

Project Estimating and Risk Analysis

Of the 29 DBB projects the MBTA awarded during our audit period, we tested a nonstatistical, random sample of 10 to determine whether the MBTA or its contracted design engineer prepared required project cost estimates and risk analyses as required by MBTA guidelines and whether all the documentation the AACE methodology requires was completed when appropriate.

We tested 10 projects to determine whether the following were prepared:

- Initial Project Estimates

- Pre-Conceptual Project Estimates

- 15% Conceptual Construction Estimates

- 30% Design Development Construction Estimates

8. The other 5 contracts were not subject to competitive bidding requirements.
9. This form is used to document a contractor's proposed change to a contract and must be reviewed and approved by the MBTA project manager and, depending on the cost of the proposed change, various other MBTA personnel.

- 60% Design Development Construction Estimates
- 100% Construction Documents Construction Estimates
- Cost Growth Reports[10]
- Bases of Estimates[11]
- Qualitative Risk Analyses and Risk Registers[12] at the 30% Design Development Construction Estimate phase
- Quantitative Risk Analyses and Risk Registers between the 90% Design Development Construction Estimate phase and 100% Construction Documents Construction Estimate phase

Construction Contract Bid Analysis

- We tested the data for all 29 DBB projects recorded in the Bid Comparison to Cost Estimate Database to the verified Contract Bidder Info, Winning Bids[13] Database for accuracy.
- We tested all 15 of the contracts that required a root cause analysis on an MBTA-prepared list that identified each bid on which a root cause analysis was performed during the audit period to obtain reasonable assurance that the MBTA's contracted design engineers properly performed that analysis.

Whenever sampling was used, we applied a nonstatistical approach, and as a result, we were not able to project our results to the entire population.

Data Reliability

We obtained the following data sets from the MBTA's Capital Management System database application, and we assessed the reliability of the data we obtained from the following databases: Disinterested Bidders, Bidders, Awarded Contracts, Change Orders, Engineer Estimate and Actual Cost Variance, Bid Comparison to Cost Estimates, and Contract Bidder Info All Bids. We reviewed the controls for access to programs and data, program changes, and security settings. We also performed additional validity and integrity tests, including testing the accuracy of manually entered data, by selecting a nonstatistical, random sample of source documentation and tracing applications to the data in the

10. This report is a table created by the design engineer that identifies and describes the factors that contributed to the growth of a project's costs.
11. A Basis of Estimate is a collection of documentation that is prepared by the design engineer and includes a project scope description, general assumed costs, pricing details, anticipated allowances, potential cost items excluded from the estimate, historical comparisons, areas of significant risk and opportunities, and a list of estimating team members.
12. This is a document developed to identify schedule and cost risks associated with a project.
13. This database identifies all winning construction contractors for all MBTA project types and includes data such as the contract number, project type, winning contractor, date of award, engineer's estimate, award amount, and variance between the engineer's estimate and the award amount.

database. We determined that the data from the system were sufficiently reliable for the purposes of our audit.

DETAILED AUDIT FINDINGS WITH AUDITEE'S RESPONSE

1. The Massachusetts Bay Transportation Authority did not ensure that its own staff, as well as its contracted design engineers and their estimators, properly conducted periodic cost estimates and risk analyses.

The Massachusetts Bay Transportation Authority (MBTA) did not ensure that its own staff, and its contracted design engineers and their estimators, properly conducted periodic cost estimates and risk analyses to evaluate potential threats to successful project completion throughout each capital construction project. The purposes of these cost estimates and risk analyses are to determine whether a project is progressing as planned and to ensure that any problems related to project costs or scheduled completion timeframes are identified and resolved promptly. Because it did not always conduct them, the agency did not collect all the information it needed to effectively and efficiently administer projects, which could result in problems such as project delays, cost overruns, and funding issues.

We selected a nonstatistical, random sample of 10 of the 29 design-bid-build (DBB) construction projects that the MBTA initiated during our audit period. The MBTA did not provide us with the following materials:

- Initial Project Estimates for 10 projects
- Pre-Conceptual Project Estimates for 10 projects
- 15% Conceptual Construction Estimates for 10 projects
- 30% Design Development Construction Estimates for 6 projects
- 60% Design Development Construction Estimates for 7 projects
- a 100% Construction Documents Construction Estimate for 1 project
- Cost Growth Reports at any design estimate phase for 10 projects
- a Basis of Estimate for 1 project
- Qualitative Risk Analyses at the 30% Design Development Construction Estimate phase for 10 projects, or Risk Registers for the same 10 projects
- Quantitative Risk Analyses between the 90% Design Development Construction Estimate phase and 100% Construction Documents Construction Estimate phase for 3 projects, or Risk Registers for the same 3 projects

Authoritative Guidance

According to the "Estimating Requirements" subsection of Section II of the MBTA Project Controls Manual, which was released October 16, 2014 and in effect during our audit period, estimates are required for MBTA construction projects at specific design phases:

- Initial Project Estimate: an initial estimate of what the total project budget will be, broken down into projected costs for construction, design, real estate, project administration, etc., that is developed by the MBTA project manager (PM)
- Pre-Conceptual Project Estimate: the PM's revision of the Initial Project Estimate after a designer is selected, if necessary
- 15% Conceptual Construction Estimate: an updated version of the estimated costs, produced by the PM, based on concept schemes submitted by the design engineer and its estimator, when the project design is 15% complete
- 30%, 60%, and 90% Design Development Construction Estimate: construction estimates of the MBTA's preferred design scheme, produced by the design engineer and its estimator, that account for all cost-sensitive project data, submitted when the project design is 30%, 60%, and 90% complete
- 100% Construction Documents Construction Estimate: a detailed construction project estimate that is produced by the design engineer and its estimator and submitted to MBTA management when the project design is 100% complete

The "Design and Construction Phase Cost Estimating" subsection of Section II of the manual states, "A Cost Growth Report (CGR) is to be provided to the MBTA with every construction estimate submittal in order to track cost growth at each design phase by comparison with the project budget."

The "Requirements for Basis of Estimate" subsection of Section II states, "A Basis of Estimate shall accompany all estimates."

The "Risk Analysis Process" subsection of Section IX of the manual states, "At 30% [design], a qualitative risk analysis is required. The output of a qualitative risk analysis is a risk register."

The "Risk Analysis Process" subsection of Section IX of the manual states, "When the project design is between 90% and 100%, a quantitative risk analysis is required. The output of a quantitative risk analysis is . . . a risk register."

Reasons for Noncompliance

MBTA management has not established effective monitoring controls to ensure that periodic project estimates and risk analyses are properly conducted during various design phases of MBTA capital construction projects as required by the Project Controls Manual.

Recommendation

MBTA management should establish effective monitoring controls to ensure that periodic project estimates and risk analyses are properly conducted by MBTA personnel, its contracted design engineers, and their estimators.

Auditee's Response

In a response to this finding dated July 26, 2018, the MBTA stated,

> *To ensure that new and existing Department staff are knowledgeable in the requirements for project cost estimates and risk analyses, the Department has developed a new on-boarding procedure for new hires that includes a review of several different Capital Delivery functions and processes, including items identified in the Draft Audit finding. This information is not only available to new hires, but is also being rolled out to the entire Capital Delivery Project staff. . . .*
>
> *The MBTA continues to improve its estimating and risk analyses procedures and documentation. For example, the Capital Investment Plan (CIP) process now includes using a standard Capital Funding Request template for new projects and requires initial estimates of the project budget and schedule. After the CIP is approved but before funding is authorized, project teams are also required to submit a Project Information Form with updated cost estimates and schedule projections. This new process requires submission and review of an initial project budget.*
>
> *The MBTA is renewing its focus on making certain that interim and final estimates and risk analyses are performed according to the requirements of the MBTA Project Managers (PM) Manual and MBTA Project Controls Manual and are well documented. It should be noted that as a result of the audit process it was found that there are inconsistencies between the MBTA PM Manual and MBTA Project Controls Manual. In some instances, a requirement in one manual was not specified in the other. An example of this was the requirement for a Cost Growth Report that is specified in the Project Controls Manual but not the PM Manual.*
>
> *The Capital Delivery Assistant General Manager has engaged the Capital Delivery Department Director of Quality Assurance and Quality Control to review both Manuals, identify inconsistencies and update each Manual accordingly. This analysis has begun. The Department's [Quality Assurance / Quality Control] Group is leading a complete review of the manuals by engaging the stakeholders in the Capital Delivery and Capital Program Oversight Departments. The Department acknowledges that the Cost Growth Report, while not required in the current PM Manual, is an important tool to evaluate cost increases. Through the review of the PM and Project Controls*

manuals this process will be evaluated, modified, and required for all projects that show an increase in cost as the design progresses.

With its written response to our draft report, the MBTA also provided copies of the following documents:

- 8 of the 10 missing Initial Project Estimates
- 3 of the 10 missing 15% Conceptual Construction Estimates
- 2 of the 6 missing 30% Design Development Construction Estimates
- 3 of the 7 missing 60% Design Development Construction Estimates
- the missing Basis of Estimate
- 1 of the 3 missing Quantitative Risk Analyses between the 90% Design Development Construction Estimate phase and 100% Construction Documents Construction Estimate phase
- 2 of the 3 missing Risk Registers for the Quantitative Risk Analyses between the 90% Design Development Construction Estimate phase and 100% Construction Documents Construction Estimate phase

In addition to these documents, the MBTA also provided explanations of why some of the documentation was still missing. For example, regarding the missing Pre-Conceptual Project Estimates, the MBTA stated in its July 26, 2018 response to the draft report,

This is a requirement of the Project Controls Manual but not the Project Managers Manual. The MBTA is doing a review of both manuals for consistency and will make a determination as to need and will revise both manuals accordingly.

Regarding Cost Growth Reports, the MBTA stated,

The development of a Cost Growth Report is required as indicated on Page 14 of the Project Controls Manual, but was not identified in the Project Managers Manual. This inconsistency will be addressed in the review of the two manuals.

To explain the missing 15% Conceptual Construction Estimates, 30% Design Development Construction Estimates, and 60% Design Development Construction Estimates, the MBTA stated that to expedite a project, depending on the project scope, these estimates might not be performed. It also stated,

In many instances the 30% design submittal may not have been required. Regardless, early identification of project schedule and cost risks are a good practice and will be completed and documented in future 30% design submissions.

Auditor's Reply

As noted above, during our audit, the MBTA could not provide various documents to substantiate that its own staff, as well as its contracted design engineers and their estimators, properly conducted periodic cost estimates and risk analyses. The MBTA did eventually provide additional documents as well as explanations of why certain documents were missing. However, since this documentation and related information were not provided to the Office of the State Auditor (OSA) during our audit fieldwork, we could not perform the testing necessary to verify their accuracy and authenticity. Even if all the records the MBTA provided with its response are accurate, there is still a significant number of instances where there is no documentation to substantiate that required periodic cost estimates and risk analyses were conducted. Although the MBTA acknowledges that, in a number of instances, estimates were forgone in order to expedite projects, OSA believes these estimates are integral to the effective administration of these projects, are required by MBTA policy for all construction projects, and therefore should have been performed.

Based on its response, the MBTA is taking measures to address our concerns in this area. However, we again recommend that the MBTA establish effective monitoring controls to ensure that periodic project estimates and risk analyses are properly conducted and documented during various design phases of its capital construction projects as required by the MBTA Project Controls Manual.

2. The MBTA did not maintain an accurate Disinterested Bidders Database or investigate all prospective bidders.

The MBTA did not maintain an accurate database of "disinterested bidders," which it defines as bidders that were prequalified and submitted proposals but elected not to submit bids, or investigate all prospective bidders that had not submitted bids. According to MBTA officials, the agency's Capital Delivery Department uses information in the Disinterested Bidders Database to maximize the participation of potential vendors in the agency's solicitation of project bids.

For the 34 construction contracts that were competitively bid during our audit period, there were 31 disinterested bidders, but 8 of them were not listed in the Disinterested Bidders Database. In addition, for the same 34 contracts, the MBTA did not investigate 883 prospective bidders identified as Other Planholders on the MBTA Planholders Lists to determine whether they were prequalified bidders and, if so, determine their reasons for not submitting a proposal. The ongoing process of market research was agreed upon by the MBTA as a result of its 2011 external audit.

If the MBTA does not identify disinterested bidders, determine their reasons for not submitting bids, and accurately record and analyze that information, it cannot develop effective strategies to encourage more potential vendors to bid on future contracts and thus increase the pool of competitive bids.

Authoritative Guidance

In an MBTA construction audit report issued August 30, 2011 by an external auditor, the MBTA formally agreed to take the following management action:

> *Management will strive to broaden the bid list and gain a better understanding as to why pre-qualified bidders choose not to bid, including additional market research to determine why contractors do not bid.*

MBTA management has an ongoing responsibility to ensure that the information in the Disinterested Bidders Database is current and accurate in order to effectively analyze why some prequalified bidders choose not to bid. Further, to broaden its bid list, the MBTA should investigate its Other Planholders list to determine why prequalified bidders on this list do not submit proposals, when that is the case.

Reasons for Noncompliance

The MBTA had no written policies and procedures for updating information in the database or identifying and researching disinterested bidders.

Recommendation

The MBTA should develop written policies and procedures for updating information in the database and identifying and researching disinterested bidders, and it should establish monitoring controls to ensure that these policies and procedures are followed.

Auditee's Response

We gave the MBTA the opportunity to respond to our draft report and provide missing documentation. The following response, dated June 18, 2018, was germane to this finding:

> *The intent of outreach to Disinterested Bidders is to increase the total number of bidders for MBTA projects. Over the three (3) year audit period the average number of bidders per project increased. The MBTA is committed to focus on efforts to expand its bidding pool. For example, recently the MBTA held Contractor Forums in advance of the advertisements of the Green Line Extension (GLX) Design Build Project and the Cabot Yard and Maintenance Facility Improvements Project for which six teams bid on this $213.8M job.*

The MBTA maintains a Disinterested Bidders List on its construction contracts. This current list includes prequalified and eligible firms who were issued proposals but did not choose to bid. The planholders list includes, in addition to prequalified firms with issued proposals, subcontractors, vendors and other interested parties. The 883 "prospective bidders" identified are not in fact eligible to bid on the job as part [of] the 34 contracts reviewed. If a planholder is not eligible to submit a bid on a project, the MBTA does not consider the planholder to be a prospective bidder. Firms are deemed eligible to bid only if they are prequalified and have submitted a Request for Proposal (RFP) to the MBTA to become a prospective bidder. The MBTA's focus has been on determining why firms that were both prequalified and were issued proposals did not bid on contracts.

As a result of discussions during the audit process, the MBTA does agree that there is value in expanding the list of disinterested bidders to include those on the planholders list that are prequalified but that do not submit a Request for Proposal. This additional investigation should prove beneficial to the MBTA in generating a more robust bidding pool.

In summary, the MBTA will continue to update its disinterested bidder's list to include why prequalified contractors did not submit a proposal to become an eligible bidder. This research will be performed for each contract and updated accordingly in the disinterested bidder's list. This process will be outlined in the Contract Administration [Department's] Standard Operating Procedure (SOP).

In addition, based on the increase in average number of bidders per project over the audit period, and the MBTA's tracking and follow up with disinterested bidders, as defined by the MBTA and consistent with [the MBTA Contract Administration Department's] Standard Operating Procedures, the management action resulting from the August 30, 2011 [external auditor's] audit report stating that "Management will strive to broaden the bid list and gain a better understanding as to why pre-qualified bidders choose not to bid, including additional market research to determine why contractors do not bid . . ." has been satisfied.

In a subsequent response, dated July 26, 2018, the MBTA stated,

The MBTA has already begun reaching out to prequalified contractors to gain an understanding as to why they did not choose to bid on a project that they were eligible to bid on. This outreach has been performed by MBTA staff on recent construction procurements. This process has also been incorporated into [the Contract Administration Department's] Standard Operating Procedures.

Auditor's Reply

We do not dispute that the average number of bidders per MBTA project increased during our audit period or that the MBTA's actions in this matter were consistent with those recommended in the external audit report. However, OSA believes that by doing a better job of maintaining an accurate database of disinterested bidders and investigating why companies may not have submitted a bid, the MBTA could facilitate even better competition/bids with its projects.

The 883 prospective bidders we identified in our report all met the definition of "prospective bidder" in the MBTA's own procedures entitled "Governing Classification and Rating of Prospective Bidders." Although we acknowledge that not all of them were necessarily eligible to bid on MBTA projects, OSA believes the MBTA should have investigated them to determine which ones were prequalified, as discussed in the external audit report, to "gain a better understanding as to why pre-qualified bidders choose not to bid." This practice could have increased the average number of bids received per project over the audit period.

Based on its response, the MBTA is taking measures to address our concerns in this area.

3. The MBTA processed change orders without adequate documentation.

MBTA staff members did not always maintain documents for contract change orders. If all the supporting documentation is not present in the final change order package retained to support each change order, there is an increased risk of inaccurate payments to contractors.

The MBTA executed 356 change orders, totaling $79.4 million, on contracts that were active during the audit period. Of these 356, we selected a nonstatistical, random sample of 40, totaling $4.3 million paid to contractors. Our review determined that $3.3 million of change orders lacked at least one form of supporting documentation. We identified the following issues:

- Three out of 40 change order packages reviewed did not contain the Explanation of Necessity (EON), which documents a detailed scope of work to be performed and the reason the extra work is required. Change orders paid without evidence of an EON totaled $276,091.
- Two out of 40 change order packages reviewed did not contain the Record of Negotiation (RON), which documents that the contractor's proposal was reviewed in detail, correct rates were used, the final price was fair and reasonable, and variances between the proposed cost and the negotiated cost were explained. Change orders paid without evidence of a RON totaled $201,172.
- Four out of 40 change order packages reviewed did not contain the Independent Cost Estimate (ICE), which documents pricing details for the work to be performed and is used by the MBTA to analyze the contractor's proposal during negotiations. Change orders paid without evidence of an ICE totaled $237,172.
- Nineteen out of 40 change order packages reviewed did not contain the Contractor's Change Order / Risk Reallocation Check-Off List. Change orders paid without evidence of this checklist totaled $3,010,494.

Authoritative Guidance

The MBTA's Construction Contract Change Order / Risk Reallocation Guidelines for Costs and Supporting Documents, last updated in October 2015, states,

> *The final change order/risk reallocation package must present a clear scope of work [EON], a cost proposal from the contractor, an independent cost estimate [ICE] and a cost analysis that demonstrates how the final price was established [RON], providing clear definition of the elements of cost and the rates applied. . . .*
>
> *An Independent Cost Estimate (ICE) . . . is required for ALL change orders/risk reallocations and extra work orders regardless of nature or size. There is no exception to this requirement. Time and material change orders/risk reallocations and credit change orders/risk reallocations include this requirement. . . . Differences between the ICE and the Contractor's Proposal and the final settlement should be documented in the Record of Negotiation.*

Regarding the inclusion of the Contractor's Change Order / Risk Reallocation Check-Off List, the guidelines state,

> *Contractor's change order/risk reallocation Check-Off List is a standard tool to ensure that each change order/risk reallocation is well supported and in compliance with the MBTA Change Order/Risk Reallocation Guideline. It is best practice to fill out and include the Check-Off List with each change order/risk reallocation.*

The MBTA's response to its 2011 external audit indicated that the Contractor's Change Order / Risk Reallocation Check-Off List was required by its Construction Contract Change Order Guidelines for Costs and Supporting Documents (Revision 4, dated February 2010). According to Revision 7 of the guidelines, dated October 2015, the checklist is no longer required, but using it is considered a best practice.

Reasons for Noncompliance

Although the MBTA has established a Contractor's Change Order / Risk Reallocation Check-Off List to ensure that change orders are properly documented before they are paid, it does not require its contractors to use the list. This creates a lack of consistency in the use of the check-off list by the MBTA's contractors and a risk that certain documents may not be properly completed and retained when a contractor elects not to use the list, which is a control to prevent this problem from happening.

Recommendation

The MBTA should codify its Contractor's Change Order / Risk Reallocation Check-Off List as a required piece of supporting documentation for all change orders and should implement monitoring controls to ensure that its contractors complete this document.

Auditee's Response

In a response to this finding dated June 18, 2018, the MBTA stated,

> *The missing documents in the first three bullets [of Finding 3] of the audit all relate to the Salem Station and Parking Garage or the Beverly Station Parking Garage Projects. These two contracts were procured as part of a . . . project delivery method that the MBTA does very infrequently.*
>
> *The final bullet is specific to the Contractor's Change Order/Risk Reallocation Check-Off List. This document is located within the Construction Contract Change Order Guidelines for Cost and Supporting Documents. . . . This is a suggested document to be prepared by the Contractor not MBTA Staff. Page 6 of 75 of the Guidelines states the following:*
>
> *"Contractor's change order/risk reallocation Check-off List is a standard tool to ensure that each change order/risk reallocation is well supported and in compliance with the MBTA Change Order/Risk Reallocation Guidelines. It is best practice to fill out and include the Check-Off list with each change order/risk reallocation.* ***However, if the list is not provided with the change order/risk reallocation, it will not constitute a hold in processing the change.*** *This is a tool meant to assist the contractor in providing a complete proposal, which will expedite the change and payment process. Incomplete proposals will not be processed and payments for extra work may be delayed if the contractor's proposal is incomplete."*
>
> *This language indicates that it is the Contractor and not the MBTA that is responsible for the checklist. The guidance even acknowledges that this is a best practice and not a requirement. The purpose of the checklist is to help reduce the amount of time it takes to review and process a change order/risk reallocation. The MBTA reviews the documentation for completeness and appropriateness regardless of whether or not the contractor submits a checklist. Therefore, this finding is not appropriate to include in the audit as a finding since there is no requirement that a checklist be submitted and the MBTA does not rely upon the information contained in the checklist even when submitted.*

In a subsequent response, dated July 26, 2018, the MBTA stated,

> *It is important to note that although the Draft Audit states that certain change orders lacked at least one form of supporting documentation, the documentation noted was either not required per the MBTA Construction Contract Change Order Guidelines or upon review of the Draft Audit Report the MBTA was able to find the majority of the missing documents and did provide that information to the State Auditor prior to the issuance of the Final Audit Report. . . .*

The MBTA is committed to ensuring that change order packages are prepared according to MBTA procedures as outlined in the current MBTA Construction Contract Change Order Guidelines. The MBTA has recently created and filled a new position within the Capital Delivery Department, Director of Contractor Change Management, who is responsible for the completeness and quality of the change order package, including all supporting documentation. The MBTA is also in the process of finalizing the MBTA Construction Contract Change Order Manual, which is an update of and will replace the current MBTA Construction Contract Change Order Guidelines.

Lastly, the MBTA is proud of its commitment and level of review and documentation required prior to issuing any change order and would like to note that as part of the recent 2018 [Federal Transit Administration] Triennial Review, construction change order documentation was a noted area of performance.

Auditor's Reply

As noted above, during our audit, we found that the MBTA processed more than $3 million in change orders without adequate documentation. With its written response to our draft report, the MBTA provided copies of the following documents:

- the three missing EONs
- one of the two missing RONs
- two of the four missing ICEs

However, despite repeated requests, this information was not provided to OSA during our audit fieldwork, so we could not perform the testing necessary to verify its accuracy and authenticity. It should be noted that if OSA had been able to test and verify the accuracy of this information, the $3.3 million in inadequately documented change orders that we questioned could have been reduced to a balance of approximately $3 million.

Since the MBTA agrees that the purpose of the checklist is to help reduce the amount of time it takes to review and process a change order / risk reallocation and help contractors provide complete proposals, which will expedite the change and payment process, we again urge the MBTA to codify its Contractor's Change Order / Risk Reallocation Check-Off List as a required piece of supporting documentation for all change orders and implement monitoring controls to ensure that its contractors complete this document.

4. The MBTA did not effectively administer its construction contract bid analysis process.

The MBTA did not maintain an accurate Bid Comparison to Cost Estimate Database of information on all DBB projects, nor did it require contracted design engineers to perform a root cause analysis on each bid that varied from the engineer's estimate by more than 10%. For all of its DBB projects, the MBTA maintains a database of information used to compare the engineers' estimates to project bids. If a bid varied from the engineer's estimate by more than 10%, the MBTA did not ensure that its design engineer for the project analyzed it to determine why it was substantially different from the agency's estimates (when that was the case) or ensure that the design engineer documented its conclusions in a root cause analysis.

a. The MBTA did not ensure that information in its Bid Comparison to Cost Estimate Database was accurate.

We found several problems with the information in the MBTA's Bid Comparison to Cost Estimate Database:

- For four contracts, the MBTA used an incorrect engineer's estimate, resulting in an incorrect calculation of the variance between the estimate and the bids.
- For one contract, the MBTA used the wrong bid amount, resulting in an incorrect variance calculation.
- Two contracts were listed twice.

Without maintaining accurate information in the database, the MBTA is at risk of not capturing the appropriate information needed to calculate variances between project estimates and bids and could be analyzing erroneous data.

Authoritative Guidance

MBTA management is responsible for ensuring that the information in this database is complete and accurate so that the agency can use it to effectively administer the bid analysis process for construction contracts.

Reasons for Noncompliance

The MBTA did not provide a reason for data entry errors in the Bid Comparison to Cost Estimate Database. However, we found that management had not established effective monitoring controls to ensure that the data entered into the database were accurate.

b. The MBTA did not ensure that contracted design engineers performed a root cause analysis on each bid that varied from the engineer's estimate by more than 10%.

For the 29 DBB contracts, there were 108 bids received that varied from the engineers' estimates by more than 10%. The MBTA did not appear to have required the project's contracted design engineer to perform and document a root cause analysis for 93 of the bids. Without requiring design engineers to perform a root cause analysis on each bid that varies from the engineer's estimate by more than 10%, the MBTA is not taking all possible measures to ensure that the bids submitted by the low bidders for projects are reasonable (e.g., that a contractor did not submit an artificially low bid to win the contract, with the intent of increasing its compensation through contract change orders) or to determine whether the information used by its contracted design engineers in developing project cost estimates is complete and accurate, which could affect project budgeting.

Authoritative Guidance

Section 8 of the MBTA Project Manager's Manual Standard Operating Procedure, released January 27, 2014, states,

> *Contract Administration [a department within the Capital Delivery Department] maintains a database comparing the engineer estimates to actual bids. In the event a bid is received that varies from the engineers estimate by more than 10%, the engineer shall include in the bid analysis a Root Cause Analysis explaining the reasons for the variance.*

MBTA management is responsible for ensuring that all the requirements of its bidding procedure are followed.

Reasons for Noncompliance

MBTA management explained that a root cause analysis was only performed for the lowest bid that varied from the engineer's estimate by more than 10% and stated that there was no value in performing them on each bid that varied from the engineer's estimate by more than 10%.

Recommendation

MBTA management should establish effective monitoring controls to ensure that information is accurately recorded in the Bid Comparison to Cost Estimate Database and that a root cause analysis is performed for each bid received that varies from the engineer's estimate by more than 10%.

Auditee's Response

In a response to Finding 4a dated June 18, 2018, the MBTA stated,

> *The auditors identified four contracts (A90CN08, C72CN01, and S19CN01 & W46CN03) and indicated the MBTA used incorrect [engineer's estimate] data. The MBTA investigated this and confirmed that the engineer' estimate was incorrectly entered for two of the engineer's estimates. The correct engineer's estimate are as follows:*
>
> - *A90CN08—$4,539,149.00 (Entered Correctly)*
> - *C72CN01—$1,990,000.00—(The correct estimate is $1,199,00.00)*
> - *S19CN01—$11,163,297—(Entered correctly)*
> - *W46CN03—$1,980,531.00—(The correct estimate is $1,908,531.00)*
>
> *The report referenced in the DRAFT audit report does not reflect the comparisons of bids report that details the engineer's estimate compared to the low bidder as well as other bidders. The "Comparison of Bids" report is the official report that is utilized for official bid results that is published on the MBTA's web site. The engineer's estimate does sometimes change from the time it is advertised through the bid phase due to questions and clarifications that may result in changes to quantities within the bidding documents. However, as identified by the auditor, these estimates were incorrectly entered and the MBTA will take necessary steps to ensure this does not happen in the future. After bid openings, data entry will be reviewed and signed off by a Senior Manager.*
>
> *In response to bullet number 2 (For one contract, the MBTA used the wrong bid amount, resulting in an incorrect variance calculation) and bullet number 3 (Two contracts were listed twice), the MBTA offers the following response:*
>
> *For Contract No. A90CN06 the MBTA did enter the incorrect bid amount. The correct bid amount should be $13,570,000.00. Additionally, Contract No. R40CN01 was entered twice. The reason that this contract number was entered into the database twice was because the MBTA canceled the original R40CN01 bid after bid opening due to the need to revise the scope of the contract. Contract No. R40CN01 was rebid months later using the same contract number but with "Re-Bid" added to the contract title. MBTA Contract No. B73CN01 was the other contract that was listed twice. This contract should have only been listed once.*
>
> *Going forward the MBTA will provide more senior management review and controls to ensure that all engineer's estimates and bid values are accurately recorded and the process for review*

will be outlined in the Contract Administration [Department's] Standard Operating Procedure (SOP).

In a subsequent response, dated July 26, 2018, the MBTA stated, "Senior Managers within the Department are currently reviewing the MBTA cost estimate database on all contracts to ensure that Engineer's Estimates and bid values are accurately recorded."

In a response to Finding 4b dated June 18, 2018, the MBTA stated,

The intent of Section 8 (Bidding) of the MBTA Project Manager's Manual Standard Operating Procedure is to perform a root cause analysis in the event the low bid received varies from the engineer's estimate by more than 10%. A root cause analysis is performed on the low bid if the low bid is not within 10% of the engineer's estimate and typically the other bids are not analyzed. The MBTA has not required a root cause analysis on bids other than the low bid.

As a result of discussions during the audit process, the MBTA does agree that there is value in performing a root cause analysis on all bids if the low bid varies from the engineer's estimate by more than 10% to explain the variances. If the low bid falls within 10% of the engineer's estimate then the MBTA proposes that the Engineer of Record (EOR) perform a root cause analysis on the low bid only. All appropriate documents and manuals will be updated accordingly.

In a subsequent response, dated July 26, 2018, the MBTA stated,

The MBTA has also initiated steps to effectively administer its construction contract bid analysis, as well as ensuring that a root cause analysis is performed on bids varying by more than 10% of Engineer's Estimate.

Additionally, the MBTA has required its Engineer of Record (EOR), to perform a root cause analysis on the low bid only if the low bid varies by more than 10% of the Engineer's Estimate. The EOR has included review of market trends and recent bid comparisons on similar scope projects in their analysis. All steps referenced above have been incorporated into MBTA Standard Operating Procedures and appropriate manuals accordingly.

Auditor's Reply

As noted above, OSA found that the MBTA did not ensure that the information in its Bid Comparison to Cost Estimate Database was accurate. The Bid Comparison to Cost Estimate Database was provided to OSA by MBTA officials during the audit and was represented by MBTA management as the official accurate record of this information. Therefore, we used it in conducting our audit testing in this area. The Comparison of Bids report referred to in the MBTA's response was never provided to OSA or discussed with us during our audit fieldwork; therefore, we were unaware of its existence.

In its response, the MBTA asserts that two of the four engineers' estimates that OSA reported as incorrect in the MBTA's Bid Comparison to Cost Estimate Database (those for Contracts A90CN08 and S19CN01) were recorded correctly. However, when OSA attempted to reconcile the two engineers' estimates in that database to the amounts in three other MBTA databases (the Contract Bidder Info, Winning Bids Database; the Contract Bidder Info All Bids Database; and the Engineer Estimate and Actual Cost Variance Database), the amounts in those three databases matched one another but did not match those in the Bid Comparison to Cost Estimate Database. This supports our assertion that the estimates for these projects in the Bid Comparison to Cost Estimate Database were inaccurate.

Based on its response, the process the MBTA is following in reviewing its bids is unclear and does not appear to follow its Standard Operating Procedure, which requires a root cause analysis to be performed on bids that vary from the engineer's estimate by more than 10%. Specifically, in its June response to our draft report, the MBTA agreed that when the low bid varies by more than 10% of the engineer's estimate, there is value in reviewing all bids; however, when the low bid is within 10% of the engineer's estimate, the MBTA proposed to analyze only the low bid. In contrast, in its July response, the MBTA stated that it performs a root cause analysis on bids that vary from the engineer's estimates by more than 10%, while also stating that it analyzes low bids only if they vary from the estimates by more than 10%. OSA recommends that the MBTA follow its Standard Operating Procedure by performing a root cause analysis of any bid that varies from the engineer's estimate by more than 10%, regardless of the low bid amount. The analysis will provide the MBTA with the necessary information to ensure that it receives the most accurate pricing.

APPENDIX

MBTA Construction Contracts Awarded
July 1, 2014 through December 31, 2016

Contract Number	Description	Original Award Amount
E22CN04	Green Line Extension (GLX), Fitchburg Mainline Track and Miller's River Drainage Improvements	$ 116,635,126
E22CN06	GLX, Procurement of Viaduct Steel, Fabrication and Pricing of Installation	39,600,110
E22CN02	GLX, Long Lead Items, Cambridge, Medford, and Somerville	32,235,006
P42CN01	Orange Line Substations, Traction Power Station Service and Building Upgrades, Boston, Medford, and Malden	30,109,912
B64CN02	Rehabilitation of Merrimack River Bridge Piers, Haverhill	28,270,000
T40CN01	Red Line Signal Trough and Winter Resiliency Improvement Project, Boston	18,510,000
K78CN01	South Coast Rail Early Work, Grade Crossings Improvement Project, Taunton, New Bedford, and Freetown	18,367,000
E22CN03	GLX Early Utility Work, Phases 2/2A and 4, Cambridge/Somerville/Medford	18,042,718
R32CN01	Wellington Yard Expansion—Tracks 33–38, Medford	17,977,777
H62CN02	Repair/Rehabilitation of Beverly Drawbridge, Contract #2 Swing Span, Beverly/Salem	16,177,594
A90CN06	Downtown Crossing, Vertical Transportation and Station Improvements, Boston	13,570,000
B73CN01	Reconstruction of Shore Line Bridge, Boston	12,450,000
S19CN03	On-Call Construction Services—Track/Row, Systemwide	10,967,000
R18CN01	Everett Bus Maintenance Facility— Cellular Concrete Fill Project, Everett	9,997,350
S19CN01	On-Call Construction Services—General Transit, Systemwide	8,680,140
A90CN01	Andrew and Tufts Medical Center Station Elevator Modernization, Boston	7,767,000
H62CN01	Repair/Rehabilitation of Beverly Drawbridge over Danvers River, Approach Span, Beverly	7,282,033
C72CN03	Worcester Line Improvement Rail Installation, Framingham to Worcester	6,467,600
P63CN01	Systemwide Transformer Replacement, Phase II	5,844,317
R40CN01	Cabot Carhouse—Phase 1 Improvements, Re-advertisement, Boston	4,933,595
H73CN01	Reconstruction of LaGrange Street Bridge, Boston	4,480,000
T92CN01	Knowledge Corridor Underpass, Northampton	4,434,700
B91CN12	Emergency Bridge Repair 2, Systemwide	4,155,600

Contract Number	Description	Original Award Amount
A90CN08	Park Street Vertical Transportation Improvement—Replacement Project, Boston	4,000,000
H74CN10	Reconstruction of Guild Street Bridge, Norwood	3,951,500
U90CN01	Underground Storage Tank Replacement Program, Systemwide	3,489,415
R20CN01	Work Platform for Riverside Carhouse, Newton	2,574,100
P90CN01	Bridgewater Wind Turbine, Bridgewater	2,282,885
Y44CN02	Rehabilitation of Red Line Tunnel Spall Repairs, Boston, Cambridge, and Somerville	2,061,250
C72CN02	Worcester Commuter Rail De-stressing Project, Framingham	1,990,800
B01CN01	Rehabilitation of Savin Hill Overpass, Boston	1,568,248
W46CN03	South Shore Garages, Urgent Repairs, Quincy and Braintree	1,465,012
C72CN01	Worcester Commuter Rail Line, Track and Signal System Improvements, Boston to Worcester	1,113,100
D74CN01	Data Center Upgrade Project, Boston	867,860
S90CN01	Braintree and Lechmere Canopy Repairs, Braintree and Cambridge	641,390
R54CN01	Stabilization Repairs—Initial Phase, Alford Street Bus Facility—Sea Wall and Drainage Structures, Boston	335,332
T32CN01	Emergency Resiliency Repairs at Malden Culvert	218,347
S03CN08	Pemberton Point Ferry Dock Emergency Repair, Hull	61,835
R28CN01	Watertown Exhaust Stack Demolition, Watertown	30,601
Total		$ 463,606,253