U.S. DEPARTMENT OF TRANSPORTATION
OFFICE OF INSPECTOR GENERAL

QUALITY CONTROL REVIEW FOR DOT's IMPLEMENTATION OF ENTERPRISE ARCHITECTURE

Report No. QC2018013

December 20, 2017

U.S. DEPARTMENT OF TRANSPORTATION
OFFICE OF INSPECTOR GENERAL

Highlights

Quality Control Review for DOT's Implementation of Enterprise Architecture

Self-Initiated

Departmentwide | QC2018013 | December 20, 2017

What We Looked At

This report summarizes the results of an audit of DOT's implementation of enterprise architecture (EA) practices. DOT relies on over 450 information technology systems to conduct business and meet its mission. In 2012, OIG conducted an enterprise architecture-related audit. The Clinger-Cohen Act of 1996 requires each Federal department to develop and maintain an EA to integrate, plan changes, and avoid duplication of information systems. An effective EA can improve information security practices and help optimize the use of limited information technology resources.

We contracted with KPMG LLP, an independent public accounting firm, to conduct this audit subject to our oversight. The audit objectives were to (1) determine whether DOT has an effective enterprise architecture program and (2) to assess its progress in developing its departmentwide EA and an EA performance measurement system. KPMG found that DOT's EA program is not fully matured, integrated, and consistently implemented across the Department's Operating Administrations.

What We Found

We performed this QCR of KPMG's report and related documentation. Our QCR disclosed no instances in which KPMG did not comply, in all material respects, with generally accepted Government auditing standards.

Recommendations

DOT concurs with KPMG's 11 recommendations.

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U.S. DEPARTMENT OF TRANSPORTATION
OFFICE OF INSPECTOR GENERAL

Memorandum

Date: December 20, 2017

Subject: ACTION: Quality Control Review for DOT's Implementation of Enterprise Architecture | Report No. QC2018013

From: Louis C. King
Assistant Inspector General for Financial and Information Technology Audits

To: Chief Information Officer, DOT
National Highway Traffic Safety Administrator
Federal Highway Administrator
Federal Railroad Administrator
Federal Transit Administrator
Pipeline and Hazardous Materials Safety Administrator

This report summarizes the results of an audit of the Department of Transportation's (DOT) implementation of enterprise architecture (EA)[1] practices. DOT relies on over 450 information technology (IT) systems to conduct business and meet its mission. In 2012, OIG conducted an enterprise architecture-related audit.[2]

The Clinger-Cohen Act of 1996[3] requires each Federal department to develop and maintain an EA to integrate, plan changes, and avoid duplication of information systems. An effective EA can improve information security practices and help optimize the use of limited information technology resources.

We contracted with KPMG LLP, an independent public accounting firm, to conduct this audit subject to our oversight. The audit objectives were to (1) determine whether DOT has an effective enterprise architecture program and

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[1] An EA defines an agency's mission, the information and technologies necessary to perform the mission, and the transitional processes for implementing new technologies in response to changing mission needs. EA includes a baseline (as-is) and target (to-be) architecture, and a sequencing plan.
[2] *DOT Does Not Have An Effective Enterprise Architecture Program for Management of Information Technology Changes* (OIG Report No. FI-2012-086), April 17, 2012.
[3] The Clinger-Cohen Act (formerly the Information Technology Management Reform Act), Public Law No. 104-106 (1996), codified at 40 U.S.C § 11101 *et seq.*

(2) to assess its progress in developing its departmentwide EA and an EA performance measurement system.

KPMG found that DOT's EA program is not fully matured, integrated, and consistently implemented across the Department's Operating Administrations (OA). KPMG made the following recommendations to improve DOT's EA program.

KPMG recommends that Office of the Secretary of Transportation direct the Chief Information Officer to:

1. Work with the OAs' Chief Information Officers to conduct the required annual assessment of DOT's and the OAs' EA programs against the Government Accountability Office's EA Management Maturity Model.

2. Supplement the existing DOT EA policy with operational guidance to clarify EA artifacts required by the DOT EA policy.

3. Require that EA artifacts illustrating implementation and execution of EA are in accordance with DOT EA policy.

4. Retain evidence of the required EA artifacts.

KPMG recommends that National Highway Traffic Safety Administration:

5. Formally approve and distribute its OA level EA policy; otherwise the OA will rely on the DOT EA policy.

6. Retain evidence of the training provided to individuals with EA IT responsibility.

KPMG recommends that Federal Highway Administration:

7. Formally approve and distribute its OA level EA policy; otherwise the OA will rely on the DOT EA policy.

KPMG recommends that Federal Railroad Administration:

8. Retain evidence of the training provided to individuals with EA IT responsibility.

KPMG recommends that Federal Transit Administration:

9. Retain evidence of the training provided to individuals with EA IT responsibility.

KPMG recommends that Pipeline and Hazardous Materials Safety Administration:

10. Produce and maintain evidence of EA reviews of IT investment risks that demonstrate alignment with appropriate DOT EA segments and DOT and OA EA standards.

11. Retain evidence of the training provided to individuals with EA IT responsibility.

We performed this quality control review (QCR) of KPMG's report, dated September 26, 2017 (see attachment), and related documentation. Our QCR, as differentiated from an audit engagement performed in accordance with generally accepted Government auditing standards, was not intended for us to express, and we do not express, an opinion on DOT's implementation of EA. KPMG is responsible for its independent auditor's report and the conclusions expressed in that report. Our QCR disclosed no instances in which KPMG did not comply, in all material respects, with generally accepted Government auditing standards.

We appreciate the courtesies and cooperation of Department of Transportation representatives during this audit. If you have any questions concerning this report, please call Louis C. King, Assistant Inspector General for Financial and Information Technology Audits, at (202) 366-1407.

cc: The Secretary
DOT Audit Liaison, M-1

Agency Comments and OIG Response

We provided DOT with our draft report on November 14, 2017, and received its formal response on December 14, 2017. DOT's response is included in its entirety as an appendix to this report. DOT concurs with all 11 of KPMG's recommendations and provided appropriate actions and completion dates.

Actions Required

We consider all 11 recommendations resolved and open pending completion of planned actions.

Exhibit. List of Acronyms

DOT	Department of Transportation
EA	enterprise architecture
IT	information technology
OA	Operating Administration
OIG	Office of Inspector General
QCR	quality control review

Appendix. Agency Comments

U.S. Department of Transportation
Office of the Secretary
of Transportation

Memorandum

Subject:	**INFORMATION:** Management Response to the Office of Inspector General (OIG) Draft Report—Quality Control Review for DOT's Implementation of Enterprise Architecture
Date:	December 14, 2017

From: Stephen Holden
Associate Chief Information Officer
 for IT Policy and Oversight

STEPHEN HUDSON HOLDEN

Digitally signed by STEPHEN HUDSON HOLDEN
DN: c=US, o=U.S. Government, ou=OSTHQ,
ou=DOT Headquarters, cn=STEPHEN HUDSON HOLDEN
Date: 2017.12.14 10:45:45 -05'00'

To: Louis C. King
Assistant Inspector General for
Financial and Information Technology Audits

The Department of Transportation (DOT) is committed to ensuring that all Operating Administrations (OAs) follow and apply the Enterprise Architecture (EA) best practices and   procedures as defined in the *DOT Order 1351.27, Enterprise Architecture Policy*. As the OIG noted in its draft report, DOT has taken efforts to develop a department-wide EA program since OIG's prior review in 2012. Going forward, DOT will continue to emphasize to all OAs the importance of following the EA guidelines documented in its policy, while highlighting the need to retain pertinent EA artifacts.

Upon review of the OIG's draft report, we concur with all the recommendations as written. We plan to implement each recommendation by the following dates:

RECOMMENDATION	TARGET ACTION DATE
3,4, 5, 6, 7, 8, and 9	March 1, 2018
10	May 1, 2018
2	June 1, 2018
11	March 1, 2018
1	January 2, 2019

We appreciate the opportunity to review the OIG draft report. Please contact Donald Buskard, Chief Enterprise Architect, at 202-366-9713 with any questions.

Attachment.
Independent Auditor's Report

The Department of Transportation (DOT) Enterprise Architecture (EA) Performance Audit

For the Period February 23, 2017 through September 26, 2017

Prepared for: U.S. Transportation
Office of the Inspector General

As of September 26, 2017

KPMG LLP
1676 International Drive
Mclean, VA 22102

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Mr. Louis King
Assistant Inspector General for Financial and Information Technology Audits
1200 New Jersey Avenue, SE
Washington, DC 20590

KPMG LLP (KPMG) has been tasked by the Department of Transportation (DOT or Department), Office of the Inspector General (OIG) to conduct a performance audit of DOT's Enterprise Architecture (EA) organizational capability to assess how mature DOT is in implementing EA. This report presents the results of our work conducted to address the performance audit objectives relative to the independent evaluation of the United States DOT Implementation of EA in support of the fiscal year (FY) 2017. The engagement audit period was from September 28, 2016 through September 26, 2017. We performed our work from February 23, 2017 through September 26, 2017, and our results are as of September 26, 2017

We conducted our audit work in accordance with Generally Accepted Government Auditing Standards (GAGAS), and the American Institute of Certified Public Accountants (AICPA) Standards for Consulting Services. 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 objectives of our audit were to (1) determine whether DOT has an effective EA program, and (2) to assess its progress in developing its department-wide EA and an EA performance management system. Our detailed audit objectives are outlined in the "Objectives" section of the report. To accomplish our objectives, we met with the Department and the Operating Administrations (OAs) Chief Information Officers (CIO) and Chief Enterprise Architects to determine the progress of DOT's Department-wide EA development, EA performance management system, as well as, the status of each OAs EA.

Based upon the performance audit procedures conducted and the results obtained, we have met our audit objectives aforementioned above. We conclude that for the testing period February 23, 2017 through September 26, 2017, DOT has taken efforts to develop a Department-wide EA program and EA performance management system; however it's not fully matured, integrated, and consistently implemented across ten (10) of the Department's OAs. Therefore, we are making a series of recommendations to assist the Department in its progress to integrate a mature Department-wide EA program across its OAs based on the five (5) deficiencies below identified during fieldwork:

1. **Inconsistencies existed with OA implementation of the DOT EA Policy.**

2. **National Highway Traffic Safety Administration (NHSTA), Federal Highway Administration (FHWA) EA policy was not approved or distributed.**

3. **Federal Railroad Administration (FRA), Federal Transit Administration (FTA), NHTSA, Pipeline Hazardous Materials Safety Administration (PHMSA) lack evidence that required EA training was provided.**

4. **PHMSA lack proactive identification, reporting and mitigation of EA-related risks.**

5. **Office of the Secretary (OST) did not provide requested EA process documentation.**

The five (5) deficiencies resulted in eleven (11) recommendations communicated to DOT management prior to the issuance of this report. The eleven (11) recommendations are contained in Section V, Findings and Recommendations, of this report.

We also reviewed eight (8) OIG prior year recommendations related to DOT's EA Policies and Procedures to determine their current status. In summary, all prior year recommendations were implemented and closed. Appendix 3, Status of PY Findings, provides the DOT's progress in addressing prior year recommendations from the OIG report FL-2012-086 dated April 17, 2012, DOT Does Not Have an Effective Enterprise Architecture for the Management of Information Technology Changes. Appendix 2 contains a glossary of terms used in the report.

This performance audit did not constitute an audit of financial statements in accordance with GAGAS and AICPA standards. For this performance audit engagement, we were not engaged to, and did not, render an opinion on DOT's internal controls over its financial report or financial management systems. KPMG cautions that projecting the results of our evaluation to future periods is subject to risks that controls may become inadequate because of changes in conditions or because compliance with controls may deteriorate.

KPMG LLP

BACKGROUND

Sections 53 and 300 of Office of the Management Budget (OMB) Circular A-11, "Preparation, Submission, and Execution of the Budget," and Circular A-130, "Management of Federal Information Resources," establish policy for the management of Federal information resources, and require Federal agencies to align their IT investments to their EAs.

Clinger-Cohen also requires each agency's CIO to develop, facilitate the implementation of, and maintain an agency-wide EA program that integrates agency business processes with agency goals. These EA programs are to establish baseline and target architectures, and transition plans for program management and investment decisions.

In September 1999, the Federal CIO Council published the Federal Enterprise Architecture Framework (FEAF) to provide Federal agencies with a common construct for their architectures, and facilitate the coordination of system investments among Federal agencies. A FEAF model describes an agency's business, the data necessary to conduct the business, applications to manage the data, technology to support the applications, and security measures that ensure the protection of information resources. In August 2010, GAO issued A Framework for Assessing and Improving EA Management (Version 2.0), an update of a 2003 version. In June 2009, OMB issued EA Framework v 3.1.

The EA defines the agency's mission, the information and technologies necessary to perform the mission, and the transitional processes for implementing new technologies in response to changing mission needs. EA includes a baseline (as-is) and target (to-be) architecture, and a sequencing plan. The overall approach to developing the DOT EA began with establishing a framework at the Department level. The DOT EA framework consists of a DOT-specific set of reference models that adapt the OMB Federal Enterprise Architecture (FEA) reference models. The DOT EA framework specifies artifacts, which will be used to collect data and information about the Department's Information Technology (IT) investments and IT standards. The OAs populate the EA artifacts with data about their specific IT investments.

The DOT EA framework provides a comprehensive overview of how DOT IT investments support the Department in accomplishing its mission. The EA framework establishes consistent, decomposable views of all the transportation missions, OA business units, programs, investments, systems, data, infrastructure, networks and business support services. In addition, the EA framework also establishes and extends EA standards identified in the FEA to include the reference models and sub-architecture domain artifacts, which are to be applied to development of segment architectures. These EA standards can be further extended by the OAs as necessary in order to serve their unique mission requirements.

The DOT EA is managed and governed through a set of supporting boards, processes and tools. These include but are not limited to a Charter, the EA Program Management Plan, and a maturity model to measure the effectiveness of the DOT EA program. Regular assessment of a department-wide EA program requires a repository for the storage of EA-related information from the Department's components, such as summaries of IT investment portfolios, metrics for investment performance, data from IT applications, and plans for security maintenance. This repository stores the information in a readily retrievable form. It may be as simple as a shared directory with Department EA artifacts, or it may include databases, web portals or EA specific modeling tools. The repository also facilitates information sharing among components so they can avoid redundancies in their IT applications and systems.

The Office of the Chief Information Office (OCIO) is responsible for establishing the requisite policies and procedures to govern the Department's OAs means for managing investments within the IT portfolio, including policies and procedures related to IT capital planning and investment control (CPIC), EA, program management, and project management. Policies and procedures should reflect OMB guidance, including provisions for incorporating EA. In addition, the OAs within DOT are responsible for implementing the policies and procedures promulgated by OCIO in a manner consistent with underlying EA objectives. Furthermore, DOT on an annual basis reports to OMB on the dollar value of its investments and major IT investments (MITIs) department-wide, including the OAs.

We accessed the OMB Federal IT Dashboard (www.itdashboard.gov) and noted that as of the final FY 2017 IT Dashboard agency submissions (June 31, 2017), the total DOT IT Portfolio, including details about the number and dollar value of investments and major investment and the CIO's risk factor associated with the portfolio, as shown in Table I:

Table I: DOT FY 2017 IT Portfolio

Department	Evaluation by Agency CIO[1]	Total FY 2017 IT Spending	Number of Investments	MITIFY 2017 Spending	Number of MITIs
Department of Transportation (DOT)	3	$3.4 B	335	$2.1 B	41

KPMG's test procedures required us to select a sample of MITIs (refer to the "Scope" section of the report for the MITIs selected) from the total population of ten (10) OAs noted in the below Table II. To do so, we employed a risk-based approach based upon the CIO agency risk score and dollar amount invested by the Department, to determine a subset of DOT's MITIs by OA for the EA performance audit. The population for this subset only included MITIs that are operational. Accordingly, our report recommendations are applicable to the sample we tested and were not extrapolated to the population (i.e. OAs and MITIs); which is described in Table III below. Table II provides the OA IT Investment and MITI data and investment spending by OA:

Table II: IT portfolio by OA

DOT OAs	Evaluation by Agency CIO[1]	Total FY 2017 Spending	Number of Investments	Major FY 2017 Spending	Number of MITIs
FAA*[2]	4	$2.9 B	140	$1.9 B	26
FHWA*	3	$62.3 M	48	$6.7 M	2
FMCSA*	3	$75.0 M	25	$11.5 M	2
FRA	3	$17.0 M	16	$1.3 M	1
FTA	5	$21.9 M	10	$4.9 M	2
MARAD	3	$19.4 M	20	$0.4 M	1
NHTSA*	4	$51.1 M	18	$10.6 M	2

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[1] Evaluation ratings are based on a five-point risk scale. The Agency CIO rates each investment based on his or her best judgment, using a set of pre-established criteria. As a rule, the Evaluation should reflect the CIO's assessment of the risk and the investment's ability to accomplish its goals. The rankings are as follows:

5 – Low Risk, 4 – Moderately Low Risk, 3 – Medium Risk, 2- Moderately High Risk, 1 – High Risk.

[2] *- Indicates these OAs were included as part of our OAs sampled for MITI testing illustrated in Table IV.

DOT OAs	Evaluation by Agency CIO[1]	Total FY 2017 Spending	Number of Investments	Major FY 2017 Spending	Number of MITIs
OIG*[3]	3	$4.1 M	2	$0.0 M	1[4]
OST*	3	$225.8 M	56	$135.6 M	4
PHMSA	3	$29.4 M	13	$0.5 M	1
SLSDC	3	$0.8 M	3	$0.1 M	1[5]
				Total: $173.5M	

KPMG noted that FAA IT Investments constitute approximately 85% of DOT's Total FY2017 spending, and over 92% of spending for MITIs. FAA's major IT portfolio value is $1.9 billion dollars, while the combined portfolio size of the other ten (10) OAs selected is $173.5 million dollars.

I.   OBJECTIVES

We conducted a performance audit to (1) determine whether DOT has an effective EA program, and (2) to assess its progress in developing its Department-wide EA and an EA performance management system. KPMG assisted the DOT OIG in evaluating the maturity of EA policies, practices, and data for the period going from February 23, 2017 to September 26, 2017. Our objectives included the following:

- Determine whether the Department's enterprise architecture framework is well-defined and is using approved standard and/or customized versions and templates.
- Determine whether EA processes are documented across the Department.
- Determine whether EA performance metrics are being tracked and monitored in relationship to other general practices and process areas.
- Determine if IT investment managers are ensuring that project management principles, including the appropriate use of EA, are applied to their investment(s).
- Determine if IT investment are managed and monitored against their approved performance measurement baselines (PMB) and that the IT investment manager performs EA as an integral part of standard investment management operations.
- Determine if IT investment managers us EA to manage and measure investment outcomes.
- Determine if IT investment managers comply with the Department requirements for reporting EA status of investments.

We were also tasked with reviewing the DOT implementation and execution of eight (8) recommendations made in the OIG report FI-2012-086, *DOT Does Not Have an Effective Enterprise Architecture Program for Management of Information Technology Changes.* The follow-up, procedures performed, and conclusions made are further detailed in Appendix 3 of this report. The prior year OIG 2012 recommendations are as follows:

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[3] *- OST and OIG are considered to be one OA; therefore the purpose of the report we're reporting 10 OAs. In addition, OST was included as part of our OAs sampled for MITI testing illustrated in Table IV.
[4] Not Applicable (N/A) - Not considered in our scope due to the investment projects being small and limited in nature, not requiring EA. The investment requires of spending of greater than 10 million and no less than 20 million.
[5] N/A - Not considered in our scope due to the investment projects being small and limited in nature, not requiring EA. The investment requires of spending of greater than 10 million and no less than 20 million.

1. Develop and/or revise the Department's EA policy and procedures to address the following:
   a. Development, maintenance, and use of EA in the IT investment process;
   b. Incorporation of the Department's Governance groups into the CPIC and Enterprise Architecture processes to provide oversight and improved decision making relating to IT investments, including security funding;
   c. Creation of a standardized methodology that provides reliable estimates of security funding needed for system investments;
   d. Development and implementation of performance measures to gauge the Department's application of EA, including investments in system security; and
   e. Tracking and formal documentation of EA changes;
2. Assist components in the selection and implementation of compatible EA tools that will facilitate the creation of a Department-wide EA;
3. Input the required data (such as business processes, workflows, and technology in use) in the selected EA tools to develop or update current and future architectures and transition plans;
4. Develop and implement a Department-wide data management practice that provides a common data dictionary that reflects commonalities in data and processes and provides methods for sharing information across the Department;
5. Develop a process to measure OAs EA programs' maturity and effectiveness using key framework elements outlined in OMB's Enterprise Architecture, and develop a plan to remediate any gaps or deficiencies found;
6. Develop a plan and work with the components to identify redundancy in current operations and technology use across the Department;
7. Identify and report EA performance measure results, outcomes and progress to DOT's Governance groups and decision makers to ensure that they have the proper information to make EA and related information security decisions;
8. Create a Department-wide EA that is consistent with OMB and Government Accountability Office (GAO) frameworks and meets the requirements of the Clinger-Cohen Act.

II. SCOPE

The performance audit procedures are designed to evaluate the implementation of EA and reporting practices over the DOT five (5) OAs and ten (10) MITIs[6] selected by KPMG, which are summarized in Table III and IV below. Table III depicts the five (5) OAs assessed in our EA scope, and Table IV illustrates the ten (10) MITIs selected per OA in scope.

Table III: Scope of OAs Selected for Testing

OAs
Federal Aviation Administration (FAA)
Office of the Secretary (OST)
Federal Highway Administration (FHWA)
Federal Motor Carrier Safety Administration (FMCSA)
National Highway Traffic Safety Administration (NHTSA)

Table IV: Scope of MITIs Selected for Testing

MITIs
FAA: Instrument Flight Procedure Automation (IFPA)
FAA: Terminal Flight Data Manager (TFDM)
FAA: Terminal Automation Modernization and Replacement Program
FAA: ERAM System Enhancements and Tech Refresh
FAA: NextGen Research & Development (R&D) Portfolio
FMCSA: Unified Registration System
OST: Delphi Version Two
OST: DOT Common Operating Environment
FHWA: Fiscal Manager Information System 5.0 (FMIS 5.0)
NHTSA: Crash Data Acquisition Network

The procedures are designed to gain an understanding of how the DOT OAs implement the EA framework consistent with the following principles:

➢ Develop information systems that facilitate interoperability, application portability, and scalability, of electronic applications across networks of heterogeneous hardware, software, and telecommunications platforms.
➢ Meet information technology needs through cost effective intra-agency sharing, before acquiring new information technology resources.
➢ Establish a level of security for all information systems that is commensurate to the risk and magnitude of the harm resulting from the loss, misuse, unauthorized access to, or modification of the information stored of flowing through these systems.

III. METHODOLOGY

We conducted this performance audit in accordance with the performance audit standards contained in GAGAS, issued by the Comptroller General of the United States, and the AICPA Standards for Consulting Services. . The engagement was performed in three phases: (1) planning, (2) testing and interviewing and (3) report writing.

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[6] "Major" investment refers to an IT investment requiring an OMB Exhibit 300 business case.

The planning phase was designed to help ensure that team members developed a collective understanding of the EA practices in place for the ten (10) OAs and the ten (10) MITIs. We provided separate questionnaires to each OA and to each major investment project team. The questionnaires are designed to provide a foundational understanding for conducting interviews and for identifying additional documentation requests and, in some cases, provide completed and final responses to inquiries.

During the testing and interviewing phases, we conducted interviews, collected and inspected artifacts, participated in process walkthroughs, and designed and performed test procedures. We conducted these test procedures primarily at DOT headquarters and FAA facilities in Washington D.C. Testing procedures over the EA are based on the Federal legislation, policies and industry standards.

KPMG's test procedures required us to select a sample of MITIs from a population of OAs for testing. To do so, we employed a risk-based approach based upon the CIO agency risk score and dollar amount invested by the Department to determine a subset of DOT's MITIs by OA. The population for this subset only included MITIs that are operational. Accordingly, our recommendations are applicable to the sample we tested and were not extrapolated to the population (i.e. OAs and MITIs).

The report writing phase entailed writing a draft report, conducting an exit conference, providing a formal draft report to the OIG for review, and preparing and issuing the final report. In addition, the OIG's Quality Control Review (QCR) will include management's response to the report; which will be provided through the OIG.

IV.   OBSERVATIONS

DOT has taken some efforts to develop a Department-wide EA program and EA performance management system, as required by the Clinger-Cohen Act of 1996; In 2013, the Department developed and implemented its EA Policy and Framework to be applied department-wide. However, the program has not been fully matured, integrated, and consistently implemented across the Department's OAs.

OMB's guidance states that each Department should measure its EA activities against quality standards, and that, in order for management to benefit from EA, each department should regularly report EA quality measurements to appropriate officials. We noted the OCIO has begun to set-up department-wide governance boards which will be responsible for the implementation and oversight of the EA policy.

In addition, we noted DOT does not have a department-wide EA program. Instead, DOT has assigned authority for EA development to its OAs, but has yet to integrate their individual EA programs into a Department-wide program. In addition, the OAs EA programs are incomplete. Specifically, they have not approved/distributed their EA policies and guidance, and/or delivered EA trainings consistently; which is documented as part of Findings 1-5 below. Without an adequate department-wide EA maturity assessment mechanism (including at the OA level), DOT may experience EA implementation efforts are that incomplete and immature.

Section V below provides the detailed "Findings and Recommendations" of our report.

V.   FINDINGS AND RECOMMENDATIONS

1. Inconsistencies existed with OA implementation of the DOT EA Policy.

Condition
The DOT OCIO has not completed an annual assessment of its EA program using the GAO EA management maturity framework, as required by its EA policy. In addition, OA Enterprise Architects have not actively assessed the maturity level of its EA OA level programs in accordance with the DOT EA Policy, due to the gaps we identified across selected OA's below. Specifically, we noted several OAs EA development and implementation efforts were missing key requirements/artifacts due to insufficient evidence being provided, as required by DOT EA Policy and FEA standards. Specifically, we noted the following gaps across several OAs:

FAA:

- Does not have a Human Capital plan for personnel responsible for EA and/or for activities that involve EA.

FHWA, FRA, FTA, PHMSA:

- Management has not identified EA product quality standards. We noted the following EA product quality attributes namely; product completeness, usability, consistency, and accuracy are not measured and/or reported to the Department.

FTA, NHSTA, PHMSA:

- Management does not have a Work Breakdown Structure (WBS) and schedule to develop EA.

While we recognize DOT has taken efforts to establish EA working group sessions to involve OAs in EA implementation; implementation at the OA level is uneven. FAA, FHWA, FRA, FTA, PHMSA, and NHSTA OA management was unable to provide supporting evidence of requested EA artifacts were in place for selected investments per DOT EA policy. While the DOT EA policy has defined EA requirements/artifacts for OA EA implementation, interviews with OA staff uncovered a lack of sufficient knowledge or understanding of those EA policy requirements essential to ensure OA level EA's are complete/compatible and support the overall DOT EA Policy and Program Metrics Plan. Without an adequate department-wide EA management maturity assessment (including at the OA level), DOT may experience EA implementation efforts at the OA level that are incomplete and immature.

The DOT EA Policy requires the following:

- Section 27.5.6.5 [Component Enterprise Arch shall] …Conduct an annual assessment of the DOT EA program using the GAO EA Management Maturity Framework.

- Section 27.4.9. The DOT EA Program shall be evaluated in accordance with the GAO EA Maturity Management Framework.

- Section 27.4.1.3- The DOT shall document its EA using artifacts as prescribed by the OMB common approach to FEA.

- Section 27.4.2- The DOT EA shall document a minimum set of IT standards in accordance with established FEA reference models.

We recommend OST:

1 OCIO work with OA CIOs to conduct the required annual assessment of the Department and OA EA programs against the GAO EA Management Maturity Model.
2 Supplement the existing DOT EA Policy with operational guidance to clarify EA artifacts required by the DOT EA policy.

2. NHSTA and FHWA EA policy was not approved or distributed.

Condition
We noted the NHTSA and FWHA OA management had not approved their OA EA level policy even though both OAs indicated they had OA-level EA standards that support DOT EA policy.

There was a lack of NHTSA and FHWA management oversight which led to management not producing documentation of OA-level EA policy.

Without documented OA-level EA policy and standards, these OAs could not ensure EA efforts are enforceable or consistent with Department-wide EA policy.

The DOT EA Policy requires the following:
- 27.4.2-The DOT EA shall document a minimum set of IT standards in accordance with established FEA Reference Models.
- 27.4.5- Each DOT component shall maintain architecture data and artifacts for currency and validity, as well as track and document changes in order for data and artifacts to be tested in planning and decision making.
- 27.4.1.3- The DOT shall document its EA using artifacts as prescribed by the OMB common approach to FEA.

We recommend NHTSA:
3 Formally approve and distribute their OA level EA policy, otherwise the OA will rely on the DOT EA policy.
   We recommend FHWA:
4 Formally approve and distribute their OA level EA policy, otherwise the OA will rely on the DOT EA policy.

3. FRA, FTA, NHTSA, PHMSA lack evidence that required EA training was provided.

Condition
During testing we noted that FRA, FTA, NHTSA, and PHMSA OA management indicated they provided training of staff for EA, but did not provide copies of the requested training content when requested.

FRA, FTA, NHTSA and PHMSA management were unable to provide supporting evidence that EA training is provided to appropriate personnel on a periodic basis, per DOT EA Program Metrics Plan.

Lack of formal training documentation relating to EA may result in a lack of clarity on whether personnel received appropriate training on the strategic direction and vision of the EA program office.

The DOT requires the following:
- DOT EA Policy 27.4.2- Each OA shall develop an architecture that documents IT standards in use and alignment with Department level IT standards.
- DOT EA Policy 27.4.5- Each DOT component shall maintain architecture data and artifacts for currency and validity, as well as track and document changes in order for data and artifacts to be tested in planning and decision making.
- DOT EA Program Metrics Plan, dated 2015: EA stakeholders, including the architects, require formal architecture training. To be successful, an EA team must have skilled and talented resources. Training will help participants understand the interdependencies between systems, applications, and infrastructure as well as how to use EA and other tools to document those items. Training is also important for those who use the EA to make decisions and modules will be developed to help them understand what parts of the EA and how it can help them make more informed decisions. The courses offered as well as the feedback received from participants will be measured and documented.

We recommend FRA:
5   Retain evidence of the training provided to individuals with EA IT responsibility.

We recommend FTA:

6   Retain evidence of the training provided to individuals with EA IT responsibility.

We recommend NHSTA:

7   Retain evidence of the training provided to individuals with EA IT responsibility.

We recommend PHMSA:

8   Retain evidence of the training provided to individuals with EA IT responsibility.

4. PHMSA lack proactive identification, reporting and mitigation of EA-related risks.

Condition
During testing, we noted that PHMSA Operating Administration (OA) management did not document how IT investments were aligned to appropriate DOT Enterprise Architecture (EA) segments. As a result, we were unable to validate how PHMSA IT investments were consistent with Department and OA EA standards as required the DOT EA policy.

KPMG noted, PHMSA management was unable to provide sufficient evidence supporting how IT investments were aligned with appropriate DOT EA segments and consistent with Department and OA EA standards per DOT EA policy. Lack of EA related risks being identified, reported and mitigated can result in low performance of the EA program deployment.

The DOT EA Policy requires the following:
- Section 27.4.1.1- Each DOT component shall align its IT investment with its architecture to the appropriate DOT EA segments, DOT reference models and FEA reference models.
- Section 27.4.2- Each OA shall develop an architecture that documents IT standards in use and alignment with Department level IT standards.
- Section 27.4.5- Each DOT component shall maintain architecture data and artifacts for currency and validity, as well as track and document changes in order for data and artifacts to be tested in planning and decision making.

We recommend PHMSA:

9 Produce and maintain evidence of EA reviews of IT investment risks that demonstrate alignment with appropriate DOT EA segments and DOT and OA EA standards.

5. OST did not provide requested EA process documentation.

While performing the testing over the EA policy and program implementation for the DOT OST, Major Investment Delphi V2.0, we noted that the supporting documentation demonstrating the implementation and execution of the OA EA process (es) was not provided.

Due to lack of documentation and supporting evidence provided by OST management by the hard stop date of September 6, 2017, KPMG was unable to validate the EA processes for the OST Delphi V2.0 major investment has been implemented and executed.

Without an adequate DOT EA implementation, OST may experience EA execution efforts that are incomplete and inaccurate, and performance measures may be inaccurate.

The DOT EA Policy requires the following:
- Section 1351.27.4.9 – The DOT EA Program shall be evaluated in accordance with the GAO EA Maturity Management Framework.
- Section 27.3- This policy applies to all DOT OA's and the OIG, including employees/contractors planning IT investment and budget requests, developing transition plans, IT roadmaps, acquiring IT resources, designing and developing software and services, securing and integrating, operating, maintaining, and retiring investments.
- 27.4.1.1- Each DOT component shall align its IT investment with its architecture to the appropriate DOT EA segments, DOT reference models and FEA reference models.
- 27.4.2- Each OA shall develop an architecture that documents IT standards in use and alignment with Department level IT standards.
- 27.4.5- Each DOT component shall maintain architecture data and artifacts for currency and validity, as well as track and document changes in order for data and artifacts to be tested in planning and decision making.
- 27.5.6.5- Conduct an annual assessment of the OA EA program using the GAO EA Management Maturity Framework.
- 27.4.1.3- The DOT shall document its EA using artifacts as prescribed by the OMB common approach to FEA.

- 27.4.2- The DOT EA shall document a minimum set of IT standards in accordance with established FEA reference models.

We recommend OST:

10 Require that the EA artifacts illustrating implementation and execution of EA are in accordance with DOT EA policy.
11 Retain evidence of the required EA artifacts.

CONCLUSION

Based upon the performance audit procedures conducted and the results obtained, we have met our audit objectives aforementioned above. We conclude that for the testing period February 23, 2017 through September 26, 2017, DOT has taken efforts to develop a Department-wide EA program and EA performance management system; however it's not fully matured, integrated, and consistently implemented across five (5) of the Department's OAs. We identified the below five (5) deficiencies during fieldwork:

1. **Inconsistencies existed with OA implementation of the DOT EA Policy.**

2. **NHTSA, FHWA EA policy was not approved or distributed.**

3. **FRA, FTA, NHTSA, PHMSA lack evidence that required EA training was provided.**

4. **PHMSA lack proactive identification, reporting and mitigation of EA-related risks.**

5. **OST did not provide requested EA process documentation.**

The 5 deficiencies resulted in eleven (11) recommendations communicated to DOT management prior to the issuance of this report. The 11 recommendations are contained in Section V, Findings and Recommendations, of this report.

We also reviewed 8 prior year recommendations related to DOT's EA Policies and Procedures to determine their current status. In summary, all prior year recommendations were implemented and closed. Appendix 3, Status of Prior-Year Findings, provides the DOT's progress in addressing prior year recommendations from the OIG report FL-2012-086 dated April 17, 2012, DOT Does Not Have an Effective Enterprise Architecture for the Management of Information Technology Changes. Appendix 2 contains a glossary of terms used in the report.

CRITERIA AND REFERENCES

KPMG considered the following criteria and references during the assessment:

<u>Federal Laws and Regulations</u>

1. OMB
2. DOT Enterprise Architect Policy
3. The E-Government Act of 2002,
4. Federal Information Security Modernization Act (FISMA) of 2002
5. DOT Order 1351.37, Departmental Cybersecurity Policy
6. U.S. DOT Departmental Cybersecurity Compendium

LIST OF ACRONYMS

Acronym	Definition
AICPA	American Institute of Certified Public Accountants
CIO	Chief Information Officer
CPIC	Capital Planning Investment Control
DOT	Department of Transportation
EA	Enterprise Architecture
FAA	Federal Aviation Administration
FEA	Federal Enterprise Architecture
FEAF	Federal Enterprise Architecture Framework
FHWA	Federal Highway Administration
FISMA	Federal Information Security Modernization Act
FMCSA	Federal Motor Carrier Safety Administration
FMIS	Federal Management Information System
FRA	Federal Railroad Administration
FTA	Federal Transit Administration
FY	Fiscal Year
GAO	Government Accountability Office
GAGAS	Generally Accepted Government Accounting Standards
GAO	Government Accountability Office
IFPA	Investment Flight Procedure Automation
IRB	Investment Review Board
IT	Information Technology
KPMG	KPMG LLP
MARAD	Maritime Administration
MITIs	Major Information Technology Investments
NHTSA	National Highway Traffic Safety Administration
OAs	Operating Administrations
OCIO	Office of the Chief Information Officer
OIG	Office of the Inspector General
OMB	Office of Management and Budget
OST	Office of the Secretary
PMB	Performance Management Board
PHMSA	Pipeline and Hazardous Materials Safety Administration
QCR	Quality Control Review
R&D	Research & Development
SLSDC	Saint Lawrence Seaway Development Corporation
TFDM	Terminal Flight Data Manager
WBS	Work Breakdown Structure
US	United States

SUMMARY OF KPMG'S PRIOR YEAR OIG EA FINDING RESULTS TO CLOSE THE OIG FL-2012-086, ENTERPRISE ARCHITECTURE PROGRAM FOR MANAGEMENT OF INFORMATION TECHNOLOGY CHANGES REPORT

The Office of the Inspector General (OIG) provided this audit report to KPMG for review and inspection. KPMG performed the below inquiry and inspection procedures, to determine whether the OIG prior year (PY) recommendations are open/closed. The table below dictates KPMG's procedures performed, and the detailed analysis is documented in KPMG's PY finding summary workpapers, provided to the OIG for review and retention. The following provides a high-level summary of KPMG's procedures performed, closure status, and summary of actions needed to close the PY findings (if applicable).

PY Recommendations	Inquiry procedures	Inspection procedures	KPMG's Closure Status: (Open/Closed)
OIG Recommendation #1 Develop and/or revise the Department's EA policy and procedures to address the following: a. Development, maintenance, and use of EA in the IT investment process. b. Incorporation of the Department's Governance groups into the CPIC and Enterprise Architecture processes to provide oversight and improved decision making relating to IT investments, including security funding. c. Creation of a standardized methodology that provides reliable estimates of security funding needed for system investments.	Inquired of management regarding the development, revisions, and updates to the EA policy and procedures used across the DOT OAs. a. Determined if the DOT has incorporated the development, maintenance, and use of EA in the IT investment process b. Verified if the Department's Governance groups have been incorporated into the CPIC and Enterprise Architecture processes to provide oversight and improved decision making relating to IT investments, including security funding. c. Determined if DOT has created of a standardized methodology that provides reliable estimates of	• Inspected the EA policy and procedures to ensure they have been updated to include standards, process, templates, and techniques for the implementation, and use of EA across DOT and the OAs. Specifically: a. Has DOT incorporated the development, maintenance, and use of EA in the IT investment process? b. Are the Department's Governance groups incorporated into the CPIC and Enterprise Architecture processes, providing oversight and improved decision making relating to IT investments, including security funding.? c. Does DOT standardized methodology that provide reliable estimates of security funding needed for system investments. a. Selected a sample of	Closed

d. Development and implementation of performance measures to gauge the Department's application of EA, including investments in system security.
e. Tracking and formal documentation of EA changes.
	security funding needed for system investments.
	d. Validated that the development and implementation of performance measures to gauge the Department's application of EA, including investments in system security has been established.
	e. Verified if tracking and formal documentation of EA changes has been created.
		security findings and the estimates used for funding metrics.
		d. How are performance measures developmented and implemented to gauge the Department's application of EA, including investments in system security.
		  a. Selected a sample of performance measures to determine if the Department's applications and investments in system security are captured.
		e. How are tracking and formal documentation of EA change captured.
		  a. Selected a sample of EA changes to determine if changes are tracked and documented.	

OIG Recommendation #2 Assist components in the selection and implementation of compatible EA tools that will facilitate the creation of a department wide EA.	• Inquired with management regarding whether DOT has assisted components in the selection and implementation of compatible EA tools that will facilitate the creation of a department wide EA.	• Inspected the DOT EA tools used for implementation and monitoring of the EA process departmentwide. • Reviewed a sample of EA tools and metrics used for tracking the implementation of EA.	Closed
OIG Recommendation #3 Input the required data (such as business	• Inquired with management regarding whether the required data (such as business	• Inspected the DOT EA policies and procedures to determine if the	Closed

processes, workflows, and technology in use) in the selected EA tools to develop or update current and future architectures and transition plans.	processes, workflows, and technology in use) is captured in the selected EA tools to develop or update current and future architectures and transition plans.	required data is documented. • Reviewed a sample of EA data metrics to determine if current and furure architectures and transition plans are documented.	
OIG Recommendation #4 Develop and implement a department wide data management practice that provides a common data dictionary that reflects commonalities in data and processes and provide methods for sharing information across the Department.	• Inquired with management regarding whether procedures have been created for data management practice that provides a common data dictionary that reflects commonalities in data and processes and provide methods for sharing information across the Department.	• Inspected EA program procedures to determine if an enterprise approach has been taken for data management practice and a common data dictionary that reflects commonalities in data and processes and provide methods for sharing information across the DOT OAs. • Reviewed a sample of common data dictionary determine if there is standardize process in place.	Closed
OIG Recommendation #5 Develop a process to measure components' EA programs' maturity and effectiveness using key framework elements outlined in OMB's Enterprise Architecture, and develop a plan to remediate any gaps, or deficiencies found.	• Inquired with management regarding whether DOT has created a process to measure components' EA programs' maturity and effectiveness using key framework elements outlined in OMB's Enterprise Architecture, and develop a plan to remediate any gaps, or deficiencies found.	• Inspected DOT's EA programs framework and determine if it has been outlined with OMB's EA • Inspected DOT's EA framework to determine if the plan contains information for remediating any gaps, or deficiencies found. • Reviewed a sample of DOT's metrics used for tracking deficiencies and remediation actions taken.	Closed
OIG Recommendation #6 Develop a plan and work with the components to identify redundancy in current operations and technology use across the Department.	• Inquired with management regarding whether a plan has been developed to help to identify redundancy in current operations and technology use across the Department	• Inspected the management plan to determine if redundancy in current operations and technology use across the Department has been captured • Reviewed a sample of notes, meetings, and metrics training records to ensure DOT has document redundancy in	Closed

		operations and technology use.	
OIG Recommendation #7 Identify and report EA performance measure results, outcomes and progress to DOT's Governance groups and decision makers to ensure that they have the proper information to make EA and related information security decisions.	• Inquired with management regarding whether the EA performance measure results, outcomes and progress to DOT's Governance have been identified and captured • Determined whether decision makers have the proper information to make EA and related information security decisions.	• Inspected the EA performance metrics and goals for DOT's Governance. • Selected a sample of DOT's Governance status meeting, documentation, and reports used to capture performance measure results, outcomes and progress.	Closed
OIG Recommendation #8 Create a department wide EA that is consistent with OMB and GAO's frameworks and meets the requirements of the Clinger-Cohen Act.	• Inquired with management regarding whether a Department wide EA program has been created that is consistent with OMB and GAO's frameworks and meets the requirements of the Clinger-Cohen Act.	• Inspected the DOT's EA policies and procedures to determine if they are consistent with OMB and GAO's frameworks and meets the requirements of the Clinger-Cohen Act	Closed

U.S. DOT OIG
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hotline@oig.dot.gov | (800) 424-9071

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Our Mission

OIG conducts audits and investigations on behalf of the American public to improve the performance and integrity of DOT's programs to ensure a safe, efficient, and effective national transportation system.