BOSTON REGION METROPOLITAN PLANNING ORGANIZATION
Richard A. Davey, MassDOT Secretary and CEO and MPO Chairman
Karl H. Quackenbush, Executive Director, MPO Staff

MEMORANDUM

DATE **September 12, 2013**

TO **Boston Region Metropolitan Planning Organization**

FROM **Karl H. Quackenbush**
CTPS Executive Director

RE **Work Program for: Central Artery/Tunnel Project Backcasting**

Action Required

Review and approval

Proposed Motion

That the Boston Region Metropolitan Planning Organization, upon the recommendation of the Massachusetts Department of Transportation, vote to approve the work program for Central Artery/Tunnel Project Backcasting in the form of the draft dated September 12, 2013.

Project Identification

Unified Planning Work Program Classification

Planning Studies

CTPS Project Number

23121

Clients

Massachusetts Department of Transportation
Project Supervisor: Steve Woelfel

CTPS Project Supervisors

Principal: Scott Peterson
Manager: Ying Bao

Funding

MassDOT Contract #TBD

Impact on MPO Work

The MPO staff has sufficient resources to complete this work in a capable and timely manner. By undertaking this work, the MPO staff will neither delay the completion of nor reduce the quality of other work in the UPWP.

Background

The Central Artery/Tunnel (CA/T) project depressed and widened Interstate 93 (I-93) through downtown Boston to Charlestown and constructed (as an extension of I-90) a seaport access highway, the Ted Williams Tunnel (TWT), through South Boston and under Boston Harbor to Logan Airport. The project includes approximately 80 lane-miles of tunnels within a 7.5-mile urban corridor. Commercial traffic started using the TWT in 1996, and the remainder of the project opened to general traffic in March 2005. The environmental documents for this project were completed in 1991, with a forecast year of 2010. The emissions forecasting documented in the environmental documents used MOBILE, one of the earliest United States Environmental Protection Agency (EPA) emission models.

In 1990 the predecessor agencies of the Massachusetts Department of Transportation (MassDOT) entered into a memorandum of understanding with the Conservation Law Foundation. The memorandum of understanding committed MassDOT to implementing air quality mitigation measures to offset air quality impacts resulting from the construction of the CA/T. Among the mitigation measures was the construction of transit system projects, referred to as transit commitments. The transit commitments were codified by the Massachusetts Department of Environmental Protection as 310 CMR 7.36: Transit System Improvements. The transit commitments were intended to expand the existing transit system in the commonwealth and thereby offset any negative air quality impacts resulting from construction of the CA/T. The outstanding transit commitments were added to the Massachusetts State Implementation Plan (SIP).

A SIP is a federally approved and enforceable plan by which each state identifies how it will attain and/or maintain the health-related primary and welfare-related secondary National Ambient Air Quality Standards (NAAQS) described in Section 109 of the Clean Air Act (CAA), and parts 50.4 through 50.12 of Title 40 of the Code of Federal Regulations. A SIP is a state's blueprint for clean air. All air quality analysis associated with the Massachusetts SIP has been done using some version of MOBILE. The EPA recently unveiled its latest emissions model, known as the Motor Vehicle Emissions Simulator (MOVES). The MOVES model is a significant improvement over its predecessor, but produces results by pollutant that differ in magnitude from MOBILE, making comparisons with earlier projects difficult.

In July of 2013, the Massachusetts Legislature passed a transportation finance law. Chapter 46 Section 73 of this law requires MassDOT to analyze the air quality

impacts of the CA/T project and the associated transit commitments that have been completed to date. The law directs MassDOT to work with the Boston Region Metropolitan Planning Organization (MPO) to report the levels of several mobile source air pollutants in eastern Massachusetts, which is the modeled region of the Boston Region MPO. This air quality analysis of the CA/T could serve three purposes:

- First, it could help to reveal the differences in the modeling assumptions and corresponding air quality impacts or benefits between what was examined in the 1991 CA/T environmental documents and what was eventually constructed.
- Second it could quantify, in aggregate, all of the air quality benefits associated with the transit commitments.
- Third, it could help planners to understand the differences between MOBILE and MOVES for the CA/T project and the transit commitments.

Given the history of the Boston Region MPO staff with respect to analyzing the air quality benefits of the SIP projects and the staff's unique capacity to model the changes in the highway and transit network, it seems appropriate that the Massachusetts legislation specifically calls on MassDOT to conduct the analysis in cooperation with the Boston Region MPO.

Objective

The objective of this study is to quantify the air quality impact that the construction of the various phases of the CA/T project and its associated transit commitments has had on regional air quality in the Boston Region MPO modeled area.

Work Description

The Central Transportation Planning Staff (CTPS), as the staff of the Boston Region MPO, will conduct this work using primarily three analytical tools, the regional travel demand model set and EPA's two emissions models, MOVES and MOBILE. By using these tools, CTPS will quantify the magnitude of emissions of the CA/T project and the SIP transit commitments. The work for this project will be done in the following tasks.

Task 1 Develop Project Inventory

A comprehensive inventory of the various distinct phases and subprojects that composed the larger CA/T project will need to be developed before modeling for this project can begin. The Final Supplemental Environmental Impact Statement/Report (FSEIS/R), approved in 1991, will serve as the guiding document for purposes of determining whether a particular improvement or project was originally part of the larger CA/T project.

In addition to developing an inventory of the highway subprojects associated with the CA/T project, an inventory of the various transit mitigation projects will also be developed. The most current version of 310 CMR 7.36 regulations and the Administrative Consent Order (ACO) as of the date of this work program will serve as the guiding document for purposes of determining whether a particular transit improvement or project was originally a transit mitigation project for the CA/T.

It is also important to understand how the 2010 land use forecasts for the Boston Region MPO modeled area that were developed in 1990 differed from the land use patterns that actually occurred. The modeling for this analysis will only utilize current land use assumptions, but old forecasts may be consulted to help explain modeling results.

Product of Task 1

The product of Task 1 will be a comprehensive inventory of the highway projects and transit commitment projects that were constructed for the CA/T project. An inventory of past and present land use assumptions will be developed to better understand the results of the modeling process.

Task 2 Develop the Model Networks

CTPS will use an existing calibrated 2012 base-year model as the baseline to which the “backcasted” scenarios will be compared. These backcasted scenarios will not be backcasted in the strictest sense of the word. A true backcasted network would attempt to replicate land use and transportation conditions as they existed in 1990. The term backcasted in this analysis refers to recreating the 1990 transportation networks under existing land use conditions. CTPS will further calibrate the baseline model to the transportation facilities in the area of the Central Artery area. Building on the inventory created in Task 1, CTPS will create model networks that can be used to backcast the air quality impacts associated with the CA/T project. A network is defined as a modeled representation of the transportation infrastructure for the highway, transit, and/or nonmotorized modes.

Products of Task 2

The products of Task 2 will be four model networks that will allow CTPS to isolate the air quality impacts associated with the highway and transit components of the CA/T project.

- The first network will be a baseline model network that will represent everything as it existed in 2012.
- The first backcasted network will be a 2012 baseline model network, but it will not include either transit commitment projects constructed as a

commitment for the CA/T project or the highway improvements constructed as part of the CA/T project.

- The second backcasted network will not include any of the transit commitment projects constructed for the CA/T project, but it will include the 2012 baseline roadway network.
- The third backcasted network will reflect 1990 pre-CA/T construction roadway network. It will include the 2012 baseline transit network.

Task 3 Perform Air Quality Analyses

All previous SIP and CA/T air quality analyses utilized EPA's MOBILE emissions model. MOBILE is now being replaced by the MOVES software tool. CTPS will estimate levels of volatile organic compounds, nitrogen oxides, and carbon monoxide for each of the alternatives listed in Task 2. To produce these emissions estimates, CTPS will use EPA's MOVES and MOBILE (version 6.2) emission factors for 2012. The analysis will compare the results of the travel demand modeling using MOVES with those using MOBILE. These emission factors will be used to estimate and compare the mobile source emissions associated with the alternatives identified under Task 2. The mobile source emissions are generated by vehicles burning some form of fuel, such as gasoline or diesel. (Stationary sources are those produced at power plants and consumed by vehicles, such as electric cars or transit vehicles that are powered by electricity)

Product of Task 3

Develop and compare emissions estimates from highway and transit modes using MOVES and MOBILE for the alternatives listed in Task 2.

Task 4 Conduct Sensitivity Analyses

Initially, highway and transit assignments will be run on the transportation networks described in Task 2 using the calibrated 2012 base-year trip tables. An assignment consists of identifying what paths a highway or transit user will take on the network given the travel times and costs associated with it. In addition to running highway and transit assignments using the calibrated 2012 base-year trip tables, CTPS will also run trip distribution and mode choice models to develop trip tables customized for each alternative listed under Task 2. The distribution process matches the location where a given trip begins with the location where it ends, regardless of what mode or path the trip would take. The mode choice step identifies the transportation mode that trip would likely take based on variables such as time and costs.

CTPS will perform this exercise to obtain a more nuanced understanding of the effect the implementation of the highway and transit projects associated with the CA/T project had on regional trip-making choices and behaviors. CTPS will also

examine the effect that the construction of the CA/T project had on trip making to and from Logan Airport.

There is a dynamic feedback between the trip-distribution, mode-choice, and assignment models in the travel demand modeling process. For this reason, CTPS anticipates running these three steps of the modeling process iteratively for each scenario. This will provide a better understanding of how trip flows will change due to the changes in the highway and transit networks.

Product of Task 4

Ultimately, this iterative process will result in one finalized model run (trip distribution, mode choice, and highway and transit assignment) for each scenario described in Task 2. Associated mobile source emission estimates will also be produced for each of these model runs.

Task 5 Produce a Technical Memorandum

Produce a technical memorandum documenting all of the modeling methodology, assumptions, and results and the analysis findings for MassDOT.

Product of Task 5

A technical memorandum documenting the project's assumptions, methods, and results

Estimated Schedule

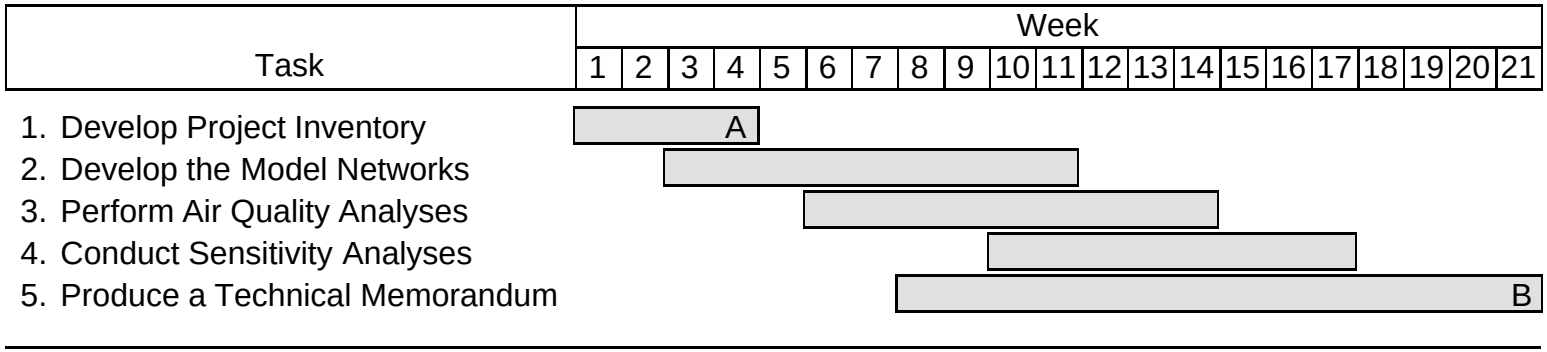
It is estimated that this project will be completed 21 weeks after work commences. The proposed schedule, by task, is shown in Exhibit 1.

Estimated Cost

The total cost of this project is estimated to be $116,500. This includes the cost of 38.0 person-weeks of staff time, overhead at the rate of 97.42 percent. A detailed breakdown of estimated costs is presented in Exhibit 2.

KQ/BHD/SAP/sap

Exhibit 1
ESTIMATED SCHEDULE
Central Artery/Tunnel Project Backcasting



Products/Milestones

A: Central Artery/Tunnel project inventory

B: Technical memorandum

Exhibit 2
ESTIMATED COST
Central Artery/Tunnel Project Backcasting

Direct Salary and Overhead	**$116,500**

Task	Person-Weeks				Direct Salary	Overhead (97.42%)	Total Cost
	M-1	P-5	P-4	Total			
1. Develop Project Inventory	1.0	3.0	3.0	7.0	$10,573	$10,301	$20,874
2. Develop the Model Networks	1.0	8.0	4.0	13.0	$20,300	$19,776	$40,076
3. Perform Air Quality Analyses	1.5	3.0	0.0	4.5	$7,619	$7,423	$15,042
4. Conduct Sensitivity Analyses	1.0	4.0	2.0	7.0	$11,001	$10,717	$21,718
5. Produce a Technical Memorandum	3.0	0.0	3.5	6.5	$9,518	$9,272	$18,790
	0.0	0.0	0.0	0.0	$00	$00	$00
Total	7.5	18.0	12.5	38.0	$59,011	$57,489	$116,500

Other Direct Costs	**$0**

TOTAL COST	**$116,500**

Funding

MassDOT Contract #TBD