



# BOSTON REGION METROPOLITAN PLANNING ORGANIZATION

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The Boston Region MPO is  
composed of:

Massachusetts Department of  
Transportation  
Metropolitan Area Planning Council  
Massachusetts Bay Transportation  
Authority Advisory Board  
Massachusetts Bay Transportation  
Authority  
Massachusetts Port Authority  
Regional Transportation Advisory  
Council  
City of Boston  
City of Beverly  
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City of Newton  
City of Somerville  
City of Woburn  
Town of Arlington  
Town of Bedford  
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Town of Framingham  
Town of Lexington  
Town of Medway  
Town of Norwood  
Federal Highway Administration  
(nonvoting)  
Federal Transit Administration  
(nonvoting)

## MEMORANDUM

**DATE** August 2, 2012  
**TO** Boston Region Metropolitan Planning Organization  
**FROM** Karl H. Quackenbush  
CTPS Executive Director  
**RE** Work Program for: MassDOT Road Inventory Supplemental  
Grant

### Action Required

Review and approval

### Proposed Motion

That the Boston Region Metropolitan Planning Organization, upon the recommendation of MassDOT, vote to approve the work program for MassDOT Road Inventory Supplemental Grant in the form of the draft dated August 2, 2012.

### Project Identification

#### Unified Planning Work Program Classification

Technical Support/Operations Analysis

#### CTPS Project Number

60616

#### Client

Massachusetts Department of Transportation, Office of Transportation  
Planning  
*Project Supervisor:* Kevin Lopes

#### CTPS Project Supervisors

*Principal:* Ben Krepp  
*Manager:* David Knudsen

#### 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 nor reduce the quality of other work in the UPWP.

## Background

The Road Inventory is the MassDOT Office of Transportation Planning's geographically enabled database of nearly all public, and some private, roadways in the state and is used internally for planning and mandatory reporting to the Federal Highway Administration (FHWA), among other internal uses. Although it is not geographically accurate enough to be used directly in engineering plans, it is built upon a base of detailed color orthophotography and is suitable for mapping at scales as large as 1:5,000. It includes physical and jurisdictional road attributes that satisfy FHWA reporting needs but for many years has lacked the information necessary to locate ("geocode") street addresses with house numbers.

Several years ago MassDOT and the state geographic information systems agency MassGIS embarked upon a project to combine ("conflate") the geocoding information found in the Master Street Address Guide (MSAG) of the state's enhanced 911 (E-911) system and in a commercially available database from Navteq, Inc., with the Road Inventory. The goal was to draw from the strengths of each source—the high geographical accuracy, physical attributes, and town-supplied updates in the Road Inventory, a thorough geocoding base in Navteq's product updated quarterly with field-verified data, and the geocoding base in the E-911 system derived in part from independent sources—to produce a unified road database that could be used by multiple interested parties in state government and the private sector.

The bulk of this conflation of data sources has taken place but was not brought to completion. The most recent work is now more than three years old.

Meanwhile, the MassDOT Registry of Motor Vehicles operates the Crash Data System (CDS), which supports the collection of crash records for safety analyses. When state police officers enter crash records, they select road names from pick lists derived from the Road Inventory. This enforces standardized names, prevents entry of invalid combinations of streets, towns, and cross streets, and is designed to aid the geocoding of crash records by the Traffic Engineering Section.

The pick lists for street names and the table of names for streets that intersect were last updated more than 10 years ago and were generated from the Road Inventory prior to the project that added house number address information. Not only is the information severely dated, but it is also insufficiently rich to support highly accurate

geocoding (ramp names are not absolutely unique in all interchanges, for example). Many street names are incorrect and are not recognized in the pick lists by people entering crash records. Geocoding occurs against the Navteq address-enabled geographic road layer and an intersection table generated from the most recent year-end Road Inventory. Both of these are very different from the Road Inventory of 10 years ago, guaranteeing that a certain percentage of crash records, constrained by the pick lists to locations that were valid 10 years ago, cannot be located in the geographic road layer.

## Objectives

This work program will complete the conflation of MassGIS's combined MSAG/Navteq base with the Road Inventory. All geocoding information in the MassGIS base that is not yet in the Road Inventory will be incorporated into it; a process will be designed for synchronizing those two databases in the future, as they continue to be edited independently.

The Road Inventory street names will be corrected using authoritative sources and will be further enriched with the addition of alternate street names from a number of sources so that those entering crash records in CDS will be more likely to find streets and intersections described in terms that they use themselves. A related effort will eliminate ambiguous ramp names.

A new intersection table, as well as other potential derivative products, will be generated from the enhanced Road Inventory for the CDS street name pick lists.

## Work Description

The work to be done falls into four broad tasks.

### **Task 1 Develop Project Methods and Future Maintenance Processes and Build Tools**

The two data sets to be conflated, the Road Inventory and the MassGIS base, are large and have very different data structures. Maintenance continues separately on each of them. Careful planning will be necessary to ensure that conflation will be carried out as simply and efficiently as possible, that all necessary data are transferred to the Road Inventory to support geocoding, and that completed work can be distinguished from work still to do, both during the course of this project and when synchronizing accumulated edits in the future.

#### ***Subtask 1.1 Update Road Inventory Structure as Needed***

The existing data structures for storing address information in the Road Inventory will be examined and adjusted if necessary to make sure that all relevant address information from the MassGIS base can be stored. Any

changes necessary to facilitate updates and synchronization of new data from the MassGIS base in the future will be made. The structures will also be evaluated for their compatibility with the geocoding engine of ArcGIS software.

#### ***Subtask 1.2 Prepare Working Data and Environment***

Some editing tasks will require the creation of temporary, working data sets from the original source data. These data sets will be designed for simultaneous editing by multiple editors, and the editors will work in application environments tailored to the tasks they must accomplish.

#### ***Subtask 1.3 Build Tools for Iterative Tasks***

Tools will be built to facilitate interim and post-project deliveries of updated address data and to aid in moving data sets to and from the temporary, working data sets.

#### ***Products of Task 1***

Modified Road Inventory data schema; temporary, working data sets and working application environments; and reusable software tools for manipulating the data

### **Task 2 Conflate MassGIS Base with Road Inventory**

Both the Road Inventory and the MassGIS base have several hundred thousand records in them; it is neither cost- nor time-effective to review each of them one at a time. Instead the data sets will be divided logically into subsets that require different levels of attention and different treatment.

Both MassDOT and MassGIS will continue to update their respective data sets over the course of this work plan and while conflation is underway. As soon as the subtasks that constitute Task 2 (below) are complete, both data sets will already be out of synchronization with each other again, although to a far smaller degree than at present. Therefore the subtasks will need to be repeated one or more additional times until the current versions of the two data sets are fully synchronized.

#### ***Subtask 2.1 Check Road Inventory Features Already Related to MassGIS Base and Fix Discrepancies***

The previously completed conflation work coded road features with the identifiers, or keys, of the corresponding MassGIS base features. These keys will be used to compare the corresponding features and look for address information—street number ranges, street names, and towns on the left and right sides of the streets—that is not the same in the correlated features. Discrepancies exist due to independent updates in both databases since the

previous conflation and due to errors in the conflation itself. Mismatched data will be corrected with bulk operations for the most part, but some mismatches will be corrected during record-by-record review. An example of a road feature that requires this sort of individual attention is one whose corresponding MassGIS base feature has larger street address ranges and on further inspection is found to have significantly greater length (new construction may have extended the road), thus requiring manual editing of the Road Inventory feature to lengthen it appropriately.

#### *Subtask 2.2 Add New Features from MassGIS Base*

Features in the MassGIS base whose keys do not correspond with any coded in the Road Inventory and which are not spatially near existing Road Inventory features will be added to the Road Inventory as new features. The minimum required information for new Road Inventory roads—the urbanized area and town the roads are located in, as well as certain other attributes, all easily determined from their location and not requiring research—will be populated, and the street names, street number ranges, and other address data will be transferred from the MassGIS base.

#### *Subtask 2.3 Conflate Remaining Features*

Remaining Road Inventory features whose keys do not match any in the MassGIS base and which are spatially near features in the MassGIS base will be reviewed one by one to establish, or re-establish as the case may be, the correspondence with the MassGIS base, and address information will be transferred as appropriate.

#### *Product of Task 2*

Road Inventory fully conflated with the MassGIS base

### **Task 3 Correct Road Inventory Street Names and Enrich Alternate Street Names**

Conflation of the Road Inventory with the MassGIS base will allow for the correction of street names, subject to review by town officials, who continue to be contributors to the Road Inventory. Street names in the MassGIS base are derived from authoritative sources such as E-911's Master Street Address Guide and Navteq's field checks.

Conflation will also allow enrichment of the Road Inventory with a certain number of alternate street names, but there are additional sources, as well, for alternate street names. The state bridge database will be used to add bridge and tunnel names, where those are not already present in the street names or alternate street names. Ramp letters for the Central Artery/Tunnel project area will be added. Tables of alternate street names or text replacements amassed during

previous geocoding work will be incorporated. MassGIS resources of alternate street names will be incorporated. As time permits, other sources, such as a database of memorial highway names, may be used as well.

Ramp names have improved significantly from earlier versions of the Road Inventory, but there are still ramps whose names do not uniquely identify them, even within a town. Those ramp names will be made unique with the addition of differentiating text.

Correction, standardization, and addition of street names will follow consistent punctuation, abbreviation, and terminology guidelines.

#### *Product of Task 3*

Road Inventory with corrected street names and enhanced set of alternate street names

#### **Task 4 Generate Intersection Table and Other Derivative Products**

The updated Road Inventory will be the source used to generate derivative data products, including the roadway and intersection tables used by CDS to validate crash data entered through its forms. Other derivative data products may be called for, for use in other crash-related data systems, such as the geocoding tool used by the MassDOT Traffic Engineering Division or the third-party systems purchased by local police departments across the commonwealth. The scope of the third-party needs is not fully known at the writing of this work scope and will be addressed as remaining budget allows.

#### *Products of Task 4*

Derivative data products of the updated Road Inventory, including roadway and intersection tables

### **Estimated Schedule**

It is estimated that this project will be completed 21 months after the notice to proceed is received. The proposed schedule, by task, is shown in Exhibit 1.

### **Estimated Cost**

The total cost of this project is estimated to be \$259,750. This includes the cost of 187 person-weeks of staff time and overhead at the rate of 96.58 percent. A detailed breakdown of estimated costs is presented in Exhibit 2.

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Exhibit 1  
 ESTIMATED SCHEDULE  
 MassDOT Roadway Inventory Supplemental Grant

Task	Month																				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1. Plan Current Work and Future Maintenance Processes and Build Tools	[Task bar]																				
2. Conflate MassGIS Base with Road Inventory	[Task bar A]																				
3. Correct Road Inventory Street Names	[Task bar B]																				
4. Generate Intersection Table and Other Derivative Products	[Task bar C D]																				

Products/Milestones

- A: Conflated Road Inventory
- B: Road Inventory with Alternate Street Names
- C: Updated intersection table
- D: Final intersection table

Exhibit 2  
 ESTIMATED COST  
 MassDOT Roadway Inventory Supplemental Grant

Direct Salary and Overhead	\$259,750
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Task	Person-Weeks				Direct Salary	Overhead (@ 96.58%)	Total Cost
	M-1	P-5	Temp	Total			
1. Plan Current Work and Future Maintenance Processes and Build Tools	1.0	4.0	0.0	5.0	\$8,405	\$8,118	\$16,523
2. Conflate MassGIS Base with Road Inventory	0.5	8.0	137.0	145.5	\$93,307	\$90,116	\$183,423
3. Correct Road Inventory Street Names	0.5	4.0	28.0	32.5	\$23,712	\$22,901	\$46,613
4. Generate Intersection Table and Other Derivative Products	0.0	4.0	0.0	4.0	\$6,711	\$6,481	\$13,192
Total	2.0	20.0	165.0	187.0	\$132,135	\$127,616	\$259,751

Other Direct Costs	\$0
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TOTAL COST	\$259,750
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Funding  
 MassDOT Contract # TBD