

Statewide Overhead Traffic Sign Structure Study - Work Plan

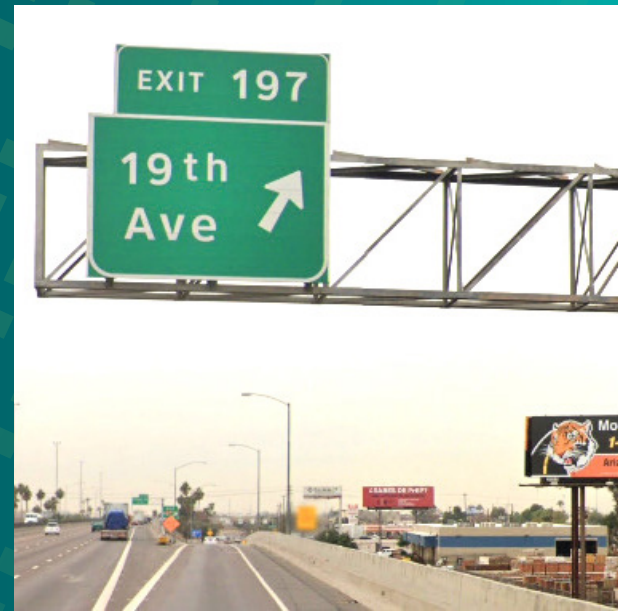


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1.0 Introduction

ADOT is preparing to initiate a sign structure inspection program to properly inspect and maintain existing sign structures across ADOT's system. As part of this inspection program, ADOT is conducting a study to determine the inspection prioritization process and other additional needs to administer the inspection program.

ADOT's overhead sign structures consist of a variety of structure types that have been constructed based on multiple iterations of standards implemented over the years. Sign structures that will need to be evaluated as a part of this study range from signs mounted above the roadway on bridge structures to large tubular frame sign structures that span across all lanes of a freeway.

This study will create a prioritization tool that identifies inspection priorities by structure type and an annual budget that meets the inspection program needs. The study will set up the inventory and prioritization for inspection of the overhead traffic sign structures on the state highway system.

AECOM Technical Services, Inc. (AECOM) will provide the services necessary for the preparation of the Statewide Overhead Traffic Sign Structure Study.

1.1 Study Area

This is a statewide project and will be conducted for overhead sign structures throughout ADOT's state highway system.

1.2 Study Objectives

The objectives for the Statewide Overhead Traffic Sign Study include the following:

- Perform and document a peer review of five other state DOT sign structure programs and how they are funded
- Conduct a system assessment of the sign structure inventory currently in the ADOT Features Inventory System (FIS)
- Identify and gather supplemental data needed for the process
- Develop a data visualization tool that identifies inspection priorities by structure type
- Identify annual budgets to meet the identified sign structure inspection program needs

1.3 Project Team

ADOT Multimodal Planning Division (MPD) will lead the study with Mark Hoffman serving as the ADOT- MPD Project Manager. The AECOM project team will be led by Kate Bondy. The project team organization chart is displayed in Figure 1.

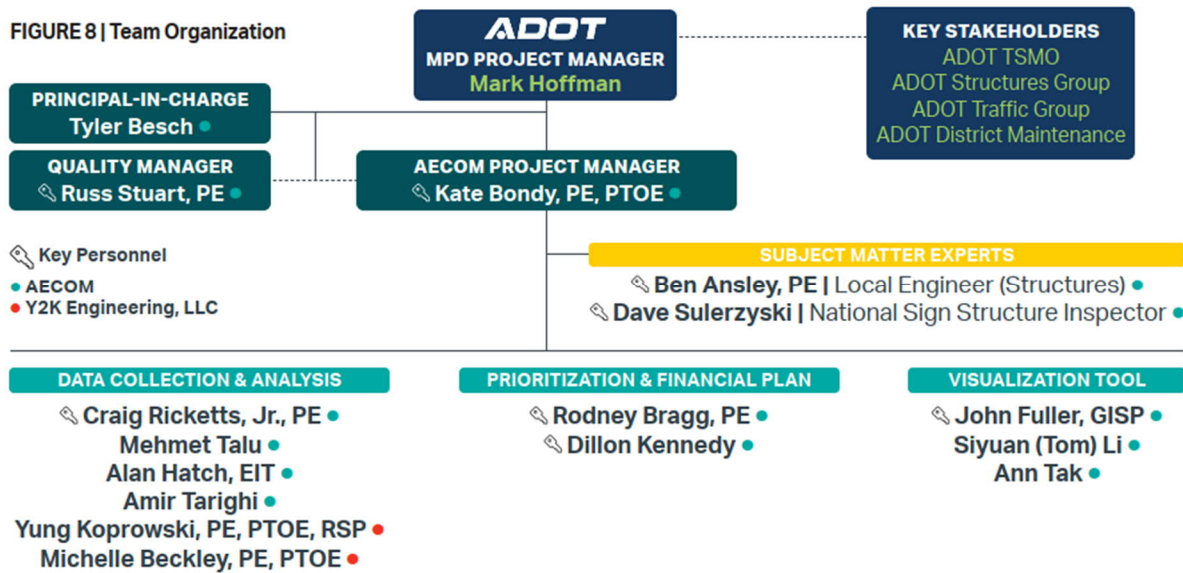


Figure 1 – Project Team Organization Chart

AECOM will meet routinely with Mark Hoffman to review study progress, present working papers and study findings, and solicit direction. The consultant project manager will be responsible to work with her technical experts and ADOT staff to meet the objectives, schedule, and deliverables described in this work plan, based on the contracted budget amount. Any out of scope work will be approved by ADOT with a written authorization prior to additional work commencement. Table 1 includes contact information for the AECOM key staff members.

Table 1 – Team Contact Information

Name	Project Role	Contact Information
Kate Bondy	Project Manager	kate.bondy@aecom.com 602-738-1651
Craig Ricketts, Jr.	Data Collection & Analysis Lead	craig.ricketts.jr@aecom.com 443-852-4773
Rodney Bragg	Prioritization Lead	Rodney.bragg@aecom.com 602-648-2527
Dillon Kennedy	Financial Plan Lead	Dillon.kennedy@aecom.com 520-609-5942
John Fuller	Visualization Tool Lead	John.Fuller@aecom.com 512-922-0478
Ben Ansley	Structural Subject Matter Expert	Ben.ansley@aecom.com 602-648-2415
Dave Sulerzyski	National Subject Matter Expert	dave.sulerzyski@aecom.com 410-991-3543
Russ Stuart	Quality Manager	russ.stuart@aecom.com 602-648-2503

1.4 Technical Advisory Committee

AECOM will conduct scheduled meetings with a Technical Advisory Committee (TAC) to present technical information, seek input, and answer questions. Working Papers and the Draft Final Report will be submitted to the TAC for review and comment prior to each meeting. AECOM will prepare meeting materials, conduct meetings, and develop meeting minutes to distribute to the TAC following each meeting. Table 2 includes contact information for the TAC.

Table 2 – TAC Contact Information

Name	Project Role	Contact Information
Mark Hoffman	ADOT-MPD Project Manager	mhoffman@azdot.gov 602-712-7454
Jim Windsor	ADOT/TSMO	jwindsor@azdot.gov 602-712-4163
Kip Carroll	ADOT/Traffic Maintenance	kcarroll@azdot.gov 480-204-4873
Sean McHugh	ADOT/Traffic Maintenance	smchugh@azdot.gov 602-320-4561
Steven Moore	ADOT/FIS	smoore@azdot.gov 602-712-4680
Cliff Guest	ADOT/Bridge	cguest@azdot.gov 602-712-8603
Dave Benton	ADOT/Bridge	dbenton@azdot.gov 602-712-7910
Bill Stone	ADOT/Research	bstone@azdot.gov 602-712-3135
Robert Bush	ADOT/MPD Data	rbush@azdot.gov 602-712-7248

2.0 Project Tasks

2.1 Work Task 1: Project Management

This task will include the initial project kickoff as well as ongoing project management and TAC meetings and materials. This will include maintaining the scope, schedule, and budget, as well as invoicing and progress reports. After receiving Notice to Proceed, AECOM will meet with the ADOT project manager to finalize the TAC representatives and project schedule. A project kickoff meeting will be scheduled and hosted virtually.

The kickoff meeting will provide an overview of the project plan. We will discuss the schedule for regular progress meetings, project milestones, and a meeting schedule for the TAC.

Task Deliverables:

- Project Work Plan
- Kickoff Meeting Agenda & Summary (TAC Mtg #1)
- Project Schedule
- TAC Meeting Minutes
- Project Management Meetings and Materials

2.2 Work Task 2: Data Collection and Analysis

The purpose of this task is to document peer views research on established sign structure inspection programs for other states, to conduct a system assessment of the sign structure inventory currently in the ADOT Features and Inventory System (FIS) and identify and gather supplemental data needed for the process.

Peer Review Research

AECOM will conduct a peer review assessment and research of five other DOT's. Other states that have been identified with sign structure inspection programs include California, Colorado, Florida, Nevada, Pennsylvania, Utah, Virginia, and Wisconsin. AECOM will engage with five of these DOT's after the project kickoff meeting. The goal of these peer reviews will be to collect program information such as:

- Current best practices
- Data collection methodologies
- Prioritization factors
- Program funding information

This peer review research will be summarized in a memorandum and presented to the TAC prior to data collection.

Data Collection

AECOM will begin the data collection effort by first determining important data elements that affect the life expectancy of each structure. The following is a preliminary list of data elements and criteria that will be presented to the TAC and optimized directly following the ADOT peer review research:

- **Asset Identification Number** | Sign structure identification will be necessary to filter and merge data sets and tools together.
- **Annual Average Daily Traffic (AADT)** | Higher traffic volumes on roadways below sign structures create a greater risk and impact if the structure were to fail.
- **Sign Structure Type** | Sign structures vary in type from overhead spans, cantilever, butterfly, and bridge-mounted signs. Different types have a greater probability of collapse if not properly inspected and maintained, due to higher loading on support anchors.
- **Age of the Structure (installation date)** | Older structures may not meet current design requirements or may have older detailing, which can be more prone to failure.

- **Record Drawings** | Structures with no record drawings should be a higher priority to inspect so structure members can be determined and structure capacities can be evaluated.
- **Speed Limit** | Roadways with higher speed limits are at higher risk of vehicle collision in the event of a sign structure collapse.
- **Number of Affected Travel Lanes** | Greater importance should be given to structures that will impact more lanes during a collapse.
- **Critical Locations (including district and GIS location)** | The sign location impacts its inspection priority, such as signs directing the public to hospitals vs. regional on/off ramp signs.
- **Elevation** | Higher elevations in Arizona receive significant snowfall, requiring use of de-icing salts on roadways. This can potentially lead to faster deterioration of steel structures.
- **Vertical/Horizontal Clearance** | Signs that do not meet clearance requirements are at a higher risk of vehicular collision and should be a high priority for inspection.
- **Sign Panel Size** | Structures supporting oversized sign panels are at greater risk of exceeding their structural capacity and are higher risk.
- **Roadway Functional Class** | Larger roadways such as interstates are at a higher risk than a local roadway or collector.
- **Fatigue Design** | Certain construction methods on steel structures are more likely to cause cracking in welds. These are known as fatigue-prone detailing. Structures that have this detailing are a higher priority to inspect.
- **Coating System** | Steel structures have different protective coatings to help against weather and rusting. These coatings include galvanization, painting, powder coating, and weathering steel.
- **Structural Component Rating** | After each inspection, the structure will be given an overall rating that will help determine how critical future inspections are. For this first prioritization, all structures will be given the same structural component rating.

Once the data element list is agreed upon, AECOM will begin data collection efforts. AECOM will obtain the current ADOT inventory from the ADOT FIS; the AECOM team understands that ADOT has inventoried the existing sign structures throughout the state and recoded the data in this system. AECOM will conduct a system assessment of the FIS data and identify any deficiencies when compared to the finalized data element list.

The following is a list of data points that are assumed to already be inventoried in the FIS:

- Asset Identification Number
- Sign Structure Type (Including dimensions)
- Age of the Structure (Installation date)
- Sign Panel Size

Other data elements will be obtained from readily available geolocated sources such as:

- ADOT MPD GIS data management
- ADOT's Sign Management System (SMS)
- ADOT's record drawings or photolog research (assumed 50% of signs)

Task Deliverables:

- *Peer Review Technical Memorandum: DOT Sign Inspection Program Best Practices* will be submitted to the ADOT PM and the TAC to be reviewed. The document will be updated with the comments to be included in the Draft Final Report.
- *Working Paper #1: Current Condition Data Collection* will be submitted to the ADOT PM and the TAC to be reviewed. The document will be updated with the comments to be included in the Draft Final Report.
- 3 TAC Meetings will be conducted during this Task; AECOM will be responsible for Meeting agenda, presentation materials and meeting minutes
 - TAC Mtg #2 – Will be conducted following the DOT peer review research where findings will be presented and data collection elements will be reviewed and agreed upon. Details of data collection efforts will also be reviewed and verified.
 - TAC Mtg #3 – Will be conducted halfway thru the actual data collection efforts to review data collection issues, needs and progress with the TAC.
 - TAC Mtg #4 – Will be conducted at the end of Task 2 and at the initiation of Task 3. All data collection efforts will be reviewed and the beginning stages of the prioritization and data visualization tool will be reviewed.

2.3 Work Task 3: Data Visualization Tool & Inspection Financial Plan

The purpose of this task is to develop evaluation criteria and a tool to prioritize sign structure inspections, develop guidance that outlines the tool, data input, and requirements, and develop a financial plan to support the inspections.

This task includes three primary work efforts: developing the evaluation/prioritization framework, creating a data visualization tool, and developing a financial plan to support the inspections. The information collected during Task 2 will be used to develop a prioritization framework that will be presented to the TAC.

Evaluation/Prioritization Framework Development

AECOM will develop and vet the prioritization framework with the ADOT TAC. The following steps will be taken with this framework:

- **Step 1:** Use the data to determine prioritization metrics with input from the TAC
- **Step 2:** Develop the prioritization scoring and scales for each metric
- **Step 3:** Establish the baseline weighting of the individual metrics to calculate an overall prioritization score for each overhead sign structure

The prioritization metrics and scoring will be presented to the TAC along with example scoring. The framework and formulas will be created and tested in Excel before creating the data visualization tool. Following a review of the draft framework, AECOM will develop a customized data visualization and prioritization tool that directly integrates the overhead sign structure inventory records and measurements.

An advantage of establishing a customized prioritization tool can be recognized by the ability to toggle and adjust prioritization weights to reflect department and agency priorities, as well as help determine an optimal investment approach. The tool will provide the flexibility to apply generic data/ scoring for metrics that do not have data during the first round or prioritization. Therefore, the inspection information can be incorporated in the scoring system such that the

second round will account for the results of the first inspections.

The scoring will require a unique set of built-in calculations that automate the calculation of raw data and assign scores. Scoring will be assigned to weighted risk factors and can be represented in category selections or more granular formula-based scoring. The full set of criteria can be scored, using either one or a combination of methodologies. We will create a scoring interface that will simplify user selections as well as automatically calculate from queried datasets.

Visualization Tool Development

Once the TAC has reviewed the draft framework, AECOM will create an ArcGIS-based backbone that connects to the ADOT GIS datasets and is based on ADOT MPD's linear referencing system.

In addition to a functional and adaptable prioritization tool, this tool will include a visualization component to geographically locate overhead sign structures and other planned projects to be able to visually assess potential improvement strategies. By overlaying the locations of different evaluation phasing, ADOT users will be able to visualize the geographic relationship of these locations against other projects and roadway features. To provide the greatest functionality of this tool, AECOM will work with the ADOT Data Analytics Group to integrate this visualizer onto ADOT's FIS and ADOT MPD's linear referencing system to be able to overlay against the wealth of hosted datasets depicting roadway features and improvements.

Financial Plan Development

Our team will work directly with ADOT stakeholders to identify a 6-year inspection approach strategy. Using best practices and coordination with ADOT technical groups, we will assess inspection program funding levels needed to execute multiple inspection strategies and frequencies. The inspection funding program will be coordinated with cyclical bridge inspections to streamline inspections of sign structures mounted to bridges. The ultimate funding of a statewide program will consider both the cyclical timing of active inspections and the 6-year individual asset inspection frequency identified by ADOT.

Task Deliverables:

- *Working Paper #2: Prioritization Framework, Data Visualization Tool and Financial Plan* will be submitted to the ADOT PM and the TAC to be reviewed. The document will be updated with the comments to be included in the Draft Final Report.
- 4 TAC Meetings will be conducted during this Task; AECOM will be responsible for Meeting agenda, presentation materials and meeting minutes
 - TAC Mtg #4 – Will be conducted at the end of Task 2 and at the initiation of Task 3. See Task 2 for summary.
 - TAC Mtg #5 – Will present and finalize the framework for the evaluation/prioritization and begin coordination on the tool.
 - TAC Mtg #6 – Will be conducted to present status on the tool development and facilitate further coordination on Value added task and tool progression.
 - TAC Mtg #7 – Will be conducted to present example prioritization, draft value added work, and draft tool functions.

2.4 Work Task 4: Final Report & Data Visualization Tool

The purpose of this task is to compile Working Papers #1 and #2 to prepare the final report and submit the final data visualization tool.

AECOM will compile the Working Papers #1 and #2, with ADOT PM and TAC comments addressed, and distribute a Draft Final Report and Data Visualization Tool to the ADOT PM for review. Once approved, the Draft Final Report and Data Visualization Tool will be presented to the TAC for final comments. AECOM will provide a summary of comments and resolution to those comments. A TAC meeting will be held to review all comments.

AECOM will facilitate the prioritization tool's successful integration into ADOT's platforms. AECOM will also create a user manual for the prioritization tool so ADOT can successfully administer the tool within the state system.

The Draft Final Report will be submitted to the TAC for review and comment. AECOM will meet with the TAC to present highlights of the report and respond to comments and questions prior to finalizing the report.

Task Deliverables:

- *Draft Final Report* and Draft Visualization Tool
- Summary of comments and resolutions
- *Final Report* and Final Visualization Tool
- *Visualization Tool User Manual*
- TAC Mtg #8 – Will be conducted to review all comments on the Draft Final Report and any questions with the User Manual and Draft Visualization Tool

2.5 Work Task 5: Value Added Engineering

The purpose of this task is to take the prioritization further to identify, prioritize, and potentially group future maintenance and capital improvement recommendations resulting directly from future sign structure inspection results. This additional prioritization effort could further assist in the ability to quickly integrate capital improvement recommendations into the ADOT Planning to Programming (P2P) system and be competitively considered in future annual programming processes.

This Task will run alongside the second half timeframe of Task 3.

This additional value added task will compound off of the existing Funding Identification scoped effort to create and apply a framework to future inspection results. Those results will then be used to identify project needs and sort projects into either maintenance activities, standalone capital investments, and/or combined capital investments. Although asset inspections are not anticipated to be completed at the time of this task, this task would include using proxy project examples based on the AECOM team's experience and known suspected results as provided by ADOT technical/district staff.

Efforts included with this task will include:

- Create fields in database for inspection results
- Create scoring thresholds within inspection results to define maintenance and/or capital investment(s) need/eligibility

- Identify guidelines and perimeters for project combination opportunities with like or unlike scopes
- Identify perimeters for project implementation strategies within the Automated P2P GIS system
- Explore opportunities to submit individual / group sign structure improvements as standalone project recommendations in various funding categories
- Explore opportunities to combine sign structure improvements with existing P2P project recommendations based on the following criteria:
 - GIS location/proximity
 - Compatible scope of work pairings (ex. such as sign replacements can only be paired with Pavement Preservation or Bridge Preservation jobs, but not safety improvements...)
 - Temporal qualifications
- Additional coordination associated with this effort includes:
 - Coordination and collaboration directly with Jason James with the P2P Program

Task Deliverables:

- All efforts with this task will be incorporated into Working Paper #2
- TAC Meetings within this task (TAC Mtgs #6 and #7) are presented in Task 3

3.0 Schedule

A study schedule has been provided in Figure 2. The schedule identifies TAC meetings, task ranges, draft and final deliverables, and review times. ADOT review time for all draft submittals will be 14 calendar days unless otherwise indicated by the ADOT project manager. A pre-final draft will be submitted for review to ADOT prior to the production of the final report. The consultant project team shall update the project schedule as necessary for it to accurately represent progress and to realistically forecast scheduled submittals.

AECOM shall complete all work associated with this scope of work within 12 months from the notice to proceed (NTP) date (inclusive of review times). The final report and data tool will be submitted by the end of November 2022.

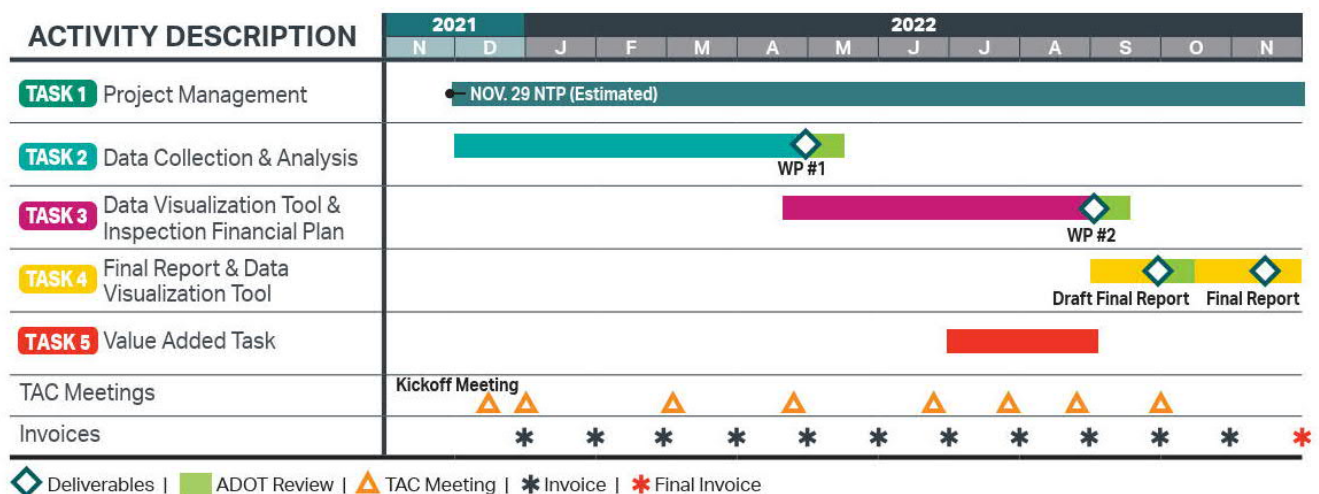


Figure 2 – Project Schedule

4.0 Quality Assurance/Quality Control

The AECOM project team will make every effort to provide ADOT with high quality technical data, analysis and documents. We use our established quality control process as shown in Figure 3 to check all deliverables, which begins with our design engineers/planners performing and self-checking their work. We identify qualified discipline and interdiscipline reviewers with the background, experience, and expertise to perform the technical backchecks and reviews.

The AECOM quality manager is ultimately responsible for an additional final review of all deliverables from AECOM to ADOT. Our QA manager, or his designee, confirms our review process is followed by all team members. Implementing quality is considered in the upfront project planning efforts and is included in our project schedule.



Figure 3 – Quality Control Process