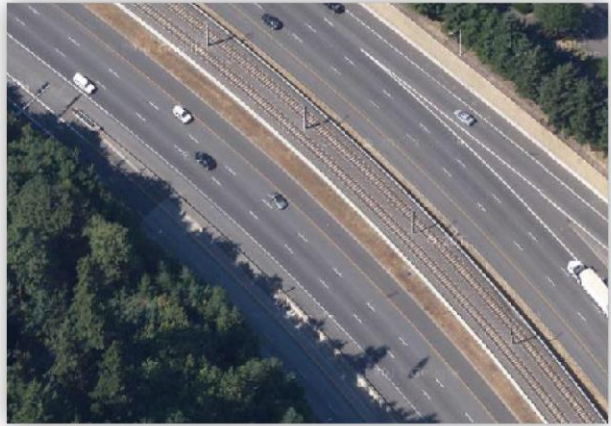
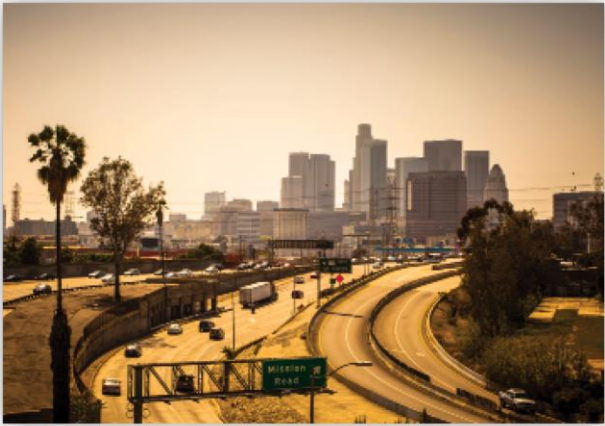


TPF-5(284) Near-Road Transportation Pooled Fund: Five-Year Strategic Research Plan



Revised Final Plan prepared for

Washington State Department of Transportation
Seattle, WA

October 2014

STi
Sonoma Technology, Inc.



TPF-5(284) Near-Road Transportation Pooled Fund: Five-Year Strategic Research Plan

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Cover graphic illustrates vehicles, traffic, and forms of transportation infrastructure that are related to near-road air quality impact assessment.

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1. Introduction

This five-year strategic plan will guide the Near-Road Air Quality Transportation Pooled Fund (TPF) partnership, led by the Washington State Department of Transportation (WSDOT), in developing and completing near-road air quality research, analysis, and tool development projects. WSDOT and its state and federal agency partners created the TPF to help agencies identify and address a broad range of near-road issues. As stated in the initial TPF announcement:¹

New federal regulations require state and local agencies to monitor near-roadway emissions and quantitatively assess potential for air quality impacts (“hot-spots”). State DOTs need to understand the implications of the new near-road data being collected; develop analysis methods and expertise to complete hot-spot modeling; and implement effective mitigation. Many states are unable to internally address all of the new emissions modeling and measurement requirements with existing resources. State DOTs need help meeting new near-road air quality analysis requirements and responding to stakeholder requests for information about near-road air pollution.

Currently, there is no forum dedicated to facilitating information and technology transfer related to near-road pollution issues. A pooled fund would allow for coordinated sharing of critical research developments, evaluation techniques, and study results to reduce overall costs and promote project delivery. It would provide a unique venue for collaboration between state DOTs and FHWA to clarify near-road emissions challenges, prioritize research needs, discourage redundant individual state efforts, and to quickly initiate research that develops solutions that meet the needs of multiple states.

Key motivators for the TPF include U.S. Environmental Protection Agency (EPA) requirements to quantitatively evaluate potential particulate matter (PM) hot-spots, EPA and U.S. Federal Highway Administration (FHWA) requirements to assess mobile source air toxics (MSATs), and recently implemented EPA requirements to monitor air quality near heavily traveled roads. As of August 2014, TPF participants include FHWA and several state DOTs, including those from Arizona, California, Texas, Virginia, and Washington. Sonoma Technology, Inc. (STI) was awarded a TPF support contract and is responsible for completing projects to meet TPF goals.

This document describes the key goals identified by the fund participants, describes the work needed (potential projects) to achieve the key goals, and identifies the sequence and priority for completing the proposed projects. [Section 2](#) describes the process used by STI and TPF participants to determine key goals; this process included preliminary research and a one-day workshop during which fund participants met to discuss and select key goals. [Section 3](#) discusses the results of the

¹ See: <http://www.pooledfund.org/Details/Study/526>.

one-day workshop, including agreed-upon goals and potential projects prioritized to achieve those goals. [Section 4](#) discusses the implementation plan for the TPF, including a description of initial and future projects to be completed. Finally, this document contains two appendices. [Appendix A](#) contains materials from the one-day workshop, including the agenda, draft goals and potential projects, and results from a voting process used to prioritize goals and projects. [Appendix B](#) contains draft one- to two-page statements of work and budget estimates for the first round of projects included in the TPF implementation plan.

2. Methods

To facilitate the creation of this strategic research plan, STI hosted a one-day workshop to discuss and prioritize goals and research projects. Prior to the workshop, STI performed the following tasks to prepare draft goals and potential projects for discussion:

- Contacted TPF participants to assess their highest priority issues, challenges, and needs, and to solicit their ideas for TPF goals and projects.
- Reviewed air quality research needs compiled by the Transportation and Air Quality Committee (ADC20) of the U.S. Transportation Research Board (TRB).
- Reviewed the air quality research needs statements from the Transportation and Environmental Research Ideas (TERI) database maintained by the Center for Environmental Excellence by the American Association of State Highway and Transportation Officials (AASHTO).

STI then synthesized the research needs and interview results to create draft goals and potential projects for discussion during the one-day workshop, held on June 6, 2014, at the STI office in Petaluma, California. Representatives from each of the TPF partner organizations participated, either in person or over the phone. The workshop consisted of roundtable discussions, small group breakout discussions, and voting for goals and projects. Vote totals were used to inform discussion, prioritize goals and projects, and provide rough cost guidelines to consider when scoping future projects. Voting was color-coded; state DOT/ FHWA participants voted with red dots, and STI participants voted with green dots. Additional details about the workshop, including the agenda and a list of participants, can be found in [Appendix A](#).

3. Workshop Results

This section provides TPF goals and prioritized projects; these are based on the June 6, 2014, workshop and clarifying comments received on the post-workshop draft strategic plan.

3.1 Key Goals

The first topic of discussion was the overall objective of the TPF.

Overall TPF Objective: *Improve the state of knowledge regarding, and the ability of state DOT staff to address, near-road air quality issues.*

TPF Goals

1. Increase knowledge of the relationship between traffic conditions and monitored near-road air quality data by
 - Obtaining, assessing, and summarizing available near-road monitoring data (including, but not limited to, PM_{2.5}, PM₁₀, MSATs, NO₂, and ultrafine particles) from new near-road monitors and special near-road field studies (where and when available)
 - Identifying trends and technically robust screening thresholds
 - Periodically synthesizing near-road monitoring studies, research, and literature
 - Developing case studies
 - Creating technical assistance resources and training materials
2. Improve best practices for project-level analyses by
 - Developing and streamlining project screening to help meet Clean Air Act (CAA) requirements
 - Building and evaluating case studies
 - Developing user-friendly tools and web-based applications
 - Performing periodic evaluation of new and emerging tools, research, and literature for completing project-level analyses
 - Creating technical assistance resources and training materials
3. Increase knowledge of operational and construction mitigation measures that support near-road air quality improvements by
 - Identifying and selecting promising measures
 - Assessing implementation feasibility
 - Quantifying the benefits of the mitigation measures

- Performing periodic evaluation of new and emerging tools, research, and literature for operational and construction mitigation measures
 - Creating technical assistance resources and training materials
4. Improve interagency exchange of information by
- Providing electronic platforms and venues for sharing case study analysis results, lessons learned, best practices, templates, and other information
 - Enabling interagency partners to identify and resolve technical and policy issues

Figure 1 is a bar chart of the workshop voting results for the key goals. As shown in the figure, Goal 2, improving best practices for project-level analyses, is the highest priority goal. It is important to note that while Goal 4, improving interagency exchange of information, was the lowest-ranked goal, participants agreed that this goal is critical to the overall success of the TPF. One of the workshop breakout groups even suggested folding Goal 4 into the overall TPF objective.

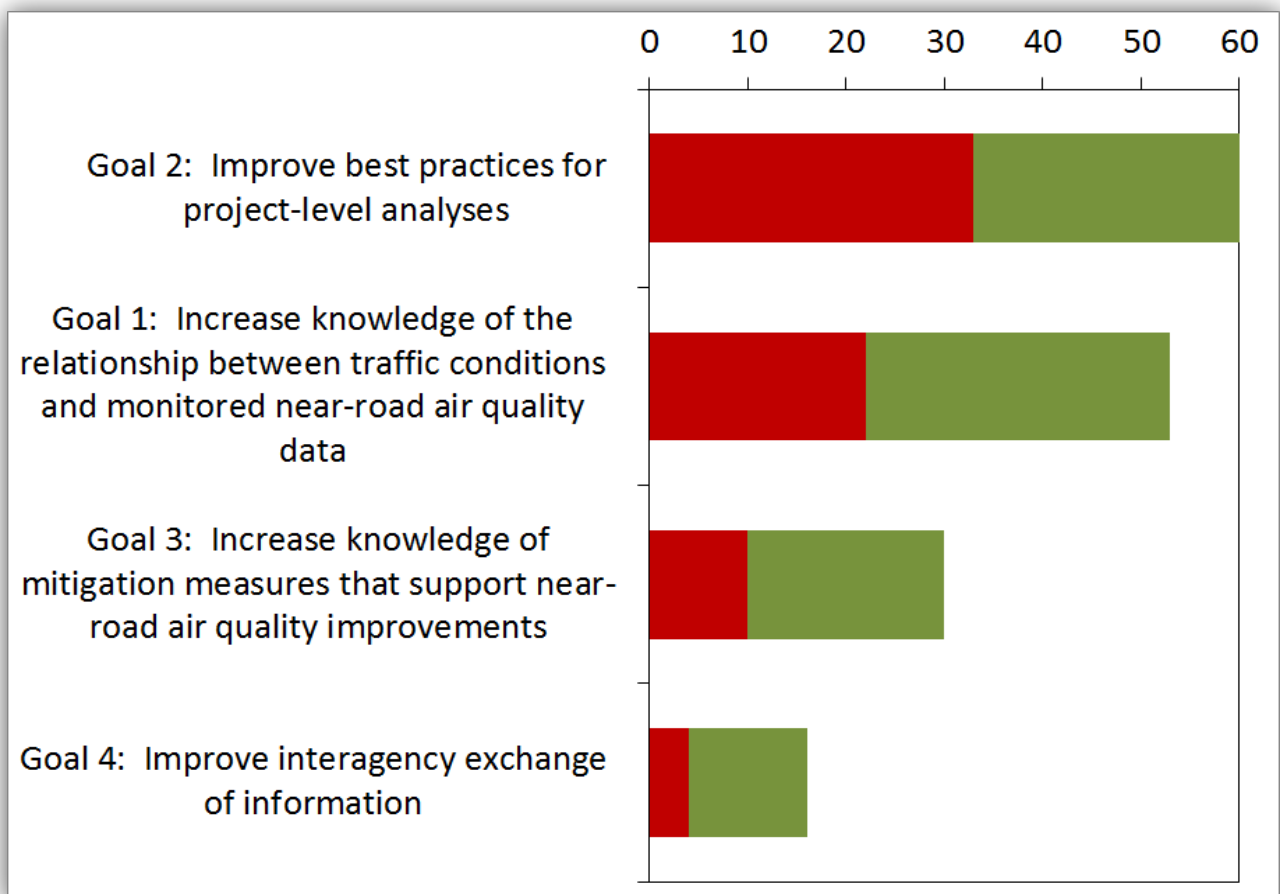


Figure 1. Bar chart with the voting results for TPF goals. The red bars represent votes by DOT/FHWA fund participants, and green bars represent votes by STI participants.

3.2 Potential Projects

During the workshop, TPF partners discussed, ranked, and estimated approximate costs for potential projects to meet the TPF goals identified in Section 3.1 (see [Table 1](#) and [Figure 2](#)). After the workshop, we organized these potential projects into three groups based on rank: high (A), medium (B), and low (C).

Table 1. Summary of potential TPF projects and associated proposed strategic goals. A check mark (✓) indicates a project that meets the primary strategic goal; a circle (●) indicates a project that meets secondary strategic goals; a cross mark (x) indicates the anticipated project cost range.

Page 1 of 2

Group	Rank	Potential Projects	Strategic Goals				Cost Range ^a		
			Traffic and monitored data	Project-level best practices	Mitigation	Information exchange	Below \$150K	\$150K to \$300K	Above \$300K
High	1	Exploratory scoping study to identify potential project types and situations that will not create PM hot spots	●	✓	●	●			x
	2	National data assessment and periodic network monitoring reports and near-road literature synthesis	✓					x	
	3	Modeling performance evaluation under different conditions (when more near-road data are available)	●	✓		●			x
	4	Information sharing website and forum	●	●		✓		x	
	5	Case study assessment of the benefits of truck retrofits using California's Schuyler-Heim Bridge	●	●	✓	●		x	

^a The cost range identified here is approximate and is meant to provide a qualitative guide when scaling work scopes to available budgets.

Table 1. Summary of potential TPF projects and associated proposed strategic goals. A check mark (✓) indicates a project that meets the primary strategic goal; a circle (●) indicates a project that meets secondary strategic goals; a cross mark (x) indicates the anticipated project cost range.

Page 2 of 2

Group	Rank	Potential Projects	Strategic Goals				Cost Range ^a		
			Traffic and monitored data	Project-level best practices	Mitigation	Information exchange	Below \$150K	\$150K to \$300K	Above \$300K
Medium	6	Synthesis of recent DOT project analysts' experience (focusing on PM hot spots)		✓	●	●	x		
	7	Resource allocation and prioritization for project-level analyses (focusing on PM hot spots)		✓	●	●		x	
	8	Vegetative screen and sound wall assessment	●		✓	●	x		
	9	Tool development to assess PM, toxics, and other important pollutant issues		✓					x
Low	10	General consultation and client assistance	●	✓	●	●	x		
	11	Annual near-road workshop	●	●		✓	x		
	12	Literature review of linkage between indoor and outdoor near-road air quality	✓				x		
	13	Mitigation literature review and compendium of options			✓	●	x		
	14	Indoor air filtration system assessment	●		✓	●	x		

^a The cost range identified here is approximate and is meant to provide a qualitative guide when scaling work scopes to available budgets.

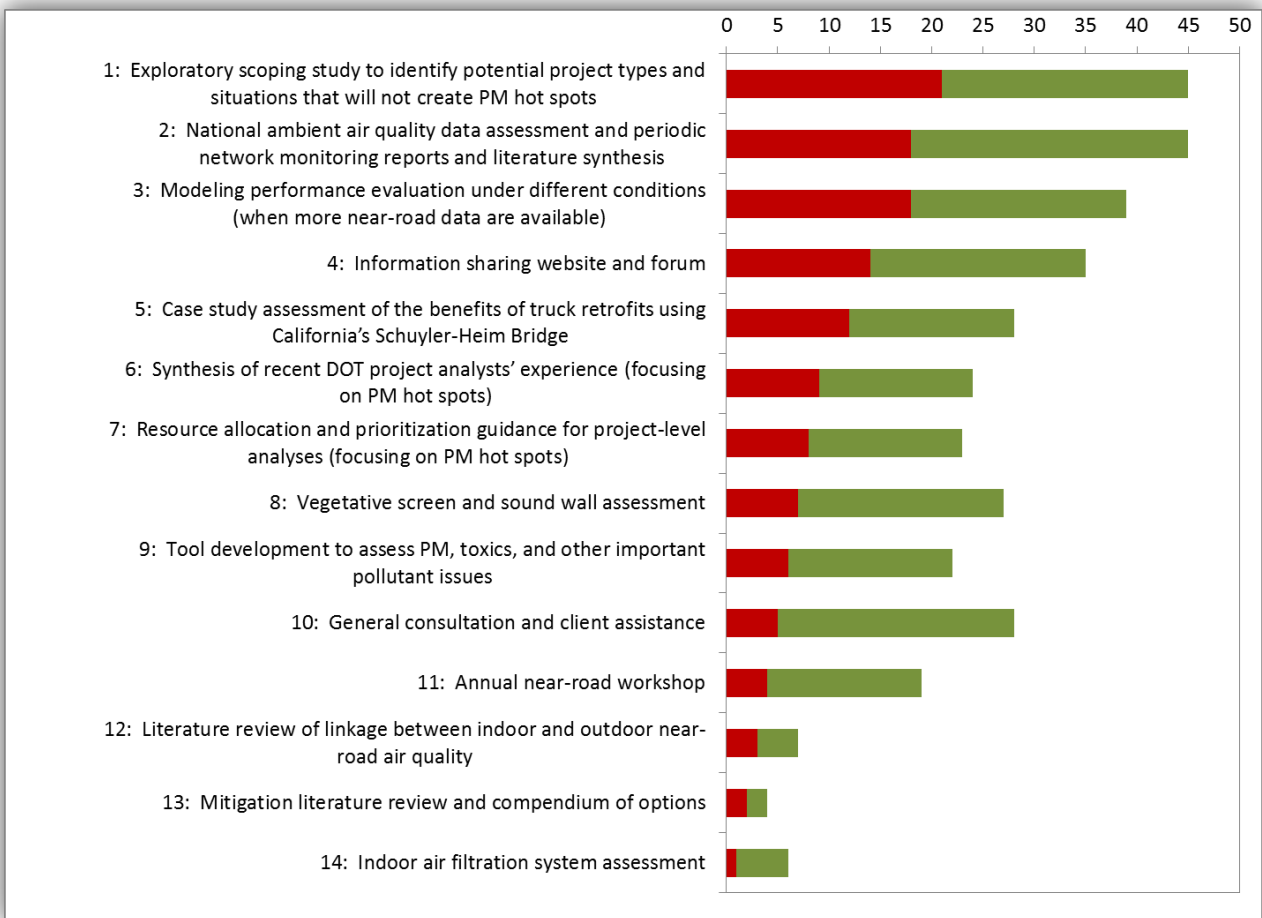


Figure 2. Voting results for potential TPF projects. The red bars represent votes by DOT/FHWA fund participants, and green bars represent votes by STI participants. Note: Projects 5, 8, and 13 were later combined into one task order.

The remainder of this section briefly describes each project by group, in priority order. Each project listing includes a short description of work elements and identifies the rough cost range anticipated to complete that effort. The work elements and costs were key considerations used to develop the implementation plan presented in [Section 4](#).

3.2.1 Group A Potential Projects (High ranking)

1. *Exploratory scoping study to identify potential project types and situations that will not create PM hot spots or are not a project of air quality concern (anticipated cost range: >\$300K).*
 - Develop case studies and identify a small set of modeling scenarios that can be used to assess the incremental PM impacts from a project.

- Perform limited modeling tests to identify a range of project parameters that result in relatively small incremental impacts (e.g., out-year build scenarios, advanced technology truck fleets).
 - Identify the technical feasibility of specifying potential projects of air quality concern given trends and situations not currently accounted for by EPA guidance (e.g., truck fleet turnover).
 - As directed by pooled-fund partners, develop a work plan for a more comprehensive modeling assessment to quantitatively establish project types and situations likely to have minimal incremental PM impacts.
 - Based on the lessons learned from case studies and other modeling assessments, develop or improve existing modeling tools to help quantitatively identify project types and situations likely to have minimal incremental PM impacts.
2. *National ambient air quality data assessment, periodic network monitoring reports, and near-road literature synthesis (anticipated cost range: \$150K–\$300K).*
- Collect all 2012–2014 near-road monitoring data from EPA-compliant monitors, special near-road studies, and existing monitors near major roads.
 - Create a high-level summary of the information available, including, but not limited to, dates and locations with the highest monitored values, trends in the data, and traffic summaries and meteorological data (for selected case studies).
 - Identify methods and criteria that explain high-concentration events in near-road pollutants; develop illustrative case studies.
 - Provide periodic updates and near-road assessment findings as new near-road monitoring data become available (e.g., every six months).
 - Track relevant near-road literature, project assessment findings, tool development, guidance, and other resources; provide periodic summaries of important insights.
3. *Modeling performance evaluation under different conditions, when more near-road data are available (anticipated cost range: >\$300K).*
- Develop a representative set of case studies that characterize different project and fleet situations (e.g., highway, intermodal facility, truck/freight corridors).
 - Collect, quality-assure, and process data from the national near-road monitoring network for the case studies.
 - Evaluate performance under different conditions by modeling selected case studies and comparing model predictions to near-road air quality measurements.
 - Develop and deliver documentation and training.

Note that, although this project ranked highly, participants preferred to complete this work in later years once more near-road data becomes available to facilitate analyses. Thus, it is not among the initial task orders detailed in [Appendix B](#).

4. *Information-sharing website and forum (anticipated cost range: \$150K–\$300K).*
 - Develop an information-exchange website with security (e.g., password access) for transportation/air quality planners and project analysts.
 - Populate the website with relevant data, FAQs, reports, software, and results from other pooled fund tasks.
 - Create an electronic forum and develop a listserv to facilitate interagency communication and information exchange (modeled after airshare.info).
 - Host and maintain the website and forum for the life of the pooled fund.
5. *Assessment of the benefits of truck retrofits, using California's Schuyler-Heim Bridge and other case studies (anticipated cost range: \$150K–\$300K).*
 - Research and describe the site-specific truck retrofit effort funded by Caltrans.
 - Identify implementation challenges and actions taken to resolve them.
 - Illustrate methods used to quantify the retrofit program benefits.
 - Create a case study that describes innovative mitigation measures and practical implementation methods.
 - Complete supplemental mitigation case studies to highlight higher-priority opportunities to reduce project-level construction and operational impacts.

3.2.2 Group B Potential Projects (Medium ranking)

6. *Synthesis of recent DOT project analysts' experience with focus on PM hot spots (anticipated cost range: <\$150K).*
 - Identify modeling tools and areas of largest impact on resources (time/budget) by obtaining feedback from DOT staff about their experience with recent project-level analyses. The interview could include the following questions:
 - What tools do you use to acquire and process traffic and meteorological data?
 - Where do you obtain the traffic and meteorological data?
 - What tools do you use, and how do you use them, to integrate (a) traffic data into your emissions model, and (b) emissions model output into your dispersion model?
 - What tools do you use, and how do you use them, to post-process dispersion model outputs and calculate design values?
 - What areas in the project-level analysis are the most complicated or take the most resources (time/budget)?
 - In what areas do you need additional resources/training/tools?
 - Obtain and assess tools for their ease of use and transferability to other states.
 - Identify tool development needs.
7. *Resource allocation and prioritization for project-level analyses with focus on PM hot spots (anticipated cost range: \$150K–\$300K).*

- Perform a literature review of relevant sensitivity studies for travel demand, emissions, and dispersion modeling.
 - Identify practical modeling lessons by obtaining feedback from key practitioners.
 - Document steps in the analysis chain on which project analysts should spend the most resources (time/budget) to best characterize their project (e.g., replacing model defaults with local data, refining travel speeds, quality-assuring model inputs and assumptions).
 - Illustrate the relative importance of the analysis steps (identified above) using a hypothetical project.
 - Develop and deliver documentation and training resources.
8. *Vegetative screen and sound wall assessment (anticipated cost range: <\$150K).*
- Gain interagency consensus on quantifiable benefits for specific vegetative species and sound wall designs by completing a literature review and publishing findings.
 - Enable analysts to select vegetative species appropriate to their project site that meet multiple selection criteria, such as tolerance to drought, low production of VOCs and pollen, and easy maintenance.
 - Identify species suitable for use as vegetative screens by evaluating modeling tools, such as SelectTree and iTree.
 - Develop and deliver resources to help analysts quantitatively assess site-specific multi-pollutant benefits from vegetative screens and/or sound walls.
9. *Tool development to assess PM, toxics, and other important pollutant issues (anticipated cost range: >\$300K).*
- Prioritize tool development needs on the basis of feedback from Project 6.
 - Develop tools to facilitate PM, toxics, and other hot-spot analyses.
 - Develop and deliver documentation and training resources.

3.2.3 Group C Potential Projects (Low ranking)

10. *General consultation and assistance (anticipated cost range: <\$150K).*
- Provide ongoing technical support to pooled fund partners, such as answering technical questions related to near-road air quality assessment, reviewing evolving policy and regulatory requirements, and developing specific support materials as needed.
11. *Annual near-road workshop (anticipated cost range: <\$150K).*
- Organize and host an annual two-day near-road information exchange workshop for pooled fund partners and other invited attendees that covers relevant issues for project analyses, conformity policy issues (emerging and resolved), and other topics.
 - Provide post-workshop summaries and related information to attendees.

12. *Literature review of linkage between indoor and outdoor near-road air quality (anticipated cost range: <\$150K).*

- Review literature to evaluate correlation between indoor and outdoor near-road air quality.
- Assess representativeness of existing research and data results to situations across the United States.

13. *Mitigation literature review and compendium of options (anticipated cost range: <\$150K).*

- Review literature to identify mitigation options.
- Develop compendium of mitigation options.

Note: TPF participants decided during the workshop to combine this project with the mitigation case study project (Project 5, Section 3.2.1).

14. *Indoor air filtration system assessment (anticipated cost range: <\$150K).*

- Assess indoor air filtration systems used near roads by completing a literature review.
- Identify practical implementation lessons learned to date from recent installations of improved filtration in schools, residences, and other buildings.
- Identify and document the quantifiable benefits of installation.
- Develop and deliver implementation resources and case studies.

4. Implementation Plan

4.1 Proposed Task Orders and Budgets for the First Round of Work Under the TPF

Based on research completed by STI and the subsequent goal setting and project prioritization done during the workshop, this discussion identifies the first round of task orders to be completed under the TPF. Task orders were identified in light of several criteria and constraints, such as the need to complete proposed work that:

- a. Contributes to meeting multiple strategic goals;
- b. Reflects the TPF partners' primary needs, as determined by their prioritization of the project ideas;
- c. Fits within the overall TPF funding level; and
- d. Allows work to be phased so that work products can be completed and delivered in a way that takes the best advantage of existing and potential funding.

Using these criteria, we constructed four first-round task orders. As shown in [Table 2](#), these task orders address the highest priorities identified during the strategic planning workshop (see Section 3.2), and are planned so that work phases optimize available funding. In addition, to assist with sequencing work and to combine common topics, Task Order 5 groups mitigation-oriented projects 5, 8, and 13 (see Section 3.2) into one mitigation-related task order. The work shown in Table 2 was planned to facilitate successful delivery of a series of work products, even if funding for individual (later) phases is not available or not approved. A description of each task order's work scope and cost is presented in [Appendix B](#).

Table 2. Summary of first round TPF task orders with proposed work scopes and budgets. Note TO 1 was to facilitate and host the one-day workshop and create this five-year strategic plan.

Proposed Task Order	Content	Phase I		Phase II		Phase III		Total Budget
		Key Work Scope	Budget	Key Work Scope	Budget	Key Work Scope	Budget	
TO 2	Exploratory scoping study to identify potential project types and situations that will not create PM hot spots	Freeway case study	\$200K	Intersection case study	\$240K	Tool development	\$300K	\$740K
TO 3	National data assessment, periodic data updates, and literature synthesis	Initial data assembly and assessment	\$100K	Full data assembly, update national assessment, and perform case studies	\$150K	Periodically update database and assessment, perform case studies	\$320K	\$570K
TO 4	Information sharing website and forum	Develop mock-up and deploy initial website	\$60K	Complete website development and continue operations	\$80K	Host, maintain, and update website	\$160K	\$300K
TO 5	Truck retrofit case study, sound barrier evaluation, and mitigation literature review and compendium	Schuyler-Heim Bridge truck retrofit program case study	\$60K	Sound barrier effects on near-road pollutant concentrations	\$75K	Mitigation measures reference document and case studies	\$225K	\$360K
Totals		Phase I Sum:	\$420K	Phase II Sum:	\$545K	Phase III Sum:	\$1,005K	\$1,970K

	Covered by existing committed funding (\$846K remaining of original \$910K)
	To be covered (approximately) by anticipated FY 14/15 funding from Caltrans (\$250K) and FHWA (\$100K)
	Additional funding needed to complete all phases of first-round (\$860K)

4.2 Implementation: First Round of Task Orders

A proposed timeline for conducting the first round of pooled fund task orders is shown in [Figure 3](#). Key considerations for implementation include:

- Conducting task orders concurrently to optimize current funding;
- Developing phase-specific, stand-alone deliverables to ensure that each individual phase generates complete work products;
- As additional funding becomes available, working with TPF partners to proceed with additional planned phases and new project ideas (as needed).

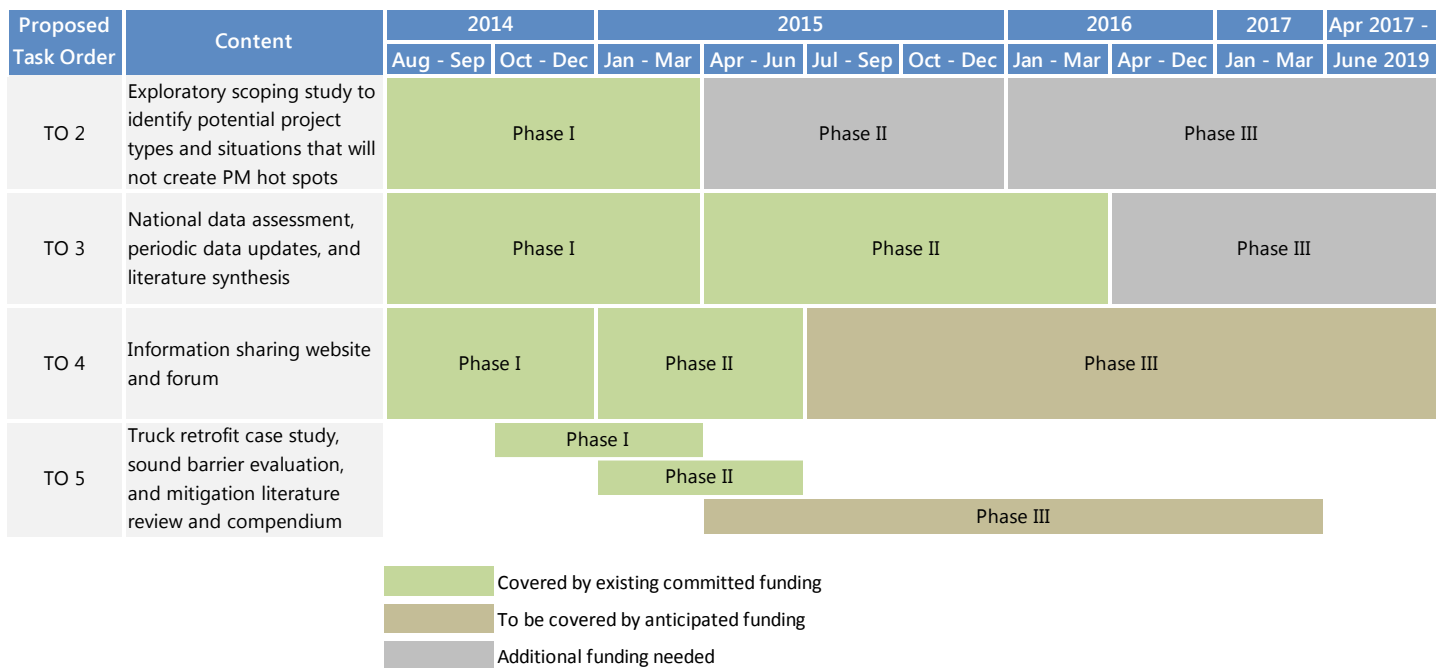


Figure 3. Proposed timeline for conducting work phases of the first round of TPF task orders. TO 1 was to facilitate the one-day workshop and create the five-year strategic plan (this document).

4.3 Implementation: Remaining Project Ideas

As discussed in Section 3, a total of 14 projects were identified and evaluated. The first round of proposed work covers six of these 14 projects. The remaining projects, and/or other projects identified by TPF partners, will be completed in future years, contingent on available funding and strategic plan updates. The TPF partners anticipate updating this plan from time to time to account for new scientific information, evolving regulatory requirements, lessons learned from completed work, and the changing needs of TPF partners and other stakeholders. Future versions of the plan will provide more detail regarding projects to be completed after the first round of work is finished.

Appendix A. Near-Road Air Quality TPF Planning Workshop Materials

This appendix contains materials used during the workshop. These include the agenda, list of attendees, and workshop logistics; draft strategic plan goals and potential projects that were discussed during the workshop; photographs of the voting results for the goals and potential projects; and photographs taken during the workshop.

Near-Road Air Quality Pooled Fund Planning Workshop

8:00 a.m. to 5:00 p.m., June 6, 2014

Sonoma Technology, Inc., 1455 N. McDowell Blvd., Suite D, Petaluma, CA

Dress: business casual

Time	Topic	Facilitators
8:00 – 8:30	Coffee and pastries	Adam, Song
8:30 – 8:45	Welcome and introductions, handouts and logistics	Tim S., Doug
8:45 – 9:30	Strategic goals roundtable discussion <ul style="list-style-type: none"> a. Review handouts with draft potential goals b. Identify additional goals (as needed) c. Discuss potential strategic goals and tasks 	Doug
9:30 – 10:30	Strategic goals group breakout discussion <ul style="list-style-type: none"> a. Discuss strategic goals b. Report out from groups (key needs and concerns) c. Prioritize (voting) goals 	Song
10:30 – 10:45	Morning break and beverage	
10:45 – 11:15	Prioritization of goals and morning session wrap-up	Steve R.
11:15 – 11:45	Brief discussion regarding potential involvement of other stakeholders in the Pooled Fund and its projects	Tim S., Doug
11:45 – 1:00	Break and lunch (brought in)	
1:00 – 1:45	Potential projects roundtable discussion (for top four goals) <ul style="list-style-type: none"> a. Review and discuss draft potential projects b. Identify additional projects under each goal 	Adam
1:45 – 2:45	Potential projects group breakout discussion <ul style="list-style-type: none"> a. Groups rotate to discuss projects under each goal b. Identify additional project ideas (as needed) c. Identify preferred rough cost range per project 	Doug
2:45 – 3:00	Afternoon break and snacks	
3:00 – 4:00	Prioritization of projects and afternoon session wrap-up <ul style="list-style-type: none"> a. Vote and prioritize potential projects b. Discuss vote results c. Discuss project timing (first ones; sequential vs. concurrent) 	Steve R.
4:00 – 4:10	Phone/email break	
4:10 – 5:00	Workshop wrap-up and next steps <ul style="list-style-type: none"> a. Summarize group consensus b. Discuss drafting and circulation of strategic plan c. Work scopes and budget estimates to follow plan d. Routine check-in meetings by phone (dates TBD) 	Doug, Tim S.
5:00	Adjourn	

Workshop Attendees

(alphabetically by last name)

Darcy Anderson (attending via WebEx)
Arizona DOT
602.712.6171
danderson3@azdot.gov

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Garnet Erdakos
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Ashley Russell
arussell@sonomatech.com

Breakout Discussion Groups

Group 1: **Chris**, Jackie, Jim,
Song, Hilary, Steve B

Group 2: **Tim W.**, Rhonda,
Ashley, Doug, Paul

Group 3: **Cecilia**, Darcy, Tim S.,
Adam, Garnet, Steve R

Bold = Reports results
Italics = Takes notes

Workshop Logistics

- WebEx setup (for Darcy Anderson, Rhonda Brooks, and Jackie Ploch).
- 3 sessions through WebEx (8:00-9:30, 1:00-1:45, 3:00-5:00).
- STI's wifi information
- See handouts in folders (potential strategic goals and projects).
- Paul will keep track of time (for round table discussion, breakout group discussion, etc.)
- Use large paper taped to walls for group discussion.
- Use stickers for voting on priorities – colored by DOT (red) and STI (green).
- STI staff will help take notes in each group.
- Guest office is available for visitor use.
- Coffee, pastries, snacks, and beverages will be available during breaks; lunch will be brought in at noon.

Near-Road Pooled Fund: Strategic Plan

Overall Objective

Improve the ability of state DOT staff to address near-road air quality issues and requirements.

Specific Goals

1. Increase knowledge of the relationship between traffic conditions and monitored near-road air quality data by
 - Obtaining, assessing, and summarizing available data
 - Identifying trends and technically robust screening thresholds
 - Developing case studies
 - Creating training materials
2. Improve best practices for project-level analyses by
 - Developing and streamlining project screening protocols
 - Building and evaluating case studies
 - Developing user-friendly tools and web-based applications
 - Creating guidance and training materials
3. Increase knowledge of mitigation measures that support near-road air quality improvements by
 - Identifying and selecting promising measures
 - Assessing implementation feasibility
 - Quantifying their benefits
 - Creating guidance and training materials
4. Improve interagency exchange of information (particularly to support conformity consultation) by
 - Providing electronic platforms and venues for sharing case study analysis results, lessons learned, best practices, templates, and other information
 - Enabling interagency partners to identify and resolve technical and policy issues

Table A-1. Summary of potential pooled fund projects and associated proposed strategic goals. A check mark (✓) indicates the project meets the primary strategic goal and a circle (●) indicates the project meets secondary strategic goals.

#	Potential Projects	Strategic Goals			
		Traffic and monitored data	Project-level best practices	Mitigation	Information exchange
1	National data assessment	✓			
2	Periodic network monitoring reports and near-road literature synthesis	✓			
3	Synthesis of recent DOT project analysts' experience (focusing on PM hot spots)		✓	●	●
4	Tool development to assess PM, toxics, and other important pollutant issues		✓		
5	Resource allocation and prioritization guidance for project-level analyses (focusing on PM hot spots)		✓	●	●
6	Modeling performance evaluation under different conditions (when more near-road data are available)	●	✓		●
7	Exploratory scoping study to identify potential project types and situations that will not create PM hot spots	●	✓	●	●
8	Vegetative screen and sound wall assessment	●		✓	●
9	Indoor air filtration system assessment	●		✓	●
10	Case study assessment of the benefits of truck retrofits using California's Schuyler-Heim Bridge	●	●	✓	●
11	Information sharing website and forum	●	●		✓
12	Annual near-road workshop	●	●		✓

Goal

Increase knowledge of the relationship between traffic conditions and monitored near-road air quality data by

- Obtaining, assessing, and summarizing available data
- Identifying trends and technically robust screening thresholds
- Developing case studies
- Creating training materials

Potential Projects

1. National data assessment.

- Collect all 2012-2014 near-road monitoring data (PM, NO₂, and toxics) from EPA-compliant monitors.
- Create a high-level summary of the information available, including, but not limited to, dates and locations with the highest monitored values, trends in the data, and traffic summaries and meteorological data (for selected case studies).
- Identify methods and criteria that explain high concentration events in near-road pollutants.
- Provide periodic updates and near-road assessment findings as new near-road monitoring data become available (e.g., every six months).

2. Periodic network monitoring reports and near-road literature synthesis.

- Collect, quality-assure, and process data from the national near-road monitoring network.
- Summarize findings from the near-road monitors (network wide and selected case studies).
- Track relevant near-road literature, project assessment findings, tool development, and guidance, and provide periodic summaries of important insights.

Goal

Improve best practices for project-level analyses by

- Developing and streamlining project screening protocols
- Building and evaluating case studies
- Developing user-friendly tools and web-based applications
- Creating other guidance and training materials

Potential Projects

3. Synthesis of recent DOT project analysts' experience (focusing on PM hot spots).
 - Identify modeling tools and areas of largest impact on resources (time/budget) by obtaining feedback from DOT staff about their experience with recent project-level analyses. The feedback interview could include the following questions:
 - What tools do you use to acquire and process traffic and meteorological data?
 - Where do you obtain the traffic and meteorological data?
 - How do you/what tools do you use to integrate
 - Traffic data into your emissions model?
 - Emissions model output into dispersion model?
 - How do you/what tools do you use to post-process dispersion model outputs and calculate design values?
 - What areas in the project-level analysis are the most complicated or take the most resources (time/budget)?
 - In what areas do you need additional guidance/training/tools?
 - Obtain and assess tools for their ease of use and transferability to other states.
 - Identify tool development needs.
4. Tool development to assess PM, toxics, and other important pollutant issues.
 - Prioritize tool development needs based on feedback results (other project).
 - Develop tools to facilitate PM, toxics, and other hot-spot analyses.
 - Develop and deliver documentation and training resources.
5. Resource allocation and prioritization guidance for project-level analyses (focusing on PM hot spots).
 - Perform a literature review of relevant sensitivity studies for travel demand, emissions, and dispersion modeling.
 - Identify practical modeling lessons by obtaining feedback from key practitioners.

- Document steps in the analysis chain for which project analysts should spend the most resources (time/budget) to best characterize their project (e.g., replacing model defaults with local data, refining travel speeds, quality assuring model inputs and assumptions).
 - Illustrate the relative importance of the analysis steps (identified above) using a hypothetical project.
 - Develop and deliver documentation and training resources.
6. Modeling performance evaluation under different conditions (when more near-road data are available).
- Develop a representative set of case studies that characterize different project and fleet situations (e.g., highway, intermodal facility, truck/freight corridors).
 - Collect, quality-assure, and process data from the national near-road monitoring network for the representative case studies.
 - Evaluate performance under different conditions by modeling selected case studies and comparing model predictions to near-road air quality measurements.
 - Develop and deliver documentation and training.
7. Exploratory scoping study to identify potential project types and situations that will not create PM hot spots.
- Identify a small set of modeling scenarios that can be used to assess the incremental PM impacts from a project.
 - Perform limited modeling tests to identify a range of project parameters that result in relatively small incremental impacts (e.g., out-year build scenarios, advanced technology truck fleets).
 - Identify technical feasibility of specifying potential projects of air quality concern given trends and situations not currently accounted for by EPA guidance (e.g., truck fleet turnover).
 - As directed by Pooled Fund partners, develop a work plan for a more comprehensive modeling assessment to quantitatively establish project types and situations likely to have minimal incremental PM impacts.

Goal

Increase knowledge of mitigation measures that support near-road air quality improvements by

- Identifying measures
- Assessing implementation feasibility
- Quantifying their benefits
- Creating other guidance and training materials

Potential Projects

8. Vegetative screen and sound wall assessment.

- Gain interagency consensus on quantifiable benefits for specific vegetative species and sound wall designs by completing a literature review and publishing findings.
 - Enable analysts to select vegetative species appropriate to their project site that meet multiple selection criteria, such as tolerance to drought, low producers of VOCs and pollen, and easily maintained.
- Identify candidate species suitable for use as vegetative screens by evaluating modeling tools, such as SelectTree and iTree.
- Develop and deliver guidance to quantitatively assess site-specific multi-pollutant benefits from implementation of vegetative screens and/or sound walls.

9. Indoor air filtration system assessment.

- Assess indoor air filtration systems used near road by completing a literature review.
- Identify practical implementation lessons learned to date from the installation of improved filtration in schools, residences, and other buildings by obtaining feedback from recent experience.
- Identify and document the quantifiable benefits from installation.
- Develop and deliver implementation guidance and document case studies.

10. Case study assessment of the benefits of truck retrofits using California's Schuyler-Heim Bridge.

- Research and describe the site-specific truck retrofit effort funded by Caltrans.
- Identify implementation challenges and actions taken to resolve them.
- Illustrate methods used to quantify the retrofit program benefits.
- Create a case study summary that includes practical implementation lessons learned.

Goal

Improve interagency exchange of information (particularly to support conformity consultation) by

- Providing electronic platforms and venues for sharing case study analysis results, lessons learned, best practices, templates, and other information
- Enabling interagency partners to identify and resolve technical and policy issues

Potential Projects

11. Information sharing website and forum.

- Develop an information-exchange website for transportation/air quality planners and project analysts.
- Populate the website with relevant data, reports, software, and results from other pooled fund tasks.
- Create an electronic forum to facilitate interagency communication and information exchange (modeled after airshare.info).
- Host and maintain the website and forum for the life of the Pooled Fund.

12. Annual near-road workshop.

- Organize and host an annual two-day near-road information exchange workshop for Pooled Fund partners and other invited attendees that covers relevant issues for project analyses, conformity policy issues (emerging and resolved), and other topics.
- Provide post-workshop summaries and related information to attendees.

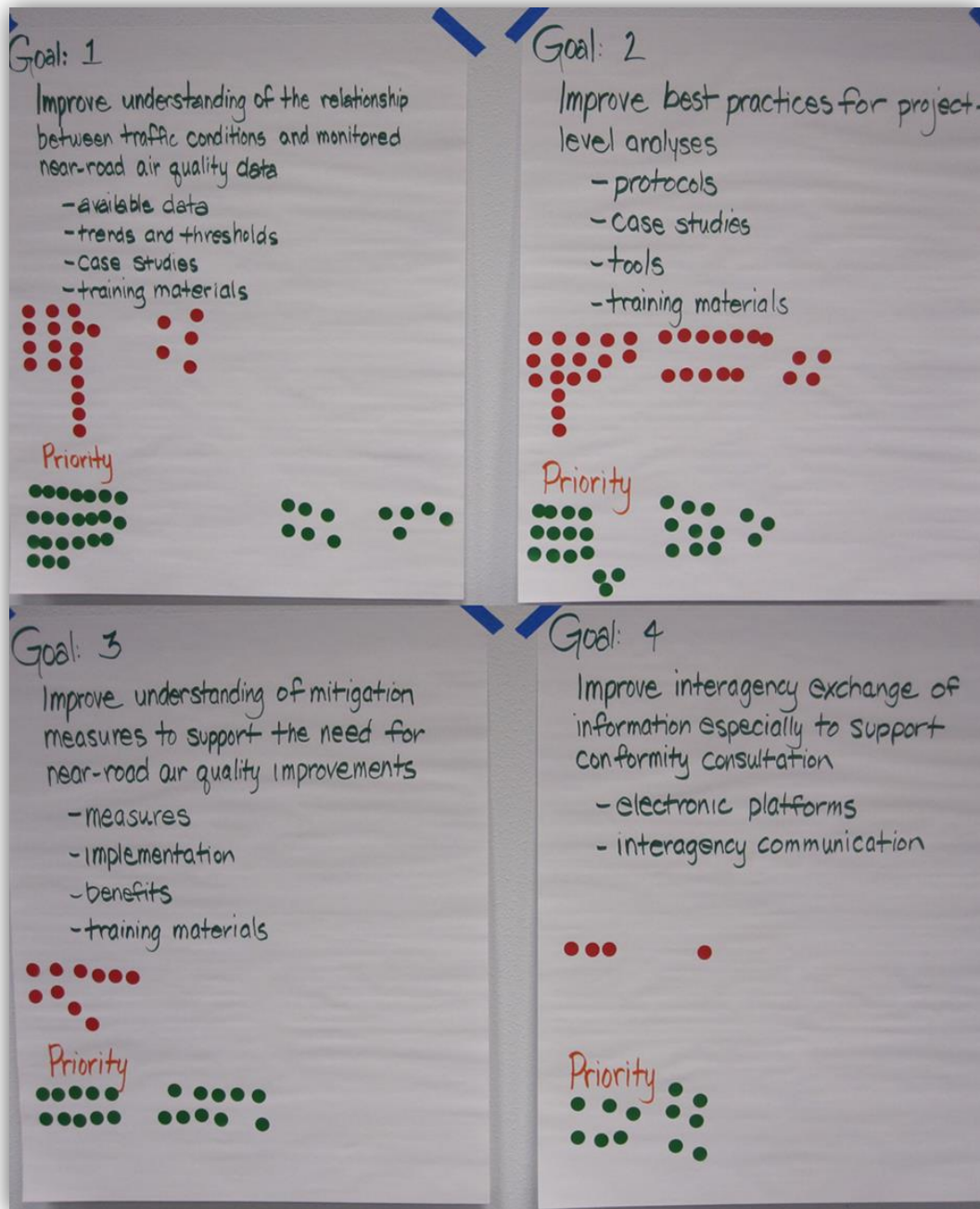


Figure A-1. Photographs of the newsprint pads used during the workshop to vote for and prioritize the four goals for the TPF. Voting was color-coded: red dots represent DOT/FHWA votes, and green dots represent STI votes.

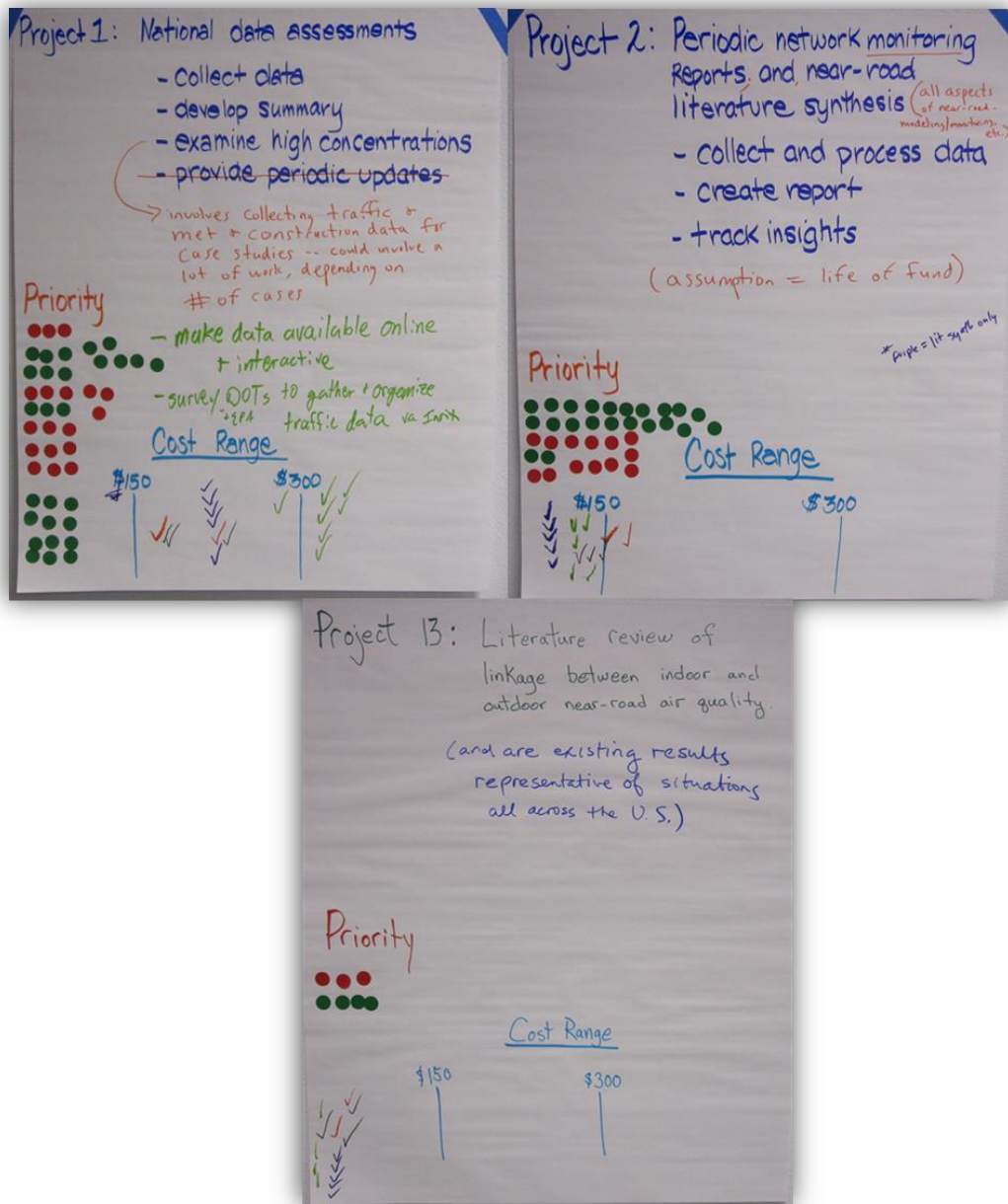


Figure A-2. Photographs of the newsprint pads used during the workshop to vote for and prioritize the three potential projects for Goal 1. Red dots represent DOT/FHWA votes, and green dots represent STI votes. Participants also voted on the estimated cost range associated with each potential project. Project numbers refer to Table A-1.

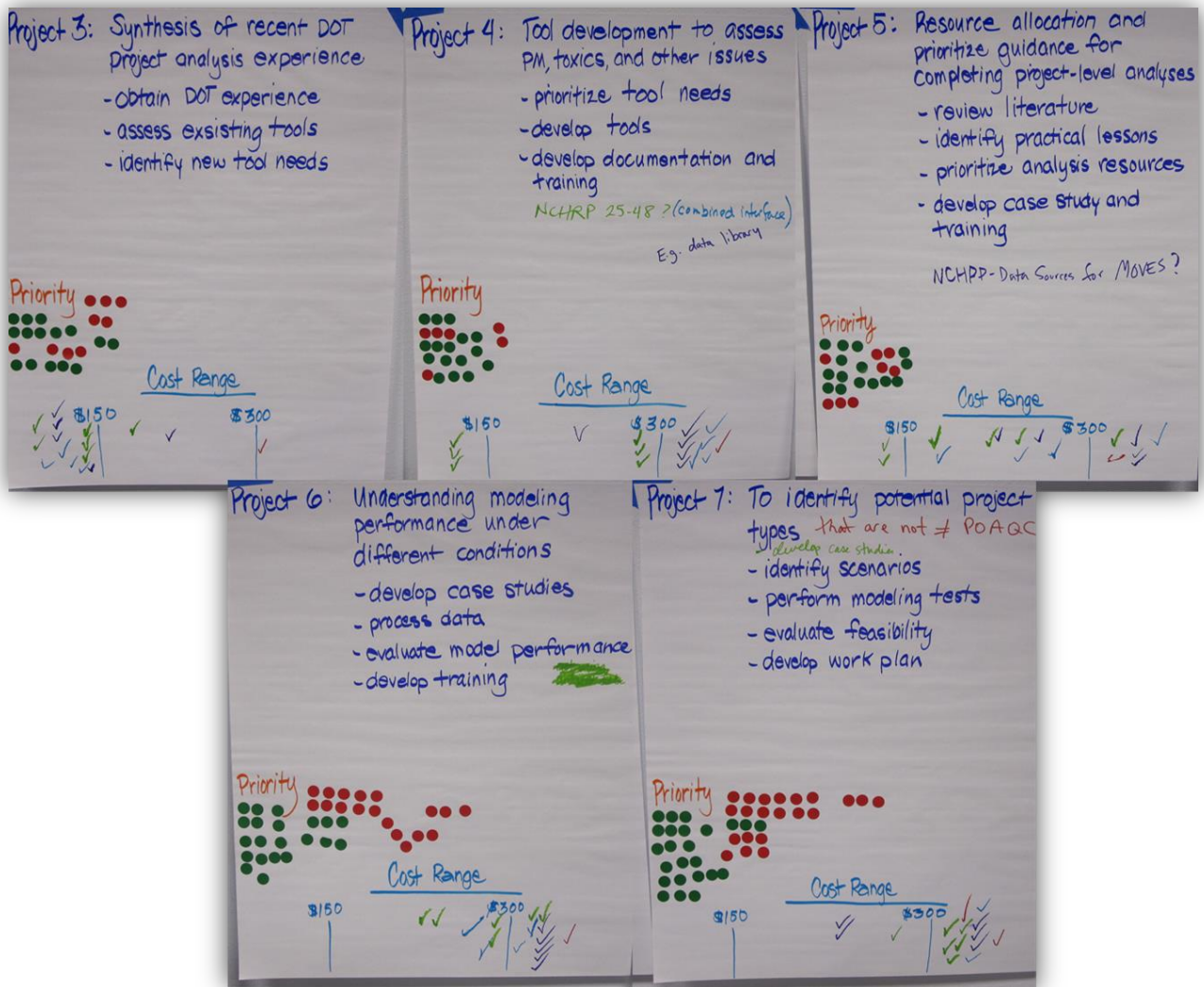


Figure A-3. Photographs of the newsprint pads used during the workshop to vote for and prioritize the five potential projects for Goal 2. Red dots represent DOT/FHWA votes, and green dots represent STI votes. Participants also voted on the estimated cost range associated with each potential project. Project numbers refer to Table A-1.

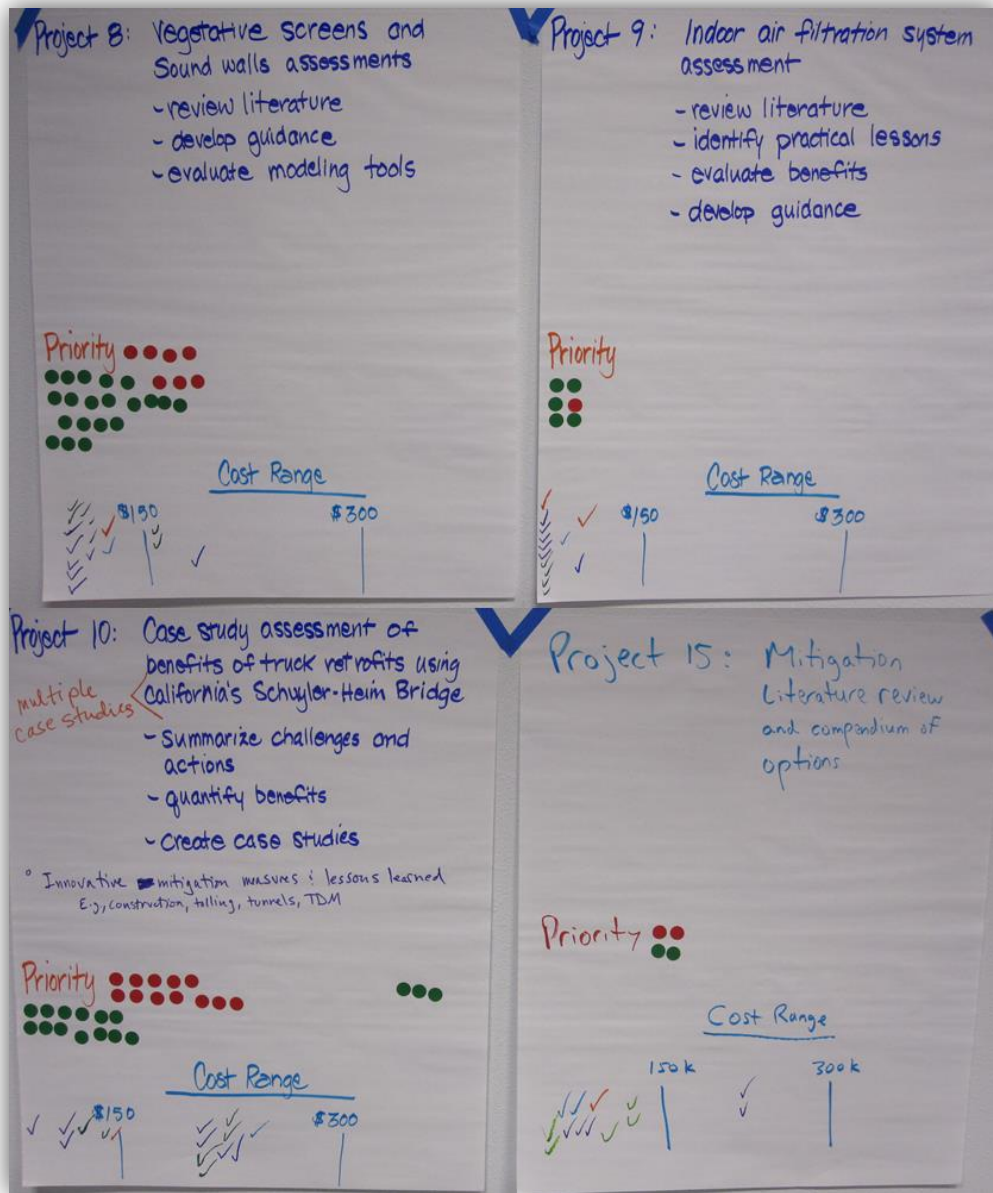


Figure A-4. Photographs of the newspaper pads used during the workshop to vote for and prioritize the four potential projects for Goal 3. Red dots represent DOT/FHWA votes, and green dots represent STI votes. Participants also voted on the estimated cost range associated with each potential project. Project numbers refer to Table A-1.

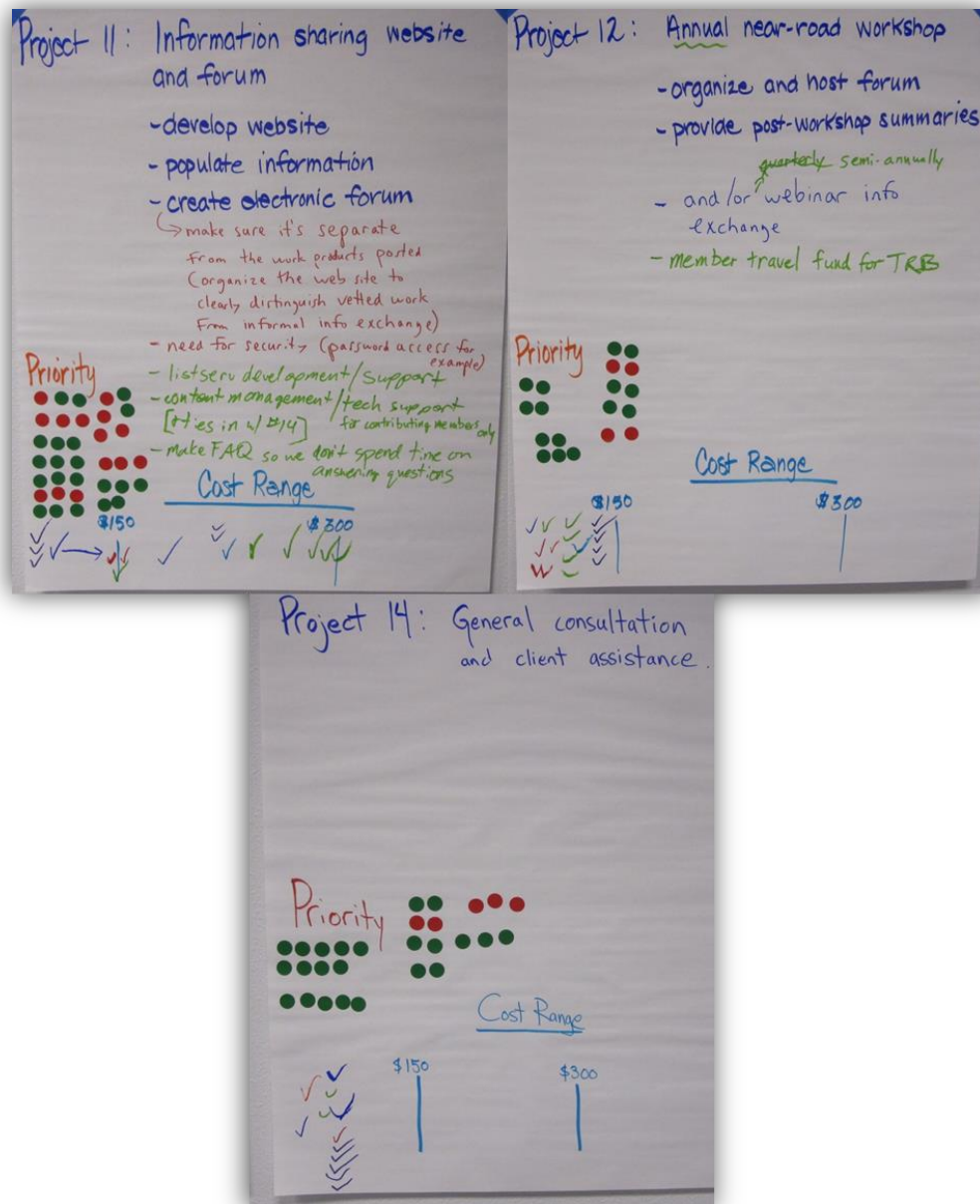


Figure A-5. Photographs of the newspaper pads used during the workshop to vote for and prioritize the three potential projects for Goal 4. Red dots represent DOT/FHWA votes, and green dots represent STI votes. Participants also voted on the estimated cost range associated with each potential project. Project numbers refer to Table A-1.



Figure A-6. Photographs of the conference room at STI and participants prior to the start of the workshop.



Figure A-7. Photograph of workshop participants voting for goals and projects.

Appendix B. Statements of Work and Estimated Budgets for the Four Proposed Task Orders

This appendix provides overviews of proposed Task Orders 2 through 5. Task Order 1 covered the development of this Strategic Plan. Costs and schedules in this Appendix are approximate and will be finalized when task orders are written and executed; the work scopes and budgets presented here include modest general assistance support throughout the study.

Proposed Task Order 2: Scoping Study to Identify Potential Project Types and Situations that will not Create PM Hot Spots

Background

Determining if a proposed action is a project of air quality concern (POAQC) and, where needed, conducting a PM hot-spot analysis requires a large amount of work: gathering diesel vehicle data, developing travel data, estimating emissions via the MOVES model (or the EMFAC model in California), acquiring and processing meteorological and background PM data, running a dispersion model such as AERMOD², and processing model output. The goal of this task order is to identify sample project types and project characteristics that, when combined, can reasonably be excluded from being considered a POAQC subject to the extensive emissions and modeling requirements of a PM hot-spot analysis. The evaluation approaches used in this work can also illustrate best practices to help TPF partners complete additional project assessments and develop and improve selected best practice analysis tools.

Summary of Approach

1. Identify and/or create two examples of project types for analysis, such as:
 - Expansion of freeways, freeway interchanges, or related projects to support intermodal goods movement
 - Expansion of arterials/intersections
2. Conduct sensitivity analyses to test which project types are unlikely to be a POAQC and result in the need to perform a PM hot-spot analysis; work will include developing hypothetical travel activity data, modeling emissions with MOVES (and a few specific examples with EMFAC), and modeling, for selected situations, PM concentrations with AERMOD. One of the most important factors for determining a POAQC is whether the project involves a significant volume of or a significant increase in diesel traffic. This work will help project sponsors determine what a significant number or increase in diesel traffic is by developing tools that evaluate how diesel traffic and related parameters affect PM concentrations. This information could then be used to support POAQC determinations during interagency consultation.
3. Identify project scenarios and diesel vehicle traffic levels that analysts can have a high degree of confidence are not POAQC.

² Another EPA-recommended model for PM dispersion modeling is CAL3QHCR, which can be used for highway and intersection projects only. For transit, freight, and other terminal projects, or for projects that involve both highway/intersections and nearby sources, AERMOD has to be used. We propose to focus on AERMOD modeling in this work.

4. Document methods, including specific instructions for analysts to follow, to identify whether a specific project scenario would be considered a POAQC.
5. Develop or improve selected best practice analysis tools.

Phase 1: Freeway/Interchange Case Study (August 2014 through March 2015), \$200k

- Identify examples of freeway project type and analysis scenarios.
- Develop emissions modeling scenarios to understand impact of changes in congestion, diesel vehicle volume and fleet turnover, and the relationship between emissions changes and "significant increases" in diesel traffic.
- Prepare meteorological data and complete example illustrative AERMOD-based PM dispersion modeling to relate changes in emissions to changes in modeled PM concentrations.
- Identify scenarios where a project's incremental contributions likely fail to meet POAQC criteria.
- Summarize findings and present them at TRB in January 2016.

Deliverables: Report documenting freeway project scenarios not likely to be POAQC; 15-minute PowerPoint presentation for delivery at TRB in 2016.

Phase 2: Arterial/Intersection Case Study (April through December, 2015), \$240k

- Identify examples of arterial and/or intersection project types and analysis scenarios.
- Develop emissions modeling scenarios to understand impact of changes in congestion, diesel vehicle volume and fleet turnover, and the relationship between emissions changes and "significant increases" in diesel traffic.
- Prepare meteorological data and complete example illustrative AERMOD-based PM dispersion modeling to relate changes in emissions to changes in modeled PM.
- Identify scenarios where a project's incremental contributions likely fail to meet POAQC criteria.
- Summarize and submit Phase I and II findings as a TRB research paper in July 2016.

Deliverables: Report documenting arterial/intersection project scenarios not likely to be POAQC; 2016 TRB paper submission; 15-minute PowerPoint presentation for delivery at TRB.

Phase 3: Tool Development for Project Evaluation Support (January 2016 through June 2019), \$300k

- Survey TPF partners and others to identify tools in use and to assess tool needs to identify projects that can reasonably be excluded from being considered a POAQC.
- Review, assess, and provide a summary description of available tools and prioritized tool development and tool improvement needs; recommend work scaled to the available budget.
- Develop and improve analysis support tools as directed by TPF participants.
- Provide basic user information on how to access, use, and interpret results from developed tools.

***Deliverables:** Memorandum summarizing survey results, tool review findings, and recommendations; new and/or improved analysis tools as directed by TPF participants; basic documentation on tool usage.*

Proposed Task Order 3: National Data Assessment, Periodic Data Updates, and Literature Synthesis

Background

EPA has mandated air quality monitoring next to major roadways throughout the United States; monitoring began in phases during 2012 through 2014. Monitoring includes NO₂ and at some sites can also include CO, PM, air toxics, and ultrafine particles (UFP). These data will be used by EPA and others to understand the relationship of near-road air pollution to traffic volumes, fleet mix, and travel speeds. In addition, several near-road research studies have been completed in recent years in various U.S. cities; these studies have collected near-road air quality data that represent different geographic locations, vehicle fleets, time periods, and other variables. Finally, some metropolitan-area monitors are collecting routine air quality measurements within a relatively short distance from a major road. These data also offer the opportunity to investigate the relationship between near-road pollution and traffic. This task order is designed to obtain, summarize, and interpret data from the national near-road monitoring program, from other air quality sites next to major roadways, and from selected special-purpose near-road studies. The project will provide a digest of findings from around the United States, and highlight and explain situations where relatively high near-road pollutant concentrations have been observed.

Summary of Approach

1. Assemble, organize, and maintain a near-road air quality database with data from:
 - Sites officially listed as “near-road” monitoring sites
 - Other air quality monitoring sites within 300 m of a major roadway
 - Special studies, e.g., FHWA/EPA Las Vegas and Detroit studies; Los Angeles I-710 study
2. Conduct broad, national-scale analyses as well as case studies:
 - Determine when and where high concentrations occurred and under what conditions (e.g., meteorology, traffic)
 - Assess trends in air quality data, e.g., by time of day, weekday/weekend, season, traffic volume, and fraction of heavy-duty diesel vehicles
 - Develop illustrative case studies
3. Provide periodic summaries of the data collected from the national near-road measurement program
4. Document methods and findings

Phase 1: Complete Initial Data Assembly and Assessment (August 2014 through March 2015), \$100k

- Assemble air quality data from official near-road monitoring sites.
- Collect state-reported AADT and fleet mix characteristics of official near-road monitoring sites by site, if readily available.
- Identify and obtain data from other air quality monitoring sites within 300 m of a major roadway and from special studies.
- Perform national-scale analysis, using official near-road monitoring site data, to determine if/where high concentrations occur.
- Summarize findings; present at TRB in January 2016.
- Following TRB, prepare report of initial findings based on national near-road monitoring network data.

Deliverables: Data summary; 15-minute PowerPoint presentation for delivery at TRB; report on initial findings.

Phase 2: Complete Full Data Assembly, Update National Assessment, and Perform Case Studies (April 2015 through March 2016), \$150k

- Periodically update database with newly collected near-road air quality data.
- Complete assembly of special study air quality and traffic data (including traffic camera data, if available) from Las Vegas (NDOT/STI, FHWA/EPA studies); Los Angeles (SCAQMD study); Detroit (FHWA/EPA study), plus selected air quality monitoring sites located within 300 m of roadways that are not part of the official near-roadway monitoring program.
- Once data are available for all of 2014, update national-scale assessments from Phase 1, including any additional analyses based on DOT/FHWA feedback.
- Develop methods for and complete two to four detailed case studies of high concentration events for near-road pollutants (the number of case studies completed will depend on the availability of related traffic and meteorological data). The intent of this work is to focus on using data from the national near-road monitoring program, assuming corresponding travel activity and meteorological data can be easily obtained and processed. Alternatively, the analysis could focus on using special study or other near-road monitoring data.
- Summarize and submit Phase I and II findings as a TRB research paper in 2016; present findings at TRB in January 2016; deliver report for TPF in 2017.

Deliverables: Report detailing national-scale and case study assessments; TRB paper submission; 15-minute PowerPoint presentation suitable for conference delivery at TRB in January 2016.

Phase 3: Periodically Update Database and National Assessment and Perform Additional Case Studies and Analyses (April 2016 through June, 2019), \$100k/Year for Three Years (\$300k)

- Periodically update national near-road air quality database.
- In Fall 2016, 2017, and 2018, update national-scale assessments, including additional analyses based on DOT/FHWA feedback.
- Depending on the availability and data formats of traffic data gathered as part of case studies, develop recommendations for collecting, organizing, and storing travel activity data and pairing these data in space and time with the near-road air quality data already being collected.
- Annually, complete two to four case studies of high-concentration events regarding near-road pollutants; case studies could focus on routinely collected near-road air quality data and/or on special study data, depending on available corresponding traffic and meteorological information. For example:
 - Contrast the most recent available (e.g., 2017) near-road monitoring data with comparable data from pre-2010 (from special study data or other monitoring sites) to evaluate whether anticipated changes in truck fleet turnover have been reflected in changes to observed near-road concentrations;
 - For selected sites where speciated data are available, assess trends in diesel particulate matter or black carbon (BC) from fossil fuel combustion sources, and evaluate relative contributions from nearby on-road (truck) versus background sources.

As work proceeds, details of the case study assessments and other data analyses will be developed in response to TPF participant feedback and priority analysis needs.

- Annually, develop report and present findings at the TRB conference.

Deliverables: Annual, updated report on national-scale and case study assessments; presentations at TRB conferences

Proposed Task Order 4: Information-Sharing Website and Forum

Background

To address the overall goal of helping state DOT staff to address near-road air quality issues, this task order will create an information-sharing website and forum. The website would be password-protected, with access determined by TPF participants. The website would include information and results generated by STI as part of the pooled fund work, a page of links, documents from work completed outside of the pooled fund on near-road air quality issues, and a forum to facilitate interagency communication and information exchange.

Summary of Approach

1. Develop mock-ups and website specifications, including:
 - Account management (e.g., available to anyone from pooled fund DOTs and FHWA)
 - News headlines of recent articles, documents, and findings relevant to DOT staff in addressing near-road air quality issues
 - Repository of useful links and documents on near-road air quality issues, in particular on PM hot spot guidance and modeling
 - Forum available to pooled fund DOT staff and FHWA to share information, ask questions, and respond
 - Repository of work products generated as part of the pooled fund project, including a portal to view ambient near-road data analyzed as part of funded TPF work
2. Develop and host website, working with pooled fund DOTs and FHWA on layout, look and feel, and features
3. Create an alert system (e.g., utilizing Google Scholar) to identify when new and relevant materials (e.g., related to PM hot spots) are published
4. Develop, maintain, and periodically update a page that includes links to relevant literature regarding near-road air quality
5. Develop and maintain a page with work products generated as part of the pooled fund
6. Develop and maintain a forum page open to TPF participants
 - Allow users to post questions and information
 - Allocate STI staff hours to be available to help answer questions from participating DOTs and FHWA

Phase 1: Develop and Deploy Initial Website (August through December 2014) \$60k

- Develop mock-ups of the overall website design to share with DOTs/FHWA.
- Implement that portion of the overall website design that enables an interactive information-sharing portal (i.e., a near-road air quality web-based forum that allows users to post messages and share links and documents).
- Provide user name and password access to TPF participants, and enable their testing of the web-based forum.
- Populate website with sample links/documents.
- Host and maintain initial website.

Deliverables: Website open to participating DOTs/FHWA, including forum.

Phase 2: Extend Website Development to Add New Features (January through June 2015) \$80k

- Develop additional website features, such as web pages that enable STI and TPF participants to upload TPF work products (reports, TRB papers and presentations), summary statistics and findings related to the national near-road data collection TPF task order (if funded), and other near-road resources such as studies completed by other organizations.
- Periodically update website with relevant links/documents and pooled fund work products.
- Manage user accounts (e.g., provide usernames and passwords; respond to website use queries and access issues). For planning purposes, the total number of users is assumed to be approximately 20 to 30.
- Host and maintain website.
- Provide general assistance such as helping TPF participants, answering questions posted on the web-based forum, overseeing web-based forum activities, and identifying and uploading relevant information on near-road air quality.

Deliverables: Updated website with enhanced features; periodic updates such as useful links/documents warehouse and pooled fund work products.

Phase 3: Update, Enhance, Host, and Maintain Website over a Four-Year Period (July 2015 through June 2019), Approximately \$40k per Year (\$160k)

- Respond to TPF's evolving needs and periodically enhance website functioning.
- Host and maintain the website.
- Periodically update website with relevant links/documents and pooled fund work products.
- Manage user accounts (e.g., provide usernames and passwords; respond to website use queries and access issues). For planning purposes, the total number of users is assumed to be approximately 20 to 30.
- Provide general assistance such as helping TPF participants, answering questions posted on the web-based forum, overseeing web-based forum activities, and identifying and uploading relevant information on near-road air quality.

***Deliverables:** Operation of website open to participating DOTs/FHWA, including forum, useful links/documents warehouse, and pooled fund work products.*

Proposed Task Order 5: Truck Retrofits Case Study, Sound Barrier Evaluation, and Mitigation Literature Review and Compendium

Background

Some transportation project analyses may result in hot-spot evaluations that fail transportation conformity tests. Therefore, there is a need to identify technically feasible mitigation measures that can be used to help reduce project impacts and facilitate approvals and project delivery. Some agencies are experimenting with mitigation actions and gaining practical insights of benefit to others. There is particular interest in quantifying (1) the use of truck retrofits at the project level, and (2) whether sound walls and other sound barriers reduce near-road pollutant concentrations. There is also broad interest in understanding whether other mitigation options are available at the project level. This work will accomplish three things: (1) document the findings from a southern California project-level truck retrofit case study, (2) document the state of knowledge regarding the modeling of sound barrier impacts on near-road air quality, and (3) provide a literature summary on project-level mitigation options and their effectiveness.

Summary of Approach

The work will proceed in three phases. The first phase will research experiences and lessons from the implementation of a Caltrans-funded effort to retrofit trucks operating in the area of a bridge rebuild; the retrofit program was designed to offset construction-related emissions. The second phase will examine the ability of existing modeling tools to quantify sound barrier effects on near-road pollutant concentrations; as appropriate, the work will describe best-practices for estimating sound barrier effects. The third phase will include a brief literature review with selected case studies that document and illustrate project-level mitigation options.

Phase 1: Case Study of Schuyler-Heim Bridge Project Truck Retrofit Program (October 2014 through March 2015) (\$60k)

- Gather case study information and related project data; interview Caltrans staff.
- Complete site visit to Caltrans field office and bridge location.
- Interview truck owner/operators participating in the retrofit program.
- Quantify construction emissions and offsetting reductions achieved via retrofits.
- Document findings with implementation lessons and practical insights for future action.

Deliverables: Report documenting findings; 2016 TRB paper submission; 15-minute PowerPoint presentation suitable for conference delivery.

Phase 2: State of Knowledge of Sound Barrier Modeling to Quantify Near-Road Pollutant Concentration Impacts (January through June 2015) (\$75k)

- Identify and assess dispersion modeling approaches.
- Develop and model scenarios by varying barrier height/type/coating, meteorology, emissions.
- Compare modeled impacts to findings from the literature, as appropriate.
- Quantify range of potential impacts from sound barriers.
- Document findings with practical insights for future action.

Deliverables: Report documenting findings; 2016 TRB paper submission; 15-minute PowerPoint presentation suitable for conference delivery.

Phase 3: Mitigation Measures Reference Document and Case Studies (April 2015 through March 2017) (\$225k)

- Complete literature review to support compendium.
- Identify and illustrate sample mitigation measures.
- Assess the potential quantitative impact of identified measures on emissions and/or concentrations.
- Illustrate (using MOVES and/or EMFAC modeling) how control measure benefits change over time with fleet turnover and other parameters.
- Prepare mitigation reference document.
- Research and document findings for two supplemental mitigation case studies (specific cases to be determined in consultation with TPF participants).

Deliverables: Mitigation measures reference document; report documenting findings for two mitigation case studies; 2017 TRB paper submission on compendium and/or case studies; 15-minute PowerPoint presentation suitable for conference delivery.