Arizona Department of Transportation

AIR QUALITY GUIDEBOOK FOR TRANSPORTATION CONFORMITY

December 2013

Baker

RBF CONSULTING

A Baker Company

THIS PAGE INTENTIONALLY LEFT BLANK

Table of Contents

Appendices

List of Tables

List of Figures

Introduction

Background

Transportation conformity is an ever-changing field of expertise and can be a complicated process, even for experienced staff and other stakeholders. Major challenges include revised National Ambient Air Quality Standards (NAAQS), new emissions models, and revised federal technical and policy guidance. However complicated, federally approved transportation conformity determinations are critical to keeping the Arizona Department of Transportation's (ADOT's) Plans, Programs and Projects moving. *The Arizona Department of Transportation Air Quality Management Guidebook: Suggested Approaches and Case Study* (Guidebook) represents a comprehensive document designed to assist ADOT in simplifying the transportation conformity process by organizing, updating and streamlining current transportation and air quality conformity procedures. The Guidebook was created as

1. A tool for technical staff that can be used to conduct transportation conformity analyses, aid in the determination process, assess the benefits of SIP elements, and identify emission reduction projects to fulfill NAAQS requirements.
2. A directional resource for applicable transportation and air quality conformity guidance, regulations and policies. The Guidebook contains detailed examples and resources, but it also leads users to resources that cannot be completely covered here, are tangentially related, or that may change over time.
3. An example that can be followed each time a conformity analysis is performed. The Nogales Case Study is designed as a model to assist state and local stakeholders and staff through the conformity process from interagency consultation to technical analysis.

The Guidebook was developed through a series of webinars and meetings involving ADOT and stakeholder participation and is a comprised of two primary pieces: 1.) a compilation of final working papers and 2.) a case study of the Nogales PM nonattainment area.

As working papers were developed, and stakeholder outreach was conducted, it was determined that definitive conformity process requirements were not practicable for incorporation into the Guidebook at this time. As a result, the chapters/working papers, where applicable, outline several potential approaches. The ADOT/stakeholder preferred approach or recommendation is described and, if appropriate, demonstrated in the Nogales Case Study.

Organization of the Guidebook

The Guidebook is organized into 5 primary Chapters. Each Chapter is representative of a final working paper and a one-stop shop for information. Accordingly, each Chapter has been authored as a stand-alone document. The remainder of the Guidebook is organized as follows:

1. **Air Quality Background**: This chapter provides a brief history of the National Ambient Air Quality Standards (NAAQS) and how they have applied to and changed throughout the state. Chapter 1 includes background on pertinent federal regulations and the basics of transportation conformity.

2. **Interagency Consultation (ICG)**: Chapter 2 provides a review of Arizona's existing requirements and other state's approaches to the ICG process, with the focus on the goal of developing a Conformity SIP for federal approval.

3. **Conformity procedures**: This chapter provides recommendations for conducting transportation regional and project-level conformity analyses in areas outside of the MAG region. In addition, Chapter 3 includes an overview of relevant modeling tool and an assessment of Arizona's past analysis procedures.
4. **Mitigation & Transportation Control Measures (TCMs)**: Chapter 4 outlines the analytical requirements and tools necessary for quantifying the benefits of TCMs. Control measure analysis methods are described in detail and accompanied by example calculations.
5. **Nogales PM_{10} / $PM_{2.5}$ Nonattainment Area Case Study:** The case study illustrates how to utilize the recommend approaches described in Chapter 1 through Chapter 4 via step-by-step examples for the Nogales area.

Appendix Documents

A. Nonattainment and Maintenance Area Maps and Current SIP Status Tables

 A-1: Statewide Nonattainment and Maintenance Area Maps & Statewide SIP Status Table

 A-2: MPO / COG Nonattainment and Maintenance Area Maps & SIP Status Tables

 A-3: Nonattainment and Maintenance Area Maps by Pollutant

B. Interagency Consultation Materials

 B-1: Checklist for Developing a Conformity SIP and Comparison between the Federal Conformity Rule and Arizona Administrative Code

 B-2: Arizona Air Quality Agency Planning & Implementation Responsibilities

 B-3: SouthEastern Arizona Governments Organization Annual Work Program (State Fiscal Year 2014)

C. ADOT Draft Congestion Mitigation and Air Quality (CMAQ) Guidelines and Procedures for $PM_{2.5}$ Nonattainment Areas

D. Nogales, Arizona Transportation Control Measures Calculation Workbook

1.0 Overview of Air Quality Requirements in Arizona *(Working Paper 1)*

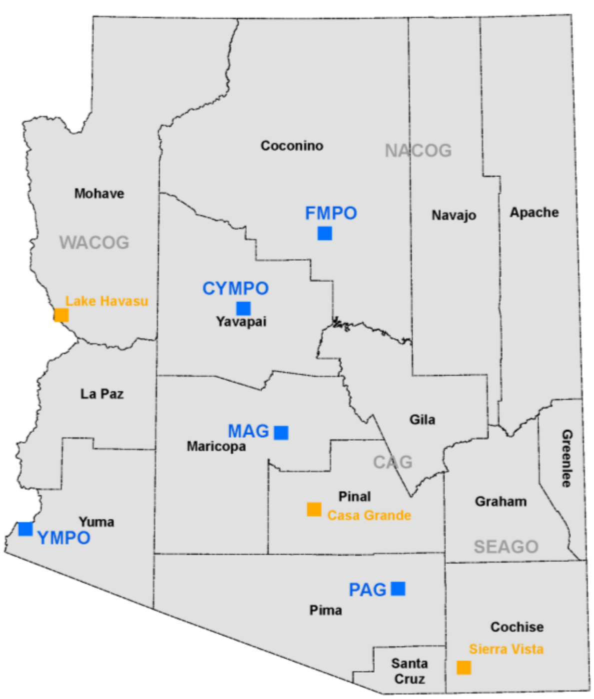
1.1 Introduction

The objective of Working Paper 1 (WP-1) is to provide an overview of the transportation-related air quality requirements in Arizona that will also act as the basis for the introduction / background section for the complete Arizona Department of Transportation (ADOT) Air Quality Management Guidebook (the Guidebook). WP-1 represents a summary of all nonattainment, maintenance and clean data areas in the state, including what each status means for transportation, and the associated requirements for developing State Implementation Plans (SIPs), and successfully demonstrating transportation conformity of transportation plans, programs and projects.

1.2 Arizona Geography

There are six councils of governments (COGs), five metropolitan planning organizations (MPOs), with populations greater than 50,000, and two Transportation Management Areas (TMAs), as illustrated in Figure 1-1, within the State of Arizona. The MPOs in the urban areas are also the regional agencies for transportation planning. In addition, MAG and PAG have been certified as TMAs (populations greater than 200,000) and, as a result, have greater requirements for congestion management, project selection and certification. In the rural areas of Arizona, the COGs perform planning services and direct service functions, such as operating the Area Agency on Aging, the Head Start programs and employment programs.

Figure 1-1: Arizona Metropolitan Planning Areas and Councils of Governments



Arizona Metropolitan Planning Organizations

- Central Yavapai Metropolitan Planning Organization (CYMPO)
- Flagstaff Metropolitan Planning Organization (FMPO)
- Maricopa Association of Governments (MAG)*
- Pima Association of Governments (PAG)*
- Yuma Metropolitan Planning Organization (YMPO)

** Transportation Management Areas (TMAs)*

Arizona Councils of Governments

- Central Arizona Governments (CAG)
- Maricopa Association of Governments (MAG)
- Northern Arizona Council of Governments (NACOG)
- Pima Association of Governments (PAG)
- SouthEastern Arizona Governments Organization (SEAGO)
- Western Arizona Council of Governments (WACOG)

New Urban Areas / MPOs (2010 Census)

- Casa Grande / (Sun Corridor Metropolitan Planning Organization)
- Lake Havasu Metropolitan Planning Organization
- Sierra Vista Metropolitan Planning Organization

Source: Maricopa Association of Governments, http://www.azmag.gov/archive/AZ-COGs/Arizona_MPOs/pg_azMPOs.asp

1.3 National Ambient Air Quality Standards

The Clean Air Act Amendments of 1990 (CAAA) require the United States Environmental Protection Agency (EPA) to set National Ambient Air Quality Standards (NAAQS) for six "criteria" pollutants. EPA regulates these pollutants (carbon monoxide, lead, nitrogen dioxide, ozone, particle pollution, and sulfur dioxide) by developing human health-based (primary) and / or environmentally-based (secondary) criteria for allowable levels or concentrations of the pollutants in the ambient air. While EPA sets standards and regulates the emissions of all six pollutants, only three of the six, outlined in Table 1-1, are relevant with respect to transportation conformity in Arizona. They are carbon monoxide, ozone and particulate matter. The EPA is charged with designating areas as attainment, maintenance or nonattainment of the NAAQS.

Table 1-1: National Ambient Air Quality Standards for Criteria Pollutants Subject to Transportation Conformity in Arizona

Pollutant [Final Rule Citation]		Primary / Secondary	Averaging Time	Level (Concentration)	Form
Carbon Monoxide (CO) [76 FR 54294, Aug 31, 2011]		Primary	8-Hour	9 ppm	Not to be exceeded more than once per year
Ozone [73 FR 16436, Mar 27, 2008]		Primary & Secondary	8-Hour	0.075 ppm	Annual fourth-highest daily maximum 8-hr concentration averaged over 3 years
Particle Pollution [78 FR 3086, Jan 15, 2013]	**$PM_{2.5}$**	Primary	Annual[1]	12 μg/m³	Annual mean, averaged over 3 years
		Secondary	Annual	15 μg/m³	Annual mean, averaged over 3 years
		Primary & Secondary	24-Hour	35 μg/m³	98th percentile, averaged over 3 years
	PM_{10}	Primary & Secondary	24-Hour	150 μg/m³	Not to be exceeded more than once per year on average over 3 years

Source: Environmental Protection Agency, http://www.epa.gov/air/criteria.html.
1. *Effective on March 18, 2013.*

1.3.1 Recent NAAQS Developments

The EPA is required to scientifically review each NAAQS on five-year intervals (42 USC § 7409) and, as a result, the NAAQS and their implementation represent an ever-changing process. Some recent developments are detailed below.

Effective on July 20, 2013
The 1997 Ozone NAAQS will no longer apply for transportation conformity purposes.

On May 21, 2012 the EPA published two final rules via the Federal Register announcing the designations for the 2008 ozone NAAQS (77 FR 30088) and implementation of the 2008 NAAQS for ozone (77 FR 30160). The rules both became effective on July 20, 2012. The implementation rule established the air quality thresholds that define the classifications assigned to all nonattainment areas for the 2008 ozone NAAQS, which were promulgated in March 2008. It also established December 31 of each relevant calendar year as the attainment date for all nonattainment area classification categories and provided for the revocation of the 1997 ozone NAAQS for transportation conformity purposes to occur one year after the effective date of designations, or July 20, 2013.

Effective on March 18, 2013

The primary, annual $PM_{2.5}$ standards will be strengthened from 15 μg/m³ to 12 μg/m³.

On January 15, 2013, the EPA published a final rule via the Federal Register (78 FR 3086) strengthening the primary, annual $PM_{2.5}$ NAAQS from 15 micrograms per cubic meter (μg/m³) to 12 μg/m³. The EPA retained the 24-hour $PM_{2.5}$ standard and the current 24-hour PM_{10} standard. EPA announced its intent to designate areas for the revised $PM_{2.5}$ NAAQS on a 2-year schedule from the signature of the final rule (December 14, 2012). Pending further direction, it is anticipated that state designation recommendations will be due to the EPA no later than December 13, 2013 and should be based on air quality data from the years 2010-2012. A final rule promulgating the initial area designations is anticipated by December 12, 2014.

1.4 Arizona's Nonattainment, Maintenance and Attainment Areas

Based largely on air quality monitoring data, the EPA must designate areas as either meeting (attainment) or not meeting (nonattainment) the NAAQS for each criteria pollutant. As illustrated in **Figure 1-2**, there are currently over 20 nonattainment or maintenance areas throughout the state of Arizona. While transportation conformity is not required in sulfur dioxide (SO_2) nonattainment areas, they have been included in **Figure 1-2** and Table 1-2 below for illustrative purposes.

Table 1-2: Arizona Sulfur Dioxide Nonattainment and Maintenance Areas

Area	Designation	County	MPO / COG
Hayden (Pinal County), AZ	Moderate	Pinal (P)	CAG
Ajo (Pima County), AZ	Maintenance	Pima (P)	PAG
Douglas (Cochise County), AZ	Maintenance	Cochise (P)	SEAGO
Miami (Gila County), AZ	Maintenance	Gila (P)	CAG
Morenci (Greenlee County), AZ	Maintenance	Greenlee (P)	SEAGO
San Manual (Pinal County), AZ	Maintenance	Pinal (P)	CAAG

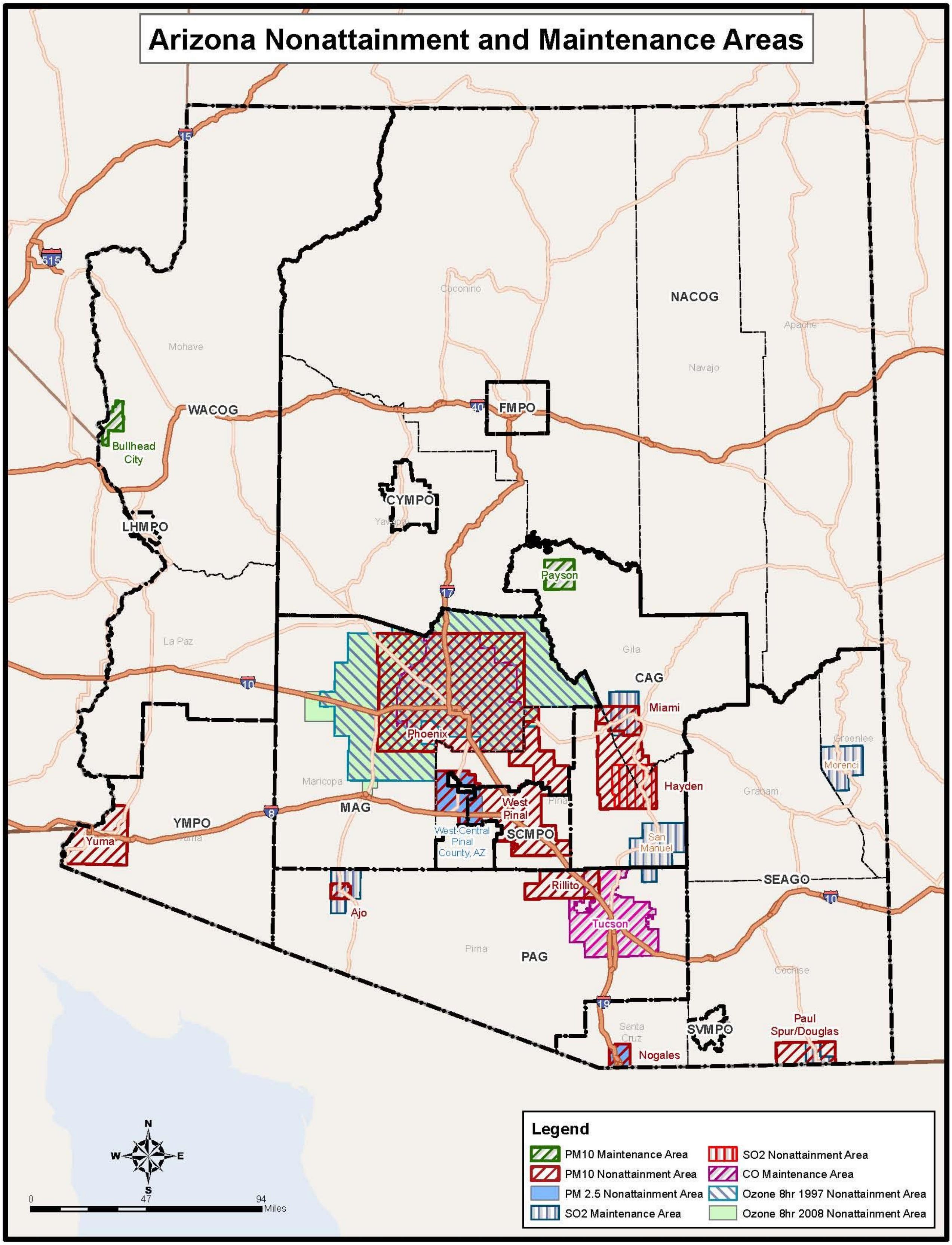
(P) = Partial County

1.5 Arizona's State Implementation Plans (SIPs)

Once an area has been designated as nonattainment for a given NAAQS, the state must create a plan, known as a State Implementation Plan (SIP), to bring the region back into attainment status. Included in the SIPs are emission budgets for various pollutant sectors, including on-road mobile source transportation, that outline the maximum emissions allowed as well as any transportation control measures (TCMs) used to reduce transportation emissions. The state air agency, The Arizona Department of Environmental Quality (ADEQ) develops the state's SIPs and submits them to the EPA for approval. In addition to ADEQ, two MPOs in Arizona, MAG and PAG, have been delegated the responsibility of completing SIP requirements for ozone, carbon monoxide, and particulate pollution (A.R.S. § 49-406) for their respective nonattainment and/or maintenance areas.

Table A1-1 in Appendix A outlines the nonattainment and maintenance areas by pollutant and includes the area name, designation, county and applicable MPO and/or COG area. The table includes the current status of SIPs (including 5 percent plans, maintenance or limited maintenance plans [LMPs]) and motor vehicle emission budgets (MVEBs) where applicable in addition to relevant notes and links to pertinent documentation.

Figure 1-2: Arizona Nonattainment and Maintenance Areas



1.6 Transportation Conformity

Transportation conformity is required by the CAA (Section 176 (c)) to ensure that federal funding and approval are given to highway and transit projects that are consistent with the area's air quality goals. Demonstrating conformity means verifying that transportation activities will not cause new air quality violations, worsen existing violations, or delay timely attainment of the NAAQS.

Transportation conformity regulations (40 CFR Parts 51 and 93) require conformity determinations for areas that have been designated as nonattainment or maintenance for the following NAAQS: carbon monoxide (CO), ozone, particulate matter ($PM_{2.5}$ and PM_{10}), and nitrogen dioxide (NO_2). Conformity applies to transportation improvement programs (TIPs), long-range transportation plans (plans), and transportation projects that require federal (FHWA or FTA) funding or approval.

Final conformity determinations are made (approved) by FHWA / FTA with EPA consultation. MPO policy boards (MAG, PAG, YMPO) make initial conformity determinations for plans, TIPs and projects. The remaining areas rely on ADOT and ADEQ to make the initial determinations. A formal interagency consultation process is required for developing SIPs, plans, TIPs and making conformity determinations and will be discussed in more detail in Working Paper 2.

If an area fails to successfully demonstrate transportation conformity according to schedule, a one-year grace period begins. The grace period provides 12 months for an area to successfully demonstrate conformity before a conformity lapse begins.[1] During a lapse no new non-exempt projects can be amended to the plan or TIP and the use of federal funds is restricted; only the following project types may proceed:

- Projects that are exempt from conformity (§93.126 and 127).
- TCMs in approved SIPs.
- Projects or project phases that are already authorized.

1.6.1 *Regional Conformity*

Essential Regional Conformity Components

- Interagency Consultation
- Latest Planning Assumptions and Emissions Model
- Regional Emissions Analysis
- Timely Implementation of Transportation Control Measures
- Fiscal Constraint
- Public Involvement

Regional conformity, or the conformity of a plan or TIP, demonstrates that the total emissions from on-road travel on an area's transportation system are consistent with goals for air quality found in the SIP, i.e., they are less than or equal to the motor vehicle emission budgets (§93.118). If an area does not have adequate or approved MVEBs another test, known as the interim emissions test (§93.119), must be performed. The interim emissions tests include either demonstrating that the emissions predicted in the "action" scenario are not greater than the emissions predicted in the "baseline" scenario or by demonstrating that the emissions predicted in the "action" scenario are not greater that the emissions in the baseline year for a given NAAQS.

[1] The one-year conformity lapse grace period does not apply to new nonattainment areas that must make a determination within 12 months of a final designation.

1.6.2 *Frequency*

Conformity determinations must be made at least every four years in areas with metropolitan plans or TIPs, but may occur more regularly if the MPOs update their transportation planning documents more frequently or amend them with non-exempt projects. In contrast, conformity determinations in isolated rural nonattainment and maintenance areas are required only when a new non-exempt FHWA/STA project needs funding or approval. A rural area is an area with a population of less than 50,000 and due to its small size, is exempted from FHWA/FTA metropolitan planning requirements related to the development of transportation plans and TIPs. Isolated rural nonattainment and maintenance areas are areas that do not contain or are not part of any metropolitan planning area as designated under the transportation planning regulations. Isolated rural areas do not have federally required plans and do not have projects that are part of the emissions analysis of any MPO's plan or TIP. Projects in such areas must be included in statewide transportation improvement programs (STIPs) prior to federal action to fund or approve such projects. In addition, the following events will trigger the need for a conformity determination:

Conformity Trigger	Grace Period (Within X Months)[2]	Reference
MVEBs approved or found adequate	24 months	§ 93.104 (e)(1-3)
Newly designated nonattainment areas	12 months	§ 93.102(d)
New EPA emissions model	No less than 3 months, no more than 24 months	§ 93.111 (b)(1)

1.6.3 *Applicability*

Limited Maintenance Plans

Transportation Conformity must be affirmed, but a regional emissions analysis is not required.

All of the areas cataloged in the Appendix A tables must continue to demonstrate regional transportation conformity with the exception of those areas that have an approved Limited Maintenance Plan. Pursuant to the original CO and Ozone guidance, issued in 1995 and 1994, respectively, and the 2001 EPA *Limited Maintenance Plan Option for Moderate PM10 Nonattainment Areas* guidance memo,

> "Emissions budgets in LMP areas may be treated as essentially not constraining for the length of the maintenance period because it is unreasonable to expect that an area satisfying the LMP criteria will experience so much growth during that period of time such that a violation of the PM10 NAAQS would result. While this policy does not exempt an area from the need to affirm conformity, it does allow the area to demonstrate conformity without undertaking certain requirements of these rules. For transportation conformity purposes, EPA would be concluding that emissions in these areas need not be capped for the maintenance period, and, therefore, a regional emissions analysis would not be required."

[2] Arizona Administrative Code (AAC) was last updated in 1995 and differs slightly from federal regulations. http://www.azsos.gov/public_services/Title_18/18-02.htm#Article_14

1.6.4 Project-Level Conformity

In addition to regional conformity determinations, project-level conformity determinations are required in CO, $PM_{2.5}$ and PM_{10} nonattainment and maintenance areas (§93.109 (d)). To demonstrate project-level conformity:

- A project must come from a conforming STIP or MPO plan / TIP.
- The project's design concept and scope must not have changed significantly from that in the STIP or MPO planning documents.
- The analysis must have used the latest planning assumptions and the latest emissions model.
- In $PM_{2.5}$/PM_{10} areas, there must be a demonstration of compliance with any control measures in the SIP.

Additional analysis may be necessary to determine if a project has localized air quality impacts. This localized air analysis is referred to as a "hot-spot" analysis. A hot-spot analysis is defined as an estimation of likely future localized CO, PM_{10}, and/or $PM_{2.5}$ pollutant concentrations and a comparison of those concentrations to the NAAQS. A hot-spot analysis assesses impacts on a scale smaller than the entire nonattainment or maintenance area, including, for example, congested roadway intersections and highways or transit terminals, and uses an air quality dispersion model to determine the effects of emissions on air quality (§93.101).

All of the areas, with the exception of ozone areas, cataloged in the Appendix A tables must continue to demonstrate project-level transportation conformity. Project-level conformity, including micro-scale air quality analysis and modeling, is currently performed by ADOT.

1.7 Resources

Table 1-3 outlines applicable federal, state, local and other resources related to transportation air quality. It represents a clearinghouse of information regarding laws, regulations and guidance documents that assist in successfully adhering to transportation air quality requirements.

Table 1-3: Resources

Federal Resources	
The Clean Air Act	http://www.epa.gov/air/caa/
EPA State and Local Transportation Resources*	http://www.epa.gov/otaq/stateresources/transconf/conf-regs.htm
National Ambient Air Quality Standards	http://www.epa.gov/air/criteria.html
Criteria Air Pollutants	http://www.epa.gov/air/urbanair/
EPA Green Book	http://www.epa.gov/oaqps001/greenbk/index.html
FHWA Air Quality	http://www.fhwa.dot.gov/environment/air_quality/
MOVES Model & Guidance	http://www.epa.gov/otaq/models/moves/index.htm
Project-Level Conformity and Hot-Spot Analysis	http://www.epa.gov/otaq/stateresources/transconf/projectlevel-hotspot.htm#pm-hotspot
MAP-21	http://www.fhwa.dot.gov/map21/
State Resources	
ADOT Air Quality	http://www.azdot.gov/mpd/air_quality/Documents.asp
ADEQ (links to SIPs)	http://www.azdeq.gov/environ/air/plan/notmeet.html
EPA Air Actions, Arizona	http://www.epa.gov/region9/air/actions/az.html
FHWA Arizona Division	http://www.fhwa.dot.gov/azdiv/responsibilities.htm
Arizona Administrative Code	http://www.azsos.gov/public_services/table_of_contents.htm
MPO & COG Resources	
CAG	http://www.cagaz.org/
PAG	http://www.pagnet.org/
MAG	http://www.azmag.gov/
SEAGO	http://www.seago.org/
WACOG	http://www.wacog.com/
YMPO	http://ympo.org/
LHMPO	http://www.lhcaz.gov/lhmpo.html
Joint Planning Advisory Council	http://www.jpacaz.org/
Other Jurisdiction Resources: ***Three Arizona counties have their own air pollution control programs and operate pursuant to agreements with ADEQ.***	
Maricopa County	http://www.maricopa.gov/aq/
Pima County	http://www.deq.pima.gov/air/
Pinal County	http://pinalcountyaz.gov/Departments/AirQuality/Pages/AirQualityNews.aspx
Other Resources	
AASHTO	http://www.transportation.org/Pages/default.aspx
AMPO	http://www.ampo.org/
TRB	http://www.trb.org/Main/Home.aspx

** This page provides access to all transportation conformity regulations, including final rules and rulemakings currently in progress. It also provides access to guidance documents that have been issued to facilitate implementation of the conformity program.*

2.0 Interagency Consultation Procedures *(Working Paper 2)*

2.1 Introduction

Working Paper 2 (WP-2) focuses exclusively on the interagency consultation component of transportation conformity[1]. The objective of WP-2 is to assist the Arizona Department of Transportation (ADOT) in creating processes that:

1. Meet or exceed federal requirements and are suitable for a State Implementation Plan (SIP) submission.
2. Maximize the use of existing state and Metropolitan Planning Organization (MPO) processes.
3. Are applicable to metropolitan and rural areas.
4. Are flexible to meet future needs and opportunities.
5. Nest within existing ADOT processes to the maximum extent feasible.

WP-2 was generated based on feedback received on Interim Working Paper 2 (IWP-2), which outlined existing state and federal requirements, provided an overview of processes in other states, and concluded with a recommended approach for meeting interagency consultation and Conformity SIP requirements. The document was shared with ADOT and stakeholders to guide the selection of an approach to be used to satisfy federal requirements and streamline Arizona's interagency consultation process.

The goals of WP-2 are to clearly identify the need for an Arizona Conformity SIP and to provide final recommendations regarding the update of ADOT's existing interagency consultation procedures to ADOT / Stakeholders.

2.2 Review of Existing Requirements and Practices

2.2.1 *Federal Regulations and Guidance*

The federal conformity rule (40 CFR 93), in addition to any existing applicable state requirements, establish the conformity criteria and procedures necessary to meet the requirements of the Clean Air Act section 176(c) until such time as EPA approves a conformity state implementation plan (Conformity SIP) required by 40 CFR 51.390.

Conformity SIPs are REQUIRED under the Clean Air Act.

Arizona does not currently have an EPA approved Conformity SIP. Conformity SIPs are required under the Clean Air Act and the regulations that explain the requirements can be found in the conformity rule (40 CFR 51.390). While EPA has not taken action to penalize Arizona, they have the authority, under the Clean Air Act, to do so.

Transportation conformity regulations (40 CFR 93.105) require interagency consultation and outline general factors, specific procedures, resolution of conflicts, and public consultation procedures. Further, the

1 General definitions and descriptions regarding transportation conformity can be found in Working Paper 1, while more detailed information will be covered in Working Papers 3 and 4.

regulations require the development of a state implementation plan (40 CFR 51.390) which must include procedures to be undertaken before making conformity determinations or developing implementation plans. Agencies involved should include MPOs, state departments of transportation, and FHWA / FTA, state and local air quality agencies, and EPA.

Interagency consultation is required in all nonattainment and maintenance areas where conformity applies and ensures that agencies involved in the conformity process meet regularly, share information, and identify key issues early in the conformity process. Additionally, the process ensures that schedules are coordinated for transportation plan / transportation improvement program (TIP) conformity determinations and SIP development.

Interagency consultation procedures for a nonattainment or maintenance area are formally integrated into the Conformity SIP, and are legally enforceable. A state's Conformity SIP, or the federal regulations (40 CFR 93.105) govern the decision-making process and specifically require that a process be established to evaluate and choose a model, associated methods, and any assumptions that will be used in the regional emissions analysis. Figure 2-1 outlines some of the general and specific processes identified in the conformity rule.

Figure 2-1: General and Specific Interagency Consultation Requirements

Federal Conformity Rule General and Specific Interagency Consultation Requirements

General

- ✓ Agency Roles & Responsibilities for each Stage of the Planning Process
- ✓ The Organizational Level for Regular Consultation
- ✓ A Process for Circulating Documents
- ✓ Frequency of and Process for Convening Meetings
- ✓ A Process for Responding to Comments of Involved Agencies
- ✓ A Process for the Development of TCMs

Specific

- ✓ Evaluating and Choosing a Model and Associated Methods and Assumptions for Regional and Project-Level Analyses
- ✓ Determining which Minor Arterials and Other Transportation Projects should be Considered "Regionally Significant"
- ✓ Evaluating whether Projects Otherwise Exempt should be Treated as Non-Exempt
- ✓ Reevaluating TCMs with Respect to Delays
- ✓ Evaluating Conformity Triggers
- ✓ A Process for Providing Final Documents

In January 2009, EPA issued a guidance document, *Guidance for Developing Transportation Conformity State Implementation Plans (SIPs)*, designed to provide guidance on the statutory and regulatory requirements for states to develop conformity state implementation plans.

The Clean Air Act Section 176(c)(4)(E) and section 51.390(b) of the conformity rule now require states to submit Conformity SIPs that address only the following provisions of the federal conformity rule:

- 40 CFR 93.105, which addresses consultation procedures

- 40 CFR 93.122(a)(4)(ii), which states that Conformity SIPs must require that written commitments to control measures be obtained prior to a conformity determination if the control measures are not included in a MPOs transportation plan and TIP, and that such commitments be fulfilled; and
- 40 CFR 93.125(c), which states that Conformity SIPs must require that written commitments to mitigation measures be obtained prior to a project-level conformity determination, and that project sponsors comply with such commitments.

Appendix B includes a detailed checklist, which was developed by EPA and completed by ADOT. The checklist is intended to guide state and local agencies as they establish or revise a Conformity SIP and to help ensure that all relevant conformity rule requirements (40 CFR 93) are addressed

In July 2012, EPA issued a guidance document, *Guidance for Transportation Conformity Implementation in Multi-Jurisdictional Nonattainment and Maintenance Areas*, designed to provide transportation conformity guidance for areas where multiple MPOs, state, and/or other agencies have jurisdiction in a nonattainment or maintenance area.

The agencies responsible for the conformity determination and regional emissions analysis in multi-jurisdictional nonattainment and maintenance areas must develop interagency consultation procedures to address certain decisions including:

- The timing of individual transportation plan and TIP conformity determinations in those circumstances where they need to be coordinated;
- The analysis years that will be examined in the regional emissions analysis;
- The agency that will analyze emissions for any donut area that is part of the nonattainment or maintenance area;
- The emissions model to be used for the regional emissions analysis, in the case where there is more than one model that could be used (e.g., during a new model grace period);
- The planning assumptions to be used in the regional emissions analysis and the sources of that information.

Per 40 CFR 93.105(b)(1), state air agencies must use the interagency consultation process in developing SIP budgets, including establishing subarea budgets for MPOs or individual state budgets in multi-jurisdictional areas.

Existing Arizona Regulations and Procedures

In April 1995, the Arizona Department of Environmental Quality (ADEQ) adopted transportation conformity rules as required under Section 176(c) of the 1990 Clean Air Act Amendments. The rules were published (adopted effective) in the Arizona Administrative Code (AAC) Title 18, Chapter 2, Article 14. The Arizona Conformity Rules have not been formally adopted by EPA and, as a result, the federal conformity rule, (40 CFR Parts 51 and 93) updated in April 2012, is currently used by Arizona. Appendix B includes a comparison between the federal conformity rule (in the form of a checklist developed by EPA) and the AAC, which was developed by ADOT. The comparison includes notes regarding ADOT's recommended updates to the AAC based on the most recent EPA guidance. A matrix detailing specific Arizona air quality agency planning and implementation responsibilities (January 2013) is included as Appendix B. The matrix highlights the general responsibilities assigned to the following entities: ADEQ, ADOT, Counties, EPA, FHWA, MPOs, and Tribes. ADOT's responsibilities with respect to transportation conformity are outlined in Figure 2- 2.

Figure 2- 2: ADOT's Transportation Conformity Responsibilities

ADOT's Transportation Conformity Responsibilities

- ✓ Micro-Scale Air Quality Analysis and Modeling (Project-Level)
- ✓ Prepare Appropriate Environmental Document
- ✓ Statewide Travel Demand Modeling and Forecast
- ✓ Coordination of Regional Transportation and Emissions Analysis in Non-MPO Councils of Governments (COGs)
- ✓ Traffic Data and Projections

Subsequent to the Arizona conformity rule adoption in the AAC, ADOT issued two interagency consultation guidance documents:

Arizona Department of Transportation Conformity Guidance and Procedures Required under Arizona Administrative Code Sections R18-2-1405 (R) and R18-2-1429 (D) which outlines project-level procedures for determining whether a project is regionally significant and performing a conformity analysis / determination if required. This guidance only applies to PM_{10} areas that are outside of the following MPOs, Maricopa Association of Governments (MAG), Pima Association of Governments (PAG), and the Yuma Metropolitan Planning Organization (YMPO).

ADOT Conformity Consultation Processes for the Nonattainment Areas Outside of a Metropolitan Planning Organization as Required under Arizona Conformity Rule which documents ADOT's interagency consultation processes for PM_{10} areas outside of MPOs. The guidance specifically addresses subsections C, M, N, O, and R of Arizona's Conformity Rule (R18-2-1405).

The guidance documents provide a background regarding Arizona policies, but must be updated to reflect Arizona's current air quality status and to meet the requirements of the current conformity rule using the most recent EPA guidance.

There are sixteen nonattainment areas in Arizona, comprised of partial sections of nine separate counties, which require transportation conformity. The areas are covered by three MPOs or COGs and three of the counties also have county air pollution control agencies. Table 2-1 provides a streamlined outline of the MPO / COG areas and corresponding counties which are currently required to perform regional and project-level conformity determinations.

Table 2-1: Current Regional and Project-Level Conformity Requirements in Arizona

	MPO / COG Area	County (ies)	Pollutants	Both Regional & Project-Level	Project-Level Only
Larger MPOs	MAG	Maricopa	CO, Ozone, PM_{10}	X	
	PAG	Pima	CO, PM_{10}	X	
Smaller MPOs / COGs	CAG	Pinal Gila	Ozone, $PM_{2.5}$, PM_{10}	X	
	SEAGO	Santa Cruz Cochise	$PM_{2.5}$, PM_{10}	X	
	WACOG	Mohave	PM_{10}		X
	YMPO	Yuma	PM_{10}	X	

In addition to the AAC and the ADOT guidance documents, Table 2-2 summarizes the areas of the state that have either conformity resolutions or conformity plans for transportation projects in PM_{10} nonattainment areas and the dates of the resolution or plan if available. These resolutions and conformity plans are out of date and, in some cases; do not reflect current air quality status information.

Table 2-2: Areas with Existing Conformity Resolutions or Conformity Plans

County / City	MPO/COG	Areas	Year
Areas with Existing Conformity Resolutions			
Gila	CAG	Hayden Payson	1997
Mohave	WACOG	Bullhead City	1998
Cochise	SEAGO	Paul Spur / Douglas	1997
Areas with Existing Conformity Plans			
City of Nogales (Santa Cruz County)	SEAGO	Nogales	NA*
City of Douglas (Cochise County)	SEAGO	Douglas	NA*
City of Bullhead City (Mohave County)	WACOG	Bullhead City	NA*

** NA = Not Available.*

Conformity resolutions are enacted by County Boards of Supervisors, signed by the County Chairmen, Clerks and Attorneys, and affirm the following:

1. Acknowledgement that the County has been consulted by the lead agency (ADOT) in the development of the transportation conformity plan for the Nonattainment Area;
2. Concurrence in defining all regionally significant transportation corridor(s) in the Nonattainment Area;
3. Concurrence that ADOT shall have original and primary responsibility for transportation conformity planning with respect to the regionally significant transportation corridor(s) defined in the Resolution;

4. Concurrence that projects less than a given distance (e.g. one mile in length) of the defined regionally significant transportation corridor(s) should be exempted from the transportation conformity planning requirements; and
5. Designation of the County's liaison for future transportation conformity-related analyses and consultation.

Conformity Plans are the direct result of the Conformity Resolutions. They declare that transportation projects determined to be regionally significant shall follow all applicable ADEQ and ADOT rules and procedures. In addition, they outline regionally significant corridors, the conditions under which a project on those corridors should be considered regionally significant, and identify the appropriate County point of contact.

2.3 Review of Other States' Consultation Procedures and Documents

A Synopsis of State Consultation Requirements and a State-by-State Comparison Matrix were delivered to ADOT on February 5, 2013. This section includes a brief summary of the areas determined to be most useful for informing ADOT's interagency consultation (ICG) procedures and Conformity SIP updates.

The three states considered for comparison were Maryland, Pennsylvania and Virginia. New Jersey was also investigated, but not included in the comparison matrix due to the dissimilarities between the nature of New Jersey's nonattainment areas / jurisdictions and Arizona's.

2.3.1 Maryland

Maryland addresses interagency consultation requirements through an approved Conformity SIP (76 FR 59252) and the Code of Maryland Regulations (COMAR 26.11.26). There are five areas in Maryland which require regional conformity; three of those areas also require project-level conformity.

Large (robust) MPO Areas

Of the five areas which require transportation conformity, four are completely included in MPOs, which are responsible for leading the interagency consultation process. Two of these MPOs (Baltimore and Washington) are robust and possess the capability to maintain their travel demand models, conduct regional and project-level conformity analyses, meet public involvement requirements, and document the conformity process with little to no support from the Maryland Department of Transportation (MDOT). As a voting Board member and MPO Technical Committee member, MDOT's primary responsibility is to attend interagency consultation meetings and review all materials provided by the MPOs. The interagency consultation groups for each MPO meet monthly. The Baltimore MPO is comprised of Baltimore City and five counties, all within the State of Maryland, which correspond to the boarders of the nonattainment / maintenance areas for ozone and $PM_{2.5}$. The Washington MPO and nonattainment / maintenance area for ozone and $PM_{2.5}$ includes counties and localities in two states and the District of Columbia.

Small MPO Areas

There are two MPOs in Maryland (Hagerstown and Cecil) that are responsible for leading the interagency consultation process, but are not sufficiently robust to manage all the technical aspects of conformity. The Hagerstown area convenes interagency consultation meetings as needed and ensures that public consultation requirements are met, but requires MDOT's assistance to maintain the travel demand model, conduct emissions analyses and document the conformity process. The MPO area spans three states and is comprised of three full counties and one partial county. These boundaries are not the same as the nonattainment area boundary, which consists of two counties in different states. Similarly, the Cecil area MPO requires technical assistance from MDOT to maintain the travel demand model, conduct regional emissions analyses, and document the conformity process for the Maryland portion of the MPO. The MPO is comprised of two counties located in two states and holds interagency consultation meetings monthly

Non-MPO Areas

There is one rural area in Maryland (Kent and Queen Anne's Counties) which relies on MDOT to lead the interagency consultation process, maintain the travel demand model, conduct regional emissions analyses, and document the conformity process. The nonattainment area is comprised of two counties, both within Maryland. County representatives from each county are responsible for ensuring public consultation procedures are followed throughout the conformity process.

Figure 2-3 highlights some of the potential advantages and disadvantages of Maryland's interagency consultation approach.

Figure 2-3: Maryland's Interagency Consultation Approach – Potential Advantages and Disadvantages

Maryland Interagency Consultation Process	
Potential Advantages	**Potential Disadvantages**
✓ MPO Responsible for Leading ICG Process	✗ Limited Economy of Scale
✓ Specialized Procedures by Area	✗ State & Federal Staff Must Attend Multiple Meetings
✓ Flexibility for MPOs to Revamp Procedures as Needed	✗ Limited Central Database of Data and Processes

2.3.2 *Pennsylvania*

Interagency consultation requirements are addressed through a Conformity SIP and individual Memorandums of Understanding (MOU) in Pennsylvania. In addition, the Pennsylvania Department of Transportation (PennDOT) is the lead agency responsible for required interagency consultation across 38 counties in 15 MPOs and 8 Rural Planning Organizations (RPOs). The Pennsylvania Transportation-Air Quality Working Group meets quarterly to discuss transportation air quality issues including conformity. The Working Group structure allows for standardized documents, data, and data development methodologies, which support not only transportation conformity, but the development of triennial emissions inventories and motor vehicle emissions budgets (MVEBs) as well. Subarea MVEBs are used for all pollutants in all relevant areas to ensure MPO / RPO autonomy, as nonattainment and maintenance area boundaries are generally different from MPO / RPO boundaries. This minimizes interagency consultation once SIPs and MVEBs are in place.

In addition, the Working Group has streamlined project reviews and classification by developing several key documents related to conformity, including:

- Conformity SIP and associated MOUs with each MPO, RPO, and the state environmental agency
- Project Review and Classification Guidelines for Regional Air Quality Conformity
- PennDOT Air Quality Manual
- Project-Level Screening Process Guidelines

Large (robust) MPO Areas

Pennsylvania refers to larger, more robust MPOs as "Scenario 2" agencies. Seven MPOs fall into this category. These seven each maintain their own travel demand models and six of the seven use PennDOT-supplied tools to perform travel and air quality modeling activities. The Philadelphia MPO includes counties in two states (Pennsylvania and New Jersey), and the nonattainment / maintenance areas span Pennsylvania, New Jersey, Delaware, and Maryland, and include consultation linkages to the North Jersey and New York-Connecticut areas. Scenario 2 agencies attend the quarterly interagency consultation process.

Small MPO Areas

Small MPOs and RPOs are referred to as Scenario 1 agencies. These agencies rely on PennDOT to perform all technical and most programmatic services related to mobile source air quality issues, including maintaining travel demand models, conducting emissions analyses, documenting the conformity process and leading interagency consultation. These agencies are welcome to attend the quarterly interagency consultation meetings, but typically attend only the biennial conformity kick-off meetings.

Figure 2-4 highlights some of the potential advantages and disadvantages of Pennsylvania's interagency consultation approach.

Figure 2-4: Pennsylvania's Interagency Consultation Approach – Potential Advantages and Disadvantages

Pennsylvania Interagency Consultation Process	
Potential Advantages	**Potential Disadvantages**
✓ Standardized Process Across all Areas ✓ Minimization of Conformity Determinations through Project Tracking & Communication ✓ Streamlined Project Reviews & Classification ✓ Centralized and Uniform ICG Process via DOT	✗ State & Federal Staff Must Attend Multiple Meetings

2.3.3 *Virginia*

Virginia addresses interagency consultation requirements through an approved Conformity SIP (76 FR 64823), the Code of Virginia (9VAC5-151), and MOUs, which include nonattainment area-specific consultation procedures. There are five areas in Virginia that require regional conformity; one of those areas also requires project-level conformity. It is the affirmative responsibility of the lead agency to initiate and conduct the interagency consultation process. MPOs are the lead agencies in larger metropolitan areas and Virginia Department of Transportation (VDOT) is the lead agency in non-MPO areas. Subarea MVEBs are not utilized in Virginia and require the coordination of TIP and Plan amendments and updates in order to smoothly accomplish regional conformity determinations.

The overall consultation process is governed by Virginia's Conformity SIP, which includes state regulations. The regional Conformity SIP and state regulations specify the basic procedures, roles, and responsibilities per 40 CFR 93.105:

- Interagency process
- Conflict resolution
- Models and input data
- Public consultation among agencies and with federal agencies
- TCMs
- Transportation plans, TIPs, and associated conformity

Individual MOUs implement the local consultation procedures documents which recite 40 CFR 93.105 and describe how each requirement will be implemented. The procedures documents identify agency-specific responsibilities for each action or step of the process. Major and/or unique components of the document and process include:

- Identification by name of all local and regional agencies involved (including the local members of each MPO).
- Listing of planning steps, identification of which steps require ICG approval and timeframe for each.
- Identification of non-applicable sections of 93.105 (e.g., $PM_{2.5}$ or PM_{10} issues when the area is not subject to these by virtue of an ozone designation only).
- A dispute resolution process and identified participants for. This process must be utilized prior to the overall state conformity regulations dispute resolution process that involves the Governor.

Finally, Virginia has accomplished several streamlining procedures for the NEPA process and project-level analyses. These include the following agreements with FHWA:

- *Project-level CO Air Quality Studies Agreement* – Includes projects of limited scope and expected air quality impacts. Projects which meet specified requirements, including certain thresholds, are exempted from additional analysis, or a qualitative analysis.
- *No-Build Analysis Agreement for Air and Noise Studies* – Is applicable to projects which qualify for a CE or EA under NEPA and minimizes the need for analysis of the no-build alternative for transportation projects which require a CO air study.

- *Procedures for Updating Air Studies when New Planning Assumptions Become Available* – Specifies the conditions under which a current air study needs to be updated if an inactive project is reactivated, or when the design year and traffic data are updated due to project delays.
- *Programmatic Categorical Exclusion Agreement* – Lists twenty project categories as programmatic categorical exclusions (CEs), which do not normally required further federal NEPA approvals.

Figure 2-5 highlights some of the potential advantages and disadvantages of Virginia's interagency consultation approach.

Figure 2-5: Virginia's Interagency Consultation Approach – Potential Advantages and Disadvantages

Virginia Interagency Consultation Process	
Potential Advantages	**Potential Disadvantages**
✓ Customized Approach for Each Area	✗ Developing Separate ICG documents and MOUs for each area
✓ Local ICG Processes Integrated into Transportation Planning Process and Schedule	✗ Must Amend Documents if Boundaries Change or New Areas are Designated
✓ Consistent Data and Analytical Practices	✗ Using Regional MVEBs Reduces Jurisdiction Flexibility
✓ Detailed Responsibilities Outlined for All ICG Agencies	

2.4 Recommendations

As outlined above, Arizona's nonattainment areas are geographically diverse and are governed by local organizations (MPOs, COGs and County Air Quality Pollution Control Agencies), which possess varying levels of expertise and capacity. The two largest MPOs, the Maricopa Association of Governments (MAG) and the Pima Association of Governments (PAG), possess greater technical capability and the ability to maintain a travel demand model, conduct regional and project-level conformity analyses, meet public involvement requirements, and document the conformity process with little to no support from ADOT. Smaller MPOs and COGs do not have the same capabilities and rely on ADOT to perform most, if not all, facets of the conformity analysis and interagency consultation processes.

The following recommendations include suggestions for meeting federal interagency consultation requirements, as well as updating and streamlining existing Arizona processes based on ADOT / stakeholder preferences and examples from other states.

1. **Update existing ADOT consultation procedures.**
   a. Current procedures only cover areas outside of MPOs; distinguish ADOT responsibilities between MPOs and non-MPOs to ensure that all ADOT consultation procedures are captured in one document.
   b. Clearly identify roles and responsibilities of all relevant agencies.
   c. Add explicit public consultation procedures.
   d. Add a procedure for resolving conflicts.
   e. Update procedures to more accurately reflect ADOT's responsibilities regarding SIP development (R18-2-1405(C)(1)), particularly the development of MVEBs. Currently, ADOT has only developed a process for R18-2-1405(C)(4) and (6), the statewide transportation plan and STIP and all transportation conformity determinations, respectively.
   f. Incorporate references to chosen SIP enforcement mechanism (see options below).

2. **Develop a Conformity SIP that meets federal requirements utilizing the most up to date federal guidance.**

   A Conformity SIP can be adopted as a state rule, as a memorandum of understanding (MOU) or a memorandum of agreement (MOA). The appropriate form of the state conformity procedures depends on the requirements of local or state law, as long as the selected form complies with all CAA requirements for adoption, approval by EPA, and implementation of SIPs. EPA will accept state Conformity SIPs in any form provided the state can demonstrate to EPA's satisfaction that, as a matter of state law, the state has adequate authority to compel compliance with the requirements of the Conformity SIP.

   The Conformity SIP does not have to be a lengthy document, but it must affirm the enforceability of the consultation procedures and it must include state-specific interagency consultation procedures. Arizona has several options for fulfilling the Conformity SIP requirement:

   a. **Revise existing COG and MPO Annual Work Programs to Include Interagency Consultation Procedures.**
   This approach is akin to developing a MOU/MOA. Each COG and MPO has an annual work program (WP) which is prepared by the ADOT Multimodal Planning Division (ADOT MPD) and defines the annual (state fiscal year) goals, objectives and required elements to be undertaken with federal funds distributed by ADOT. ADOT MPD and MPO / COG officials approve (sign) the WP and budget.

   There are several ways to integrate interagency consultation into the WP and the specificity may vary between each MPO and COG. For example, interagency consultation may represent a new, stand-alone work element within the WP. Alternatively, it may be included under an existing work element, such as the TIP development or regional planning coordination, and required only when air quality appears on the MPO/COG agenda.

For illustrative purposes, a sample of the SouthEastern Arizona Governments Organization (SEAGO) Annual Work Program for state fiscal year 2014 (July 1, 2013 – June 30, 2014) has been provided in Appendix B.

b. Update the existing Arizona Conformity Rule.

i. This recommendation is contingent upon either the legislature's (in lieu of a state agency) ability to approve the rulemaking change or waiting until the moratorium on state agency rulemakings is lifted, after December 31, 2014.

ii. Utilize the comparison table in Appendix B to propose language updates and process streamlining to the Arizona Conformity Rule.

iii. Ensure $PM_{2.5}$ is included in the Conformity Rule, particularly in the Applicability Subsection (R18-2-1402 (D)), and anywhere project-level conformity is addressed.

iv. Add language for inclusion of all criteria pollutants and areas of the state without formal regulatory amendments, should additional nonattainment designations for pollutants or areas occur.

v. If the Conformity SIP is in the form of a state rule, then any new agencies not previously covered by the conformity rule are automatically covered by the rule. This could happen if an area that has never been subject to conformity before were to become a newly designated nonattainment area.

Following the development of an MOU / MOA or revisions to the Arizona Conformity Rule, ADEQ and ADOT should collaborate to develop a Conformity SIP (in consultation with EPA, FHWA, FTA and local air quality and transportation agencies) for submission to EPA.

Providing a simple background document and attaching the MOU / MOA or updated Arizona Conformity Rule should satisfy EPA's Conformity SIP requirements.

3. **Consider formal differentiation of areas** such that ADOT is a key member of the interagency consultation process in areas with independent technical capabilities and legal authority (e.g., MAG), and leads the technical and interagency consultation processes in areas with limited technical expertise and / or capacity (i.e., small MPOs and rural areas). Differentiation of the areas may be through the SIP document or an MOU / MOA executed among the parties, of which the latter approach provides more flexibility.

3.0 Air Quality Conformity Procedures *(Working Paper 3)*

3.1 Introduction

The objective of Working Paper 3 (WP-3) is to provide recommendations for conducting transportation regional and project-level conformity analyses in areas outside of the Maricopa Association of Governments (MAG). The paper includes an overview of past procedures, a discussion on key modeling issues related to EPA's MOVES emission model, and recommendations for developing a technically robust analytical framework based on available local data. Project-level conformity procedures are also addressed with a concentration on project screening methods, interagency consultation, and key technical analysis and data items that will impact future project-level studies.

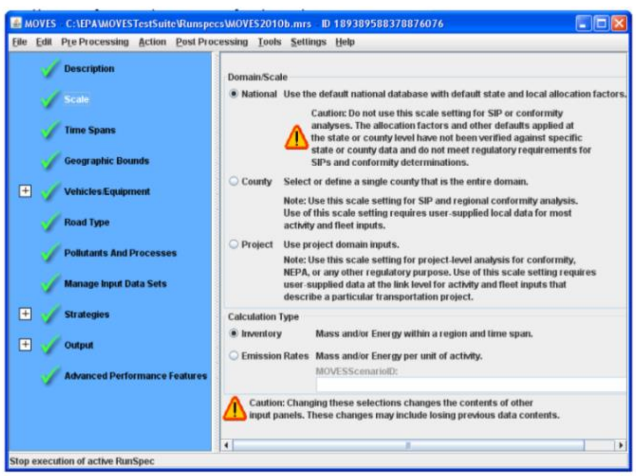
This document is intended to complement the technical items and details recommended in available EPA guidance documents including:

- *Technical Guidance on the Use of MOVES2010 for Emission Inventory Preparation in State Implementation Plans and Transportation Conformity*, April 2010, EPA-420-B-10-023
- *Transportation Conformity Guidance for Quantitative Hot-spot Analyses in $PM_{2.5}$ and PM_{10} Nonattainment and Maintenance Areas*, December 2010, EPA-420-B-10-040

The available EPA guidance provides some flexibility in developing roadway emission inventories in support of transportation conformity and State Implementation Plans (SIPs). This flexibility is based on available local data, analytical tools, and other resource constraints. As a result, the recommendations provided in this paper include options representing different levels of technical robustness and quality control. The recommendations include best practice approaches that have been utilized in other regions within the country.

3.2 Overview of EPA's MOVES Emission Model

MOVES is the state-of-the-art upgrade to EPA's modeling tools and is the current official model for estimating emissions from highway vehicles replacing the previous MOBILE6.2 model. MOVES was developed by EPA's Office of Transportation and Air Quality (OTAQ). As required by the Clean Air Act (CAA), EPA regularly updates its mobile source emission models. This latest model incorporates several changes to the EPA's approach to mobile source emission modeling based upon recommendations made to the Agency by the National Academy of Sciences. Compared to previous tools, MOVES incorporates the latest emissions data, more sophisticated calculation algorithms, increased user flexibility, new software design, and significant new capabilities.



Unlike EPA's previous mobile source emission models, MOVES has a graphical user interface (GUI) which allows users to more easily set up and run the model, though the model can still be run in batch mode to support linkages to other processing software. More fundamentally, it has been designed to do calculations with information in databases, using the open source database management software known as MySQL.

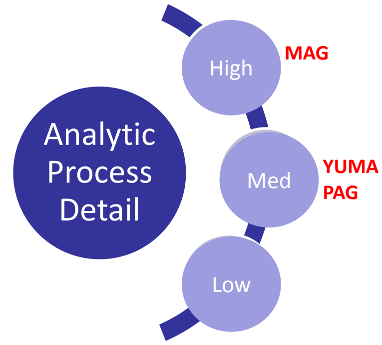
EPA announced the release of MOVES2010 in March 2010 (75 FR 9411), and released a minor revision as MOVES2010a in September 2010. In April 2012, EPA released MOVES2010b to allow MOVES users to benefit from several improvements to general model performance. MOVES2010b does not affect the criteria pollutant emissions results of MOVES2010a and therefore is not considered a new model. MOVES is required for new regional emissions analyses for transportation conformity determinations that began after March 2, 2013 (77 FR 11394). As summarized in Table 3-1, EPA has developed several guidance documents to assist in implementing MOVES.

EPA is in the process of developing a major update to the MOVES model (MOVES2013). The update will incorporate new functionality, research and emission factors. Planned improvements include upgraded diesel retrofit processing, improved evaporative emission processing, better performance, and other various improvements. MOVES2013 is anticipated to be released in late 2013. Major structural changes are not anticipated as many agencies have already developed customized tools based on the structure and formats of MOVES2010.

Table 3-1: EPA Guidance Documents for MOVES

Topic	Document
General Operation of MOVES Model	• *Motor Vehicle Emission Simulator, User Guide for MOVES2010b*, EPA-420-B-12-001b, June 2012.
Use of MOVES for Conformity and SIP Analyses	• *Policy Guidance on the Use of MOVES2010 and Subsequent Minor Revisions for SIP Development, Transportation Conformity, and Other Purposes*, US EPA Office of Air and Radiation, EPA-420-B-12-010, April 2012. • *Using MOVES to Prepare Emission Inventories in State Implementation Plans and Transportation Conformity, Technical Guidance for MOVES2010, 2010a and 2010b*, US EPA Office of Air and Radiation, and Office of Transportation and Air Quality, EPA-420-B-12-028, April 2012.
Use of MOVES for Project-Level Analyses	• *Transportation Conformity Guidance for Quantitative Hot-Spot Analyses in $PM_{2.5}$ and PM_{10} Nonattainment and Maintenance Areas, US EPA Office of Air and Radiation*, EPA-420-B-10-040, December 2010. • *Using MOVES in Project-Level Carbon Monoxide Analyses*, US EPA Office of Air and Radiation, EPA-420-B-10-041, December 2010.
Use of MOVES for Greenhouse Gases	• *Using MOVES for Estimating State and Local Inventories of On-Road Greenhouse Gas Emissions and Energy Consumption*, US EPA Office of Air and Radiation, EPA-420-B-12-068, November 2012.

3.3 Assessing Past Analysis Procedures



Emission analyses conducted by MAG, the Yuma Metropolitan Planning Organization (YMPO), and the Pima Association of Governments (PAG) were reviewed to assess past practices in computing roadway emissions using EPA's MOBILE6.2 emission model. The review was based on the information and details provided in the transportation conformity and regional plan documents. For each of these areas, a regional TransCAD travel demand model has been used as the traffic data source for vehicle miles of travel (VMT) and speeds. Other key inputs are based on local data as recommended by EPA guidance. These include:

- registration data to determine the vehicle fleet ages
- local environmental data including temperatures and humidity
- regional fuel characteristics
- local control strategies including the vehicle inspection and maintenance program

MAG's analysis approach fully utilizes MOBILE6.2 capabilities and satisfies procedures recommended in EPA guidance

The methodology differences between these areas primarily relate to the methods used in applying emission factors from MOBILE6.2 to the available traffic data. The analysis detail is determined by the types of pollutants being analyzed and the purpose of the emission analysis results. Table 3-2 highlights specific features of the calculation methods in each area as compared to best practices.

MAG has produced emission analyses to support regional conformity determinations for carbon monoxide (CO), ozone and PM_{10}. Custom software (M6Link) is used to assist with batch processing, the development of speed inputs to MOBILE6.2, and the application of emission rates to aggregated VMT totals. Within the software, travel model volumes by time period are expanded to each hour of the day to support diurnal analyses accounting for the variance of emission factors by environmental conditions. The M6Link software is used to prepare a distribution of link speeds by time period for input to MOBILE6.2. The approach conducted by MAG fully utilizes EPA's MOBILE6.2 capabilities and satisfies the procedures recommended in EPA guidance. This approach is consistent with best practice approaches including those used throughout the northeast (Pennsylvania, Maryland, New Jersey, and New York). One key difference between MAG's process and other best practice approaches is the lack of speed post processing from the travel model. However, MAG has conducted speed validation efforts to affirm the calculated speeds from the travel model are consistent with observed peak and off-peak conditions.

The YMPO analysis approach does not address the variance of speeds by time of day. MOVES PM emissions factors are sensitive to speed

YMPO has conducted transportation conformity analyses for PM_{10}. The methodology assumes a more simplistic application of emission factors as compared to MAG. Daily VMT estimates are multiplied by a single average emission factor. In this respect, the changes of VMT and emission factors by hour of the day are not specifically accounted for in this approach. In addition, the emission factors are based on a single daily average speed and not a distribution of speeds by time period. Since PM_{10} emissions do not vary by speed in MOBILE6.2, the simplified approach for preparing speed inputs is acceptable. However, as illustrated in Figure 3-1, EPA's MOVES emission model does adjust $PM_{2.5}$-related emission factors by speed and engine operation, so future application of this approach does not meet EPA guidance recommendations.

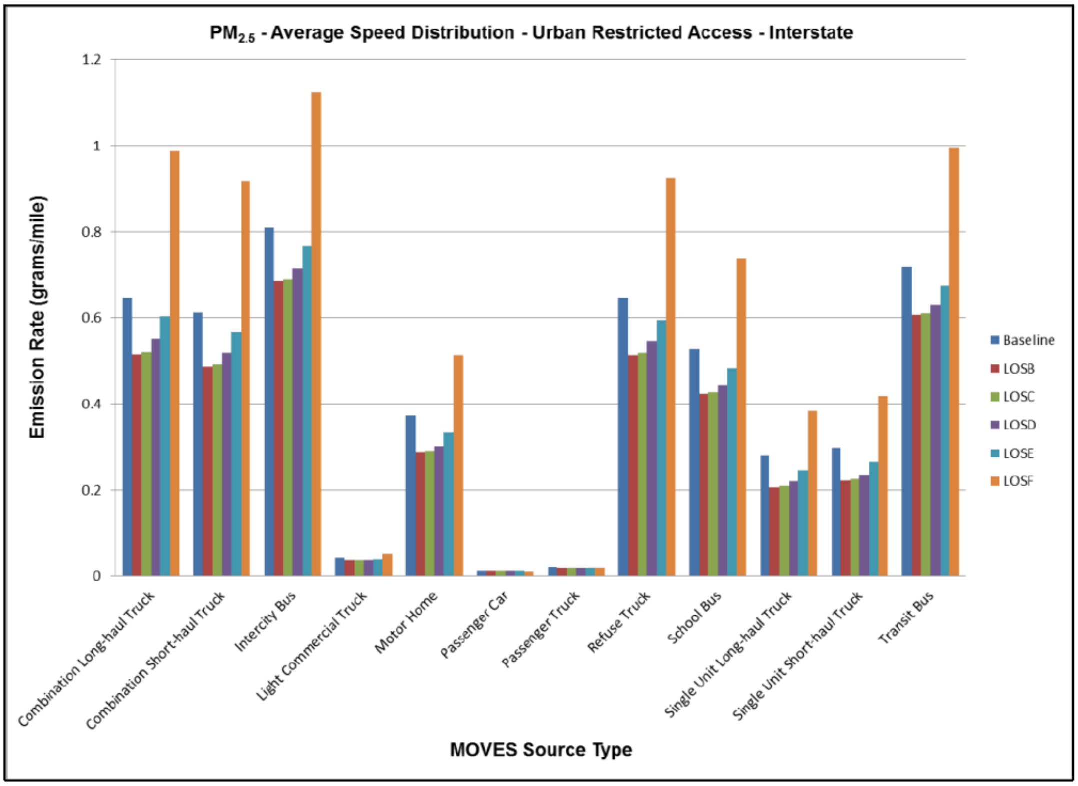
Table 3-2: Evaluation of Past Emission Analysis Procedures

Area (MPO)	Strength of Approach	Differences from Best Practices
MAG	• Automated batch processing improves quality control • Software incorporates AP-42 emission factors for re-entrained road dust • Utilizes local data for key inputs recommended by EPA guidance. • Emission factors are applied to each hour of the day accounting for variances in hourly environmental conditions and traffic volumes. • Traffic speed inputs to MOBILE6.2 are developed for distinct time periods and account for distribution of speeds across all links. • Approach includes method to account for I/M and non-IM vehicles	• No re-calculation of travel model speeds using post processing algorithms due to validation of speed data conducted by MAG
YMPO PAG	• Simplified analysis procedures allow emissions to be estimated quickly. • Analysis detail consistent with fact that PM emissions do not vary by speed in MOBILE6.2. • Utilizes local data for key inputs recommended by EPA guidance.	• Lack of customized automated procedures • Accounting for variance of emission factors and travel speeds by time of day. • No re-calculation of travel model speeds using post processing algorithms.

PAG has a CO limited maintenance plan and thus a regional emissions analysis for CO is not required in determining conformity of transportation plans and programs. However, modeling of the regional CO emissions is used for comparative purposes within the Regional Transportation Plan (RTP). The PAG RTP does not provide a detailed methodology for emission calculations, though the methods appear to be conducted using methods more consistent with YMPO.

Past methods used to produce emissions do vary among the three regions discussed. As EPA's MOVES model is integrated into the conformity process, past methods may need to be revised or enhanced to utilize the full capability of MOVES and to improve quality control and management of data files. MAG's current process addresses many of EPA's guidance recommendations and is consistent with best practice approaches in other states. The following sections will provide more details on the MOVES model and provide key analysis considerations that draw on these past practices and other best practices approaches for emission estimation.

Figure 3-1: **Sensitivity of $PM_{2.5}$ to Vehicle Speed in MOVES Emission Model**



* *$PM_{2.5}$ Average Speed Distribution Sensitivity Urban Restricted Access – Interstate*
MOVES2010a Regional Level Sensitivity Analysis December 2012
DOT-VNTSC-FHWA-12-05 (http://ntl.bts.gov/lib/46000/46500/46598/DOT-VNTSC-FHWA-12-05.pdf)

3.4 Assessing Available VMT Data Sources for Air Quality Analyses

Vehicle miles of travel (VMT) is the primary traffic input that affects emission results. MOVES requires annual VMT to be input for six HPMS vehicle classes. The format and issues related to the development of the MOVES VMT input file is discussed in **Section 5**. Typically, roadway VMT is estimated from an MPO regional travel demand model since it provides a robust method for estimating future forecasts of VMT related to demographics. Travel models are also a valuable tool since they can estimate the traffic impacts and diversions related to transportation projects. Where regional travel models are not available, state DOT's or MPOs have often relied on statewide travel demand models or the traffic databases used to develop VMT estimates for the Highway Performance Monitoring System (HPMS).

3.4.1 Summary of Available VMT Data Sources in Arizona

Table 3-3 provides a summary of available VMT data sources in Arizona. ADOT's statewide travel model serves as a valuable data source for areas without MPO models due to its robust roadway coverage, continued maintenance and validation by ADOT, inclusion of multiple time periods, and its truck model component.

Table 3-3: Available VMT Data Sources in Arizona

Data Source	Potential Uses	Key Characteristics
MPO Model	• Conformity • SIP Inventories	• Available for MAG, PIMA, YMPO nonattainment areas • MAG model contains speed validation
Statewide Model	• Conformity • SIP Inventories	• Consistent with HPMS roadway coverage across state • Contains additional detail of MPO models and enhanced detail for Pinal County • Four time periods (AM, Midday, PM, Night) • Addition of Mode choice component in process • Validated to 2008 conditions (in process to validate to 2010) • Speeds have not been validated • Estimates Single Unit and Multi-Unit trucks (Short haul base on MAG truck model, Long-Haul based on FHWA FAF data)
HPMS VMT	• SIP Inventories • Investigative Efforts • EPA NEI	• Summary VMT totals by county lack detail for speed estimation • VMT by time of day is not supported directly • Includes methods to estimate local VMT
HPMS Source Traffic Databases	• Conformity • SIP Inventories • EPA NEI	• Used to support model validation • Contains roadway characteristics, speed limits and intersection signal information (not comprehensive coverage) that could be used for speed estimation • Incorporates truck count data that can support vehicle type disaggregation

These characteristics of the statewide model allow for:

- calculation of VMT by time period to support MOVES emission rates by time of day;
- estimation of travel speeds using roadway capacity information and travel time data; and,
- disaggregation to vehicle types using link-specific truck forecasts in combination with other data sources including MOVES national defaults, national transit data, and vehicle registration information from the state.

The HPMS traffic databases also have information that could be used to support emission analyses. These databases contain traffic volumes and physical attribute information (e.g. travel lanes, facility class) that may be used to calculate VMT and travel speeds. However, these databases have several key deficiencies that include the lack of forecasted travel volumes, time period volumes, and traffic diversion methodologies to account for the impact of transportation projects.

Based on the above deficiencies, it is anticipated that the non-model data sources (in Table 3-3), including the HPMS VMT summaries, HPMS traffic database, and permanent traffic count stations, will complement the regional and state travel models in completing regional conformity and SIP emission estimates. These data sources can be used to develop important adjustments to the VMT forecasts including:

- seasonal and daily adjustments to convert model VMT to the required seasons for each pollutant (e.g. ozone = summer weekday, PM = daily or annual that may require an estimate of an average day in each month); and
- HPMS VMT reconciliation to ensure that base year VMT totals are consistent with the totals reported to FHWA. This will include accounting for missing local VMT not accounted for in the regional/state travel models.

Many states have been utilizing the HPMS traffic databases to support submittals for EPA's triennial National Emissions Inventory (NEI). Since HPMS is continually updated based on traffic counts and roadway inventories, it serves as a valuable data source for monitoring traffic conditions. In Pennsylvania and Maryland, these databases have been linked to the MOVES emission model using custom processing software to provide an automated method to produce the MOVES traffic and average speed inputs needed for every county in each state.

3.4.2 Key Issues Integrating the ADOT Statewide Model

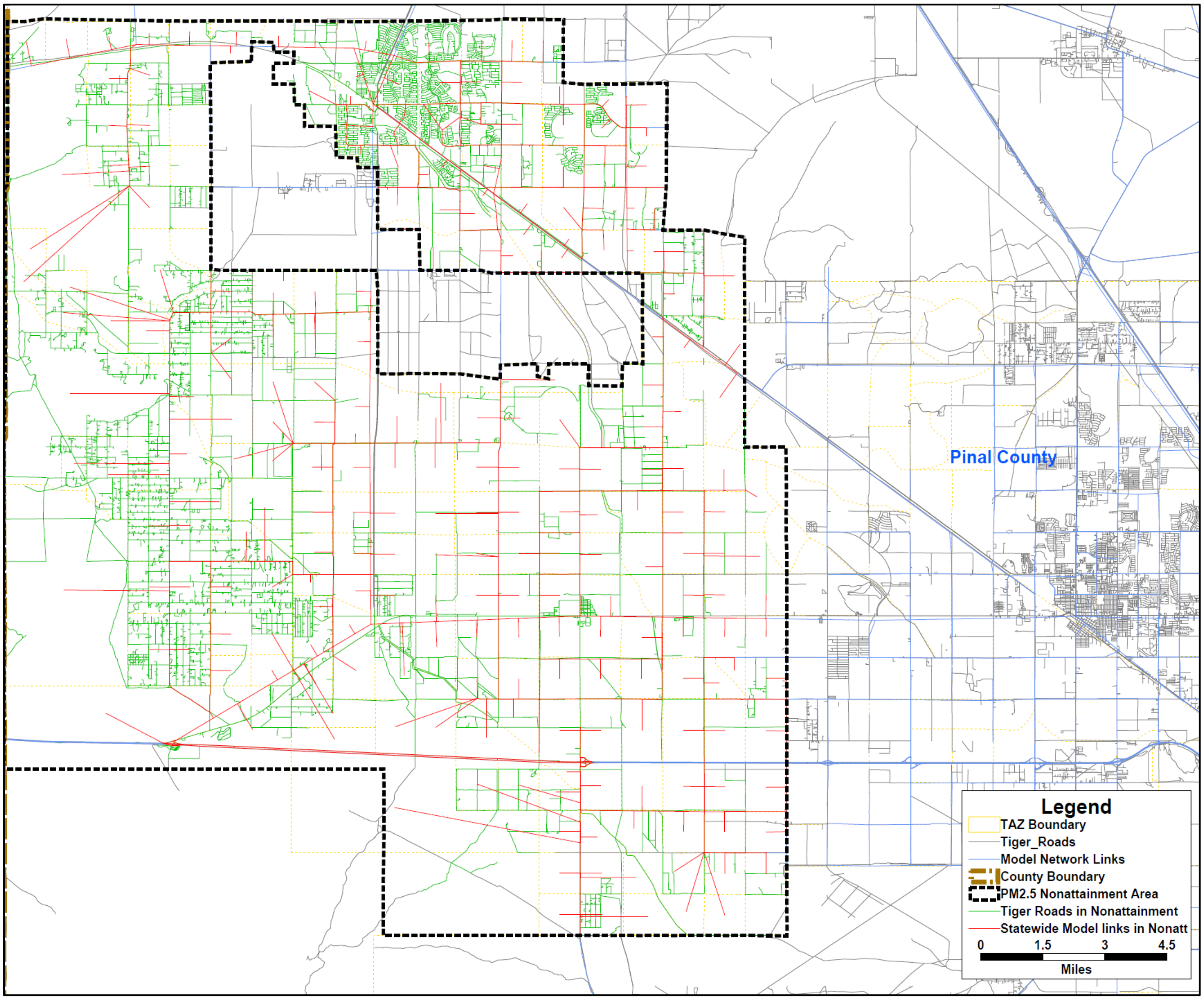
The MPO regional travel models will serve as the primary data source for emission estimates. For areas not covered by an MPO model or to support statewide performance measure analyses, the use of ADOT's statewide travel model is recommended. The statewide model has been the primary data source used for ADOT's sample analyses and will be the focus of future work in developing a case study approach.

The model provides the key information needed to produce the VMT and speed estimates (with potential post processing) for input to the MOVES model. In addition, the statewide model's roadway coverage is consistent with the state HPMS system with enhanced detail for MPO regions.

As illustrated in Figure 3-2 (sample for CAG $PM_{2.5}$ area), there are still a significant number of local roadways not included in the statewide model network, as is the case for many regional travel models. This emphasizes the need for additional VMT adjustments and reconciliation.

The statewide model has various data fields that can be used to support the development of VMT, traffic speed distributions, and vehicle type inputs to the MOVES air quality model. Key network fields that may be used for air quality processing include those provided in Table 3-4. Traffic volumes and roadway distances can be directly used to estimate regional VMT. Traffic speeds can be translated to MOVES input file formats to support the detailed hourly speed data recommended for air quality processing. Truck volumes can be used as the basis for assembling VMT by the MOVES six HPMS vehicle classes. The use and application of the travel model data may require additional pre/post processing as described in **Section 5** and **6**.

Figure 3-2: Statewide Model Coverage for CAG $PM_{2.5}$ Nonattainment Area



** TAZ refers to model Traffic Analysis Zone system*

Table 3-4: Potential Statewide Model Fields for Air Quality Processing

(Based on Statewide Model Version 5 User's Guide)

Model Field	Description	Potential Use
Variables in the Input Highway Network		
Length	Length (mi), automatically computed from TransCAD	Estimation of VMT
FT	Facility type (1=freeway, 2=major arterial, 3=minor arterial, 4=collector, 5=minor collector, 7=ramp, 8=metered ramp, 9=centroid connector)	Lookup of other link attributes (e.g. speeds, signal densities, capacities) for speed recalculation in post processing routines
AREATYPE	Area type (1=CBD, 2=Outlying CBD, 3=Urban, 4=Suburban, 5=Rural, 6=Out-of-State)	Lookup of other link attributes (e.g. speeds, signal densities, capacities) for speed recalculation in post processing routines
AB_SPEED BA_SPEED	Link posted speed limit (mph)	Free-flow speed used if recalculating congested speed in post processing routines
AB_LANES BA_LANES	Number of lanes	Used to estimate capacity
Intermediate Variables Appended to HWY.DBD File		
AB_CAP_*AM* BA_CAP_*AM* (*AM, MD, PM, NT*)	Total capacity for the period (factored by lanes and hours)	May have limited use for recalculation of speeds in post processing routines.
AB_CAP BA_CAP	Capacity in vehicles per hour per lane	
AB_BPR_*A* BA_BPR_*A* (*A, B*)	BPR alpha(A) and beta(B) parameters	Possible use in post processing routines for speed recalculation.
Variables from the Output Assignment (*.Bin) Files (for AM, PM, Midday, and Night Time Periods)		
AB_FLOW BA_FLOW	Total flow of all vehicles	Estimation of VMT
AB_FLOW_SUT BA_FLOW_SUT	Flow of single-unit trucks	Use for vehicle disaggregation of VMT
AB_FLOW_MUT BA_FLOW_MUT	Flow of multi-unit trucks	Use for vehicle disaggregation of VMT
TOT_VHT	Total vehicle hours of travel	Use in preparation of MOVES speed distribution file which is based on distribution of VHT by speed bin
AB_SPEED BA_SPEED	Loaded (congested) speed	Use in preparation of MOVES speed distribution file. Reflect speeds by time period.

3.4.3 *Adjusting VMT from Available Data Sources*

Travel demand models will typically serve as the primary highway data source for the county and functional class VMT estimates. However, the models do not contain all the roadways in each region. Table 3-5 illustrates a comparison of the ADOT statewide model roadway mileage as compared to the CENSUS GIS Tiger roadway layer. Although most of the VMT will be covered by roadways in the statewide model, there is a portion of missing collector and local VMT that will need to be accounted for in the emission methodology.

Table 3-5: Roadway Mileage Coverage in Statewide Travel Model

(Note much of the differences in mileage are local roadways with low traffic volumes)

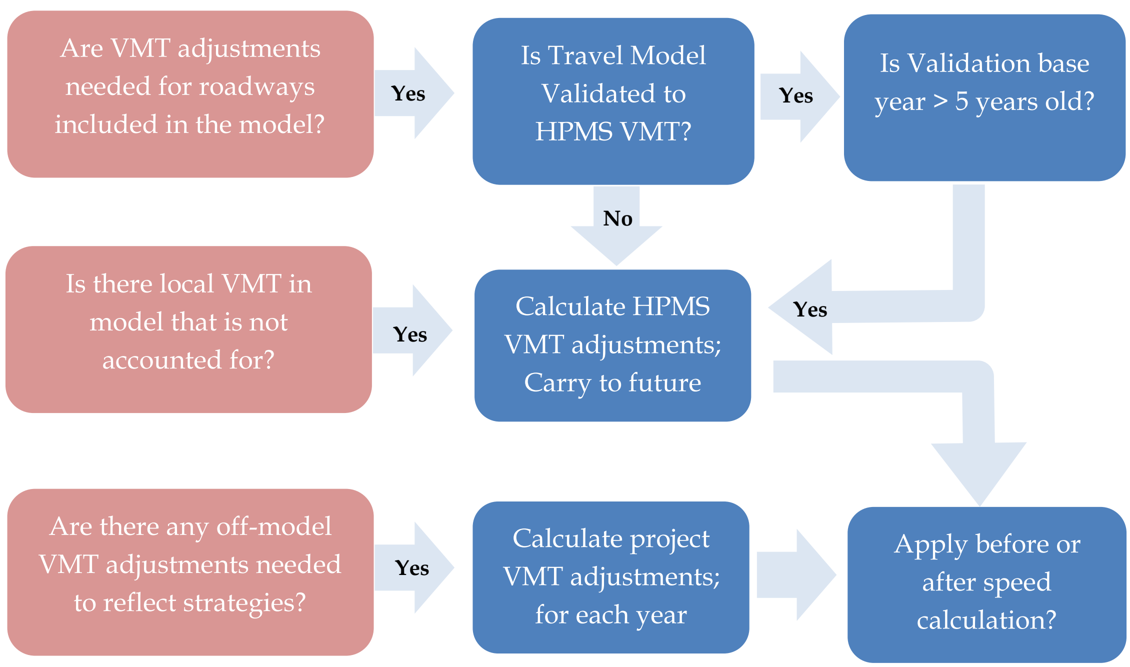
Nonattainment Area	Statewide Model Roadway Mileage	CENSUS TIGER Roadway Mileage
MAG 8-hr Ozone	7,422	28,796
CAG 8-hr Ozone	194	978
CAG $PM_{2.5}$	397	1,233
SEAGO $PM_{2.5}$	97	422
MAG PM_{10}	6,531	23,400
CAG PM_{10}	2,244	7,415
PAG PM_{10}	317	972
SEAGO PM_{10}	190	948
WACOG PM_{10}	679	2,182
CAG SO2	60	333

According to EPA guidance, baseline inventory VMT computed from available traffic sources must be adjusted to be consistent with HPMS VMT totals. The HPMS VMT reported for Arizona is a subsystem of a roadway and traffic database established to meet the data reporting requirements of the FHWA. Although it has some limitations, the HPMS system is currently in use in all 50 states and is being improved under FHWA direction.

Other VMT adjustments to the travel model outputs may include project specific adjustments based on off-model analyses. These may include regional TDM strategies or other VMT reducing measures.

Figure 3-3 illustrates the key decisions in assessing what VMT adjustments may be needed for the travel model data source as part of a regional emissions inventory. Note that additional seasonal and hourly adjustments are discussed separately in **Section 5**. Typically, travel model validation efforts include an assessment and adjustments to ensure the model properly reflects the right amount of travel for higher functional classes (e.g. freeway, arterial). However, adjustments may still be needed if the model validation is not recent of if the model is missing a significant amount of collector or local VMT. In those cases, an assessment should be conducted to verify if the travel model is producing reasonable VMT estimates for a more recent analysis year. If separate adjustments are needed, adjustment factors should be calculated and used to adjust the travel model base year VMT to the reported HPMS VMT totals submitted to FHWA. The VMT contained in the HPMS reports are considered to represent average annual daily traffic (AADT). Adjustment factors can be developed for each county and functional class grouping and applied to all future analysis year runs. Adjustments for the "higher" functional classes (e.g. Freeway, Arterials - major routes) should be close to 1.000 since the travel model will include all of these facilities. "Lower" classes (e.g. local roads) require greater adjustment since a large part of the local system is not under state jurisdiction and is not in the travel model. There is, of course, a significant amount of local road mileage in the state. It is assumed that those local streets that are in the travel model are representative of all local streets in their area with respect to volume and speed.

Figure 3-3: Decision Process for HPMS VMT Adjustments



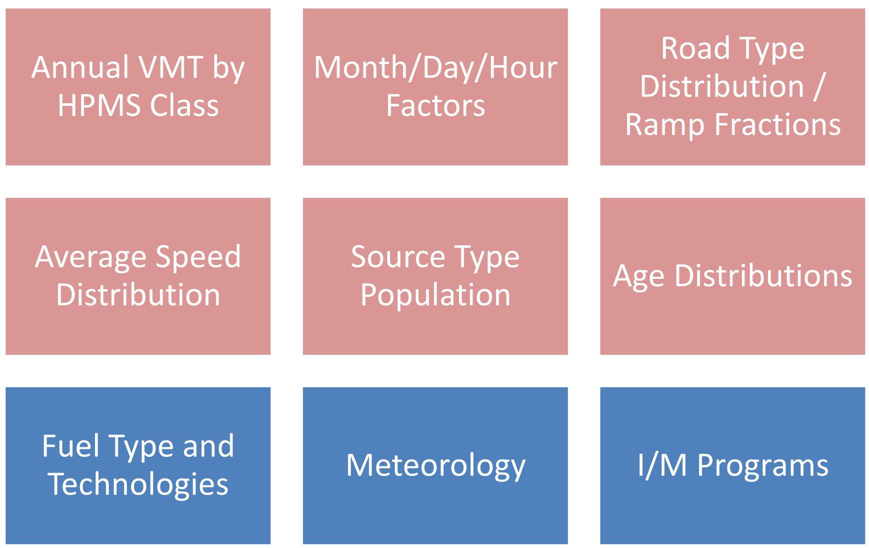
Additional decisions will be required to determine if the VMT adjustments should impact regional speeds. For example, if the model is under representing freeway VMT and/or project strategies are applied to affect regional VMT, then it may be assumed that such adjustments should have an impact on speed. If adjustments are simply to account for missing VMT, then speed adjustments may not be warranted. However, the recalculation of speeds may require additional post processing procedures as discussed in the following sections.

3.5 Recommendations for MOVES County Data Manager Inputs

MOVES includes a default national database of meteorology, vehicle fleet, vehicle activity, fuel, and emission control program data for every county; but EPA cannot certify that the default data is the most current or best available information for any specific area. As a result, local data is recommended for use for conformity analyses.

MOVES allows input of local data through its County Data Manager (CDM), an interface developed to simplify importing specific local data for a single county without requiring direct interaction with the underlying MySQL database. Use of the CDM is necessary when the scale is set to County and is required for SIPs and regional conformity analyses. Key inputs to the CDM are summarized in Figure 3-4 and are addressed within this section with a specific concentration on the traffic-related inputs and vehicle age distributions.

Figure 3-4: Key MOVES CDM Inputs



EPA has developed tools and EXCEL convertor spreadsheets to help prepare the CDM inputs (www.epa.gov/otaq/models/moves/tools.htm). Many of these tools are focused on converting existing MOBILE6.2-formatted data into that needed by MOVES.

ADOT has developed custom spreadsheets to assist in converting the statewide model and state registration data into the input formats needed by the EPA convertor spreadsheets. A summary of ADOT's tools are summarized in Table 3-6. Data for I/M programs, alternative vehicles, meteorology and fuel parameters are either not currently used in ADOT's current sample process or utilize MOVES defaults.

In other regions, the EPA tools have been replaced by pre/post processing software or other custom EXCEL spreadsheets. Where possible, some regions have moved away from developing files using MOBILE6.2 formats, and instead directly creating the inputs for MOVES. The exception has been for vehicle age distributions, which are typically based on weight-based vehicle categories that better match with the MOBILE6.2 vehicle types. The following sections describe key issues and recommendations related to the preparation of CDM inputs.

Table 3-6: ADOT Custom Spreadsheet Tools

MOVES Input	ADOT Tool (EXCEL)	EPA Converter (EXCEL)	MOVES CDM File
Vehicle Population	MVD Registration Converter		SourceTypeYear
– Age Distribution – VMT by HPMS Vehicle Type – VMT Fraction – Road Type Distribution	– Daily VMT Converter – Hourly VMT Converter – Mobile6 Reg Distribution Calculator	vmt-converter-road-veh16	SourceTypeAgeDistribution HourVMTFraction RoadTypeDistribution
		aadvmtcalculator_hpms	HPMSvTypeYear DayVMTFraction MonthVMTFraction
Ramp Fraction	HPMS Ramp Fraction Calculator	vmt-converter-road-veh16	RoadType RampFraction
Speed Distribution	Speed Calculator	averagespeedconverter_mobile6_weekdays	AvgSpeedDistribution

3.5.1 *Annual VMT by HPMS Class*

EPA expects users to develop local VMT estimates for SIPs and regional conformity analyses. The data sources discussed in **Section 4** will likely serve as the primary source of that information in Arizona. MOVES requires annual VMT by six HPMS vehicle classes. Within MOVES these vehicle classes are disaggregated to 13 source types. Per information received from EPA's OTAQ, the relationship between the HPMS vehicle classes and MOVES source types is described in Table 3-7. These definitions are also important in mapping vehicle classes to registration data for the vehicle population and fleet age inputs as discussed in later sections.

The preparation of the MOVES VMT input file will include two primary steps: annualization of model results and disaggregation to vehicle classes. The annualization of travel model VMT will most likely depend on the seasonal and daily factors input to MOVES. This will require identifying what type of day is represented by the travel model results (e.g. annual average daily traffic (AADT), an average annual weekday (AWDT), or a specific weekday in a month). EPA provides an EXCEL tool to help compile daily VMT and seasonal/daily factors into the formats required by MOVES.

Table 3-7: Description of MOVES Vehicle Categories

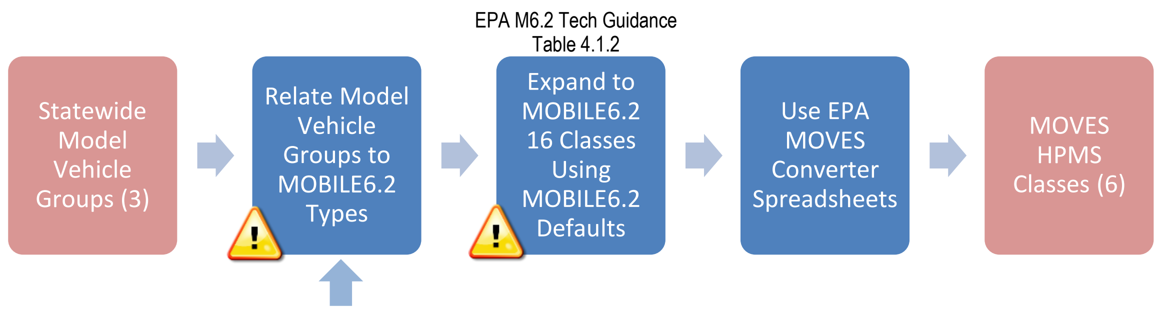
Source Type ID	Source Use Type	Description	HPMS Vehicle Class
11	Motorcycle	Vehicles with less than four wheels.	**Motorcycle**
21	Passenger Car	Four wheel, two axle vehicles whose primary function is passenger transport.	**Passenger Car**
31	Passenger Truck	Four wheel, two axle trucks whose primary functional design is for cargo, but are used primarily for passenger transport.	**Light Trucks**
32	Light Commercial Truck	Four wheel, two axle trucks used primarily for cargo transport.	
41	Intercity Bus	Passenger vehicles with a capacity of 15 or more persons primarily used for transport between cities.	**Buses**
42	Transit Bus	Passenger vehicles with a capacity of 15 or more persons primarily used for transport within cities.	
43	School Bus	Passenger vehicles with a capacity of 15 or more persons used primarily for transport of students for school.	
51	Refuse Truck	Trucks primarily used to haul refuse to a central location.	**Single Unit Trucks**
52	Single Unit Short-haul Truck	Single unit trucks with more than four tires with a range of operation of up to 200 miles.	
53	Single Unit Long-haul Truck	Single unit trucks with more than four tires with a range of operation of over 200 miles.	
54	Motor Home	Trucks whose primary functional design is to provide sleeping quarters.	
61	Combination Short-haul Truck	Combination tractor/trailer trucks with more than four tires with a range of operation of up to 200 miles.	**Combination Trucks**
62	Combination Long-haul Truck	Combination tractor/trailer trucks with more than four tires with a range of operation of over 200 miles.	

The disaggregation of travel model vehicle groups to the six HPMS classes is an important step that may include a combination of local and national data. For the ADOT statewide travel demand model, traffic volumes are produced for three vehicle groupings:

- Auto
- Single-unit trucks (SUT)
- Multi-unit trucks (MUT)

Figure 3-5 illustrates the sample EXCEL-based process for Pinal County ("*ADOT Daily VMT Calculator for Pinal.xls*"). In that process, EPA's converter spreadsheets are used to convert MOBILE6.2-based data into the formats needed by MOVES.

Figure 3-5: Existing Sample Pinal Process for Vehicle Disaggregation



Mapping of Statewide Model Vehicle Types to MOBILE6.2 Classes

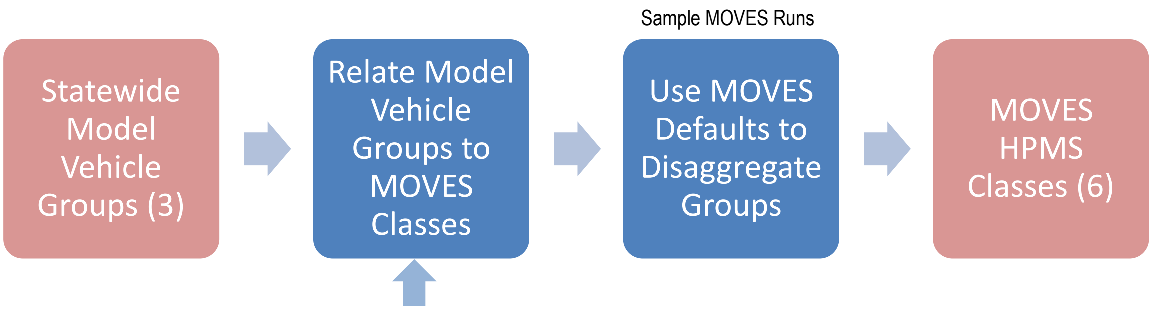
Statewide Model	MOBILE6.2 Types
Auto	LDV
SUT	LDT1-4
MUT	HDV2-HDV8B
HDBS, HDBT (Assumed 0 for Pinal)	
MC (Used National Default)	

Several concerns have been identified with the sample vehicle mapping approach. These concerns are summarized as follows:

- The mapping of statewide model vehicle groups to the MOBILE6.2 weight-based classes may require additional review and/or assessment. In MOBLE6.2, the light-duty trucks (LDT1-4) include many of the sport utility vehicles (SUVs) being used for passenger travel. It is expected that the statewide travel model's "auto" category actually includes a large percentage of these vehicles. If that is the case, then the SUT model category most likely includes heavier trucks in the HDV2-HDDV7 range.
- Table 4.1.2 from EPA's MOBILE6.2 technical guidance provides the national distribution of VMT by the MOBILE6.2 16 weight-based vehicle types. This data is based on 1999-2002 information and forecasted trends developed by EPA at that time. There are several concerns with using this information for future studies. The late 1990's included a significant growth in SUV vehicles (LDT1-4). As can be seen in Table 4.1.2 (of the guidance), EPA continued this growth out to 2020. These forecasted growth trends are not representative of recent trends. With higher gas prices, large SUVs have decreased significantly and cars and light trucks have become of lighter weight to improve fuel economy. As a result, it is not recommended to utilize Table 4.1.2 from EPA's MOBILE6.2 technical guidance.

Many areas have worked to move away from using MOBILE6.2 and EPA's converter spreadsheets in preparing the MOVES VMT input file. In these cases, mapping the vehicle groups directly to the MOVES HPMS vehicle classes will be necessary using the information as shown in Table 3-7. This recommended process is illustrated in Figure 3-6 and can be adjusted based on more specific information on the types of vehicles included in each travel model vehicle group.

Figure 3-6: Recommended Process for Vehicle Disaggregation



Potential Mapping of Statewide Model Vehicle Types to MOVES HPMS Classes

Statewide Model	MOVES Classes
Auto	Passenger Car
	Motorcycle
	(x%) of Light Trucks
SUT	(x%) of Light Trucks
	Single Unit Trucks
	Buses
MUT	Combination Trucks

Disaggregating the statewide model Auto and SUT vehicle groups to the MOVES classes can be supported by MOVES default runs to identify the percentage distribution among vehicle types. In addition, other states (e.g. Pennsylvania and Maryland) have developed mapping schemes that utilize information from the National Transit Database (NTD) and school bus registrations to better identify the portion of VMT related to those vehicle classes.

3.5.2 *Month/Day/Hour Fractions*

MOVES emission rates vary by month, day (weekday vs. weekend) and hour due to variations relating to environmental data (e.g. temperatures, humidity) fuel characteristics, and the number of starts assumed per day. The MOVES CDM files can be indexed as follows:

- Month – by vehicle class
- Day – by vehicle class and road type
- Hour – by vehicle class and road type

States and MPOs typically either develop these fractions based on available traffic count data or using MOVES national defaults. State DOT permanent count locations used to support the HPMS are often the primary data source for the development of these adjustments. In Pennsylvania and Maryland, the factors are extracted from an annual report prepared by the DOT documenting the results of the traffic count data system.

Sample MOVES CDM inputs for Pinal County do not provide the monthly and daily factors so it is assumed that the national defaults are currently being used. These defaults are provided within several of EPA's Excel MOVES data preparation tools. In many areas, local data appears reasonably consistent with national averages. If a specific county has unique travel characteristics by season or between weekdays and weekends, then it may be recommended that local count data be used as input to MOVES instead of the national defaults.

ADOT has developed hourly pattern files based on information from the statewide model. The current approach represents an acceptable methodology that has been used in other custom post processing software. The approach utilizes the fraction of total VMT for each time period (AM, midday, PM, and night) and the national hourly default fractions. For each time period the national hourly data is normalized to the model results. These results are then developed in MOBILE6.2 format and input to the EPA converter spreadsheets to prepare the MOVES CDM inputs. More robust methods may be considered to account for potential differences by each MOVES road type. The PPSUITE post processing software (as used in areas within the northeast) contains methodologies to estimate an aggregate hourly fraction file based on variances by functional class or even link. The post processor combines the information to develop a composite average for all the links with a common MOVES road type value.

3.5.3 Road Type Distribution/Ramp Fractions

The fraction of VMT by road type varies from area to area and can have a significant effect on overall emissions from on-road mobile sources. EPA expects states to develop and use their own specific estimates of VMT by road type and have provided tools to assist in developing the CDM inputs.

As is the case for other MOVES inputs, EPA does not expect that users will be able to develop local road type distributions for all 13 vehicle source types. If local road type distribution information is not available for some source types, states can use the same road type distribution for all source types within an HPMS vehicle class.

The sample processing for Pinal County utilizes travel model outputs by vehicle type and functional class to develop a roadway type distribution. This meets and exceeds EPA's recommendations and is consistent with methods used by other states. As done for other CDM inputs, some states have focused on automating the production of these files based on the travel model outputs.

Ramp fractions is an optional MOVES CDM input file. A default of 8% of the total vehicle hours of travel (VHT) will be used if local data is not available. The ADOT statewide model does have ramp facilities coded allowing for a direct computation of the ramp fractions by road type. However, if there are concerns over the model's ability to produce accurate ramp volumes, then the use of defaults may be warranted. It should be noted and stressed that the ramp fractions are determined based on VHT, not VMT. This is a difference from the MOBILE6.2 ramp fraction inputs. As a result, additional computations may be required to determine appropriate values by VHT using both the VMT and speeds for each facility.

3.5.4 *Travel Speeds*

Emissions for many pollutants (including VOC, NOx and PM) vary significantly with travel speed. The variance of $PM_{2.5}$ (similar trends for PM_{10}) emissions was illustrated earlier in this document in Figure 3-1. MOVES allows users to provide a distribution of vehicle hours of travel (VHT) by 16 speed bins, by each road type, source type, and hour of the day. The bins relate to ranges of average driving speed. EPA also allows modification of more detailed drive cycles and operating mode distributions; however, such changes are primarily used for project-level analyses where detailed simulation or test drive data are available.

> From Section 3.6 of EPA's Technical Guidance:
> (http://www.epa.gov/oms/models/moves/420b10023.pdf)
>
> Selection of vehicle speeds is a complex process. The recommended approach for estimating average speeds is to post-process the output from a local travel demand network model. In most transportation models, speed is estimated primarily to allocate travel across the roadway network. Speed is used as a measure of impedance to travel rather than as a prediction of accurate travel times. For this reason, speed results from most travel demand models must be adjusted to properly estimate actual average speeds.

For SIP and conformity analyses, EPA expects states to develop and use local estimates of average speed. Per their technical guidance, EPA recommends that this data be prepared at the most detailed level that is reasonable to obtain and that users develop speed distributions to represent vehicle speed, rather than one average value. Use of a distribution will give a more accurate estimate of emissions than use of a single average speed. These concepts provide the reasoning for more sophisticated post processing software used in other states. MAG's M6Link processor has been developed to process individual link speeds by time period and to prepare a speed distribution file for input to MOBILE6.2. These same concepts still apply to the MOVES application except for some slight differences in processing (MOVES requires distribution of VHT by speed bin, MOBILE6.2 requires distribution of VMT by speed bin). Other states and MPOs including those in Pennsylvania, Maryland, New Jersey, New York, and West Virginia have opted for more sophisticated post processing software that aims to perform the following functions:

- re-calculate congested speeds based on travel model volumes, roadway physical characteristics, and available free-flow speed data
- estimate impact of intersection control devices at a planning level of detail based on available signal location and intersection characteristics
- estimate congested speeds by hour of the day for input to MOVES
- preparation of MOVES speed-VHT distribution file

For regions with travel models, the need for speed post processing is often determined by the validity of the travel model speeds. MAG does not recalculate speeds from the travel model, but has conducted formal validation efforts of the regional speed data. However, speed validation has not been formally conducted for ADOT's statewide model where validation has focused primarily on the travel volumes produced by the model.

ADOT's sample process in Pinal County estimates the speed distribution file utilizing time period VMT and speed results from the statewide travel model. Individual link VMT and speeds are tabulated into each of the MOBILE6.2 speed bin categories. A final distribution is developed for each road type and hour combination using the link data. EPA's Excel converter spreadsheet is then used to develop the MOVES average speed distribution inputs by VHT (as required by MOVES). Although this process meets EPA's recommendations, there are several options to improve the sensitivity of the speed input parameters. These include:

- When assigning each link to a speed bin, the process can be enhanced to interpolate between two adjacent speed bins as to represent the exact value from the model. This process is illustrated in **Table 3-8**. This allows emission factors to be more sensitive to speed changes from the travel model.

Table 3-8: Example of Speed Bin Interpolation to Represent Link Speed

Travel Model Link Speed	MOBILE6.2 Speed Bin #	Speed Bin Description	% VMT Assigned to Each Bin
42	9	37.5 - 42.5 mph (40mph Midpoint)	60%
	10	42.5 - 47.5 mph (45mph Midpoint)	40%

- Areas with post processing software have developed methods to expand time period volumes to each hour of the day. In these cases, hourly speeds can then be determined and input to the MOVES model. The need for speed recalculation was discussed earlier in this section.

3.5.5 Vehicle Population Data

The information on the number of vehicles is a new input to MOVES (as compared to MOBILE6.2). The MOVES model requires the population of vehicles by the 13 source type categories, which are used to estimate the amount of start and evaporative emissions in the analysis region. According to EPA, the population data can be developed for many of these source types from state motor vehicle registration data, local transit agencies, school districts, bus companies, and refuse haulers.

If population data is not available for a particular source type, population data can be calculated based on the VMT estimates for that particular source type and the ratio of MOVES default population to VMT by source type. That ratio can be determined by doing a very simple MOVES run at the national scale for the county being analyzed, and including VMT and population in the output.

In Arizona, registration data is available for vehicle categories that are more consistent with the weight-based MOBILE6.2 vehicle types. The sample Pinal County analyses include the following steps:

- Convert registration data (for all vehicle classes) to MOBILE6.2 vehicle categories
- Use population mapping from Table A.1 of EPA MOVES technical guidance to convert to MOVES 13 source types

The above approach utilizes registration data for all vehicle types and follows methods approved by EPA.

Key Considerations for Preparing Vehicle Population:

- Does registration data adequately reflect the number of vehicles operating in the region on a daily basis?
- Are heavy trucks adequately represented in the registration database?
- Are there other data sources to improve mapping of vehicles to the MOVES 13 source types?

Other states including Pennsylvania have determined that their state registration data does not adequately represent the number of heavy trucks operating in some areas. This is due to a large number of trucks being registered in other states and the impacts of trucks traveling through the state from other regions. Likewise, similar evaluations may apply to an assessment of light-duty vehicles. Cities like New York and Washington, D.C. have determined that local registration data is not representative of the number of vehicles operating in their respective regions, since a large percentage of vehicles either come from neighboring counties or states, yet are contributing a significant amount of vehicle starts and evaporative emissions. However, adjustments to registration data are difficult to determine. Typically this involves comparing registration numbers to vehicle population numbers as calculated from available VMT (as described earlier in this section) and considering the number of starts and/or trips those vehicles are making. In New Jersey, investigations have been conducted to evaluate the use of travel demand model trip tables to determine the location and number of vehicle starts, but EPA does have some concerns on whether such models properly represent the number of actual trips in an area.

An evaluation must be conducted to determine whether registration data is appropriate for the MOVES emission analyses. In Pennsylvania, this has involved assessing alternative analysis options, testing the impacts of those options on emissions, and choosing the most conservative approach.

The mapping of registration data to MOVES sources types has primarily relied on EPA convertor spreadsheets (MOBILE6.2 to MOVES). Most states have registration data that more closely correspond to the MOBILE6.2 weight-based categories rather than the MOVES source types. Additional data sources can supplement the estimation of vehicle population for different MOVES sources types as discussed in the EPA technical guidance. Pennsylvania has used a separate download of school bus registrations by county, information from the National Transit Database (NTD), and other data from local transit operators to estimate the number of vehicles in each county. An adequate information source for refuse trucks and other bus companies has not been identified or used for MOVES application.

Forecasting the MOVES input source type population plays an important role in determining emissions for future years. The current conversion tools used for Pinal County do not address the growth of source type population. Other areas have forecasted the number of vehicles using:

- Household growth
- Population Growth
- Employment Growth
- VMT Growth

In Pennsylvania, the household, population and employment forecasts are obtained through a triennial purchase of Woods and Poole data. The growth rates for light-duty vehicles are calculated assuming the highest growth rate of household and population data but then limiting it to the VMT growth rate. Heavy vehicles have also considered the employment growth. This methodology has been used for past conformity analyses and has been accepted using the interagency consultation process.

3.5.6 Vehicle Ages

Vehicle age distributions are required as an input to MOVES for each county by the thirteen source types. The distributions reflect the percentage of vehicles in the fleet up to 31 years old. The vehicle age distributions can be prepared based on information from state vehicle registration database. For the sample Pinal County analyses, ADOT has utilized local registration data for all vehicle types.

Many of the issues in preparing vehicle age distributions are the same as those discussed in the previous section for vehicle population. This includes an assessment of whether state registration data for heavy trucks are representative of the actual trucks operating on the roadways. If this is determined to be an issue, then the potential use of national default data from the MOVES default database should be considered. In Pennsylvania, MOVES default ages for heavy trucks are used for all analysis runs.

Vehicle age distributions are considered one of the most significant items affecting regional emissions. Special considerations and review must be conducted when preparing and updating this data input.

Vehicle ages do have a significant impact on emission results and have been the source of a number of transportation conformity failures across the country. In most cases, this has been the result of updating vehicle age distributions for conformity as compared to existing SIP motor vehicle emission budgets. Since 2008, most areas have seen a substantial aging of the fleet. As a result, the recent use of newer data has increased mobile source emissions. Special review, test analyses, and considerations are required when determining what age data to use for:

- SIP emission inventories (especially those that will set new motor vehicle emission budgets, and
- transportation conformity forecast years to satisfy latest planning assumption requirements and to ensure that ages are representative of what may be expected over the next 10-20 years.

3.5.7 *Other Data*

Emission factors are impacted by other local input data including meteorology, fuel and control strategy assumptions. These assumptions are typically developed in close coordination with the state environmental agency (ADEQ).

EPA requires temperature data used for transportation conformity to be consistent with the SIP that contains applicable motor vehicle emission budgets.

The MOVES model requires temperature and relative humidity data for each hour of the day. The MOVES database includes default average monthly temperature and humidity data for every county. However, EPA does not recommend using these default values for conformity analyses. Detailed local meteorological data are available from the National Climatic Data Center which is recommended for conformity purposes. EPA's data converters are used to convert minimum and maximum daily temperatures to an hourly temperature profile that could be input to MOVES. Note that conformity requirements do specify that temperatures and humidity must be consistent with those used for any SIPs that establish motor vehicle emission budgets (MVEBs).

The MOVES default database has fuel formulation and fuel supply data which are to be reviewed and updated based on available local volumetric fuel property information. However, in the case of RVP, the default value should be changed to reflect the regulatory requirements and differences between ethanol- and non-ethanol blended gasoline. In other states, there have been some discussions with EPA in deciding on appropriate fuel assumptions for future analysis years including the appropriate content for ethanol mixes.

The MOVES model has simplified the I/M program input parameters compared to MOBILE6.2. The default I/M program parameters included in MOVES need to be examined and necessary changes are to be made to the defaults to match the actual local program. In particular, users should note that any grace periods or exemptions ages need to be included in the beginning and ending model years based on the calendar year of evaluation. The default I/M files do not incorporate grace periods or exemption ages.

3.5.8 *Summary Evaluation of Current Practices for Pinal County*

The previous sections have discussed the key inputs to MOVES CDM. Table 3-9 summarizes the key issues and recommendations for each of the inputs based on the review of the sample Pinal County files.

Table 3-9: Summary of Key Recommendations Regarding MOVES CDM Input Data

MOVES CDM Input Data	Existing Process Review (Pinal) Issues/Considerations	Options for Process Modification/Enhancement
Annual VMT	• Ensure method to account for missing VMT and HPMS reconciliation • Re-evaluate mapping of travel model vehicle types to MOBILE6.2 classes (e.g. Auto and SUT categories) • Use of MOBILE6.2 national default distributions by type is outdated especially for determining light truck percentages	• Consider direct conversion from travel model vehicle types to MOVES HPMS vehicle class • Use MOVES defaults to disaggregate data since based on newer information. • Integration of other data sources for transit and other vehicle types.
Month/Day/Hour Fractions	• Evaluate if Monthly/Daily default data is representative of analysis region.	• Develop separate hourly pattern data by MOVES road type using travel model results
Road Type Distribution		
Ramp Fractions	• Evaluate if ramp VMT is reasonable from travel model. May consider using defaults if any issues. • Ensure that fractions are based on VHT not VMT	
Travel Speeds	• Are travel model speeds acceptable for air quality analysis? Is post processing required?	• Speed post processing to obtain better speed estimates with possible inclusion of intersection delay. • Enhance computation of average speed distribution by interpolating between multiple speed bins to represent individual link speeds • Estimate speeds by hour of day
Vehicle Population	• Evaluate methods to forecast vehicle population • Evaluate if state registration data is representative of heavy vehicle population	• Enhanced methods for forecasting. • Investigate alternative methods for estimating heavy vehicle population for SIPs including calculation from heavy vehicle VMT
Vehicle Ages	• Evaluate if state registration data is representative of heavy vehicle population	• Considerations for further investigation in developing ages for conformity based on recent trends.
Fuel Parameters / IM	• Evaluate assumptions for future forecast years with EPA including ethanol percentage.	
Temperature Humidity	• Must be consistent with SIP.	

3.6 Recommendations for MOVES Operation

This section addresses several key issues related to the operation of the MOVES emission model. For SIP and transportation conformity analyses, MOVES must be run using the software's "County" scale. Under that mode, specific county data is provided through a County Data Manager (CDM) input interface. A discussion of the specific county inputs is provided in **Section 5.0**. This section focuses on evaluating the operation of MOVES in the "inventory" vs. "rate" modes and the potential role of batch processing and custom pre/post processing software.

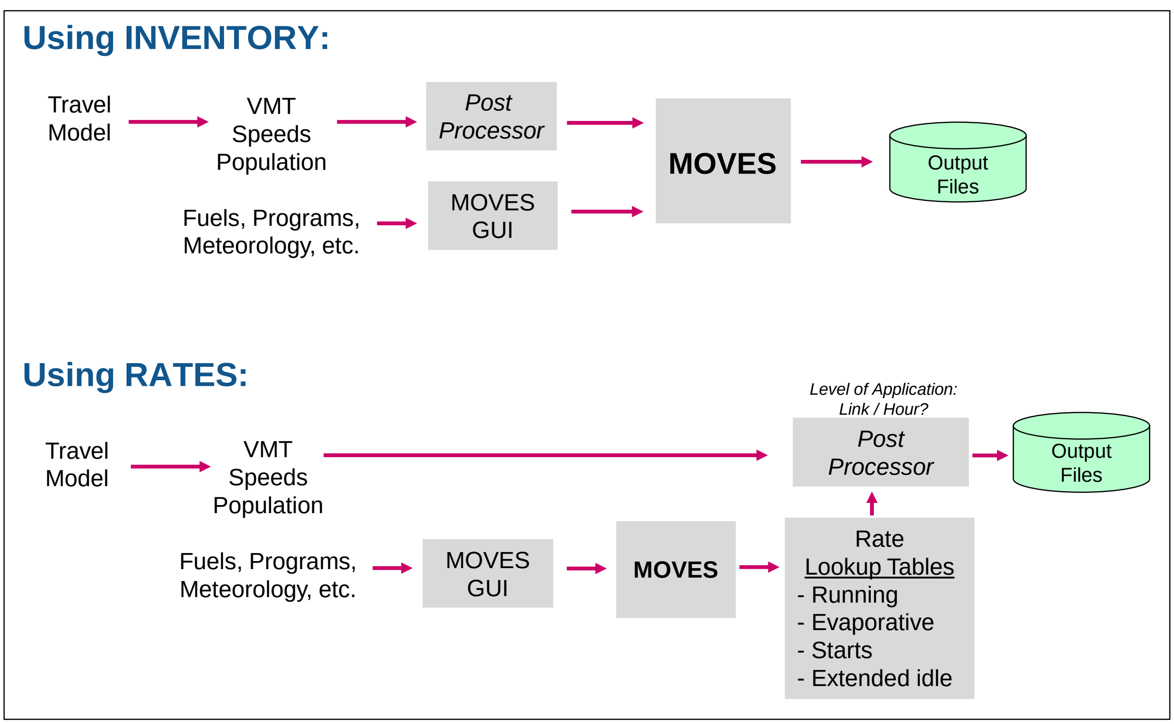
3.6.1 Identifying Method to Run MOVES (Inventory vs. Rate)

MOVES offers two run mode options for calculation emissions:

- Inventory Mode
- Rate Mode

As illustrated in Figure 3-7, the choice of the above modes will affect the design and methods for batch processing and the selection of post processing methodologies and tools. With an inventory approach, users input VMT and vehicle population data into MOVES and the model outputs emissions (in units of mass). With the emission rates approach, users apply VMT and vehicle population to the emission rates that MOVES generates to calculate an inventory (although VMT and vehicle population data are still needed as inputs for a MOVES emission rates run). The emission rates approach produces a look-up table of emission rates (as mass per unit of activity) that must be post-processed to produce an inventory.

Figure 3-7: MOVES Inventory vs. Rate Methods



Users may select either the inventory or emission rates approach to develop emissions estimates for SIPs and regional conformity analyses. Each approach has advantages and limitations and users will need to decide which approach is more appropriate for the type of analysis that is being conducted and available post processing tools. Both approaches use the same underlying emissions data and will produce, essentially, the same results if the user calculates an inventory from rates in the same way that MOVES performs this internally.

When modeling a single time and place, the inventory method may be preferable since the emission rate calculations in MOVES are significantly more time consuming. Also, the post-processing steps required can be minimized with the inventory method, thus avoiding inadvertent errors during the application of rates. The emission rates method may be preferable for large scale projects, to obtain a lookup table of rates that can be applied to many times and places, thereby reducing total MOVES run time. Successful application of this approach requires a clear understanding of the rates calculations in MOVES and careful planning.

EPA recommends that the same approach be used in any analysis that compares two or more cases (e.g., the base year and attainment year in a SIP analysis or the SIP budget and the regional conformity analysis). The interagency consultation process should be used to agree upon a common approach. If different approaches are used for the SIP budget and the regional conformity analysis for practical reasons, the interagency consultation process should be used to determine how to address (and minimize) any differences in results. The methods, and those methods used to develop inventories should be fully documented in the regulatory submittal and conformity determinations.

In Pennsylvania, Maryland and New Jersey both methods have been investigated for conformity application. Each of these states have chosen the inventory method due to its more reasonable run times and simpler application. It also provides a cleaner framework for EPA review. However, the use of emission rates remains an alternative option for other emission calculation activities. In each of these states, MOVES rate tables are being used to support off-model analysis tools to evaluate the emission impacts of various strategy types. In these cases, detailed rate tables by model year, vehicle type, and speed bin are produced for each analysis year. Custom software has been designed to utilize these rates to produce strategy emission results. Other areas, including the Indianapolis MPO have designed custom post processing software to apply MOVES emission rates to the traffic data produced from the travel model. These efforts require upfront time to create the lookup tables and to design software to apply those rates but provide efficient run times for future applications of the conformity runs. For application in Arizona, the choice of methods will ultimately be influenced by available software and methodology tools. It is recommended initially that the MOVES inventory method be used for emission computations in support of regional conformity analyses. The development and application of a rate-based process creates additional complexities requiring more upfront resources. As EPA integrates future emission standards and releases MOVES2013, rate tables would require frequent updates.

Recommendation for Arizona Conformity Analyses:

- Prepare county inputs to MOVES.
- Run MOVES using the inventory mode
- Summarize MOVES output emissions

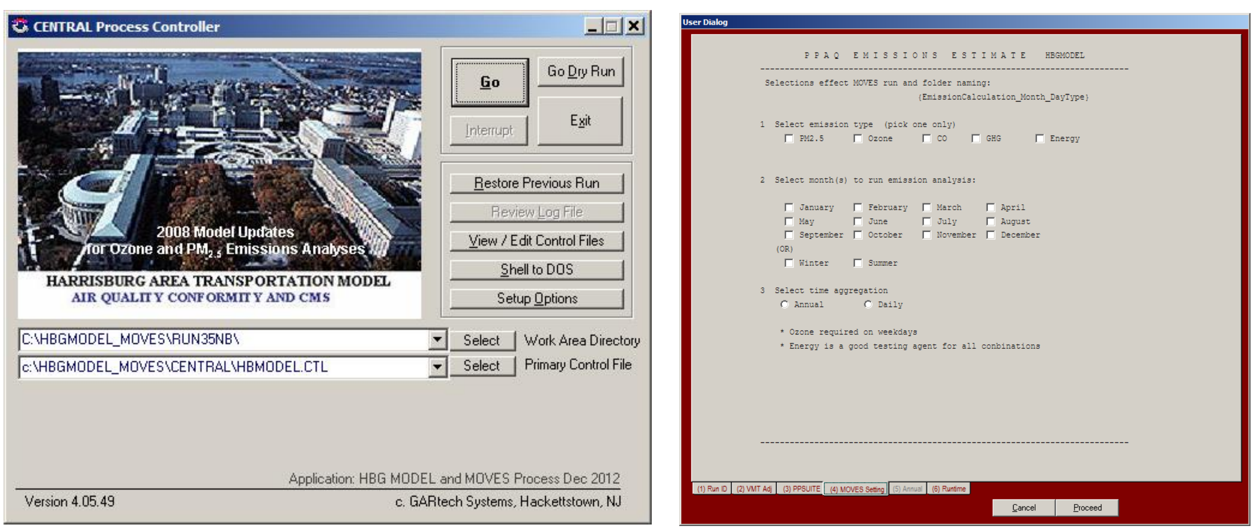
3.6.2 *Batch Processing*

One of the enhancements of MOVES over MOBILE6.2 is the inclusion of a graphical user interface (GUI). The GUI allows users to select key run options, provide county input data, and select output database names. The GUI does allow users to more easily modify the key input parameters and data needed to make an analysis run. However, many regions have looked to integrate the MOVES model with other travel modeling procedures and have focused on running the MOVES model in batch mode.

The focus on batch processing (i.e. allowing for many runs to be conducted concurrently without using the MOVES interface) has been a key feature that allows agencies to efficiently complete emission inventories. Such processing can be integrated with other quality control features, file naming conventions, and other calculation processing including that for re-entrained road dust.

In Pennsylvania, New Jersey, Maryland and Louisiana, MOVES has been integrated with custom pre/post processing software. In each of those areas, the running of MOVES is handled as part of a consolidated batch process. In these cases, MOVES driver files (for both the main program [.mrs] and the county data manager [.xml] are created during the run based on parameters provided in defined menu screens. Figure 3-8 illustrates the use of the CENTRAL batch software, which has been used by a number of MPOs and states.

Figure 3-8: Example of Specialized Software to Control Emission Processes



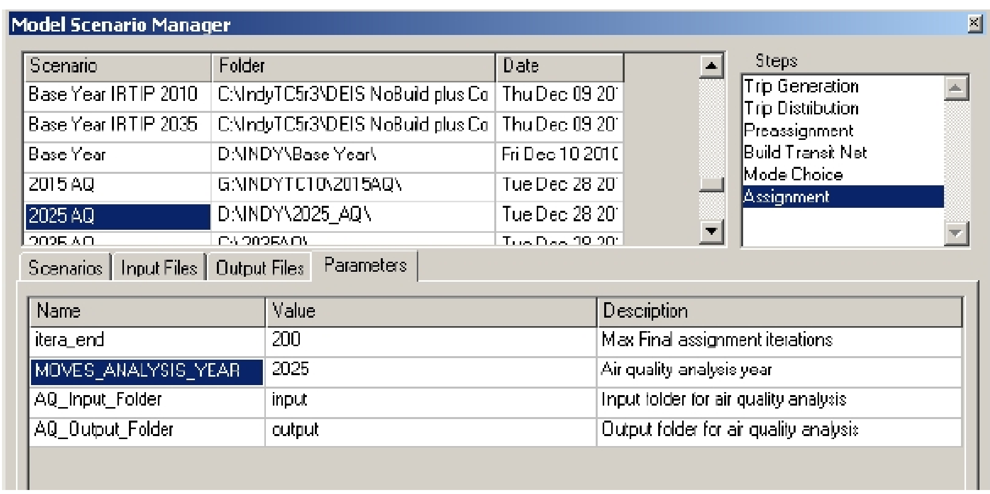
CENTRAL is a PC-based program which runs within the standard Windows environment. It manages multi-step jobs which can include elements of traffic modeling software (e.g. TransCAD, Cube Voyager), xBase, EXCEL, air quality software (MOVES, MOBILE6.2), as well as user-specified and supplied DOS and Windows programs. CENTRAL provides three primary components:

- The Central Interface provides control and management over the preparation, running, and review of the job. It is customizable with user-prepared graphics and user dialogs so that a unique look and feel can be presented to a model end-user.

- The Batch Processor provides tools to assemble and process the job stream at execution time. Token substitution, file inclusion, logical switches, transparent program library references, and myriad other mechanisms allow the developer to essentially "program" and maintain the job stream.
- The User Dialog system allows the developer to set up the model's front end with Windows-like controls for data entry, file specification, check-offs and option buttons, and logical screen controls. The Dialog system is programmed in an intuitively obvious format within the job stream's control files; no special Windows programming skills are needed.

Other areas have accomplished batch processing directly through modeling software and other computer programming languages. As illustrated in Figure 3-9, the Indianapolis MPO has utilized TransCAD's GISDK scripting language to provide an automated method to apply emission rate tables to the travel model assignments. GISDK provides tools that can be used to design menus and dialog boxes (including toolbars and toolboxes) and for writing macros.

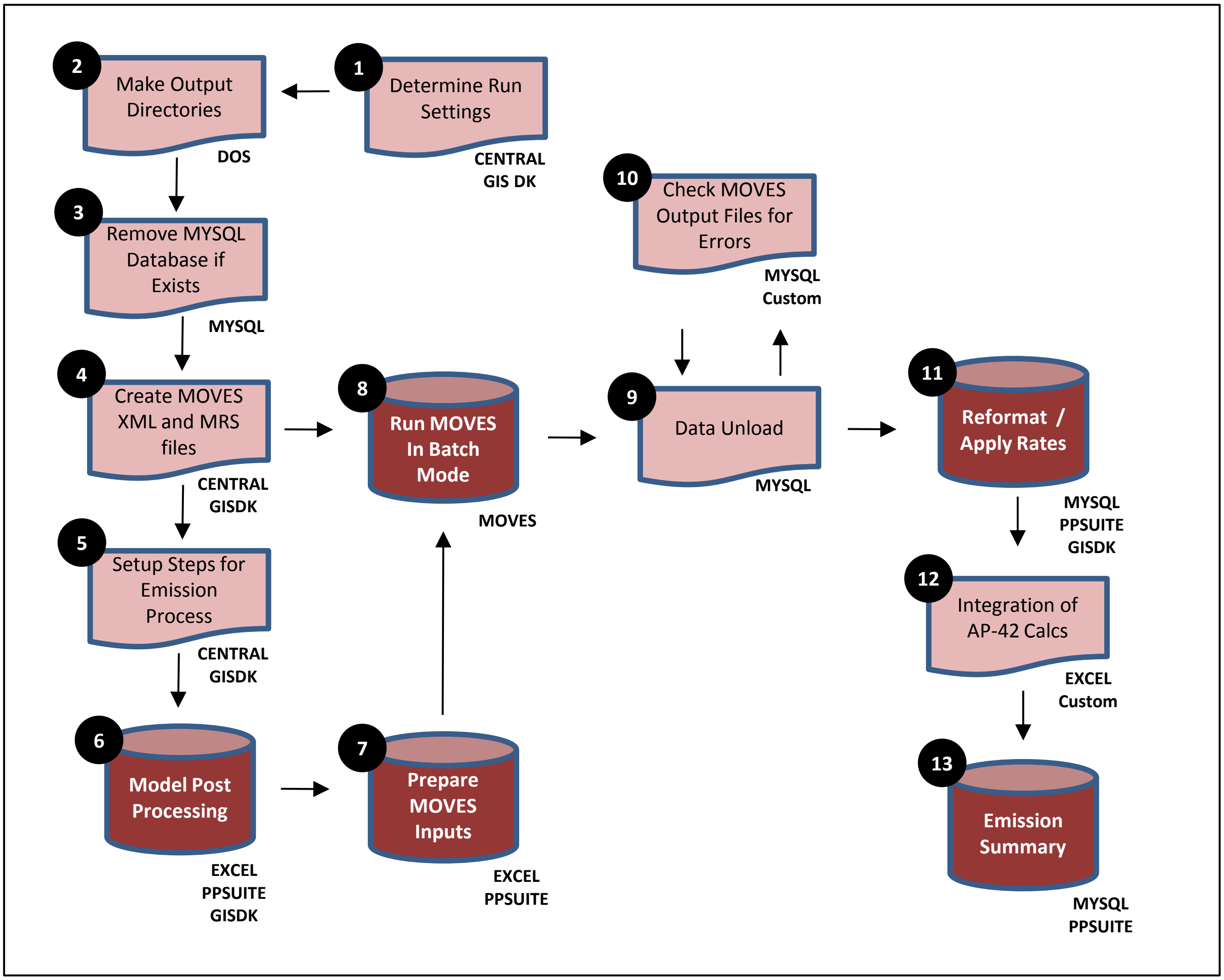
Figure 3-9: Use of GISDK to Support Air Quality Inventory Estimation



Although the above example illustrates the use of GISDK as a potential tool to conduct batch processing, the Indianapolis MPO process did not include the MOVES runs as part of the batch procedure. In this case, MOVES was run separately to produce the emission rate tables.

A batch process to support the running of MOVES can include a variety of steps and software. These steps may include processes for file management, quality control and pre/post processing of MOVES input and output files and integration of AP-42 re-entrained road dust calculations. Such steps may include use of the MYSQL data management software, simple DOS routines, custom software like CENTRAL, and pre or post processing software (e.g. GISDK, PPSUITE as described in more detail in **Section 6.3**, and EXCEL spreadsheets and/or macros). Figure 3-10 illustrates the key steps of a potential batch process illustrating the potential linkages of multiple steps and programs.

Figure 3-10: Sample Steps for MOVES Batch Processing



In Arizona, re-entrained road dust calculations using AP-42 must be integrated with the MOVES emission results to produce total emissions for PM. Batch processing methods can be used to integrate these calculations as part of an automated process. The MAG conformity process includes post processing software (M6link) to apply the AP-42 factors to the traffic data.

Batch processing has proven to be valuable in limiting file management errors and efficiently running analyses for multiple years and scenarios. As a result, it is recommended that software or custom routines be developed to support future transportation conformity and SIP emission calculations.

3.6.3 Integration of Pre-Post Processing Routines/Software

Pre and Post processing software/routines have been emphasized in previous sections and can play a key role in:

- batch processing,
- recalculating more accurate congested speeds from a regional travel model,
- applying VMT adjustments,
- mapping and disaggregating model vehicles types to the MOVES source types,
- developing the traffic inputs needed by the MOVES CDM, and
- summarizing MOVES output files.

Some of the above functions can be designed and customized using EXCEL spreadsheets. Several of ADOT's tools have already been created to help format and calculate the data needed for EPA's conversion tools. More sophisticated software has been used in other areas to improve efficiency and quality control and to provide enhanced methods for speed recalculation and disaggregation.

The following sections provide several examples of software and programs developed for other regions. The PPSUITE software has a flexible framework allowing its use for different regions. The NYMTC and Indianapolis processing tools are customized for their specific travel models but illustrate alternative methods for developing post processing routines.

➢ *Example1: PPSUITE*

PPSUITE is a custom post-processing software that has been designed to provide a flexible framework for linking regional travel demand model outputs to EPA's MOBILE6 and MOVES software, and for computing a variety of transportation system performance measures. PPSUITE consists of a set of programs that perform the following functions:

- Analyzes highway operating conditions.
- Calculates highway speeds.
- Compiles vehicle miles of travel (VMT) and vehicle type mix data.
- Prepares MOVES runs and processes MOVES outputs.

PPSUITE is a widely used and accepted tool for estimating speeds and processing emissions rates. It has been used for past SIP and conformity highway inventories in Maryland, Pennsylvania, New Jersey, New York City, West Virginia, and Louisiana. The software is based upon accepted transportation engineering methodologies. For example, PPSUITE utilizes speed and delay estimation procedures based on planning methods provided in the Highway Capacity Manual, a report prepared by the Transportation Research Board (TRB) summarizing current knowledge and analysis techniques for capacity and level-of-service analyses of the transportation system.

The PPSUITE process is integral to producing traffic-related input files to the MOVES emission model. Figure 3-11 summarizes the key functions of PPSUITE within the emission calculation process. Other

MOVES input files are prepared external to the PPSUITE software. These include vehicle population, vehicle age, environmental, and fuel input files. PPSUITE has been developed and maintained since the early 1990's. As a result, the software has been built and enhanced with a wide variety of options and flexibility. Table 3-10 illustrates some of the key features.

PPSUITE is typically integrated with the CENTRAL batching software as described in **Section 5.** CENTRAL is a menu-driven software platform used to execute the PPSUITE and MOVES processes in batch mode. CENTRAL allows users to execute runs for a variety of input options and integrates custom MYSQL steps into the process. While the individual PPSUITE programs could be executed singly, from a simple DOS batch file or from another executive program, the CENTRAL system provides an open and maintainable method for controlling a PPSUITE run through a series of interactive dialogs.

Figure 3-11: PPSUITE Process and Sample Menu Screens

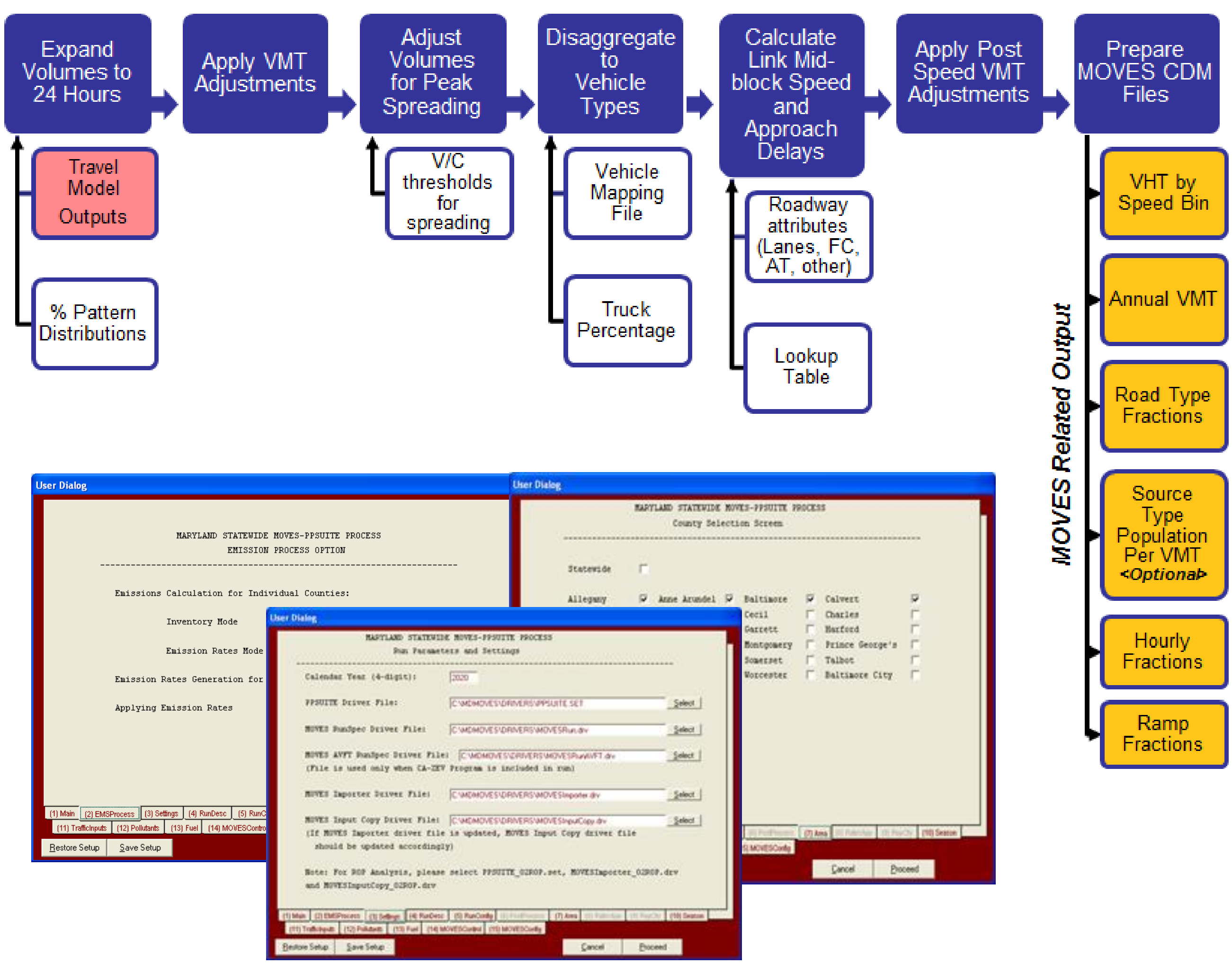


Table 3-10: Summary of PPSUITE Features

Category	PPSUITE Feature
VMT Adjustments	Applies up to 9 VMT adjustment files. ○ Can be applied as additive or factors. ○ Can be applied to daily total or to individual hours. ○ Can be applied before or after speed calculations.
Hourly Disaggregation of VMT	Disaggregate model volumes to individual hours to support emission calculations ○ Flexible to use available model time periods in combination with defined hourly patterns by functional class ○ Methods for peak spreading – can spread unreasonable hourly volumes to nearby hours as defined by user thresholds
Vehicle Type Disaggregation	Disaggregate model volumes to defined vehicle type categories ○ Can be based on a combination of model vehicle types and supplied input pattern files ○ Special features to handle mapping to MOVES source types
Speed Calculation	Flexible process to use travel model speeds or conduct speed re-calcuation ○ Speeds are calculated for each hour based on VMT disaggregation and VMT adjustments ○ Speed calculations based on available fields from travel model and/or a speed/capacity lookup table ○ Intersection delays can be synthesized using HCM planning methods ○ Roadway capacities are impacted by heavy vehicle percentages ○ A minimum speed or delay can be specified to prevent unreasonable speeds
MOVES Inputs	Automated creation of MOVES traffic input files for each scenario run ○ Creates a speed distribution file for each road type based on hourly speeds for each link ○ Creates the annual VMT file ○ Creates the road type distribution file based on supplied mapping scheme between model facility types and MOVES road type ○ Creates ramp fraction file if the ramp facility types are identified ○ Additional options for development of vehicle population file from supplied VMT (according to methods in EPA guidance)
MOVES Outputs	Extracts MOVES outputs to create an ASCII emission summary table ○ Can process results from a MOVES inventory run ○ Alternatively can take a supplied emission factor table from MOVES and apply the rates to VMT by source type.

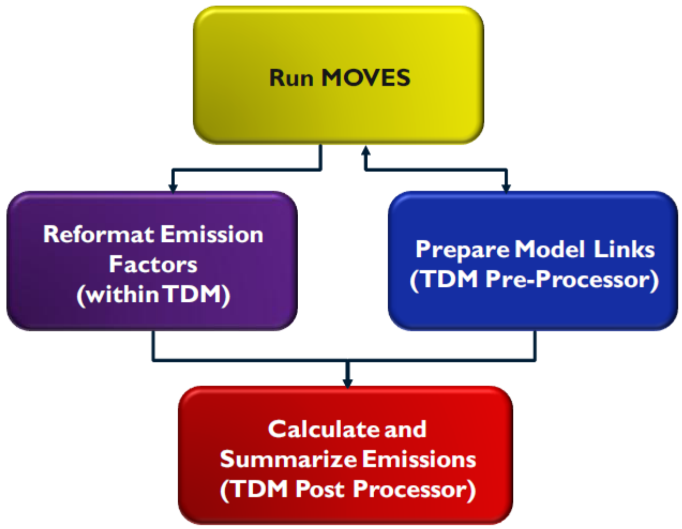
➢ *Example 2: TDM Post Processing for Indianapolis MPO (Custom GISDK)*

For the Indianapolis MPO, a custom processor for MOVES application has been linked to their regional TransCAD travel model. This example illustrates the use of Caliper's GISDK programming language in developing customized tools.

As illustrated in Figure 3-12 the processor does not control the running of MOVES; however, it does provide several traffic inputs to MOVES, which is run separately to generate emission factor tables. The processor extracts travel model information (e.g. VMT) and applies the MOVES emission rates to generate total emissions. The pre/post processor can be run from the MPO travel model interface by checking an

"Air Quality" option in the "Assignment" stage of the interface. The entire process takes approximately 10 to 15 minutes to run depending on the computer system's specifications.

Figure 3-12: Indianapolis MPO Emission Calculation Process



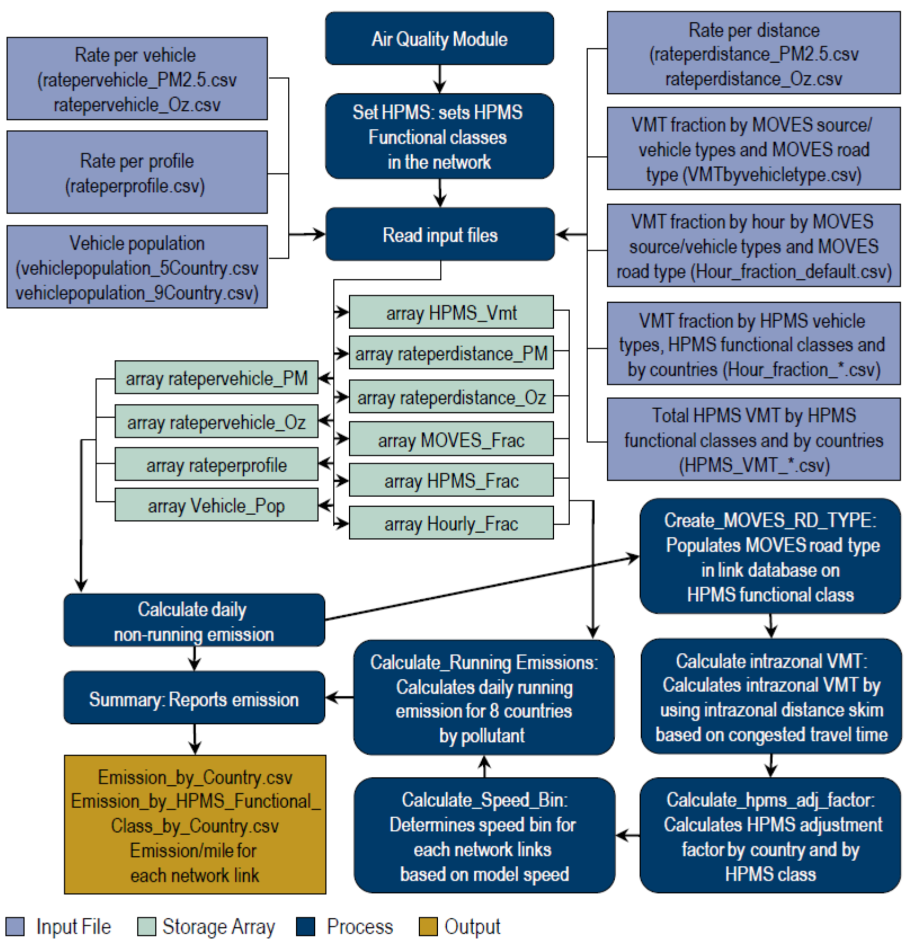
The pre-processor provides some inputs to MOVES, such as VMT and road type distribution. Once emission factors are generated from MOVES, the emission factors are reformatted in order to streamline the reading of the factors within the GISDK script and to get them in the format needed to apply to the travel activity data. The pre-processor prepares the travel activity data on the model links in order to apply the factors and then the post-processor calculates and summarizes both the running and non-running emissions.

The air quality processing script was written in GISDK to make it compatible with the other components of the TransCAD model. The structure of the modules is illustrated in Figure 3-13. The air quality module consists of the following macros:

- *Set_HPMS*: Sets the HPMS functional class code in the line layer of the model network based on specified Facility Type and Area Type combinations on each link.
- *ReadFiles*: Reads the input files and stores the input data in arrays.
- *Calculate_NonRunning_Emissions*: Calculates the daily non-running emissions based on emission rates generated by MOVES and the vehicle population within the MPO model boundary.
- *Create_MOVES_RD_TYPE*: Populates each network link with a MOVES road type code based on an HPMS functional class code equivalency table.
- *CalculateIntrazonalVMT*: Calculates intrazonal Vehicle Miles Traveled (VMT) based on intrazonal travel distance and intrazonal trips. The intrazonal VMT includes all travel activity that begins and ends within the same traffic analysis zone and it is calculated for each time period and for both AB and BA directions.

- *Calculate_hpms_adj_factor*: Calculates adjustment factors based on the ratio of HPMS VMT to the model VMT. The adjustment factors are calculated for each of the HPMS functional class codes and for each of the nine counties. Based on previous interagency consultation discussions, HPMS adjustment factors are not currently used by the Indianapolis MPO and as such, these factors are set to 1.0.
- *Calculate_Speed_Bin*: Sets the speed bins for each network link based on congested model speeds for different times of day. It uses the five mile per hour (mph) speed bin ranges defined in MOVES to determine the speed bins for the network links.
- *Calculate_Running_Emissions*: This macro calculates the daily running emissions by applying the emission rates generated by MOVES to the weighted VMT. Summary: Summarizes the daily emissions by functional class and county.

Figure 3-13: Flow Diagram of GISDK Script for Air Quality Module



➢ *Example 3: NYMTC MOVES Post Processing Software*

The New York Metropolitan Transportation Council (NYMTC) has utilized the PPSUITE software for past conformity analyses. They are currently finalizing a new post processing system developed by Cornell University. This software was developed using the Microsoft .NET Framework with scripts written in the Python computer language. Several of the components still rely on PPSUITE software modules. The process and software is expected to be finalized in several months.

The post processing software focuses on linking NYMTC's travel model (referred to as BPM) to the MOVES emission model. A focus of emphasis as compared to previous tools has been to enhance the usage on servers allowing web-based control of process runs. Although the software was developed specifically for NYMTC, there may be opportunities for Cornell to transfer the framework to other areas in the future. Like PPSUITE, the software is made up of several key modules that perform similar functions. These include:

- *Scenario Manager* – Generates xml scripts to create MOVES input databases, MOVES Run Specification files, as well as scenario information. The module invokes execution of MOVES and uploads emission rate databases to the server.
- *PPS-Core* – Integrates emission rate databases and traffic-related information to calculate an emissions inventory.
- *PPS-PRELINK* – Prepares the appropriate traffic activity information. This includes methods to apply link-level adjustment procedures, post process link average speeds and adjust VMT with HPMS data.
- *PPS-ELINK* – Further disaggregates VMT data to the same resolution as the MOVES emission rate database. Calculates an emissions inventory for link-based emission processes (e.g. running, exhaust emissions)
- *PPS-EZONE* – Calculates a total start and evaporative emission inventory. Distributes the emissions inventory to different road types, proportional to the VMT on each road type.
- *PPS-EPOST* – Integrates link level and zone level emission inventories. Incorporates off-model VMT adjustment factors for each county and road type.

Recommendation

To assist with the integration of MOVES and to support the batch processing options discussed in Section 6.2, a customized pre/post processing system is recommended for integrating ADOT's statewide model to the MOVES emission calculation process. As an example process, a case study will be conducted utilizing the PPSUITE software.

3.7 PM Emissions from Re-entrained Road Dust

In Arizona, re-entrained road dust is a significant component of PM_{10} mobile source inventories and is required to be included in all conformity analyses of direct PM_{10} emissions, including hot-spot analyses [refer to the March 2006 Final Rule (40 CFR 93.116) and (71 FR 12496-98)].

MOVES does not estimate emissions of re-entrained road dust. Therefore, re-entrained road dust emissions must be calculated using the empirical equations found in AP-42, Chapter 13, *Miscellaneous Sources*. Variables to calculate road dust emissions included VMT, average vehicle weight, AP-42 silt loading factors and particle size coefficients, and precipitation data.

3.7.1 Paved Roads

Paved road dust is fugitive dust that is deposited on a paved roadway and then re-entrained into the air by passing vehicles. Dust is deposited on the roadway by being blown from disturbed areas, tracked from unpaved shoulders or vehicles traveling on connecting unpaved roads, stirred up from unpaved shoulders by wind currents created from traffic movement, spilled by haul trucks, and deposited by water runoff or erosion. Vehicles cause dust from paved and unpaved roads to be re-entrained or re-suspended in the atmosphere. The forces created by the rolling wheels of vehicles remove fine particles from the road bed and also pulverize aggregates lying on the surface. Re-entrained road dust emission rates are primarily affected by the silt loading on the road and amount of vehicle travel. Emission rates are lower per mile traveled on more trafficked roads.[1]

<u>Using AP-42 for Road Dust on Paved Roads</u>

Section 13.2.1 of AP-42 provides a method for estimating emissions of re-entrained road dust from paved roads for situations for which silt loading, mean vehicle weight, and mean vehicle speeds on paved roads fall within ranges given in AP-42, Section 13.2.1.3 and with reasonably free-flowing traffic. Section 13.2.1 of AP-42 contains predictive emission factor equations that can be used to estimate an emission factor for road dust.

When estimating emissions of re-entrained road dust from paved roads, site-specific silt loading data must be consistent with the data used for the project's county in the regional emissions analysis (40 CFR 93.123[c][3]). In addition, if the project is located in an area where anti-skid abrasives for snow-ice removal are applied, information about their use should be included (e.g., the number of times such anti-skid abrasives are applied).

For the paved roadway improvements the calculation begins with the calculation of the base emissions on the roadway from re-entrained dust:

---

[1] United States Environmental Protection Agency, *EPA's Technical Support Document for the San Joaquin Valley, California, 2003 PM_{10} Plan and 2003 PM_{10} Plan Amendments*, January 27, 2004.

Emissions Factor is E_{ext} = [k (sL)0.91 x (W)1.02] (1 – P/4N)

Annual Emissions Reduction = Roadway VMT_{Annual} * E_{ext}

Where:

Eext = annual or other long-term average emission factor in the same units as *k*,

k = particle size multiplier for particle size range and units of interest – AP-42 Recommends a value of 1.00 g/VMT for PM_{10}

sL = road surface silt loading (grams per square meter) g/m^2 – supporting documentation recommends a value of 3.8 g/m^2 for Arizona

W = average weight (tons) of the vehicles traveling the road

P = number of "wet" days with at least 0.254 mm (0.01 in) of precipitation during the averaging period

N = number of days in the averaging period (e.g., 365 for annual)

3.7.2 *Unpaved Roads*

When a vehicle travels on an unpaved surface, such as an unpaved road or unpaved parking lot, the force of the wheels on the road surface causes pulverization of surface material. The dust is suspended by the turbulent vehicle wakes and ejected into the air by the shearing force of the tires. The quantity of dust emissions from a given segment of unpaved road varies linearly with the volume and speed of traffic. Field investigations also have shown that emissions depend on source parameters that characterize the condition of a particular road and the associated vehicle traffic. Characterization of these source parameters allow for the adjustment of emission estimates based on specific road and traffic conditions present on public and industrial roadways.

Using AP-42 for Road Dust on Unpaved Roads

Section 13.2.2 of AP-42 provides a method for estimating emissions of re-entrained road dust from unpaved roads. Different equations are provided for vehicles traveling unpaved surfaces at industrial sites and vehicles traveling on publicly accessible roads. Most PM hot-spot analyses will involve only vehicles traveling on publicly accessible roads. When applying an equation that accounts for surface material moisture content, the percentage of surface material moisture must be consistent with the data used for the project's county in the regional emissions analysis (40 CFR 93.123[c][3]).

AP-42 provides the following formulations for calculating emissions on an unpaved roadway depending on the nature of the road.

For vehicles traveling on unpaved surfaces, emissions are estimated from the following equations:

Industrial Sites: $\mathbf{E = k\,(s/12)^{a}(w/3)^{b} * 281.9\ g/VKT}$

Public Roads: $\mathbf{E = k(s/12)^{a} * 281.9\ g/VKT}$
(Assumed Primarily Light-Duty Vehicles)

Where:

E = size-specific emission factor (lb/VMT)

k, a and **b** are constants. For PM_{10} the values are:

k = 1.5 (lb/VMT)

a = 0.9

b = 0.45

s = surface material silt content (%) – see Table 3-11below

w = mean vehicle weight (tons)

Table 3-11: Typical Silt Content Values of Surface Material for Unpaved Roads (from AP-42)

Industry	Road Use or Surface Material	Plant Sites	No. of Samples	Silt Content	
				Range	Mean
Copper smelting	Plant road	1	3	16 – 19	17
Iron and steel production	Plant road	19	135	0.2 – 19	6.0
Sand and gravel processing	Plant road	1	3	4.1 – 6.0	4.8
	Material storage area	1	1	-	7.1
Stone quarrying and processing	Plant road	2	10	2.4 -16	10
	Haul road to-from pit	4	20	5.0 – 15	8.3
Taconite mining and processing	Service road	1	8	2.4 – 7.1	4.3
	Haul road to-from pit	1	12	3.9 – 9.7	5.8
Western surface coal mining	Haul road to-from pit	3	21	2.8 – 18	8.4
	Plant road	2	2	4.9 – 5.3	5.1
	Scraper Route	3	10	7.2 – 25	17
	Haul road (freshly graded)	2	5	18 – 29	24
Construction Sites	Scraper routes	7	20	0.56 – 23	8.5
Lumber sawmills	Log yards	2	2	4.8 – 12	8.4
Municipal solid waste landfills	Disposal routes	4	20	2.2 – 21	6.4

Source: United States Environmental Protection Agency, *AP-42 Chapter 13.2.2 Unpaved Roads*, January 2011.

3.7.3 *Emissions from Construction-Related Activities*

Emissions from construction-related activities are not required to be included in PM hotspot analyses if such emissions are considered temporary as defined in 40 CFR 93.123(c)(5) (i.e., emissions which occur only during the construction phase and last five years or less at any individual site). Construction emissions would include any direct PM emissions from construction-related dust and exhaust emissions from construction vehicles and equipment.

For most projects, construction emissions would not be included in $PM_{2.5}$ or PM_{10} hotspot analyses (because, in most cases, the construction phase is less than five years at any one site).[2] However, there may be limited cases where a large project is constructed over a longer time period, and non-temporary construction emissions must be included when an analysis year is chosen during project construction. Evaluating and choosing models and associated methods and assumptions for quantifying construction-related emissions must be determined through an area's interagency consultation procedures (40 CFR 93.105[c][1][i]).

[2] Refer to the EPA's January 11, 1993 proposed rule (58 FR 3780), which limits the consideration of construction emissions to five years.

3.8 Addressing Project-Level $PM_{2.5}$ and PM_{10} Hotspot Requirements

On March 10, 2006, EPA published a Final Rule (40 Code of Federal Regulations [CFR] 93.116) that establishes transportation conformity criteria and procedures for determining which transportation projects must be analyzed for local air quality impacts in $PM_{2.5}$ and PM_{10} nonattainment and maintenance areas. A quantitative PM hot-spot analysis using EPA's MOVES emission model is required for those projects that are identified as projects of local air quality concern. Quantitative PM hot-spot analyses are not required for other projects. The interagency consultation process plays an important role in evaluating which projects require quantitative hot-spot analyses and determining the methods and procedures for such analyses.

Carbon Monoxide (CO) Hotspot Requirements
This section focuses on the requirements related to PM hotspots. The MAG (Phoenix) and PAG (Tucson) areas are also responsible for addressing CO hotspots.

3.8.1 *Screening Projects for Analysis*

Available EPA and FHWA rulemaking and guidance currently does not provide specific thresholds for determining which projects are of air quality concern (e.g. projects that require a quantitative hot-spot analysis); however, examples are provided in the rule preamble and the federal guidance. To assist in the decision-making process, states have established screening procedures to determine projects of air quality concern. These screening procedures require an interagency consultation group (ICG) that may be the same as established to support regional conformity analyses. ADOT will typically be the lead agency for highway-related projects. Other agencies may serve as the lead for transit projects. In either case, ADOT will typically initiate the consultation process and assure that all relevant documents and information are supplied to consultation process participants in a timely manner, and maintaining a written record of the consultation process.

In some states, this process is not formally documented and utilizes the regional air quality consultation partners. The Pennsylvania Department of Transportation (PennDOT) is one of the first agencies to formally document a consultation process for project-level screening, and their work has served as a basis for efforts conducted in other states. PennDOT's focus was to develop a documented process that would clearly define projects that are not of "air quality concern", limiting formal interagency consultation to a select number of projects. In those cases, the documented process and thresholds agreed upon by the ICG provide the formal acceptance of the decision for most of the projects. PennDOT's screening process has three distinct screening levels as illustrated in Table 3-12. A project does not have to go through each screening level. For example, if a project is determined to be *exempt* in Level 1 screening, then additional traffic data and interagency consultation review are not required; likewise, if the project can be screened using the Level 2 thresholds, than the ICG review is not needed.

The Level 2 screening process quickly identifies projects (which are not exempt and are located within a $PM_{2.5}$ or PM_{10} nonattainment or maintenance area) that clearly do not create new PM hot-spots or worsen existing air quality conditions. This includes the review of project information, including traffic/truck volumes and level-of-service (LOS). If the project is identified as being not of "air quality concern", this determination is documented in the project record. If a determination cannot be made under the Level 2 screening, then PennDOT will initiate the Level 3 screening process that includes interagency review.

The ICG has agreed on criteria and assumptions to screen out projects that clearly do not contribute or worsen air quality conditions within the project area. This required the development of and consensus on several key assumptions, including the following:

- Total traffic and diesel truck volume totals or increases that clearly do not cause a potential $PM_{2.5}$ or PM_{10} hot-spot concern.
- Vehicle classes that are considered to represent diesel trucks.

Table 3-12: Example of PennDOT's Project-Level Screening Process

Screening Level	Criteria Based On	Who Makes Decision?	What Data is Used?
LEVEL 1 Is the project exempt or does the project fall in an area that requires analysis?	Final Rule and EPA/FHWA guidance	PennDOT	Maps of nonattainment and maintenance areas and/or Exempt project table.
LEVEL 2 Is the project clearly not of air quality (AQ) concern?	Above plus agreed upon thresholds (Level 2 Flowchart)	PennDOT	Project traffic data, Base year traffic maps, and/or Intermodal facility information.
LEVEL 3 Does the project require more substantial review to determine if it is of AQ concern?	Above plus ICG review of project	ICG*	Project traffic data, Base year traffic maps, and/or Intermodal facility information. May be supplemented by additional information.

* *ICG decisions are by consensus*

The assumptions for PennDOT's Level 2 screening process are illustrated in Figure 3-14. The ICG may reconsider these assumptions and decisions, particularly upon the receipt of future federal guidance or additional information. Projects that are considered not of "air quality concern" per the Level 2 screening criteria should include reasons for that conclusion within the hot-spot conformity determination section of the environmental report.

Projects that cannot be screened out (e.g. determined to be a project not of "air quality concern") using the Level 2 thresholds are to be submitted to the ICG to make the decision on whether the project is of "air quality concern", requiring a quantitative hot-spot analysis. Level 3 screening may use the same or more detailed information as the Level 2 screening but is performed and decided by the ICG rather than a single person or agency.

Figure 3-14: PennDOT's Level 2 Project PM Screening Thresholds

Project Type	Level 2 Screening Evaluation Criteria

Highway Capacity <u>Expansion</u>	Is the design year <u>total</u> Build condition traffic volume **≤125,000** annual average daily traffic (AADT) **and** <u>truck</u> volume **≤10,000** heavy trucks per day in the project vicinity [1] **?**
	YES → **Not a Project of AQ Concern**
	NO → Does the project cause a **≤6,250 and ≤500** increase in total and truck volume respectively between Build and No Build conditions [2] **?**
	  YES → **Not a Project of AQ Concern**
	  NO → **Level 3 ICG Screening Required**

Intersection (Channelization, Circles, Roundabouts, Signalization) or Interchange Reconfiguration	Does the above criteria for the "Highway Capacity Expansion" project type identify this project as "**Not a Project of AQ Concern**" **?**
	YES → Is the project expected to improve (or not further degrade) LOS and delay for the roadway with the highest number of diesel vehicles in the project vicinity [3] **?**
	  YES → **Not a Project of AQ Concern**
	  NO → **Level 3 ICG Screening Required**
	NO → **Level 3 ICG Screening Required**

<u>New</u> Highway, Expressway, or Interchange Construction	Is the design year <u>total</u> traffic volume **≤125,000** AADT **<u>and</u>** <u>truck</u> volume **≤10,000** trucks per day in the project vicinity [4] **?**
	YES → Does the project include new ramps or other improvements to connect a highway to a major freight, bus, or intermodal terminal **?**
	  YES → **Level 3 ICG Screening Required**
	  NO → **Not a Project of AQ Concern**
	NO → **Level 3 ICG Screening Required**

<u>Expanded</u> Intermodal or Transit Facility for Rail, Bus, or Truck	Is the existing facility **<u>not</u>** regionally significant under 40CFR 93.101[5] **<u>or</u>** does the expanded facility have **≤10** buses/trucks in peak hour (of that facility) [6] **?**
	YES → **Not a Project of AQ Concern**
	NO → Will the facility involve a **≥25%** increase in peak diesel bus/truck arrivals between Build and No Build conditions [7] **?**
	  YES → Will the facility expansion include **>80%** non-diesel vehicles (CNG, Hybrid, etc.) [8] **?**
	    YES → **Not a Project of AQ Concern**
	    NO → **Level 3 ICG Screening Required**
	  NO → **Not a Project of AQ Concern**

<u>New</u> Intermodal or Transit Facility For Rail, Bus, or Truck	Is the facility considered to be a "regionally significant project" under 40 CFR 93.101[5] **?** **YES** → **Level 3 ICG Screening Required** **NO** → **Not a Project of AQ Concern**
Other Project Types	**Level 3 ICG Screening Required**

3.8.2 Project Information Template for ICG Review

As discussed in the previous section, the interagency consultation process plays a key role in evaluating whether a project is of "air quality concern". That decision is based on available data and modeling for the project study area. A draft template has been prepared that can guide the project sponsor or consultant in preparing information for the ICG. This template is provided below:

PM Project-Level Air Quality Conformity Determination
Screening Support Document

[*Insert project name*]
[*County name*], Arizona

[*Preparing Agency/Consultant and Date*]

I. Background

The [*project name*] is located in [*county name*] which falls within the [*nonattainment or maintenance area name*] fine particulate matter ([$PM_{2.5}$ *or* PM_{10}]) area. Effective April 5, 2006, the U.S. Environmental Protection Agency (EPA) published a Final Rule (40 CFR §93.116) that establishes transportation conformity criteria and procedures for determining which transportation projects must be analyzed for local air quality impacts in particulate matter nonattainment and maintenance areas. The rule was followed by a guidance document issued by the EPA and the Federal Highway Administration (FHWA) that provides the information for state and local agencies to meet the hot-spot requirements established in the conformity rule.

ADOT guidelines provide the procedures for screening transportation projects for particulate matter hot-spot analyses. The screening process includes levels to determine if a project is of "air quality concern". ADOT is responsible for compiling available project information and distributing it to the *ICG Name* (i.e. the statewide interagency consultation group consisting of ADOT, EPA, FHWA, FTA, ADEQ and MPO representatives). This screening includes the review and discussion of project information by the interagency group, which then decides whether the project is of "air quality concern" thus requiring a quantitative hot-spot analysis.

This document provides supporting information needed to conduct the ICG screening review. It includes a project description, traffic data, project location information and other pertinent data needed to conduct an assessment. This document, in itself, is not a formal hot-spot analysis. Such an analysis will need to be completed according to federal guidance if the screening concludes that the project is of "air quality concern". A quantitative hot-spot analysis is required using EPA's Motor Vehicle Emission Simulator (MOVES) model.

II. Project Description

[*Location and extent of project including project map*]
[*Project type and scope*]
[*Year open to public*]
[*Description of preferred alternative including diagram of improvements*]

III. Summary of Project Objectives

[*Provide summary bullet points addressing key objectives and goals of project*]
[*If appropriate, provide summary map indicating multiple objectives (e.g. locations where safety, capacity, accessibility, access management, and truck travel improvements are focused)*]

IV. Current Project Area Conditions

This section includes a discussion of available information on current air quality, traffic and land use conditions in the project area..

Air Quality

The [*nonattainment/maintenance area name*] includes [*list all counties/townships in area if applicable*]. The closest monitors to the project include [*list monitor locations*] which are approximately [*distance of each monitor from project location*] miles from the project area. The following tables illustrate recent monitor trends based on EPA-verified data obtained from EPA's AirData website (http://www.epa.gov/airdata/).

[*Summarize monitor data for Annual and Daily $PM_{2.5}$ using EPA AirData for the 3 most recent years of data available*]

$PM_{2.5}$ Monitor Annual Mean Concentration (ug/m^3)

Monitor Reference	Distance from Study Area	[*Year 1*] Mean Value	[*Year 2*] Mean Value	[*Year 3*] Mean Value	3-Year Average

$PM_{2.5}$ Monitor Daily (24-hour) 98th Percentile Concentration (ug/m^3)

Monitor Reference	Distance from Study Area	[*Year 1*] 98th Percentile	[*Year 2*] 98th Percentile	[*Year 3*] 98th Percentile	3-Year Average

Traffic / Transportation

[*Specify current traffic conditions and congestion levels (e.g. LOS if available)*]
[*Include base year AADT traffic volumes and truck volumes*]
[*Locations of any truck idling (e.g. rest stops, intermodal centers, etc.)*]
[*If available, provide map illustrating congested corridors or locations*]

Natural Environment

[*Identify land use within study area (residential, commercial, industrial, and agricultural)*]
[*If known, identify other significant background sources (e.g. major factories, point sources)*]

Sensitive Receptors

[*Identify any sensitive receptors (e.g. schools, hospitals, licensed daycare facilities, and elderly care facilities) within 1 mile of the project study area. Indicate their approximate distance from project*]

V. Project Impact on Future Conditions

The effect of the [*project name*] on future traffic conditions for the project's opening and design year is discussed in the following sections. Available quantitative and qualitative insights on project impacts have been compiled from the following resources:

[*Identify traffic studies or reports used*]
[*Identify dates of studies*]
[*Identify forecasting tools used (e.g. MPO regional travel demand model)*]

Forecast Traffic Volumes [*if available*]

The following table illustrates the impact of the transportation project on total highway and truck traffic volumes within the study area. This information was compiled from available traffic studies as listed above.

Project Impact on Future Traffic Conditions
[*Multiple tables may be needed if project encompasses several facilities or if volumes vary by section*]

Scenario*	Total Traffic (AADT)		Truck Traffic (ADTT)	
	[*Year*] Opening Year Volume	[*Year*] Design Year Volume	[*Year*] Opening Year Volume	[*Year*] Design Year Volume
No-build	[xxxx]	[xxxx]	[xxxx] [%]	[xxxx] [%]
Build	[xxxx]	[xxxx]	[xxxx] [%]	[xxxx] [%]
Difference	[*Build-NoBuild*]	[*Build-NoBuild*]	[*Build-NoBuild*]	[*Build-NoBuild*]

[*if pertinent*] This project also has significant impacts on regional travel routing and is expected to [*increase / decrease*] overall) VMTwithin the region. [*provide additional detail documenting project impact on regional VMT*]

Forecast Traffic Congestion [*if available*]

Available studies have provided potential project impacts on regional congestion measures including roadway and intersection level of service (LOS).

[*Provide table illustrating available data; highlight differences between No-build and Build conditions*]
[*Discuss impacts of project on truck idling]*

Qualitative Assessment of Project Impacts

[*Discuss project impacts on VMT and congestion and how that could impact air quality (e.g. does the project increase VMT, does it improve congestion, does a reduction in idling delay offset any emissions due to an increase in traffic volumes)*]

[*Projects that divert traffic volumes or facilitate new development may generate additional fine particulate matter emissions in the local project area; however, such activity may be attracted from elsewhere in the region. As a result, on a regional scale, there may be no net change in emissions or potentially an overall benefit from this project. The above data may not eliminate the need for potential mitigation measures within the project vicinity but should certainly be considered in the evaluation of the project*.]

[*Any changes that will impact natural environment that could impact dispersion of PM*]
[*Discuss future trends in development within project vicinity*]
Other Mitigating Factors

[*Discuss potential non-highway improvements including transit and park-and-ride lots that will be completed in the project timeframe that may lead to reduced VMT or emissions within the study area*]

VI. Summary of Resources

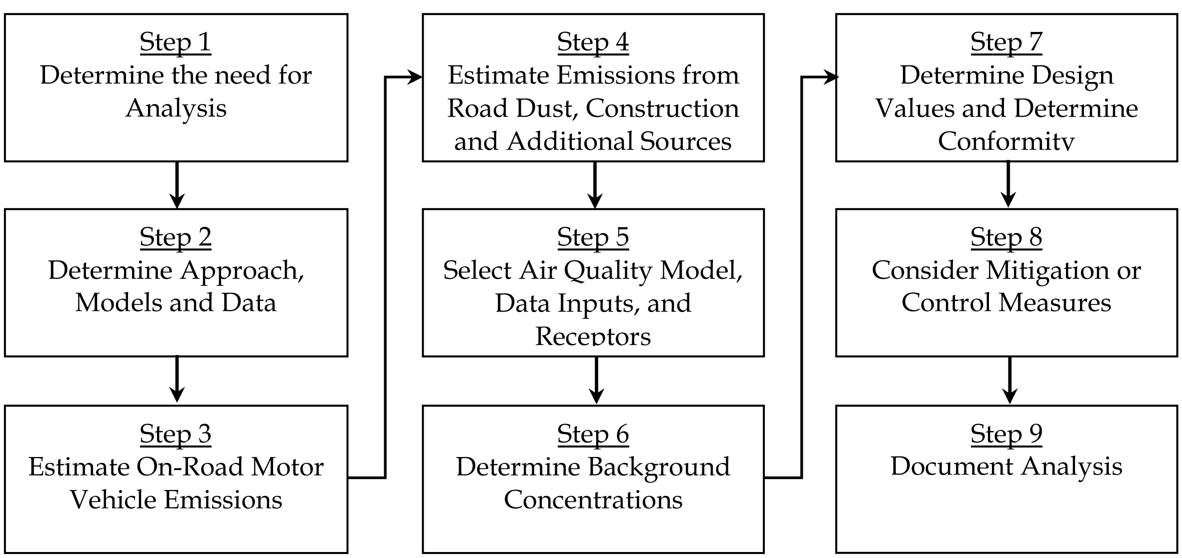
[*List all pertinent project documentation and resource materials*]
[*Provide web links if available*]

3.8.3 Key Issues for Conducting a Quantitative Analysis

On December 10, 2010, EPA released guidance for quantifying the local air quality impacts of certain transportation projects for the $PM_{2.5}$ and PM_{10} NAAQS, *Transportation Conformity Guidance for Quantitative Hot-spot Analyses in* $PM_{2.5}$ *and* PM_{10} *Nonattainment and Maintenance Areas* (EPA-420-B-10-040). This guidance must be used by state and local agencies to conduct quantitative hot-spot analyses for new or expanded highway or transit projects with significant increases in diesel traffic in PM nonattainment or maintenance areas.

The steps required to complete a quantitative PM hotspot analysis are summarized in Figure 3-15. A hot-spot analysis compares the air quality concentrations modeled for the proposed project to the NAAQS. These air quality concentrations are determined by calculating a design value, which is a statistic that describes a future air quality concentration in the project area that can be compared to a particular NAAQS. It is always necessary to complete emissions and air quality modeling on the "build" scenario and compare the resulting design values to the relevant PM NAAQS. If the "build" scenario does not meet the NAAQS, then a comparison to the "nobuild" scenario is conducted.

Figure 3-15: EPA's PM Hotspot Analysis Process



The interagency consultation process is an important component in completing project-level conformity determinations and hot-spot analyses. Per (40 CFR 93.105(c)(1)(i)), interagency consultation must be used to determine key methods and assumptions regarding the analysis. Table 3-13 summarizes the key decisions and associated considerations for the ICG.

Table 3-13: Key ICG Decisions on Quantitative Methods and Data

Topic	Key Decisions/Considerations
Analysis Approach	• Will analysis focus on Build condition only? • Project alternative to model (if more than one)
Study Area	• Location(s) of highest emissions • Consider locations outside project area that may be affected by the project
Analysis Years	• Year of highest emissions • May consider that emission factors are decreasing in future years
Type of PM Emissions Analyzed	• PM mobile source types to include (are there any start or idling emissions?) • Construction emissions (are they < 5 years in duration) • Any non-road sources near the project location • Is road dust considered a significant source? (AP-42)
Emission Models	• MOVES2010b • AERMOD or CAL3QHC • Methods for using AERMOD (treat road as volume or area source) • What recent meteorology data is available for each model?
Background Concentrations	• Closest monitor locations • Will more than one monitor be averaged? • Insights of environmental agency on background concentrations • Are forecast concentrations available from chemical transport models?
Traffic Data Source – MOVES Application Methods	• Is a traffic simulation model available? • Source of traffic speeds by time period • How will MOVES be run? (Average speed, Drive schedule, Operating mode distribution)
Receptor Locations	• Sensitive populations near the study area
Other Input Parameters	• Are MOVES inputs consistent with SIP/Conformity? • Recommendations from FHWA hotspot training • Are assumptions the best available?

3.8.4 Documenting Results

The following present the relevant discussions that should be included in the NEPA document where applicable for project-level PM air quality screening and analyses. For projects that do not require a quantitative analysis, documentation is usually limited to a description of the screening process, ICG involvement and the key reasons for the decision. Quantitative analyses require a more detailed technical report or appendix documenting the methodology and results.

Exempt Projects / Projects Not of "Air Quality Concern"

The information below includes sample text for conditions where a $PM_{2.5}$ or PM_{10} hot-spot quantitative analysis is not required: Note that additional projects may need hot-spot analyses in PM_{10} nonattainment and maintenance areas with approved conformity SIPs that are based on the federal PM_{10} hotspot requirements that existed before the March 2006 final rule.

- **Project is Exempt from Hot-Spot Requirements** - For projects located in nonattainment or maintenance $PM_{2.5}$ and/or PM_{10} areas that are considered exempt according to the latest version of Table 2.1 of 40 CFR Part 93.126 and 93.128, a conformity determination or a quantitative $PM_{2.5}$ and/or PM_{10} analysis is not required. Document the county, area, or partial county nonattainment/maintenance designation and include the following statement in the environmental report:

  "The proposed project is located in a county that has been designated as being in nonattainment or maintenance (*SPECIFY*) for $PM_{2.5}$ and/or PM_{10}. According to the latest version of Table 2.1 of 40 CFR Part 93.126 and 93.128, the project is considered exempt from a quantitative $PM_{2.5}$ and/or PM_{10} analysis (*LIST THE EXEMPTION FROM THE TABLE*). No further project-level conformity determination or air quality analysis for this/these pollutant(s) is therefore required."

- **Non-Exempt Project that is Not a Project of "Air Quality Concern"** - For projects located in nonattainment or maintenance $PM_{2.5}$ and/or PM_{10} areas that are not considered exempt according to 40 CFR Part 93.126 and 93.128, a determination must be made if the project is considered to be of "air quality concern" under 40 CFR 93.123(b)(1)(i-v) and as further described in the December 2010 EPA guidance, "*Transportation Conformity Guidance for Quantitative Hot-Spot Analysis in $PM_{2.5}$ and PM_{10} Nonattainment and Maintenance Areas*." A documented account of the ICG finding should be included in the NEPA documentation. This would include a listing of the ICG consultation partners, conclusions for the project, and a statement indicating a consensus decision and a date of approval. The text should include specific reasons why the project was not considered to be of "air quality concern" which may include addressing the examples provided in the hotspot rule (http://www.epa.gov/fedrgstr/EPA-AIR/2006/March/Day-10/a2178.pdf). The documentation may include the following statements:

On March 10, 2006, EPA published a final rule establishing transportation conformity requirements for analyzing the local particulate matter (PM) air quality impacts of transportation projects (71FR 12468). An interagency consultation process plays an important role in identifying whether a project requires a quantitative PM hot-spot analysis. A hotspot analysis is defined in 40 CFR 93.101 as an estimation of likely future localized pollutant concentrations and a comparison of those concentrations to the relevant National Ambient Air Quality Standards (NAAQS). A hot-spot analysis assesses the air quality impacts on a scale smaller than an entire nonattainment or maintenance area.

The proposed project is located in [*county*] that has been designated as being in [*nonattainment / maintenance*] for [*$PM_{2.5}$ or PM_{10}*]. An interagency consultation process consisting of [*list agencies included in process*] has determined that the project is not of "air quality concern" according to 40 CFR 93.123(b)(1) and EPA's "*Transportation Conformity Guidance for Quantitative Hot-spot Analyses in $PM_{2.5}$ and PM_{10} Nonattainment and Maintenance Areas*" (EPA-420-B-10-040). As a result, the requirements of the Clean Air Act (CAA) and 40 CFR 93.116 are met without a hot-spot analysis. This decision was based on [*provide reasons for determination – reference conformity rule examples*]. The decision is documented [*specify dates of decisions*].

Documenting Quantitative Hotspot Analyses

When a quantitative PM hot-spot analysis is performed, the NEPA document should summarize the analysis results and reference the stand-alone air quality technical report. The main body of the NEPA document should include a tabular summary of results for each analysis year and alternative under consideration. The technical report should describe the sources of data used in preparing emissions and air quality modeling inputs. This documentation should also describe any critical assumptions that have the potential to affect predicted concentrations. Documentation of PM hot-spot analyses would be included in the project-level conformity determination

Section 3.10 of EPA's *Transportation Conformity Guidance for Quantitative Hot-spot Analyses in $PM_{2.5}$ and PM_{10} Nonattainment and Maintenance Areas* (EPA-420-B-10-040) provides guidelines for preparing a PM hot-spot analysis technical report. These guidelines include:

- A description of the proposed project, including where the project is located, the project's scope (e.g., adding an interchange, widening a highway, expanding a major bus terminal), when the project is expected to be open to traffic, travel activity projected for the analysis year(s), and what part of 40 CFR 93.123(b)(1) applies;
- A description of the analysis year(s) examined and the factors considered in determining the year(s) of peak emissions;
- Emissions modeling, including the emissions model used (e.g., MOVES), modeling inputs and results, and how the project was characterized in terms of links;
- Modeling inputs and results for estimating re-entrained road dust, construction emissions, and any nearby source emissions (if applicable to the pollutant of concern);
- Air quality modeling data, including the air quality model used, modeling inputs and results, and description of the receptors employed in the analysis;
- A description of the assumptions used to determine background concentrations;

- A discussion of any mitigation or control measures that will be implemented, the methods and assumptions used to quantify their expected effects, and associated written commitments;
- A description of how the interagency consultation and public participation requirements in 40 CFR 93.105 were met; and
- A conclusion (in the case of PM this would include how the proposed project meets 40 CFR 93.116 and 93.123 conformity requirements for the $PM_{2.5}$ and/or PM_{10} NAAQS).

The AASHTO Standing Committee of the Environment (SCOE) has recently completed NCHRP 25-25 Task 71. That study developed a template technical report document for completing project-level analyses. This template may serve as an additional reference when documenting a PM quantitative hotspot analysis. EPA's OTAQ is currently reviewing these templates and plans to release additional guidance for documenting hotspot analyses later this year.

4.0 Transportation Control Measures *(Working Paper 4)*

4.1 Introduction

The objective of Working Paper 4 (WP-4) is to provide an overview of transportation control measures (TCMs) analytical requirements, tools and methodologies. WP-4 includes methodologies for the following project categories:

- Dust Mitigation
- Vehicle Emissions Controls
- Trip Reduction Measures
- Traffic Flow Improvements

Existing Arizona Department of Transportation (ADOT) methodologies were reviewed and compared with current Environmental Protection Agency (EPA) and Federal Highway Administration (FHWA) guidance, as well as national best practices. To ensure all required project types were addressed, ADOT/stakeholder input was solicited in identifying all project types needing analysis. A draft list of project types to be analyzed was provided to ADOT/stakeholders prior to proceeding. The Air Quality Management Guidebook (the Guidebook) will contain all of the methodologies presented in WP-4 in the form of a spreadsheet tool. In addition, the Nogales Case Study will include sample calculations for select project types utilizing MOVES-generated emission rates.

4.2 Review of Existing Requirements and Practices

Transportation agencies through their regulatory, operational and purchasing activities have a number of opportunities to initiate programs and policies that may help to mitigate criteria pollutant emissions from a variety of sources. While detailed regional and project-level transportation emission calculations are covered in Working Paper 3: *Air Quality Conformity Procedures*; WP-4 focuses on those additional programs or projects that an agency may need to quantify in order to meet the goals of a State Implementation Plan (SIP), as part of a conformity demonstration, or simply to show a commitment to reducing regional emissions even if the credit is not taken. Such programs and projects are generically referred to as Transportation Control Measures (TCMs).

As stated on the FHWA Website[1]:

> *Under the Transportation Conformity Rule, Transportation Control Measures (TCMs) are strategies that:*
>
> 1. *are specifically identified and committed to in State Implementation Plans (SIPs); and*
> 2. *are either listed in Section 108 of the Clean Air Act (CAA) or will reduce transportation-related emissions by reducing vehicle use or improving traffic flow.*

[1] http://www.fhwa.dot.gov/environment/air_quality/conformity/policy_and_guidance/tcm.cfm

Section 108 of the CAA provides examples of transportation control measures including, but not limited to:

- *improved public transit,*
- *traffic flow improvements and high-occupancy vehicle lanes,*
- *shared ride services,*
- *pedestrian/bicycle facilities, and*
- *flexible work schedules.*

Timely implementation of TCM's criterion must be satisfied before conformity determinations can be made. Consequently, TCMs receive the highest priority for funding under the Congestion Mitigation and Air Quality Improvement (CMAQ) Program.

Many other measures, similar to the TCMs listed in the CAA, are being used throughout the country to manage traffic congestion on streets and highways and to reduce vehicle emissions. Increasingly they are being recognized for their benefits toward improving an area's livability. These TCM type activities may be eligible for CMAQ funding, whether or not they are in approved SIPs, if they are documented to have emission reduction benefits in nonattainment and maintenance areas. These activities have been employed throughout the country for many years and include many travel demand management and transportation system management applications.

Some control measures may be intrinsically incorporated into regional emissions calculations, e.g., through the values and data used to develop mobile source emission budgets or to demonstrate conformity. Common examples of TCMs intrinsic in regional emissions calculations include: the impacts of land use decisions on overall travel, fuel parameters that reflect the impacts of reformulations, and the impacts of federal or state policies aimed at increasing the efficiency of the overall fleet or targeted vehicle populations. Care must be taken to ensure that the impact of TCMs are not double counted; if a project can be addressed in the general development of an emissions inventory rather than separately, that is the preferred approach.

The control measures outlined in this document are commonly used in Arizona and are typically above and beyond the baseline calculations found in most conformity analyses. This is not intended to represent an exhaustive list, as the range of possible control measures is extensive and new and innovative TCMs emerge frequently. It should be noted that the approaches provided are generic in nature and, while sufficient, are not a substitute for detailed analyses.

4.3 Analytical Requirements

Control measures are generally held to a higher level of analytical rigor, particularly if their implementation is necessary for an area to demonstrate conformity or if TCMs make a sizable contribution toward meeting local air quality goals. Often these measures are funded by programs such as the CMAQ program and the Diesel Emissions Reduction Act (DERA), which require more rudimentary reporting. When taking credit for a TCM in a SIP or a conformity demonstration these reported values may not be sufficient. The most recent

EPA/FHWA guidance and analysis should always be reviewed to ensure the project/program/policy analyses provided are sufficiently robust for the purposes of being considered as TCMs.[2]

The EPA provides a webpage with a compendium of current guidance, analysis approaches and recent research on TCMs and similar projects/programs.[3]

4.3.1 Consistency and Local Data

There is a significant body of research outlining methods to estimate the impact of various control measures. Under the authority of the CAA, the EPA provides some flexibility in the analysis approaches used, provided they are reasonable and have a sound analytic foundation. When control measures are also determined to be regionally significant projects or programs there are often existing studies that use local data, surveys, modeling, etc. to calculate the transportation or trip-making impacts of the measure. Depending on the availability and design of the regional travel demand model, many control measures that impact trip generation, mode choice, vehicle occupancy and, in some cases, vehicle flow (traffic signal progression, incident response, highway information systems, etc.) may best be investigated using existing analytical tools. Consistency between all planning efforts is desirable. If a particular control measure has been studied locally, and the analysis and data used were developed in a reasonable manner, then those results should be included in the evaluation of air quality impacts. The published generic methods, including those provided below, are generally sketch-level in nature and less rigorous. The interagency consultation process is often helpful in identifying the existence of previous work and ensuring consistency with other reported results (See Working Paper 2: *Interagency Consultation Procedures)*.

4.3.2 Partial Credit, Bundling, and Voluntary Mobile Source Measures

Some TCMs are difficult to quantify, either because the impacts of a particular measure are not well studied, the data needed to calculate the impacts are inadequate or data may need to be synthesized from other sources. The EPA recognizes this issue and, on a case-by-case basis, allows agencies to incorporate uncertainty and still take credit for TCMs. An agency may choose to qualitatively include such TCMs or take partial credit for their impact and can work with their local EPA representatives to identify how partial credits can be used.

Examples of TCMs where taking partial credit may be appropriate are Travel Demand Management (TDM) strategies, such as ride matching, parking management, funding of Transportation Management Associations (TMAs), vanpool programs and other projects designed to shift peak period traffic from Single Occupancy Vehicles (SOVs) to more efficient modes. Historically, the impacts of these programs were believed to overlap and taking credit for them individually could result in over estimating benefits. The benefits of each element of the program are generally calculated independently, however the total benefit was limited to 100 percent of

---

[2] FHWA provides general guidance and references to recent information via their website: http://www.fhwa.dot.gov/environment/air_quality/conformity/policy_and_guidance/tcm.cfm
[3] http://www.epa.gov/OMS/stateresources/policy/pag_transp.htm

the most impactful project, 50 percent of the next project, and no credit at all for the remaining TCMs in this category.

States can also group individual measures and "bundle" them in a single submission in a SIP. The emissions reductions for each measure in the bundle can be quantified independently and, with an appropriate discount factor for uncertainty applied, the total reductions can be summed together in the SIP submission. After SIP approval, each individual measure will be implemented according to its schedule in the SIP. It is the performance of the entire bundle (the sum of the emissions reductions from all the measures in the bundle) that is considered for SIP evaluation purposes, not the effectiveness of any individual measure.

Bundling is an option for control measures which individually may not have a significant impact or which cannot be reasonably calculated in isolation, but should be analyzed as elements of a broader program or collection of similar projects. In cases where projects might be inter-related, bundling can reduce the chances of double counting and simplify the analysis when data is not readily available.

As an example, retrofitting a single older diesel vehicle with improved emission control technology on its own may be insignificant, however if it is included with several other trucks undergoing similar retrofits the total cumulative impact may warrant consideration and inclusion as a reported benefit. Any correction or discount factor used to account for uncertainty should be developed in conjunction with local EPA representatives. The need to bundle is dependent on the analysis methods used, the data available, and the degree to which the benefits are needed to achieve air quality goals. As with all other TCMs, agencies may choose to pursue programs and not take air quality credit for them and use them solely as a demonstration of a region's commitment to air quality. Additional information on bundling can be found in the EPA guidance.[4]

Voluntary mobile source measures are strategies that are not enforceable against an individual source. An emerging measure is a measure or strategy that does not have the same high level of certainty as traditional measures for quantification purposes.[5] EPA has set a limit on the amount of emission reductions which are permitted to result from the implementation of voluntary measures in a SIP. The limit is set at three percent of the total projected future year emissions reductions required to attain the appropriate National Ambient Air Quality Standard (NAAQS). However, the total amount of emissions reductions from voluntary measures shall also not exceed 3 percent of the statutory requirements of the CAA with respect to any SIP submittal to demonstrate progress towards attainment or maintaining compliance with the NAAQS.

States that use voluntary mobile source measures must commit to evaluating these measures. These enforceable commitments would describe how the agency plans to evaluate program implementation and report on program results in terms of actual emissions reductions. Program evaluation provisions must be

[4] http://www.epa.gov/ttn/oarpg/t1/memoranda/10885guideibminsip.pdf
[5] United States Environmental Protection Agency. Incorporating Bundled Measures in a State Implementation plan (SIP). August 2005

accompanied by procedures designed to compare projected emissions reductions with actual emissions reductions achieved. The timing of the evaluations must be specified in the SIP submittal.[6]

4.4 Analytical Tools

4.4.1 EPA MOVES Model

The transition from EPA's MOBILE model to the Motor Vehicle Emission Simulator (MOVES) model impacted the way in which TCMs are being analyzed because the basic concepts on how emission rates are developed changed significantly. The generic emission factors that can be found in previous guidance documents were developed using MOBILE and must be updated using MOVES. More fundamentally, MOVES changes the way projects that improve vehicle flow are perceived and quantified. MOBILE was unable to accurately reflect the drive cycle for vehicles in unstable traffic flow such as in highway congestion or at traffic signals. Projects that addressed these vehicle delays were often analyzed as a reduction in idling emissions. MOVES is capable of more directly analyzing these types of speed profile changes, however guidance and research are limited and continue to evolve. Agencies may wish to acknowledge, but not take credit for the following types of projects, in the interim:

- Intelligent Transportation Systems (ITS) designed to reduced recurring and accident/incident roadway delay
- Service patrols
- Traffic signal improvement projects
- Roundabouts

Alternately, a number of existing methods exist which calculate the impacts of these projects as a reduction in vehicle idling. While MOVES can generate emission rates for queuing conditions, this is likely a very conservative estimate of the project benefits. Some MOVES pre and post processors, as well as regional travel demand models, already include methods to estimate the emission benefits of these and similar projects. If those capabilities exist, it is likely that employing those modules/models is the most appropriate way to handle these project types.

4.4.2 AP-42

In much of the US, air quality issues are primarily the result of chemical processes and combustion sources from industrial, commercial and personal activities. As a result, research and guidance at the national level has focused more on control measures that address ozone and $PM_{2.5}$ emissions. In Arizona the climate conditions and soil composition make airborne dust and PM_{10} important issues. This fugitive dust is both naturally occurring, as well as the result of activities such as construction grading and re-entrained roadway dust. Methods to reduce this fugitive dust have traditionally focused solely on PM_{10} impacts, although by definition PM_{10} contains varying degrees of $PM_{2.5}$ as well.

[6] United States Environmental Protection Agency. *Memorandum: Guidance on Incorporating Voluntary Mobile Source Emission Reduction Programs in State Implementation Plans (SIPs)* dated 10/24/1997

The EPA guidance "AP 42, Compilation of Air Pollutant Emission Factors" commonly referred to as "AP-42" or "AP-42 methods" is the definitive source for analysis techniques used to quantify the impacts of control measures for re-entrained dust as highlighted below. In particular "Chapter 13-Other Sources" covers baseline emissions and methods to calculate the benefits of several control measures.

Throughout AP-42 all emission reductions are calculated using the following formulation:

E = A x EF x (1-ER/100)

Where:
E = Emissions
A = Activity rate (Generally VMT)
EF = Emission factor
ER = Overall emission reduction efficiency (%)

The Maricopa Association of Governments (MAG) *Methodologies for Evaluating Congestion Mitigation and Air Quality Improvement Projects*[7] also provides a number of useful analytical approaches. While CMAQ analysis in general does not need to be as in depth as the analysis typical of a control measure, the MAG CMAQ methodologies are notable for their completeness and have been used by other agencies in evaluating TCM benefits.

Measures to control PM_{10} from fugitive sources generally have the co-benefit of reducing $PM_{2.5}$. EPA has estimated that approximately 25 percent of PM_{10} fugitive dust by weight can be attributed to $PM_{2.5}$[8]; while the Western Regional Air Partnership (WRAP) estimates this at approximately 21 percent by weight. Benefits can be estimated by first determining PM_{10} reductions using either AP-42 or another methodology, and then applying one of the recommended percentages (21 percent or 25 percent) to calculate the corresponding $PM_{2.5}$ emissions reduced. Care must be taken when using this approach as $PM_{2.5}$ may not necessarily be reduced to the same degree as PM_{10}. For example, while efforts to reduce the amount of grading at a construction site would impact PM_{10} and $PM_{2.5}$ in a similar ratio, this assumption may not be appropriate when analyzing road sweepers that are not rated for $PM_{2.5}$.

The fugitive dust sections of AP-42 do not provide estimates for other criteria pollutants (VOC, NO_X, etc.) as they are not present in significant amounts in re-entrained, airborne dust.

4.5 Control Measure Analysis: Methods and Examples

The following section contains suggested analytical methods for various control measures that have historically been used in the state of Arizona, as well as some additional project types that may be of use to agencies in the development of SIPs and conformity demonstrations. The focus of these measures is PM_{10} emission reductions and accompanying $PM_{2.5}$ emission reductions, primarily through fugitive dust reductions.

[7] http://www.azmag.gov/Documents/CMAQ_2011-04-05_Final-CMAQ-Methodologies_3-31-2011.pdf
[8] United States Environmental Protection Agency, *AP-42, Background Documentation, Figure 13.2.1-2*, January 2011.

In cases where projects would also have accompanying ozone or $PM_{2.5}$ precursor emission reductions, these are provided as well.

Methods to calculate the emission benefits of common transportation and related control measures are continually evolving as new research and guidance become available. Additionally, there are often multiple ways in which any given project might be analyzed. This document does not represent an endorsement of particular methodologies, but has been designed as a resource containing several samples. Agencies are encouraged to use any existing, detailed analyses that may be available rather than applying more generic approaches.

Agencies should always check for updated guidance and research from EPA, FHWA and other sources. The recent Moving Ahead for Progress in the 21st Century (MAP-21) transportation legislation is funding several concurrent studies on measuring the effectiveness of projects and programs, some of which include common TCMs. In particular the CMAQ section of the bill funds two studies, one evaluating the existing success of the program and a second, separate effort to develop consistent metrics and methods going forward. It is expected that the recommended analysis approaches for many control measures will benefit from this work.

List of Control Measures Reviewed

Dust Mitigation Projects

- Unpaved Roads Surface Treatments
- Unpaved Roads Surface Improvement
- Road/Alleyway Paving
- Paving Shoulder/Gutter/Curb
- Paving Bicycle Trails
- Certified Street Sweepers

Vehicle Emissions Controls

- Non-Road Diesel Retrofits
- Retrofits, Clean Diesel and Alternative Fuel Vehicles
- Truck Stop Electrification/Auxiliary Power Units

Additional Significant Control Measures

- Regional Diesel Anti-idling Regulations
- Fuel Measures - Inspection and Maintenance Programs

Trip Reduction Measures

- Bicycle and Pedestrian Facilities
- New Bus Service
- Park and Ride
- Trip Reduction Programs/Measures

Traffic Flow Improvements

- Traffic Sign Coordination & Intelligent Transportation Systems
- Land Ports of Entry (Border Crossings) Operational Improvements

4.5.1 *Dust Mitigation Projects*

4.5.1.1 Unpaved Roads Surface Treatments

All roads release dust (PM_{10} and $PM_{2.5}$) when traveled on, and depending on the soil and climate conditions this tends to be far more pronounced on unpaved roads. Rainfall and moisture play a significant role in the amount of dust generated per vehicle passing, and the dry conditions in much of Arizona make air quality issues due to re-entrained road dust prevalent in the state. Surface treatments are a lower-cost way to help reduce the dust production on unpaved roads on a temporary basis. A number of products are available and are generally sprayed onto the roadway surface or mixed with aggregate and then reapplied as the running surface on the roadbed.

ADOT tested two surface treatments for unpaved roads as part of the project entitled "Identification of Emissions Sources for Pinal County." Field measurements of PM_{10} emission rates were made on two different state routes, SR88 and SR288. The segment of SR88 between mile point 220.1 and mile point 227.5 was treated with Envirotac II Acrylic copolymer at a rate of 1 gallon per 36 square feet; after 5 months the PM_{10} emissions were reduced by a factor of 5. The segment of SR288 between mile points 274.7 and 280.5 was treated by milling 6 inches of the base material that was treated with a 1:1 ratio of slow setting emulsified asphalt (SS1) followed by an application of catatonic rapid setting (CRS) II Emulsified liquid at a rate of 0.5 gallons per square yard and then 28 pounds per square yard of 3/8 inch chips; after 1 year PM_{10} emissions were reduced by a factor of 60. This study also looked at typical cost effectiveness results from other dust palliative applications as illustrated by Table 4-1.

Table 4-1: Dust Control Surface Treatments Methods Costs and Effectiveness

Dust Control Category	Specific Product	Control Cost ($/Mile of Roadway Treated)	Control Effectiveness Range	Control Duration
Moisture Increase	Watering	$31	0% - 50%*	0.5-1 Hours
	Calcium Chloride	$18,000	0% - 70%**	6 Months
Particle Agglomeration	EK-35	$16,000	0% - 99%***	1 Year
	Lignosulfonate	$12,000	0% - 90%*	2 Months
	Soil Sement	$18,000	0% - 84%****	1 Year
Soil Coverage	Gravel	$16,000	0% - 30%*	1 Year
	Asphalt Paving	$311,000	90% - 99%	20 Years
* Orlemann, 1983				
** Morgan, 2005				
*** MRI, 2002				
****California ARB, 2002				

Given the wide range of effectiveness for dust palliatives, ADOT intends on adopting dust control methodologies from the Idaho Department of Transportation, which lists the emissions reduction control efficiencies for water at 50 percent and chemical stabilizers at 70 percent. ADOT is also reviewing the appropriateness of the emissions factors assumption for unpaved roads and construction fugitive dust emissions as these factors may change in the future.

Example: The City of Nogales will apply chemical dust palliatives twice a year to stabilize 4 miles of a rural unpaved road with an average daily traffic (ADT) of 200. The product specifications state that one application will be effective for 180 days and the City is purchasing a one year supply of dust palliative. Figure 4-1 illustrates how the emissions benefits are calculated. This project produces an annual PM_{10} emissions reduction of 142,591.68 kg/year and an adjustment factor of 0.25 is used to estimate a $PM_{2.5}$ emissions reduction of 35,647.92 kg/year.

Figure 4-1: Sample of Dust Suppression Calculation

Dust Suppression Calculation Sheet

	Emissions Factor (kg/mile)
Urban Unpaved	0.36
Rural Unpaved	0.7073
Topsoil Removal	9
Earthmoving	1.95
Truck Haulage	4.54

	Control Efficiency		Number of Days
Water	50%		N/A
Chemical Stabilizers	70%		180

Daily Emissions Reductions

Road Name	Emissions Factor (kg/mile)	x	Control Efficiency	x	Average Daily Traffic	x	Length of Segment (miles)	=	Daily Emissions Reductions (kg/day)
Example	0.7073	x	0.70	x	200	x	4	=	396.09

Number of Days with Emissions Reductions

Number of Days Effective per Application	x	Number of Applications per Year	=	Number of Days with Emissions Reductions (days/year)
180	x	2	=	360

Annual Emissions Reductions

Daily Emissions Reductions (kg/day)	x	Number of Days with Emissions Reductions (days/year)	=	Annual PM_{10} Emissions Reductions (kg/year)		$PM_{2.5}$ Conversion Factor		Annual $PM_{2.5}$ Emissions Reductions (kg/year)
396.09	x	360	=	142,591.68	x	0.25	=	35,647.92

4.5.1.2 Unpaved Roads Surface Improvement

Unlike the temporary surface treatments described above, surface improvements are relatively permanent and do not require periodic retreatment. The most obvious surface improvement is paving an unpaved road. This option is comparatively high-cost and is most applicable to relatively short stretches of unpaved road with at least several hundred ADT. Furthermore, if the newly paved road is located near unpaved areas or is used to transport material, it is essential that the control plan address routine cleaning of the newly paved road surface. The control efficiencies achievable by paving can be estimated by comparing emission factors for unpaved and paved road conditions.

Other surface improvement methods involve covering the road surface with another material that has lower silt content. Examples include placing gravel or slag on a dirt road. The control efficiency can be estimated by comparing the emission factors obtained using the silt content before and after improvement. The silt content of the road surface should be determined after 3 to 6 months rather than immediately following placement. Control plans should address regular maintenance practices, such as grading, to retain larger aggregate on the traveled portion of the road. The paving of unpaved roads and unpaved parking areas can result in a control efficiency of 99 percent based on the comparison of paved road and unpaved road emissions factors.

Calculations for Paving Unpaved Roads or Alleys:

Daily Emission Reductions = (BEF – AEF) * Miles * 0.93 * ADT * 1 /1000 (kg/day)

Where:

BEF =	The PM_{10} emission factor (g/mi) for vehicles traveling on unpaved roads or alleys
AEF =	The PM_{10} emission factor (g/mi) for vehicles traveling on paved roads or alleys The MAG CMAQ guidance recommends 658.69 g/mi for BEF-AEF (660.16 g/mi– 1.47 g/mi)
Miles =	The length of the project (in centerline miles)
ADT =	The average weekday traffic on the unpaved road or alley
0.93 =	The factor to convert from weekday to annual average daily traffic on arterials.

Example: The City of Nogales plans to pave a 2 mile section of unpaved road that accesses an existing paved road. This road has an annual VMT of 200,000 with an ADT of 550. The City will also install curb and gutter on both sides of the road with paved shoulders; the paving has an expected lifecycle of 15 years. The calculations are illustrated in Figure 4-2.

Figure 4-2: Sample Paving Unpaved Road or Alley Calculation

Difference in Emissions Factors

	Emissions Factor Unpaved (g/mile)	-	Emissions Factor Paved (g/mile)	=	Difference in Emissions Factors (g/mile)
Road	660.16	-	1.47	=	658.69
Alley	417.45	-	1.47	=	415.98

Daily Emissions Reductions = (BEF – AEF) x Miles x 0.93 x ADT x 1 /1000 (Kg/day)

Road Name	Difference in Emissions Factors (g/mile)	x	Length of Segment (miles)	x	Average Daily Traffic	=	$PM_{10}/PM_{2.5}$ Emissions Reductions (kg/day)
Example	658.69	x	2	x	550	=	673.84
Example	658.69	x	2	x	550	=	168.46

Annual PM_{10} Emissions Reductions

Total Daily Emissions Reductions (kg/day)	x	Number of Days per Year (days/year)	=	Annual Emissions Reductions (kg/year)
673.84	x	365	=	245,951.55

Annual $PM_{2.5}$ Emissions Reductions

Total Daily Emissions Reductions (kg/day)	x	Number of Days per Year (days/year)	=	Annual Emissions Reductions (kg/year)
168.46	x	365	=	61,487.89

4.5.1.3 Paving Shoulders and/or Curbs and Gutters

Re-entrained dust emanating from paved roads is in part dependent on whether the road shoulder is paved. Paving shoulders and gutters reduces the generation of dust, particularly from vehicle excursion onto unpaved shoulders. It is recommended that roads with an ADT of 500 to 3,000 should have an average shoulder width of at least four feet. Roads with an ADT that is greater than 3,000 should have an average shoulder width of at least eight feet. The reduction of road dust associated with paved shoulders depends on other site-specific variables including silt loading.

The following approach was taken from the MAG *Methodologies for Evaluating Congestion Mitigation and Air Quality Improvement Projects* and provides a basic framework for analyzing these project types.

Calculations for Paving Unpaved Shoulders and/or Providing Curbs and Gutters (C&G):

Daily Emission Reductions = Miles * ADT * 0.93 * RF * 1 /1000 (kg/day)

Where:

Miles = The length of the project (in centerline miles)
ADT = The average weekday traffic on the road adjacent to the unpaved shoulders

0.93 = The factor to convert from weekday to annual average daily traffic
RF = Emission reduction factor in grams per VMT for PM_{10}

Low volume arterials (<10,000 ADT)

- 0.76 g/VMT, if paving shoulders and providing C&G on both sides of the road
- 0.57 g/VMT, if paving shoulders on both sides of the road without C&G
- 0.38 g/VMT, if paving shoulder and providing C&G on one side of the road
- 0.29 g/VMT, if paving shoulder on one side of the road without C&G
- 0.19 g/VMT, if providing C&G on both sides of a road with paved shoulders
- 0.10 g/VMT, if providing C&G on one side of a road with a paved shoulder

High volume arterials (> 10,000 ADT)

- 0.53 g/VMT, if paving shoulders and providing C&G on both sides of the road
- 0.40 g/VMT, if paving shoulders on both sides of the road without C&G
- 0.27 g/VMT, if paving shoulder and providing C&G on one side of the road
- 0.20 g/VMT, if paving shoulder on one side of the road without C&G
- 0.14 g/VMT, if providing C&G on both sides of a road with paved shoulders
- 0.07 g/VMT, if providing C&G on one side of a road with a paved shoulder

Example: A two-mile road paving project will add shoulders, curb and gutter to an existing paved roadway. The following values have been provided:

- A reduction Factor (RF) of 0.19 g/mi for a low volume road
- An ADT of 550
- There are 365 days in the analysis year (no reduction for holidays or weekends)
- The lifespan of the project is estimated at 15 years

The calculations are summarized in Figure 4-3 below. Emissions reductions for $PM_{2.5}$ were calculated by assuming that 25 percent of total PM_{10} can be attributed to $PM_{2.5}$. The example produces a PM_{10} emissions reduction of 70.95 kg/year and a $PM_{2.5}$ emissions reduction of 17.74 kg/year.

Figure 4-3: Sample Shoulder and/or Curb & Gutter Paving Calculation

Reduction Factor (RF) (g/vmt)			
	Low volume arterials (<10,000 ADT)		High Volume arterials (>=10,000 ADT)
If paving shoulders and providing C&G on both sides of the road	0.76		0.53
If paving shoulders on both sides of the road without C&G	0.57		0.4
If paving shoulders and providing C&G on one side of the road	0.38		0.27
If paving shoulders on one side of the road without G&G	0.29		0.2
If providing C&G on both sides of a road with paved shoulders	0.19		0.14
If providing C&G on one side of a road with paved shoulders	0.1		0.07

Daily Emissions Reductions = miles x ADT x 0.93 x RF x 1/1000 x 0.25 (PM_{10} to $PM_{2.5}$) (kg/day)

Project Name	Length of Segment (miles)	x	Average Daily Traffic	x	RF	=	PM_{10}/$PM_{2.5}$ Emissions Reductions (kg/day)
Example	2	x	550	x	0.19	=	0.19437
Example	2	x	550	x	0.19	=	0.0485925

PM_{10} Annual Emissions Reductions

Total Daily Emissions Reductions (kg/day)	x	Number of Days per year (days/year)	=	Annual Emissions Reductions (kg/year)
0.19437	x	365	=	70.94505

$PM_{2.5}$ Annual Emissions Reductions

Total Daily Emissions Reductions (kg/day)	x	Number of Days per year (days/year)	=	Annual Emissions Reductions (kg/year)
0.0485925	x	365	=	17.7362625

4.5.1.4 Paved Road Baseline Emissions

For some projects, it is necessary to calculate the baseline emissions for a paved roadway and then use this as the starting point for further calculations. Base emissions on the roadway from re-entrained dust are illustrated in Figure 4- 4 and are calculated as follows:

Emissions Factor is $E = [k\,(sL)^{0.91} \times (W)^{1.02}]\,(1 - P/4N)$
Annual Emissions Reduction = Roadway $VMT_{Annual} * E$

Where:

E = Annual or other long-term average emission factor in the same units as k
k = Particle size multiplier for particle size range and units of interest (PM_{10} = 1.0 g/VMT and $PM_{2.5}$ = 0.25 g/VMT)
sL = Road surface silt loading = 0.105 g/m² (ADEQ Nogales PM_{10} SIP)
W = Average weight (tons) of the vehicles traveling on the road = 3 tons
P = Number of "wet" days with at least 0.254 mm (0.01 in) of precipitation during the averaging period
AP-42 = 60 days/365 days per year in the region containing Nogales
ADEQ Nogales Nonattainment Plan = 45 days/365 days per year
N = Number of days in the averaging period (e.g., 365 for annual)

Figure 4- 4: Sample Paved Road Baseline Emissions Calculation

Emissions Factor = $[\,k\,(sL)^{0.91} \times (W)^{1.02}\,]\,(1 - P/4N)$

Particle Size Multiplier (k) (g/VMT)	Road Surface Silt Loading (sL) (g/m²)	Average Weight of Vehicles (W) (ton)	Number of Wet Days (P) (>=0.254mm)	Number of Days in Averaging Period	$PM_{10}/PM_{2.5}$ Emission Factor (E_{ext})
1	0.105	3	45	365	0.382251788
0.25	0.105	3	45	365	0.095562947

Annual PM_{10} Emissions Reduction: Roadway $VMT_{Annual} \times E_{ext}$

Road Name	$RoadwayVMT_{Annual}$	x	Emissions Factor (E_{ext})	=	Annual Emissions Reduction (kg/year)
Example	220,000	x	0.382251788	=	84.09539346

Annual $PM_{2.5}$ Emissions Reduction: Roadway $VMT_{Annual} \times E_{ext}$

Road Name	$RoadwayVMT_{Annual}$	x	Emissions Factor (E_{ext})	=	Annual Emissions Reduction (kg/year)
Example	220,000	x	0.095562947	=	21.02384837

4.5.1.5 Bicycle and Pedestrian Projects (Re-entrained PM only)

The methodology for calculating emission reductions from a bike or pedestrian project assumes that a dirt surface will be paved requiring the use of the Baseline Paved Road Calculation (see Figure 4- 4 above.) The project must demonstrate there will be a reduction in auto travel to be eligible for CMAQ funding. This simplified approach requires a separate analysis to estimate the bicycle trips generated by the project.

Example: The City of Nogales wishes to provide a bicycle path along an arterial roadway; it is assumed that 15 bikes a day will use this path. The calculations and assumptions used are shown in Figure 4-5 below.

Figure 4-5: Bicycle and Pedestrian Calculation Sheet

	Single Occupancy Vehicle (SOV) Miles Replaced						
	Expected Average Daily Bike Traffic	/	Average Auto Occupancy*	x	Average Trip Length (miles/trip)**	=	Daily SOV Miles Replaced (miles/day)
	15	/	1.4	x	3	=	32.14285714
	*NOTE: For Average vehicle occupancy use local data, or 1.4 as default.						
	**NOTE: For Average Trip Length use local data, 3 is conservative						

Pollutant	Emissions Factor (kg/mile)
PM_{10} Paved	0.382251788
$PM_{2.5}$ Paved	0.095562947

Daily Emissions Reductions (SOV Vehicle Emissions Saved)

Pollutant	Daily SOV Miles Replaced (miles/day)	x	Emissions Factor	=	Daily Emissions Reductions (kg/day)
PM_{10}	32.14285714	x	0.382251788	=	12.28666461
$PM_{2.5}$	32.14285714	x	0.095562947	=	3.071666154

Annual Emissions Reductions

Pollutant	Daily Emissions Reductions (kg/day)	x	Number of Days per Year (days/year)	=	Annual Emissions Reductions (kg/year)
PM_{10}	12.28666461	x	365	=	4,484.63
$PM_{2.5}$	3.071666154	x	365	=	1,121.16

4.5.1.6 Certified Road Street Sweepers

Paved road dust is fugitive dust that is deposited on a paved roadway and then re-entrained into the air by passing vehicles. Dust is deposited on the roadway by being blown from disturbed areas, tracked from unpaved shoulders or vehicles traveling on connecting unpaved roads, stirred up from unpaved shoulders by wind currents created from traffic movement, spilled by haul trucks, and deposited by water runoff or erosion. Vehicles cause dust from paved and unpaved roads to be re-entrained or re-suspended in the atmosphere. The forces created by the rolling wheels of vehicles remove fine particles from the road bed and also pulverize aggregates lying on the surface. Emissions of paved road dust are generally proportional to vehicle miles traveled. Re-entrained road dust emission rates are primarily affected by the silt loading on the road and amount of vehicle travel. Emission rates are lower per mile traveled on more trafficked roads.

According to the WRAP Fugitive Dust Handbook, an 86 percent sweeping efficiency and a 14-day frequency can result in a PM_{10} control efficiency of 16 percent for local streets and a control efficiency of 26 percent for arterial/collector streets.

Table 4-2 illustrates the anticipated emissions effectiveness of paved road dust reduction control measures based on research compiled within the AP-42 background documentation. It is important to note that not all sweepers are certified to reduce $PM_{2.5}$, which is necessary if the quoted reductions are to be achieved[9].

Table 4-2: Particulate Matter (PM10 and PM2.5) Emissions Effectiveness of Paved Road Dust Reduction Control Measures

Sweeper Technology	Percent Effectiveness
Sweeping Alone	**16-50 Percent**
Water Flushing	**30-70 Percent**
Sweeping and Water Flushing	**35-90 Percent**

Environment Canada has verified the effectiveness of certain sweepers as being equally capable (on a percent reduction basis) in reducing fugitive $PM_{2.5}$ and PM_{10} [10] without special considerations. By extension, the PM_{10} reduction effectiveness percentages in Table 4-2 may be extended to $PM_{2.5}$ emissions reductions with some confidence.

Example: A county is requesting CMAQ funding to purchase a street sweeper. The county has four roads with a total of 65 miles that will be swept twice a month. The County provided a listing of each road name, length, and ADT. The control efficiency of this sweeper was determined to be 30 percent due to the limited sweeping schedule and the type of sweeper that was purchased (not on the South Coast Air Quality Management District (SCAQMD) certified PM_{10} efficient street sweeper list). It is expected that this sweeper will be used for 18 years. Figure 4-6 outlines the emission reduction calculations for PM_{10} to $PM_{2.5}$. This example produces a PM_{10} emission reduction of 115,381.30 kg/year and a $PM_{2.5}$ emission reduction of 28,845.30 kg/year.

[9] http://www.aqmd.gov/rules/doc/r1186/r1186_equip.pdf lists SCAQMD Certified Street Sweepers under Rule 1186 (August 30, 2012).

[10] http://www.tymco.com/environment/dustless-sweeping.htm. Note that the Environmental Technology Verification (ETV) is funded by the government agency Environment Canada and is considered an independent testing resource.

Figure 4-6: Paved Road Sweeping Calculation Sheet

Emission Factor	
0.382251788	PM_{10}
0.095562947	$PM_{2.5}$

Control Measure	
Sweeping Alone	16 - 50%
Flusher Truck	30 - 70%
Combined	35 - 90%

PM_{10} Emissions Reductions Over Entire Network

Road Name	Emissions Factor (kg/mile)	x	Control Efficiency	x	Average Daily Traffic	x	Lane Miles to be Cleaned (miles)	=	PM_{10} Emissions Reductions (kg/day)
Road 1	0.000382252	x	30	x	100,000	x	20.00	=	22,935.12
Road 2	0.000382252	x	30	x	75,000	x	20.00	=	17,201.34
Road 3	0.000382252	x	30	x	120,000	x	10.00	=	13,761.07
Road 4	0.000382252	x	30	x	50,000	x	15.00	=	8,600.67
								Emissions Reductions Over Entire Network	62,498.20
					Total Lane Miles to Be Cleaned		65.00		

$PM_{2.5}$ Emissions Reductions Over Entire Network

Road Name	Emissions Factor (kg/mile)	x	Control Efficiency	x	Average Daily Traffic	x	Lane Miles to be Cleaned (miles)	=	$PM_{2.5}$ Emissions Reductions (kg/day)
Road 1	9.55629E-05	x	30	x	100,000	x	20.00	=	5,733.77
Road 2	9.55629E-05	x	30	x	75,000	x	20.00	=	4,300.33
Road 3	9.55629E-05	x	30	x	120,000	x	10.00	=	3,440.26
Road 4	9.55629E-05	x	30	x	50,000	x	15.00	=	2,150.17
								Emissions Reductions Over Entire Network	15,624.53
					Total Lane Miles to Be Cleaned		65.00		

Percent of Total Lane Miles to be Cleaned per Day

Lane Miles Cleaned per Day	÷	Total Lane Miles to Be Cleaned	=	Percent of Total Lane Miles to be Cleaned per Day
5	÷	65.00	=	8%

Daily Emission Reductions

Emissions Reductions Over Entire Network (kg)	x	Percent of Total Lane Miles to be Cleaned per Day	=	Daily PM_{10} Emissions Reductions (kg/day)
62,498.20	x	8%	=	4,807.55
Emissions Reductions Over Entire Network (kg)	**x**	**Percent of Total Lane Miles to be Cleaned per Day**	**=**	**Daily $PM_{2.5}$ Emissions Reductions (kg/day)**
15,624.53	x	8%	=	1,201.89

Annual Emissions Reductions

Daily Emissions Reductions (kg/day)	x	Number of Days per Year that Roads are Cleaned (days/year)	=	Annual PM_{10} Emissions Reductions (kg/year)
4,807.55	x	24	=	115,381.30
Daily Emissions Reductions (kg/day)	**x**	**Number of Days per Year that Roads are Cleaned (days/year)**	**=**	**Annual $PM_{2.5}$ Emissions Reductions (kg/year)**
1,201.89	x	24	=	28,845.29

4.5.2 *Vehicle Control Measures*

4.5.2.1 *Non-Road Diesel Retrofits*

Non-road diesel equipment, primarily construction equipment, has only been subject to significant emission reduction levels since 2012 when Ultra Low Sulfur Diesel (ULSD) fuel became required for all off-road vehicles. Construction equipment tends to have long lifespans and, as a result, these retrofits may have a longer-term impact than retrofits to on-road vehicles, which have been subject to stricter emission standards starting with the 2008 model year.

While many technologies to reduce PM emissions from diesel engines result in co-benefits (generally reducing hydrocarbon (HC) emissions and occasionally NO_X as well), the retrofit verification process does not necessarily certify reductions for any pollutant other than PM. Most retrofit programs allow for CARB-verified technologies to be used which, by definition, have no verified NO_X reductions. Given that retrofit technologies are not necessarily certified for reductions in precursors to ozone, taking credit for potential HC or NO_X reductions is not possible at this time.

4.5.2.2 *Construction Equipment Related Emissions/Exhaust*

In 2009 ADOT conducted a yearlong study on emissions impacts of widening SR92 in Sierra Vista[11]. One of the goals of this study was to determine the impact of a road construction project on $PM_{2.5}$ emissions. A summary of the emission results from this study is in Table 4-3. While a large portion of $PM_{2.5}$ is generated from exhaust from diesel engines, in the absence of strict controls, fugitive dust still contributes a larger percentage of emissions for a road construction project.

ADOT is still researching ways to estimate road construction dust and emissions factors for potential CMAQ projects. The Sierra Vista study estimated the construction activity for a 4-mile road widening project that added 2 travel lanes and a center auxiliary lane. This project produced 29.0 kg/day of PM_{10}, 6.0 kg/day of $PM_{2.5}$, and 30.0 kg/day of NO_X; assumptions could be made that similar types of projects would produce similar emissions. In addition to measuring emissions from a typical road construction project, this study looked at existing mitigation controls for $PM_{2.5}$ including retrofitting construction equipment.

Table 4-3: Emissions from SR92 Road Widening Year 2009

Emissions Source	PM_{10} (kg)	$PM_{2.5}$ (kg)
Construction Equipment Exhaust	553 (8%)	537 (37%)
Fugitive Dust	6,490 (92%)	924 (63%)

Construction equipment inventories at a given site can be difficult to obtain, rendering the calculation of programs that address the emissions from these vehicles challenging. Anecdotally, the longevity of the equipment, along with the fact that tighter controls were only mandated with the 2012 model year, would indicate some potential for declines in emissions from this source.

In the absence of good local data, the generic emissions rates generated from national databases may offer the best opportunity to calculate the impacts of these activities. Both the National Mobile Inventory Model (NMIM)[12] and the NONROAD[13] model have the ability to generate estimates of total emissions by industry, fuel, month, and vehicle type at the county level. The total emissions for a given category of equipment can be

[11] http://ntl.bts.gov/lib/37000/37800/37836/2010-STI-ADOT-Construction-Study-Final-Report-10-25-10.pdf
[12] http://www.epa.gov/otaq/nmim.htm
[13] http://www.epa.gov/otaq/nonrdmdl.htm

divided by the vehicle population to yield the average emissions per vehicle. As the population includes a combination of newer, older and retrofitted equipment, the average emission rate is a conservative value. Using retrofit emission reduction percentages found in the EPA[14] or CARB[15] lists of certified technologies, the reduction in emissions can be calculated by multiplying the total emissions for the period in question by the reduction rates. Additional correction factors may be applied to account for unknowns such as the percent of time the retrofitted equipment might be operating within a given non-attainment area. Such reduction factors should be developed in conjunction with local EPA representatives.

Example: ADOT has developed a program to encourage contractors to use retrofitted construction equipment on state contracts through financing the installation of Best Available Retrofit Technologies (BART) with a threshold goal of 85 percent reduction in $PM_{2.5}$ emissions. With the funding available the agency estimated 40 vehicles could be retrofitted through this program. As the program focused solely on $PM_{2.5}$ reductions, no other co-benefits (i.e. reductions in other emissions) were accredited to this TCM.

The EPA NONROAD 2008a model was used for this analysis. NONROAD2008a is a major update of the NONROAD model and it supersedes all previous versions of this model, most recently NONROAD2005. It calculates past, present and future emissions inventories (i.e., tons of pollutant) for all non-road equipment categories except commercial marine, locomotives and aircraft. The model estimates exhaust and evaporative hydrocarbons (HC), carbon monoxide (CO), oxides of nitrogen (NO_X), particulate matter (PM), sulfur dioxide (SO_2), and carbon dioxide (CO_2). The user may select a specific geographic area (i.e., national, state or county) and time period (i.e., annual, monthly, seasonal or daily) for analysis. Note the emissions rates provided are only samples and not specific to Arizona; any analysis would require application of the NONROAD model for a specific location and date. These calculations are illustrated in Figure 4-7.

[14] http://www.epa.gov/cleandiesel/verification/verif-list.htm
[15] http://www.arb.ca.gov/msprog/ordiesel/vdecs.htm#currentdevices

Figure 4-7: Sample Calculations of the Benefits of Construction Retrofit program

Total Emissions for Contraction Source Type for State of AZ 2008 - EPA NONROAD Model													
HP Range	Population	Total Fleet Summer Day Emission (Tons)					Total Fleet Annual Emission (Tons)						
		VOC	NOX	CO	PM10	PM2.5	VOC	NOX	CO	PM10	PM2.5	SO2
100 < HP <= 175	13,297	1.42	13.43	5.74	1.13	**1.10**	410.49	3,887.46	1,661.24	327.82	**317.98**	92.99
175 < HP <= 300	6,629	0.98	12.90	3.96	0.83	**0.81**	284.06	3,733.32	1,145.71	241.12	**233.89**	101.29
175 < HP <= 600	3,672	0.86	14.45	6.00	0.85	**0.82**	249.24	4,183.38	1,735.92	245.93	**238.55**	97.96
600 < HP <= 750	762	0.28	5.32	2.77	0.33	**0.32**	81.67	1,540.20	800.45	94.14	**91.31**	38.16
750 < HP <= 1,000	212	0.18	2.61	0.87	0.14	**0.13**	50.90	754.76	525.86	39.13	**37.95**	14.49
1,000 < HP <= 1,200	114	0.12	1.73	0.61	0.09	**0.09**	34.59	501.35	176.76	26.49	**25.70**	9.55
1,200 < HP <= 2,000	173	0.32	5.02	1.56	0.25	**0.24**	91.91	1,452.05	450.28	72.15	**69.99**	29.13
2,000 < HP <= 3,000	26	0.07	1.20	0.33	0.06	**0.05**	20.33	346.17	94.91	16.00	**15.52**	7.24
Total:	**24,885**	4.23	56.66	21.84	3.68	**3.56**	1,223.19	16,398.69	6,591.13	1,062.78	**1,030.89**	390.81
Emissions/Vehicle (Tons):		0.00017	0.00228	0.00088	0.00015	**0.00014**	0.049	0.659	0.265	0.043	**0.041**	0.016
Reduction Potential (1)		0%	0%	0%	0%	**85%**	0%	0%	0%	0%	**85%**	0%
Average Benefit/Vehicle (Tons)		0.00000	0.00000	0.00000	0.00000	**0.00012**	0.0000	0.0000	0.0000	0.0000	**0.0352**	0.0000
Benefit for 40 Vehicles (Tons)		0.0000	0.0000	0.0000	0.0000	**0.0049**	0.00	0.00	0.00	0.00	**1.41**	0.00
Benefit for 40 Vehicles (Kg)		0.000	0.000	0.000	0.000	**4.413**	0.00	0.00	0.00	0.00	**1,277.76**	0.00
(1) Typical Target reductions for Retrofit Program - PM2.5 is only pollutant for which CARB certifies reductions													

4.5.2.3 <u>Diesel Retrofits, Clean Diesel and Alternative Fuels</u>

Diesel vehicles have historically been a significant source of PM emissions and as such the EPA moved to lower the emissions of these vehicle classes several years ago. The mandating of ULSD for all on-road diesel fuel allowed for the universal adoption of emission devices that significantly reduced the PM and NO_X emissions associated with diesel vehicles. This was adopted with the 2008 model year and all on-road diesel engines after that date are effectively "clean diesel" as they were commonly referred to prior to the standard being implemented. Retrofits are only effective as a control measure in the short term. When older vehicles are retired their replacements will meet the new emissions criteria and no additional benefit will be realized.

Alternative fuels historically had inherent emissions benefits over conventional fuels; however it is not clear that this remains the case. Heavy duty diesel vehicle emissions standards encouraged the development of engine and exhaust control systems that dramatically lowered diesel emissions to levels originally thought difficult to achieve, while at the same time the state of the practice in alternative fuels (namely compressed/liquid natural gas, biodiesel, and propane) remained largely unchanged. The benefits of alternative fuels are no longer a certainty, and in recent work published for city buses[16] it was noted that alternative fuels do not show a demonstrable benefit over diesel buses built to current standards. Emissions standards for heavy duty engines are independent of fuel type, and the choice to use alternative fuel vehicles is generally driven by co-benefits outside of emission reductions such as the reduced cost of fuel. Compressed Natural Gas is increasingly being promoted as a cleaner fuel source; however the range of these vehicles tends to be shorter and is not appropriate for long distance hauling. Liquid Natural Gas allows for an increase in range; however the limited number of refueling stations makes this a viable solution only in specific cases.

[16] Transportation Research Board. TCRP REPORT 146: Guidebook for Evaluating Fuel Choices for Post-2010 Transit Bus Procurements. March, 2011.

Biodiesel and ethanol have lower energy densities than the fuels they replace which impacts mileage, however in general emissions are considered on par with similar, new diesel vehicles. No definitive work could be located verifying that a new, modern alternative fuel vehicle is any less polluting than a current model diesel vehicle, nor are there any indications that alternative fueled vehicles are now more polluting. It is recommended that replacement of an existing vehicle with an alternative fuel equivalent be analyzed as though the replacement was a modern, conventional (petroleum) fueled vehicle.

Hydrogen fueled and electric heavy duty vehicles were not considered a viable control measure due to the limitations of current technology. As the technology evolves these alternatives may warrant future consideration.

Calculations for Diesel Retrofits, Clean Diesel and Alternative Fuels

The EPA developed a "Retrofit Converter Tool" that may be used with the on-road retrofit strategy panel in MOVES that allows users to enter details about diesel trucks and buses that have installed emissions control equipment. Any retrofit projects must use the technology on EPA's Verification list[17]; however most regions only take credit for $PM_{2.5}$ and PM_{10} reductions as the verification for other pollutants has been questioned.[18] Care should be taken when calculating long term benefits for these projects, as retrofits only have a benefit over the remaining life of the vehicle. A five year impact is recommended in the CMAQ guidance, with retrofits only being appropriate to advance near term air quality goals and not as a long term measure.

An alternative to using the diesel retrofit calculator is to use MOVES emission rates for the pre-2007 model year vehicle (source) types. The list of verified retrofit technologies provided by the EPA gives percent reductions in emissions by pollutant and by device. MOVES can be used to generate an emission rate for a pre-2007 model year vehicle and the percent reduction applied directly to that rate. This also requires an estimate of the average annual vehicle mileage. As bus engines have been the focus of such programs, Table 4-4 below provides a list of Arizona transit agencies and an estimate of the revenue vehicles miles of travel per bus using data in the National Transit Database. Note this mileage does not include non-revenue "deadhead" mileage. This is typically assumed to be around 15 percent more mileage on top of the revenue mileage, or may be omitted if a more conservative value is preferred.

The impacts of engine replacement, early vehicle replacement and alternative fuels can be estimated using average emission rates for current model years or, conservatively, that of a current 2013 model year vehicle. These rates can be developed on a region by region basis using MOVES and available local data.

---

17 http://www.epa.gov/cleandiesel/verification/verif-list.htm

18 An informal review found many programs specifically seek to reduce PM related emissions although it is common for HC and NO_X emissions to be reduced concurrently. As these co-benefits are not mandated or specifically enforceable, areas have opted not to take credit for them.

Table 4-4: Average Transit Vehicle Revenue Mileage

Agency	Bus			Demand Responsive		
	Revenue Vehicle Miles	Buses in Max. Service	Annual VMT/BUS (Miles)	Revenue Vehicle Miles	Buses in Max. Service	Annual VMT/BUS (Miles)
City of Glendale Transit	99,773	3	33,258	406,413	14	29,030
City of Phoenix Public Transit Department dba Valley Metro (Valley Metro)	16,914,563	427	39,613	3,733,691	117	31,912
Regional Public Transportation Authority, dba: Valley Metro (RPTA)	5,909,527	163	36,255	1,974,940	50	39,499
City of Scottsdale - Scottsdale Trolley (COS)	619,115	17	36,419	N/A	N/A	N/A
Surprise Dial-A-Ride Transit System (Surprise DAR)	N/A	N/A	N/A	84,859	7	12,123
City of Tempe Transit Division - dba Valley Metro (TIM - Tempe in Motion)	5,700,178	129	44,187	N/A	N/A	N/A
City of Tucson (COT)	7,985,511	200	39,928	3,332,883	115	28,982
Yuma Metropolitan Planning Organization (Yuma County Area Transit)	378,218	8	47,277	182,846	8	22,856

Source: 2011 National Transit Database

Using the values in Table 4-4, the equations used to determine the benefits of retrofits or engine replacements are:

Retrofits:
Daily Emission Reductions = (BEF) * EFF * ADT * 0.93 * 1 /1000 (kg/day)

Replacements:
Daily Emission Reductions = (BEF – AEF) * ADT * 0.93 * 1 /1000 (kg/day)

Where:

- ***BEF* =** The before emission factor for the current vehicles
- ***EFF* =** The effective reduction in the emissions for that specific pollutant as per the EPA verified list. In the case of VOC the HC reduction factor can be used[19]
- ***AEF* =** The after emission factor for the replacement vehicles
- ***ADT* =** The average daily mileage of the vehicles
- ***0.93* =** The factor to convert from weekday to annual average daily traffic on arterials.

To generate annual emissions reductions, either substitute the average annual mileage (if known) or multiply the daily results by 250 days per year, which is equivalent to the number of weekdays per year (260) minus holidays per year (10).

4.5.2.4 Truck Stop Electrification/Auxiliary Power Units (APU)

During mandated rest periods, long distance truck drivers often remain in the cab of their vehicles if they are equipped for overnight stays. A trucker is likely to leave the engine running for cooling/heating and to provide power for appliances and accessories resulting in avoidable idling emissions. Some trucks are provisioned for “shore-side” power, similar to a recreational vehicle, which negates the need to run the engine while the driver rests. Another technology uses a device that inserts into a sleeve in an open window and provides climate control and additional services (electrical outlets, cable, internet access, etc.). Auxiliary Power Units (APUs) are a third idling alternative that provide air conditioning, heat, and power for sleeper cab appliances, as well as battery charging and start assist for the main engine while being less polluting than running the main engine. These devices can be diesel fueled, battery powered or a combination of both (FHWA, 2009).

To quantify the benefit of an anti-idling project, MOVES can be run to estimate extended idling emission factors for NO_X, PM_{10} and $PM_{2.5}$ for heavy duty diesel vehicles in the year of project implementation. The equipment must be installed within the air quality region in question. However, a correction factor may be applied to account for the times an APU is used outside the area. MOVES emission rates in grams per vehicle per hour are then multiplied by the estimated daily reduction in idling hours to determine the emissions benefits associated with truck stop electrification. For a project providing APUs, the benefit will be calculated as the difference between the idling emissions for diesel trucks before and after installation of the APUs.

[19] http://www.epa.gov/cleandiesel/verification/verif-list.htm

Calculation of the Benefits of Truck Stop Electrification/Auxiliary Power Units (APU)

In the absence of usage data, assume truckers are generally required to take a 10 hour break after 11 hours of driving. Therefore multiplying 10 hours by the number of spaces provides a coarse estimate of overall hours of idling reduced. If parking space utilization data is available for a particular location it should be used as the basis of the calculation. If estimates are used and are not based on survey data, a further reduction to account for uncertainty (developed in conjunction with EPA regional staff) may need to be employed.

4.5.3 Additional Significant Control Measures

4.5.3.1 Regional Diesel Anti-Idling Programs

Unnecessary diesel idling often occurs while vehicles wait at various terminals, buses wait outside schools, or commercial vehicles make deliveries. Attempting to restrict these and similar types of idling may have a significant impact on emissions, particularly $PM_{2.5}$ emissions. These programs commonly limit idling to no more than 5 minutes, and while most are focused on diesel vehicles some regions have expanded these programs to include all vehicle types. Enforcement is handled differently region by region and is a challenge in many locations as local police are often unable to dedicate additional resources to the effort. The number of vehicles at a single location does not need to be great to have a significant localized benefit. The MOVES hotspot guidance suggests that at levels as low as 10 heavy duty diesel vehicles idling on average is enough to be of air quality concern.[20]

The challenge in quantifying the benefits of these programs is that the amount of short term idling occurring (in excess of 5 minutes but less than a mandated 10-hour rest period) is not well understood. While idling emission rates can be obtained from MOVES, it is unclear what amount of time (the activity data for this measure) should be assigned. Such programs have obvious air quality benefits, however quantified benefits would be difficult to justify. In the research undertaken for this working paper, all the regions identified that had implemented these programs justified them qualitatively and did not calculate a specific air quality benefit.

4.5.3.2 Expanded or New Fuel Measures and Vehicle Inspection and Maintenance (I/M) Programs

In regions with significant air quality issues, reformulated fuel requirements and expanding vehicle I/M activities have the potential to generate substantial emissions benefits since these measures impact almost every vehicle within a region.

Calculating the benefits of such programs must be done within the context of MOVES and will impact how regional emissions inventories and/or conformity demonstrations are handled. As outlined in Working Paper 3, *Air Quality Conformity Procedures*, MOVES databases specify fuel formulation and fuel supply data based on available local volumetric fuel property information. For example, in the case of Reid Vapor Pressure (RVP), the default value should be changed to reflect the regulatory requirements and differences between ethanol-

[20] USEPA. *Transportation Conformity Guidance for Quantitative Hot-spot Analyses in $PM_{2.5}$ and PM_{10} Nonattainment and Maintenance Areas.* December, 2010

and non-ethanol blended gasoline. Agencies should coordinate with EPA to change their fuel and/or I/M programs and to incorporate appropriate assumptions for future analysis years into their MOVES modeling protocols. Legislation must be in place to ensure the requirements are enforceable before credit can be taken.

When calculating the benefit of other control measures, any expanded fuel reformulation and/or I/M program must be analyzed first. Implementation of these measures will reduce the emission rates for entire vehicle classes. As a result, the incremental benefit for other control measures that reduce trips or improve vehicle operations will decrease.

4.5.4 Trip Reduction Measures

The MAG *Methodologies for Evaluating Congestion Mitigation and Air Quality Improvement Projects* is recognized nationally as a well-developed analysis framework for the project types it covers. The TCMs analyses below are based on the methods found in the MAG CMAQ guidance, and were altered to remove any weighting factors developed to assist MAG in rating and ranking projects. Note that because generic emission rates are not available for Arizona, the following describe only the methods for calculating the transportation impacts.

4.5.4.1 Bicycle and Pedestrian Facilities

Bicycle and pedestrian facilities can help encourage the use of "active transportation" modes to supplant local, short distance commuter and other personal trips. The improvements should not be focused on recreational facilities as these are unlikely to off-set auto trips. Also note that the benefits calculated here are focused on tailpipe emissions and not re-entrained dust (covered earlier in this working paper).

The estimated number of vehicle trips replaced by bicycle or pedestrian trips is based on a number of factors. The ADT on the adjacent or nearest parallel arterial to the proposed bicycle or pedestrian facility is a basic input. The maximum allowable ADT is 30,000 vehicle trips per weekday for this approach to be valid. Weekday ADT can be converted to annual average daily traffic (AADT) by multiplying by a conversion factor of 0.93. The vehicle trips reduced will be calculated by multiplying the AADT by the sum of the adjustment factor (A) found in Table 4- 5 and the activity center credit (C) found in Table 4- 6. The adjustment factor (A) is dependent upon the length of the bicycle/pedestrian project and the AADT as well. Given the relative importance of bridges and underpasses that connect bicycle/pedestrian paths, the adjustment factor used for bridges and underpasses should be based on the sum of the lengths of the two paths connected. Usage estimates for bicycle/pedestrian facilities can also benefit from credit (C) for the number of activity centers near the proposed facility.

Table 4- 5: Adjustment Factors[21]

ANNUAL AVERAGE DAILY TRAFFIC (AADT)	LENGTH OF PROJECT (one direction)	**ADJUSTMENT FACTOR (*A*)**
AADT ≤ 12,000 vehicles per day	≤ 1 mile	0.0019
	> 1 mile and ≤ 2 miles	0.0029
	> 2 miles	0.0038
12,000 < AADT≤ 24,000 vehicles per day	≤ 1 mile	0.0014
	> 1 mile and ≤ 2 miles	0.0020
	> 2 miles	0.0027
AADT > 24,000 vehicles per day	≤ 1 mile	0.0010
	> 1 mile and ≤ 2 miles	0.0014
	> 2 miles	0.0019

Table 4- 6 : Activity Center Credits[22]

Examples of Activity Centers: bank, church, hospital, health care facility, park and ride lot, office park, post office, public library, shopping area or grocery store, schools, university or junior college.		
Number of activity centers	**ACTIVITY CENTER CREDIT (*C*)**	
	Within ½ mile	Within ¼ mile
at least three	0.0005	0.001
more than three but less than seven	0.001	0.002
seven or more	0.0015	0.003

The VMT reduced by bicycle/pedestrian facilities is estimated by multiplying the vehicles reduced by the average trip length. Consistent with assumptions in MAG transportation modeling concerning pedestrian trips to transit centers, a pedestrian trip length of one-half mile will be assumed. Based on data in the Bicycle Demand and Benefit Model (Alta Transportation Consulting, 2000), an average bicycle trip length of four miles will be assumed. For multi-use paths, it will be assumed that half of the trips are bicycle and half are pedestrian. Therefore, an average trip length of 2.25 miles will be applied for multi-use paths.

Calculations of the Potential Impacts of Bicycle and Pedestrian Facilities

Vehicle Trips Reduced (VR) = AADT * (A + C)
Vehicle Miles of Travel Reduced (VMTR) = VR * Trip Length

Where

[21] Adapted from CARB, 2005
[22] Adapted from CARB, 2005

- ***A*** = The adjustment factor from Table 4- 5
- ***C*** = The activity center credit from Table 4- 6
- ***AADT*** = The average daily traffic on the adjacent or nearest parallel arterial (Maximum 30,000) multiplied by 0.93

The VMTR value can then be multiplied by emissions rates in grams/mile developed from MOVES runs for the specific region in question. If per trip vehicle starting emissions are available those values can be multiplied by the VR value to account for this additional reduction.

4.5.4.2 New Bus Service

Bus service on new routes and increased frequency on existing bus routes reduce vehicle trips and VMT. The daily emissions reduction attributable to new bus service can be estimated based on the difference between the emissions from the light duty vehicles replaced by the bus service and the sum of the bus emissions from the new service. Vehicle emissions resulting from people driving to access the bus will also be accounted for.

Existing transit models in the region should be investigated for the ability to estimate the impact of new bus routes prior to using the following methodology. If the regional travel demand model is capable of modeling the impact of transit improvements then it should be used as the preferred tool for determining emissions credit. The methodology presented here is intended for small routes that a regional travel demand model might be insensitive to, or for isolated routes in a region not currently modeled.

The vehicle miles of travel replaced (VMT_{REP}) by the new bus service is estimated based on the fraction of riders on the bus who drove to their destination prior to introduction of the new bus service (F_1). This fraction will be multiplied by total bus riders and the average trip length replaced by the bus service (Trip Length_1). The VMT replaced by bus trips will be multiplied by on-road light duty vehicle emission factors from MOVES.

The Vehicle Trips Reduced (VR) by the new bus service will be estimated as the number of riders who previously drove to their destination minus the number of riders that drove to the bus. The vehicles reduced will be multiplied by the off-network light duty vehicle emission factors per vehicle per hour from MOVES.

Calculation of the Impact for New Bus Service

$$\textit{VMT Replaced } (VMT_{REP}) = R * F_1 * \textit{trip length}_1$$
$$\textit{VMT Added } (VMT_{ADD}) = R * F_2 * \textit{trip length}_2$$
$$\textit{Vehicles Trips Reduced } (VR) = R * (F_1 - F_2)$$

Where:

- ***R*** = The average ridership on the bus per operating day
  For example, if the new bus is expected to carry 400 passengers per day, *R* would equal 400. Default = 284 (Based on 2011 RPTA data).
- ***F_1*** = The fraction of riders on the bus who previously drove a single occupant vehicle
  For example, if 75 of 100 bus riders would have driven an SOV to their destination, F_1 would equal 0.75. Default = 0.50 (CARB, 2005).

- ***Trip length$_1$* =** The average trip length replaced for each rider who previously drove
  Default = 10.6 miles (from 2001 Maricopa Regional Household Travel Survey and 2002 transportation model validation, Feb.15, 2005).
- ***F_2* =** The fraction of riders who drive to transit
  For example, if 5 of 100 riders of the new bus drive to reach the bus, F_2 would equal 0.05. Default = 0.03 (RPTA, 2008).
- ***Trip length$_2$* =** The average trip length driven to transit
  Default = 5 miles (Valley Metro, 2001).

The (VMT Replaced – VMT Added) can then be multiplied by emissions rates developed from MOVES runs for the specific region in question. If off-network (starting) emission rates are also available those can be multiplied by the [R x (F_2-F_1)] value to get an additional reduction. The VMT for the bus should be calculated using available route and schedule data, which can be further adjusted by multiplying by a factor to account for non-revenue mileage (1.15 is a commonly used value, but local data should be used if available). The bus mileage can be multiplied by appropriate emission rates for the region and subtracted from the overall benefit of the project.

4.5.4.3 Park and Ride Facilities

Park and ride facilities reduce light duty vehicle trips and emissions by encouraging carpooling, vanpooling, and transit ridership.

This methodology is based on the number of park and ride spaces and the projected utilization rate. It assumes that each vehicle parked in the facility (spaces times the utilization rate) represents two commute trips. The average trip length for commute trips is derived from regional commuting data collected by the Maricopa County Trip Reduction Program. The average trip length driven to park and ride lots (derived from a MAG park and ride lot survey) is subtracted from the average commute trip length. The net trip length is applied to the total commute trips reduced to obtain the average weekday reduction in VMT.

Calculation of the Impacts of Park and Ride Facilities:

VMT Reduced (VMTR) = S * U * 2 * (15.4 – 3.5)

Where

- ***S* =** Number of parking spaces provided in the park and ride facility
- ***U* =** Average weekday utilization rate
- **2 =** Number of vehicle commute trips per average weekday
- ***15.4* =** Average commuter trip length by all modes (MCAQD, 2009)
- ***3.5* =** Average miles driven to park and ride lots

The VMTR value can then be multiplied by emissions rates developed from MOVES runs for the specific region in question.

4.5.4.4 *Trip Reduction Programs/Measures*

Travel Demand Management (TDM), Transportation Management Associations (TMA), trip reduction programs and similar activities promote and facilitate efforts to help alleviate peak period congestion. These programs are challenging to quantify for a number of reasons. Many programs use overall mode share as a measure of their impact, for example a TMA may set a goal for a certain percent of all trips to be diverted from the drive-alone mode and use ongoing surveys to verify their effectiveness. This allows for flexibility to implement the most effective regional programs and allows the programs to evolve over time.

One recommended tool to analyze these programs is the EPA COMMUTER Model[23]. The COMMUTER Model has not been updated with MOVES emission rates. Agencies may wish to use the COMMUTER Model to calculate total VMT and vehicle trips reduced, and then apply locally-developed MOVES emission rates. Agencies may also wish to bundle the TMA efforts with other voluntary measures which would restrict the maximum impact to 3 percent of the overall emissions inventory.

4.5.5 *Traffic Flow Improvements*

4.5.5.1 *Traffic Signal Coordination and Intelligent Transportation Systems*

At this time there is some question on how to use the MOVES model to analyze control measures that improve vehicular traffic flow. Traditionally, simulation methods were used to estimate the reduction in vehicle delay, which were assumed to be idling emissions (in whole or in part), and that value was multiplied by an idling emission rate. MOVES fundamentally changes the way in which these projects should be reviewed; unfortunately, guidance is not available at this time to leverage these capabilities in the model. During this time of transition agencies may wish to use other tools, omit these projects for credit all together, or work with the regional EPA office to develop a sensible approach to quantifying the benefits that can be expected.

4.5.5.2 *Land Ports of Entry Operational Improvements*

The Border Crossings/Land Ports of Entry (LPOE) between the US and Mexico are a known source of emissions. The flow of freight traffic between the US and Mexico ensures high volumes, and the delays due to excessive congestion and additional inspection procedures results in significant amounts of localized vehicle emissions. Streamlining LPOE operations in order to improve local air quality was identified as a goal in the Border 2020: U.S.-Mexico Environmental Program[24]; elements of which have already been implemented under the Department of Homeland Security's US-VISIT program. Analysis of the air quality impacts of LPOE operations is very complex and requires traffic micro-simulation. Such an air quality analysis was completed under the US-VISIT program and may be available by request. If these studies are unavailable, agencies should seek assistance from regional EPA representatives on appropriate background emissions assumptions. Given the lack of local or state control over the operation of these facilities they are unlikely to be suitable candidates for inclusion as a specific, local control measure.

---

[23] http://www.epa.gov/OMS/stateresources/policy/pag_transp.htm
[24] http://www2.epa.gov/border2020/borderwide-publications

5.0 Nogales $PM_{2.5}$ / PM_{10} Nonattainment Areas Case Study

5.1 Purpose and Organization of the Case Study

The Nogales $PM_{2.5}$ / PM_{10} Nonattainment Areas Case Study (The Case Study) outlines a sample regional conformity analysis and the supporting documentation for analysis year 2008. This documentation and emissions analysis is based on data provided by ADOT and is meant to be illustrative only. The analysis and documentation should be updated as necessary to reflect real-world conditions for any future conformity analyses. Areas where updates are required are [contained in brackets and highlighted].

The Case Study is organized into the following sections, which would be found in a typical regional conformity analysis:

1) **Introduction:** Includes information on the nonattainment or maintenance area, background on transportation conformity and the applicable national ambient air quality standards (NAAQS), as well as a status update on the TIP and LRTP.
2) **Interagency Consultation:** Outlines interagency consultation requirements and includes a tabulation of all decisions made through interagency consultation.
3) **Analysis Methodology and Data:** This section outlines all of the technical steps taken to conduct the conformity analysis and includes details on MOVES and AP-42 inputs and methodologies.
4) **Transportation Control Measures (TCMs):** This section outlines any TCMs that have been specifically identified and committed to in State Implementation Plans. Timely implementation of TCMs must be demonstrated before conformity determinations can be made.
5) **Conformity Analysis Results:** Building upon the methodology and data described in the previous sections, this section documents the actual results by emissions test and analysis year.
6) **Conformity Determination:** The final result of the conformity analysis, which includes documentation demonstrating financial constraint, public participation, and the conformity statement.
7) **Resources:** Lists of informational websites and guides, particularly with respect to the MOVES model.
8) **Attachments:** The attachments contain additional detail including the project list, detailed emission results, interagency consultation materials and checklist, and sample run specifications for MOVES.

5.2 Introduction

This report provides an analysis of the air quality implications of the current [SouthEastern Arizona Governments Association (SEAGO)] Transportation Improvement Program (TIP) and the [Arizona Department of Transportation (ADOT) Statewide Transportation Improvement Program (STIP)] and Long-Range Transportation Plan (LRTP). This analysis demonstrates transportation conformity for the [Nogales] nonattainment area (NA) for the [2006, 24-hour fine particulate matter ($PM_{2.5}$) and 1987 coarse particulate matter (PM_{10})] National Ambient Air Quality Standards (NAAQS). The air quality conformity analysis reflects regionally significant, non-exempt transportation projects included in the TIP / [STIP and Statewide] LRTP. [Since there is no metropolitan planning organization (MPO) associated with the planning process in the Nogales NA, ADOT and the Arizona Department of Environmental Quality (ADEQ) coordinated the conformity process closely with SEAGO and local representatives.]

5.2.1 Background on Transportation Conformity

Transportation conformity is required by the CAA (Section 176 (c)) to ensure that federal funding and approval are given to highway and transit projects that are consistent with the area's air quality goals. Demonstrating conformity means verifying that transportation activities will not cause new air quality violations, worsen existing violations, or delay timely attainment of the NAAQS.

Regional conformity, or the conformity of a plan or TIP, demonstrates that the total emissions from an area's transportation system are consistent with goals for air quality found in the SIP, i.e., they are less than or equal to the motor vehicle emission budgets (MVEBs) (§93.118). If an area does not have adequate or approved MVEBs another test, known as the interim emissions test (§93.119), must be performed. The interim emissions tests include either demonstrating that the emissions predicted in the "action" scenario are not greater than the emissions predicted in the "baseline" scenario or by demonstrating that the emissions predicted in the "action" scenario are not greater than the emissions in the baseline year for a given NAAQS.

The transportation conformity determination includes an assessment of future fugitive dust and on-road, highway emissions for defined analysis years including the end year of the LRTP. Emissions are estimated using the latest available planning assumptions and available analytical tools, including the Environmental Protection Agency's (EPA's) latest approved on-highway mobile sources emissions model. The conformity determination includes a tabulation of the analysis results for applicable pollutants demonstrating that the required conformity test was met for each analysis year.

5.2.2 National Ambient Air Quality Standards

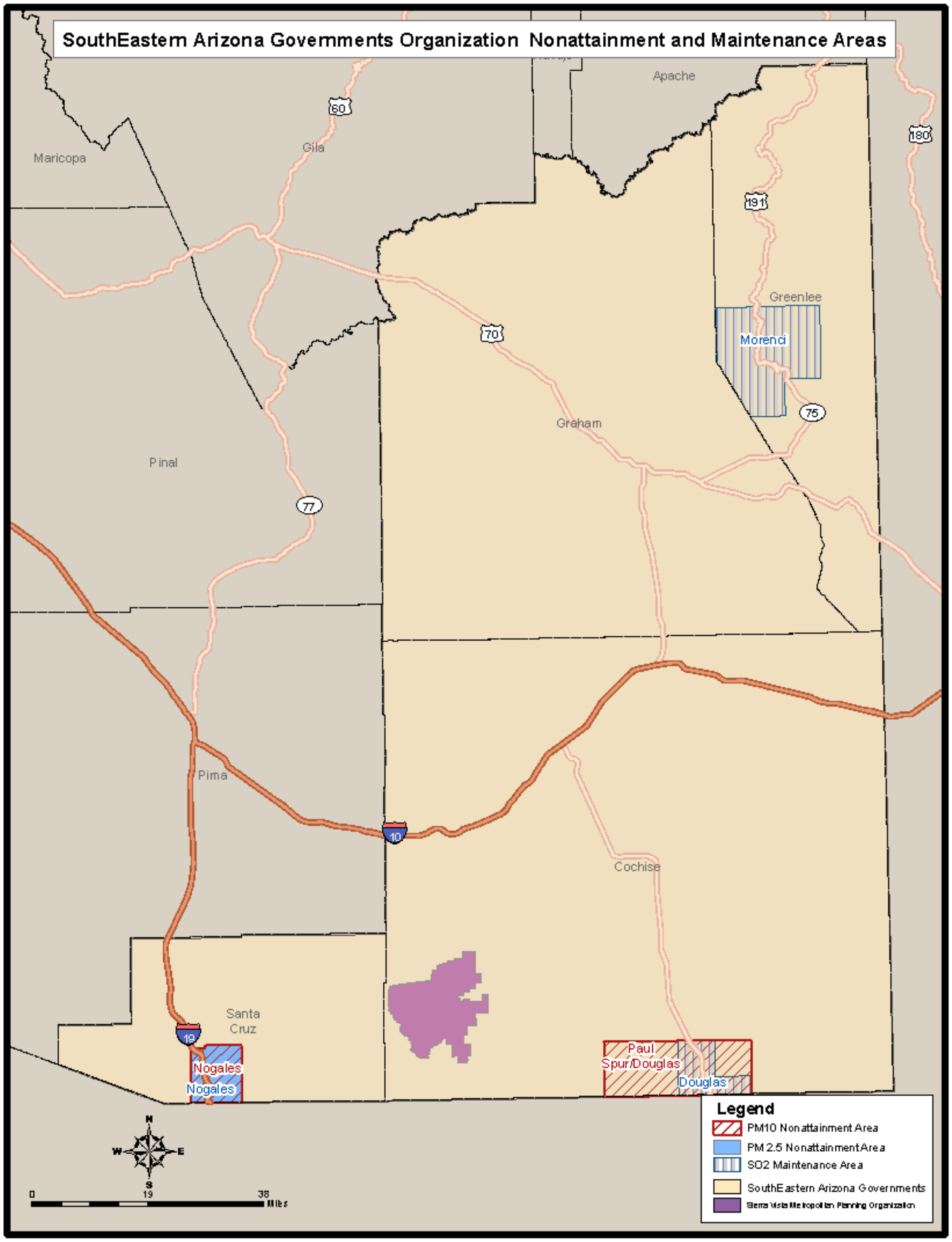
The CAA requires EPA to set NAAQS for pollutants considered harmful to public health and the environment. A nonattainment area is any area that does not meet the national primary or secondary NAAQS. A maintenance area is any area that the EPA previously designated as a nonattainment area for one or more pollutants, and subsequently redesignated as an attainment area following the fulfillment of the requirement to develop a maintenance plan under section 175A of the CAA. The [Nogales] area has been designated as [nonattainment] under the [$PM_{2.5}$ and PM_{10}] NAAQS. Transportation conformity requires nonattainment and maintenance areas to demonstrate that the implementation of planned and programmed transportation projects will not prevent the area from reaching its attainment goals.

Particle pollution (also called particulate matter or PM) is the term for a mixture of solid particles and liquid droplets found in the air. Some particles, such as dust, dirt, soot, or smoke, are large or dark enough to be seen with the naked eye. Others are so small they can only be detected using an electron microscope.

Particle pollution includes "inhalable coarse particles," with diameters larger than 2.5 micrometers and smaller than 10 micrometers and "fine particles," with diameters that are 2.5 micrometers and smaller. These particles come in many sizes and shapes and can be made up of hundreds of different chemicals. Some particles, known as primary particles, are emitted directly from a source, such as construction sites, unpaved roads, fields, smokestacks or fires. Others form in complicated reactions in the atmosphere of chemicals such as sulfur dioxides and nitrogen oxides that are emitted from power plants, industries and automobiles. These particles, known as secondary particles, make up most of the fine particle pollution in the country.

Effective on December 18, 2006, the EPA tightened the 24-hour $PM_{2.5}$ standard from 65 µg/m³ to 35 µg/m³, and retained the current 1987 24-hour PM_{10} standard at 150 µg/m³. Figure 5-1 illustrates the air quality status in the SEAGO region for the 1987 PM_{10} and 2006 $PM_{2.5}$ NAAQS. On December 14, 2012, EPA issued a revised $PM_{2.5}$ annual NAAQS of 12 µg/m³. This was published in Federal Register on January 15, 2013 and was effective March 18, 2013. Nonattainment designations have not yet been issued under this new NAAQS, therefore conformity to this NAAQS is not yet applicable.

Figure 5-1: SEAGO Nonattainment and Maintenance Areas Map



[$PM_{2.5}$

The Nogales area was designated as nonattainment under the 2006 24-hour $PM_{2.5}$ standard. Effective February 6, 2013, the EPA took final action to determine that the Nogales NA attained the 2006 $PM_{2.5}$ standard (see Table 5-1). The finding did not constitute a redesignation of the Nogales NA to attainment; the classification and designation status remain nonattainment until such time as EPA determines that Arizona has met the CAA requirements for redesignating the Nogales nonattainment area to attainment.

At this time, the Nogales $PM_{2.5}$ NA does not have adequate or approved MVEBs, and will therefore use the interim conformity test for the 24-hour $PM_{2.5}$ standard. According to the EPA Final Rule for the 24-hour $PM_{2.5}$ standard, prior to the approval of SIP budgets, $PM_{2.5}$ areas may use either the "build-no-greater-than-no-build" test or the "no-greater-than 2008" test. Following interagency consultation, the Nogales area used the "no-greater-than-2008" test for 24-hour $PM_{2.5}$ direct emissions and $PM_{2.5}$ precursors. The only $PM_{2.5}$ precursor that is required to be analyzed is NOx.

The pollutant sources to be analyzed in the conformity analysis are:

[1] Direct $PM_{2.5}$ emissions (exhaust emissions, brake and tire wear),
[2] Re-entrained road dust, and
[3] Precursors NOx.

Until a SIP is established, the EPA has ruled that, unless the EPA or the State's Division of Air Quality finds otherwise, direct $PM_{2.5}$ emissions and NOx are the only emissions that must be analyzed for transportation conformity (§93.119).]

[PM_{10}

The Nogales area was designated as a nonattainment area under the 1987 24-hour PM10 standard, which was retained under the EPA's 2006 PM NAAQS review (effective December 18, 2006). The EPA approved the Nogales 2012 PM10 nonattainment area SIP; "Final 2012 State Implementation Plan Nogales PM10 Nonattainment Area," effective October 25, 2012 (see Table 5-1). As part of that process, EPA approved the MVEBs and the demonstration that the Nogales nonattainment area is attaining the NAAQS, but for international emission sources in Nogales, Mexico.]

[Table 5-2 illustrates the EPA-approved MVEBs which must be used for transportation conformity determinations.]

Table 5-1: [Nogales Area] Nonattainment and Maintenance Areas and Current SIP Status by Pollutant

County	Current SIP Status[1]	Notes *(as of February 1, 2013)*
Nogales, AZ 24-Hour $PM_{2.5}$ Nonattainment Area		
Santa Cruz (P)	Attainment Finding Effective 2/6/2013 78 FR 887	Area remains nonattainment until a Maintenance Plan is submitted and approved. Regional conformity still applies.
Nogales, AZ 24- Hour PM_{10} Moderate Nonattainment Area		
Santa Cruz (P)	2012 SIP Approval Effective 10/25/2012 77 FR 58962	EPA approved the plan element demonstrating that the Nogales nonattainment area is attaining the NAAQS for PM10, but for international emissions sources in Nogales, Mexico.

Table 5-2: [2011] Nogales Nonattainment Area PM_{10} Motor Vehicle Emissions Budgets

Sector	PM_{10} Tons per Year (tpy)
Dust – Unpaved Road Dust	864.9
Dust – Paved Road Dust	121.4
Dust – Road Construction	26.0
Mobile – Gasoline and Diesel (Including Exhaust, Brake and Tire Wear)	21.0
2011 MVEB	1274.3

5.2.3 *Status of the FY [2013-2017 TIP and 2035] Long Range Plan*

The [2013-2017] SEAGO TIP was approved by the executive committee on [May 31, 2012] and the ADOT LRTP was adopted by the Arizona State Transportation Board on [November 18, 2011]. The SEAGO TIP was submitted to the United States Department of Transportation (US DOT) on [Date] and was approved on [Date].

5.3 Interagency Consultation

As required by the Federal transportation conformity rule (§93.105), the conformity process includes a significant level of cooperative interaction among federal, state, and local agencies. For this air quality conformity analysis, interagency consultation was conducted as required by the Arizona Conformity SIP. Conference call(s) or meeting(s), involving ADOT, ADEQ, EPA, FHWA, FTA, [representatives from SEAGO and other Interagency Consultation Group members] were conducted on [Date(s)] to review all input planning assumptions, methodologies and analysis years. Table 5-3 summarizes the key decisions made by the interagency consultation group.

Table 5-3: Interagency Consultation Decisions

Item	Decision
Traffic Forecasts	Use of statistical relationships based on historic HPMS VMT trends and future county socioeconomic projections.
EPA Emission Model(s)	[MOVES2010b and EPA's AP-42]
Regionally Significant Projects, Projects with a Significant Change in Design Concept and Scope	As shown in TIP and Plan listing, and project coding.
Transportation Control Measures (TCM) Progress	[Pave or Chemically Stabilize Unpaved Roads; Pave, Vegetate or Chemically Stabilize Access Points Where Unpaved Traffic Surfaces Adjoin Unpaved Roads.]
Exempt Projects	Notification of transportation plan or TIP amendments which merely add or delete exempt projects listed in §93.126 or §93.127.
Triggers for Conformity	[New or revised TIP or LRTP. NAAQS designation grace period. Other.]
24-Hour $PM_{2.5}$ Conformity Test	Analysis for [Nogales Nonattainment Area] Use [interim "No Greater Than 2008"] emission test Analysis Years: [2008], [Year2], [Year3], [Year4]
24-Hour PM_{10} Conformity Test	Analysis for [Nogales Nonattainment Area] Compare to EPA-Approved 2011 SIP MVEBs Analysis Years : [2008], [Year2], [Year3], [Year4]
Analysis Years	Analysis years (by pollutant/precursor) as shown in this report.
Boundary Issues	MPO, RPO, nonattainment and maintenance area boundaries as stated in this report.
Project Identification	All regionally significant, non-exempt projects, regardless of funding source, have been identified and included in this analysis.
Design Scope	The design scope of projects under development is as stated or modeled in this analysis.
Latest Planning Assumptions	As stated in this report, including: fleet age data, I/M program, fuels used, environmental data, and other MOVES inputs (see MOVES input summary).

5.4 Analysis Methodology and Data

This transportation conformity analysis was conducted using EPA's Motor Vehicle Emission Simulator (MOVES) model to estimate on-road emissions and EPA's AP-42 methodologies to estimate fugitive dust impacts including paved and unpaved road dust. The methodologies used for this analysis are consistent with those used to develop SIP inventories. Since no substantial road construction projects have taken place in the last five years, and no projects are planned for the next five years, estimates for this category represent a conservative, worst-case scenario, not actual emissions.

5.4.1 On-Road Analysis Background

MOVES represents a state-of-the-art upgrade to EPA's modeling tools. It is the EPA-approved model required for estimating emissions from highway vehicles, replacing the MOBILE6.2 model. EPA announced the release of MOVES2010 in March 2010 (75 FR 9411), and released a minor revision as MOVES2010a in September 2010. In April 2012, EPA released MOVES2010b to allow MOVES users to benefit from several improvements to general model performance. MOVES2010b does not affect the criteria pollutant emissions results of MOVES2010a and therefore is not considered a new model.

This analysis utilizes available traffic, vehicle fleet, and environmental data to estimate regional on-road emissions. Air quality conformity analyses must use the most recent planning assumptions that are available at the start of the analysis. Areas are encouraged to review and update their planning assumptions and strive towards regular 3-year updates of planning assumptions, especially population, employment and vehicle registration assumptions.

The analysis methodology and data inputs were developed through interagency consultation and using available EPA guidance documents including:

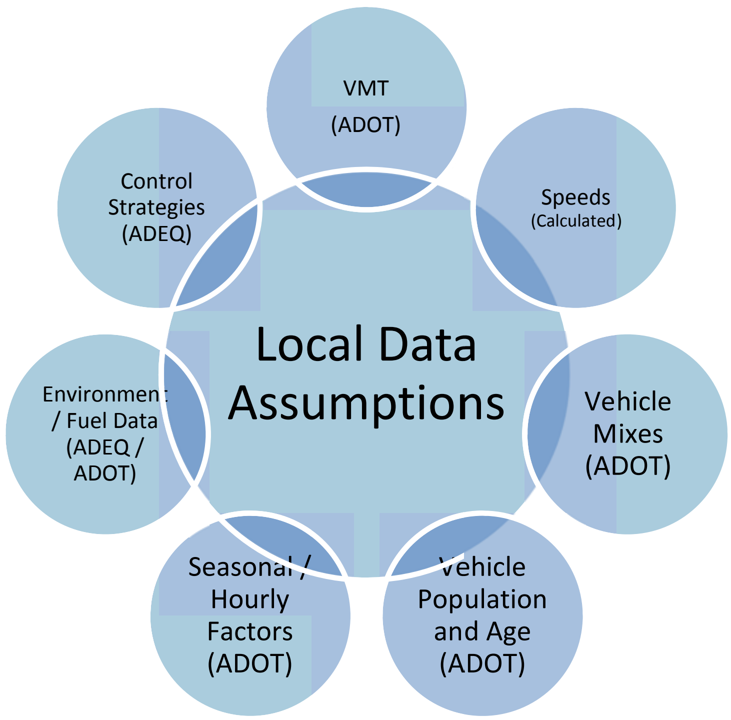
- Policy Guidance on the Use of MOVES2010 and Subsequent Minor Revisions for SIP Development, Transportation Conformity, and Other Purposes, US EPA Office of Air and Radiation, EPA-420-B-12-010, April 2012.
- Using MOVES to prepare Emission Inventories in State Implementation Plans and Transportation Conformity: Technical Guidance for MOVES2010, 2010a and 2010b. US EPA Office of Air and Radiation, and Office of Transportation and Air Quality, EPA-420-B-12-028, April 2012.
- Motor Vehicle Emission Simulator, User Guide Version, MOVES2010b, EPA-420-B-12-001, March 2012.

The methodologies used to produce the emissions data conform to the recommendations provided in EPA's technical guidance. A mix of local and national default (internal to MOVES) data are used in the analysis. As illustrated in Figure 5-2, local data have been used for the primary data items that have a significant impact on emissions including vehicle miles of travel, vehicle population, congested speeds, vehicle type mix and environmental and fuel assumptions. Local data inputs to the analysis process reflect the latest available planning assumptions using information obtained from the ADOT, ADEQ and other local/national sources.

The methodology used for this analysis includes the use of traffic data from ADOT's statewide travel demand model and custom post-processing software (PPSUITE) to calculate hourly speeds and prepare key traffic input files to the MOVES emission model. PPSUITE consists of a set of programs that perform the following functions:

- Analyze highway operating conditions.
- Calculate highway speeds.
- Compile vehicle miles of travel (VMT) and vehicle type mix data.
- Prepare MOVES runs and processes MOVES outputs.

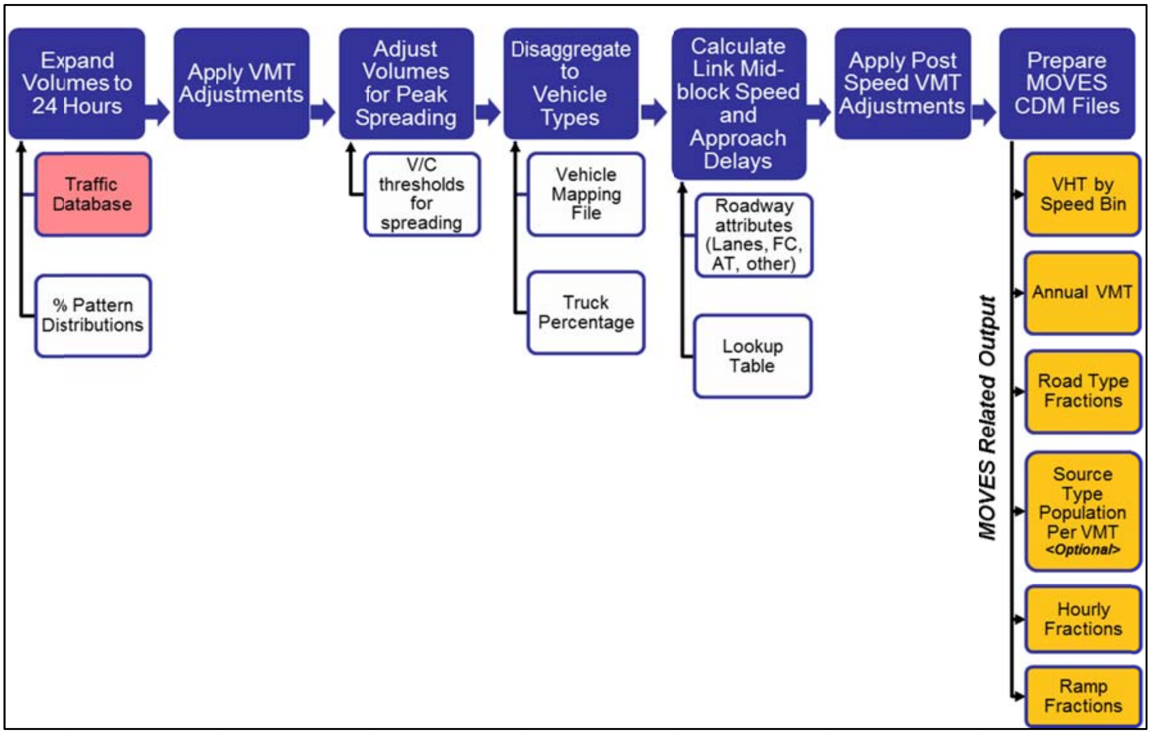
Figure 5-2: Local Data Inputs Used for Conformity Runs



PPSUITE is a widely used and accepted tool for estimating speeds and processing emissions rates. It has been used for SIP highway inventories, control strategy analyses, and conformity analyses in other states. The software is based upon accepted transportation engineering methodologies. The PPSUITE process is integral to producing traffic-related input files to the MOVES emission model. Figure 5-3 summarizes the key functions of PPSUITE within the emission calculation process. Other MOVES input files are prepared external to the PPSUITE software. These include vehicle population, vehicle age, environmental, and fuel input files.

The CENTRAL software is also used in this analysis. CENTRAL is a menu-driven software platform that executes the PPSUITE and MOVES processes in batch mode. The software allows users to execute runs for a variety of input options and integrates custom MYSQL steps into the process. CENTRAL provides important quality control and assurance steps including file naming and storage automation.

Figure 5-3: Emission Calculation Process



5.4.2 *Key MOVES Input Data*

A large number of inputs to MOVES are needed to fully account for the numerous vehicle and environmental parameters that affect emissions. These include traffic flow characteristics, vehicle descriptions, fuel parameters, inspection/maintenance program parameters, and environmental variables. MOVES includes a default national database of meteorology, vehicle fleet, vehicle activity, fuel, and emission control program data for every county; but EPA cannot certify that the default data represent the most current or best available information for any specific area. As a result, local data are recommended for use in conformity analyses, where available. A mix of local and default data are used for this analysis. These data items are discussed in the following sections.

Roadway Data Inputs

The traffic data from the statewide travel model are used to prepare PPSUITE-ready network databases. Key tasks to develop these databases included:

- Reformatting the traffic data to extract data fields needed for PPSUITE processing. Data reformatting can be accomplished in Microsoft ACCESS, EXCEL, or other database software such as FoxPro.
- Adding a ROADTYPE variable to support MOVES runs based on a mapping scheme between the model facility type and the MOVES road types.
- Separation of traffic data into two input databases to account for AB and BA directions.

Figure 5-4 summarizes the statewide model data used to prepare the network databases for the PPSUITE process. Traffic volumes and distances are used in calculating highway VMT totals for the [Nogales NA] area. Adjustments are needed to convert the volumes to an average annual daily traffic (AADT) which will be discussed later. Lane values are an important input for determining the congestion and speeds for individual model links. Facility type and area type are important indicators of the type and function of each roadway segment and are also used to create the ROADTYPE variable added to the network database as discussed above.

Figure 5-4: Statewide Model Data Used for Preparing Network Database

Field Type	Use
Length	To compute VMT for each segment
Facility Type	Lookup of other link attributes (e.g. capacities, signal characteristics, congested speed curve coefficients)
Area Type	
Speed Limit	Free-flow speed
Lanes	To determine total capacity of link
Daily Volume	Daily volume to distributed to each hour of the day
AM Peak Period Volume	Adjust hourly pattern to ensure match with model peak volumes
PM Peak Period Volume	
Daily Truck Volume	Adjust vehicle mix pattern to match truck volume on each link
Roadtype	Used to aggregate data for input to MOVES

Hourly Pattern Data/Hour VMT Fractions

Speeds and emissions vary considerably depending on the time of day. Therefore, it is important to estimate the pattern by which roadway volume varies by hour. Pattern data are in the form of a percentage of the daily volumes for each hour and was developed by each facility type grouping for Santa Cruz County. The hourly pattern input file in PPSUITE format is prepared based on the traffic volume pattern data from ADOT. The same factors are also used to develop the MOVES hourly fraction file.

Vehicle Type Mix

Emission rates within MOVES vary significantly by the type of vehicle. The MOVES model produces emissions and rates by thirteen MOVES vehicle source types. However, VMT is input to MOVES by six HPMS vehicle groups. Figure 5-5 summarizes the distinction between each classification scheme.

Figure 5-5: MOVES Source Types and HPMS Vehicle Groups

SOURCE TYPES

11	Motorcycle
21	Passenger Car
31	Passenger Truck
32	Light Commercial Truck
41	Intercity Bus
42	Transit Bus
43	School bus
51	Refuse Truck
52	Single Unit Short-haul Truck
53	Single Unit Long-haul Truck
54	Motor Home
61	Combination Short-haul Truck
62	Combination Long-haul Truck

HPMS Class Groups

10	Motorcycle
20	Passenger Car
30	Passenger/Light Truck
40	Buses
50	Single Unit Trucks
60	Combination Trucks

For this case study, vehicle type pattern data are developed for each facility type based on the statewide travel model outputs and internal MOVES defaults. As the first step, travel model data are used to develop percentage splits of the total volume to the following vehicle groups by facility type and time period:

- Autos
- Single Unit Trucks (SUT)
- Multiple Unit Trucks (MUT)

MOVES default VMT by HPMS vehicle type (per MOVES selection, State of Arizona) are then used to split the above vehicle groups (autos, SUT and MUT) into the six HPMS vehicle classes needed by MOVES. Figure 5-6 illustrates how the statewide model traffic is used to develop vehicle type mix. [For this case study exercise, no portion of the SUT category is assumed to be part of the MOVES light commercial truck category. Additional research and examination of the vehicles contained in this category may be necessary to determine the validity of this assumption.]

The daily truck volumes (sum of SUT and MUT) are also provided to PPSUITE to guarantee the truck volumes created by the pattern file and the vehicle mix file match the observed truck volumes specified in the network databases.

Figure 5-6: Vehicle Type Mix Preparation

VMT Data Source		MOVES Source Type Mapping	Calculate Vehile Mix Distribution
AZ Statewide Model	Auto	**Auto by MOVES Source Type** 11_Motorcycle 21_ Passenger Car 31_Passenger Truck 32_Light Commercial Truck	**Auto VMT Mix** Based on MOVES Default VMT Mix (AZ Statewide 2008 Total) Normalized by Auto Grouping [Do not vary by county & road type]
	SUT	**SUT by MOVES Source Type** 42_Transit Bus 43_School Bus 41_Intercity Bus 51_Refuse Truck 52_Single Unit Short-haul Truck 53_Single Unit Long-haul Truck 54_Motor Home	**SUT VMT Mix** Based on MOVES Default VMT Mix (AZ Statewide 2008 Total) Normalized by SUT Grouping [Do not vary by county & road type]
	MUT	**MUT by MOVES Source Type** 61_Combination Short-haul Truck 62_Combination Long-haul Truck	**MUT VMT Mix** Based on MOVES Default VMT Mix (AZ Statewide 2008 Total) Normalized by MUT Grouping [Do not vary by county & road type]

HPMS VMT Adjustments

According to EPA guidance, baseline inventory VMT computed from the regional model must be adjusted to be consistent with HPMS VMT totals. Although it has some limitations, the HPMS system is currently in use in all 50 states and is being improved under FHWA direction. [Adjustment factors are calculated which adjust the 2008 travel model VMT to be consistent with the AADT using reported 2008 HPMS totals for that year.] These factors are applied to facility group combinations within the county. These adjustments are important for accounting for missing local roadway VMT that is not represented within the regional travel model.

Fuel Inputs

The fuel inputs were developed based on local fuel supply and fuel formulation data as prepared by ADOT and ADEQ.

Vehicle Population Inputs

Vehicle population is a key input that has an important impact on start and evaporative emissions. Vehicle population data was developed from state registration data. [For the Nogales NA, the population is estimated by applying a factor to the county population. The factor is calculated by dividing the VMT in Nogales NA by the VMT in Santa Cruz County].

Other Inputs Used Directly from ADOT Sample Files

The following MOVES input files are used directly from ADOT sample files for Santa Cruz County:

- Day VMT Fractions
- Month VMT Fractions
- Meteorology Inputs

5.4.3 MOVES Analysis Process Details

This section describes how PPSUITE and MOVES use input data to produce emission estimates. Figure 5-7 provides a more detailed overview of the PPSUITE analysis.

VMT Preparation

Producing an emissions inventory with PPSUITE requires a process of disaggregation and aggregation. Data are available and used on a very detailed scale – individual roadway segments for each of the 24 hours of the day. These data need to be processed individually to determine the distribution of vehicle hours of travel (VHT) by speed and then aggregated by vehicle class to determine the input VMT to the MOVES emission model. Key steps in the preparation of VMT include:

- *Assemble VMT* – The network databases, prepared from the statewide travel model data as described above, contain the roadway segments, distances and travel volumes needed to estimate VMT. The PPSUITE software processes each segment by simply multiplying the assigned travel volume by the distance to obtain VMT.
- *Disaggregate to Hours* - The traffic volumes are split into each hour of the day. This allows for more accurate speed calculations (effects of congested hours) and allows PPSUITE to prepare the hourly VMT and speeds for input to the MOVES model.
- *Peak Spreading* - After dividing the daily volumes to each hour of the day, PPSUITE identifies hours that are unreasonably congested. For those hours, PPSUITE then spreads a portion of the volume to other hours within the same peak period, thereby approximating the "peak spreading" that normally occurs in such over-capacity conditions. This process also helps prevent the generation of hours with unreasonably congested speeds that may impact emission calculations.
- *Disaggregation to Vehicle Types* - EPA requires VMT estimates to be prepared by the six HPMS vehicle groups, reflecting specific local characteristics. As described previously, the hourly volumes are disaggregated to the thirteen MOVES source types based on data from the travel model and MOVES defaults. The thirteen MOVES source types are then recombined to the six HPMS vehicle classes.
- *Apply HPMS VMT Adjustments* - Volumes must also be adjusted to account for differences with the HPMS VMT totals, as described previously. VMT adjustment factors are provided as inputs to

PPSUITE, and are applied to each of the roadway segment volumes. [The 2008 HPMS adjustment factors developed for the Santa Cruz County are also applied to the Nogales area.]

Speed Estimation

Emissions for many pollutants vary significantly with travel speed. To calculate speeds, PPSUITE first obtains initial capacities (how much volume the roadway can serve before heavy congestion) and free-flow speeds (speeds assuming no congestion) from the speed/capacity lookup data. This data table contains default roadway information indexed by the area and facility type codes. For areas with known characteristics, values can be directly coded to the database and the speed/capacity data can be overridden. The result of this process is an estimated average travel time for each hour of the day for each highway segment. The average time multiplied by the volume produces VHT.

Developing the MOVES Traffic Input Files

The PPSUITE software is responsible for producing the following MOVES input files during any analysis run:

- VMT by HPMS vehicle class
- VHT by speed bin
- Road type distributions
- Hourly VMT fractions
- Ramp fractions

These files are text formatted files with a *.csv extension. The files are provided as inputs within the MOVES County Data Manager (CDM) and are described below:

- *VMT Input File* – VMT is the primary traffic input that affects emission results. The roadway segment distances and traffic volumes are used to prepare estimates of VMT. PPSUITE performs these calculations and outputs the MOVES annual VMT input file to the CDM. The annual VMT is computed by multiplying the travel model AADT by 365 or 366 days in a leap year.

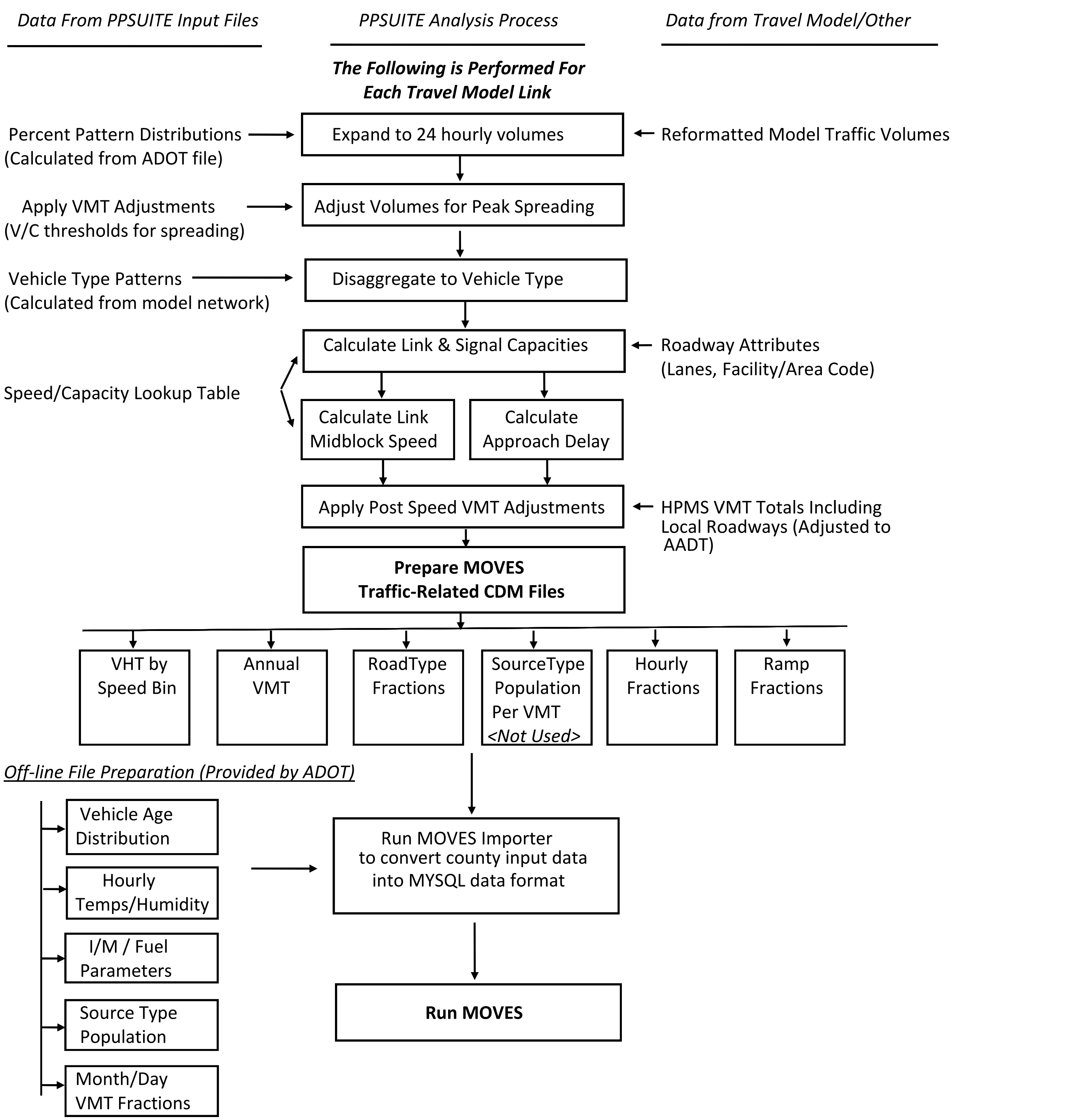
- *VHT by Speed Bin File* – The PPSUITE software prepares the MOVES VHT by speed bin file which summarizes the distribution of speeds across all links into each of the MOVES speed bins for each hour of the day by road type. This robust process ensures that MOVES emission rates are used to the fullest extent and are consistent with the methods and recommendations provided in EPA's technical guidance.

- *Road Type Distributions* – In MOVES, typical drive cycles and associated operating conditions vary by the type of roadway. MOVES defines five different road types as follows:
  1 Off-Network
  2 Rural Restricted Access
  3 Rural Unrestricted Access
  4 Urban Restricted Access
  5 Urban Unrestricted Access

  For this analysis, the MOVES road type distribution file is automatically generated by PPSUITE using defined equivalencies. The off-network road type includes emissions from vehicle starts, extended idle activity, and evaporative emissions. Off-network activity in MOVES is primarily determined by the Source Type Population input.

- *Ramp Fractions* – The Arizona statewide travel model has separate facility classes (urban and rural) for ramps. As a result, PPSUITE assembles ramp VMT for these links and prepares the Ramp Fraction file for input to MOVES.

Figure 5-7: PPSUITE Process and Input Files Integration



<u>*MOVES Runs*</u>

After computing speeds and aggregating VMT and VHT, PPSUITE prepares traffic-related inputs needed to run EPA's MOVES software. Additional required MOVES inputs are prepared external to the processing software and include temperatures, I/M program parameters, fuel characteristics, vehicle fleet age distributions and source type population.

The MOVES county importer is run in batch mode. This program converts all data files into the MYSQL formats used by the MOVES model. At that point a MOVES run specification file (*.mrs) is created which specifies options and key data locations for the run. The MOVES model is then executed in batch mode. A summary of key MOVES run specification settings is shown in Table 5-4Table 5-4. For this analysis, MOVES is applied using the *inventory-based* approach. Under this method, actual VMT and population are provided as inputs to the model; MOVES is responsible for producing the total emissions for the region.

Table 5-4: MOVES Run Specification File Parameter Settings

Parameter	Setting
MOVES Default Database Version	[8/26/2010 or 4/10/2012]
Scale	COUNTY
Analysis Mode	Inventory
Time Span	Annual Runs: 12 months, Weekday and Weekend, 24 hours July Weekday Runs: July month, Weekday, 24 hours
Time Aggregation	Hour
Geographic Selection	[Santa Cruz County / Nogales]
Vehicle Selection	All source types Gasoline, Diesel, CNG
Road Type	All road types including off-network
Pollutants and Processes	[All $PM_{2.5}$ and PM_{10} categories, NOx]
General Output	Units: Emission = grams; Distance = miles; Time = hours; Energy = Million BTU
Output Emissions	Time = Month, Emissions by Process ID, Source Type, and Road Type

5.4.4 *Fugitive Dust Analyses*

The arid conditions and soil composition in many areas of Arizona make fugitive dust a major contributor to regional PM_{10} and, to a lesser extent, $PM_{2.5}$ levels. Fugitive dust was determined through interagency consultation to be a significant factor in the [Nogales PM_{10} SIP], requiring that re-entrained road dust from paved roads, unpaved roads and fugitive dust from roadway construction activities be considered in subsequent air quality planning efforts.

The methods used to calculate fugitive dust emissions are consistent with the MVEB methodologies contained in the SIP and with EPA's AP-42 methodologies.

Paved Roadway Emissions

Paved roadway fugitive dust emissions were calculated using the MOVES-based VMT estimates documented in this analysis and the following methodology and assumptions,[consistent with the Nogales NA SIP]:

Emissions Factor is $E = [k\ (sL)^{0.91} \times (W)^{1.02}]\ (1 - P/4N)$
Annual Emissions Reduction = Roadway VMT_{Annual} * E

Where:
E = Annual or other long-term average emission factor in the same units as k,
k = Particle size multiplier for particle size range and units of interest

- PM_{10}: 1.0 g/VMT,
- $PM_{2.5}$: 0.25 g/VMT

sL = Road surface silt loading [(0.105 g/m^2 ADEQ Nogales PM_{10} SIP)]
W = Average weight (tons) of the vehicles traveling the road (3 tons)
P = Number of "wet" days with at least 0.254 mm (0.01 in) of precipitation during the averaging period
For precipitation a value of 60 days/365 days per year is the value presented in the AP-42 references for the region containing [Nogales]; ADEQ used 45 days in nonattainment plan (conservative).
N = Number of days in the averaging period (e.g., 365 for annual)

Emissions Factor
$E = [k\ (sL)^{0.91} \times (W)^{1.02}]\ (1 - P/4N)$
$E = [1(0.105)^{0.91} \times (3)^{1.02}](1-(45)/(4 \times 365)$
E = 0.38225 g/VMT

Unpaved Roadways

The main contributor to the fugitive dust inventory was re-entrained dust from unpaved roads. Unpaved road emission factors were calculated for a range of possible surface material silt contents within the [Nogales NA] using a low surface material silt content value of 2.90 percent and a high surface material silt content value of 7.50 percent per EPA recommendation.

Unpaved roadway fugitive dust emissions were calculated using the MOVES-based VMT estimates documented in this analysis and the following methodology and assumptions, consistent with the [Nogales NA] SIP:

Emission factor is $E = ([k(s/12)^a(S/30)^d] / [(M/0.5)^c]) -C$

Where:
E = PM_{10} emission factor (lb/VMT) = 0.248 lb/VMT (low value) & 0.642 lb/VMT (high value)
k = Empirical Constant = 1.8 lb/VMT (EPA AP-42 Chapter 13.2.2, 2006)
s = surface material silt content (%) = 2.90 % and 7.50 % (recommended by EPA and based on the Mexican NEI – 2004 and the Mexicali Emission Inventory - 2005).
M = Surface material moisture content (%) = 5.23 % (No reliable surface soil moisture measurements are known for the area. Therefore, the average 2 inch depth soil moisture from Walnut Gulch, AZ NRCS Site

2026 for the year of 2008 of 4.30% was adjusted for [Nogales, AZ] based on the average annual difference in rainfall between the two locations of 21.5% [Balling, 1988])

S = Mean vehicle speed (mph) = 25 mph (Based on the typical unpaved road speed limit in Arizona)

a = Empirical Constant = 1 (EPA AP-42 Chapter 13.2.2, 2006)

c = Empirical Constant = 0.2 (EPA AP-42 Chapter 13.2.2, 2006)

d = Empirical Constant = 0.5 (EPA AP-42 Chapter 13.2.2, 2006)

C = 0.00047 lb/VMT (EPA AP-42 Chapter 13.2.2, 2006)

This emission factor is then corrected to only account for non-rainy days:

$E_{est} = E[(365-P)/365]$

Where:

E_{est} = Annual size-specific emission factor extrapolated for natural mitigation (lb/VMT) = 0.217 lb/VMT (low value) & 0.563 lb/VMT (high value)

E = The unadjusted emission factor = 0.248 lb/VMT (low value) & 0.642 lb/VMT (high value)

P = Number of days in a year with at least 0.254 mm (0.01 in) of precipitation = 45 days (EPA AP-42 Figure 13.2.2-1., 2006)

E_{low} = VMT* E_{est} / 2000 lb/ton

E_{high} = VMT* E_{est} / 2000 lb/ton

[*Road Construction*

Based on documentation in the SIP and the current TIP, there have been no substantial road construction projects in the Nogales NA in the last five years and no projects are planned for the next five years; therefore, estimates for this category represent a conservative worst-case scenario, not actual emissions. This methodology was determined appropriate through interagency consultation.]

5.4.5 Transportation Control Measures

[There is one transportation control measure in the SIP:

- Pave or Chemically Stabilize Unpaved Roads; Pave, Vegetate or Chemically Stabilize Access Point Where Unpaved Traffic Surfaces Adjoin Paved Roads

The TCM is continuing to be implemented in a timely manner and none of the projects in the TIP or LRTP interfere with the implementation of the TCM.

Paving of unpaved roadways is the single most effective control measure available to reduce re-entrained road dust. The emissions reductions resulting from the implementation of this TCM were calculated using the following methodology and assumptions, consistent with the Nogales NA SIP:

Daily Emission Reductions = (BEF – AEF) * Miles * 0.93 * ADT * 1 /1000 (Kg/day)

Where:

BEF = The PM10 emission factor for vehicles traveling on unpaved roads or alleys

AEF = The PM10 emission factor for vehicles traveling on paved roads

Miles = The length of the project (in centerline miles)
ADT = The average weekday traffic on the unpaved road or alley
0.93 = The factor to convert from weekday to annual average daily traffic on arterials.
0.25 = The factor to convert from PM_{10} to $PM_{2.5}$.

5.5 Conformity Analysis Results

A transportation conformity analysis of the current TIP and LRTP has been completed for the [Nogales NA]. The analyses were performed according to the requirements of the federal transportation conformity rule 40 CFR Part 93, Subpart A. The PM_{10} analysis was performed in accordance with 40 CFR 93.118 (Criteria and procedures: Motor vehicle emissions budget). The $PM_{2.5}$ analysis was conducted pursuant to 40 CFR 93.119 (Criteria and procedures: Interim emissions in areas without motor vehicle budgets). The analysis utilized the methodologies, assumptions and data as presented in previous sections. Interagency consultation has been used to determine applicable emission models, analysis years and emission tests.

5.5.1 Emission Tests

[The PM_{10} conformity analysis was conducted to evaluate emissions in comparison to the applicable MVEBs summarized in Table 5-5. The budgets were established using the MOVES emission model.]

Table 5-5: [2011] Nogales Nonattainment Area PM_{10} Motor Vehicle Emissions Budgets

Sector	PM_{10} Tons per Year (tpy)
Dust – Unpaved Road Dust	864.9
Dust – Paved Road Dust	121.4
Dust – Road Construction	26.0
Mobile – Gasoline and Diesel (Including Exhaust, Brake and Tire Wear)	21.0
2011 MVEB	1274.3

[There are currently no approved SIP budgets for the Nogales 24-hour $PM_{2.5}$ NA. Until budgets are developed by ADEQ and found adequate by EPA, the area must continue to demonstrate conformity to the interim emission test (§93.119). Per the interagency consultation process, the interim emission test has been defined as: the "no-greater-than 2008" test. The analysis has been conducted for direct $PM_{2.5}$ emissions (exhaust and brake/tire wear), the precursor NO_x and re-entrained road dust (paved and unpaved road dust).]

5.5.2 Analysis Years

EPA regulations, as outlined in Sections §93.118(c) and §93.119(g) of the Final Transportation Conformity Rule, require that emissions analyses be conducted for specific analysis years as follows:

- Each year for which the applicable implementation plan specifically establishes a MVEB(s)
- A near-term year, one to five years in the future (applicable in areas without budgets).
- The last year of the LRTP's forecast period.
- Attainment year of the standard if within timeframe of TIP and LRTP.
- An intermediate year or years such that analysis years are no more than ten years apart.

All analysis years were determined through the interagency consultation process. Table 5-6 provides the analysis years used for this conformity analysis.

Table 5-6: Transportation Conformity Analysis Years

Analysis Year	Description	Applicable To 24-Hour PM_{10}	Applicable To 24-Hour $PM_{2.5}$
[2008]	Base Year for Interim Conformity Test	[Yes/No]	[Yes/No]
[2011]	Near-Term Analysis Year/ Proposed Budget Year	[Yes/No]	[Yes/No]
[Year]	Interim Year/ Proposed Budget Year	[Yes/No]	[Yes/No]
[Year]	Interim Year	[Yes/No]	[Yes/No]
[Year]	Last Year of LRTP	[Yes/No]	[Yes/No]

5.5.3 *Regionally Significant Highway Projects*

For the purpose of conformity analysis, model highway networks are created for each analysis year. For the horizon years, regionally significant projects from the LRTP were coded onto the networks. Detailed assessments were only performed for those new projects which may have a significant effect on emissions in accordance with 40 CFR Parts 51 and 93. Essentially, only those projects which would increase capacity or significantly impact vehicular speeds were considered. Projects such as bridge replacements and roadway restoration projects, which constitute the majority of the TIP and LRTP list, have been excluded from consideration since they are not expected to significantly alter the volume or speed of traffic. A list of highway projects is shown in **Attachment A**. [There are no air quality significant transit TIP/LRTP projects in the region.]

5.5.4 *Analysis Results*

An emissions analysis has been completed for the [2006 24-Hour PM_{10} and $PM_{2.5}$ NAAQS]. The results of the analysis are summarized in the tables below. A detailed emission summary is also provided in **Attachment B**. A summary of MOVES input parameters is provided in **Attachment C**. Example MOVES importer (XML) and run specification (MRS) files are provided in **Attachment D**.

[Table 5-7 summarizes the PM_{10} emission results for a summer weekday in each analysis year. The summer weekday was converted to an annual value by multiplying by 315.38 days/year to match the annual budgets in the SIP. The [Year], [Year], [Year] and [Year] analysis years are compared to the [2011] and [Year] budgets. The table illustrates that all years satisfy the conformity PM budget test.]

Table 5-8 summarizes the 24-hour $PM_{2.5}$, NOx, and road dust emissions for summer weekday conditions. Emissions are compared against a 2008 baseline estimate. The table illustrates that all future analysis year emissions are below the 2008 baseline.]

Table 5-7: 24-Hour PM_{10} Emission Analysis Results and Conformity Test
(July Weekday Converted to Tons per Year to Match SIP MVEBs)

Pollutant	2011 MVEB (tons/year)	[2008 Example] (tons/year)	[Year] (tons/year)	[Year] (tons/year)	[Year] (tons/year)
Dust – Unpaved Road Dust	864.9	891.39	X.XX	X.XX	X.XX
Dust – Paved Road Dust	121.4	131.91	X.XX	X.XX	X.XX
Dust – Road Construction	267.0	267.00	X.XX	X.XX	X.XX
Mobile Gasoline & Diesel (Exhaust Brake and Tire Wear)	21.0	27.96	X.XX	X.XX	X.XX
2011 MVEB	1274.3	1318.26	X.XX	X.XX	X.XX
TCM Emissions Benefits (Paving Unpaved Roads)		-51.76			
Conformity Result		Pass	Pass/Fail	Pass/Fail	Pass/Fail

Table 5-8: 24-Hour $PM_{2.5}$ Emission Analysis Results and Conformity Test
(July Weekday)

Pollutant	2008 BASELINE (tons/day)	[Year] (tons/day)	[Year] (tons/day)	[Year] (tons/day)	[Year] (tons/day)
Dust – Unpaved Road Dust	0.71	X.XX	X.XX	X.XX	X.XX
Dust – Paved Road Dust	0.11	X.XX	X.XX	X.XX	X.XX
Mobile $PM_{2.5}$	0.08	X.XX	X.XX	X.XX	X.XX
Mobile NO_x	3.39	X.XX	X.XX	X.XX	X.XX
Conformity Result		Pass/Fail	Pass/Fail	Pass/Fail	Pass/Fail

5.6 Conformity Determination

Financial Constraint

The federal planning regulations, Sections 450.322(b)(11) and 450.324(e), require the transportation program and plan to be financially constrained while the existing transportation system is being adequately operated and maintained. Only projects for which construction and operating funds are reasonably expected to be available are included. ADOT, in conjunction with [SEAGO], ADEQ, FHWA and FTA, has developed an estimate of the cost to maintain and operate existing roads and bridges in the [Nogales NA] and has compared that with the estimated revenues and maintenance needs of the new roads over the same period. The TIP and LRTP have been determined to be financially constrained.

Public Participation

The TIP and LRTP have undergone the public participation requirements and the comment and response requirements set forth in the Final Conformity Rule, the Final Statewide/Metropolitan Planning Rule, and

Arizona's Conformity SIP. The draft document was made available for [30-days of public review and comment] beginning on [Date].

Conformity Statement
Based on the quantitative assessment of the [SEAGO] TIP and ADOT LRTP for the [Nogales NA], it has been determined that the project elements and programmatic strategies of the TIP and LRTP conform to the [Nogales PM_{10} SIP and the $PM_{2.5}$ interim emissions test (emissions are below the 2008 baseline)].

5.7 Resources

MOVES Model
Modeling Page within EPA's Office of Mobile Sources Website contains a downloadable model, MOVES users guide and other information. (http://www.epa.gov/omswww/models.htm)

Policy Guidance on the Use of MOVES2010 and Subsequent Minor Revisions for SIP Development, Transportation Conformity, and Other Purposes, US EPA Office of Air and Radiation, EPA-420-B-12-010, April 2012.

Using MOVES to prepare Emission Inventories in State Implementation Plans and Transportation Conformity: Technical Guidance for MOVES2010, 2010a and 2010b. US EPA Office of Air and Radiation, and Office of Transportation and Air Quality, EPA-420-B-12-028, April 2012.

Motor Vehicle Emission Simulator, User Guide for MOVES2010a, EPA-420-B-10-036, August 2010.

Motor Vehicle Emission Simulator, User Guide Version, MOVES2010b, EPA-420-B-12-001, March 2012.

Traffic Engineering
Highway Capacity Manual, Transportation Research Board, presents current knowledge and techniques for analyzing the transportation system.

5.8 Glossary and Definitions

AADT: Average Annual Daily Traffic, average of ALL days.

Air Quality Concern: PM hot-spot analyses are required for projects "of local air quality concern," which include certain highway and transit projects that involve significant levels of diesel vehicle traffic and any other project identified in a PM SIP as a localized air quality concern. PM hot-spot analyses are not required for projects that are not of local air quality concern. Section 93.123 of the conformity rule contains further guidance on determining whether a project is of local air quality concern.

Attainment Area: An area considered to have air quality that meets or exceeds the EPA national ambient air quality standards, which EPA establishes according to the requirements of the Clean Air Act. An area may be an attainment area for one pollutant and a nonattainment area for others. Nonattainment areas are areas designated by EPA as not meeting a standard for a pollutant.

Carbon Monoxide (CO): A colorless, odorless, tasteless gas formed in large part by incomplete combustion of fuel. Human activities (e.g., transportation or industrial processes) are largely the source for CO contamination in ambient air.

Clean Air Act (CAA): Clean Air Act as amended in 1990.

CARB: California Air Resources Board.

CFR: Code of Federal Regulations.

CDM: County Data Manager. User interface developed to simplify importing specific local data for a single county or a user-defined custom domain without requiring direct interaction with the underlying MySQL database.

Congestion Mitigation and Air Quality Improvement Program (CMAQ): A categorical funding program under the Federal-aid Highway Program. Directs funding to projects that contribute to meeting or maintaining NAAQS in nonattainment and maintenance areas.

Emissions Inventory: A complete list of sources and amounts of pollutant emissions within a specific area and time interval.

Emission rate or factor: Expresses the amount of pollution emitted per unit of activity. For highway vehicles, usually in grams of pollutant emitted per mile driven.

EPA: Environmental Protection Agency. The Federal regulatory agency responsible for administering and the enforcement of Federal environmental laws including the Clean Air Act.

FC: Functional code, applied in data management to road segments to identify their type (freeway, local, etc.).

FHWA: Federal Highway Administration. An agency of the U.S. Department of Transportation that provides financial and technical support for constructing, improving, and preserving the highway system.

Final Rule: Current conformity guidance under the CAA.

FR: Federal Register.

FTA: Federal Transit Administration. An agency of the U.S. Department of Transportation that provides stewardship of combined formula and discretionary programs to support a variety of locally planned, constructed, and operated public transportation systems.

Growth factor: Factor used to convert volumes to future years.

Highway: A term that applies to roads, streets, and parkways, and also includes rights-of-way, bridges, railroad crossings, tunnels, drainage structures, signs, guardrails, and protective structures in connection with highways.

Hot-Spot Analysis: An estimation of likely or future localized CO and/or PM pollutant concentrations and a comparison of those concentrations to the NAAQS. Hot-spot analyses asses impacts on a scale smaller than the entire nonattainment or maintenance area, including, for example, congested roadway intersections and highways or transit terminals, and uses an air quality dispersion model to determine the effects of emissions on air quality.

HPMS: Highway Performance Monitoring System.

I/M: Vehicle emissions inspection/maintenance programs ensure that vehicle emission controls are in good working order throughout the life of the vehicle. The programs require vehicles to be tested for emissions. Most vehicles that do not pass must be repaired.

Isolated Rural Area: Areas that do not contain or are not part of any metropolitan planning area as designed under the transportation planning regulations. Isolated rural areas do not have federally required metropolitan transportation plans or TIPs and do not have projects that are part of the emissions analysis of any MPO's metropolitan transportation plan or TIP. Projects in such areas are instead included in statewide transportation improvement programs. These areas are not donut areas.

Land Use: Refers to the manner in which portions of land or the structures on them are used (i.e., commercial, residential, retail, industrial, etc.).

Lapse: A lapse means that the conformity determination(s) for a metropolitan transportation plan or TIP has expired, and thus there is no currently conforming metropolitan transportation plan or TIP.

Level of Service (LOS): This term refers to a standard measurement used by transportation officials which reflects the relative ease of traffic flow on a scale of A to F, with free-flow being rated LOS-A and congested conditions rated as LOS-F.

Maintenance Area: Any region previously designated nonattainment pursuant to the CAA Amendments of 1990 and subsequently redesignated to attainment subject to the requirement to develop a maintenance plan under section 175A of the CAA, as amended.

Metropolitan Planning Organization (MPO): The policy board of an organization created and designated to carry out the metropolitan transportation planning process.

Metropolitan Transportation Plan/TIP Amendment: A revision to a metropolitan transportation plan or TIP that involves a major change to a project included in a metropolitan transportation plan or TIP including the addition or deletion of a project or a major change in project cost, project/project phase initiation dates, or a major change in design concept or design scope (e.g., changing project termini or the number of through traffic lanes). Changes to projects that are included only for illustrative purposes do not require an amendment. An amendment is a revision that requires public review and comment, redemonstration of fiscal constraint, or a conformity determination (for those involving "non-exempt" projects in nonattainment and maintenance areas).

Metropolitan Transportation Plan/TIP Update: Making current a metropolitan transportation plan or TIP through a comprehensive review. Updates require public review and comment, a 20-year horizon year for the metropolitan transportation plan, a four-year program period for TIPs, demonstration of fiscal constraint, and a conformity determination (in nonattainment and maintenance areas).

Metropolitan Transportation Plan: The official multimodal metropolitan transportation plan addressing no less than a 20-year planning horizon that is developed, adopted, and updated by the MPO through the metropolitan transportation planning process.

Mobile Sources: Mobile sources include motor vehicles, aircraft, seagoing vessels, and other transportation modes. The mobile source related pollutants are carbon monoxide (CO), hydrocarbons (HC) or volatile organic compounds (VOCs), nitrogen oxides (NOx), and particulate matter (PM_{10} and $PM_{2.5}$).

Mode: A form of transportation such as an automobile, bus or bicycle.

Motor Vehicle Emissions Budget (MVEB): That portion of the total allowable emissions defined in the submitted or approved control strategy implementation plan revision or maintenance plan for a certain date for the purpose of meeting reasonable further progress milestones or demonstrating attainment or maintenance of the NAAQS, for any criteria pollutant or its precursors, allocated to highway and transit vehicle use and emissions.

MOVES: The latest model EPA has developed to estimate emissions from highway vehicles.

National Ambient Air Quality Standards (NAAQS): Those standards established pursuant to section 109 of the CAA. Conformity applies in areas that are nonattainment or maintenance for one or more of the NAAQS of the transportation-related pollutants: ozone, carbon monoxide, nitrogen dioxide, and particulate matter ($PM_{2.5}$ and PM_{10}).

National Environmental Policy Act (NEPA): The National Environmental Policy Act of 1969, as amended (42 U.S.C. 4321 et seq.). It is the major legislation that requires Federal actions to address potential environmental impacts.

Nitrogen Oxides (NOx): A group of highly reactive gases that contain nitrogen and oxygen in varying amounts. Many of the nitrogen oxides are colorless and odorless. NOx is formed when the oxygen and nitrogen in the air react with each other during combustion. The primary sources of nitrogen oxides are motor vehicles, electric utilities, and other industrial, commercial, and residential sources that burn fuels.

Nonattainment Area: A geographic region of the United States that the EPA has designated as not meeting the NAAQS.

Ozone (O_3): Ozone is a pollutant that is not directly emitted from transportation sources. It is a secondary pollutant formed when hydrocarbons and NOx combine in the presence of sunlight. Ozone is associated with smog or haze conditions. Although the ozone in the upper atmosphere protects us from harmful ultraviolet rays, ground-level ozone produces an unhealthy environment in which to live. Ozone is created by human and natural sources.

Particulate Matter (PM), (PM_{10}), ($PM_{2.5}$): Any material that exists as solid or liquid in the atmosphere. Particulate matter may be in the form of fly ash, soot, dust, fog, fumes, etc. Particulate matter can be of such a small size that it cannot be filtered by the nose and lungs. PM_{10} is particulate matter that is less than 10 microns in size. $PM_{2.5}$ is particulate matter that is less than 2.5 microns in size. A micron is one millionth of a meter.

Pattern data: Extrapolations of traffic patterns (such as how traffic volume on road segment types varies by time of day, or what kinds of vehicles tend to use a road segment type) from segments with observed data to similar segments.

Public Participation: The active and meaningful involvement of the public in the development of state/metropolitan transportation plans and programs.

Public Transportation: Generally refers to passenger service provided to the general public along established routes with fixed or variable schedules at published fares. Related terms include: public transit, mass transit, public transportation, urban transit and paratransit.

Regionally Significant Project: A transportation project (other than an exempt project) that is on a facility which serves regional transportation needs (such as access to and from the area outside of the region, major activity centers in the region, major planned developments such as new retail malls, sports complexes, etc., or transportation terminals as well as most terminals themselves) and would normally be included in the modeling of a metropolitan area's transportation network, including at a minimum all principal arterial highways and all fixed guideway transit facilities that offer an alternative to regional highway travel.

PPSUITE: Post-Processor for Air Quality, a set of programs that estimates speeds and processes MOBILE emission rates.

Road Type: Functional code, applied in data management to road segments to identify their type (rural/urban highways, rural/urban arterials, etc.).

Source Type: One of thirteen vehicle types used in MOVES modeling.

State Implementation Plan (SIP): A SIP is the State air quality plan for meeting the NAAQS. It is a compilation of legally enforceable rules and regulations prepared by a State or local air quality agency and submitted by the State's governor to EPA for approval. A SIP is designed to achieve better air quality by attaining, making progress toward attaining, or maintaining the NAAQS.

Transportation Conformity: Process to assess the compliance of any transportation plan, program, or project with air quality implementation plans. The conformity process is defined by the Clean Air Act and regulated by the conformity rule.

Transportation Control Measures (TCMS): Any measure that is specifically identified and committed to in the applicable implementation plan, including a substitute or additional TCM that is incorporated into the applicable SIP through the process established in the CAA section 176(c)(8), that is either one of the types listed in section 108 of the CAA, or any other measure for the purpose of reducing emissions or concentrations of air pollutants from transportation sources by reducing vehicle use or changing traffic flow or congestion conditions. Notwithstanding the first sentence of this definition, vehicle technology-based, fuel-based, and maintenance-based measures which control the emissions from vehicles under fixed traffic conditions are not TCMs for the purposes of transportation conformity.

Transportation Improvement Program (TIP): A prioritized listing/program of transportation projects covering a period of four years that is developed and formally adopted by an MPO as part of the metropolitan transportation planning process, consistent with the metropolitan transportation plan, and required for projects to be eligible for funding under Title 23 USC and Title 49 USC Chapter 53.

U.S. Department of Transportation (DOT): The principal, direct, Federal funding agency for transportation facilities and programs. Includes the Federal Highway Administration, the Federal Transit Administration, the Federal Railroad Administration (FRA), and others.

Urbanized Area: An urbanized: area is a statistical geographic entity designated by the Census Bureau, consisting of a central core and adjacent densely settled territory that together contain at least 50,000 people, generally with an overall population density of at least 1,000 people per square mile.

VHT: Vehicle hours traveled.

VMT: Vehicle miles traveled. In modeling terms, it is the simulated traffic volumes multiplied by the link length.

Volatile Organic Compounds (VOCs): VOCs come from vehicle exhaust, paint thinners, solvents, and other petroleum-based products. A number of exhaust VOCs are also toxic, with the potential to cause cancer.

ATTACHMENT A

Project List

The following TIP/LRTP air quality significant highway projects are included in this analysis:

[Insert Project List]

ATTACHMENT B

Detailed Emission Results

Detailed On-Road Emission Results for 24-hour Analysis [Sample]

Road Type	Vehicle Mile of Travel (VMT)	Source Type Population (VPOP)	Vehicle Hours of Travel (VHT)	Average Speed (mph)	PM2.5 Emissions (tons/day)	PM10 Emissions (tons/day)	NOX Emissions (tons/day)
	2008 Summer Day						
Off-Road	-		-	-	0.012	0.013	0.79
Rural Restricted Access	46,794		632	74.0	0.004	0.005	0.16
Rural UnRestricted Access	98,275		1,900	51.7	0.005	0.006	0.21
Urban Restricted Access	200,586		2,980	67.3	0.021	0.023	0.75
Urban UnRestricted Access	659,130		19,490	33.8	0.039	0.055	1.48
Off Network Emission Benefits	-		-	-	0.000	0.000	0.00
TOTAL	***1,004,785***	***59,314***	***25,002***	***40.2***	***0.081***	***0.102***	***3.39***

Detailed On-Road Emission Results for Annual Analysis [Sample]

Road Type	Vehicle Mile of Travel (VMT)	Source Type Population (VPOP)	Vehicle Hours of Travel (VHT)	Average Speed (mph)	PM2.5 Emissions (tons/year	PM10 Emissions (tons/year)	NOX Emissions (tons/year)
	2008 Annual						
Off-Road							
Rural Restricted Access	14,757,736		199,359	74.0	1.34	1.47	51.79
Rural UnRestricted Access	30,994,063		599,122	51.7	1.48	1.85	66.83
Urban Restricted Access	63,260,886		939,833	67.3	6.67	7.35	236.21
Urban UnRestricted Access	207,876,504		6,146,904	33.8	12.23	17.29	466.02
Off Network Emission Benefits	-			-	-	-	-
TOTAL	***316,886,804***	***59,314***	***7,885,217***	***40.2***	***21.72***	***27.96***	***820.85***

Detailed Paved Road Baseline Emission Results [Sample]

Particle Size Multiplier (k)	Road Surface Silt Loading (sL) (g/m^2)	Average Weight of Vehicles (W)	Number of Wet Days (P)	Number of Days in Averaging	$PM_{2.5}/PM_{10}$ Ratio
0.0022	0.105	3	45	365	0.25

Emissions Factor Calculation $E = [\, k\,(sL)^{0.91} \times (W)^{1.02}\,]\,(1 - P/4N)$

PM_{10} Emission Factor (E_{ext}) (lbs/VMT)	$PM_{2.5}$ Emission Factor (E_{ext}) (lbs/VMT)	lb to grams Conversion Factor	PM_{10} Emission Factor (E_{ext}) (g/VMT)	$PM_{2.5}$ Emission Factor (E_{ext}) (g/VMT)
0.000841	0.000210	453.592	0.381450	0.095362

Annual PM_{10} Re-entrained Dust Emissions: Roadway $VMT_{Annual} \times E_{ext}$

Road Name	$RoadwayVMT_{Annual}$	x	Emissions Factor (E_{ext}) (g/VMT)	=	Annual Emissions (kg/year)	Annual Emissions (tons/year)
Road 1	313,717,936	x	0.3814500	=	119,667.70	131.91

Annual $PM_{2.5}$ Re-entrained Dust Emissions: Roadway $VMT_{Annual} \times E_{ext}$

Road Name	$RoadwayVMT_{Annual}$	x	Emissions Factor (E_{ext}) (g/VMT)	=	Annual Emissions (kg/year)	Annual Emissions (tons/year)
Road 1	313,717,936	x	0.0954	=	29,916.92	32.98

Emissions Factor is $E = [\, k\,(sL)^{0.91} \times (W)^{1.02}\,]\,(1 - P/4N)$

Annual Emissions Reduction = Roadway VMT_{Annual} * E

Where:

E	=	Annual or other long-term average emission factor in the same units as k
k	=	particle size multiplier for particle size range and units of interest = 0.0022 lbs/VMT (Table 13.2.1-1 from AP-
sL	=	Road surface silt loading – 0.105 g/m2 ADEQ Nogales PM_{10} SIP
W	=	Average weight (tons) of the vehicles traveling the road – 3 tons
P	=	Number of "wet" days with at least 0.254 mm (0.01 in) of precipitation during the averaging period. For precipitation a value of 60 days/365 days per year is the value presented in the AP-42 references for the region containing Nogales, ADEQ used 45 days in nonattainment plan.
N	=	Number of days in the averaging period (e.g., 365 for annual)

Detailed Unpaved Road Baseline Emission Results [Sample]

	% Road Surface Silt Loading (s)	% Road Surface Moisture Content(M)	Mean Vehicle Speed (MPH)	Number of Wet Days (P) (>=0.254mm)	Number of Days in Averaging Period	$PM_{2.5}/PM_{10}$ Ratio
Low Estimate	2.9	5.23	25	45	365	0.25
High Estimate	7.5	5.23	25	45	365	0.25

	Empirical Constant (k) (lb/VMT)	Empirical Constant (a)	Empirical Constant (c)	Empirical Constant (d)	Empirical Constant (C) lb/VMT
	1.8	1	0.2	0.5	0.00047
	1.8	1	0.2	0.5	0.00047

PM_{10} Emissions Factor Calculation

	Unadjusted Emissions Factor (E) lb/VMT	Number of Wet Days (P) (>=0.254mm)	PM_{10} Adjusted Emissions Factor (E_{est}) lb/VMT	lb to grams Conversion Factor	PM_{10} Adjusted Emissions Factor (E_{est}) g/VMT
Low Estimate	0.248	45	0.21728	453.592	98.558
High Estimate	0.642	45	0.56259	453.592	255.188

Annual PM_{10} Emissions: Roadway VMT_{Annual} x E_{ext}

Road Name	$RoadwayVMT_{Annual}$	x	PM_{10} Emissions Factor (E_{ext})	=	Annual Emissions (kg/year)	Annual Emissions (tons/year)
Low Estimate	3,168,868	x	98.558	=	312,317.37	344.27
High Estimate	3,168,868	x	255.188	=	808,656.80	891.39

Annual $PM_{2.5}$ Emissions: Roadway VMT_{Annual} x E_{ext}

Road Name	$RoadwayVMT_{Annual}$	x	$PM_{2.5}$ Emissions Factor (E_{ext})	=	Annual Emissions (kg/year)	Annual Emissions (tons/year)
Low Estimate	3,168,868	x	24.640	=	78,079.34	86.07
High Estimate	3,168,868	x	63.797	=	202,164.20	222.85

Emissions Factor = $([k(s/12)^a(S/30)^d] / [(M/0.5)^c]) - C$

Where:

E	=	the unadjusted emission factor (lb/VMT)
E_{est}	=	annual size-specific emission factor extrapolated for natural mitigation (lb/VMT)
s	=	surface material silt content (%) = 2.90 % and 7.50 % (recommended by EPA and based on the Mexican NEI – 2004 and the Mexicali Emission Inventory - 2005).
M	=	surface material moisture content (%) = 5.23 % (No reliable surface soil moisture measurements are known for the area. Therefore, the average 2 inch depth soil moisture from Walnut Gulch, AZ NRCS Site # 2026 for the year of 2008 of 4.30% was adjusted for Nogales, AZ based on the average annual difference in rainfall between the two locations of 21.5% [Balling, 1988])
S	=	mean vehicle speed (mph) = 25 mph (Based on the typical unpaved road speed limit in Arizona)
k	=	Empirical Constant = 1.8 lb/VMT (EPA AP-42 Chapter 13.2.2, 2006)
a	=	Empirical Constant = 1 (EPA AP-42 Chapter 13.2.2, 2006)
c	=	Empirical Constant = 0.2 (EPA AP-42 Chapter 13.2.2, 2006)
d	=	Empirical Constant = 0.5 (EPA AP-42 Chapter 13.2.2, 2006)
C	=	0.00047 lb/VMT (EPA AP-42 Chapter 13.2.2, 2006)
P	=	number of days in a year with at least 0.254 mm (0.01 in) of precipitation = 45

Detailed TCM Calculations: Paving Unpaved Roads or Alleys [Sample]

Difference in Emissions Factors

Emissions Factor Paved (AEF) (g/mile)	-	Emissions Factor Unpaved (BEF) (g/mile)	=	Difference in Emissions Factors (g/mile)
0.382251788	-	255	=	-254.6177482

Daily Emissions Reductions = (BEF – AEF) x Miles x 0.93 x ADT x 1 /1000 (Kg/day)

Road Name	Difference in Emissions Factors (g/mile)	x	Length of Segment (miles)	x	Average Daily Traffic	=	PM_{10} Emissions Reductions (kg/day)
Road 1	-254.6177482	x	6	x	100	=	-142.08

Annual PM_{10} Emissions Reductions

Total Daily Emissions Reductions (kg/day)	x	Number of Days per Year (days/year)	=	Annual Emissions Reductions (kg/year)	Annual Emissions Reductions (tons/year)
-142.08	x	365	=	-51,858.00	-57.16

Annual $PM_{2.5}$ Emissions Reductions

Total Daily Emissions Reductions (kg/day)	x	Number of Days per Year (days/year)	=	Annual Emissions Reductions (kg/year)	Annual Emissions Reductions (tons/year)
-35.52	x	365	=	-12,964.50	-14.29

For Paving Unpaved Roads or Alleys:
Daily Emission Reductions = (BEF – AEF) * Miles * 0.93 * ADT * 1 /1000 (Kg/day)

Where:

BEF	=	The PM_{10} emission factor for vehicles traveling on unpaved roads or alleys
AEF	=	The PM_{10} emission factor for vehicles traveling on paved roads
Miles	=	The length of the project (in centerline miles)
ADT	=	The average weekday traffic on the unpaved road or alley
0.93	=	The factor to convert from weekday to annual average daily traffic on arterials.
0.25	=	Ratio of $PM_{2.5}/PM_{10}$

ATTACHMENT C

Air Quality Interagency Consultation and Data Checklist

Air Quality Conformity Analysis: Interagency Consultation Conference Call
Meeting Minutes
[Date Time]

[Insert Interagency Consultation Group Meeting Minutes]

Attendees:

- XXX
- XXX
- XXX
- XXX
- XXX
- XXX
- XXX
- XXX

Meeting Minutes / Discussion Points:

- XXXXXX

Air Quality Data Checklist Summary [Sample]

Data Item	Inputs Assumptions
MOVES RunSpec	
Scale/Calculation Type	County Scale Inventory Run
Analysis County	Santa Cruz County (FIPS:4023)
Analysis Year	2008
Analysis Days/Months	July Weekday Annual (Convert July weekday results to annual values by multiplying by 315.38 days/year)
Pollutants	PM2.5, PM10, NOx
Stage II Refueling Emissions	Not Included
Fuel Types	Gasoline, Diesel, CNG
Traffic Data	
Highway Network	Use 2008 statewide travel model data provided by ADOT. Data are reformatted and additional fields are added to prepare PPSUITE-ready network databases.
County HPMS VMT Adjustments	Calculate AADT HPMS adjustments for 2008 to ensure VMT is consistent with reported 2008 HPMS total.
Seasonal Adjustments	Seasonal adjustments are not applied to model traffic volume. (Use MOVES day/month VMT fractions in MOVES run for seasonal adjustments).
Vehicle Mixes	MOVES VMT required by 6 HPMS vehicle classes. Use model traffic volume (by auto, SUT, MUT), and MOVES default VMT distributions for the state to split the three vehicle groups into MOVES 13 source types, which are recombined to the 6 HPMS vehicle classes.
MOVES Inputs	
Annual VMT	Calculated by PPSUITE from model / seasonal factors / vehicle mapping.
Avg. Hourly Speed Distribution	Calculated by PPSUITE (Minimum Speed = 2.5 mph).
Road Type Distribution	Calculated by PPSUITE; a RoadType field must be added to the travel model network based on FC.
Ramp Fraction	Calculated by PPSUITE (use ramp classes coded in model network).
Month VMT Fractions	Based on ADOT data.
Day VMT Fractions	Based on ADOT data.
Hour VMT Fractions	Calculated by PPSUITE. Factors to disaggregate daily traffic volumes by hour for different roadway functional classes. Use 2008 model network volume to calculate hourly distribution as inputs to PPSUITE.
Source Type Population	Based on ADOT data.
Vehicle Age Distribution	Based on ADOT data.
Fuel Parameters (Gasoline/Diesel/CNG)	Based on ADOT data and add MOVES default CNG fuel parameters.
I/M Parameters	No I/M programs.
Temperatures/Humidity	Based on ADOT data.
Control Programs	
Early NLEV/ CA LEV-II	Not Included
Stage II Refueling Parameters	Not Included

ATTACHMENT D

Sample MOVES
Data Importer (XML) Input File
and
Run Specification (MRS) Input File

[(Sample For 2008 July Weekday and Annual Runs)]

MOVES County Data Manager Importer File – July Weekday Run (MOVESIMPORTER.XML)


```
<moves>
    <importer mode="county" >
        <filters>
    <geographicselections>
        <geographicselection type="COUNTY" key="4023" description="ARIZONA - Santa Cruz County"/>
    </geographicselections>
    <timespan>
        <year key="2008"/>
        <month id="07"/>
        <day id="2"/>
        <day id="5"/>
        <beginhour id="1"/>
        <endhour id="24"/>
        <aggregateBy key="Hour"/>
    </timespan>
    <onroadvehicleselections>
        <onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel" sourcetypeid="62" sourcetypename="Combination Long-haul Truck"/>
        <onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel" sourcetypeid="61" sourcetypename="Combination Short-haul Truck"/>
        <onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel" sourcetypeid="41" sourcetypename="Intercity Bus"/>
        <onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel" sourcetypeid="32" sourcetypename="Light Commercial Truck"/>
        <onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel" sourcetypeid="54" sourcetypename="Motor Home"/>
        <onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel" sourcetypeid="11" sourcetypename="Motorcycle"/>
        <onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel" sourcetypeid="21" sourcetypename="Passenger Car"/>
        <onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel" sourcetypeid="31" sourcetypename="Passenger Truck"/>
        <onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel" sourcetypeid="51" sourcetypename="Refuse Truck"/>
        <onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel" sourcetypeid="43" sourcetypename="School Bus"/>
        <onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel" sourcetypeid="53" sourcetypename="Single Unit Long-haul Truck"/>
        <onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel" sourcetypeid="52" sourcetypename="Single Unit Short-haul Truck"/>
        <onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel" sourcetypeid="42" sourcetypename="Transit Bus"/>
        <onroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sourcetypeid="62" sourcetypename="Combination Long-haul Truck"/>
        <onroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sourcetypeid="61" sourcetypename="Combination Short-haul Truck"/>
        <onroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sourcetypeid="41" sourcetypename="Intercity Bus"/>
        <onroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sourcetypeid="32" sourcetypename="Light Commercial Truck"/>
        <onroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sourcetypeid="54" sourcetypename="Motor Home"/>
        <onroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sourcetypeid="11" sourcetypename="Motorcycle"/>
        <onroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sourcetypeid="21" sourcetypename="Passenger Car"/>
        <onroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sourcetypeid="31" sourcetypename="Passenger Truck"/>
        <onroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sourcetypeid="51" sourcetypename="Refuse Truck"/>
        <onroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sourcetypeid="43" sourcetypename="School Bus"/>
        <onroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sourcetypeid="53" sourcetypename="Single Unit Long-haul Truck"/>
        <onroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sourcetypeid="52" sourcetypename="Single Unit Short-haul Truck"/>
        <onroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sourcetypeid="42" sourcetypename="Transit Bus"/>
    </onroadvehicleselections>
    <offroadvehicleselections>
    </offroadvehicleselections>
    <offroadvehiclesccs>
    </offroadvehiclesccs>
    <roadtypes>
        <roadtype roadtypeid="1" roadtypename="Off-Network"/>
        <roadtype roadtypeid="2" roadtypename="Rural Restricted Access"/>
        <roadtype roadtypeid="3" roadtypename="Rural Unrestricted Access"/>
        <roadtype roadtypeid="4" roadtypename="Urban Restricted Access"/>
        <roadtype roadtypeid="5" roadtypename="Urban Unrestricted Access"/>
    </roadtypes>
        </filters>
        <databaseselection servername="localhost" databasename="4023_2008_07_05_Wkd_Inv_Nogales_Final3_mi"/>
        <agedistribution>
            <description><![CDATA[]]></description>
            <parts>
                <sourceTypeAgeDistribution>
                    <filename>C:\AZMOVES\MOVESInputs\AgeDistribution\4023_2008_SourceTypeAgeDistribution.csv</filename>
                </sourceTypeAgeDistribution>
            </parts>
        </agedistribution>
```

```
        <avgspeeddistribution>
            <description><![CDATA[]]></description>
            <parts>
                <avgSpeedDistribution>
<filename>C:\AZMOVES\Out\Inv_2008_Nogales_Final3\\4023_2008_07_05_Wkd_Inv_Nogales_Final3\CDM\avgSpeedDistribution.csv</filename>
                </avgSpeedDistribution>
            </parts>
        </avgspeeddistribution>
        <imcoverage>
            <description><![CDATA[]]></description>
            <parts>
                <imcoverage>
                    <filename>C:\AZMOVES\MOVESInputs\IM\4000_IMCoverage.csv</filename>
                </imcoverage>
            </parts>
        </imcoverage>
     <fuel>
       <description><![CDATA[]]></description>
       <parts>
         <FuelSupply>
           <filename>C:\AZMOVES\MOVESInputs\Fuel\4000_2008_FuelSupply_moves2010ab.csv</filename>
         </FuelSupply>
         <FuelFormulation>
           <filename>C:\AZMOVES\MOVESInputs\Fuel\4000_FuelFormulation_moves2010ab.csv</filename>
         </FuelFormulation>
       </parts>
     </fuel>
        <zonemonthhour>
            <description><![CDATA[]]></description>
            <parts>
                <zoneMonthHour>
                    <filename>C:\AZMOVES\MOVESInputs\Meteorology\4023_2008_met.csv</filename>
                </zoneMonthHour>
            </parts>
        </zonemonthhour>

        <roadtypedistribution>
            <description><![CDATA[]]></description>
            <parts>
                <roadTypeDistribution>
<filename>C:\AZMOVES\Out\Inv_2008_Nogales_Final3\\4023_2008_07_05_Wkd_Inv_Nogales_Final3\CDM\roadTypeDistribution.csv</filename>
                </roadTypeDistribution>
            </parts>
        </roadtypedistribution>

        <sourcetypepopulation>
            <description><![CDATA[]]></description>
            <parts>
                <sourceTypeYear>
<filename>C:\AZMOVES\Out\Inv_2008_Nogales_Final3\\4023_2008_07_05_Wkd_Inv_Nogales_Final3\CDM\SourceTypePopulation.csv</filename>
                </sourceTypeYear>
            </parts>
        </sourcetypepopulation>
        <rampfraction>
            <description><![CDATA[]]></description>
            <parts>
                 <roadType>
                    <filename>C:\AZMOVES\Out\Inv_2008_Nogales_Final3\\4023_2008_07_05_Wkd_Inv_Nogales_Final3\CDM\rampFraction.csv</filename>
                 </roadType>
            </parts>
        </rampfraction>
        <vehicletypevmt>
            <description><![CDATA[]]></description>
            <parts>
                <hpmsVTypeYear>
```

```
<filename>C:\AZMOVES\Out\Inv_2008_Nogales_Final3\\4023_2008_07_05_Wkd_Inv_Nogales_Final3\CDM\hpmsVTypeYear.csv</filename>
                </hpmsVTypeYear>
                <monthvmtfraction>
                    <filename>C:\AZMOVES\MOVESInputs\MonthDayHourFractions\MonthFraction\4023_2008_MonthVMTFraction.csv</filename>
                </monthvmtfraction>
                <dayvmtfraction>
                    <filename>C:\AZMOVES\MOVESInputs\MonthDayHourFractions\DayFraction\4023_2008_dayvmtfraction.csv</filename>
                </dayvmtfraction>
                <hourvmtfraction>
                    <filename>C:\AZMOVES\Out\Inv_2008_Nogales_Final3\\4023_2008_07_05_Wkd_Inv_Nogales_Final3\CDM\hourvmtfraction.csv</filename>
                </hourvmtfraction>
            </parts>
        </vehicletypevmt>
    </importer>
</moves>
```

MOVES Run Specification File – July Weekday Run (MOVESRUN.MRS)


```
<runspec>
  <description><![CDATA[MOVES2010 RunSpec Created by CENTRAL4 Scenario: SANT 2008 JULWKD Wkd_Inv_Nogales_Final3 Emission Inventory with user's data]]></description>
<modelscale value="INV"/>
  <modeldomain value="SINGLE"/>
  <geographicselections>
    <geographicselection type="COUNTY" key="4023" description="ARIZONA - Santa Cruz County"/>
  </geographicselections>
  <timespan>
    <year key="2008"/>
<month id="07"/>
<day id="5"/>
    <beginhour id="1"/>
    <endhour id="24"/>
<aggregateBy key="Hour"/>
  </timespan>
  <onroadvehicleselections>
<onroadvehicleselection fueltypeid="3" fueltypedesc="Compressed Natural Gas (CNG)" sourcetypeid="11" sourcetypename="Motorcycle"/>
<onroadvehicleselection fueltypeid="3" fueltypedesc="Compressed Natural Gas (CNG)" sourcetypeid="21" sourcetypename="Passenger Car"/>
<onroadvehicleselection fueltypeid="3" fueltypedesc="Compressed Natural Gas (CNG)" sourcetypeid="31" sourcetypename="Passenger Truck"/>
<onroadvehicleselection fueltypeid="3" fueltypedesc="Compressed Natural Gas (CNG)" sourcetypeid="32" sourcetypename="Light Commercial Truck"/>
<onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel" sourcetypeid="11" sourcetypename="Motorcycle"/>
<onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel" sourcetypeid="21" sourcetypename="Passenger Car"/>
<onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel" sourcetypeid="31" sourcetypename="Passenger Truck"/>
<onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel" sourcetypeid="32" sourcetypename="Light Commercial Truck"/>
<onroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sourcetypeid="11" sourcetypename="Motorcycle"/>
<onroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sourcetypeid="21" sourcetypename="Passenger Car"/>
<onroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sourcetypeid="31" sourcetypename="Passenger Truck"/>
<onroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sourcetypeid="32" sourcetypename="Light Commercial Truck"/>
<onroadvehicleselection fueltypeid="3" fueltypedesc="Compressed Natural Gas (CNG)" sourcetypeid="41" sourcetypename="Intercity Bus"/>
<onroadvehicleselection fueltypeid="3" fueltypedesc="Compressed Natural Gas (CNG)" sourcetypeid="42" sourcetypename="Transit Bus"/>
<onroadvehicleselection fueltypeid="3" fueltypedesc="Compressed Natural Gas (CNG)" sourcetypeid="43" sourcetypename="School Bus"/>
<onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel" sourcetypeid="41" sourcetypename="Intercity Bus"/>
<onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel" sourcetypeid="42" sourcetypename="Transit Bus"/>
<onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel" sourcetypeid="43" sourcetypename="School Bus"/>
<onroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sourcetypeid="41" sourcetypename="Intercity Bus"/>
<onroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sourcetypeid="42" sourcetypename="Transit Bus"/>
<onroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sourcetypeid="43" sourcetypename="School Bus"/>
<onroadvehicleselection fueltypeid="3" fueltypedesc="Compressed Natural Gas (CNG)" sourcetypeid="51" sourcetypename="Refuse Truck"/>
<onroadvehicleselection fueltypeid="3" fueltypedesc="Compressed Natural Gas (CNG)" sourcetypeid="52" sourcetypename="Single Unit Short-haul Truck"/>
<onroadvehicleselection fueltypeid="3" fueltypedesc="Compressed Natural Gas (CNG)" sourcetypeid="53" sourcetypename="Single Unit Long-haul Truck"/>
<onroadvehicleselection fueltypeid="3" fueltypedesc="Compressed Natural Gas (CNG)" sourcetypeid="54" sourcetypename="Motor Home"/>
<onroadvehicleselection fueltypeid="3" fueltypedesc="Compressed Natural Gas (CNG)" sourcetypeid="61" sourcetypename="Combination Short-haul Truck"/>
<onroadvehicleselection fueltypeid="3" fueltypedesc="Compressed Natural Gas (CNG)" sourcetypeid="62" sourcetypename="Combination Long-haul Truck"/>
<onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel" sourcetypeid="51" sourcetypename="Refuse Truck"/>
<onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel" sourcetypeid="52" sourcetypename="Single Unit Short-haul Truck"/>
<onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel" sourcetypeid="53" sourcetypename="Single Unit Long-haul Truck"/>
<onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel" sourcetypeid="54" sourcetypename="Motor Home"/>
<onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel" sourcetypeid="61" sourcetypename="Combination Short-haul Truck"/>
<onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel" sourcetypeid="62" sourcetypename="Combination Long-haul Truck"/>
<onroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sourcetypeid="51" sourcetypename="Refuse Truck"/>
<onroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sourcetypeid="52" sourcetypename="Single Unit Short-haul Truck"/>
<onroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sourcetypeid="53" sourcetypename="Single Unit Long-haul Truck"/>
<onroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sourcetypeid="54" sourcetypename="Motor Home"/>
<onroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sourcetypeid="61" sourcetypename="Combination Short-haul Truck"/>
<onroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sourcetypeid="62" sourcetypename="Combination Long-haul Truck"/>
  </onroadvehicleselections>
  <offroadvehicleselections>
  </offroadvehicleselections>
  <offroadvehiclesccs>
  </offroadvehiclesccs>
  <roadtypes>
    <roadtype roadtypeid="1" roadtypename="Off-Network"/>
    <roadtype roadtypeid="2" roadtypename="Rural Restricted Access"/>
    <roadtype roadtypeid="3" roadtypename="Rural Unrestricted Access"/>
```

```
        <roadtype roadtypeid="4" roadtypename="Urban Restricted Access"/>
        <roadtype roadtypeid="5" roadtypename="Urban Unrestricted Access"/>
    </roadtypes>
    <pollutantprocessassociations>
<pollutantprocessassociation pollutantkey="3" pollutantname="Oxides of Nitrogen" processkey="1" processname="Running Exhaust"/>
<pollutantprocessassociation pollutantkey="3" pollutantname="Oxides of Nitrogen" processkey="2" processname="Start Exhaust"/>
<pollutantprocessassociation pollutantkey="3" pollutantname="Oxides of Nitrogen" processkey="15" processname="Crankcase Running Exhaust"/>
<pollutantprocessassociation pollutantkey="3" pollutantname="Oxides of Nitrogen" processkey="16" processname="Crankcase Start Exhaust"/>
<pollutantprocessassociation pollutantkey="3" pollutantname="Oxides of Nitrogen" processkey="17" processname="Crankcase Extended Idle Exhaust"/>
<pollutantprocessassociation pollutantkey="3" pollutantname="Oxides of Nitrogen" processkey="90" processname="Extended Idle Exhaust"/>
<pollutantprocessassociation pollutantkey="79" pollutantname="Non-Methane Hydrocarbons" processkey="1" processname="Running Exhaust"/>
<pollutantprocessassociation pollutantkey="79" pollutantname="Non-Methane Hydrocarbons" processkey="2" processname="Start Exhaust"/>
<pollutantprocessassociation pollutantkey="79" pollutantname="Non-Methane Hydrocarbons" processkey="12" processname="Evap Fuel Vapor Venting"/>
<pollutantprocessassociation pollutantkey="79" pollutantname="Non-Methane Hydrocarbons" processkey="13" processname="Evap Fuel Leaks"/>
<pollutantprocessassociation pollutantkey="79" pollutantname="Non-Methane Hydrocarbons" processkey="15" processname="Crankcase Running Exhaust"/>
<pollutantprocessassociation pollutantkey="79" pollutantname="Non-Methane Hydrocarbons" processkey="16" processname="Crankcase Start Exhaust"/>
<pollutantprocessassociation pollutantkey="79" pollutantname="Non-Methane Hydrocarbons" processkey="17" processname="Crankcase Extended Idle Exhaust"/>
<pollutantprocessassociation pollutantkey="79" pollutantname="Non-Methane Hydrocarbons" processkey="90" processname="Extended Idle Exhaust"/>
<pollutantprocessassociation pollutantkey="1" pollutantname="Total Gaseous Hydrocarbons" processkey="1" processname="Running Exhaust"/>
<pollutantprocessassociation pollutantkey="1" pollutantname="Total Gaseous Hydrocarbons" processkey="2" processname="Start Exhaust"/>
<pollutantprocessassociation pollutantkey="1" pollutantname="Total Gaseous Hydrocarbons" processkey="12" processname="Evap Fuel Vapor Venting"/>
<pollutantprocessassociation pollutantkey="1" pollutantname="Total Gaseous Hydrocarbons" processkey="13" processname="Evap Fuel Leaks"/>
<pollutantprocessassociation pollutantkey="1" pollutantname="Total Gaseous Hydrocarbons" processkey="15" processname="Crankcase Running Exhaust"/>
<pollutantprocessassociation pollutantkey="1" pollutantname="Total Gaseous Hydrocarbons" processkey="16" processname="Crankcase Start Exhaust"/>
<pollutantprocessassociation pollutantkey="1" pollutantname="Total Gaseous Hydrocarbons" processkey="17" processname="Crankcase Extended Idle Exhaust"/>
<pollutantprocessassociation pollutantkey="1" pollutantname="Total Gaseous Hydrocarbons" processkey="90" processname="Extended Idle Exhaust"/>
<pollutantprocessassociation pollutantkey="87" pollutantname="Volatile Organic Compounds" processkey="1" processname="Running Exhaust"/>
<pollutantprocessassociation pollutantkey="87" pollutantname="Volatile Organic Compounds" processkey="2" processname="Start Exhaust"/>
<pollutantprocessassociation pollutantkey="87" pollutantname="Volatile Organic Compounds" processkey="12" processname="Evap Fuel Vapor Venting"/>
<pollutantprocessassociation pollutantkey="87" pollutantname="Volatile Organic Compounds" processkey="13" processname="Evap Fuel Leaks"/>
<pollutantprocessassociation pollutantkey="87" pollutantname="Volatile Organic Compounds" processkey="15" processname="Crankcase Running Exhaust"/>
<pollutantprocessassociation pollutantkey="87" pollutantname="Volatile Organic Compounds" processkey="16" processname="Crankcase Start Exhaust"/>
<pollutantprocessassociation pollutantkey="87" pollutantname="Volatile Organic Compounds" processkey="17" processname="Crankcase Extended Idle Exhaust"/>
<pollutantprocessassociation pollutantkey="87" pollutantname="Volatile Organic Compounds" processkey="90" processname="Extended Idle Exhaust"/>
<pollutantprocessassociation pollutantkey="110" pollutantname="Primary Exhaust PM2.5 - Total" processkey="1" processname="Running Exhaust"/>
<pollutantprocessassociation pollutantkey="110" pollutantname="Primary Exhaust PM2.5 - Total" processkey="2" processname="Start Exhaust"/>
<pollutantprocessassociation pollutantkey="110" pollutantname="Primary Exhaust PM2.5 - Total" processkey="15" processname="Crankcase Running Exhaust"/>
<pollutantprocessassociation pollutantkey="110" pollutantname="Primary Exhaust PM2.5 - Total" processkey="16" processname="Crankcase Start Exhaust"/>
<pollutantprocessassociation pollutantkey="110" pollutantname="Primary Exhaust PM2.5 - Total" processkey="17" processname="Crankcase Extended Idle
Exhaust"/>
<pollutantprocessassociation pollutantkey="110" pollutantname="Primary Exhaust PM2.5 - Total" processkey="90" processname="Extended Idle Exhaust"/>
<pollutantprocessassociation pollutantkey="116" pollutantname="Primary PM2.5 - Brakewear Particulate" processkey="9" processname="Brakewear"/>
<pollutantprocessassociation pollutantkey="112" pollutantname="Primary PM2.5 - Elemental Carbon" processkey="1" processname="Running Exhaust"/>
<pollutantprocessassociation pollutantkey="112" pollutantname="Primary PM2.5 - Elemental Carbon" processkey="2" processname="Start Exhaust"/>
<pollutantprocessassociation pollutantkey="112" pollutantname="Primary PM2.5 - Elemental Carbon" processkey="15" processname="Crankcase Running
Exhaust"/>
<pollutantprocessassociation pollutantkey="112" pollutantname="Primary PM2.5 - Elemental Carbon" processkey="16" processname="Crankcase Start Exhaust"/>
<pollutantprocessassociation pollutantkey="112" pollutantname="Primary PM2.5 - Elemental Carbon" processkey="17" processname="Crankcase Extended Idle
Exhaust"/>
<pollutantprocessassociation pollutantkey="112" pollutantname="Primary PM2.5 - Elemental Carbon" processkey="90" processname="Extended Idle Exhaust"/>
<pollutantprocessassociation pollutantkey="111" pollutantname="Primary PM2.5 - Organic Carbon" processkey="1" processname="Running Exhaust"/>
<pollutantprocessassociation pollutantkey="111" pollutantname="Primary PM2.5 - Organic Carbon" processkey="2" processname="Start Exhaust"/>
<pollutantprocessassociation pollutantkey="111" pollutantname="Primary PM2.5 - Organic Carbon" processkey="15" processname="Crankcase Running Exhaust"/>
<pollutantprocessassociation pollutantkey="111" pollutantname="Primary PM2.5 - Organic Carbon" processkey="16" processname="Crankcase Start Exhaust"/>
<pollutantprocessassociation pollutantkey="111" pollutantname="Primary PM2.5 - Organic Carbon" processkey="17" processname="Crankcase Extended Idle
Exhaust"/>
<pollutantprocessassociation pollutantkey="111" pollutantname="Primary PM2.5 - Organic Carbon" processkey="90" processname="Extended Idle Exhaust"/>
<pollutantprocessassociation pollutantkey="115" pollutantname="Primary PM2.5 - Sulfate Particulate" processkey="1" processname="Running Exhaust"/>
<pollutantprocessassociation pollutantkey="115" pollutantname="Primary PM2.5 - Sulfate Particulate" processkey="2" processname="Start Exhaust"/>
<pollutantprocessassociation pollutantkey="115" pollutantname="Primary PM2.5 - Sulfate Particulate" processkey="15" processname="Crankcase Running
Exhaust"/>
<pollutantprocessassociation pollutantkey="115" pollutantname="Primary PM2.5 - Sulfate Particulate" processkey="16" processname="Crankcase Start Exhaust"/>
<pollutantprocessassociation pollutantkey="115" pollutantname="Primary PM2.5 - Sulfate Particulate" processkey="17" processname="Crankcase Extended Idle
Exhaust"/>
<pollutantprocessassociation pollutantkey="115" pollutantname="Primary PM2.5 - Sulfate Particulate" processkey="90" processname="Extended Idle Exhaust"/>
<pollutantprocessassociation pollutantkey="117" pollutantname="Primary PM2.5 - Tirewear Particulate" processkey="10" processname="Tirewear"/>
```

<pollutantprocessassociation pollutantkey="91" pollutantname="Total Energy Consumption" processkey="1" processname="Running Exhaust"/>
<pollutantprocessassociation pollutantkey="91" pollutantname="Total Energy Consumption" processkey="2" processname="Start Exhaust"/>
<pollutantprocessassociation pollutantkey="91" pollutantname="Total Energy Consumption" processkey="90" processname="Extended Idle Exhaust"/>
<pollutantprocessassociation pollutantkey="100" pollutantname="Primary Exhaust PM10 - Total" processkey="1" processname="Running Exhaust"/>
<pollutantprocessassociation pollutantkey="100" pollutantname="Primary Exhaust PM10 - Total" processkey="2" processname="Start Exhaust"/>
<pollutantprocessassociation pollutantkey="100" pollutantname="Primary Exhaust PM10 - Total" processkey="15" processname="Crankcase Running Exhaust"/>
<pollutantprocessassociation pollutantkey="100" pollutantname="Primary Exhaust PM10 - Total" processkey="16" processname="Crankcase Start Exhaust"/>
<pollutantprocessassociation pollutantkey="100" pollutantname="Primary Exhaust PM10 - Total" processkey="17" processname="Crankcase Extended Idle Exhaust"/>
<pollutantprocessassociation pollutantkey="100" pollutantname="Primary Exhaust PM10 - Total" processkey="90" processname="Extended Idle Exhaust"/>
<pollutantprocessassociation pollutantkey="106" pollutantname="Primary PM10 - Brakewear Particulate" processkey="9" processname="Brakewear"/>
<pollutantprocessassociation pollutantkey="102" pollutantname="Primary PM10 - Elemental Carbon" processkey="1" processname="Running Exhaust"/>
<pollutantprocessassociation pollutantkey="102" pollutantname="Primary PM10 - Elemental Carbon" processkey="2" processname="Start Exhaust"/>
<pollutantprocessassociation pollutantkey="102" pollutantname="Primary PM10 - Elemental Carbon" processkey="15" processname="Crankcase Running Exhaust"/>
<pollutantprocessassociation pollutantkey="102" pollutantname="Primary PM10 - Elemental Carbon" processkey="16" processname="Crankcase Start Exhaust"/>
<pollutantprocessassociation pollutantkey="102" pollutantname="Primary PM10 - Elemental Carbon" processkey="17" processname="Crankcase Extended Idle Exhaust"/>
<pollutantprocessassociation pollutantkey="102" pollutantname="Primary PM10 - Elemental Carbon" processkey="90" processname="Extended Idle Exhaust"/>
<pollutantprocessassociation pollutantkey="101" pollutantname="Primary PM10 - Organic Carbon" processkey="1" processname="Running Exhaust"/>
<pollutantprocessassociation pollutantkey="101" pollutantname="Primary PM10 - Organic Carbon" processkey="2" processname="Start Exhaust"/>
<pollutantprocessassociation pollutantkey="101" pollutantname="Primary PM10 - Organic Carbon" processkey="15" processname="Crankcase Running Exhaust"/>
<pollutantprocessassociation pollutantkey="101" pollutantname="Primary PM10 - Organic Carbon" processkey="16" processname="Crankcase Start Exhaust"/>
<pollutantprocessassociation pollutantkey="101" pollutantname="Primary PM10 - Organic Carbon" processkey="17" processname="Crankcase Extended Idle Exhaust"/>
<pollutantprocessassociation pollutantkey="101" pollutantname="Primary PM10 - Organic Carbon" processkey="90" processname="Extended Idle Exhaust"/>
<pollutantprocessassociation pollutantkey="105" pollutantname="Primary PM10 - Sulfate Particulate" processkey="1" processname="Running Exhaust"/>
<pollutantprocessassociation pollutantkey="105" pollutantname="Primary PM10 - Sulfate Particulate" processkey="2" processname="Start Exhaust"/>
<pollutantprocessassociation pollutantkey="105" pollutantname="Primary PM10 - Sulfate Particulate" processkey="15" processname="Crankcase Running Exhaust"/>
<pollutantprocessassociation pollutantkey="105" pollutantname="Primary PM10 - Sulfate Particulate" processkey="16" processname="Crankcase Start Exhaust"/>
<pollutantprocessassociation pollutantkey="105" pollutantname="Primary PM10 - Sulfate Particulate" processkey="17" processname="Crankcase Extended Idle Exhaust"/>
<pollutantprocessassociation pollutantkey="105" pollutantname="Primary PM10 - Sulfate Particulate" processkey="90" processname="Extended Idle Exhaust"/>
<pollutantprocessassociation pollutantkey="107" pollutantname="Primary PM10 - Tirewear Particulate" processkey="10" processname="Tirewear"/>
<pollutantprocessassociation pollutantkey="116" pollutantname="Primary PM2.5 - Brakewear Particulate" processkey="9" processname="Brakewear"/>
<pollutantprocessassociation pollutantkey="117" pollutantname="Primary PM2.5 - Tirewear Particulate" processkey="10" processname="Tirewear"/>
<pollutantprocessassociation pollutantkey="91" pollutantname="Total Energy Consumption" processkey="1" processname="Running Exhaust"/>
<pollutantprocessassociation pollutantkey="91" pollutantname="Total Energy Consumption" processkey="2" processname="Start Exhaust"/>
<pollutantprocessassociation pollutantkey="91" pollutantname="Total Energy Consumption" processkey="90" processname="Extended Idle Exhaust"/>
<pollutantprocessassociation pollutantkey="90" pollutantname="Atmospheric CO2" processkey="1" processname="Running Exhaust"/>
<pollutantprocessassociation pollutantkey="90" pollutantname="Atmospheric CO2" processkey="2" processname="Start Exhaust"/>
<pollutantprocessassociation pollutantkey="90" pollutantname="Atmospheric CO2" processkey="90" processname="Extended Idle Exhaust"/>
<pollutantprocessassociation pollutantkey="91" pollutantname="Total Energy Consumption" processkey="1" processname="Running Exhaust"/>
<pollutantprocessassociation pollutantkey="91" pollutantname="Total Energy Consumption" processkey="2" processname="Start Exhaust"/>
<pollutantprocessassociation pollutantkey="91" pollutantname="Total Energy Consumption" processkey="90" processname="Extended Idle Exhaust"/>
<pollutantprocessassociation pollutantkey="90" pollutantname="Atmospheric CO2" processkey="1" processname="Running Exhaust"/>
<pollutantprocessassociation pollutantkey="90" pollutantname="Atmospheric CO2" processkey="2" processname="Start Exhaust"/>
<pollutantprocessassociation pollutantkey="90" pollutantname="Atmospheric CO2" processkey="90" processname="Extended Idle Exhaust"/>
<pollutantprocessassociation pollutantkey="98" pollutantname="CO2 Equivalent" processkey="1" processname="Running Exhaust"/>
<pollutantprocessassociation pollutantkey="98" pollutantname="CO2 Equivalent" processkey="2" processname="Start Exhaust"/>
<pollutantprocessassociation pollutantkey="98" pollutantname="CO2 Equivalent" processkey="90" processname="Extended Idle Exhaust"/>
<pollutantprocessassociation pollutantkey="91" pollutantname="Total Energy Consumption" processkey="1" processname="Running Exhaust"/>
<pollutantprocessassociation pollutantkey="91" pollutantname="Total Energy Consumption" processkey="2" processname="Start Exhaust"/>
<pollutantprocessassociation pollutantkey="91" pollutantname="Total Energy Consumption" processkey="90" processname="Extended Idle Exhaust"/>
<pollutantprocessassociation pollutantkey="5" pollutantname="Methane (CH4)" processkey="1" processname="Running Exhaust"/>
<pollutantprocessassociation pollutantkey="5" pollutantname="Methane (CH4)" processkey="2" processname="Start Exhaust"/>
<pollutantprocessassociation pollutantkey="5" pollutantname="Methane (CH4)" processkey="15" processname="Crankcase Running Exhaust"/>
<pollutantprocessassociation pollutantkey="5" pollutantname="Methane (CH4)" processkey="16" processname="Crankcase Start Exhaust"/>
<pollutantprocessassociation pollutantkey="5" pollutantname="Methane (CH4)" processkey="17" processname="Crankcase Extended Idle Exhaust"/>
<pollutantprocessassociation pollutantkey="5" pollutantname="Methane (CH4)" processkey="90" processname="Extended Idle Exhaust"/>
<pollutantprocessassociation pollutantkey="1" pollutantname="Total Gaseous Hydrocarbons" processkey="1" processname="Running Exhaust"/>
<pollutantprocessassociation pollutantkey="1" pollutantname="Total Gaseous Hydrocarbons" processkey="2" processname="Start Exhaust"/>
<pollutantprocessassociation pollutantkey="1" pollutantname="Total Gaseous Hydrocarbons" processkey="12" processname="Evap Fuel Vapor Venting"/>
<pollutantprocessassociation pollutantkey="1" pollutantname="Total Gaseous Hydrocarbons" processkey="13" processname="Evap Fuel Leaks"/>
<pollutantprocessassociation pollutantkey="1" pollutantname="Total Gaseous Hydrocarbons" processkey="15" processname="Crankcase Running Exhaust"/>
<pollutantprocessassociation pollutantkey="1" pollutantname="Total Gaseous Hydrocarbons" processkey="16" processname="Crankcase Start Exhaust"/>

<pollutantprocessassociation pollutantkey="1" pollutantname="Total Gaseous Hydrocarbons" processkey="17" processname="Crankcase Extended Idle Exhaust"/>
<pollutantprocessassociation pollutantkey="1" pollutantname="Total Gaseous Hydrocarbons" processkey="90" processname="Extended Idle Exhaust"/>
<pollutantprocessassociation pollutantkey="6" pollutantname="Nitrous Oxide (N2O)" processkey="1" processname="Running Exhaust"/>
<pollutantprocessassociation pollutantkey="6" pollutantname="Nitrous Oxide (N2O)" processkey="2" processname="Start Exhaust"/>
<pollutantprocessassociation pollutantkey="6" pollutantname="Nitrous Oxide (N2O)" processkey="15" processname="Crankcase Running Exhaust"/>
<pollutantprocessassociation pollutantkey="6" pollutantname="Nitrous Oxide (N2O)" processkey="16" processname="Crankcase Start Exhaust"/>
<pollutantprocessassociation pollutantkey="79" pollutantname="Non-Methane Hydrocarbons" processkey="11" processname="Evap Permeation"/>
<pollutantprocessassociation pollutantkey="1" pollutantname="Total Gaseous Hydrocarbons" processkey="11" processname="Evap Permeation"/>
<pollutantprocessassociation pollutantkey="87" pollutantname="Volatile Organic Compounds" processkey="11" processname="Evap Permeation"/>
<pollutantprocessassociation pollutantkey="1" pollutantname="Total Gaseous Hydrocarbons" processkey="11" processname="Evap Permeation"/>
</pollutantprocessassociations>
<databaseselections>
</databaseselections>
<inputdatabase servername="" databasename="" description=""/>
<uncertaintyparameters uncertaintymodeenabled="false" numberofrunspersimulation="0" numberofsimulations="0"/>
<geographicoutputdetail description="COUNTY"/>
<outputemissionsbreakdownselection>
<modelyear selected="false"/>
<fueltype selected="false"/>
<emissionprocess selected="false"/>
<onroadoffroad selected="true"/>
<roadtype selected="true"/>
<sourceusetype selected="true"/>
<movesvehicletype selected="false"/>
<onroadscc selected="false"/>
<offroadscc selected="false"/>
<estimateuncertainty selected="false" numberOfIterations="2" keepSampledData="false" keepIterations="false"/>
<sector selected="false"/>
<engtechid selected="false"/>
<hpclass selected="false"/>
</outputemissionsbreakdownselection>
<outputdatabase servername="localhost" databasename="4023_2008_07_05_Wkd_Inv_Nogales_Final3_mo" description=""/>>
<outputtimestep value="Hour"/>
<outputvmtdata value="true"/>
<outputsho value="true"/>
<outputsh value="true"/>
<outputshp value="true"/>
<outputshidling value="true"/>
<outputstarts value="true"/>
<outputpopulation value="true"/>
<scaleinputdatabase servername="localhost" databasename="4023_2008_07_05_Wkd_Inv_Nogales_Final3_mi" description=""/>
<pmsize value="0"/>
<outputfactors>
<timefactors selected="true" units="Hours"/>
<distancefactors selected="false" units="Miles"/>
<massfactors selected="false" units="Grams" energyunits="Million BTU"/>
</outputfactors>
<savedata>
</savedata>
<donotexecute>
</donotexecute>
<generatordatabase shouldsave="false" servername="" databasename="" description=""/>
<donotperformfinalaggregation selected="false"/>
<lookuptableflags scenarioid="" truncateoutput="false" truncateactivity="false"/>
<internalcontrolstrategies>
<internalcontrolstrategy classname="gov.epa.otaq.moves.master.implementation.ghg.internalcontrolstrategies.rateofprogress.RateOfProgressStrategy"><![CDATA[
useParameters No
]]></internalcontrolstrategy>
</internalcontrolstrategies>
</runspec>

<pollutantprocessassociation pollutantkey="1" pollutantname="Total Gaseous Hydrocarbons" processkey="17" processname="Crankcase Extended Idle Exhaust"/>
<pollutantprocessassociation pollutantkey="1" pollutantname="Total Gaseous Hydrocarbons" processkey="90" processname="Extended Idle Exhaust"/>
<pollutantprocessassociation pollutantkey="6" pollutantname="Nitrous Oxide (N2O)" processkey="1" processname="Running Exhaust"/>
<pollutantprocessassociation pollutantkey="6" pollutantname="Nitrous Oxide (N2O)" processkey="2" processname="Start Exhaust"/>
<pollutantprocessassociation pollutantkey="6" pollutantname="Nitrous Oxide (N2O)" processkey="15" processname="Crankcase Running Exhaust"/>
<pollutantprocessassociation pollutantkey="6" pollutantname="Nitrous Oxide (N2O)" processkey="16" processname="Crankcase Start Exhaust"/>
<pollutantprocessassociation pollutantkey="79" pollutantname="Non-Methane Hydrocarbons" processkey="11" processname="Evap Permeation"/>
<pollutantprocessassociation pollutantkey="1" pollutantname="Total Gaseous Hydrocarbons" processkey="11" processname="Evap Permeation"/>
<pollutantprocessassociation pollutantkey="87" pollutantname="Volatile Organic Compounds" processkey="11" processname="Evap Permeation"/>
<pollutantprocessassociation pollutantkey="1" pollutantname="Total Gaseous Hydrocarbons" processkey="11" processname="Evap Permeation"/>
</pollutantprocessassociations>
<databaseselections>
</databaseselections>
<inputdatabase servername="" databasename="" description=""/>
<uncertaintyparameters uncertaintymodeenabled="false" numberofrunspersimulation="0" numberofsimulations="0"/>
<geographicoutputdetail description="COUNTY"/>
<outputemissionsbreakdownselection>
<modelyear selected="false"/>
<fueltype selected="false"/>
<emissionprocess selected="false"/>
<onroadoffroad selected="true"/>
<roadtype selected="true"/>
<sourceusetype selected="true"/>
<movesvehicletype selected="false"/>
<onroadscc selected="false"/>
<offroadscc selected="false"/>
<estimateuncertainty selected="false" numberOfIterations="2" keepSampledData="false" keepIterations="false"/>
<sector selected="false"/>
<engtechid selected="false"/>
<hpclass selected="false"/>
</outputemissionsbreakdownselection>
<outputdatabase servername="localhost" databasename="4023_2008_07_05_Wkd_Inv_Nogales_Final3_mo" description=""/>>
<outputtimestep value="Hour"/>
<outputvmtdata value="true"/>
<outputsho value="true"/>
<outputsh value="true"/>
<outputshp value="true"/>
<outputshidling value="true"/>
<outputstarts value="true"/>
<outputpopulation value="true"/>
<scaleinputdatabase servername="localhost" databasename="4023_2008_07_05_Wkd_Inv_Nogales_Final3_mi" description=""/>
<pmsize value="0"/>
<outputfactors>
<timefactors selected="true" units="Hours"/>
<distancefactors selected="false" units="Miles"/>
<massfactors selected="false" units="Grams" energyunits="Million BTU"/>
</outputfactors>
<savedata>
</savedata>
<donotexecute>
</donotexecute>
<generatordatabase shouldsave="false" servername="" databasename="" description=""/>
<donotperformfinalaggregation selected="false"/>
<lookuptableflags scenarioid="" truncateoutput="false" truncateactivity="false"/>
<internalcontrolstrategies>
<internalcontrolstrategy classname="gov.epa.otaq.moves.master.implementation.ghg.internalcontrolstrategies.rateofprogress.RateOfProgressStrategy"><![CDATA[
useParameters No
]]></internalcontrolstrategy>
</internalcontrolstrategies>
</runspec>