Air Quality Technical Report

$PM_{2.5}$ Quantitative Hot-spot Analysis

I-69 Evansville to Indianapolis, Indiana: Section 5 Bloomington to Martinsville

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A. Introduction

This technical report outlines the methodology, inputs and results of the $PM_{2.5}$ quantitative hot-spot analysis presented in the I-69 Evansville to Indianapolis, Indiana, Section 5, Bloomington to Martinsville, Indiana Tier 2 Final Environmental Impact Statement (referred herein as I-69 Section 5). A portion of the project (Morgan County) is within the Central Indiana nonattainment area for the 1997 annual fine particles ($PM_{2.5}$) National Ambient Air Quality Standard (NAAQS).

On March 10, 2006, the U.S. Environmental Protection Agency (EPA) published a Final Rule (71 FR 12468) 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.

The air quality analysis for the I-69 Section 5 project included modeling techniques to estimate project-specific emission factors from vehicle exhaust and local $PM_{2.5}$ concentrations due to project operation. Emissions and dispersion modeling techniques were consistent with the EPA quantitative PM hot-spot analysis guidance, "*Transportation Conformity Guidance for Quantitative Hot-spot Analysis in $PM_{2.5}$ and PM_{10} Nonattainment and Maintenance Areas*" (USEPA, 2010)[1] that was released in December, 2010.

B. Interagency Consultation

The conformity rule requires that federal, state and local transportation and air quality agencies establish formal procedures for interagency coordination. This analysis included participation from the following agencies:

- FHWA Indiana Division and Resource Center
- Indiana Department of Environmental Management (IDEM)
- Indiana Department of Transportation (INDOT)
- Indianapolis Metropolitan Planning Organization (MPO)
- EPA Office of Transportation and Air Quality (OTAQ)
- EPA Region 5

Interagency consultation provides an opportunity to reach agreements on key assumptions to be used in conformity analyses, strategies to reduce mobile source emissions, specific impacts of major projects,

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[1] US EPA. 2010. Transportation Conformity Guidance for Quantitative Hot-spot Analyses in $PM_{2.5}$ and PM_{10} Nonattainment and Maintenance Areas" (EPA-420-B-10-040) located online at: http://www.epa.gov/otaq/stateresources/transconf/policy/420b10040.pdf

issues associated with travel demand and emissions modeling for hot-spot analyses. 40 CFR 93.105(c)(1)(i) requires interagency consultation to "evaluate and choose models and associated methods and assumptions." Per Section 2.3 of EPA's hot-spot guidance, "for many aspects of PM hot-spot analyses, the general requirement of interagency consultation can be satisfied without consulting separately on each and every specific decision that arises. In general, as long as the consultation requirements are met, agencies have discretion as to how they consult on hot-spot analyses."

For this project, an interagency consultation meeting was conducted on April 19, 2013. A follow-up meeting was conducted on April 29, 2013 to finalize key decisions. **Exhibit 1** provides a summary of the meeting topics and the key decisions by the interagency consultation group (ICG).

Exhibit 1: Key ICG Decisions on Quantitative Methods and Data

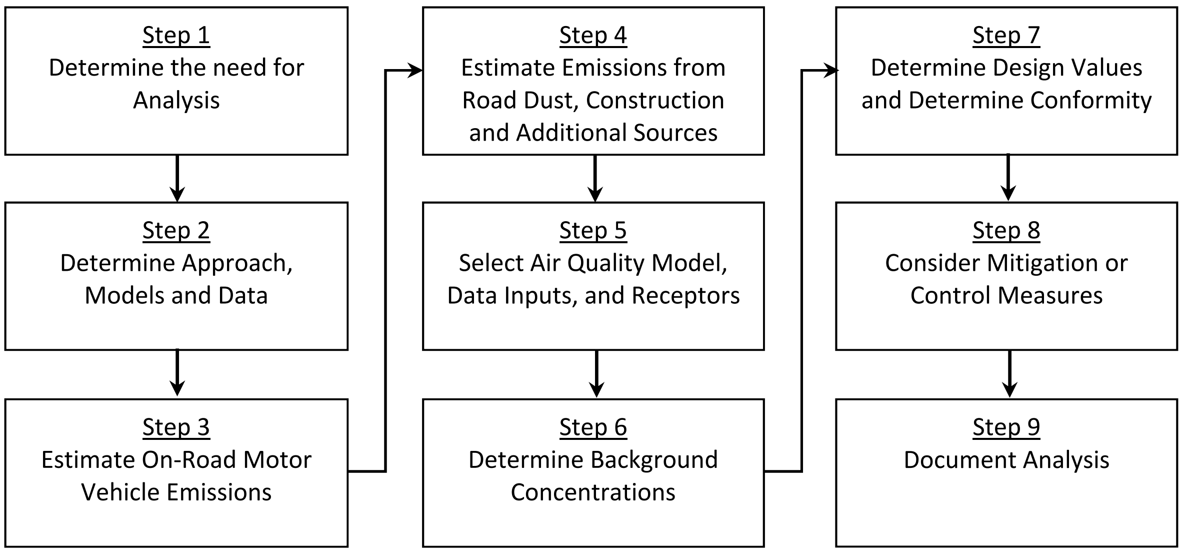
Topic	Key Decisions/Considerations
Analysis Approach	• Compare results of the Build analyses to the NAAQS.
Study Area	• Focus on the I-69 / SR39 Interchange. It was determined this location was the location with highest emissions.
Analysis Years	• Analyze both 2018 and 2035
Type of PM Emissions Analyzed	• Direct $PM_{2.5}$ mobile source running emissions (exhaust, crankcase, brake/tire wear) • Construction emissions are not considered (< 5 years in duration) • No major non-road sources near the project location • Road dust is not considered a significant source
Emission and Air Quality Models	• MOVES2010b • AERMOD (run using "Area" method)
Background Concentrations	• Based on closest monitor location in Bloomington • Average monitor reading 2010-2012 = 10.43
Traffic Data Source – MOVES Application Methods	• Utilize project corridor model used for other components of EIS
Receptor Locations	• Placed according to EPA guidance
Other Input Parameters	• MOVES inputs consistent with SIP/Conformity analysis by Indianapolis MPO • Recommendations from hot-spot training • AERMOD meteorology from IDEM

C. Overview of the Analysis Approach

EPA released guidance for quantifying the local air quality impacts of certain transportation projects for the $PM_{2.5}$ and PM_{10} NAAQS on December 10, 2010. 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 nonattainment or maintenance areas.

The steps required to complete a quantitative PM hot-spot analysis are summarized in **Exhibit 2**. The hot-spot analysis compares the air quality concentrations with the proposed project (the build scenario) to the 1997 annual $PM_{2.5}$ NAAQS. These air quality concentrations are determined by calculating a future 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. This report serves as documentation of the PM hot-spot analysis (Step 9) and includes a description of all steps.

Exhibit 2: EPA's PM Hot-spot Analysis Process



D. (Step 1) Determine Need for PM Hot-spot Analysis

Section 93.109(b) of the conformity rule outlines the requirements for project-level conformity determinations. A $PM_{2.5}$ hot-spot analysis is required for projects of local air quality concern, per Section 93.123(b)(1). The need for a quantitative $PM_{2.5}$ analysis for I-69 Section 5 was discussed by the ICG. It was noted that the project is located in a $PM_{2.5}$ nonattainment area with an increase in the number of diesel vehicles expected in future years. The ICG agreed that a project level hot-spot analysis would be conducted for I-69 Section 5 although the group did not conclude that the project was a Project of Air Quality Concern.

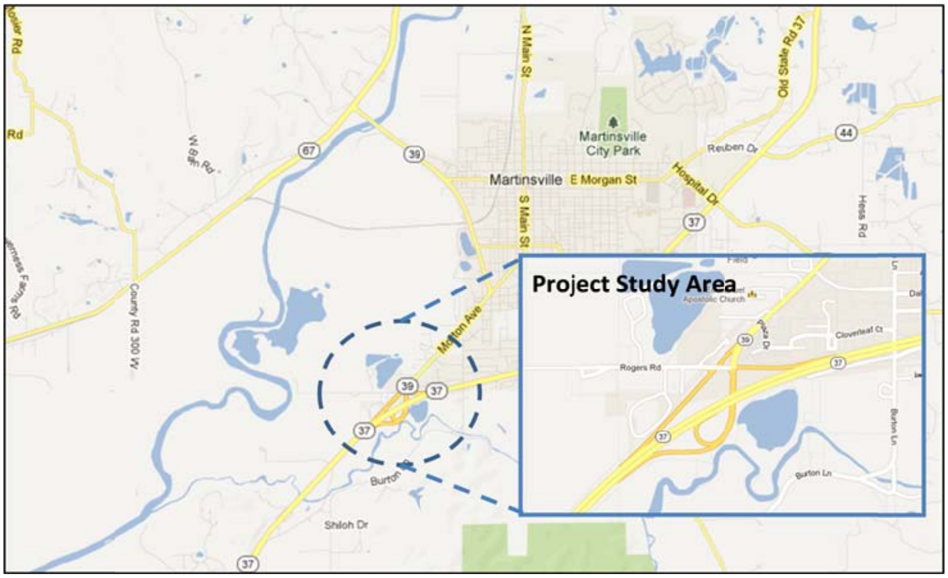
E. (Step2) Determine Approach, Models and Data

Geographic Area and Emission Sources

PM hot-spot analyses must examine the air quality impacts for the relevant PM NAAQS in the area substantially affected by the project (40 CFR 93.123(c)(1)). It is appropriate in some cases to focus the PM hot-spot analysis only on the locations of highest air quality concentrations. For large projects, it may be necessary to analyze multiple locations that are expected to have the highest air quality concentrations and, consequently, the most likely new or worsened NAAQS violations.

In ICG discussions regarding I-69 Section 5, the length of the project falling within the Indianapolis $PM_{2.5}$ non-attainment area was selected as a starting point in determining the geographic area impacted by the project. Results from regional traffic modeling were compiled and evaluated for locations within the Morgan County portion of the project (e.g. within the nonattainment area) and for other nearby areas that could be affected by the project. The location that was determined to potentially have the highest traffic and emissions is the interchange of I-69 with State Route (SR) 39 as illustrated in **Exhibit 3**. This interchange falls just out of the Section 5 project study area but within the $PM_{2.5}$ hot-spot analysis area due to its potential to be influenced by the project. This interchange was chosen for evaluation to ensure that the location with the greatest likelihood to cause a potential exceedance would still meet the applicable NAAQS. The geographic area for the analysis was therefore focused on this area including the roadways accessing the freeway.

Exhibit 3: Study Area for Quantitative Hot-spot Analysis



Maps from Google

The emissions and air quality analysis were based on the earlier traffic forecasting effort which considered all reasonable and foreseeable development within the region. That effort did not identify any new or worsening point sources or facilities with significant numbers of idling diesel vehicles that would require individual consideration.

Analysis Approach and Year(s)

As this project is being constructed as part of a national corridor, the most significant increases in diesel vehicle volumes are expected in the 2035 analysis year once the national corridor is largely completed. The opening year (2018) will have a smaller number of diesel vehicles but this 2018 fleet is assumed to include more trucks that pre date newer emission standards. The ICG felt that the staging of the projects was such that there were no intermediate years that warranted additional consideration above and beyond these two analysis years. The ICG agreed to model both the 2018 and 2035 analysis years, to assure the peak emission year was analyzed.

According to EPA guidance and per ICG agreement, the hot-spot analysis focused on the project's build alternative. A hot-spot evaluation of the no-build analysis is not required to demonstrate conformity when the build alternative does not show a new or worsened violation of the NAAQS.

PM NAAQS Evaluated

The project is located in an area designated as nonattainment for the 1997 annual $PM_{2.5}$ NAAQS (15 micrograms per cubic meter $\mu g/m^3$). The area is currently attaining the 24-hour $PM_{2.5}$ NAAQS and 24-hour PM_{10} NAAQS.

Type of PM Emissions Modeled

The PM hot-spot analyses include only directly emitted $PM_{2.5}$ emissions. These include vehicle running and crankcase exhaust, brake wear, and tire wear emissions from on-road vehicles. Start and evaporative emissions are not a significant portion of the roadway emissions in the study area. Any non-running emissions are assumed to be included in the background concentrations. $PM_{2.5}$ precursors are not considered in PM hot-spot analyses, since precursors take time at the regional level to form into secondary PM.

Re-entrained road dust was not included because the State Implementation Plan does not identify that such emissions are a significant contributor to the $PM_{2.5}$ air quality in the nonattainment area. In addition, emissions from construction-related activities were not included because they are considered temporary as defined in 40 CFR 93.123(c)(5) (i.e. emissions that occur only during the construction phase and last five years or less at any individual site).

Models and Methods

The latest approved emissions model must be used in quantitative PM hot-spot analyses. The latest approved emission factor model is EPA's MOVES2010b. Ground-level air concentrations of $PM_{2.5}$ were estimated using AERMOD which is listed as one of the recommended air quality models for highway and intersection projects in the EPA quantitative PM hot-spot guidance. Per EPA OTAQ recommendations, the roadway emissions were treated as an area source within the AERMOD model.

Project-Specific Data

The conformity rule requires that the latest planning assumptions (available at the time that the analysis begins) must be used in conformity determinations (40 CFR 93.110). In addition, the regulation states that hot-spot analysis assumptions must be consistent with those assumptions used in the regional emissions analysis for any inputs that are required for both analyses (40 CFR 93.123(c)(3)).

This quantitative analysis uses local-specific data for both emissions and air quality modeling whenever possible, though default inputs may be appropriate in some cases. The Indianapolis MPO provided MOVES input files that were used for regional emissions analyses, including vehicle/fleet characterization data (age, fleet mix etc.), meteorological data, fuel, and control strategy parameters.

Under a separate traffic evaluation effort[2], a corridor-specific regional travel demand model was developed to evaluate travel conditions in the future. The results of the travel model were used in determining the link characteristics (roadway type, number of lanes, coordinates, etc.) as well as future operating characteristics (traffic volume, speed, levels of congestion, etc.). As with most typical regional models, the study area is represented using a series of one and two-way links, with each link representing a section of roadway with similar traffic/activity conditions and characteristics. The regional corridor modeling was available for a base year and a 2035 forecast year. The modeling completed for 2035 showed little congestion on any of the roadways in the study area. The traffic volumes for 2018 were developed by interpolating the base and forecast analysis year results. Given the nature of the improvements that will occur in the study area, it was also predicted that conditions would be similarly uncongested in the 2018 analysis year. It should be noted that there are no signalized intersections within the boundary area for the hot-spot analysis, and all intersections were controlled

[2] See Section 5.6 of the I-69 Evansville to Indianapolis, Indiana, Section 5, Bloomington to Martinsville, Indiana Tier2 Final Environmental Impact Statement

with a combination of stop and yield signs. Queuing within the study area impacting the PM hot-spot analysis is expected to be minimal. Estimates of the 2018 and 2035 traffic volumes can be found in **Attachment A**. Interagency consultation agreed that the 2035 No-Build traffic should assume Section 6 is built and open to traffic, to be consistent with the Indianapolis Metropolitan Transportation Planning assumptions.

To support the MOVES modeling of specific roadway links, geographic digital elevation files were also obtained from the Indianapolis Mapping and Geographic Infrastructure System (*imagis*). This data was used to estimate a link-specific grade that impacted the resulting emission factors from MOVES. **Attachment B** summarizes the MOVES input data for each roadway link.

Hourly meteorological data is used for dispersion modeling and must be representative of the project area. The most recent available years (2006-2010) of off-site meteorological data prepared by IDEM was downloaded from the IDEM website (http://www.in.gov/idem/airquality/2376.htm). Surface meteorological data is from the National Weather Service Site for Indianapolis, IN, while upper air meteorological data is from the Lincoln, IL station.

F. (Step 3) Estimate On-Road Vehicle Emissions

On-road vehicle emissions were estimated using the MOVES emission factor model. As discussed in the previous section, the MOVES inputs are consistent with recent SIP and conformity analyses conducted by the Indianapolis MPO. The modeling undertaken for this project includes traffic estimates subdivided into light duty vehicles (autos) and trucks. These values were allocated into the various MOVES source-type (vehicle) classifications by applying vehicle distributions used in the development of the on-road mobile source emissions inventory found in the SIP.

The MOVES input traffic information relies on link-specific data, a distinction that is particularly important when employing it for project level analysis. A link file includes the vehicle volume, average speed, facility type, and grade. The PM emissions vary by time of day and time of year. Volume and speed data for each link were provided by the traffic analysts for AM peak, PM peak, and daily average traffic conditions.

For each analysis year, MOVES was run for four weekday time periods (AM peak, midday, PM peak, and overnight) for four different months (January, April, July, and October) to account for different climate conditions throughout the year. The AM and PM peak time periods were run with peak-hour traffic activity while the midday and overnight time periods were run with average-hour activity. Time periods were represented by the following hours:

- 6 AM was used to represent the AM time period (6 AM – 9 AM.)
- 12 PM was used to represent the midday time period (9 AM – 4 PM)
- 6 PM was used to represent PM peak time period (4 PM – 7 PM)
- 12 AM was used to represent the overnight time period (7 PM – 6 AM)

The results of the four hours were extrapolated to cover the entire day. The MOVES2AERMOD tool downloaded from the EPA website was utilized to post-process MOVES outputs for generating the "EMISFACT" portion of an AERMOD input file. The emission rates as input to AERMOD are in units of grams per second per square meter. **Attachment C** summarizes MOVES emission rates by four representative time periods for each of the four representative months. A checklist summarizing MOVES "Run Spec" and input assumptions is shown in **Attachment D**.

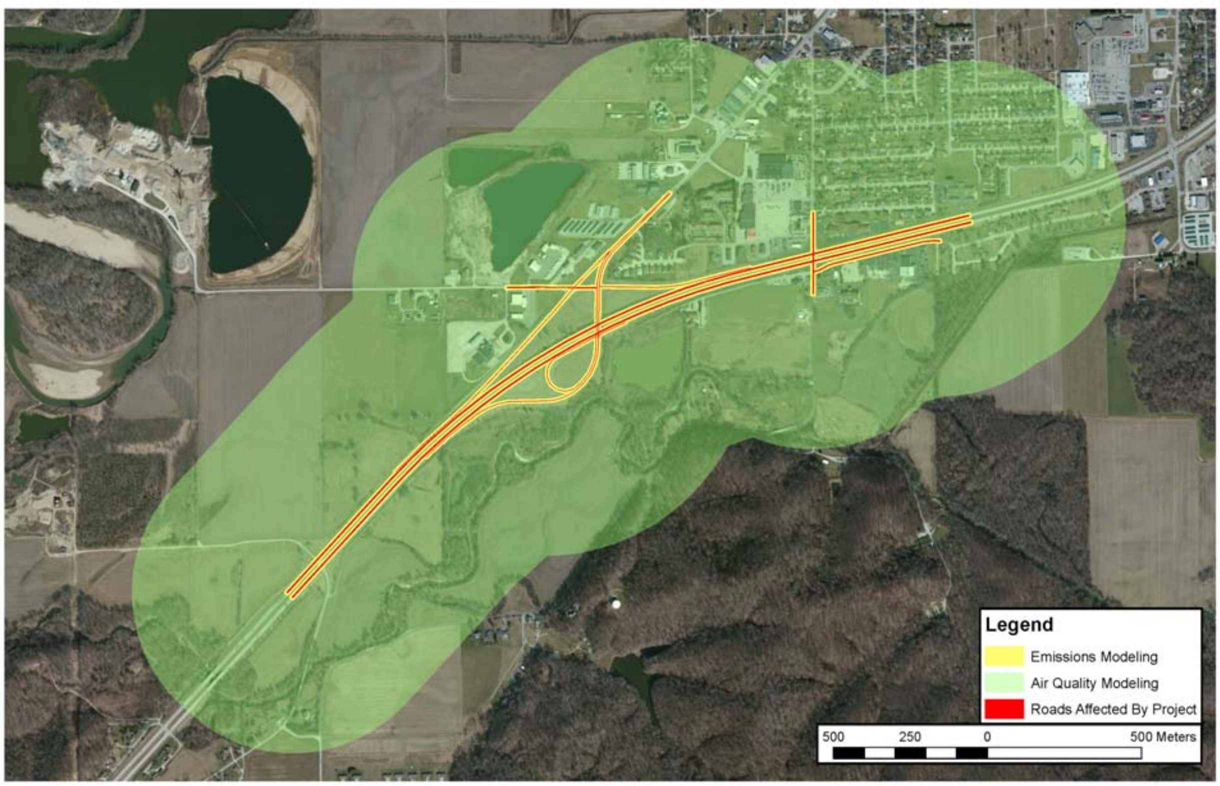
G. (Step 4) Road Dust, Construction, and Additional Sources

Road dust emissions were not included in the analysis as described in Step 2. Construction emissions were not included as the period of construction for this segment will be for less than five years. No additional sources of $PM_{2.5}$ emissions were included in this analysis. It is assumed that $PM_{2.5}$ concentrations due to any nearby emissions sources are included in the ambient monitor values that are used as background concentrations. In addition, this project is not expected to result in changes to emissions from existing nearby sources or support any new facilities that would impact localized $PM_{2.5}$ emissions

H. (Step 5) Air-Quality Model, Data Inputs, and Receptors

The following provides an overview of the air quality modeling undertaken including the assumptions used in EPA's AERMOD model that was used to estimate concentrations of $PM_{2.5.}$ The AERMOD model requires the determination of the emission sources (e.g. the roadway) and the locations to measure air quality concentrations (e.g. the receptors). **Exhibit 4** illustrates the extents used to define the source and receptor locations.

Exhibit 4: Extent of Emissions and Air Quality Modeling

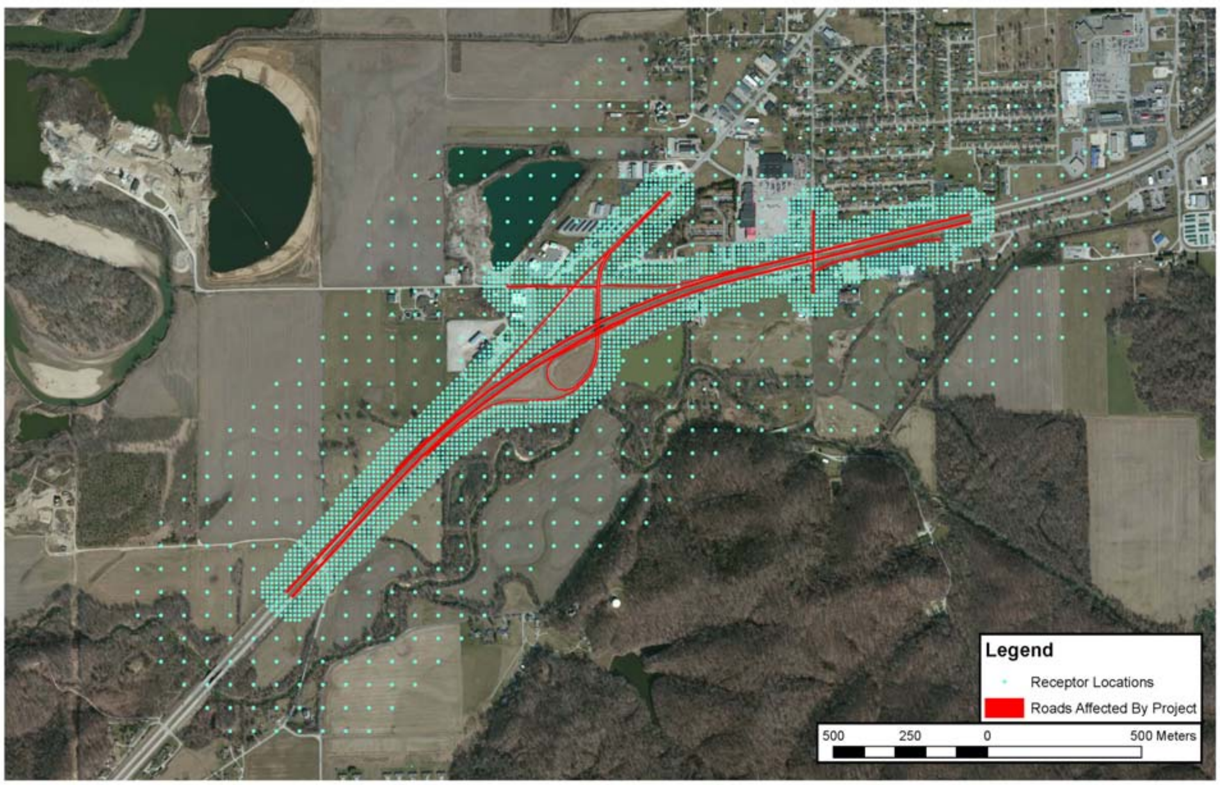


Defined areas were used to delineate the emission sources. Using GIS software, polygons were created having the same roadway segmentation as found in the traffic forecasting and MOVES modeling, with the width set to the width of the travel lanes. The areas/polygons representing ramps include an additional one-lane wide section parallel the mainline roadway to represent the merge areas.

As recommended in the EPA PM hot-spot guidance, receptors were placed in order to estimate the highest concentrations of $PM_{2.5}$ and to determine any possible violations of the NAAQS. Areas with higher concentrations of $PM_{2.5}$ are expected nearest the interchange and along the I-69 right–of-way. An area within 5m of the edge of all roadways was excluded as were medians and other areas to which the public would not have access. In cases where it was unclear if the area might be the site for future development, the area was included as a conservative assumption.

GIS software was used to define an area within 80 meters of the roadway edges. Within this area (but outside the excluded areas) receptors were located in a 15m grid formation. A second area was then defined between 80m and 500m of the edge of the roadways. Within this area, receptors were located in 75m grid formation. The extensive grid of receptors is used to evaluate the impact of the roadway emissions within the study area. **Exhibit 5** illustrates the extent area for receptor locations.

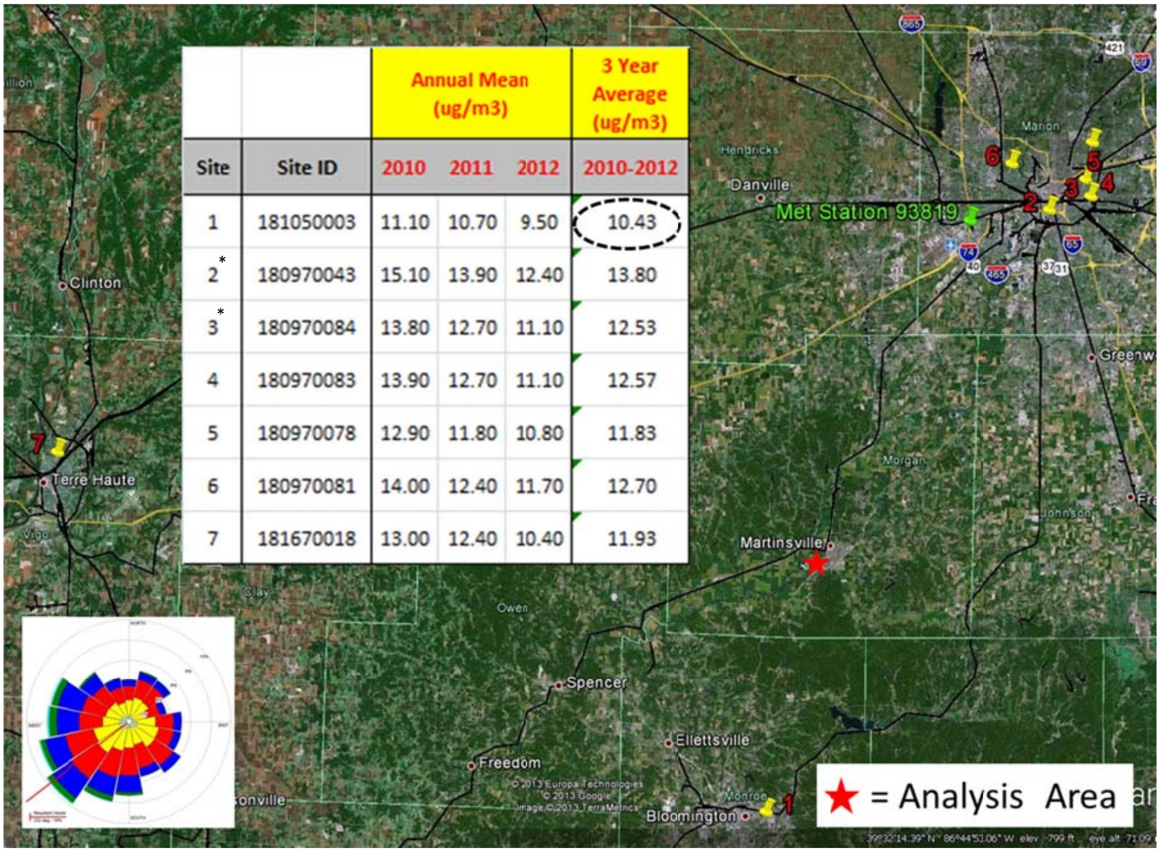
Exhibit 5: Modeled Receptor Locations



I. (Step 6) Background Concentrations from Nearby and Other Sources

The determination of background emissions was based on readings available from monitors in the region. No monitor is located immediately within the study area. Nearby monitors are shown in **Exhibit 6**.

Exhibit 6: Monitor Locations and Average Annual $PM_{2.5}$ Levels Reported



		Annual Mean (ug/m3)			3 Year Average (ug/m3)
Site	Site ID	2010	2011	2012	2010-2012
1	181050003	11.10	10.70	9.50	10.43
2*	180970043	15.10	13.90	12.40	13.80
3*	180970084	13.80	12.70	11.10	12.53
4	180970083	13.90	12.70	11.10	12.57
5	180970078	12.90	11.80	10.80	11.83
6	180970081	14.00	12.40	11.70	12.70
7	181670018	13.00	12.40	10.40	11.93

**Per IDEM, monitor sites 2 and 3 are considered not appropriate for NAAQS comparison.*

Key references used in determining the appropriate background concentration levels to use include:

- The EPA PM Hot-spot guidance (Section 8)
- Conformity rule, Sections 93.105(c)(1)(i) and 93.123(c)
- 40 CFR Part 51, Appendix W, Section 8.2.1 and 8.2.3

Monitor data was obtained from the EPA's AIR website (http://www.epa.gov/airdata/). Factors in choosing the monitors included:

- Distance of monitor from project area
- Wind patterns between monitor from project area
- Similar characteristics between the monitor location and project area

Based on ICG discussions, the Bloomington monitor was selected for representative background concentrations for this analysis due to its proximity to the study area. With prevailing winds generally from the southwest during most of the year (http://iclimate.org/narrative.asp) this appeared to be a conservative choice. The average monitor reading over last 3 years (2010-2012) was equal to a value of 10.43 µg/m^3; a monitor value that the ICG agreed reasonably reflected the background concentration in this region. These values are conservative because it is expected that ambient $PM_{2.5}$ concentrations will be lower in future years as a result of the State Implementation Plan and the general trend in declining vehicle emissions due to technological advances. Also, the project area is decidedly less developed than the areas sampled by these monitors, making the estimated background emissions even more conservative. This value was added to the AERMOD modeled receptor values to yield a design values for comparison to the NAAQS.

J. (Step 7) Calculate Design Values and Determine Conformity

The previous steps of the PM hot-spot analysis were combined to determine design values that were compared to the NAAQS for each analysis year. The annual $PM_{2.5}$ design values are defined as the average of three consecutive years' annual averages, each estimated using equally-weighted quarterly averages. This NAAQS is met when the three-year average concentration is less than or equal to the 1997 annual $PM_{2.5}$ NAAQS.

AERMOD was run to provide the annual average $PM_{2.5}$ concentrations at each receptor. For the receptor with the maximum modeled concentration (in each analysis year), the following steps were used to determine the design value, as outlined in EPA's guidance.

1. Obtain the average annual concentration for the receptor with the maximum modeled concentration from AERMOD output.
2. Add the average annual background concentration (10.43 µg/m^3 as described in Step 6) to the average annual modeled concentration to determine the total average annual concentration.
3. **Exhibit 7** summarizes the design values that correspond to the receptor with the maximum modeled concentration for each analysis year. All design values for the maximum receptor location are below the 1997 annual $PM_{2.5}$ NAAQS of 15.0 µg/m^3.
4. It is implied that the design value for all other receptors within the model domain are equal to, or lower than, the values in **Exhibit 7**, and therefore, are also below the NAAQS.

Exhibit 7: Estimated 2018 and 2035 Design Values

Analysis Year	Background Concentration (µg/m^3)	AERMOD Modeling Results* (µg/m^3)	Design Value (µg/m^3) (rounded to one decimal per EPA Guidance)
2018	10.43	0.99	11.4
2035	10.43	0.70	11.1

Notes: *Modeling results are for the receptors with the maximum concentration.*
1997 annual $PM_{2.5}$ NAAQS is 15 µg/m^3
µg/m^3 = micrograms per cubic meter

AERMOD air quality modeling results show that the annual average concentrations are higher in 2018 than in 2035 as emission rates from MOVES for 2018 are higher than for 2035. **Exhibit 8** illustrates the top 10 receptors with the highest concentrations, all of which are from 2018 modeling results. The project does not create a violation of the 1997 annual $PM_{2.5}$ NAAQS or worsen an existing exceedance of the NAAQS, which supports the project level conformity determination. **Attachment E** summarizes the AERMOD modeling results for top 10 receptors with the highest concentrations and the receptor with lowest concentration for 2018 and 2035.

Exhibit 8: Receptors with Highest Concentrations (2018)

K. (Step 8) Mitigation or Control Measures

No mitigation of air quality effects was proposed. All modeled annual $PM_{2.5}$ concentrations are below the NAAQS.

L. (Step 9) Document the PM Hot-Spot Analysis

This report documents the PM hot-spot analysis. Because of the large volume of input and output files, they are not included in this report and are available electronically upon request.

M. Conclusion

This technical report has provided a quantitative $PM_{2.5}$ hot-spot analysis for the I-69 Section 5 project in Indiana. The interagency consultation process played an integral role in defining the need, methodology and assumptions for the analysis. The air quality analysis included modeling techniques to estimate project-specific emission factors from vehicle exhaust and local $PM_{2.5}$ concentrations due to project operation. Emissions and dispersion modeling techniques were consistent with the EPA quantitative PM hot-spot analysis guidance, "*Transportation Conformity Guidance for Quantitative Hot-spot Analysis in*

$PM_{2.5}$ and PM_{10} Nonattainment and Maintenance Areas" (USEPA, 2010) that was released in December, 2010.

The analysis had demonstrated transportation conformity for the project by determining that future design value concentrations for the 2018 and 2035 analysis year will be lower than the 1997 annual $PM_{2.5}$ NAAQS of 15.0 μg/m³. As a result, the project does not create a violation of the 1997 annual $PM_{2.5}$ NAAQS, worsen an existing violation of the NAAQS, or delay timely attainment of the NAAQS and interim milestones, which meets 40 CRF 93.116 and 93.123 and supports the project level conformity determination.

References

- "I-69 Evansville to Indianapolis, Indiana, Section 5, Bloomington to Martinsville, Indiana Tier 2 Final Environmental Impact Statement"
- United States Environmental Protection Agency (USEPA). 2010. "Transportation Conformity Guidance for Quantitative Hot-spot Analyses in $PM_{2.5}$ and PM_{10} Nonattainment and Maintenance Areas."
- United States Environmental Protection Agency (USEPA) and United States Department of Transportation. 2012. "Completing Quantitative PM Hot-spot Analysis: 3 Day Course"

Attachments

- Attachment A: I-69 Section 5 Traffic Volumes
- Attachment B: MOVES Link Data Input Files
- Attachment C: MOVES Outputs (Emission Rates for AERMOD Modeling)
- Attachment D: MOVES and AERMOD Input Data Assumptions and Parameters
- Attachment E: AERMOD Outputs for Top 10 and Lowest Receptors

Attachment A:
I-69 Section 5 Traffic Volumes

2035 NO BUILD ASSUMES SECTION 5 IS NOT BUILT BUT SECTION 6 IS BUILT - TRUCK VOLUMES												
Segment	2018 No Build Truck Volumes			2018 Build Truck Volume			2035 No Build Truck Volumes			2035 Build Truck Volumes		
	AM	PM	Daily	AM	PM	Daily	AM	PM	Daily	AM	PM	Daily
SR 37 / I-69												
South of Liberty Church Road	200	113	3,417	209	122	3,576	568	197	11,034	656	247	12,726
Between Liberty Church Road and SR 39	210	105	3,571	220	113	3,714	569	199	11,060	658	248	12,785
North of SR 39	170	95	3,318	189	105	3,669	436	157	8,767	608	216	12,005
Liberty Church Road												
West of I-69	1	1	9	1	1	18	-	-	10	3	2	74
East of I-69	2	2	36	3	3	47	2	1	40	5	3	90
SR 39												
North of SR 37 / I-69	70	36	1,095	49	32	804	141	49	2,391	55	36	857

2035 NO BUILD ASSUMES SECTION 5 IS NOT BUILT BUT SECTION 6 IS BUILT - AADT												
Segment	2018 No Build AADT			2018 Build AADT			2035 No Build AADT			2035 Build AADT		
	AM	PM	Daily	AM	PM	Daily	AM	PM	Daily	AM	PM	Daily
SR 37 / I-69												
South of Liberty Church Road	2,200	2,503	29,490	2,444	2,822	32,648	3,294	3,559	42,926	4,580	5,179	58,890
Between Liberty Church Road and SR 39	2,379	2,597	29,146	2,648	2,934	32,331	3,399	3,702	44,550	4,752	5,422	61,588
North of SR 39	1,894	2,245	23,252	2,178	2,621	26,810	2,574	2,827	34,350	3,984	4,589	53,104
Liberty Church Road												
West of I-69	42	50	300	84	101	1,311	24	36	402	206	319	3,199
East of I-69	56	98	1,148	80	147	1,724	82	106	1,110	250	374	3,957
SR 39												
North of SR 37 / I-69	732	846	9,579	710	830	8,811	1,053	1,210	15,320	957	1,140	11,799

Attachment B:
MOVES Link Data Input Files

MOVES Emissions Analysis Inputs
2018 Daily (For Hours 12 AM and 12 PM Runs)

link ID	Road Type ID	link Length (miles)	Link Volume (veh/hour)	Link Avg Speed (mph)	Link Description	Link Avg Grade
1	4	0.77	674	75.74	55-I-069 AB Link	0.05
2	4	0.23	536	76.67	55-I-069 AB Link	0.66
3	4	0.94	552	78.33	55-I-069 AB Link	-0.12
4	4	0.26	185	31.84	55-R-Flare Ramp AB Link	-0.15
5	4	0.22	55	34.74	55-R-Flare Ramp AB Link	-0.17
6	4	0.12	19	28.8	55-R-Loop Ramp AB Link	1.58
7	4	0.05	158	30	55-R-Flare Ramp AB Link	0.76
8	5	0.05	21	8.82	55-CR-150 S AB Link	0
9	5	0.04	23	34.29	55-LS-ROGERS RD AB Link	0.95
10	4	0.21	25	34.05	55-R-Flare Ramp AB Link	-0.54
11	5	0.19	206	49.57	55-S-039-0-01 AB Link	0.4
12	5	0.04	9	7.27	55-LS-BURTON LN AB Link	0
13	5	0.13	71	39	55-LS-BURTON LN AB Link	0
14	5	0.26	47	35.45	55-LS-SOUTH VIEW D AB Link	0
15	4	0.93	674	76.44	55-I-069 BA Link	-0.04
16	4	0.58	546	77.33	55-I-069 BA Link	-0.13
17	4	0.55	559	76.74	55-I-069 BA Link	0.07
18	4	0.22	180	32.2	55-R-Flare Ramp BA Link	0.17
19	4	0.05	29	33.33	55-R-Flare Ramp BA Link	-0.76
20	4	0.36	175	27.69	55-S-039-0-01 BA Link	0
21	5	0.05	18	8.82	55-CR-150 S BA Link	0
22	5	0.06	28	32.73	55-LS-ROGERS RD BA Link	-1.26
23	5	0.19	162	49.57	55-S-039-0-01 BA Link	-0.4
24	5	0.08	177	53.33	55-S-039-0-01 BA Link	-0.47
25	5	0.04	17	34.29	55-LS-BURTON LN BA Link	0
26	5	0.13	70	16.96	55-LS-BURTON LN BA Link	0
27	5	0.26	60	22.29	55-LS-SOUTH VIEW D BA Link	0
28	5	0.02	23	4	55-LS-ROGERS RD AB Link	1.89

MOVES Emissions Analysis Inputs
2018 AM Peak Period (For Hour 6 AM Run)

link ID	Road Type ID	link Length (miles)	Link Volume (veh/hour)	Link Avg Speed (mph)	Link Description	Link Avg Grade
1	4	0.77	1324	75.74	55-I-069 AB Link	0.05
2	4	0.23	1064	76.67	55-I-069 AB Link	0.66
3	4	0.94	1086	78.33	55-I-069 AB Link	-0.12
4	4	0.26	459	31.84	55-R-Flare Ramp AB Link	-0.15
5	4	0.22	74	34.74	55-R-Flare Ramp AB Link	-0.17
6	4	0.12	37	28.8	55-R-Loop Ramp AB Link	1.58
7	4	0.05	423	30	55-R-Flare Ramp AB Link	0.76
8	5	0.05	36	8.82	55-CR-150 S AB Link	0
9	5	0.04	39	34.29	55-LS-ROGERS RD AB Link	0.95
10	4	0.21	39	34.05	55-R-Flare Ramp AB Link	-0.54
11	5	0.19	473	49.57	55-S-039-0-01 AB Link	0.4
12	5	0.04	26	7.27	55-LS-BURTON LN AB Link	0
13	5	0.13	125	39	55-LS-BURTON LN AB Link	0
14	5	0.26	78	35.45	55-LS-SOUTH VIEW D AB Link	0
15	4	0.93	1324	76.44	55-I-069 BA Link	-0.04
16	4	0.58	1082	77.33	55-I-069 BA Link	-0.13
17	4	0.55	1089	76.74	55-I-069 BA Link	0.07
18	4	0.22	424	32.2	55-R-Flare Ramp BA Link	0.17
19	4	0.05	41	33.33	55-R-Flare Ramp BA Link	-0.76
20	4	0.36	346	27.69	55-S-039-0-01 BA Link	0
21	5	0.05	30	8.82	55-CR-150 S BA Link	0
22	5	0.06	53	32.73	55-LS-ROGERS RD BA Link	-1.26
23	5	0.19	326	49.57	55-S-039-0-01 BA Link	-0.4
24	5	0.08	334	53.33	55-S-039-0-01 BA Link	-0.47
25	5	0.04	32	34.29	55-LS-BURTON LN BA Link	0
26	5	0.13	121	16.96	55-LS-BURTON LN BA Link	0
27	5	0.26	91	22.29	55-LS-SOUTH VIEW D BA Link	0
28	5	0.02	39	4	55-LS-ROGERS RD AB Link	1.89

MOVES Emissions Analysis Inputs
2018 PM Peak Period (For Hour 6 PM Run)

link ID	Road Type ID	link Length (miles)	Link Volume (veh/hour)	Link Avg Speed (mph)	Link Description	Link Avg Grade
1	4	0.77	1467	75.74	55-I-069 AB Link	0.05
2	4	0.23	1298	76.67	55-I-069 AB Link	0.66
3	4	0.94	1316	78.33	55-I-069 AB Link	-0.12
4	4	0.26	488	31.84	55-R-Flare Ramp AB Link	-0.15
5	4	0.22	116	34.74	55-R-Flare Ramp AB Link	-0.17
6	4	0.12	48	28.8	55-R-Loop Ramp AB Link	1.58
7	4	0.05	426	30	55-R-Flare Ramp AB Link	0.76
8	5	0.05	43	8.82	55-CR-150 S AB Link	0
9	5	0.04	59	34.29	55-LS-ROGERS RD AB Link	0.95
10	4	0.21	56	34.05	55-R-Flare Ramp AB Link	-0.54
11	5	0.19	529	49.57	55-S-039-0-01 AB Link	0.4
12	5	0.04	30	7.27	55-LS-BURTON LN AB Link	0
13	5	0.13	160	39	55-LS-BURTON LN AB Link	0
14	5	0.26	110	35.45	55-LS-SOUTH VIEW D AB Link	0
15	4	0.93	1467	76.44	55-I-069 BA Link	-0.04
16	4	0.58	1322	77.33	55-I-069 BA Link	-0.13
17	4	0.55	1311	76.74	55-I-069 BA Link	0.07
18	4	0.22	426	32.2	55-R-Flare Ramp BA Link	0.17
19	4	0.05	65	33.33	55-R-Flare Ramp BA Link	-0.76
20	4	0.36	429	27.69	55-S-039-0-01 BA Link	0
21	5	0.05	41	8.82	55-CR-150 S BA Link	0
22	5	0.06	70	32.73	55-LS-ROGERS RD BA Link	-1.26
23	5	0.19	381	49.57	55-S-039-0-01 BA Link	-0.4
24	5	0.08	412	53.33	55-S-039-0-01 BA Link	-0.47
25	5	0.04	47	34.29	55-LS-BURTON LN BA Link	0
26	5	0.13	158	16.96	55-LS-BURTON LN BA Link	0
27	5	0.26	135	22.29	55-LS-SOUTH VIEW D BA Link	0
28	5	0.02	59	4	55-LS-ROGERS RD AB Link	1.89

MOVES Emissions Analysis Inputs
2035 Daily (For Hours 12 AM and 12 PM Runs)

link ID	Road Type ID	link Length (miles)	Link Volume (veh/hour)	Link Avg Speed (mph)	Link Description	Link Avg Grade
1	4	0.77	1295	75.74	55-I-069 AB Link	0.05
2	4	0.23	1036	76.67	55-I-069 AB Link	0.66
3	4	0.94	1115	78.33	55-I-069 AB Link	-0.12
4	4	0.26	259	31.84	55-R-Flare Ramp AB Link	-0.15
5	4	0.22	79	34.74	55-R-Flare Ramp AB Link	-0.17
6	4	0.12	79	28.8	55-R-Loop Ramp AB Link	1.58
7	4	0.05	324	30	55-R-Flare Ramp AB Link	0.76
8	5	0.05	23	8.82	55-CR-150 S AB Link	0
9	5	0.04	29	34.29	55-LS-ROGERS RD AB Link	0.95
10	4	0.21	87	34.05	55-R-Flare Ramp AB Link	-0.54
11	5	0.19	311	49.57	55-S-039-0-01 AB Link	0.4
12	5	0.04	11	7.27	55-LS-BURTON LN AB Link	0
13	5	0.13	56	39	55-LS-BURTON LN AB Link	0
14	5	0.26	43	35.45	55-LS-SOUTH VIEW D AB Link	0
15	4	0.93	1281	76.44	55-I-069 BA Link	-0.04
16	4	0.58	1086	77.33	55-I-069 BA Link	-0.13
17	4	0.55	1174	76.74	55-I-069 BA Link	0.07
18	4	0.22	259	32.2	55-R-Flare Ramp BA Link	0.17
19	4	0.05	59	33.33	55-R-Flare Ramp BA Link	-0.76
20	4	0.36	194	27.69	55-S-039-0-01 BA Link	0
21	5	0.05	20	8.82	55-CR-150 S BA Link	0
22	5	0.06	36	32.73	55-LS-ROGERS RD BA Link	-1.26
23	5	0.19	245	49.57	55-S-039-0-01 BA Link	-0.4
24	5	0.08	198	53.33	55-S-039-0-01 BA Link	-0.47
25	5	0.04	22	34.29	55-LS-BURTON LN BA Link	0
26	5	0.13	55	16.96	55-LS-BURTON LN BA Link	0
27	5	0.26	55	22.29	55-LS-SOUTH VIEW D BA Link	0
28	5	0.02	29	4	55-LS-ROGERS RD AB Link	1.89

MOVES Emissions Analysis Inputs
2035 AM Peak Period (For Hour 6 AM Run)

link ID	Road Type ID	link Length (miles)	Link Volume (veh/hour)	Link Avg Speed (mph)	Link Description	Link Avg Grade
1	4	0.77	2549	75.74	55-I-069 AB Link	0.05
2	4	0.23	2018	76.67	55-I-069 AB Link	0.66
3	4	0.94	2110	78.33	55-I-069 AB Link	-0.12
4	4	0.26	531	31.84	55-R-Flare Ramp AB Link	-0.15
5	4	0.22	92	34.74	55-R-Flare Ramp AB Link	-0.17
6	4	0.12	92	28.8	55-R-Loop Ramp AB Link	1.58
7	4	0.05	646	30	55-R-Flare Ramp AB Link	0.76
8	5	0.05	36	8.82	55-CR-150 S AB Link	0
9	5	0.04	42	34.29	55-LS-ROGERS RD AB Link	0.95
10	4	0.21	151	34.05	55-R-Flare Ramp AB Link	-0.54
11	5	0.19	626	49.57	55-S-039-0-01 AB Link	0.4
12	5	0.04	27	7.27	55-LS-BURTON LN AB Link	0
13	5	0.13	76	39	55-LS-BURTON LN AB Link	0
14	5	0.26	53	35.45	55-LS-SOUTH VIEW D AB Link	0
15	4	0.93	2249	76.44	55-I-069 BA Link	-0.04
16	4	0.58	1869	77.33	55-I-069 BA Link	-0.13
17	4	0.55	2020	76.74	55-I-069 BA Link	0.07
18	4	0.22	531	32.2	55-R-Flare Ramp BA Link	0.17
19	4	0.05	63	33.33	55-R-Flare Ramp BA Link	-0.76
20	4	0.36	380	27.69	55-S-039-0-01 BA Link	0
21	5	0.05	29	8.82	55-CR-150 S BA Link	0
22	5	0.06	57	32.73	55-LS-ROGERS RD BA Link	-1.26
23	5	0.19	431	49.57	55-S-039-0-01 BA Link	-0.4
24	5	0.08	389	53.33	55-S-039-0-01 BA Link	-0.47
25	5	0.04	33	34.29	55-LS-BURTON LN BA Link	0
26	5	0.13	74	16.96	55-LS-BURTON LN BA Link	0
27	5	0.26	63	22.29	55-LS-SOUTH VIEW D BA Link	0
28	5	0.02	42	4	55-LS-ROGERS RD AB Link	1.89

MOVES Emissions Analysis Inputs
2035 PM Peak Period (For Hour 6 PM Run)

link ID	Road Type ID	link Length (miles)	Link Volume (veh/hour)	Link Avg Speed (mph)	Link Description	Link Avg Grade
1	4	0.77	2801	75.74	55-I-069 AB Link	0.05
2	4	0.23	2160	76.67	55-I-069 AB Link	0.66
3	4	0.94	2334	78.33	55-I-069 AB Link	-0.12
4	4	0.26	641	31.84	55-R-Flare Ramp AB Link	-0.15
5	4	0.22	174	34.74	55-R-Flare Ramp AB Link	-0.17
6	4	0.12	174	28.8	55-R-Loop Ramp AB Link	1.58
7	4	0.05	794	30	55-R-Flare Ramp AB Link	0.76
8	5	0.05	55	8.82	55-CR-150 S AB Link	0
9	5	0.04	75	34.29	55-LS-ROGERS RD AB Link	0.95
10	4	0.21	208	34.05	55-R-Flare Ramp AB Link	-0.54
11	5	0.19	761	49.57	55-S-039-0-01 AB Link	0.4
12	5	0.04	37	7.27	55-LS-BURTON LN AB Link	0
13	5	0.13	127	39	55-LS-BURTON LN AB Link	0
14	5	0.26	94	35.45	55-LS-SOUTH VIEW D AB Link	0
15	4	0.93	2668	76.44	55-I-069 BA Link	-0.04
16	4	0.58	2220	77.33	55-I-069 BA Link	-0.13
17	4	0.55	2428	76.74	55-I-069 BA Link	0.07
18	4	0.22	641	32.2	55-R-Flare Ramp BA Link	0.17
19	4	0.05	122	33.33	55-R-Flare Ramp BA Link	-0.76
20	4	0.36	448	27.69	55-S-039-0-01 BA Link	0
21	5	0.05	52	8.82	55-CR-150 S BA Link	0
22	5	0.06	89	32.73	55-LS-ROGERS RD BA Link	-1.26
23	5	0.19	548	49.57	55-S-039-0-01 BA Link	-0.4
24	5	0.08	459	53.33	55-S-039-0-01 BA Link	-0.47
25	5	0.04	57	34.29	55-LS-BURTON LN BA Link	0
26	5	0.13	126	16.96	55-LS-BURTON LN BA Link	0
27	5	0.26	116	22.29	55-LS-SOUTH VIEW D BA Link	0
28	5	0.02	75	4	55-LS-ROGERS RD AB Link	1.89

Attachment C:
MOVES Outputs (Emission Rates for AERMOD Modeling)

<Data Outputs Begin on Following Page>

2018 MOVES Emission Rates (grams/second/meter^2)
January & April

Month	Link ID	AM	MD	PM	NT
January	1	1.0449E-06	4.64884E-07	6.97945E-07	5.54276E-07
January	2	7.35515E-07	3.54488E-07	5.27919E-07	4.12416E-07
January	3	6.10349E-07	2.89435E-07	4.44551E-07	3.40225E-07
January	4	1.4007E-06	5.22692E-07	1.38016E-06	5.72218E-07
January	5	1.85977E-07	9.47632E-08	2.29162E-07	1.10319E-07
January	6	6.21373E-08	7.69971E-08	8.49173E-08	8.33754E-08
January	7	1.42402E-06	5.12238E-07	1.38993E-06	5.58896E-07
January	8	1.44249E-07	7.37719E-08	1.49142E-07	8.96929E-08
January	9	9.34881E-08	3.9046E-08	1.04114E-07	4.98402E-08
January	10	5.31102E-08	2.88111E-08	6.99454E-08	3.56161E-08
January	11	6.08975E-07	2.21277E-07	5.70261E-07	2.52897E-07
January	12	1.1337E-07	3.13094E-08	9.71662E-08	3.8746E-08
January	13	2.80771E-07	1.08934E-07	2.77829E-07	1.35974E-07
January	14	1.57766E-07	6.79063E-08	1.62605E-07	8.65607E-08
January	15	1.02633E-06	4.53451E-07	6.87626E-07	5.42238E-07
January	16	6.16804E-07	2.90899E-07	4.50985E-07	3.41665E-07
January	17	6.54335E-07	3.1476E-07	4.73718E-07	3.69522E-07
January	18	1.30457E-06	5.40939E-07	1.20756E-06	5.91529E-07
January	19	1.14488E-07	5.50252E-08	1.4835E-07	6.23892E-08
January	20	1.24172E-06	5.65694E-07	1.29584E-06	6.13212E-07
January	21	1.20207E-07	6.08584E-08	1.37734E-07	7.45516E-08
January	22	1.05849E-07	4.19673E-08	1.11744E-07	5.14709E-08
January	23	3.46488E-07	1.39462E-07	3.3126E-07	1.6148E-07
January	24	3.55056E-07	1.46708E-07	3.37415E-07	1.70369E-07
January	25	6.0222E-08	2.55211E-08	6.27698E-08	3.23442E-08
January	26	4.21571E-07	1.75219E-07	4.16585E-07	2.18692E-07
January	27	3.06271E-07	1.42585E-07	3.56347E-07	1.73177E-07
January	28	2.74524E-07	1.20324E-07	3.20365E-07	1.47784E-07
April	1	6.67303E-07	3.44008E-07	4.06479E-07	3.8702E-07
April	2	4.83555E-07	2.7616E-07	3.12488E-07	3.0403E-07
April	3	3.91432E-07	2.20757E-07	2.59134E-07	2.45193E-07
April	4	1.14315E-06	4.55729E-07	1.19873E-06	4.79551E-07
April	5	1.435E-07	7.37284E-08	1.84282E-07	8.12131E-08
April	6	3.36122E-08	6.83739E-08	6.06979E-08	7.14416E-08
April	7	1.16098E-06	4.49154E-07	1.21536E-06	4.71597E-07
April	8	8.6652E-08	5.22431E-08	1.03784E-07	5.99038E-08
April	9	5.54557E-08	2.44491E-08	6.57285E-08	2.96435E-08
April	10	3.07848E-08	1.9609E-08	4.88914E-08	2.28836E-08
April	11	4.57847E-07	1.78523E-07	4.57451E-07	1.93735E-07
April	12	6.8403E-08	2.12534E-08	6.25483E-08	2.48318E-08
April	13	1.82643E-07	7.23677E-08	1.9402E-07	8.53801E-08
April	14	9.34021E-08	4.26801E-08	1.02027E-07	5.16571E-08
April	15	6.51271E-07	3.33391E-07	3.98114E-07	3.76112E-07
April	16	3.96265E-07	2.22256E-07	2.62465E-07	2.46681E-07
April	17	4.20776E-07	2.4071E-07	2.77367E-07	2.67058E-07
April	18	1.05281E-06	4.72538E-07	1.03995E-06	4.96874E-07
April	19	9.35415E-08	4.5068E-08	1.25947E-07	4.86109E-08
April	20	1.04607E-06	5.01449E-07	1.13241E-06	5.24305E-07
April	21	7.22101E-08	4.23422E-08	9.43645E-08	4.89311E-08
April	22	6.84559E-08	2.91159E-08	7.88892E-08	3.36891E-08
April	23	2.545E-07	1.09688E-07	2.59387E-07	1.20282E-07
April	24	2.63126E-07	1.14713E-07	2.60663E-07	1.26097E-07
April	25	3.32576E-08	1.62944E-08	3.63451E-08	1.95778E-08
April	26	2.65786E-07	1.16431E-07	2.80771E-07	1.37351E-07
April	27	2.10711E-07	1.01217E-07	2.61613E-07	1.15938E-07
April	28	1.77768E-07	8.31934E-08	2.22715E-07	9.64054E-08

2018 MOVES Emission Rates (grams/second/meter^2)
July & October

Month	MOVESlinkID	AM	MD	PM	NT
July	1	5.95063E-07	3.39754E-07	3.89155E-07	3.56384E-07
July	2	4.35351E-07	2.7341E-07	2.99683E-07	2.84178E-07
July	3	3.4955E-07	2.18343E-07	2.48112E-07	2.27787E-07
July	4	1.09388E-06	4.53392E-07	1.18804E-06	4.62581E-07
July	5	1.35374E-07	7.29888E-08	1.81628E-07	7.58824E-08
July	6	2.81551E-08	6.80736E-08	5.9261E-08	6.92562E-08
July	7	1.11066E-06	4.46956E-07	1.20508E-06	4.5561E-07
July	8	7.56334E-08	5.14848E-08	1.01094E-07	5.44481E-08
July	9	4.81797E-08	2.39329E-08	6.34476E-08	2.59444E-08
July	10	2.65138E-08	1.92843E-08	4.76425E-08	2.05517E-08
July	11	4.28934E-07	1.77023E-07	4.50784E-07	1.82898E-07
July	12	5.98006E-08	2.08992E-08	6.04948E-08	2.22834E-08
July	13	1.6387E-07	7.10762E-08	1.89047E-07	7.61135E-08
July	14	8.10886E-08	4.17884E-08	9.84277E-08	4.52644E-08
July	15	5.79518E-07	3.29167E-07	3.80903E-07	3.45683E-07
July	16	3.54073E-07	2.19843E-07	2.51259E-07	2.29282E-07
July	17	3.76093E-07	2.38108E-07	2.65696E-07	2.4829E-07
July	18	1.00464E-06	4.70153E-07	1.03006E-06	4.79539E-07
July	19	8.95344E-08	4.47188E-08	1.24626E-07	4.60874E-08
July	20	1.00864E-06	4.99215E-07	1.12279E-06	5.08022E-07
July	21	6.30278E-08	4.16897E-08	9.17925E-08	4.42387E-08
July	22	6.13023E-08	2.86622E-08	7.69393E-08	3.04325E-08
July	23	2.36901E-07	1.08643E-07	2.55134E-07	1.12737E-07
July	24	2.45539E-07	1.1359E-07	2.56122E-07	1.17989E-07
July	25	2.8099E-08	1.59682E-08	3.47741E-08	1.72396E-08
July	26	2.35982E-07	1.14354E-07	2.72706E-07	1.22453E-07
July	27	1.92429E-07	9.97569E-08	2.55993E-07	1.05454E-07
July	28	1.59258E-07	8.18895E-08	2.16938E-07	8.69958E-08
October	1	8.71803E-07	4.10616E-07	5.67415E-07	4.77657E-07
October	2	6.20011E-07	3.1932E-07	4.31438E-07	3.62765E-07
October	3	5.09993E-07	2.58601E-07	3.61512E-07	2.96691E-07
October	4	1.28264E-06	4.92626E-07	1.29891E-06	5.29771E-07
October	5	1.66506E-07	8.53197E-08	2.09063E-07	9.69866E-08
October	6	4.90612E-08	7.31254E-08	7.40711E-08	7.79086E-08
October	7	1.30344E-06	4.83915E-07	1.31175E-06	5.18907E-07
October	8	1.17846E-07	6.41069E-08	1.28829E-07	7.60474E-08
October	9	7.60535E-08	3.2493E-08	8.6924E-08	4.05885E-08
October	10	4.28764E-08	2.46801E-08	6.05169E-08	2.97838E-08
October	11	5.39696E-07	2.02081E-07	5.19739E-07	2.25796E-07
October	12	9.27569E-08	2.67949E-08	8.16636E-08	3.23723E-08
October	13	2.35789E-07	9.25185E-08	2.40296E-07	1.12798E-07
October	14	1.28261E-07	5.65817E-08	1.35476E-07	7.05723E-08
October	15	8.54392E-07	3.99549E-07	5.57968E-07	4.66136E-07
October	16	5.15703E-07	2.60081E-07	3.66558E-07	2.98153E-07
October	17	5.47266E-07	2.81512E-07	3.85783E-07	3.22585E-07
October	18	1.18916E-06	5.10229E-07	1.1325E-06	5.4817E-07
October	19	1.04886E-07	5.05549E-08	1.38317E-07	5.60778E-08
October	20	1.15203E-06	5.3685E-07	1.22265E-06	5.72487E-07
October	21	9.82051E-08	5.2546E-08	1.18312E-07	6.28156E-08
October	22	8.87076E-08	3.61981E-08	9.70307E-08	4.33256E-08
October	23	3.04319E-07	1.26095E-07	2.99072E-07	1.42608E-07
October	24	3.12914E-07	1.32343E-07	3.03042E-07	1.50089E-07
October	25	4.78612E-08	2.13791E-08	5.09361E-08	2.64962E-08
October	26	3.50156E-07	1.48827E-07	3.55762E-07	1.81431E-07
October	27	2.62465E-07	1.24013E-07	3.13921E-07	1.46957E-07
October	28	2.30172E-07	1.03655E-07	2.76636E-07	1.2425E-07

2035 MOVES Emission Rates (grams/second/meter^2)
January & April

Month	Link ID	AM	MD	PM	NT
January	1	1.21261E-06	4.2384E-07	8.76147E-07	5.57726E-07
January	2	8.01159E-07	2.88295E-07	5.64625E-07	3.73834E-07
January	3	7.09373E-07	2.6038E-07	5.18629E-07	3.39648E-07
January	4	7.22501E-07	2.66233E-07	6.26542E-07	3.30259E-07
January	5	1.20092E-07	7.25254E-08	1.60024E-07	9.26794E-08
January	6	1.4445E-07	8.53202E-08	1.87388E-07	1.10342E-07
January	7	9.14102E-07	3.38989E-07	7.93906E-07	4.26287E-07
January	8	1.32663E-07	6.21682E-08	1.48443E-07	7.7321E-08
January	9	7.83307E-08	3.68604E-08	9.64936E-08	4.87591E-08
January	10	1.91124E-07	7.97971E-08	1.90857E-07	1.00548E-07
January	11	3.83146E-07	1.29211E-07	3.13192E-07	1.72802E-07
January	12	1.03843E-07	3.12758E-08	1.05099E-07	3.92891E-08
January	13	1.17988E-07	5.96745E-08	1.37228E-07	7.85002E-08
January	14	8.62894E-08	4.85519E-08	1.07812E-07	6.36153E-08
January	15	1.05973E-06	4.15093E-07	8.30292E-07	5.46144E-07
January	16	6.34824E-07	2.57729E-07	5.00383E-07	3.34974E-07
January	17	7.22548E-07	2.91088E-07	5.73846E-07	3.80811E-07
January	18	7.26854E-07	2.6474E-07	6.22888E-07	3.3133E-07
January	19	8.2266E-08	5.52775E-08	1.13894E-07	6.8978E-08
January	20	5.46102E-07	2.13526E-07	4.70333E-07	2.62659E-07
January	21	1.06112E-07	5.32902E-08	1.39049E-07	6.65173E-08
January	22	9.27493E-08	4.25893E-08	1.06205E-07	5.35399E-08
January	23	2.39251E-07	9.33032E-08	2.07321E-07	1.23642E-07
January	24	2.07255E-07	7.1458E-08	1.65149E-07	9.58045E-08
January	25	5.53079E-08	2.58081E-08	6.75275E-08	3.35828E-08
January	26	1.94695E-07	1.03494E-07	2.39617E-07	1.32303E-07
January	27	1.44014E-07	8.94737E-08	1.90927E-07	1.13872E-07
January	28	2.31109E-07	1.13151E-07	2.92916E-07	1.44416E-07
April	1	6.18235E-07	2.4282E-07	4.0036E-07	3.07218E-07
April	2	4.17383E-07	1.72649E-07	2.59414E-07	2.13785E-07
April	3	3.68495E-07	1.53206E-07	2.39406E-07	1.91332E-07
April	4	4.47505E-07	1.79659E-07	4.01453E-07	2.10463E-07
April	5	7.18988E-08	4.52724E-08	9.79867E-08	5.49701E-08
April	6	8.46285E-08	5.14846E-08	1.10356E-07	6.35246E-08
April	7	5.50398E-07	2.20949E-07	4.91008E-07	2.6295E-07
April	8	8.36091E-08	4.16784E-08	9.79072E-08	4.89693E-08
April	9	4.26616E-08	2.07699E-08	5.35826E-08	2.64959E-08
April	10	1.16548E-07	5.17372E-08	1.21532E-07	6.17219E-08
April	11	1.99715E-07	7.02664E-08	1.62085E-07	9.1241E-08
April	12	6.28016E-08	2.044E-08	6.75088E-08	2.42958E-08
April	13	6.509E-08	3.42171E-08	7.77445E-08	4.32764E-08
April	14	4.77233E-08	2.81817E-08	6.20046E-08	3.54307E-08
April	15	5.49068E-07	2.37907E-07	3.81224E-07	3.00941E-07
April	16	3.37283E-07	1.53294E-07	2.32866E-07	1.90444E-07
April	17	3.79339E-07	1.6978E-07	2.64451E-07	2.12934E-07
April	18	4.40845E-07	1.747E-07	3.88778E-07	2.06737E-07
April	19	5.23491E-08	3.67513E-08	7.42895E-08	4.33435E-08
April	20	3.44305E-07	1.47089E-07	3.09568E-07	1.70728E-07
April	21	6.6474E-08	3.54044E-08	9.113E-08	4.17687E-08
April	22	5.68605E-08	2.7781E-08	6.85159E-08	3.30506E-08
April	23	1.27854E-07	5.22786E-08	1.11508E-07	6.68769E-08
April	24	1.07059E-07	3.85358E-08	8.53048E-08	5.02511E-08
April	25	3.10804E-08	1.52946E-08	3.94501E-08	1.90359E-08
April	26	1.14175E-07	6.45364E-08	1.47736E-07	7.83997E-08
April	27	8.63492E-08	5.6481E-08	1.19281E-07	6.82218E-08
April	28	1.37367E-07	7.08769E-08	1.80193E-07	8.59189E-08

2035 MOVES Emission Rates (grams/second/meter^2)
July & October

Month	MOVESlinkID	AM	MD	PM	NT
July	1	5.04522E-07	2.36516E-07	3.721E-07	2.61335E-07
July	2	3.4396E-07	1.68645E-07	2.41292E-07	1.84471E-07
July	3	3.03279E-07	1.49482E-07	2.22824E-07	1.64166E-07
July	4	3.94896E-07	1.76621E-07	3.88109E-07	1.88523E-07
July	5	6.26792E-08	4.43117E-08	9.43054E-08	4.80638E-08
July	6	7.31844E-08	5.02925E-08	1.05786E-07	5.49499E-08
July	7	4.8082E-07	2.16808E-07	4.73055E-07	2.33036E-07
July	8	7.42249E-08	4.09571E-08	9.49112E-08	4.37767E-08
July	9	3.58377E-08	2.02011E-08	5.10321E-08	2.24182E-08
July	10	1.02281E-07	5.07487E-08	1.1742E-07	5.46111E-08
July	11	1.64622E-07	6.81893E-08	1.53112E-07	7.63028E-08
July	12	5.49501E-08	2.00582E-08	6.5279E-08	2.15498E-08
July	13	5.497E-08	3.33173E-08	7.42098E-08	3.6825E-08
July	14	4.03451E-08	2.74612E-08	5.92818E-08	3.02686E-08
July	15	4.51369E-07	2.31736E-07	3.54552E-07	2.5603E-07
July	16	2.80358E-07	1.49669E-07	2.16983E-07	1.63972E-07
July	17	3.13679E-07	1.65564E-07	2.46077E-07	1.82185E-07
July	18	3.86129E-07	1.7154E-07	3.74898E-07	1.83918E-07
July	19	4.66258E-08	3.60991E-08	7.19409E-08	3.86486E-08
July	20	3.057E-07	1.44758E-07	3.00039E-07	1.53891E-07
July	21	5.8891E-08	3.47743E-08	8.82884E-08	3.72361E-08
July	22	4.99946E-08	2.72582E-08	6.62778E-08	2.92979E-08
July	23	1.06542E-07	5.08322E-08	1.05818E-07	5.64802E-08
July	24	8.78906E-08	3.73746E-08	8.05617E-08	4.19077E-08
July	25	2.64455E-08	1.49229E-08	3.77814E-08	1.63716E-08
July	26	9.87708E-08	6.31596E-08	1.42277E-07	6.8527E-08
July	27	7.5317E-08	5.53156E-08	1.15025E-07	5.98606E-08
July	28	1.19434E-07	6.93922E-08	1.73519E-07	7.52056E-08
October	1	9.40131E-07	3.42558E-07	6.63065E-07	4.4297E-07
October	2	6.25224E-07	2.36365E-07	4.27935E-07	3.00517E-07
October	3	5.53107E-07	2.12256E-07	3.93578E-07	2.71706E-07
October	4	5.96441E-07	2.27366E-07	5.25741E-07	2.75384E-07
October	5	9.80001E-08	6.02905E-08	1.32242E-07	7.54057E-08
October	6	1.17027E-07	7.01302E-08	1.52891E-07	8.88963E-08
October	7	7.47379E-07	2.85996E-07	6.5826E-07	3.51467E-07
October	8	1.10176E-07	5.29696E-08	1.25811E-07	6.43339E-08
October	9	6.19795E-08	2.96368E-08	7.72765E-08	3.85606E-08
October	10	1.56938E-07	6.72001E-08	1.59812E-07	8.27629E-08
October	11	2.99058E-07	1.02748E-07	2.45521E-07	1.3544E-07
October	12	8.50295E-08	2.64113E-08	8.82653E-08	3.24211E-08
October	13	9.37392E-08	4.82461E-08	1.10589E-07	6.23648E-08
October	14	6.86102E-08	3.94072E-08	8.7298E-08	5.07044E-08
October	15	8.25629E-07	3.35534E-07	6.29176E-07	4.33819E-07
October	16	4.98424E-07	2.10834E-07	3.80575E-07	2.68765E-07
October	17	5.65213E-07	2.36617E-07	4.35283E-07	3.03906E-07
October	18	5.95746E-07	2.24317E-07	5.18047E-07	2.74257E-07
October	19	6.85519E-08	4.69604E-08	9.61579E-08	5.72356E-08
October	20	4.53597E-07	1.83699E-07	3.98338E-07	2.20549E-07
October	21	8.79416E-08	4.52605E-08	1.17589E-07	5.51806E-08
October	22	7.62974E-08	3.59414E-08	8.93268E-08	4.41542E-08
October	23	1.88185E-07	7.48857E-08	1.64413E-07	9.76388E-08
October	24	1.61324E-07	5.6678E-08	1.29393E-07	7.49373E-08
October	25	4.42017E-08	2.10883E-08	5.49537E-08	2.69191E-08
October	26	1.57783E-07	8.60046E-08	1.98469E-07	1.07611E-07
October	27	1.1758E-07	7.46624E-08	1.58841E-07	9.29602E-08
October	28	1.88138E-07	9.41728E-08	2.42436E-07	1.1762E-07

Attachment D:
MOVES and AERMOD Input Data Assumptions and Parameters

Data Checklist
MOVES Project-Level Emission Modeling

Data Item	Inputs Needed/Assumptions	Data Source
MOVES RunSpec		
Scale/Calulation Type	Project Scale Inventory Run	
Analysis County	Morgan County (FIPS: 18109)	
Analysis Years	2018 & 2035	
Representative Months	January (Jan-Mar), April (Apr-Jun), July (Jul-Sep), October(Oct-Dec)	
Representative Hours	6 am (6am-9am), 12 pm (9am-4pm), 6 pm(4pm-7pm), 12 am(7pm-6am)	
Number of Runs	4 hours of a weekday x 4 quarters = 16 runs per scenario	
Pollutants and Processes	Primary Exhuast PM2.5 - Total: Running Exhaust & Crankcase Running Exhaust Primary PM2.5 - Brakewear Particulate Primary PM2.5 - Tirewear Particulate	
Stage II Refueling Emissions	Not Applicable	
Fuel Types	Gasoline, Diesel, CNG	
Traffic Data		
Highway Network	Requried traffic volume, speed, distance and facility type by time period (AM/PM peak and daily average) for each link. Average speed will be estimated using traffic volume and traffic delay from model network.	- Traffic network databases received from Brian Curtis on 4/2/2013 - Network field definition file received from Brian Curtis on 4/8/2013
MOVES Inputs		
Fuel Supply	Use MOVES defaults (Marion County's fuel inputs for regional analysis as provided by Indianapolis MPO are based on MOVES defaults)	- MOVES inputs for Marion County received from Indianapolis MPO (Catherine Kostyn) on 4/8/2013 -Seasonal MOVES meteorology inputs for Marion County received from CDM Smith (Roberto Miquel) on 4/22/2013
Fuel Formulation		
I/M Parameters	Not Applicable	
Vehicle Age Distribution	Use same inputs as developed for PM2.5 SIP (Marion County inputs)	
Temperatures/Humidity	Average meteorology data for each hour for each representative time period. Use same inputs as developed for recent PM2.5 SIP/regional analysis.	
Links	Average speed, traffic volume, distance and road type (facility type) for each link. Examine traffic network to define representative links based on geographic and vehicle activity parameters (e.g. traffic volume and congested speed) Grade: Calculated based on link length and elevation data provided by IMAGIS.	- Elevation data (DEMs) received from IMAGIS (Jim Stout) on 4/22/2013
Link Source Type	Distribution of source type population for each link. Use traffic volumes from model network and regional fleet distribution (based on MOVES source type population input for reginal analysis) to calculate link source type distribution.	MOVES data received from Indianapolis MPO (Catherine Kostyn) on 4/8/2013
Link Drive Schedule	Not Applicable	
Operating Mode Distribution	Not Applicable	
Off-Network Link	Not Applicable	
Control Programs		
Early NLEV / CALLEVII	Not Applicable	
Stage II Refueling Parameters	Not Applicable	

Data Checklist
AERMOD Dispersion Modeling

Data Item	Inputs Needed/Assumptions	Data Source
Analysis		
Air Quality Dispersion Model	AERMOD (Dated 12345)	Downloaded from EPA's SCRAM website (http://www.epa.gov/ttn/scram/dispersion_prefrec.htm#aermod)
Key AERMOD Inputs		
Modeling Options	Modle concentration and assume flat terrain	
Pollutant	PM 2.5	
Averaging Period	Annual	
Receptor Height	1.8 meters	Per EPA & DOT "Completing Quantitative PM Hot-spot Analysis: 3 Day Course" Training Document (2012)
Emission Source Type	Model roadway links as "Area" sources, and use "AREAPOLY" option to specify area sources.	
Release Height	1.3~1.8 meters (estimated using a volume-weighted avearge for each link). Assume release height is 1.3 meters for light duty vehicles and 3.4 meters for heavy duty vehicles.	Per EPA & DOT "Completing Quantitative PM Hot-spot Analysis: 3 Day Course" Training Document (2012)
Initial Vertical Dispersion Coefficient	1.2~1.7 meters (estimated using a volume-weighted avearge for each link). Assume coefficient is 1.2 meters for light duty vehicles and 3.2 meters for heavy duty vehicles.	Per EPA & DOT "Completing Quantitative PM Hot-spot Analysis: 3 Day Course" Training Document (2012)
Emission Rates	Emission factors (g/s/m2) by season and hour of day derived from MOVES outputs	
Receptors	Receptor are placed per PM Hot-Spot Guidance and considering sensitive populations: First receptor network is within 5-80 meters of the roadway edges with 15 meters of spacing among receptors. Second receptor network is within 80-500 meters of the roadway edges with 75 meters of spacing among receptors.	Per EPA Quantitative PM Hot-Spot Analyses Guidance
Meteorology Data (*.sfc & *.pfl)	Use 5 most recent available years (2006-2010) of off-site meteorological data available from IDEM website: - Surface meteorological data is from the National Weather Service Site for Indianapolis, IN - Upper air meteorological data is from Lincoln, IL station.	Downloaded from IDEM website (http://www.in.gov/idem/airquality/2376.htm)

Attachment E:
AERMOD Outputs for Top 10 and Lowest Receptors

2018 AERMOD Outputs

Rank	X	Y	AERMOD Modeling Results (µg/m³)
1	954470	461105	0.98771
2	954455	461090	0.95111
3	954410	461120	0.9481
4	954425	461135	0.92261
5	954440	461075	0.91043
6	954545	461165	0.90249
7	954440	461150	0.89479
8	954455	461165	0.86358
9	954530	461150	0.86002
10	954425	461060	0.85588
Lowest	953465	460535	0.02154

2035 AERMOD Outputs

Rank	X	Y	AERMOD Modeling Results (µg/m³)
1	954470	461105	0.69623
2	954455	461090	0.6766
3	954410	461120	0.65825
4	954440	461075	0.65513
5	954425	461135	0.63944
6	954425	461060	0.62783
7	954170	460805	0.6239
8	954440	461150	0.61853
9	954185	460820	0.60922
10	954200	460835	0.59584
Lowest	953465	460535	0.01767