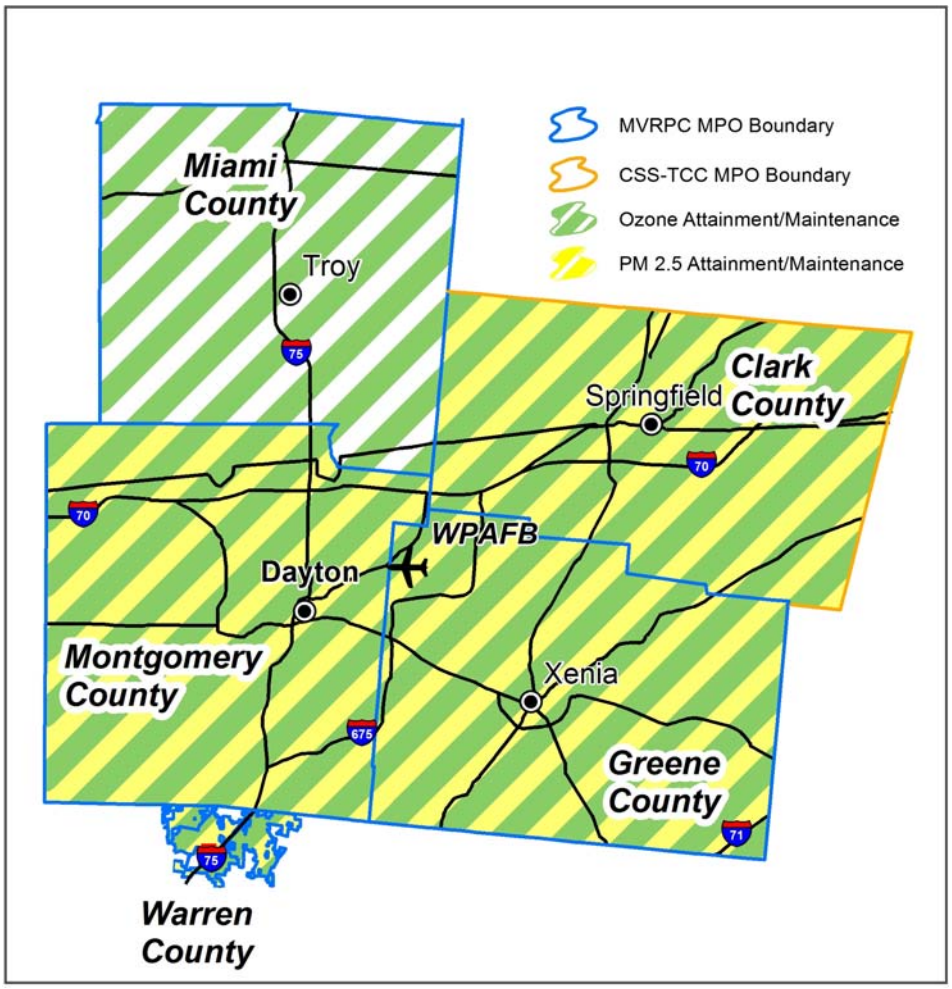
Technical Memorandum
MVRPC/Clark County Springfield TCC
2016 Update of Regional Transportation Plans
Mobile Emissions Estimate

March 2016
(Draft)



By MVRPC and Ohio Department of Transportation

In coordination with Clark County Springfield TCC

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1. Overview

This memorandum is intended to document the air quality analyses and underlying assumptions performed by the Ohio Department of Transportation (ODOT), Division of Planning – Modeling and Forecasting Section and the Miami Valley Regional Planning Commission (MVRPC) for the 2016 Update of the 2040 Long Range Transportation Plan regional emissions analysis of PM 2.5 precursors.

The D/S Region is comprised of the counties of Clark, Greene, Miami, and Montogomery in west-central Ohio. Three counties (Clark, Greene, and Montgomery) are designated attainment/maintenance for the Annual PM2.5 Standard. All four counties are designated attainment/maintenance for the 1997 Ozone Standard. On March 6, 2015, U.S. EPA published the final rule for the *Implementation of the 2008 NAAQS for Ozone: State Implementation Plan Requirements,* 80 FR 12264, effective April 6, 2015. The final rule revoked the 1997 ozone standard for all purposes including transportation conformity. Therefore, a regional emission analysis for ozone precursors is no longer required.

Clark County Springfield Transportation Coordinating Committee (CCSTCC) serves as the Metropolitan Planning Organization (MPO) for Clark County while MVRPC serves as the MPO for the remainder counties: Greene, Miami, and Montgomery.

The ODOT Modeling and Forecasting section performed the MOVES runs to generate travel demand model based emission factors as well as the complete air quality analyses for Clark County. Using ODOT generated emission factors, MVRPC completed the air quality analyses for Greene, and Montgomery Counties.

Latest Planning Assumptions

The annual PM2.5 regional emissions analysis meets the latest planning assumption requirement. As discussed in Section 2 of this report, the modeling process used to develop each MPO emissions is calibrated using the latest population and land use data available and is validated using corresponding traffic count data. Currently, the travel demand models are validated to year 2010 (CCSTCC) or year 2005 (MVRPC) depending on available data.

U.S. EPA's emissions software, MOVES, is used for all mobile source emission analyses with MOVES inputs being established at various interagency consultation meetings, between November 2010 and April 2012, during the SIP development process. It was also established at these meetings that annual emission estimates for PM 2.5 would be based on a single-season approach. Since travel demand models produce average daily conditions, the daily emissions estimates in **Appendix B.1** are multiplied by 365 days to produce annual emissions estimates expressed in tons per year. Final budgets were approved on September 26, 2013 (78 FR 59258) for PM 2.5.

Additional interagency consultation took place in December 2015 to address issues specific to the 2016 Update of the Transportation Plan conformity determination. Documentation of these discussions can be found on **Appendix A**.

On Road Mobile Emission Summary

Table 1 presents a summary of PM 2.5 related emissions for the applicable counties in the D/S Region for direct PM and NOx. The results indicate that the 2040 Plans and TIPs demonstrate conformity to the PM 2.5 State Implementation Plans (SIPs) consistent with the April 2012 U.S. EPA Transportation Conformity Regulations.

The remainder of the document focuses on the assumptions behind the analyses.

Table 1 – Dayton/Springfield Region On-Road Mobile Emissions – PM 2.5

	PM 2.5					
	Tons / Year					
	2015 Budget	2020 Emissions	2022 Budget	2022 Emissions	2030 Emissions	2040 Emissions
GRE/MOT						
PM2.5		192.65		174.47	152.94	154.94
NOx		4,991.81		4,152.57	2,859.05	2,526.90
CLA						
PM2.5		45.59		41.46	37.67	38.47
NOx		1,292.76		1,093.76	803.55	724.53
Totals						
PM2.5	404.43	238.24	261.33	215.93	190.60	193.41
NOx	12,865.54	6,284.57	6,270.64	5,246.33	3,662.59	3,251.42

2. Urban Travel Demand Models

CCSTCC and MVRPC maintain regional travel demand forecasting models for use in the urban transportation planning process. The models employ the traditional four step modeling process to project existing and future traffic volumes and travel patterns on the regional transportation network. The four step process consists of trip generation, trip distribution, modal split, and route assignment. Output from the urban models is link-by-link directional 24-hour traffic volumes.

During 2000-2002 MVRPC, in cooperation with the Ohio Kentucky Indiana Regional Council of Governments, updated its travel demand model. The new model includes the combined regions under the jurisdictions of OKI and MVRPC. In 2005, the combined model was updated again to incorporate the results of a household interview survey in the MVRPC Region, change the model interface to Cube Voyager, and improve model functionality. The changes primarily affected trip generation distribution functions in the MVRPC Region. In 2011 in preparation for the 2012 Transportation Plan Update the model was validated using circa 2005 traffic counts. The 2005 Cube Voyager model with the latest planning assumptions (networks and socio-economic data) is used to calculate 2020-2040 emissions in the MVRPC Region. MVRPC 2016 LRTP emission analyses directory structure can be seen in Figure 1.

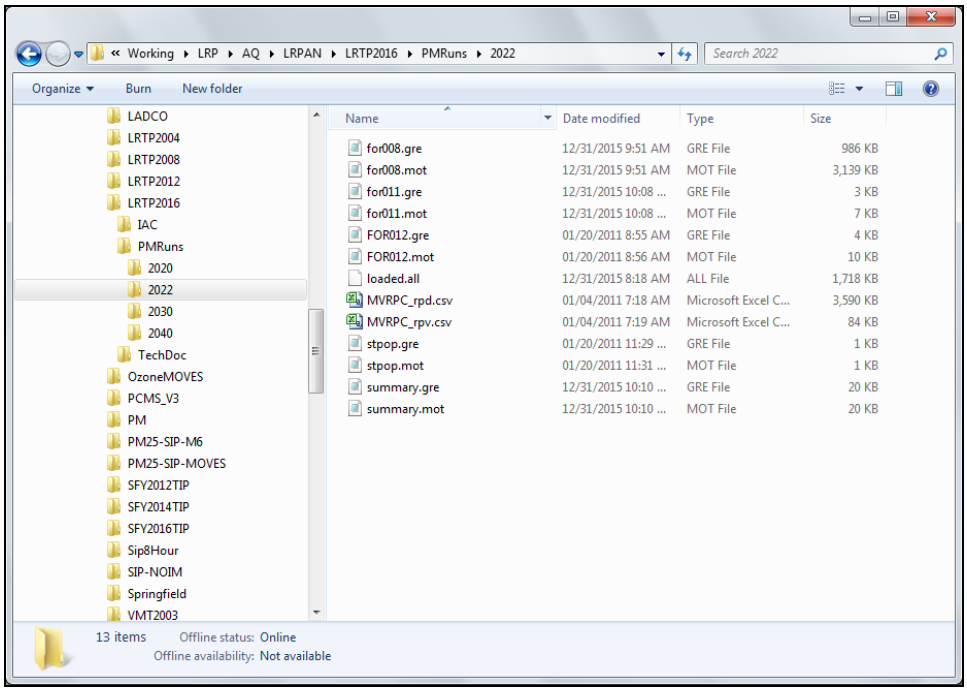

Figure 1 – MVRPC Emission Analyses Runs Directory Structure

Similarly, the Springfield Region also has a new travel demand model that combined with the latest planning assumptions was used to generate emissions in Clark County. The new travel demand model now covers all of Clark County. Figure 2 shows the directory structure or model run location. Due to the number of files and complexity, travel demand model run details have not been included in this technical memo.

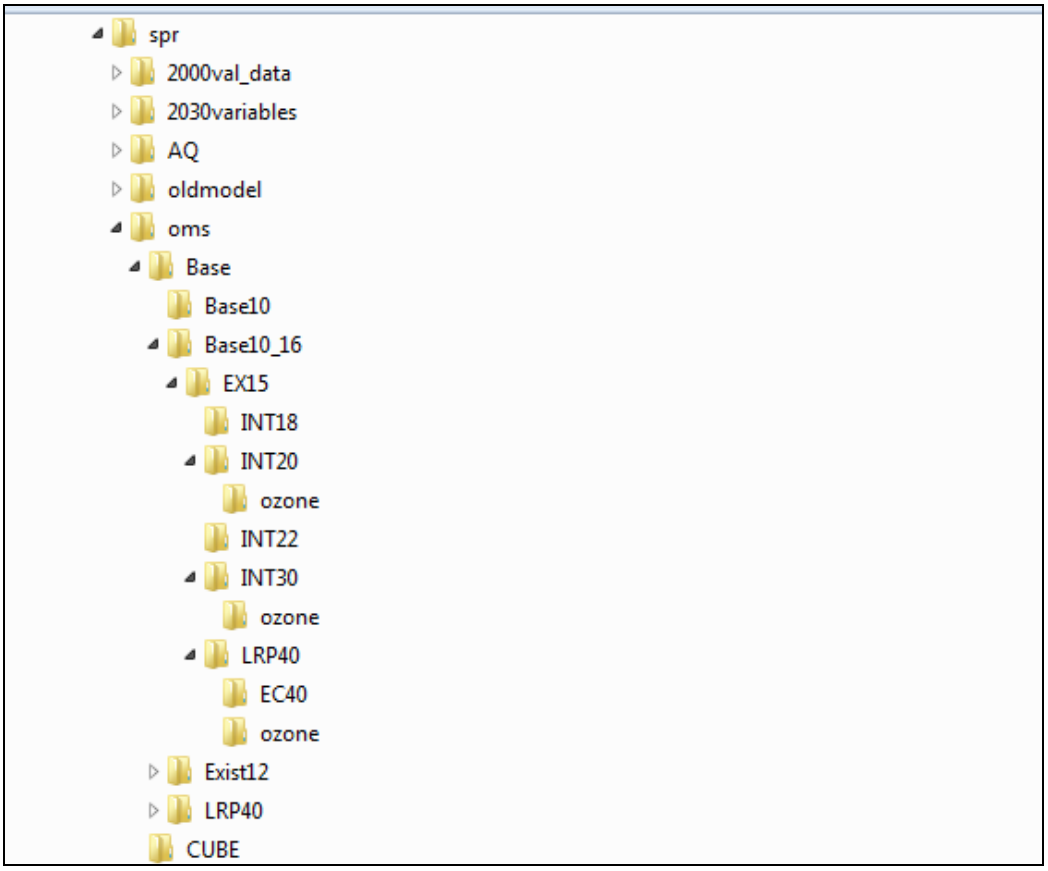

Figure 2 – CCSTCC Travel Demand Model Run Directory Structure

Networks

Both CCSTCC and MVRPC's modeled networks accurately reflect projects in their respective TIPs and 2040 Long Range Transportation Plans. Project lists can be found online as listed below:

CCSTCC
http://www.clarktcc.com/LRP/2016LRP_Project%20List.pdf

MVRPC
http://www.mvrpc.org/sites/default/files/lrtp16-draft-DraftProjectListRev.pdf

Land use and Socio-Economic Data

Both CCSTCC and MVRPC's socio-economic model variables reflect the current and expected future regional land uses.

MVRPC's socio-economic variables were developed for the May 2012 2040 LRTP Update and are based on 2010 Census variables. Because the population projections differ from the most current ODSA projections, the use of this socio-economic data set was vetted through the interagency consultation process in May 2015.

On the employment side, adjustments were made primarily to account for manufacturing job loses between 2000 and 2010, recognizing that the local economy is moving away from a manufacturing base and to account for known planned development efforts.

Independent variables are available for 2 analysis years (2010 and 2040) and the travel demand model has the ability of interpolating data for any year between available data sets. A summary of MVRPC's socio-economic data is available in Table 3. As can be seen from the table, population, households, and employment are expected to make modest gains between 2010 and 2040. Both households and employment are expected to decline in the older urban areas of the region as the trend to develop in the suburban fringes and rural areas continues.

Table 3 – MVRPC Socio-Economic Variables

Variable	Area Type				
	CBD	Urban	Suburban	Rural	**Total**
# of TAZs	65	209	413	130	**817**
Acres	880	30,675	297,967	495,879	**825,401**
2010 Census Population	-	-	-	-	**799,232**
2010 Households	2,151	77,584	220,039	27,856	**327,630**
2010 Employment	28,042	94,306	303,504	15,541	**441,393**
2040 Population	-	-	-	-	**820,227**
2040 Households	2,280	70,336	229,678	32,550	**334,844**
2040 Employment	29,653	87,835	329,415	16,730	**463,633**
2010 Persons per Household	1.35	2.30	2.37	2.61	**2.37**
2010 Workers per Household	0.70	1.11	1.24	1.39	**1.22**
2010 Autos per Household	0.77	1.44	1.83	2.27	**1.77**

Note: Includes Greene, Miami, and Montgomery Counties.

CCSTCC's socio-economic variables were developed for the 2040 Plan based on the 2010 Census variables, 2010 employment from QCEW, and 2040 population projections from the Ohio Development Services Agency. Projections were updated for the 2016 Plan update based on 2010 census results and known employment changes including: school enrollment, hotels, educational and recreational employment, and area type. Independent variables (land use/socio-economic data) as provided by CCSTCC are available for 2010 and 2040 and all other years are interpolated.

Table 4 shows a summary of CCSTCC's socio-economic data. This summary shows a decline in population, households, and employment.

Table 4 – CCSTCC Socio-Economic Variables

	Area Type (2010)				
	CBD	Urban	Suburban	Rural	**Total**
# of TAZs	9	70	120	126	325
2010 Population	1,835	20,764	61,942	53,793	138,334
2010 Households	682	7,901	25,219	21,444	55,246
2010 Employment	697	7,909	25,643	23,376	58,625
	Area Type (2040)				
	CBD	Urban	Suburban	Rural	**Total**
# of TAZs	9	70	120	126	325
2040 Population	1,706	19,300	57,574	50,000	128,580
2040 Households	593	6,874	21,941	18,656	48,064
2040 Employment	544	6,621	20,710	19,586	47,461

VMT Trends

Figure 3 shows Vehicle Miles Traveled (VMT) trends for each of the analysis years 2020- 2040 for the MVRPC and CCSTCC areas. These values represent un-factored travel demand model output. MVRPC includes VMT for the entire MPO area.

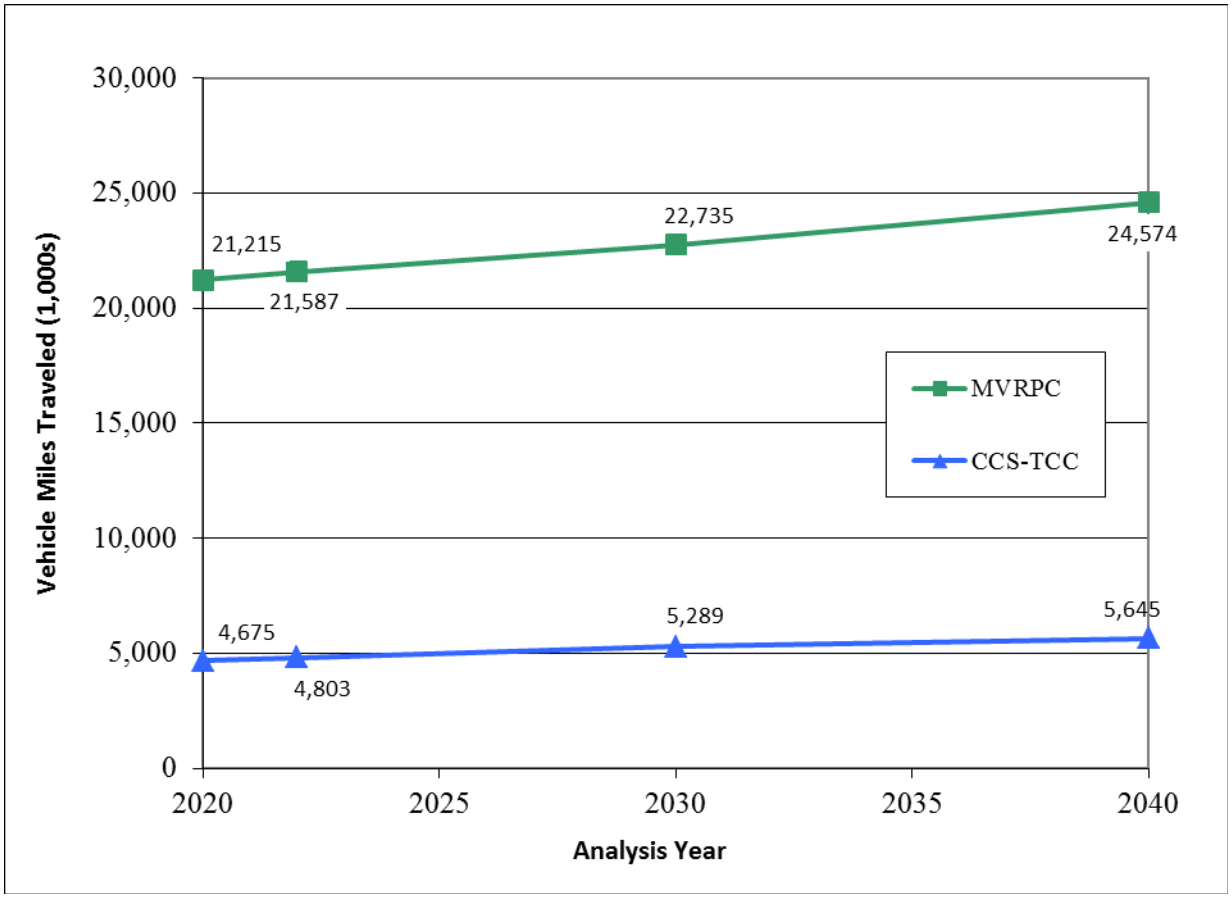

Figure 3 – Dayton/Springfield Region VMT Trends

3. Emission Factor Generation

Using MOVES, emission factor files were generated for years 2020, 2022, 2030, and 2040, representing the programs being implemented in the D/S Region and using the same assumptions that were agreed upon via interagency consultation for the PM 2.5 SIP. Future year scenarios assume no I/M since the program was terminated in 2005. Tables 5-14 illustrate input and output files using year 2005 as an example.

Technical Details

Table 5 summarizes the settings used in the MOVES run specification file and the MOVES County-Data Manager. Further details in specific inputs that are not using default values are provided below.

Table 5 – MOVES Inputs – PM 2.5

RunSpec Parameter Settings	
MOVES Version	2010/08/26
Scale	Custom Domain
MOVES Modeling Technique	Emission Factor Method Rates per Distance Rates per Vehicle
Time Span	Time Aggregation: Hour 1 Month representing average annual temperatures All hours of day selected 16 speed bins Weekdays only
Geographic Bounds	Clark, Greene, and Montgomery Counties
Vehicles/Equipment	All source types, gasoline and diesel
Road Type	All road types including off-network
Pollutants and Processes	NO_x, All $PM_{2.5}$ categories, SO_2, Total Energy Consumption
Strategies	None
General Output	Units = grams, joules and miles
Output Emissions	Time = hour, Location = custom area, on-road emission rates by road type and source use type.
Advance Performance	None
County Data Manager Sources	
Source Type Population	Combination of local and default data Local data (2010) ODOT from motor vehicle registration Default data used for source types 41, 51, 54, 61, and 62 Future year growth rate based on MPO model

	Household growth rate.
Vehicle Type VMT	Combination of local and default data HPMSVTypeYear VMT = daily VMT from travel demand model monthVMTFraction = default dayVMTFraction=default hourVMTFraction=local
I/M Program	I/M program information applied for 2005 where applicable
Fuel Formulation	Default
Fuel Supply	Default Future runs will be modified for reformulated gas, RVP, etc. for summer analyses
Metereology Data	Local data obtained from NOAA National Climatic Data Center. Data will consist of monthly high and low temperatures and daily relative humidity for 2002.
Ramp Fraction	Using the base year travel demand model for VHT fractions. Future fractions will be assumed constant
Road Type Distribution	Use ODOT county summary VMT categorized by federal functional classes
Age Distribution	Combination of local and default data. Local data (2010) ODOT from motor vehicle registration Default data used for source types 41, 51, 54, 61, and 62 The same age distribution will be used for all analysis years
Average Speed Distribution	Default
Alternative Fuel Type	Default

Temperature and Relative Humidity

Temperatures are representative of 2002 based on NOAA data from the National Climate Data Center website. Data for Wright Patterson AFB was used because it was the most complete compared to other airports in the non-attainment area. The single season PM 2.5 approach used average monthly hourly temperatures and the ozone runs used the average July hourly temperature. To get the correct format for MOVES, the data was entered into a spreadsheet provided by EPA which was designed to convert Mobile6 data to MOVES. Representative hourly temperatures and relative humidity distribution profiles can be seen in Table 6.

Table 6 – Temperature and Relative Humidity Data

	PM 2.5		Ozone	
Hour	Average Temperature	Average Relative Humidity	Average Temperature	Average Relative Humidity
1	47.9467	78	71.3367	78
2	46.8033	79	70.0883	78
3	45.905	80	69.1075	80
4	45.2517	79	68.3942	81
5	44.7617	81	67.8592	83
6	44.19	82	67.2350	85
7	43.7	82	66.7000	81
8	44.1083	77	67.1458	76
9	46.5583	71	69.8208	69
10	50.4783	66	74.1008	63
11	54.48	62	78.4700	58
12	57.91	58	82.2150	54
13	60.9317	57	85.5142	50
14	62.565	56	87.2975	48
15	63.1367	55	87.9217	47
16	63.3	55	88.1000	46
17	62.8917	57	87.6542	47
18	61.7483	58	86.4058	50
19	59.7883	62	84.2658	54
20	57.2567	66	81.5017	60
21	54.725	69	78.7375	66
22	52.52	72	76.3300	70
23	50.9683	75	74.6358	71
24	49.4167	76	72.9417	76

Ramp Fraction

Ramp fractions were derived using the base year travel demand model VHT fractions. Ramp fractions can be seen in Table 7. Base year fractions were assumed to apply to future years.

Table 7 – Ramp Fractions

roadTypeID	roadDesc	rampFraction
2	Rural Restricted Access	0.04
4	Urban Restricted Access	0.11

Source Type Population

Source type population is based on a combination of local and MOVES default data. Local data was provided by ODOT based on 2010 motor vehicle registration. Default data is used for source types 41, 51, 54, 61, and 62. Future year growth rate is based on MPO model household growth rate which is 0% in MVRPC. In Clark County cars are an independent variable to the travel demand model. The base year (2000) and the LP year (2040) are used to interpolate the number of cars for the needed analysis years in Clark County. Table 8 shows source type population for the analyzed counties in 2005.

Table 8 – Source Type Population for year 2005

sourceTypeID	sourceTypeName	Clark	Greene	Montgomery
11	MotorCycle	8,341	9,014	25,096
21	Passenger Car	96,932	105,808	395,925
31	Passenger Truck	44,885	53,557	172,425
32	Light Commercial Truck	1,129	1,235	4,614
41	Intercity Bus	71	52	178
42	Transit Bus	17	14	66
43	School Bus	256	356	1,187
51	Refuse truck	44	36	138
52	Single Unit Short-haul Truck	68	46	119
53	Single Unit Long-haul Truck	133	124	169
54	Motor Home	214	172	665
61	Comb Short-haul Truck	877	478	1,789
62	Comb Long-haul Truck	1,009	550	2,058

I/M Program

The I/M program was turned “off” for analyses years after 2005.

Vehicle Age Distribution

Vehicle age distribution information was derived using Ohio Bureau of Motor Vehicle registration data for year 2010. The data was given to OEPA who supplied a VIN decoder that allowed ODOT to create correctly formatted MOVES inputs. MOVES default data is used for source types 41, 51, 54, 61, and 62. The registration data for all three counties in the non-attainment area were combined to create a regional vehicle age distribution file, see Table 9. The same age distribution will be used for all analysis years

Table 9 – Vehicle Age Distribution

yearid	sourcetypeid	ageid	ageFraction	sourcetypeid	ageid	ageFraction	sourcetypeid	ageid	ageFraction
2005	11	0	0.0018	21	17	0.0364	32	3	0.0708
2005	11	1	0.0214	21	18	0.0330	32	4	0.0678
2005	11	2	0.0551	21	19	0.0256	32	5	0.0341
2005	11	3	0.0702	21	20	0.0211	32	6	0.0268
2005	11	4	0.0831	21	21	0.0174	32	7	0.0330
2005	11	5	0.0782	21	22	0.0133	32	8	0.0332
2005	11	6	0.0617	21	23	0.0098	32	9	0.0367
2005	11	7	0.0775	21	24	0.0087	32	10	0.0497
2005	11	8	0.0569	21	25	0.0067	32	11	0.0525
2005	11	9	0.0506	21	26	0.0051	32	12	0.0406
2005	11	10	0.0429	21	27	0.0026	32	13	0.0411
2005	11	11	0.0328	21	28	0.0016	32	14	0.0348
2005	11	12	0.0241	21	29	0.0015	32	15	0.0745
2005	11	13	0.0205	21	30	0.0444	32	16	0.0526
2005	11	14	0.0215	31	0	0.0062	32	17	0.0408
2005	11	15	0.0164	31	1	0.0255	32	18	0.0354
2005	11	16	0.0136	31	2	0.0463	32	19	0.0267
2005	11	17	0.0124	31	3	0.0558	32	20	0.0215
2005	11	18	0.0089	31	4	0.0650	32	21	0.0245
2005	11	19	0.0082	31	5	0.0782	32	22	0.0156
2005	11	20	0.0079	31	6	0.0722	32	23	0.0135
2005	11	21	0.0086	31	7	0.0708	32	24	0.0102
2005	11	22	0.0091	31	8	0.0674	32	25	0.0107
2005	11	23	0.0125	31	9	0.0545	32	26	0.0066
2005	11	24	0.0186	31	10	0.0579	32	27	0.0039
2005	11	25	0.0172	31	11	0.0569	32	28	0.0014
2005	11	26	0.0147	31	12	0.0507	32	29	0.0007
2005	11	27	0.0169	31	13	0.0452	32	30	0.0094
2005	11	28	0.0249	31	14	0.0407	41	0	0.0000
2005	11	29	0.0168	31	15	0.0424	41	1	0.0282
2005	11	30	0.0950	31	16	0.0350	41	2	0.0466
2005	21	0	0.0063	31	17	0.0298	41	3	0.0791
2005	21	1	0.0237	31	18	0.0215	41	4	0.0819
2005	21	2	0.0347	31	19	0.0166	41	5	0.0819
2005	21	3	0.0428	31	20	0.0123	41	6	0.0636
2005	21	4	0.0439	31	21	0.0114	41	7	0.0734
2005	21	5	0.0478	31	22	0.0096	41	8	0.0381
2005	21	6	0.0504	31	23	0.0072	41	9	0.0678
2005	21	7	0.0527	31	24	0.0057	41	10	0.0664
2005	21	8	0.0548	31	25	0.0038	41	11	0.0438

yearid	sourcetypeid	ageid	ageFraction	sourcetypeid	ageid	ageFraction	sourcetypeid	ageid	ageFraction
2005	21	9	0.0523	31	26	0.0026	41	12	0.0297
2005	21	10	0.0571	31	27	0.0016	41	13	0.0226
2005	21	11	0.0570	31	28	0.0006	41	14	0.0212
2005	21	12	0.0519	31	29	0.0004	41	15	0.0480
2005	21	13	0.0518	31	30	0.0062	41	16	0.0367
2005	21	14	0.0489	32	0	0.0063	41	17	0.0155
2005	21	15	0.0535	32	1	0.0418	41	18	0.0071
2005	21	16	0.0432	32	2	0.0828	41	19	0.0353
2005	41	20	0.0226	43	6	0.0595	51	23	0.0086
2005	41	21	0.0056	43	7	0.0584	51	24	0.0086
2005	41	22	0.0056	43	8	0.0623	51	25	0.0000
2005	41	23	0.0071	43	9	0.0639	51	26	0.0086
2005	41	24	0.0085	43	10	0.0611	51	27	0.0043
2005	41	25	0.0155	43	11	0.0823	51	28	0.0000
2005	41	26	0.0127	43	12	0.0656	51	29	0.0000
2005	41	27	0.0014	43	13	0.0506	51	30	0.0385
2005	41	28	0.0056	43	14	0.0183	52	0	0.0043
2005	41	29	0.0042	43	15	0.0222	52	1	0.0343
2005	41	30	0.0243	43	16	0.0183	52	2	0.0343
2005	42	0	0.0103	43	17	0.0167	52	3	0.1159
2005	42	1	0.0000	43	18	0.0178	52	4	0.0730
2005	42	2	0.0515	43	19	0.0178	52	5	0.0472
2005	42	3	0.0412	43	20	0.0167	52	6	0.0472
2005	42	4	0.0309	43	21	0.0156	52	7	0.0815
2005	42	5	0.0928	43	22	0.0117	52	8	0.1373
2005	42	6	0.0309	43	23	0.0133	52	9	0.0429
2005	42	7	0.0412	43	24	0.0117	52	10	0.0386
2005	42	8	0.0412	43	25	0.0078	52	11	0.0472
2005	42	9	0.1237	43	26	0.0044	52	12	0.0386
2005	42	10	0.0412	43	27	0.0061	52	13	0.0343
2005	42	11	0.0412	43	28	0.0006	52	14	0.0129
2005	42	12	0.0515	43	29	0.0028	52	15	0.0258
2005	42	13	0.0515	43	30	0.0093	52	16	0.0258
2005	42	14	0.0515	51	0	0.0043	52	17	0.0172
2005	42	15	0.0412	51	1	0.0343	52	18	0.0258
2005	42	16	0.0412	51	2	0.0343	52	19	0.0258
2005	42	17	0.0103	51	3	0.1159	52	20	0.0129
2005	42	18	0.0412	51	4	0.0730	52	21	0.0043
2005	42	19	0.0515	51	5	0.0472	52	22	0.0043
2005	42	20	0.0206	51	6	0.0472	52	23	0.0086
2005	42	21	0.0000	51	7	0.0815	52	24	0.0086

yearid	sourcetypeid	ageid	ageFraction	sourcetypeid	ageid	ageFraction	sourcetypeid	ageid	ageFraction
2005	42	22	0.0309	51	8	0.1373	52	25	0.0000
2005	42	23	0.0103	51	9	0.0429	52	26	0.0086
2005	42	24	0.0106	51	10	0.0386	52	27	0.0043
2005	42	25	0.0103	51	11	0.0472	52	28	0.0000
2005	42	26	0.0103	51	12	0.0386	52	29	0.0000
2005	42	27	0.0000	51	13	0.0343	52	30	0.0385
2005	42	28	0.0103	51	14	0.0129	53	0	0.0043
2005	42	29	0.0000	51	15	0.0258	53	1	0.0343
2005	42	30	0.0107	51	16	0.0258	53	2	0.0343
2005	43	0	0.0534	51	17	0.0172	53	3	0.1159
2005	43	1	0.0361	51	18	0.0258	53	4	0.0730
2005	43	2	0.0400	51	19	0.0258	53	5	0.0472
2005	43	3	0.0539	51	20	0.0129	53	6	0.0472
2005	43	4	0.0523	51	21	0.0043	53	7	0.0815
2005	43	5	0.0495	51	22	0.0043	53	8	0.1373
2005	53	10	0.0386	54	26	0.0226	62	11	0.0716
2005	53	11	0.0472	54	27	0.0151	62	12	0.0508
2005	53	12	0.0386	54	28	0.0108	62	13	0.0339
2005	53	13	0.0343	54	29	0.0064	62	14	0.0329
2005	53	14	0.0129	54	30	0.1363	62	15	0.0277
2005	53	15	0.0258	61	0	0.0015	62	16	0.0195
2005	53	16	0.0258	61	1	0.0124	62	17	0.0102
2005	53	17	0.0172	61	2	0.0270	62	18	0.0080
2005	53	18	0.0258	61	3	0.0335	62	19	0.0052
2005	53	19	0.0258	61	4	0.0436	62	20	0.0058
2005	53	20	0.0129	61	5	0.0460	62	21	0.0056
2005	53	21	0.0043	61	6	0.0550	62	22	0.0026
2005	53	22	0.0043	61	7	0.0601	62	23	0.0009
2005	53	23	0.0086	61	8	0.0536	62	24	0.0017
2005	53	24	0.0086	61	9	0.0496	62	25	0.0017
2005	53	25	0.0000	61	10	0.0533	62	26	0.0013
2005	53	26	0.0086	61	11	0.0527	62	27	0.0002
2005	53	27	0.0043	61	12	0.0453	62	28	0.0004
2005	53	28	0.0000	61	13	0.0489	62	29	0.0002
2005	53	29	0.0000	61	14	0.0407	62	30	0.0013
2005	53	30	0.0385	61	15	0.0439			
2005	54	0	0.0048	61	16	0.0443			
2005	54	1	0.0148	61	17	0.0315			
2005	54	2	0.0268	61	18	0.0307			
2005	54	3	0.0365	61	19	0.0282			
2005	54	4	0.0423	61	20	0.0237			

yearid	sourcetypeid	ageid	ageFraction		sourcetypeid	ageid	ageFraction		sourcetypeid	ageid	ageFraction
2005	54	5	0.0482		61	21	0.0273				
2005	54	6	0.0504		61	22	0.0278				
2005	54	7	0.0431		61	23	0.0179				
2005	54	8	0.0413		61	24	0.0183				
2005	54	9	0.0418		61	25	0.0130				
2005	54	10	0.0499		61	26	0.0096				
2005	54	11	0.0487		61	27	0.0056				
2005	54	12	0.0454		61	28	0.0046				
2005	54	13	0.0336		61	29	0.0034				
2005	54	14	0.0355		61	30	0.0470				
2005	54	15	0.0381		62	0	0.0045				
2005	54	16	0.0292		62	1	0.0448				
2005	54	17	0.0235		62	2	0.0074				
2005	54	18	0.0171		62	3	0.1062				
2005	54	19	0.0148		62	4	0.1088				
2005	54	20	0.0169		62	5	0.1557				
2005	54	21	0.0209		62	6	0.0692				
2005	54	22	0.0234		62	7	0.0424				
2005	54	23	0.0230		62	8	0.0478				
2005	54	24	0.0200		62	9	0.0504				
2005	54	25	0.0188		62	10	0.0813				

Road Type Distribution

Road type distribution is based on the 2008 ODOT, county summary, HPMS VMT data categorized by federal functional class for the three county non-attainment area. Road type distribution can be seen in Table 10.

Table 10 – Road Type Distribution

sourceTypeID	roadTypeID	roadTypeVMTFraction		sourceTypeID	roadTypeID	roadTypeVMTFraction
11	1	0		43	4	0.29
11	2	0.06		43	5	0.52
11	3	0.13		51	1	0
11	4	0.29		51	2	0.06
11	5	0.52		51	3	0.13
21	1	0		51	4	0.29
21	2	0.06		51	5	0.52
21	3	0.13		52	1	0
21	4	0.29		52	2	0.06
21	5	0.52		52	3	0.13
31	1	0		52	4	0.29
31	2	0.06		52	5	0.52
31	3	0.13		53	1	0
31	4	0.29		53	2	0.06
31	5	0.52		53	3	0.13
32	1	0		53	4	0.29
32	2	0.06		53	5	0.52
32	3	0.13		54	1	0
32	4	0.29		54	2	0.06
32	5	0.52		54	3	0.13
41	1	0		54	4	0.29
41	2	0.06		54	5	0.52
41	3	0.13		61	1	0
41	4	0.29		61	2	0.06
41	5	0.52		61	3	0.13
42	1	0		61	4	0.29
42	2	0.06		61	5	0.52
42	3	0.13		62	1	0
42	4	0.29		62	2	0.06
42	5	0.52		62	3	0.13
43	1	0		62	4	0.29
43	2	0.06		62	5	0.52
43	3	0.13				

Vehicle Type VMT and VMT Fractions

The first component of the VMT inputs is the Yearly HPMS VMT, but the travel demand model was used instead of ODOT's HMPS data since it was felt that the model would better predict future year VMT. ODOT's CMS post-processor was run for each year to generate congestion reports, which includes total daily VMT. The vehicle type percentages of the total VMT were based on ODOT's weigh-in-motion (WIM) data. Since there are not enough WIM stations for lower class facilties in the non-attainment area, a statewide average of all ODOT WIM data collectors was used. Daily VMT was then converted to yearly. Yearly HPMS VMT for 2005 can be seen in Table 11. The same method was to generate all other analysis years

Table 11 – Yearly HPMS VMT for 2005

HPMSVtypeID	yearID	HPMSBaseYearVMT	baseYearOffNetVMT
10	2005	30590102	0
20	2005	5455503318	0
30	2005	1683283544	0
40	2005	17205399	0
50	2005	127192033	0
60	2005	301977250	0

Monthly and daily VMT fractions used MOVES default data. The hourly VMT fractions were derived from ODOT WIM data. Hourly VMT fractions vary for each of the five MOVES road types but do not change for each of the 16 MOVES source types. A representative sample of the hour VMT fraction input file can be seen in Table 12, the entire file is too large to include in this document.

Table 12 – Hourly VMT Fractions

sourceTypeID	roadTypeID	dayID	hourID	hourVMTFraction
11	1	2	1	0.0089
11	1	2	2	0.00564
11	1	2	3	0.00424
11	1	2	4	0.00427
11	1	2	5	0.00695
11	1	2	6	0.01798
11	1	2	7	0.03806
11	1	2	8	0.057
11	1	2	9	0.05773
11	1	2	10	0.05538
11	1	2	11	0.05554
11	1	2	12	0.05558
11	1	2	13	0.05584

sourceTypeID	roadTypeID	dayID	hourID	hourVMTFraction
11	1	2	14	0.06051
11	1	2	15	0.06765
11	1	2	16	0.07755
11	1	2	17	0.08428
11	1	2	18	0.0797
11	1	2	19	0.06012
11	1	2	20	0.04522
11	1	2	21	0.03646
11	1	2	22	0.02912
11	1	2	23	0.02142
11	1	2	24	0.01486
11	2	2	1	0.0089
11	2	2	2	0.00564
11	2	2	3	0.00424
11	2	2	4	0.00427
11	2	2	5	0.00695
11	2	2	6	0.01798
11	2	2	7	0.03806
11	2	2	8	0.057
11	2	2	9	0.05773
11	2	2	10	0.05538
11	2	2	11	0.05554
11	2	2	12	0.05558
11	2	2	13	0.05584
11	2	2	14	0.06051
11	2	2	15	0.06765
11	2	2	16	0.07755
11	2	2	17	0.08428
11	2	2	18	0.0797
11	2	2	19	0.06012
11	2	2	20	0.04522
11	2	2	21	0.03646
11	2	2	22	0.02912
11	2	2	23	0.02142
11	2	2	24	0.01486
11	3	2	1	0.00655
11	3	2	2	0.0037
11	3	2	3	0.00304

sourceTypeID	roadTypeID	dayID	hourID	hourVMTFraction
11	3	2	4	0.00363
11	3	2	5	0.00792
11	3	2	6	0.02343
11	3	2	7	0.04899
11	3	2	8	0.06319
11	3	2	9	0.05402
11	3	2	10	0.05121
11	3	2	11	0.0528
11	3	2	12	0.05608
11	3	2	13	0.05814
11	3	2	14	0.05875
11	3	2	15	0.06676
11	3	2	16	0.07812
11	3	2	17	0.08469
11	3	2	18	0.08152
11	3	2	19	0.05852
11	3	2	20	0.04343
11	3	2	21	0.03606
11	3	2	22	0.02829
11	3	2	23	0.01883
11	3	2	24	0.01233
11	4	2	1	0.00752
11	4	2	2	0.0044
11	4	2	3	0.00354
11	4	2	4	0.00374
11	4	2	5	0.00705
11	4	2	6	0.02123
11	4	2	7	0.054
11	4	2	8	0.0768
11	4	2	9	0.06545
11	4	2	10	0.05114
11	4	2	11	0.04692
11	4	2	12	0.04916
11	4	2	13	0.05112
11	4	2	14	0.0534
11	4	2	15	0.06105
11	4	2	16	0.07421
11	4	2	17	0.08321
11	4	2	18	0.08385

sourceTypeID	roadTypeID	dayID	hourID	hourVMTFraction
11	4	2	19	0.06062
11	4	2	20	0.04229
11	4	2	21	0.03442
11	4	2	22	0.0292
11	4	2	23	0.02137
11	4	2	24	0.01431
11	5	2	1	0.00678
11	5	2	2	0.00378
11	5	2	3	0.00295
11	5	2	4	0.0029
11	5	2	5	0.00498
11	5	2	6	0.01422
11	5	2	7	0.03449
11	5	2	8	0.05728
11	5	2	9	0.05435
11	5	2	10	0.04991
11	5	2	11	0.05261
11	5	2	12	0.06098
11	5	2	13	0.06457
11	5	2	14	0.06387
11	5	2	15	0.06812
11	5	2	16	0.07672
11	5	2	17	0.08274
11	5	2	18	0.08284
11	5	2	19	0.06344
11	5	2	20	0.04866
11	5	2	21	0.0407
11	5	2	22	0.03083
11	5	2	23	0.01966
11	5	2	24	0.01262

Output Emission Factors

Table 13 shows the first record in a MOVES sample output (rate per distance) emission file for PM 2.5. For any given month, day of week, hour of the day, pollutant, and process; the rate per distance varies by road type, and speed bin. Rates per distance emissions are applied to link and intrazonal VMT.

Table 13 – Sample Emission File (Rate per Distance) – PM 2.5

Heading:	MOVESScenarioID	MOVESRunID	yearID	monthID	dayID	hourID
Record:	OhioCustomDomain	5	2005	4	5	1
Heading:	linkID	pollutantID	processID	sourceTypeID	SCC	fuelTypeID
Record:	990570201	3	1	0		0
Heading:	modelYearID	roadTypeID	avgSpeedBinID	temperature	relHumidity	ratePerDistance
Record:	0	2	1	47.9467	78	19.2283

Table 14 shows the first record in a MOVES sample output (rate per vehicle) emission file for for PM 2.5. The rate per vehicle varies for any combinations of month, day of week, hour of the day, pollutant, and process. Rates per vehicle emissions are applied to the vehicle source type population.

Table 14 – Sample Emission File (Rate per Vehicle) – PM2.5

Heading:	MOVESScenarioID	MOVESRunID	yearID	monthID	dayID
Record:	OhioCustomDomain	5	2005	4	5
Heading:	hourID	zoneID	pollutantID	processID	sourceTypeID
Record:	1	990570	3	2	0
Heading:	SCC	fuelTypeID	modelYearID	temperature	ratePerVehicle
Record:		0	0	47.9467	0.0678071

4. Post Processing

Total emissions were computed with the aid of several custom programs by ODOT. The process uses data on daily and directional traffic distributions as well as more up to date volume/delay functions from the 2000 Highway Capacity Manual (HCM). This process, described below and illustrated in Figure 4, also uses rewritten code able to handle the newer model network formats and MOVES generated emission factors.

The first step in the the process involves running postcms.exe to calculate hourly link volumes based on the percentage of the daily volume (travel demand model output) determined by a link's facility and area type. Link speeds from the travel demand model are not used in the analysis. The speeds are estimated as a post-process to the model based on HCM methods using a link's volume-to-capacity ratio and link group code. The daily to hourly volume conversion percentages and speed tables can be seen in **Appendix B.1.**

The second step (mmoves.exe) uses a combination of the MOVES emission factors and the hourly link volumes that are output of the postcms.exe program. The hourly volumes are multiplied by the MOVES emission factor for the corresponding hour of day, speed bin, and roadtype to calculate emissions for every network link for each hour. The final link on road vehicle emissions for the area is the sum of all individual link-hour emissions.

The third step, (vehcalm.exe), calculates vehicle-based emissions for each source type for each hour of the day. The vehicle source type is based on a combination of local and default data. The final vehicle emissions for each county are the sum of all individual hourly emissions for all vehicle types.

Intrazonal trips do not get loaded onto the network, so the fourth step in the process requires a separate method to account for those trips that use local roads to travel within a zone. The intracalm.exe program uses intrazonal trips to estimate VMT using the area in square miles and intrazonal trips of each zone. The zone is assumed circular and the radius of the circle is used as the average trip length for these intrazonal trips. Intrazonal emissions are then calculated by combining MOVES generated emissions with estimated intrazonal VMT. The emission rates are the same as those used to calculated link based emissions.

The final step is to summarize link, vehicle, and intrazonal emissions for each county, pollutant, and analyzed year, and to multiply annual average daily emissions by 365 to produce an annual estimate if appropriate. Daily summary emissions for each pollutant, county, and scenario year in the Dayton Springfield Region can be found in **Appendix B.2**.

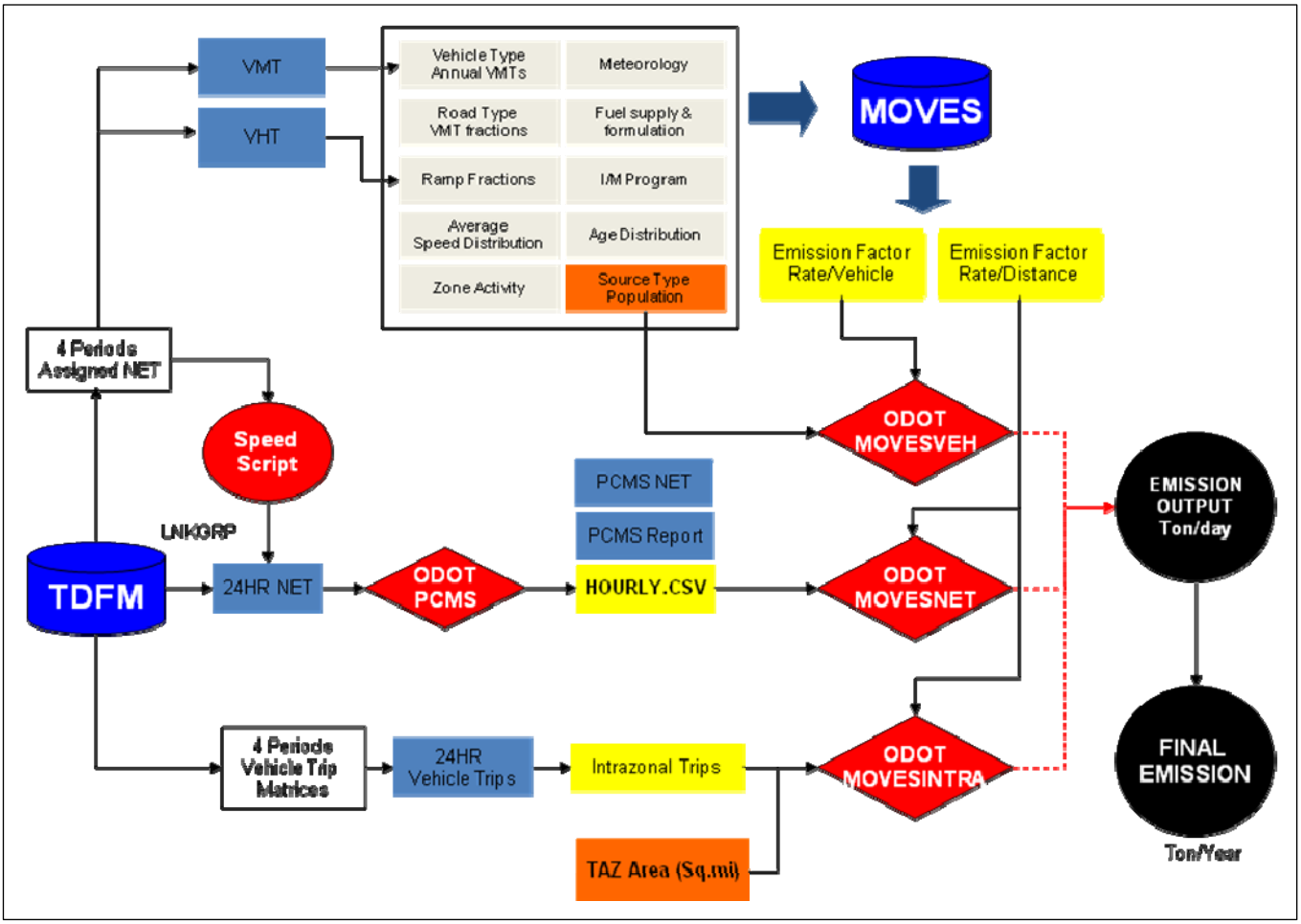

Figure 4 – Emission Calculation Process

5. Multiple MPO Coordination Issues

CCSTCC, MVRPC, ODOT, and OEPA have a long history of working together in air quality issues, the Memorandum of Understanding, listed below, documents these working relationships.

- Memorandum of Understanding among the MVRPC, the CCSTCC, the OKI Regional Council of Governments, the OEPA, the ODOT, the U.S. EPA-Region 5, the FHWA-Ohio Division, and the FTA-Region 5. The final memorandum was signed by all parties and completed on July 2014.

Appendix A
Interagency Consultation Documentation

Dayton-Springfield – 2016 Regional Transportation Plan Update Interagency Consultation.
December 1, 2015

The Dayton and Springfield MPOs' quadrennial Transportation Plan updates have progressed to the point of initiating the air quality conformity interagency consultation process. The Plans' horizon year will remain 2040.

Below is a brief documentation of the conformity criteria as it relates to each MPO Transportation Plan and Conformity process.

- **Latest planning assumptions** – travel demand modeling and socio-economic data.

  Both MPOs will use the latest available travel demand models and fiscally constrained transportation projects for the air quality regional emissions analysis.

  Dayton: MVRPC will be using the socio-economic data that was developed for the 2012 update of the Long Range Transportation Plan based on 2010 Census results. The use of this socio-economic data set was vetted through the interagency consultation process in May 2015.

  Springfield: The socio-economic variables reflect the current and expected future regional land uses and were developed for the 2040 LRTP based on the 2010 Census variables, 2010 employment from QCEW, and 2040 population projections from ODSA.

- **Latest emission modeling** – The Transportation Plans regional emissions analyses will use MOVES 2010a using inputs consistent with the transportation conformity budgets. Analysis years, budgets, and attainment status are documented on the attached spreadsheet. MOVES2010, MOVES2010a, and MOVES2010b can be used for conformity purposes until October 7, 2016, the end of the MOVES2014 grace period.

- **SIP TCM funding status** – The SIP for the Dayton-Springfield area does not include any TCMs.

- The regional emissions analysis conformity documentation will include the results of the interagency consultation outcomes and conformity analysis.

- See below for each MPO schedule for Transportation Plan adoption and public participation efforts.

Dayton – The MVRPC's Transportation Plan Public Participation process will be followed throughout the development of the 2040 Transportation Plan. The process is consistent with the MVRPC Public Participation Policy for transportation planning.

- A kick-off open house public participation meeting in August 2015.
- Jurisdictional/interested parties workgroup meetings in September 2015.
- Open house meetings, (3), to present draft projects and programs in October 2015.
- Draft projects and programs adoption in December 2015 by the MVRPC Board.
- Open house meeting to present Draft Transportation Plan in April 2016.

- 2040 Transportation Plan adoption by the MVRPC Board on May 5, 2016.
- Various updates to TAC and Board as needed throughout the update process.

Springfield – The CCSTCC's approved Public Involvement Process will be followed for the development and adoption of the 2040 Transportation Plan. The process includes:

- An open house public involvement meeting on December 16, 2015 to present the draft project list.
- Technical Advisory Committee review and action.
- Transportation Coordinating Committee review of plan no later than March 11, 2016.
- Open house public involvement meetings on April 12 and 13, 2016 to present the draft of the Transportation Plan.
- Transportation Coordinating Committee adoption of the Transportation plan on May 13, 2016.

The final round of public participation meetings in April 2016 will include AQ conformity analyses results, including coordination with OKI for the northern Warren County area.

The final MVRPC and CCSTCC Transportation Plan and Air Quality Conformity documentation and MPO Board T-Plan/Conformity Determination resolutions will be forwarded to the federal review agencies on or before May 20, 2016. MVRPC and CCSTCC will request a new US DOT conformity determination effective June 26, 2016.

Ozone

Attainment status: 1997 8-Hour Ozone Maintenance Area
8-Hour Geography: CLA, GRE, MIA, MOT Cos., OH
SIP Status: Redesignation/Maintenance Plan approved, effective 8/13/07
Conformity Tests: No longer required

$PM_{2.5}$

Attainment status: 1997 Standard $PM_{2.5}$ Nonattainment Area
Geography: CLA, GRE, MOT Cos., OH
Budget test based on budgets approved on 09/26/2013
Analysis Years: 2020 - 1st analysis year within timeframe of conformity determination
2022 Budget year
2030 Interim year
2040 Plan(s) horizon year

PM 2.5						
	Tons / Year					
	2015 Budget	2020 Emissions	2022 Budget	2022 Emissions	2030 Emissions	2040 Emissions
MVRPC						
PM2.5						
NOx						
CCS-TCC						
PM2.5						
NOx						
Totals						
PM2.5	404.43		261.33			
NOx	12,865.54		6,270.64			

Ramirez, Ana

From: Maietta, Anthony <maietta.anthony@epa.gov>
Sent: Monday, December 14, 2015 11:15 AM
To: Michael.Maleski@epa.ohio.gov; Dave.Moore1@dot.ohio.gov; Andy.Johns@dot.gov
Cc: Ramirez, Ana; cgolden@clarkcountyohio.gov; leigh.oesterling@dot.gov; 'vanessa.adams@dot.gov'
Subject: RE: FHWA OH Division Response: Dayton-Springfield Transportation Plan Update IAC

EPA concurs also

-Tony

Anthony Maietta
EPA Region 5
maietta.anthony@epa.gov
(312) 353-8777

From: Michael.Maleski@epa.ohio.gov [mailto:Michael.Maleski@epa.ohio.gov]
Sent: Monday, December 14, 2015 10:09 AM
To: Dave.Moore1@dot.ohio.gov; Andy.Johns@dot.gov; Maietta, Anthony <maietta.anthony@epa.gov>
Cc: aramirez@mvrpc.org; cgolden@clarkcountyohio.gov; leigh.oesterling@dot.gov; 'vanessa.adams@dot.gov' <vanessa.adams@dot.gov>
Subject: RE: FHWA OH Division Response: Dayton-Springfield Transportation Plan Update IAC

Dave,

Ohio EPA concurs with the conformity criteria.

Thanks,
Mike Maleski
Ohio EPA - Division of Air Pollution Control
Mailing Address: P.O. Box 1049, Columbus, OH 43216-1049
Street Address: 50 West Town Street, Suite 700 Columbus, OH 43215
Phone: 614-644-1961 Fax: 614-644-3681
michael.maleski@epa.ohio.gov

From: Moore, David
Sent: Monday, December 14, 2015 10:21 AM
To: Andy.Johns@dot.gov; Maleski, Michael; Anthony Maietta (Maietta.Anthony@epamail.epa.gov)
Cc: aramirez@mvrpc.org; cgolden@clarkcountyohio.gov; Oesterling, Leigh; 'vanessa.adams@dot.gov'
Subject: RE: FHWA OH Division Response: Dayton-Springfield Transportation Plan Update IAC

Federal and State AQ Interagency Consultation Partners,

FHWA Ohio and FTA Region V have concurred with the attached Dayton/Springfield, Ohio Transportation Plan Updates air quality conformity criteria. Please respond with your agency's review results.

Thanks
DM

From: Andy.Johns@dot.gov [mailto:Andy.Johns@dot.gov]
Sent: Wednesday, December 02, 2015 7:38 AM
To: sschmid@clarkcountyohio.gov
Cc: aramirez@mvrpc.org; Moore, David <Dave.Moore1@dot.ohio.gov>; cgolden@clarkcountyohio.gov; Oesterling, Leigh <leigh.oesterling@dot.gov>
Subject: RE: FHWA OH Division Response: Dayton-Springfield Transportation Plan Update IAC

Scott:

This is reasonable.

Dave:

When ODOT sends the request for a conformity determination, please indicate that ODOT will forward the signed resolution for CCSTCC as soon as it is signed on the 13th.

Thank you.

Respectfully,
Andy Johns
FHWA - Ohio Division
614.280.6850

From: Schmid, Scott [mailto:sschmid@clarkcountyohio.gov]
Sent: Tuesday, December 01, 2015 2:00 PM
To: Johns, Andy (FHWA)
Cc: 'Ramirez, Ana'; Dave.Moore1@dot.ohio.gov; Golden, Cory
Subject: RE: FHWA OH Division Response: Dayton-Springfield Transportation Plan Update IAC

Andy,

Our plan document will be complete one week prior to the May 12 date below, however TCC action on adoption and conformity determination will not occur until May 13. We will forward the TCC resolution electronically as soon as it is signed on the 13th.

Please let me know if this will be an issue moving forward.

Thanks,
Scott

Scott Schmid
Clark County-Springfield TCC
(937) 521-2133

From: Andy.Johns@dot.gov [mailto:Andy.Johns@dot.gov]
Sent: Tuesday, December 01, 2015 1:50 PM
To: Dave.Moore1@dot.ohio.gov; Maietta.Anthony@epamail.epa.gov; Leigh.Oesterling@dot.gov; Michael.Maleski@epa.ohio.gov
Cc: areser@oki.org; aramirez@mvrpc.org; Schmid, Scott; Matt.Parrill@dot.ohio.gov; Nino.Brunello@dot.ohio.gov; Greg.Giaimo@dot.ohio.gov; Vanessa.Adams@dot.gov
Subject: FHWA OH Division Response: Dayton-Springfield Transportation Plan Update IAC

Dave:

The FHWA OH Division concurs with the conformity criteria.

According to our records, the USDOT Conformity Determination must be completed no later than June 26, 2016. The USDOT Determination can take up to 45 days. So, we would like ODOT's request for federal review prior to May 12, 2016.

Thank you for your cooperation.

Respectfully,
Andy Johns
FHWA - Ohio Division
614.280.6850

From: Dave.Moore1@dot.ohio.gov [mailto:Dave.Moore1@dot.ohio.gov]
Sent: Tuesday, December 01, 2015 12:56 PM
To: Anthony Maietta (Maietta.Anthony@epamail.epa.gov); Oesterling, Leigh (FHWA); Johns, Andy (FHWA); Michael.Maleski@epa.ohio.gov
Cc: Andy Reser ; aramirez@mvrpc.org; sschmid@clarkcountyohio.gov; Matt.Parrill@dot.ohio.gov; Nino.Brunello@dot.ohio.gov; Greg.Giaimo@dot.ohio.gov
Subject: FW: Dayton-Springfield Transportation Plan Update IAC

All,

The Dayton and Springfield, Ohio MPOs have initiated quadrennial updates to their 2040 Transportation Plans. The Plan update process has progressed to the point that it is time to initiate air quality conformity interagency consultation. The attached files document the conformity criteria and schedules associated with the T-Plans' development and approval and public involvement processes.

Conformity will be established based on 1997 $PM_{2.5}$ Standard SIP budget tests.

Please review this information and respond with any questions and/or concurrence that this documentation addresses needed interagency consultation. A more formal conference call can be conducted as needed.

Thanks
DM

From: Ramirez, Ana [mailto:ARamirez@mvrpc.org]
Sent: Tuesday, December 01, 2015 10:03 AM
To: Moore, David <Dave.Moore1@dot.ohio.gov>
Subject: Dayton-Springfield Transportation Plan Update IAC

Dave,

See attached and let me know if you need anything else.

Ana

Appendix B

Appendix B.1
Post Processing Default Distributions

HOUR	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
PCTADT																								
URB FWY	0.9	0.6	0.5	0.6	0.9	2.2	5.2	7.3	6.4	5.2	4.9	5.1	5.3	5.5	6.1	7.2	8.0	7.9	5.8	4.2	3.4	2.9	2.2	1.5
URB ART	0.7	0.4	0.3	0.3	0.6	1.5	3.5	5.7	5.5	5.1	5.3	6.2	6.5	6.4	6.8	7.6	8.2	8.1	6.2	4.8	4.0	3.0	1.9	1.3
RUR FWY	1.4	1.1	0.9	1.0	1.3	2.2	3.7	5.2	5.4	5.4	5.6	5.6	5.7	6.0	6.5	7.1	7.5	7.0	5.6	4.5	3.8	3.2	2.5	2.0
RUR ART	0.8	0.5	0.4	0.5	1.0	2.4	4.8	6.2	5.5	5.3	5.5	5.8	6.0	6.0	6.7	7.6	8.1	7.7	5.6	4.2	3.5	2.8	1.9	1.3
PCTADT TRK																								
URB FWY	2.1	1.9	1.8	2.0	2.4	3.0	3.9	4.6	5.3	6.0	6.3	6.4	6.4	6.4	6.3	5.8	5.2	4.6	4.1	3.7	3.4	3.1	2.8	2.4
URB ART	1.1	0.9	1.0	1.2	1.6	2.3	3.9	5.9	6.9	6.7	7.1	7.6	7.4	7.2	7.4	7.2	6.0	5.0	3.7	2.8	2.3	1.9	1.5	1.3
RUR FWY	2.6	2.2	2.1	2.3	2.6	3.1	3.5	4.0	4.5	5.1	5.6	5.8	5.8	5.8	5.8	5.6	5.3	4.9	4.6	4.3	4.0	3.8	3.5	3.1
RUR ART	1.5	1.3	1.4	1.6	2.2	3.0	4.2	5.3	6.1	6.7	7.0	7.1	7.0	6.9	6.8	6.3	5.5	4.6	3.8	3.1	2.6	2.3	2.1	1.7
PCTDIR																								
URB FWY	38	40	40	46	56	64	70	70	68	62	58	52	52	52	50	46	38	38	46	52	46	42	42	40
URB ART	44	46	44	48	54	62	66	68	64	56	54	52	50	50	50	46	40	38	46	52	48	46	46	46
RUR FWY	44	46	48	54	60	68	68	64	58	54	52	50	50	52	52	48	42	40	44	48	48	44	46	44
RUR ART	40	42	44	48	58	66	72	68	60	56	54	50	50	50	50	46	40	38	46	50	46	44	44	44

LOS E VC	0	0.625	1.25	1.875	2.5	3.125	3.75	4.375	5	5.625	6.25	6.875	7.5	8.125	8.75	9.375	10	10.625	11.25	11.875	12.5	13.125	13.75	14.375
SPEEDVC																								
curve1	75	75	75	75	75	75	74.9	74.8	74.6	74.2	73.5	72.3	70.5	67.8	64.2	59.5	54	47.7	41.2	34.9	28.9	23.7	19.2	15.5
curve2	70	70	70	70	70	70	70	69.9	69.8	69.6	69.2	68.4	67.1	65.1	62.2	58.2	53	47	40.5	33.9	27.7	22.2	17.6	13.8
curve3	65	65	65	65	65	65	65	65	65	64.9	64.8	64.4	63.8	62.6	60.5	57	52	45.4	37.8	29.9	22.7	16.7	12.1	8.6
curve4	60	60	60	60	60	60	60	60	60	59.9	59.8	59.6	59.1	58.2	56.7	54.3	50.8	46.1	40.3	33.8	27.3	21.3	16.2	12.2
curve5	55	55	55	55	55	55	55	55	55	55	55	54.9	54.7	54.3	53.6	52.3	50	46.5	41.5	35.3	28.5	21.9	16.1	11.5
curve6	60	60	60	60	60	60	60	60	59.9	59.8	59.7	59.4	59.1	58.5	57.7	56.5	55	53.1	50.7	47.9	44.7	41.1	37.3	33.4
curve7	55	55	55	55	55	55	55	55	54.9	54.9	54.7	54.5	54.2	53.8	53.1	52.2	50.9	49.3	47.3	44.9	42.1	39	35.7	32.2
curve8	50	50	50	50	50	50	50	50	49.9	49.9	49.8	49.6	49.4	49	48.5	47.7	46.7	45.4	43.8	41.8	39.5	36.8	33.9	30.9
curve9	45	45	45	45	45	45	45	45	45	44.9	44.8	44.7	44.4	44.1	43.6	43	42.1	40.9	39.4	37.6	35.5	33.1	30.5	27.8
curve10	50	50	50	50	49.9	49.8	49.7	49.4	49	48.4	47.5	46.5	45.1	43.5	41.7	39.6	37.3	34.9	32.4	29.8	27.3	24.9	22.6	20.4
curve11	50	50	50	50	50	49.9	49.7	49.4	48.9	48	46.7	44.9	42.5	39.6	36.2	32.6	28.7	25	21.4	18.2	15.3	12.9	10.8	9
curve12	50	50	50	50	50	49.9	49.8	49.6	49.1	48.2	46.8	44.5	41.4	37.5	32.9	28	23.1	18.7	14.9	11.8	9.2	7.2	5.7	4.5
curve13	40	40	40	40	40	40	39.9	39.8	39.5	39.2	38.6	37.8	36.7	35.3	33.5	31.4	29	26.4	23.7	21.1	18.5	16.1	13.9	12
curve14	40	40	40	40	40	39.9	39.8	39.6	39.1	38.5	37.5	36.1	34.3	32.1	29.4	26.5	23.5	20.5	17.7	15.1	12.8	10.7	9	7.6
curve15	40	40	40	40	40	39.9	39.7	39.4	38.8	37.9	36.5	34.7	32.3	29.5	26.4	23.2	20	17	14.3	11.9	9.9	8.2	6.8	5.6
curve16	35	35	35	35	35	34.9	34.8	34.5	34	33.2	32.1	30.5	28.5	26.1	23.5	20.6	17.9	15.2	12.8	10.7	8.9	7.4	6.1	5.1
curve17	35	35	35	35	35	34.9	34.7	34.4	33.9	33.1	32	30.3	28.3	25.8	23.1	20.3	17.5	14.9	12.5	10.4	8.6	7.2	5.9	4.9
curve18	35	35	35	35	35	34.9	34.6	34.2	33.5	32.4	30.9	28.8	26.3	23.4	20.4	17.4	14.6	12.1	9.9	8.1	6.6	5.4	4.4	3.6
curve19	30	30	30	30	30	29.9	29.8	29.5	29	28.2	27.1	25.6	23.7	21.5	19.1	16.6	14.2	12	10	8.3	6.8	5.6	4.6	3.8
curve20	30	30	30	30	30	29.9	29.7	29.4	28.9	28.1	26.9	25.3	23.4	21.1	18.6	16.1	13.6	11.4	9.5	7.8	6.4	5.3	4.3	3.6
curve21	30	30	30	30	30	29.9	29.7	29.3	28.7	27.7	26.2	24.4	22.1	19.6	17	14.4	12	9.9	8.1	6.6	5.4	4.4	3.6	2.9

VC RATIO TO LOS CONVERSION (VALUE SHOWN IS LOWER LIMIT FOR THAT LOS)(URBAN ROADS USE SPEED BREAKS BELOW FOR LOS DETERMINATION) (ALL USE THE BASE VC'S TO DETERMINE EXCEEDANCE)

	BASE	RUR2	FWY
A	0.00	0.00	0.00
B	0.30	0.00	0.25
C	0.50	0.10	0.40
D	0.70	0.30	0.60
E	0.90	0.50	0.80
F	1.00	1.00	1.00
F+	1.10	1.10	1.10
F++	1.30	1.30	1.30

SPEED VC RATIO BREAKS FOR URBAN STREETS (HIGHEST SPEED FOR GIVEN LOS & FF SPEED)

FFS	B	C	D	E	F
>47	42.	34.	27.	21.	16.
>37	35.	28.	22.	17.	13.
>32	30.	24.	18.	14.	10.
<33	25.	19.	13.	9.	7.

LEVEL OF SERVICE THRESHOLD BY AREA

NUM	LOS	DEFINITION
1	F	CINCINNATI,CLEVELAND,COLUMBUS CENTRAL MPO COUNTIES (CUY,FRA,HAM)
2	E	OTHER TMA MPOS (AKRON,CANTON,DAYTON,TOLEDO,YOUNGSTOWN + NON-CENTRAL COUNTIES FROM 1)
3	E	OTHER MPOS & PARTS OF AREAS 1 & 2 OUTSIDE URBANIZED AREA
4	E	RURAL NON MPO COUNTIES

PEAK SPREADING MODEL INFO (SET MAX ITERATIONS TO 0 TO DISABLE PEAK SPREADING)
MAX VC RATIO FWY: 1.30
MAX VC RATIO ART: 1.30
MAX ITERATIONS : 1000

TRUCK PCE: 2.00

AQ SEASON FACTOR: 1.00

MODEL CLASS PARAMETERS (MAX 4 CLASSES, HOURS 0-23 W/ NO OVERLAP IN CLASS, ALLOCATE ENTIRE CLASS AS TRUCK(1) OR NOT(0))

CLS	TRK	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
CLS	BEG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CLS	END	23	23	0	0	0	0	0	0	0	0	0	0	0	0	0
CLS	NUM	1	3	0	0	0	0	0	0	0	0	0	0	0	0	0

Appendix B.2
PM2.5 EmissionSummaries

Clark County Daily Summary

	2020 (No I/M)	
CLARK	**NOX (tons/day)**	**PM 2.5 (tons/day)**
Link Emissions	2.5204	0.1030
Vehicle Emissions	1.0151	0.0215
Intrazonal Emissions	0.0063	0.0004
TOTAL	**3.5418**	**0.1249**

	2022 (No I/M)	
CLARK	**NOX (tons/day)**	**PM 2.5 (tons/day)**
Link Emissions	2.1242	0.0930
Vehicle Emissions	0.8673	0.0202
Intrazonal Emissions	0.0051	0.0004
TOTAL	**2.9966**	**0.1136**

	2030 (No I/M)	
CLARK	**NOX (tons/day)**	**PM 2.5 (tons/day)**
Link Emissions	1.5613	0.0852
Vehicle Emissions	0.6370	0.0177
Intrazonal Emissions	0.0032	0.0003
TOTAL	**2.2015**	**0.1032**

	2040 (No I/M)	
CLARK	**NOX (tons/day)**	**PM 2.5 (tons/day)**
Link Emissions	1.4320	0.0875
Vehicle Emissions	0.5503	0.0176
Intrazonal Emissions	0.0027	0.0003
TOTAL	**1.9850**	**0.1054**

Greene County Daily Summary

	2020 (No I/M)	
GREENE	**NOX (tons/day)**	**PM 2.5 (tons/day)**
Link Emissions	2.3712	0.1077
Vehicle Emissions	0.9846	0.0221
Intrazonal Emissions	0.0172	0.0009
TOTAL	**3.3730**	**0.1307**

	2022 (No I/M)	
GREENE	**NOX (tons/day)**	**PM 2.5 (tons/day)**
Link Emissions	1.9737	0.0974
Vehicle Emissions	0.8259	0.0206
Intrazonal Emissions	0.0133	0.0009
TOTAL	**2.8129**	**0.1189**

	2030 (No I/M)	
GREENE	**NOX (tons/day)**	**PM 2.5 (tons/day)**
Link Emissions	1.3967	0.0886
Vehicle Emissions	0.5714	0.0177
Intrazonal Emissions	0.0088	0.0009
TOTAL	**1.9769**	**0.1072**

	2040 (No I/M)	
GREENE	**NOX (tons/day)**	**PM 2.5 (tons/day)**
Link Emissions	1.3234	0.0943
Vehicle Emissions	0.4643	0.0170
Intrazonal Emissions	0.0083	0.0007
TOTAL	**1.7960**	**0.1120**

Montgomery County Daily Summary

	2020 (No I/M)	
MONTGOMERY	**NOX (tons/day)**	**PM 2.5 (tons/day)**
Link Emissions	6.8054	0.3178
Vehicle Emissions	3.4737	0.0778
Intrazonal Emissions	0.0241	0.0015
TOTAL	**10.3032**	**0.3971**

	2022 (No I/M)	
MONTGOMERY	**NOX (tons/day)**	**PM 2.5 (tons/day)**
Link Emissions	5.6306	0.2849
Vehicle Emissions	2.9139	0.0728
Intrazonal Emissions	0.0195	0.0014
TOTAL	**8.5640**	**0.3591**

	2030 (No I/M)	
MONTGOMERY	**NOX (tons/day)**	**PM 2.5 (tons/day)**
Link Emissions	3.8269	0.2483
Vehicle Emissions	2.0169	0.0623
Intrazonal Emissions	0.0123	0.0012
TOTAL	**5.8561**	**0.3118**

	2040 (No I/M)	
MONTGOMERY	**NOX (tons/day)**	**PM 2.5 (tons/day)**
Link Emissions	3.4771	0.2513
Vehicle Emissions	1.6395	0.0600
Intrazonal Emissions	0.0104	0.0012
TOTAL	**5.1270**	**0.3125**