Appendix H
Central Ohio On-Road Mobile Emission Estimates

CENTRAL OHIO ON-ROAD MOBILE EMISSION ESTIMATES PREPARED FOR OHIO ENVIRONMENTAL PROTECTION AGENCY CENTRAL OHIO YEAR 2008 INVENTORY FOR THE 8-HOUR OZONE STANDARD

JULY, 2014

Mid-Ohio Regional Planning Commission

111 Liberty Street
Columbus, Ohio 43215
614-228-2663

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1.0 Introduction & Background

1.1 Introduction

This Report documents the on-road mobile emission estimates for the Columbus and Central Ohio area, in conjunction with the Ohio Environmental Protection Agency (OEPA) State Implementation Plan (SIP) update for Central Ohio area, primarily to establish base year inventory for the ozone marginal nonattainment area. Currently the region is designated as marginal nonattainment for 2008 Ozone National Ambient Air Quality Standards (NAAQS), Federal Register Vol. 77, No. 98, FR 30141, May 21, 2012.This report presents the summary of on road mobile emissions for the analysis year 2008 as the base year. Year 2008 computations for VOC (volatile organic compounds, gaseous compounds made of carbon and hydrogen) and NOx (Oxides of Nitrogen), are presented in this report. VOC and NOx interacting with sunlight in the lower atmosphere develops the primary constituent of smog, Ozone, a criteria pollutant. These emissions documented here are the emissions due to on-road vehicles for the counties in the marginal nonattainment area of Central Ohio. The methodologies in computing emissions and forecasting models used are also summarized in this report.

1.2 Background

Under the 1990 Clean Air Act Amendments (CAAA), because of the 1997 eight-hour ozone standard, on April 15, 2004, U.S. EPA issued final designations with regard to the 8-hour ozone standard, designating the central Ohio basic non-attainment area to be the six counties of Franklin, Delaware, Licking, Madison, Fairfield and Knox counties were designated as a basic nonattainment area for ozone. The CAAA defines nonattainment areas as geographic regions of the country that do not meet the National Ambient Air Quality Standards (NAAQS). In nonattainment areas, air quality implementation plans must be developed that identify strategies and programs that nonattainment areas will implement to provide the emission reductions needed for the areas to meet the NAAQS. In Ohio, OEPA is the lead agency for coordinating development of the SIP. The SIP includes actions done on a statewide basis as well as actions done within each specific nonattainment area of the state to achieve the air quality standards.

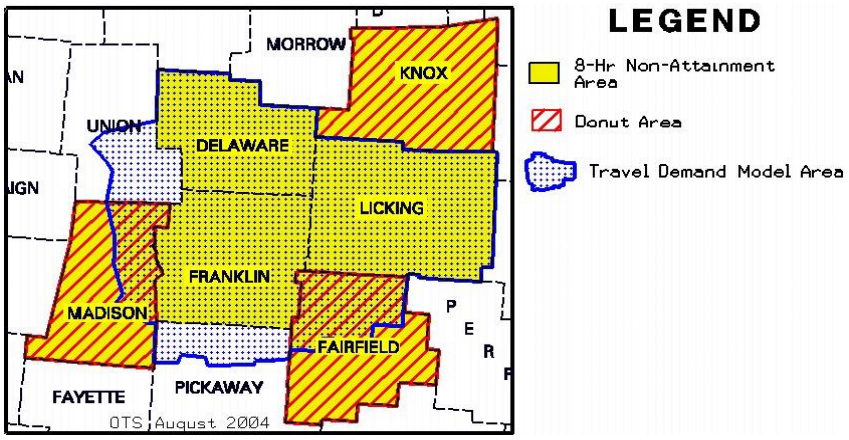
Re-designation of an area from ‘eight-hour ozone basic non-attainment’ to attainment is based on criteria and guidance set forth by U.S. EPA. Re-designation requests to attainment include SIP revisions that document that the NAAQS have been met and provide a maintenance plan to ensure meeting the standards for the next ten years. One of the items of documentation contained in a re-designation request is three consecutive years of air quality monitoring data that meet the NAAQS. A Re-designation request to attainment was submitted to EPA in March 2009. This re-designation request to attainment was approved on September 15, 2009, based on 1997 eight-hour ozone standard, which is 80 ppb (0.08 ppm).

In September 2009, Central Ohio area reached attainment, by re-designation, based on 1997 eight-hour ozone standard. However on May 21, 2012 US EPA’s Federal Register notice designated Columbus Central Ohio area as marginal nonattainment area for the 2008 eight-hour ozone standard, Federal Register Vol. 77, No. 98, FR 30141. Thus SIP update is required to establish base year as 2008 for Ozone. This report updates ozone emissions inventory using MOVES software program.

1.3 Geographic Area of Analysis

The six-county marginal non-attainment areas consist of two metropolitan planning organizations (MPOs), MORPC and LCATS and also areas outside of the two MPO's in Fairfield, Madison, and Knox Counties, illustrated in Figure 1. The MORPC transportation planning area consists of Franklin County, Delaware County, Pataskala and Etna Township in Licking County, and Violet and Bloom Townships in Fairfield County. The LCATS transportation planning area covers the remainder of Licking County. The travel demand model area comprising MORPC and LCATS transportation planning areas is illustrated in Figure 1. Donut areas, referring to Figure 1, are the counties or portions of counties that are outside of the travel demand model area. As illustrated, these are portions of Fairfield and Madison counties and all of Knox county. On-road mobile emissions analysis methodologies for counties within the travel demand area, as well as for counties outside the model area are discussed in the next sections. The geographic area of re-designation request for the Columbus, Central Ohio area, comprises of six-counties: Franklin county, Delaware county, Licking county, Fairfield county, Madison county, and Knox county.

FIGURE 1: COLUMBUS, CENTRAL OHIO, 8-HOUR MARGINAL NON-ATTAINMENT AREA



2.0 QUANTITATIVE ANALYSIS

The methodologies used and background information for estimating on-road mobile emissions are discussed in the foregoing sections for the geographic area of 8-hour ozone non-attainment area.

2.1 Analysis Years

Analysis year used in this documentation is 2008 since the need for establishing the base year as 2008 for the region's ozone National Ambient Air Quality Standards (NAAQS). Methodology for emissions analysis is presented next in this document for year 2008.

2.2 General Methodology

Evaluating emissions for year 2008 analysis requires several data inputs, discussed in the foregoing sections. Among these, vehicle travel characteristics data can be obtained from regionally maintained travel demand model. Travel demand model provides daily traffic volumes, congested travel times, speeds, v/c (volume to capacity ratios), VMT (vehicle miles traveled), VHT (vehicle hours traveled) among other input travel characteristics data used in evaluating emissions in this report. Areas that are not within the regional travel demand model boundary utilized HPMS (Highway Performance Monitoring Systems) based travel characteristics data. Thus, the travel demand model is used in evaluating emissions for Franklin county, Delaware county, and Licking county. Both the travel demand model as well as HPMS is used in evaluating emissions for Fairfield county and Madison county. HPMS only is used for the Knox county, in evaluating emissions. Each of the aforementioned process is detailed further in sections 2.5.1 and 2.5.2.

2.3 Travel Demand Model

For these analyses the latest planning assumptions available for the Central Ohio area were used. For the travel demand model, model validation is a joint process between MORPC, LCATS and the ODOT Office of Technical Services. In December 2004, a new model was accepted and installed for use at MORPC. The new model covers all of the MORPC and LCATS area including portions of Pickaway, Madison and Union Counties along with additional portions of Fairfield County outside of the MORPC MPO area. Further, MORPC continuously updates the highway and transit network information and maintains accurate networks for future year analysis. The new model used is a multi-step tour-based model, incorporating more advanced simulation methods than compared to traditional four step model. Thus model inputs were tested for quality control and quality assurance. Forecasted variables such as population, employment, traffic counts, roadway network, etc. were developed by MORPC in coordination with LCATS and used for the analysis.

Due to the advance simulation methods incorporated, there is some variation in model results from one complete model run to another with all of the same input data. MORPC performed a check on this variability with regard to on-road mobile emission estimates. The emission estimates for several 2002 model runs were calculated. The variation in the emission estimates were less than one-tenth of one percent (0.1%). Thus it was determined that the variability due to the simulation is insignificant.

2.3.1 Independent Variables

Independent variables (land use/socio-economic data) were developed as well as interpolated for year 2008 analysis. Trip tables for the analysis year 2008 were interpolated. MORPC continually monitors land use, population and employment information. MORPC performs complete land use inventories every five years. The complete documentation of the process and future forecasts is provided in 2012-2035 Transportation Plans completed in May 2012 by MOPRC and LCATS.

2.3.2 Model Networks

MORPC staff in conjunction with LCATS and ODOT continuously update the model networks to accurately reflect projects in the current TIP and Metropolitan Transportation Plan. The Transportation Plan horizon year for MORPC and LCATS is 2035. The model networks developed for this emission estimates is for the analysis year 2008.

2.3.3 Loaded Highway Networks

Trip assignment was run for model year 2008 using CUBE. The assignment produced a loaded highway network for the analysis year. This loaded network files includes total volume for each link in the network. Programming scripts in CUBE (a model software), illustrated in Appendix A, incorporate ODOT's CMAQ process, discussed in more detail in Section 2.5.1. The loaded highway network for the analysis year was split into separate files for each county. Each county network was run independently through the CMAQ process for each analysis year, which combined the volumes and emission factors for computing VOC and NOx emissions for the entire county.

2.3.4 IntraZonal Trips

Intrazonal trips are the trips that are generated within a traffic analysis zone (TAZ), that use local roads. Intrazonal trips do not get loaded onto the highway networks so Cube/Voyager emission calculation script requires a separate input file to account for these trips. Input files for evaluating intrazonal emissions are intrazonal trips file, intrazonal area file, and intrazonal emissions factor file. These input files for the areas within the travel demand model area are for Franklin county, Licking county, Delaware county, as well as for partial areas of Fairfield county and Madison county. The intrazonal trips were extracted from the trip tables using a Cube/Voyager script.

2.4 Emission Factor Generation

Base Year 2008

Using MOVES, emission factor files were generated for year-2008. Programs and corresponding MOVES parameters were developed in consultation with OEPA.

Technical Details

Table 1 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 1 – MOVES Inputs

RunSpec Parameter Settings	
MOVES Version	MOVES2010b
Scale	Custom Domain
MOVES Modeling Technique	Emission Factor Method Rates per Profile (grams/vehicle) Rates per Distance (grams/mile) Rates per Vehicle (grams/vehicle)
Time Span	Time Aggregation: Hour 1 Month representing average annual temperatures All hours of day selected 16 speed bins Weekdays only
Geographic Bounds	Franklin, Delaware, Licking, Fairfield, Madison & Knox Counties.
Vehicles/Equipment	All source types, gasoline and diesel
Road Type	All road types including off-network
Pollutants and Processes	Total Gaseous Hydrocarbons, Non-Methane Hydrocarbons, Volitile Organic Compounds, NO_x, NO, NO_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	None
Fuel Formulation	Default
Fuel Supply	Default Future runs modified for reformulated gas, RVP, etc. for summer analyses
Metereology Data	Local data obtained from NOAA National Climatic Data Center. Data 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 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 used for all analysis years
Average Speed Distribution	Default
Alternative Fuel Type	Default

Temperature and Relative Humidity

Temperatures used for the single season approach are representative of 12 months in 2002 based on NOAA data from the National Climate Data Center website. Data for Port Columbus International Airport was used because it was the most complete compared to other airports in the non-attainment area. 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. An average annual hourly temperature and relative humidity distribution profile can be seen in Table 2.

Table 2 – Temperature and Relative Humidity Data

Hour	Average Temperature	Average Relative Humidity
1	48.9	73.0
2	47.8	75.0
3	46.9	77.0
4	46.2	80.0
5	45.7	81.0
6	45.1	81.0
7	44.6	80.0
8	45.0	77.0
9	47.5	73.0
10	51.5	67.0
11	55.6	64.0
12	59.1	61.0
13	62.2	57.0
14	63.9	56.0
15	64.4	53.0
16	64.6	53.0
17	64.2	54.0
18	63.0	55.0
19	61.0	57.0
20	58.4	63.0
21	55.9	67.0
22	53.6	70.0
23	52.0	72.0
24	50.4	75.0

Ramp Fraction

Ramp fractions were derived using the base year travel demand model VHT fractions. Ramp fractions can be seen in Table 3. Base year fractions were assumed to apply to future years.

Table 3 – Ramp Fractions

RoadTypeID	Road Description	Ramp Fraction
2	Rural Restricted Access	0.02
4	Urban Restricted Access	0.13

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 growth in cars which is an independent variable to the travel demand model. Table 4 shows source type population for the analyzed counties in 2008.

Table 4 – Source Type Population for year 2008

Source Type ID	sourceTypeName	Franklin	Delaware	Licking	Fairfield	Madison & Knox
11	MotorCycle	55,222	6,868	8,999	2,444	3,565
21	Passenger Car	878,901	97,120	128,334	35,905	43,829
31	Passenger Truck	383,900	44,774	58,759	16,550	31,914
32	Light Commercial Truck	11,553	1,348	1,768	498	1,280
41	Intercity Bus	294	66	83	23	66
42	Transit Bus	79	18	22	6	35
43	School Bus	1,582	357	446	126	405
51	Refuse truck	228	39	49	13	37
52	Single Unit Short-haul Truck	205	35	44	12	1,553
53	Single Unit Long-haul Truck	264	44	57	15	198
54	Motor Home	1,102	184	235	65	181
61	Comb Short-haul Truck	3,144	653	905	154	780
62	Comb Long-haul Truck	3,616	750	1,040	178	897

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 most populous four counties were obtained in the non-attainment area and combined to create a regional vehicle age distribution file, see Table 5. This data is applied to all six counties in the region. The same age distribution will be used for all analysis years

Table 5 – Vehicle Age Distribution

Year ID	Source Type ID	Age ID	Age Fraction	Source Type ID	Age ID	Age Fraction	Source Type ID	Age ID	Age Fraction
2008	11	0	0.0017	21	8	0.0599	31	16	0.0300
2008	11	1	0.0228	21	9	0.0580	31	17	0.0256
2008	11	2	0.0552	21	10	0.0634	31	18	0.0157
2008	11	3	0.0765	21	11	0.0615	31	19	0.0118
2008	11	4	0.0864	21	12	0.0562	31	20	0.0084
2008	11	5	0.0820	21	13	0.0527	31	21	0.0077
2008	11	6	0.0664	21	14	0.0460	31	22	0.0062
2008	11	7	0.0839	21	15	0.0465	31	23	0.0048
2008	11	8	0.0584	21	16	0.0383	31	24	0.0031
2008	11	9	0.0540	21	17	0.0318	31	25	0.0024
2008	11	10	0.0442	21	18	0.0269	31	26	0.0015
2008	11	11	0.0333	21	19	0.0209	31	27	0.0009
2008	11	12	0.0260	21	20	0.0162	31	28	0.0005
2008	11	13	0.0204	21	21	0.0127	31	29	0.0003
2008	11	14	0.0195	21	22	0.0092	31	30	0.0037
2008	11	15	0.0188	21	23	0.0069	32	0	0.0059
2008	11	16	0.0153	21	24	0.0057	32	1	0.0452
2008	11	17	0.0128	21	25	0.0042	32	2	0.1089
2008	11	18	0.0091	21	26	0.0031	32	3	0.0740
2008	11	19	0.0085	21	27	0.0017	32	4	0.0699
2008	11	20	0.0078	21	28	0.0011	32	5	0.0388
2008	11	21	0.0078	21	29	0.0010	32	6	0.0331
2008	11	22	0.0074	21	30	0.0321	32	7	0.0376
2008	11	23	0.0106	31	0	0.0071	32	8	0.0370
2008	11	24	0.0156	31	1	0.0277	32	9	0.0441
2008	11	25	0.0144	31	2	0.0494	32	10	0.0557
2008	11	26	0.0126	31	3	0.0584	32	11	0.0557
2008	11	27	0.0163	31	4	0.0676	32	12	0.0472
2008	11	28	0.0237	31	5	0.0828	32	13	0.0456
2008	11	29	0.0163	31	6	0.0800	32	14	0.0385
2008	11	30	0.0723	31	7	0.0727	32	15	0.0609
2008	21	0	0.0075	31	8	0.0752	32	16	0.0476
2008	21	1	0.0279	31	9	0.0613	32	17	0.0340
2008	21	2	0.0396	31	10	0.0647	32	18	0.0273
2008	21	3	0.0489	31	11	0.0622	32	19	0.0155
2008	21	4	0.0508	31	12	0.0515	32	20	0.0156
2008	21	5	0.0537	31	13	0.0433	32	21	0.0156
2008	21	6	0.0561	31	14	0.0373	32	22	0.0118
2008	21	7	0.0595	31	15	0.0362	32	23	0.0095

Year ID	Source Type ID	Age ID	Age Fraction	Source Type ID	Age ID	Age Fraction	Source Type ID	Age ID	Age Fraction
2008	32	24	0.0045	42	2	0.0592	43	11	0.0557
2008	32	25	0.0057	42	3	0.0592	43	12	0.0843
2008	32	26	0.0044	42	4	0.0592	43	13	0.0484
2008	32	27	0.0019	42	5	0.0395	43	14	0.0178
2008	32	28	0.0010	42	6	0.0724	43	15	0.0192
2008	32	29	0.0007	42	7	0.0461	43	16	0.0129
2008	32	30	0.0068	42	8	0.0592	43	17	0.0132
2008	41	0	0.0013	42	9	0.0855	43	18	0.0181
2008	41	1	0.0344	42	10	0.0592	43	19	0.0213
2008	41	2	0.0607	42	11	0.1316	43	20	0.0139
2008	41	3	0.0837	42	12	0.0395	43	21	0.0087
2008	41	4	0.1005	42	13	0.0329	43	22	0.0077
2008	41	5	0.0870	42	14	0.0263	43	23	0.0087
2008	41	6	0.0972	42	15	0.0395	43	24	0.0056
2008	41	7	0.0607	42	16	0.0461	43	25	0.0066
2008	41	8	0.0742	42	17	0.0132	43	26	0.0049
2008	41	9	0.0472	42	18	0.0197	43	27	0.0024
2008	41	10	0.0466	42	19	0.0197	43	28	0.0017
2008	41	11	0.0614	42	20	0.0000	43	29	0.0038
2008	41	12	0.0290	42	21	0.0132	43	30	0.0064
2008	41	13	0.0263	42	22	0.0066	51	0	0.0097
2008	41	14	0.0189	42	23	0.0132	51	1	0.0290
2008	41	15	0.0162	42	24	0.0000	51	2	0.0258
2008	41	16	0.0229	42	25	0.0329	51	3	0.0839
2008	41	17	0.0142	42	26	0.0000	51	4	0.0968
2008	41	18	0.0081	42	27	0.0129	51	5	0.0226
2008	41	19	0.0175	42	28	0.0000	51	6	0.0677
2008	41	20	0.0101	42	29	0.0000	51	7	0.0774
2008	41	21	0.0101	42	30	0.0000	51	8	0.0419
2008	41	22	0.0121	43	0	0.0561	51	9	0.0323
2008	41	23	0.0094	43	1	0.0411	51	10	0.0710
2008	41	24	0.0061	43	2	0.0491	51	11	0.0710
2008	41	25	0.0034	43	3	0.0655	51	12	0.0613
2008	41	26	0.0081	43	4	0.0564	51	13	0.0516
2008	41	27	0.0020	43	5	0.0516	51	14	0.0387
2008	41	28	0.0000	43	6	0.0627	51	15	0.0419
2008	41	29	0.0034	43	7	0.0537	51	16	0.0355
2008	41	30	0.0273	43	8	0.0666	51	17	0.0161
2008	42	0	0.0000	43	9	0.0603	51	18	0.0258
2008	42	1	0.0132	43	10	0.0756	51	19	0.0129

Year ID	Source Type ID	Age ID	Age Fraction	Source Type ID	Age ID	Age Fraction	Source Type ID	Age ID	Age Fraction
2008	51	20	0.0000	52	29	0.0032	54	7	0.0450
2008	51	21	0.0032	52	30	0.0484	54	8	0.0417
2008	51	22	0.0065	53	0	0.0097	54	9	0.0414
2008	51	23	0.0032	53	1	0.0290	54	10	0.0524
2008	51	24	0.0032	53	2	0.0258	54	11	0.0482
2008	51	25	0.0065	53	3	0.0839	54	12	0.0409
2008	51	26	0.0032	53	4	0.0968	54	13	0.0334
2008	51	27	0.0000	53	5	0.0226	54	14	0.0356
2008	51	28	0.0097	53	6	0.0677	54	15	0.0315
2008	51	29	0.0032	53	7	0.0774	54	16	0.0285
2008	51	30	0.0484	53	8	0.0419	54	17	0.0254
2008	52	0	0.0097	53	9	0.0323	54	18	0.0197
2008	52	1	0.0290	53	10	0.0710	54	19	0.0177
2008	52	2	0.0258	53	11	0.0710	54	20	0.0180
2008	52	3	0.0839	53	12	0.0613	54	21	0.0263
2008	52	4	0.0968	53	13	0.0516	54	22	0.0243
2008	52	5	0.0226	53	14	0.0387	54	23	0.0230
2008	52	6	0.0677	53	15	0.0419	54	24	0.0166
2008	52	7	0.0774	53	16	0.0355	54	25	0.0193
2008	52	8	0.0419	53	17	0.0161	54	26	0.0208
2008	52	9	0.0323	53	18	0.0258	54	27	0.0130
2008	52	10	0.0710	53	19	0.0129	54	28	0.0089
2008	52	11	0.0710	53	20	0.0000	54	29	0.0074
2008	52	12	0.0613	53	21	0.0032	54	30	0.1404
2008	52	13	0.0516	53	22	0.0065	61	0	0.0021
2008	52	14	0.0387	53	23	0.0032	61	1	0.0135
2008	52	15	0.0419	53	24	0.0032	61	2	0.0306
2008	52	16	0.0355	53	25	0.0065	61	3	0.0385
2008	52	17	0.0161	53	26	0.0032	61	4	0.0509
2008	52	18	0.0258	53	27	0.0000	61	5	0.0527
2008	52	19	0.0129	53	28	0.0097	61	6	0.0590
2008	52	20	0.0000	53	29	0.0032	61	7	0.0584
2008	52	21	0.0032	53	30	0.0484	61	8	0.0571
2008	52	22	0.0065	54	0	0.0051	61	9	0.0551
2008	52	23	0.0032	54	1	0.0130	61	10	0.0628
2008	52	24	0.0032	54	2	0.0257	61	11	0.0608
2008	52	25	0.0065	54	3	0.0382	61	12	0.0501
2008	52	26	0.0032	54	4	0.0413	61	13	0.0542
2008	52	27	0.0000	54	5	0.0472	61	14	0.0390
2008	52	28	0.0097	54	6	0.0501	61	15	0.0435

Year ID	Source Type ID	Age ID	Age Fraction		Source Type ID	Age ID	Age Fraction		Source Type ID	Age ID	Age Fraction
2008	61	16	0.0430		62	1	0.0485		62	17	0.0079
2008	61	17	0.0314		62	2	0.0193		62	18	0.0039
2008	61	18	0.0269		62	3	0.1651		62	19	0.0026
2008	61	19	0.0228		62	4	0.0912		62	20	0.0032
2008	61	20	0.0192		62	5	0.1263		62	21	0.0034
2008	61	21	0.0217		62	6	0.0858		62	22	0.0027
2008	61	22	0.0203		62	7	0.0529		62	23	0.0013
2008	61	23	0.0144		62	8	0.0286		62	24	0.0008
2008	61	24	0.0135		62	9	0.0663		62	25	0.0008
2008	61	25	0.0099		62	10	0.1102		62	26	0.0006
2008	61	26	0.0069		62	11	0.0600		62	27	0.0002
2008	61	27	0.0036		62	12	0.0353		62	28	0.0001
2008	61	28	0.0032		62	13	0.0186		62	29	0.0003
2008	61	29	0.0028		62	14	0.0196		62	30	0.0001
2008	61	30	0.0321		62	15	0.0208				
2008	62	0	0.0076		62	16	0.0160				
2008											

Road Type Distribution

Road type distribution is based on the 2008 ODOT, county summary, HPMS VMT data categorized by federal functional class obtained for the most populous four counties, and is applied to the region, similar to development of vehicle age distribution data used for the region. Road type distribution can be seen in Table 6.

Table 6 – Road Type Distribution

Source Type ID	Road Type ID	Road Type VMT Fraction		Source Type ID	Road Type ID	Road Type VMT Fraction
11	1	0		43	4	0.37
11	2	0.05		43	5	0.46
11	3	0.12		51	1	0
11	4	0.37		51	2	0.05
11	5	0.46		51	3	0.12
21	1	0		51	4	0.37
21	2	0.05		51	5	0.46
21	3	0.12		52	1	0
21	4	0.37		52	2	0.05
21	5	0.46		52	3	0.12
31	1	0		52	4	0.37
31	2	0.05		52	5	0.46
31	3	0.12		53	1	0
31	4	0.37		53	2	0.05
31	5	0.46		53	3	0.12
32	1	0		53	4	0.37
32	2	0.05		53	5	0.46
32	3	0.12		54	1	0
32	4	0.37		54	2	0.05
32	5	0.46		54	3	0.12
41	1	0		54	4	0.37
41	2	0.05		54	5	0.46
41	3	0.12		61	1	0
41	4	0.37		61	2	0.05
41	5	0.46		61	3	0.12
42	1	0		61	4	0.37
42	2	0.05		61	5	0.46
42	3	0.12		62	1	0
42	4	0.37		62	2	0.05
42	5	0.46		62	3	0.12
43	1	0		62	4	0.37
43	2	0.05		62	5	0.46
43	3	0.12				

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 facilities 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 2008 can be seen in Table 7. The same method was used to generate all other analysis years

Table 7 – Yearly HPMS VMT for 2008

HPMS VtypeID	Year ID	HPMS BaseYear VMT
10	2008	65,724,689
20	2008	11,721,479,841
30	2008	3,616,636,813
40	2008	36,966,843
50	2008	273,279,798
60	2008	648,816,441

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 8, the entire file is too large to include in this document.

Table 8 – Hourly VMT Fractions

Source TypeID	Road TypeID	DayID	HourID	Hour VMTFraction
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

Source TypeID	Road TypeID	DayID	HourID	Hour VMTFraction
11	1	2	11	0.05554
11	1	2	12	0.05558
11	1	2	13	0.05584
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

Source TypeID	Road TypeID	DayID	HourID	Hour VMTFraction
11	3	2	1	0.00655
11	3	2	2	0.0037
11	3	2	3	0.00304
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

Source TypeID	Road TypeID	DayID	HourID	Hour VMTFraction
11	4	2	16	0.07421
11	4	2	17	0.08321
11	4	2	18	0.08385
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 9 shows the first record in a MOVES sample output (rate per distance) emission file for year 2008. 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 9 – Sample Emission File (Rate per Distance) for year 2008

Heading:	MOVESScenarioID	MOVESRunID	yearID	monthID	dayID	hourID
Record:	OhioCustomDomain	6	2008	7	5	1
Heading:	linkID	pollutantID	processID	sourceTypeID	SCC	fuelTypeID
Record:	990250201	3	0	1		0
Heading:	modelYearID	roadTypeID	avgSpeedBinID	temperature	relHumidity	ratePerDistance
Record:	0	2	1	48.9333	73	12.9489

Table 10 shows the first record in a MOVES sample output (rate per vehicle) emission file for year 2008. 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 10 – Sample Emission File (Rate per Vehicle) for year 2008

Heading:	MOVESScenarioID	MOVESRunID	yearID	monthID	dayID
Record:	OhioCustomDomain	6	2008	7	5
Heading:	hourID	zoneID	pollutantID	processID	sourceTypeID
Record:	1	990250	3	0	2
Heading:	SCC	fuelTypeID	modelYearID	temperature	ratePerVehicle
Record:		0	0	48.9333	0.054967

Air Quality Consultation Process

The 1990 Clean Air Act amendments required identification of the consultation procedures that Ohio's air quality and transportation agencies will follow in the conformity process. To fulfill this requirement, the Ohio EPA has adopted Ohio Administrative Code 3745-101-04 to define the interagency consultation procedures used on air quality issues. These rules define a "straw man" process, whereby the lead agencies in the conformity process assume responsibility for preparing and distributing draft documents, with supporting information, and ensuring that each affected party involved in the conformity process is included in the consultation process. In addition, a Memorandum of Understanding (MOU) between MORPC, LCATS, ODOT and Ohio EPA has been signed to clarify OAC 3745-101-04 for the Columbus maintenance area. As a result of SAFETEA-LU Ohio EPA led the process to update MOU. This process is concluding with signatures from all parties obtained in February/March 2008.

The Columbus non-attainment area SIP development process employed the consultation procedures embodied in the rules. The procedures used in the current air quality analysis are comparable to the previous on road emission inventory and forecasting process. In addition, MORPC has had various telephone conversations and e-mail correspondence with Ohio EPA, ODOT and FHWA. Ohio EPA has also discussed various issues with U.S. EPA.

2.4.1 Vehicle Age Distribution

OEPA provided vehicle age distribution information that was derived using USEPAs VIN decoder and Ohio Bureau of Motor Vehicle registration data. The registration data for Central Ohio area, Vehicle age distribution used to represent the MORPC/LCATS area is listed in Table 5.

2.4.2 Temperatures

The low and high input temperatures used for MORPC area was given by OEPA. ODOT developed an average daily temperature distribution profile to derive the hourly temperature values. Temperature data input used is shown in table 2.

2.5 Computations Methodology

2.5.1 Areas with Regional Model

Post Processing

Custom programs developed by ODOT in conjunction with MPO models, were used in computing total emissions. 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, uses rewritten code able to handle the newer model network formats and MOVES generated emission factors.

The first step in the process involves running postcms10.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 A, model script.

The second step (movesnet.exe) uses a combination of the MOVES emission factors and the hourly link volumes that are output of the postcms10.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, (movesveh.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 intracalc2.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. Daily summary emissions for each pollutant, county, and scenario year in the Central Ohio Region can be found in Appendix B through G. A summary of these emissions are tabulated in Sections 3.1.1 and 3.1.2

2.5.2 Areas without Regional Model

The travel demand forecasting model discussed in the preceding sections does not cover the entire non-attainment area. Therefore, a standard process based on HPMS VMT was employed for the rest of the area which includes portions of Fairfield County, Madison County, and Knox County. This process first requires estimating the proportion of county VMT covered by the model and not covered by the model. This was accomplished using a GIS procedure, whereby, the proportion of the number of vehicles from census data, inside and outside of the model boundary, was calculated. This information was then combined with countywide average volumes by functional class to obtain the proportion of VMT inside and outside of the model. This computation yields 47% of the Fairfield county VMT, being inside the model area. Thus 53% of the HPMS VMT is used as the basis of the off-model computation for Fairfield County. For Madison County 71% HPMS VMT is used as the basis of the off-model computation of emissions. HPMS VMT data is used for all of Knox County.

VMT by functional classification obtained for outside regional model area, also provides speed data based on the type of facility. MOVES generated factors of rate per distance as well as rate per vehicle were used to generate emissions for VOC, and NOx. A summary of these emissions are tabulated in Sections 3.1.2 and 3.1.3

3.0 SUMMARY OF RESULTS

Emission estimates summary of results is presented in the next sections.

3.1.1 Areas within The Regional Travel Demand Model

Table 11: Emission Estimations for On-Road Mobile Sources - Franklin County

Franklin County	2008
VMT (miles/day)	33,674,281
VOC (tons/day)	94.250
NOx (tons/day)	168.462

Table 12: Emission Estimations for On-Road Mobile Sources - Delaware County

Delaware County	2008
VMT (miles/day)	5,163,945
VOC (tons/day)	8.742
NOx (tons/day)	18.995

Table 13: Emission Estimations for On-Road Mobile Sources - Licking County

Licking County	2008
VMT (miles/day)	5,269,914
VOC (tons/day)	10.034
NOx (tons/day)	20.839

3.1.2 Areas partially within The Regional Travel Demand Model

Counties that are partially within regional travel demand model are Fairfield county, and Madison county.

Tables 14a, and 14b, summarize emissions estimates for Fairfield county, for the areas within and outside travel demand model area, respectively. Results presented in Table 14a is for the area covered by the travel demand model. Table 14b is for the area not covered by the travel demand model. These are derived by using 53% of the total county HPMS based VMT as described in section 2.5.2. Table 14c presents the emissions for the entire Fairfield county, which is simply sum of emissions from Tables 14a, and 14b.

Table 14a: Emission Estimations for Fairfield County within the Travel Demand Model Area

Fairfield County	2008
VMT (miles/day)	1,762,320
VOC (tons/day)	2.711
NOx (tons/day)	6.126

Table 14b: Emission Estimations for Fairfield County outside of the Travel Demand Model Area- using HPMS data

Fairfield County	2008
VMT (miles/day)	1,674,173
VOC (tons/day)	2.411
NOx (tons/day)	5.393

Table 14c: Emission Estimations for Fairfield County sum of emissions from both the Travel Demand Model area as well as the HPMS area

Fairfield County	2008
VMT (miles/day)	3,436,493
VOC (tons/day)	5.122
NOx (tons/day)	11.519

Tables 15a, and 15b, summarize emissions estimates for Madison county, for the areas within and outside travel demand area, respectively. Results presented in Table 15a is for the area covered by the travel demand model. Table 15b is for the area not covered by the travel demand model. These are derived by using 71% of the Madison county HPMS based VMT as described in section 2.5.2. Table 15c presents the emissions for the entire Madison county, which is simply sum of emissions from Tables 15a, and 15b.

Table 15a: Emission Estimations for Madison County within the Travel Demand Model Area

Madison County	2008
VMT (miles/day)	902,205
VOC (tons/day)	1.319
NOx (tons/day)	3.056

Table 15b: Emission Estimations for Madison County outside of the Travel Demand Model Area - using HPMS data

Madison County	2008
VMT (miles/day)	1,521,185
VOC (tons/day)	2.191
NOx (tons/day)	4.900

Table 15c: Emission Estimations for Madison County
sum of emissions from both the Travel Demand Model area as well as the HPMS area

Madison County	2008
VMT (miles/day)	2,423,389
VOC (tons/day)	3.510
NOx (tons/day)	7.956

3.1.3 Area outside Regional Travel Demand Model

Tables 16, summarizes emissions estimates for Knox county, and the results presented in this Table used methodology based on HPMS data.

Table 16: Emission Estimations for Knox County – using only HPMS

Knox County	2008
VMT (miles/day)	1,221,494
VOC (tons/day)	1.759
NOx (tons/day)	3.935

3.1.4 Total Emissions for the Columbus/Central Ohio area

Table 17, summarizes emissions estimates for the entire six county area. These emissions presented here is simply sum of all emissions in six counties summarized in Tables 11 through 16.

Table 17: Emission Estimations for On-Road Mobile Sources for Columbus/Central Ohio

Central Ohio Area	2008
VMT (miles/day)	51,189,516
VOC (tons/day)	123.416
NOx (tons/day)	231.706

3.2 Emissions Summary for the Columbus/Central Ohio Area

Tables 18 and 19, summarize VOC and NOx emissions estimates respectively for the analysis years. The summary presented in the following tables is from the aforementioned in Tables 11 through 16.

In addition, these emissions are also tabulated based on RoadTypeID, as follows

RoadTypeID #	RoadTypeID - Description
1	**Off-Network**- all locations where the predominant activity is vehicle starts, parking and idling (parking lots, truck stops, rest areas, freight or bus terminals)
2	**Rural Restricted Access** - rural highways that can only be accessed by an on-ramp
3	**Rural Unrestricted Access**- all other rural roads (arterials, connectors, and local streets)
4	**Urban Restricted Access** - urban highways that can only be accessed by an on-ramp
5	**Urban Unrestricted Access** - all other urban roads (arterials, connectors, and local streets)

Table 18: VOC Emission Inventory Summary - Year 2008, (tons/day)

		RoadTypeID #				
VOC	**2008**	**1**	**2**	**3**	**4**	**5**
Franklin	94.25	59.444	1.093	4.750	9.453	19.510
Delaware	8.742	5.514	0.101	0.441	0.877	1.810
Licking	10.034	6.329	0.116	0.506	1.006	2.077
Fairfield	5.122	3.230	0.059	0.258	0.514	1.060
Madison	3.51	2.214	0.041	0.177	0.352	0.727
Knox	1.759	1.109	0.020	0.089	0.176	0.364
Total	**123.416**	77.840	1.432	6.220	12.379	25.547

Table 19: NOx Emission Inventory Summary - Year 2008, (tons/per day)

	Total	RoadTypeID #				
NOx	**2008**	**1**	**2**	**3**	**4**	**5**
Franklin	168.462	31.472	5.620	16.528	47.262	67.580
Delaware	18.995	3.549	0.634	1.864	5.329	7.620
Licking	20.839	3.893	0.695	2.045	5.846	8.360
Fairfield	11.519	2.152	0.384	1.130	3.232	4.621
Madison	7.956	1.486	0.265	0.781	2.232	3.192
Knox	3.935	0.735	0.131	0.386	1.104	1.579
Total	**231.706**	43.287	7.730	22.733	65.005	92.951

APPENDIX

- Appendix A –Model Script for computing emissions
- Appendix B – MORPC Travel Demand Model Emission Run Report for 2008
- Appendix C – MORPC HPMS VMT and Emissions

Appendix A – Model Script, Figures illustrating Data

CUBE VOYAGER PROGRAM SCRIPT FOR COMPUTING VOC & NOx EMISSIONS

```
;[CMS (AQ), Produce Viper Network Output]
;;<<Process Template>>;;
;Input Network File: {cm3neti,filename,"Input Network File
Name",x,"N:\AQ\MOVES\morpc\Ozone\2014_04\model\AQ\Network\AQ_asgn_2008.net","Network File (*.net)|*.net"}
;Output Network File: {cm3neto,filename,"Output Network File
Name",x,"N:\AQ\MOVES\morpc\Ozone\2014_04\model\AQ\Network\fra_out\AQ_2008out.net","Network File
(*.net)|*.net"}
;Output CSV Summary File: {cm3sumo,filename,"Output CSV Summary
File",x,"N:\AQ\MOVES\morpc\Ozone\2014_04\model\AQ\Network\fra_out\fra2008.csv","Report File
(*.csv;*.txt)|*.csv;*.txt"}
;Output TXT Report File: {cm3rpto,filename,"Output TXT Report
File",x,"N:\AQ\MOVES\morpc\Ozone\2014_04\model\AQ\Network\fra_out\fra2008.rpt","Report File
(*.rpt;*.txt)|*.rpt;*.txt"}
;Output CSV Hourly File: {cm3hro,filename,"Output CSV Hourly File (Needed for benefits calc but very
big)",x,"NONE","Report File (*.csv;*.txt)|*.csv;*.txt"}
;Note: {cm3junkname,note,"Optional Air Quality Files, Leave Blank When Not Doing Air Quality Calculations"}
;AQ Run Type: {cm3aqtype,combolist,"AQ Run Type","MOVES","NONE","MOBILE"}
;AQ Comment Line: {cm3aqcom,editbox,"Optional AQ Report Comment",T,"Ozone Analysis with MOVES - MORPC"}
;Input Network Emissions Factors: {cm3effile,filename,"Input Network (per distance)Emissions
Factors",x,"N:\AQ\MOVES\morpc\Ozone\2014_04\model\factors\2008MORPC_ozone_3source_rpd.csv","Emissions File
(*.fac;*.csv)|*.fac;*.csv"}
;Input Vehicle (MOV) or Intrazonal (MOB) Emissions Factors: {cm3ieffile,filename,"Input Vehicle (MOV) or
Intrazonal (MOB) Emissions
Factors",x,"N:\AQ\MOVES\morpc\Ozone\2014_04\model\factors\2008MORPC_ozone_3source_rpv.csv","Emissions File
(*.crd; *.csv)|*.crd; *.csv"}
;Input area file: {cm3afile,filename,"Input Area
File",x,"N:\AQ\MOVES\morpc\Ozone\2014_04\model\AQ\area_taz\TAZ_areain.txt","Text File (*.txt; *.prn)|*.txt;
*.prn"}
;Input Intrazonal Trips File: {cm3ifile,filename,"Input Intrazonal Trips (Matrix must be OMS format else use
text)",x,"N:\AQ\MOVES\morpc\Ozone\2014_04\model\AQ\intra_z\county\fra08.txt","Matrix or Text File (*.txt;
*.prn; *.mat; *.trp)|*.txt; *.prn; *.mat; *.trp"}
;Intrazonal File Type: {cm3iztype,combolist,"Intrazonal File Type","TEXT","NONE","OMSTABLE"}
;Input vehicle file: {cm3vfile,filename,"Input Vehicle File (Moves
Only)",x,"N:\AQ\MOVES\morpc\Ozone\2014_04\model\factors\Source_Type_Pop_2008_MORPC_on-Model.csv","Text File
(*.csv)|*.csv"}
;Space: {cm3space,note,"Parameters"}
```

```
;Truck PCE: {cm3tpce,editbox,"Truck PCE",N,"2.0"}
;Capacity Field: {cm3capf,comboedit,"Capacity Field","CAP24","CAP1","CAP2","CAP3","CAP4"}
;Hourly/Model Capacity Factor: {cm3kfact,editbox,"Hourly/Model(usually daily) Capacity Factor",N,"0.10"}
;AQ Season Factor: {cm3aqfact,comboedit,"AQ Season Factor (Ozone Only)","1.08","1.00"}
;Set Priority Code from ADMCLASS?:{cm3pri,combolist,"Set Priority Code from ADMCLASS? (CMSCOST can
use)","NO","SW","OMS"}
;Run Mode: {cm3rmode,combolist,"Run Mode (usually use Normal for
AQ)","NORMAL","4PERIOD_OMS","4PERIOD_SW","4PERIOD_MARKETSEGMENTS_SW"}
;Note: {cm3junkname2,note,"Normal Mode Inputs (if you specify another mode the fields are predetermined)"}
;Volume Field: {cm3volf,comboedit,"Volume Field", "VOL24_TOT","V_1", "LOADEDVOL","WINTERVOL","SUMMERVOL"}
;Truck Volume Field: {cm3trkf,comboedit,"Truck Volume Field (leave to NONE for AQ unless EFs generated by
source)", "NONE","VOL24_TRK","VOL24_TRKHV","V2_1"}
;;<<End Parameters>>;;
*if exist tempcms.txt DEL tempcms.txt
*if exist summary.rpt DEL summary.rpt
*if exist hourly.rpt DEL hourly.rpt
*if exist cmstext.rpt DEL cmstext.rpt
COPY FILE=county.dat
ADA 1 4
ALL 2 3
ASD 3 4
ATB 4 4
ATH 5 4
AUG 6 4
BEL 7 3
BRO 8 4
BUT 9 2
CAR10 4
CHP11 4
CLA12 3
CLE13 2
CLI14 4
COL15 4
COS16 4
CRA17 4
CUY18 1
DAR19 4
DEF20 4
DEL21 2
ERI22 3
FAI23 4
```

```
FAY24 4
FRA25 1
FUL26 4
GAL27 4
GEA28 2
GRE29 2
GUE30 4
HAM31 1
HAN32 4
HAR33 4
HAS34 4
HEN35 4
HIG36 4
HOC37 4
HOL38 4
HUR39 4
JAC40 4
JEF41 3
KNO42 4
LAK43 2
LAW44 3
LIC45 3
LOG46 4
LOR47 2
LUC48 2
MAD49 4
MAH50 2
MAR51 4
MED52 2
MEG53 4
MER54 4
MIA55 2
MOE56 4
MOT57 2
MRG58 4
MRW59 4
MUS60 4
NOB61 4
OTT62 4
PAU63 4
PER64 4
```

```
PIC65 4
PIK66 4
POR67 2
PRE68 4
PUT69 4
RIC70 3
ROS71 4
SAN72 4
SCI73 4
SEN74 4
SHE75 4
STA76 2
SUM77 2
TRU78 2
TUS79 4
UNI80 4
VAN81 4
VIN82 4
WAR83 2
WAS84 3
WAY85 4
WIL86 4
WOO87 2
WYA88 4
ENDCOPY
COPY FILE=dailya.dat
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: {cm3tpce}

AQ SEASON FACTOR: {cm3aqfact}
ENDCOPY

rrmode='{cm3rmode}'
if(rrmode='NORMAL')
COPY FILE=dailyb.dat

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       0
CLS BEG        0       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       0
CLS NUM        1       3       0       0       0       0       0       0       0       0       0       0
0       0       0       0
ENDCOPY
   volff='li.1.{cm3volf}'
   trkfff='{cm3trkf}'
   if (trkfff == 'NONE') then
    trkff='_zero'
   else
    trkff='li.1.{cm3trkf}'
   endif
   vol1s='_zero'
   vol2s='_zero'
   vol3s='_zero'
```

```
   vol4s='_zero'
   vol5s='_zero'
   vol6s='_zero'
   vol7s='_zero'
   vol8s='_zero'
   vol9s='_zero'
   vol10s='_zero'
   vol11s='_zero'
   vol12s='_zero'
   vol13s='_zero'
   vol14s='_zero'
   vol15s='_zero'
   vol16s='_zero'
elseif(rrmode='4PERIOD_OMS')
COPY FILE=dailyb.dat

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       0       0       0       1       1       1       1       0       0       0       0
0       0       0       0
CLS BEG       18       6       9      14      18       6       9      14       0       0       0       0
0       0       0       0
CLS END        5       8      13      17       5       8      13      17       0       0       0       0
0       0       0       0
CLS NUM        1       1       1       1       3       3       3       3       0       0       0       0
0       0       0       0
ENDCOPY
   volff='_zero'
   trkff='_zero'
   vol1s='li.1.volnt_aut'
   vol2s='li.1.volam_aut'
   vol3s='li.1.volmd_aut'
   vol4s='li.1.volpm_aut'
   vol5s='li.1.volnt_trk'
   vol6s='li.1.volam_trk'
   vol7s='li.1.volmd_trk'
   vol8s='li.1.volpm_trk'
   vol9s='_zero'
   vol10s='_zero'
   vol11s='_zero'
   vol12s='_zero'
```

```
   vol13s='_zero'
   vol14s='_zero'
   vol15s='_zero'
   vol16s='_zero'
elseif(rrmode='4PERIOD_SW')
COPY FILE=dailyb.dat

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       0       0       0       1       1       1       1       0       0       0       0
0       0       0       0
CLS BEG       19       7      10      16      19       7      10      16       0       0       0       0
0       0       0       0
CLS END        6       9      15      18       6       9      15      18       0       0       0       0
0       0       0       0
CLS NUM        1       1       1       1       3       3       3       3       0       0       0       0
0       0       0       0
ENDCOPY
   volff='_zero'
   trkff='_zero'
   vol1s='li.1.evvol_aut'
   vol2s='li.1.amvol_aut'
   vol3s='li.1.mdvol_aut'
   vol4s='li.1.pmvol_aut'
   vol5s='li.1.evvol_trk'
   vol6s='li.1.amvol_trk'
   vol7s='li.1.mdvol_trk'
   vol8s='li.1.pmvol_trk'
   vol9s='_zero'
   vol10s='_zero'
   vol11s='_zero'
   vol12s='_zero'
   vol13s='_zero'
   vol14s='_zero'
   vol15s='_zero'
   vol16s='_zero'
elseif(rrmode='4PERIOD_MARKETSEGMENTS_SW')
COPY FILE=dailyb.dat

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       0       0       0       1       1       1       1       0       0       0       0
0       0       0       0
CLS BEG        19       7      10      16      19       7      10      16      19       7      10      16
19       7      10      16
CLS END         6       9      15      18       6       9      15      18       6       9      15      18
6       9      15      18
CLS NUM         1       1       1       1       3       3       3       3       2       2       2       2
4       4       4       4
ENDCOPY
   volff='_zero'
   trkff='_zero'
   vol1s='li.1.evvol_autwk'
   vol2s='li.1.amvol_autwk'
   vol3s='li.1.mdvol_autwk'
   vol4s='li.1.pmvol_autwk'
   vol5s='li.1.evvol_trkhv'
   vol6s='li.1.amvol_trkhv'
   vol7s='li.1.mdvol_trkhv'
   vol8s='li.1.pmvol_trkhv'
   vol9s='li.1.evvol_autnw'
   vol10s='li.1.amvol_autnw'
   vol11s='li.1.mdvol_autnw'
   vol12s='li.1.pmvol_autnw'
   vol13s='li.1.evvol_trklt'
   vol14s='li.1.amvol_trklt'
   vol15s='li.1.mdvol_trklt'
   vol16s='li.1.pmvol_trklt'
endif

*if exist daily.dat del daily.dat
*copy dailya.dat+dailyb.dat daily.dat
*del dailya.dat
*del dailyb.dat
RUN PGM=NETWORK
  NETI={cm3neti.q}
  LINKO=templnk.txt, format = TXT, include = a(6),b(6),junk1(1),junk1(4),junks(1),moffpspd(4),
         ctoll(4),junkb(1),lanes(1),twidth(2),junkb(1),terrain(1),junk1(1),junkb(1),
         cap(6),vol(6),loneway(1),boffpspd(4),ttoll(4),junkb(1),blanes(1),areatype(1),admclass(1),
         junkb(1),bterrain(1),junk1(1),junkb(1),bcap(6),bvol(6),medturn(1),pcttrk(2),junk1(2),
         funclass(2),lnkgrp(2),mpostspd(2),jurisdic(1),county(3),rtenumb(5),junk1(7),nhs(1),
         fedfunc(2),trkvol(5),junkp(1),junk1(30),junk1(30),junk1(30),junk1(21),mdist(6),
```

```
         vol1(6),vol2(6),vol3(6),vol4(6),vol5(6),vol6(6),vol7(6),vol8(6),vol9(6),vol10(6),vol11(6),
         vol12(6),vol13(6),vol14(6),vol15(6),vol16(6)
  NODEO=tempnod.txt, format = TXT, include = junkn(1),n(6),x(11),y(11)
  PHASE=NODEMERGE
   junkn='N'
  ENDPHASE
  PHASE=LINKMERGE
   _zero=0
   junk1=0
   junks='S'
   junkp='P'
   fffff='{cm3pri}'
/*;commented out 04/02/2012

if(fffff=='SW')
   if(li.1.admclass==1 && li.1.district <13 && li.1.district>0)
    junkp='P' ;state system
   elseif(li.1.district<13 && li.1.district>0)
    junkp='G' ;non-state
   else
    junkp='U' ;out of state
   endif
elseif(fffff='OMS')
   if(li.1.admclass<6)
     junkp='P'
   else
     junkp='G'
   endif
endif
*/;commented out 04/02/2012

jurisdic=' '
nhs=0
fedfunc=li.1.fedfuncl

   junkb=' '
   ctoll=0; =cartoll*10
   ttoll=0; =trktoll*10
   mdist = LI.1.DIST*1000
   moffpspd=li.1.offpspd*100
   mpeakspd=li.1.peakspd*100
```

```
    cap=li.1.{cm3capf}*{cm3kfact}
    loneway='1' ; el_oneway change
    bcap=0
    bvol=0
    boffpspd=0
    bpeakspd=0
    blanes=0
    bterrain=0
    mpostspd=round(li.1.postspd)
    vol=@volff@
    trkvol=@trkff@
    vol1=@vol1s@
    vol2=@vol2s@
    vol3=@vol3s@
    vol4=@vol4s@
    vol5=@vol5s@
    vol6=@vol6s@
    vol7=@vol7s@
    vol8=@vol8s@
    vol9=@vol9s@
    vol10=@vol10s@
    vol11=@vol11s@
    vol12=@vol12s@
    vol13=@vol13s@
    vol14=@vol14s@
    vol15=@vol15s@
    vol16=@vol16s@
  ENDPHASE
ENDRUN
aqmode='{cm3aqtype}'
if(aqmode=='MOBILE')
*copy {cm3effile.q} tempef.txt
*N:\AQ\MOVES\morpc\Ozone\model\AQ\utils\postcms10.exe templnk.txt tempcms.txt N tempef.txt {cm3rmode}
*del tempef.txt
else
*N:\AQ\MOVES\morpc\Ozone\model\AQ\utils\postcms10.exe templnk.txt tempcms.txt N NONE {cm3rmode}
endif
if(aqmode=='MOVES')
*copy {cm3effile.q} tempef.txt
if(rrmode='NORMAL' && trkfff == 'NONE')then
*N:\AQ\MOVES\morpc\Ozone\model\AQ\utils\movesnet.exe hourly.rpt tempef.txt cmstext.rpt {cm3aqfact}
```

```
else
*N:\AQ\MOVES\morpc\Ozone\model\AQ\utils\movesnet.exe hourly.rpt tempef.txt cmstext.rpt {cm3aqfact} 1
{cm3tpce} 3
endif
endif

RUN PGM=NETWORK
  NETI[1]={cm3neti.q}
  LINKI[2]=tempcms.txt var=a,1-6,b,8-13,
         cVMT,97-111,cTRKVMT,113-128,cVOLPERLANE,130-137,cCONINDEX,139-146,
         cVCRATIO,148-155,cPEAKHOUR,157-160,cVHT,162-169,cCONGDELAY,171-178,
         cPHYSDELAY,180-187,cSPDLIMDELAY,189-196,cDELAYRATIO,198-205,
         cDIR1HRSEXCEED,229-232,cDIR2HRSEXCEED,234-237,cPKVMT,253-267,cEXCEEDVMT,269-283,
         cEXCEEDPKVMT,285-299,cLOS,317,1,,,1,
         select=(substr(record,1,1)!= 'A')
  NODEI[2]=tempnod.txt var=n,2-7, x,8-18, y,19-29
  NETO={cm3neto.q}
  MERGE RECORD=F
ENDRUN

iiztype='{cm3iztype}'
if(iiztype=='TEXT')
*copy {cm3ifile.q} tempif.txt
elseif(iiztype=='OMSTABLE')

RUN PGM=MATRIX
FILEO PRINTO[1] = tempif.txt
FILEI MATI[1] = {cm3ifile.q}
MW[1]=mi.1.5+mi.1.10+mi.1.15
jloop
if(j=i)
print list=i(4.0),mw[1][j](6.0),printo=1
endif
endjloop
ENDRUN

endif

if(iiztype!='NONE')
*copy {cm3afile.q} tempaf.txt
```

```
if(aqmode=='MOBILE')
*copy {cm3ieffile.q} tempief.txt
*N:\AQ\MOVES\morpc\Ozone\model\AQ\utils\intracal2.exe tempif.txt summary.rpt tempaf.txt tempief.txt
*del tempief.txt

elseif(aqmode=='MOVES')
*N:\AQ\MOVES\morpc\Ozone\model\AQ\utils\movesintra.exe tempif.txt tempef.txt tempaf.txt cmstext.rpt
{cm3aqfact}
*del tempef.txt
endif

*del tempaf.txt
*DEL tempif.txt
endif

if(aqmode=='MOVES')
*copy {cm3ieffile.q} tempief.txt
*copy {cm3vfile.q} tempveh.txt
*N:\AQ\MOVES\morpc\Ozone\model\AQ\utils\movesveh.exe tempveh.txt tempief.txt cmstext.rpt {cm3aqfact}
*del tempveh.txt
*del tempief.txt
endif

if(aqmode=='MOVES')
*echo MOVES BASED EMISSIONS REPORT > tempcom.txt
elseif(aqmode=='MOBILE')
*echo MOBILE BASED EMISSIONS REPORT >> tempcom.txt
else
*echo NO EMISSIONS ANALYSIS CONDUCTED >> tempcom.txt
endif
*echo {cm3aqcom} >> tempcom.txt
*echo Loaded Network:              {cm3neti} >> tempcom.txt
*echo Network Emission Factors:    {cm3effile} >> tempcom.txt
if(aqmode=='MOVES')
*echo Vehicle Emission Factors:    {cm3ieffile} >> tempcom.txt
*echo Vehicle Population      :    {cm3vfile} >> tempcom.txt
else
*echo Intrazonal Emission Factors: {cm3ieffile} >> tempcom.txt
endif
*echo Intrazonal Trips  :          {cm3ifile} >> tempcom.txt
*echo Area File (sq mi):           {cm3afile} >> tempcom.txt
```

```
*echo Volume Field Used:           {cm3volf} >> tempcom.txt
*echo Truck Volume Field Used:     {cm3trkf} >> tempcom.txt
*echo Capacity Field Used:         {cm3capf} >> tempcom.txt
*echo ---------------------------------------- >> tempcom.txt
*copy /B tempcom.txt+cmstext.rpt {cm3rpto.q}
*if exist {cm3sumo.q} del {cm3sumo.q}
*rename summary.rpt {cm3sumo.q}
*del tempcom.txt
*del cmstext.rpt
*DEL tempnod.txt
*DEL templnk.txt
*DEL tempcms.txt
hhro=rightstr('{cm3hro}',4)
if(hhro=='NONE')
*del hourly.rpt
else
*if exist {cm3hro.q} del {cm3hro.q}
*rename hourly.rpt {cm3hro.q}
endif
```

Appendix B – MORPC Travel Demand Model Emission Run Report for 2008

```
                                                MOVES BASED EMISSIONS REPORT
Ozone Analysis with MOVES - MORPC
Loaded Network:              N:\AQ\MOVES\morpc\Ozone\2014_04\model\AQ\Network\AQ_asgn_2008.net
Network Emission Factors:    N:\AQ\MOVES\morpc\Ozone\2014_04\model\factors\2008MORPC_ozone_3source_rpd.csv
Vehicle Emission Factors:    N:\AQ\MOVES\morpc\Ozone\2014_04\model\factors\2008MORPC_ozone_3source_rpv.csv
Vehicle Population      :    N:\AQ\MOVES\morpc\Ozone\2014_04\model\factors\Source_Type_Pop_2008_MORPC_on-Model.csv
Intrazonal Trips  :          N:\AQ\MOVES\morpc\Ozone\2014_04\model\AQ\intra_z\county\fra08.txt
Area File (sq mi):           N:\AQ\MOVES\morpc\Ozone\2014_04\model\AQ\area_taz\TAZ_areain.txt
Volume Field Used:           VOL24_TOT
Truck Volume Field Used:     NONE
Capacity Field Used:         CAP24
----------------------------------------
 CMS/AQ REPORT
 POSTCMS10, UPDATED DEC 2009, GTG
 DATE:04/29/2014 TIME:10:40:49

 PARAMETER FILE DUMP (DAILY.DAT FILE)

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      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: 2.0

AQ SEASON FACTOR: 1.08

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
0
CLS BEG        0       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
0
CLS NUM        1       3       0       0       0       0       0       0       0       0       0       0       0       0       0
0

 MOVES NETWORK LINK EMISSIONS OUTPUT
 COUNTY MONTH     VMT       HC        NOX       SO2       PM2.5
 ADA    JANUARY           0.    0.0000    0.0000    0.0000    0.0000
 ALL    JANUARY           0.    0.0000    0.0000    0.0000    0.0000
 ASD    JANUARY           0.    0.0000    0.0000    0.0000    0.0000
 ATB    JANUARY           0.    0.0000    0.0000    0.0000    0.0000
 ATH    JANUARY           0.    0.0000    0.0000    0.0000    0.0000
 AUG    JANUARY           0.    0.0000    0.0000    0.0000    0.0000
```

BEL	JANUARY	0.	0.0000	0.0000	0.0000	0.0000
BRO	JANUARY	0.	0.0000	0.0000	0.0000	0.0000
BUT	JANUARY	0.	0.0000	0.0000	0.0000	0.0000
CAR	JANUARY	0.	0.0000	0.0000	0.0000	0.0000
CHP	JANUARY	0.	0.0000	0.0000	0.0000	0.0000
CLA	JANUARY	0.	0.0000	0.0000	0.0000	0.0000
CLE	JANUARY	0.	0.0000	0.0000	0.0000	0.0000
CLI	JANUARY	0.	0.0000	0.0000	0.0000	0.0000
COL	JANUARY	0.	0.0000	0.0000	0.0000	0.0000
COS	JANUARY	0.	0.0000	0.0000	0.0000	0.0000
CRA	JANUARY	0.	0.0000	0.0000	0.0000	0.0000
CUY	JANUARY	0.	0.0000	0.0000	0.0000	0.0000
DAR	JANUARY	0.	0.0000	0.0000	0.0000	0.0000
DEF	JANUARY	0.	0.0000	0.0000	0.0000	0.0000
DEL	JANUARY	4593746.	0.0000	0.0000	0.0000	0.0000
ERI	JANUARY	0.	0.0000	0.0000	0.0000	0.0000
FAI	JANUARY	1564756.	0.0000	0.0000	0.0000	0.0000
FAY	JANUARY	0.	0.0000	0.0000	0.0000	0.0000
FRA	JANUARY	29955170.	0.0000	0.0000	0.0000	0.0000
FUL	JANUARY	0.	0.0000	0.0000	0.0000	0.0000
GAL	JANUARY	0.	0.0000	0.0000	0.0000	0.0000
GEA	JANUARY	0.	0.0000	0.0000	0.0000	0.0000
GRE	JANUARY	0.	0.0000	0.0000	0.0000	0.0000
GUE	JANUARY	0.	0.0000	0.0000	0.0000	0.0000
HAM	JANUARY	0.	0.0000	0.0000	0.0000	0.0000
HAN	JANUARY	0.	0.0000	0.0000	0.0000	0.0000
HAR	JANUARY	0.	0.0000	0.0000	0.0000	0.0000
HAS	JANUARY	0.	0.0000	0.0000	0.0000	0.0000
HEN	JANUARY	0.	0.0000	0.0000	0.0000	0.0000
HIG	JANUARY	0.	0.0000	0.0000	0.0000	0.0000
HOC	JANUARY	0.	0.0000	0.0000	0.0000	0.0000
HOL	JANUARY	0.	0.0000	0.0000	0.0000	0.0000
HUR	JANUARY	0.	0.0000	0.0000	0.0000	0.0000
JAC	JANUARY	0.	0.0000	0.0000	0.0000	0.0000
JEF	JANUARY	0.	0.0000	0.0000	0.0000	0.0000
KNO	JANUARY	0.	0.0000	0.0000	0.0000	0.0000
LAK	JANUARY	0.	0.0000	0.0000	0.0000	0.0000
LAW	JANUARY	0.	0.0000	0.0000	0.0000	0.0000
LIC	JANUARY	4683831.	0.0000	0.0000	0.0000	0.0000
LOG	JANUARY	0.	0.0000	0.0000	0.0000	0.0000
LOR	JANUARY	0.	0.0000	0.0000	0.0000	0.0000
LUC	JANUARY	0.	0.0000	0.0000	0.0000	0.0000
MAD	JANUARY	802361.	0.0000	0.0000	0.0000	0.0000
MAH	JANUARY	0.	0.0000	0.0000	0.0000	0.0000
MAR	JANUARY	0.	0.0000	0.0000	0.0000	0.0000
MED	JANUARY	0.	0.0000	0.0000	0.0000	0.0000
MEG	JANUARY	0.	0.0000	0.0000	0.0000	0.0000
MER	JANUARY	0.	0.0000	0.0000	0.0000	0.0000
MIA	JANUARY	0.	0.0000	0.0000	0.0000	0.0000
MOE	JANUARY	0.	0.0000	0.0000	0.0000	0.0000
MOT	JANUARY	0.	0.0000	0.0000	0.0000	0.0000

MRG	JANUARY	0.	0.0000	0.0000	0.0000	0.0000
MRW	JANUARY	0.	0.0000	0.0000	0.0000	0.0000
MUS	JANUARY	107344.	0.0000	0.0000	0.0000	0.0000
NOB	JANUARY	0.	0.0000	0.0000	0.0000	0.0000
OTT	JANUARY	0.	0.0000	0.0000	0.0000	0.0000
PAU	JANUARY	0.	0.0000	0.0000	0.0000	0.0000
PER	JANUARY	0.	0.0000	0.0000	0.0000	0.0000
PIC	JANUARY	771943.	0.0000	0.0000	0.0000	0.0000
PIK	JANUARY	0.	0.0000	0.0000	0.0000	0.0000
POR	JANUARY	0.	0.0000	0.0000	0.0000	0.0000
PRE	JANUARY	0.	0.0000	0.0000	0.0000	0.0000
PUT	JANUARY	0.	0.0000	0.0000	0.0000	0.0000
RIC	JANUARY	0.	0.0000	0.0000	0.0000	0.0000
ROS	JANUARY	0.	0.0000	0.0000	0.0000	0.0000
SAN	JANUARY	0.	0.0000	0.0000	0.0000	0.0000
SCI	JANUARY	0.	0.0000	0.0000	0.0000	0.0000
SEN	JANUARY	0.	0.0000	0.0000	0.0000	0.0000
SHE	JANUARY	0.	0.0000	0.0000	0.0000	0.0000
STA	JANUARY	0.	0.0000	0.0000	0.0000	0.0000
SUM	JANUARY	0.	0.0000	0.0000	0.0000	0.0000
TRU	JANUARY	0.	0.0000	0.0000	0.0000	0.0000
TUS	JANUARY	0.	0.0000	0.0000	0.0000	0.0000
UNI	JANUARY	1375900.	0.0000	0.0000	0.0000	0.0000
VAN	JANUARY	0.	0.0000	0.0000	0.0000	0.0000
VIN	JANUARY	0.	0.0000	0.0000	0.0000	0.0000
WAR	JANUARY	0.	0.0000	0.0000	0.0000	0.0000
WAS	JANUARY	0.	0.0000	0.0000	0.0000	0.0000
WAY	JANUARY	0.	0.0000	0.0000	0.0000	0.0000
WIL	JANUARY	0.	0.0000	0.0000	0.0000	0.0000
WOO	JANUARY	0.	0.0000	0.0000	0.0000	0.0000
WYA	JANUARY	0.	0.0000	0.0000	0.0000	0.0000
XXX	JANUARY	34621.	0.0000	0.0000	0.0000	0.0000
TOT	JANUARY	43874524.	0.0000	0.0000	0.0000	0.0000
ADA	APRIL	0.	0.0000	0.0000	0.0000	0.0000
ALL	APRIL	0.	0.0000	0.0000	0.0000	0.0000
ASD	APRIL	0.	0.0000	0.0000	0.0000	0.0000
ATB	APRIL	0.	0.0000	0.0000	0.0000	0.0000
ATH	APRIL	0.	0.0000	0.0000	0.0000	0.0000
AUG	APRIL	0.	0.0000	0.0000	0.0000	0.0000
BEL	APRIL	0.	0.0000	0.0000	0.0000	0.0000
BRO	APRIL	0.	0.0000	0.0000	0.0000	0.0000
BUT	APRIL	0.	0.0000	0.0000	0.0000	0.0000
CAR	APRIL	0.	0.0000	0.0000	0.0000	0.0000
CHP	APRIL	0.	0.0000	0.0000	0.0000	0.0000
CLA	APRIL	0.	0.0000	0.0000	0.0000	0.0000
CLE	APRIL	0.	0.0000	0.0000	0.0000	0.0000
CLI	APRIL	0.	0.0000	0.0000	0.0000	0.0000
COL	APRIL	0.	0.0000	0.0000	0.0000	0.0000
COS	APRIL	0.	0.0000	0.0000	0.0000	0.0000
CRA	APRIL	0.	0.0000	0.0000	0.0000	0.0000
CUY	APRIL	0.	0.0000	0.0000	0.0000	0.0000

DAR	APRIL	0.	0.0000	0.0000	0.0000	0.0000
DEF	APRIL	0.	0.0000	0.0000	0.0000	0.0000
DEL	APRIL	4593746.	0.0000	0.0000	0.0000	0.0000
ERI	APRIL	0.	0.0000	0.0000	0.0000	0.0000
FAI	APRIL	1564756.	0.0000	0.0000	0.0000	0.0000
FAY	APRIL	0.	0.0000	0.0000	0.0000	0.0000
FRA	APRIL	29955170.	0.0000	0.0000	0.0000	0.0000
FUL	APRIL	0.	0.0000	0.0000	0.0000	0.0000
GAL	APRIL	0.	0.0000	0.0000	0.0000	0.0000
GEA	APRIL	0.	0.0000	0.0000	0.0000	0.0000
GRE	APRIL	0.	0.0000	0.0000	0.0000	0.0000
GUE	APRIL	0.	0.0000	0.0000	0.0000	0.0000
HAM	APRIL	0.	0.0000	0.0000	0.0000	0.0000
HAN	APRIL	0.	0.0000	0.0000	0.0000	0.0000
HAR	APRIL	0.	0.0000	0.0000	0.0000	0.0000
HAS	APRIL	0.	0.0000	0.0000	0.0000	0.0000
HEN	APRIL	0.	0.0000	0.0000	0.0000	0.0000
HIG	APRIL	0.	0.0000	0.0000	0.0000	0.0000
HOC	APRIL	0.	0.0000	0.0000	0.0000	0.0000
HOL	APRIL	0.	0.0000	0.0000	0.0000	0.0000
HUR	APRIL	0.	0.0000	0.0000	0.0000	0.0000
JAC	APRIL	0.	0.0000	0.0000	0.0000	0.0000
JEF	APRIL	0.	0.0000	0.0000	0.0000	0.0000
KNO	APRIL	0.	0.0000	0.0000	0.0000	0.0000
LAK	APRIL	0.	0.0000	0.0000	0.0000	0.0000
LAW	APRIL	0.	0.0000	0.0000	0.0000	0.0000
LIC	APRIL	4683831.	0.0000	0.0000	0.0000	0.0000
LOG	APRIL	0.	0.0000	0.0000	0.0000	0.0000
LOR	APRIL	0.	0.0000	0.0000	0.0000	0.0000
LUC	APRIL	0.	0.0000	0.0000	0.0000	0.0000
MAD	APRIL	802361.	0.0000	0.0000	0.0000	0.0000
MAH	APRIL	0.	0.0000	0.0000	0.0000	0.0000
MAR	APRIL	0.	0.0000	0.0000	0.0000	0.0000
MED	APRIL	0.	0.0000	0.0000	0.0000	0.0000
MEG	APRIL	0.	0.0000	0.0000	0.0000	0.0000
MER	APRIL	0.	0.0000	0.0000	0.0000	0.0000
MIA	APRIL	0.	0.0000	0.0000	0.0000	0.0000
MOE	APRIL	0.	0.0000	0.0000	0.0000	0.0000
MOT	APRIL	0.	0.0000	0.0000	0.0000	0.0000
MRG	APRIL	0.	0.0000	0.0000	0.0000	0.0000
MRW	APRIL	0.	0.0000	0.0000	0.0000	0.0000
MUS	APRIL	107344.	0.0000	0.0000	0.0000	0.0000
NOB	APRIL	0.	0.0000	0.0000	0.0000	0.0000
OTT	APRIL	0.	0.0000	0.0000	0.0000	0.0000
PAU	APRIL	0.	0.0000	0.0000	0.0000	0.0000
PER	APRIL	0.	0.0000	0.0000	0.0000	0.0000
PIC	APRIL	771943.	0.0000	0.0000	0.0000	0.0000
PIK	APRIL	0.	0.0000	0.0000	0.0000	0.0000
POR	APRIL	0.	0.0000	0.0000	0.0000	0.0000
PRE	APRIL	0.	0.0000	0.0000	0.0000	0.0000
PUT	APRIL	0.	0.0000	0.0000	0.0000	0.0000

RIC	APRIL	0.	0.0000	0.0000	0.0000	0.0000
ROS	APRIL	0.	0.0000	0.0000	0.0000	0.0000
SAN	APRIL	0.	0.0000	0.0000	0.0000	0.0000
SCI	APRIL	0.	0.0000	0.0000	0.0000	0.0000
SEN	APRIL	0.	0.0000	0.0000	0.0000	0.0000
SHE	APRIL	0.	0.0000	0.0000	0.0000	0.0000
STA	APRIL	0.	0.0000	0.0000	0.0000	0.0000
SUM	APRIL	0.	0.0000	0.0000	0.0000	0.0000
TRU	APRIL	0.	0.0000	0.0000	0.0000	0.0000
TUS	APRIL	0.	0.0000	0.0000	0.0000	0.0000
UNI	APRIL	1375900.	0.0000	0.0000	0.0000	0.0000
VAN	APRIL	0.	0.0000	0.0000	0.0000	0.0000
VIN	APRIL	0.	0.0000	0.0000	0.0000	0.0000
WAR	APRIL	0.	0.0000	0.0000	0.0000	0.0000
WAS	APRIL	0.	0.0000	0.0000	0.0000	0.0000
WAY	APRIL	0.	0.0000	0.0000	0.0000	0.0000
WIL	APRIL	0.	0.0000	0.0000	0.0000	0.0000
WOO	APRIL	0.	0.0000	0.0000	0.0000	0.0000
WYA	APRIL	0.	0.0000	0.0000	0.0000	0.0000
XXX	APRIL	34621.	0.0000	0.0000	0.0000	0.0000
TOT	APRIL	43874524.	0.0000	0.0000	0.0000	0.0000
ADA	JULY	0.	0.0000	0.0000	0.0000	0.0000
ALL	JULY	0.	0.0000	0.0000	0.0000	0.0000
ASD	JULY	0.	0.0000	0.0000	0.0000	0.0000
ATB	JULY	0.	0.0000	0.0000	0.0000	0.0000
ATH	JULY	0.	0.0000	0.0000	0.0000	0.0000
AUG	JULY	0.	0.0000	0.0000	0.0000	0.0000
BEL	JULY	0.	0.0000	0.0000	0.0000	0.0000
BRO	JULY	0.	0.0000	0.0000	0.0000	0.0000
BUT	JULY	0.	0.0000	0.0000	0.0000	0.0000
CAR	JULY	0.	0.0000	0.0000	0.0000	0.0000
CHP	JULY	0.	0.0000	0.0000	0.0000	0.0000
CLA	JULY	0.	0.0000	0.0000	0.0000	0.0000
CLE	JULY	0.	0.0000	0.0000	0.0000	0.0000
CLI	JULY	0.	0.0000	0.0000	0.0000	0.0000
COL	JULY	0.	0.0000	0.0000	0.0000	0.0000
COS	JULY	0.	0.0000	0.0000	0.0000	0.0000
CRA	JULY	0.	0.0000	0.0000	0.0000	0.0000
CUY	JULY	0.	0.0000	0.0000	0.0000	0.0000
DAR	JULY	0.	0.0000	0.0000	0.0000	0.0000
DEF	JULY	0.	0.0000	0.0000	0.0000	0.0000
DEL	JULY	4961246.	4.9865	14.6985	0.0000	0.0000
ERI	JULY	0.	0.0000	0.0000	0.0000	0.0000
FAI	JULY	1689937.	1.5448	4.7334	0.0000	0.0000
FAY	JULY	0.	0.0000	0.0000	0.0000	0.0000
FRA	JULY	32351584.	53.7694	130.3709	0.0000	0.0000
FUL	JULY	0.	0.0000	0.0000	0.0000	0.0000
GAL	JULY	0.	0.0000	0.0000	0.0000	0.0000
GEA	JULY	0.	0.0000	0.0000	0.0000	0.0000
GRE	JULY	0.	0.0000	0.0000	0.0000	0.0000
GUE	JULY	0.	0.0000	0.0000	0.0000	0.0000

HAM	JULY	0.	0.0000	0.0000	0.0000	0.0000
HAN	JULY	0.	0.0000	0.0000	0.0000	0.0000
HAR	JULY	0.	0.0000	0.0000	0.0000	0.0000
HAS	JULY	0.	0.0000	0.0000	0.0000	0.0000
HEN	JULY	0.	0.0000	0.0000	0.0000	0.0000
HIG	JULY	0.	0.0000	0.0000	0.0000	0.0000
HOC	JULY	0.	0.0000	0.0000	0.0000	0.0000
HOL	JULY	0.	0.0000	0.0000	0.0000	0.0000
HUR	JULY	0.	0.0000	0.0000	0.0000	0.0000
JAC	JULY	0.	0.0000	0.0000	0.0000	0.0000
JEF	JULY	0.	0.0000	0.0000	0.0000	0.0000
KNO	JULY	0.	0.0000	0.0000	0.0000	0.0000
LAK	JULY	0.	0.0000	0.0000	0.0000	0.0000
LAW	JULY	0.	0.0000	0.0000	0.0000	0.0000
LIC	JULY	5058537.	5.7217	16.1163	0.0000	0.0000
LOG	JULY	0.	0.0000	0.0000	0.0000	0.0000
LOR	JULY	0.	0.0000	0.0000	0.0000	0.0000
LUC	JULY	0.	0.0000	0.0000	0.0000	0.0000
MAD	JULY	866550.	0.7521	2.3643	0.0000	0.0000
MAH	JULY	0.	0.0000	0.0000	0.0000	0.0000
MAR	JULY	0.	0.0000	0.0000	0.0000	0.0000
MED	JULY	0.	0.0000	0.0000	0.0000	0.0000
MEG	JULY	0.	0.0000	0.0000	0.0000	0.0000
MER	JULY	0.	0.0000	0.0000	0.0000	0.0000
MIA	JULY	0.	0.0000	0.0000	0.0000	0.0000
MOE	JULY	0.	0.0000	0.0000	0.0000	0.0000
MOT	JULY	0.	0.0000	0.0000	0.0000	0.0000
MRG	JULY	0.	0.0000	0.0000	0.0000	0.0000
MRW	JULY	0.	0.0000	0.0000	0.0000	0.0000
MUS	JULY	115932.	0.0927	0.2925	0.0000	0.0000
NOB	JULY	0.	0.0000	0.0000	0.0000	0.0000
OTT	JULY	0.	0.0000	0.0000	0.0000	0.0000
PAU	JULY	0.	0.0000	0.0000	0.0000	0.0000
PER	JULY	0.	0.0000	0.0000	0.0000	0.0000
PIC	JULY	833698.	0.6705	2.2002	0.0000	0.0000
PIK	JULY	0.	0.0000	0.0000	0.0000	0.0000
POR	JULY	0.	0.0000	0.0000	0.0000	0.0000
PRE	JULY	0.	0.0000	0.0000	0.0000	0.0000
PUT	JULY	0.	0.0000	0.0000	0.0000	0.0000
RIC	JULY	0.	0.0000	0.0000	0.0000	0.0000
ROS	JULY	0.	0.0000	0.0000	0.0000	0.0000
SAN	JULY	0.	0.0000	0.0000	0.0000	0.0000
SCI	JULY	0.	0.0000	0.0000	0.0000	0.0000
SEN	JULY	0.	0.0000	0.0000	0.0000	0.0000
SHE	JULY	0.	0.0000	0.0000	0.0000	0.0000
STA	JULY	0.	0.0000	0.0000	0.0000	0.0000
SUM	JULY	0.	0.0000	0.0000	0.0000	0.0000
TRU	JULY	0.	0.0000	0.0000	0.0000	0.0000
TUS	JULY	0.	0.0000	0.0000	0.0000	0.0000
UNI	JULY	1485973.	1.7530	4.8751	0.0000	0.0000
VAN	JULY	0.	0.0000	0.0000	0.0000	0.0000

VIN	JULY	0.	0.0000	0.0000	0.0000	0.0000
WAR	JULY	0.	0.0000	0.0000	0.0000	0.0000
WAS	JULY	0.	0.0000	0.0000	0.0000	0.0000
WAY	JULY	0.	0.0000	0.0000	0.0000	0.0000
WIL	JULY	0.	0.0000	0.0000	0.0000	0.0000
WOO	JULY	0.	0.0000	0.0000	0.0000	0.0000
WYA	JULY	0.	0.0000	0.0000	0.0000	0.0000
XXX	JULY	37391.	0.0236	0.0867	0.0000	0.0000
TOT	JULY	47384488.	69.2779	175.6670	0.0000	0.0000

MOVES INTRAZONAL EMISSIONS OUTPUT

FRANKLIN COUNTY

MONTH	VMT	HC	NOX	SO2	PM2.5
JANUARY	21378.	0.0000	0.0000	0.0000	0.0000
APRIL	21378.	0.0000	0.0000	0.0000	0.0000
JULY	23088.	0.0175	0.0605	0.0000	0.0000

DELAWARE COUNTY

MONTH	VMT	HC	NOX	SO2	PM2.5
JANUARY	3147.	0.0000	0.0000	0.0000	0.0000
APRIL	3147.	0.0000	0.0000	0.0000	0.0000
JULY	3399.	0.0026	0.0089	0.0000	0.0000

LICKING COUNTY

MONTH	VMT	HC	NOX	SO2	PM2.5
JANUARY	7563.	0.0000	0.0000	0.0000	0.0000
APRIL	7563.	0.0000	0.0000	0.0000	0.0000
JULY	8168.	0.0062	0.0214	0.0000	0.0000

FAIRFIELD COUNTY

MONTH	VMT	HC	NOX	SO2	PM2.5
JANUARY	4163.	0.0000	0.0000	0.0000	0.0000
APRIL	4163.	0.0000	0.0000	0.0000	0.0000
JULY	4496.	0.0034	0.0118	0.0000	0.0000

MADISON COUNTY

MONTH	VMT	HC	NOX	SO2	PM2.5
JANUARY	782.	0.0000	0.0000	0.0000	0.0000
APRIL	782.	0.0000	0.0000	0.0000	0.0000
JULY	844.	0.0006	0.0022	0.0000	0.0000

MOVES VEHICLE BASED EMISSIONS OUTPUT

MONTH	VEHICLES	HC	NOX	SO2	PM2.5
JANUARY	1763111.	0.0000	0.0000	0.0000	0.0000
APRIL	1763111.	0.0000	0.0000	0.0000	0.0000
JULY	1904160.	52.1614	51.2648	0.0000	0.0000

Appendix C – MORPC HPMS VMT and Emissions

COMBINED OFF-MODEL AREA EMISSIONS

```
2008
MOVES BASED HPMS EMISSIONS REPORT
MORPC area AQ analysis - Ozone emissions Analysis
Input VMT File:              N:\AQ\MOVES\morpc\Ozone\2014_04\model\factors\MORPC_All_Off-Model_VMT_2008.csv
Network Emission Factors:    N:\AQ\MOVES\morpc\Ozone\2014_04\model\factors\2008MORPC_ozone_3source_rpd.csv
Vehicle Emission Factors:    N:\AQ\MOVES\morpc\Ozone\2014_04\model\factors\2008MORPC_ozone_3source_rpv.csv
Vehicle Population:          N:\AQ\MOVES\morpc\Ozone\2014_04\model\factors\Source_Type_Pop_2008_MORPC_off-model_HPMS.csv
----------------------------------------
 DATE:04/29/2014 TIME:12:52:09

 PARAMETER FILE DUMP (DAILY.DAT FILE)

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

 AQ SEASON FACTOR: 1.08000004

 MOVES HPMS EMISSIONS OUTPUT
        MONTH     VMT       HC        NOX       SO2       PM2.5
        JANUARY     4521707.    0.0000    0.0000    0.0000    0.0000
        APRIL       4521707.    0.0000    0.0000    0.0000    0.0000
        JULY        4883444.    2.0500    9.6658    0.0000    0.0000
 MOVES VEHICLE BASED EMISSIONS OUTPUT
        MONTH     VEHICLES  HC        NOX       SO2       PM2.5
        JANUARY      143274.    0.0000    0.0000    0.0000    0.0000
        APRIL        143274.    0.0000    0.0000    0.0000    0.0000
        JULY         154736.    4.2387    4.1659    0.0000    0.0000
```