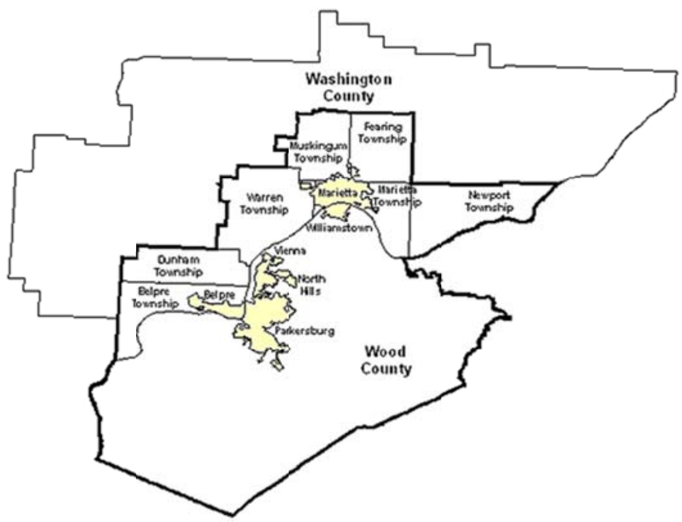
WOOD-WASHINGTON-WIRT INTERSTATE PLANNING COMMISSION
Transportation Air Quality Analysis and Technical Documentation
State Implementation Plan Inventory Mobile Emission Estimates
For the U.S. EPA Daily $PM_{2.5}$ National Ambient Air Quality Standard

Submitted: September 2011



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SELECTED ABBREVIATIONS & ACRONYMS

DOT – Department of Transportation
EPA – Environmental Protection Agency
FHWA – Federal Highway Administration;
FTA – Federal Transit Administration;
LRTP – Long Range Transportation Plan
MOBILE6 – Mobile Source Emission Factor Model
MOU – Memorandum of Understanding
MPO – Metropolitan Planning Organization
MVEB – Motor Vehicle Emissions Budget
NAAQS – National Ambient Air Quality Standard
NOx – Nitrogen Oxides

PM2.5 - Particulate Matter with an aerodynamic diameter less than 2.5 microns (often referred to as Fine Particulate Matter)

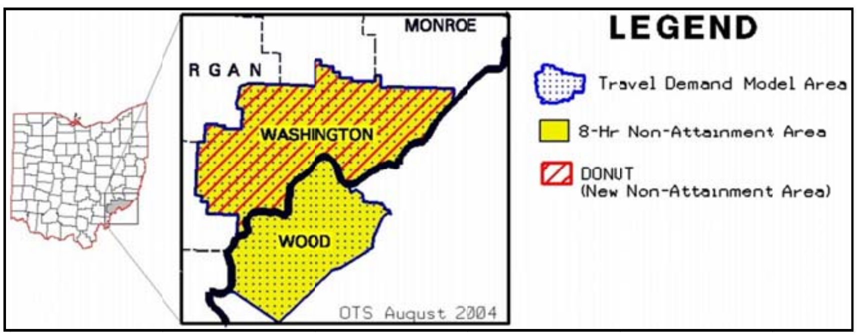
PM10 – Particulate Matter with an aerodynamic diameter less than 10 microns

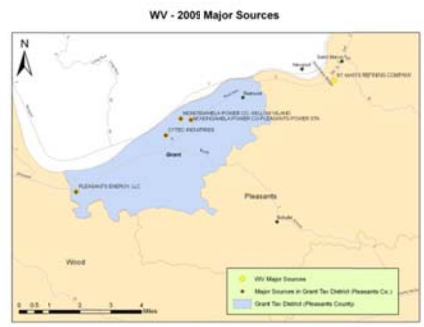
SIP – State Implementation Plan
TIP – Transportation Improvement Program
TAZs – Traffic Analysis Zones
TCM – Transportation Control Measure
TDM – Travel Demand Model
TIP – Transportation Improvement Program
VMT – Vehicle Miles of Travel
VOC – Volatile Organic Compounds

INTRODUCTION

This memorandum documents the air quality analyses and underlying planning assumptions performed by the Ohio Department of Transportation (ODOT), Division of Transportation System Development-Modeling and Forecasting Section and the Wood-Washington-Wirt Interstate Planning Commission (WWW) for the Annual PM2.5 on-road mobile source emission inventories for the Parkersburg-Marietta WV/OH Metropolitan area State Implementation Plan (SIP) in coordination with the Ohio Environmental Protection Agency (OEPA) and West Virginia Department of Environmental Protection (WVDEP). The WWW Region is comprised of Washington county, Ohio, Wood county, West Virginia, and the Grant Tax district of Pleasant county, West Virginia. On January 5, 2005, the USEPA designated these areas as non-attainment for the PM2.5 air quality standard. The designation became effective on April 5, 2005; 90 days after USEPA published action in the *Federal Registry*. Figure 1 displays the geographic extent of the WWW region non-attainment area.

Figure 1
NON-ATTAINMENT AREA BOUNDARY





As part of $PM_{2.5}$ analysis, the Grant Tax district in Pleasant county, West Virginia (shown above and adjacent to Wood county) is considered a “doughnut area” for planning purposes. For the most part, roadways within this district are not included in the travel demand model network. The WVDOT provided WWW with the VMT on the roads in this district by federal functional class for the year 2004. Based upon the advice of the WVDAQ, the modeling area’s growth factor was used to calculate future year VMT within this Tax district by functional class.

ON ROAD MOBILE EMISSION SUMMARY

Tables 1 and 2 present a summary of the pollutant emissions including Fine Particulate Matter (PM2.5) and Nitrogen Oxides (NOx) modeled for each county and Tax District that makes up the WWW PM 2.5 Non-Attainment Region. The Model Years for the demonstration includes the Base Year 2005, Attainment Year 2008, Interim Year 2015, and Maintenance Year 2022.

Table 1

WWW REGION ON-ROAD MOBILE EMISSIONS BY STATE AND COUNTY (2005 & 2008)

MOBILE AIR QUALITY ANALYSIS FOR THE PARKERSBURG METRO AREA		WASHINGTON COUNTY OHIO	WOOD COUNTY WV	GRANT TAX DIST, PLEASANT CO WV	WV TOTALS	METRO AREA TOTALS
YEAR 2005 NETWORK VMT		2,158,784	2,406,670	60,534	2,467,204	4,625,988
YEAR 2005 INTRAZONAL VMT		35,270	39,320	-	39,320	74,590
YEAR 2005 TOTAL VMT		2,194,054	2,445,990	60,534	2,506,524	4,700,578
YEAR 2005 VEHICLES		71,535	72,819	1,614	74,433	145,968
NETWORK EMISSIONS:	NOX	2282.60	2049.33	45.92	2,095.25	4,377.85
	SO2	26.02	30.08	0.66	30.73	56.76
(TONS/YEAR)	PM 2.5	80.48	72.56	1.46	74.02	154.50
INTRAZONAL EMISSIONS:	NOX	42.60	37.70	0.00	37.70	80.30
	SO2	0.51	0.58	0.00	0.58	1.10
(TONS/YEAR)	PM 2.5	1.86	1.68	0.00	1.68	3.54
VEHICLE-BASED EMISSIONS:	NOX	361.90	372.23	8.25	380.48	742.37
	SO2	0.44	0.47	0.04	0.51	0.95
(TONS/YEAR)	PM 2.5	8.10	7.19	0.15	7.34	15.44
TOTAL EMISSIONS:	NOX	2687.09	2459.26	54.17	2,513.43	5,200.52
	SO2	26.97	31.13	0.69	31.83	58.80
(TONS/YEAR)	PM 2.5	90.45	81.43	1.61	83.04	173.48
YEAR 2008 NETWORK VMT		2,202,857	2,705,663	61,267	2,766,930	4,969,787
YEAR 2008 INTRAZONAL VMT		34,631	77,167	-	77,167	111,798
YEAR 2008 TOTAL VMT		2,237,488	2,782,830	61,267	2,844,097	5,081,585
YEAR 2008 VEHICLES		72,004	73,314	1,625	74,939	146,943
NETWORK EMISSIONS:	NOX	1857.05	1714.59	34.60	1,749.19	3,606.24
	SO2	7.99	9.75	0.18	9.93	17.92
(TONS/YEAR)	PM 2.5	67.23	57.89	1.06	58.95	126.18
INTRAZONAL EMISSIONS:	NOX	35.92	55.99	0.00	55.99	91.91
	SO2	0.26	0.33	0.00	0.33	0.58
(TONS/YEAR)	PM 2.5	1.61	2.48	0.00	2.48	4.09
VEHICLE-BASED EMISSIONS:	NOX	354.45	352.04	7.81	359.85	714.31
	SO2	0.29	0.29	0.04	0.33	0.62
(TONS/YEAR)	PM 2.5	6.68	5.95	0.15	6.10	12.78
TOTAL EMISSIONS:	NOX	2247.41	2122.62	42.41	2,165.03	4,412.45
	SO2	8.54	10.37	0.22	10.59	19.13
(TONS/YEAR)	PM 2.5	75.52	66.32	1.20	67.53	143.04

Table 2

WWW REGION ON-ROAD MOBILE EMISSIONS BY STATE AND COUNTY (2015 & 2022)

MOBILE AIR QUALITY ANALYSIS FOR THE PARKERSBURG METRO AREA		WASHINGTON COUNTY OHIO	WOOD COUNTY WV	GRANT TAX DIST, PLEASANT CO WV	WV TOTALS	METRO AREA TOTALS
YEAR 2015 NETWORK VMT		2,412,956	2,985,297	62,971	3,048,268	5,461,224
YEAR 2015 INTRAZONAL VMT		38,158	85,367	-	85,367	123,525
YEAR 2015 TOTAL VMT		2,451,114	3,070,664	62,971	3,133,635	5,584,749
YEAR 2015 VEHICLES		73,172	74,333	1,647	75,980	149,152
NETWORK EMISSIONS:	NOX	926.63	749.53	14.20	763.73	1,690.35
	SO2	6.06	7.37	0.15	7.52	13.58
(TONS/YEAR)	PM 2.5	36.65	28.73	0.47	29.20	65.85
INTRAZONAL EMISSIONS:	NOX	22.52	23.98	0.00	23.98	46.50
	SO2	0.15	0.26	0.00	0.26	0.40
(TONS/YEAR)	PM 2.5	1.10	1.31	0.00	1.31	2.41
VEHICLE-BASED EMISSIONS:	NOX	251.38	219.11	4.85	223.96	475.34
	SO2	0.26	0.26	0.04	0.29	0.55
(TONS/YEAR)	PM 2.5	3.94	3.58	0.07	3.65	7.59
TOTAL EMISSIONS:	NOX	1200.52	992.62	19.05	1,011.67	2,212.19
	SO2	6.46	7.88	0.18	8.07	14.53
(TONS/YEAR)	PM 2.5	41.68	33.62	0.55	34.16	75.85
YEAR 2022 NETWORK VMT		2,595,217	3,220,378	64,570	3,284,948	5,880,165
YEAR 2022 INTRAZONAL VMT		41,224	92,378	-	92,378	133,602
YEAR 2022 TOTAL VMT		2,636,441	3,312,756	64,570	3,377,326	6,013,767
YEAR 2022 VEHICLES		74,357	75,540	1,674	77,214	151,571
NETWORK EMISSIONS:	NOX	419.79	396.68	7.08	403.76	823.55
	SO2	5.95	7.19	0.11	7.30	13.25
(TONS/YEAR)	PM 2.5	21.61	20.48	0.29	20.77	42.38
INTRAZONAL EMISSIONS:	NOX	11.61	12.41	0.00	12.41	24.02
	SO2	0.11	0.26	0.00	0.26	0.37
(TONS/YEAR)	PM 2.5	0.69	0.95	0.00	0.95	1.64
VEHICLE-BASED EMISSIONS:	NOX	140.85	129.50	2.88	132.39	273.24
	SO2	0.26	0.26	0.04	0.29	0.55
(TONS/YEAR)	PM 2.5	2.92	2.74	0.07	2.81	5.73
TOTAL EMISSIONS:	NOX	572.25	538.59	9.96	548.56	1,120.81
	SO2	6.31	7.70	0.15	7.85	14.16
(TONS/YEAR)	PM 2.5	25.22	24.16	0.37	24.53	49.75

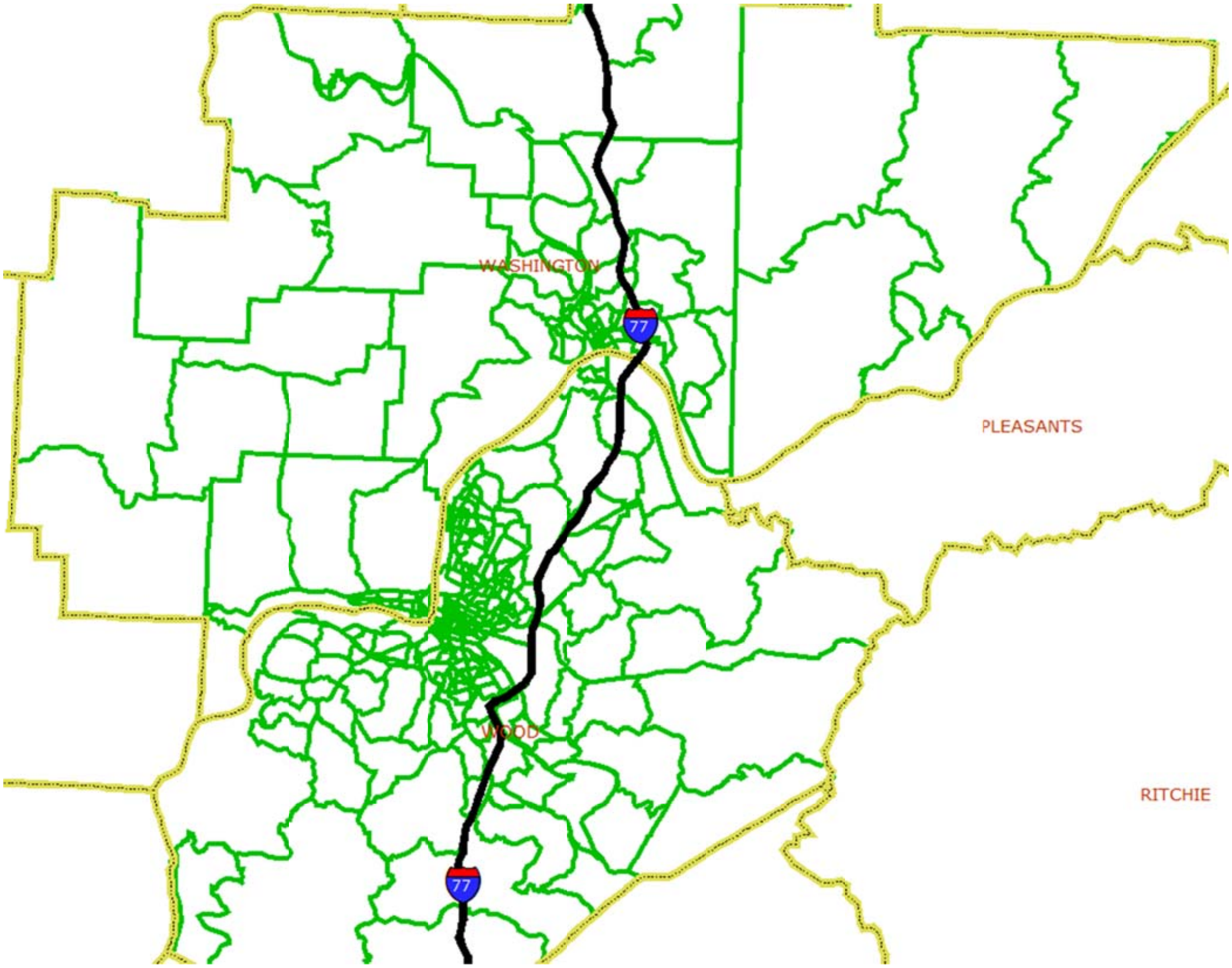
LATEST PLANNING ASSUMPTIONS
The annual PM2.5 inventory runs meet the latest planning assumption requirement. This report presents the latest population and land use data available that calibrated the modeling process used to calculate the vehicle emissions for the mobile emissions budgets as well as the input values for U.S. EPA's most recent emissions software (MOVES) for this attainment demonstration. A series of conference calls held during the winter of 2010/2011 by the Interagency Consultancy Group established two parameters. First, that this re-designation effort will require the use of MOVES software for all mobile source emission analyses and second, the annual emission estimates will be based a single-season approach.

LAND USE DATA:
Travel analysis zones (376 in the 2-county area) and external roadway "stations" (34) are the basic geographic units for estimating travel patterns. Socioeconomic data used to forecast these patterns shown in Table 3 include household population, household vehicles, and employment by category and location. Sources for year 2000 data include the 2000 Census and QCEW/ES202 employment data adjusted to Year 2005 county-level control totals. All data sources were geocoded to the zone level. Future year data for each variable were projected through various methods. More detailed explanation of base year and future year data generation for each of the above-mentioned categories of planning data follows. The forecasted distribution of land use by industry and traffic zone was developed in 2003 by WWW staff working in conjunction with WVU's Regional Research Institute and a consulting firm, as documented in their 2002 Transportation Plan update. Figure 2 displays the zones boundaries in the region.

Table 3
WWW REGION LAND USE DATA USED FOR TRAFFIC FORECASTING

	Population			Employment		
Year	**Wood**	**Washington**	**Study Area**	**Wood**	**Washington**	**Study Area**
2000	87,986	63,251	151,237	53,759	33,003	86,762
2025	83,094	61,650	144,744	69,973	42,957	112,930
Net Change	-4,892	-1,601	-6,493	16,214	9,954	26,168
% Change	-5.56%	-2.53%	-4.29%	30.16%	30.16%	30.16%

Figure 2
GEOGRAPHIC AREA COVERED BY TRAVEL MODEL AND TRAFFIC ZONE STRUCTURE



TRAVEL MODELING:
A travel demand model (TDM) is the traditional tool used to examine potential changes in future travel patterns. The road networks within them include all planned federal-aid projects as well as any regionally significant projects found in the TIP and LRTP expected to be open for traffic by the end of each respective analysis year. All projects identified in the LRTP having an impact on travel time and/or vehicle carrying capacity regardless of funding source were included in the air quality analysis. Trip generation figures by zone, are assumed to change linearly with time between the model base year and the Plan Horizon year.

The WWWW region area travel demand model network covers about 1000 miles of streets and highways in the 2-county area including all collector and arterial streets, and has been validated to observed traffic for year 2005. The trip generation model is patterned on the national default structure described in TRB's NCHRP Report 365 and adjusted as needed to match field studies of trip generation. The hourly distribution of trips by trip purpose and direction are constrained to match the hourly distribution of traffic counts. Trip distribution also begins with a trip-length distribution by purpose borrowed from another urban area and adjusted to ensure modeled VMT matched HPMS estimates of VMT within 1% in the model base year of 2005. (Home-based work trips were separately constrained to a target average value based on the 2000 Census.)

The modeling software program utilizes hourly saturation flow rates that are calculated based on road inventory data, roadway type, and the 2000 version of the Highway Capacity Manual (HCM). Coded speeds by street segment are a function of road type and posted speed limits and are based on the Ohio statewide travel time study conducted in 2000 (available on the web at http://www.dot.state.oh.us/urban/data/statewid/report.doc) using the "run time" version of speeds without intersection delays. The model software program internally estimates additional travel times for vehicles that stop for traffic control (stop signs and red lights) based on HCM methods and modeled traffic patterns. The traffic assignment RMS (root mean square) error meets FHWA/ODOT standards for all specified volume groups. Modeled VMT for 2005 was roughly 2% different than HPMS estimated VMT both overall and for freeways. Modeled travel times on arterial streets also match quite closely the results of WWW's travel time field studies.

The interagency consultation process, as previously discussed, established the following model years for Wood county, WV and Washington County, OH that reflected the most recent correspondence from the U.S. EPA:

Analysis Year 2005 – Baseline Emissions
Analysis Year 2008 – Attainment Year
Analysis Year 2015 – Interim Year
Analysis Year 2022 – Maintenance Year

EMISSION FACTOR GENERATION

The MOVES model generated the emission factor files were for base year-2005 and attainment year-2008 representing the transportation improvement programs implemented in the WWW Region. The model also generated emission factors for two future year scenarios 2015 and 2022.

Table 4 summarizes the settings used in the MOVES run specification file and the MOVES County-Data Manager. The subsequent tables provide the specific inputs that are not using the MOVES default values.

Table 4 – MOVES Inputs

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	Washington OH, Wood WV, Pleasant WV 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.

County Data Manager Sources	
Source Type Population	Combination of local and default data Local data (Ohio and West Virginia) from motor vehicle registration Default data used for source types 51, 52, 53, 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
Meteorology 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.
Road Type Distribution	Use ODOT and WV Division of Highways county summary VMT categorized by federal functional classes
Age Distribution	Combination of local and default data. Local data (Ohio and West Virginia) from motor vehicle registration Default data used for source types 41, 42, 43, 51, 52, 53, 61, and 62 The same age distribution will be used for all analysis years
Average Speed Distribution	Default
Alternative Fuel Type	Default

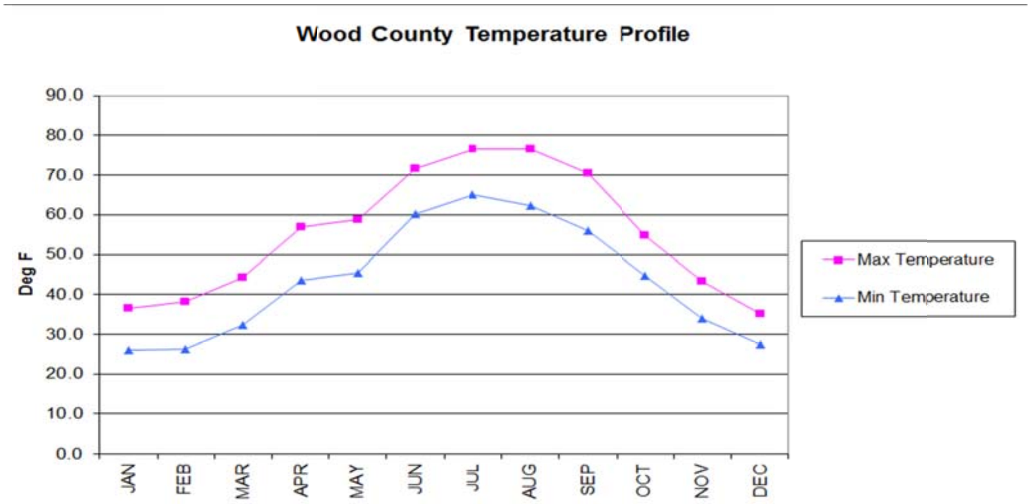
TEMPERATURE AND RELATIVE HUMIDITY

The single season approach for temperature and relative humidity uses weather data collected by the National Oceanic and Atmospheric Administration (NOAA) National Climatic Data Center (NCDC). The data used in this report, taken from the Parkersburg/Wood County Airport, is representative of 12 months in 2009. Data entered into a spreadsheet provided by U.S. EPA converted the Mobile6 to get the correct data for the MOVES model. Table 5 below contains the average annual hourly temperatures and relative humidity distribution profiles used for the WWW region, while Figure X depicts the typical minimum and maximum temperatures by month of year.

Table 5
AVERAGE TEMPERATURE AND RELATIVE HUMIDITY DATA

Time of Day	Average Temperature	Average Relative Humidity (%)
Midnight	47.2	79.7
1 AM	46.1	67.1
2 AM	45.2	80.7
3 AM	44.6	82.9
4 AM	44.1	83.8
5 AM	43.6	84.1
6 AM	43.1	82.6
7 AM	43.5	79.6
8 AM	45.9	74.8
9 AM	49.6	70.1
10 AM	53.5	65.7
11 AM	56.8	62.0
12 PM	59.7	59.8
1 PM	61.3	58.2
2 PM	61.9	57.4
3 PM	62.0	57.3
4 PM	61.6	58.3
5 PM	60.5	61.2
6 PM	58.6	65.3
7 PM	56.2	69.2
8 PM	53.7	66.1
9 PM	51.6	74.3
10 PM	50.1	75.7
11 PM	48.6	78.1

Figure 3



RAMP FRACTION

The Vehicles Hour of Travel (VHT) fractions from the travel demand model were used to derive the Ramp Fraction values needed for the MOVES model procedures (approximately 16.1% in Washington county Ohio and 12.5% in Wood county West Virginia).

SOURCE TYPE POPULATION

A combination of local and MOVES default data is the Source Type Population for vehicle classifications. The MOVES default values provided the data for vehicle Source Types 51, 52, 53, 61, and 62 while local data from Ohio and West Virginia motor vehicle registrations accounted for all other Source Type Populations needed to run the MOVES model. Table 6 shows the Source Type Population identifications, the corresponding Source Type Name, and the number of vehicles analyzed for Washington County, OH and Wood County, WV. Analysis of the Grant Tax District in Pleasants County WV used the same distribution by source type as Wood County, scaled to Census data of total vehicle ownership within the district.

Table 6

SOURCE TYPE POPULATION FOR YEAR 2005

year	Source Type	Washington Co OH #	Wood Co WV #
2005	11 MotorCycle	4668	2260
2005	21 Passenger Car	42583	31331
2005	31 Passenger Truck	21741	30775
2005	32 Light Commercial Truck	465	4917
2005	41 Intercity Bus	44	33
2005	42 Transit Bus	3	18
2005	43 School Bus	123	137
2005	51 Refuse truck	25	30
2005	52 Single Unit Short-haul Truck	8	1774
2005	53 Single Unit Long-haul Truck	98	202
2005	54 Motor Home	122	129
2005	61 Combination Short-haul Truck	472	575
2005	62 Combination Long-haul Truck	1183	638

VEHICLE AGE DISTRIBUTION

A grouping of data from Ohio and West Virginia sources along with the MOVES model defaults make up the Vehicle Age Distribution. MOVES default values included Vehicle Type ID 41, 42, 51, 52, 53, 61, and 62. Local data from Ohio and West Virginia motor vehicle registrations accounted for all other Vehicle Type ID. Table 7 shows a sample Vehicle Age Distribution By Source Type for Washington County, OH in 2005.

Table 7

VEHICLE AGE DISTRIBUTION BY SOURCE TYPE FOR WASHINGTON COUNTY, OHIO IN 2005

yearid	ageid	11	21	31	32	41	42	43	51	52	53	54	61	62
2005	0	0.0021	0.0048	0.0045	0.0043	0.0000	0.0000	0.0484	0.0000	0.0000	0.0000	0.0060	0.0018	0.0000
2005	1	0.0255	0.0178	0.0189	0.0171	0.0000	0.0000	0.0403	0.2500	0.2500	0.2500	0.0276	0.0093	0.0319
2005	2	0.0577	0.0266	0.0349	0.0321	0.0000	0.0000	0.0565	0.0000	0.0000	0.0000	0.0272	0.0220	0.0361
2005	3	0.0849	0.0336	0.0451	0.0534	0.0667	0.0000	0.0645	0.0000	0.0000	0.0000	0.0388	0.0288	0.0806
2005	4	0.0828	0.0367	0.0528	0.0513	0.0000	0.0000	0.0323	0.0000	0.0000	0.0000	0.0392	0.0319	0.0865
2005	5	0.0862	0.0409	0.0648	0.0363	0.1333	0.0000	0.0806	0.0000	0.0000	0.0000	0.0444	0.0384	0.0949
2005	6	0.0638	0.0391	0.0643	0.0278	0.0667	0.0000	0.0565	0.0000	0.0000	0.0000	0.0568	0.0419	0.0537
2005	7	0.0777	0.0434	0.0620	0.0556	0.2667	0.3333	0.0806	0.0000	0.0000	0.0000	0.0504	0.0420	0.0353
2005	8	0.0594	0.0545	0.0658	0.0235	0.0667	0.0000	0.1129	0.0000	0.0000	0.0000	0.0404	0.0417	0.0428
2005	9	0.0500	0.0543	0.0606	0.0321	0.0000	0.0000	0.0887	0.0000	0.0000	0.0000	0.0352	0.0474	0.0537
2005	10	0.0406	0.0644	0.0651	0.0641	0.0000	0.0000	0.0726	0.1250	0.1250	0.1250	0.0380	0.0570	0.0789
2005	11	0.0336	0.0639	0.0626	0.0406	0.1333	0.6667	0.0161	0.0000	0.0000	0.0000	0.0548	0.0554	0.0621
2005	12	0.0236	0.0590	0.0566	0.0235	0.1333	0.0000	0.0806	0.1250	0.1250	0.1250	0.0348	0.0459	0.0512
2005	13	0.0217	0.0547	0.0498	0.0470	0.0000	0.0000	0.0484	0.0000	0.0000	0.0000	0.0348	0.0504	0.0260
2005	14	0.0206	0.0519	0.0477	0.0449	0.0000	0.0000	0.0081	0.1250	0.1250	0.1250	0.0312	0.0390	0.0411
2005	15	0.0177	0.0568	0.0479	0.0620	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0272	0.0465	0.0386
2005	16	0.0121	0.0456	0.0439	0.0833	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0244	0.0505	0.0311
2005	17	0.0160	0.0426	0.0319	0.0342	0.0000	0.0000	0.0081	0.1250	0.1250	0.1250	0.0224	0.0402	0.0260
2005	18	0.0092	0.0361	0.0235	0.0299	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0236	0.0381	0.0235
2005	19	0.0092	0.0326	0.0194	0.0321	0.0000	0.0000	0.0242	0.0000	0.0000	0.0000	0.0168	0.0337	0.0109
2005	20	0.0094	0.0238	0.0144	0.0406	0.0000	0.0000	0.0161	0.0000	0.0000	0.0000	0.0196	0.0279	0.0067
2005	21	0.0077	0.0213	0.0145	0.0256	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0196	0.0332	0.0168
2005	22	0.0085	0.0150	0.0111	0.0449	0.0000	0.0000	0.0161	0.0000	0.0000	0.0000	0.0272	0.0326	0.0151
2005	23	0.0104	0.0117	0.0104	0.0192	0.0000	0.0000	0.0081	0.0000	0.0000	0.0000	0.0244	0.0237	0.0168
2005	24	0.0213	0.0088	0.0077	0.0214	0.0667	0.0000	0.0081	0.0000	0.0000	0.0000	0.0176	0.0231	0.0042
2005	25	0.0177	0.0068	0.0050	0.0128	0.0000	0.0000	0.0081	0.0000	0.0000	0.0000	0.0216	0.0167	0.0092
2005	26	0.0134	0.0049	0.0030	0.0107	0.0666	0.0000	0.0000	0.0000	0.0000	0.0000	0.0176	0.0125	0.0059
2005	27	0.0168	0.0027	0.0024	0.0085	0.0000	0.0000	0.0081	0.0000	0.0000	0.0000	0.0176	0.0084	0.0008
2005	28	0.0213	0.0017	0.0007	0.0043	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0088	0.0064	0.0034
2005	29	0.0196	0.0020	0.0007	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0108	0.0054	0.0025
2005	30	0.0595	0.0420	0.0080	0.0169	0.0000	0.0000	0.0160	0.2500	0.2500	0.2500	0.1412	0.0482	0.0137

ROAD TYPE DISTRIBUTION

The ODOT and WV Division of Highway county summary Vehicle Miles Traveled (VMT) data categorized by federal functional class for the three county non-attainment areas is the basis for Road Type Distribution Fraction. Table 8 illustrates Road Type Distribution.

Table 8

ROAD TYPE DISTRIBUTION FOR THE WWW REGION

sourceTypeID	roadTypeID	roadTypeVMTFraction	sourceTypeID	roadTypeID	roadTypeVMTFraction
11	1	0	51	1	0
11	2	0.33	51	2	0.33
11	3	0.34	51	3	0.34
11	4	0.08	51	4	0.08
11	5	0.25	51	5	0.25
21	1	0	52	1	0
21	2	0.33	52	2	0.33
21	3	0.34	52	3	0.34
21	4	0.08	52	4	0.08
21	5	0.25	52	5	0.25
31	1	0	53	1	0
31	2	0.33	53	2	0.33
31	3	0.34	53	3	0.34
31	4	0.08	53	4	0.08
31	5	0.25	53	5	0.25
32	1	0	54	1	0
32	2	0.33	54	2	0.33
32	3	0.34	54	3	0.34
32	4	0.08	54	4	0.08
32	5	0.25	54	5	0.25
41	1	0	61	1	0
41	2	0.33	61	2	0.33
41	3	0.34	61	3	0.34
41	4	0.08	61	4	0.08
41	5	0.25	61	5	0.25
42	1	0	62	1	0
42	2	0.33	62	2	0.33
42	3	0.34	62	3	0.34
42	4	0.08	62	4	0.08
42	5	0.25	62	5	0.25
43	1	0	roadTypeID	roadDesc	
43	2	0.33	2	Rural Restricted Access	
43	3	0.34	3	Rural Unrestricted Access	
43	4	0.08	4	Urban Restricted Access	
43	5	0.25	5	Urban Unrestricted Access	

POST PROCESSING

Several custom programs created by ODOT staff were used to compute the total emissions. The process uses data on daily and directional traffic distributions as well as volume/delay functions from the 2000 Highway Capacity Manual (HCM). This process also uses rewritten code focused on newer CUBE Voyager-based model network formats and MOVES generated emission factors.

The first step in 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. The analysis does not use the link speeds from the travel demand model. Using a link's volume-to- capacity ratio and link group code, a post-process to the model based on HCM methods estimates the link speeds. 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 multiplied by the MOVES emission factor for the corresponding hour of day, speed bin, and road type; 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. A combination of local and default data is the source for the vehicle source type. The final vehicle emissions for each county are the sum of all individual hourly emissions for all vehicle types. Since the intrazonal trips are not loaded onto the network, 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 computer program assumes that the zone is circular and uses the radius of the circle as the average trip length for these intrazonal trips. By combining MOVES generated emissions with estimated intrazonal VMT, the intrazonal emissions are then calculated. The emission rates are the same as those used to calculate link based emissions. The final step is to summarize link, vehicle, and intrazonal emissions for each county, pollutant, and analyzed year.

More details are provided at
http://www.dot.state.oh.us/Divisions/Planning/SPR/ModelForecastingUnit/Documents/cmaqr3.PDF

APPENDIX A

INTERAGENCY CONSULTATION DOCUMENTATION