TOLEDO METROPOLITAN AREA COUNCIL OF GOVERNMENTS
ON-ROAD MOBILE EMISSION ESTIMATES
PREPARED FOR THE SIP INVENTORY
FOR THE 8-HOUR OZONE STANDARD

NOVEMBER 2012

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1. Overview

This report is intended to document the air quality analyses and underlying assumptions performed by the Ohio Department of Transportation (ODOT), Division of Transportation System Development-Modeling and Forecasting Section and the Toledo Metropolitan Area Council of Governments (TMACOG) for the 8-hour ozone on-road mobile source emission inventories for the Toledo Region State Implementation Plan (SIP) revision in coordination with the Ohio Environmental Protection Agency (OEPA).

The Toledo Region is comprised of Lucas and Wood Counties in northwest Ohio. Both counties are designated as a maintenance area for the 8-hour Ozone Standard. TMACOG serves as the Metropolitan Planning Organization (MPO) for Lucas and Wood Counties.

The ODOT Modeling and Forecasting section performed the MOVES runs to generate travel demand model based emission factors as well as the complete air quality analyses for the Toledo region.

Latest Planning Assumptions

The ozone inventory runs meet the latest planning assumption requirement. As discussed in Section 2 of this report, the modeling process used to develop each MPO emissions is calibrated using the latest population and land use data available and is validated using corresponding traffic count data. Currently, the travel demand models are validated to year 2000. The regional emissions analysis includes emissions for Volatile Organic Compounds (VOC) and Nitrogen Oxides (NOX).

On Road Mobile Emission Summary

Tables 1 to 4 present a summary of emissions for the Toledo Region for the required precursors VOC and NOX for the requested scenarios: 2002 base, 2004 attainment, 2009 interim and 2018 maintenance. Years 2009 and 2018 are established as budget years.

Table 1 – TMACOG 2002 On-Road Mobile Emissions

	2002 Base		
	Daily VMT	VOC (tons/day)	NOX (tons/day)
Lucas County Emissions	10,302,083	20.51	40.26
Wood County Emissions	5,162,330	9.23	19.33
TOTAL	15,464,413	29.74	59.59

Table 2 – TMACOG 2004 On-Road Mobile Emissions

	2004 Attainment		
	Daily VMT	VOC (tons/day)	NOX (tons/day)
Lucas County Emissions	10,245,650	17.86	35.58
Wood County Emissions	5,738,286	9.00	19.54
TOTAL	15,983,936	26.86	55.12

Table 3 – TMACOG 2009 On-Road Mobile Emissions

	2009 Interim		
	Daily VMT	VOC (tons/day)	NOX (tons/day)
Lucas County Emissions	10,320,228	12.49	26.41
Wood County Emissions	5,895,270	6.30	14.27
TOTAL	16,215,498	18.79	40.68

Table 4 – TMACOG 2018 On-Road Mobile Emissions

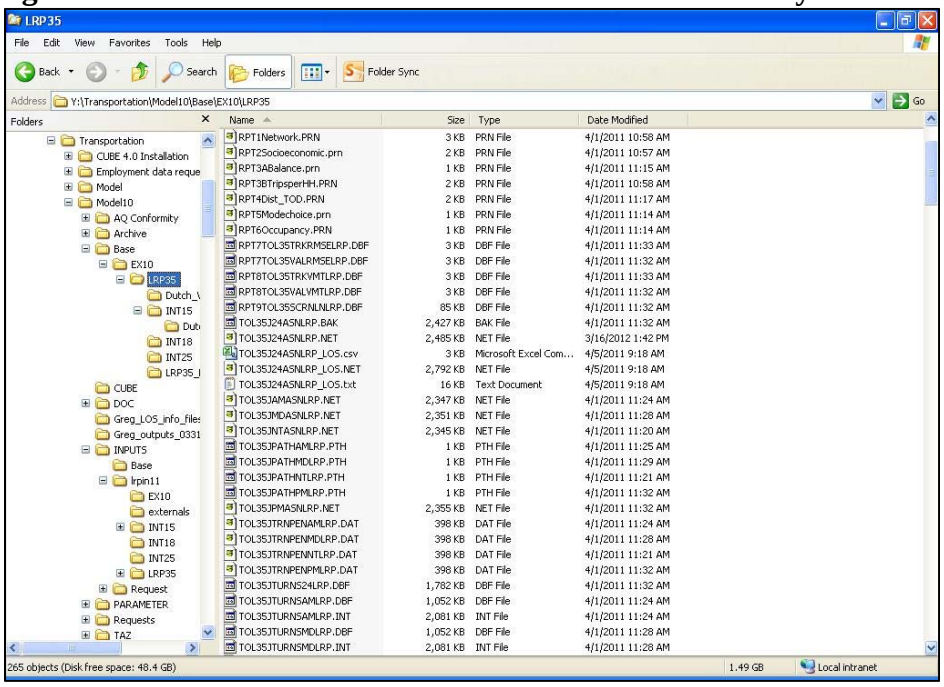
	2018 Maintenance		
	Daily VMT	VOC (tons/day)	NOX (tons/day)
Lucas County Emissions	9,654,159	5.20	9.63
Wood County Emissions	5,792,238	2.94	5.71
TOTAL	15,446,397	8.14	15.34

2. Urban Travel Demand Models

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

TMACOG was part of the ODOT Model Task Order for small and medium MPOs which updated the travel demand model. The new model includes Lucas and Wood counties, parts of Ottawa and Sandusky counties in Ohio, and the southern three townships in Monroe County, Michigan. The new model uses the Cube/Voyager interface and improves model functionality. The 2000 Cube/Voyager model with the latest planning assumptions (network and socioeconomic data) is used to calculate 2008-2035 emissions in the TMACOG Region. Socioeconomic data and network data (Figure 1) are maintained for use in the model. The network data is updated each year to include all projects from the most current TIP.

Figure 1 – TMACOG Travel Demand Model Run Directory Structure



Networks

TMACOG's modeled networks accurately reflect projects in their respective TIPs and Long Range Transportation Plans. The following network files were used to create the 2035 Plan–Update 2011. Projects included in the various files are listed in order to track where various plan

projects were included in the analysis. Projects in the TIP and 2035 Plan–Update 2011 not listed below were not modeled in the systems analysis. Most of these "not modeled" projects are of a nature not easily analyzed in a region-wide model (Ozone Action Days, traffic signal interconnects, etc.).

The network files are built sequentially and are listed in sequence order. The files are:

1. **Base Network "Official 2010 Validation"**

2. **2007-2010 completed projects**
    a. Monclova Rd. intersection improvements (at Anthony Wayne Trail)
    b. Improvements around Fallen Timbers Mall (Russell Rd. and Fallen Timbers Rd.)
    c. Sylvania Rd./Holland-Sylvania Rd. intersection improvements
    d. Jerome Rd. extension (Monclova Rd. to Technology Dr.)
    e. Roundabout at King Rd. and Nebraska Ave.
    f. Roundabout at Brint Rd. and Mitchaw Rd.
    g. Westwood Ave. vacation (north of South Ave. to south of Hill Ave.)
    h. Airport Hwy. widening and intersection improvements (Reynolds Rd. to Byrne Rd.)
    i. Detroit Ave. widening (near Arlington Ave.)
    j. Erie St. conversion to two-way
    k. Huron St. conversion to two-way
    l. Jefferson St. conversion to two-way
    m. Madison St. conversion to two-way
    n. Norwood Ave. conversion to two-way
    o. Southard Ave. conversion to two-way
    p. St. Clair St. conversion to two-way
    q. Superior St. conversion to two-way
    r. Woodruff Ave. conversion to two-way
    s. Superior St. vacation (Madison Ave. to Jefferson St.)
    t. Craig Bridge improvements
    u. Indiana/Cherry/Findlay intersection improvements (Perrysburg)
    v. Oregon Rd./CSX grade separation
    w. Wheeling St./Starr Ave. intersection improvements
    x. Anthony Wayne Trail intersection upgrades (Waterville)
    y. Holland-Sylvania Rd. roadway reconstruction (Hill Ave. to Dorr St.) – widen and improve curvature at Nebraska Ave.
    z. Coy Rd./Pickle Rd. intersection improvements
    aa. Airport Hwy. safety upgrade (Holland-Sylvania Rd. to Reynolds Rd.)
    bb. SR 64 intersection improvements (Finzel Rd. and Cemetery Rd.)
    cc. Eckel Junction signalization and widening (Ft. Meigs Rd. to SR 199)
    dd. Angola Rd. widening (Whisperwood to McCord Rd.)
    ee. McCord Rd. widening Phase 2 (Woodlake to Sylvania Ave.)

3. TIP 2011-2014 Project File

2011

a. Salisbury/I-475 interchange modification and Salisbury/Dussel Rd. widening
b. Secor Rd. widening (Alexis Rd. to Michigan state line)
c. Roachton Rd. widening with center turn lane addition and signalization upgrade (Ft. Meigs Rd. to SR 25)
d. N. Main St. widening with center turn lane addition and signalization upgrade (Poe Rd. to Bishop Rd.)
e. SR 64/Waterville-Monclova Rd intersection improvements
f. Wheeling St. widening (Navarre Ave. to Pickle St.)
g. Coy Rd./Starr Ave. intersection improvements

2012

h. McCord Rd. widening and left turn lane additions (Regents Park to Central Ave.)

2013

i. U.S. 24 Fort to Port freeway project
j. I-75/I-475 system interchange Phase 1 (Jeep split)
k. Wales Rd. rail grade separation project
l. Stearns Rd. widening (SR 199 to U.S. 23)
m. Jackson St. reduced to two lanes with boulevard (Erie St. to Summit St.)

2014

n. McCord Rd. rail grade separation project and roundabout

2015

o. Brint Rd./King Rd. roundabout
p. Dorr St./King Rd. roundabout
q. Haskins Rd./Poe Rd. intersection – left turn lanes
r. SR 65 left turn lanes (Colony Rd. to Lime City Rd.)
s. SR 795 left turn lanes (Valleybrook)
t. Eckel Junction left turn lanes (Carronade Dr.)
u. Toledo-Napoleon Rd. (old U.S. 24) 3rd lane addition (South to Waterville-Monclova Rd.)
v. SR 64/River Rd. intersection improvements
w. Waterville-Monclova Rd./Dutch Rd. roundabout
x. Buck Rd./Lime City Rd. roundabout
y. Russel Rd. relocation (reconnect to Jerome Rd.)

RESULTS IN 2015 NETWORK

4. TIP Pipeline and 2035 Plan projects constructed by 2018

2016

a. Sylvania Ave. widening (McCord Rd. to Oak Park)

b. Douglas Rd./Dorr St. intersection improvements
c. Dorr St. widening (Byrne Rd. to Douglas Rd.)
d. Ft. Meigs widening (Five Point Rd. to High School driveway)
e. Coy Rd./Dustin Rd. intersection improvements
f. Stitt Rd./Waterville-Monclova Rd. roundabout
g. Centennial Rd./Dorr St. roundabout
h. S. Main St./Gypsy Lane Rd. intersection realignment

2017

i. SR 64/Finzel Rd. roundabout
j. Hull Prairie Rd. widening (SR 65 to Roachton Rd.)
k. I-75 widen to 6 lanes (Phillips Av. to I-280)

2018

l. Miami/Front St. realignment to eliminate left turn (Yondata to Main)

RESULTS IN 2018 NETWORK

5. 2035 Plan projects constructed by 2025

a. I-75/I-475 systems interchange Phase 2
b. I-475 exit ramp at Corey Rd. (possible roundabout)
c. I-75 widen to 6 lanes (Washington to SR 25)
d. Upgrade I-475/U.S. 23 system interchange
e. Widen I-475 (SR 2 to U.S. 20), improve U.S. 20 interchange, and add Springfield area interchange at Dorr St.
f. Dorr St. roundabouts at Parkside and Upton (related to previous work in 2016)
g. Douglas/Laskey/Tremainsville roundabout
h. Detroit/Telegraph/Laskey roundabout
i. U.S. 20 turn lanes (at intersections between Perrysburg to SR 420)
j. Tracy Rd. widening (SR 795 to Wales Rd.)
k. U.S. 20A relocation and widening (I-475 to Toledo Express Airport)

RESULTS IN 2025 NETWORK

6. 2035 Plan projects constructed by 2035

a. I-75 Disalle bridge widen and ramp improvements (South Ave. to Miami)
b. I-75 widen to 6 lanes (City of Perrysburg to Hancock County boundary line)
c. I-475 widening (Secor Rd. to Douglas Rd.) and improve interchanges (at Secor Rd., Monroe St., and Douglas Rd.)
d. I-475 widening (Dussel/Salisbury to SR 2)
e. Add braided interchange connection to U.S. 20A from existing Salisbury/I-475/U.S. 23 interchange
f. I-475/SR 25 interchange upgrade (Perrysburg)

RESULTS IN 2035 NETWORK

2035 Plan Projects							
RANK	**MODE**	**Project Description**	**Project Sponsor**	**2015 TIP**	**2018 Build**	**2025 Build**	**2035 Build**
C-1	Rail/Roadway	Build McCord Road rail grade separation (underpass)	ODOT/Lucas Co.	Exempt	Exempt	Exempt	Exempt
C-2	Roadway	Build North Baltimore area road improvements to provide safe travel for increased traffic between I-75 and CSX intermodal yard	ODOT/Wood Co.		Analyzed	Analyzed	Analyzed
C-3	Expressway	I-75, widen to 6-lanes from Phillips Ave to I-280	ODOT	Analyzed	Analyzed	Analyzed	Analyzed
C-4	Rail/Roadway	Build Wales Rd. rail grade separation (overpass)	ODOT	Exempt	Exempt	Exempt	Exempt
C-5	Expressway/ Roadway	Construct I-75/I-475 systems interchange Phase 2 and related improvements to local arterials including Cherry St. and Phillip Ave.	ODOT			Analyzed	Analyzed
C-6	Roadway	Dorr St. safety & pedestrian improvements, Byrne to Upton (widen & signal modifications Byrne-Secor; add median Secor-Douglas; improve Douglas intersection; possible roundabouts Parkside, Upton; improve ped safety/crossings).	City of Toledo		Exempt	Exempt	Exempt
C-7	Expressway	I-75, widen to 6-lanes, Washington St. to SR25/Anthony Wayne Trail	ODOT			Analyzed	Analyzed
C-8	Roadway	Upgrade Buck Rd./Lime City Rd. intersection area, with roundabout & turn lanes	Wood Co./ODOT/City of Rossford	Analyzed	Analyzed	Analyzed	Analyzed
C-9	Roadway	Widen Stearns Rd., US-23 to SR-199, to three lanes	City of Fostoria	Analyzed	Analyzed	Analyzed	Analyzed
C-10	Expressway/ ITS	Build ITS freeway management / travel info system	ODOT	Exempt	Exempt	Exempt	Exempt
C-11	Transit	Provide real time bus arrival information	TARTA	Exempt	Exempt	Exempt	Exempt
C-12	Ped/Bike	Build Riverside Trail-Phase 2 from Craig Bridge to Point Place	City of Toledo	Exempt	Exempt	Exempt	Exempt
C-13	Roadway	Replace/widen Perrysburg-Holland Bridge over Swan Creek	Lucas Co./City of Toledo	Analyzed	Analyzed	Analyzed	Analyzed
C-14	Roadway	Waterville-Monclova at Dutch Rd., two roundabouts	Lucas Co./ Village of Waterville	Analyzed	Analyzed	Analyzed	Analyzed
C-15	Roadway	Brint & King Rd. roundabout	City of Sylvania	Analyzed	Analyzed	Analyzed	Analyzed
C-16	Roadway	King rd. alignment at Dorr St. intersection improvement	Lucas Co.	Analyzed	Analyzed	Analyzed	Analyzed
C-17	Roadway	Sylvania Ave., widen from McCord Rd. to Oak Park Dr.	Lucas Co.		Analyzed	Analyzed	Analyzed
C-18	Transit	Replace TARTA bus fleets (2 cycles of replacement)	TARTA	Exempt	Exempt	Exempt	Exempt
C-19	Roadway/ Ped/Bike	Convert US-24 through Waterville to local street; widen to 3-lanes, add bike/ped path	Village of Waterville	Analyzed	Analyzed	Analyzed	Analyzed
C-20	Ped/Bike	Complete Sylvania-Metamora Rd. (Erie St.) bike path west of Centennial Park, add bike lanes south on Kilburn Road to Central Ave.	Lucas Co.		Exempt	Exempt	Exempt
C-21	Roadway	SR-64 & Finzel Rd. intersection alignment (roundabout)	Village of Whitehouse		Analyzed	Analyzed	Analyzed
1	Expressway	Widen I-75 to 6 lanes from Hancock Co. line to Perrysburg (part of Findlay to Perrysburg; also part of I-73/74/75 multi-state project)	ODOT				Analyzed
2	Expressway	Upgrade I-475/US-23 systems interchange	ODOT			Analyzed	Analyzed
3	Expressway	Widen I-475, Secor to Douglas, and improve interchanges at Secor, Monroe & Douglas	ODOT				Analyzed
4	Expressway	Widen I-475, SR-2 (Airport Hwy.) to US-20	ODOT			Analyzed	Analyzed

2035 Plan Projects							
RANK	**MODE**	**Project Description**	**Project Sponsor**	**2015 TIP**	**2018 Build**	**2025 Build**	**2035 Build**
		(Central Ave.), improve US-20 interchange, and add Springfield area interchange (Hill or Dorr)					
5	Expressway	Widen I-475, Dussel/Salisbury to SR-2, and improve SR-2 interchange	ODOT				Analyzed
6	Expressway	Widen the I-75 Disalle Bridge to improve South Ave. and Miami St. ramps	ODOT				Analyzed
7	Transit	Add intermodal/ transit hub, downtown Toledo	TARTA / City of Toledo	Exempt	Exempt	Exempt	Exempt
8	Expressway	Add braided interchange connection to US-20A from existing Salisbury/Dussel and I-475/US-23 interchange	ODOT (&Lucas Co.?)				Analyzed
9	Expressway	I-475 at SR-25 interchange upgrades, incl. widen SR-25 bridge and add ped/bike facilities; address weave, I-475 between SR-25 and I-75	ODOT / City of Perrysburg				Analyzed
10	Expressway	Upgrade I-75/Miami St. interchange and straighten curve between Wales & Miami	ODOT				Analyzed
11	Passenger Rail	Ohio Hub high speed passenger rail implementation, may include passenger rail/ rail overpass in Northwood, new Maumee River bridge, upgrade to MLK Plaza infrastructure & passenger access to multiple rail lines, etc.	Ohio Rail Development Commission				Exempt
12	Rail / Roadway	Eliminate rail/hwy conflict that impedes access to north Toledo industrial area (rail overpass or relocation)	City of Toledo			Analyzed	Analyzed
13	Roadway	Build Douglas/Laskey/ Tremainsville Rds. Intersection improvements, possibly a roundabout	City of Toledo			Analyzed	Analyzed
14	Ped/Bike	"Westside" Trail – buy rail corridor and construct multi-use path, Laskey Rd. to Knight Preserve (excludes bridge reconstruction)	Various (UT, Metroparks, Wood Co. Parks District, City of Toledo?)			Exempt	Exempt
15	Roadway	Build Detroit/Telegraph/Laskey intersection improvements, possibly a roundabout	City of Toledo			Analyzed	Analyzed
16	Ped/Bike	Provide Airport Hwy. bike/ped facilities from Holland-Sylvania Rd. across I-475 and accessing Spring Meadows shopping center	ODOT / Lucas Co.			Exempt	Exempt
17	Ped/Bike	Eliminate constricted areas for ped/bikes (Berdan from Martha to Cherry; Detroit and Glendale from Schneider to Harvard; Detroit from Waggoner to Lagrange; Monroe/Alexis/Main St. in Sylvania; and Alexis Road)	Cities of Toledo and Sylvania			Exempt	Exempt
18	Roadway	US-20 – add turn lanes at intersections from City of Perrysburg to SR-420	ODOT			Analyzed	Analyzed
19	Rail / Roadway (ITS)	Provide advance warning signal for blocked rail crossings (Consaul/NS & CSX, Matzinger/CSX & AA, Summit/CSX)	City of Toledo		Exempt	Exempt	Exempt
20	Ped/Bike	Eliminate SR-51 (Woodville Rd.) constricted area for ped/bikes from Oak to Curtice Rd. esp. at RR crossing	Cities of Toledo, Oregon & Northwood				Exempt
21	Ped/Bike	Build Sylvania River Trail multi-use path	City of Sylvania		Exempt	Exempt	Exempt
22	Roadway / (& Rail/ Roadway?)	Tracy Rd. improvements – SR-795 to Wales, including intersection improvements at Wales (wider turn radii) and solution to blocked rail crossings (possible grade separation)	Wood Co. / City of Northwood				Analyzed
23	Ped/Bike	Add pedestrian facilities on Wooster crossing of I-	City of				Exempt

2035 Plan Projects							
RANK	**MODE**	**Project Description**	**Project Sponsor**	**2015 TIP**	**2018 Build**	**2025 Build**	**2035 Build**
		75	Bowling Green				
24	Ped/Bike	Complete Oregon bike network (19.6 miles) (partial funding – additional $3.8M needed)	City of Oregon				Exempt
25	Ped/Bike	Riverside Trail-Phase 1, build bike/walk path from downtown Toledo to Craig Bridge	City of Toledo	Exempt	Exempt	Exempt	Exempt
26	ITS (Transit)	Provide signal prioritization for transit and emergency vehicles	TARTA, TARTA member jurisdictions		Exempt	Exempt	Exempt
27	Ped/Bike	Build Eastside Maumee River Trail from Craig Bridge to International Park including ped/bike crossing of Main St. (possibly grade separated)	City of Toledo			Exempt	Exempt
28	Roadway	I-475 exit ramp at Corey Rd. low cost interchange improvement (roundabouts)	Lucas Co.			Analyzed	Analyzed
29	Ped/Bike	SR-65 – add paved berms from Grand Rapids to Rossford, excluding curb sections and areas within City of Perrysburg (needs additional $1.1M funding)	ODOT				Exempt
30	Roadway	US-20A from I-475 to Toledo Express Airport – relocate, widen & managed access for improved road access to freight terminals, pending evaluation of environmental impact on Oak Openings region	ODOT			Analyzed	Analyzed

Landuse and Socio-economic Data

The socioeconomic data used is the set consistent with the current trends scenario used in the development of the year 2035 Plan–Update 2011. The population data is consistent with the county totals projected by Ohio Department of Development (ODOD), Office of Strategic Research. The other socioeconomic parameters (dwelling units, school attendance, vehicles and labor force) were defined using the standard conversion parameters for either population or employment for Traffic Analysis Zones (TAZs) as defined for the 2035 Plan–Update 2011 development process.

Summaries of TMACOG's socioeconomic data for Lucas and Wood counties are available in **Tables 5 and 6.** Lucas County loses population and employment while Wood County gains population and employment. There is a shift in population and employment from Lucas to Wood County. Overall population and households are expected to decline in Lucas and Wood counties over the planning period.

Table 5 – TMACOG Socio-Economic Variables (Lucas County)

Variable	Lucas County Area type				Total
	CBD	Urban	Suburban	Rural	
# TAZs	45	288	210	81	624
Acres	1,178	38,010	62,234	121,507	222,931
2000 Population	5,874	229,646	190,119	29,415	455,054
2000 Households	2,630	91,706	78,262	10,249	182,847
2010 Employment	39,240	98,194	75,287	11,597	224,318
2035 Population	4,770	176,923	178,786	47,021	407,500
2035 Households	2,128	70,740	73,122	15,974	161,964
2035 Employment	1,843	76,184	88,728	22,828	189,583
Person per Household	2.23	2.50	2.43	2.87	2.51
Workers per Household	0.87	1.07	1.20	1.40	1.13
Autos per Household	1.04	1.46	1.74	2.14	1.60

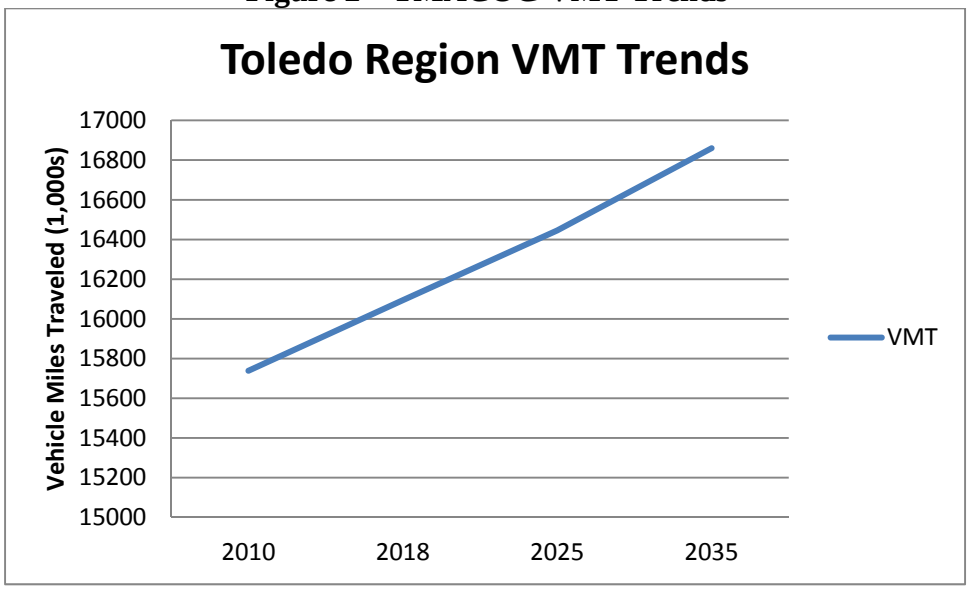
Table 6 – TMACOG Socio-Economic Variables (Wood County)

Variable	Wood County Area type				Total
	CBD	Urban	Suburban	Rural	
# TAZs	5	30	98	97	230
Acres	221	3,111	45,513	348,336	397,181
2000 Population	1,871	23,155	67,208	28,831	121,065
2000 Households	985	7,668	25,937	10,582	45,172
2010 Employment	5,879	7,424	31,977	14,680	59,960
2035 Population	2,109	23,856	85,397	34,000	145,362
2035 Households	1,103	8,028	32,763	12,763	54,657
2035 Employment	1,320	12,252	43,140	17,435	74,147
Person per Household	1.90	3.02	2.59	2.72	2.56
Workers per Household	1.18	1.53	1.31	1.38	1.35
Autos per Household	1.73	1.69	1.90	2.07	1.85

VMT Trends

Figure 2 shows Vehicle Miles Traveled (VMT) trends for years 2010- 2018-2025-2035 for the TMACOG region. These values represent un-factored travel demand model output. For ozone runs, model VMT is factored to represent an average summer day using a seasonal factor of 1.08.

Figure 2 – TMACOG VMT Trends



3. Emission Factor Generation

Base and Attainment Years

Using MOVES, emission factor files were generated for base year-2002 and attainment year-2004 to represent the programs being implemented in the TMACOG Region. Programs and corresponding MOVES parameters were developed in consultation with OEPA.

Future Years

Emission factors were also generated for two future year scenarios: 2009 and 2018. All assumptions remain the same as those used to generate 2002 emission factors and are further illustrated in this section using year 2002 as an example.

Technical Details

Table 7 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 7 – MOVES Inputs

RunSpec Parameter Settings	
MOVES Version	MOVES2010A
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 summer temperatures All hours of day selected 16 speed bins Weekdays only
Geographic Bounds	Lucas and Wood 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	Default values with assumed CNG buses removed
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
Metereology Data	Local data obtained from NOAA National Climatic Data Center. Data will consist of monthly high and low temperatures and daily relative humidity for 2002.
Ramp Fraction	Using the base year travel demand model for VHT fractions. Future fractions will be assumed constant
Road Type Distribution	Use ODOT county summary VMT categorized by federal functional classes
Age Distribution	Combination of local and default data. Local data (2010) ODOT from motor vehicle registration Default data used for source types 41, 51, 54, 61, and 62 The same age distribution will be used for all analysis years
Average Speed Distribution	Default
Alternative Fuel Type	Default

Temperature and Relative Humidity

Temperatures used for the single season approach are representative of July 2002 based on NOAA data from the National Climate Data Center webiste. To get the correct fomat for MOVES, the data was entered into a spreadsheet provided by EPA which was designed to convert Mobile6 data to MOVES. The average July hourly temperature and relative humidity distribution profile can be seen in Table 8.

Table 8 – Temperature and Relative Humidity Data

Hour	Average Temperature	Average Relative Humidity
1	60.8	82
2	57.2	93
3	57.2	93
4	60.8	82
5	60.8	87
6	62.6	82
7	62.6	82
8	64.4	77
9	66.2	72
10	66.2	72
11	68	68
12	69.8	64
13	69.8	64
14	71.6	60
15	69.8	60
16	69.8	60
17	69.8	64
18	66.2	68
19	66.2	63
20	66.2	68
21	66.2	68
22	64.4	72
23	64.4	72
24	60.8	82

Ramp Fraction

Ramp fractions were derived using the base year travel demand model VHT fractions. Ramp fractions can be seen in Table 9. Base year fractions were assumed to apply to future years.

Table 9 – Ramp Fractions

roadTypeID	roadDesc	rampFraction
2	Rural Restricted Access	0.07
4	Urban Restricted Access	0.10

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. The base year (2002) and the LP year (2035) are used to interpolate the number of cars for the needed analysis years. Table 10 shows source type population for the analyzed counties in 2004.

Table 10 – Source Type Population for year 2004

sourceTypeID	sourceTypeName	Lucas	Wood
11	MotorCycle	12973	4544
21	Passenger Car	189392	58454
31	Passenger Truck	130135	41634
32	Light Commercial Truck	5219	1670
41	Intercity Bus	131	72
42	Transit Bus	70	38
43	School Bus	804	438
51	Refuse truck	102	44
52	Single Unit Short-haul Truck	4201	1809
53	Single Unit Long-haul Truck	536	231
54	Motor Home	490	211
61	Combination Short-haul Truck	1268	932
62	Combination Long-haul Truck	1458	1072

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. The registration data for all three counties in the non-attainment area were combined to create a regional vehicle age distribution file, see Table 11. The same age distribution will be used for all analysis years

Table 11 – Vehicle Age Distribution

yearid	sourcetypeid	ageid	ageFraction
2004	11	0	0.0015
2004	11	1	0.0239
2004	11	2	0.0521
2004	11	3	0.0751
2004	11	4	0.0796
2004	11	5	0.0777
2004	11	6	0.0698
2004	11	7	0.0701
2004	11	8	0.0541
2004	11	9	0.0522
2004	11	10	0.0438
2004	11	11	0.0344
2004	11	12	0.0265
2004	11	13	0.0208
2004	11	14	0.0216
2004	11	15	0.0201
2004	11	16	0.0149
2004	11	17	0.0119
2004	11	18	0.0098
2004	11	19	0.0065
2004	11	20	0.0072
2004	11	21	0.0071
2004	11	22	0.0075
2004	11	23	0.01
2004	11	24	0.0173
2004	11	25	0.0169
2004	11	26	0.0149
2004	11	27	0.0147
2004	11	28	0.0232
2004	11	29	0.0171
2004	11	30	0.0977

yearid	sourcetypeid	ageid	ageFraction
2004	21	0	0.0048
2004	21	1	0.0185
2004	21	2	0.0293
2004	21	3	0.0348
2004	21	4	0.0361
2004	21	5	0.038
2004	21	6	0.0399
2004	21	7	0.0441
2004	21	8	0.0462
2004	21	9	0.0437
2004	21	10	0.0464
2004	21	11	0.0504
2004	21	12	0.0483
2004	21	13	0.0513
2004	21	14	0.0497
2004	21	15	0.0555
2004	21	16	0.0469
2004	21	17	0.0402
2004	21	18	0.0305
2004	21	19	0.0277
2004	21	20	0.0199
2004	21	21	0.0209
2004	21	22	0.0156
2004	21	23	0.0125
2004	21	24	0.0114
2004	21	25	0.01
2004	21	26	0.0087
2004	21	27	0.0038
2004	21	28	0.0032
2004	21	29	0.0041
2004	21	30	0.1076

Road Type Distribution

Road type distribution is based on the 2008 ODOT HPMS VMT data categorized by federal functional class for TMACOG area. Road type distribution can be seen in Table 12.

Table 12 – Road Type Distribution

sourceTypeID	roadTypeID	roadTypeVMTFraction
11	1	0
11	2	0.09
11	3	0.11
11	4	0.24
11	5	0.56
21	1	0
21	2	0.09
21	3	0.11
21	4	0.24
21	5	0.56
31	1	0
31	2	0.09
31	3	0.11
31	4	0.24
31	5	0.56
32	1	0
32	2	0.09
32	3	0.11
32	4	0.24
32	5	0.56
41	1	0
41	2	0.09
41	3	0.11
41	4	0.24
41	5	0.56
42	1	0
42	2	0.09
42	3	0.11
42	4	0.24
42	5	0.56
43	1	0
43	2	0.09
43	3	0.11
43	4	0.24
43	5	0.56
51	1	0
51	2	0.09
51	3	0.11
51	4	0.24
51	5	0.56
52	1	0
52	2	0.09
52	3	0.11
52	4	0.24
52	5	0.56
53	1	0
53	2	0.09
53	3	0.11
53	4	0.24
53	5	0.56
54	1	0
54	2	0.09
54	3	0.11
54	4	0.24
54	5	0.56
61	1	0
61	2	0.09
61	3	0.11
61	4	0.24
61	5	0.56
62	1	0
62	2	0.09
62	3	0.11
62	4	0.24
62	5	0.56

Vehicle Type VMT and VMT Fractions

The first component of the VMT inputs is the Yearly HPMS VMT, but the travel demand model was used instead of ODOT's HMPS data since it was felt that the model would better predict future year VMT. ODOT's CMS post-processor was run for each year to generate congestion reports, which includes total daily VMT. The vehicle type percentages of the total VMT were based on ODOT's weigh-in-motion (WIM) data. Since there are not enough WIM stations for lower class facilties in the non-attainment area, a statewide average of all ODOT WIM data collectors was used. Daily VMT was then converted to yearly. Yearly HPMS VMT for 2004 can be seen in Table 13. The same method was to generate all other analysis years

Table 13 – Yearly HPMS VMT for 2004

HPMSVtypeID	yearID	HPMSBaseYearVMT	baseYearOffNetVMT
10	2004	22066599	0
20	2004	3935403821	0
30	2004	1214260189	0
40	2004	12411356	0
50	2004	91751756	0
60	2004	217835524	0

Monthly and daily VMT fractions used MOVES default data. The hourly VMT fractions were derived from ODOT WIM data. Hourly VMT fractions vary for each of the five MOVES road types but do not change for each of the 16 MOVES source types. A representative sample of the hour VMT fraction input file can be seen in Table 14, the entire file is too large to include in this document.

Table 14 – Hourly VMT Fractions

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

Output Emission Factors

Table 15 shows the first record in a MOVES sample output (rate per distance) emission file for year 2005 with I/M programs. For any given month, day of week, hour of the day, pollutant, and source type; the rate per distance varies by road type and speed bin. Rates per distance emissions are applied to link and intrazonal VMT.

Table 15 – Sample Emission File (Rate per Distance) for year 2005

Heading:	MOVESScenarioID	MOVESRunID	yearID	monthID	dayID	hourID
Record:			2005	7	5	1
Heading:	linkID	pollutantID	processID	sourceTypeID	SCC	fuelTypeID
Record:		87	0	1		0
Heading:	modelYearID	roadTypeID	avgSpeedBinID	temperature	relHumidity	ratePerDistance
Record:	0	2	1			6.90740776

Table 16 shows the first record in a MOVES sample output (rate per vehicle) emission file for year 2005 with I/M programs. 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 16 – Sample Emission File (Rate per Vehicle) for year 2005

Heading:	MOVESScenarioID	MOVESRunID	yearID	monthID	dayID
Record:			2005	7	5
Heading:	hourID	zoneID	pollutantID	processID	sourceTypeID
Record:	1		87		1
Heading:	SCC	fuelTypeID	modelYearID	temperature	ratePerVehicle
Record:		0	0		0.27257887

Table 17 shows the first record in a MOVES sample output (rate per profile) emission file for year 2005 with I/M programs. The rate per vehicle varies for any combinations of month, day of week, hour of the day, pollutant, and process. Rates per profile emissions are applied to the vehicle souce type population.

Table 17 – Sample Emission File (Rate per Profile) for year 2005

Heading:	MOVESScenarioID	MOVESRunID	yearID	monthID	dayID
Record:			2005	0	5
Heading:	hourID	zoneID	pollutantID	processID	sourceTypeID
Record:	1		87	0	1
Heading:	SCC	fuelTypeID	modelYearID	temperature	ratePerVehicle
Record:		0	0		0.01774139

4. Post Processing

Total emissions were computed with the aid of several custom programs by ODOT. The process uses data on daily and directional traffic distributions as well as more up to date volume/delay functions from the 2000 Highway Capacity Manual (HCM). This process, described below and illustrated in Figure 3, also uses rewritten code able to handle the newer model network formats and MOVES generated emission factors.

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

The second step (movesnet.exe) uses a combination of the MOVES emission factors and the hourly link volumes that are output of the postcms.exe program. The hourly volumes are

multiplied by the MOVES emission factor for the corresponding hour of day, speed bin, and roadtype to calculate emissions for every network link for each hour. The final link on road vehicle emissions for the area is the sum of all individual link-hour emissions.

The third step, (movesveh.exe), calculates vehicle-based emissions (using a combination of the Rate per Distance and Rate per Profile files) 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 movesintra.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. Daily summary emissions for each pollutant, county, and scenario year in the TMACOG Region can be found in **Appendix B.2.**

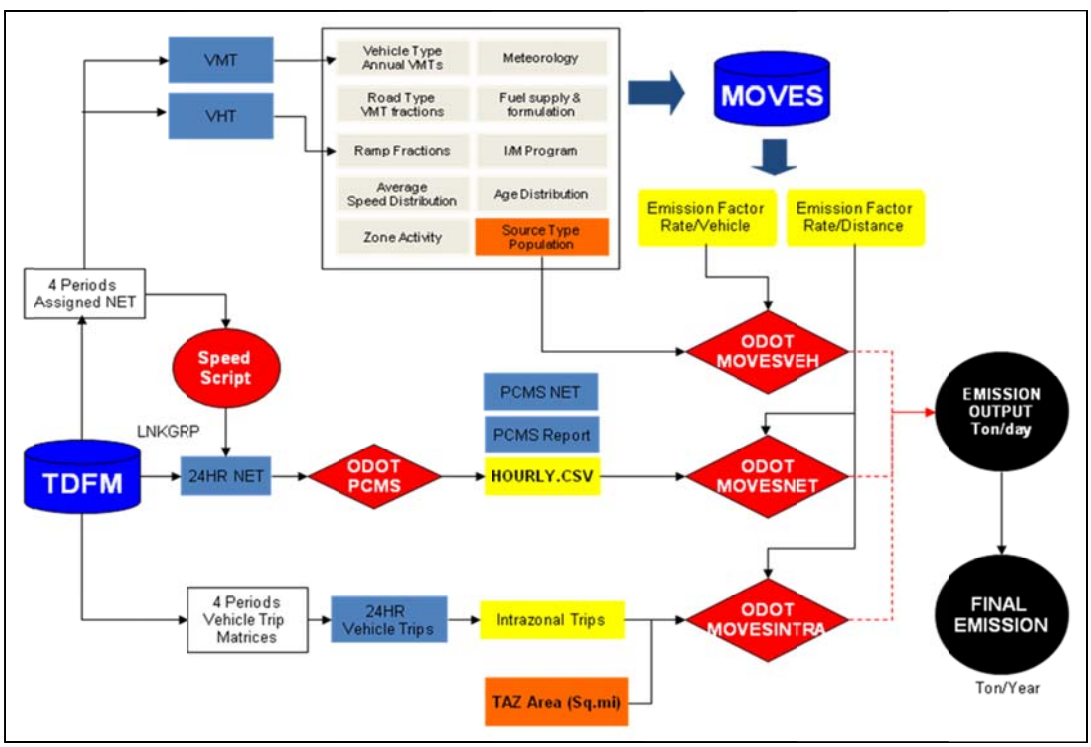


Figure 3 – Emission Calculation Process

5. Multiple MPO Coordination Issues

TMACOG, ODOT, and OEPA have a long history of working together in air quality issues, the Memorandum of Understanding, listed below, documents these working relationships. The document is moving through the involved federal agencies for their approval.

- Memorandum of Understanding among the TMACOG, the OEPA, the ODOT, the US EPA-Region 5, the FHWA-Ohio Division, and the FTA-Region 5.

Appendix A

Interagency Consultation Documentation

From: David Gedeon
Sent: Friday, April 20, 2012 4:34 PM
To: 'Brunello, Nino'; PJividen@AkronOhio.gov; CBaker@akronohio.gov; Jeff Dutton; Bill Davis; Nick Gill (NGILL@morpc.org); aramirez@mvrpc.org; Saleem Salameh; Lima (tmazur@lacrpc.com); smapel@lcounty.com; 'randy.durst@movrc.org' (randy.durst@movrc.org); sschmid@clarkcountyohio.gov; mikepap@bhjmpc.org; rsharma@belomar.org; krodi@eastgatecog.org
Cc: Fred Durham; Dines, Jennifer; Patricia Morris (Morris.Patricia@epamail.epa.gov) (Morris.Patricia@epamail.epa.gov); Moore, Dave; Byram, Mark
Subject: RE: Ozone Summer Day Factors

TMACOG concurs. Thank you for the opportunity to review it.

David Gedeon, AICP
Director of Commuter Services
Transportation Project Manager
Toledo Metropolitan Area Council of Governments
p: 419.241.9155 ext. 125
www.tmacog.org

TMACOG
A forum for regional cooperation since 1968

From: Brunello, Nino [mailto:Nino.Brunello@dot.state.oh.us]
Sent: Thursday, April 19, 2012 2:30 PM
To: PJividen@AkronOhio.gov; CBaker@akronohio.gov; Jeff Dutton; Bill Davis; Nick Gill (NGILL@morpc.org); aramirez@mvrpc.org; Saleem Salameh; Lima (tmazur@lacrpc.com); smapel@lcounty.com; 'randy.durst@movrc.org' (randy.durst@movrc.org); sschmid@clarkcountyohio.gov; mikepap@bhjmpc.org; David Gedeon; rsharma@belomar.org; krodi@eastgatecog.org
Cc: Fred Durham; Dines, Jennifer; Patricia Morris (Morris.Patricia@epamail.epa.gov) (Morris.Patricia@epamail.epa.gov); Moore, Dave; Byram, Mark
Subject: FW: Ozone Summer Day Factors

All:

After discussions with ODOT, OEPA, WVDEP, and USEPA, we are of the opinion that there needs to be an additional seasonal factor for summer when calculating ozone pollutants.

There is currently an adjustment for increasing average daily VMT (+ 8%) which was used in previously when using Moblie6 to generate emission factors. With MOVES, there is a vehicle component used in addition to VMT, so there needs to be an adjustment from average number of vehicles to the number of vehicles in summer day. We propose to use the same 8% increase.

We need to have an inter-agency agreement on this, and would prefer to do it via email (to make it easier on all of us). Please respond with your approval and/or questions.

Thanks,

~~~
~~~

From: Dines, Jennifer
Sent: Monday, April 09, 2012 8:47 AM
To: Brunello, Nino; Durham, William F
Subject: RE: Ozone Summer Day Factors

I'm available

Jennifer Dines
Manager, State Implementation Plan and Rulemaking Section
Division of Air Pollution Control
Ohio Environmental Protection Agency
Wk (614) 644-3696
Fax (614) 644-3681

From: Brunello, Nino
Sent: Monday, April 09, 2012 8:30 AM
To: Durham, William F; Dines, Jennifer
Subject: RE: Ozone Summer Day Factors

I can call anytime. Will you both be around at 9:00? If not, when would be the next earliest time? (on the half hours)

-Nino

From: Durham, William F [mailto:William.F.Durham@wv.gov]
Sent: Friday, April 06, 2012 8:50 AM
To: Brunello, Nino
Cc: Dines, Jennifer
Subject: Ozone Summer Day Factors

Nino:
I spoke with Jenn this morning and outlined the issue of Summer day VMT v. Average daily VMT.
We agreed that Pat Morris may be able to shed some light on the question.
Jenn & my calendars are open next Mon. and Tues. afternoon. Please give me a call & I'll patch Jenn in.
Fred

Appendix B

Appendix B.1
Post Processing Default Distributions

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

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

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

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

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

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

LEVEL OF SERVICE THRESHOLD BY AREA

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

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

TRUCK PCE: 2.00

AQ SEASON FACTOR: 1.08

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

Appendix B.2
Ozone Emission Summaries

TMACOG Daily Summary

TYPE	YEAR	VMT/VEH	HC	NOX	SO2	PM2.5
Link Emissions	2002	15,417,881	16.353	52.108	0.000	0.000
Vehicle Emissions	2002	377,449	13.306	7.295	0.000	0.000
Intrazonal Emissions	2002	46,532	0.080	0.193	0.000	0.000
TOTAL		15,464,413	29.738	59.595	0.000	0.000

TYPE	YEAR	VMT/VEH	HC	NOX	SO2	PM2.5
Link Emissions	2004	15,937,244	14.012	47.517	0.000	0.000
Vehicle Emissions	2004	376,911	12.784	7.431	0.000	0.000
Intrazonal Emissions	2004	46,692	0.068	0.173	0.000	0.000
TOTAL		15,983,936	26.864	55.120	0.000	0.000

TYPE	YEAR	VMT/VEH	HC	NOX	SO2	PM2.5
Link Emissions	2009	16,171,948	9.095	34.239	0.000	0.000
Vehicle Emissions	2009	347,793	9.678	6.320	0.000	0.000
Intrazonal Emissions	2009	43,550	0.039	0.116	0.000	0.000
TOTAL		16,215,498	18.812	40.675	0.000	0.000

TYPE	YEAR	VMT/VEH	HC	NOX	SO2	PM2.5
Link Emissions	2018	15,396,708	2.997	11.534	0.000	0.000
Vehicle Emissions	2018	373,220	5.122	3.756	0.000	0.000
Intrazonal Emissions	2018	49,689	0.016	0.047	0.000	0.000
TOTAL		15,446,397	8.135	15.337	0.000	0.000