Appendix D

New York State On-Road Motor Vehicle Emission Budget MOVES Technical Support Documentation

New York State On-Road

Motor Vehicle Emission Budget

MOVES Technical Support Documentation

Prepared by:

New York State Department of Environmental Conservation

Division of Air Resources

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Mobile Source Section

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1.0 Introduction

In early 2010, the U.S. Environmental Protection Agency (EPA) released the Motor Vehicle Emissions Simulator (MOVES). MOVES is used to calculate average in-use fleet emission factors for a wide variety of on-road vehicle types, model years, and pollutants. The MOVES model represents a major change from EPA's MOBILE6 emission factor model released in 2002. This latest version differs significantly from previous versions in the type and quantity of data (both required and optional) that the model is capable of utilizing.

MOVES includes default values for most inputs; however, using these default values gives results that are designed to reflect national average values. In order to produce results that give more representative estimates of local emissions it is necessary to provide MOVES with appropriate local inputs. This document outlines the sources of these local inputs and provides references, where necessary, with even more detailed information.

2.0 Vehicle Miles Traveled

2.1 VMT (HPMSVtypeVMT Table)

MOVES requires annual, county-level VMT by HPMS Vehicle type for each county input table. The following discussion describes the development of this information.

The Planning and Strategy Group of the New York State Department of Transportation (NYSDOT) developed the Vehicle Miles Traveled (VMT) data used to calculate the emissions for the on-road mobile inventory. The NYSDOT uses their submittal of the US Department of Transportation's Highway Performance Monitoring System (HPMS) VMT as the basis for developing county-level, grouped functional class VMT estimates. This process is described in more detail in the NYSDOT report "Estimated County Level Vehicle Miles of Travel," of April 1, 1989 and updated in an April 27, 1992 memo, both authored by Nathan Earlbaum of NYSDOT. These documents are labeled as Attachment 1 to this document and are available upon request.

A new 2007 Daily Vehicle Miles Traveled (DVMT) inventory was constructed by NYSDOT to provide DVMT estimates by county, geographic component (urban, small urban, and rural) and grouped functional class. In addition, functional class shares are provided to expand the DVMT to more specific functional classes The DVMT inventory is updated on a continuous cycle every three years. The methodology employed to develop the 2007 DVMT inventory remains the same as documented in the Radian Report, NYS 1990 Base Year Carbon Monoxide and Ozone Precursor On-Road Mobile Source Inventory, Final Report March 1993, Appendix B: Background Documentation for the Development of VMT Estimates. Future years are linearly forecast using all available data starting from 1981 to determine the slope.

DVMT by county and by grouped functional class are multiplied by functional class shares to expand the DVMT to the 12 functional classes. The by-functional class DVMT is then multiplied by seasonal adjustment factors and the number of days per month to get the annual vmt by functional class. The seasonal adjustment factors are also supplied by the NYSDOT. For more information on the seasonal adjustment factors see Section 10.0 Seasonal Adjustment Factors. Next, the annual VMT by functional class is summed over geographic component to get the annual county-level VMT by functional class. Annual VMT by functional class is then aggregated to MOVES road type. In order to fit the new MOVES framework, Functional Class 01 becomes Rural Restricted, classes 02, 06, 07, 08, & 09 become Rural Unrestricted, classes 11 and 12 are Urban Restricted and classes 14, 16, 17, & 19 become Urban Unrestricted. The next step is to apply the vehicle mix by MOVES source type and road type to the annual VMT by road type. This will yield the annual VMT by MOVES Road type and Source type which is then summed over MOVES road type. Development of vehicle mix is discussed in section 2.3 below. Finally, the resulting annual VMT by MOVES source type is aggregated to HPMS vehicle type which is then used to populate the county-level HPMSVType VMT tables.

2.2 RoadTypeDistribution Table

The road type distribution table contains the fraction of VMT allocated to each MOVES road type for each vehicle type. This information is calculated during the above HPMS vehicle type VMT process. Once the annual VMT by MOVES Road type and Source type is developed the fraction of VMT allocated to each road type is calculated. This is done at the county level.

2.3 Vehicle Mix

The vehicle mix for each of the 11 NYSDOT regions in New York State are used to produce the by vehicle type VMT. Vehicle types are the 13 Use Types and 6 Fuel Types that are used by MOVES. The main objective of the process is to create a separate, distinct (where justified) vehicle mix for each of the four roadway types used in MOVES.

Ideally, sufficient roadway survey data would exist to characterize the vehicle mix reliably into the level of detail required by MOVES. In reality, data from roadway surveys is available by 6 roadway types by only three broad vehicle categories. These categories, called FHWA vehicle classifications, or the FHWA "F" scheme (of which there are thirteen, i.e. f1 to f13, characterized by axle count and tractor/trailer combinations), are traditionally consolidated down to three by NYSDOT because of sample size concerns. The three categories provided are a combined f1 & f2 that represents motorcycles and light duty vehicles, f3 which is currently considered by New York State Department of Environmental Conservation (NYSDEC) to be all LDT3 and LDT4 (in the EPA MOBILE6 scheme of vehicle types), and f4 thru f13 lumped as a single aggregate count representing all heavy duty vehicles. In order to expand these 3 broad categories into the 13 vehicle types of the MOVES framework, data from other sources, namely New York State Department of Motor Vehicles (NYSDMV) registrations along with NYSDOT and EPA mileage accumulations, are used to create the requisite vehicle mixes.

The process used by NYSDEC to generate a vehicle mix is a three-step process. The first step utilizes NYSDMV registration data resulting in counts of vehicles registered on or around July 1st of the analysis year. The process of obtaining and refining this registration data is outlined in Section 11.0 Decoding the NYSDMV Database. This process yields vehicle populations for the thirteen MOVES vehicle types for each of the 62 counties in NYS. The county counts are aggregated to eleven NYSDOT regions.

Registration-based counts, while relatively easy to assemble, do not adequately represent the mix of vehicles on various roadway types. This is because certain vehicle types drive many more miles than others. In an attempt to compensate for this, the next step is to take the thirteen vehicle type categories, subdivide each category further by vehicle age, and then apply an adjustment (weighting factor) based on mileage accumulation. The EPA mileage accumulation data for cars and light trucks are supplemented by NYS-specific results from the NPTS (National Personal Transportation Survey). This step is detailed in Section 9.0 Mileage Accumulation Rate

The third step of the NYSDEC process uses the 'intermediate vehicle mix' to adjust the roadway classification counts developed by NYSDOT and provided as the three groupings of the FHWA "Scheme F" classification system discussed earlier. The 'intermediate vehicle mix' is applied to these three axle count groups, yielding a vehicle mix for the thirteen MOVES vehicle types.

2.4 Hour VMT Fraction Table

Hourly VMT fractions are developed for 26 specific regions (counties) through analysis of the 1995 National Personal Transportation Survey (NPTS) by NYSDOT. The NPTS Time of Day graphs are contained in a document labeled as Attachment 2 which is available upon request. Hourly VMT fraction assignments are shown in table 2.1 below.

Table 2.1 - Hourly VMT Fraction Assignments 2007	
Hourly VMT Fraction Profile	Counties
Albany	Albany
Bronx	Bronx
Broome	Broome
Chemung	Chemung
Dutchess	Dutchess
Erie	Erie
Kings	Kings
Monroe	Monroe
Nassau	Nassau
New York	New York
Niagara	Niagara
Oneida	Oneida
Onondaga	Onondaga
Orange	Orange
Putnam	Putnam
Queens	Queens
Rensselaer	Rensselaer
Richmond	Richmond
Rockland	Rockland
Saratoga	Saratoga
Schenectady	Schenectady
Suffolk	Suffolk
Tompkins	Tompkins
Warren	Warren
Washington	Washington
Westchester	Westchester
Remainder	Remaining counties in state

2.5 Day VMT Fraction Table

NYSDEC utilizes a uniform allocation of VMT over all days of the week for all counties and as such populated the Day VMT fraction table accordingly.

2.6 Month VMT Fraction Table

Monthly VMT fractions are developed based on the seasonal adjustment factors described in section 10.

2.7 References

1. Estimated County Level Vehicle Miles of Travel. Erlbaum, Nathan S., New York State Department of Transportation, Planning Division. April 1, 1989

2. “Estimation of Vehicle Miles of Travel for 1990, by County and Functional Class and Method Documentation”. Memorandum from Erlbaum, Nathan S., Traffic Monitoring Section to Cioffi, G., Office of the Commissioner, New York State Department of Transportation. April 27, 1992 pp. 1 to 5. (APPENDIX B of Radian Report listed below)

3. New York State 1990 Base Year Carbon Monoxide and Ozone Precursor On-Road Mobile Source Inventory. Radian Corporation. March 1993, revised by NYSDEC on April 1993.

3.0 Ramp Fraction Table

The ramp fraction table allows for the input of specific ramp driving times for the restricted access road types. Neither NYSDEC nor NYSDOT is in possession of ramp VMT or speed data, so the default value 0.08 (8%) was used for all counties.

4.0 Average Speed Distribution Table

The Planning Division of the NYSDOT developed speed estimates for air quality modeling in 1994. Speeds were computed through a number of steps detailed in a 1994 report copied and included as Attachment 3. Speeds were developed for 15 areas, some as small as a single county, throughout the state along with each of the 12 possible functional classes and 4 time periods (Morning, Daytime, Evening, and Nighttime). The resulting speeds are contained in 6 tables which have been included as Attachment 4. A weighted average using 2007 VMT was used to determine the new speeds for each of the 4 roadways in MOVES. Table 4.1below shows the speed distribution assignments for New York counties.

Table 4.1 Average Speed Distribution Assignment 2007	
Speed Distribution	**Counties**
Capital District	Albany, Rensselaer, Saratoga, Schenectady & Saratoga
Syracuse	Onondaga, Oswego & Jefferson
Rochester	Genesee, Livingston, Monroe, Ontario, Orleans, & Wayne Counties
Buffalo	Erie & Niagara
Rest of State	Remaining Upstate Counties
Putnam	Putnam
Westchester	Westchester
Rockland	Rockland
Bronx	Bronx
New York	New York
Queens	Queens
Kings	Kings
Richmond	Richmond
Nassau	Nassau
Suffolk	Suffolk

5.0 Fuel Data

5.1 Fuel Supply Table

New York State uses two types of gasoline: eastern conventional gasoline for upstate counties and reformulated gasoline for the NY Metropolitan area including Putnam and Orange counties. In 1990 NYSDEC conducted a fuel sampling program. The results of this survey are provided in the New York State 1990 Base Year Carbon Monoxide and Ozone Precursor On-Road Mobile Source Inventory Appendix D.3 Based on the results of this survey, fuel formulations were selected from the default table which closely matched the sample data. Formulations were also selected to take into account the lower sulfur content of diesel fuel mandated by the Federal Highway Diesel rule implemented in late 2006. Table 5.1 includes the fuel sample data for conventional and reformulated gasoline and the selected fuel formulations used to populate the fuel supply table for each of the county input files. The fuel supply assignments for New York Counties are shown in Table 5.2.

Table 5.1 Fuel Sample Data and Selected Fuel Formulations for New York Counties 2007

RFG Sample										
Month	RVP	T10	T50	T90	Benzene	Sulfur	Oxygen		E200	E300
	(psi)	(°F)	(°F)	(°F)	(v%)	(ppm)	(wt%)	(%E10)	(%)	(%)
January	13.1	109	158	315	0.62	20	3.8		70.6	86.2
February	12.6	111	158	316	0.69	35	3.8		70.6	86.0
March	12.4	111	158	312	0.63	32	3.7		70.6	86.9
April	10.4	120	181	315	0.57	31	3.3		59.3	86.2
May	7.3	135	206	315	0.42	28	3.5		47.0	86.2
June	6.9	136	211	319	0.41	29	3.6		44.6	85.4
July	6.9	136	209	316	0.36	35	3.6		45.6	86.0
August	6.9	135	208	311	0.30	32	3.6		46.1	87.1
September	7.1	134	207	313	0.29	35	3.6		46.6	86.7
October	10.6	117	169	306	0.34	25	3.7		65.2	88.2
November	12.4	113	162	309	0.37	42	3.8		68.6	87.6
December	12.7	113	165	312	0.41	48	3.7		67.1	86.9
Winter	12.64	111.4	160.2	312.8	0.544	35.40	3.76		69.5	86.7
Summer	7.02	135.2	208.2	314.8	0.356	31.80	3.58		46.0	86.3
Sprall	10.50	118.5	175.0	310.5	0.455	28.00	3.50		62.2	87.2
RFG Formulas Used (Selected from FuelFormulation Table)										
Formula	**RVP**				**Benzene**	**Sulfur**			**E200**	**E300**
8841	12.5864				0.5400	30			57.5155	92.3729
8519	7.01143				0.6857	30			51.8284	86.3126
8874	10.4738				0.5400	30			54.8602	92.5775
Conventional Gasoline Sample										
Month	RVP	T10	T50	T90	Benzene	Sulfur	Oxygen		E200	E300
	(psi)	(°F)	(°F)	(°F)	(v%)	(ppm)	(wt%)	(%E10)	(%)	(%)
January	12.80	109	208	320	1.06	31	0.2		46.1	85.1
February	13.30	108	206	322	0.76	30	0.3		47.0	84.7
March	13.00	108	203	316	1.03	35	0.2		48.5	86.0
April	10.30	121	212	325	1.21	33	0.3		44.1	84.0
May	8.50	128	214	320	1.21	38	0.2		43.1	85.1
June	8.50	130	214	320	1.18	50	0.1		43.1	85.1
July	8.30	132	215	319	0.99	40	0.2		42.6	85.4
August	8.40	131	215	319	1.02	37	0.1		42.6	85.4
September	8.30	130	213	319	0.9	41	0.1		43.6	85.4
October	10.40	119	213	322	0.81	51	0		43.6	84.7
November	11.50	116	205	317	0.74	47	0.2		47.5	85.8
December	12.80	111	196	318	0.88	76	0.4		51.9	85.6
Winter	12.68	110.4	203.6	318.6	0.894	43.80	0.26	0.07	48.216	85.448
Summer	8.40	130.2	214.2	319.4	1.06	41.20	0.14	0.04	43.022	85.272
Sprall	10.35	120.0	212.5	323.5	1.01	42.00	0.15	0.04	43.855	84.37
Conventional Gasoline Formulas Used (Selected from FuelFormulation Table)										
Formula	**RVP**				**Benzene**	**Sulfur**			**E200**	**E300**
7788	12.7571				0.935	45.5725			53.9283	85.5086
7800	8.39143				1.085	45.5725			44.9932	84.0594
7962	10.3708				0.983333	42.4925			50.1003	87.2421

Table 5.2 New York State Fuel Supply Assignments	
Fuel	**Counties**
Reformulated	Bronx, Kings, Nassau, New York, Orange, Putnam, Queens, Richmond, Rockland, Suffolk & Westchester
Eastern Conventional	All Remaining Upstate Counties

5.2 Fuel Formulation Table

MOVES contains a default fuel formulation table containing thousands of unique fuel formulations for gasoline and diesel fuel each with an assigned fuel formula ID. NYSDEC used this table as a source for selecting fuel formula ID's to assign to the fuel sampling data discussed above.

5.3 Stage II Refueling

The Stage II Refueling program began for the NYMA area in 1989. While refueling emissions are estimated using MOVES and the locally developed data described in this document, they are included in the area source inventory.

5.4 References

1. New York State 1990 Base Year Carbon Monoxide and Ozone Precursor On-Road Mobile Source Inventory. Radian Corporation. March 1993, revised by NYSDEC on April 1993.

6.0 Meteorological Data

6.1 Surface Temperature

Surface meteorological data, including temperature and dew point temperature for 2007, were obtained from the National Climatic Data Center for all available National Weather Service offices and reporting stations across the state. Monthly average diurnal temperature and relative humidity were subsequently calculated for each dataset. Meteorological data was then selected for each county based on climatological representativeness and/or location of the available stations. If a county did not have a specific NWS office located in it, data from a nearby office with similar meteorological conditions were used. Based on these considerations, a county assignment table (Table 6.1) was developed and used to populate the respective ZoneMonthHour tables for each county input file.

Table 6.1 New York State meteorological data assignments for county input files 2007				
County	FIPS Code	Synoptic Station Code	Airport Code	Airport/Location
Albany	36001	725180	ALB	Albany International Airport
Allegany	36003	725157	ELZ	Wellsville Municipal Airport
Bronx	36005	725030	LGA	LaGuardia Airport
Broome	36007	725150	BGM	Greater Binghamton Airport
Cattaraugus	36009	725235	JHW	Chautauqua County Airport
Cayuga	36011	725194	PEO	Penn Yan Airport
Chautauqua	36013	725235	JHW	Chautauqua County Airport
Chemung	36015	725156	ELM	Elmira - Corning Regional Airport
Chenango	36017	725150	BGM	Greater Binghamton Airport
Clinton	36019	726170	BTV	Burlington International Airport
Columbia	36021	725180	ALB	Albany International Airport
Cortland	36023	725155	ITH	Tompkins County
Delaware	36025	725150	BGM	Greater Binghamton Airport
Dutchess	36027	725036	POU	Dutchess County Airport
Erie	36029	725280	BUF	Buffalo/Niagara International Airport
Essex	36031	726170	BTV	Burlington International Airport
Franklin	36033	726223	MSS	Massena International Airport- Richards Field
Fulton	36035	725180	ALB	Albany International Airport
Genesee	36037	725290	ROC	Monroe County Airport | Rochester Airport
Greene	36039	725180	ALB	Albany International Airport
Hamilton	36041	726228	SLK	Adirondack Regional Airport
Herkimer	36043	725196	RME	Griffiss AFB
Jefferson	36045	726227	ART	Watertown International Airport
Kings	36047	744860	JFK	John F Kennedy International Airport
Lewis	36049	743700	GTB	Wheeler-Sack Airfield | Great Bend
Livingston	36051	725157	ELZ	Wellsville Municipal Airport
Madison	36053	725190	SYR	Hancock International Airport
Monroe	36055	725290	ROC	Monroe County Airport | Rochester Airport
Montgomery	36057	725180	ALB	Albany International Airport
Nassau	36059	744864	FRG	Farmindale - Republic Field
New York	36061	725033	NYC	Central Park
Niagara	36063	725289	IAG	Niagara Falls International Airport
Oneida	36065	725196	RME	Griffiss AFB
Onondaga	36067	725190	SYR	Hancock International Airport
Ontario	36069	725290	ROC	Monroe County Airport | Rochester Airport
Orange	36071	725015	MGJ	Orange County Airport
Orleans	36073	725290	ROC	Monroe County Airport | Rochester Airport
Oswego	36075	725146	FZY	Oswego County
Otsego	36077	725196	RME	Griffiss AFB
Putnam	36079	725086	DXR	Danbury Municipal Airport
Queens	36081	725030	LGA	LaGuardia Airport
Rensselaer	36083	725180	ALB	Albany International Airport
Richmond	36085	725020	EWR	Newark Airport
Rockland	36087	725037	HPN	Westchester County Airport
St. Lawrence	36089	726223	MSS	Massena International Airport- Richards Field
Saratoga	36091	725180	ALB	Albany International Airport
Schenectady	36093	725180	ALB	Albany International Airport
Schoharie	36095	725180	ALB	Albany International Airport
Schuyler	36097	725194	PEO	Penn Yan Airport
Seneca	36099	725194	PEO	Penn Yan Airport
Steuben	36101	725156	ELM	Elmira - Corning Regional Airport
Suffolk	36103	744865	FOK	Suffolk County Airport
Sullivan	36105	725145	MSV	Monticello
Tioga	36107	725150	BGM	Greater Binghamton Airport
Tompkins	36109	725155	ITH	Tompkins County
Ulster	36111	725036	POU	Dutchess County Airport
Warren	36113	725185	GFL	Floyd Bennett Memorial Airport (Warren County Airport)
Washington	36115	725185	GFL	Floyd Bennett Memorial Airport (Warren County Airport)
Wayne	36117	725290	ROC	Monroe County Airport | Rochester Airport
Westchester	36119	725037	HPN	Westchester County Airport
Wyoming	36121	725157	ELZ	Wellsville Municipal Airport
Yates	36123	725194	PEO	Penn Yan Airport

6.2 Relative Humidity

The relative humidity data was calculated from hourly NWS observations that NYSDEC obtained from the National Climatic Data Center. Dew point observations for the same dates and locations that were used in temperature calculations were also used to determine hourly relative humidity values. The calculation method assumed standard atmospheric pressure to determine saturation vapor pressure from the temperature and vapor pressure from the dew point. The vapor pressure divided by the saturation vapor pressure, multiplied by 100, equals relative humidity. Monthly average diurnal humidity was then calculated from the hourly values.

7.0 Inspection/Maintenance Program (IMCoverage Table)

In 2007, several Inspection and Maintenance programs were in effect across the state. Statewide, the NYVIP program was in effect and tested light duty gasoline vehicles starting with the 1996 model year. This program included both evaporative and exhaust system OBD tests as well as a gas cap check. It gave vehicles that were 25 years and older an exemption and granted a grace period for vehicles 2 years old or newer. NYMA counties were also subject to the NYTEST program which included an IM240 and an idle program for heavy duty gasoline vehicles. Both programs tested vehicles starting with model year 1983. All programs also include a 30% stringency, 98% compliance rate and include a gas cap pressure test and no credit for technician training program. A waiver rate of 2% for NYMA counties and 3% for upstate counties was used to calculate the Compliance factor for the MOVES I/M Coverage table

8.0 LEV Programs

Beginning in the 1990’s, a number of states chose to adopt California LEV standards in place of federal standards. The effects of these LEV standards are not included in the MOVES database. As a result EPA has created a separate input database for states adopting California LEV program regulations. The California LEV input database provides a set of alternative VOC, CO and NOx start and running emissions factors based of EPA and CARB analysis of LEV programs. The input database provides rates from model year 1994 until model year 2050, including both the California LEV 1 and LEV 2 standards. These rates replace the rates in the default database for these particular pollutants.

EPA has provided a MySQL script along with the supplemental database to replace the emissions rates depending on when states adopted the LEV program. The use of this script and supplemental database are outlined in the EPA guidance document “Instructions for using LEV and NLEV Inputs for MOVES". NYSDEC followed this guidance and created the appropriate supplemental database called ny_lev and used it along with the other local inputs.

8.1 References

1. "Instructions for using LEV and NLEV Inputs for MOVES", EPA-420-B-10-003a, August 2010, Assessment and Standards Division, EPA OTAQ, http://www.epa.gov/oms/models/moves/tools.htm

9.0 Mileage Accumulation Rate

Mileage accumulation rates were used in the development of the vehicle mix. The following section discusses the origins of these rates

Mileage Accumulation Rates for LDGV, LDDV, LDGT1, and LDGT2 were developed in conjunction with the NYSDOT. Mileage accumulation rates for MC were carried over from MOBILE5 default rates. All other vehicle type mileage accumulation rates are taken from the EPA's Fleet Characterization Data for MOBILE6.

The NYSDOT used the vehicle file component of the National Personal Transportation Survey (NPTS) to create annual mileage utilization rates for four LDV types. Part of these vehicle files is an average annualized vehicle odometer reading for passenger vehicles. The NYSDOT report Improving Air Quality Models in New York State: Utility of the 1995 Nationwide Personal Transportation Survey May 13, 1999, presented as Attachment 5, goes into more detail regarding the procedure used to curve fit New York specific data. This curve fitted data was then used to replace the national data for LDGV, LDDV, LDGT1, and LDGT2. The New York specific mileage accumulation table is included as Attachment 6. These mileage accumulation rates were then applied to the MOVES vehicle types where appropriate.

The report also illustrates the differences in New York and national curve fitted annual mileage accumulation data, specifically that while initial (first three years) mileage accumulation rates are lower for New York than the national average, older New York vehicles maintain higher mileage rates for longer periods of time. It is these significant differences that led to the decision to use New York specific data for these vehicle classes instead of using EPA recommended MOBILE6 defaults. These mileage accumulation rates were carried over from MOBILE5.

9.1 References

1. Fleet Characterization Data for MOBILE6. (EPA420-R-01-047), U.S. Environmental Protection Agency, Sept 2001.

2. Improving Air Quality Models in New York State: Utility of the 1995 Nationwide Personal Transportation Survey. New York State Department of Transportation, May 13, 1999. (Attachment 5)

10.0 Seasonal Adjustment Factors

The Planning Division of the NYSDOT develops seasonal adjustment factors in conjunction with their AADT-based DVMT estimates. After consultation with NYSDOT Planning & Strategy Group's Data Analysis & Forecasting Section it was decided that the three available Factor Groups (FG30, FG40, FG60) be used where applicable throughout the State to more accurately determine Ozone Season VMT in highly variable areas. Note that this is a change from previous modeling methodology that used FG30 (large urban area) for all roadways in New York State. Attachment 7 is a March 28, 2003 memo from NYSDOT Planning & Strategy Group with their recommendations, and Attachment 8 is a summary table of the spreadsheet referenced in the memo.

Further analysis (as shown in graphs on following pages) of the seasonal adjustment factors indicated that each factor group's values are relatively constant from year to year and that variations are within the range of sampling errors. Due to this NYSDEC has decided to take the average SAF for each factor group and use that value for all years rather than change it every three years. The graphs below show four lines, the annual ozone season factor for that functional group, plus one standard deviation, minus one standard deviation, and the average of the factors.

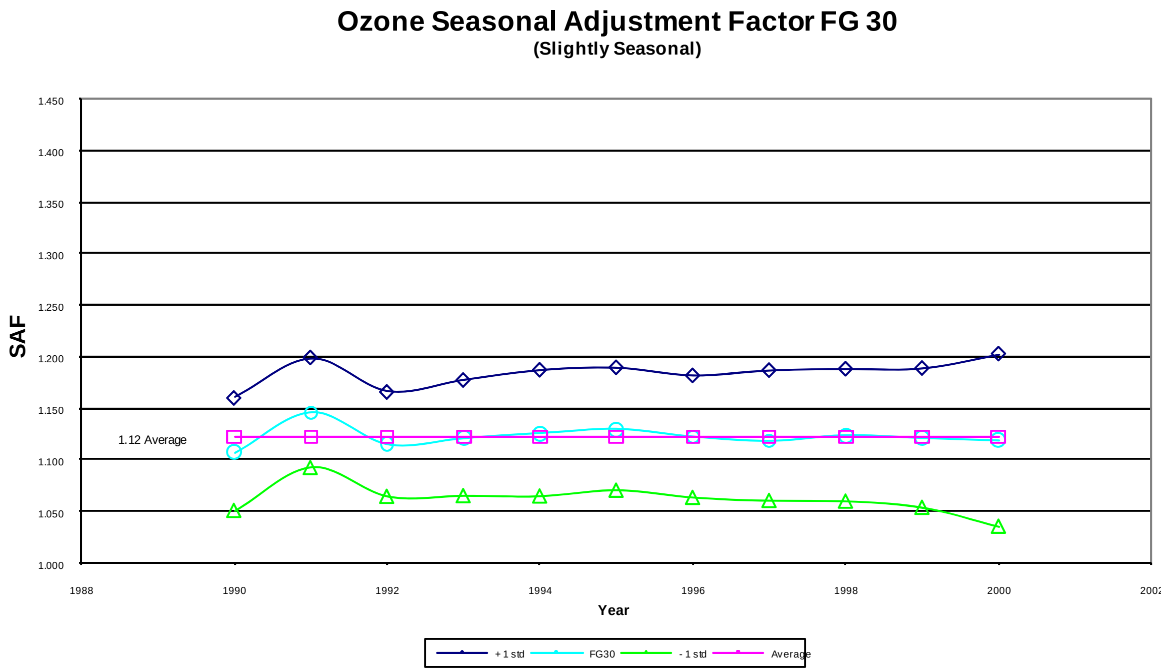

Figure 10-1

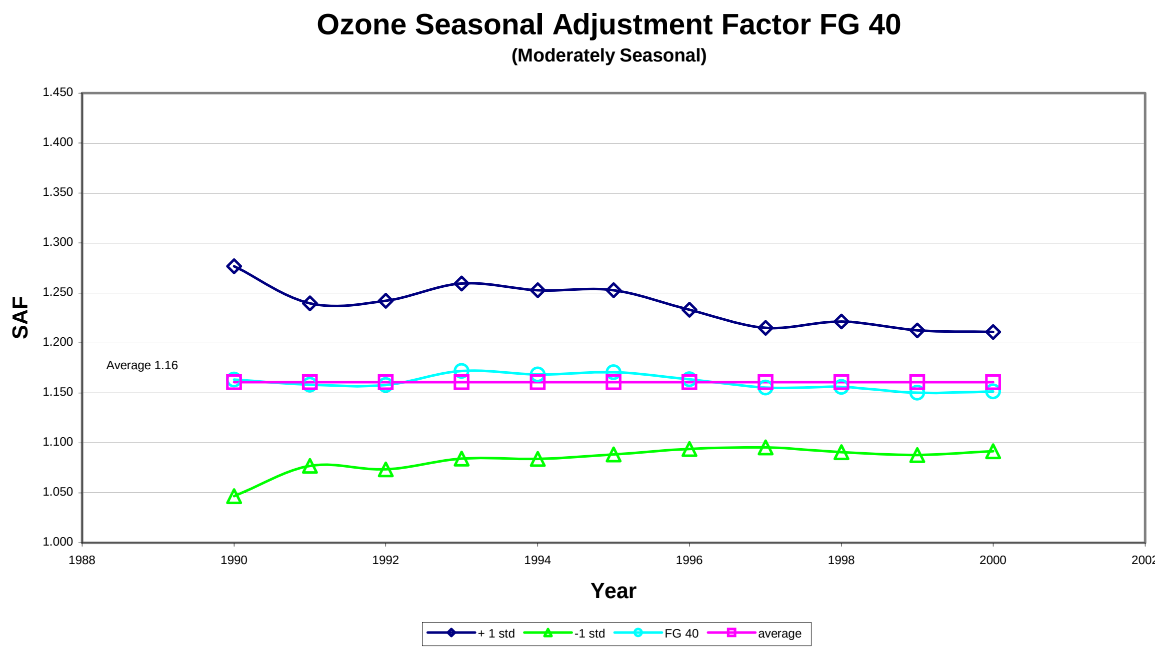

Figure 10-2

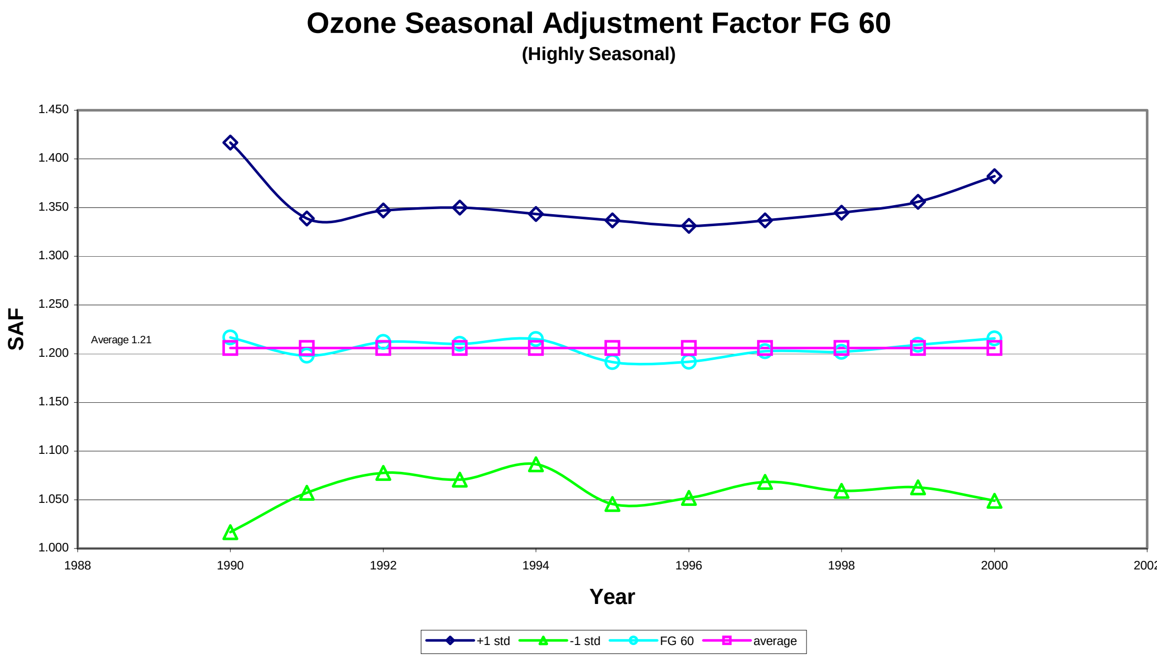

Figure 10-3

11.0 Decoding the NYSDMV database

11.1 Introduction

The MOVES model is different from previous EPA emissions models in that it is designed with a modular database structure. Now, when new data becomes available, it can easily be incorporated into the model. In addition, MOVES allows easier importation of local data that is specific to a user's unique needs. However, these changes required a complete re-write of the modeling framework.

The MOVES model includes a “default” database that will produce summary emissions for the entire United States. While national level emission estimates will be adequate utilizing this database, for many uses, up-to-date local inputs will be more appropriate, especially for analyses supporting State Implementation Plans (SIPs) and conformity determinations.

The first set of these local inputs are those that describe the local fleet. These inputs consist of Source Type (a.k.a. Vehicle Type) Age Distributions, Source Type Populations and Fuel Fractions. The two significant changes from MOBILE6 are the requirement for the number of vehicles (used to calculate start emissions) and the change from vehicle types to source types. There are 13 different source types; however, the information required to accurately count and classify all of them is not obtainable.

The next several pages step through the methodology used by the NYSDEC in sorting the 2007 NYSDMV Registration Database into the required vehicle inputs for MOVES. Table 11.1 provides a sample of what the sorting table looks like. The complete table contains each of the State's 62 counties and vehicle ages from 0 to 31+ with the Count column being the total of all vehicles of that type in that county regardless of age.

Table 11.1 Sample Sorting Table

County	County Code	Body Number	Body_Type	Count	0	1	2	3	4	5	6
1	001	11	MC	0	0	0	0	0	0	0	0
1	001	21	CAR	0	0	0	0	0	0	0	0
1	001	31	PTRUCK	0	0	0	0	0	0	0	0
1	001	32	COMMTRUCK	0	0	0	0	0	0	0	0
1	001	41	IBUS	0	0	0	0	0	0	0	0
1	001	42	TBUS	0	0	0	0	0	0	0	0
1	001	43	SBUS	0	0	0	0	0	0	0	0
1	001	51	REFUSETRUCK	0	0	0	0	0	0	0	0
1	001	52	SUSHORTTRUCK	0	0	0	0	0	0	0	0
1	001	53	SULONGTRUCK	0	0	0	0	0	0	0	0
1	001	54	MH	0	0	0	0	0	0	0	0
1	001	61	CSHORTTRUCK	0	0	0	0	0	0	0	0
1	001	62	CLONGTRUCK	0	0	0	0	0	0	0	0

11.2 Starting Point

The NYSDMV database that NYSDEC acquires each year contains the following data: VIN, NYSDMV Registration Type, County, Weight/Seating Capacity, Suspended Individual, NYSDMV Body Type, Fuel Type, Vehicle Year, Make, and Color. In 2007 there were 11,137,009 records. Table 11.2 below provides a snapshot of one record from that database.

Table 11.2 Snapshot of NYSDMV Database									
July2007RegData									
VIN	Reg Type	County	Wt/Seating Capacity	Susp Ind	Body Type	Fuel	Vehicle Year	Make	Color
4T1BE46K77U613161	16	41	003253	N	13	GAS	2007	TOYOT	GY

These records now need to be distilled into the following 13 Source Types:

Table 11.3 Thirteen Source Types		
SourceTypeID	SourceType Name	SourceType Abbreviation
11	Motorcycle	MC
21	Passenger Car	CAR
31	Passenger Truck	PTRUCK
32	Light Commercial Truck	COMMTRUCK
41	Intercity Bus	IBUS
42	Transit Bus	TBUS
43	School Bus	SBUS
51	Refuse Truck	REFUSETRUCK
52	Single Unit Short-Haul Truck	SUSHORTTRUCK
53	Single Unit Long-Haul Truck	SULONGTRUCK
54	Motor Home	MH
61	Combination Short-Haul Truck	CSHORTTRUCK
62	Combination Long-Haul Truck	CLONGTRUCK

The NYSDMV Body Type code is the most useful descriptor for sorting the various vehicle types into the MOVES Source Type ID's provided above. Additional refinement of the vehicle count is accomplished by also using the registration, gross vehicle weight, and even the color (school busses) for allocating vehicle counts into the appropriate MOVES vehicle categories.

The Body Type decoder in Table 11.4 below, provided by NYSDMV, has 71 different body types listed. Sixty-one of the body types account for the 11,137,009 vehicles included in the July 2007 database. Only 36 body types represent vehicles to be processed and considered for inclusion as an input for development of the on-road emission inventory. The removal of body types that contain invalid codes and types not considered to be on-road sources (267,252 records removed) results in 10,869,757 vehicles considered for further processing.

Table 11.4 NYSDMV Body Type Decoder		
Computer	Body Type	Count
01	Limited Use Vehicle - Sedan	
02	Limited Use Mcy – A	
03	Limited Use Mcy – B	
04	Limited Use Mcy - A, B or C	
05	Motorized Bicycle	
06	Limited Use Mcy - A, B or C or Motorized	
07	Limited Use Mcy - C	
08	Police	
09	Fire	677
10	Convertible	170,076
11	Sedan	29,737
12	Suburban	3,312,529
13	4 Door Sedan	4,492,050
14	2 Door Sedan	854,783
15	House on Wheels	29,384
18	All Terrain Vehicle	158,461
19	Motorcycle	300,322
20	Hearse-Invalid Comb.	112
21	Locomotive	8
22	Custom	143
23	Replica	14
30	Unknown Truck	
31	Unknown Passenger	1
32	Minibike	
33	Snowmobile	
34	Other Off-Highway Vehicle	
35	Bicyclist	
36	Pedestrian	
37	Other (Person)	
38	Misc. Farm Vehicle	
39	Ambulance	968
41	Power Shovel	11,477
42	Road Building Machine	12,457
43	Road Roller	1,281
44	Road Sweepers	4,847
45	Sand Spreader	1,642
46	Snow Plow	2,003
47	Snow Traveler	27
48	Snowmobile	10
49	Traction Engine	217
50	Tractor Crane	1,000

Computer	Body Type	Count
51	Truck Crane	2,674
52	Small Wheel Truck	940
53	Well Driller	666
54	Well Servicing Rig	352
55	Feed Processing Machine	73
56	Mobile Car Crusher	111
57	Earth Mover	687
58	Tractor	38,733
59		8,280
60	Delivery Truck	22,226
61	Dump Truck	103,375
62	Flat Bed Truck	19,300
63	Pick-up Truck	1,034,553
64	Stake Truck	17,956
65	Tank Truck	9,849
66	Refrigerated Truck	3,461
67	Tow Truck	7,229
68	Van Truck	256,974
70	Utility Truck	51,049
71	Pole Trailer	4
80	Boat Trailer	139
81	House Trailer	44,329
82	/1	
83	Semi-Trailer or Misc.	2,271
84	/1	
85	Trailer	14,228
87	Light Trailer /2	4,097
90	Bus (Omnibus)	85,858
91	Limousine (Omnibus)	1,075
92	Hearse (Ambulance)	798
93	Taxi	12,073
94	Disable Commercial /3	693
95	Cement Mixer	1,693
96	Moped /4	4,482
97	Manufactured Home	
98	Snowmobile	
99	Low Speed Vehicle	2,548
*26, 69, 76	*Invalid Body Type codes found in 2007	7

11.3 FUEL TYPES (ALTERNATIVE VEHICLE AND FUEL TECHNOLOGIES TABLE)

The NYSDMV Database includes 8 different fuel codes. These codes are included in Table 11.5.

Table 11.5 NYSDMV Fuel Tables		
CODE	DMV FUEL	COUNT
C	CNG	2,601
D	Diesel	425,980
E	Electric	3,836
F	Flex	2,709
G	Gasoline	10,629,389
P	Propane	478
O	Other	1,236
U	Unknown/Blank	70,780

The MOVES model has 6 possible fuel types, these are listed in Table 11.6.

Table 11.6 MOVES Fuel Types	
FuelTypeID	MOVES FUEL TYPE
1	Gasoline
2	Diesel
3	CNG
4	LPG (Propane)
5	Ethanol
6	
7	
8	
9	Electric

For modeling purposes, vehicles identified as Flex fuel types will be added to the Gasoline counts, while vehicles with “Other” and “Unknown” fuel types will be discarded. Because there is no hybrid code in the database hybrid vehicles cannot be counted individually and are instead counted under one of the above fuel types. The number of hybrids modeled in NYS in 2007 is zero.

Diesel Fractions are obtained at the same time as the registration distributions. The by-county and by-vehicle type totals created for the registration distributions are further sorted by fuel type and converted into the percent of diesel-powered vehicles by type and by age. The results are then used to populate the Alternative Vehicle Fuels Technology table.

Once vehicles are categorized by fuel type, the NYSDEC begins to move those vehicles into their appropriate source type by fuel. The next set of tables contain vehicle counts by MOVES source and fuel types along with a description of each necessary adjustment made for processing final vehicle counts. Adjustments include removal of records with any combination of invalid county identifiers, registration types and/or fuel types per category.

11.4 Source Type ID 11 - Motorcycles

The body types that could be considered “motorcycles” are #02 – #07 the Limited use Motorcycles Types A – C, #18 All Terrain Vehicle, #19 Motorcycle, #32 Minibike, & #96 Moped. Of these body types only #19 Motorcycles, and #96 Mopeds are being used by the NYSDMV. There are 304,804 motorcycles in Table 11.7 provided below with the percentage by fuel type showing that nearly all motorcycles operate on gasoline.

Table 11.7 Motorcycles		
MOTORCYCLES (Body Types 19, 96)		
DMV FUEL	COUNT	PERCENTAGE
CNG	6	0.00%
Diesel	30	0.01%
Electric	39	0.01%
Flex	39	0.01%
Gasoline	304,609	99.94%
Propane	0	0.00%
Other	2	0.00%
Unknown/Blank	79	0.03%

Further processing of this category requires removal of various registration types such as “84”, “85”, or “86” (trailers), “63” (in transit), and “35” (all terrain vehicles) which represent counts for registered vehicles other than on-road motorcycles. Other registration types that need to be identified and removed include contradictory registration types such as codes corresponding to busses, trucks, and tractor trailers, as examples. Removing additional records consisting of invalid county identifiers and fuel types “other” and “unknown” (758 records removed), provides a final total of 304,046 motorcycles in NYS, for emission inventory year 2007, under MOVES source type 11.

11.5 Source Type ID 21 - Passenger Car

The body types that could be considered “passenger cars” are #01 Limited Use Vehicle – Sedan, #8 Police, #10 Convertible, #11 Sedan, #13 4 Door Sedan, #14 2 Door Sedan, #20 Hearse-Invalid Comb. , #22 Custom, #23 Replica, #31 Unknown Passenger, #91 Limousine (Omnibus), #92 Hearse (Ambulance) and #93 Taxi. Body type #99 Low Speed Vehicle consist of mostly electric vehicles (2537 of 2548) and because of their limited range and speed, will not be considered true passenger cars. It was noted that in 2007, there are no vehicles registered as either body type #01 Limited Use Vehicle – Sedan or #8. A count of the valid body types listed returns 5,560,862 vehicles that could be passenger cars with nearly all operating on gasoline. These are shown in Table 11.8.

Table 11.8 Passenger Cars		
PASSENGER CARS (Body Types 01, 08, 10, 11, 13, 14, 20, 22, 23, 31, 91, 92, 93)		
DMV FUEL TYPE	COUNT	PERCENTAGE
CNG	852	0.02%
Diesel	11,326	0.20%
Electric	448	0.01%
Flex	1,221	0.02%
Gasoline	5,545,460	99.72%
Propane	44	0.00%
Other	422	0.01%
Unknown/Blank	1,089	0.02%

Further processing of this category requires removal of various registration types such as “84”, “85”, or “86” (trailers), and “63” (in transit) which represent counts for registered vehicles other than on-road passenger cars. Other registration types that need to be identified and removed include contradictory registration types such as codes corresponding to motorcycles, busses, trucks, and tractor trailers, as examples. Removing additional records consisting of invalid county identifiers and fuel types “other” and “unknown” (62,551 records removed), provides a final total of 5,498,311 passenger cars in NYS, for emission inventory year 2007, under MOVES source type 21.

11.6 Source Type IDs 31- Passenger Truck & 32 - Light Commercial Truck

The body types that are part of these two groups are #12 Suburban, #63 Pick-up Truck, and #68 Van Trucks up to 10,000lbs Gross Vehicle Weight Rating (GVWR). The trucks are separated into the appropriate source types of passenger or commercial based on corresponding registration codes. All vehicles of these body types having an estimated gross weight greater than 10,000 lbs. will be counted as source type ID 52, Single Unit/Short-Haul trucks, regardless of their registration code. There are a total of 4,604,056 Pick-ups, Suburbans, and Vans in the database. These are shown in Table 11.9.

Table 11.9 Light Commercial Trucks		
PASSENGER/COMMERCIAL TRUCKS (Body Types 12, 63, 68)		
DMV FUEL TYPE	COUNT	PERCENTAGE
CNG	804	0.02%
Diesel	127,684	2.77%
Electric	161	0.00%
Flex	1,362	0.03%
Gasoline	4,472,598	97.14%
Propane	171	0.00%
Other	253	0.01%
Unknown/Blank	1023	0.02%

Further processing of this category requires removal of 68,629 vehicles with an estimated gross weight greater than 10,000 lbs which are added to MOVES source type ID 52. Commercial registration codes are used to separate out commercial trucks from the three valid body types for vehicles with an estimated gross weight of 10,000 lbs. or less. Registration types such as “84”, “85”, or “86” (trailers), and “63” (in transit) which represent counts for registered vehicles other than on-road passenger trucks are removed. Registration codes are also used to identify and remove contradictory registration types such as codes corresponding to motorcycles, busses, and tractor trailers, as examples. Removing additional records consisting of invalid county identifiers and fuel types “other” and “unknown” (48,798 records removed), provides a final total of 3,667,233 passenger trucks (MOVES source type ID 31) and 819,396 commercial trucks (MOVES source type ID 32) in NYS, for emission inventory year 2007.

11.7 Source Type ID 41 - Intercity Busses, 42 - Transit Busses, & 43 - School Busses

The Body Type that is used for busses is #90 Bus (Omnibus). There are 85,858 Busses registered in New York State. Table 11.10 lists the number of vehicles with the various registration types. Table 11.11 lists busses by fuel type.

Table 11.10 Bus Registration Types		
BUSSES (Body Type 90)		
Number of Vehicles	Registration Type	
59,390	Political Subdivision (Municipal or Thruway)	69.17%
22,403	Omnibus (regular)	26.09%
2,698	School Car	3.14%
478	Omnibus (vanity + livery)	0.56%
301	International Reg Plan	0.35%
172	State Agencies	0.20%
113	Commercial (Regular)	0.13%
95	Omnibus (Public Service)	0.11%
42	Omnibus (Taxi)	0.05%
90	Passenger or Suburban (Regular)	0.10%
30	Omnibus (Special)	0.03%
26	Farm/Ag	0.03%
18	Historical	0.02%
2	Other	0.00%

Table 11.11 Bus Fuel Types		
Busses (Body Type 90)		
DMV FUEL	COUNT	PERCENTAGE
CNG	909	1.06%
Diesel	64,178	74.75%
Electric	508	0.59%
Flex	25	0.03%
Gasoline	19,667	22.91%
Propane	2	0.00%
Other	462	0.54%
Unknown/Blank	107	0.12%

Further processing of this category requires removal of various registration types such as “84”, “85”, or “86” (trailers), and “63” (in transit) which represent counts for registered vehicles other than on-road passenger cars. Other registration types that need to be identified and removed include contradictory registration types such as codes corresponding to motorcycles, trucks, and tractor trailers, as examples. Removing additional records consisting of invalid county identifiers and fuel types “other” and “unknown” (1,423 records removed), provides a final total of 84,426 busses.

Additional segregation of the valid vehicle count is necessary to separate busses into source type ID’s 41 - Intercity (5,882), 42 - Transit (19,993) and 43 - School (58,551). This step requires reapportioning busses by registration type and vehicle color (“YW” = yellow) for all valid records, as provided in Table 11.12 below.

Table 11.12 Bus Reapportion by Registration and Color

BUSSES	INTERCITY	TRANSIT	SCHOOL	# of Records
Registration Type [#]	Src ID 41	Src ID 42	Src ID 43	Removed
Political Subdivision [88]	0	19,899	38,340	1,151
Omnibus (regular) [56]	4,763	0	17,640	0
School Car [19]	0	0	2,571	127
Omnibus (vanity + livery) [55, 57]	469	0	0	9
International Reg Plan [70]	301	0	0	0
State Agencies [77]	172	0	0	0
Commercial (Regular) [76]	111	0	0	2
Omnibus (Public Service) [53]	0	94	0	1
Omnibus (Taxi) [54]	42	0	0	0
Passenger or Suburban (Regular) [16]	0	0	0	90
Omnibus (Special) [52]	24	0	0	6
Farm/Ag [46, 72]	0	0	0	26
Historical [21]	0	0	0	18
Other [10, 69]	0	0	0	2
Totals	5,882	19,993	58,551	1,432

For comparison, in *School Bus Fleet Magazine 2001 Fact Book* there are 22,497 District-owned busses and 23,000 Contractor-owned busses for a total of 45,497 school busses in NY State. The *2007 National Transit Database* lists 9,288 transit busses in NY State.

11.8 Source Type ID 51 - Refuse Trucks

There is no Body or Registration Type that corresponds to any type of Garbage or Refuse trucks. It was therefore not possible to pick them out of the 2007 database with any type of certainty. New York will continue to work on identifying methods for accurately segregating, from other source types, vehicle counts associated with MOVES source type 51 - Refuse Trucks in future efforts.

11.9 Source Type ID 52 - Single Unit Short-Haul & 53 - Long-Haul Trucks

There are several truck types that will have a portion of the registered vehicles fall into the Single Unit Truck Category. These Body Types are #09 Fire, #39 Ambulance, #45 Sand Spreaders, #46 Snow Plows, #51 Truck Cranes, #52 Small Wheel Truck, #53 Well Driller, #54 Well Servicing Rig, #60 Delivery Truck, #61 Dump Truck, #62 Flat Bed Truck, #64 Stake Truck, #65 Tank Truck, #66 Refrigerated Truck, #67 Tow Truck, #70 Utility Truck, #95 Cement Mixer. There were 314,689 of these vehicle body types in New York in 2007. These are shown in Table 11.13.

Table 11.13 Single Unit Short-Haul Trucks		
Single Unit, Short-Haul Trucks (Body Type 09, 39, 45, 46, 51, 52, 53, 54, 60, 61, 62, 64, 65, 66, 67, 70, 95 & overweight 12, 63, 68)		
DMV FUEL	COUNT	PERCENTAGE
CNG	25	0.01%
Diesel	199,657	63.45%
Electric	71	0.02%
Flex	21	0.01%
Gasoline	112,199	35.65%
Propane	333	0.11%
Other	105	0.03%
Unknown/Blank	2,278	0.72%

Further processing of this category requires removal of various registration types such as “84”, “85”, or “86” (trailers), and “63” (in transit) which represent counts for registered vehicles other than on-road passenger cars. 68,629 total overweight trucks have to also be added and processed to remove invalid records resulting in 64,982 valid records from the passenger and light commercial truck categories.

Because NYSDEC does not have data that would indicate if a vehicle was of a long-haul or short-haul variety, all single unit trucks will be modeled as the short-haul variety in much the same way that all combination unit trucks are being modeled as long-haul. Therefore, there are 280,654 trucks registered in New York, for emission inventory year 2007, under MOVES source type 52.

11.10 Source Type ID 54 - Motor Homes

The Body Types of #15 “House on Wheels” will be allocated to Motor Homes. There are 29,384 vehicles with a Body Type of #15. These are shown in Table 11.14.

Table 11.14 Motor Homes		
MOTOR HOMES (Body Type 15)		
DMV FUEL	COUNT	PERCENTAGE
CNG	1	0.00%
Diesel	3,352	11.41%
Electric	0	0.00%
Flex	6	0.02%
Gasoline	25,465	86.66%
Propane	0	0.00%
Other	0	0.00%
Unknown/Blank	560	1.91%

Further processing of this category requires removal of various registration types such as “84”, “85”, or “86” (trailers), and “63” (in transit) which represent counts for registered vehicles other than on-road motor homes. Other registration types that need to be identified and removed include contradictory registration types such as codes corresponding to motorcycles, busses, and tractor trailers, as examples. Removing additional records consisting of invalid county identifiers and fuel types “other” and “unknown” (646 records removed), provides a final total of 28,738 motor homes registered in New York, for emission inventory year 2007, under MOVES source type 54.

11.11 Source Type ID 61 - Combination Short-Haul & 62 - Long-Haul Trucks

Body Type 58 “Tractor” is the only body type being used for either of the combination type trucks. Because NYSDEC does not have data that would indicate if a vehicle was of a long-haul or short-haul variety, all combination trucks will be modeled as the long-haul variety in much the same way that all single unit trucks are being modeled as short-haul. There are 38,733 vehicles of this body type in the database. These are shown in Table 11.15.

Table 11.15 Combination Long-Haul Trucks		
Combination Long-Haul Trucks (Body Type 58)		
DMV FUEL	COUNT	PERCENTAGE
CNG	0	0.00%
Diesel	36,861	95.17%
Electric	3	0.01%
Flex	2	0.01%
Gasoline	1,849	4.77%
Propane	0	0.00%
Other	0	0.00%
Unknown/Blank	18	0.05%

Further processing of this category for removal of various registration types such as “84”, “85”, or “86” (trailers), and “63” (in transit) or for other types inconsistent with this category resulted in no invalid matches for combination trucks. Removing additional records consisting of invalid county identifiers and fuel types “other” and “unknown” (135 records removed), provides a final total of 38,598 combination long-haul trucks registered in New York, for emission inventory year 2007, under MOVES source type 62.

12.0 QA/QC

Quality assurance (QA) is the systematic measurement, comparison with a standard, monitoring of processes and an associated feedback loop that confers error prevention. By getting the on-road model inputs right most mistakes should be eliminated. QA for on-road inventory development includes management of the model inputs. Through the interagency consultation process defined under the transportation conformity regulation and regional inventory efforts, NYSDEC accomplishes high levels of input QA by sharing information with our partners. Through this process NYSDEC receives feedback that is used to make all necessary adjustments to the model inputs. For this inventory, our partners included all of the state’s municipal planning organizations, the NYSDOT, the Federal Highway Administration, the Federal Transit Administration, the EPA (regional staff and staff from the Office of Transportation and Air Quality), other state agencies and regional organizations.

QA can be contrasted with Quality Control (QC) which is focused on process outputs. In developing the on-road inventory through the MOVES model NYSDEC staff, along with its many partners, relied on inspection of the completed inventories to ensure its alignment with expected outcomes. For this effort multiple iterations of the inventory were developed, and adjustments were made based on output inconsistencies found through comparison of NYSDEC's data with other state inventories. In some instances this output QC resulted in changes to the input, in how the model was run and in adjustments to post processing scripts, all of which resulted in a better quality inventory.

While there are levels of uncertainty associated with every component an inventory, the NYSDEC believes that by applying QA/QC procedures throughout every step of the process we are developing the best inventory possible. NYSDEC further believes that by inspecting both the inputs to the model and the inventory outputs and by sharing both during inventory development we are constantly able to improve on our emissions results.

Attachment 3

SPEED METHODOLOGY MEMO FROM NYSDOT

SPEED ESTIMATES FOR USE IN

1994 AIR QUALITY STATE IMPLEMENTATION PLAN

October 24, 1994

by GUNNAR HALL, Associate Transportation Analyst
PLANNING DIVISION
NEW YORK STATE DEPARTMENT OF TRANSPORTATION

CONTENTS

1. OVERVIEW

This report documents the procedures, data sources and estimated highway speeds for 1990 through 2007, needed for this year's update of the Air Quality State Implementation Plan. A Lotus worksheet was prepared to carry out the necessary calculations. The average highway speeds for 1990, 1996, 1999, 2002, 2005 and 2007 for selected urban areas and the rest of the State are presented at the end of the report.

The NYS Department of Environmental Conservation requested the speeds for six urban and six rural functional classes, in four time periods (morning, day, evening and night) for each geographic area.

Speeds have changed from last year's submission for four major reasons: 1) The requested time periods - morning, day, evening and night - are different from those used last year - prime time and off-prime for the New York Metropolitan area; peak, off-peak, midday and midnight for upstate areas. 2) 12 functional classes are used, versus 6 functional class groups last year. 3) Additional speed and VMT data was obtained from urban areas with a functioning urban transportation model, and finally 4) The speed estimation procedure is

more directly tied to procedures recommended in the current Highway Capacity Manual, while consistency with last year's results have been attempted.

Speeds are determined for each time period through a number of successive steps that will be described in detail below. A general outline of the procedure is shown in Table 1. It may be useful for quick reference when the details have become familiar.

TABLE 1: SUMMARY REVIEW OF SPEED ESTIMATION PROCEDURE	
1	**Speed data for a base and a future year is collected from Metropolitan Planning Organizations (MPOs) that maintain urban transportation network analysis models. Upstate MPOs provide peak hour and off-peak hour speeds for all functional classes; the NYMTC provides 24 hour average speeds for three functional class groups for the New York metropolitan area (NYA).**
2	**Speeds for intermediate years are linearly interpolated between the base and future years.**
3	**The relationship between speed and the volume-capacity ratio (vcr) for different functional classes are identified from the 1985 Highway-Capacity Manual (HCM) and other sources. While these relationships are given in different forms, and converted to equations in the final speed calculation worksheet, they are referred to here as the HCM speed-vcr curves.**
4	**Speeds are described as initial, preliminary and final speeds. Initial speeds are read or computed directly from the HCM speed-vcr curves. Preliminary speeds are generally proportional to the initial speeds obtained from the HCM speed curves. The final speeds are based on adjustments of the preliminary speeds to reflect differences between MPO model and HCM based off-peak speed data. Final speeds are the speeds presented in the worksheet.**
5	**The peak hour vcr for freeways and expressways in upstate areas is estimated from the peak hour speed and HCM curves. The HCM speed-vcr curves were designed for individual facilities rather than for systems (functional classes) with a variety of different facilities. However, interstates and freeways are designed to similar standards everywhere and therefore, the freeway speed-vcr curves should closely match actual speeds.**
6	**The peak hour vcr for upstate urban and rural freeways provide reference points from which the vcr and corresponding speeds for each time period is determined. For urban arterial, collector and local systems, the volume capacity ratio at peak periods have been assumed to be the same as the freeway vcr. In rural areas these speed-vcr relationships are linear and speeds can be determined directly from the**

	peak and off-peak data supplied by the MPOs.
7	**In the NYA, traffic during the evening period is assumed to equal capacity for all functional class systems except for freeways in Suffolk, Westchester, & Rockland where the evening peak vcr is assumed equal .9 and in Putnam where .8 is assumed. Evening speed is then read from the HCM curves.**
8	**The vcr for a requested time period is related to peak hour or peak period vcr through the known temporal distribution of VMT. With vcr calculated, the speed-vcr curve allows the calculation of initial speeds.**
9	**In the NYA and for upstate arterial and local systems, preliminary speeds are assumed to be proportional to, but not the same as the initial speeds obtained directly from the HCM speed-vcr relationships.**
10	**In the NYA, preliminary speeds are computed as functions of the 24 hour average speeds obtained from the NYMTC model, the initial time period speeds read from the HCM speed-vcr curve and the computed 24 hour average speeds based on these initial period speeds.**
11	**Upstate, the preliminary speeds are calculated as a function of the peak period speed obtained from the MPO models, the initial time period speeds and the initial peak period speed computed from the HCM speed-vcr curves.**
12	**In the NYA, the 24 hour average speeds in each county were available for only three functional classes. To estimate speeds by the required 6 functional classes, the distribution of VMT between functional classes were obtained from HPMS data. A speed difference between the two functional classes represented in each functional class group was assumed: The average speed in the lower functional class was assumed to be 95% of the average speed in the higher functional class.**
13	**To calculate the 24 hour average speeds from HCM, a selected vmt is divided by the total travel time for that vmt for all time periods, in both functional classes included in a functional class group.**
14	**Adjustments to preliminary upstate speeds are made to insure that estimated off-peak speeds are consistent with off-peak speed data submitted by the MPOs. The off-peak vcr was determined from the assumptions made by the MPOs for computing these speeds. Initial and preliminary off-peak speeds were then estimated based on the HCM speed-vcr curves.**
15	**The adjustment factor is applied to the difference between the peak period speed and the preliminary speed calculated for any given time period. At the peak hour, no adjustment is needed, since at this point the HCM initial speed is the reported or assumed speed.**

2. DATA COLLECTED IN 1994

Estimates of highway speeds by 6 urban and 6 rural functional classes were requested from New York's Metropolitan Planning Organizations (MPOs) on February 17 (Attachment 2). These organizations maintain urban transportation network analysis models designed to estimate such speeds for the facilities included in their coded network. These networks include arterial and freeway facilities and most major collectors but do not include a representative sample of minor collectors or local roads.

Upstate MPOs provide peak hour and off-peak hour speeds for all functional classes represented; the NYMTC provides 24 hour average speeds for three groups of two functional classes each in the New York metropolitan area (NYA). For functional classes not adequately represented in their analysis models, some MPOs provided speed estimates, others did not. The speed estimates received was examined and generally accepted. Default values estimated based on speed data provided in other areas were used in a few cases when speeds were omitted or apparently unreasonable, as follows:

system	peak hour speed	off-peak speed
CDTC, urb, local rur, local		25 25
NFTS, rur, maj. collectors min. collectors local	40 35 30	45 40 35
BMTS	last year's data	last year's data

Speeds for the 1990 base year were provided by all MPOs; future year speeds were generally for the year of their "planning horizon" (2010 or 2015). The differences in present and future speeds were generally small and the selected linear interpolation of given speeds for the necessary forecast years should give reasonable results.

3. TIME PERIODS

The specific hours of the day included in each time period were suggested by DEC, as indicated in Attachment 1: Time of Day Factors used to Estimate Hourly VMT. The temporal distri-bution of travel by hour of the day shown in this attachment for the New York metropolitan area was developed by NYMTC and reflect survey results of the Nationwide Personal Transportation Study. The distribution shown for upstate urban and upstate rural areas was supplied by DOT Data Services Bureau. These data items are described in a memo from Cohen to Cioffi, dated 5/26/92.

Table 1 summarizes this data by the four requested time periods and for the peak hour:

TABLE 2: PERCENT OF VMT PER DAY

Time Period	No of Hours	N.Y. Metro Area	No of Hour s	Upstate Urban	Upstate Rural
Morning	5	23.0%	4	17.0%	21.7%
Day	4	21.0%	6	36.7%	30.2%
Evening	5	40.6%	3	23.4%	25.0%
Night	10	15.3%	11	23.9%	23.1%
Peak hour vmt	1	8.8%	1	8.2%	8.9%

4. SPEED - TRAVEL VOLUME RELATIONSHIPS

The relationship between speed and the volume-capacity ratio (vcr) for the facility types typical of each functional class was identified from the 1985 Highway-Capacity Manual (HCM) and other sources. These relationships are given in different forms, and converted to equations in the final speed calculation worksheet. Seven facility types were used:

for freeways and expressways in the New York Metro area;

B. Freeways with 70mph design speed, 4 lanes (HCM, figure 3-4),
for upstate urban and rural freeways, urban expressways and rural principal arterials;

C. Urban arterials with 10 signals per mile (HCM, table 11-9),
for principal and minor arterials in Manhatten;
D. Urban arterials with 5 signals per mile (HCM, table 11-8),
for arterials in urban areas other than Manhatten, and
for collectors and local streets in the New York Metro area;
E. Rural arterials with 55mph max speed (HCM 1965, figure 10-1),
for rural minor arterials and major collectors;
F. Urban streets (HCM 1965, figure 10-3),
for urban collectors and local streets outside NYA;
G. Local roads with 45mph max speed (HCM 1965, figure 10-1),
for rural minor collectors and local roads.

As noted, some of these relationships are given by tables and some are given graphically. Each of these were converted into one or two algebraic equations for use in the worksheet as follows:

TABLE 3: SPEED-VCR RELATIONSHIPS	
A	prelim. spd read directly from HCM figure 3-4 (since NYA vcr is assumed)
B	spd = 30 + (50000*(1-vcr))^.333 for .80 < vcr <= 1 spd = 60 - 1.46*vcr - 11.46*vcr^2 for 0 < vcr < .80
C	prelim. spd read directly from HCM table 11-9 (since NYA ref.vcr=1)
D	spd = 12.8 + 21*(1-vcr)^.65 for .74 < vcr <= 1 spd = 12.8 + 12*(1-vcr)^.30 for 0 < vcr < .75
E	spd = 55 - 25*vcr
F	spd = 15 + 24.4*(1-vcr)^.48 for .65 < vcr <= 1 spd = 17 + 15*(1-vcr)^.14 for 0 < vcr < .65 NYA prelim. spd read directly from HCM(65) fig 10-1 (since ref.vcr=1)
G	spd = 45 - 25*vcr

5. NOTES ON SPEED CALCULATIONS

With speeds the basic input data source, a reference point in the speed-vcr curve is needed in order to use them to determine the average speeds in the desired time periods. In upstate urban and rural areas, the urban transportation models determined the peak hour

speed for each functional class (speeds in the "rest of the State" are assumed to equal speeds in the Binghamton urban area). With this speed, the corresponding vcr is determined, using the assumed relationships.

In the New York metropolitan area, the NYMTC highway evaluation model (HEM) determine the 24 hour average speed, which can not be related to a point on the speed-vcr curves. However, in this area we know that most of the highway system operates near capacity levels in the evening peak period. For freeways and expressways within the city, a peak period volume capacity ratio of 1 is assumed. In Suffolk, Westchester and Rockland counties, vcr=.9 was assumed and in Putnam county, vcr=.8. This deviation from a general vcr = 1 was needed to assure consistent reasonable speeds in other time periods. For other systems in the New York metropolitan area, the volume capacity ratio of 1 is assumed since this will only impact differences in speed between time periods but not their average value. With the vcr assumed we have a reference point on the speed-vcr curve.

The Volume Capacity Ratio for a requested time period is related to peak vcr through the known temporal distribution of VMT. From the data given in Table 1 above, the VMT per hour is calculated for any system, with an assumed total VMT of 100,000 per day. Since the physical capacity of the system is the same in all time periods, the vcr for a requested time period equals the vcr computed or known for the peak period multiplied by the ratio of hourly volumes in the given time period and the peak period.

From the vcr for a given time period, an initial or preliminary average speed for that period is computed from the formulas shown in Table 2 above. In the NYA and for upstate arterial and local systems, where preliminary speeds are assumed to be proportional to, but not the same as the speeds obtained from the HCM speed-vcr relationships, preliminary speeds are computed from the following relationship:

upstate:

SPEED(period) = SPEED(peak) * SPEED(period,HCM) / SPEED(peak,HCM)

in the NYA:

SPEED(period) = SPEED(24hr ave) * SPEED(period,HCM) / SPEED(24hr ave, HCM)

where

SPEED(period) = preliminary speed computed for a given time period.
SPEED(period,HCM) = initial speed for the time period from the HCM curves.
SPEED(peak) = known peak hour speed obtained from urban models.
SPEED(peak,HCM) = initial peak speed estimated from the HCM curves,

using the peak vcr estimated for freeways.
SPEED(24hr ave) = 24 hour average speed in the NYA, from NYMTC.
SPEED(24hr ave,HCM) = initial 24 hour average speed from HCM relationships, estimated by dividing a selected daily level of VMT by the corresponding number of hours travelled, at the initial speeds in all time periods.

To calculate the 24 hour average speeds from HCM, a selected vmt is divided by the total travel time for that vmt for all time periods, in both functional classes included in a functional class group.

The numerator and denominator in the formula for the period speed of a given system may use different formulas from Table 2 when the vcr for the peak and the desired time period straddle the validity range limit. Thus, the formulas used to calculate, say evening speeds for upstate urban arterials, may not be the same for all upstate urban areas.

In the NYA, the 24 hour average speeds in each county were available for only three functional classes. To estimate speeds by the required 6 functional classes, the distribution of VMT between functional classes were obtained from HPMS data and a speed difference between the two functional classes represented in each functional class group was made: The average speed in the lower functional class was assumed to be 95% of the average speed in the higher functional class.

Adjustments to preliminary speeds are made to insure that estimated off-peak speeds are consistent with off-peak speed data submitted by the MPOs. First, the volume capacity ratios corresponding to the off-peak speeds were determined. The MPOs defined off-peak speeds in different ways and therefore, the vcr for off-peak speeds varied by geographic area. The Capital District and Rochester urban area transportation systems were modeled using 38% of peak hour trips to obtain off-peak speeds. Thus off-peak vcr was assumed to be 38% of peak hour vcr. Syracuse used 50% of peak hour trips to obtain off-peak speeds. Buffalo determined off-peak speeds based on free-flow conditions, so for this area the off-peak vcr was assumed equal to zero.

Given the off-peak vcr, an off-peak speed based on the HCM speed-vcr curve is easily determined. At this vcr, the final adjustment is simply this HCM speed estimate less the MPO based off-peak speed. For other time periods the adjustment depend on the difference in estimated time period speed and the peak hour speed.

The preliminary speeds for the four desired time periods are adjusted using a speed multiplication factor. This factor is the difference between the off-peak speed as calculated from the HCM curves at the off-peak vcr and the assumed correct off-peak speed reported by the MPOs, divided by the difference in estimated off-peak and peak hour speeds,

multiplied by the difference in estimated preliminary time period speed and the peak hour speed. At the peak hour, the adjustment is zero; for the off-peak vcr, the adjustment is as calculated above.

6. ACTUAL COMPUTATIONS

Attachment 3 illustrates how the computations discussed above are carried out in the worksheet.

Pages 3a through 3d show a section of the worksheet with all formulas used for the calculation of night, morning, day and evening speeds for urban functional classes in the Capital District. All data elements used in these calculations are shown and referenced to their location.

Pages 3e through 3g similarly show a section from the New York Metropolitan Area. The data given above row 141 and to the right of column R is not shown in the final printout of results. As noted above, the procedure and formulas used are different from those used in upstate urban areas.

7. WORKSHEET ORIENTATION

A. Final Results and Printouts:

a16....r65	**Upstate urban areas of Capital District, Syracuse and Rochester**
a66...r112	**Upstate urban areas of Buffalo and Binghamton**
a153..q207	**New York Metropolitan Area; Manhatten, Bronx, Kings, Queens, Richmond, Nassau, Suffolk**
a208..q232	**New York Metropolitan Area; Westchester, Rockland, Putnam.**
a233..r248	**Rest of State.**

B. Data Required for Worksheet Operation

a8.....r15	**Upstate VMT and Time Period data**
s17...w112	**Upstate Peak and Off-Peak Speeds, 1990 and horizon year; adjustment factors.**
x16...y112	**Upstate Off-peak adjustments DMAX; estimate years.**
a116..l151	**Downstate VMT and Initial Speed data**
s153..v230	**Downstate 24 hour speeds, 1990, 1996, 2005, 2015.**
w153.aa230	**Downstate hours travelled, by time period and total.**
aa97..ae112	**Peak and Off-Peak Speeds and VMT data for Binghamton**

C. Speed Calculation Factors and Formulas (not printed)

a254..k342	**Upstate general data, Freeways and Expressways, Arterials, Local Roads and Streets**
a346..l364	**Downstate general data, Freeways and Expressways, Arterials, Local Roads and Streets**

D. Miscellaneous (not printed)

b1......c8	**Print Macros \p, \r, \i, \n**
e1......r6	**Formulas used**
z1....aw21	**Formula development**

8. RESULTS

1990, 1996	**Capital District, Syracuse, Rochester**	**T1**
	Buffalo, Binghamton	**T2**
	NYA: New York City; Nassau, Suffolk	**T3**
	NYA: Westchester, Rockland, Putnam, Rest of State	**T4**
1999, 2002	**Capital District, Syracuse, Rochester**	**T5**
	Buffalo, Binghamton	**T6**
	NYA: New York City; Nassau, Suffolk	**T7**
	NYA: Westchester, Rockland, Putnam, Rest of State	**T8**
2005, 2007	**Capital District, Syracuse, Rochester**	**T9**
	Buffalo, Binghamton	**T10**
	NYA: New York City; Nassau, Suffolk	**T11**
	NYA: Westchester, Rockland, Putnam, Rest of State	**T12**

TO: J. Ralston, NYSDEC

FROM: G. J. Cioffi, Urban Planning Section, 4-206

SUBJECT: SPEED ESTIMATES FOR AIR QUALITY STATE IMPLEMENTATION PLAN

DATE: November 4, 1994

Attached for your use are average highway travel speeds for 1990, 1996, 1999, 2002, 2005 and 2007; they are presented in the attached report "Speed Estimates for use in 1994 Air Quality State Implementation Plan". The speed data was developed using the functional classes, geographic breakdown and time periods requested (four time periods; 12 functional classes; selected urban areas and rest of State).

A draft of this report, dated June 15, was sent to you on August 26 by Mike Fay. The major changes from the draft are described on a separate, attached sheet. The new grouping of VMT by morning, day, evening and night in the New York Metropolitan area resulted in significant changes in the corresponding speeds. Other changes had minor impacts, but were included to improve the general quality of the report.

The report documents the procedures and data sources used to calculate these speeds. A Lotus worksheet named 94SPEEDS.WK3 was prepared to carry out the necessary calculations. It shows precisely how the speed data was developed and is included to clarify any procedures that may have been inadequately described in the attached documentation. We hope that it addresses the relevant issues regarding speeds for the SIP analysis. If you have further concerns, please call.

Attachments

cc: R. Tweedie, Data Services Bureau, 4-115
J. Zamurs, Envir. Analysis Bureau, 5-303
N. Erlbaum, Data Services Bur., 4-115
G. Hall, Urban Planning Section, 4-207

TO REVIEWERS OF JUNE 15 DRAFT:

The major changes from the previous draft of this report are as follows:

1. **The temporal distribution of VMT in the New York Metropolitan Area and the grouping of VMT by morning, day, evening and night has changed. This affected all speed estimates for all counties in the New York area. The revised temporal distribution is summarized in Table 2 on page 6 and included in Attachment 1.**

2. **Page 4, first paragraph and Page 8, first paragraph: With the evening peak period now 5 hours, it has been assumed that freeways and expressways in Suffolk, Westchester and Rockland counties have an average vcr = .9 during the evening peak and in Putnam county, vcr = .8. This deviation from the previously used assumption of vcr = 1 for all systems in the metropolitan area was needed to assure consistent and reasonable speeds in non-peak time periods. For other systems, the assumed vcr = 1 is retained since the assumed volume capacity ratios will only impact differences in speed between time periods and not their average level.**

3. **The speed - volume relationship for arterials in the New York Metropolitan area counties outside Manhattan has been changed to follow Table 11-8 (Table 11-9 was used before) of the highway capacity manual. Table 11-8 is also used for urban collectors and streets in these counties. This is stated on page 6, section 4 C & D and reflected in the tables of section 12.**

   These changes result in final speed estimates that more closely conform with earlier estimates by NYMTC.

4. **An attempted clarification of Table 1, section 4 on page 3. A typographic correction of the same table, in section 12 last line to read: 95% rather than 90%.**

5. **Miscellaneous minor wording and cosmetic changes.**

Attachment 4

SPEED TABLES

COUNTY	TIME PERIOD	R_INT	R_PA	R_MNA	R_MJC	R_MNC	R_LCL	U_INT	U_EXP	U_PA	U_MNA	U_MJC	U_LCL	YEAR
New York	Night	NA	NA	NA	NA	NA	NA	37.8	35.9	12.1	11.5	5.6	5.4	1990
New York	Morning	NA	NA	NA	NA	NA	NA	34.0	32.3	11.5	10.9	5.5	5.2	1990
New York	Daytime	NA	NA	NA	NA	NA	NA	32.9	31.3	11.1	10.5	5.3	5.1	1990
New York	Evening	NA	NA	NA	NA	NA	NA	21.7	20.6	5.2	4.9	3.0	2.9	1990
Kings	Night	NA	NA	NA	NA	NA	NA	48.8	46.3	21.2	20.1	11.4	10.9	1990
Kings	Morning	NA	NA	NA	NA	NA	NA	43.8	41.6	20.6	19.5	11.1	10.5	1990
Kings	Daytime	NA	NA	NA	NA	NA	NA	42.5	40.3	20.0	19.0	10.8	10.3	1990
Kings	Evening	NA	NA	NA	NA	NA	NA	28.0	26.6	11.4	10.9	6.2	5.9	1990
Queens	Night	NA	NA	NA	NA	NA	NA	47.5	45.1	20.4	19.3	12.5	11.8	1990
Queens	Morning	NA	NA	NA	NA	NA	NA	42.6	40.5	19.8	18.8	12.1	11.5	1990
Queens	Daytime	NA	NA	NA	NA	NA	NA	41.3	39.3	19.2	18.3	11.8	11.2	1990
Queens	Evening	NA	NA	NA	NA	NA	NA	27.3	25.9	11.0	10.4	6.7	6.4	1990
Bronx	Night	NA	NA	NA	NA	NA	NA	51.2	48.6	22.9	21.8	12.8	12.1	1990
Bronx	Morning	NA	NA	NA	NA	NA	NA	46.0	43.7	22.3	21.1	12.4	11.8	1990
Bronx	Daytime	NA	NA	NA	NA	NA	NA	44.6	42.3	21.7	20.6	12.1	11.5	1990
Bronx	Evening	NA	NA	NA	NA	NA	NA	29.4	27.9	12.4	11.8	6.9	6.5	1990
Richmond	Night	NA	NA	NA	NA	NA	NA	54.7	51.9	25.5	24.2	14.5	13.8	1990
Richmond	Morning	NA	NA	NA	NA	NA	NA	49.1	46.6	24.7	23.5	14.1	13.4	1990
Richmond	Daytime	NA	NA	NA	NA	NA	NA	47.6	45.2	24.1	22.9	13.7	13.0	1990
Richmond	Evening	NA	NA	NA	NA	NA	NA	31.4	29.8	13.8	13.1	7.8	7.5	1990
Nassau	Night	NA	NA	NA	NA	NA	NA	50.7	48.1	21.2	20.2	13.6	12.9	1990
Nassau	Morning	NA	NA	NA	NA	NA	NA	45.5	43.2	20.6	19.6	13.2	12.5	1990
Nassau	Daytime	NA	NA	NA	NA	NA	NA	44.1	41.9	20.1	19.1	12.8	12.2	1990
Nassau	Evening	NA	NA	NA	NA	NA	NA	29.1	27.6	11.5	10.9	7.3	7.0	1990
Suffolk	Night	55.2	52.4	29.3	27.8	18.2	17.3	55.2	52.4	29.3	27.8	18.2	17.3	1990
Suffolk	Morning	49.6	47.2	28.4	27.0	17.7	16.8	49.6	47.2	28.4	27.0	17.7	16.8	1990
Suffolk	Daytime	48.1	45.7	27.7	26.3	17.2	16.3	48.1	45.7	27.7	26.3	17.2	16.3	1990
Suffolk	Evening	39.1	37.2	15.8	15.0	9.8	9.3	39.1	37.2	15.8	15.0	9.8	9.3	1990
Westchester	Night	53.9	51.2	28.5	27.0	17.1	16.2	53.9	51.2	28.5	27.0	17.1	16.2	1990
Westchester	Morning	48.5	46.1	27.6	26.2	16.6	15.7	48.5	46.1	27.6	26.2	16.6	15.7	1990
Westchester	Daytime	47.1	44.7	26.9	25.6	16.1	15.3	47.1	44.7	26.9	25.6	16.1	15.3	1990
Westchester	Evening	38.2	36.3	15.4	14.6	9.2	8.8	38.2	36.3	15.4	14.6	9.2	8.8	1990
Rockland	Night	54.6	51.9	30.1	28.6	18.2	17.3	54.6	51.9	30.1	28.6	18.2	17.3	1990
Rockland	Morning	49.1	46.7	29.2	27.7	17.7	16.8	49.1	46.7	29.2	27.7	17.7	16.8	1990
Rockland	Daytime	47.7	45.3	28.4	27.0	17.2	16.4	47.7	45.3	28.4	27.0	17.2	16.4	1990
Rockland	Evening	38.7	36.8	16.2	15.4	9.8	9.3	38.7	36.8	16.2	15.4	9.8	9.3	1990
Putnam	Night	59.9	56.9	39.6	37.6	23.9	22.7	59.9	56.9	39.6	37.6	23.9	22.7	1990
Putnam	Morning	55.0	52.2	38.4	36.5	23.2	22.0	55.0	52.2	38.4	36.5	23.2	22.0	1990
Putnam	Daytime	53.9	51.2	37.4	35.6	22.6	21.4	53.9	51.2	37.4	35.6	22.6	21.4	1990
Putnam	Evening	47.9	45.5	21.4	20.3	12.9	12.3	47.9	45.5	21.4	20.3	12.9	12.3	1990
Capital District	Night	59.5	54.4	44.5	44.5	39.2	26.2	57.8	57.8	38.0	31.6	28.2	25.2	1990
Capital District	Morning	57.9	53.0	43.3	43.3	38.6	23.1	56.1	56.1	36.0	30.3	27.8	24.8	1990
Capital District	Daytime	58.1	53.2	43.4	43.4	38.7	23.5	53.1	53.1	33.0	28.3	27.2	24.2	1990
Capital District	Evening	55.6	50.8	42.2	42.2	38.1	20.5	49.0	49.0	27.7	24.8	24.0	21.0	1990
Onondaga	Night	55.9	55.9	48.1	45.3	42.0	39.3	46.6	46.6	29.2	27.0	24.9	28.9	1990
Onondaga	Morning	54.5	54.5	46.3	44.1	40.7	39.1	46.0	46.0	28.5	26.4	24.6	28.7	1990
Onondaga	Daytime	54.7	54.7	46.5	44.2	40.9	39.1	44.7	44.7	27.5	25.5	24.2	28.3	1990
Onondaga	Evening	52.3	52.3	44.8	43.0	39.6	38.8	42.4	42.4	24.8	23.3	21.3	25.8	1990
Monroe	Night	54.2	49.8	49.0	43.1	38.9	32.4	49.5	49.5	30.3	29.8	28.3	19.3	1990
Monroe	Morning	53.8	48.8	46.4	42.5	38.7	32.4	48.6	48.6	29.5	29.2	28.1	19.3	1990
Monroe	Daytime	53.9	49.0	46.7	42.6	38.7	32.4	46.8	46.8	28.1	28.2	27.7	19.2	1990
Monroe	Evening	53.2	47.3	44.1	42.0	38.4	32.5	43.5	43.5	25.0	25.7	25.4	18.6	1990
Buffalo Area	Night	55.0	54.5	53.6	46.2	41.2	36.2	56.5	55.9	37.2	34.6	37.3	37.2	1990
Buffalo Area	Morning	55.0	54.4	50.9	43.1	38.1	33.1	55.7	55.1	36.5	34.0	37.1	37.0	1990
Buffalo Area	Daytime	55.0	54.4	51.2	43.5	38.5	33.5	54.1	53.8	35.4	33.1	36.8	36.7	1990
Buffalo Area	Evening	54.9	54.2	48.4	40.5	35.5	30.5	53.0	52.9	34.9	32.8	35.8	35.7	1990
Rest of State	Night	55.7	53.0	46.6	44.3	36.5	34.7	54.8	52.1	35.2	33.2	25.7	24.4	1990
Rest of State	Morning	55.7	53.0	46.0	43.7	36.5	34.7	54.4	51.7	33.7	32.2	25.4	24.1	1990
Rest of State	Daytime	55.7	53.0	46.1	43.8	36.5	34.7	53.5	51.0	31.6	30.7	24.8	23.7	1990
Rest of State	Evening	55.7	53.0	45.5	43.2	36.5	34.7	52.9	50.3	30.9	29.0	23.2	21.9	1990

1990 SPEEDS used for 1990-1992 modeling runs

Morning hours are 5am to 8am, Daytime hours are 9am to 2pm, Evening hours are 3pm to 5pm, and Night hours are 6pm to 4am

Capital District includes the counties of Albany, Rensselaer, Saratoga, and Schenectady

Bufalo Area includes the counties of Erie and Niagara

COUNTY	TIME PERIOD	R_INT	R_PA	R_MNA	R_MJC	R_MNC	R_LCL	U_INT	U_EXP	U_PA	U_MNA	U_MJC	U_LCL	YEAR
New York	Night	NA	NA	NA	NA	NA	NA	36.9	35.0	12.4	11.8	5.7	5.5	1995
New York	Morning	NA	NA	NA	NA	NA	NA	33.1	31.5	11.8	11.3	5.6	5.3	1995
New York	Daytime	NA	NA	NA	NA	NA	NA	32.1	30.5	11.4	10.8	5.4	5.2	1995
New York	Evening	NA	NA	NA	NA	NA	NA	21.2	20.1	5.3	5.1	3.1	2.9	1995
Kings	Night	NA	NA	NA	NA	NA	NA	48.3	45.9	20.9	19.9	11.3	10.8	1995
Kings	Morning	NA	NA	NA	NA	NA	NA	43.4	41.2	20.3	19.3	11.0	10.4	1995
Kings	Daytime	NA	NA	NA	NA	NA	NA	42.1	39.9	19.8	18.8	10.7	10.2	1995
Kings	Evening	NA	NA	NA	NA	NA	NA	27.7	26.3	11.3	10.7	6.1	5.8	1995
Queens	Night	NA	NA	NA	NA	NA	NA	47.1	44.7	20.1	19.1	12.3	11.7	1995
Queens	Morning	NA	NA	NA	NA	NA	NA	42.3	40.2	19.5	18.5	12.0	11.4	1995
Queens	Daytime	NA	NA	NA	NA	NA	NA	41.0	38.9	19.0	18.0	11.7	11.1	1995
Queens	Evening	NA	NA	NA	NA	NA	NA	27.0	25.7	10.8	10.3	6.7	6.3	1995
Bronx	Night	NA	NA	NA	NA	NA	NA	50.9	48.3	22.7	21.6	12.7	12.0	1995
Bronx	Morning	NA	NA	NA	NA	NA	NA	45.7	43.4	22.0	20.9	12.3	11.7	1995
Bronx	Daytime	NA	NA	NA	NA	NA	NA	44.3	42.1	21.5	20.4	12.0	11.4	1995
Bronx	Evening	NA	NA	NA	NA	NA	NA	29.2	27.7	12.3	11.7	6.8	6.5	1995
Richmond	Night	NA	NA	NA	NA	NA	NA	53.6	51.0	24.6	23.4	14.2	13.5	1995
Richmond	Morning	NA	NA	NA	NA	NA	NA	48.2	45.8	23.9	22.7	13.8	13.1	1995
Richmond	Daytime	NA	NA	NA	NA	NA	NA	46.7	44.3	23.3	22.1	13.4	12.8	1995
Richmond	Evening	NA	NA	NA	NA	NA	NA	30.8	29.3	13.3	12.6	7.7	7.3	1995
Nassau	Night	NA	NA	NA	NA	NA	NA	50.0	47.5	20.9	19.9	13.4	12.8	1995
Nassau	Morning	NA	NA	NA	NA	NA	NA	44.9	42.7	20.3	19.3	13.0	12.4	1995
Nassau	Daytime	NA	NA	NA	NA	NA	NA	43.6	41.4	19.8	18.8	12.7	12.1	1995
Nassau	Evening	NA	NA	NA	NA	NA	NA	28.7	27.3	11.3	10.7	7.3	6.9	1995
Suffolk	Night	54.4	51.7	28.7	27.3	17.9	17.1	54.4	51.7	28.7	27.3	17.9	17.1	1995
Suffolk	Morning	48.9	46.5	27.9	26.5	17.4	16.5	48.9	46.5	27.9	26.5	17.4	16.5	1995
Suffolk	Daytime	47.5	45.1	27.1	25.8	17.0	16.1	47.5	45.1	27.1	25.8	17.0	16.1	1995
Suffolk	Evening	38.6	36.6	15.5	14.7	9.7	9.2	38.6	36.6	15.5	14.7	9.7	9.2	1995
Westchester	Night	53.5	50.8	28.1	26.7	16.9	16.1	53.5	50.8	28.1	26.7	16.9	16.1	1995
Westchester	Morning	48.1	45.7	27.3	25.9	16.4	15.6	48.1	45.7	27.3	25.9	16.4	15.6	1995
Westchester	Daytime	46.7	44.3	26.6	25.2	16.0	15.2	46.7	44.3	26.6	25.2	16.0	15.2	1995
Westchester	Evening	37.9	36.0	15.2	14.4	9.1	8.7	37.9	36.0	15.2	14.4	9.1	8.7	1995
Rockland	Night	53.9	51.2	29.5	28.1	18.0	17.1	53.9	51.2	29.5	28.1	18.0	17.1	1995
Rockland	Morning	48.5	46.1	28.7	27.2	17.4	16.6	48.5	46.1	28.7	27.2	17.4	16.6	1995
Rockland	Daytime	47.0	44.7	27.9	26.5	17.0	16.1	47.0	44.7	27.9	26.5	17.0	16.1	1995
Rockland	Evening	38.2	36.3	15.9	15.2	9.7	9.2	38.2	36.3	15.9	15.2	9.7	9.2	1995
Putnam	Night	59.3	56.3	39.0	37.0	23.6	22.4	59.3	56.3	39.0	37.0	23.6	22.4	1995
Putnam	Morning	54.4	51.7	37.8	35.9	22.9	21.7	54.4	51.7	37.8	35.9	22.9	21.7	1995
Putnam	Daytime	53.3	50.7	36.8	35.0	22.3	21.2	53.3	50.7	36.8	35.0	22.3	21.2	1995
Putnam	Evening	47.4	45.0	21.0	20.0	12.7	12.1	47.4	45.0	21.0	20.0	12.7	12.1	1995
Capital District	Night	59.5	54.3	44.6	44.6	39.3	26.2	57.6	57.6	37.9	31.4	28.0	25.2	1995
Capital District	Morning	57.8	52.5	43.0	43.0	38.5	23.1	55.8	55.8	36.1	30.2	27.6	24.8	1995
Capital District	Daytime	58.0	52.8	43.2	43.2	38.6	23.5	52.5	52.5	33.1	28.2	27.0	24.3	1995
Capital District	Evening	55.2	49.8	41.7	41.7	37.7	20.5	47.0	47.0	26.7	23.9	23.4	21.1	1995
Onondaga	Night	55.9	55.9	48.0	45.3	41.9	39.2	46.6	46.6	29.2	27.0	24.9	28.6	1995
Onondaga	Morning	54.4	54.4	46.2	44.0	40.6	39.0	45.9	45.9	28.5	26.4	24.6	28.4	1995
Onondaga	Daytime	54.6	54.6	46.4	44.1	40.8	39.0	44.6	44.6	27.4	25.5	24.1	28.0	1995
Onondaga	Evening	52.1	52.1	44.6	42.8	39.5	38.8	42.1	42.1	24.8	23.2	21.2	25.6	1995
Monroe	Night	54.3	49.6	49.0	43.2	38.9	32.4	49.7	49.7	30.3	29.9	28.3	19.3	1995
Monroe	Morning	53.8	48.6	46.4	42.4	38.6	32.4	48.7	48.7	29.4	29.2	28.1	19.3	1995
Monroe	Daytime	53.9	48.7	46.7	42.5	38.6	32.4	46.8	46.8	28.0	28.1	27.7	19.1	1995
Monroe	Evening	53.1	47.0	44.1	41.8	38.3	32.4	43.4	43.4	24.7	25.6	25.3	18.5	1995
Buffalo Area	Night	55.0	54.5	53.9	46.2	41.2	36.2	56.4	55.8	37.2	34.5	37.3	37.2	1995
Buffalo Area	Morning	54.9	54.2	50.5	43.1	38.1	33.1	55.4	54.9	36.5	33.9	37.0	37.0	1995
Buffalo Area	Daytime	54.9	54.2	50.9	43.5	38.5	33.5	53.5	53.2	35.4	33.0	36.6	36.6	1995
Buffalo Area	Evening	54.7	53.8	47.4	40.5	35.5	30.5	51.6	51.6	34.3	32.1	35.1	35.1	1995
Rest of State	Night	55.7	53.0	46.4	44.0	36.5	34.7	54.9	52.1	35.2	33.2	25.7	24.4	1995
Rest of State	Morning	55.7	53.0	45.7	43.5	36.4	34.6	54.3	51.6	33.6	32.2	25.3	24.1	1995
Rest of State	Daytime	55.7	53.0	45.8	43.5	36.4	34.6	53.4	50.9	31.4	30.5	24.7	23.6	1995
Rest of State	Evening	55.7	53.0	45.2	42.9	36.2	34.4	52.7	50.1	30.4	28.6	22.7	21.5	1995

1995 SPEEDS used for 1993-1997 modeling runs

Morning hours are 5am to 8am, Daytime hours are 9am to 2pm, Evening hours are 3pm to 5pm, and Night hours are 6pm to 4am

Capital District includes the counties of Albany, Rensselaer, Saratoga, and Schenectady

Bufalo Area includes the counties of Erie and Niagara

COUNTY	TIME PERIOD	R_INT	R_PA	R_MNA	R_MJC	R_MNC	R_LCL	U_INT	U_EXP	U_PA	U_MNA	U_MJC	U_LCL	YEAR
New York	Night	NA	NA	NA	NA	NA	NA	35.9	34.1	12.8	12.1	5.8	5.6	2000
New York	Morning	NA	NA	NA	NA	NA	NA	32.3	30.7	12.2	11.6	5.7	5.4	2000
New York	Daytime	NA	NA	NA	NA	NA	NA	31.3	29.7	11.7	11.1	5.5	5.2	2000
New York	Evening	NA	NA	NA	NA	NA	NA	20.6	19.6	5.5	5.2	3.2	3.0	2000
Kings	Night	NA	NA	NA	NA	NA	NA	47.8	45.4	20.6	19.6	11.2	10.6	2000
Kings	Morning	NA	NA	NA	NA	NA	NA	43.0	40.8	20.0	19.0	10.9	10.3	2000
Kings	Daytime	NA	NA	NA	NA	NA	NA	41.6	39.6	19.5	18.5	10.6	10.1	2000
Kings	Evening	NA	NA	NA	NA	NA	NA	27.5	26.1	11.1	10.6	6.1	5.7	2000
Queens	Night	NA	NA	NA	NA	NA	NA	46.7	44.4	19.8	18.8	12.2	11.6	2000
Queens	Morning	NA	NA	NA	NA	NA	NA	41.9	39.8	19.2	18.2	11.9	11.3	2000
Queens	Daytime	NA	NA	NA	NA	NA	NA	40.6	38.6	18.7	17.8	11.6	11.0	2000
Queens	Evening	NA	NA	NA	NA	NA	NA	26.8	25.5	10.7	10.1	6.6	6.3	2000
Bronx	Night	NA	NA	NA	NA	NA	NA	50.6	48.0	22.5	21.4	12.6	11.9	2000
Bronx	Morning	NA	NA	NA	NA	NA	NA	45.4	43.2	21.8	20.7	12.2	11.6	2000
Bronx	Daytime	NA	NA	NA	NA	NA	NA	44.0	41.8	21.3	20.2	11.9	11.3	2000
Bronx	Evening	NA	NA	NA	NA	NA	NA	29.0	27.6	12.2	11.5	6.8	6.4	2000
Richmond	Night	NA	NA	NA	NA	NA	NA	52.6	50.0	23.8	22.6	13.9	13.2	2000
Richmond	Morning	NA	NA	NA	NA	NA	NA	47.3	44.9	23.1	21.9	13.5	12.8	2000
Richmond	Daytime	NA	NA	NA	NA	NA	NA	45.8	43.5	22.5	21.4	13.2	12.5	2000
Richmond	Evening	NA	NA	NA	NA	NA	NA	30.2	28.7	12.8	12.2	7.5	7.1	2000
Nassau	Night	NA	NA	NA	NA	NA	NA	49.4	46.9	20.6	19.6	13.3	12.6	2000
Nassau	Morning	NA	NA	NA	NA	NA	NA	44.4	42.2	20.0	19.0	12.9	12.2	2000
Nassau	Daytime	NA	NA	NA	NA	NA	NA	43.0	40.9	19.5	18.5	12.5	11.9	2000
Nassau	Evening	NA	NA	NA	NA	NA	NA	28.4	26.9	11.1	10.6	7.2	6.8	2000
Suffolk	Night	53.6	50.9	28.1	26.7	17.7	16.8	53.6	50.9	28.1	26.7	17.7	16.8	2000
Suffolk	Morning	48.2	45.8	27.3	25.9	17.2	16.3	48.2	45.8	27.3	25.9	17.2	16.3	2000
Suffolk	Daytime	46.8	44.4	26.6	25.3	16.7	15.9	46.8	44.4	26.6	25.3	16.7	15.9	2000
Suffolk	Evening	38.0	36.1	15.2	14.4	9.6	9.1	38.0	36.1	15.2	14.4	9.6	9.1	2000
Westchester	Night	53.0	50.4	27.8	26.4	16.8	15.9	53.0	50.4	27.8	26.4	16.8	15.9	2000
Westchester	Morning	47.7	45.3	27.0	25.6	16.3	15.5	47.7	45.3	27.0	25.6	16.3	15.5	2000
Westchester	Daytime	46.3	43.9	26.3	24.9	15.9	15.1	46.3	43.9	26.3	24.9	15.9	15.1	2000
Westchester	Evening	37.6	35.7	15.0	14.3	9.1	8.6	37.6	35.7	15.0	14.3	9.1	8.6	2000
Rockland	Night	53.2	50.5	29.0	27.5	17.7	16.8	53.2	50.5	29.0	27.5	17.7	16.8	2000
Rockland	Morning	47.9	45.5	28.1	26.7	17.2	16.3	47.9	45.5	28.1	26.7	17.2	16.3	2000
Rockland	Daytime	46.4	44.1	27.4	26.0	16.7	15.9	46.4	44.1	27.4	26.0	16.7	15.9	2000
Rockland	Evening	37.7	35.8	15.6	14.9	9.6	9.1	37.7	35.8	15.6	14.9	9.6	9.1	2000
Putnam	Night	58.6	55.7	38.3	36.4	23.2	22.1	58.6	55.7	38.3	36.4	23.2	22.1	2000
Putnam	Morning	53.8	51.2	37.2	35.3	22.5	21.4	53.8	51.2	37.2	35.3	22.5	21.4	2000
Putnam	Daytime	52.8	50.1	36.2	34.4	22.0	20.9	52.8	50.1	36.2	34.4	22.0	20.9	2000
Putnam	Evening	46.9	44.6	20.7	19.6	12.5	11.9	46.9	44.6	20.7	19.6	12.5	11.9	2000
Capital District	Night	59.6	54.2	44.8	44.8	39.4	26.2	57.5	57.5	37.9	31.2	27.8	25.1	2000
Capital District	Morning	57.7	52.1	42.8	42.8	38.3	23.1	55.5	55.5	36.1	30.0	27.4	24.9	2000
Capital District	Daytime	58.0	52.4	43.0	43.0	38.5	23.5	52.0	52.0	33.1	28.0	26.8	24.3	2000
Capital District	Evening	54.9	48.9	41.1	41.1	37.4	20.5	45.2	45.2	25.9	23.2	22.9	21.2	2000
Onondaga	Night	55.9	55.9	48.0	45.2	41.8	39.2	46.5	46.5	29.2	27.0	24.9	28.2	2000
Onondaga	Morning	54.3	54.3	46.1	43.9	40.5	38.9	45.8	45.8	28.5	26.4	24.6	28.0	2000
Onondaga	Daytime	54.6	54.6	46.3	44.0	40.7	38.9	44.4	44.4	27.4	25.4	24.1	27.7	2000
Onondaga	Evening	51.9	51.9	44.5	42.7	39.4	38.7	41.7	41.7	24.7	23.0	21.1	25.5	2000
Monroe	Night	54.3	49.5	49.0	43.2	39.0	32.5	49.8	49.8	30.3	30.0	28.4	19.3	2000
Monroe	Morning	53.8	48.4	46.4	42.3	38.6	32.4	48.7	48.7	29.4	29.3	28.1	19.2	2000
Monroe	Daytime	53.9	48.5	46.7	42.4	38.6	32.4	46.9	46.9	27.9	28.1	27.7	19.1	2000
Monroe	Evening	53.1	46.7	44.1	41.6	38.2	32.3	43.2	43.2	24.5	25.5	25.1	18.4	2000
Buffalo Area	Night	55.0	54.4	54.2	46.2	41.2	36.2	56.3	55.7	37.3	34.5	37.2	37.2	2000
Buffalo Area	Morning	54.8	54.0	50.0	43.1	38.1	33.1	55.1	54.6	36.5	33.9	37.0	36.9	2000
Buffalo Area	Daytime	54.8	54.0	50.5	43.5	38.5	33.5	52.9	52.7	35.2	32.9	36.5	36.5	2000
Buffalo Area	Evening	54.5	53.3	46.4	40.5	35.5	30.5	50.3	50.5	33.6	31.6	34.5	34.5	2000
Rest of State	Night	55.7	53.0	46.1	43.8	36.6	34.8	54.9	52.1	35.2	33.3	25.8	24.4	2000
Rest of State	Morning	55.7	53.0	45.5	43.2	36.3	34.5	54.3	51.6	33.6	32.1	25.3	24.1	2000
Rest of State	Daytime	55.7	53.0	45.6	43.3	36.3	34.5	53.3	50.8	31.2	30.4	24.7	23.6	2000
Rest of State	Evening	55.7	53.0	44.9	42.7	36.0	34.2	52.5	49.9	30.0	28.2	22.3	21.2	2000

2000 SPEEDS used for 1998-2002 modeling runs

Morning hours are 5am to 8am, Daytime hours are 9am to 2pm, Evening hours are 3pm to 5pm, and Night hours are 6pm to 4am

Capital District includes the counties of Albany, Rensselaer, Saratoga, and Schenectady

Bufalo Area includes the counties of Erie and Niagara

COUNTY	TIME PERIOD	R_INT	R_PA	R_MNA	R_MJC	R_MNC	R_LCL	U_INT	U_EXP	U_PA	U_MNA	U_MJC	U_LCL	YEAR
New York	Night	NA	NA	NA	NA	NA	NA	35.0	33.2	13.1	12.5	5.9	5.6	2005
New York	Morning	NA	NA	NA	NA	NA	NA	31.4	29.8	12.5	11.9	5.8	5.5	2005
New York	Daytime	NA	NA	NA	NA	NA	NA	30.4	28.9	12.0	11.4	5.6	5.3	2005
New York	Evening	NA	NA	NA	NA	NA	NA	20.1	19.1	5.6	5.3	3.2	3.1	2005
Kings	Night	NA	NA	NA	NA	NA	NA	47.4	45.0	20.3	19.3	11.1	10.5	2005
Kings	Morning	NA	NA	NA	NA	NA	NA	42.5	40.4	19.7	18.7	10.8	10.2	2005
Kings	Daytime	NA	NA	NA	NA	NA	NA	41.2	39.2	19.2	18.3	10.5	10.0	2005
Kings	Evening	NA	NA	NA	NA	NA	NA	27.2	25.8	11.0	10.4	6.0	5.7	2005
Queens	Night	NA	NA	NA	NA	NA	NA	46.3	44.0	19.5	18.5	12.1	11.5	2005
Queens	Morning	NA	NA	NA	NA	NA	NA	41.6	39.5	18.9	18.0	11.8	11.2	2005
Queens	Daytime	NA	NA	NA	NA	NA	NA	40.3	38.3	18.4	17.5	11.4	10.9	2005
Queens	Evening	NA	NA	NA	NA	NA	NA	26.6	25.2	10.5	10.0	6.5	6.2	2005
Bronx	Night	NA	NA	NA	NA	NA	NA	50.3	47.8	22.3	21.2	12.5	11.8	2005
Bronx	Morning	NA	NA	NA	NA	NA	NA	45.1	42.9	21.6	20.5	12.1	11.5	2005
Bronx	Daytime	NA	NA	NA	NA	NA	NA	43.8	41.6	21.1	20.0	11.8	11.2	2005
Bronx	Evening	NA	NA	NA	NA	NA	NA	28.9	27.4	12.0	11.4	6.7	6.4	2005
Richmond	Night	NA	NA	NA	NA	NA	NA	51.6	49.0	23.0	21.8	13.6	12.9	2005
Richmond	Morning	NA	NA	NA	NA	NA	NA	46.3	44.0	22.3	21.2	13.2	12.5	2005
Richmond	Daytime	NA	NA	NA	NA	NA	NA	44.9	42.7	21.7	20.6	12.9	12.2	2005
Richmond	Evening	NA	NA	NA	NA	NA	NA	29.6	28.1	12.4	11.8	7.4	7.0	2005
Nassau	Night	NA	NA	NA	NA	NA	NA	48.8	46.3	20.3	19.3	13.1	12.5	2005
Nassau	Morning	NA	NA	NA	NA	NA	NA	43.8	41.6	19.7	18.7	12.7	12.1	2005
Nassau	Daytime	NA	NA	NA	NA	NA	NA	42.5	40.3	19.2	18.2	12.4	11.8	2005
Nassau	Evening	NA	NA	NA	NA	NA	NA	28.0	26.6	11.0	10.4	7.1	6.7	2005
Suffolk	Night	52.8	50.1	27.5	26.2	17.4	16.6	52.8	50.1	27.5	26.2	17.4	16.6	2005
Suffolk	Morning	47.5	45.1	26.7	25.4	16.9	16.1	47.5	45.1	26.7	25.4	16.9	16.1	2005
Suffolk	Daytime	46.1	43.8	26.0	24.7	16.5	15.7	46.1	43.8	26.0	24.7	16.5	15.7	2005
Suffolk	Evening	37.4	35.6	14.9	14.1	9.4	8.9	37.4	35.6	14.9	14.1	9.4	8.9	2005
Westchester	Night	52.5	49.9	27.4	26.1	16.6	15.8	52.5	49.9	27.4	26.1	16.6	15.8	2005
Westchester	Morning	47.3	44.9	26.6	25.3	16.2	15.3	47.3	44.9	26.6	25.3	16.2	15.3	2005
Westchester	Daytime	45.9	43.6	25.9	24.6	15.7	14.9	45.9	43.6	25.9	24.6	15.7	14.9	2005
Westchester	Evening	37.3	35.4	14.8	14.1	9.0	8.5	37.3	35.4	14.8	14.1	9.0	8.5	2005
Rockland	Night	52.5	49.9	28.4	27.0	17.5	16.6	52.5	49.9	28.4	27.0	17.5	16.6	2005
Rockland	Morning	47.2	44.9	27.6	26.2	16.9	16.1	47.2	44.9	27.6	26.2	16.9	16.1	2005
Rockland	Daytime	45.8	43.5	26.9	25.5	16.5	15.7	45.8	43.5	26.9	25.5	16.5	15.7	2005
Rockland	Evening	37.2	35.4	15.4	14.6	9.4	9.0	37.2	35.4	15.4	14.6	9.4	9.0	2005
Putnam	Night	58.0	55.1	37.6	35.7	22.9	21.8	58.0	55.1	37.6	35.7	22.9	21.8	2005
Putnam	Morning	53.3	50.6	36.5	34.7	22.2	21.1	53.3	50.6	36.5	34.7	22.2	21.1	2005
Putnam	Daytime	52.2	49.6	35.6	33.8	21.6	20.6	52.2	49.6	35.6	33.8	21.6	20.6	2005
Putnam	Evening	46.4	44.1	20.3	19.3	12.4	11.7	46.4	44.1	20.3	19.3	12.4	11.7	2005
Capital District	Night	59.6	54.1	44.9	44.9	39.5	26.2	57.3	57.3	37.9	31.0	27.6	25.1	2005
Capital District	Morning	57.5	51.7	42.6	42.6	38.2	23.1	55.3	55.3	36.1	29.8	27.2	24.9	2005
Capital District	Daytime	57.9	52.1	42.9	42.9	38.3	23.5	51.6	51.6	33.0	27.8	26.6	24.4	2005
Capital District	Ev ening	54.5	48.1	40.6	40.6	37.0	20.5	44.0	44.0	25.3	22.6	22.5	21.4	2005
Onondaga	Night	55.9	55.9	47.9	45.2	41.8	39.1	46.5	46.5	29.2	27.0	24.8	27.8	2005
Onondaga	Morning	54.2	54.2	46.0	43.8	40.4	38.8	45.7	45.7	28.5	26.4	24.6	27.7	2005
Onondaga	Daytime	54.5	54.5	46.2	43.9	40.6	38.9	44.3	44.3	27.4	25.4	24.1	27.4	2005
Onondaga	Evening	51.8	51.8	44.3	42.5	39.3	38.6	41.4	41.4	24.7	22.9	21.0	25.4	2005
Monroe	Night	54.3	49.3	49.0	43.2	39.0	32.5	49.9	49.9	30.2	30.0	28.4	19.3	2005
Monroe	Morning	53.8	48.1	46.4	42.2	38.5	32.3	48.8	48.8	29.3	29.3	28.1	19.2	2005
Monroe	Daytime	53.9	48.3	46.7	42.3	38.6	32.4	46.9	46.9	27.8	28.1	27.7	19.1	2005
Monroe	Evening	53.1	46.4	44.1	41.4	38.1	32.2	43.1	43.1	24.3	25.3	24.9	18.3	2005
Buffalo Area	Night	54.9	54.4	54.4	46.2	41.2	36.2	56.2	55.6	37.3	34.4	37.2	37.2	2005
Buffalo Area	Morning	54.7	53.8	49.6	43.1	38.1	33.1	54.8	54.4	36.4	33.8	36.9	36.9	2005
Buffalo Area	Daytime	54.7	53.9	50.2	43.5	38.5	33.5	52.4	52.2	35.1	32.7	36.4	36.4	2005
Buffalo Area	Evening	54.3	52.8	45.4	40.5	35.5	30.5	49.0	49.3	33.0	31.0	33.9	33.9	2005
Rest of State	Night	55.7	53.0	45.9	43.6	36.7	34.8	54.9	52.1	35.3	33.3	25.8	24.4	2005
Rest of State	Morning	55.7	53.0	45.2	43.0	36.2	34.4	54.3	51.6	33.6	32.1	25.3	24.1	2005
Rest of State	Daytime	55.7	53.0	45.3	43.0	36.2	34.4	53.2	50.7	31.1	30.2	24.6	23.5	2005
Rest of State	Evening	55.7	53.0	44.7	42.4	35.8	34.0	52.3	49.7	29.6	27.8	21.9	20.8	2005

2005 SPEEDS used for 2003-2007 modeling runs

Morning hours are 5am to 8am, Daytime hours are 9am to 2pm, Evening hours are 3pm to 5pm, and Night hours are 6pm to 4am
Capital District includes the counties of Albany, Rensselaer, Saratoga, and Schenectady
Bufalo Area includes the counties of Erie and Niagara

COUNTY	TIME PERIOD	R_INT	R_PA	R_MNA	R_MJC	R_MNC	R_LCL	U_INT	U_EXP	U_PA	U_MNA	U_MJC	U_LCL	YEAR
New York	Night	NA	NA	NA	NA	NA	NA	34.0	32.3	13.5	12.8	6.0	5.7	2010
New York	Morning	NA	NA	NA	NA	NA	NA	30.6	29.0	12.8	12.2	5.9	5.6	2010
New York	Daytime	NA	NA	NA	NA	NA	NA	29.6	28.1	12.3	11.7	5.7	5.4	2010
New York	Evening	NA	NA	NA	NA	NA	NA	19.5	18.6	5.8	5.5	3.3	3.1	2010
Kings	Night	NA	NA	NA	NA	NA	NA	46.9	44.5	20.0	19.0	11.0	10.4	2010
Kings	Morning	NA	NA	NA	NA	NA	NA	42.1	40.0	19.4	18.5	10.6	10.1	2010
Kings	Daytime	NA	NA	NA	NA	NA	NA	40.8	38.8	18.9	18.0	10.4	9.8	2010
Kings	Evening	NA	NA	NA	NA	NA	NA	26.9	25.6	10.8	10.3	5.9	5.6	2010
Queens	Night	NA	NA	NA	NA	NA	NA	45.9	43.6	19.2	18.2	12.0	11.4	2010
Queens	Morning	NA	NA	NA	NA	NA	NA	41.2	39.2	18.6	17.7	11.6	11.1	2010
Queens	Daytime	NA	NA	NA	NA	NA	NA	39.9	38.0	18.1	17.2	11.3	10.8	2010
Queens	Evening	NA	NA	NA	NA	NA	NA	26.3	25.0	10.4	9.8	6.5	6.2	2010
Bronx	Night	NA	NA	NA	NA	NA	NA	50.0	47.5	22.1	21.0	12.4	11.7	2010
Bronx	Morning	NA	NA	NA	NA	NA	NA	44.9	42.6	21.4	20.3	12.0	11.4	2010
Bronx	Daytime	NA	NA	NA	NA	NA	NA	43.5	41.3	20.9	19.8	11.7	11.1	2010
Bronx	Evening	NA	NA	NA	NA	NA	NA	28.7	27.2	11.9	11.3	6.7	6.3	2010
Richmond	Night	NA	NA	NA	NA	NA	NA	50.6	48.1	22.1	21.0	13.3	12.6	2010
Richmond	Morning	NA	NA	NA	NA	NA	NA	45.4	43.2	21.5	20.4	12.9	12.3	2010
Richmond	Daytime	NA	NA	NA	NA	NA	NA	44.0	41.8	20.9	19.9	12.6	11.9	2010
Richmond	Evening	NA	NA	NA	NA	NA	NA	29.0	27.6	11.9	11.3	7.2	6.8	2010
Nassau	Night	NA	NA	NA	NA	NA	NA	48.2	45.8	20.0	19.0	13.0	12.3	2010
Nassau	Morning	NA	NA	NA	NA	NA	NA	43.3	41.1	19.4	18.4	12.6	12.0	2010
Nassau	Daytime	NA	NA	NA	NA	NA	NA	41.9	39.8	18.9	17.9	12.3	11.6	2010
Nassau	Evening	NA	NA	NA	NA	NA	NA	27.6	26.3	10.8	10.3	7.0	6.7	2010
Suffolk	Night	52.0	49.4	27.0	25.6	17.2	16.3	52.0	49.4	27.0	25.6	17.2	16.3	2010
Suffolk	Morning	46.8	44.5	26.2	24.9	16.7	15.8	46.8	44.5	26.2	24.9	16.7	15.8	2010
Suffolk	Daytime	45.4	43.1	25.5	24.2	16.2	15.4	45.4	43.1	25.5	24.2	16.2	15.4	2010
Suffolk	Evening	36.9	35.0	14.6	13.8	9.3	8.8	36.9	35.0	14.6	13.8	9.3	8.8	2010
Westchester	Night	52.1	49.5	27.1	25.7	16.5	15.7	52.1	49.5	27.1	25.7	16.5	15.7	2010
Westchester	Morning	46.9	44.5	26.3	25.0	16.0	15.2	46.9	44.5	26.3	25.0	16.0	15.2	2010
Westchester	Daytime	45.5	43.2	25.6	24.3	15.6	14.8	45.5	43.2	25.6	24.3	15.6	14.8	2010
Westchester	Evening	36.9	35.1	14.6	13.9	8.9	8.5	36.9	35.1	14.6	13.9	8.9	8.5	2010
Rockland	Night	51.8	49.2	27.9	26.5	17.2	16.3	51.8	49.2	27.9	26.5	17.2	16.3	2010
Rockland	Morning	46.6	44.3	27.0	25.7	16.7	15.9	46.6	44.3	27.0	25.7	16.7	15.9	2010
Rockland	Daytime	45.2	42.9	26.3	25.0	16.3	15.5	45.2	42.9	26.3	25.0	16.3	15.5	2010
Rockland	Evening	36.7	34.9	15.1	14.3	9.3	8.8	36.7	34.9	15.1	14.3	9.3	8.8	2010
Putnam	Night	57.4	54.6	37.0	35.1	22.6	21.4	57.4	54.6	37.0	35.1	22.6	21.4	2010
Putnam	Morning	52.7	50.1	35.9	34.1	21.9	20.8	52.7	50.1	35.9	34.1	21.9	20.8	2010
Putnam	Daytime	51.7	49.1	34.9	33.2	21.3	20.3	51.7	49.1	34.9	33.2	21.3	20.3	2010
Putnam	Evening	45.9	43.6	20.0	19.0	12.2	11.6	45.9	43.6	20.0	19.0	12.2	11.6	2010
Capital District	Night	59.7	54.0	45.0	45.0	39.6	26.2	57.1	57.1	37.9	30.8	27.4	25.1	2010
Capital District	Morning	57.4	51.3	42.4	42.4	38.0	23.1	55.1	55.1	36.0	29.6	27.0	24.9	2010
Capital District	Daytime	57.8	51.8	42.7	42.7	38.2	23.5	51.4	51.4	32.9	27.5	26.4	24.4	2010
Capital District	Evening	54.2	47.4	40.1	40.1	36.7	20.5	43.2	43.2	24.8	22.0	22.1	21.6	2010
Onondaga	Night	55.9	55.9	47.8	45.2	41.7	39.0	46.5	46.5	29.1	27.0	24.8	27.5	2010
Onondaga	Morning	54.1	54.1	45.9	43.7	40.3	38.8	45.6	45.6	28.5	26.4	24.6	27.3	2010
Onondaga	Daytime	54.4	54.4	46.1	43.8	40.5	38.8	44.1	44.1	27.4	25.3	24.1	27.0	2010
Onondaga	Evening	51.6	51.6	44.2	42.3	39.2	38.5	41.1	41.1	24.6	22.8	20.9	25.2	2010
Monroe	Night	54.3	49.1	49.0	43.3	39.0	32.6	50.0	50.0	30.2	30.1	28.4	19.3	2010
Monroe	Morning	53.8	47.9	46.4	42.1	38.5	32.3	48.9	48.9	29.3	29.4	28.1	19.2	2010
Monroe	Daytime	53.9	48.1	46.7	42.3	38.5	32.3	46.9	46.9	27.7	28.1	27.7	19.1	2010
Monroe	Evening	53.1	46.1	44.1	41.1	38.0	32.1	43.0	43.0	24.0	25.2	24.8	18.2	2010
Buffalo Area	Night	54.9	54.3	54.7	46.2	41.2	36.2	56.1	55.5	37.2	34.4	37.2	37.1	2010
Buffalo Area	Morning	54.6	53.5	49.2	43.1	38.1	33.1	54.6	54.2	36.4	33.7	36.9	36.8	2010
Buffalo Area	Daytime	54.6	53.7	49.9	43.5	38.5	33.5	52.0	51.9	35.0	32.6	36.3	36.3	2010
Buffalo Area	Evening	54.1	52.4	44.4	40.5	35.5	30.5	47.8	48.2	32.5	30.5	33.3	33.3	2010
Rest of State	Night	55.7	53.0	45.6	43.3	36.7	34.9	54.9	52.1	35.3	33.3	25.8	24.5	2010
Rest of State	Morning	55.7	53.0	45.0	42.7	36.1	34.3	54.3	51.6	33.5	32.1	25.3	24.1	2010
Rest of State	Daytime	55.7	53.0	45.0	42.8	36.2	34.4	53.1	50.6	31.0	30.1	24.5	23.4	2010
Rest of State	Evening	55.7	53.0	44.4	42.2	35.6	33.8	52.1	49.5	29.1	27.4	21.5	20.4	2010

2010 SPEEDS used for 2008-2012 modeling runs

Morning hours are 5am to 8am, Daytime hours are 9am to 2pm, Evening hours are 3pm to 5pm, and Night hours are 6pm to 4am

Capital District includes the counties of Albany, Rensselaer, Saratoga, and Schenectady

Bufalo Area includes the counties of Erie and Niagara

COUNTY	TIME PERIOD	R_INT	R_PA	R_MNA	R_MJC	R_MNC	R_LCL	U_INT	U_EXP	U_PA	U_MNA	U_MJC	U_LCL	YEAR
New York	Night	NA	NA	NA	NA	NA	NA	33.1	31.4	13.8	13.1	6.1	5.8	2015
New York	Morning	NA	NA	NA	NA	NA	NA	29.7	28.2	13.1	12.5	6.0	5.7	2015
New York	Daytime	NA	NA	NA	NA	NA	NA	28.8	27.3	12.6	12.0	5.8	5.5	2015
New York	Evening	NA	NA	NA	NA	NA	NA	19.0	18.0	5.9	5.6	3.3	3.2	2015
Kings	Night	NA	NA	NA	NA	NA	NA	46.4	44.1	19.7	18.8	10.9	10.3	2015
Kings	Morning	NA	NA	NA	NA	NA	NA	41.7	39.6	19.2	18.2	10.5	10.0	2015
Kings	Daytime	NA	NA	NA	NA	NA	NA	40.4	38.4	18.7	17.7	10.3	9.7	2015
Kings	Evening	NA	NA	NA	NA	NA	NA	26.6	25.3	10.7	10.1	5.9	5.6	2015
Queens	Night	NA	NA	NA	NA	NA	NA	45.5	43.2	18.9	17.9	11.9	11.3	2015
Queens	Morning	NA	NA	NA	NA	NA	NA	40.9	38.8	18.3	17.4	11.5	10.9	2015
Queens	Daytime	NA	NA	NA	NA	NA	NA	39.6	37.6	17.8	17.0	11.2	10.7	2015
Queens	Evening	NA	NA	NA	NA	NA	NA	26.1	24.8	10.2	9.7	6.4	6.1	2015
Bronx	Night	NA	NA	NA	NA	NA	NA	49.7	47.2	21.8	20.7	12.3	11.6	2015
Bronx	Morning	NA	NA	NA	NA	NA	NA	44.6	42.4	21.2	20.1	11.9	11.3	2015
Bronx	Daytime	NA	NA	NA	NA	NA	NA	43.2	41.1	20.6	19.6	11.6	11.0	2015
Bronx	Evening	NA	NA	NA	NA	NA	NA	28.5	27.1	11.8	11.2	6.6	6.3	2015
Richmond	Night	NA	NA	NA	NA	NA	NA	49.6	47.1	21.3	20.2	13.0	12.3	2015
Richmond	Morning	NA	NA	NA	NA	NA	NA	44.5	42.3	20.6	19.6	12.6	12.0	2015
Richmond	Daytime	NA	NA	NA	NA	NA	NA	43.1	41.0	20.1	19.1	12.3	11.7	2015
Richmond	Evening	NA	NA	NA	NA	NA	NA	28.5	27.0	11.5	10.9	7.0	6.7	2015
Nassau	Night	NA	NA	NA	NA	NA	NA	47.5	45.2	19.7	18.7	12.8	12.2	2015
Nassau	Morning	NA	NA	NA	NA	NA	NA	42.7	40.6	19.1	18.1	12.4	11.8	2015
Nassau	Daytime	NA	NA	NA	NA	NA	NA	41.4	39.3	18.6	17.7	12.1	11.5	2015
Nassau	Evening	NA	NA	NA	NA	NA	NA	27.3	25.9	10.6	10.1	6.9	6.6	2015
Suffolk	Night	51.2	48.6	26.4	25.1	16.9	16.1	51.2	48.6	26.4	25.1	16.9	16.1	2015
Suffolk	Morning	46.1	43.8	25.6	24.3	16.4	15.6	46.1	43.8	25.6	24.3	16.4	15.6	2015
Suffolk	Daytime	44.7	42.5	24.9	23.7	16.0	15.2	44.7	42.5	24.9	23.7	16.0	15.2	2015
Suffolk	Evening	36.3	34.5	14.2	13.5	9.1	8.7	36.3	34.5	14.2	13.5	9.1	8.7	2015
Westchester	Night	51.6	49.1	26.8	25.4	16.4	15.6	51.6	49.1	26.8	25.4	16.4	15.6	2015
Westchester	Morning	46.5	44.1	26.0	24.7	15.9	15.1	46.5	44.1	26.0	24.7	15.9	15.1	2015
Westchester	Daytime	45.1	42.8	25.3	24.0	15.5	14.7	45.1	42.8	25.3	24.0	15.5	14.7	2015
Westchester	Evening	36.6	34.8	14.4	13.7	8.8	8.4	36.6	34.8	14.4	13.7	8.8	8.4	2015
Rockland	Night	51.1	48.5	27.3	25.9	17.0	16.1	51.1	48.5	27.3	25.9	17.0	16.1	2015
Rockland	Morning	46.0	43.7	26.5	25.2	16.5	15.6	46.0	43.7	26.5	25.2	16.5	15.6	2015
Rockland	Daytime	44.6	42.4	25.8	24.5	16.0	15.2	44.6	42.4	25.8	24.5	16.0	15.2	2015
Rockland	Evening	36.2	34.4	14.8	14.0	9.2	8.7	36.2	34.4	14.8	14.0	9.2	8.7	2015
Putnam	Night	56.8	54.0	36.3	34.5	22.2	21.1	56.8	54.0	36.3	34.5	22.2	21.1	2015
Putnam	Morning	52.2	49.6	35.2	33.5	21.6	20.5	52.2	49.6	35.2	33.5	21.6	20.5	2015
Putnam	Daytime	51.1	48.6	34.3	32.6	21.0	20.0	51.1	48.6	34.3	32.6	21.0	20.0	2015
Putnam	Evening	45.5	43.2	19.6	18.6	12.0	11.4	45.5	43.2	19.6	18.6	12.0	11.4	2015
Capital District	Night	59.7	53.8	45.2	45.2	39.7	26.2	56.9	56.9	38.0	30.6	27.2	25.1	2015
Capital District	Morning	57.3	51.0	42.1	42.1	37.9	23.1	54.9	54.9	36.0	29.3	26.8	24.9	2015
Capital District	Daytime	57.7	51.5	42.5	42.5	38.1	23.5	51.1	51.1	32.8	27.2	26.2	24.5	2015
Capital District	Evening	53.8	46.8	39.5	39.5	36.3	20.5	42.8	42.8	24.2	21.5	21.8	21.8	2015
Onondaga	Night	55.9	55.9	47.8	45.2	41.6	39.0	46.4	46.4	29.1	27.0	24.8	27.1	2015
Onondaga	Morning	54.1	54.1	45.8	43.6	40.2	38.7	45.6	45.6	28.5	26.4	24.5	27.0	2015
Onondaga	Daytime	54.4	54.4	46.0	43.8	40.4	38.7	44.0	44.0	27.4	25.3	24.0	26.7	2015
Onondaga	Evening	51.4	51.4	44.0	42.2	39.1	38.4	40.8	40.8	24.6	22.6	20.8	25.1	2015
Monroe	Night	54.4	49.0	49.0	43.3	39.0	32.6	50.1	50.1	30.2	30.2	28.4	19.2	2015
Monroe	Morning	53.8	47.7	46.4	42.0	38.4	32.3	49.0	49.0	29.2	29.4	28.2	19.2	2015
Monroe	Daytime	53.9	47.9	46.7	42.2	38.5	32.3	46.9	46.9	27.6	28.1	27.7	19.0	2015
Monroe	Evening	53.1	45.8	44.1	40.9	37.9	32.0	42.9	42.9	23.8	25.1	24.6	18.1	2015
Buffalo Area	Night	54.9	54.3	55.0	46.2	41.2	36.2	56.0	55.5	37.2	34.3	37.2	37.1	2015
Buffalo Area	Morning	54.5	53.3	48.8	43.1	38.1	33.1	54.5	54.0	36.3	33.6	36.8	36.8	2015
Buffalo Area	Daytime	54.6	53.5	49.5	43.5	38.5	33.5	51.6	51.5	34.8	32.4	36.2	36.2	2015
Buffalo Area	Evening	53.9	51.9	43.3	40.5	35.5	30.5	46.7	47.2	31.9	30.0	32.8	32.7	2015
Rest of State	Night	55.7	53.0	45.3	43.1	36.8	34.9	54.9	52.1	35.3	33.4	25.8	24.5	2015
Rest of State	Morning	55.7	53.0	44.7	42.5	36.0	34.2	54.2	51.6	33.5	32.0	25.3	24.0	2015
Rest of State	Daytime	55.7	53.0	44.8	42.5	36.1	34.3	53.0	50.5	30.8	30.0	24.4	23.3	2015
Rest of State	Evening	55.7	53.0	44.2	42.0	35.3	33.6	51.8	49.3	28.7	27.0	21.1	20.0	2015

2015 SPEEDS used for 2013 and beyond modeling runs

Morning hours are 5am to 8am, Daytime hours are 9am to 2pm, Evening hours are 3pm to 5pm, and Night hours are 6pm to 4am

Capital District includes the counties of Albany, Rensselaer, Saratoga, and Schenectady

Bufalo Area includes the counties of Erie and Niagara

Attachment 5

IMPROVING AIR QUALITY MODELS IN NEW YORK STATE: UTILITY OF THE
1995 NATIONWIDE PERSONAL TRANSPORTATION SURVEY

Improving Air Quality Models in New York State: Utility of the 1995 Nationwide Personal Transportation Survey

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May 13, 1999

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Introduction

The New York State Department of Transportation (NYSDOT) is legislatively responsible for the management of 14% of the 112,000 miles of public roads that carried 52% of the 118 billion vehicle miles of travel in 1996. These roads are comprised primarily of the Interstate and State Highway System which serve as the backbone for highway transportation in the state. As a state agency, the Department is concerned with many issues including infrastructure maintenance, safety, mobility, economic development, congestion management, and air quality. The Department's capital program is multi modal with investments in public transportation facilities, as well as constructing, operating and maintaining the highway infrastructure. Its goal is to insure transportation access and mobility to all of its citizens.

This paper will describe several analyses of the 1995 Nationwide Personal Transportation Survey undertaken by the New York State Department of Transportation. These analyses are presented to illustrate the value of the Nationwide Personal Transportation Survey for New York State and the ability of NYSDOT to focus transportation studies on state-based travel characteristics. The analyses address issues raised by the New York State Department of Environmental Conservation (ENCON), the state's environmental agency, and the New York State Department of Transportation. They were identified during the development of the Air Quality State Implementation Plan, and related activities, such as creating vehicle miles of travel inventories, updating ENCON's emission model, and the conformity analyses of the Department's Transportation Program.

Background

Early travel surveys, limited primarily to automobile and truck travel, were conducted in a number of States between 1930 and 1940 and again between 1950 and 1960. As transportation planning evolved, metropolitan area surveys became more common. In 1961, a survey was conducted by the Federal Highway Administration (FHWA) to determine on a nationwide basis the characteristics of travel, and the ownership and use of automobiles. In 1969, the Nationwide Personal Transportation Survey as we know it was conducted. Since then this survey has been conducted almost every five years, expanding in scope and geographic coverage. In 1990 and 1995, it was possible for metropolitan areas and states to participate with FHWA to obtain additional samples for greater local coverage.

In each survey prior to 1995, New York State was represented more by its largest urban area (New York Metropolitan area), because of its sheer size within the nation than by the distribution of population in other areas-- both urban and rural--within the State. New York State has 12 large urban areas: three of which have populations around 100,000, five between 250,000-500,000 in population, two between 700,000-800,000 in population, and one at 1.2 million in population. The twelfth and the largest is the ten county New York Metropolitan area with a population of 11.2 million (with six of the ten counties having populations greater than one million). Yet as urban as New York State seems, a population of 2.8 million resides in the non urban counties making the State the fourth most rural state in the nation in the 1990 Census.

This very diverse population distribution shows why participation in a survey such as the Nationwide Personal Transportation Survey is important for describing the personal travel characteristics of the different urban and rural areas, or for characterizing the state as a whole. Given the diversity in population sizes, New York State is a microcosm of the country. The nature of the transportation problems are diverse and transportation planning issues facing the state during the next 20 years require a broad, but detailed state-level database. Although individual Metropolitan Planning Organizations (MPOs) have conducted area-specific surveys over the years, the most recent comprehensive statewide home interview survey for transportation was collected during the late 1960s.

The recognition of the limitations of existing data that is available to characterize travel on a statewide and urban-area basis and the need to understand non urban travel led the New York State Department of Transportation (NYSDOT) to choose to become an add-on participant with the Federal Highway Administration (FHWA) in the conduct of 1995 Nationwide Personal Transportation Survey. The 1995 Nationwide Personal Transportation Survey as conducted in New York State, surveyed 11,000 households. The sample varied in size from 425 to 650 households in the primary counties in each urban area and 1,400 households in the remaining rural counties. The New York Metropolitan area had almost 4,000 households sampled within its ten county area. Each county represented a separate sample area varying from almost 300 to 500 households.

In addition to participating in the 1995 Nationwide Personal Transportation Survey, NYSDOT undertook two separate but related initiatives to address the transportation planning challenges facing the state. The first initiative was the acquisition of a detailed county and sub-county forecast of demographics and business economics, and the development of a vehicle miles of travel model driven by these data. This model is calibrated against the Highway Performance Monitoring System travel data for each of the 12 large urban areas, and the small urban and rural aggregated areas. The second initiative was a review of the state of the practice(s) in travel demand modeling currently in effect in each of the urban areas. Both initiatives, along with the Nationwide Personal Transportation Survey add-on, will enable NYSDOT to better address the patterns and characteristics of current and future travel in the state.

This paper examines five issues that arose during the reevaluation of air quality inventories and modeling for conformity analysis of the Department=s Transportation Program. The first topic examines:

$ Tele-Commuting or Work at Home - a comparison of results from the 1990 Census and the 1995 Nationwide Personal Transportation Survey. It studies the emerging pattern of increasing number of workers who Awork at home@ that suggests a possible reduction in the number of work trips.

The remaining four topics originate from the desire of NYSDOT to reflect New York State-based data in ENCON=s use and adaptation of EPA=s MOBILE Emission Model.

$ Hourly Vehicle Distributions - a comparison of hourly Nationwide Personal Transportation Survey-based vehicle trip distributions with hourly ground count data

$ Area-wide Speeds - a comparison of Nationwide Personal Transportation Survey derived speeds with four-step model-based network speeds

$ Vehicle Use - a comparison of Nationwide Personal Transportation Survey-based estimates of annual vehicle usage (miles traveled) with distributions developed by the U.S. Environmental Protection Agency for use with its MOBILE 6 Emissions Model.

$ Engine Mode of Operation - a comparison of Nationwide Personal Transportation Survey-based estimates of area-wide 24-hour hot and cold starts with the four time period estimates currently being used in the New York State Environmental Conservation=s Mobile 5b Emission Model.

TELE-COMMUTING OR WORK AT HOME

After the 1995 Nationwide Personal Transportation Survey (NPTS) data became available, analysis of total travel, not just journey to work travel as in the 1990 Census, became possible. One of the first questions posed was whether tele-commuting or working at home was affecting the journey to work. If technology such as cellular telephones, laptop computers, and Internet access typically used by the mobile work force were having an impact, then a significant change in the number of workers working at home should appear in the data. Unfortunately, neither the Census nor the 1995 Nationwide Personal Transportation Survey specifically addressed Atele-commuting@ as a work activity. While this is a definite shortcoming, both surveys identified in different ways the number of workers who worked at home.

Focusing on this issue, the 1990 Census asked about mode to work: A**How did this person usually get to work last week?**@ One possible response was Awork at home.@ The 1995 Nationwide Personal Transportation Survey asked a very different question: A**What is the one-way distance from your home to your workplace?**@ Possible NPTS responses included the specific number of blocks or miles coded as Agoes to work,@ and two alternatives when distance was not provided Ano fixed work place@ or Aworks at or out of home.@ The intent of the 1995 Nationwide Personal Transportation Survey category Ano fixed work place@ was meant to capture migrant workers following work, as in construction or farming. This category *may* also contain sales persons, such as a manufacturer=s representative who did not have a fixed work location, and who may not have work from home. Unfortunately, the 1995 Nationwide Personal Transportation Survey lacked a category to describe the classification of the work site, job, or why a person was working at home. **Table 1** illustrates that the number of workers and the percentage of those who Awork at home@ for both the 1990 Census and the 1995 Nationwide Personal Transportation Survey for New York State. The data for New York State are summarized in this table for the sample strata with the constituent counties noted. *The number of workers who Awork at home@ in the 1995 Nationwide Personal Transportation Survey for New York State was about double that of the 1990 Census.* The 1990 Census sampled 16.7% of the households in New York State. The 1995 Nationwide Personal Transportation Survey sampled 0.2% of the households in 1995, a smaller number, but reliable at the 95% confidence level. ***Table 1*** *shows that the number of workers who Awork at home@ in New York State has increased from 2.6% of all workers in the 1990 Census to 5.1% in the 1995 Nationwide Personal Transportation Survey for New York State. This doubling has occurred in most areas shown in* ***Table 1****. However, it is interesting to note that the share of the workforce working at home is highest in Ithaca, Glens Falls, Poughkeepsie, Westchester, Putnam and Rockland counties and the aggregate Arest of state@ area. These areas may be viewed as places where workers may commute a much longer distance to an employment location in a nearby urban area (e.g., Ithaca to Syracuse or Binghamton, Glens Falls to Albany, Westchester, Putnam and Rockland counties to New York City, and any of the rural counties to an urban area).*

The observation that the increase in Awork at home@ is occurring across the state, and is an increasing proportion of all workers in areas with Along commutes@ to a nearby urban area, raises a number of further policy questions. In what areas will Awork at home@ continue to increase and at what rate? In which industries, job classifications or professions are these workers engaged? Can reasons for working at home be enumerated? *Clearly the findings of* ***Table 1*** *suggest that the design of the year 2000 Nationwide Personal Transportation Survey must focus more attention on these questions.*

Table 1 Working at Home, Census V. Nationwide Personal Transportation Survey

	1995 Nationwide Personal Transportation Survey Work Location				1990 Census Table P49-Journey to Work		
	(Shown by NYS 1995 NPTS Sample Stratum)						
	All Workers	Work@ Home	%		All Workers	Work@ Home	%
Upstate Areas (Sample Counties)							
Albany (Albany, Rensselaer, Saratoga, Schenectady)	410,418	20,636	5.0%		382,229	8,474	2.2%
Glens Falls (Warren, Washington)	58,973	5,633	9.6%		51,864	1,933	3.7%
Utica-Rome (Herkimer, Oneida)	150,829	8,446	5.6%		135,041	3,891	2.9%
Syracuse (Onondaga)	244,025	13,694	5.6%		223,650	5,295	2.4%
Ithaca (Tompkins)	49,853	3,050	6.1%		45,175	1,990	4.4%
Rochester (Monroe)	366,085	11,307	3.1%		347,088	7,403	2.1%
Buffalo (Erie, Niagara)	562,013	16,997	3.0%		531,122	9,808	1.9%
Elmira (Chemung)	40,657	1,784	4.4%		40,325	881	2.2%
Poughkeepsie (Dutchess)	136,474	8,371	6.1%		125,726	2,991	2.4%
Binghamton (Broome, Tioga)	114,967	4,920	4.3%		121,274	3,201	2.6%
Newburgh (Orange)	157,607	7,984	5.1%		141,664	3,406	2.4%
Upstate Urban Area Total	2,291,901	102,822	4.5%		2,145,158	49,273	2.3%
New York Metropolitan Area (Sample Counties)							
Bronx	447,511	16,723	3.7%		429,777	5,379	1.3%
Kings	966,600	30,513	3.2%		907,010	14,510	1.6%
New York	845,535	56,275	6.7%		754,148	41,102	5.5%
Queens	950,510	41,488	4.4%		918,063	13,372	1.5%
Richmond	194,047	3,751	1.9%		174,090	2,456	1.4%
New York City Total	3,404,203	148,750	4.4%		3,183,088	76,819	2.4%
Nassau	672,349	30,490	4.5%		650,947	16,383	2.5%
Suffolk	701,974	37,757	5.4%		652,989	12,794	2.0%
Putnam/Rockland (Combined for NPTS)	192,409	13,915	7.2%		177,973	4,481	2.5%
Westchester	439,844	33,930	7.7%		437,753	13,813	3.2%
New York Metropolitan Suburban County Total	2,006,576	116,092	5.8%		1,919,662	47,471	2.5%
Rest-of-State	1,071,958	77,166	7.2%		972,705	39,659	4.1%
New York State	8,774,638	444,830	5.1%		8,220,613	213,222	2.6%

Source:
Unpublished 1995 NPTS Data Extracted from FHWA NPTS web site: http://www-cta.ornl.gov/npts
1990 Census, Journey-to-Work, available from BTS on 1990 CTPP CD-ROM or from Census web site : http://www.census.gov
Prepared by:
NYSDOT, Planning and Strategy Group, March 1998

AN HOURLY TRAFFIC DISTRIBUTION ALTERNATIVE

Air Quality Analysis is a cooperative activity between the New York State Department of Environmental Conservation (ENCON) which performs the emission=s analysis, and the New York State Department of Transportation, which develops the vehicle miles of travel (VMT) inventory and related highway measures for use with the State Implementation Plan. The VMT inventory provides county level area-wide estimates of VMT based on the Highway Performance Monitoring System (HPMS) data by rural, small urban and large urban areas, as well as by roadway functional classification.

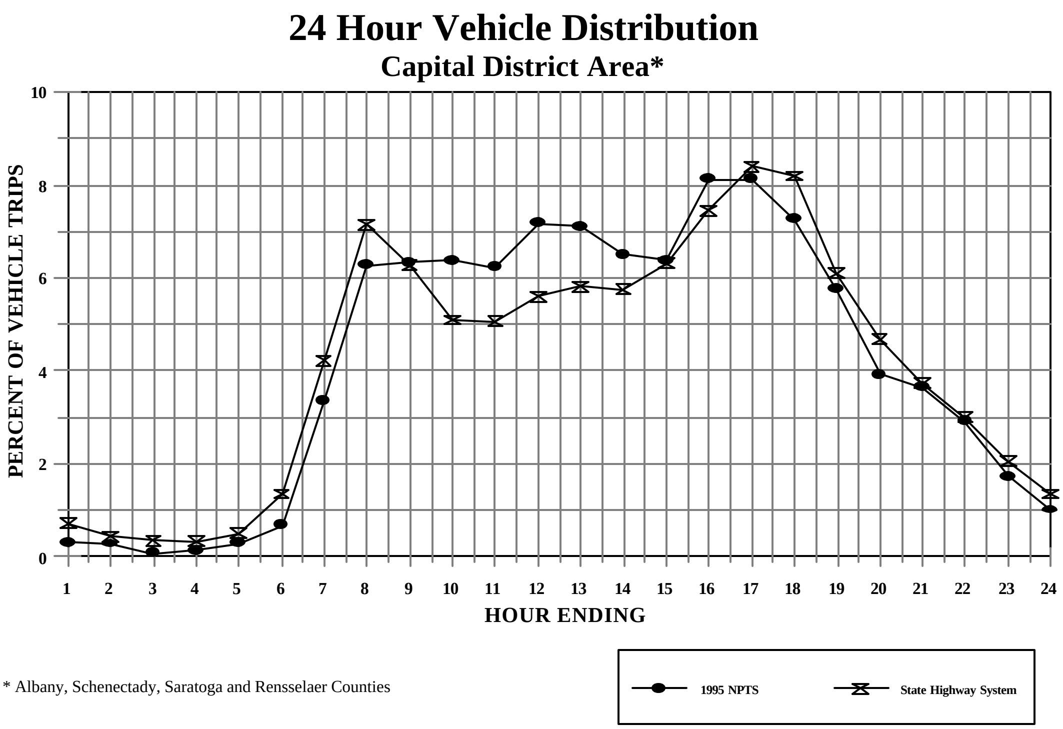
This section will focus on the use of the 1995 Nationwide Personal Transportation Survey for New York State (NPTS_NY) as a source for hourly vehicle distributions to provide greater detail to improve upon the traffic count distributions developed in 1992. That year, ENCON observed that modeled emissions begin to increase in the morning and then drop off by 10:00 a.m., but not rise again until early afternoon following the apparent pattern of the hourly ground count distributions. This was in stark contrast to ozone formation that was observed to increase throughout the day. The Nationwide Personal Transportation Survey collected travel data across the entire day, every day for a whole year. It is possible, therefore, that the 1995 NPTS_NY could shed some light on this problem.

The 1995 Nationwide Personal Transportation Survey for New York State was summarized by urban area strata, for the proportion of hourly Apersonally occupied vehicle@ trips as a percent of the entire day. Since these data represent travel on all roadways within the individual areas, a software routine was developed to construct comparable area-wide hourly vehicle distributions from traffic counts on the State Highway System.

Figure 1 contains two curves; The first is the hourly distribution from the Nationwide Personal Transportation Survey for the Capital District (the counties of Albany, Schenectady, Saratoga, and Rensselaer)-- a typical upstate urban area. The second is the comparable area-wide weighted average hourly traffic count distribution for the State Highway System for the same area. This figure shows that the NPTS_NY hourly distribution of vehicle trips generally follows the State Highway System traffic count pattern especially for the peak periods. However, a midday peak not present in the actual ground count data is observed. This peak is more typical of local non arterial traffic not typically measured in State Highway System arterial counts.

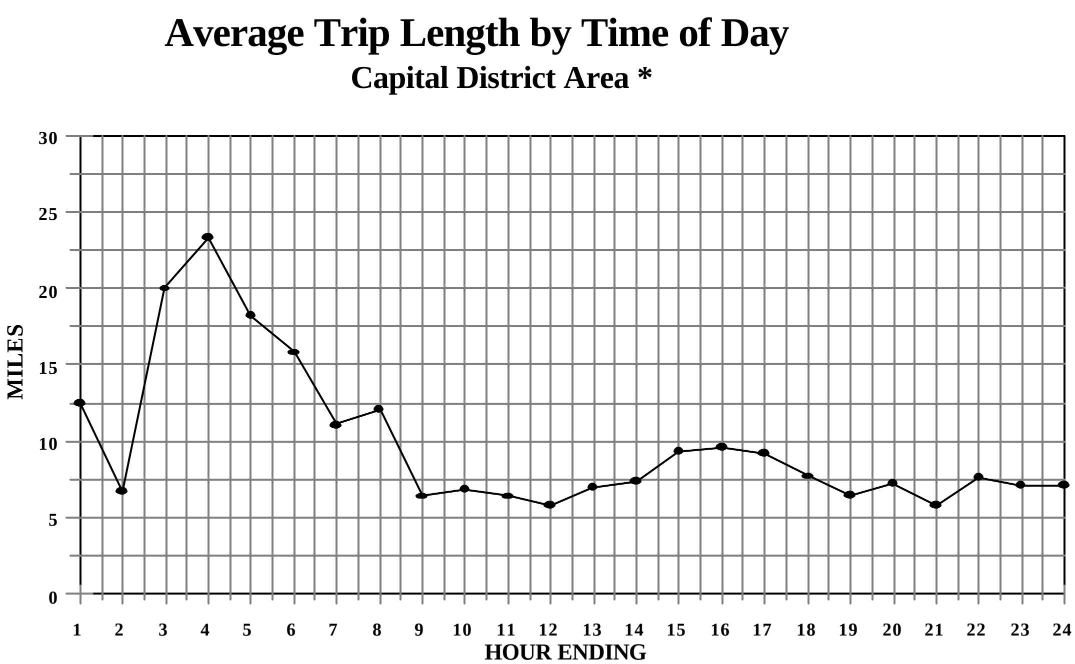
Since midday peaks occurred in the hourly distributions from the NPTS_NY for all urban areas, a computation of the average hourly trip length was undertaken. If the midday peaks are representative of local traffic, it is reasoned that the average trip length would likely be shorter. **Figure 2** for Capital District Area, illustrates the finding for all urban areas, the average trip length is shortest during the midday peak. The very high values in the early morning hours result from fewer observations and longer trip lengths.

Figure 1



* Albany, Schenectady, Saratoga and Rensselaer Counties

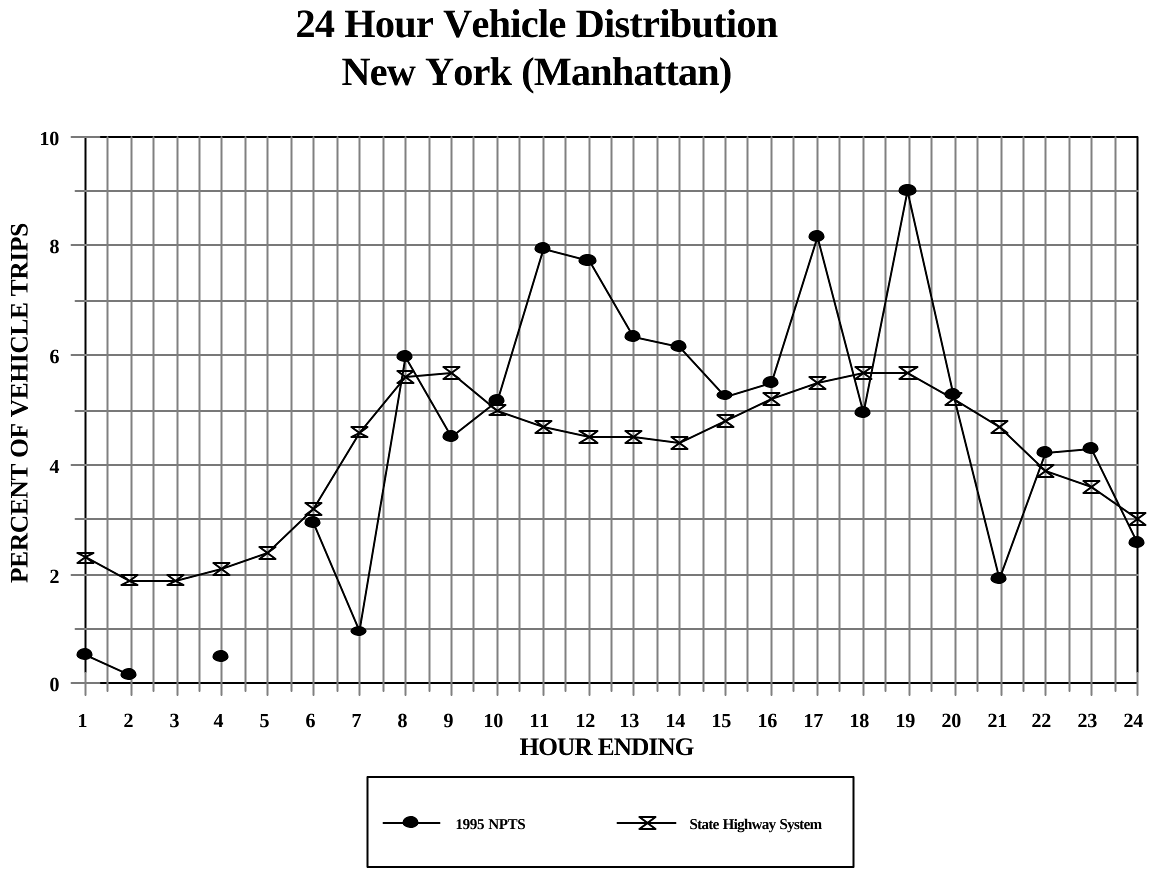
Figure 2



* Albany, Schenectady, Saratoga and Rensselaer Counties

Figure 3 shows the area-wide hourly distributions from both the NPTS_NY and the State Highway System for New York County.

Figure 3



As in **Figure 1**, the prominent midday peak is present along with two or more significant peaks in the evening period. This particular pattern was found in the hourly distributions for each of the five counties within New York City (NYC). The counties of Nassau and Suffolk, east of New York City and the counties of Westchester, Rockland and Putnam, north of New York City exhibited hourly distribution patterns similar to typical urban areas in the state as depicted by **Figure 1**. Depending upon the individual county within New York City, the size of the peaks varied. However, each showed an evening rush hour peak around 5 p.m., an after rush hour peak around 7 p.m., and a smaller late night peak around 10 or 11 p.m. It is probable that the characteristics of New York City, (population density, the individuality of each county as a city within a city, or the nature of local self-contained neighborhoods) may explain the personal vehicle travel behavior noted in the evening peak, compared with that of **Figure 1** for typical upstate areas.

These data were provided to ENCON for each of the urban areas in New York State. For the New York Metropolitan Area, the ten individual county distributions were provided. ENCON replaced the upstate, downstate, and rural hourly distributions with specific NPTS_NY hourly distributions and tested the effects on the EPA MOBILE Emissions model output. *This test showed that the modeled hourly emission results more closely correlate with the increasing hourly profile for the measured ozone data with no significant net change in the overall level of emissions.*

In summary, the data from the Nationwide Personal Transportation Survey for New York State has provided more reliable area-wide hourly traffic distribution for use with ENCON's MOBILE Emissions model. The distribution fits the expected progression of area-wide emissions throughout the day. The NPTS_NY has also shown that the Department's ground count program, when taken in the aggregate, is a good indicator of hourly arterial traffic distributions, but not overall area-wide traffic that includes local roads. Lastly, the NPTS_NY has identified differences in hourly distributions for the evening peak period within the five counties of New York City which requires further examination.

SPEED FROM TRIP LENGTH AND TRAVEL TIME ESTIMATES

One of the critical input parameters for EPA=s MOBILE Emissions Model is the estimate of speed by roadway functional class and time of the day. All transportation projects planned for an air quality non attainment area are required to demonstrate conformity with the area=s emission target. Low speeds and an increasing number of stops per mile are indicative of both high levels of congestion and emissions. As a result, NYSDOT was interested in validating and assessing the accuracy of the speed estimates in current usage.

In 1992, speed estimates by functional classification were developed from each of the urban area network travel demand models. They were based upon Highway Capacity Manual volume/capacity ratios (V/C), and empirical speed data gathered from the field. Three years later, the Nationwide Personal Transportation Survey for New York State (NPTS_NY) collected respondent trip length and travel time which could be used for computing a respondent trip speed. In addition, NYSDOT had the Research Triangle Institute geo-code all trip ends during the conduct of the NPTS_NY. As a result, a separate geo-coded data set exists for New York State.

This section compares several survey-based speed computations and the network travel demand model-based speeds on an urban area-wide basis. In order to examine these different speeds, it is important first to acknowledge some problems with the data:

$ Survey-based travel time clusters around the hour, half, or quarter-hour period. Survey-based distances are reported in whole units and usually rounded to the nearest mile.

$ The geo-coding of the origins and destinations are accurate to the street address, nearest intersection, or zip code centroid.

$ Computation of a straight-line distance between an origin and destination ignores the actual path within the grid-based street network that a traveler might use.

$ Speeds estimated from calibrated network travel demand model assignments are predominantly from arterials and subject to the uniform applicability of capacity type calculations and assumptions about headway and observed V/C at given speeds. Additionally, the tolerance for link volume variations from actual traffic count volumes may introduce variability for V/C and therefore speed calculations from network assignments.

$ Only area-wide speeds can be computed from the Nationwide Personal Transportation Survey for New York State. These are obtained by dividing the reported survey trip length by the reported travel time and for the geo-coded records by using the computed coordinate length between the origin and the destination (the straight-line distance). For comparability, the network travel demand model speeds by roadway functional class were weighted by vehicle miles of travel to construct area-wide speeds for each of the urban areas or counties.

Table 2 contains five columns that compare the computed area-wide speed estimates for the different urban areas or counties. The definitions for these columns are:

$ a) Speeds computed from **all** NPTS_NY trip records for personally occupied vehicle trips using the respondent=s reported trip length and travel time;

$ b) Speeds computed from the respondent=s reported trip length and travel time using personally occupied vehicle trip records from the 82.5% of all records for which geo-coded information exists;

$ c) Speeds computed from the geo-coded straight-line trip length and the respondent=s travel time using the same data records as in b);

$ d) The speed ratio derived from A(c)@ divided by A(b)@ and,

$ e) The vehicle miles of travel weighted average area-wide speeds used by ENCON=s Mobile Emissions model.

Table 2 Estimated Speeds by Stratum

	(a)	(b)	(c)	(d)	(e)
	All NPTS records	NPTS records with O/D coordinates			
Stratums(1)	**Survey Trip Length / Survey Travel Time**	**Survey Trip Length / Survey Travel Time**	**Coordinate Trip Length / Survey Travel Time**	**Coordinate Trip Length(c) / Survey Trip Length(b)**	**NYS ENCON (Weighted Average Area Speeds 1992 SIP)**
Upstate Areas					
Albany	28.05	29.94	23.36	78.0%	35.8
Glens Falls	29.22	30.78	25.67	83.4%	39.5
Utica-Rome	29.29	32.14	26.11	81.2%	37.0
Syracuse	29.83	31.60	22.66	71.7%	33.7
Ithaca	28.31	31.09	25.73	82.8%	38.1
Rochester	28.97	30.64	23.03	75.2%	31.6
Buffalo	26.35	29.28	22.20	75.8%	40.5
Elmira	27.02	27.67	21.45	77.5%	35.1
Poughkeepsie	28.83	31.05	25.11	80.9%	35.8
Binghamton	29.22	30.72	26.99	87.8%	36.8
Newburgh	21.22	22.07	18.88	85.5%	36.1
Small Urban and Rural Areas					
Small urban in rural counties	24.54	28.78	25.92	90.0%	
Rural Counties w/o small urban	31.57	34.61	29.07	84.0%	
New York City					
Bronx	18.57	19.71	15.06	76.4%	21.0
Kings	17.40	18.96	12.49	65.9%	16.6
New York	19.93	19.53	14.88	76.2%	9.6
Queens	21.79	21.33	17.45	81.8%	17.5
Richmond	20.84	21.49	16.44	76.5%	18.7
Nassau	22.91	26.10	19.62	75.2%	17.5
Suffolk	27.98	28.63	22.75	79.5%	23.7
Putnam/Rockland	30.51	30.87	20.61	66.8%	29.5
Westchester	25.21	25.42	20.06	78.9%	26.7
			Average Ratio (c)/(b)	78.7%	
			SD	5.9%	
(1) NYS 1995 NPTS Add-on Stratum (Primary Urban County)					

Speeds from the NPTS_NY are computed in a fashion similar to the interval-grouping for speed based ground counts. The trip records are summarized by speed intervals and the percentage of the total computed for all records within each urban area or county. The weighted harmonic average speed for each area is then computed using the midpoint of each speed interval and its percentage.

Several interesting observations regarding **Tables 2 and 3** are noted:

- The speeds from the selected set of survey records that have geo-coded trip ends (b) are *not appreciably* different from those of the entire survey data set (a) for New York State.

- In *less congested upstate urban areas*, the network-based speed estimates (e) from the travel demand model assignments provide speeds that are on average *25% higher* than the survey-based speeds (b).

- In the ten individual counties within the New York Metropolitan area, the conclusions on speed are varied. For the five counties within New York City except the Bronx, and the suburban counties of Rockland and Putnam the network-based speed estimate (e) is lower than the survey-based speed (b). In most instances the network speed seems to fall between the survey speed (b) and the coordinate length estimates (c) except New York County. In this instance, the network speed estimate (e) is half the survey estimate (b).

Differences In Trip Length Estimates

Column (d) in **Table 2**, shows that the NPTS_NY straight-line speed (c) is 78.7% of the survey length-based speed (b) with a deviation of +/- 5.9%. Travel time is constant in each of the speed estimates and the ratio of these two weighted average speed measures essentially yields the ratio of the coordinate and survey trip length. This means that the coordinate-based trip length is 73% to 85% of the respondent-based trip length in the survey.

Table 3 Column (d) shows that even for different destination trip purposes, the proportional relationship of speed based upon the survey in column (b) is 76.8% of the speed based upon the coordinate or straight-line distance (c) with a deviation of +/- 2.2%. This indicates that trip purpose is not a factor in this difference.

Table 3 Estimated Speeds by Trip Purpose

	(a)	(b)	(c)	(d)
Trip Purpose (1)	**Survey Trip Length / Survey Travel Time**	**Survey Trip Length / Survey Travel Time**	**Coordinate Trip Length / Survey Travel Time**	**Coordinate Trip Length(c) / Survey Trip Length(b)**
Work		31.80	23.95	75.3%
Shop		28.04	22.64	80.8%
School Religion		26.41	20.11	76.2%
Personal Business		27.25	20.65	75.8%
Social Recreation		30.87	22.85	74.0%
Home		27.82	21.85	78.5%
			AVG. ratio	76.8%
			SD ratio	2.2%

(1) WHYTRP95 Re-code Home = codes 17 Work = codes 1,2,3 Shop = codes 4
School Religion = codes 5,6 Personal Business = codes 7 - 10 Social Recreation = codes 11-16

Straight-line distance between two points views the urban street grid system from the standpoint of the Pythagorean Theorem. Evaluating a right triangle with values of two sides between 0.25 and 7.0 in one-quarter increments shows that the ratio of the hypotenuse to the sum of the other two sides is 77.7%, with a variation of + / - 7.4%. Therefore, the difference between straight-line or coordinate distance and survey trip length may be attributed to highway system geometry and not respondent estimation error, because people do not generally travel in a straight line.

In a somewhat related analysis that examined a GIS based network routing solution for geo-coded trip data in the Syracuse urban area, a much more interesting finding was discovered regarding the accuracy of respondents= reported trip length estimates. The average NPTS_NY personally occupied vehicle trip length in the Syracuse area is 9.08 miles. For personally occupied vehicle trip records with intersection geo-coded origins and destinations, 63% of the time the respondent=s estimate of trip length was longer than the network-based trip routing solution by no more then 5%. Moreover, the respondent=s trip length estimate was 5-10% longer than the routing solution 36% of the time. Only 1% of the respondents exceeded the network routing solution by more than 10%. A 5% error in the respondent=s trip length, converts to a difference of less than a half mile. Considering that the respondent is probably rounding distance to at least the nearest mile, this difference suggests that the respondent=s estimate may be very reliable.

The examination of the Nationwide Personal Transportation Survey for New York State and its geo-coded data leads to the conclusion that the network travel demand model estimated speeds are a reasonable approach. *However in the less congested upstate urban areas, the network speeds tend to provide higher calculated area-wide speeds than the survey would suggest. In the more congested counties within the New York Metropolitan area, they are much closer to the survey-based area-wide speeds. The only exception is in New York County (Manhattan) which requires further examination. Straight-line trip length appears to be less accurate than the respondent=s trip length estimate. However, the GIS network-based trip routing solution for intersection geo-coded data in the Syracuse urban area suggests that the respondent=s estimate is an accurate estimate of the actual trip length.*

ANNUAL VEHICLE UTILIZATION

Vehicle emissions are a factor of vehicle age, type, and annual usage during the year. Emissions vary by vehicle model year, as well as a model year=s proportion of the total vehicle population. Vehicle age distributions by vehicle type are readily obtainable from the New York State Department of Motor Vehicles registration data files, but actual vehicle usage is not. The New York State Department of Transportation was concerned that national level data recommended for use with EPA=s MOBILE 6 Emissions Model would not be appropriate for New York State. One of the component data sets in the Nationwide Personal Transportation Survey is the vehicle file. The vehicle data from this file were examined to compare the average annualized vehicle odometer readings with the U.S. distributions and fitted data being supplied with EPA=s MOBILE 6 Emissions Model.

Figures 4, shows this comparison for light duty gas vehicles (LDGV), Aautos.@ **Figure 5**, shows this comparison for light duty gas trucks (LDGT), Apickups, sports utility vehicles, and vans.@ Both figures show the raw data and the fitted exponential curves for both the U. S. and New York State.

Figure 4

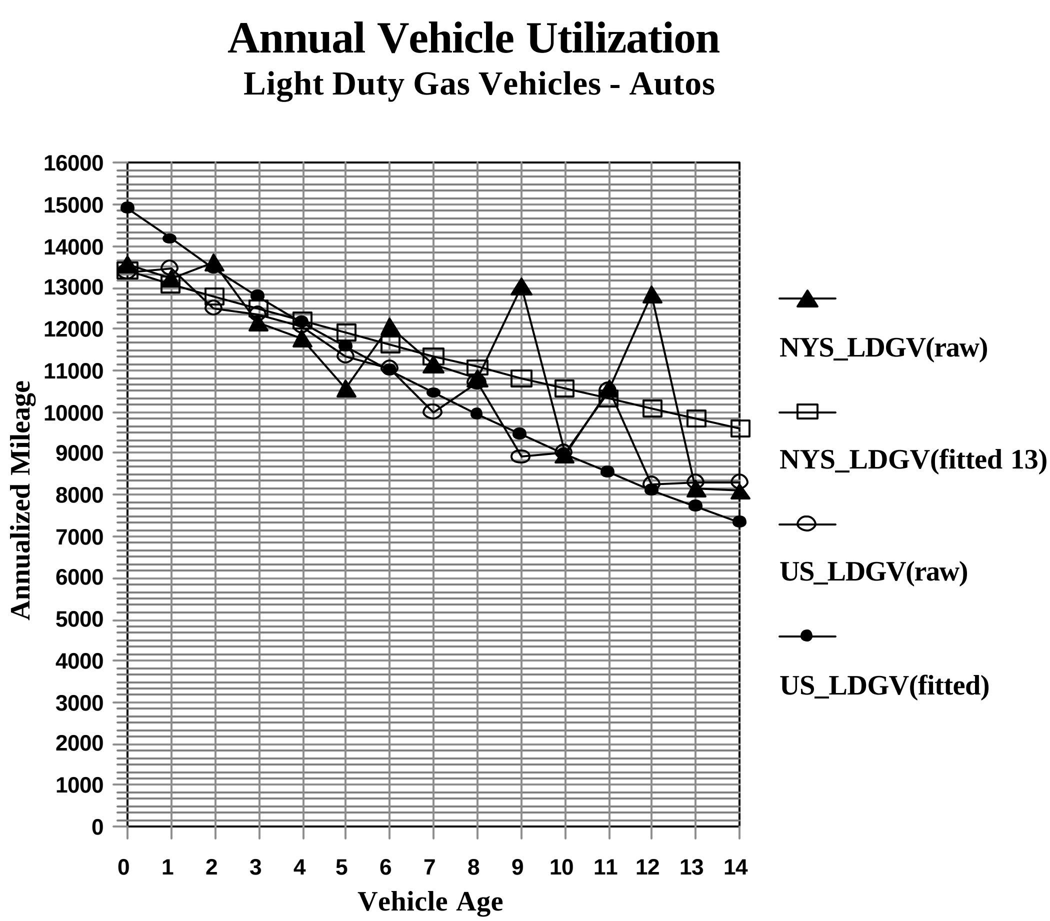
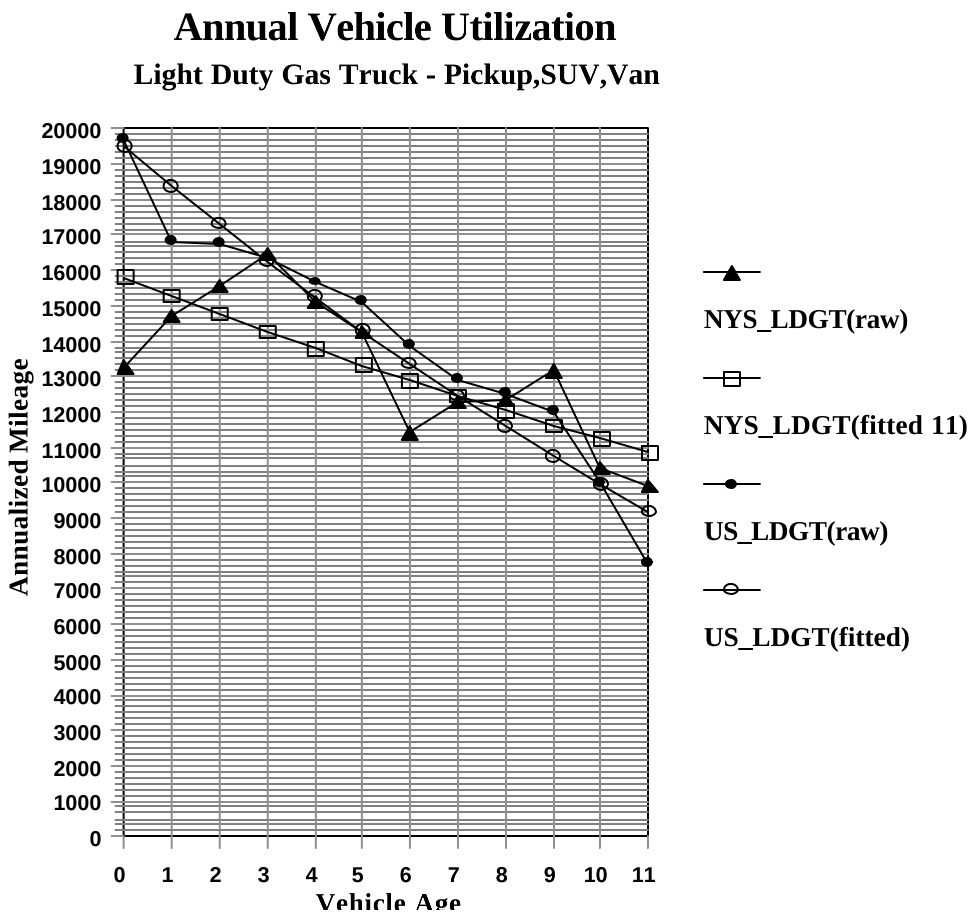


Figure 5



Figures 4 and 5 contain the fitted exponential curves calibrated against the New York State and U.S. average annualized vehicle odometer readings. The figures show that fitted EPA data is significantly different from the fitted New York State data. Of 75,217 vehicle records in the U.S. data set, average annualized mileages were computed for 42.7% of the vehicles. Of the 17,606 vehicle records in the New York State data set (which are part of the national set), average annualized mileages were computed for 46.2% of the vehicles.

Examination of the New York State data set shows extremely wide variations in annualized mileage for vehicles older than 14 or 12 years of age (not shown) respectively, for both autos or light trucks. **Table 4** shows the average number of data points represented by each average annualized mileage point for all vehicle ages and those in **Figures 4 and 5**. Variability in a data set due to outliers or, in this case, too few observations, significantly influences the ability to fit a reliable curve to the raw data. Although these observations are readily identifiable in the New York State data set, the number of observations used in the EPA analysis for MOBILE 6 is not known. A larger data set drives average annualized mileage variation toward the mean in each age cohort and significantly reduces the variability in the data. If this were a problem in the EPA data set, its resolution is unknown, because the data do not exhibit extreme values for average annualized mileage. As a result, the equations fitted for the New York State data were done for vehicle ages 0-13 years for autos, and 0-11 years for light duty trucks as in **Table 4**.

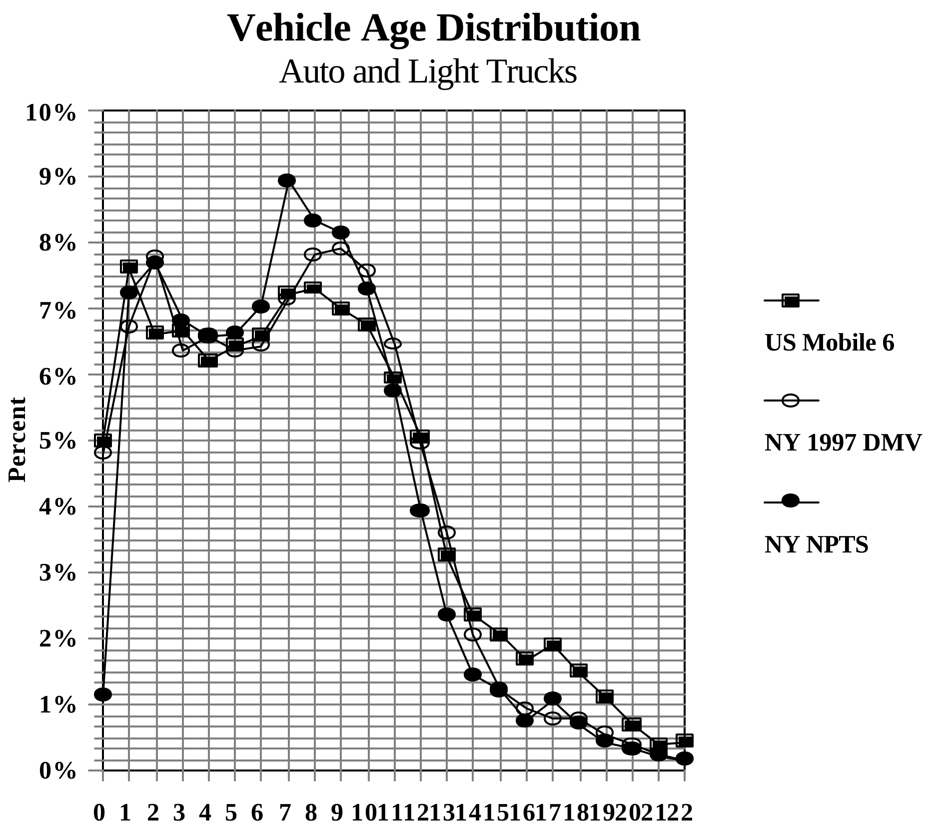
Table 4 Number of Survey Records with Annualized Mileage

Age Cohort	LDGV Avg. # of records		Age Cohort	LDGT Avg. # of records
0 - 13	**391**		0 - 11	**164**
14 - 62+	**15**		12 - 77+	**12**

Examination of the resultant fitted curves in **Figures 4 and 5**, showed that the New York State average annualized mileage does not decline as rapidly as the national data set, especially for autos, and that newer light trucks in general have a lower rate of use than in the nation. ***Figure 4*** *shows that auto use in New York State remains higher over a longer period than for the U. S. The initial annual utilization rates for autos and light trucks are noticeably lower in the first three years than it is for the U. S. Lastly, while light duty trucks have a lower initial average annualized mileage it rises above the national average as the vehicle moves into the 7-10 year age group.*

Figure 6 compares the age distributions for light duty autos and trucks in the 1996 national fleet, with the 1997 New York State Department of Motor Vehicles AVehicles in Operation@ data, and the 1995 vehicle age distributions from the NPTS_NY. The proportion of 5-10 year-old vehicles in the New York State fleet exceed that for the nation based on the area under the curve for these age cohorts. In addition, for all vehicle age cohorts 2-10 years, the New York State vehicle fleet has higher distribution proportions than the national of which it is part. *This indicates that a vehicle=s retention in the fleet lasts longer in New York State.* It is possible that this is the result of the high level of public transit use, primarily in New York City and the lower per capita vehicle ownership that results. *The rate of vehicle retention coupled with the difference in annual usage rates for autos and light trucks in* ***Figures 4 and 5*** *will affect emissions.*

Figure 6


Vehicle Age Distribution
Auto and Light Trucks
Percent
10%
9%
8%
7%
6%
5%
4%
3%
2%
1%
0%
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
US Mobile 6
NY 1997 DMV
NY NPTS

ENGINE MODE OF OPERATION

Estimates of hot and cold start percentages are the most problematic of the input parameters to the Mobile Emissions Model. In particular, the range of cold start modes of operation can have as much impact on emissions as speed and ambient temperature input ranges; yet it is more difficult to assess. The current Mobile 5b Emissions Model in use by the New York State Department of Environmental Conservation (ENCON) relies upon percent cold proportions established in 1992. These data were based upon estimates derived from several studies described in the literature dating from the late 1970s to the late1980s. The percentage of hot and cold starts were synthesized for four time periods. The time periods or bands reflected peak and off peak periods in a typical 24-hour traffic volume distribution. The data were prepared for three highway categories (Interstate and Expressway, Arterial, and All Other Roadways). The data were also weighted by the vehicle miles of travel in each highway category. At the time this approach relied upon engineering judgement and the best available data.

The 1995 Nationwide Personal Transportation Survey in New York State (NPTS_NY) provided the opportunity to reexamine this issue both geographically and temporally within a 24-hour period. Because the 1995 NPTS_NY was a residential home interview-based survey, it was only possible to compute area-wide estimates. This approach required the computation of the number of hot and cold starts for the trips taken by each vehicle in the household. By sequencing the trips for the individual vehicles, the duration between the end of one trip and the beginning of the next can be calculated. If the duration between trips was greater than 60 minutes, a cold start was determined. A cold start was assumed for the first trip of the day for all vehicles.

Engine mode of operation was classified into four categories. These categories are based on the length of time (duration) between the ending of one trip and the beginning of the next and in the trip length measured in minutes. The 1995 NPTS_NY trip travel time was compared to nine minutes to reflect the 505 second Federal Test Procedure (FTP) engine start and driving cycle.

The duration is **more** then 60 minutes:

- Cold Start-Cold Mode (**CS_CM**) - vehicle started **cold**, driven **less** than nine minutes.
- Cold Start-Hot Mode (**CS_HM**) - vehicle started **cold**, driven **more** than nine minutes.

The duration is **less** then 60 minutes:

- Hot Start-Cold Mode (**HS_CM**)- vehicle started **hot**, driven **less** than nine minutes.
- Hot Start-Hot Mode (**HS_HM**)- vehicle started **hot**, driven **more** than nine minutes.

Figure 7, shows the 24-hour distribution of the four engine modes of operation for statewide vehicle trips as a percent of all vehicle trips, and the percentage of hourly vehicle trips. Categories CS_HM and HS_HM when taken together represent the hot stabilized emission mode of vehicle operation.

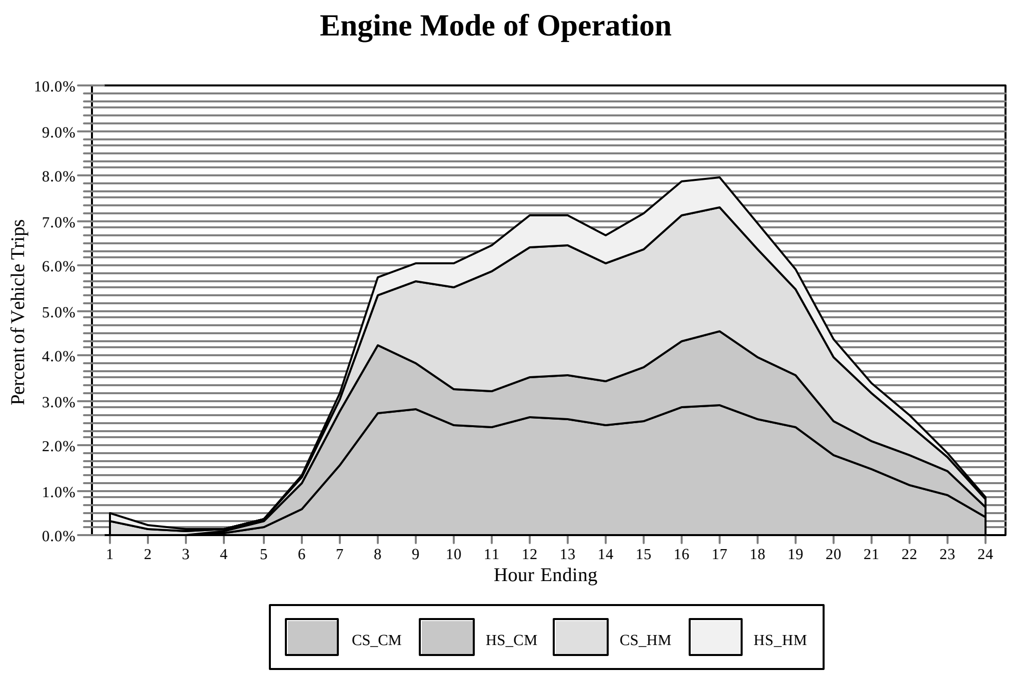
Figure 8, uses the duration between engine starts to classify hot or cold starts. The data are presented for statewide vehicle trips as a percent of all vehicle trips, and for the percentage of hourly vehicle trips.

Figure 9, shows the number and percent of statewide vehicle trips less than and more than nine minutes in duration for vehicle trips as a percent of all vehicle trips, and the percentage of hourly vehicle trips.

The 24-hour distribution of statewide vehicle trips in ***Figures 7, 8, and 9****, reflects the temporal traffic distribution described in* ***Figure 1****.* The morning, midday, and evening peaks are evident in these figures. ***Figure 2 and 9*** *describing average trip lengths and trip time also show consistency.* However, differences in the percent of vehicle trips in hours one and 24 are displayed in **Figures 7, 8** and to a lesser extent **Figure 9**. *This may result from too few trips being reported in this period, or problems with coding trips that did not start or end on the Atravel day.@*

Figure 10 shows the hot/cold start distribution from the New York State Department of Environmental Conservation=s Mobile 5b emissions model for AAll Other Roads@ as the hourly percentage of vehicle trips (in this roadway category statewide). The short individual trip lengths in the Nationwide Personal Transportation Survey best reflect the AAll Other Roads@ category (Minor Arterial, Major and Minor Collectors and Locals) rather than the longer distance trips that would more likely use the AInterstate or Expressways@ and/or APrincipal Arterial@ roadways. ***Figure 10****, suggests that the peak period cold start cold mode, the midday cold start hot mode, and the midday stabilized mode (CS_HM and HS_HM) estimates currently being used, shared some similarity with those periods in the engine mode of operation data obtained from the NPTS_NY 24-hour statewide distribution in* ***Figures 7, 8, and 9****. Variation throughout the day as shown in* ***Figure 10****, is obviously not handled well by the current hot and cold start estimates. The availability of a 24-hour distribution from the NPTS_NY for these data, as well as developing these data for different metropolitan areas within New York State, will clearly have an impact on the accumulation of emissions throughout the day. The continuous 24-hour statewide distribution obtained from the NPTS_NY, also suggests that the hot and cold start estimates for the other two roadway categories may need to be reexamined in light of these findings.*

Figure 7


Engine Mode of Operation
10.0%
9.0%
8.0%
7.0%
6.0%
5.0%
4.0%
3.0%
2.0%
1.0%
0.0%
Percent of Vehicle Trips
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Hour Ending
CS_CM
HS_CM
CS_HM
HS_HM

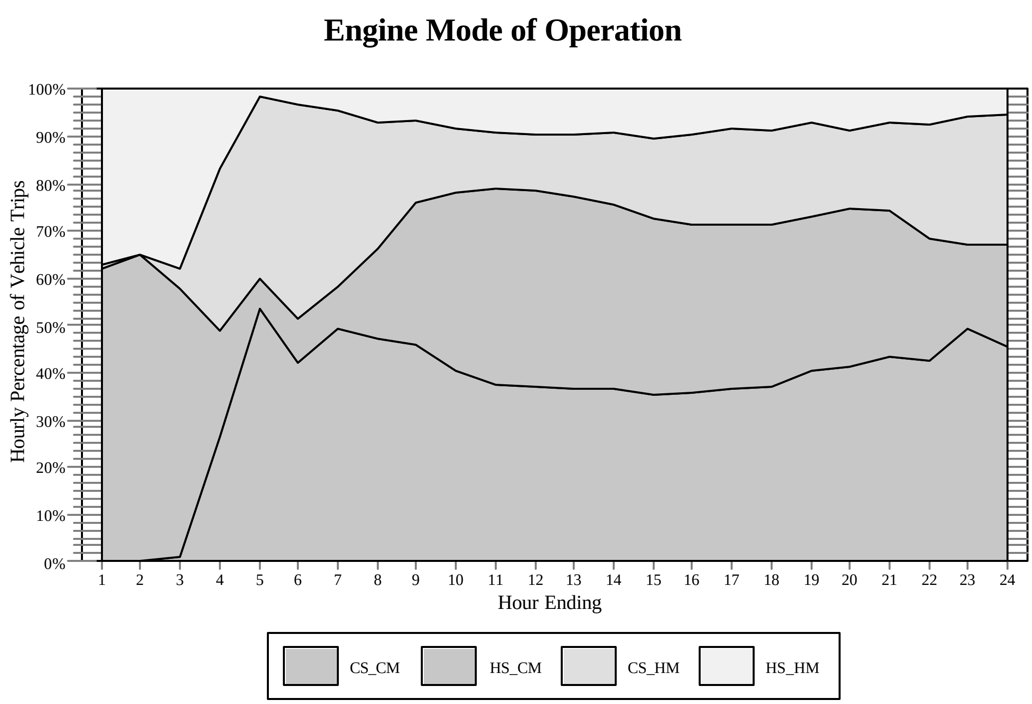
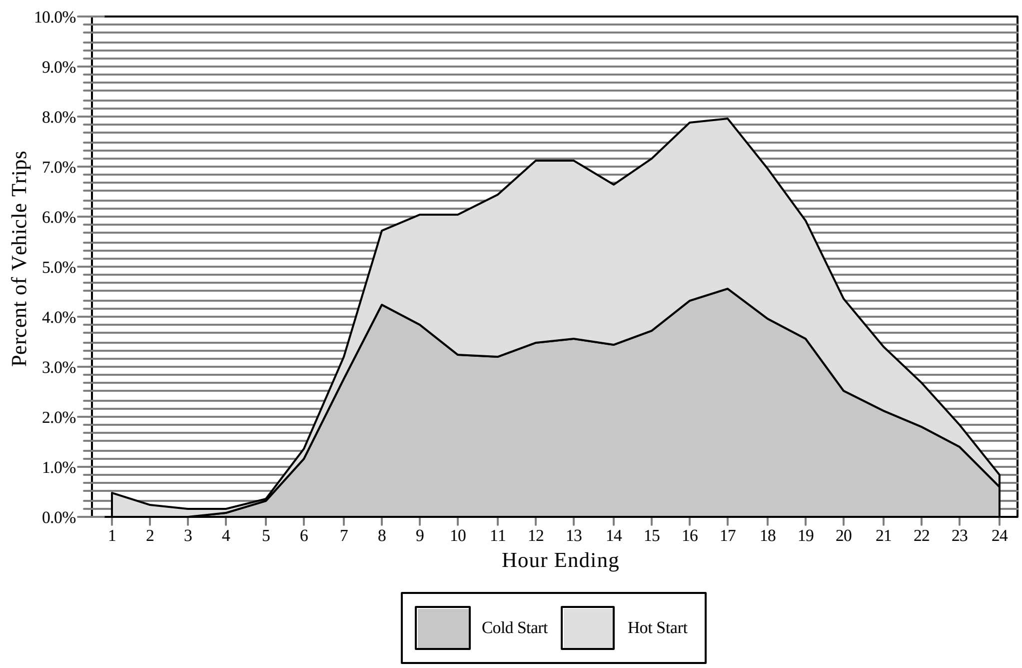

Engine Mode of Operation
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Hourly Percentage of Vehicle Trips
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Hour Ending
CS_CM
HS_CM
CS_HM
HS_HM

Figure 8

Duration Between Engine Starts



Duration Between Engine Starts

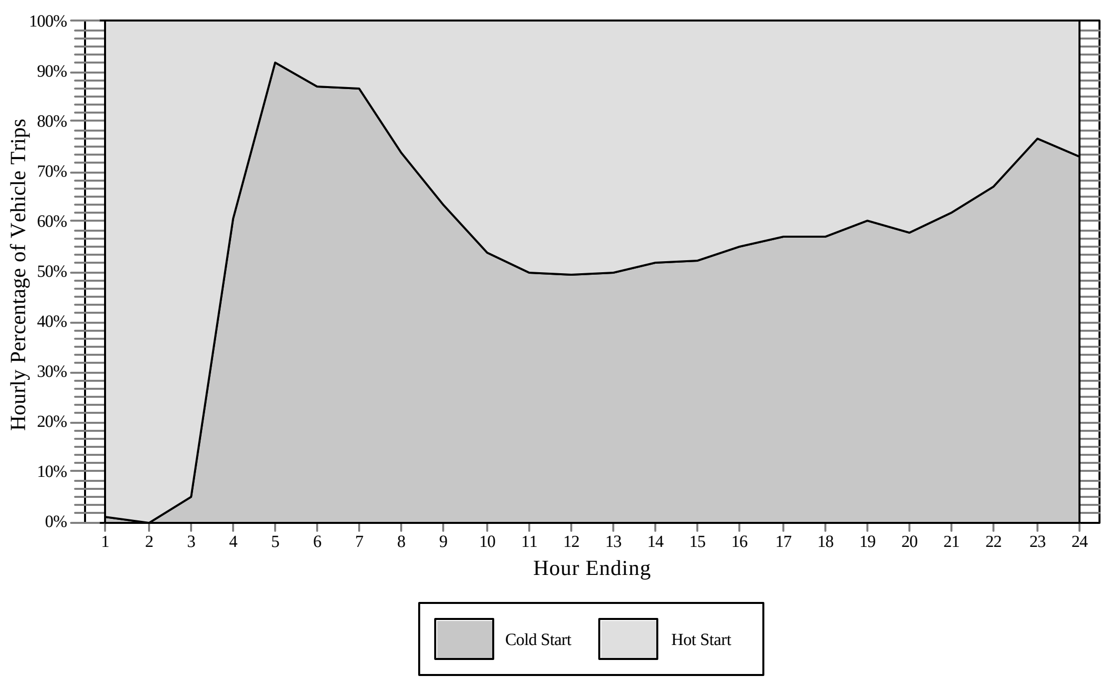
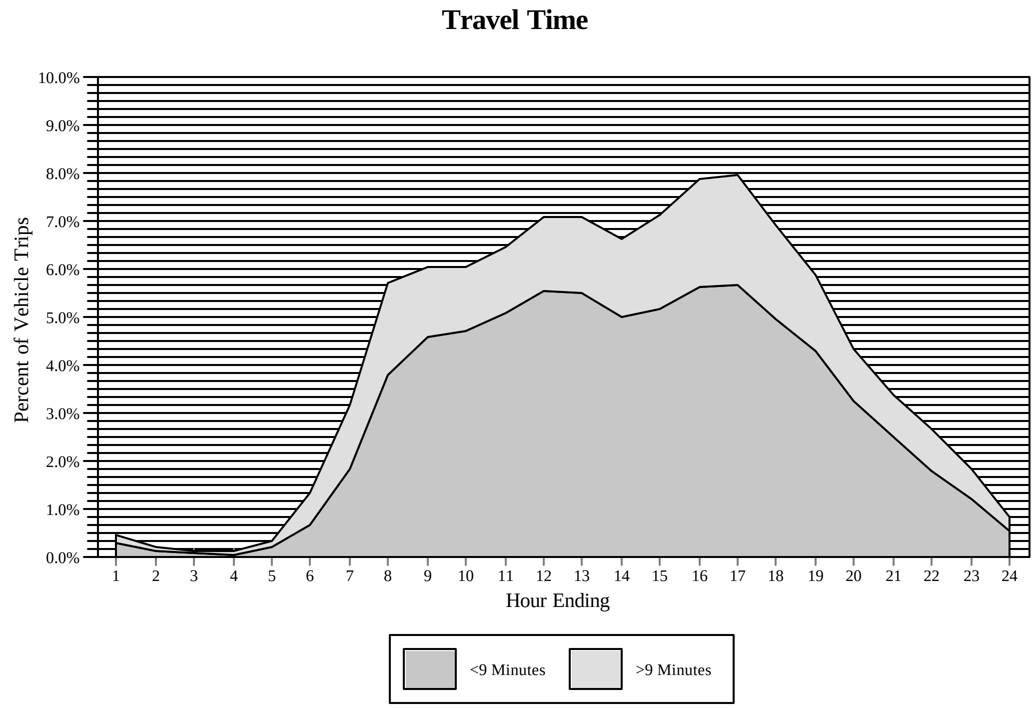


Figure 9


Travel Time
10.0%
9.0%
8.0%
7.0%
6.0%
5.0%
4.0%
3.0%
2.0%
1.0%
0.0%
Percent of Vehicle Trips
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Hour Ending
<9 Minutes
>9 Minutes

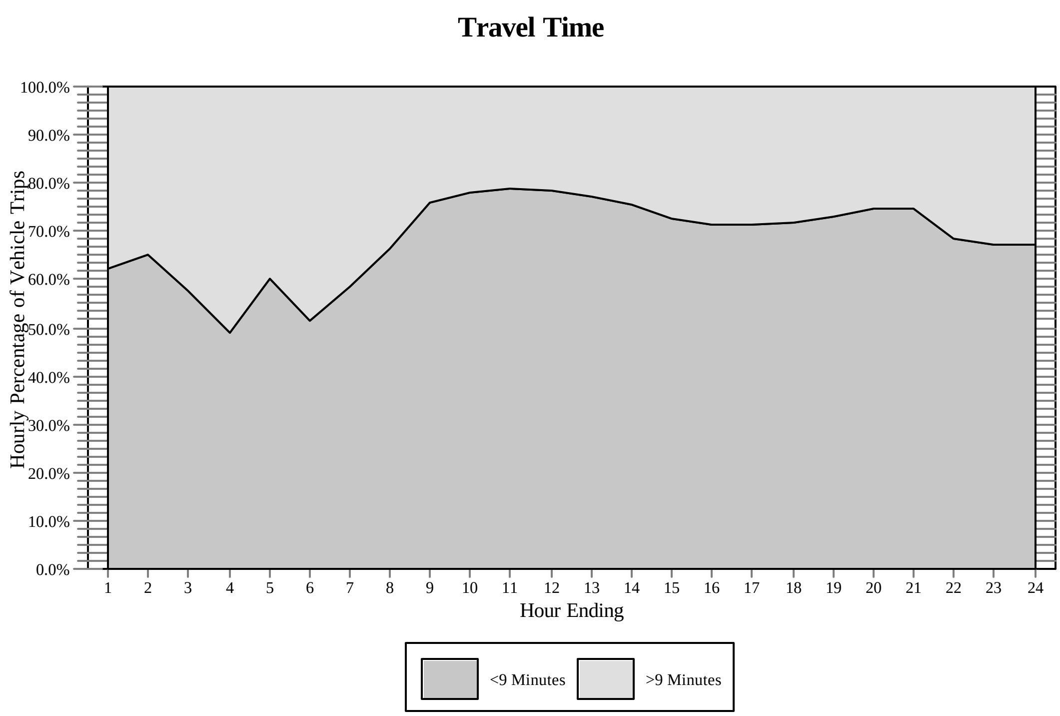
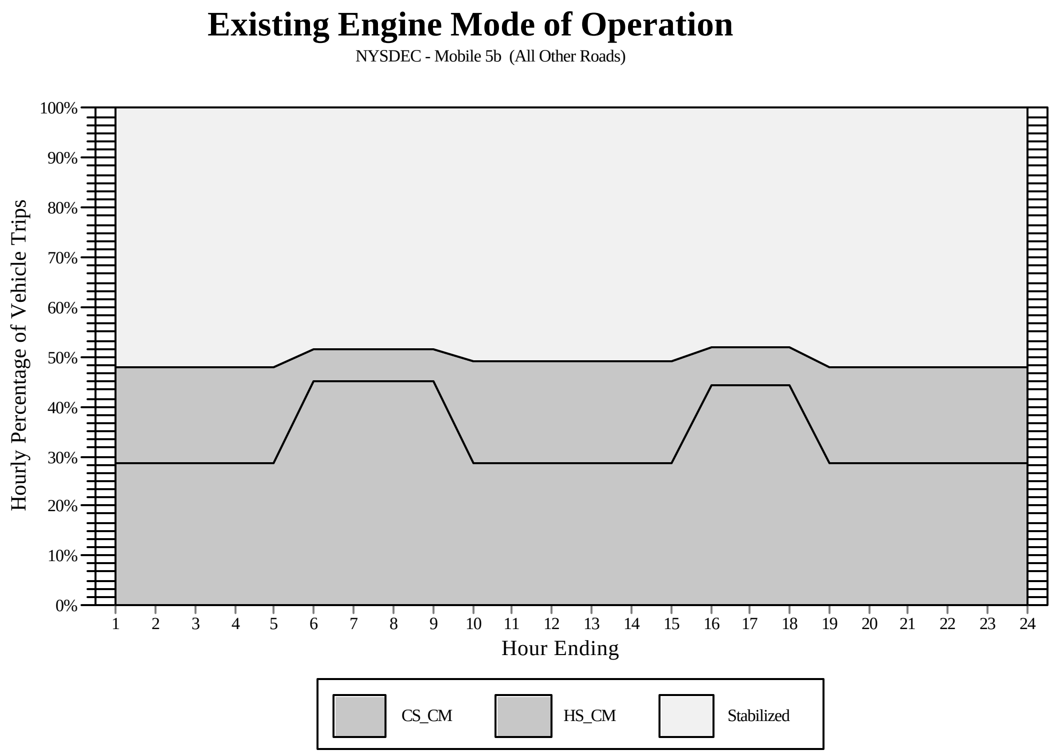

Travel Time
100.0%
90.0%
80.0%
70.0%
60.0%
50.0%
40.0%
30.0%
20.0%
10.0%
0.0%
Hourly Percentage of Vehicle Trips
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Hour Ending
<9 Minutes
>9 Minutes

Figure 10



Existing Engine Mode of Operation
NYSDEC - Mobile 5b (All Other Roads)
Hourly Percentage of Vehicle Trips
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Hour Ending
CS_CM
HS_CM
Stabilized

General Findings

The 1995 Nationwide Personal Transportation Survey for New York State provides a valuable metropolitan area, and in the case of the New York Metropolitan area, a county data set to address a variety of transportation air quality related questions. Perhaps the most important finding is that a state specific survey has a major role in addressing state transportation issues, especially those related to using state values in EPA=s MOBILE Emission Model.

$ The survey shows that the number of workers working at home in 1995 is 5.1% of all workers--double that reported in the 1990 Census.

$ The survey also suggests that while the number of workers working at home is increasing, the real increase may be occurring with those workers who have long distance commutes to other urban areas for employment.

$ The findings have demonstrated that this survey can serve as a source for area-wide hourly vehicle distributions.

$ These area-wide hourly vehicle distributions capture local traffic that is not part of arterial distributions available from traffic counts on the State Highway System.

$ The survey based, hourly vehicle distributions have improved the correlation between hourly emission model results and measured ozone data.

$ Area-wide speed estimates developed from the survey are a useful measure for testing the reasonableness of the network travel demand model speed estimates.

$ Area-wide speed estimates from the survey also indicate that the network-based speed methodology may overestimate speeds in less congested areas, and provide comparable speeds in more congested areas. However, speeds in New York County (Manhattan) may require further examination.

$ A GIS network routing solution for geo-coded NPTS_NY vehicle trip data in the Syracuse urban area suggests that the respondents= trip length estimate may indeed be an accurate estimate of how far they travel. However, this requires further confirmation by examining other urban areas in the data set.

$ Analysis of the vehicle file in the NPTS_NY reveals that national average annualized mileage estimates for auto and light truck usage and the age proportion of these fleets differ noticeably from those for New York State.

$ Analysis of the engine mode of operation from the NPTS_NY discloses a 24-hour distribution that is significantly different from that currently being used. Implementation of this distribution will impact the accumulation of emissions throughout the day.

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Mobile 5b Users Manual, September 1996, United States Environmental Protection Agency.

Attachment 6

MILEAGE ACCUMULATION RATES

Vehicle Type	LDGV	LDGT1	LDGT2	LDGT3	LDGT4	HDGV2B	HDGV3	HDGV4	HDGV5
yr1	0.13531	0.15810	0.15810	0.21331	0.21331	0.19977	0.19977	0.21394	0.21394
yr2	0.13172	0.15281	0.15281	0.19865	0.19865	0.18779	0.18779	0.19692	0.19692
yr3	0.12823	0.14769	0.14769	0.18500	0.18500	0.17654	0.17654	0.18125	0.18125
yr4	0.12483	0.14274	0.14274	0.17228	0.17228	0.16596	0.16596	0.16683	0.16683
yr5	0.12152	0.13796	0.13796	0.16044	0.16044	0.15601	0.15601	0.15356	0.15356
yr6	0.11830	0.13333	0.13333	0.14942	0.14942	0.14666	0.14666	0.14134	0.14134
yr7	0.11516	0.12885	0.12885	0.13915	0.13915	0.13787	0.13787	0.13010	0.13010
yr8	0.11210	0.12453	0.12453	0.12959	0.12959	0.12961	0.12961	0.11975	0.11975
yr9	0.10912	0.12035	0.12035	0.12068	0.12068	0.12184	0.12184	0.11022	0.11022
yr10	0.10622	0.11630	0.11630	0.11239	0.11239	0.11454	0.11454	0.10145	0.10145
yr11	0.10339	0.11239	0.11239	0.10466	0.10466	0.10768	0.10768	0.09338	0.09338
yr12	0.10064	0.10861	0.10861	0.09747	0.09747	0.10122	0.10122	0.08595	0.08595
yr13	0.09796	0.10495	0.10495	0.09077	0.09077	0.09516	0.09516	0.07911	0.07911
yr14	0.09535	0.10142	0.10142	0.08453	0.08453	0.08946	0.08946	0.07282	0.07282
yr15	0.09281	0.09800	0.09800	0.07872	0.07872	0.08409	0.08409	0.06703	0.06703
yr16	0.09033	0.09470	0.09470	0.07331	0.07331	0.07905	0.07905	0.06169	0.06169
yr17	0.08792	0.09151	0.09151	0.06828	0.06828	0.07432	0.07432	0.05679	0.05679
yr18	0.08557	0.08842	0.08842	0.06358	0.06358	0.06986	0.06986	0.05227	0.05227
yr19	0.08329	0.08543	0.08543	0.05921	0.05921	0.06568	0.06568	0.04811	0.04811
yr20	0.08106	0.08255	0.08255	0.05514	0.05514	0.06174	0.06174	0.04428	0.04428
yr21	0.07889	0.07976	0.07976	0.05135	0.05135	0.05804	0.05804	0.04076	0.04076
yr22	0.07678	0.07706	0.07706	0.04782	0.04782	0.05456	0.05456	0.03752	0.03752
yr23	0.07473	0.07445	0.07445	0.04454	0.04454	0.05129	0.05129	0.03453	0.03453
yr24	0.07273	0.07194	0.07194	0.04184	0.04184	0.04822	0.04822	0.03178	0.03178
yr25	0.07078	0.06950	0.06950	0.03863	0.03863	0.04533	0.04533	0.02926	0.02926
Vehicle Type	HDGV6	HDGV7	HDGV8A	HDGV8B	LDDV	LDDT12	HDDV2B	HDDV3	HDDV4
yr1	0.21394	0.21394	0.21394	0.21394	0.13531	0.27059	0.27137	0.32751	0.30563
yr2	0.19692	0.19692	0.19692	0.19692	0.13172	0.24384	0.24831	0.28984	0.28622
yr3	0.18125	0.18125	0.18125	0.18125	0.12823	0.21973	0.22721	0.25650	0.26805
yr4	0.16683	0.16683	0.16683	0.16683	0.12483	0.19801	0.20791	0.22699	0.25103
yr5	0.15356	0.15356	0.15356	0.15356	0.12152	0.17843	0.19024	0.20088	0.23509
yr6	0.14134	0.14134	0.14134	0.14134	0.11830	0.16079	0.17407	0.17778	0.22016
yr7	0.13010	0.13010	0.13010	0.13010	0.11516	0.14490	0.15928	0.15733	0.20618
yr8	0.11975	0.11975	0.11975	0.11975	0.11210	0.13057	0.14575	0.13923	0.19309
yr9	0.11022	0.11022	0.11022	0.11022	0.10912	0.11766	0.13336	0.12321	0.18083
yr10	0.10145	0.10145	0.10145	0.10145	0.10622	0.10603	0.12203	0.10904	0.16935
yr11	0.09338	0.09338	0.09338	0.09338	0.10339	0.09555	0.11166	0.09650	0.15860
yr12	0.08595	0.08595	0.08595	0.08595	0.10064	0.08610	0.10217	0.08540	0.14853
yr13	0.07911	0.07911	0.07911	0.07911	0.09796	0.07759	0.09349	0.07557	0.13910
yr14	0.07282	0.07282	0.07282	0.07282	0.09535	0.06992	0.08555	0.06688	0.13026
yr15	0.06703	0.06703	0.06703	0.06703	0.09281	0.06301	0.07828	0.05919	0.12199
yr16	0.06169	0.06169	0.06169	0.06169	0.09033	0.05678	0.07163	0.05238	0.11425
yr17	0.05679	0.05679	0.05679	0.05679	0.08792	0.05116	0.06554	0.04635	0.10699
yr18	0.05227	0.05227	0.05227	0.05227	0.08557	0.04610	0.05997	0.04102	0.10020
yr19	0.04811	0.04811	0.04811	0.04811	0.08329	0.04155	0.05488	0.03630	0.09384
yr20	0.04428	0.04428	0.04428	0.04428	0.08106	0.03744	0.05021	0.03213	0.08788
yr21	0.04076	0.04076	0.04076	0.04076	0.07889	0.03374	0.04595	0.02843	0.08230
yr22	0.03752	0.03752	0.03752	0.03752	0.07678	0.03040	0.04204	0.02516	0.07707
yr23	0.03453	0.03453	0.03453	0.03453	0.07473	0.02740	0.03847	0.02227	0.07218
yr24	0.03178	0.03178	0.03178	0.03178	0.07273	0.02469	0.03520	0.01971	0.06760
yr25	0.02926	0.02926	0.02926	0.02926	0.07078	0.02225	0.03221	0.01744	0.06331

Vehicle Type	HDDV5	HDDV6	HDDV7	HDDV8A	HDDV8B	MC	HDGB	HDDBT	HDDBS	LDDT34
yr1	0.30563	0.40681	0.40681	0.87821	1.24208	0.04786	0.35123	0.45171	0.09939	0.26040
yr2	0.28622	0.36827	0.36827	0.78257	1.12590	0.04475	0.31914	0.43731	0.09939	0.24018
yr3	0.26805	0.33420	0.33420	0.69735	1.02060	0.04164	0.28999	0.42337	0.09939	0.22154
yr4	0.25103	0.30291	0.30291	0.62141	0.92514	0.03853	0.26350	0.40987	0.09939	0.20434
yr5	0.23509	0.27455	0.27455	0.55374	0.83861	0.03543	0.23942	0.39681	0.09939	0.18848
yr6	0.22016	0.24885	0.24885	0.49343	0.76017	0.03232	0.21755	0.38416	0.09939	0.17385
yr7	0.20618	0.22555	0.22555	0.43970	0.68907	0.02921	0.19768	0.37191	0.09939	0.16036
yr8	0.19309	0.20443	0.20443	0.39181	0.62462	0.02611	0.17926	0.36005	0.09939	0.14791
yr9	0.18083	0.18529	0.18529	0.34915	0.56620	0.02300	0.16321	0.34857	0.09939	0.13643
yr10	0.16935	0.16795	0.16795	0.31112	0.51324	0.01989	0.14830	0.33746	0.09939	0.12584
yr11	0.15860	0.15222	0.15222	0.27724	0.46523	0.01678	0.13475	0.32670	0.09939	0.11607
yr12	0.14853	0.13797	0.13797	0.24705	0.42172	0.01368	0.12244	0.31629	0.09939	0.10706
yr13	0.13910	0.12505	0.12505	0.22015	0.38228	0.01368	0.11126	0.30620	0.09939	0.09875
yr14	0.13026	0.11335	0.11335	0.19617	0.34652	0.01368	0.10109	0.29644	0.09939	0.09109
yr15	0.12199	0.10273	0.10273	0.17481	0.31411	0.01368	0.09186	0.28699	0.09939	0.08402
yr16	0.11425	0.09312	0.09312	0.15577	0.28473	0.01368	0.08347	0.27784	0.09939	0.07749
yr17	0.10699	0.08440	0.08440	0.13881	0.25810	0.01368	0.07584	0.26898	0.09939	0.07148
yr18	0.10020	0.07650	0.07650	0.12369	0.23396	0.01368	0.06891	0.26041	0.09939	0.06593
yr19	0.09384	0.06933	0.06933	0.11022	0.21208	0.01368	0.06262	0.25211	0.09939	0.06081
yr20	0.08788	0.06284	0.06284	0.09822	0.19224	0.01368	0.05690	0.24407	0.09939	0.05609
yr21	0.08230	0.05696	0.05696	0.08752	0.17426	0.01368	0.05170	0.23629	0.09939	0.05174
yr22	0.07707	0.05163	0.05163	0.07799	0.15796	0.01368	0.04698	0.22875	0.09939	0.04772
yr23	0.07218	0.04679	0.04679	0.06950	0.14319	0.01368	0.04268	0.22146	0.09939	0.04402
yr24	0.06760	0.04241	0.04241	0.06193	0.12979	0.01368	0.03879	0.21440	0.09939	0.04060
yr25	0.06331	0.03844	0.03844	0.05518	0.11765	0.01368	0.03524	0.20757	0.09939	0.03745

Attachment 7

NYSDOT SEASONAL ADJUSTMENT MEMO

Discussion with DEC Air Quality Staff on Traffic Seasonal Adjustment Factors

This documents the recommendations by NYSDOT Planning & Strategy Group's Data Analysis & Forecasting Section regarding seasonal adjustment factors for estimating mobile source emissions, per our phone discussion of March 25, 2003.

To incorporate the full spectrum of Factor Groups (FG) developed for seasonally adjusting AADT-based DVMT estimates for summer and winter travel periods, it has been suggested that application of the FGs developed for rural areas be used where appropriate. DOT recommendations are as follows:

- Use FG 30 in all large urban areas
- In counties with large urban areas, use FG 30 in urban areas and FG 40 in rural areas.
- In counties with only small urban areas where the county is essentially rural in nature, use FG 40 in the small urban areas and FG 60 in the rural areas.

In applying the above general rule to all the counties in New York State, we also reviewed the lane mileage factor group assignments for the State touring routes by the Department's Regional Offices, in order to determine which Factor Groups dominate the county. Background on the Factor Groups is provided below.

The attached spreadsheet uses the 1999 HPMS Grouped Functional Class DVMT and Forecast to show our recommendation for applying these Factor Groups. A column was added next to the urban area codes (UAC) called "SeasADJ" that provides FG codes for each county's urban and rural areas.

The statewide weighted average FG equals 34.5, indicating the seasonality of total DVMT is closer to that of urban areas than rural areas (FG 30 than FG 40 or 60). Since the weighted average is almost midway between FG 30 and 40, however, this seems to support changing to the use of all FG groups for improved estimates of seasonal traffic volume.

It was noted that these are only recommendations by NYSDOT Planning & Strategy, and the ultimate decision lies with DEC and their partners on the air quality interagency consultation group, including NYSDOT's Environmental Analysis Bureau. While we have kept EAB in the loop and let them know of our recommendations, this does not necessarily represent endorsement of these recommendations by EAB at this time.

Background on Seasonal Adjustment Factor Groups:

The DEC "Radian Report" for establishing 1990 base-year emissions estimates used the FG 30 seasonal factor to develop summer ozone mobile source emission estimates. The majority of DOT's continuous traffic counter stations for developing seasonal adjustment factors are located in urban areas, so FG 30 is a more robust sample of traffic counts compared to FG 40 and 60. However, it may be an improved procedure to use the seasonal adjustment factors for the rural areas as well. These factor groups are roughly constructed as follows:

FG 30 - This factor group is the least variable on a seasonal basis, as it is generally dominated by peak period work trip travel flow. FG 30 originally had a total of 24 continuous traffic counter locations statewide to develop these factors in 1990. Now a total of 70 are used to develop the FG 30 factors. FG 30 mostly consists of facilities classified as urban interstate, urban principal arterial and urban minor arterial.

FG 40 - This category is "moderately seasonal." This group originally had a total of 17 stations, and now has a total of 55 stations statewide. FG 40 consists mostly of locations classified as rural minor arterial and rural major collectors.

FG 60 - This group shows the most "highly seasonal" variability in traffic volume throughout the year. The group originally had 8 continuous counter stations used to develop the factors, and now has 36. FG 60 mostly consists of rural interstate and rural principal arterial locations.

The 1999 DVMT Inventory was based on the roadway functional classifications (FC) in place at the time, which were developed consistent with the 1990 Census urban boundaries. These urban boundaries will be adjusted based on the 2000 Census, which will lead to some changes in the roadway functional classifications. We know from the new population figures that the urban areas in New York have changed in some cases relative to the size of the rural areas. Therefore, any calculation performed with the 1999 DVMT inventory may slightly overestimate DVMT traveling on roadways with rural FCs and slightly underestimate travel on urban FCs.

Attachment 8

SEASONAL ADJUSTMENT FUNCTIONAL GROUP TABLE

COUNTY	AT	UAC*	FG CODE
BRONX	3	1001	30
KINGS	3	1001	30
NEW YORK	3	1001	30
QUEENS	3	1001	30
RICHMOND	3	1001	30
NASSAU	3	1001	30
SUFFOLK	1	0	60
SUFFOLK	2	2	30
SUFFOLK	3	1001	30
PUTNAM	1	0	40
PUTNAM	3	1001	30
PUTNAM	3	11240	30
ROCKLAND	1	0	40
ROCKLAND	3	1001	30
WESTCHESTER	1	0	40
WESTCHESTER	3	1001	30
ALBANY	1	0	40
ALBANY	3	11041	30
RENSSELAER	1	0	40
RENSSELAER	2	2	30
RENSSELAER	3	11041	30
SARATOGA	1	0	40
SARATOGA	2	2	30
SARATOGA	3	11041	30
SARATOGA	3	11341	30
SCHENECTADY	1	0	40
SCHENECTADY	3	11041	30
WARREN	1	0	60
WARREN	3	11341	30
WASHINGTON	1	0	40
WASHINGTON	3	11341	30
HERKIMER	1	0	40
HERKIMER	3	11089	30
ONEIDA	1	0	40
ONEIDA	3	11089	30
ONONDAGA	1	0	40
ONONDAGA	3	11056	30
TOMPKINS	1	0	40
TOMPKINS	3	11077	30
MONROE	1	0	40
MONROE	2	2	30
MONROE	3	11039	30
ERIE	1	0	40
ERIE	3	11016	30
NIAGARA	1	0	40
NIAGARA	3	11016	30
CHEMING	1	0	40
CHEMING	3	11269	30
DUTCHESS	1	0	40
DUTCHESS	3	11270	30
BROOME	1	0	40
BROOME	3	11110	30
TIOGA	1	0	40
TIOGA	3	11110	30
ORANGE	1	0	40
ORANGE	2	2	30
ORANGE	3	11342	30
ESSEX	1	0	60
ESSEX	2	2	40

* AT = Area Type 1=Rural, 2=Small Urban, 3=Urban

COUNTY	AT	UAC	FG CODE
GREENE	1	0	40
FULTON	1	0	40
FULTON	2	2	30
HAMILTON	1	0	60
MADISON	1	0	40
MADISON	2	2	30
MONTGOMERY	1	0	40
MONTGOMERY	2	2	30
CAYUGA	1	0	40
CAYUGA	2	2	30
CORTLAND	1	0	40
CORTLAND	2	2	30
OSWEGO	1	0	40
OSWEGO	2	2	30
SENECA	1	0	40
SENECA	2	2	30
GENESEE	1	0	40
GENESEE	2	2	30
LIVINGSTON	1	0	40
LIVINGSTON	2	2	30
ONTARIO	1	0	40
ONTARIO	2	2	30
ORLEANS	1	0	40
ORLEANS	2	2	30
WYOMING	1	0	40
WAYNE	1	0	40
WAYNE	2	2	30
CATTARUAGUS	1	0	40
CATTARUAGUS	2	2	30
CHAUTAQUA	1	0	40
CHAUTAQUA	2	2	30
ALLEGANY	1	0	60
ALLEGANY	2	2	40
SCHUYLER	1	0	40
STEUBEN	1	0	40
STEUBEN	2	2	30
YATES	1	0	40
YATES	2	2	30
CLINTON	1	0	60
CLINTON	2	2	40
FRANKLIN	1	0	60
FRANKLIN	2	2	40
JEFFERSON	1	0	60
JEFFERSON	2	2	40
LEWIS	1	0	40
ST LAWERENCE	1	0	60
ST LAWERENCE	2	2	40
COLUMBIA	1	0	40
COLUMBIA	2	2	30
ULSTER	1	0	40
ULSTER	2	2	30
CHENANGO	1	0	60
CHENANGO	2	2	40
DELAWARE	1	0	60
OTSEGO	1	0	60
OTSEGO	2	2	40
SCHOHARIE	1	0	60
SCHOHARIE	2	2	40
SULLIVAN	1	0	60
SULLIVAN	2	2	40

UAC = Modified HPMS Areawide Urban Area Code