

APPENDIX C:

TRANSPORTATION CONFORMITY DETERMINATION

for

Federal Fiscal Years 2006-2010

TRANSPORTATION IMPROVEMENT PROGRAM

and

Federal Fiscal Years 2005-2030

REGIONAL TRANSPORTATION PLAN

**TRANSPORTATION CONFORMITY
DETERMINATION**

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**Federal Fiscal Years 2006-2010
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**Federal Fiscal Years 2005-2030
REGIONAL TRANSPORTATION PLAN**

February 9, 2007

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Table of Acronyms

ACRONYM	MEANING
BPM	Best Practice Model
CAAA	Clean Air Act Amendments (1990)
CO	Carbon Monoxide
FFY	Federal Fiscal Year
ICG	Inter Agency Consulting Group
ISTEA	Intermodal Surface Transportation Efficiency Act
MPO	Metropolitan Planning Organization
NAAQS	National Ambient Air Quality Standards
NO_x	Nitrogen Oxides
NYMTC	New York Metropolitan Transportation Council
NYSDEC	New York State Department of Environmental Conservation
NYSDOT	New York State Department of Transportation
PM	Particulate Matter
RTP	Regional Transportation Plan; also the Plan
SIP	State Implementation Plan
STIP	Statewide Transportation Improvement Program
SO₂	Sulfur Dioxide
TCM	Transportation Control Measure
TIP	Transportation Improvement Program
USDOT	United States Department of Transportation
USEPA	United States Environmental Protection Agency
VMT	Vehicle Miles Traveled
VOC	Volatile Organic Compound

Executive Summary

This report presents the results of the regional emissions analysis performed for the TIP and Plan and documents the process and methods undertaken by NYMTC to demonstrate air quality conformity. The regional emissions analysis demonstrates that the NYMTC TIP and Plan pass the required quantitative tests for the following nonattainment areas within the NYMTC planning boundary:

1. New York Metropolitan moderate eight-hour ozone nonattainment area¹:

The emissions estimated for the TIP and Plan build scenarios are consistent with the approved motor vehicle emissions budgets for volatile organic compounds (VOC), oxides of nitrogen (NO^x) previously established under the one-hour ozone standard.

2. New York Metropolitan carbon monoxide (CO) maintenance area²:

The emissions estimated for the TIP and Plan build scenarios are consistent with the approved motor vehicle emissions budgets for CO.

3. New York County moderate nonattainment area for particulate matter with an aerometric diameter less than 10 microns (PM₁₀)³:

The PM₁₀ emissions estimated for the TIP and Plan build scenario are less than the PM₁₀ emissions estimated in the TIP and Plan no-build scenario.

4. The New York-Northern New Jersey-Connecticut (NY-NJ-CT) PM_{2.5} non-attainment area for particulate matter with an aerometric diameter less than 2.5 microns (PM_{2.5})⁴:

All of the Metropolitan Planning Organizations (MPOs) within the New York-Northern New Jersey-Connecticut, (NY-NJ-CT) PM_{2.5} nonattainment area have determined that their respective Long-range Transportation Plans (“Plans”) and Transportation Improvement Programs (TIPs) conform to the transportation conformity rules for PM_{2.5}, by passing the required Interim Emissions Test for PM_{2.5} individually and therefore as an entire region.

5. The Consistency Assessment of NYMTC’s 2006-2010 Transportation Improvement Program (TIP) and 2005-2030 Regional Transportation Plan with the New York State Energy Plan:

NYMTC’s TIP and Plan are consistent with the 2002 State Energy Plan, and the forecasted reduction in future energy consumption for years 2010, 2020, and 2030.

¹ Counties of Westchester, Rockland, Bronx, New York, Richmond, Kings, Queens, Nassau, and Suffolk

² Counties of Westchester, Bronx, New York, Richmond, Kings, Queens, and Nassau

³ New York County

⁴ Counties of Bronx, Kings, Nassau, New York, Orange, Queens, Richmond, Rockland, Suffolk, Westchester, Fairfield, and New Haven. EPA found New Jersey’s PM_{2.5} emissions budget to be adequate on June 23, 2006. Therefore, both the North Jersey Transportation Planning Authority (NJTPA) and the Delaware Valley Regional Planning Commission (DVRPC) are no longer required to participate in the multi-state process.

Introduction

NYMTC is updating its transportation conformity determination for the FFY 2006-2010 Transportation Improvement Program and FFY 2005-2030 Regional Transportation Plan to add nine non-exempt projects and update information about its project level database. NYMTC also updated the off-model calculations to establish emission credit for projects that are not possible to include in the modeled calculations. Complete information about the PM_{2.5} interim emissions test is provided in the documentation in the following section, and Table 7B as well as in the umbrella PM_{2.5} document that is found in Section 9) Analysis Results, Table 1.

Included in this transportation conformity document is the Consistency Assessment of NYMTC's 2006-2010 Transportation Improvement Program (TIP) and 2005-2030 Regional Transportation Plan with the New York State Energy Plan, which is provided in the Appendix 9.

Regarding the modeling and project level database changes, it is important to note that there were nine (9) new projects in this conformity run, identified in Table 1 below:

TABLE 1: New Projects on the TIP*

	PIN #	TCC	Project Name	Project Type
1	X823.29	NYCTCC	LaGuardia Airport Ferry	Transit Improvements
2	AF-07-01	NYCTCC	Municipal Diesel Fleet Retrofit Program	Regional Clean Fuels
3	X501.39	NYCTCC	Private Fleet Alternative Fuels Program	Regional Clean Fuels
4	ITS-07-01	NYCTCC	Procurement of Advanced Solid State Traffic Signal Controllers	Regional Signal Timing
5	ITS-07-02	NYCTCC	Traffic Signal Retiming	Regional Signal Timing
6	EN12 (ED12)	MHSTCC	Haverstraw-Yonkers-Lower Manhattan Ferry	Regional Commuter Choice
7**	XT-EAR#4067	NYCTCC	Manhattan College: Van Cortlandt Parking Facility	Parking
8**	XT-EAR#588	NYCTCC	Harlem Hospital Center Parking Garage	Parking
9**	X760.41	NYCTCC	Reconstruction of the 125 th Street Waterfront Piers & Open Space Development	Regional Commuter Choice

* New projects to the TIP and will be modeled using the BPM and USEPA's updated Mobile 6.2 emissions model.

** Non-exempt projects which are not modelable using BPM or other regional emissions modeling techniques.

Air Quality Standards

The CAAA requires USEPA to establish the national ambient air quality standards (NAAQS) for various pollutants. Areas where air quality monitoring shows a violation of the NAAQS are designated “nonattainment.” By law the NYSDEC is required to produce a plan, known as the *State Implementation Plan (SIP)* that details how sufficient emission reductions, including reductions in the mobile source sector, will be achieved to meet the NAAQS. In addition, nonattainment areas are subject to a provision in CAA §176(c) known as *transportation conformity*.

The intent of the transportation conformity process is to fully coordinate transportation and air quality planning to ensure that Plans, TIPs, and transportation projects will not 1) cause or contribute to any new violation of the NAAQS, 2) increase the frequency or severity of any existing NAAQS violations, or 3) delay timely attainment of the NAAQS or any required interim emissions reductions or other milestones in any area. Conformity requires that the overall set of investments moves the region toward cleaner air. Therefore, NYMTC, as the Metropolitan Planning Organization (MPO) must consider the air quality impacts of its transportation investments. In order to demonstrate conformity, it must be shown that the emissions produced by the mobile sources will meet various emissions tests prescribed in the federal transportation conformity regulation, 40 CFR Part 93, as revised on July 1, 2004. This conformity determination addresses three nonattainment areas within the NYMTC planning boundary: the New York State portion of the New York-Northern New Jersey-Long Island eight-hour ozone nonattainment area, the New York State portion of the New York-Northern New Jersey-Long Island carbon monoxide maintenance area and the New York County PM₁₀ nonattainment area.

Description of Pollutants and Corresponding Air Quality Standards

a) Ground Level Ozone

The reaction of emissions of volatile organic compounds (VOC) and oxides of nitrogen (NO_x) in the presence of sunlight forms ground level ozone. Sources of these pollutants, also referred to as ozone precursors, include cars and trucks, power plants, refineries and other large industrial facilities and some natural sources.

USEPA classifies ozone nonattainment areas based on the severity of their ozone problem. Classified areas fall into six categories: Subpart 1 basic, marginal, moderate, serious, severe or extreme.

USEPA classified Westchester, Rockland, Bronx, New York, Richmond, Kings, Queens, Nassau and Suffolk Counties as a moderate nonattainment area for the eight-hour ozone standard on June 15, 2004. The eight-hour ozone design value for the area is 0.089 ppm. NYMTC came into compliance with the new eight-hour ozone standard in the last conformity determination of October 27, 2005, using a budget test previously established for the older one-hour standard as allowed by federal regulations. This conformity determination will use the one-hour budget test again. Federal regulations allow use of the one-hour budget test until a new eight-hour budget test is issued by NYSDEC.

Under the federal transportation conformity regulation (40 CFR Part 93) revised on July 1, 2004 by EPA, MPOs were required to demonstrate conformity under the eight-hour ozone standard within one year after the effective date of the new designation. This is NYMTC’s

second conformity determination under the new eight-hour ozone standard. In addition, consistent with 40 CFR Part 93.109(e) and 93.118, NYMTC is demonstrating conformity using the existing budgets for VOC and NO_x established under the one-hour ozone standard until new SIP budgets for the eight-hour ozone standard are determined to be adequate by USEPA. NYSDEC has until April 2007 to develop a new motor vehicle emissions budget for the eight-hour ozone standard.

The Poughkeepsie, NY eight-hour ozone nonattainment area, comprising Putnam, Orange and Dutchess counties, is classified as a moderate nonattainment area under this standard. The Putnam County portion of the Poughkeepsie nonattainment area is within the NYMTC planning boundary. For information purposes only, NYMTC has included information about Putnam's emissions in the regional emissions analysis table in Appendix 1A. However, since none of the changes to the NYMTC TIP and Plan described in the introduction affect the Putnam County portion of the NYMTC planning area, this document does not include a conformity determination for the Poughkeepsie nonattainment area.

As appropriate, conformity determinations for the entire Poughkeepsie nonattainment area are made in a coordinated effort by NYMTC, the Poughkeepsie-Dutchess County Transportation Council and the Orange County Transportation Council.

b) Carbon Monoxide

Carbon monoxide (CO) is a colorless, odorless and poisonous gas produced by incomplete burning of carbon in fuels. Transportation sources account for most of the nationwide CO emissions. The largest emissions contribution comes from highway motor vehicles. Thus, the focus of CO monitoring has been on traffic oriented sites in urban areas where the main source of CO is motor vehicle exhaust. Other major CO sources are wood-burning stoves, incinerators and industrial sources.

There are two NAAQS for carbon monoxide. The eight-hour average ambient CO concentration may not exceed 9 ppm more than once per year. The one-hour average CO ambient concentration may not exceed 35 ppm more than once per year.

On November 6, 1991 the counties of Westchester, Bronx, New York, Richmond, Kings, Queens and Nassau were classified as a moderate nonattainment area under the eight-hour CO standard. By 1999, air quality monitoring demonstrated the CO standard had been attained in this area. Before an area can be permanently redesignated to attainment, it must first be reclassified as a *Maintenance Area*. The designation of *maintenance* means the monitored air quality has attained the CO standards, but the ambient CO standard must be attained for a period of at least ten years. On April 19, 2002 EPA officially redesignated these seven counties as a CO Maintenance Area and approved New York State's proposed CO Maintenance Plan for the New York Metropolitan Area. This Maintenance Plan included an emissions budget for CO and is expected to be in effect for two ten-year periods. Consistent with 40 CFR Part 93.109(f) and 93.118, NYMTC is demonstrating conformity using the budget test for CO.

c) Fine Particulate Matter Less than 10 Microns in Diameter (PM₁₀)

Air pollutants called *particulate matter* include dust, dirt, soot, smoke and liquid droplets directly emitted into the air by sources such as factories, power plants, vehicles,

construction activity, fires and natural windblown dust. Particles formed in the atmosphere by condensation or the transformation of emitted gases such as sulfur dioxide (SO₂) and VOCs are also considered particulate matter.

Annual and 24-hour NAAQS for particulate matter were first set in 1971. The *total suspended particulates* were the first indicator used to represent suspended particles in the ambient air. Since July 1, 1987, however, USEPA has used the indicator PM₁₀, which includes only those particles with aerodynamic diameter smaller than 10 micrometers. These smaller particles are likely responsible for most of the adverse health effects of particulate matter because of their ability to reach the thoracic or lower regions of the respiratory tract.

New York County was classified as a moderate nonattainment area for PM₁₀ on January 20, 1994. Consistent with 40 CFR Part 93.109(g) and 93.119 the regional emissions analysis includes a comparison of the TIP and RTP *build* scenario emissions to the *no build* scenario in each conformity analysis year.

d) *Fine Particulate Matter Equal to or less than 2.5 micrometers in Diameter (PM_{2.5})*

Fine particulate matter, also called PM_{2.5}, is a mixture of microscopic solids and liquid droplets suspended in air, where the size of the particles is equal to or less than 2.5 micrometers (about one-thirtieth the diameter of a human hair). Fine particles can be emitted directly (such as smoke from a fire, or as a component of automobile exhaust) or be formed indirectly in the air from power plant, industrial and mobile source emissions of gases such as sulfur dioxide and nitrogen oxides.

EPA has determined that meeting the PM_{2.5} standards nationwide will annually prevent at least 15,000 premature deaths; 75,000 cases of chronic bronchitis; 10,000 hospital admissions for respiratory and cardiovascular disease; hundreds of thousands of occurrences of aggravated asthma; and 3.1 million person-days of missed work due to symptoms related to particle pollution exposure.

PM_{2.5} National Ambient Air Quality Standards and Non-Attainment

In July 1997, EPA issued National Ambient Air Quality Standards (NAAQS) for fine particulate matter (PM_{2.5}), designed to protect the public from exposure to PM_{2.5} at levels that may cause health problems. The standards include an annual standard set at 15 micrograms per cubic meter, based on the 3-year average of annual mean PM_{2.5} concentrations and a 24-hour standard of 65 micrograms per cubic meter, based on the 3-year average of the 98th percentile of 24-hour concentrations. In general, areas need to meet both standards to be considered in attainment of PM_{2.5} NAAQS.

Areas not meeting the PM_{2.5} NAAQS are called PM_{2.5} nonattainment areas. These areas have had or have contributed to PM_{2.5} levels higher than allowed under EPA's national air quality standard. Nonattainment areas are subject to a measure known as "transportation conformity," which requires local transportation and air quality officials to coordinate planning efforts to ensure that transportation projects, such as road construction, do not hinder an area's ability to reach its clean air goals.

The NYMTC region is part of the NY-NJ-CT PM_{2.5} nonattainment area encompassing all or portions of nine MPOs, as follows:

- Connecticut: Council of Governments of the Central Naugatuck Valley (COGCNV)
Greater Bridgeport and Valley Regional Planning Organizations (GB&V MPO)
Housatonic Valley Council of Elected Officials (HVCEO)
South Central Regional Council of Governments (SCRCOG)
South Western Regional Planning Agency (SWRPA)
- New Jersey⁵: Delaware Valley Regional Planning Commission (DVRPC)
North Jersey Transportation Planning Authority (NJTPA)
- New York: New York Metropolitan Transportation Council (NYMTC)
Orange County Transportation Council (OCTC)

Transportation conformity requirements become effective one year after an area is designated as nonattainment. EPA issued official designations for the PM_{2.5} standard which became effective on April 5, 2005. As required by the conformity regulations, the 2006-2010 TIP and 2030 LRP conformity determination was approved by FHWA/FTA on April 4, 2006 and again on September 27, 2006.

Areas are required to meet the PM_{2.5} NAAQS (“reach attainment”) as soon as possible, but no later than 2010. EPA may grant attainment date extensions of up to five years in areas with more severe PM_{2.5} problems and where emissions control measures are not available or feasible.

A special multi-interagency consultation process took place to address the need to establish interim tests in the nonattainment area. This process included the development of PM_{2.5} multistate conformity protocols for TIP and Plan Adoptions and Actions, the development of an umbrella document to address the conformity requirements across the entire multistate nonattainment area, and a PM_{2.5} Clearinghouse for dissemination of public information. Led by NYMTC, the multistate process is the first of its’ kind for air quality conformity and is fully discussed in the attached document. New Jersey received approvals on a SIP budget and has graduated out of the multistate conformity process. Information on their analysis is described in umbrella documents for PM_{2.5} conformity determination currently undergoing public review. As other MPOs and states within the PM_{2.5} nonattainment area achieve approved SIP budgets for conformity, they will also graduate out of the multistate process.

Components of PM_{2.5} Regional Emissions Analyses

PM_{2.5} can result from both direct and indirect sources. Gasoline and diesel on-road vehicles emit both direct PM_{2.5} and other gases that react in the air to form PM_{2.5}. Transportation-related direct PM_{2.5} emissions can result from particles in exhaust fumes, from brake and tire wear, from road dust kicked up by vehicles, and from highway and transit construction. Transportation-related indirect PM_{2.5} emissions can result from one or more of several exhaust components, including nitrogen oxides (NO_x), volatile organic compounds (VOCs), sulfur oxides (SO_x), and ammonia (NH₃).

For the regional analysis of direct PM_{2.5} emissions, EPA has ruled that both exhaust and brake/tire

⁵ No longer part of the multistate NY-NJ-CT PM_{2.5} conformity process.

wear must be included. However, EPA has ruled that regional emissions analyses for direct PM_{2.5} should include road dust only if road dust is found to be a significant contributor to PM_{2.5} by either the EPA Regional Administrator (RA) or a state air agency. For the NY-NJ-CT PM_{2.5} nonattainment area, neither of the EPA RAs nor any of the three state air agencies have found that road dust is a significant PM_{2.5} contributor. Finally, EPA has ruled that regional direct PM_{2.5} analyses only need to include fugitive dust from construction of transportation projects if the SIP identifies these emissions as significant contributors to the regional PM_{2.5} problem. Because no PM_{2.5} SIP has been established, construction-related dust does not need to be considered. Thus, the only components of direct PM_{2.5} emissions to be considered in the NY-NJ-CT PM_{2.5} nonattainment area are exhaust and brake/tire wear.

For the regional analysis of indirect PM_{2.5} emissions (also called PM_{2.5} precursors), EPA has identified four potential transportation-related PM_{2.5} precursors: NO_x, VOCs, SO_x, and NH₃. Once a SIP is established, any precursors identified in the SIP will be required in the analysis of indirect PM_{2.5} emissions. Until a SIP is established, EPA has ruled that indirect PM_{2.5} emissions must be analyzed for NO_x, unless EPA and the state determine that NO_x is insignificant; and must be analyzed for VOCs, SO_x, and NH₃ only if the EPA or the state determines that one or more of these precursors are significant. EPA and the states have made no such determinations for the NY-NJ-CT PM_{2.5} nonattainment area. Thus, the only indirect PM_{2.5} component that needs to be considered in the NY-NJ-CT PM_{2.5} nonattainment area is NO_x.

The results of the quantitative tests for PM_{2.5} and the other described pollutants are found in the Regional Emissions Analysis section which follows.

PM_{2.5} Regional Interim Emissions Tests

As stated above, states must submit SIPs by April 5, 2008. Once SIPs have been established, each MPO will have a budget for PM_{2.5} emissions with which to compare projected future emissions resulting from implementation of Plans and TIPs. However, until that time, EPA requires that one of two interim emission tests be used to demonstrate PM_{2.5} conformity, either the baseline year test, or the build/no-build test. The baseline year test requires that emissions projected for each future analysis year be no greater than emissions in 2002 (the baseline year). The build/no-build test requires that, for each future analysis year, emissions from the “build” scenario be no greater than emissions from the “no-build” scenario. The selected interim emission test must be used for the entire nonattainment area. Within the NY-NJ-CT PM_{2.5} nonattainment area, the baseline year test has been selected, through the interagency consultation process, as the interim emissions test. MPOs in New York State have also included a build/no-build analysis in their conformity determination for information purposes only (see Section 2 of the NYMTC and OCTC determinations). Again, because New Jersey has established, a budget for PM_{2.5} emissions with which to compare projected future emissions resulting from implementation of Plans and TIPs, both the North Jersey Transportation Planning Authority (NJTPA) and the Delaware Valley Regional Planning Commission (DVRPC) are graduated out of the multistate process.

Analysis Years

EPA regulations require that emissions analysis be conducted for specific analysis years. Section 93.119(g) of the Final Rule states that these analysis years must include:

- A near-term year (one to five years in the future)

- The last year of the plan
- An intermediate year or years such that analysis years are no more than 10 years apart.

The near-term year has been selected as 2010 by the Multi-State ICG. Furthermore, because this nonattainment area includes multiple MPOs, the last year of all of the MPOs' Plans must be included as analysis years. Although New Jersey and DVRPC have graduated out of the multi-state conformity process, there are still three different plan horizon years within the NY-NJ-CT PM_{2.5} nonattainment area: 2025 (OCTC), 2028 (SCRCOG, GB&V MPO), and 2030 (COGCNV, HVCEO, SWRPA, and NYMTC). An intermediate year of 2020 was selected so that no two analysis years are more than 10 years apart. Therefore, the analysis years are 2010, 2020, 2025, 2028, and 2030.

Emissions Reduction Strategies

Substantial commitment and progress has been made in the region to adopt and implement strategies to reduce emissions from the transportation sector. Specifically, the region has agreed to initiate Regional Commuter Choice, Enhanced Ozone Action Days, Regional Clean Fuels and Regional Signal Timing and to evaluate additional strategies for possible adoption.

a) *Regional Commuter Choice*

Regional Commuter Choice is an umbrella program that encompasses various techniques for managing the demand for vehicular travel, particularly during peak travel periods. A specific emphasis of the program is the promotion and use of the pre-tax commuter benefit provided by the Transportation Equity Act for the 21st Century to encourage ridesharing and the use of public transit.

The goal of this program is to increase the number of people using alternatives to travel by driving alone. To achieve this goal, NYMTC is coordinating the consolidation and promotion of existing localized programs for the delivery of commuter choice services and benefits under a unified regional umbrella. This effort includes the development of a single branding concept and a common market strategy across the region, targeting both travelers and their employers. Outreach to the traveling public will focus on social marketing strategies to measure and influence the public's overall perceptions and awareness of air quality impacts and to promote the reduction of vehicle trips.

Outreach to commuters and employers will occur more directly through supporting groups such as business organizations, economic development agencies, employment agencies and property managers. In addition, a program of common implementation actions, known as the Integrated Service Delivery Program, will be funded at a significantly increased level.

As one element of Regional Commuter Choice, NYMTC and USEPA worked together to develop the Metro NY-NJ-CT *Best Workplaces for Commuters*TM program. This is an employee recognition program to acknowledge business leaders who have incorporated innovative commuter benefits for their employees in accordance with USEPA's National Standard of Excellence.

b) *Enhanced Ozone Action Days*

The Ozone Action Days program is a year-round education and outreach effort to raise awareness of the connection between individual transportation choices and air quality improvement. The program is also a coordinated set of public information mechanisms that alerts the traveling public to forecasts of high ozone levels and encourages use of alternatives to single-occupancy vehicles for travel on those days.

The enhanced program is providing alerts through an expanded network of local media outlets for travelers within New York, New Jersey and Connecticut, encouraging them to reduce auto usage on days when ozone levels are forecast to be high. NYSDOT has designated a consultant team to establish and manage the enhanced Ozone Action Days program.

c) *Regional Clean Fuels*

Regional Clean Fuels is a coordinated initiative aimed at providing incentives for public and private owners of vehicle fleets to choose fuels and technologies that will reduce vehicular emissions.

A regional consortium called the Clean Technology Group is being established. This group is expected to identify and support opportunities for emissions reduction pilot programs and funding opportunities; to match emissions control technologies with fleets; and to provide a forum for sharing technical knowledge as new technologies are implemented.

d) *Regional Signal Timing*

Regional Signal Timing targets hundreds of traffic signals across the region for retiming and/or computerization to optimize traffic flow and reduce vehicular emissions that result from repeated acceleration and deceleration. The goal of this program is to inventory and upgrade the timing and/or coordination of traffic signals within key regional corridors.

Estimation of Effectiveness

In order to estimate the air quality impacts of these emissions reduction programs, NYMTC uses various computer simulation techniques to monitor the impact of each of them on regional emissions. For Regional Commuter Choice and Enhanced Ozone Action Days, the number of commuters who will switch from single occupant auto use to ridesharing or transit as a result of each initiative is estimated and multiplied by the average trip lengths derived from NYMTC's Regional Household Travel Survey. Specialized air quality models then calculate the reduction in emissions based on the estimated reduction of vehicle miles traveled.

The air quality impacts of Regional Signal Timing are estimated according to the length, number of lanes and roadway type of each link on which the project has been implemented. The resulting estimated capacity, speed and delay can be compared with previous figures to calculate the expected emissions reduction generated by the program.

Measuring the effectiveness of Regional Clean Fuels is done by tracking clean fuels usage in fleets throughout the NYMTC region, along with fleet retrofits and new clean technology vehicle purchases. Because the BPM does not provide fully for evaluating alternative transportation fuels, emission changes are calculated by changing inputs into the conformity analysis to analyze both traditional and alternative transportation fuels.

Addressing Transportation Conformity Requirements

The following checklist describes how each requirement of the Federal Transportation Conformity rule has been met for NYMTC's FFY 2006-2010 TIP and FFY 2005-2030 Plan:

- **Nonattainment Areas:**

This conformity determination addresses four nonattainment areas within the NYMTC planning boundary. The New York Metropolitan eight-hour ozone moderate nonattainment area includes all NYMTC counties except Putnam. The CO maintenance area consists of New York City (New York, Kings, Queens, Bronx and Richmond counties), Nassau County, and Westchester County. The particulate matter (PM₁₀) nonattainment area is limited to the county of Manhattan. The NY-NJ-CT PM_{2.5} nonattainment area includes all NYMTC counties except Putnam and also includes all or portions of eight other MPO boundaries in the tri-state area as described the attached "umbrella document.

- **Latest Planning Assumptions:**

The text of the Plan fully describes the latest planning assumptions used by NYMTC Conformity Determination. These documents show the population, employment, travel and congestion assumptions used for forecasting the key analysis years of the regional emissions analysis. The fifteen socioeconomic forecast variables that are input to the model were disaggregated to Transportation Analysis Zones for each future scenario year. The model inputs are described in detail in the Best Practice Model section. The model was run with corresponding socioeconomic forecasts and modified networks for each future no build and build year. The model produced traffic flows on assigned highway networks with congested speeds and vehicle miles of travel and transit ridership by route for the transit system.

Based on consultation with the Interagency Consultation Group and under 40 CFR Part 93.110(a), June 12, 2006 is the date the conformity analysis began for this 2006-2010 TIP and 2030 Plan update. The regional emissions analysis in support of the conformity determination is based on the planning assumptions in place on that date.

- a) ***Estimates of current and future population, employment, travel, and congestion***

Data collection and analysis included:

Population

Racial-ethnic population enumerated on a county basis by the 2000 Census was obtained from the *MRS (Modified Race Sex)* file of the Census Bureau and compiled on a subregional basis by mutually exclusive racial-ethnic category, 5-year age cohort and gender. Census Bureau estimates of the resident population and the components of change were available through 2003. Vital statistics data were compiled from state Departments of Health on births and deaths.

Employment

Employment was projected using Global Insight's Summer 2003 national forecasts. Historical employment data were obtained from the state Departments of Labor for the period Qtr I 1990 through Qtr IV 2003.

Development Data

Future Development Inventory of region wide projects in the development pipeline was completed in May 2004, and was appended by extracts from major Environmental Impact Statements (EIS) in the Fall of 2004. Information on planned developments was provided by the New York City Department of Planning and county Departments of Planning.

Travel and Congestion

The New York Best Practice Model (BPM) was developed by NYMTC to meet the requirements for the Clean Air Act Amendments of 1990 (CAAA90) for Conformity Analysis. The BPM is a travel demand forecasting model that provides the region with an analytical tool for informed decision making. It predicts travel patterns for the future based on a set of algorithms and assumptions which are applied to a known base year condition. In addition to the Conformity Analysis and Plan, it is also being used for a number of MIS and Corridor Projects. The BPM was validated for the 2002 base year and validated against traffic counts collected through 2003.

b) Transit operating policies and ridership trends

NYMTC staff collected and analyzed 2002 transit data from various sources for the BPM runs. These data included ridership data, schedule changes, and new services. Data sources that NYMTC used for data collection are listed in Appendix 5C.

c) Status of Transportation Control Measures (TCMs) implementation

TCMs are strategies that are specifically identified and committed to in SIPs; and are either listed in Section 108 of the CAAA, or will reduce transportation-related emissions by reducing vehicle use or improving traffic flow. Measures which reduce emissions by improving vehicle technologies, fuels, or maintenance practices are not TCMs.

The State and federal conformity regulations require all TIPs and RTPs to provide for the timely implementation of any TCMs from the applicable SIP and to ensure that no project in the program interferes with the implementation of any TCM.

There are no active TCMs in the NYMTC area. All TCMs previously included in the SIP have been completed in a timely manner or, in a few special cases, removed from the SIP. For example, on April 19, 2002 USEPA approved a request from the State of New York to remove several TCMs from the CO SIP that were demonstrated to no longer be necessary. Therefore, as described in Appendix 2, Program Status of Committed Projects in the SIP, there are a number of completed TCMs and several TCMs in the Downtown Brooklyn Master Plan that are no longer required.

In addition, no project in the 2006-2010 TIP or 2030 Plan would interfere with the timely implementation of TCMs in other areas.

d) Other key assumptions

Geocoding of new developments was completed in December 2004. Additional new non-exempt and regionally significant projects were coded in Summer 2005 for the September

30, 2005 conformity determination, in Fall 2005 for the April 2006 conformity determination, and Summer 2006 for this conformity determination.

○ **Latest Emissions Model:**

By interagency agreement in developing the regional emissions analysis, the USEPA's updated Mobile 6.2 emissions model was used to develop future emissions estimates from the BPM forecasts. The various model input parameters for the nonattainment area for ozone conditions during the summer ozone and winter CO and PM₁₀ seasons were developed by NYSDEC's Bureau of Air Quality Planning, in consultation with NYSDOT's Environmental Analysis Bureau, to produce the required emissions analysis for the NYMTC region.

The 2005 vehicle registration data and diesel fractions data provided by NYSDEC on September 28, 2005 were used in the emissions analysis for all future analysis years. The previously issued 2002 vehicle registration and diesel fraction files were used for the 2002 year analyses. In addition, consistent with the assumptions in the applicable SIP, a seasonal adjustment factor of 1.12 was applied to the summer DVMT estimates.

○ **Action Scenario:**

All projects in the 2006-2010 TIP and 2035 RTP that could be accommodated in the modeling process were included in NYMTC's conformity analysis "build" scenario networks. Therefore this analysis includes not only the effect of the non-exempt and regionally significant projects but also a number of exempt projects that produce system performance benefits and can be modeled. NYMTC reviewed all projects in the TIP Update to determine their year of implementation as shown in the Appendix detailing the inputs of the T-Master.

○ **Years of Analysis:**

In following the pertinent regulations and ICG guidance, several milestone years were identified as analysis years to demonstrate conformity with the SIP. Attainment of the new eight-hour ozone standard in the moderate nonattainment areas is required by the year 2010. Therefore, this year is specifically included as a new analysis year for ozone purposes. The years analyzed in the regional emissions analysis are: 2007 (budget year for ozone and CO), 2010 (attainment year for eight-hour ozone standard for moderate nonattainment areas), 2012 (budget year for CO), 2020 (interim analysis years may be no more than ten years apart), 2025 (horizon year of OCTC RTP), 2028 (horizon year of SCRCOG, GB&V RTPs), and 2030 (horizon year of COGCNV, HVCEO, SWRPA, and NYMTC RTPs)..

○ **Use of the Best Practice Model:**

The federal conformity regulation stipulates that a network-based transportation model with a capacity sensitive assignment technique be used to develop reasonable speed (travel time) and volume forecasts on roadways. It also stipulates that the travel models must have a logical correspondence to land use and that land use and trip generation procedures include measures of accessibility to both highway and transit users. In addition, it is necessary to analyze peak and off-peak travel. These requirements are satisfied through the use of the BPM.

It should be noted that future analysis year scenario trip tables were developed based on the socioeconomic and demographic projections adopted by the Council on September 23, 2004 after NYMTC's forecasting working group reached a consensus.

The travel forecasting approach that is implemented using the BPM is fully described in the BPM section comprising the second half of this document.

○ **Description of projects analyzed with an off-model process:**

Information for Park and Ride projects was also collected as part of the regional emissions analysis process. The Park and Ride projects that were connected to the rail stations were coded into the transit networks. The bus Park and Ride projects were also coded into the transit networks. However, independent Park and Ride lots could not be coded in the highway network. This is due to the fact that the highway network is not detailed enough for this level of coding and the PPSuite software does not have provision to code Park and Ride projects. An alternate method had to be used to evaluate these projects. After considering various options and with concurrence from ICG, it was agreed that the CMAQtraq tool will be used to evaluate the Park and Ride projects. The CMAQtraq tool has been developed by NYSDOT to evaluate projects for CMAQ funding. The emissions calculated for the Park and Ride projects are documented in Tables 1, 2 and 3 in the row “Off Model Emissions.” The estimate of diversion has been estimated by the project managers, based on their calculation of the amount of travel distance saved and the number of diversions.

○ **Consistency of TIP with the Plan:**

The FFY 2006-2010 TIP is consistent with the future transportation system described in NYMTC’s FFY 2005-2030 Plan and the required regional emissions analysis includes the Plan’s horizon year of 2030.

○ **Exempt/Non-Exempt Project Identification:**

The project listing in the TIP includes a code under the “Remarks” column that indicates whether they are exempt from conformity requirements (AQ:E) or nonexempt (AQ:N). This listing is subject to the public involvement regulations and NYMTC’s operating procedures was reviewed in draft form by the ICG prior to the beginning of the regional emissions analysis. Transportation projects that are non-exempt (and, therefore, included in the regional emissions analysis) are identified along with either an indication of how they are included in the transportation demand forecasts or that separate detailed calculations are provided to measure air quality impacts.

All federally-funded transportation projects within the NYMTC region must be included in the 2006-2010 TIP. NYMTC and ICG members evaluated the projects in the 2006-2010 TIP to determine their exempt or non-exempt status as defined by the criteria of the federal conformity rules and guidance (July 1, 2004-Final Rule-Paragraph 93.126-Exempt projects-Table 2 and 93.127-Projects exempt from regional emissions analysis –Table 3).

Typically, projects that improve the safety of the highway network, preserve/maintain existing transportation infrastructure, contribute to minor increases in the efficiency of public transportation services, or enhance non-motorized travel are considered exempt. Non-exempt projects are those projects that do not meet the criteria of exempt projects and must be included in the regional emissions analysis to determine their impact on air quality.

In addition to those projects that are programmed to receive federal transportation funds through the 2006-2010 TIP, projects on the current schedules of improvements for NYSDOT-Region 8, 10, and 11 were also evaluated to determine the exempt/non-exempt status regardless of whether

or not federal transportation funds are programmed for their implementation.

○ **Regionally Significant Projects:**

A regionally significant project is defined as a project that is expected to impact regional travel patterns but will be implemented without using federal funds. Although these projects may not be included in the MPO process, they have the potential to impact regional air quality and therefore must be included in the regional emissions analysis as part of a conformity determination.

For the purposes of this conformity determination, NYMTC and ICG members reviewed development data to determine which projects are regionally significant. The Future Development Inventory of regionwide projects in the development pipeline was completed in May 2004, and was appended by extracts from major Environmental Impact Statements (EIS) in the Fall of 2004. Information on planned developments was provided the New York City Department of City Planning, and county Departments of Planning. Geocoding of developments was completed in December 2004.

The ICG concurred with the proposed air quality classifications for all new and significantly modified projects were made during ICG meetings on 4/25/2006, 5/4/2006, 6/8/2006, 7/6/2006, and 8/9/2006.

○ **Interagency Consultation:**

NYMTC has followed a process that provides opportunity for local, State and Federal transportation and environmental agencies to consult on all elements of the transportation planning process and the associated Transportation Conformity Determination through the ICG, including the following specifically required items from the Transportation Conformity rule. The ICG has met on a regular basis to discuss and resolve conformity issues in the NYMTC region. Participants include NYSDEC, NYSDOT, USEPA, FHWA and FTA. This consultation process primarily focused on the following tasks:

1) *Choosing the emission model, and assumptions used in the analysis:*

The ICG and other key local, State, and Federal agencies have been consulted to assure highway networks were created for each future no build year and build year. Future build or action scenarios were incorporated into proposed TIP projects according to their completion dates and whether they were *previously conformed* and had progressed through the environmental review process. These projects are referred to as committed TIP projects. In addition, all committed projects from the Plan were included in the future year build scenarios. All projects that are scheduled for completion before a scenario year were coded into the next and each successive future build year. Based on information provided by the transit agencies on future running schedules and operating plans, transit networks were similarly created for each build and no-build scenario in each analysis year. The future year no build baseline scenarios in each analysis year assume no nonexempt or regionally significant programs or projects will be implemented in the NYMTC region in each future analysis year. In addition, modeling issues pertaining to the multi-state PM_{2.5} nonattainment area were discussed at numerous meetings as described in detail in the attached “umbrella document.”

2) ***Identification of exempt, non-exempt and regionally significant projects:***

As previously described, the ICG identifies and reviews all non-exempt and regionally significant, but non-federally funded projects. ICG also identifies any exempt but “not model-able” projects and approves off-model analysis. These projects were included in the regional emissions analysis. Additional information on these projects can be found in Appendix 3.

3) ***Notification of TIP and Plan amendments, including those that only add or delete exempt projects:***

The ICG and all agencies actively involved in NYMTC’s planning activities are routinely notified of all TIP actions at all times.

o **Public Involvement:**

NYMTC has pursued an extensive public involvement program in the development of the TIP and Plan. This process has included multiple meetings and workshops in each of NYMTC’s ten counties as well as professionally organized focus groups. Planning for new emissions reduction measures has likewise employed stakeholder participation and discussion of various topics using NYMTC’s advisory working groups.

A public review period of 30 days was established for this conformity determination from November 13, 2006 through December 12, 2006. Two public meetings were held November 27, 2006 at 199 Water St., 22nd Floor, in lower Manhattan. Written comments received from the public during the public comment period are addressed in Section 5) Multi-State Public Consultation within the PM 2.5 Umbrella Document.

o **Emissions Tests:**

Air quality conformity tests were performed for the following:

1) ***NY-NJ-LI Eight-hour Ozone Area:***

In accordance with 40 CFR Part 93.109 conformity findings within NY-NJ-LI moderate eight-hour ozone nonattainment area are required to be based on the existing 1-hour SIP budgets for volatile organic compounds (VOCs) and nitrogen oxides (NOx) for all applicable analysis years until new eight-hour ozone SIPs are implemented. These pollutants are analyzed as precursors for ozone formation.

2) ***NY-NJ-LI CO Maintenance Area:***

In accordance with 40 CFR Part 93.109(e) and 93.118, the conformity finding for the NY-NJ-LI CO Maintenance Area is based on the approved motor vehicle emissions budgets for CO in all applicable conformity analysis years.

3) ***New York County PM₁₀ Moderate Nonattainment Area:***

In accordance with 40 CFR Part 93.119 (d), the conformity finding for the New York County PM₁₀ nonattainment area is based on the build/no-build emission test in all applicable conformity analysis years. Several specific pollutants analyzed are components of particulate matter, including road dust.

4) ***NY-NJ-CT PM_{2.5} Nonattainment Area:***

Once a motor vehicle emissions budget for the New York State portion of the PM_{2.5} nonattainment area is found to be adequate by USEPA, the budget test for PM_{2.5} and PM_{2.5} precursors will be required. However, until that time, the federal conformity regulation requires that one of two interim emission tests be used to demonstrate PM_{2.5} conformity, either the baseline year test, or the build/no-build test. The baseline year test requires that emissions projected for each future analysis year be no greater than emissions in 2002 (the baseline year). The build/no-build test requires that, for each future analysis year, emissions from the "build" scenario be no greater than emissions from the "no-build" scenario. The selected interim emission test must be used for the entire nonattainment area. Within the NY-NJ-CT PM_{2.5} nonattainment area, the baseline year test was selected as the interim emissions test through the interagency consultation process. NYMTC has also included a build/no-build analysis in the conformity determination appendices to demonstrate consistency with New York State's policies and strategies to improve environmental conditions.

o **Statement of Conformity with the SIP:**

The NYMTC 2006-2010 TIP As Amended and 2030 Plan support the broad intentions of the CAAA Amendments of 1990 and the New York State Implementation Plan for Air Quality for achieving and maintaining the National Ambient Air Quality Standards.

o **Evidence of Metropolitan Planning Organization (MPO) resolution approving the TIP, Plan and Conformity Determination:**

On January 4, 2007 the Program, Finance and Administration Committee of NYMTC adopted ***Resolution #224 – Adoption of a Transportation Conformity Determination for the 2005-2030 Regional Transportation Plan and 2006-2010 Transportation Improvement Program, As Amended.*** A signed copy of this resolution is included in Appendix B of the PM_{2.5} multistate conformity document.

o **Evidence of Metropolitan Planning Organization (MPO) resolutions approving the PM_{2.5} Conformity Determination:**

Because NYMTC's PM_{2.5} Conformity Determination requires confirmation that all of the MPOs within the New York-Northern New Jersey-Connecticut (NY-NJ-CT) PM_{2.5} non-attainment area determine that their respective Long-range Transportation Plans and Transportation Improvement Programs conform to the transportation conformity rules for PM_{2.5}. Details are in the PM_{2.5} Umbrella Document.

On December 11, 2006 the South Western Region MPO adopted ***Resolution 2006-021: Resolution on Conformity with the Clean Air Act –PM_{2.5}***, documenting that the results of the required emissions analysis performed by the Connecticut Department of Transportation on the South Western Region Long Island Transportation Plan 2004-2030 and the FFY 2007-2011 South Western Region Transportation Improvement Program (TIP) conform to the air quality requirements of the U.S. Environmental Protection Administration (40 CFR 51 and 93), and related U.S. Department of Transportation guidelines (23 CFR 450) and with Title 42, Section 7506 (3) (A) and approves the PM_{2.5} Conformity Determination.

On December 8, 2006 the Council of Governments of Central Naugatuck Valley adopted ***Resolution on Conformity with Clean Air Act PM_{2.5}*** finding that the Council of Governments Central Naugatuck Valley's Long Range Transportation Plan: 2004-2030 and the FFY 2007-2011 CNVR Transportation Improvement Plan conform to air quality requirements of the U.S. Environmental Protection Administration (40 CFR 51 and 93), and related U.S. Department of Transportation guidelines (23 CFR 450) and with Title 42, Section 7506 (3) (A) and approves the PM_{2.5} Conformity Determination.

On December 19, 2006 Greater Bridgeport Regional Planning Agency and Valley Council of Governments adopted ***Resolution 2007-02 Air Quality Conformity Statement PM_{2.5} Greater Bridgeport and Valley MPO***, finding that the long range plans for the Greater Bridgeport and Valley planning regions and the FFY 2007-2011 Transportation Improvement Program conform to air quality requirements of the U.S. Environmental Protection Administration (40 CFR 51 and 93), and related U.S. Department of Transportation guidelines (23 CFR 450) and with Title 42, Section 7506 (3) (A) and approves the PM_{2.5} Conformity Determination.

On November 17, 2006 Housatonic Valley Council of Elected Officials adopted a resolution: ***Conformity with Clean Air Act for Fine Particulate Matter of Less than 2.5 Micrometers*** finding that the 2004 Regional Transportation Plan and the FFY2007-2011 Transportation Improvement Program conform to air quality requirements of the U.S. Environmental Protection Administration (40 CFR 51 and 93), and related U.S. Department of Transportation guidelines (23 CFR 450) and with Title 42, Section 7506 (3) (A) and approves the PM_{2.5} Conformity Determination.

On November 15, South Central Regional Council of Governments adopted ***Resolution on Conformity with the Clean Air Act PM 2.5*** finding that the long range plan and the FFY 2007-2011 Transportation Improvement Program conform to air quality requirements of the U.S. Environmental Protection Administration (40 CFR 51 and 93), and related U.S. Department of Transportation guidelines (23 CFR 450) and with Title 42, Section 7506 (3) (A) and approves the PM_{2.5} Conformity Determination.

Regional Emissions Analysis for Base and Future Years

Description of Emissions Analysis Modeling Process

a) *Modeling Assumptions*

It is important to note some of the significant aspects of the modeling process that produces the emission estimates for each pollutant.

- NYMTC incorporated the population and employment forecasts for each county into the model as approved in September, 2004. NYMTC input a total of 14 socioeconomic variables to the model and then assigned them to Transportation Analysis Zones for each future year of analysis.
- NYMTC created highway networks for each future build and no build year. One key aspect of developing the built system is that all projects are coded based on scheduled completion date. Similarly, NYMTC created transit networks for each build and no build year; incorporating information provided by the transit agencies on future running schedules and operating plans in the build year.
- NYMTC ran the model with corresponding socioeconomic forecasts and modified networks for each future no build and build year. The model produced traffic flows on assigned highway networks, including estimates of congested speeds and vehicle miles of travel for the highway network, and transit ridership by route for the transit system.
- The BPM estimated Vehicles Miles of Travel (VMT) for the years of analysis: 2007, 2010, 2020, 2025, 2028 and 2030.

BPM highway networks include minor arterial and above roadways only. It is necessary to also take the VMT generated by the local roads into account. This is done by reconciling the VMT estimates from BPM with the Highway Performance Monitoring System (HPMS) VMT using adjustments found in PPSuite.

- Working from the VMT estimates, NYMTC employed an emission modeling software package called *PPSUITE* to develop the emission estimates. This package contains required input data for the USEPA's Mobile 6.2 Model, and several adjustment factors. PPSUITE generates vehicle emissions factors (in grams per mile) which are multiplied by the VMTs produced by the BPM to produce emission estimates for each county.

The local traffic information is then used to construct *pattern files* for the time periods, in other words, the temporal distribution of VMT, or traffic volume variation by hour of the day. Additional pattern files for truck percentages, cold and hot-start percentages, and speed/capacity characteristics support the postprocessor computations. The post-processor program is also used to establish consistency of VMT estimates with independent Highway Performance Monitoring System estimates. When peak hour traffic becomes overly congested on particular facilities, travelers tend to avoid the peak period of travel making future growth in travel likely to occur during periods surrounding the peak. This is called *peak spreading*. The post-processor software uses a

number of mechanisms including peak spreading models to apply pattern characteristics and adjusts them for local conditions.

In addition, PPSUITE converts typical weekday daily and morning peak period traffic volumes produced by the BPM to seasonally appropriate estimates of weekday volumes and VMT. It also uses a complex set of delay models to estimate recurring and non-recurring delay and the resulting average speeds for each of four time periods (morning peak, evening peak, midday, and night), across functional class for each county. The VMT and speeds are input to MOBILE 6.2 to compute emissions totals in kilograms per day.

Table 2 lists four (4) existing projects that have been modified and will be modeled using the BPM and USEPA’s Mobile 6.2 emissions model:

TABLE 2: Modified Projects in the BPM

	PIN #	TCC	Project Name	Project Type	Project Change
1	8110.29 8110.47	MHSTCC	Westchester Local Signal Re- Timing Study Part 1 and Part 2	Regional Signal Timing	Project rescoped and split into two PINS for contract purposes.
2	8110.46	MHSTCC	Rockland Local Signal Re- Timing Study	Regional Signal Timing	Minor scope change.
3	8TRM49	MHSTCC	Pelham Intermodal Facility	Parking	Scope change from planning study to coded project.
4	M402-03-14	MHSTCC	Brewster Parking Expansion	Transit Improvements	Completion date changed from 2006 to 2007; number of parking spaces reduced from 70 to 55.

Table 3 lists two (2) projects for which the preferred alternatives were already coded into this updated 2006 Transportation Conformity Determination but which have not yet moved beyond the study phase.

TABLE 3: Modeled Planning Studies in the BPM

	PIN #	TCC	Project Name	Project Type
1	TR-07-02	NYCTCC	Rockway Parkway Station Improvements	Transit Improvements
2	T4120403	NYCTCC	New York City Bus Rapid Transit Demonstration Program	Transit Improvements

b) Off-Modeling Assumptions

For a variety of reasons, NYMTC found it necessary to use off-model estimation techniques to account for some emission reductions. These calculations are described as follows:

- Due to limits to the network, Park and Ride lots could not be coded in the highway or transit networks unless they were connected to rail or bus stations. Several new Park and Ride lots for highway travel are included in the Plan. NYMTC used an off model calculation tool developed by NYSDOT called the CMAQtraq to evaluate these projects. The emissions calculated for the Park and Ride projects are documented in the tables in the row “Off Model Emissions”.

Regional Emission Analysis

This regional emissions analysis for each pollutant presented in this section demonstrates that NYMTC's TIP and Plan conform to the SIP. The following tables present a comparison of the NYMTC emissions estimates with those from the SIP for the years of analysis.

In the tables describing the regional emission analysis which follow, the emissions calculated from all off-model sources are subtracted from the emissions calculated by the model (in the row labeled "Off Model Emissions") to develop a final emission estimate.

Budget Tests for Ozone Precursors

TABLE 4A: VOC Emissions Comparison for Summer Analysis in Tons/Days

Years of Analysis								
	2002 Base Year	2007	2010	2012	2020	2025	2028	2030
Emissions for 9 county ozone non-attainment areas	224.18	134.34	102.89	93.11	53.98	48.02	48.34	48.33
Off model emissions		-0.30	-0.30	-0.30	-0.30	-0.30	-0.30	-0.30
Total emissions		134.04	102.59	92.81	53.67	47.72	48.04	48.03
SIP budget		176.30	176.30	176.30	176.30	176.30	176.30	176.30

TABLE 4B: NO_x Emissions Comparison for Summer Analysis in Tons/Days

Years of Analysis								
	2002 Base Year	2007	2010	2012	2020	2025	2028	2030
Emissions for 9 county ozone non-attainment areas	285.99	188.21	145.33	128.55	61.40	48.45	43.46	41.74
Off model emissions		-0.67	-0.67	-0.67	-0.67	-0.67	-0.67	-0.67
Total emissions		187.54	144.67	127.88	60.73	47.78	42.79	41.07
SIP budget		227.8	227.80	227.80	227.80	227.80	227.80	227.80

Budget Test for CO

TABLE 5: CO Emissions Comparison for Winter Analysis in Tons/Days

	Years of Analysis							
	2002 Base Year	2007	2010	2012	2020	2025	2028	2030
Emissions for 9 county ozone non-attainment areas	1,964.93	1,141.97	1,001.98	965.04	817.32	806.12	806.34	805.98
Off model emissions		-3.17	-3.17	-3.17	-3.17	-3.17	-3.17	-3.17
Total emissions		1,138.80	998.80	961.87	814.15	802.95	803.17	802.81
SIP budget		2,381.00	2,381.00	2,431.00	2,431.00	2,431.00	2,431.00	2,431.00

Build – No Greater Than No Build Test for PM₁₀

TABLE 6: PM₁₀ Emissions Comparison for New York County (Manhattan) for Winter

Scenario Year	PM ₁₀ Emissions in (tons/day) No Build Scenarios	PM ₁₀ Emissions (tons/day) Build Scenarios
2002 base	13.64	
2007	13.88	13.44
2010	13.98	13.78
2012	14.08	13.85
2020	14.49	14.11
2025	14.68	14.33
2028	14.90	14.52
2030	15.11	14.72

Note: Off model emissions are negligible for PM₁₀ in Manhattan.

No Greater Than 2002 Test for PM_{2.5} Precursors

TABLE 7A: NO_x Emissions in Tons/Year

Years of Analysis								
	2002 Base Year	2007	2010	2012	2020	2025	2028	2030
Emissions for 9 county ozone non-attainment areas	106,839.48	70,645.96	54,619.12	48,244.62	22,746.63	17,825.34	15,955.40	15,294.70
Off model emissions		-160.00	-160.00	-160.00	-160.00	-160.00	-160.00	-160.00
Total emissions		70,485.96	54,459.11	48,084.61	22,586.62	17,665.34	15,795.40	15,134.70

Build-Less Than Baseline 2002 Test for Direct PM_{2.5}

TABLE 7B: Annual PM_{2.5} Emission Analysis for NYMTC Nine Counties (excluding Putnam) in Tons/Year

Years of Analysis								
	2002 Base Year	2007	2010	2012	2020	2025	2028	2030
Emissions for 9 county PM_{2.5} non-attainment area	2,016.98	1,655.50	1,465.79	1,371.47	976.87	984.66	997.99	1007.38
Off model emissions		-3.59	-3.59	-3.59	-3.59	-3.59	-3.59	-3.59
Total emissions		1,651.90	1,462.19	1,367.88	973.27	981.06	994.40	1003.79

Build-Less Than No Build Test for PM_{2.5}

TABLE 8: Annual PM_{2.5} Emission Analysis for NYMTC Nine Counties (excluding Putnam)

Scenario Year	PM_{2.5} Emissions (tons/year) No-Build Scenarios	PM_{2.5} Emissions (tons/year) Build Scenarios	NO_x Emissions (tons/year) No-Build Scenarios	NO_x Emissions (tons/year) Build Scenarios
2002 base	2,016.98		106,839.48	
2007	1,671.58	1,651.90	71,292.61	70,485.96
2010	1,465.81	1,462.19	54,692.42	54,459.11
2012	1,371.47	1,367.88	48,363.60	48,084.61
2020	994.14	973.27	23,048.34	22,586.62
2025	1,002.99	981.06	18,071.72	17,665.34
2028	1,019.48	994.40	16,253.16	15,795.40
2030	1,045.50	1,003.79	18,774.99	15,134.70

Note: PM_{2.5} and NO_x has been interpolated for 2012 from 2010 and 2020 for Build and no-build scenarios. For all the Off Model projects the results were negligible.

Overview of the Best Practice Model (BPM)

The New York Best Practice Model (BPM) was developed by NYMTC to meet the requirements for the Clean Air Act Amendments of 1990 (CAAA90) for Conformity Analysis. The BPM is a travel demand forecasting model that provides the region with an analytical tool for informed decision making. It predicts travel patterns for the future based on a set of algorithms and assumptions which are applied to a known base year condition. In addition to the Conformity Analysis and Plan, it is also being used for a number of MIS and Corridor Projects.

The BPM is an activity-based model which simulates the behavior of people in their choice of travel patterns, rather than the travel itself. The BPM was designed and developed based on contemporary best practices in travel demand modeling and extensive field research over the last few years. The guiding principle in developing this model set was to incorporate the best modeling structures and components available that could be practically implemented within the project time and budget framework.

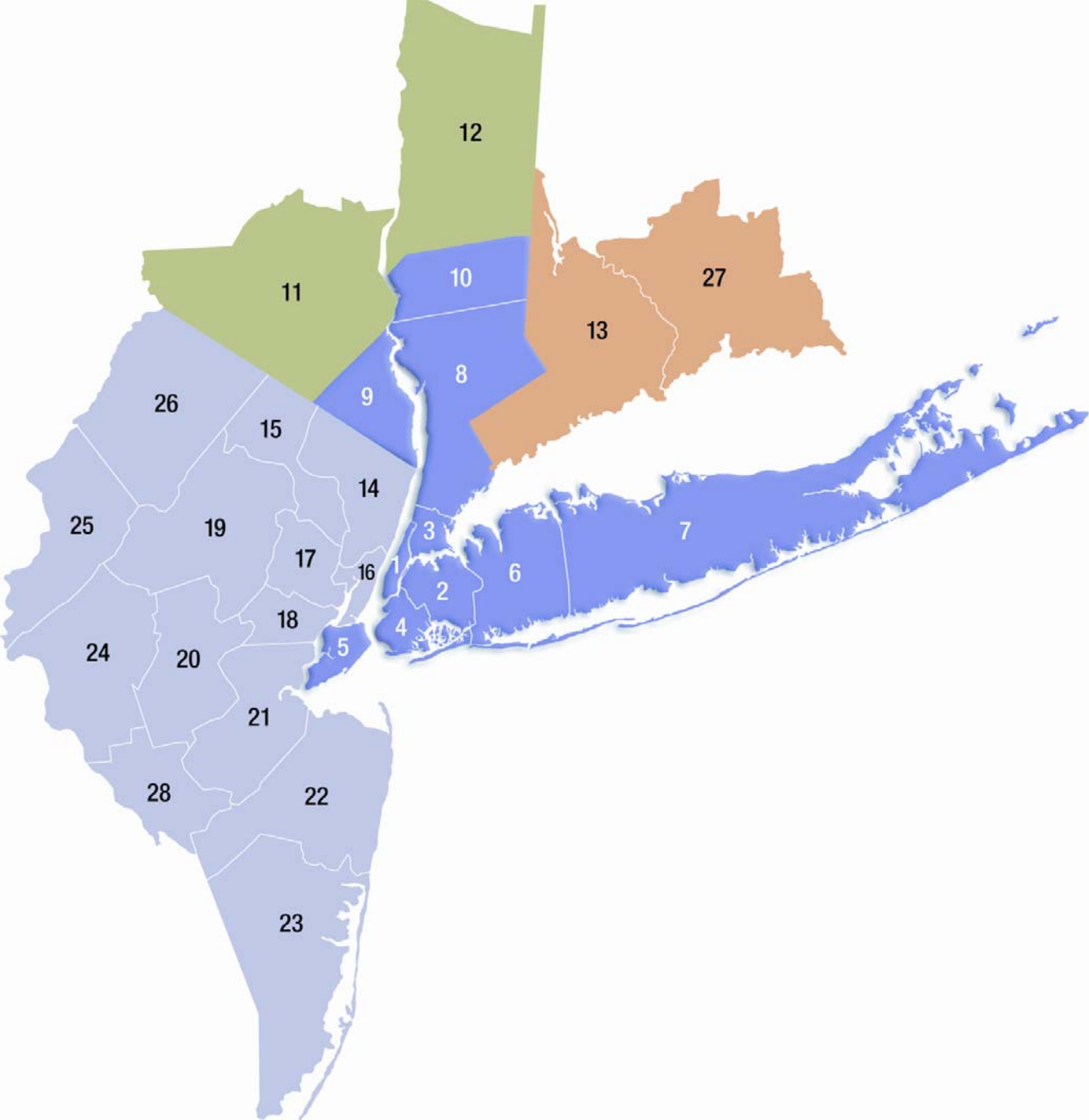
The BPM is characterized by the following main features:

- Comprehensive coverage of *all modes and vehicle types* in detailed highway and transit simulations.
- Use of the *tour* (or paired journeys) as the basic unit of modeling, instead of *trip* that is used in conventional demand models of the previous generation.
- Use of a *micro-simulation* approach to generate forecasts that are discrete choices for individuals as opposed to probabilities that are aggregated to transportation analysis zones in conventional models.
- Use of a contemporary conceptual framework of *daily activity agenda* of individuals which accounts for the intra-household interactions between members of a household and applies constraints on travel in terms of both time and space.

a) Regional Model Area

The BPM area covers 28 counties in New York, New Jersey and Connecticut. It is composed of 3,586 transportation analysis zones and includes most types of roadway facilities, from minor arterials and above. It includes all forms of public transportations such as subways, buses, ferries and commuter rail. Figure 1 represents the model study area.

Figure 1: New York Best Practice Model Study Area



Best Practice Model - Counties			
1. New York	8. Westchester	15. Passaic	22. Monmouth
2. Queens	9. Rockland	16. Hudson	23. Ocean
3. Bronx	10. Putnam	17. Essex	24. Hunterdon
4. Kings	11. Orange	18. Union	25. Warren
5. Richmond	12. Dutchess	19. Morris	26. Sussex
6. Nassau	13. Fairfield	20. Somerset	27. New Haven
7. Suffolk	14. Bergen	21. Middlesex	28. Mercer

The BPM is a very complex model which is designed to predict the detailed travel patterns of a diverse population using numerous travel modes. This is done by introducing some innovative approaches to the traditional travel demand models and those are:

- **Journey as a Unit of Travel:** The unit of travel for the BPM is the journey, also known as half tour. Journey is defined as travel between two principal locations where one end is always home and the other end can be work, school, university or some primary destination. The journey may or may not have stops. The advantage of using journeys rather than trips is that journeys can explain the behavior which accounts for decisions regarding travel time, destination and mode choices.

The traditional trip, home to work, for example, would identify the point of origin and the destination. It would not however include details specific to the individual, such as daily stops at a day care center, gym or other unique aspect of travel that might very well influence the individual's decision regarding mode choice. The use of the journey helps planners form a more realistic analysis based on decisions made by travelers between these locations regarding mode, purpose, destination and location of intermediate stops as well as time of day periods. The eight million households of the study area generate 25 million paired journeys per day for the base year 2002.

- **Micro-Simulation Approach:** Where traditional models use an average rate of travel by aggregating the fractional probabilities for each of the choices, the BPM uses a micro-simulation method to simulate the travel pattern of each person in the region. This emulates the behavior of real people where discrete choices are made regarding the frequency of journeys, travel modes and destination. This provides a closer level of detail which, combined with the model's use of the journey, increases the accuracy and usefulness of analyses.
- **Non-Motorized:** This model distinguishes between motorized and non-motorized travel by predicting the walk only mode of travel based on the person, household characteristics and land-use densities around the journey origin.

b) Input Data

NYMTC undertook a significant data collection effort in order to maximize the information available for estimating with the BPM. The surveys and data collection activities are described below.

c) Surveys and Traffic Counts

The Regional Travel-Household Interview Survey (RT-HIS) was conducted in 1997/1998 primarily to capture typical weekday travel. A one-day travel diary was retrieved for every member of 11,264 households (a 26% response rate) in the 28-county model study area. The survey included information of all the places visited by the respondents, their activities by major categories, travel time between locations, auto availability and modes of travel.

A complex sampling plan was developed based on the concept of density and mode leadership in the region to account for numerous travel modes and to consider socioeconomic and transportation variables critical to the BPM.

NYMTC conducted an Origin-Destination (OD) auto survey in 1998 to study the external travel patterns in the region. The survey was conducted at 12 external stations in upstate New York. Close to 50,000 questionnaires were distributed and approximately 6,000 completed questionnaires were returned. The results of the survey were used to develop the external trip tables for the BPM.

NYMTC enlisted the help of its member agencies to assemble traffic count data at the 2,300 screenline locations for BPM validation. The data was collected from state, city and county agencies and manipulated to produce a 24-hour hourly count for the screenline locations. A methodology was created to estimate counts where data from local agencies was not available.

d) *Travel Time*

Initial speeds for highway links are required as input to a travel demand model. A speed lookup table was created by area type and physical link type, Travel time observations were collected at 4,500 roadway segments from 5AM-9PM on an average weekday using the floating car method.

e) *Socioeconomic Data and Forecast*

NYMTC collected extensive socioeconomic and land use data for the development of the BPM. The fifteen variables of the socioeconomic data indicated in Table 5, are the fundamental input to the BPM.

The data were collected at census tract level for New York Counties and by Minor Civil Division (MCDs) for New Jersey and Connecticut. Population, Households, Labor Force, and Employment were also forecasted by county for every five years over a 20-year period and adopted by NYMTC for the region.

Table 9: Socioeconomic and Demographic Variables

Population	Household	Employment	Enrollment
Households	Household Number	Total	School
Group Quarters	Household size	Retail	University
Institutions	Employed labor force	Office	
Street People	Mean household income	Earnings per	
Other (school, military)		worker	

f) *Highway and Transit Networks*

The highway and transit networks of the BPM were developed and are maintained and applied with TransCAD, which features a Geographical Information System (GIS) framework that provides a realistic representation of the highway and transit route systems.

The Highway Network—The BPM highway network contains more than 53,000 links and includes most minor arterial and higher class roadway facilities. The database includes information on the number of lanes, functional class, speed, parking restriction and truck-usage. As inputs to the BPM, the networks are used to estimate travel times and distances between all parts of the regions (by

TAZs), when assigning trip tables to the networks, to produce link level traffic volume flows by vehicle class (SOV, HOV, Taxi, Truck, and Commercial Van) and congested speeds reflecting volumes and capacities.

The Transit Network—The complex transit network in the BPM is based on information provided by the Metropolitan Transit Authority (MTA), New Jersey Transit (NJT) and other transit operators in the region. The network contains commuter rails, express and local buses, subways, light rail, PATH and ferries as well as the sidewalk network in Manhattan.

In addition, the transit network component also includes station-to-station transfer databases, walk/drive links for rail and other transit connectivity, route coding and fare coding. Detailed information about current transit fares and bridge and tunnel tolls is appended. (See Appendix 4)

g) Model Structure

This section will provide an overview of the main components of the BPM.

The four steps of the BPM are:

1. Household Auto Journey Generation (HAJ)
2. Mode, Destination and Stop Choice (MDSC)
3. Time of Day (TOD)
4. Traffic Assignment

Each of these steps consists of several sub-models:

- **Household Auto Journey Generation (HAJ)**

Household Auto Journey Generation (HAJ) replaces the traditional trip generation model and consists of the following three sub-models: the household-synthesizing model, auto-ownership model and journey production (frequency) model.

Household-Synthesizing Model – This model forecasts the number and distribution of households by income, size, and number of workers, non-working adults and children in each zone. The source of all of this information is the 2000 Public Use Micro Data Sample.

Auto Ownership Model – The auto-ownership model determines the number of automobiles available for each household. The model takes into account the influence of household income and composition, vehicle-maintenance cost, parking availability, transit and highway accessibility, density and residential area type.

Journey Production (frequency) Model – This model determines the daily number of paired journeys (outbound and inbound) each person makes in each household for each purpose. Each person is categorized as a worker, non-working adult or a child. This model evaluates the intra-household interrelationships across different household members, transit accessibility, and auto availability to come up with journey frequency for each person. Linkage of journey-frequency models across different household members allows for forecasting a realistic set of journeys made by each household. This

model also considers absentee factors to account for the fact that not every worker goes to work everyday nor does every child attend school everyday.

- **Mode Destination and Stop Choice Model (MDSC)**

This model combines the destination and the mode choice model and introduces the concept of intermediate stops in a journey. This model distinguishes between motorized and non-motorized travel based on the person and household characteristics and land-use densities around the journey origin. There are a substantial number of walk trips in the survey. For the work journeys there are 1,107 walk journeys. This is about five percent of the total work journeys, of which there are 22,522.

The motorized mode-choice model predicts travelers' decisions based on various time and cost factors, person and household characteristics, and highway and transit accessibilities. The eight travel purposes included in this model are:

1. Work-Low income
2. Work-Med income
3. Work-High income
4. University
5. School
6. Maintenance
7. Discretionary
8. At-work

The travel modes included in the model are:

- SOV
- HOV2
- HOV3
- HOV4+
- Walk to Commuter Rail
- Drive to Commuter Rail
- Walk to Transit
- Drive to Transit
- Taxi
- Walk/Bike
- School Bus

[Transit includes all transit models except commuter rail.]

- **Truck and Commercial Trip Model**

Trucks and commercial vehicles are estimated by a separate model input to the preassignment processor, which produces total vehicle trips by time period. Trucks are defined as all vehicles with at least 2 axles and six tires. The commercial vehicles constitute small trucks and vans that are used for commercial purposes. The truck and commercial trip tables are generated based on the employment growth of the transportation zones.

- **External (Auto) Travel Model**

The external model takes into account the external-external and external-internal trips. The external trips are all trips originating from outside of the study area and either pass through the study area or end their trip in the study area. The external trips are fed into the pre-assignment processor to get the total number of auto trips.

- **Pre-Assignment Processor (PAP) or Time of Day**

This model predicts the time of day for journeys and converts them to trips based on the number of stops in the journeys. This model separates sets of OD trip tables for four time periods. It also includes the truck and commercial vehicle trips and external auto trips.

The time periods are AM= 6-10AM (Peak), Midday = 10AM-4PM, PM= 4-8PM (Peak), Night = 8PM-6AM.

- **Highway and Transit Assignment**

At this step the trips are assigned to four time period networks. Both highway and transit assignment procedures are based on network equilibrium procedures, which reflect the impacts of facility congestion on route choices in networks. Assignment of vehicle trip tables to the coded highway network produces estimated traffic volumes, congested speeds, and vehicle travel times on individual links of the network and also zone-to-zone travel times. In time periods where volumes may exceed capacities, the assignment estimates the equilibrium effect of congestion on path choices and link-specific speeds.

- **2002 Model Update and Emissions Analysis**

The BPM was originally estimated for 1996 with the RT-HIS and other data collections done during that period. The Waiver legislation required NYMTC to prepare its analytical capabilities to evaluate the emissions impacts of the updated TIP and Plan. The BPM required updating to reflect post 9/11 travel pattern changes in Manhattan. The model base year was consequently updated to 2002. The following steps were taken:

- **Data Collection**

A data collection effort was undertaken to ensure that the model is validated to match the data for the baseline year of 2002.

- **Employer Dislocation Data Post 9/11:** This task was completed with the publication of the final Technical Memorandum on December 5, 2002. (Appendix 5A).
- **Population and Employment Data:** An updated population and employment database was developed for the BPM for the year 2002 at the TAZ level. In addition to employment and population data, BPM required other socioeconomic variables as input. These data items were also generated by TAZ.
- **2002 Traffic Count Data:** Post-September 11th traffic counts were collected at over 2,200 locations throughout the region, including major entry points to Lower and

Midtown Manhattan, to establish new 2002 baseline vehicular travel conditions for the BPM. As part of this effort, NYMTC identified and compiled a set of traffic count databases and documents from various regional and sub-regional agencies.

The appropriateness of each traffic count database or document, as well as the validity of the individual records, were reviewed and incorporated into the 2002 BPM screenline database. In the case of locations that were not updated with new counts, growth factors were developed and applied to the 1997 database counts to project to 2002 levels.

The primary data sources compiled by NYMTC for the 2002 BPM screenline database update are listed in Appendix 5B.

- **2002 Traffic Count Data:** NYMTC staff collected and analyzed transit data from various sources for the BPM runs. These data included ridership data, schedule changes, and new services. Data sources that NYMTC used for data collection are listed in Appendix 5C.
- **Socioeconomic Forecasts**

NYMTC had previously adopted socioeconomic forecasts for a 2025 horizon year in December 2003. These forecasts were adjusted for the impacts of September 11th and extended by five years to 2030 for the update of the Plan. The 2030 forecasts employed new macroeconomic assumptions at the national level in the form of U.S. employment, earnings, population and labor force forecasts from 2003 to 2027. The new assumptions indicate that long-term growth will be considerably stronger than previously anticipated. The 2030 forecasts were adopted into the draft Plan in September 2004. In addition to the new assumptions, adjustments included a re-benchmarking of demographic forecasts to the results of the 2000 Census, a reflection of the employment impacts of September 11th on job growth and distribution in the tri-state region, and an inventory of regionally significant land use developments planned for the region. Please refer to Appendices 6A and 6B for employment and population forecast tables. The development inventory is attached as Appendix 6C.
- **Project Information**

NYMTC staff collected information for the improvement projects from the appropriate agencies. This information appears in the draft TIP and Plan that must be included in the Regional Emissions Analysis due to their classification as non-exempt projects. Information such as scope of project, date of completion, and type of proposed projects was provided via electronic forms for each project category. For modeling purposes, this information was transferred into a single database. This database appears in Appendix 3.
- **Model Calibration/Validation**
 - **Network Updates**

The highway and the transit networks were updated to match the existing conditions of the 2002 base year. Changes in capacities of the roadways and speed limits, addition of new lanes and ramps and signal computerizations were incorporated into

the highway networks. Transit route systems were revised to include new services, operational changes and changes in schedule.

- **Model Enhancements**

Several enhancements were incorporated in the BPM to get a more realistic result. The transit and highway networks that were independent in the previous version of the model were linked in the updated model so that the congested speeds on highway would take the bus flows into account as well.

Algorithms were modified to get a better estimate of all the external trips that pass through the region. Mobile 6.2, USEPA's current emissions model, was integrated with the post processor, *PPSuite*, to meet the Federal requirements for transportation conformity.

- **Calibration/Validation of the 2002 Base Year**

The model was run with revised socioeconomic data and modified networks for 2002. The traffic flows at screenline locations were compared with actual counts that were collected for the year 2002. Adjustment factors were applied where significant differences were observed and the model was rerun. After several such iterations of the model run, the resulting traffic flow was determined to be within an acceptable range of the traffic count database. A similar process was undertaken to match the transit ridership projections with the observed ridership counts by route and at major transit terminals.

Appendix 7-A1 shows a comparison of traffic flows from the screenline by three functional class groups with observed counts while Appendix 7-A2 presents a comparison of the NYMTC's Hub Bound Report counts and BPM output. The differences between model output and observed values are within an acceptable range.

Appendix 7-A3 shows VMT by three functional class groups by county and Appendices 8-A1 and 8-A2 present results for transit validation where mode shares of transit trips to total person trips were reviewed by district of origin and by district of destination, respectively. For more detailed information on the calibration and validation process, please refer to Appendix 8-A3.

Transportation Conformity Finding

The findings of this report are that the Federal Fiscal Year (FFY) 2006-2010 Transportation Improvement Program (TIP) and FFY 2005-2030 Regional Transportation Plan (Plan) conform to the State Implementation Plan (SIP), the 2002 State Energy Plan, and the air quality milestones set forth under the Clean Air Act (CAA).

This report is available electronically on NYMTC's website www.NYMTC.com. For further information on the analysis and results of the regional emissions analysis performed for the TIP and Plan for information on the process and methods undertaken by NYMTC to demonstrate air quality conformity, contact Karen A. Rosenberger, PP, AICP at krosenberger@dot.state.ny.us.