APPENDIX G

AIR QUALITY

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G.1 REGIONAL EMISSIONS ANALYSIS

In order to calculate regional emissions, regional average emission factors for 2007 were first computed; this was achieved by dividing the total resulting tons of each pollutant emitted per day (as calculated by NYSDEC, MOBILE6 in 2003 update) by the daily traveled vehicle miles traveled (VMT) in each county, as presented in Table G-1. Since the Proposed action includes traffic increments of all vehicle types operating on all roadway classes, this is a good estimate. Most of the travel would be within New York City; since the emissions for NYC were higher, using the NYC emissions is a conservative estimate.

Table G-1
2007 Control Strategies SIP Run

	1000 dvmt	**tons VOC**	**tons NOx**	**g VOC/VMT**	**g NOx/VMT**
Bronx	14,143	13	15.5	0.83	0.99
Kings	14,379	13.1	15.8	0.83	1.00
Locma	4,077	3.1	5.4	0.69	1.20
Nassau	35,369	32.6	39.7	0.84	1.02
New York	12,683	15.8	15.8	1.13	1.13
Queens	22,965	19.6	24	0.77	0.95
Richmond	6,019	5	6.3	0.75	0.95
Rockland	8,643	6.7	9.8	0.70	1.03
Suffolk	62,274	51.7	64.4	0.75	0.94
Westchester	28,938	22.3	33.5	0.70	1.05
Total	*14,143*	*182.9*	*230.2*	*0.79*	*1.00*
NYC	***14,379***	***66.5***	***77.4***	***0.86***	***1.00***

Sources: NYSDEC SIP update, 2003 (MOBILE6)

In order to estimate the reduction of the emissions in the years analyzed, 2009 and 2015, the original 2007 files were rerun for those years. The results were compared with those of 2007, and the highest ratio (from the various roadway classes and scenarios used in the SIP) was used to scale down the emissions to 2009 and 2015. This produced a conservatively high estimate of the average region-wide per-mile emission rates for those years.

PM_{10} emissions were calculated similarly, conservatively adding 1 g/VMT to include road dust based the AP-42 calculation for fugitive resuspended road dust.

Since this conservative approach yielded regionally low emissions as compared to the general conformity screening levels, refinement was not necessary.

G.2 MOBILE SOURCE ANALYSIS

G.2.1 EMISSIONS MODEL

Aside from the change in direction of Liberty Street due to the Proposed Action, all roadway parameters for Proposed Action were the same as those for the future without the Proposed Action, in both the Pre-September 11 and the Current Conditions Scenarios.

Since the greatest traffic volumes were predicted for the evening peak, and since CO analyses were performed using the CAL3QHC screening model which does not utilize time-sensitive meteorological data, CO analyses were performed for that period. Particulate matter models were all CAL3QHCR analyses utilizing five years of hourly meteorological data.

MOBILE6 SIP preparation input files were obtained DEC; all settings regarding vehicle registration, inspection and maintenance programs, diesel fractions, mile accumulation fuels and fuel programs were taken from those files. Additionally, specific taxi registration data obtained from NYCDEP were used for taxis. Since SUVs have similar emissions to LDGT, but have registration and start-per-day similar to cars, a separate file was prepared for SUVs accordingly. For VOCs and NO_x summertime conditions were used, as in the SIP. For CO, worst case winter conditions were used. Since CO emissions are for short-term calculations, no hourly distribution of any variables were used (the SIP calculations utilize a daily profile). When in doubt, CO analyses assumed all trucks to be HDGT, which emit more CO. Detailed breakdown of vehicle types to sub categories (which are not detailed in field counts or other specific data) was performed by utilizing the fraction of each sub category from the broader category as in the New York State registration data (e.g., MOBILE6 utilizes four categories of LDGT). All construction trucks were assumed to be the heaviest category of HDDV.

G.2.2 SPECIAL APPLICATION OF DISPERSION MODELS

TUNNEL EMISSIONS

The dispersion of pollutants from the proposed short bypass tunnel alternative for Route 9A was modeled within the same traffic modeling framework, with a special procedure applied to the tunnel emissions. The tunnel would consist of two separate tubes, one for each traffic direction. Vehicle engine missions within the tunnel would be mixed within the tunnel air and emitted via the exit portals. Air flow in the tunnel would be induced by a longitudinal, portal to portal jet fan ventilation system assisted by the traffic induced piston air flow.

This type of emission, known as turbulent horizontal jet flow, has similar dispersion to vertical point source emissions in that the concentrations are highest at the source, in this case the portal, and decrease as the pollutants disperse from the source. However, the CAL3 model does not provide for initial horizontal momentum due to the exit velocity; in the model emissions are dispersed downwind only. Since the initial jet is confined within the exit depressed section, this situation can be simulated by placing a line source along a small section starting out from the exit portal, and emitting the entire mass that would be emitted inside the tunnel. The estimated link length of 60 meters (roughly 197 feet) was based on the low end of measured jet length estimates in a physical road tunnel study performed by RWDI (Nadel C. *et al*, Physical Modeling of Dispersion of a Tunnel Portal Exhaust Plume, *8th International Conference on Aerodynamics and Ventilation of Vehicle Tunnels*, Vol. 12, 1994), producing a conservatively high estimate of concentrations. This simulation produces higher concentrations further downwind due to the emission all along the line (rather that from the portal only), and is still conservatively high near the portal due to the concentrated mass emission from the line source (rather than a well mixed volume actually produced by tunnel ventilation).

In the model, in order to achieve the correct total mass emission rate, the jet links included the correct traffic volumes flowing through the tunnel, with the per–mile emission rate multiplied by the ratio between the actual tunnel length (where the emission actually occurs) and the 60 meter length used for the jet (e.g. the tunnel length was 325 meters, emissions were multiplied by 325/60=5.42).

Both the jet links, described above, and the tunnel approach and exit links were modeled as depressed links.

BUS LOADING AND UNLOADING AREA

The Greenwich Street area from Liberty to Vesey Street would function as a loading and unloading area for tour busses bringing visitors to the site. These buses would idle for up to three minutes while passengers embark or disembark. Since particulate matter is the main pollutant of concern in regard to diesel bus emissions, $PM_{2.5}$ and PM_{10} were analyzed for this location. The CAL3 model does not provide for stationary emissions such as this one; the model does have a provision for idle emissions from queuing at traffic lights, but since neither the timing of this case, nor the physical layout of the buses can be emulated as a traffic light, the use of queuing links was deemed inappropriate for this model. (The buses are expected to line up starting at the intersection of Fulton Street, with the line extending south as necessary.)

The bus idle emissions were modeled as a free flow link. Total average emissions were calculated, as presented in Table G-2, on an hourly basis by multiplying the idle emission rate by three minutes per arrival/departure, and divided by 60 minutes and by the length of the link to produce a pseudo per mile emission rate needed for CAL3; the link length was calculated as the minimum bus parking length, 12.2 meter, multiplied by the number of berths needed in any given hour. These calculations were performed for the annual average, used to model annual concentrations, and peak, used to model peak 24-hour concentrations.

Links were then placed accordingly, one for each hour of bus activity. Since this would not be a moving lane, and since the exhaust of standing busses are actually point sources, emissions would have less vertical and horizontal dispersion; to simulate this, a very narrow mixing width of one meter was employed (vertical dispersion in CAL3 is based on the horizontal, so this would limit both.)

G.2.3 RECEPTOR LOCATIONS

Standard receptor locations, used for CO, PM_{10} and local $PM_{2.5}$ analyses, were located on sidewalks just outside of the roadway mixing zone. Receptors in the annual $PM_{2.5}$ neighborhood scale models were placed at a minimum distance of 15 meters from the nearest moving lane. The NYCDEP procedure for neighborhood scale corridor $PM_{2.5}$ modeling is based on the procedure for placement of ambient air quality monitoring stations, defined in Part 58 Appendix E. The procedure calls for the placement of PM_{10} monitors at a minimum distance of 15 meters from the roadway or 1 meter for every 1,000 vehicles average daily traffic—the greater of the two distances. The use of 15 meters is a conservative screening approach, resulting in higher concentrations. Since Route 9A would serves over 30,000 vehicles per day, the neighborhood scale concentrations presented in Chapter 14, “Air Quality,” are highly conservative.

Table G-2
Bus Idle Emissions Calculation—2009

Hour	Arrivals	No. of Berths	Departures	No. Berths	Total Trips	Idle Time (hrs per hr)	Total Berths	Link Length (meters)	PM_{10} EF (g/mile)	$PM_{2.5}$ EF (g/mile)
Average Month Tour Bus Volumes (annual)										
24-9	0	0	0	0	0	0	0	-	-	-
9-10	8	1	3	1	11	0.53	3	32	67.9	62.5
10-11	12	3	7	3	19	0.93	5	65	59.4	54.7
11-12	13	3	13	4	27	1.33	7	81	67.9	62.5
12-13	33	7	16	4	49	2.46	11	130	78.5	72.2
13-14	21	4	19	5	40	2.00	9	114	72.8	66.9
14-15	17	4	40	11	57	2.86	15	178	66.4	61.1
15-16	15	3	20	5	35	1.73	8	97	73.6	67.7
16-17	9	3	13	4	23	1.13	7	81	57.7	53.1
17-18	4	1	3	1	7	0.33	3	32	42.4	39.0
18-24	0	0	0	0	0	0	0	-	-	-
Peak Tour Bus Volumes (24-hour)										
24-9	0	0	0	0	0	0	0	-	-	-
9-10	12	3	4	1	16	0.80	4	49	67.9	62.5
10-11	17	4	9	3	27	1.33	7	81	67.9	62.5
11-12	20	4	20	5	40	2.00	9	114	72.8	66.9
12-13	49	9	24	7	73	3.66	16	195	77.8	71.6
13-14	32	5	28	8	60	2.99	13	162	76.4	70.3
14-15	25	5	60	16	85	4.26	21	260	67.9	62.5
15-16	21	4	29	8	51	2.53	12	146	71.7	65.9
16-17	13	3	20	5	33	1.66	8	97	70.7	65.1
17-18	5	1	4	1	9	0.47	3	32	59.4	54.7
18-24	0	0	0	0	0	0	0	-	-	-

Notes: Mobile 6.2 Idle emission factors (g/hr): 2.5739 PM_{10} ; 2.368 $PM_{2.5}$

Sources: PANYNJ Traffic Engineering

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