Clean Fuel Fleet Transit Buses - Worksheet

Average Emissions (Grams/Mile)

Bus Type	HC	CO	NOx	PM-10
Typical Existing Urban Bus	3.8	49	26.3	5.1
1994 Clean Diesel	1.3	39	25.9	3
1994 Clean Diesel/Catalyst	0.3	18.6	23.2	0.9
1994 Clean Diesel/Trap	1.3	74.2	25.9	0.3
Average Diesel New Bus	1.0	43.9	25.0	1.4
1994 CNG/LNG	1.3	7.4	10.3	0.2

Source: Congestion Mitigation and Air Quality (CMAQ) Analysis Process For Pennsylvania, Draft Final Report, March 1994, Transit 1 - 3.

Average MARTA transit bus vehicle miles traveled per day = 166
Source: MARTA planning & Programming

Number of New Buses into Fleet 1996 & 1999 Scenario Years = 83
Number of New Buses into Fleet in 2005 & 2010 Scenario Years = 200

Assumption - Replacement - No New Service

Calculations:	HC	NOx
Emissions if typical buses were purchased	530.8	4365.8
Emissions from CNG bus purchases	315.4	1709.8
Net Difference in Emissions Per Bus Per Day	315.4	2656
Net Daily Difference in Emissions 1996 & 1999	26178.2	220448
Net Daily Difference in Emissions 2005 & 2010	63080	531200
Net Annual Emission Reduction 1996 & 1999	0.029	0.243
Net Annual Emission Reduction 2005 & 2010	0.070	0.586

Transportation Control Measure (TCM)
Summary Assessment

TCM Definition: Improved Signalization

TCM Project Description:

The Advanced Transportation Management System (ATMS) is one element of Intelligent Vehicle Highway Systems (IVHS). The Atlanta Region is receiving over 52 million dollars in federal funds for phase I of a regional ATMS. ATMS will provide the communication backbone and the software and hardware for an advanced freeway and arterial surveillance and control system that includes aerial and camera surveillance, changeable message signs, computerized and coordinated traffic signals, a Transportation Management Center and Transportation Control Centers (TCC's).

The benefits of this project are enormous considering the improvements to traffic surveillance and control that will enhance traffic operations and incident detection and response. Measuring the air quality benefits of ATMS is limited in this analysis to improved signalization, while Incident management benefits are analyzed separately. Other elements of ATMS such as ramp metering and the Advanced Traveler Information System (ATIS) are not analyzed.

The air quality benefits of the ATMS project consist of the benefits of upgrading, coordinating and computerizing approximately 500 signalized intersections by 1996. Improved signalization provides capabilities for flexible and efficient signal timing, enhanced vehicle detection, better signal coordination and quick malfunction detection. Consequently, vehicular stops and delays are minimized and average travel speeds are increased.

In addition to the 500 signalized intersections to be improved through ATMS, it is estimated that Congestion Mitigation and Air Quality (CMAQ), State and local funds will improve an additional 1208 intersections, resulting in 1,708 signal improvements. Funding and distribution of the signal improvements is as follows:

ATMS and State funds:

GDOT	609

CMAQ and Local funds:

Atlanta	294
Clayton	72
Cobb	214
DeKalb	89
Fulton	146
Gwinnett	284

Regional Commitment:

CL 094, CO 249, DK 118, FN 086, FS 068 and GW 135

	Traffic Signal System Optimization	\$ 3,948,000
AT 89	Traffic Signal Upgrades	\$ 3,364,073
R 098	Regional Adv. Traffic Mgt. System	\$10,000,000

(amount shown for R 098 includes signal cost only)

TABLE 1.0 SUMMARY OF AIR QUALITY IMPACTS

Year	1996	1999	2005	2010
HC Reduction Tons/Day	1.32	1.10	1.00	0.90
NOx Reduction Tons/Day	-0.16	-.13	-0.14	-0.20

Assumptions:

(a) 10% projected increase in average speeds
(b) No emission reduction for vehicles on cross streets
(c) 80% cold starts

Calculations:

The air quality benefits of the 1,708 signal improvements may be quantified as follows:

(a) Based on a sampling of the arterials on which signal improvements will be implemented, the average number of signalized intersections per mile of arterial length is five.

(b) The average daily traffic (ADT) on the Atlanta Region's arterials is 27,120 vehicles, based on the VMT's and lengths of arterials in Clayton, Cobb, DeKalb, Fulton and Gwinnett Counties.

(c) This analysis assumes no improvements to side street traffic flow.

(d) The improvement of 1,708 signalized intersections will affect 341.6 miles of arterials (1,708/5) or a total of 9,264,192 vehicle miles of travel (341.6*27,120). That is 3,705,677 vehicle miles of peak-period travel (i.e. 40%), and 5,558,515 vehicle miles of off-peak travel (i.e. 60%).

(e) It is anticipated that the signal improvements will increase vehicle speeds on the arterials on which they are located by 10 percent. This percent increase is estimated after examining research results published by the Federal Highway Administration (FHWA). The results are shown in the attached table. Due to the diversity of signal operation conditions that exist in the Atlanta Region, our "before conditions" do not match any of the cases in the table. The 10 percent increase was estimated based on our "before conditions" of interconnected and non interconnected pretimed and actuated signals that operate with various types of timing plans and an "after condition" of computer based control.

(f) The 10 percent increase will raise average travel speeds from 21.5 mph to 23.6 mph in the peak period, and 26.8 mph to 29.4 mph in off peak periods.

(g) The reduction in vehicle emissions that will result from this change in travel speeds can be seen in table 1.0. Total emissions for each analysis period can be seen in table 1.1.

TABLE 1.1 VEHICLE EMISSIONS

YEAR	PARTICLE	SPEED	EMISSIONS RATE	VMT	EMISSIONS
		BEFORE/AFTER	80% COLD STARTS	PEAK/OFF-PEAK	TONS/DAY
1996	HC	21.1	2.13	3705677	8.700497778
1996	HC	23.6	1.99	3705677	8.128634074
1996	NOx	21.1	1.61	3705677	6.576432593
1996	NOx	23.6	1.63	3705677	6.658127407
1996	HC	26.8	1.806	5558515	11.06556267
1996	HC	29.4	1.684	5558515	10.31805511
1996	NOx	26.8	1.654	5558515	10.13424178
1996	NOx	29.4	1.666	5558515	10.20776711
1999	HC	21.1	1.72	3705677	7.025754074
1999	HC	23.6	1.6	3705677	6.535585185
1999	NOx	21.1	1.45	3705677	5.922874074
1999	NOx	23.6	1.47	3705677	6.004568889
1999	HC	26.8	1.45	5558515	8.884311111
1999	HC	29.4	1.35	5558515	8.2716
1999	NOx	26.8	1.49	5558515	9.129395556
1999	NOx	29.4	1.5	5558515	9.190666667
2005	HC	21.1	1.47	3705677	6.004568889
2005	HC	23.6	1.36	3705677	5.555247407
2005	NOx	21.1	1.31	3705677	5.35101037
2005	NOx	23.6	1.33	3705677	5.432705185
2005	HC	26.8	1.23	5558515	7.536346667
2005	HC	29.4	1.14	5558515	6.984906667
2005	NOx	26.8	1.34	5558515	8.210328889
2005	NOx	29.4	1.35	5558515	8.2716
2010	HC	21.1	1.37	3705677	5.596094815
2010	HC	23.6	1.27	3705677	5.187620741
2010	NOx	21.1	1.26	3705677	5.146773333
2010	NOx	23.6	1.28	3705677	5.228468148
2010	HC	26.8	1.14	5558515	6.984906667
2010	HC	29.4	1.06	5558515	6.494737778
2010	NOx	26.8	1.29	5558515	7.903973333
2010	NOx	29.4	1.31	5558515	8.026515556