Birmingham In-Town Transit Partnership Project

Air Quality Assessment
Technical Memorandum

June 2008

1.0 INTRODUCTION

This report summarizes the results of the air quality assessment for the Birmingham Bus Rapid Transit (BRT) study proposed through downtown Birmingham, Alabama. This analysis was conducted according to the guidelines established by the Environmental Protection Agency (EPA) as required by the National Environmental Policy Act (NEPA).

2.0 PROJECT DESCRIPTION

The primary purpose of the In-Town Transit Partnership Project has been to develop a vision of the future for transit services in the study area – supported by project stakeholders and the public – that will provide improved mobility, support continued economic growth and revitalization, enhance current and future regional transit services, protect natural and cultural resources, and better serve area residents and businesses. The In-Town Transit Partnership Project (ITP) is being managed by the Regional planning Commission of Greater Birmingham (RPCGB) with assistance from project sponsors Jefferson and Shelby Counties; the cities of Birmingham, Homewood, Hoover, Irondale, Mountain Brook, and Vestavia Hills; the Birmingham and Jefferson County Transit Authority (BJCTA); and the Federal Transit Administration.

The recommended alignment for the ITP project occurs within the existing street right-of-ways and consists of two lines (Blue and Green) which share an alignment between the Birmingham-Jefferson Convention Complex (BJCC) and the University of Alabama at Birmingham (UAB). At 5th Avenue South, the lines split and the Green Line provides connection to the medical facilities along 5th Avenue South and the UAB remote parking facility at 8th Street and 6th Avenue South. The Blue Line continues on 18th Street South, providing additional stops to serve the university and the medical center, before terminating at Five Points South. The alignment is illustrated in the attached study area map. The alignment serves a wide variety of City Center destinations, including the Convention Complex, the Civic Center and Linn Park, the downtown core, the Civil Rights District, the 4th Avenue District, the Theater District, the planned Intermodal Center, the planned Railroad Reservation Park, the University of Alabama at Birmingham and Medical Center, and Five Points South.

The preferred alternative uses a Bus rapid transit technology along the Blue and Green lines. The BRT would consist of buses with a unique identity, providing frequent service, and traveling in dedicated lanes. The preferred alternative also consists of a network of 'neighborhood connectors' which provide access to the in-town neighborhoods near the City Center. The neighborhood connector alignments, shown on the attached study area map, are based on operational analysis and the desire to reach high density locations and important activity centers. The connector routes travel in mixed traffic and will make use of smaller vehicles in order to enable more efficient service and use of resources within the neighborhoods. They also will feature regular, reliable service, be given a unique identity, and include improved stops at important neighborhood locations.

3.0 METHODOLOGY

In compliance with the Clean Air Act (CAA) and its amendments, this document addresses the status of this projects conformity in accordance with 40 CFR Parts 51 and 93, "Criteria and Procedures for Determining Conformity to State or Federal Implementation Plans of Transportation Plans, Programs, and Projects Funded or Approved Under Title 23 USC or the Federal Transit Act". It presents a qualitative discussion on carbon monoxide, particulates and Mobile Source Air Toxics. The air quality assessment also includes descriptions of the federal air quality standards and a traffic screening analysis used to evaluate potential project impacts.

3.1 Criteria Pollutants of Concern

The pollutants that are most important for a transit air quality impact analysis are those that can be traced principally to motor vehicles and electrical power plants. In the study area, however, ambient concentrations of carbon monoxide (CO) and ozone (O_3) are predominantly influenced by motor vehicle activity. Emissions of hydrocarbons (HC), nitrogen oxides (NO_x) and particulate matter smaller than 10 and 2.5 microns (respectively, PM10/2.5) come from both mobile and stationary sources while emissions of sulfur oxides (SO_x) and lead (Pb) are associated mainly with various stationary sources. The air quality assessment focused on emission sources that could be traced directly to the Project, which included primarily motor vehicles and buses. Since the existing network of buses will be redistributed along new and consolidated routes, the change in emissions is expected to be negligible.

CO is the primary pollutant used to indicate the potential for adverse air quality impacts from motor vehicles in general, and at roadway intersections in particular. This is because motor vehicles produce most of the ambient CO, and emission rates of CO from vehicles are relatively high compared to emissions of other pollutants. The federal ambient air quality standards are set up in such a way that, should adverse impacts occur, the CO standard would most likely be exceeded first. Accordingly, CO is the main pollutant of concern for the air quality analysis.

Similarly, because ozone is a regional pollutant that is formed in the presence of volatile organic compounds (VOC) and NO_x, it is not possible to evaluate ozone directly. Ozone is typically assessed through its precursors. As a result, concentrations of ozone are typically measured directly in the atmosphere rather than through modeling predictions.

3.2 Hazardous Pollutants of Concern

The Clean Air Act identified 188 air toxics, also known as hazardous air pollutants. The EPA has assessed this expansive list of toxics and identified a group of 21 as mobile source air toxics, which are set forth in an EPA final rule, Control of Emissions of Hazardous Air Pollutants from Mobile Sources (66 FR 17235). The EPA also extracted a subset of this list of 21 that it now labels as the six priority MSATs. These are benzene, formaldehyde, acetaldehyde, diesel particulate matter/diesel exhaust organic gases, acrolein, and 1,3-butadiene. The MSATs are compounds emitted from highway vehicles and non-road equipment. Some toxic compounds are present in fuel and are emitted to the air when the fuel evaporates or passes through the engine unburned. Other toxics are emitted from the incomplete combustion of fuels or as secondary combustion products. Metal air toxics also result from engine wear or from impurities in oil or gasoline.

The EPA is the lead Federal Agency for administering the Clean Air Act and has certain responsibilities regarding the health effects of MSATs. The EPA issued a Final Rule on Controlling Emissions of Hazardous Air Pollutants from Mobile Sources, 66 FR 17229 (March 29, 2001). This rule was issued under the authority in Section 202 of the Clean Air Act. In its

rule, EPA examined the impacts of existing and newly promulgated mobile source control programs, including its reformulated gasoline (RFG) program, its national low emission vehicle (NLEV) standards, its Tier 2 motor vehicle emissions standards and gasoline sulfur control requirements, and its proposed heavy duty engine and vehicle standards and on-highway diesel fuel sulfur control requirements. Between 2000 and 2020, FHWA projects that even with a 64 percent increase in VMT, these programs will reduce on-highway emissions of benzene, formaldehyde, 1,3-butadiene, and acetaldehyde by 57 percent to 65 percent, and will reduce on-highway diesel PM emissions by 87 percent.

3.3 Ambient Air Quality Standards

Under the authority of the Clean Air Act, EPA established a set of *National Ambient Air Quality Standards* (NAAQS) for various "criteria" air pollutants listed in **Table 3-1**[1]. Presently, there are NAAQS for six criteria pollutants: ozone (O_3), carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), particulate matter (PM) of diameter 10 microns or less (PM10) and 2.5 microns or less (PM2.5), and lead (Pb).

Table 3-1: National Ambient Air Quality Standards

Pollutant	Standard Type	Averaging Period	Standard Value[a]
Carbon Monoxide (CO)	Primary and Secondary[b]	8-Hour average 1-Hour average	9 ppm (10 mg/m^3)[c] 35 ppm (40 mg/m^3)
Nitrogen Dioxide (NO_2)	Primary and Secondary	Annual arithmetic mean	0.053 ppm (100 µg/m^3)[c]
Ozone (O_3)	Primary and Secondary	1-Hour average 8-Hour average	0.12 ppm (235 µg/m^3)[d] 0.08 ppm (155 µg/m^3)
Particulate Matter (PM10)	Primary and Secondary	Annual arithmetic mean 24-Hour average	50 µg/m^3 [e] 150 µg/m^3
Particulate Matter (PM2.5)	Primary and Secondary	Annual arithmetic mean 24-Hour average	15 µg/m^3 65 µg/m^3
Lead (Pb)	Primary and Secondary	Quarterly mean	1.5 µg/m^3
Sulfur Dioxide (SO_2)	Primary Primary Secondary	Annual arithmetic mean 24-Hour average[f] 3-Hour average	0.03 ppm (80 µg/m^3) 0.14 ppm (365 µg/m^3) 0.5 ppm (1300 µg/m^3)

a Short-term standards (1 to 24 hours) are not to be exceeded more than once per calendar year.
b Former national secondary standards for carbon monoxide have been repealed.
c Pollutant concentrations are reported in parts per million (ppm), milligrams per cubic meter (mg/m^3) or micrograms per cubic meter (µg/m^3).
d Maximum daily 1-hour (8-hour) average. The ozone standard is attained when the expected number of days with maximum hourly (8-hourly) average concentrations above the value of the standard, averaged over a three year period, is less than or equal to one.
e For each particle size, the annual PM standard is met when the three-year average of the annual mean concentration is less than or equal to the value of the standard. The 24-hour PM10 (PM2.5) standard is met when the three-year average of the annual 99th (98th) percentile values of the daily average concentrations is less than or equal to the value of the standard.
f National standards are block averages rather than moving averages.
Note: CO, NO_2, O_3, and PM are transportation related pollutants
Source: 40 CFR 50, National Primary and Secondary Ambient Air Quality Standards.

3.4 Traffic Screening

Motor vehicles emit CO at the highest rates when they are operating at low speeds or idling. For this reason, the potential for adverse air quality impacts is greatest at intersections where traffic is most congested. An initial screening of 34 traffic intersections in the traffic study area was performed to assess the current levels of congestions as well as where traffic volumes

[1] 40 CFR 50, National Primary and Secondary Ambient Air Quality Standards.

would be likely to increase due to the project. For the 34 intersections included in the traffic study, the level of service (LOS) ratings were evaluated against typical congestion that begins at LOS 'D'. Based on the results of this initial intersection screening, only one of the intersections is expected to operate at LOS 'D' (8th Avenue between 11th and 12th Streets), which could contribute to an exceedance of the air quality standards.

As reported in the *Draft Existing Conditions Report* (August 2005), traffic data was gathered in July and August of 2005. Data sets were taken in one hour increments for a 24-hour period beginning at 7 a.m. on a Tuesday or Thursday. Adjustment factors were obtained from ALDOT that are specific to the downtown area. These increased the measured values in the order of 0 to 4 percent. **Table 3-2** shows the adjusted peak hour volumes for the study area and the maximum volume for a street to be considered LOS 'D'. Based upon the criteria from **Table 3-2**, all but one location where traffic data were taken would perform better than LOS 'D'. The one location that does not meet a LOS 'D' is University Avenue between 11th and12th Streets. Here the a.m. peak hourly volume of 1,833 vehicles per hour gives a LOS 'F' for eastbound traffic. Even at this location, only two of the hourly volumes for eastbound traffic exceed LOS 'D'.

Table 3-2: Peak Hourly Volumes for Subject Roadways

Location		One Directional		
		No. of Thru Lanes	Measured Peak Hourly Volume	Maximum for LOS 'D'
			(vehicles/hour)	
18th St	9th - 8th Ave N	3	229	2,340
	4th - 3rd Ave N	4	486	2,860
	7th - 8th Ave S	2	429	1,540
	9th - 10th Ave S	2	328	1,540
19th St	8th - 7th Ave N	2	524	1,540
	3rd - 2nd Ave N	1	351	690
	5th - 6th Ave S	2	423	1,540
	9th - 10th Ave S	2	412	1,540
20th St	6th - 5th Ave N	2	409	1,540
	2nd - 1st Ave N	2	441	1,540
	2nd - 3rd Ave S	2	560	1,540
	6th - 7th Ave S	2	768	1,540
	9th - 10th Ave S	2	902	1,540
21st St	9th - 8th Ave N	3	1,018	2,340
	2nd - 1st Ave N	3	782	2,340
	3rd - 4th Ave S	3	1,152	2,340
	7th - 8th Ave S	3	806	2,340
	9th - 10th Ave S	2	723	1,540
5th Ave S	11th - 12th St	2	470	1,540
	14th - 15th St	2	538	1,540
	20th - 21st St	2	422	1,540
	23rd - 24th St	2	419	1,540
6th Ave S	11th - 12th St	2	1,215	1,540

Location		One Directional		
		No. of Thru Lanes	Measured Peak Hourly Volume	Maximum for LOS 'D'
			(vehicles/hour)	
	14th - 15th St	2	905	1,540
	17th - 18th St	2	799	1,540
	21st – 22nd St	2	598	1,540
	24th - 25th St	2	356	1,540
7th Ave S	14th - 15th St	1	374	690
	20th - 21st St	1	434	690
	23rd - 24th St	1	384	690
8th Ave S	11th - 12th St	2	1,833	1,540
	14th - 15th St	2	1,394	1,540
	18th - 19th St	2	1,090	1,540
	24th - 25th St	2	1,431	1,540

Source: *Draft Existing Conditions Report*, prepared for The Regional Planning Commission of Greater Birmingham, DMJM Harris, Birmingham, AL, August 2005.

As a result of the initial traffic analysis, a CO "hot spot" analysis to determine the onset of impact was not conducted as part of this analysis due to the low likelihood of impact and the inclusion of the project in a conforming transportation plan.

4.0 EXISTING CONDITIONS

The Alabama Department of Environmental Management (ADEM) develops and implements plans and programs to meet and maintain federal and State air quality standards. The ADEM protects and manages the region's air resources through the Air Division. The Air Division's mission is to protect, conserve and restore the air resources of the state with the primary goal of protecting human health. They accomplish this mission by implementing the federal Clean Air Act and appropriate Alabama statutes, monitoring the state's air quality, administering Alabama's air pollution control programs to provide more protection with less process, promoting pollution prevention, and coordinating their work with the efforts of other local, state, and federal air quality programs. For example, the Air Division has primary jurisdiction over all air emission sources within the State, except those emission sources located within Jefferson County or the City of Huntsville. The Air Pollution Control Programs in Jefferson County (Birmingham) are administered by the Jefferson County Department of Health.

This section summarizes measured ambient air quality data for the region including the study area. The ADEM maintains a state wide network of monitoring stations that routinely measure pollutant concentrations in the ambient air. These stations provide data to assess compliance with the NAAQS and to evaluate the effectiveness of pollution control strategies. The relevant monitored pollutants are ozone, NO_2, CO, PM10/2.5, and SO_2. **Table 4-1** presents the maximum measured concentrations for these pollutants measured at representative monitoring stations nearest to the study area, as reported by the ADEM for the three most recent years for which data are available (2005-2007).

Table 4-1: Monitored Ambient Air Quality in the Region

				Maximum Concentrations[1]					
Pollutant	**Monitor**		**Averaging**	**2005**		**2006**		**2007**	
Name	**Location**	**Number**	**Period**	**1st**	**2nd**	**1st**	**2nd**	**1st**	**2nd**
Carbon Monoxide (CO)	East Thomas, Finley, 841 Finley Ave. Bp.	10730028	1 Hour	4.4	4.1	4.2	3.8	5.2	3.1
			8 Hours	3.2	3.1	3.3	3.2	2.3	2.3
Nitrogen Dioxide (NO_2)	Tva Widows Crk 11 2.0 Mi Ese Widows Crk	10710020	Annual	0.005	--	N/A	--	N/A	--
Ozone (O_3)	No. B'Ham, Sou R.R., 3009 28th St. No.	10730023	8 Hours	0.087	0.084	0.097	0.092	0.102	0.098
Particulate Matter (PM10)	No. B'Ham, Sou R.R., 3009 28th St. No.	10730023	24 Hours	114	112	95	93	103	101
Particulate Matter (PM2.5)	No. B'Ham, Sou R.R., 3009 28th St. No.	10730023	24 Hours	63	63	49	49	60	55
			Annual	19.6		18.4		18.8	
Sulfur Dioxide (SO_2)	Tva Widows Crk 11 2.0 Mi Ese Widows Crk	10710020	3 Hours	0.093	0.07	0.046	0.046	0.054	0.047
			24 Hours	0.022	0.015	0.013	0.011	0.013	0.012
			Annual	0.003	--	0.002	--	0.002	--

1 Highest and second highest measured concentrations (1st and 2nd maximum concentrations) are reported for each pollutant.
Source: Alabama Department of Environmental Management, as reported to U.S. Environmental Protection Agency AIRData website (http://www.epa.gov/air/data/geosel.html).

As shown in **Table 4-1**, the highest eight-hour ozone concentration of 0.102 parts per million (ppm) occurred in 2007 and was measured in North Birmingham on 28th Street. This level is above the eight-hour ozone standard of 0.08 ppm. Additionally, exceedances of the annual PM2.5 standard of 15 µg/m^3 were measured the past three years. No other pollutant concentrations exceeded their respective standards in the three years since 2005. Although recent monitored maximum values of ozone exceed the NAAQS, the Jefferson County air quality region is in attainment for ozone and all other criteria pollutants except PM2.5.

5.0 NO BUILD CONDITION

As reported in the *Existing Conditions Report (August 2005)*, the cordon report predicts a 30% increase in ADT and the resultant LOS (as a measure of congestion at intersections) between 2002 and 2030. Although bus service under the No Build Alternative is expected to remain the same or similar to existing service, traffic delays are expected to get worse due this increased congestion along the current bus routes. Therefore, monitored ambient air quality is also expected to remain the same or increase slightly as a result of the increased congestion from traffic along the existing bus routes. However, based on the low levels measured for the criteria pollutants recently, no exceedances of the NAAQS are expected under the No Build Condition except PM2.5. Based on recent monitored levels, exceedances of the annual standard are expected under the future No Build Condition.

6.0 BUILD CONDITIONS

6.1 Operations

As part of the proposed BRT system, future bus service under the Build Alternative is expected to operate more efficiently due to reduced delays and improved transit times. For example, 10-minute headways are proposed during the peak periods (from 7:00-9:00 a.m. and from 3:30-7:00 p.m) and 15-minute headways during all off-peak periods. BRT vehicles are also expected to idle only 20 seconds at each stop. As a result, emissions from bus service in the project study area are expected to improve for several reasons. Improved bus transit times are expected to reduce delays, congestion and overall idling times for bus compared to the Existing or future No Build Conditions. Additionally, the Birmingham Long Rang Plan (BLRP) estimates up to a 4.8% reduction in VMTs due to proposed public transit projects like the ITP BRT corridor in the Design Year 2030. As a result, this improved service is expected to lead to an increase in transit ridership thereby reducing the number of vehicle miles traveled for other commuters. Essentially, as drivers migrate from automobiles to bus rapid transit service, overall regional emissions are expected to decrease under the Build Alternative. Therefore, no impacts are expected under the Build Alternative. Therefore, based on the low levels measured for the criteria pollutants recently, no exceedances of the NAAQS are expected under the Build Alternative.

As described in Section 3.5 (Traffic Screening), the LOS for most of the corridor (except 8th Avenue between 11th and 12th Streets) is expected to operate well below any congested condition. Therefore, no exceedances of the CO standards are expected since on average, most of the traffic operates under free flow conditions with minimal congestion. Even at the congested 8th Avenue location, LOS is only slightly above LOS 'D' indicating that there is only a marginal potential to approach or exceed the CO standards. As a result, no exceedances of the CO one-hour or 8-hour standards are expected under the future Build Alternative.

6.2 Effects of Heavy-Duty Diesel Emissions on PM2.5

According to EPA, the 2007 heavy-duty engine standards will result in the introduction of new, highly-effective control technologies for heavy-duty engines, beginning in 2007. Particulate matter emission levels are expected to be 90 percent lower on a per vehicle basis than 2000 levels, due to the 2007 diesel engine and fuel program. On-Road diesel trucks began to use Ultra-Low Sulfur Diesel (ULSD) fuel in the fall of 2006. As older heavy-duty diesel vehicles are replaced with newer less polluting vehicles, the heavy duty diesel truck fleet emission rate, based on MOBILE6.2 emission rates, is projected to decrease 70 to 80% from today through the 2030 Design Year.

PM2.5 emissions, like all other pollutants from transportation, are a function of emission rates, traffic volumes and meteorological conditions. Based on the fact that the annual PM2.5 concentrations in Birmingham have exceeded the NAAQS of 15 $\mu g/m^3$ the past few years, future exceedances of the PM2.5 standard are likely without any new transit initiatives. Although the project improvements will not change the number of diesel trucks in the study area, new transit opportunities is expected to reduce the projected increase in VMT by diverting drivers from cars to transit. Furthermore, with the introduction of ULSD fuel in the study area, and EPA's new heavy-duty engine emission standards, this project is not expected to create a violation of the PM2.5 NAAQS in the 2030 Design Year even with the introduction of new diesel bus transit service.

6.3 Construction

Construction activities can result in short-term impacts on ambient air quality. These potential impacts include direct emissions from construction equipment and trucks, increased emissions from motor vehicles on the streets due to disruption of traffic flow, and fugitive dust emissions. These impacts would be temporary, and would affect only the immediate vicinity of the construction sites and their access routes. However, emissions from project-related construction equipment and trucks are expected to be insignificant with respect to compliance with the NAAQS since only minor construction activities are proposed.

Project construction activities may include installation of canopies and seating areas at station stops. Maintenance of buses is expected to continue to be serviced at the existing BJCTA facility along Morris Avenue. Increased motor vehicle exhaust emissions due to traffic disruption from lane closures, detours, and construction vehicles are expected to be minimal if proper traffic management and control measures are implemented.

6.4 Mitigation

The ITP project is expected to consolidate existing bus service along select downtown routes under the proposed Build Alternative. As a result of this consolidation of bus service, the change in emissions is expected to be negligible. Therefore, the project is not expected to create any new violation of the NAAQS and is expected to conform to the SIP. No mitigation measures are necessary with respect to compliance with the transportation conformity requirements (i.e., no mitigation measures are required for operation of this project).

Direct emissions from construction equipment are not expected to produce adverse effects on local air quality provided that all equipment is properly operated and maintained. If required, traffic management techniques are available during the construction period that would mitigate increased emissions from traffic congestion due to lane closures, detours, and construction vehicles accessing sites. Mitigation techniques could include development of site-specific traffic management plans; temporary signage and other traffic controls; designated staging areas, worker parking lots (with shuttle bus service if necessary), and truck routes; and prohibition of construction vehicle travel during peak traffic periods.

Potential fugitive dust impacts would be mitigated through good "housekeeping" practices such as water sprays during demolition; wetting, paving, or landscaping exposed earth areas; covering dust-producing materials during transport; limiting dust-producing construction activities during high wind conditions; and providing street sweeping and tire washes for trucks leaving the site.

7.0 CONFORMITY

The NAAQS are used as the basis for determining an area's air quality designation (i.e., status as "attainment" or "nonattainment"). Generally, a nonattainment area is one that does not meet a particular standard in the NAAQS. An area may be classified nonattainment for one or more pollutants and attainment for others. A nonattainment area is reclassified as attainment when it achieves the standard. Such areas are given a "maintenance" designation, requiring them to demonstrate continued compliance with a specific standard, but not requiring additional controls to reduce emissions. For example, Birmingham and Jefferson County are an ozone maintenance area for violation in the recent past.

EPA has promulgated two sets of regulations to implement the General Conformity Rule (40 CFR 93, subpart A): 1) Transportation Conformity Regulations, which apply to highways and mass transit and establish the criteria and procedures for determining whether transportation

plans, programs, and projects funded under title 23 U.S.C. or the Federal Transit Act conform with the State Implementation Plan (58 FR 62188); and, 2) the General Conformity Regulations, which apply to everything else.

Birmingham and Jefferson County are currently in attainment for all criteria pollutants except PM2.5. The proposed ITP project is included in the current conforming Birmingham Metropolitan Planning Area 2030 Long Range Transportation Plan, as amended in September 2007. According to the BLRP, the ITP study is currently exempt from demonstrating conformity. Therefore, because the ITP project is included in the BLRP, which has been shown to conform to the NAAQS, the ITP project is also assumed to conform and to be in compliance with the NAAQS.

8.0 CONCLUSION

The project is not predicted to cause any violations of the applicable NAAQS. Similarly, the project has been shown to conform to the SIP with respect to regional emissions and conformity. No mitigation measures are necessary with respect to compliance with the transportation conformity requirements.

Construction activities have the potential to produce short-term, localized air quality impacts. These potential impacts can be minimized with appropriate mitigation measures.