Birmingham In-Town Transit Partnership Project

Noise Assessment
Technical Memorandum

June 2008

1.0 INTRODUCTION

This report summarizes the results of the noise assessment for the Birmingham Bus Rapid Transit (BRT) study in Birmingham, AL. This analysis was conducted according to the recently updated Federal Transit Administration's (FTA) *Transit Noise and Vibration Impact Assessment*[1] guidelines.

2.0 METHODOLOGY

The modeling methodologies used for the noise assessment, including descriptions of the noise metrics, are described in the following section.

2.1 Human Perception of Noise

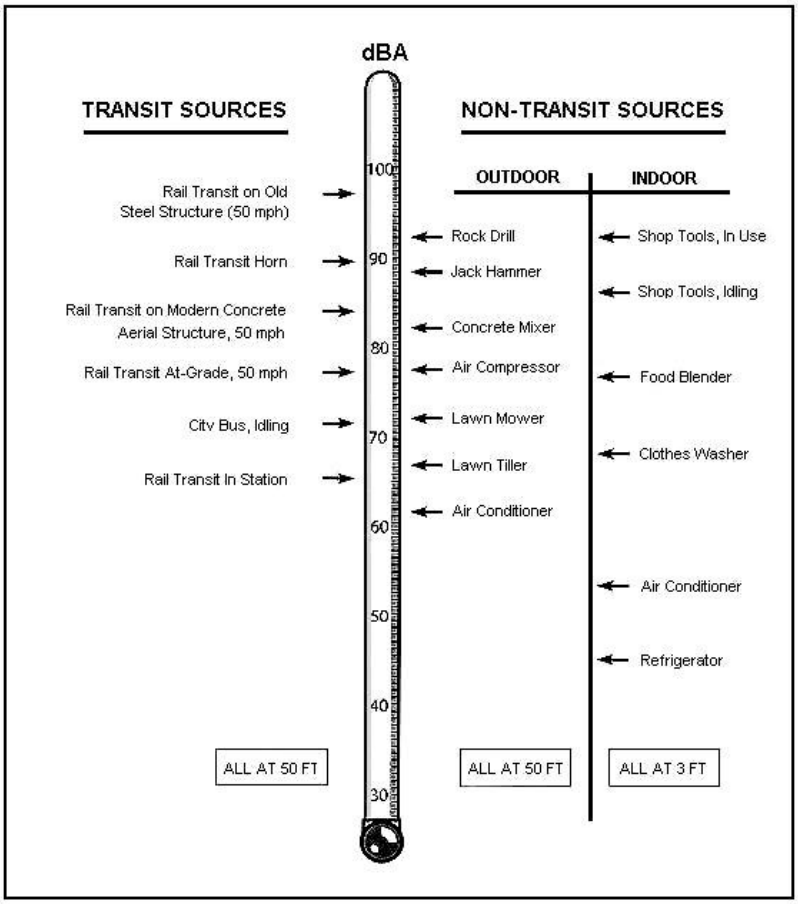
Noise is "unwanted sound" and, by this definition, the perception of noise is a subjective process. Several factors affect the actual level and quality of sound (or noise) as perceived by the human ear and can generally be described in terms of loudness, pitch (or frequency), and time variation. The loudness, or magnitude, of noise determines its intensity and is measured in decibels (dB) that may range from 40 decibels (the rustling of leaves) to over 100 decibels (a rock concert). Pitch describes the character and frequency content of noise such as the very low "rumbling" noise of stereo sub-woofers, or the very high-pitched whistle noise. Finally, the time variation of some noise sources can be characterized as continuous, such as a building ventilation fan; intermittent, such as for a train passby; or impulsive, like a car backfire.

Various sound levels are used to quantify noise from transit sources, including a sound's loudness, duration, and tonal character. For example, the A-weighted decibel (dBA) is commonly used to describe the overall noise level because it is an attempt to take into account the human ear's response to audible frequencies. Because the decibel is based on a logarithmic scale, a 10-decibel increase in noise level is generally perceived as a doubling of loudness, while a 3-decibel increase in noise is just barely perceptible to the human ear. Typical A-weighted sound levels from transit and other common sources are shown in **Figure 1**.

Several A-weighted noise descriptors are used to determine impacts from transit related sources including the Lmax, which represents the maximum noise level that occurs during an event such as a bus or train passby; the Leq, which represents a level of constant noise with the same acoustical energy as the fluctuating noise levels observed during a given interval, such as one hour; and the Ldn, or the 24-hour day-night noise level that includes a 10-decibel penalty for all nighttime activity between 10 PM and 7 AM.

[1] "Transit Noise and Vibration Impact Assessment", FTA-VA-90-1003-06, U.S. Department of Transportation, Federal Transit Administration, Office of Planning and Environment, Washington, DC, May 2006.

Figure 1: Typical A-weighted Noise Levels



Source: "Transit Noise and Vibration Impact Assessment", FTA-VA-90-1003-06, U.S. Department of Transportation, Federal Transit Administration, Office of Planning and Environment, Washington, DC, May 2006.

2.2 Modeling Methodology

The noise assessment was conducted in accordance with the FTA's *Transit Noise and Vibration Impact Assessment* guidelines. Specifically, a General Assessment was conducted to compute project noise levels from the proposed BRT operations under the Build Alternative in the design year. The following modeling assumptions and input parameters were included in the noise assessment:

- Operations were determined based on the following operating characteristics:[2]
  - o Peak Period: 10-minutes headways were utilized during the peak periods from 7:00-9:00 a.m. and from 3:30-7:00 p.m.;
  - o Off-Peak Period: 15-minute headways were utilized during the other off-peak periods between 9:00 a.m. and midnight; and,
  - o Idle Time at Stops: BRT vehicles will idle for 20 seconds at each of the designated station stops.

[2] "Ms. Lee Farmer, DMJM Harris, email correspondence per the "LPA Report_Combined.doc" report, May 19, 2008.

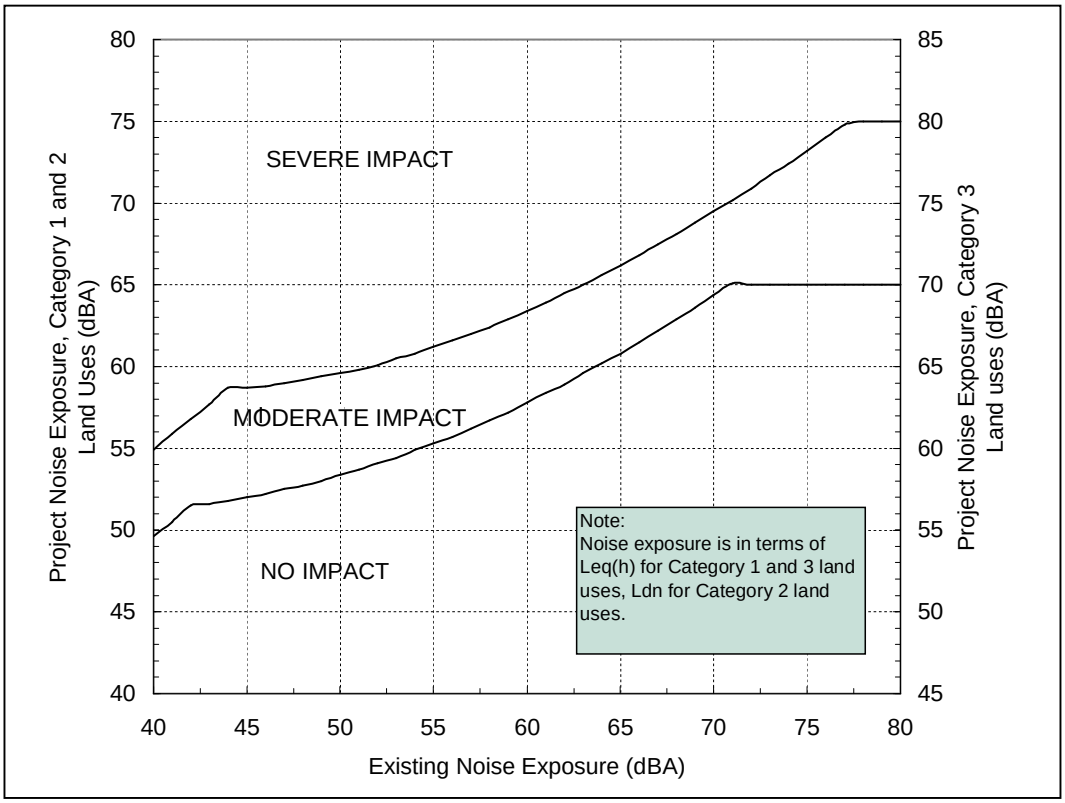
- Average travel speeds of 25 miles per hour were used for segments of the proposed corridors;
- To be conservative, the default FTA reference noise levels were used for the modeling analysis rather than other typical low-floor buses. The following reference noise levels were used for the North American Bus Industries (NABI) Model 42-BRT bus.
    - o Passbys: A sound exposure noise level (SEL) of 82 dBA and a maximum noise level (Lmax) of 79 dBA were used to compute impacts due to passbys. These levels are approximately 3-5 dBA higher than newer late-model buses;
    - o Idling: An SEL of 111 dBA and an Lmax of 75 dBA were used to compute impacts due to idling at stops. These levels are approximately 5 dBA higher than newer late-model buses;
- The vibration impacts from rubber-tired buses at receptors adjacent to the facility are typically not a problem due to slower speeds, lighter vehicle weights, damped suspension and relatively longer receptor distances. Therefore, a vibration impact assessment is not included as part of this analysis per the FTA guidelines.

2.3 Noise Evaluation Criteria

FTA's guidance manual presents the basic concepts, methods, and procedures for evaluating the extent and severity of noise impacts from transit projects. Transit noise impacts are assessed based on land use categories and sensitivity to noise from transit sources under the FTA guidelines. As shown in **Figure 2**, the FTA noise impact criteria are defined by two curves that allow increasing project noise levels as existing noise increases up to a point, beyond which impact is determined based on project noise alone. The FTA land use categories and required noise metrics are described in **Table 1**.

The FTA noise criteria are delineated into two categories: *moderate impact* and *severe impact*. The *moderate impact* threshold defines areas where the change in noise is noticeable but may not be sufficient to cause a strong, adverse community reaction. The *severe impact* threshold defines the noise limits above which a significant percentage of the population would be highly annoyed by new noise. The level of impact at any specific site can be established by comparing the predicted project noise level at the site to the existing noise level at the site. The FTA noise impact criteria for all three land use categories are shown in **Figure 2-2**.

Figure 2: FTA Noise Impact Criteria for Transit Projects



Source: "Transit Noise and Vibration Impact Assessment", FTA-VA-90-1003-06, U.S. Department of Transportation, Federal Transit Administration, Office of Planning and Environment, Washington, DC, May 2006.

Table 1: FTA Land Use Categories and Noise Metrics

Land Use Category	Noise Metric	Description
1	Leq(h)	Tracts of land set aside for serenity and quiet, such as outdoor amphitheaters, concert pavilions, and historic landmarks.
2	Ldn	Buildings used for sleeping such as residences, hospitals, hotels, and other areas where nighttime sensitivity to noise is of utmost importance.
3	Leq(h)	Institutional land uses with primarily daytime and evening uses including schools, libraries, churches, museums, cemeteries, historic sites, and parks, and certain recreational facilities used for study or meditation.

Source: "Transit Noise and Vibration Impact Assessment", FTA-VA-90-1003-06, U.S. Department of Transportation, Federal Transit Administration, Office of Planning and Environment, Washington, DC, May 2006.

3.0 EXISTING CONDITIONS

To determine the existing background or baseline noise levels at sensitive receptors along the proposed BRT corridors, ambient noise levels were estimated based on several environmental factors including distance from major roadways and population density. Average 24-hour day-night noise levels (or Ldn) were estimated at various locations along the project corridors. Based on the FTA guidelines, the average Ldn noise level at residential receptors in the downtown Birmingham area is approximately 60 dBA. This baseline estimate reflects various urban noise sources including interstate traffic (such as along I-20 and I-59), city traffic along local roadways such as 18th Street. This estimate reflects both daytime peak periods as well as nighttime off-peak periods. The background noise levels estimated for the project corridor are summarized in **Table 2**.

Although urban centers are typically higher, these estimated ambient noise levels are conservative and are expected to yield more stringent thresholds for impact. The background noise levels are used to establish the impact criteria against which future project noise levels are compared. All noise levels are reported in A-weighted decibels, which best approximate the sensitivity of human hearing.

Table 2: Estimated Ambient Noise Levels along the Project Corridor (in dBA)

Segment		FTA	Leq Noise Levels (dBA)[1]			Ldn
No.	Description	Cat.	Day	Evening	Night	(dBA)
S1	5th Ave South	2	60	55	50	60
S2	18th St, south of 5th Ave S.	2	60	55	50	60
S3	18th St, 5th Ave S. to 5th Ave N. (CBD)	2	60	55	50	60
S4	I-20/I-59 Area south of convention center	2	60	55	50	60

1 Hourly Leq noise levels were estimated using the FTA "General Assessment" guidelines (Table 5-7).
Source: DMJM Harris, Birmingham, AL, June 2008.

4.0 NO BUILD CONDITION

Under the future No Build Condition, no facilities or other developments are proposed at the selected park-and-ride site. As a result, ambient noise levels will not change under the No Build Condition due to the proposed project. However, future ambient noise levels may be affected by other sources in the area unrelated to the project. For example, measured ambient noise levels are currently dominated by traffic along Tara Boulevard as there are no other major noise contributors in the immediate area. As a result, future noise levels under the No Build Condition are expected to remain the same or change slightly due to any changes to the future traffic along Tara Boulevard and other nearby roadways. However, it is important to note that the FTA criteria specify a comparison of future project noise with existing noise and not with projections of future No Build noise exposure (i.e., without the project). Therefore, an impact determination is not conducted under the No Build Condition.

As a result, ambient noise levels under the No Build Condition at receptors closest to the currently undeveloped park-and-ride site are expected to remain the same as those measured under the Existing Conditions.

5.0 BUILD ALTERNATIVE

Maximum noise levels from BRT operations along the proposed Blue and Green alignments were evaluated at the closest noise-sensitive receptors. The dominant noise sources from the buses are the engine and the rooftop exhaust. Tire-pavement noise is typically not an issue in urban areas due to the slower travel speeds.

Typical maximum Ldn noise levels from bus passbys are predicted to range from 45 dBA at 50 feet from the corridor to 52 dBA only 10 feet from the corridor. Similarly, typical maximum Ldn noise levels from bus idling at passenger stops are predicted to range from 51 dBA at 50 feet from the corridor to 65 dBA only 10 feet from the corridor. The project thresholds of impact range from 58 dBA for *moderate impact* to 63 dBA for *severe impact* based on the estimated existing Ldn level of 60 dBA.

As shown in **Table 3**, the distances at which the onset of *moderate impact* at residential and other FTA Category 2 receptors is predicted less than 2 feet for bus passbys and less than 22 feet for idling at stops. Distances to impact for institutional receptors such as schools and libraries are even less. Except for residences and other FTA Category 2 receptors directly adjacent to proposed station stops, none of the Ldn noise levels are predicted to exceed the FTA *moderate* or *severe impact* criteria under the future Build Alternative.

Table 3: Predicted Distances to *Moderate Impact*

Segment		Category 2		Category 3		Estimated
No.	Description	Passbys	Idling	Passbys	Idling	Impacts
S1	5th Ave South	<2 ft	22 ft	<2 ft	14 ft	None
S2	18th St, south of 5th Ave S.	<2 ft	22 ft	<2 ft	14 ft	None
S3	18th St, 5th Ave S. to 5th Ave N. (CBD)	<2 ft	22 ft	<2 ft	14 ft	None
S4	I-20/I-59 Area south of convention center	<2 ft	22 ft	<2 ft	14 ft	None

Source: DMJM Harris, Birmingham, AL, June 2008.

6.0 CONSTRUCTION IMPACTS

Noise and vibration levels from construction activities along the proposed BRT corridor, although temporary, could create a nuisance condition at nearby sensitive receptors along 18th Street and 5th Avenue. Exposure to excessive noise and vibration levels varies depending on the types of construction activity and the types of equipment used for each stage of work. Project construction activities may include heavy machinery to relocate curb cuts, to construct station stops, lay down new pavement, and other miscellaneous activities. Although details of the actual construction activities are not known at this preliminary phase of the project, particular attention should be paid during final design when details of the actual construction equipment

required become clearer. However, several “good housekeeping” practices are recommended in Section 7 (Mitigation Measures) to eliminate or reduce the annoyance associated with these activities.

7.0 MITIGATION MEASURES

To avoid potential impacts from the project during operations such as excessive idling from buses, proposed station stops should be relocated away from noise-sensitive receptors identified within 50 feet. Similarly, to avoid potential impacts from the project during construction, the following mitigation measures are recommended to eliminate or minimize short-term annoyances due to construction activities:

- Conducting all construction activities during the daytime between 7 AM and 7 PM;
- Erecting temporary noise barriers between noisy activities and noise-sensitive receptors;
- Establishing equipment and material staging areas away from sensitive receptors;
- Re-routing construction traffic along roadways that minimize impacts at nearby sensitive receptors.

These “good housekeeping” practices are available to contractors to minimize temporary construction impacts at nearby residences. Other noise control measures, such as staging of noisy equipment and procedures at the same time, could be incorporated into the final design to minimize potential annoyance and duration during the temporary construction activities.