Creek lie near Frisco, Texas north of State Highway 121. The creek flows south to its confluence with the East Fork of the Trinity River at Lake Ray Hubbard. The Rowlett Creek watershed has a total drainage area of 139 square miles at Lake Ray Hubbard and is approximately 23 miles long and eight miles wide. The main stem has a length of 26.4 miles above Miller Road. The channel has been straightened from the lake to a point about 0.5 miles downstream of Ben Davis Road. A portion of this straightened channel is within the DART Rail to Rowlett Study Area. This portion of the channel is small, but the floodplain is broad and flat, varying from 1,700 to 5,000 feet in width. Parts of the floodplain are extensively wooded, while others have been reclaimed for residential development. According to the floodplain management study, during a 100-year flood event, the MKT railroad within the project area that crosses the Rowlett Creek floodplain is severely and relatively frequently inundated. The railroad is overtopped by 5.6 feet by the 100-year water surface elevation.

## 2.8 Noise and Vibration

### 2.8.1 Noise Methodology

Noise is typically defined as unwanted or undesirable sound, where sound is characterized by small air pressure fluctuations above and below the atmospheric pressure. The basic parameters of environmental noise that affect human subjective response are

- Intensity or level
- Frequency content
- Variation with time

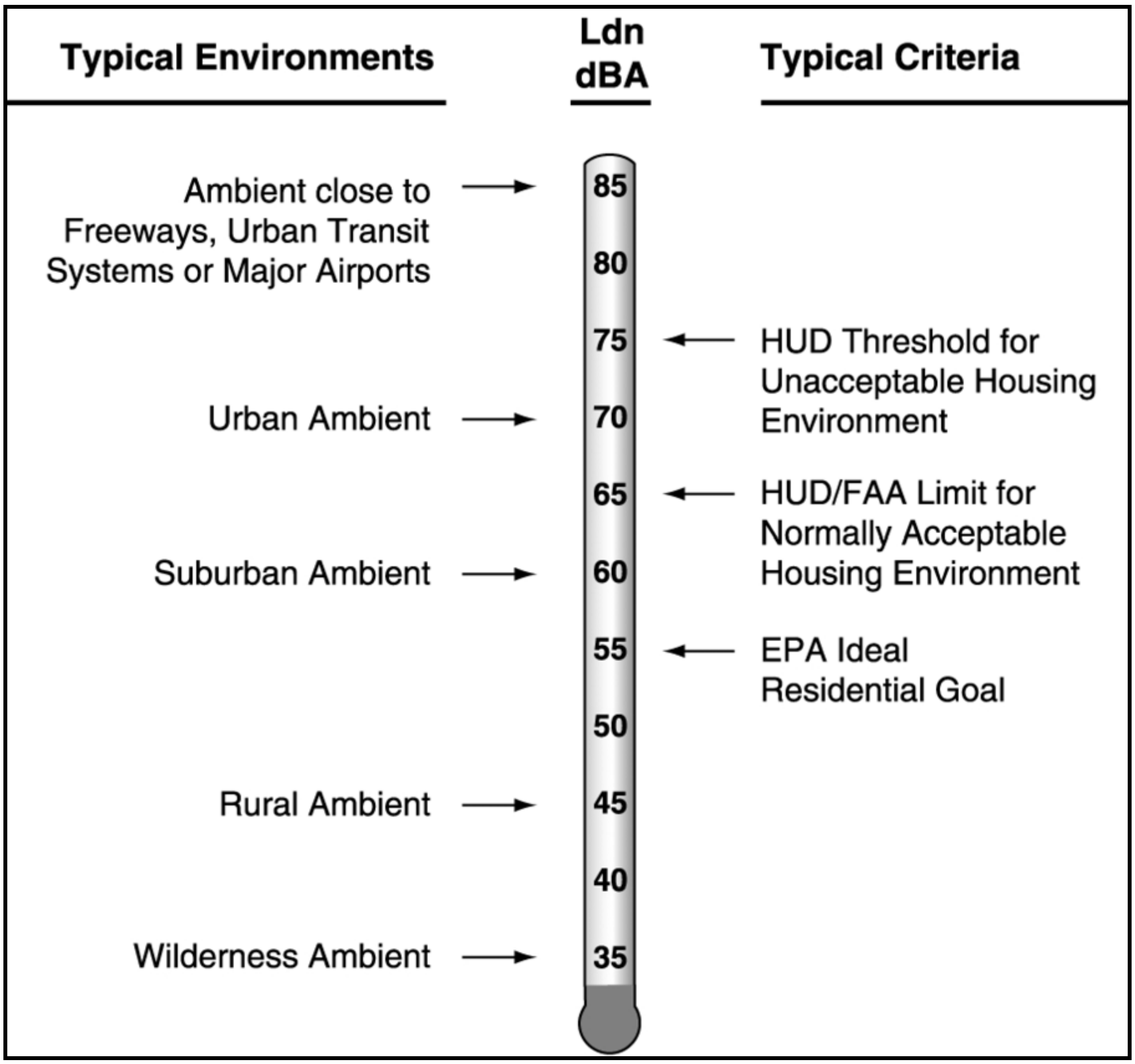
The first parameter is determined by how greatly the sound pressure fluctuates above and below the atmospheric pressure and is expressed on a compressed scale in units of decibels (dB). By using this scale, the range of normally encountered sound can be expressed by values between zero and 120 dB. On a relative basis, a 3-decibel change in sound level generally represents a barely noticeable change outside the laboratory, whereas a 10-dB change in sound level would typically be perceived as a doubling (or halving) in the loudness of a sound.

The frequency content of noise is related to the tone or pitch of the sound and is expressed based on the rate of the air pressure fluctuation in terms of cycles per second (Hz). The human ear can detect a wide range of frequencies from about 20 Hz to 17,000 Hz. However, because the sensitivity of human hearing varies with frequency, the A-weighting system is commonly used when measuring environmental noise to provide a single number descriptor that correlates with human subjective response. Sound levels measured using this weighting system are called “A-weighted” sound levels and are expressed in dB notation as “dBA.” The dBA is widely accepted by acousticians as a proper unit for describing environmental noise.

Because environmental noise fluctuates from moment to moment, it is common practice to condense all of this information into a single number, called the equivalent sound level (Leq). Leq can be thought of as the steady sound level that represents the same sound energy as the varying sound levels over a specified time period (typically one hour or 24 hours). Often the Leq values over a 24-hour period are used to calculate cumulative noise exposure in terms of the Day-Night Sound Level (Ldn). Ldn is the A-weighed Leq for a 24-hour period with an added 10-

dB penalty imposed on noise that occurs during the nighttime hours (between 10 pm and 7 am). Many surveys have shown that Ldn is well correlated with human annoyance; therefore, this descriptor is widely used for environmental noise impact assessments. **Figure 2-25** provides examples of typical noise environments and criteria in terms of Ldn. While the extremes of Ldn are shown to range from 35 dBA in a wilderness environment to 85 dBA in noisy urban environments, Ldn is generally found to range between 55 dBA and 75 dBA in most communities. As shown in **Figure 2-25,** this spans the range between an “ideal” residential environment and the threshold for an unacceptable residential environment according to U. S. Federal Agency criteria.

**Figure 2-25: Examples of Typical Outdoor Noise Exposure**



## 2.8.2 Vibration Methodology

Ground-borne vibration is the oscillatory motion of the ground around some equilibrium position that can be described in terms of displacement, velocity or acceleration. Because sensitivity to vibration typically corresponds to the amplitude of vibration, velocity within the low-frequency range is of most concern for environmental vibration (roughly five to 100 Hz). Velocity is the preferred measure for evaluating ground-borne vibration from transit projects.

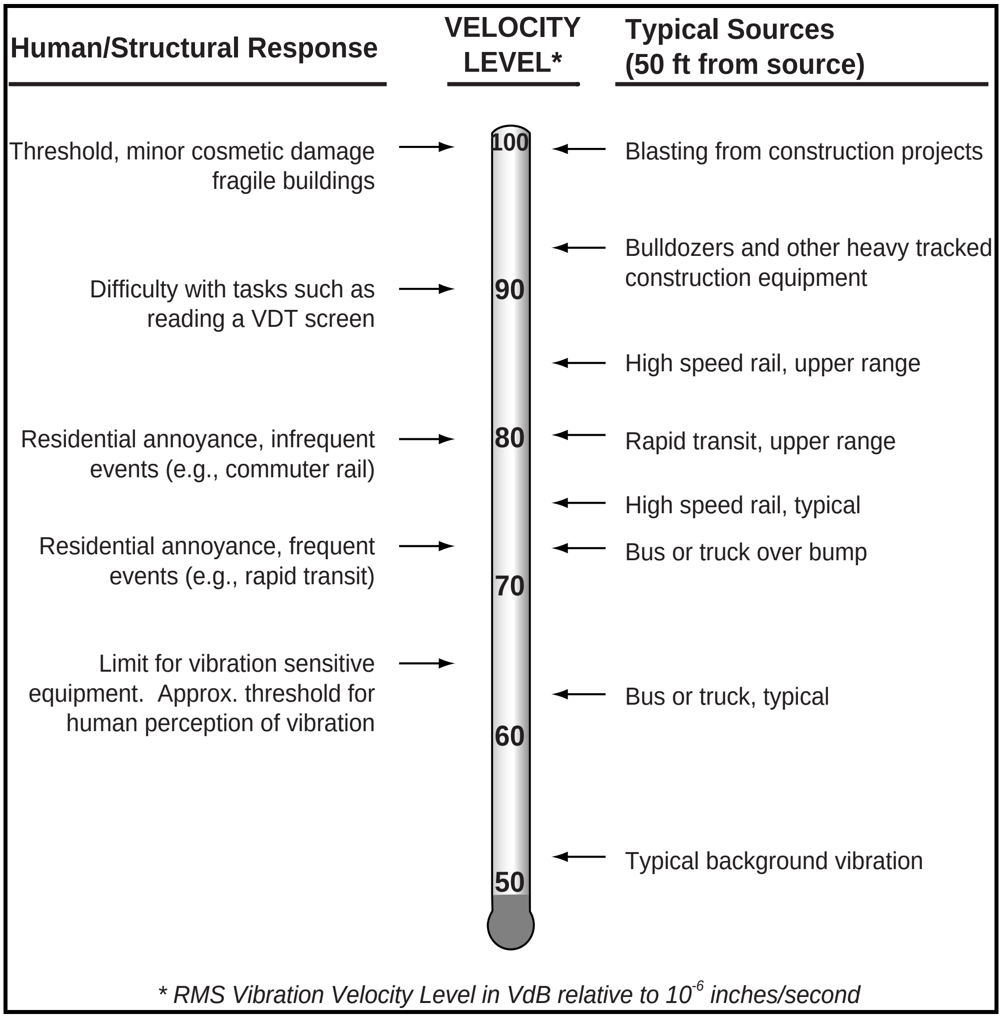
The most common measure used to quantify vibration amplitude is the peak particle velocity (PPV), defined as the maximum instantaneous peak of the vibratory motion. PPV is typically used in monitoring blasting and other types of construction-generated vibration, since it is related to the stresses experienced by building components. Although PPV is appropriate for evaluating building damage, it is less suitable for evaluating human response, which is better related to the average vibration amplitude. Thus, ground-borne vibration from transit trains is usually characterized in terms of the “smoothed” root mean square vibration velocity level in decibels (VdB), with a reference quantity of one micro-inch per second. VdB is used in place of dB to avoid confusing vibration dBs with sound dBs.

**Figure 2-26** illustrates typical ground-borne vibration levels for common sources as well as criteria for human and structural response to ground-borne vibration. As shown, the range of interest is from approximately 50 to 100 VdB, from imperceptible background vibration to the threshold of damage. Although the approximate threshold of human perception to vibration is 65 VdB, annoyance is usually not significant unless the vibration exceeds 70 VdB.

## 2.8.3 Transit Noise Criteria

Noise impacts for this project are based on the criteria as defined in the FTA guidance manual Transit Noise and Vibration Impact Assessment (FTA Report FTA-VA-90-1003-06, May 2006). The FTA noise impact criteria are founded on well-documented research of community reaction to noise and are based on change in noise exposure using a sliding scale. Although more transit noise is allowed in neighborhoods with high levels of existing noise, smaller increases in total noise exposure are allowed with increasing levels of existing noise.

**Figure 2-26: Typical Ground-Borne Vibration Levels and Criteria**




The FTA Noise Impact Criteria group noise sensitive land uses into the following three categories:

- Category 1: Buildings or parks, where quiet is an essential element of their purpose
- Category 2: Residences and buildings where people normally sleep. This includes residences, hospitals, and hotels where nighttime sensitivity is assumed to be of utmost importance
- Category 3: Institutional land uses with primarily daytime and evening use. This category includes schools, libraries, and places of worship

Ldn is used to characterize noise exposure for residential areas (Category 2). For other noise sensitive land uses such as parks and school buildings (Categories 1 and 3), the maximum 1-hour Leq during the facility's operating period is used.

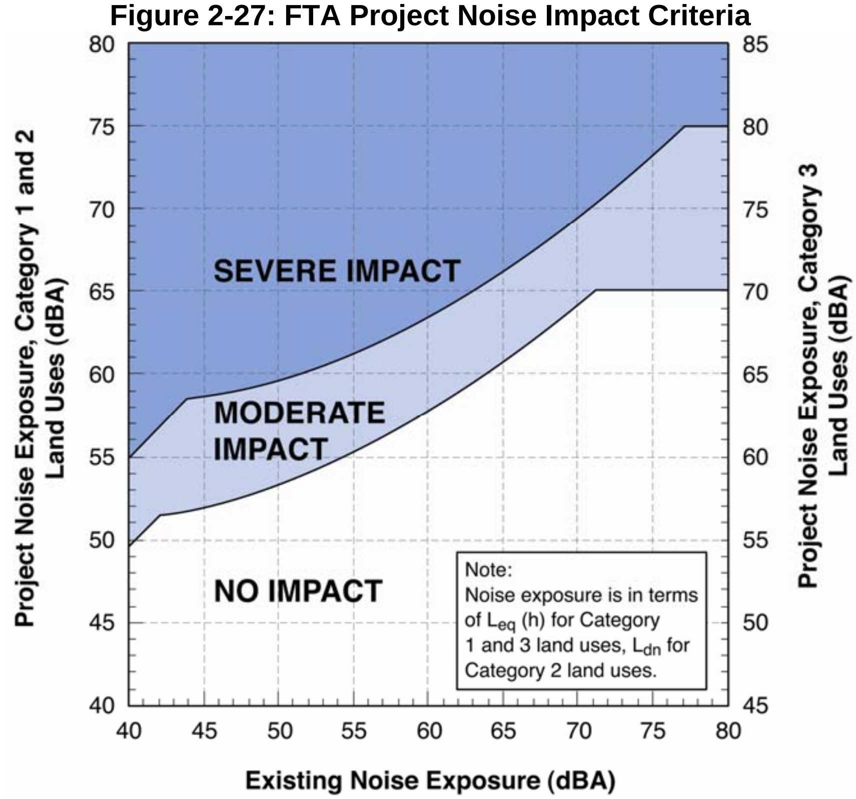
There are two levels of impacts included in the FTA criteria. The interpretation of these two levels of impact is summarized below:

- **Severe Impact**: Severe noise impacts are considered "significant" as this term is used in the National Environmental Policy Act (NEPA) and implementing regulations. Noise mitigation will normally be specified for severe impact areas unless there is no practical method of mitigating the noise.

- **Moderate Impact**: In this range of noise impact, other project-specific factors must be considered to determine the magnitude of the impact and the need for mitigation. These other factors can include the predicted increase over existing noise levels, the types and numbers of noise-sensitive land uses affected, existing outdoor-indoor sound insulation, and the cost effectiveness of mitigating noise to more acceptable levels.

The noise impact criteria are summarized in graphical form in **Figure 2-27**. The figure shows the existing noise exposure and the additional noise exposure from the transit project that would cause either moderate or severe impact. The future noise exposure would be the combination of the existing noise exposure and the additional noise exposure caused by the transit project.

**Figure 2-27: FTA Project Noise Impact Criteria**



## 2.8.4 Train Vibration Criteria

The FTA ground-borne vibration impact criteria are based on land use and train frequency, as shown in **Table 2-27**. There are some buildings, such as concert halls, recording studios and theaters that can be very sensitive to vibration but do not fit into any of the three categories listed in **Table 2-27**. Due to the sensitivity of these buildings, they usually warrant special attention during the LEA of a transit project. **Table 2-28** gives criteria for acceptable levels of ground-borne vibration for various types of special buildings.

It should also be noted that there are separate FTA criteria for ground-borne noise, the "rumble" that can be radiated from the motion of room surfaces in buildings due to ground-borne vibration. Such criteria are particularly important for underground transit operations. However, because airborne noise tends to mask ground-borne noise for above ground (i.e. at-grade or elevated) rail systems, ground-borne noise criteria are not applied to this project.

**Table 2-27: Ground-Borne Vibration Impact Criteria**

| Land Use Category | Ground-Borne Vibration Impact (VdB re 1 micro inch/sec) | | |
|---|---|---|---|
| | Frequent Events[1] | Occasional Events[2] | Infrequent Events[3] |
| **Category 1**: Buildings where low ambient vibration is essential for interior operations. | 65 VdB[4] | 65 VdB[4] | 65 VdB[4] |
| **Category 2**: Residences and buildings where people normally sleep. | 72 VdB | 75 VdB | 80 VdB |
| **Category 3**: Institutional land uses with primarily daytime use. | 75 VdB | 78 VdB | 83 VdB |

**Source**: FTA, 2006

**Notes**:
1 "Frequent Events" is defined as more than 70 vibration events of the same source per day. Most rapid transit projects fall into this category.
2 "Occasional Events" is defined as between 30 and 70 vibration events of the same source per day. Most Commuter trunk lines have this many operations.
3 "Infrequent Events" is defined as fewer than 70 vibration events of the same kind per day. This category includes most commuter rail branch lines.
4 This criterion limit is based on levels that are acceptable for most moderately sensitive equipment such as optical microscopes. Vibration sensitive manufacturing or research would require detailed evaluation to define the acceptable vibration levels. Ensuring lower vibration levels in a building often requires special design of the heating ventilating, and air-conditioning systems and stiffened floors.

**Table 2-28: Ground-Borne Vibration Impact Criteria for Special Buildings**

| Type of Building or Room | Ground-Borne Vibration Impact Levels (VdB re 1 micro-inch/sec) | |
|---|---|---|
| | Frequent Events[1] | Occasional or Infrequent Events[2] |
| Concert Halls | 65 VdB | 65 VdB |
| TV Studios | 65 VdB | 65 VdB |
| Recording Studios | 65 VdB | 65 VdB |
| Auditoriums | 72 VdB | 80 VdB |
| Theaters | 72 VdB | 80 VdB |

**Source**: FTA, 2006

**Notes**: [1] "Frequent Events" is defined as more than 70 vibration events per day. Most transit projects fall into this category.

[2] "Occasional or Infrequent Events" is defined as fewer than 70 vibration events per day. This category includes most commuter rail systems.

[3] If the building would rarely be occupied when the trains are operating, there is no need to consider impact. As an example consider locating a commuter rail line next to a concert hall. If no commuter trains will operate after 7 pm, it should be rare that the trains interfere with the use of the hall.

### 2.8.5 Existing Noise and Vibration Levels

Noise

Noise-sensitive land use along the proposed DART Rail to Rowlett Corridor was first identified based on preliminary alignment drawings, aerial photographs, visual surveys and land use information from engineering drawings. Based on this review, summary descriptions of noise-sensitive land use and existing noise sources along the proposed DART Rail to Rowlett Alignment are as follows:

- **Victory Baptist Church (Garland)**: The church is located to the north of East Walnut Street on the north side of the proposed DART Rail to Rowlett Alignment. The noise environment in the area is dominated by traffic on East Walnut Street and is also contributed to by noise from freight train operations.
- **Rainbow Estates (Garland)**: The Rainbow Estates neighborhood, along Parker Circle and Davidson Drive, is located to the south of the proposed DART Rail to Rowlett Alignment. The existing noise environment is contributed to by local neighborhood activities and by freight train operations on the existing tracks.
- **Mt. Hebron Baptist Church (Garland)**: This church is located to the north of the proposed DART Rail to Rowlett Alignment on Route 66 in Garland. The major noise source in the area is traffic on Route 66. Local traffic on North Country Club Road and freight train operations also contribute to the noise environment.
- **Pentecost Church of God parcel (Garland)**: This land is located to the south of the proposed DART Rail to Rowlett Alignment. While there is currently no building, a church may be built at this location in the future. Noise sources include traffic on Route 66 and freight train operations.

- **Dexham Estates (Rowlett)**: The proposed DART Rail to Rowlett Alignment is located to the north of this single-family residential development on Palomino Drive. The noise environment is contributed to by noise from local traffic on Dexham Road and Palomino Drive. Freight train operations also contribute to the noise environment at this location.
- **Downtown Rowlett (Rowlett):** The proposed DART Rail to Rowlett Alignment is located between Main Street and Melcer Drive in downtown Rowlett. Land use in this area is a mix of residential and commercial. There are scattered single-family residences in this area, both to the north and south of the proposed alignment. Kingdom Hall of Jehovah's Witnesses is located on Main Street. Two other places of worship and associated schools, the First Baptist Church of Rowlett and the Rowlett Methodist Church, are located past the proposed DART Downtown Rowlett LRT Station on the tail track.

Existing ambient noise levels in the above areas were characterized through direct measurements at selected sites along the proposed DART Rail to Rowlett Alignment during the period from November 1 through November 3, 2005. Estimating existing noise exposure is an important step in the noise impact assessment since, as indicated above in Section 2.8.3, the thresholds for noise impacts are based on the existing levels of noise exposure. The measurements included both long-term (24-hour) and short-term (60-minute) monitoring of the dBA at representative noise-sensitive locations.

All of the measurement sites were located in noise-sensitive areas and were selected to represent a range of existing noise conditions along the proposed DART Rail to Rowlett Alignment. **Figure 2-28** shows the general location of the three long-term monitoring sites (LT-1 through LT-3) and two short-term monitoring sites (ST-1 and ST-2). At each site, the measurement microphone was positioned to characterize the exposure of the site to the dominant noise sources in the area. For example, microphones were located at the approximate setback lines of the receptors from adjacent roads or rail lines, and were positioned to avoid acoustic shielding by landscaping, fences, or other obstructions.


DART RAIL TO ROWLETT | Connecting Communities

Figure 2-28

**Ambient Noise and Vibration Measurement Locations**

DART Rail to Rowlett LEA

N

0 1,000 2,000 Feet

Data Source: Aerials - NCTCOG, 2003; Measurements - HMMH, 2005.

The results of the existing ambient noise measurements, which are summarized in **Table 2-29**, serve as the basis for determining the existing noise conditions at all noise-sensitive receptors along the proposed DART Rail to Rowlett. The results at each site are described below.

**Table 2-29: Summary of Existing Noise Measurement Results**

| Site No. | Measurement Location Description | State of Measurement | | Meas. Time (hrs) | Noise Exposure (dBA) | |
|---|---|---|---|---|---|---|
| | | Date | Time | | Ldn | Leq |
| LT-1 | 318 Davidson Drive. – Garland | 11-1-05 | 13:00 | 24 | 68* | -- |
| LT-2 | 1918 Palomino Drive. – Rowlett | 11-1-05 | 15:00 | 24 | 54* | -- |
| LT-3 | Kingdom Hall of Jehovah's Witnesses – Rowlett | 11-2-05 | 13:00 | 24 | 55* | -- |
| ST-1 | Victory Baptist Church – Garland | 11-2-05 | 15:28 | 1 | -- | 68 |
| ST-2 | Mt. Hebron Baptist Church – Garland | 11-3-05 | 7:55 | 1 | -- | 60 |

**Source**: Harris Miller Miller & Hanson Inc., 2005
**Note:** *The noise measurement at Site LT-1 included a freight train after 11 p.m., which contributed significantly to the existing noise exposure. There were no freight train events at Sites LT-2 and LT-3.

<u>Ambient Noise Monitoring Locations</u>

- **Site LT-1: Single-family residence at 318 Davidson Drive, Garland**: The measured Ldn at this location was 68 dBA. The microphone was located behind the home, adjacent to the proposed alignment and the existing freight tracks. Noise sources included local traffic on Davidson Drive and Route 66 and freight train operations.

- **Site LT-2: Single-family residence at 1918 Palomino Drive, Rowlett**: The measured Ldn at this location was 54 dBA. The microphone was located in the back yard of the home. Noise sources included local traffic from Palomino Drive and Dexham Road.

- **Site LT-3: Kingdom Hall of Jehovah's Witnesses, Rowlett**: The measured Ldn at this location was 55 dBA. The microphone was located behind the parking lot in the back of the church, adjacent to the proposed alignment. Noise sources included local traffic from Main Street in Rowlett.

- **Site ST-1: Victory Baptist Church, Garland**: The measured one-hour Leq at this location was 68 dBA. The dominant noise source was traffic from East Walnut Street.

- **Site ST-2: Mt. Hebron Baptist Church, Garland**: The measured one-hour Leq at this location was 60 dBA. The major noise source was traffic on Route 66.

<u>Vibration</u>

Because there are no significant sources of existing vibration along the proposed DART Rail to Rowlett Corridor, vibration measurements for this project focused on characterizing the vibration propagation properties of the soil at representative locations along the corridor. Two vibration testing sites, at the locations shown in **Figure 2-29**, were selected to represent the range of soil conditions in areas along the corridor that include a significant number of vibration-sensitive receptors. At each of these sites, ground-borne vibration propagation tests were conducted by impacting the ground and measuring the input force and corresponding ground vibration response at various distances. The resulting force-response transfer function can be combined with the known input force characteristics of the DART LRV to predict future vibration levels at locations along the proposed DART Rail to Rowlett Alignment. The two vibration testing sites are described below.

- **Site V-1: Mt. Hebron Baptist Church**: This site was located in the parking lot of Mt. Hebron Baptist Church. The vibration measurement at this site is representative of the portion of the proposed DART Rail to Rowlett Alignment in Garland.

- **Site V-2: DART Rowlett Park & Ride Lot**: This site was located in the DART Rowlett Park & Ride lot on Industrial Street. The vibration measurement at this site is representative of the portion of the proposed DART Rail to Rowlett Alignment in Rowlett.

## 2.9 Air Quality

This section describes existing air quality conditions and associated regulatory requirements and criteria. The DART Rail to Rowlett is subject to compliance with the Clean Air Act (CAA) Amendments of 1990 (42 U.S. Code [USC], Sections 7401-7671, et seq., as amended). Section 110 of the CAA requires states to develop State Implementation Plans (SIPs) that identify how the state will attain and maintain National Ambient Air Quality Standards (NAAQS) and other federal air quality regulations.

### 2.9.1 State and Regional Air Quality Strategies

The DFW Metropolitan Area is currently in attainment for all criteria pollutants except $O_3$, a pollutant formed by photochemical reactions involving volatile organic compounds (VOCs) and nitrogen oxides ($NO_X$) emissions from vehicles in the presence of sunlight. On April 15, 2004, the EPA designated nine North Central Texas Counties (including Dallas County) as “moderate” $O_3$ nonattainment for the 8-hour $O_3$ standard in accordance with NAAQS. Dallas County was formally in nonattainment for the 1-hour $O_3$ standard, but as of June 15, 2005 is no longer subject to the 1-hour standard.

### 2.9.2 Air Quality Criteria

The EPA has established NAAQS to limit levels of pollutants in the air pursuant to Section 109 of the CAA for criteria pollutants, including the following: