



**LYNX Blue Line Extension
(Northeast Corridor)
Light Rail Project
Contract #: 08-477
WBS #: 6.12**

Noise and Vibration Technical Report Addendum #1

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TABLE OF CONTENTS

1.0 INTRODUCTION 1

2.0 EXISTING CONDITIONS 1

2.1 Existing Conditions of Noise and Vibration Sensitive Receptors 2

3.0 IMPACT ASSESSMENT 4

3.1 Noise 4

3.2 Vibration..... 5

List of Tables

Table 1: Noise Monitoring Results 3

Table 2: Light Rail Alternative – CRISP Alignment
 Noise Impact General Assessment (2009) Category 1 & 2 Land Uses..... 4

Table 3: Light Rail Alternative – Revised UNC Charlotte Alignment
 Noise Impact General Assessment (2009) Category 1 & 2 Land Uses..... 5

Table 4: Light Rail Alternative – Revised UNC Charlotte Alignment
 Noise Impact General Assessment (2009) Category 3 Land Uses 5

Table 5: Light Rail Alternative – CRISP Alignment
 Vibration Impact General Assessment (2009) Category 2 & 3 Land Uses..... 6

Table 6: Light Rail Alternative – Revised UNC Charlotte Alignment
 Vibration Impact General Assessment (2009) Category 2 & 3 Land Uses..... 7

1.0 INTRODUCTION

This report is an addendum to the *Lynx Blue Line Extension (LYNX BLE) - Noise and Vibration Technical Report*, prepared for the City of Charlotte – Charlotte Area Transit System (CATS). It incorporates the review of the following design changes under consideration; the Charlotte Rail Improvement and Safety Project (CRISP) alignment and the revised University of North Carolina at Charlotte (UNC Charlotte) alignment.

The approximate boundaries of the CRISP alignment noise and vibration area of concern are 30th Street and E. Craighead Road. The alignment would include the shifting of the existing mainline freight tracks in this area (which also include Amtrak train traffic) to the north. In addition, and simultaneously, the location of the proposed LYNX BLE alignment studied in the *LYNX BLE - Noise and Vibration Tech Report* would be shifted to the south. Both elements of this alignment could potentially impact sensitive noise and vibration receptors previously studied. Due specifically to the proposed freight line shift, sensitive noise and vibration receptors not previously studied could also be potentially affected.

The noise and vibration area of concern for the revised UNC Charlotte alignment would include the segment of North Tryon Street/US-29 from Grove Lake Drive to Barton Creek Drive. The revised UNC Charlotte alignment would extend the light rail track further along the North Tryon Street/US-29 median; toward Barton Creek Drive before turning southward to enter the UNC Charlotte campus property. This alignment shift would increase the distance between the UNC Charlotte Bioinformatics Building and the alignment but would also bring the alignment closer to a residential development on the north side of North Tryon Street/US-29. As the alignment turns into the UNC Charlotte campus area, it would also come closer to a veterinary office on the south side of North Tryon Street/US-29.

This report assesses the impacts of these alignments on sensitive noise and vibration properties. The same basic methodology and assumptions described in the *LYNX BLE - Noise and Vibration Technical Report* is used here for noise and vibration impact predictions. The basic background information for noise and vibration fundamentals are also provided in *LYNX BLE - Noise and Vibration Technical Report* and is therefore not repeated here.

2.0 EXISTING CONDITIONS

Noise and vibration-sensitive land use were identified by screening GIS data for buildings with residential or institutional uses nearby the proposed alignment. For rail traffic from an LRT project such as the BLE, the Federal Transit Administration (FTA) - defined noise screening distance for locations with unobstructed views is 350 feet. The screening distance when intervening buildings are present is 175 feet. Vibration screening distances are 450, 150 and 100 feet for vibration category 1, 2 and 3 land uses, respectively. Field observations were made by Harris Miller Miller and Hanson Incorporated (HMMH) and STV incorporated in 2005 and 2008, respectively to identify and confirm sensitive land use locations within the larger study area to ensure that the maximum screening distance of 450 feet for vibration was captured.

Areas where existing receptors could be affected by the two alignments are described below;

CRISP

Along North Davidson Street and East 37th Street, there are four single-family residences approximately 250 to 300 feet from the proposed alignment. In addition, at North Davidson Street and Patterson Street, the Colony has mixed-use commercial (1st floor) and residential (2nd floor). There are four single-family residences on North Davidson Street near Herrin Avenue approximately 110 feet from the proposed alignment and nine single-family residences 150 to 250 feet from the proposed alignment. The Renaissance Apartments have 43 multi-family units located approximately 235 feet from the proposed alignment, near the Craighead Road grade crossing. Finally, there are 11 homes along Benard Avenue located north of the proposed CRISP freight alignment and east of 36th Street which could potentially be affected. With the exception of the homes along Benard Avenue, all of the homes described above were accounted for in the *LYNX BLE - Noise and Vibration Technical Report*.

Revised UNC Charlotte Alignment

On North Tryon Street/US-29 near Grove Lake Road, the Charlotte Research Institute's (CRI) Bioinformatics building is approximately 210 feet away from the proposed alignment as it enters the UNC Charlotte campus property. Also along North Tryon Street/US-29 to the north between Grove Crest Lane and Barton Creek Drive are the Grove at Mallard Lake and the Ashford Green Apartments. Of the two apartment complexes, the Grove at Mallard Lake apartments is closest to the proposed alignment at 105 feet. The Hight Veterinary office would be located 170 feet from the revised UNC Charlotte alignment.

2.1 Existing Conditions of Noise and Vibration Sensitive Receptors

The existing noise conditions recorded at three locations near the CRISP and revised UNC Charlotte alignment are shown in Table 1 and on Figures 6a and 6b in the *LYNX BLE - Noise and Vibration Technical Report*. All values represent monitored values with the exception of noise level at noise site #4.

This level was calculated based on the distance from the existing freight mainline to the receptor and existing freight and Amtrak rail traffic on the mainline corridor. Although there may also be an existing traffic noise component experienced at this receptor, it is assumed that because of the existing 36th Street grade crossing, the horn, grade crossing and rail noise components of the freight and Amtrak trains represent the dominant noise sources in the area. Assumptions used in these calculations were based on existing freight and Amtrak rail travel in the area. They include:

- Fourteen nighttime and ten daytime freight trains per 24-hour period (averaging 125 cars, 3 locomotives)
- Four nighttime and two daytime Amtrak trains per 24-hour period (averaging 8 cars, 1 locomotive)
- Average train speed through the 36th Street rail grade crossing – 50 mph.

Table 1
Noise Monitoring Results ¹

Site#	Monitoring Location Description	Date	Duration	Existing Noise Exposure	
				Ldn	Leq
1 *	The Colony - Mixed-use, 3440 North Davidson Street (1st floor commercial, 2nd floor residential)	10/3/2005	24	69	71
2 *	Ashford Green Apartments ² , 230 Barton Creek Drive	10/3/2005	24	62	61
3 **	Highland Mill Residential Apartments, 2901 North Davidson Street	10/01/08	1	63.1	61.3
4 ***	3312 Benard Avenue	NA	NA	71.3	NA

¹ Only noise monitoring results relevant to this report are included here.

² Previously referred to as Summit Green Apartments in the LYNX BLE - Noise and Vibration Technical Report.

* Source: Harris Miller and Hanson Incorporated, 2005

** Source: STV Incorporated, 2008

*** Represents a calculated existing noise level derived from existing rail traffic.

CRISP

Long-term Site 1 was located along the proposed alignment at 3440 North Davidson Street. The site is a mixed-use building with a commercial first floor and a residential second floor. The microphone was located along the side yard of the building. Traffic noise from North Davidson Street contributed to the noise environment as well as freight train traffic along the Norfolk-Southern rail line grade crossing at both 36th Street and Craighead Road. The 24-hour measured Ldn at this site was 69 dBA. This monitoring location is representative of three single-family residences and several multi-family residential buildings on North Davidson Street between 36th Street and Craighead Road.

Short-term Site 3 was located along the proposed alignment at North Brevard Street. The site contains the Highland Mill multi-family residential complex. The microphone was located along the front edge of the property nearest to the proposed alignment. Traffic noise from the adjacent North Brevard Street was the principal contributor to the noise environment. Utilizing FTA guidelines, an Ldn noise level of 63.1 dBA was calculated for this site by using a monitored 1-hour Leq noise level. The monitoring location is representative of the several private homes along Faison Avenue nearest to the proposed alignment.

Revised UNC Charlotte Alignment

Long-term Site 2 was located along the proposed alignment at the Ashford Green Apartments. The microphone was located in the front yard of the apartments at the bottom of a 20-foot embankment below North Tryon Street/US-29. The noise environment was dominated by traffic noise from North Tryon Street/US-29. The 24-hour measured Ldn at this site was 62 dBA. This monitoring location was representative of several multi-family residences on North Tryon Street/US-29 that are located at the bottom of an embankment.

No existing vibration measurements were taken along any portion of the LYNX BLE project. These measurements will be undertaken during the subsequent detailed assessment phase of the project.

3.0 IMPACT ASSESSMENT

3.1 Noise

The prediction of noise impacts involves a determination of project-related noise levels at identified noise sensitive receptors and then comparing them to applicable FTA noise criteria shown on Figure 5 and in Table 2 of the *LYNX BLE - Noise and Vibration Technical Report*. To assess the proposed project, the impacts of the CRISP alignment were examined using FTA general assessment guidelines. Table 2 and 3 show the resulting impact assessment performed for noise category 1 and 2 land uses. Table 4 shows the resulting impact assessment performed for noise category 3 land uses.

Each of the noise sensitive receptors examined could either be uniquely affected by the proposed project or representative of a cluster of potentially impacted noise sensitive properties. Only receptors which would be affected by the CRISP and revised UNC Charlotte alignments are considered in the assessment. When a receptor would be affected by more than one project-related noise source, the noise levels of the different sources are combined to predict the total noise impact level at that receptor. The tables present the levels of impact as a function of a site's distance from the track and the light rail vehicle speed.

Table 2
Light Rail Alternative – CRISP Alignment
Noise Impact General Assessment (2009) Category 1 & 2 Land Uses

Description	Land Use	Existing Ldn (dBA)	LRT Speed (mph)	Distance to Track (feet)	Impact Thresholds		Project - Related Prediction Ldn (dBA)	Type of Impact
					Impact	Severe		
3440 North Davidson Street (1st floor commercial, 2nd floor residential)	MU	69	35	120	64	69	56.9	None
3312 Benard Avenue ¹	SFR	71.3	35	650	66	70	60.4	None

SFR = Single-family Residential, MFR = Multi-family Residential, MU = Mixed Use, SFU = Single-family Unit, MFU = Multi-family Unit

Source: STV Incorporated, 2009

¹ Includes the contribution from the shifted freight mainline and the shifted LRT

Table 2 indicates that noise impacts would not occur at any of the studied noise receptors. The most critical component of this result would not be the proposed shift in the alignments but would be the proposed grade separations under the Light Rail Alternative at both the 36th Street and E. Craighead Road rail grade crossings. These grade separations would eliminate the requirement for both existing freight and future light rail trains to blow their horns thereby, eliminating the most critical component of rail noise.

Table 3
Light Rail Alternative – Revised UNC Charlotte Alignment
Noise Impact General Assessment (2009) Category 1 & 2 Land Uses

Description	Land Use	Existing Ldn (dBA)	LRT Speed (mph)	Distance to Track (feet)	Impact Thresholds		Project - Related Prediction Ldn (dBA)	Type of Impact
					Impact	Severe		
The Grove at Mallard Lake Apartments, 9401 Grove Hill Drive	MFR	62	40	105	59	64	58.7	None

SFR = Single-family Residential, MFR = Multi-family Residential, MU = Mixed Use, SFU = Single-family Unit, MFU = Multi-family Unit

Source: STV Incorporated, 2009

Although the revised UNC Charlotte alignment would bring the alignment closer to the Grove at Mallard Lake Apartments, the results still indicate that no impacts would occur at the studied noise receptor.

Table 4
Light Rail Alternative – Revised UNC Charlotte Alignment
Noise Impact General Assessment (2009) Category 3 Land Use

Description	Land Use	Existing Ldn (dBA)	LRT Speed (mph)	Distance to Track (feet)	Impact Thresholds		Project - Related Prediction Ldn (dBA)	Type of Impact
					Impact	Severe		
Charlotte Research Institute, Bioinformatics Building	School	65	35	210	66	71	53.1	None

SFR = Single-family Residential, MFR = Multi-family Residential, MU = Mixed Use, SFU = Single-family Unit, MFU = Multi-family Unit

Source: STV Incorporated, 2009

Results indicate no impacts at the CRI Bioinformatics building.

3.2 Vibration

CRISP

As mentioned above in the introduction, the CRISP alignment would include a shifting of the existing freight mainline to the north of its present position. In addition, the light rail alignment studied in the *LYNX BLE - Noise and Vibration Technical Report* would be shifted southward closer to some vibration sensitive residential properties. However, while the shift in the freight mainline would bring the freight alignment closer to several residential properties along Benard Avenue, the 650 foot distance between the shifted alignment and the homes would be well beyond the screening distance of 200 feet described in the *FTA - Transit Noise and Vibration*

Impact Assessment Manual. As a result vibration impacts would not result at properties along Barton Avenue.

Several vibration sensitive residential properties exist south of the proposed CRISP alignment on North Davidson Street. As the CRISP alignment would move the tracks closer to these homes the potential for impacts from vibration was examined. The results of the noise assessment for the representative receptor shown in Table 5 indicate that no impacts would be predicted.

**Table 5
Light Rail Alternative – CRISP Alignment
Vibration Impact General Assessment (2009) Category 2 & 3 Land Uses**

Description	Land Use*	Land Use Category	Average Train Speed (mph)	Distance To Track (feet)	FTA Threshold (VdB)	Predicted Vibration Level (VdB)	Impact?
3440 North Davidson Street (1st floor commercial, 2nd floor residential)	MU	2	35	120	72	64	No

*SFR = Single-family Residential, MFR = Multi-family Residential, MU = Mixed Use, SFU = Single-family Unit, MFU = Multi-family Unit

Source: STV Incorporated, 2009

Revised UNC Charlotte Alignment

The Revised UNC Charlotte alignment would extend the light rail track further along the North Tryon Street/US-29 median; toward Barton Creek Drive before turning southward to enter the UNC Charlotte campus property. The resulting alignment shift would result in a distance of 210 feet between the UNC Charlotte Bioinformatics Building and the alignment. The FTA screening criteria for vibration category 3 properties is 100 feet and therefore, the building sits outside of the impact area. As a result no impacts are expected. With respect to the sensitive vibration category 1 uses within the Bioinformatics Building, the FTA screening distance for vibration category 1 properties is 450 feet. However, given the vibration sensitive equipment contained within this building, a more detailed assessment approach as described in the *LYNX BLE - Noise and Vibration Technical Report* would have to be undertaken during the more advanced stages of project design.

For the Grove at Mallard Lake Apartments at 9401 Grove Hill Drive, the distance to the light rail for the revised alignment would be decreased to 105 feet from 137 feet. The FTA screening distance for vibration category 2 land uses is 150 feet. Therefore, an assessment of potential impacts on the vibration category 2 land uses was conducted. The results, as shown in Table 6, indicate that there would be no vibration impacts at this sensitive residential receptor.

Table 6
Light Rail Alternative - Revised UNC Charlotte Alignment
Vibration Impact General Assessment (2009) Category 2 & 3 Land Uses

Description	Land Use*	Land Use Category	Average Train Speed (mph)	Distance To Track (feet)	FTA Threshold (VdB)	Predicted Vibration Level (VdB)	Impact?
The Grove at Mallard Lake Apartments, 9401 Grove Hill Drive	MFR	2	40	105	72	66	No

* SFR = Single-family residential, MFR = Multi-family residential Source: STV Incorporated, 2009

The revised UNC Charlotte alignment would also bring the light rail track to within 170 feet of the Hight Veterinary Office as it turns southward into the UNC Charlotte campus area. However, this distance is more than the 100' FTA screening distance for vibration category 3 land uses. In addition, the veterinary office would not contain vibration sensitive instrumentation which would trigger an assessment for a category 1 land use. Therefore, no vibration impacts are anticipated to occur at the veterinary office.