18.0 CONSTRUCTION IMPACTS

This chapter summarizes anticipated construction impacts and mitigation measures for the Preferred Alternative. A qualitative analysis has been performed to identify construction impacts in order to determine where preventative measures to minimize the adverse impacts of construction activities might be warranted. Since the No-Build Alternative would not include construction activities, it also would not create any construction-related impacts.

Impacts to the natural and built environments would be anticipated during construction of the Preferred Alternative; however, these impacts would be temporary and intermittent. The use of mitigation techniques and adherence to applicable construction regulations will help reduce the severity of impacts encountered during construction.

18.1 Changes to this Chapter since the Draft EIS

This chapter has been revised to reflect the identification of the Light Rail Alternative as the Preferred Alternative for the LYNX Blue Line Extension Northeast Corridor Light Rail Project (LYNX BLE). Additionally, since the Draft Environmental Impact Statement (EIS), design of the LYNX BLE has been refined as described in Chapter 2.0: Alternatives Considered. These refinements are included in this chapter and reflected in the analysis of potential impacts during construction of the proposed project. This chapter also reflects the results of the detailed noise and vibration analysis.

18.2 Construction

The construction of a major capital improvement project such as the LYNX BLE involves four major steps before revenue service can begin: final design, pre-construction activities, construction and testing. These major steps are described in the following sections.

18.2.1 Final Design

Final design would follow the approval of the 65% Preliminary Engineering Design plans and approval to enter final design. The final design submission would include: sealed Construction Plans; Erosion and Sediment Control Plans; Traffic Control Plans; Traffic Signal Plans; Construction Specifications/Special Provisions; Quantity Summary; and the Cost Estimate.

18.2.2 Pre-Construction Activities

Pre-construction activities, as the name suggests, must occur prior to the beginning of construction activities. These activities typically include: construction contracts development; construction community outreach and education programs; environmental permits and approvals; property acquisition; and vehicle procurement. At the conclusion of the EIS process, pre-construction activities may begin immediately following the execution of a Record of Decision.

18.2.3 Construction Activities

Construction activities include those items required to construct the light rail track, overhead catenary system, signal and safety systems, ancillary facilities, and all proposed construction required for the light rail to be able to physically operate for revenue service.

As described in the *Bid Packaging Strategy* (November 2009) document, in order to procure the services and goods needed to complete the construction of the light rail, the work is divided into separate "bid packages." The Preferred Alternative would be accomplished through the implementation of at least eleven construction contracts. These packages would be assembled and scheduled to expedite construction, combine similar work, accommodate bonding and foster competitive bidding. The bid packages are planned to be assembled into the following categories:

- One or more advanced utility relocations
- Three civil and roadway packages, broken down by segments
- Freight track relocation plans

- Track construction (may be combined with systems contracts)
- Station finishes
- Park-and-ride facilities
- Parking garages
- Vehicle storage yard and dispatch facility
- One or more systems contracts (traction power, overhead catenary system, signals and communication system)
- Fare collection

These packages would be advertised and awarded to the qualified low bidder through the Design-Bid-Build delivery method.

18.2.4 Testing

Following construction, testing of completed light rail components would occur. This involves the required testing of light rail vehicles. Construction would be planned to be sufficiently complete from Center City Charlotte to the planned storage yard to facilitate testing of the light rail vehicles prior to operation. Project wide systems testing would also occur following construction activities. Systems to be tested include: communication systems; fare collection systems; signal systems; traction power substations; and overhead catenary systems.

18.3 Construction Education and Outreach Plan

Construction of the Preferred Alternative would temporarily affect local businesses, residences and traffic operations along the entire alignment. A Community Relations Program is planned to provide general construction scheduling information, coordination of construction work with adjacent business activities and assistance with the resolution of issues that may develop between local residents, motorists, the contractor and the sponsoring agency. The details of the program will be included in a Construction Education and Outreach Plan, to be executed prior to and during construction activities. The program would be implemented by the Charlotte Area Transit System (CATS) and the City of Charlotte.

18.4 Construction Regulations

The North Carolina Division of Water Quality (NCDWQ) regulates groundwater by preventing pollution, managing and restoring degraded groundwater and protecting groundwater resources. To improve water quality, Mecklenburg County enacted a Surface Water Improvement and Management (SWIM) program. Under this program, the County enacted a stream buffer ordinance to protect surface waters. Jurisdictional Waters of the United States are defined by 33 CFR 328.3(b) and are protected by Section 404 of the Clean Water Act (33 U.S.C. 1344), which is administered and enforced in North Carolina by the U.S. Army Corps of Engineers (USCOE), Wilmington District. Construction activities would also require adherence to the federal, state and local agency guidelines.

18.5 Construction Schedule

The overall construction and start-up would take approximately four years. This includes over a year for advanced utility relocations, approximately three years of construction and approximately four months of testing and pre-revenue service activities.

18.6 Construction Methods

The Preferred Alternative would require the construction of basic elements not found in typical roadway projects, such as: stations, park-and-ride facilities, parking garages, vehicle storage yard, track bed, trackwork and catenary poles and wires. A number of methods would be used to construct the proposed alignment of the Preferred Alternative. These methods would vary depending on the geographic conditions and the design. The construction methods include at-grade, retained fill, built-up fill, grade separated and underpass configurations. A description of the proposed alignment for the Preferred Alternative can be found in Chapter 2.0: Alternatives Considered.

18.6.1 At-Grade Configuration

At-grade configuration example.

An at-grade configuration would position the proposed alignment at the same level as the ground surface. The actual construction for the at-grade configurations would take place within the street crossings, as is typically seen in city street construction projects in the surrounding area. The intersections that would include an at-grade configuration under the Preferred Alternative can be found in Chapter 3.0: Transportation. Construction of the at-grade configurations would involve traffic detours and temporary lane closures.

The equipment utilized during construction would be consistent with street construction. Pavement cutting machinery, rubber-tired excavators and all-terrain cranes would be necessary for at-grade construction.

18.6.2 Retained Fill Configuration

Construction of the retained fill portions of the proposed alignment would precede and/or follow construction of grade-separated sections, such as bridges. In a retained fill configuration, the location of the proposed alignment would be elevated above the existing ground on fill material.

Construction of the retained fill configurations would begin with excavation for retaining wall footings, which would typically be performed using excavators or backhoes. Piles may be required depending on soil conditions and design requirements. Piles would be installed using either conventional pile drivers or vibratory pile driving equipment. Mechanically stabilized earth (MSE) walls would subsequently be constructed. An earth embankment would form a part of the structure. Both driven and hand-operated compacting equipment would be necessary for the backfilling operations.

Retained fill configuration example.

18.6.3 Built-Up Fill Configuration

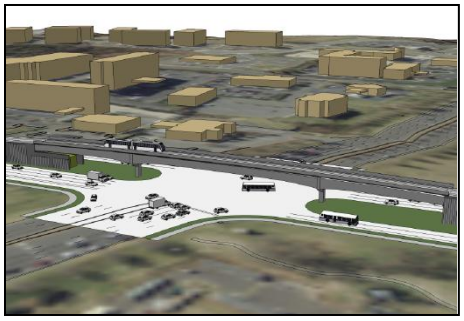
Built-up fill construction would occur where the proposed light rail tracks run on earth embankments that will be constructed on top of the existing ground. The height of the embankments would vary along the proposed alignment. In some instances, the track profile would be raised above the existing ground on built-up fill, then onto retained fill and then onto a grade separated bridge structure.

Construction of the built-up fill would be typical of earthen embankment construction. Construction equipment would include: bulldozers, dump trucks, excavators and graders. Erosion control measures, including silt fences, detention basins and seeding and drainage measures, including ditches, catch basins and underground pipes would generally involve smaller construction equipment.

18.6.4 Grade Separated Configuration

Construction would include grade separations between the proposed alignment and roadways and/or freight tracks. A grade separated configuration would consist of an aerial crossing with a bridge structure that would separate the proposed track operations from the roadway and/or freight track network. The intersections that would include a grade separated configuration under the Preferred Alternative can be found in Chapter 3.0: Transportation.

Actual construction for the grade separated configuration would be typical to new bridge construction projects. Temporary lane and road closures would be utilized to accommodate construction sequencing.



Grade separated configuration example.

When practical, temporary road closures would occur during nighttime hours to minimize traffic disruptions. Temporary roadway widening would be anticipated to accommodate construction operations and maintenance of traffic.

Grade separated configurations would require the construction of foundation systems, which would require excavation by means of track-mounted excavators or backhoes. Additionally, drill rigs and/or pile driving equipment would be used to install various foundation elements. Cranes, track-mounted and/or truck mounted, would subsequently be used to erect superstructure components, such as girders. Additional all-terrain cranes would be utilized when installing other various bridge components.

18.6.5 Underpass Configuration

The underpass configuration would position the proposed alignment below grade entailing excavation of material to form a trench and/or covered passageway. The underpass configuration would be situated just north of Grove Lake Drive, where the proposed alignment would cross under the North Tryon Street/US-29 northbound travel lanes and enter the University of North Carolina at Charlotte (UNC Charlotte) campus.

Underpass configuration example.

Staged construction would be required for this underpass configuration. Temporary shoring would be utilized during the construction operations. Soil nail walls with concrete wall facing and bottom slab and overhead support structures would be constructed for maintaining grade above the proposed alignment.

Construction equipment necessary for both at-grade and grade-separated construction would be used for the construction of the underpass configuration. Additionally, specialty equipment for soil nail wall installation would be required.

18.6.6 Trackwork Installation

Light rail track construction would include the installation of the fixed guideway elements, such as: ballast, ties and rail. These items would be placed in construction staging areas throughout the corridor to minimize haul distances and facilitate construction. The contractor would be responsible for obtaining the construction staging areas.

18.6.7 Parking Facilities

Transit only park-and-ride lots would be constructed at four station locations and construction would utilize grading equipment, asphalt pavers and rollers.

Parking garages would be constructed at the University City Blvd. and JW Clay Blvd. Stations. The University City Blvd. Station parking garage would be designed to accommodate approximately 1,485 parking spaces and would be located north of North Tryon Street/US-29, between I-85 Connector and City Boulevard. Vehicular access would be by way of a new street connection to be built between North Tryon Street/US-29 and Ikea Boulevard. This new street (University City Boulevard Access Road) would intersect North Tryon Street/US-29 just south of the station platform and would be signalized. A pedestrian bridge crossing over southbound North Tryon Street/US-29 would connect the parking garage to the north end of the station platform. The JW Clay Blvd. Station would be designed to accommodate approximately 690 parking spaces. The parking garage would be located in the northwest quadrant of the

North Tryon Street/US-29 and JW Clay Boulevard intersection. Vehicles would access the parking garage from Olmsted Drive, which intersects JW Clay Boulevard. A pedestrian bridge crossing over southbound North Tryon Street/US-29 would connect the parking garage to the north end of the station platform.

Foundation systems for the parking garages would require excavation by means of track-mounted excavators or backhoes. Drill rigs and pile driving equipment would be used to install various foundation elements. Cranes, track-mounted and/or truck-mounted, would subsequently be used to erect parking garage structure components, such as girders. Concrete pumps and vibrators would be utilized when placing concrete for the parking garage structures. Additional all-terrain cranes would be utilized when installing the vehicular and pedestrian bridge components.

18.6.8 Vehicle Storage Yard

The Preferred Alternative proposes construction of a vehicle storage yard to provide space for vehicle storage. The vehicle storage yard would be comprised of: the site, track yard and a small dispatch building. The facility would be located within the existing Norfolk Southern Intermodal Yard located just northeast of Brevard Street and would occupy approximately 18 acres.

Construction of the vehicle storage yard would utilize equipment used in typical highway and building construction. Light rail tracks would also be installed, which would include ballast, ties and rail. The dispatch facility would require foundation construction by means of excavators, backhoes, concrete pumps and vibrators.

18.7 Utilities

The Preferred Alternative would conflict with existing utilities along North Tryon Street/US-29 and where the proposed project within the existing rail corridor could cross roadways. Access to utilities that require constant inspection and maintenance would not be allowed to be located within the clearance envelope of the light rail vehicles and tracks. Those utilities within the proposed right-of-way (ROW) would be the most likely to require relocation.

The utilities affected include: electrical power utilities, primarily overhead electric lines and poles; telecommunication, including telephone and cable (both above and below ground); water and sewer mains; natural gas utilities; and traffic signals and communications.

A substantial amount of the utility adjustments and relocations would occur between Old Concord Road and JW Clay Boulevard, along North Tryon Street/US-29. The Preferred Alternative alignment would be situated in the median and would necessitate the widening of North Tryon Street/US-29. Many utilities run parallel to, and cross, North Tryon Street/US-29, which creates conflicts with the proposed construction. Widening would require that these utilities be relocated to make room for the new typical section. Asymmetrical widening is proposed from Old Concord Road to the “weave,” which will minimize the number of utility relocations required in this segment.

The construction of the underpass configuration where the light rail tracks would descend below the northbound side of North Tryon Street/US-29 would require excavation below existing underground utilities. The change in ground elevations would require relocations of existing underground utilities and aerial utility poles. Staged construction would allow relocations to occur once a portion of the roadway excavation is complete.

Mitigation techniques would include relocation, removal and protection (e.g., pipe casing). Utility conflicts would typically be addressed via in-kind replacement. In certain cases, overhead utilities may be relocated underground. Existing utilities in conflict with the Preferred Alternative would potentially be relocated to “utility corridors” identified by the engineering team. These utility corridors would potentially be located between the back-of-curb and the outside ROW.

Construction equipment typically required for relocating utilities would include excavators/backhoes, trenchers, boring machines, trucks, cranes and generators/compressors. Utility relocations located in existing streets would require the demolition of pavement, sidewalks and curbs where open trench

construction is employed. This work would require breaking operations consistent with sawing, jack hammering or breaking. In order to repair the damaged structures, concrete or asphalt construction methods would be utilized. Jack and bore and tunneling methods would reduce the amount of demolition needed and would typically be employed at sensitive locations, major intersections and perpendicular crossings. The design of utility adjustments and relocations would be developed as part of the final construction plans. Relocations would be addressed in the traffic control plans by the use of lane closures or temporary road closures.

To minimize scheduling conflicts and coordination issues during construction, it is anticipated that numerous utility relocations would occur prior to the start of major construction activities. This advance utility relocation would facilitate the subsequent construction and minimize delays required to resolve utility conflicts.

18.8 Transportation, Traffic and Parking

Construction of the Preferred Alternative and would affect numerous major and minor roadways. Careful planning would be required to reduce disruptions to traffic. The majority of the Preferred Alternative construction would take place in, or immediately adjacent to, the railroad ROW or would occur within the median of North Tryon Street/US-29. Currently, there is no on-street parking along North Tryon Street/US-29 or the side streets. As a result, only private parking lots would be affected by construction activities.

The staging of construction would require astute planning and coordination to minimize the need for traffic detours while maintaining adequate traffic flow. Maintaining business access and safe passage of materials and equipment throughout the construction areas would be priorities for the contractor. Temporary lane and road closures would be required during construction of the Preferred Alternative. CATS and its contractors would coordinate with the traffic control divisions of the Charlotte Department of Transportation (CDOT) and the North Carolina Department of Transportation (NCDOT) to maintain reasonable and safe traffic operations along the corridor.

Construction in or adjacent to railroad ROW would require planning and coordination with North Carolina Railroad (NCRR), Norfolk Southern (NS) and CSX railroads. Track construction staging plans would be developed to maintain freight track operations throughout construction. Construction within the railroad ROW would be subject to the control of railroad flagmen as required by the freight railroads.

18.9 Land Use, Community Facilities and Businesses

A combination of newly acquired ROW, permanent easements and temporary construction easements would be necessary for the construction of the Preferred Alternative. Temporary construction easements would typically be acquired to provide the necessary room to construct the proposed features. The contractor would be required to return these easement areas to the appropriate condition based on the plan specifications and the existing conditions. The contractor would be responsible for negotiating the rights to, or purchasing, staging areas needed for construction. The contractor would be responsible for returning these sites to the appropriate conditions, as agreed upon with the individual property owners. CATS may choose to make land that is purchased for the construction of the project available to the contractor for staging areas. The conditions for the use of these areas would be addressed in the specifications. However, CATS would not purchase property for the sole purpose of providing staging areas.

Construction of the Preferred Alternative would cause temporary impacts to community facilities (i.e. police station, fire station, school) due to access restrictions and temporary blocking of adjoining roadway intersections. The availability of alternative routes, in addition to the temporary duration of construction periods, would minimize the disruptions to the community facilities. Furthermore, alternative routes would ensure that access to the community facilities is maintained throughout all phases of construction.

Local businesses would be affected by the construction of the Preferred Alternative due to access restrictions, loss of parking and landscape, business signage removal, traffic congestion, noise, dust and aesthetic disruptions. CATS would be responsible for providing local business owners with notification of

traffic interruptions and descriptions of alternative routes. Furthermore, attempts would be made to minimize the duration of parking disruptions.

18.10 Displacements and Relocation of Existing Uses

Property acquisitions would be required for the Preferred Alternative. However, no additional displacements or relocations are anticipated due to construction activities outside the planned ROW. The contractor would be responsible for identifying potential staging areas and negotiating mutually agreeable terms with individual property owners in order to secure permission to utilize them. Property owners would be compensated; therefore, mitigation would not be required. A detailed list of the partial property acquisitions and displacements, along with the necessary temporary construction easements, can be found in Appendix C.

18.11 Visual and Aesthetic Qualities

The construction activities related to the Preferred Alternative would be highly visible but would only temporarily affect the visual environment, with the exception of trees that must be removed to accommodate construction activities. Temporary visual impacts would include the presence and movement of construction machinery, equipment, building materials, temporary roads and access ways, construction cranes, temporary construction fences and screens. Furthermore, staging areas would be dispersed along the alignment and would require temporary access for the storage of equipment and materials. Nighttime construction may occur, subject to local regulations. Lights used for nighttime construction could affect residents within one or two blocks of the construction or staging areas. Impacts from lights used during nighttime operations would be minimized by aiming construction lights directly at the work area and/or shielding the lights to avoid disturbing nearby residences. Additional access and clearing would potentially be required at bridge construction sites. These and any other areas requiring temporary access would be restored in accordance with the appropriate construction contract special provisions. Construction of the Preferred Alternative would also affect existing landscaping. Where existing vegetation serving to buffer adjacent properties is altered or removed, vegetation or other screening would be restored as outlined in the *LYNX BLE Design Criteria*, Ch. 3, Urban Design Framework.

18.12 Neighborhoods, Community Services and Environmental Justice

Construction of the Preferred Alternative is not anticipated to significantly impact communities within the proposed project corridor. Despite the close proximity of the Howie Acres community to Sugar Creek Road, construction of the Preferred Alternative in this area would not isolate the community, as access would be maintained throughout all phases of construction. Similarly, lengthening of the bridge on Eastway Drive would not isolate the Hampshire Hills neighborhood. Access to this neighborhood would be maintained during all phases of construction. There is a potential impact to the neighborhood related to traffic from construction vehicles and equipment to access the railroad ROW. To avoid this impact, CATS would include provisions that restrict contractors from accessing the worksite through the Hampshire Hills neighborhood. Access would occur along the ROW. Furthermore, CATS and its contractors would continuously coordinate with community service providers (i.e. police, fire and ambulance service) to ensure emergency vehicles have access to all areas.

18.13 Air Quality

Construction activities for the Preferred Alternative could result in increases in localized air quality emissions. Potential air quality impacts would be related to increases in fugitive dust, particulates ($PM_{2.5}$, PM_{10}) and gaseous pollutant emissions (CO, VOCs, and NO_x) from mobile and stationary construction related equipment. Pollutant emissions would be generated from the following construction activities:

- Excavation related to cut-and-cover construction;
- Mobile emissions from construction workers' private vehicles as they travel to and from the construction site;
- Mobile emissions from trucks delivering and hauling construction supplies and debris to and from the construction site;

- Stationary emissions from on-site construction equipment; and
- Mobile emissions from diverted vehicles due to road closures and vehicles whose speeds are slowed because of increased congestion caused by construction activity.

Any increase in construction related pollutant emissions from the Preferred Alternative would be temporary in nature with exposure to construction related dust lasting only the duration of construction. Staged construction would proceed in a linear fashion with site excavation, bed preparation and track installation beginning at one or more locations along the proposed alignment. As such, although the overall construction would last approximately three years, the period of time for which specific locations would be exposed to increased emissions would be far less. Air quality impacts would be minimized by adherence to the following recommended construction control measures:

- Shutting off construction equipment not in direct use;
- Watering areas of exposed soil;
- Covering open body trucks transporting materials to and from construction sites;
- Rerouting truck traffic away from schools and residential communities when possible;
- Repaving and/or replanting exposed areas as soon as possible following construction;
- Employing adequately secured tarps, plastic or other material to further reduce dust emissions from debris piles; and
- Prohibiting delivery trucks or other equipment from idling during periods of extended unloading or inactivity.

18.14 Noise and Vibration

18.14.1 Noise

Noise during construction would be an inconvenience to nearby residents and some businesses. The most common noise source in construction areas would be from engine powered machinery, such as bulldozers, cranes and generators. Mobile equipment would operate in a sporadic manner, while stationary equipment would generate noise at fairly constant levels. The loudest and most disruptive construction activities would be associated with pile driving, which would occur in areas where bridges would be constructed. Building demolition incorporates several types of construction related machinery, which could also produce significant potential community disruption. Chapter 13.0: Noise and Vibration provides some typical construction equipment noise emission levels.

A detailed noise and vibration impact assessment was completed as part of this Final EIS and included an assessment of potential construction noise impacts. It was determined that construction noise would occur at 19 residential properties, nine hotels or motels, 12 commercial properties and five industrial properties. Seven of these properties are listed as historic resources. Although construction noise is highly-dependent on the specific construction methods used by the contractor, the following information provides a worst-case analysis of the potential for impact prior to mitigation. Depending on the land use category (i.e. residential, commercial or industrial) and time of day, potential impact from construction noise may occur within 197 feet for at-grade track, station and parking lot construction, within 280 feet for road construction and within 331 feet for construction involving pile driving such as that for elevated guideways retaining walls, bridges, underpasses and parking garages. A summary of the aforementioned sensitive receptors within potential construction noise impact is included in Table 18-1.

Table 18-1
Summary of Potential Construction Noise Impact Prior to Mitigation

Receptor Number	Receptor Location	Land Use Type	Receptor Number	Receptor Location	Land Use Type
1	301 East 7th Street	Commercial	24	325 Prince Charles Street	Residential
2	301 East 8th Street	Commercial	25	321 Prince Charles Street	Residential

Table 18-1 (continued)
Summary of Potential Construction Noise Impact Prior to Mitigation

3	301 East 9th Street	Commercial	26	317 Prince Charles Street	Residential
4	311 East 12th Street	Residential	27	5500 North Tryon Street/US-29	Commercial
5	430 East 36th Street	Industrial	28	5636 North Tryon Street/US-29	Commercial
6	407 East 36th Street	Industrial	29	5655 North Tryon Street/US-29	Commercial
7	3327 North Davidson Street	Industrial	30	5703 North Tryon Street/US-29	Commercial
8	501 Patterson Street	Residential	31	5732 North Tryon Street/US-29	Commercial
9	3440 North Davidson Street	Residential	32	5901 North Tryon Street/US-29	Residential
10	500 Herrin Avenue	Residential	33	5911 North Tryon Street/US-29	Hotel/Motel
11	3510 North Davidson Street	Residential	34	6001 North Tryon Street/US-29	Hotel/Motel
12	3528 North Davidson Street	Residential	35	6426 North Tryon Street/US-29	Hotel/Motel
13	601 East Sugar Creek Road	Industrial	36	110 West Rocky River Road	Hotel/Motel
14	4300 Raleigh Street	Industrial	37	7706 North Tryon Street/US-29	Hotel/Motel
15	352 Leafmore Drive	Residential	38	8001 North Tryon Street/US-29	Commercial
16	358 Leafmore Drive	Residential	39	132 East McCullough Drive	Hotel/Motel
17	364 Leafmore Drive	Residential	40	8404 North Tryon Street/US-29	Commercial
18	331 Barrymore Drive	Residential	41	8419 North Tryon Street/US-29	Hotel/Motel
19	332 St. Anne Place	Residential	42	8503 North Tryon Street/US-29	Hotel/Motel
20	341 Prince Charles Street	Residential	43	8517 North Tryon Street/US-29	Hotel/Motel
21	337 Prince Charles Street	Residential	44	8926 J.M.Keynes Drive	Commercial
22	333 Prince Charles Street	Residential	45	9321 JW Clay Boulevard	Commercial
23	329 Prince Charles Street	Residential			

South of 30th Street, construction noise would be similar to that produced by typical highway/bridge and city street construction projects. This section would include one bridge structure over the CSX tracks, two bridges over Little Sugar Creek and the vehicle storage yard. Pile foundations for the bridge structures would typically be used, which would require the use of pile hammers. Although this section would include pile driving, any potential elevated noise levels would be relatively short in duration. The other major construction operations in this area would be grading and track construction. However, as these would be done in a linear fashion, any potential elevated noise levels would be temporary.

In the area between 30th Street and the proposed Old Concord Road Station, construction noise levels would be typical of those experienced during highway construction projects. Construction of several bridges and park-and-ride facilities would be anticipated in this section. A combination of pile and/or drilled shaft foundations would most likely support the bridges. The other major construction operations in this section would be grading and track construction.

North of the Old Concord Road Station to the entrance into the North Tryon Street/US-29 median, potential construction noise would be typical of highway and bridge construction projects. As with other project sections, construction operations in this area would include pile driving activities. For example, the Preferred Alternative proposes a bridge over Old Concord Road; construction of this bridge would include noise from the pile driving operations, which would generate temporary impacts.

Construction activities within the median of North Tryon Street/US-29 could potentially result in elevated noise levels. Activities in this area would generally include the widening of North Tryon Street/US-29 to accommodate the median width required for the proposed light rail alignment. Widening operations would include demolition, utility relocations, grading, retaining wall construction, paving and signalization. Construction of the proposed light rail would begin once roadway widening is sufficiently complete to allow traffic shifts. This would include grading, drainage, utility relocations, retaining wall, bridge and track construction.

Potential construction noise would also result from the activities associated with the development of the parking garages at University City Blvd. Station and the JW Clay Blvd. Station. Potential noise from construction of these multi-level garages would be typical of new building projects. Construction of the University City Blvd. Station would require clearing and grading of the undeveloped site. Construction of the JW Clay Blvd. Station would require the demolition of an existing building and a potential noise impact would occur at a commercial business on JW Clay Boulevard.

A significant portion of the construction on the UNC Charlotte campus would be on a greenfield site removed from residents and businesses. Construction in this section would include the underpass construction, grading, drainage and track construction. The other major elements in this section would be the construction of one station and one bridge. The station construction would be closer to the business/residential locations than the bridge construction. The bridge in this area would most likely require pile driving or drilled shaft operations. The underpass construction would require major excavation.

18.14.2 Vibration

Vibration would result from the use of construction equipment, such as pile hammers, jack hammers and hoe rams. The movement of heavy equipment, such as large vibratory compaction equipment, dump trucks and bulldozers, would also contribute to vibration. The nature of this type of vibration is temporary and intermittent. Generally speaking, sensitive receivers for highway and light rail construction would not experience vibration unless they are in close proximity to the construction operations. The primary concern for vibration from construction activities is potential structural damage to buildings. As part of the detailed noise and vibration impact assessment completed for this Final EIS, potential vibration impact from construction activities has been assessed at all properties in close proximity to construction activities associated with the LYNX BLE. In addition, potential short-term impact to vibration sensitive equipment has been assessed. The sensitivity of a structure to potential damage depends primarily on the building's construction (i.e. reinforced concrete or non-engineered timber) The following are the range of distances that potential structural damage may occur from construction equipment for the range of different building construction types.

- Potential structural damage may occur within seven to 18 feet of buildings from large bulldozers, dump trucks, concrete mixers and hoe rams.
- Potential structural damage may occur within one to two feet of buildings from small bulldozers.
- Potential structural damage may occur within eight to 20 feet of buildings from auger drilling.
- Potential structural damage may occur within 14 to 34 feet of buildings from vibratory roller compaction.
- Potential structural damage may occur within 29 to 73 feet from impact pile driving and within 13 to 31 feet from sonic pile driving.

Table 18-2 presents the locations that certain construction equipment may potentially cause structural damage prior to mitigation. Table 18-3 presents the locations that certain construction equipment may potentially impact vibration-sensitive equipment at UNC Charlotte - Charlotte Research Institute (CRI).

Table 18-2
Summary of Potential for Structural Damage from Construction Vibration

Receptor Location	Property	Building Construction	Construction Equipment
301 East 7th Street	Philip Carey Company Warehouse (Historic Property)	Engineered Masonry	Vibratory Roller
301 East 9th Street	Commercial Building (Multiple Occupants)	Engineered Masonry	Large Bulldozer, Auger Drilling, Vibratory Roller, Impact Pile Driver, Sonic Pile Driver
430 East 36th Street	Grinnell Manufacturing Company (Historic Property)	Engineered Masonry	Large Bulldozer, Auger Drilling, Vibratory Roller, Impact Pile Driver, Sonic Pile Driver
300 East 36th Street	Parish and Leonard Tire Company	Engineered Masonry	Vibratory Roller, Impact Pile Driver, Sonic Pile Driver
315 East 36th Street	Herrin Brothers Coal & Ice Company Complex (Historic Property)	Engineered Masonry and Metal	Vibratory Roller, Impact Pile Driver, Sonic Pile Driver
407 East 36th Street	Johnston Mill (Historic Property)	Engineered Masonry and Timber	Vibratory Roller, Impact Pile Driver, Sonic Pile Driver
3327 North Davidson Street	Mecklenburg Mill (Historic Property)	Engineered Masonry	Impact Pile Driver
601 East Sugar Creek Road	Republic Steel Corporation Plant (Historic Property)	Engineered Masonry	Vibratory Roller, Impact Pile Driver, Sonic Pile Driver
4300 Raleigh Street	State Industries	Engineered Masonry	Impact Pile Driver
332 St. Anne Place	Single-family Residence	Timber	Impact Pile Driver

Table 18-3
Summary of Potential Impact to Sensitive Equipment from Construction Vibration

Receptor Location	Construction Equipment
UNC Charlotte Bioinformatics	Impact Pile Driver
UNC Charlotte Duke Centennial Hall	Impact Pile Driver, Sonic Pile Driver
UNC Charlotte Grigg Hall	Impact Pile Driver, Sonic Pile Driver
UNC Charlotte EPIC Building	Impact Pile Driver

Potential impact at 301 East 7th Street (Philip Carey Company Warehouse) is due to its proximity (14 feet) to at-grade track and ballast curb construction. At a distance of 14 feet from the proposed ballast curb, a vibratory roller (102 VdB) could generate vibration in excess of the criterion of 98 VdB.

Potential impact at 301 East 9th Street (a commercial building with multiple occupants) is due to its proximity to a proposed retaining wall (five feet) and the proposed 9th Street Station (16 feet). At five feet, a large bulldozer or backhoe (107 VdB), vibratory roller (115 VdB), impact (125 VdB) or sonic (114 VdB) sheet piling and auger drilling (108 VdB) could generate vibration in excess of the criterion of 98 VdB. For construction of the station, a vibratory roller could generate vibration of 100 VdB which is in excess of the criterion.

There is the potential for significant construction vibration impact for several structures at 36th Street in close proximity to proposed retaining walls on 36th Street for the grade separation construction and proposed retaining walls along the NCRR ROW. Potential impact at 430 East 36th Street Grinnell Manufacturing Company (currently Newco Fiber Company) is due to its proximity (five feet) to a proposed retaining wall on 36th Street. At five feet, a large bulldozer or backhoe (107 VdB), vibratory roller (115 VdB), impact (125 VdB) or sonic (114 VdB) sheet piling and auger drilling (108 VdB) could generate vibration in excess of the criterion of 98 VdB.

At 300 East 36th Street (Parish and Leonard Tire Company), there is the potential for construction vibration impact due to its proximity to a proposed retaining wall on the NCRR ROW (16 feet) and a proposed retaining wall on 36th Street (35 feet). For construction of the retaining wall on the NCRR ROW, a vibratory roller (100 VdB) and either impact (110 VdB) or sonic (99 VdB) impact sheet piling could generate vibration in excess of the criterion of 98 VdB. For construction of the retaining wall on 36th Street, impact (100 VdB) sheet piling could generate vibration in excess of the criterion.

At 315 East 36th Street (Herrin Brothers Coal and Ice), there are several structures in close proximity to proposed construction activities including a historic masonry building, metal shed, metal parking garage and steel supported pressure vessels. Construction in this area includes a proposed retaining wall on the NCRR ROW (10 feet from the steel-supported pressure vessels), a retaining wall on 36th Street (15 feet from several structures including the masonry building) and typical at-grade track construction (25 feet from the steel-supported pressure vessels). For construction of the NCRR ROW retaining wall, a vibratory roller (105 VdB) and either impact (116 VdB) or sonic (105 VdB) sheet piling could generate vibration in excess of the criterion for the metal structure (102 VdB). For construction of the 36th Street retaining wall, a vibratory roller (101 VdB) and either impact (111 VdB) or sonic (100 VdB) sheet piling could generate vibration in excess of the criterion for the masonry building (98 VdB). No construction vibration impact is projected for at-grade track construction or for auger drilling.

Potential construction vibration impact at 407 East 36th Street (Johnston Mill) is due to the proximity of two structures to a proposed retraining wall on the NCRR ROW (10 feet) and a proposed retaining wall on 36th Street (30 feet). For construction of the NCRR ROW retaining wall, a vibratory roller (105 VdB) and either impact (116 VdB) or sonic (105 VdB) sheet piling could generate vibration in excess of the criterion for the timber structure (102 VdB). For construction of the 36th Street retaining wall, impact sheet piling (102 VdB) could generate vibration in excess of the criterion for the masonry structure (98 VdB). No construction vibration impact is projected for at-grade track construction or for auger drilling.

At 3327 North Davidson Street (Mecklenburg Mill), there is the potential for construction vibration impact from a proposed retaining wall along the NCRR ROW (25 feet). Impact sheet piling (104 VdB) could generate vibration in excess of the criterion of 98 VdB.

At 601 East Sugar Creek Road (Republic Steel Corporation), construction activities include at-grade track (20 feet from the building) and a proposed retaining wall (12 feet from the building). No construction vibration impact is projected for at-grade track construction. For construction of the retaining wall, a vibratory roller (104 VdB) and either impact (114 VdB) or sonic (103 VdB) sheet piling could generate vibration in excess of the criterion (98 VdB).

At 4300 Raleigh Street (State Industries), there is the potential for construction vibration impact from a proposed retaining wall (30 feet from the building). Impact sheet piling (102 VdB) could generate vibration in excess of the criterion of 102 VdB.

At 332 St. Anne Place (a single-family residence), there is the potential for construction vibration impact from a proposed retaining wall (18 feet from the building). Impact sheet piling (108 VdB) could generate vibration in excess of the criterion of 102 VdB.

Construction vibration impact is not projected at any other historic buildings including 301 East 8th Street (McNeil Paper Company), 5500 North Tryon Street (General Motors Training Company, currently Crossroads Charter High School), 311 East 12th Street (Orient Manufacturing Company, currently Alpha Mill Apartments), 451 Jordan Place (Chadbourn Hosiery Mills) and 600 East Sugar Creek Road (Standard Chemical Products Plant).

The potential for short-term construction vibration impact to sensitive equipment has been assessed at UNC Charlotte Bioinformatics (construction 200 feet from building), Duke Centennial Hall (construction 500 feet from building), Grigg Hall (construction 550 feet from building) and EPIC buildings (construction 1250 feet from building). Based on the outdoor-to-indoor building coupling measurements, 10 VdB of attenuation has been assumed for vibration entering the buildings and propagating to sensitive equipment. Potential impact has been assessed by comparing the overall RMS vibration level of

construction activities to the applicable VC criteria. Since the VC criteria are 1/3-octave band criteria, comparing overall construction vibration levels to these criteria is a conservative approach.

At-grade track, retaining wall and underpass construction is proposed near UNC Charlotte. In the Bioinformatics building, vibration from impact pile driving (67 VdB) for retaining wall and underpass construction could be in excess of the VC-B impact criterion for the DNA microarray. At Duke Centennial Hall, a vibratory roller (45 VdB) and either impact (55 VdB) or sonic (44 VdB) sheet piling could generate vibration in excess of the VC-E (42 VdB) criterion. At Grigg Hall, a vibratory roller (44 VdB) and either impact (54 VdB) or sonic (43 VdB) sheet piling could generate vibration in excess of the VC-E criterion. At the EPIC building, impact pile driving (43 VdB) could potentially generate vibration in excess of the VC-E criterion.

18.15 Natural Resources

Impacts to wildlife would result from both temporary impacts from construction and long term impacts from the elimination and/or fragmentation of forested habitat. Construction noise and construction staging may temporarily displace some wildlife species. The majority of the wildlife species common to the corridor are typical of urban and/or disturbed environments and would adapt and recover quickly. It is expected that most wildlife capable of relocating would temporarily relocate to other existing habitat near the proposed project corridor until construction has completed and vegetation along the construction limits has been re-established. The loss of terrestrial forested habitat and fragmentation of forested habitat may result in the displacement and/or loss of some wildlife species.

18.16 Water Resources

Excavation, grading and other construction activities would require adjustments and modifications to existing stormwater infrastructure. These construction activities could increase sediment levels in stormwater runoff. Staged construction of the proposed stormwater system would reduce disruptions to existing flow characteristics; however, the increased sediment load has the potential to enter nearby waterways without proper Best Management Practice (BMP) measures. The BMP measures would comply with federal, state and local guidelines on sediment discharge thresholds, particularly the City of Charlotte Post-Construction Controls Ordinance (PCCO). A detailed analysis of the sediment load anticipated to be generated by the proposed project, in addition to the BMP measures that would be employed, would be outlined in the Erosion and Sediment Control Plans developed during final design. The various water systems that would be subject to construction-related impacts are outlined in the subsequent sections.

18.16.1 Floodplains

The Federal Emergency Management Administration (FEMA) develops and updates floodway boundaries for Mecklenburg County. Construction of the Preferred Alternative would take place in two floodplains: Little Sugar Creek and Toby Creek. FEMA has mandated that projects can cause no rise in the regulatory floodway, and a one-foot cumulative rise for all projects in the base (100-year) floodplain. Mitigation of the impacts related to construction of the Preferred Alternative would be conducted in accordance with federal, state and local agency regulations.

Construction equipment would encroach upon the Little Sugar Creek Floodplain during construction of the bridge crossing adjacent to North Brevard Street, a portion of the proposed access drive to the Duke Energy substation and a portion of the proposed freight alignment behind the Cullman Avenue industrial facilities. The bridge crossing of Little Sugar Creek adjacent to North Brevard Street would require the construction of two bridge end bents and two center bents. The two end bents would not impact regulatory floodways. The two center bents would be composed of two columns each, each column with a drilled shaft, for a total of four drilled shafts within the mapped Community Floodplain and Community Encroachment Area. The proposed alignment behind the Cullman Avenue industrial facilities (including the 36th Street Station) would encroach upon a portion of the Community Floodplain of Little Sugar Creek for construction of fill embankments and retaining walls.

Toby Creek has a wide Community Floodplain Area northwest of the proposed UNC Charlotte Station. The proposed bridge crossing of Toby Creek would require the construction of approach fill embankments, two bridge end bents and ten interior bents. Each of the ten interior bents would be supported by two columns, each column with a 4.5 diameter drilled shaft. This would result in five interior bents (ten drilled shafts) within the FEMA floodway, two interior bents (four drilled shafts) within the Community Encroachment Area and three interior bents (six drilled shafts) within the Community Floodplain. One proposed end bent with riprap is located partially within the FEMA Floodway, the Community Encroachment Area and Community Floodplain. One proposed end bent with riprap is located partially within the Community Floodplain.

18.16.2 Groundwater

Ten privately-owned groundwater wells and one public groundwater well are located within the study area. There is also a well located on the UNC Charlotte campus. Groundwater could potentially be affected by excavation near the wells. Two project components that would require excavation include the depression of 36th Street beneath the light rail and freight tracks and carrying of the light rail below North Tryon Street/US-29 onto the UNC Charlotte campus. There are no wells within the vicinity of the proposed project at 36th Street; therefore, no groundwater impacts by well intrusion would be anticipated as a result of excavation. Geotechnical soil borings indicated that the proposed 36th Street underpass area would come nearest to intercepting the groundwater table in the development areas to be cut. The shallowest depth to groundwater at the proposed 36th Street underpass would be approximately five feet from the surface. Therefore, it has been determined that groundwater will not be encountered during the proposed development activities. The well located on the UNC Charlotte campus within the proposed project alignment is no longer in use. CATS and/or UNC Charlotte will complete the abandonment/closure process per North Carolina Department of Environment and Natural Resources (NCDENR) requirements prior to construction of the project. It is anticipated that the well will be filled and sealed and the outer well casing will be grouted to a minimum depth of 20 feet or removed, per state regulations. The next closest public water supply well to the project corridor is more than 1,500 feet away. As such, no other groundwater impacts would be anticipated. Additionally, each station location and park-and-ride facility would implement best management practice (BMP) measures for the collection and treatment of stormwater runoff.

18.16.3 Surface Waters

Federal, state and local governments monitor and enforce water quality standards. Construction could result in the generation of temporary impacts to surface water quality and sediment runoff. Construction activities within the floodplains could potentially increase sediment loads to perennial streams if proper erosion control methods are not consistently employed. The named perennial streams in the project vicinity include: Little Sugar Creek and Toby Creek. Other unnamed perennial streams also exist and include: Streams C, J, K and A, as described in Chapter 11:0 Water Resources. Minor impacts to streams that could result from construction include the degradation of water quality as a result of changes to the existing landscape. Development of the light rail stations and park-and-ride facilities could also result in changes to existing runoff patterns, which may generate soil erosion during construction. Water quality and runoff issues would be addressed for the Preferred Alternative through the development of a comprehensive Erosion and Sediment Control plan developed during final design. Also, the proposed storm water design would accommodate the changes in the runoff.

18.16.4 Wetlands

Permanent impacts to wetlands would occur under the proposed Preferred Alternative due to fill slope encroachment, bridges, foundation elements and retaining walls. These long term impacts are discussed in Chapter 11.0: Water Resources. Heavy construction equipment such as dozers, track-mounted excavators and truck hauling equipment would be utilized during fill operations. Construction activities that may impact wetlands include increased stormwater runoff and increased sedimentation in wetland areas. The temporary effect on wetlands as a result of construction activities would be reduced by minimizing work inside wetlands to the extent feasible and as required by permits. Careful planning and coordination would reduce any unnecessary encroachment into wetlands. As previously noted, water

quality and runoff issues would be addressed for the Preferred Alternative through the development of a comprehensive Erosion and Sediment Control plan developed during final design. Proposed storm water design would accommodate the changes in the runoff as well.

18.16.5 Jurisdictional Streams

Permanent impacts to jurisdictional streams would occur under the proposed Preferred Alternative due to fill slope encroachment, bridges, foundation elements and retaining walls. These long term impacts are discussed in Chapter 11.0: Water Resources. Heavy construction equipment such as dozers, track-mounted excavators and truck hauling equipment would be utilized during fill operations and extensions of existing drainage pipes. Construction activities have the potential to increase stormwater runoff and sedimentation entering jurisdictional streams. These temporary effects on jurisdictional streams resulting from construction activities would be reduced by minimizing work inside jurisdictional streams to the extent feasible and by utilizing proper erosion and sedimentation controls and other measures as required by permits.

18.17 Cultural, Historical and Archaeological Resources

Constructing the Preferred Alternative would have the potential to create impacts to cultural, historical and archaeological resources. Construction impacts to these resources would generally result from activities that directly disturb a resource or produce a secondary detrimental effect to the value of the resource. Direct disturbance of a resource would consist of discovering archaeological artifacts during construction, such as excavation or grading operations. The disturbance of archaeological artifacts would be controlled by the construction contract special provisions, which will require the contractor implement a Late Discovery Archaeological Recovery Plan. Direct disturbance is not anticipated but has the potential to occur due to the proximity of historic buildings. Secondary effects also are not anticipated but could occur as a result of negligent construction practices. They could potentially include the discharge of dust, failure to restore surrounding construction areas to preconstruction conditions or poorly implemented aesthetic features.

There are several resources adjacent to the proposed light rail alignment where construction impacts would potentially occur. As noted in Section 18.4.1, a total of seven historic resources would experience potential construction noise impacts. The noise impacts are expected to be temporary and have no effect on the historic qualities of the properties. As described in Section 18.4.2, six historic resources would experience potential construction vibration impacts. Vibration caused by construction activities has the potential to cause structural damage to historic buildings. Mitigation measures would be used to avoid impacts to historic buildings. Contractors will prepare a Construction Noise and Vibration Control Plan, and conduct vibration monitoring during construction. In addition, contractors would be instructed to avoid adjacent historic sites through construction fencing or some other clearly understood construction/staging technique. As requested during consultation, CATS will send the proposed pile/panel walls along the edges of the Herrin Brothers Coal and Ice site to the State Historic Preservation Office for review during Final Design.

18.18 Parklands

Construction of the Preferred Alternative would have moderate impacts to parklands. Impacts to the existing Toby Creek Greenway would be due to the construction of overhead bridges crossing the greenway. Impacts to this area would include temporary trail closures during certain construction activities. Access to the trails would generally be maintained during most construction activities and the temporary closures would be minimized to the extent practical.

18.19 Energy

Approximately 30 percent, or 1,210 Billion BTUs, of the total estimated demand for indirect infrastructure energy (excluding vehicles) is estimated to be consumed locally during construction, including transporting materials and operating construction equipment (Caltrans, *Energy and Transportation Systems*, 1983). This additional energy expenditure would comprise a small fraction of the total regional

energy consumed annually for transportation and would not impact regional energy sources or fuel availability.

18.20 Hazardous and Contaminated Materials

Hazardous and contaminated material impacts during construction would typically result from the removal and transportation of material on the site or the discovery of previously unidentified materials during construction. Both of these situations would be addressed by contract requirements consistent with federal, state or local law or agency regulations.

Materials necessary for construction that would be transported to the site would typically consist of native or manufactured materials. Manufactured materials would typically include concrete, metal components, reinforcing steel, fencing or similar elements that would not contain hazardous or contaminated materials. Native materials incorporated into the construction would typically consist of borrow material or select material for use in embankments and MSE retaining wall type applications. As a precautionary measure, the contractor would be required to submit the sources and the appropriate testing for approval, which would prevent hazardous or contaminated materials from being incorporated into construction operations.

Based on preliminary site investigations, several locations may contain contaminated and/or hazardous materials requiring removal and/or remediation as noted in Chapter 15.0: Hazardous and Contaminated Materials. For these operations, the contractor would be required to properly remove, contain and transport the materials in accordance with all applicable regulations. Additionally, the contractor would be required to clean its vehicles to prevent off-site contamination. This would be applicable to several sites and for equipment involved in the removal of the existing railroad ballast, which is potentially contaminated with arsenic.

There is a possibility that arsenic contaminated soil may be encountered during construction within the former freight track corridor. Any arsenic contaminated soil would be disposed of as special waste consistent with methods employed during the construction of the Charlotte Trolley and LYNX Blue Line rail projects. These same requirements would be included in the construction contract special provisions. Proper handling of arsenic contaminated soil would minimize potential impacts.

Construction operations that could potentially discharge hazardous or contaminated materials would require on-site remediation so that contamination would not occur. These construction operations would include the demolition of existing buildings that may contain materials such as lead or asbestos and the painting of the existing steel girders, such as in the Eastway Drive Bridge modifications. The contractor would be responsible for removal, remediation and disposal of any contaminated materials encountered during construction activities.

Accidental spills from equipment would be another source of potentially hazardous or contaminated materials during construction. These types of spills typically occur as a result of mechanical failure of the equipment or during maintenance or repair of the equipment. The contractor would be responsible for removal, remediation and disposal of any accidental spills during construction.

The excavation of previously unidentified hazardous or contaminated materials during construction would be another potential source of impacts. Procedures for safely handling this potential circumstance would be included in the contract specifications, which would require conformance to all appropriate safety and environmental controls including the containment and remediation of any potential contaminated materials. The environmental investigations would minimize the potential for encountering previously unknown contaminated materials, but this risk would not be eliminated completely since portions of the Preferred Alternative would be located in older industrial areas where complete information is either unknown or unavailable.

18.21 Safety and Security

The Preferred Alternative would be constructed according to generally accepted principles of safety and security. As a result, adverse safety and security impacts are not anticipated during construction. Pedestrian and bicyclist safety in the vicinity of construction activities would be provided through the use

of temporary construction fencing and barricades around construction sites. Access to the construction sites would be controlled. The maintenance of traffic plan, developed during final design, would address motorist safety through the construction work zones. Furthermore, police, fire and ambulance services would have continuous access to all areas.

To eliminate potential health concerns, an investigation would be undertaken prior to the commencement of construction by the contractor of each location where potential concerns have been identified. The investigation would include the development of a health and safety plan to be implemented during construction to minimize the potential exposure of workers to contaminants and hazards. In addition, all on-site personnel would be required to follow all applicable local, state and OSHA construction codes and regulations. Any contaminated materials encountered during construction would be handled and disposed of in accordance with all applicable federal, state and local regulations and in compliance with the site-specific health and safety plan.

18.22 Mitigation

Construction of the Preferred Alternative could generate a variety of impacts to the existing environment and surrounding features. These potential impacts would be neither permanent nor severe. A summary of the mitigation techniques that will be applied is listed in Table 18-4.

Table 18-4
Summary of Mitigation Techniques During Construction

Impact Type	Mitigation
Utility	1. Coordinate with utility owners to ensure maintenance of utility services and timely relocation. 2. Relocate, remove and protect existing utilities.
Transportation, Traffic and Parking	1. Schedule construction activities that require lane or road closures during off-peak hours, where practical. 2. Develop Maintenance of Traffic Plan. 3. Coordinate freight schedule and construction activities with the railroads.
Land Use, Community Facilities and Businesses	1. Coordinate with local business owners and provide advance notification of roadway disruptions and descriptions of alternative routes. 2. Maintain access to community facilities throughout construction by providing alternative routes when necessary. 3. Provide temporary entrance signs during construction.
Visual and Aesthetic	1. Shield and aim night work lights directly at the work zone. 2. Stage construction activities to limit the duration of impacts at individual locations. 3. Where practical, restore existing vegetation that serves as a buffer to adjacent properties.
Neighborhoods, Community Services and Environmental Justice	1. Inform local property owners, through the Construction Education and Outreach Plan, of roadway disruptions. 2. Provide continuous coordination with community service providers to maintain access for emergency vehicles. 3. Restrict contractors from accessing the railroad ROW through the Hampshire Hills neighborhood.
Air Quality	1. Shut off construction equipment not in direct use. 2. Water areas of exposed soil. 3. Cover open body trucks transporting materials to and from construction sites. 4. Reroute truck traffic away from schools and residential communities when possible. 5. Repave and/or replant exposed areas as soon as possible following construction. 6. Adequately secure tarps, plastic or other material over debris piles. 7. Prohibit idling of delivery trucks or other equipment during periods of extended unloading or inactivity.
Noise and Vibration	1. Construction activities will be carried out in compliance with all applicable local noise regulations including the City of Charlotte Noise Ordinance, FTA guidelines and UNC Charlotte specified parameters. • At UNC Charlotte, construction will not be allowed near residence halls prior to 8:00 am nor within 200 feet of campus buildings during the week of final exams. 2. Contractors will prepare a Construction Noise and Vibration Control Plan. 3. Contractor(s) will involve an Acoustical Engineer to ensure noise and vibration levels are effectively managed and excessive noise and vibration is prevented • Contractors will provide a phone number and/or website for community complaints, and the Acoustical Engineer will respond and coordinate with the Construction Manager to resolve complaints. • For blasting operations, contractors will consult with nearby sensitive receptors to schedule the least disturbing times and provide advance notice of blasting operations. The contractor shall prepare a Blasting Plan to be approved by CATS and others designated by CATS (e.g., UNC Charlotte). • For blasting operations near UNC Charlotte, the contractor shall follow specific notification procedures to avoid damages to vibration sensitive equipment. The contractor shall provide a one-week advance notice of the start of blasting operations. The contractor shall facilitate a pre-blast meeting to define the entire schedule and scope of sequence of blasting. Blasting shall be scheduled in batches to the extent possible. The schedule shall be kept current at all times. The contractor shall provide a 24-hour notification for each blast. 4. The contractors will conduct noise and vibration monitoring at locations where potential impact from construction activities may occur. 5. Contractors will conduct pre-construction and post-construction surveys of buildings with the potential for structural damage.

Table 18-4 (continued)
Summary of Mitigation Techniques During Construction

Impact Type	Mitigation
Noise and Vibration	6. Specific construction noise and vibration measures to be implemented near sensitive receptors will be identified by the contractor in the Construction Noise and Vibration Control Plan. General noise mitigation measures including, but not limited to: operational restrictions; the use of alternative construction methods and equipment*; locating stationary equipment away from noise sensitive sites; the use of shields, shrouds or intake exhaust mufflers; the use of special back-up alarms; rerouting truck routes; use of temporary noise barriers or noise blankets; use of static rollers instead of vibratory rollers where practicable; pier drilling stead of pile driving where practicable.
Natural Resources	1. Best management practice (BMP) measures would be followed by the contractor during construction. BMP measures would include the demarcation of the construction limits and staging areas prior to the initiation of construction, to limit the disturbances to the vegetative community/habitat.
Water Resources	1. Minimize disturbed areas. 2. Apply prompt stabilization. 3. Employ an Erosion and Sediment Control Plan to treat stormwater runoff. 4. Prevent the storage of fill or other materials in floodplains, to the extent practicable. 5. Stage construction of proposed stormwater systems to reduce the duration of construction disturbances to a given area. 6. Recycle topsoil removed during construction by using it to reclaim disturbed areas and enhance regrowth. 7. Avoid excessive slopes during excavation and blasting operations to reduce erosion. 8. Use isolation techniques, such as berming or diversion, for in-stream construction near wetlands.
Cultural Resources	1. Stop construction activities immediately upon the discovery of any new cultural resources. 2. Contractors will prepare a Construction Noise and Vibration Control Plan, and conduct vibration monitoring during construction. 3. Contractors will be instructed to avoid adjacent historic sites through construction fencing or some other clearly understood construction/staging technique. 4. The State Historic Preservation Office will review the proposed pile/panel walls along the edges of the Herrin Brothers Coal and Ice site during Final Design. 5. Maintain minimum allowable distances from historic resources, to the extent practicable.
Parklands	1. Maintain access to trails and minimize temporary closures to the extent practical. 2. Notify MCPR 48 hours in advance of temporary closures of greenways due to construction.
Energy	1. Measures to minimize energy consumption during construction could include limiting the idling of construction equipment and employee vehicles, as well as locating staging areas and material processing facilities as close as practical to work sites.
Hazardous and Contaminated Materials	1. Dispose of hazardous materials according to applicable federal, state and local guidelines. 2. Clean construction vehicles to prevent off-site contamination.
Safety and Security	1. Provide construction barriers and fencing to secure construction sites and staging areas.

* The actual construction methods and equipment used for the project will depend on the individual contractors approach and the actual vibration levels will depend on site conditions (i.e. soil types and presence or rock). The type of construction and equipment required for the project is not expected to be extraordinarily different than other transit projects.