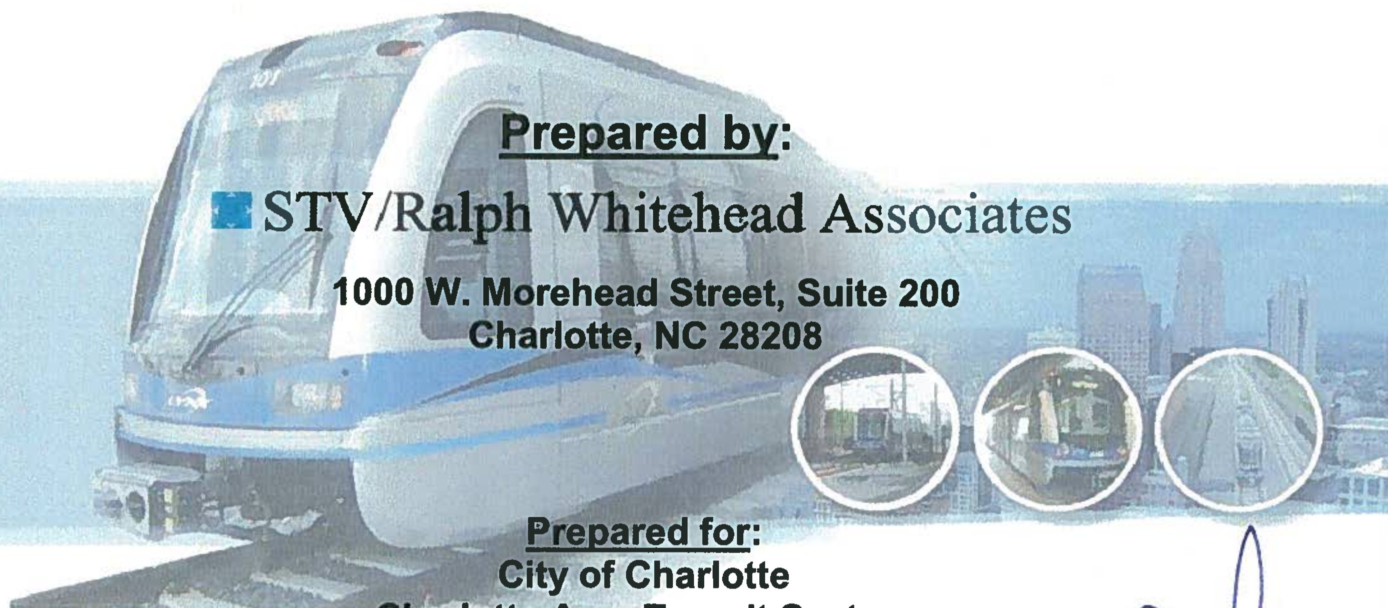
CATS
CHARLOTTE AREA TRANSIT SYSTEM

LYNX Blue Line Extension
(Northeast Corridor)
Light Rail Project

Contract #: 08-477

WBS #: 6.10

Traffic Analysis Report



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1.0 INTRODUCTION

1.1 Purpose of Report

This technical report is a revision to the Traffic Analysis Report prepared by STV/Ralph Whitehead Associates on November 30, 2009. The purpose of the revised technical report is to document the recent changes that occurred on the proposed Charlotte Area Transit System (CATS) LYNX Blue Line Extension Northeast Corridor (LYNX BLE) light rail project and to investigate the subsequent traffic impacts. The following traffic modeling software was used to determine several measures of effectiveness for the traffic operations within the study area:

- SYNCHRO was used to determine intersection delay and level of service (LOS), and intersection volume to capacity ratio (v/c).
- VISSIM was used to simulate the highway and rail interactions and to supplement the Synchro analysis, including LOS and intersection delay.
- Bicycle and Pedestrian (Bike/Ped) LOS were determined for the signalized intersections using worksheets developed by the Charlotte Department of Transportation (CDOT).

The analysis contained in this report seeks to identify areas where the projected no-build traffic conditions may be adversely affected by the proposed LYNX BLE project. Recommendations are provided to mitigate, to the extent practical, any impacts due to the Preferred Alternative.

1.2 Review of LYNX BLE

Recently, several major changes have occurred on the proposed LYNX BLE light rail project, which would affect the operational characteristics presented in the *Traffic Analysis Report (STV, 2009)*. In November 2010, the Metropolitan Transportation Commission (MTC) received a report on the financial capacity of CATS and its ability to deliver the 2030 Transit System Plan. Based on the analysis presented, it was determined that the current plan could not be completed as planned. In order to advance the Blue Line Extension, the MTC directed CATS Staff to reduce the project scope by approximately 20 percent.

After the November meeting, CATS staff initiated extensive coordination with its partner departments, governing board, advisory committees and groups, UNC Charlotte, NCDOT and FTA and other project stakeholders, as well as with the members of the public. During the month of December, CATS met with UNC Charlotte, NCDOT, University City Partners, and via phone with FTA to begin discussions about the concept of an Affordable Alternative for the BLE.

On December 15, 2010, CATS presented the BLE Affordable Alternative Concept as an information item to the MTC. Project changes include:

- Shorten the project to UNC Charlotte Station (Eliminating I-485/N. Tryon Station and Mallard Creek Church Station)
- Operate 3-car trains every 10 minutes instead of 2-car trains every 6 minutes
- Add a parking garage at JW Clay Blvd. Station (690 spaces)
- Provide additional parking at University City Blvd Station (1,485 total spaces)
- Eliminate all parking at McCullough Station
- Provide surface lots instead of a parking garage at Sugar Creek Station
- Provide a storage yard for rail vehicles at the site along North Brevard Street and use the existing South Blvd Light Rail Facility for maintenance
- Provide an additional right/through lane along North Tryon Street from Orchard Trace to Shopping Center Drive to accommodate additional traffic from the University City Boulevard park and ride

On January 26, 2011, the MTC voted to adopt these changes. Most of these changes would affect the operational characteristics presented in the previous Traffic Analysis Report (STV, 2009). Therefore, this report has been prepared to replace it. The following sections summarize the traffic analysis changes resulting from the overall project changes.

1.2.1 Changes to Project Limits

In addition to revising the terminus, the scope of the revised Traffic Analysis Report has been broadened to include peak hour analyses at the JW Clay Boulevard & Olmsted Drive intersection. The JW Clay Boulevard & Olmsted Drive intersection was included in the revised Traffic Analysis Report because of the parking facilities added to the JW Clay Blvd. Station and the connectivity Olmsted Drive provides to transit patrons traveling to and from the JW Clay parking garage using W.T. Harris Boulevard and JW Clay Boulevard.

Currently, the proposed light rail project starts at the 7th Street Station and terminates at the UNC Charlotte Station. The modified project terminus would remove approximately 1.2 miles of track alignment. As a result, the North Tryon Street/US-29 & Mallard Creek Church Road intersection would be the last intersection analyzed under the revised Traffic Analysis Report.

1.2.2 Changes to Stations

Scope changes, including the elimination of parking at the I-485/N. Tryon Station, generated a project-wide redistribution of parking and resulted in a 10 percent reduction in projected ridership. The 2035 Metrolina Regional Travel Demand Model provided estimates for the daily parking demand as a result of terminating the light rail alignment at the UNC Charlotte Station. The station trip generation was based on the revised number of parking spaces planned under each station site plan following the January 26, 2011 MTC meeting. The proposed number of parking spaces either met or exceeded the daily parking demand associated with the 2035 Metrolina Regional Travel Demand Model. The following section summarizes the changes that occurred at each of the previously proposed Park-and-Ride locations.

Sugar Creek Station

The Sugar Creek Station design would be modified from a parking garage with 1,000 spaces to two park-and-ride lots with approximately 665 parking spaces. The new surface lots would be located on the north and south sides of Raleigh Street, just west of the Sugar Creek Road and Raleigh Street intersection. The station location was not changed.

Old Concord Road Station

The parking capacity of the Old Concord Road Station would be reduced from 505 parking spaces to approximately 330 parking spaces. The station and surface park-and-ride lot would remain in the same location; between the North Carolina Railroad (NCRR) Right-of-Way (ROW) and Old Concord Road.

Tom Hunter Station

The Tom Hunter Station park-and-ride lot would be removed from the proposed project due to low parking demand. A Value Engineering exercise was performed by a third party in July 2010 to assure efficient use of funds, capital and life cycle costs to provide the best value and meet the project goals. Revised projections for parking requirements indicate a need of only 35 spaces at this location. Due to low demand and alternate park-and-ride locations nearby, the 117 space park-and-ride has been eliminated. The majority of the station generated trips were redistributed to the University City Blvd. Station and have been included in this analysis.

University City Blvd. Station

The University City Blvd. Station was previously designed to accommodate three park-and-ride lots with 591 parking spaces. Due to the elimination of two nearby park-and-ride stations (Mallard Creek Church Station & I-485/N. Tryon Station) the current design proposes a parking garage with approximately 1,485 parking spaces. The station location would remain in the median of North Tryon Street/US-29; between the intersections of the I-85 Connector and University City Boulevard/NC-49. The parking garage would be located on the west side of North Tryon Street/US-29.

McCullough Station

The McCullough Station park-and-ride lot would be removed from the proposed project. The park-and-ride lot was previously designed to accommodate 225 parking spaces. The majority of the station generated trips were redistributed to the JW Clay Blvd. Station. The station location was unchanged.

JW Clay Blvd. Station

Due to the close proximity of the Mallard Creek Church Station and I-485 N. Tryon Station, the JW Clay Blvd. Station was not previously designed with parking facilities. The current station layout includes 690 spaces in a parking garage that would be located in the northwest quadrant of the North Tryon Street/US-29 & JW Clay Boulevard intersection. The station location was unchanged.

<u>Mallard Creek Church Station</u>

The Mallard Creek Church Station would be removed from the proposed project due to terminating the light rail alignment at the UNC Charlotte Station. A surface park-and-ride lot with 150 parking spaces was part of the previous station layout. The majority of the station generated trips were redistributed to the JW Clay Blvd. Station.

<u>I-485/N. Tryon Station</u>

The I-485/North Tryon Station would be removed from the proposed project due to terminating the light rail alignment at the UNC Charlotte Station. Under the previous station design, a parking garage was planned to accommodate 2,134 parking spaces. The majority of the station generated trips were redistributed to the JW Clay Blvd. Station and University City Blvd. Station.

1.2.3 Changes to the Weave Area

The "Weave Area" is a 4-lane segment of North Tryon Street/US-29 between the I-85 Connector and University City Boulevard/NC 49; where merging and diverging traffic from the I-85 ramps and University City Boulevard/NC-49 creates an area of highly intense weaving traffic within a relatively short section of roadway (approximately 0.3 miles in length). The US-29/NC-49 Improvement Project, currently under construction, creates a four lane roadway with two full movement 8-phase signalized intersections, one at North Tryon Street/US-29 & I-85 Connector and the other at North Tryon Street/US-29 & University City Boulevard/NC-49. Roadway construction is expected to be complete by ~~in~~ August 2012.

The new terminus at UNC Charlotte created the need for additional parking at University City Blvd. Station, which in turn would require additional vehicular capacity on North Tryon Street/US-29 in the "Weave Area." A six-lane typical section with turn lanes is proposed under the revised LYNX BLE light rail project. The project would add a northbound through lane that starts north of Orchard Trace Lane and drops at University City Boulevard/NC 49 as one of two right turn lanes. An additional southbound through lane would start just north of Shopping Center Drive and drop at the I-85 Connector as one of two right turn lanes.

1.2.4 Changes to Signal Timing/Phasing

The Charlotte Department of Transportation (CDOT) presented information at a February 10, 2011 meeting with the North Carolina Department of Transportation (NCDOT) in Albemarle that most at-grade crossings along North Tryon Street/US-29 would need to be split-phased due to the compact footprint of the intersections. These intersections are designed to aide pedestrian crossings of North Tryon Street/US 29 and the light rail tracks by providing median refuge areas within North Tryon Street. With the assistance of pedestrian signals, pedestrians will be able to cross the roadway and tracks in stages, which in turn will allow side-street signal times to be minimized. The trade off with this design, however, is that opposing left turn movements physically overlap and will have to be separated in time by signal phasing. As a result, McCullough Drive, Ken Hoffman Drive, JM Keynes Drive, JW Clay Boulevard and UNC Research Drive would have split phasing. Left turns from the I-85 Connector, University City Boulevard/NC 49 and WT Harris Boulevard would operate as lead/lag phasing.

1.3 Corridor Objectives

Light Rail Transit is a core component of the 2030 Transit Corridor System Plan for the region, which was developed to create alternate route and mode choices, improve connectivity and develop and enhance pedestrian facilities. The LYNX BLE is a transit project; not a roadway project intended to add capacity or ameliorate existing traffic congestion. The proposed project enhances the corridor through transit by providing additional transportation capacity and options.

The existing road network has three main arteries in the corridor; North Tryon Street/US-29, W.T. Harris Boulevard and University City Boulevard. Long term goals for the corridor couple the proposed light rail project with improved capacity and connectivity to abate the dependence on the existing major thoroughfares. The improvement of pedestrian and bicycle facilities also plays a critical role in the long term goals of the corridor by promoting walking and cycling, rather than vehicular travel.

An important design element of a pedestrian-friendly transit facility is the minimization of intersection footprints at median station locations. Minimizing the number of turn lanes and curb radii at these intersections reduces the crossing distance for pedestrians. The attainment of pedestrian-friendly environments is consistent with the urban vision for the corridor and would stimulate transit oriented developments (TODs). These types of communities allow for a high quality of life and mobility, while simultaneously helping to reduce pollution and vehicle miles traveled.

North Tryon Street/US-29 currently has 20 median openings from Old Concord Road to UNCC Research Drive, and eight of these are signalized. Two additional signals will be installed by the Weave Project at the I-85 Connector and University City Boulevard. Two intersections are anticipated to be signalized by 2030; Orr Road and Arrowhead Drive. The proposed Preferred Alternative would signalize these two intersections, plus three additional intersections; Owen Boulevard, Orchard Trace Lane, and University City Station Access. Totaled, there would be 16 signalized intersections between Old Concord Road and UNCC Research Drive. With light rail transit running in the median, safety requires traffic signals at all median openings. Preserving median openings and adding additional traffic signals restores some of the access that would be lost if the existing unsignalized median openings were closed or restricted. Preserving median openings also reduces U-turn movements that would otherwise be redistributed to the existing signalized intersections under the proposed Preferred Alternative. This is particularly important in reducing the footprint at those intersections where light rail stations are located.

1.4 2030 Transit Corridor System Plan Criteria

When developing the 2030 Transit Corridor System Plan, the Charlotte Area Transit System (CATS), used the following criteria as a baseline of services that fit each corridor.

Land Use – The key to a successful transit corridor lies in the integration of transit and land development. The plan developed by CATS actively encourages transit use by fostering development along transit lines, TODs. One example of this type of development can be found in the University City Area Plan.

Environment – Public transportation helps minimize air and noise pollution by lowering the number of vehicles on the road and fostering development patterns that produce fewer and shorter trips. The introduction of public transportation in areas with severe congestion would reduce the source of environmental contaminants as well as the negative effect of pollution on local communities, natural areas and cultural resources.

System Integration – Each corridor is part of a larger system, making it vital to ensure that each new transit corridor solution has the ability to operate within the entire system. The system should consider passenger distribution, service between regional corridors and balanced use of system capacity.

Mobility – Several components constitute mobility, with ridership being an integral element. Ridership includes the number of passengers utilizing public transportation and the quantity of new transit trips exchanged for automobiles. Improving accessibility is another component, which is essential for serving a variety of travel markets. Increased mobility will ultimately produce savings in travel times and enhance reliability.

Financial – The level of investment to build, operate and maintain a transit system must be balanced with ridership demand. With appropriations being limited and federal and state revenue sources existing as grants, consideration should be given to improvements that attract those particular grants.

2.0 FUTURE ROADWAY PROJECTS

The following five projects have been identified to be planned and/or constructed within the limits of this project. It is assumed that these projects would be completed prior to the future analysis year of 2030. All impacts associated with these projects would be realized prior to the opening of the LYNX BLE.

2.1 First Ward Improvements Project

10th Street would be extended from N. Brevard Street up to the eastern side of the proposed light rail tracks. Construction of this project would occur prior to or during the LYNX BLE project.

2.2 US-29/NC-49 Improvement "Weave Area" Project

In 1998, the City of Charlotte (City) allocated funding from its Capital Investment Plan to plan, design and construct an interchange between US-29 and NC-49, in an effort to improve safety and capacity within the "Weave Area." Ongoing transportation and land use planning in the corridor influenced the City to reevaluate the scope of the interchange project in 2006. As a result, the City decided to forego construction of an interchange and instead chose to construct two at-grade multi-lane signalized intersections on North Tryon Street/US 29, one at the I-85 Connector and the other at University City Boulevard/NC-49. As part of this new project, North Tryon Street/US 29 would have four through travel lanes and a median wide enough to accommodate two additional travel lanes or a future light rail transit line. The ramp type design at the I-85 Connector would be eliminated by its realignment with Sandy Avenue and the ramp type design at University City Boulevard /NC 49 would be eliminated by its realignment with City Boulevard/NC 49. The US-29/NC-49 Improvement Project would be complete prior to the construction of the proposed LYNX BLE light rail project.

2.3 University Pointe Boulevard

The City plans to eventually extend University Pointe Boulevard (also known as Shopping Center Drive) westward across I-85 to tie into IBM Drive, and extend Nevin Road to connect with IBM Drive. When complete, these two streets will provide a significant new east/west connection into the corridor.

2.4 JW Clay Boulevard

JW Clay Boulevard is currently a three-leg signalized intersection. Due to the growth of the UNC Charlotte Research Institute a fourth leg would be added to the JW Clay Boulevard intersection. It was assumed that the fourth leg would be constructed prior to the opening of the proposed BLE project.

2.5 Sugar Creek Road Grade Separation Project

North Carolina Railroad (NCRR) recently initiated an engineering study to investigate the feasibility of grade separating Sugar Creek Road from the existing and proposed freight tracks. This project is also included in the North Carolina State Transportation Improvement Plan (STIP) as U-5008. This project is planned to be constructed prior to or concurrently with the construction of the proposed BLE project and would result in the light rail being grade-separated from Sugar Creek Road.

3.0 BUILD ALTERNATIVE

3.1 Light Rail Alignment

The Preferred Alternative (**Figure 1: Northeast Corridor Base Map**) begins at the southern terminus of the CATS LYNX Blue Line Light Rail at 7th Street in Center City Charlotte and would follow the former NCRR right-of-way (ROW) north through Center City. This ROW is owned by the City of Charlotte up to 12th Street and was purchased for transit use in 1998. The light rail would travel at the existing street level, and light rail crossings with gates would be used at 7th Street, 8th Street, 9th Street, the proposed 10th Street Connector and 12th Street.

North of 12th Street, the alignment would be grade-separated over the CSX Transportation (CSXT) rail line and would return to ground level just before 16th Street. The proposed Preferred Alternative would cross 16th Street at the existing street level with a gated light rail crossing, followed by a shift south that would run between the southern edge of the Norfolk Southern Intermodal Facility and North Brevard Street. The alignment would continue beside North Brevard Street crossing over Little Sugar Creek and continuing under the 30th Street bridge.

While the proposed Preferred Alternative remains within the NCRR corridor east of 30th Street, four grade separations occur with existing roadways. After crossing 36th Street via grade separation, the proposed alignment would be grade separated over Craighead Road on a S-curve to position the proposed light rail tracks on the east side of the existing freight tracks. The proposed alignment would continue on the east side of the existing freight tracks and would have grade separations with Sugar Creek Road and Eastway Drive. NCDOT Rail plans to depress Sugar Creek Road under the existing at-grade freight tracks. CATS has coordinated with NCDOT Rail to ensure the light rail tracks can be grade-separated over Sugar Creek Road on a separate bridge beside the freight bridge. The alignment would continue along the northwest side of the existing NS tracks within the NCRR ROW. The proposed alignment would be grade-separated under Eastway Drive. The Eastway Drive bridge would be lengthened to accommodate the proposed light rail tracks. Just east of the Northpark Shopping Center, the proposed Preferred Alternative would exit the NCRR corridor and would shift north towards Old Concord Road.

The Preferred Alternative would be grade separated over Old Concord Road and the northbound travel lanes of North Tryon Street/US-29. The grade-separated design would align the proposed light rail within the median of North Tryon Street/US-29. The proposed Preferred Alternative would return to street level approximately 300 feet south of the North Tryon Street/US-29 and Orr Road intersection and would continue in the median at street level just south of the North Tryon Street/US 29 & I-85 Connector intersection.

At the confluence of North Tryon Street/US-29, the I-85 Connector, and University City Boulevard/NC-49, the City is upgrading the existing “Weave Area.” CDOT has designed safety improvements that include the construction of two at-grade signalized intersections. Construction for this project began in 2010 and is scheduled to be complete prior to construction of the LYNX BLE light rail project. In order to pass through the reconfigured intersections, the light rail would be grade separated over the realigned I-85 Connector Road-North Tryon Street/US-29 intersection. The proposed Preferred Alternative would return to street level south of the proposed University City Blvd. Station park-and-ride entrance road. The intersection with the University City Blvd. Station park-and-ride entrance would be an at-grade light rail crossing.

The North Tryon Street/US-29 intersections with Stetson Drive and Rocky River Road would be restricted to right-in/right-out with the light rail running through the median. North of Rocky River Road, the light rail would again be grade-separated over the realigned University City Boulevard/NC-49 and North Tryon Street/US-29 intersection. The alignment would return to street level north of Brookside Lane.

The proposed alignment would continue at street level in the median of North Tryon Street/US-29, past McCullough Drive. Just north of Ken Hoffman Drive, the alignment would transition to an aerial structure, crossing over W.T. Harris Boulevard and return to street level south of JM Keynes Drive/Hospital Drive. After an at-grade crossing with JM Keynes Drive, the proposed alignment would continue north and cross JW Clay Boulevard at-grade. Just north of the at-grade crossing with UNCC Research Drive the proposed Preferred Alternative would descend and cross under the northbound North Tryon Street/US-29 travel lanes to enter the University of North Carolina at Charlotte (UNC Charlotte) campus.

Following the entrance onto the UNC Charlotte campus, the proposed alignment would travel south towards the northeastern edge of the existing UNC Charlotte buildings. A bridge would carry the light rail over Toby Creek and the Toby Creek Greenway, and continue along the northern side of Cameron Boulevard to the terminal station.

3.2 Light Rail Stations

<u>9th Street Station</u>

The 9th Street Station (side loaded platform, loaded from both ends) would be located between 9th Street and the proposed 10th Street extension, along the former NCRR ROW. The station would be designed as an urban station with walk-up access and eight short-term bicycle parking spaces. Sidewalks, like those placed next to the LYNX Blue Line light rail tracks within Center City Charlotte, would extend between 9th and 12th Streets. No trip generation was performed for this station since no permanent parking spaces are proposed.

<u>Parkwood Station</u>

This station (side loaded platforms) would be located at the intersection of Parkwood Avenue and North Brevard Street. Parkwood Station would be designed as a neighborhood walk-up station with eight short-term and eight long-term bicycle parking spaces. Kiss-and-ride spaces would not be provided. A small landscaped esplanade would be located in front of the station. No trip generation was performed for this station since no permanent parking spaces are proposed.

<u>25th Street Station</u>

The 25th Street Station (center platform, loaded from both ends, with approach access ramps) would be located along the west side of North Brevard Street and centered between 25th Street and 26th Street. The station would be a neighborhood walk-up station with 16 short-term bicycle parking spaces. No trip generation was performed for this station since no permanent parking spaces are proposed.

<u>36th Street Station</u>

Located along the south side of the NCRR ROW, the 36th Street Station (center platform, loaded from one end) would be designed as a neighborhood walkup station, with eight short-term and eight long-term bicycle parking spaces. The station platform would be positioned on a bridge structure and 36th Street would be depressed under the existing Norfolk Southern freight tracks and the proposed light rail tracks. The bridge structure would be at the same elevation as the existing freight tracks. 36th Street would be lower than the existing elevation.

Pedestrian access would be available via a sidewalk along the east side of 36th Street that connects to a ramp with platform access. No trip generation was performed for this station since no permanent parking spaces are proposed.

<u>Sugar Creek Station</u>

The Sugar Creek Station (center platform, loaded from both ends) would be at grade approximately 330 feet south of Sugar Creek Road. Access to the station from the south side of Sugar Creek Road would be via sidewalks, a ramp and stairs. Access from the north side of Sugar Creek Road would be by way of a ramped sidewalk alongside Sugar Creek Road that connects to a pedestrian walkway on the light rail bridge over Sugar Creek Road.

The station would be designed as a regional station and would include two park-and-ride lots with approximately 665 spaces, 180 parking spaces in the southern lot and 485 parking spaces in the western lot. An exclusive bus-only circle drive around the southern lot would accommodate three bus bays. Twenty-two long-term and six short-term bicycle spaces would be provided. Vehicular access to the park-and-ride lots would be available from Raleigh Street, Sugar Creek Road and a connection to Greensboro Street. Access to the south end of the station would be provided via a walkway along the north side of the southern parking lot.

<u>Old Concord Road Station</u>

The Old Concord Station (side platforms, loaded from each end) would be located between the NCRR ROW and Old Concord Road, in the area the alignment would depart the NCRR ROW. Old Concord Road Station would function as a community station and would include a surface park-and-ride lot with approximately 330 parking spaces. Fourteen long-term and six short-term bicycle spaces, along with two bus bays, would be provided. An at-grade light rail crossing with gates would be provided at the park-and-ride access road. Access to the park-and-ride lot would be from Old Concord Road and North Tryon Street/US-29.

<u>Tom Hunter Station</u>

The Tom Hunter Station (center platform, loaded from one end) would be located directly north of Tom Hunter Road, in the median of North Tryon Street/US-29. The station would operate as a neighborhood station with walk-up access. One bus stop would be provided on each side of Tom Hunter Road. Eight long-term and eight short-term bicycle spaces would be provided. No trip generation was performed for this station since no permanent parking spaces are proposed.

University City Blvd. Station

The University City Blvd. Station is proposed in the median of North Tryon Street/US-29 within the “Weave Area”; between the intersections of US-29 Connector Road and University City Boulevard/NC-49. This station is proposed as a regional station, accommodating a parking garage with approximately 1,485 parking spaces. Twenty-four long-term bicycle spaces would be provided in the parking garage. 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. Two bus bays would be provided on a secondary access road behind the parking garage. A pedestrian bridge crossing over southbound North Tryon Street/US-29 would connect the parking garage to the north end of the station platform.

McCullough Station

The McCullough Station (center platform, loaded from one end) would be located directly north of McCullough Drive within the median of North Tryon Street/US-29, and would be designed as a neighborhood station. The McCullough Station would include walk-up access and two bus stops; one on North Tryon Street/US-29 and one on McCullough Drive. No trip generation was performed for this station since no permanent parking spaces are proposed.

JW Clay Blvd. Station

The JW Clay Blvd. Station (center platform, loaded from both ends) would be located north of JW Clay Boulevard in the median of North Tryon Street/US-29. The station would be designed as a regional station with a parking garage that would contain 690 parking spaces. The parking garage would be located in the northwest quadrant of the North Tryon Street/US-29 & JW Clay Boulevard intersection. Fourteen long-term bicycle spaces would be provided in the parking garage. Vehicles would access the parking garage from Olmsted Drive, which intersects JW Clay Boulevard. Two bus bays along the private street adjacent to the parking garage would be included at the JW Clay Station. A pedestrian bridge crossing over southbound North Tryon Street/US-29 would connect the parking garage to the north end of the station platform.

UNC Charlotte Station

The UNC Charlotte Station (center platform, loaded from both ends) would be located on the UNC Charlotte campus near Laurel Hall, on a fill embankment adjacent to Cameron Boulevard. The station would be designed with walk-up access, two bus bays, 32 short-term bicycle parking spaces and connections with the campus shuttle service. No trip generation was performed for this station since no permanent parking spaces are proposed.

4.0 METHODOLOGY

4.1 Traffic Counts

Daily traffic volumes for all significant roadway segments within the proposed LYNX BLE area of influence were obtained from CDOT and collected by the STV Team. CDOT provided intersection counts for all signalized intersections, while the STV Team conducted intersection counts for all un-signalized intersections. The raw turning movement traffic count data can be found in **Appendix A**.

Turning movement counts were conducted between March 23, 2008 and May 9, 2008 during the AM and PM peak travel periods (6:30 – 9:30 AM, 4:00 – 7:00 PM). Additional counts were conducted on January 8, 2009 and January 15, 2009. A review of the traffic counts revealed that the morning peak hour was 7:30 to 8:30 AM and the afternoon peak hour was 4:45 to 5:45 PM for the study area. The peak hours (four consecutive fifteen minute intervals) were determined by the peak hour volumes of the intersections within the study area. The traffic counts for the North Tryon Street/US-29 & Mallard Creek Church Road intersection were updated on March 28, 2010. The JW Clay Boulevard & Olmsted Drive turning movement counts were conducted on January 25, 2011.

4.2 Scenarios and Segments

Several scenarios were analyzed as part of this technical report. The 2008 Existing and the 2030 No-Build Alternative scenarios were developed to determine the expected traffic operations without the construction of the LYNX BLE. The 2030 Preferred Alternative was developed to determine the expected traffic operations if the proposed project is constructed.

All scenarios were divided into two segments due to the length of the corridor, changes in growth rates and changes in surrounding land uses. Segment 1 includes the intersections from Center City Charlotte north to Owen Boulevard along North Tryon Street/US-29. This segment also includes all intersections analyzed on Sugar Creek Road and Eastway Drive. Segment 2 begins with Tom Hunter Road and runs along North Tryon Street/US-29 through Mallard Creek Church Road.

The 2008 Existing Scenario included all roadway characteristics that were present in the year 2008 (See **Figures 2.1** through **2.11: Measures of Effectiveness – 2008 Existing Conditions**). These roadway characteristics included lane configurations, speed limits, peak hour traffic volumes, traffic signal timing and truck percentages. Data for the lane configurations, speed limits and peak hour traffic volumes were taken from field observations and aerial mapping. The peak hour traffic volumes were balanced between intersections. Most adjacent intersections were not balanced completely because of midblock driveways. Traffic volumes were not balanced between segments. CDOT approved the resulting 2008 Existing Scenario traffic volumes, and provided traffic signal timing. Additionally, CDOT approved the use of a two percent truck percentage and a peak hour factor of 1.00 for all segments and scenarios.

The 2030 No-Build Alternative was subsequently developed (See **Figures 3.1** through **3.11: Measures of Effectiveness – 2030 No-Build Alternative**). Growth factors were developed and applied to the 2008 base year traffic volumes to estimate year 2030 traffic. These growth factors, shown in **Appendix B**, were derived from the 2030 Metrolina Travel Demand model maintained by CDOT. The growth factors were applied to the peak hour traffic volumes that were used for the 2008 Existing Scenario. **Table 4.1: Growth Factors** show the growth factors for each segment.

Table 4.1
Growth Factors

Corridor Segment	Growth Factor
Segment 1	1.30
Segment 2	1.25

Source: Charlotte Department of Transportation

Several other changes were applied to the 2030 No-Build Scenario, which included roadway improvement projects that were expected to be complete by 2030. Modifications to the “Weave Area”, Shopping Center Drive and JW Clay Boulevard were included as discussed in Section 2 of this technical report. Pedestrian phases were added to each signalized intersection. The existing signal phase splits and offsets were adjusted to account for changes in the peak hour traffic volumes.

The 2030 Preferred Alternative was developed next (See **Figures 4.1** through **4.11: Measures of Effectiveness – 2030 Preferred Alternative**). Lane configurations for the 2030 Preferred Alternative began with existing conditions and incorporated future roadway projects, such as the “Weave Area.” Traffic volumes were adjusted according to access changes and turn restrictions proposed by the BLE project, and park-and-ride traffic generated by the light rail stations was added to the 2030 No-Build peak hour volumes. Pedestrian phases were adjusted based on the changes to existing lane configurations. A walk speed of 3.5 feet per second was used to determine the necessary pedestrian phase timing, and existing signal phase splits and offsets were adjusted to account for the changes in the peak hour traffic volumes. Due to the compact footprints of the signalized intersections along North Tryon Street/US 29, opposing left turn movements must be separated in time by signal phasing because they physically overlap. Therefore, left turns from North Tryon Street/US 29 would be lead/lag protected phasing, and phasing on the side streets would be lead/lag or split. Lead/lag phases would be used at the I-85 Connector, University City Boulevard/NC 49, and WT Harris Boulevard. Split phases would be used at McCullough Drive, Ken Hoffman Drive, JM Keynes Drive, JW Clay Boulevard and UNC Research Drive.

4.3 Synchro

Synchro 7.0 was used to analyze intersection operations in the study area. The Synchro results give several measures of effectiveness (MOE) which are used to evaluate the operations for each intersection. It should be noted that the measure of effectiveness results from Synchro do not reflect the operational impacts of light rail running at-grade. Instead, the Synchro results reflect the impacts that physical changes to the streets, caused by the proposed project, are expected to have on intersections. Synchro results are reported for intersections outside the North Tryon Street/US-29 corridor.

Level of service (LOS) and delay are quality MOEs describing conditions within a traffic stream, generally in terms of service measures such as speed and travel time. The LOS is an important measure of roadway congestion. The LOS ranges from A (no congestion) to F (severe congestion). The LOS criteria for signalized and unsignalized intersections are shown in **Table 4.2: Intersection Level of Service**.

Table 4.2
Intersection Level of Service

Signalized Intersections		Unsignalized Intersections	
LOS	**Delay per Vehicle (seconds)**	**LOS**	**Delay per Vehicle (seconds)**
A	≤10	A	≤10
B	>10 and ≤20	B	>10 and ≤15
C	>20 and ≤35	C	>15 and ≤25
D	>35 and ≤55	D	>25 and ≤35
E	>55 and ≤80	E	>35 and ≤50
F	>80	F	>50

Source: Highway Capacity Manual

4.4 VISSIM

VISSIM 5.3 was used to analyze the interaction between the light rail system and vehicular traffic, which Synchro is unable to do. Results are reported for intersections inside the North Tryon Street/US-29 corridor, from Sugar Creek Road to Mallard Creek Church Road. VISSIM was used to analyze traffic conditions during the three highest hours of the morning and afternoon periods using 15 minute volume intervals. The results shown in this report reflect conditions during the peak one hour of each three hour period and are based on an average of 5 simulation runs. Several assumptions were considered when modeling the light rail system, namely:

1. The light rail system would operate with 10 minute headways with three car trains
2. Three car trains would be used with a total train length of 270 feet
3. Dwell times at each station were derived from the BLE Running Times Calculation Report dated February 18, 2011
4. Trains would accelerate at a rate of 1.5 miles per hour per second (mphps) and decelerate at a rate of 1.5 mphps (including civil braking distances), as referenced in the BLE Running Times Calculation Report dated February 18, 2011
5. Maximum light rail operating speed used would be 55 miles per hour (mph)
6. Maximum light rail operating speed within North Tryon Street/US-29 would be 45 mph
7. Traffic signal preemption would be utilized
8. Split phasing would be utilized along the North Tryon Street/US-29 side streets, which have at-grade crossings with the light rail alignment, from McCullough Drive to UNC Research Drive.

Signalized intersections were analyzed with the unsignalized intersection nodes removed from the model to include any queue build up adjacent to the signalized intersection. During the course of the analysis, large delays were observed at unsignalized intersections adjacent to signalized intersections. This was mainly due to queues building up at signalized intersections and extending through the adjacent unsignalized intersections. Due to VISSIM software parameters, the signalized intersection queue extending through the adjacent unsignalized intersections was solely reported under the unsignalized intersections, when in fact the queue had developed from the signalized intersection. In an effort to capture the entire queue for the signalized intersection analysis, the unsignalized intersection nodes were removed to include any queue built prior to the signalized intersection. Intersection nodes are consistent between the No-Build and Build scenarios to account for unsignalized intersections that become signalized in the Build scenario.

Intersection delays and levels of service were analyzed using the VISSIM node evaluation. To report these values, nodes were placed at each intersection to encompass the entire intersection storage lane lengths. Signalized and unsignalized intersections were analyzed separately to report the delays associated with the specific intersection type. The purpose of this was to capture the delays created by signalized intersections that queue through adjacent unsignalized intersections. The signalized intersection delay reported is the average intersection delay for all movements. Unsignalized intersection delays were reported based on the worst movement of the minor street. For both node evaluations, a 2,500 foot “start of delay segment” parameter was used to capture the total delay due to extensive queues in certain locations. Intersection nodes are consistent between the No-Build and Build scenarios to account for unsignalized intersections that become signalized in the Build scenario. This ensures the same intersection areas are analyzed for all scenarios.

4.5 Duration of Congestion

Analysis was performed using 15 minute intervals for three hours surrounding the a.m. and p.m. peak hours of the 2030 Preferred Alternative. The purpose of the 15 minute analysis was to estimate the duration of congestion beyond the peak one hour. The trigger for performing this analysis was when a peak hour volume to capacity (v/c) was greater than 0.95. The v/c ratio, also referred to as degree of saturation, represents the sufficiency of an intersection to accommodate the vehicular demand. This provides an additional MOE to evaluate intersections.

Counts, provided by CDOT, were used to calculate the 15 minute interval volumes for each corresponding segment. Each 15 minute interval, contained in the peak hour, was converted to a percentage of the peak hour. For intervals outside the peak hour the 15 minute tube count volume was converted to a percentage of the peak hour volume. These percentages were then used to calculate the 15 minute interval volumes for each intersection using the balanced peak hour volumes.

The 15 minute interval volumes, derived from the peak hour volumes, were projected to hourly conditions by applying a peak hour factor (PHF) of 0.25. The existing tube count data along the corridor was used to calculate each 15 minute interval as a percentage of the peak hour volume. These percentages were then used to calculate the 15 minute interval volumes from the peak hour volumes. The 15 minute v/c ratios were inserted into worksheets, provided by CDOT, to calculate the incremental capacity of the intersections which had v/c ratios of 0.95 or greater. These worksheets illustrate the projected demand and capacity utilization at the intersection. Projected demand is defined as the v/c ratio, for a particular intersection, as a percentage of each 15 minute interval. The projected capacity utilization is the capacity of the intersection, with a maximum value of 100 percent. For intervals where the v/c ratio is greater than 100 percent (volume exceeds capacity), the overflow capacity is carried over to the next interval. The carry over continues until an interval is reached with a v/c percentage less than 100 percent. In cases where the v/c ratio could not be calculated, a value of 999 percent was used to represent the error value produced by the Synchro calculation. The results of the v/c analysis can be found in **Appendices D.3** and **E.3** for Segments 1 and 2 respectively.

4.6 Bicycle/Pedestrian Levels of Service

Levels of service were calculated for the bicycle and pedestrian facilities using the Bicycle/Pedestrian Levels of Service worksheets developed by CDOT. These worksheets evaluate the intersection geometry and signalization characteristics according to the comfort and safety of bicyclists and pedestrians at signalized intersections. The Pedestrian Level of Service worksheet specifically evaluates the crossing distance, left turn conflicts, right turn conflicts, pedestrian phasing, corner radius, right turns on red, crosswalk treatment and adjustments for one-way streets. These eight individual scores are evaluated for the crossing of each approach. The total for each approach is averaged to calculate the level of service of the intersection as a whole. The Bicycle Level of Service evaluates left turn conflicts, stop bar location, bicycle travel through the intersection, right turn conflicts, right turn on red conflicts and the intersection crossing distance. Similar to the Pedestrian level of service, the sum of the six individual scores are averaged to calculate the level of service.

4.7 Signal Timing

The existing signal timing along North Tryon Street/US-29 is not conducive for optimal transit and traffic operations with pre-emption. The analysis revealed that significant delays would be produced at traffic signals that operate with the existing cycle lengths. In order to improve the level of service and delay under the No-Build and Build scenarios, cycle lengths were increased to 150 seconds at intersections along and adjacent to North Tryon Street/US-29. Signal pre-emption, associated with the Build scenario, also required that left turn phases on North Tryon Street become protected in order to maintain safe left turn movements across the light rail alignment. Additionally, lead/lag phasing was employed for left turn movements at grade separated intersections with the light rail alignment and split side street phasing was utilized at intersections with light rail at-grade crossings. Lastly, green time adjustments were made throughout the network to maximize the number of processed vehicles through an intersection.

4.8 Park-and-Ride Traffic

4.8.1 Station Trip Generation

Trip generation was performed for light rail stations that have proposed park-and-ride lots. To calculate the trip generation for these stations it was assumed 50 percent of the capacity of the park-and-ride lot would be entering/exiting during the a.m./p.m. peak hour. This assumption is consistent with CDOT's findings at the Blue Line's I-485 station. The station trip generation and distribution exhibits are included in **Appendix C**.

4.8.2 Station Trip Distribution

Trips were distributed for each park-and-ride lot based on the projected trip production scatter-plots provided by CATS. From these scatter plots it was assumed that the majority of the generated trips would move in the peak direction and that less than 1/3 of the trips would back-track to access these stations.

5.0 Capacity Analysis Results

The capacity analysis results presented in this chapter are based on the currently proposed project, including the project changes illustrated in **Chapter 1.0: Introduction**. All intersection MOEs supersede the analysis results presented in the *Traffic Analysis Report (STV, 2009)*.

5.1 Segment 1

Segment 1 includes the intersections from Center City Charlotte north to Owen Boulevard along North Tryon Street/US-29. This segment also includes all intersections analyzed on Sugar Creek Road & Eastway Drive. The Preferred Alternative alignment would enter the North Tryon Street/US-29 median at Old Concord Road. The analysis results for this segment are included in **Appendix D**.

5.1.1 Unsignalized Intersections Measures of Effectiveness

In order to assess the effects of the proposed Preferred Alternative on individual unsignalized intersections within the corridor, a Synchro analysis and VISSIM simulations were performed. Synchro provided v/c ratio information for every unsignalized intersection, and LOS/delay results for unsignalized intersections outside the North Tryon Street/US-29 corridor. For unsignalized intersections along North Tryon Street/US-29, VISSIM results are provided to account for light rail interactions with vehicular traffic. The delays at unsignalized intersections are reported for the minor roadway approaches since they are stop controlled. It is assumed that delays on the major roadway approaches (i.e., North Tryon Street/US-29) are due to congestion at nearby signalized intersections, otherwise traffic is free flowing with little or no delay. The MOEs for the unsignalized intersections in Segment 1 can be found in **Table 5.1**.

Regarding LOS, the 2008 Existing Scenario shows that most unsignalized intersections in Segment 1 currently operate at LOS C, or better, during both the a.m. and p.m. peak period. The model indicates that the background traffic growth affects the majority of the unsignalized intersections from the Existing Scenario to the No-Build Scenario. Specifically, the increase in traffic by 2030 would cause most intersections to operate at LOS D, or better, during the a.m. peak hour. Conversely, delays during the p.m. peak hour continue to increase, causing most intersections to operate at LOS D, or worse by 2030. For the purposes of this study, two unsignalized intersections along North Tryon Street/US-29, Orr Road and Arrowhead Drive, are assumed to be signalized by the year 2030. Analysis results for these two intersections are discussed in **Section 5.1.2**. Craighead Road was assumed to be closed during the 2030 No-Build and Build Scenarios as part of the Charlotte Railroad Improvement and Safety Program (CRISP). Traffic on Craighead Road was redistributed to Sugar Creek Road and 36th Street.

Construction of the proposed project would improve the MOEs for a few unsignalized intersections along North Tryon Street/US-29 such as Austin Drive during the p.m. peak hour and Heathway Drive during the a.m. peak hour. The improvements in LOS and delay for these two intersections can be attributed to geometry restrictions (i.e. right-in/right-out access) resulting from the light rail running within the median of North Tryon Street/US-29. The level of service would remain the same as the 2030 No-Build for most other unsignalized intersections.

Traffic queues have the potential of extending over the light rail tracks given the proposed alignment south of Sugar Creek Road, particularly at 16th Street & Parkwood Avenue. Based on the 95th queue analysis provided by Synchro, traffic queues should not extend over the proposed light rail tracks.

It should also be noted that two park-and-ride lots would be situated in Segment 1 for the Sugar Creek Station, while the Old Concord Road Station would have one park-and-ride lot. For analysis purposes, the traffic analysis assumed: a connection between Raleigh Street and Greensboro Street through the Sugar Creek Station northern parking lot, left turns would be restricted from Sugar Creek Road onto westbound Raleigh Street and vice versa (for safety and operational reasons) and a driveway on Sugar Creek Road for the northern parking lot with turning restrictions for exiting traffic. These assumptions are subject to change based on the future Sugar Creek Grade Separation Project. The changes associated with the proposed project would improve the level of service for the two offset Raleigh Street intersections with Sugar Creek Road, but with limited access. The Old Concord Road Station would create two driveways on North Tryon Street/US-29 and Old Concord Road to access the parking facilities.

Table 5.1
Segment 1 Unsignalized Measures of Effectiveness

	2008 Existing						2030 No-Build						2030 Build (Preferred Alternative)					
	v/c ratio		delay (sec.)		LOS		v/c ratio		delay (sec.)		LOS		v/c ratio		delay (sec.)		LOS	
	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.
16th Street & Parkwood Avenue	0.40	0.38	23.5	17.2	C	C	0.52	0.50	41.9	25.9	E	D	0.52	0.50	41.9	25.9	E	D
Parkwood Avenue & Brevard Street	0.43	0.31	15.6	11.1	C	B	0.68	0.41	26.6	13.4	D	B	0.68	0.41	26.6	13.4	D	B
28th Street & Brevard Street	0.07	0.11	10.4	9.8	B	A	0.11	0.15	10.9	10.3	B	B	0.11	0.15	10.9	10.3	B	B
Craighead Road & Raleigh Street	0.19	0.21	12.3	11.7	B	B	0.02	0.03	8.4	8.4	A	A	0.03	0.03	8.4	8.4	A	A
N Davidson Street & Craighead Road	0.35	0.35	14.0	17.0	B	C	0.27	0.25	10.4	10.4	B	B	0.27	0.25	10.4	10.4	B	B
Sugar Creek Road & N Davidson Street	0.32	1.25	22.9	188.9	C	F	3.36	7.42	Error	Error	F	F	3.82	9.65	Error	Error	F	F
Sugar Creek Road & Raleigh Street (S)	0.31	0.43	17.7	18.4	C	C	0.51	0.56	47.2	78.3	E	F	0.45	0.58	10.8	12.2	B	B
Sugar Creek Road & Raleigh Street (N)	0.31	0.43	15.0	17.8	B	C	0.51	0.57	31.4	57.5	D	F	0.59	0.59	43.0	68.7	E	F
Sugar Creek Road & Sugar Creek Road Station Access	-	-	-	-	-	-	-	-	-	-	-	-	0.45	0.56	12.9	10.9	B	B
North Tryon Street/US-29 & Beechway Circle	0.41	0.36	5.5	9.3	A	A	0.53	0.47	6.6	84.1	A	F	0.53	0.47	5.4	100.5	A	F
North Tryon Street/US-29 & Wellingford Street	0.40	0.40	19.3	7.6	C	A	0.53	0.52	15.3	30.5	C	D	0.53	0.53	16.6	192.1	C	F
North Tryon Street/US-29 & Dorton Street	0.40	0.52	12.7	18.1	B	C	0.52	0.68	9.4	62.6	A	F	0.53	0.68	14.7	46.2	B	E
North Tryon Street/US-29 & Mellow Drive	0.40	0.71	8.6	7.0	A	A	0.52	0.92	15.4	58.9	C	F	0.52	0.93	13.5	39.9	B	E
North Tryon Street/US-29 & Bennett Street	0.53	0.76	17.7	16.1	C	C	1.41	0.99	190.4	55.9	F	F	1.44	1.00	24.1	57.7	C	F

SYNCHRO Results
VISSIM Results

Table 5.1 (continued)

Segment 1 Unsignalized Measures of Effectiveness

	2008 Existing						2030 No-Build						2030 Build (Preferred Alternative)					
	v/c ratio		delay (sec.)		LOS		v/c ratio		delay (sec.)		LOS		v/c ratio		delay (sec.)		LOS	
	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.
North Tryon Street/US-29 & Bingham Drive	0.41	0.78	14.1	30.7	B	D	0.53	1.01	32.0	76.5	D	F	0.54	1.02	19.4	179.7	C	F
North Tryon Street/US-29 & Lambeth Drive	0.69	0.77	16.2	17.1	C	C	0.90	1.00	51.4	65.4	F	F	0.90	1.12	27.3	187.6	D	F
Eastway Drive & Northpark Mall Entrance #1	0.27	0.34	10.6	10.4	B	B	0.36	0.44	11.3	10.7	B	B	0.36	0.44	11.7	11.2	B	B
Eastway Drive & Curtiswood Drive	0.37	0.46	12.2	15.8	B	C	0.48	0.60	15.0	27.1	B	D	0.48	0.60	15.2	28.6	C	D
North Tryon Street/US-29 & Northchase Drive	0.52	0.53	10.6	9.2	B	A	0.67	0.69	16.9	17.6	C	C	0.67	0.69	14.6	40.0	B	E
North Tryon Street/US-29 & Old Concord Station Access	-	-	-	-	-	-	-	-	-	-	-	-	0.58	0.71	0.0	7.6	A	A
Old Concord Road & Old Concord Road Station Access	-	-	-	-	-	-	-	-	-	-	-	-	0.54	0.59	8.9	38.6	A	E
North Tryon Street/US-29 & Orr Road	0.57	1.22	80.7	46.7	F	E	-	-	-	-	-	-	-	-	-	-	-	-
North Tryon Street/US-29 & Austin Drive	0.63	Error	17.4	27.4	C	D	0.72	0.91	50.3	78.3	F	F	0.73	0.92	29.7	16.0	D	C
North Tryon Street/US-29 & Arrowhead Drive	1.07	Error	21.5	49.5	C	E	-	-	-	-	-	-	-	-	-	-	-	-
North Tryon Street/US-29 & Heathway Drive	0.57	4.63	15.0	23.9	B	C	1.33	Error	18.4	42.6	C	E	0.75	0.88	7.8	55.6	A	F
North Tryon Street/US-29 & Owen Boulevard	0.40	4.57	7.4	10.3	A	B	0.82	167.29	9.0	39.1	A	E	-	-	-	-	-	-

SYNCHRO Results

VISSIM Results

5.1.2 Signalized Intersections Measures of Effectiveness

In order to assess the effects of the proposed Preferred Alternative on individual signalized intersections within the corridor, a Synchro analysis and VISSIM simulations were performed. VISSIM was used to evaluate the interaction between light rail and roadway traffic where light rail is proposed to run within or in proximity to North Tryon Street/US-29. Data extracted from VISSIM contains an analysis for a three car train scenario with ten minute headways. Where light rail runs within the NCRR/NS ROW, Synchro was used to measure traffic effects. While VISSIM delay and LOS results are reported only for the North Tryon Street/US-29 intersections, Synchro estimates of intersection capacity (reported as volume to capacity ratios) are provided for all intersections within the assessment area. The 2030 No-Build conditions show that most signalized intersections in this segment operate above LOS F with the exception of North Tryon Street/US-29 & Sugar Creek Road (a.m. and p.m. peak hours) and North Tryon Street/US-29 & Eastway Drive (p.m. peak hour). The 2030 Build Scenario produces similar results to the 2030 No-Build Scenario. The majority of the signalized intersections operate above LOS F, with the exception of North Tryon Street/US-29 & Sugar Creek Road (a.m. and p.m. peak hours) and North Tryon Street/US-29 & Eastway Drive (p.m. peak hour). A summary of the MOEs at individual signalized intersections based on the Synchro and VISSIM analyses are as follows:

<u>12th Street & College Street</u>

This signalized intersection currently operates at LOS B. The 2030 No-Build Scenario shows an increase to LOS A for the a.m. peak hour due to signal timing adjustments (cycle length changes) despite an increase in traffic volumes due to background growth. Signal timing adjustments were made to account for changes in demand volumes. No additional trips would be added to this intersection due to the construction of the proposed project; therefore the LOS would not change for the 2030 Build Scenarios. Additionally, there would be no change in the pedestrian and bicycle LOS. The probability of queues extending from this intersection to the proposed tracks is a potential impact that could result from the construction of the proposed project. However, based on the 95th queue analysis results, queuing should not extend back to the light rail tracks. The Synchro MOEs are shown in **Table 5.2**. The Synchro analysis can be found in **Appendix D.2**. Pedestrian and bicycle levels of service can be found in **Tables 5.13** and **5.14** at the end of this section.

Table 5.2
12th Street & College Street Measures of Effectiveness

	2008 Existing		**2030 No-Build**		**2030 Build (Preferred Alternative)**	
	a.m.	**p.m.**	**a.m.**	**p.m.**	**a.m.**	**p.m.**
v/c ratio *(SYNCHRO)*	0.09	0.18	0.12	0.22	0.13	0.22
LOS *(SYNCHRO)*	B	B	A	B	A	B
Delay (sec.) *(SYNCHRO)*	12.1	14.7	9.7	14.7	9.8	14.7

Note: v/c ratio and delay are based on the entire intersection for signalized intersections.

36th Street & North Davidson Street

This signalized intersection currently operates at LOS A for both period peaks. The 2030 No-Build Scenario maintains LOS A during the a.m. peak period, but decreases the p.m. peak period to LOS B, due to background growth and redistributed traffic associated with CRISP. Signal timing adjustments (cycle length changes) were made to mitigate the additional traffic volumes. The 2030 Build Scenario maintains LOS A and LOS B during the a.m. and p.m. peak periods, respectively. No additional trips would be added to this intersection due to construction of the proposed project. Additionally, there would be no change in the pedestrian and bicycle LOS. **Table 5.3** illustrates the Synchro MOEs for this intersection. The Synchro analysis can be found in **Appendix D.2**. Pedestrian and bicycle levels of service can be found in **Tables 5.13** and **5.14** at the end of this section.

Table 5.3
36th Street & North Davidson Street Measures of Effectiveness

	2008 Existing		2030 No-Build		2030 Build (Preferred Alternative)	
	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.
v/c ratio *(SYNCHRO)*	0.37	0.45	0.50	0.57	0.50	0.57
LOS *(SYNCHRO)*	A	A	A	B	A	B
Delay (sec.) *(SYNCHRO)*	8.4	8.4	8.8	11.1	8.8	11.1

Note: v/c ratio and delay are based on the entire intersection for signalized intersections.

Sugar Creek Road & Greensboro Street

This signalized intersection currently operates at LOS A. Traffic was added to this intersection during the 2030 No-Build Scenario to account for background growth and redistributed traffic associated with CRISP. The level of service is maintained through the 2030 No-Build Scenario due to signal timing adjustments (cycle length changes). Timing adjustments were made to account for changes in demand volumes. The p.m. peak hour would decrease to LOS B during the 2030 Build Scenario as a result of trips generated by the Sugar Creek Station. The Sugar Creek Park-and-Ride lots would have approximately 665 parking spaces under the Preferred Alternative. Further information related to the Sugar Creek Station can be found in **Appendix C.1**. The proposed project would create a connection between Raleigh Street and Greensboro Street, through the northern park-and-ride lot, giving direct access to the existing signal at the Greensboro Street & Sugar Creek Road intersection. Dual left turn lanes would be provided for the eastbound Greensboro Street approach to Sugar Creek Road to mitigate the effects of exiting station generated trips. **Table 5.4** presents the Synchro MOEs for this intersection. The Synchro analysis can be found in **Appendix D.2**. Pedestrian and bicycle levels of service can be found in **Tables 5.13** and **5.14** at the end of this section.

Table 5.4
Sugar Creek Road & Greensboro Street Measures of Effectiveness

	2008 Existing		2030 No-Build		2030 Build (Preferred Alternative)	
	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.
v/c ratio *(SYNCHRO)*	0.27	0.43	0.44	0.60	0.53	0.85
LOS *(SYNCHRO)*	A	A	A	A	A	B
Delay (sec.) *(SYNCHRO)*	3.7	7.9	3.9	9.9	5.5	17.7

Note: v/c ratio and delay are based on the entire intersection for signalized intersections.

North Tryon Street/US-29 & Sugar Creek Road

This signalized intersection currently operates at LOS F during the a.m. peak hour and LOS D during the p.m. peak hour. Background traffic growth and redistributed traffic associated with CRISP would maintain the a.m. peak hour at LOS F and decrease the p.m. peak hour to LOS F during the 2030 No-Build Scenario. The cycle length was changed from the 2008 Existing scenario to help mitigate the effects of traffic growth. The increased cycle length provides more green time to the southbound North Tryon Street/US-29 approach, which lowers the overall intersection delay. The 2030 Build Scenario would maintain LOS F during the a.m. and p.m. peak hours. Trips generated by the Sugar Creek Station in the 2030 Build Scenario would increase the delay at this intersection during the p.m. peak hour. The Sugar Creek Park-and-Ride lots would have approximately 665 parking spaces under the Preferred Alternative. Further information related to the Sugar Creek Station can be found in **Appendix C.1**. The intersection MOEs can be found in Table **5.5**. The VISSIM analysis can be found in **Appendix D.1**, while the Synchro analysis is presented in **Appendix D.2**. Pedestrian and bicycle levels of service can be found in **Tables 5.13** and **5.14** at the end of this section.

The analysis also examined the duration of congestion for this intersection due to the v/c ratios exceeding 0.95. This analysis spanned a three hour period surrounding the peak hours. The intersection would operate over capacity for 1.00 hours during the a.m. peak period and for 0.25 hours during the p.m. peak period of the 2030 No-Build Scenario. Furthermore, the intersection would take approximately 0.50 hours and 0.25 hours to recover during the a.m. and p.m. peak periods, respectively. During the 2030 Build Scenario of the Preferred Alternative, the intersection would operate over capacity for 1.5 hours during the a.m. peak period and for 0.25 hours during the p.m. peak periods. The recovery time for the a.m. peak period would start approximately 0.75 hours after the intersection reached capacity and would extend past the end of the analysis period. The recovery time for the p.m. peak period would be approximately 0.25 hours. The duration of congestion analysis for this intersection can be found in **Appendix D.3**.

Table 5.5
North Tryon Street/US-29 & Sugar Creek Road Measures of Effectiveness

	2008 Existing		2030 No-Build		2030 Build (Preferred Alternative)	
	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.
v/c ratio *(SYNCHRO)*	0.80	0.77	1.02	0.93	1.06	0.97
LOS *(VISSIM)*	F	D	F	F	F	F
Delay (sec.) *(VISSIM)*	84.2	42.9	132.9	105.9	117.8	142.3

Note: v/c ratio is based on the entire intersection for signalized intersections.

North Tryon Street/US-29 & Eastway Drive

This signalized intersection currently operates at LOS B during the a.m. peak hour and LOS C during the p.m. peak hour. The additional background traffic growth during the 2030 No-Build Scenario would degrade the level of service to LOS C and LOS F during the a.m. and p.m. peak hours, respectively. Trips generated by the Old Concord Road Station would slightly increase the volume demand during the 2030 Build Scenario; however, due to traffic metering from the North Tryon Street/US-29 & Sugar Creek Road intersection, the level of service maintains LOS C and LOS F during the a.m. and p.m. peak hours, respectively. Traffic metering also takes place in the 2030 No-Build Scenario, but not as severely as in the 2030 Build Scenario. The congestion in the northbound direction limits the amount of traffic that can pass through the intersection and therefore processes less volume than the demand dictates. This causes an improvement in the level of service during the a.m. peak period despite increased traffic from the Old Concord Road Station. The Old Concord Road Park-and-Ride would have approximately 330 parking spaces under the Preferred Alternative. Further information related to the Old Concord Road Station can be found in **Appendix C.2**. **Table 5.6** illustrates the intersection MOEs. The VISSIM analysis can be found in **Appendix D.1**, while the Synchro analysis is presented in **Appendix D.2**.

The existing pedestrian and bicycle level of service is LOS F. The pedestrian level of service improves in the 2030 No-Build and Build Scenarios due to the addition of pedestrian signals at the intersection. Pedestrian and bicycle levels of service can be found in **Tables 5.13** and **5.14** at the end of this section.

The analysis also examined the duration of congestion for this intersection due to the v/c ratios exceeding 0.95. This analysis spanned a three hour period surrounding the peak hours. During the 2030 No-Build Scenario, the intersection would operate under capacity during the a.m. peak hours and would operate over capacity for the entire three hour period of the 2030 No-Build p.m. peak scenario. The p.m. peak period recovery time is uncertain due to the timeframe of the analysis. The 2030 Build Scenario would operate over capacity for 0.25 hours during the a.m. peak period and for the entire three hour period during the p.m. peak period. The a.m. peak would take approximately 0.25 hours to recover; however, the p.m. period recovery time is unknown due to the timeframe of the analysis. The duration of congestion analysis for this intersection can be found in **Appendix D.3**.

Table 5.6
North Tryon Street/US-29 & Eastway Drive Measures of Effectiveness

	2008 Existing		2030 No-Build		2030 Build (Preferred Alternative)	
	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.
v/c ratio *(SYNCHRO)*	0.74	0.94	0.90	1.19	0.93	1.19
LOS *(VISSIM)*	B	C	C	F	C	F
Delay (sec.) *(VISSIM)*	19.8	26.2	32.7	96.2	25.9	109.6

Note: v/c ratio is based on the entire intersection for signalized intersections.

Eastway Drive & Northpark Mall Driveway #2

This signalized intersection currently operates at LOS A during both peak hours. The background traffic growth associated with the 2030 No-Build Scenario would not affect the level of service at this intersection. The proposed project, during the 2030 Build Scenario, would remain LOS A during both peak periods. Trips generated by the Old Concord Road Station would have a slight impact on delay during the 2030 Build Scenario. The existing signal does not include pedestrian phases. It was assumed that pedestrian phases would be installed at this intersection by 2030. The pedestrian phases would improve the pedestrian level of service for the 2030 No-Build Scenario. **Table 5.7** illustrates the intersection MOEs. The Synchro analysis is presented in **Appendix D.2**. Pedestrian and bicycle levels of service can be found in **Tables 5.13** and **5.14** at the end of this section.

Table 5.7
Eastway Drive & Northpark Mall Driveway #2 Measures of Effectiveness

	2008 Existing		2030 No-Build		2030 Build (Preferred Alternative)	
	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.
v/c ratio *(SYNCHRO)*	0.32	0.38	0.42	0.50	0.42	0.49
LOS *(SYNCHRO)*	A	A	A	A	A	A
Delay (sec.) *(SYNCHRO)*	2.4	5.3	3.3	7.4	2.8	7.6

Note: v/c ratio and delay are based on the entire intersection for signalized intersections.

North Tryon Street/US-29 & Old Concord Road

This signalized intersection currently operates at LOS E during the a.m. peak hour and LOS C during the p.m. peak hour. Traffic growth associated with the 2030 No-Build Scenario would have little effect on the delay and would maintain the a.m. and p.m. peak hours at LOS E and LOS C, respectively. These results are mainly due to signal timing adjustments (cycle length changes). Old Concord Road would be realigned in the 2030 Build Scenario; removing the free flowing northbound North Tryon Street/US-29 right turn lane and providing dual westbound left turn lanes on Old Concord Road with 350 feet of storage on each lane. The Preferred Alternative would be grade-separated over northbound North Tryon Street/US-29 as it enters the median just north of the intersection.

Minor impacts to the level of service would occur at this intersection due to the proposed project. The a.m. peak hour would maintain LOS E and the p.m. peak hour would decrease to LOS D. The decrease in the levels of service would be due to the redistributed traffic from the North Tryon Street/US-29 & Orr Road intersection and additional traffic volume from the Old Concord Road Station. Traffic was redistributed due to the proposed signal at North Tryon Street/US-29 & Orr Road, which will attract motorists that do not use this route today. Signal timing adjustments were made to the intersection, which include cycle length changes and modifications to the northbound and southbound North Tryon Street/US-29 left turn phases (permitted phasing to protected phasing). This would add phases to the signal timing; therefore, reducing the amount of green time to the other phases since the cycle length would remain the same. Additional volume would also be added to this intersection due to the trips generated by the Old Concord Road Station. The Old Concord Road Park-and-Ride would have approximately 330 parking spaces under the Preferred Alternative. Further information related to the Old Concord Road Station can be found in **Appendix C.2**. The intersection MOEs are illustrated in **Table 5.8**. The VISSIM analysis can be found in **Appendix D.1**, while the Synchro analysis is presented in **Appendix D.2**. The pedestrian and bicycle levels of service improve in the 2030 Build Scenarios due to the addition of protected left turn phases and bike lanes. Pedestrian and bicycle levels of service can be found in **Tables 5.13** and **5.14** at the end of this section.

The analysis also examined the duration of congestion for this intersection due to the v/c ratios exceeding 0.95. This analysis spanned a three hour period surrounding the peak hours. The intersection would operate over capacity for 0.75 hours during the a.m. peak period, but would not exceed capacity during the p.m. peak period of the 2030 No-Build Scenario. The recovery time for the a.m. peak period would be approximately 0.50 hours. During the 2030 Build Scenario, the intersection would operate over capacity for 0.25 hours during the a.m. and p.m. peak periods. The a.m. peak timeframe is shorter in the Build than in the No-Build Scenario due to changes in traffic distribution from the No-Build Scenario to the Build Scenario. Both the a.m. and p.m. peaks would take approximately 0.25 hours to recover. The duration of congestion analysis for this intersection can be found in **Appendix D.3**.

Table 5.8
North Tryon Street/US-29 & Old Concord Road Measures of Effectiveness

	2008 Existing		2030 No-Build		2030 Build (Preferred Alternative)	
	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.
v/c ratio *(SYNCHRO)*	0.79	0.67	1.01	0.86	0.96	0.96
LOS *(VISSIM)*	E	C	E	C	E	D
Delay (sec.) *(VISSIM)*	58.3	22.2	56.2	23.4	61.8	36.4

Note: v/c ratio is based on the entire intersection for signalized intersections.

North Tryon Street/US-29 & Orr Road

This unsignalized intersection currently operates at LOS F during the a.m. peak hour and LOS E during the p.m. peak hour. Orr Road is particularly important to the corridor's limited street network and was assumed to be signalized at some point in the future with or without the proposed light rail project. As a result, the 2030 No-Build Scenario analyzes the intersection with a signal, which provides LOS E during the a.m. peak hour and LOS C during the p.m. peak hour. The 2030 Build Scenario would add traffic to this intersection as a result of trips generated by the Old Concord Road Park-and-Ride, which would have approximately 330 parking spaces. Further information related to the Old Concord Road Station can be found in **Appendix C.2**. A fourth leg would be added to the intersection under the 2030 Build Scenario. The additional eastbound Orr Road approach intends to restore connectivity for residents on the west side of North Tryon Street/US-29 that would be lost due to the proposed turning restrictions at Austin Drive. The proposed project would remain LOS E and LOS C during the a.m. and p.m. peak periods, respectively. Redistributed traffic from the Old Concord Road & Orr Road intersection, along with the additional traffic generated by the Old Concord Road Station are the likely causes for the increase in delay during the a.m. peak period. This full movement intersection would allow U-turns for the adjacent unsignalized intersections and driveways that would be restricted to right-in/right-out due to the construction of the proposed project in the median of North Tryon Street/US-29. **Table 5.9** depicts the intersection MOEs. The VISSIM analysis can be found in **Appendix D.1**, while the Synchro analysis is presented in **Appendix D.2**. Pedestrian and bicycle levels of service can be found in **Tables 5.13** and **5.14** at the end of this section.

The proposed traffic signal would be approximately 1,540 feet north of the existing traffic signal at North Tryon Street/US-29 & Old Concord Road. The North Tryon Street/US-29 & Arrowhead Drive traffic signal is approximately 1,840 feet north of Orr Road along North Tryon Street/US-29.

The analysis also examined the duration of congestion for this intersection due to the v/c ratios exceeding 0.95. This analysis spanned a three hour period surrounding the peak hours. The intersection would operate under capacity during the a.m. peak period of the 2030 No-Build Scenario, but would operate over capacity for 0.25 hours during the p.m. peak period. The recovery time for the p.m. peak period would be approximately 0.25 hours. The 2030 Build Scenario would operate over capacity for 0.25 hours for p.m. peak period. The recovery time for both the p.m. peak period would be approximately 0.25 hours. The duration of congestion analysis for this intersection can be found in **Appendix D.3**.

Table 5.9
North Tryon Street/US-29 & Orr Road Measures of Effectiveness

	2008 Existing*		**2030 No-Build**		**2030 Build (Preferred Alternative)**	
	a.m.	**p.m.**	**a.m.**	**p.m.**	**a.m.**	**p.m.**
v/c ratio *(SYNCHRO)*	0.57	1.22	0.68	0.97	0.92	0.96
LOS *(VISSIM)*	F	E	E	C	E	C
Delay (sec.) *(VISSIM)*	80.7	46.7	55.6	27.0	68.1	25.3

Note: v/c ratio is based on the entire intersection for signalized intersections.
*Note: Intersection unsignalized

Old Concord Road & Orr Road

This signalized intersection currently operates at LOS C during the a.m. peak hour and LOS D during the p.m. peak hour. The 2030 No-Build traffic growth would decrease the a.m. peak hour level of service to LOS E, but would remain LOS D during the p.m. peak hour. Timing adjustments (cycle length changes) would be made to account for changes in demand volumes. The 2030 Build Scenario improves the level of service during the a.m. and p.m. peak hours to LOS D and LOS C, respectively. Additional volume would also be added to this intersection due to the trips generated by the Old Concord Road Station. The Old Concord Road Park-and-Ride would have approximately 330 parking spaces under the Preferred Alternative. Further information related to the Old Concord Road Station can be found in **Appendix C.2**. The 2030 Build Scenario decreases the delay over the 2030 No-Build Scenario due to the redistribution of the westbound through traffic to North Tryon Street/US-29 & Orr. Traffic was redistributed due to the new signal at North Tryon Street/US-29 & Orr Road. **Table 5.10** illustrates the Synchro MOEs for this intersection. The Synchro analysis can be found in **Appendix D.2**. Pedestrian and bicycle levels of service can be found in **Tables 5.13** and **5.14** at the end of this section.

Table 5.10
Old Concord Road & Orr Road Measures of Effectiveness

	2008 Existing		**2030 No-Build**		**2030 Build (Preferred Alternative)**	
	a.m.	**p.m.**	**a.m.**	**p.m.**	**a.m.**	**p.m.**
v/c ratio *(SYNCHRO)*	0.66	0.46	0.90	0.65	0.90	0.71
LOS *(SYNCHRO)*	C	D	E	D	D	C
Delay (sec.) *(SYNCHRO)*	30.4	37.1	62.0	37.5	46.0	29.5

Note: v/c ratio and delay are based on the entire intersection for signalized intersections.

North Tryon Street/US-29 & Arrowhead Drive

Currently this unsignalized intersection operates at LOS C during the a.m. peak hour and LOS E during the p.m. peak hour. Based on the accident history and planned connections to a residential development, business park and Old Concord Road, this intersection was assumed to be signalized in the 2030 No-Build and Build Scenarios. The 2030 No-Build Scenario provides LOS C during the a.m. peak hour and LOS B during the p.m. peak hour. The proposed configuration includes exclusive left turn lanes. The 2030 Build Scenario would add traffic to this intersection due to trips generated by the Old Concord Road Station. The Old Concord Road Park-and-Ride would have approximately 330 parking spaces under the Preferred Alternative. Further information related to the Old Concord Road Station can be found in **Appendix C.2**. The proposed project would decrease the a.m. peak hour to LOS D and the p.m. peak hour to LOS C. Similar to North Tryon Street/US-29 & Orr Road; this full movement intersection would allow U-turns for the adjacent unsignalized intersections and driveways that would be restricted to right-in/right-out due to the construction of the proposed project. The intersection MOEs can be found in **Table 5.11**. The VISSIM analysis can be found in **Appendix D.1**, while the Synchro analysis is presented in **Appendix D.2**. Pedestrian and bicycle levels of service can be found in **Tables 5.13** and **5.14** at the end of this section.

The proposed traffic signal would be approximately 1,840 feet north of the proposed traffic signal at North Tryon Street/US-29 & Orr Road. The North Tryon Street/US-29 & Owen Boulevard traffic signal is approximately 1,450 feet north of Arrowhead Road along North Tryon Street/US-29.

The duration of congestion analysis shows that both the No-Build and Build Scenarios operate under capacity during the a.m. and p.m. peak periods. The duration of congestion analysis for this intersection can be found in **Appendix D.3**.

Table 5.11
North Tryon Street/US-29 & Arrowhead Drive Measures of Effectiveness

	2008 Existing*		2030 No-Build		2030 Build (Preferred Alternative)	
	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.
v/c ratio *(SYNCHRO)*	1.07	Error	0.65	0.77	0.71	0.80
LOS *(VISSIM)*	C	E	C	B	D	C
Delay (sec.) *(VISSIM)*	21.5	49.5	23.9	17.6	41.8	24.1

Note: v/c ratio is based on the entire intersection for signalized intersections.
*Note: Intersection unsignalized

North Tryon Street/US-29 & Owen Boulevard

Currently this unsignalized intersection operates at LOS A during the a.m. peak hour and LOS B during the p.m. peak hour. Background traffic growth associated with the 2030 No-Build Scenario maintains LOS A during the a.m. peak hour and decreases the p.m. peak hour to LOS E. The 2030 Build Scenario proposes a traffic signal at this intersection and would provide LOS C and LOS B during the a.m. and p.m. peak hours, respectively. The purpose of the proposed traffic signal is to provide more access points between signalized intersections and to help reduce some of the traffic demand at those intersections. Furthermore, this signalized intersection is intended to maintain pedestrian connectivity across North Tryon Street/US-29. This full movement intersection would allow U-turns for the adjacent unsignalized intersections and driveways that would be restricted to right-in/right-out due to the construction of the proposed project in the median of North Tryon Street/US-29. **Table 5.12** illustrates the intersection MOEs. The VISSIM analysis can be found in **Appendix D.1**, while the Synchro analysis is presented in **Appendix D.2**. Pedestrian and bicycle levels of service can be found in **Tables 5.13** and **5.14** at the end of this section.

The proposed traffic signal would be approximately 1,450 feet north of the proposed traffic signal at North Tryon Street/US-29 & Arrowhead Drive. The North Tryon Street/US-29 & Tom Hunter Road traffic signal is approximately 1,250 feet north of Owen Boulevard along North Tryon Street/US-29.

The duration of congestion analysis shows that the Build Scenario operates under capacity during the a.m. and p.m. peak periods. The duration of congestion analysis for this intersection can be found in **Appendix D.3**.

Table 5.12
North Tryon Street/US-29 & Owen Boulevard Measures of Effectiveness

	2008 Existing*		2030 No-Build*		2030 Build (Preferred Alternative)	
	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.
v/c ratio *(SYNCHRO)*	0.40	4.57	0.82	167.29	0.66	0.81
LOS *(VISSIM)*	A	B	A	E	C	B
Delay (sec.) *(VISSIM)*	7.4	10.3	9.0	39.1	27.7	11.3

Note: v/c ratio is based on the entire intersection for signalized intersections.
*Note: Intersection unsignalized

5.1.3 Pedestrian and Bicycle Measures of Effectiveness

Levels of service were calculated for the bicycle and pedestrian facilities using the Bicycle/Pedestrian Levels of Service worksheets developed by CDOT. These worksheets evaluate the intersection geometry and signalization characteristics according to the comfort and safety of bicyclists and pedestrians at signalized intersections. **Tables 5.13** and **5.14** illustrate the pedestrian and bicycle levels of service for the signalized intersections in Segment 1.

Table 5.13
Segment 1 Pedestrian Level of Service

Intersection	2008 Existing	2030 No-Build	2030 Build (Preferred Alternative)
12th Street & College Street	B+	B+	B+
36th Street & North Davidson	B	B	B
Sugar Creek Road & North Davidson Street	-	-	C-
Sugar Creek Road & Greensboro Street	C	C	C+
North Tryon Street/US-29 & Sugar Creek Road	E+	E+	E+
North Tryon Street/US-29 & Eastway Drive	F	E	E
Eastway Drive & Northpark Mall Driveway #2	D	C	C
North Tryon Street/US-29 & Old Concord Road	E	D	D+
Old Concord Road & Orr Road	C	B-	B-
North Tryon Street/US-29 & Orr Road	-	C	B-
North Tryon Street/US-29 & Arrowhead Road	-	C	C
North Tryon Street/US-29 & Owen Boulevard	-	-	C+

Table 5.14
Segment 1 Bicycle Level of Service

Intersection	2008 Existing	2030 No-Build	2030 Build (Preferred Alternative)
12th Street & College Street	D	D	D
36th Street & North Davidson	C	C	C
Sugar Creek Road & North Davidson Street	-	-	E
Sugar Creek Road & Greensboro Street	D-	D-	E
North Tryon Street/US-29 & Sugar Creek Road	F	F	E
Eastway Drive & Northpark Mall Driveway #2	F	F	E
North Tryon Street/US-29 & Eastway Drive	F	F	F
North Tryon Street/US-29 & Old Concord Road	F	F	B
Old Concord Road & Orr Road	E	E	E
North Tryon Street/US-29 & Orr Road	-	C	B
North Tryon Street/US-29 & Arrowhead Road	-	C	C
North Tryon Street/US-29 & Owen Boulevard	-	-	B

5.2 Segment 2

Segment 2 begins with Tom Hunter Road and runs along North Tryon Street/US-29 through Mallard Creek Church Road. This segment also includes the JW Clay Boulevard and Olmsted Drive intersection. In Segment 2, the light rail alignment is proposed in the North Tryon Street/US-29 median from Tom Hunter Road to just north of the UNCC Research Drive intersection and exits the median through a grade separated underpass. The analysis results for this segment are included in **Appendix E**.

5.2.1 Unsignalized Intersections Measures of Effectiveness

In order to assess the effects of the proposed Preferred Alternative on individual unsignalized intersections within the corridor, a Synchro analysis and VISSIM simulations were performed. Synchro provided v/c ratio information for every unsignalized intersection, and LOS/delay results for unsignalized intersections outside the North Tryon Street/US-29 corridor. For unsignalized intersections along North Tryon Street/US-29, VISSIM results are provided to account for light rail interactions with vehicular traffic. The delays at unsignalized intersections are reported for the minor roadway approaches since they are stop controlled. It is assumed that delays on the major roadway approaches (i.e., North Tryon Street/US-29) are due to congestion at nearby signalized intersections, otherwise traffic is free flowing with little or no delay. The MOEs for the unsignalized intersections in Segment 2 can be found in **Table 5.15**.

During the 2008 Existing Scenario, the majority of the unsignalized intersections along North Tryon Street/US-29 in Segment 2 operate at or above LOS C during the a.m. peak hour, with the exception of Mineral Springs Road (LOS F). During the p.m. peak hour of the 2008 Existing scenario, most intersections along North Tryon Street/US-29 operate at LOS D or better, with the exception of Mineral Springs Road (LOS F) and I-85 Connector/Sandy Avenue (LOS F). These intersections are situated within the “Weave Area” and will be modified as part of the US-29/NC-49 Improvement Project.

Background traffic growth associated with the 2030 No-Build Scenario will affect the majority of the unsignalized intersections in Segment 2. Despite decreases in the level of service at most of the unsignalized intersections, the majority of the intersections will still operate at LOS D or above. Intersections that will experience significant reductions in level of service include, Gloryland Avenue, Orchard Trace Lane, Kemp Street, Stetson Drive and Brookside Lane. Construction of the “Weave Area” project will reconfigure a large number of the unsignalized intersections from a design and operational standpoint.

Construction of the proposed project would signalize two currently unsignalized intersections in Segment 2; North Tryon Street/US-29 & Orchard Trace Lane and JW Clay Boulevard & Olmsted Drive. All of the unsignalized intersections operate at LOS C or better during the a.m. peak hour of the 2030 Build Scenario in Segment 2. For the most part, the proposed project would maintain or improve the level of service at the unsignalized intersections along North Tryon Street/US-29 during the p.m. peak hour of the 2030 Build Scenario, with the exception of Kemp Street, Clark Boulevard, Hampton Church Road and Grove Lake Drive. The unsignalized intersections that produce substantial declines in levels of service, such as Kemp Street (LOS F), Clark Boulevard (LOS E) and Hampton Church Road (LOS F) are adjacent to congested signalized intersection that produce long queues during the 2030 Build Scenario. Despite the right-in/right-out configuration of the unsignalized intersections, the long queues generated by the signalized intersection do not provide sufficient gaps for the side street traffic to enter North Tryon Street/US-29. Unsignalized intersections produce improved level of service results during the 2030 Build Scenario because of the turn restrictions imposed by the proposed project.

Table 5.15
Segment 2 Unsignalized Measures of Effectiveness

	2008 Existing						2030 No-Build						2030 Build (Preferred Alternative)					
	v/c ratio		delay (sec.)		LOS		v/c ratio		delay (sec.)		LOS		v/c ratio		delay (sec.)		LOS	
	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.
North Tryon Street/US-29 & Gloryland Avenue	0.45	0.61	1.4	9.1	A	A	0.57	0.76	0.0	719.2	A	F	0.76	0.76	0.0	72.6	A	F
North Tryon Street/US-29 & Orchard Trace Lane	0.60	0.98	14.3	21.1	B	C	6.36	Error	24.9	128.0	C	F	-	-	-	-	-	-
North Tryon Street/US-29 & Mineral Springs Road	1.11	1.01	68.2	61.9	F	F	-	-	-	-	-	-	-	-	-	-	-	-
North Tryon Street/US-29 & Kemp Street	0.29	1.03	10.0	29.1	B	D	0.58	0.76	30.0	45.1	D	E	0.58	0.53	18.7	273.9	C	F
North Tryon Street/US-29 & I-85 Connector/ Sandy Avenue	0.32	0.61	7.1	57.1	A	F	-	-	-	-	-	-	-	-	-	-	-	-
North Tryon Street/US-29 & I-85 Service Road	0.62	1.04	0.0	11.9	A	B	0.68	0.96	0.0	17.1	A	C	0.55	0.64	0.0	5.0	A	A
North Tryon Street/US-29 & Stetson Drive	5.33	5.14	7.2	28.0	A	D	1.49	2.43	39.5	24.2	E	C	0.63	0.73	7.9	7.3	A	A
North Tryon Street/US-29 & Rocky River Road	0.63	0.98	6.7	10.0	A	B	0.71	0.96	15.8	15.2	C	C	0.53	0.86	8.1	12.9	A	B
North Tryon Street/US-29 & University City Boulevard	0.27	0.38	109.8	10.8	F	B	-	-	-	-	-	-	-	-	-	-	-	-
North Tryon Street/US-29 & Brookside Lane	0.50	0.55	7.4	4.4	A	A	0.49	0.79	24.5	52.2	C	F	0.45	0.85	0.0	7.1	A	A

SYNCHRO Results
VISSIM Results

Table 5.15 (continued)
Segment 2 Unsignalized Measures of Effectiveness

	2008 Existing						2030 No-Build						2030 Build (Preferred Alternative)					
	v/c ratio		delay (sec.)		LOS		v/c ratio		delay (sec.)		LOS		v/c ratio		delay (sec.)		LOS	
	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.
North Tryon Street/US-29 & Shopping Center Drive	0.37	18.12	0.6	1.7	A	A	-	-	-	-	-	-	-	-	-	-	-	-
North Tryon Street/US-29 & Clark Boulevard	0.51	0.83	18.5	11.7	C	B	0.66	1.06	15.5	16.9	C	C	0.74	0.79	8.1	16.8	A	C
North Tryon Street/US-29 & Hampton Church Road	0.39	0.53	1.8	10.5	A	B	0.51	0.80	12.0	15.4	B	C	0.55	0.79	7.4	1412.7	A	F
JW Clay Boulevard & Olmsted Drive	0.15	0.39	9.4	31.3	A	D	0.22	1.00	10.3	47.5	B	D	-	-	-	-	-	-
North Tryon Street/US-29 & Grove Lake Drive	0.53	0.59	7.8	9.3	A	A	0.69	0.79	8.5	11.6	A	B	0.69	0.79	6.2	16.5	A	C
North Tryon Street/US-29 & Barton Creek Drive	0.51	0.63	4.4	7.6	A	A	1.89	3.25	11.0	8.9	B	A	2.83	4.26	8.8	0.0	A	A

(white)	SYNCHRO Results
(blue)	VISSIM Results

5.2.2 Signalized Intersections Measures of Effectiveness

In order to assess the effects of the proposed Preferred Alternative on individual signalized intersections within the corridor, a Synchro analysis and VISSIM simulations were performed. VISSIM was used to evaluate the interaction between light rail and roadway traffic where light rail is proposed to run within or in proximity to North Tryon Street/US-29. Data extracted from VISSIM contains an analysis for a three car train scenario with ten minute headways. The VISSIM analysis also analyzed traffic operations in this segment with split phasing on the North Tryon Street/US-29 side streets at McCullough Drive, Ken Hoffman Drive, JM Keynes Drive, JW Clay Blvd. and UNC Research Drive. Lead/lag phasing was used for the side streets at the I-85 Connector, University City Boulevard, and WT Harris Boulevard. Synchro estimates of intersection capacity (reported as volume to capacity ratios) are provided for all intersections within the assessment area.

The 2008 Existing Scenario indicates that all of the signalized intersections along North Tryon Street/US-29 in Segment 2 function at or above LOS D during the a.m. peak hour. The majority of the signalized intersections along North Tryon Street/US-29 operate at LOS D or above during the p.m. peak hour of the 2008 Existing Scenario, with the exception of Mallard Creek Church Road (LOS F).

Two intersections become signalized in the 2030 No-Build Scenario in Segment 2 as part of the “Weave Area” project; I-85 Connector and University City Boulevard. The 2030 No-Build Scenario shows that most signalized intersections in this segment operate at LOS D or above during the a.m. peak hour, with the exception of University City Boulevard (LOS F) and Mallard Creek Church Road (LOS E). The p.m. peak hour of the 2030 No-Build Scenario shows considerable congestion in Segment 2, as a result of background traffic growth. Approximately half of the signalized intersections would operate at LOS D or better.

Construction of the proposed Preferred Alternative would signalize two additional intersections along North Tryon Street/US 29 in Segment 2; Orchard Trace Lane and the University City Blvd. Station Access. The light rail project would also provide additional capacity along North Tryon Street/US-29 between Orchard Trace Lane and Shopping Center Drive by adding a northbound and southbound through lane. Similar to the 2030 No-Build Scenario, the majority of the signalized intersections operate at LOS D or better during the a.m. peak hour of the 2030 Build Scenario, with the exception of University City Boulevard (LOS F), W.T. Harris Boulevard (LOS E) and Mallard Creek Church Road (LOS E). The p.m. peak hour level of service during the 2030 Build Scenario shows substantial congestion, with all signalized intersections operating at LOS F. One component of the poor level of service can be attributed to the signal phasing adjustments that were required as part of the LYNX BLE. Due to the compact intersection footprint, most at-grade intersections required split phase signalization of the side streets. Furthermore, signal operations were modified to prevent side street phases from being skipped after pre-emption of the light rail. These signal operation changes dramatically affect traffic operations along North Tryon Street/US-29 but are essential to maintain safety and balance delay between the side streets and the North Tryon Street/US-29 corridor. Additionally, project related access changes along North Tryon Street/US-29 further contribute to the increases in delay. As stated earlier, cycle lengths were increased at the signalized intersections to help mitigate the effects of the increased traffic volumes.

North Tryon Street/US-29 & Tom Hunter Road

Currently this signalized intersection operates at LOS B during the a.m. peak hour and LOS C during the p.m. peak hour. The background traffic growth associated with the 2030 No-Build Scenario would increase delay at this intersection, degrading the p.m. peak hour to LOS F. The a.m. peak hour would remain LOS B. During the 2030 Build Scenario, the a.m. peak hour would degrade to LOS C; while the p.m. peak hour would remain LOS F. The Tom Hunter Station would be located in the median of North Tryon Street/US-29, just north of the intersection. The station would operate as a neighborhood station with no parking spaces; however, this intersection would be slightly impacted from trips generated by the University City Blvd. Station. The University City Blvd. Park-and-Ride would have approximately 1,485 parking spaces under the Preferred Alternative. Further information related to the University City Blvd. Station can be found in **Appendix C.3**. The intersection MOEs are presented in **Table 5.16**. The VISSIM analysis can be found in **Appendix E.1**, while the Synchro analysis is presented in **Appendix E.2**.

Pedestrian signal phases are planned to be installed prior to construction of the proposed project, which improves the pedestrian level of service during the 2030 No-Build Scenario. Pedestrian refuges in the median of North Tryon Street/US-29 and bike lanes, as part of the 2030 Build Scenario, would also improve the pedestrian and bicycle level of service at this intersection. Pedestrian and bicycle levels of service can be found in **Tables 5.30** and **5.31** at the end of this section.

The analysis also examined the duration of congestion for this intersection due to the v/c ratios exceeding 0.95. This analysis spanned a three hour period surrounding the peak hours. The intersection would operate under capacity in the 2030 No-Build Scenario during the a.m. and p.m. peak periods. During the 2030 Build Scenario, the intersection would operate over capacity for 0.25 hours during the a.m. peak period and under capacity during the p.m. peak period. The a.m. peak period would take approximately 0.25 hours to recover. The duration of congestion analysis for this intersection can be found in **Appendix E.3**.

Table 5.16
North Tryon Street/US-29 & Tom Hunter Road Measures of Effectiveness

	2008 Existing		**2030 No-Build**		**2030 Build (Preferred Alternative)**	
	a.m.	**p.m.**	**a.m.**	**p.m.**	**a.m.**	**p.m.**
v/c ratio *(SYNCHRO)*	0.67	0.76	0.82	0.94	0.87	0.95
LOS *(VISSIM)*	B	C	B	F	C	F
Delay (sec.) *(VISSIM)*	16.4	27.4	19.1	135.7	29.2	145.7

Note: v/c ratio is based on the entire intersection for signalized intersections.

North Tryon Street/US-29 & Orchard Trace Lane

Currently this unsignalized intersection operates at LOS B during the a.m. peak hour and LOS C during the p.m. peak hour. The a.m. and p.m. peak hour levels of service would decrease in the 2030 No-Build Scenario to LOS C and LOS F, respectively. The construction of the Preferred Alternative proposes a traffic signal at this intersection. The 2030 Build Scenario also proposes a third northbound travel lane immediately north of this intersection, as part of the additional capacity provided for the "Weave Area." The signalized intersection would produce LOS B during the a.m. peak hour and LOS F during the p.m. peak hour. The poor level of service during the p.m. peak hour is due to backups from the North Tryon Street/US-29 & I-85 Connector intersection. This intersection would be slightly impacted from trips generated by the University City Blvd. Station. The University City Blvd. Park-and-Ride would have approximately 1,485 parking spaces under the Preferred Alternative. Further information related to the University City Blvd. Station can be found in **Appendix C.3**. The full access intersection at Orchard Trace Lane would allow U-turns for the adjacent unsignalized intersections and driveways that would be restricted to right-in/right-outs due to the construction of the proposed project in the median of North Tryon Street/US-29. Signalization of this intersection would also help restore access for Mineral Springs Road to North Tryon Street/US-29, which will be severed when the "Weave Area" project is constructed. **Table 5.17** illustrates the intersection MOEs. The VISSIM analysis can be found in **Appendix E.1**, while the Synchro analysis is presented in **Appendix E.2**.

The pedestrian and bicycle levels of service are shown for the 2030 Build Scenarios. The intersection is unsignalized in the other scenarios and; therefore, no pedestrian or bicycle levels of service could be evaluated. Pedestrian and bicycle levels of service can be found in **Tables 5.30** and **5.31** at the end of this section.

The proposed traffic signal would be approximately 920 feet north of the traffic signal at the North Tryon Street/US-29 & Tom Hunter Road intersection. The North Tryon Street/US-29 and I-85 Connector traffic signal is approximately 1,350 feet north of Orchard Trace Lane along North Tryon Street/US-29.

The duration of congestion analysis shows that the Build Scenario operates under capacity during the a.m. and p.m. peak periods. This is due to the signalization of the intersection. The duration of congestion analysis for this intersection can be found in **Appendix E.3**.

Table 5.17
North Tryon Street/US-29 & Orchard Trace Lane Measures of Effectiveness

	2008 Existing*		2030 No-Build*		2030 Build (Preferred Alternative)	
	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.
v/c ratio *(SYNCHRO)*	0.60	0.98	6.36	Error	0.74	0.73
LOS *(VISSIM)*	B	C	C	F	B	F
Delay (sec.) *(VISSIM)*	14.3	21.1	24.9	128.0	13.0	104.8

Note: v/c ratio is based on the entire intersection for signalized intersections.
*Note: Intersection unsignalized

North Tryon Street/US-29 & I-85 Connector/Sandy Avenue

Currently this unsignalized intersection of North Tryon Street/US-29 & Sandy Avenue operates at LOS A during the a.m. peak hour and LOS F during the p.m. peak hour. The "Weave Area" project would reconfigure this intersection to become a four-way signalized intersection with I-85 Connector from the west and Sandy Avenue from the east. During the 2030 No-Build Scenario, the intersection would operate at LOS D during the a.m. peak hour and LOS F during the p.m. peak hour. The 2030 Build Scenario would add a third northbound travel lane. Additionally, a third through lane in the southbound direction would drop at this intersection as one of two right turn lanes. The 2030 Build Scenario shows increases in delay during the a.m. and p.m. peak periods. The additional traffic volumes generated by the University City Blvd. Station contributes to the increase in delay from the No-Build to the Build Scenario during the p.m. peak hour. The University City Blvd. Park-and-Ride would have approximately 1,485 parking spaces under the Preferred Alternative. Further information related to the University City Blvd. Station can be found in **Appendix C.3**. The intersection MOEs are illustrated in **Table 5.18**. The VISSIM analysis can be found in **Appendix E.1**, while the Synchro analysis is presented in **Appendix E.2**.

The pedestrian level of service decreases during the 2030 Build Scenario due to the additional travel lanes on North Tryon Street/US-29. The pedestrian phasing is timed so that pedestrians cross the full distance of North Tryon Street/US-29 in one cycle during the 2030 No-Build Scenario; however, during the 2030 Build Scenario, the pedestrian phasing is timed so that pedestrians only cross to the median in one cycle due to the increased median width. The bicycle level of service remains the same. Pedestrian and bicycle levels of service can be found in **Tables 5.30** and **5.31** at the end of this section.

The analysis also examined the duration of congestion for this intersection due to the v/c ratios exceeding 0.95. This analysis spanned a three hour period surrounding the peak hours. During the 2030 No-Build Scenario, the intersection would operate over capacity for 0.25 hours in the a.m. peak period and over capacity for the entire three hour period in the p.m. peak period. The a.m. peak period would take approximately 0.25 hours to recover. It is unclear when the p.m. peak period would recover due to the timeframe of the analysis. The 2030 Build Scenario would operate over capacity for 0.50 hours in the a.m. peak period and for 1.75 hours in the p.m. peak period. The a.m. peak period would take approximately 0.25 hours to recover, while it is unclear when the p.m. peak periods would recover due to the timeframe of the analysis. The duration of congestion analysis for this intersection can be found in **Appendix E.3**.

Table 5.18
North Tryon Street/US-29 & I-85 Connector/Sandy Avenue Measures of Effectiveness

	2008 Existing*		**2030 No-Build**		**2030 Build (Preferred Alternative)**	
	a.m.	**p.m.**	**a.m.**	**p.m.**	**a.m.**	**p.m.**
v/c ratio *(SYNCHRO)*	0.32	0.61	0.92	1.21	0.99	1.13
LOS *(VISSIM)*	A	F	D	F	D	F
Delay (sec.) *(VISSIM)*	7.1	57.1	41.6	189.8	42.0	289.3

Note: v/c ratio is based on the entire intersection for signalized intersections.
*Note: Intersection unsignalized

North Tryon Street/US-29 & University City Blvd. Station Access Road

This intersection does not currently exist but would be constructed to access the University City Blvd. Station from North Tryon Street/US-29. This would be a full movement signalized "T" intersection and would be designed to accommodate a future westbound approach. A southbound left turn lane is proposed to allow U-turn movements from Stetson Drive and driveway entrances north of this intersection. The 2030 Build Scenario would also provide an additional through lane in the northbound direction and a through/right lane in the southbound direction. This new intersection would operate at LOS B and LOS F during the a.m. and p.m. peak hours, respectively. The 2030 Build Scenario adds station generated trips to the surrounding street network. The University City Blvd. Park-and-Ride would have approximately 1,485 parking spaces under the Preferred Alternative. Further information related to the University City Blvd. Station can be found in **Appendix C.3**. The intersection MOEs are illustrated in **Table 5.19**. The VISSIM analysis can be found in **Appendix E.1**, while the Synchro analysis is presented in **Appendix E.2**. Pedestrian and bicycle levels of service can be found in **Tables 5.30** and **5.31** at the end of this section.

The proposed traffic signal would be located approximately 1,200 feet north of the North Tryon Street/US-29 & I-85 Connector intersection and 2,000 feet south of the University City Boulevard intersection.

The duration of congestion analysis shows that the Build Scenario operates under capacity during the a.m. and p.m. peak periods. The duration of congestion analysis for this intersection can be found in **Appendix E.3**.

Table 5.19
North Tryon Street/US-29 & University City Blvd. Station Access Measures of Effectiveness

	2008 Existing		**2030 No-Build**		**2030 Build (Preferred Alternative)**	
	a.m.	**p.m.**	**a.m.**	**p.m.**	**a.m.**	**p.m.**
v/c ratio *(SYNCHRO)*	-	-	-	-	0.67	0.85
LOS *(VISSIM)*	-	-	-	-	B	F
Delay (sec.) *(VISSIM)*	-	-	-	-	12.2	111.8

Note: v/c ratio is based on the entire intersection for signalized intersections.

North Tryon Street/US-29 & University City Boulevard/NC-49

The "Weave Area" project, currently under construction, is upgrading this intersection from a merge area between North Tryon Street/US-29 and University City Boulevard/NC-49 to a full movement signalized intersection that connects University City Boulevard from the east with City Boulevard from the west. When complete, this new intersection configuration will provide direct connectivity from University City Boulevard/NC-49 to I-85. Prior to construction of the "Weave Area" project, the stop-controlled connector segment operated at LOS F for the a.m. peak hour and LOS B for the p.m. peak hour. During the 2030 No-Build Scenario, the signalized intersection would operate at LOS F in both the a.m. and p.m. peak hours. The 2030 Build Scenario would add an additional northbound and southbound through lane to North Tryon Street/US-29. The additional northbound through lane would drop as one of two right turn lanes onto University City Boulevard/NC 49. The University City Blvd. Park-and-Ride would have approximately 1,485 parking spaces under the Preferred Alternative and station generated trips would impact this intersection during the 2030 Build Scenario. Further information related to the University City Blvd. Station can be found in **Appendix C.3**. The resulting level of service would be LOS F during the a.m. and p.m. peak hours. The pedestrian level of service remains the same in the 2030 Build Scenario. **Table 5.20** illustrates the intersection MOEs. The VISSIM analysis can be found in **Appendix E.1**, while the Synchro analysis is presented in **Appendix E.2**.

The bicycle level of service remains the same in the 2030 Build Scenario. However, the pedestrian level of service declines slightly due to the additional crossing distance created by the additional North Tryon Street/US-29 through lanes. Pedestrian and bicycle levels of service can be found in **Tables 5.30** and **5.31** at the end of this section.

The analysis also examined the duration of congestion for this intersection due to the v/c ratios exceeding 0.95. This analysis spanned a three hour period surrounding the peak hours. During the 2030 No-Build Scenario the intersection would operate over capacity for 1.75 hours during the a.m. and p.m. peak periods. The recovery time for the a.m. peak period would start approximately 0.75 hours after the intersection reached capacity, while it is unclear when the p.m. peak period would recover due to the timeframe of the analysis. The 2030 Build Scenario would operate over capacity for 1.50 hours, while the p.m. peak period would operate over capacity for the entire three hours. It is unclear when either peak period would recover due to the timeframe of the analysis. The duration of congestion analysis for this intersection can be found in **Appendix E.3**.

Table 5.20
North Tryon Street/US-29 & University City Boulevard/NC-49 Measures of Effectiveness

	2008 Existing*		2030 No-Build		2030 Build (Preferred Alternative)	
	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.
v/c ratio *(SYNCHRO)*	0.27	0.38	1.05	1.12	1.10	1.43
LOS *(VISSIM)*	F	B	F	F	F	F
Delay (sec.) *(VISSIM)*	109.8	10.8	118.6	196.1	101.6	277.1

Note: v/c ratio is based on the entire intersection for signalized intersections.
*Note: Intersection unsignalized

North Tryon Street/US-29 & Shopping Center Drive

This intersection currently exists as a signalized intersection. However, during the time the traffic counts were conducted in the 2008 base year the intersection was unsignalized. As such, the Shopping Center Drive approach was restricted to right-in/right-out access and a fourth leg was being added to the intersection. This fourth leg was built as part of new development on the west side of North Tryon Street/US-29 and was operating with right-in/right-out access. Eventually, the City plans to extend this segment of Shopping Center Drive across I-85 to connect with IBM Drive. For the purposes of this analysis, it was assumed that the extension of Shopping Center Drive would be complete by 2030. This intersection operated at LOS A during the a.m. and p.m. peak hours in the Existing Scenario. The 2030 No-Build Scenario, which includes signalization, would operate at LOS C during the a.m. peak hour and LOS E during the p.m. peak hour.

The 2030 Build Scenario would add a third southbound through/right turn lane to North Tryon Street/US-29, and the lane would begin at this intersection. The Preferred Alternative would impact this intersection with station generated trips from the University City Blvd. Park-and-Ride, which would have approximately 1,485 parking spaces. Further information related to the University City Blvd. Station can be found in **Appendix C.3**. As a result, the 2030 Build Scenario would produce LOS C during the a.m. peak hour and LOS F during the p.m. peak hour. Some of the northbound left turns from the McCullough Drive intersection were redistributed to this intersection during the 2030 Build Scenario because the increased connectivity Shopping Center Drive would provide. The redistributed traffic contributes to the increase in delay from the 2030 No-Build Scenario. **Table 5.21** illustrates the intersection MOEs. The VISSIM analysis can be found in **Appendix E.1**, while the Synchro analysis is presented in **Appendix E.2**.

The pedestrian and bicycle levels of service improve in the 2030 Build Scenario. The pedestrian phasing is timed so that pedestrians cross the full distance of North Tryon Street/US-29 in one cycle during the 2030 No-Build Scenario; however, during the 2030 Build Scenario, the pedestrian phasing is timed so that pedestrians only cross to the median in one cycle due to the increased median width. The bicycle level of service improves due to the addition of bike lanes and a reduction in the speed limit as part of the proposed project. Pedestrian and bicycle levels of service can be found in **Tables 5.30** and **5.31** at the end of this section.

The duration of congestion analysis shows that both the No-Build and Build Scenarios operate under capacity during the a.m. and p.m. peak periods. The duration of congestion analysis for this intersection can be found in **Appendix E.3**.

Table 5.21
North Tryon Street/US-29 & Shopping Center Drive Measures of Effectiveness

	2008 Existing*		2030 No-Build		2030 Build (Preferred Alternative)	
	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.
v/c ratio *(SYNCHRO)*	0.37	18.12	0.60	0.67	0.68	0.74
LOS *(VISSIM)*	A	A	C	E	C	F
Delay (sec.) *(VISSIM)*	0.6	1.7	27.6	65.2	32.7	195.8

Note: v/c ratio is based on the entire intersection for signalized intersections.
*Note: Intersection unsignalized

North Tryon Street/US-29 & McCullough Drive

Currently this signalized intersection operates at LOS B during both peak hours. With the background traffic growth associated with the 2030 No-Build Scenario, the level of service would remain LOS B during the a.m. peak hour and degrade to LOS D for the p.m. peak hour. This intersection would be impacted by trips generated from the University City Blvd. Park-and-Ride, which would have approximately 1,485 parking spaces under the Preferred Alternative. Further information related to the University City Blvd. Station can be found in **Appendix C.3**. The 2030 Build Scenario would maintain LOS B during the a.m. peak hour, but would degrade the p.m. peak hour to LOS F. **Table 5.22** illustrates the intersection MOEs. The VISSIM analysis can be found in **Appendix E.1**, while the Synchro analysis is presented in **Appendix E.2**.

The pedestrian level of service improves in the 2030 No-Build Scenario due to the addition of pedestrian phases. The 2030 Build Scenario improves the pedestrian and bicycle levels of service. The pedestrian phasing is timed so that pedestrians cross the full distance of North Tryon Street/US-29 in one cycle during the 2030 No-Build Scenario; however, during the 2030 Build Scenario, the pedestrian phasing is timed so that pedestrians only cross to the median in one cycle due to the increased median width. The bicycle level of service improves due to the addition of bike lanes and a reduction in the speed limit as part of the proposed project. Pedestrian and bicycle levels of service can be found in **Tables 5.30** and **5.31** at the end of this section.

The duration of congestion analysis shows that both the No-Build and Build Scenarios operate under capacity during the a.m. and p.m. peak periods. The duration of congestion analysis for this intersection can be found in **Appendix E.3**.

Table 5.22
North Tryon Street/US-29 & McCullough Drive Measures of Effectiveness

	2008 Existing		2030 No-Build		2030 Build (Preferred Alternative)	
	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.
v/c ratio *(SYNCHRO)*	0.49	0.48	0.63	0.64	0.64	0.68
LOS *(VISSIM)*	B	B	B	D	B	F
Delay (sec.) *(VISSIM)*	16.3	17.9	15.6	36.3	16.8	220.7

Note: v/c ratio is based on the entire intersection for signalized intersections.

<u>North Tryon Street/US-29 & Ken Hoffman Drive</u>

This signalized intersection currently operates at LOS C during the a.m. peak hour and LOS B during the p.m. peak hour. Under the 2030 No-Build Scenario, the level of service would increase to LOS B during the a.m. peak hour and would remain LOS B during the p.m. peak hour due to adjustments to the signal timing (cycle length changes). The 2030 Build Scenario would maintain LOS B during the a.m., but would degrade the p.m. peak hour to LOS F. This intersection would be impacted by trips generated from the University City Blvd. Park-and-Ride, which would have approximately 1,485 parking spaces under the Preferred Alternative. Further information related to the University City Blvd. Station can be found in **Appendix C.3**. The intersection MOEs are illustrated in **Table 5.23**. The VISSIM analysis can be found in **Appendix E.1**, while the Synchro analysis is presented in **Appendix E.2**.

The pedestrian level of service improves in the 2030 No-Build Scenario due to the addition of pedestrian phases. The 2030 Build Scenario improves the pedestrian and bicycle levels of service. The pedestrian phasing is timed so that pedestrians cross the full distance of North Tryon Street/US-29 in one cycle during the 2030 No-Build Scenario; however, during the 2030 Build Scenario, the pedestrian phasing is timed so that pedestrians only cross to the median in one cycle due to the increased median width. The bicycle level of service improves due to the addition of bike lanes and a reduction in the speed limit as part of the proposed project. Pedestrian and bicycle levels of service can be found in **Tables 5.30** and **5.31** at the end of this section.

The duration of congestion analysis shows that both the No-Build and Build Scenarios operate under capacity during the a.m. and p.m. peak periods. The duration of congestion analysis for this intersection can be found in **Appendix E.3**.

Table 5.23
North Tryon Street/US-29 & Ken Hoffman Drive Measures of Effectiveness

	2008 Existing		**2030 No-Build**		**2030 Build (Preferred Alternative)**	
	a.m.	**p.m.**	**a.m.**	**p.m.**	**a.m.**	**p.m.**
v/c ratio *(SYNCHRO)*	0.45	0.38	0.55	0.51	0.62	0.71
LOS *(VISSIM)*	C	B	B	B	B	F
Delay (sec.) *(VISSIM)*	22.5	16.4	16.5	12.6	19.7	97.3

Note: v/c ratio is based on the entire intersection for signalized intersections.

North Tryon Street/US-29 & W.T. Harris Boulevard

Currently this signalized intersection operates at LOS D during the a.m. and p.m. peak hours. With the background traffic growth associated with 2030 No-Build scenario, the intersection would remain LOS D during the a.m. peak hour and decrease to LOS F during the p.m. peak hour. The 2030 Build Scenario shows a.m. peak hour would degrade to LOS E and the p.m. peak hour would remain LOS F. This intersection would be potentially impacted due to the trips generated by the University City Blvd. Station (1,485 parking spaces) and the JW Clay Blvd. Station (690 parking spaces) under the Preferred Alternative. Station information for the University City Blvd. Station can be found in **Appendix C.3**, while Appendix C.4 presents information related to the JW Clay Blvd. Station. The intersection MOEs are illustrated in **Table 5.24**. The VISSIM analysis can be found in **Appendix E.1**, while the Synchro analysis is presented in **Appendix E.2**.

The 2030 Build Scenario improves the pedestrian and bicycle levels of service. The pedestrian phasing is timed so that pedestrians cross the full distance of North Tryon Street/US-29 in one cycle during the 2030 No-Build Scenario; however, during the 2030 Build Scenario, the pedestrian phasing is timed so that pedestrians only cross to the median in one cycle due to the increased median width. The bicycle level of service improves due to the addition of bike lanes and a reduction in the speed limit as part of the proposed project. **Table 5.26** illustrates the VISSIM MOEs for this intersection. Pedestrian and bicycle levels of service can be found in **Tables 5.30** and **5.31** at the end of this section.

The analysis also examined the duration of congestion for this intersection due to the v/c ratios exceeding 0.95. This analysis spanned a three hour period surrounding the peak hours. During the 2030 No-Build Scenario, the intersection would operate under capacity during the a.m. period and over capacity for 1.75 hours during the p.m. peak period. It is unclear when the p.m. peak period would recover due to the timeframe of the analysis. During the 2030 Build Scenario, the intersection would operate over capacity for 0.25 hours during the a.m. peak period and over capacity for the entire three hour period during the p.m. peak period. The a.m. peak period would take approximately 0.25 hours to recover, while it is unclear when the p.m. peak period would recover due to the timeframe of the analysis. The duration of congestion analysis for this intersection can be found in **Appendix E.3**.

Table 5.24
North Tryon Street/US-29 & W.T. Harris Boulevard Measures of Effectiveness

	2008 Existing		2030 No-Build		2030 Build (Preferred Alternative)	
	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.
v/c ratio *(SYNCHRO)*	0.68	0.92	0.82	1.12	0.94	1.14
LOS *(VISSIM)*	D	D	D	F	E	F
Delay (sec.) *(VISSIM)*	40.3	51.6	50.5	185.6	70.4	340.2

Note: v/c ratio is based on the entire intersection for signalized intersections.

North Tryon Street/US-29 & JM Keynes Boulevard

This signalized intersection currently operates at LOS B during the a.m. and p.m. peak hours. With the background traffic growth associated with the 2030 No-Build Scenario, the intersection would remain LOS B during the a.m. peak hour and degrade to LOS C during the p.m. peak hour. The 2030 Build Scenario would provide LOS C during the a.m. peak hour and LOS F during the p.m. peak. This intersection would be impacted by the JW Clay Blvd. Park-and-Ride, which would have approximately 690 parking spaces. Further information related to the JW Clay Blvd. Station can be found in **Appendix C.4**. The intersection MOEs are illustrated in **Table 5.25**. The VISSIM analysis can be found in **Appendix E.1**, while the Synchro analysis is presented in **Appendix E.2**.

The pedestrian level of service improves slightly due to changes in the crossing distance. The pedestrian phasing is timed so that pedestrians cross the full distance of North Tryon Street/US-29 in one cycle during the 2030 No-Build Scenario; however, during the 2030 Build Scenario, the pedestrian phasing is timed so that pedestrians only cross to the median in one cycle due to the increased median width. The bicycle level of service improves due to the addition of bike lanes and a reduction in the speed limit as part of the proposed project. Pedestrian and bicycle levels of service can be found in **Tables 5.30** and **5.31** at the end of this section.

The duration of congestion analysis shows that both the No-Build and Build Scenarios operate under capacity during the a.m. and p.m. peak periods. The duration of congestion analysis for this intersection can be found in **Appendix E.3**.

Table 5.25
North Tryon Street/US-29 & JM Keynes Drive Measures of Effectiveness

	2008 Existing		**2030 No-Build**		**2030 Build (Preferred Alternative)**	
	a.m.	**p.m.**	**a.m.**	**p.m.**	**a.m.**	**p.m.**
v/c ratio *(SYNCHRO)*	0.47	0.56	0.58	0.76	0.64	0.72
LOS *(VISSIM)*	B	B	B	C	C	F
Delay (sec.) *(VISSIM)*	17.9	13.9	10.8	24.8	26.2	137.9

Note: v/c ratio is based on the entire intersection for signalized intersections.

North Tryon Street/US-29 & JW Clay Boulevard

This signalized intersection currently operates at LOS B during the a.m. peak hour and LOS D during the p.m. peak hour. With the background traffic growth associated with the 2030 No-Build Scenario, and adjustments to the signal timing (cycle length changes) the intersection would remain LOS B and LOS D during the a.m. and p.m. peak hours, respectively. A fourth westbound leg would be added to this intersection to provide an entrance to the UNC Charlotte Research Institute. This fourth leg was included in both the 2030 No-Build and Build Scenarios. The 2030 Build Scenario degrades to LOS C during the a.m. peak hour and LOS F during the p.m. peak hour. The removal of a northbound left turn lane contributes to the increase in delay from the 2030 No-Build Scenario. The left turn lane was removed to reduce the crossing distance for pedestrians accessing the light rail station. Parking facilities, which would have approximately 690 parking spaces, were added to the JW Clay Blvd. Station as part of the parking redistribution related to shortening the light rail alignment. The additional station generated trips that would utilize this intersection to access the parking garage are one component for the increase in delay. Further information related to the JW Clay Blvd. Station can be found in **Appendix C.4**. The intersection MOEs are illustrated in **Table 5.26**. The VISSIM analysis can be found in **Appendix E.1**, while the Synchro analysis is presented in **Appendix E.2**.

The pedestrian level of service improves in the 2030 No-Build Scenario due to the addition of pedestrian phases. The 2030 Build Scenario improves the pedestrian and bicycle levels of service. The pedestrian phasing is timed so that pedestrians cross the full distance of North Tryon Street/US-29 in one cycle during the 2030 No-Build Scenario; however, during the 2030 Build Scenario, the pedestrian phasing is timed so that pedestrians only cross to the median in one cycle due to the increased median width. The bicycle level of service improves due to the addition of bike lanes and a reduction in the speed limit as part of the proposed project. Pedestrian and bicycle levels of service can be found in **Tables 5.30** and **5.31** at the end of this section.

The analysis also examined the duration of congestion for this intersection due to the v/c ratios exceeding 0.95. This analysis spanned a three hour period surrounding the peak hours. During the 2030 No-Build Scenario, the intersection would operate under capacity during the a.m. peak period and over capacity for 1.0 hours during the p.m. peak period. The p.m. peak period would take approximately 0.50 hours to recover. The 2030 Build Scenario indicates that the intersection would operate under capacity for the a.m. peak period and over capacity for 1.75 hours during the p.m. peak period. It is unclear how long the p.m. peak period would take to recover due to the timeframe of the analysis. The duration of congestion analysis for this intersection can be found in **Appendix E.3**.

Table 5.26
North Tryon Street/US-29 & JW Clay Boulevard VISSIM Delay Results

	2008 Existing		2030 No-Build		2030 Build (Preferred Alternative)	
	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.
v/c ratio *(SYNCHRO)*	0.50	0.64	0.67	1.01	0.81	1.08
LOS *(VISSIM)*	B	D	B	D	C	F
Delay (sec.) *(VISSIM)*	14.1	37.7	17.1	38.5	29.8	154.3

Note: v/c ratio is based on the entire intersection for signalized intersections.

<u>JW Clay Boulevard & Olmsted Drive</u>

Analysis of the JW Clay Blvd. & Olmstead Drive/JM Keynes Drive intersection was added to the revised project scope due to the addition of an approximately 690 space parking garage at the JW Clay Blvd. Station. This intersection would be the primary access for Park-and-Ride traffic using the garage. Currently, this intersection is unsignalized and operates at LOS A during the a.m. peak hour and LOS D during the p.m. peak hour. Background traffic growth associated with the 2030 No-Build Scenario would decrease the a.m. peak hour to LOS B, but the p.m. peak hour would remain LOS D. The 2030 Build Scenario would signalize this intersection and modify the JM Keynes approach to allow left turns and through movements that are currently restricted. The proposed signal would be coordinated with the North Tryon Street/US-29 & JW Clay Boulevard intersection to minimize queue lengths for exiting station traffic. The resulting signalized intersection would operate at LOS D during the a.m. peak hour and LOS F during the p.m. peak hour of the 2030 Build Scenario. Further information related to the JW Clay Blvd. Station can be found in Appendix C.4. The intersection MOEs are illustrated in **Table 5.27**. The VISSIM analysis can be found in **Appendix E.1**, while the Synchro analysis is presented in **Appendix E.2**. Pedestrian and bicycle levels of service can be found in **Tables 5.30** and **5.31** at the end of this section.

Table 5.27
JW Clay Boulevard & Olmsted Drive Measures of Effectiveness

	2008 Existing*		**2030 No-Build***		**2030 Build (Preferred Alternative)**	
	a.m.	**p.m.**	**a.m.**	**p.m.**	**a.m.**	**p.m.**
v/c ratio *(SYNCHRO)*	0.15	0.39	0.22	1.00	0.31	0.59
LOS *(VISSIM)*	A	D	B	D	D	F
Delay (sec.) *(VISSIM)*	9.4	31.3	10.3	47.5	36.5	357.2

Note: v/c ratio is based on the entire intersection for signalized intersections.
*Note: Intersection unsignalized

North Tryon Street/US-29 & UNCC Research Drive

Currently this signalized intersection operates at LOS C during the a.m. peak hour and LOS D during the p.m. peak hour. The 2030 No-build Scenario adds background traffic to the intersection; however, adjustments to the signal timings (cycle length changes) improve the a.m. and p.m. peak hours to LOS B and LOS C, respectively. The 2030 Build Scenario degrades the a.m. peak hour to LOS C and the p.m. peak hour to LOS F. This intersection would be impacted by the JW Clay Blvd. Station, which would have approximately 690 parking spaces. Further information related to the JW Clay Blvd. Station can be found in **Appendix C.4**. The intersection MOEs are illustrated in **Table 5.28**. The VISSIM analysis can be found in **Appendix E.1**, while the Synchro analysis is presented in **Appendix E.2**.

The pedestrian level of service would improve in the 2030 Build Scenario with the addition of pedestrian refuges in the median of North Tryon Street/US-29. The pedestrian phasing is timed so that pedestrians cross the full distance of North Tryon Street/US-29 in one cycle during the 2030 No-Build Scenario; however, during the 2030 Build Scenario, the pedestrian phasing is timed so that pedestrians only cross to the median in one cycle due to the increased median width. The bicycle level of service would improve due to the addition of bike lanes and a reduction in the speed limit as part of the proposed project. Pedestrian and bicycle levels of service can be found in **Tables 5.30** and **5.31** at the end of this section.

The analysis also examined the duration of congestion for this intersection due to the v/c ratios exceeding 0.95. This analysis spanned a three hour period surrounding the peak. The 2030 No-Build Scenario operates under capacity during the a.m. peak period and over capacity for 1.75 hours during the p.m. peak period. It is unclear how long the p.m. peak period would take to recover due to the timeframe of the analysis. The 2030 Build Scenario operates under capacity during the a.m. peak period and over capacity for 1.75 hours in the p.m. peak period. It is unclear how long the p.m. peak period would take to recover due to the timeframe of the analysis. The duration of congestion analysis for this intersection can be found in **Appendix E.3**.

Table 5.28
North Tryon Street/US-29 & UNCC Research Drive Measures of Effectiveness

	2008 Existing		**2030 No-Build**		**2030 Build (Preferred Alternative)**	
	a.m.	**p.m.**	**a.m.**	**p.m.**	**a.m.**	**p.m.**
v/c ratio *(SYNCHRO)*	0.48	0.81	0.55	1.09	0.68	1.07
LOS *(VISSIM)*	C	D	B	C	C	F
Delay (sec.) *(VISSIM)*	29.6	44.1	11.5	27.6	28.1	192.4

Note: v/c ratio is based on the entire intersection for signalized intersections.

North Tryon Street/US-29 & Mallard Creek Church Road

This signalized intersection currently operates at LOS D during the a.m. peak hour and LOS F during the p.m. peak hour. The 2030 No-Build Scenario would decrease the a.m. peak hour to LOS E, while the p.m. peak hour would remain LOS F. Background traffic growth can be attributed to the decrease in the level of service. This intersection would operate at LOS E during the a.m. peak hour and LOS F during the p.m. peak hour under the 2030 Build Scenario, too. The JW Clay Blvd. Park-and-Ride, which would have approximately 690 parking spaces, would impact this intersection. Further information related to the JW Clay Blvd. Station can be found in Appendix **C.4**. The intersection MOEs are illustrated in **Table 5.29**. The VISSIM analysis can be found in **Appendix E.1**, while the Synchro analysis is presented in **Appendix E.2**. Pedestrian and bicycle levels of service can be found in **Tables 5.30** and **5.31** at the end of this section.

The analysis also examined the duration of congestion for this intersection due to the v/c ratios exceeding 0.95. This analysis spanned a three hour period surrounding the peak hours. During the 2030 No-Build scenario, the intersection would operate under capacity during the a.m. peak period and over capacity for 1.75 hours during the p.m. peak period. It is unclear when the p.m. peak period would recover due to the timeframe of the analysis. During the 2030 Build scenario, the a.m. peak period would operate over capacity for 0.25 hours in the a.m. peak period and over capacity for the entire three hour period during the p.m. peak period. The a.m. peak period would take approximately 0.25 hours to recover, while it is unclear when the p.m. peak period would recover due to the timeframe of the analysis. The duration of congestion analysis for this intersection can be found in **Appendix E.3**.

Table 5.29
North Tryon Street/US-29 & Mallard Creek Church Road Measures of Effectiveness

	2008 Existing		2030 No-Build		2030 Build (Preferred Alternative)	
	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.
v/c ratio *(SYNCHRO)*	0.72	0.91	0.82	1.08	0.87	1.13
LOS *(VISSIM)*	D	F	E	F	E	F
Delay (sec.) *(VISSIM)*	37.9	167.1	68.2	104.3	56.8	169.1

Note: v/c ratio is based on the entire intersection for signalized intersections.

5.2.4 Pedestrian and Bicycle Measures of Effectiveness

Levels of service were calculated for the bicycle and pedestrian facilities using the Bicycle/Pedestrian Levels of Service worksheets developed by CDOT. These worksheets evaluate the intersection geometry and signalization characteristics according to the comfort and safety of bicyclists and pedestrians at signalized intersections. **Tables 5.30** and **5.31** illustrate the pedestrian and bicycle levels of service for the signalized intersections in Segment 2.

Table 5.30
Segment 2 Pedestrian Level of Service

Intersection	2008 Existing	2030 No-Build	2030 Build (Preferred Alternative)
North Tryon Street/US-29 & Tom Hunter Road	D	C	C
North Tryon Street/US-29 & Orchard Trace Lane	-	-	B
North Tryon Street/US-29 & I-85 Connector	-	B	C-
North Tryon Street/US-29 & University City Blvd. Station Access	-	-	C-
North Tryon Street/US-29 & University City Boulevard	-	C	D+
North Tryon Street/US-29 & Shopping Center Drive	-	D	D+
North Tryon Street/US-29 & McCullough Drive	D-	D	C
North Tryon Street/US-29 & Ken Hoffman Drive	D-	C	B
North Tryon Street/US-29 & W.T. Harris Boulevard	F	E-	E+
North Tryon Street/US-29 & JM Keynes Boulevard	C-	C-	C
North Tryon Street/US-29 & JW Clay Boulevard	E	D	C
JW Clay Boulevard & Olmsted Drive	-	-	C
North Tryon Street/US-29 & UNCC Research Drive	D	D	C
North Tryon Street/US-29 & Mallard Creek Church Road	D-	D-	D+

Table 5.31
Segment 2 Bicycle Level of Service

Intersection	2008 Existing	2030 No-Build	2030 Build (Preferred Alternative)
North Tryon Street/US-29 & Tom Hunter Road	E+	E+	B
North Tryon Street/US-29 & Orchard Trace Lane	-	-	B-
North Tryon Street/US-29 & I-85 Connector	-	D	D
North Tryon Street/US-29 & University City Blvd. Station Access	-	-	B
North Tryon Street/US-29 & University City Boulevard	-	D	D
North Tryon Street/US-29 & Shopping Center Drive	-	F	C-
North Tryon Street/US-29 & McCullough Drive	E	E	D
North Tryon Street/US-29 & Ken Hoffman Drive	E+	E+	C-
North Tryon Street/US-29 & W.T. Harris Boulevard	F	F	D
North Tryon Street/US-29 & JM Keynes Boulevard	F	F	D+
North Tryon Street/US-29 & JW Clay Boulevard	E	F	C
JW Clay Boulevard & Olmsted Drive	-	-	E
North Tryon Street/US-29 & UNCC Research Drive	E	E	D+
North Tryon Street/US-29 & Mallard Creek Church Road	F	F	F

6.0 SUMMARY OF RESULTS

This technical report provides an analysis of the traffic operations associated with the Preferred Alternative. The Preferred Alternative is an extension of the existing LYNX BLE and extends approximately 9.8 miles from Center City Charlotte northeastward to UNC Charlotte. The proposed alignment enters the median of North Tryon Street/US-29, via grade separation, just north of Old Concord Road. While in the median of North Tryon Street/US-29, the proposed alignment would be grade separated with the I-85 Connector, University City Boulevard and W.T. Harris Boulevard. The remaining street crossings would be at-grade, signalized intersections. The proposed alignment would exit the median of North Tryon Street/US-29 just north of UNCC Research Drive, via grade separation, and then enters the UNC Charlotte campus. Following the entrance onto the UNC Charlotte campus, the proposed alignment would travel south towards the northeastern edge of the existing UNC Charlotte buildings. A bridge would carry the light rail over Toby Creek and the Toby Creek Greenway, and continue along the northern side of Cameron Boulevard, across from Laurel Hall, to the terminal station. All unsignalized intersections north of Old Concord Road would be restricted to right-in/right-out access to prevent vehicles from crossing the proposed alignment without protection from a traffic signal. U-turns were allowed at the signalized intersections due to restricted access at unsignalized intersections.

The transit capacity provided by the LYNX BLE will enhance the North Tryon Street/US-29 corridor by both increasing the overall person carrying capacity of the corridor and by providing a transit option for north/south trips in the corridor. Long term goals for the corridor couple the proposed light rail project with additional street connectivity to lessen the dependence on the existing major thoroughfares. The improvement of pedestrian and bicycle facilities also plays a critical role in the long term goals for the corridor by promoting walking and cycling, in addition to vehicular travel. As a way to support these other travel modes, the BLE project proposes that a safe and comfortable environment be built along North Tryon Street/US 29 that includes bike lanes, pedestrian crosswalks & signals, pedestrian refuge within medians, and minimized intersection crossing distances (particularly where transit stations are located within the median).

The “Weave Area” Project (currently under construction by the City) installs two signals on North Tryon Street/US-29; one at I-85 Connector and another at University City Boulevard. The proposed Preferred Alternative would signalize five additional intersections on North Tryon Street/US-29; Orr Road, Arrowhead Drive, Owen Boulevard, Orchard Trace Lane, and University City Station Access. With light rail transit running in the median, safety requires traffic signals at all median openings. The location and spacing of median openings reflects an attempt to balance the competing needs of pedestrians, adjacent land uses, traffic circulation and mobility, and light rail operations.

6.1 Traffic Signal Measures of Effectiveness

With the compact design of the median openings along North Tryon Street/US 29 (described in Section 1.2.4), changes to existing signal phasing is required so that opposing left turn movements do not physically conflict with one another. Therefore, lead/lag phases would be used for left turns from North Tryon Street/US 29 and for left turns from the grade separated side streets of the I-85 Connector, University City Blvd. and WT Harris Blvd. Split phasing would be used at McCullough Drive, Ken Hoffman Drive, JM Keynes Drive, JW Clay Blvd., and UNCC Research Drive. Also, VISSIM simulation of these intersections was set up so that phases would not be skipped due to light rail pre-emption. These signal operation changes significantly affect traffic operations along North Tryon Street/US-29 but are essential to maintain safety and balance delay between the side streets and the North Tryon Street/US-29 corridor. A summary of the VISSIM MOEs for the intersections along North Tryon Street/US-29 are presented in **Table 6.1**, while a summary of the Synchro v/c analysis results for these intersections are listed in **Table 6.2**.

Table 6.1
North Tryon Street/US-29 Signalized Intersections VISSIM Measures of Effectiveness

Cross Street	2008 Existing				2030 No-Build				2030 Preferred Alternative*			
	Delay (sec.)		LOS		Delay (sec.)		LOS		Delay (sec.)		LOS	
	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.
Sugar Creek Road	84.2	42.9	F	D	132.9	105.9	F	F	117.8	142.3	F	F
Eastway Drive	19.8	26.2	B	C	32.7	96.2	C	F	25.9	109.6	C	F
Old Concord Road	58.3	22.2	E	C	56.2	23.4	E	C	61.8	36.4	E	D
Orr Road[1]	80.7	46.7	F	E	55.6	27.0	E	C	68.1	25.3	E	C
Arrowhead Drive[1]	21.5	49.5	C	E	23.9	17.6	C	B	41.8	24.1	D	C
Owen Boulevard[2]	7.4	10.3	A	B	9.0	39.1	A	E	27.7	11.3	C	B
Tom Hunter Road	16.4	27.4	B	C	19.1	135.7	B	F	29.2	145.7	C	F
Orchard Trace Lane[2]	14.3	21.1	B	C	24.9	128.0	C	F	13.0	104.8	B	F
I-85 Connector[1]	7.1	57.1	A	F	41.6	189.8	D	F	42.0	289.3	D	F
University City Blvd Station Access[2]	-	-	-	-	-	-	-	-	12.2	111.8	B	F
University City Boulevard[1]	109.8	10.8	F	B	118.6	196.1	F	F	101.6	277.1	F	F

*Note: LOS and delay results reflect 3 car trains with 10 minute headways and a grade separated rail configuration as listed in Section 6.1

[1]Note: Signalized in the 2030 No-Build Scenario

[2]Note: Signalized in the 2030 Build Scenario

Table 6.1 (continued)
North Tryon Street/US-29 Signalized Intersections VISSIM Measures of Effectiveness

Cross Street	2008 Existing				2030 No-Build				2030 Preferred Alternative*			
	Delay (sec.)		LOS		Delay (sec.)		LOS		Delay (sec.)		LOS	
	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.
Shopping Center Drive[1]	0.6	1.7	A	A	27.6	65.2	C	E	32.7	195.8	C	F
McCullough Drive	16.3	17.9	B	B	15.6	36.3	B	D	16.8	220.7	B	F
Ken Hoffman Drive	22.5	16.4	C	B	16.5	12.6	B	B	19.7	97.3	B	F
W.T. Harris Boulevard	40.3	51.6	D	D	50.5	185.6	D	F	70.4	340.2	E	F
JM Keynes Drive	17.9	13.9	B	B	10.8	24.8	B	C	26.2	137.9	C	F
JW Clay Boulevard	14.1	37.7	B	D	17.1	38.5	B	D	29.8	154.3	C	F
UNCC Research Drive	29.6	44.1	C	D	11.5	27.6	B	C	28.1	192.4	C	F
Mallard Creek Church Road	37.9	167.1	D	F	68.2	104.3	E	F	56.8	169.1	E	F

*Note: LOS and delay results reflect 3 car trains with 10 minute headways and a grade separated rail configuration as listed in Section 6.1
[1]Note: Signalized in the 2030 No-Build Scenario
[2]Note: Signalized in the 2030 Build Scenario

Table 6.2
North Tryon Street/US-29 Signalized Intersections V/c Ratio Summary

	2008 Existing		2030 No-Build		2030 Preferred Alternative*	
	V/c Ratio		V/c Ratio		V/c Ratio	
	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.
Sugar Creek Road	0.80	0.77	1.02	0.93	1.06	0.97
Eastway Drive	0.74	0.94	0.90	1.19	0.93	1.19
Old Concord Road	0.79	0.67	1.01	0.86	0.96	0.96
Orr Road[1]	0.57	1.22	0.68	0.97	0.92	0.96
Arrowhead Drive[1]	1.07	Error	0.65	0.77	0.71	0.80
Owen Boulevard[2]	0.40	4.57	0.82	167.29	0.66	0.81
Tom Hunter Road	0.67	0.76	0.82	0.94	0.87	0.95
Orchard Trace Lane[2]	0.60	0.98	6.36	Error	0.74	0.73
I-85 Connector[1]	0.32	0.61	0.92	1.21	0.99	1.13
University City Blvd Station Access[2]	-	-	-	-	0.67	0.85
University City Boulevard[1]	0.27	0.38	1.05	1.12	1.10	1.43
Shopping Center Drive[1]	0.37	18.12	0.60	0.67	0.75	0.78
McCullough Drive	0.49	0.48	0.63	0.64	0.64	0.68
Ken Hoffman Drive	0.45	0.38	0.55	0.51	0.62	0.71
W.T. Harris Boulevard	0.68	0.92	0.82	1.12	0.94	1.14
JM Keynes Drive	0.47	0.56	0.58	0.76	0.64	0.72
JW Clay Boulevard	0.50	0.64	0.67	1.01	0.81	1.08
UNCC Research Drive	0.48	0.81	0.55	1.09	0.68	1.07
Mallard Creek Church Road	0.72	0.91	0.82	1.08	0.87	1.13

*Note: LOS and delay results reflect 3 car trains with 10 minute headways and a grade separated rail configuration as listed in Section 6.1

[1]Note: Signalized in the 2030 No-Build Scenario

[2]Note: Signalized in the 2030 Build Scenario

6.2 Project Related Changes and Mitigation

Access and operational improvements are recommended at intersections where impacts have been identified. The recommendations include installation of traffic signals and turn lanes along North Tryon Street/US-29, capacity improvements within the “Weave Area”, as well as a reduction in the posted speed limit from 45 mph to 35 mph. Storage length recommendations are presented in **Section 6.4**. The following recommendations apply to the Preferred Alternative:

- *Sugar Creek Road & Greensboro Street* – Provide exclusive dual left turn lanes and a through/right turn lane for the eastbound Greensboro Street approach.
- *North Tryon Street/US-29 & Old Concord Road* - Provide exclusive dual left turn lanes and a separate right lane for the westbound Old Concord Road approach.
- *North Tryon Street/US-29 & Orr Road* – Provide a second approach lane for Orr Road. This lane can either serve as a through-right lane or as a separate right turn lane. Its use will be determined as the design proceeds. This intersection will be signalized by the project.
- *North Tryon Street/US-29 & Arrowhead Drive* - Remove the existing northbound and southbound right turn lanes on North Tryon Street/US-29. The right turn volume at this intersection is minimal and the removal of these turn lanes do not adversely affect the level of service at this location. This intersection will be signalized by the project.
- *North Tryon Street/US-29 & Owen Boulevard* - Install a traffic signal at this intersection and remove the northbound and southbound right turn lanes on North Tryon Street/US-29. Removal of these two lanes does not adversely affect the level of service at this location based on existing and projected volumes.
- *North Tryon Street/US-29 & Orchard Trace Lane* - Install a traffic signal at this intersection. A second approach lane on Orchard Trace Lane is also recommended. This lane can either serve as a through-right lane or as a separate right turn lane, depending on whether a fourth leg is eventually added to the intersection. Its use will be determined as the design process proceeds.
- *“Weave Area”* – Add additional lanes on North Tryon Street/US-29. Due to the new terminus at UNC Charlotte and elimination of the two park-and-rides stations formally proposed beyond UNC Charlotte, additional parking needs are accommodated at the University City Blvd. Station. As such, additional lanes along North Tryon Street/US-29 in the “Weave Area” are needed to accommodate the additional projected traffic One additional thru/right lane in each direction would need to be provided. In the northbound direction, the 3-lane section would run from north of Orchard Trace Lane to University City Boulevard. In the southbound direction, the additional lane would run from Shopping Center Drive to the I-85 Connector.
- *North Tryon Street/US-29 & University City Blvd. Station Access* - Install a traffic signal at this intersection. Provide a northbound left turn lane to access the park-and-ride facility and a southbound left turn lane to permit U-turns.
- *North Tryon Street/US-29 & McCullough Drive* – Remove one of the dual left turn lanes on the southbound approach of North Tryon Street/US-29. The removal of this turn lane will not adversely impact the level of service for traffic and will in turn provide a shorter crossing distance for transit patrons accessing the station platform. The Preferred Alternative would also remove the northbound right turn lane on North Tryon Street/US-29. The right turn volume at this intersection is minimal and the removal of this lane does not adversely affect the level of service at this location.

- *North Tryon Street/US-29 & Ken Hoffman Drive* – Modify the North Tryon Street/US-29 northbound approach thru/right turn lane to become a dedicated right turn lane.
- *North Tryon Street/US-29 & JW Clay Boulevard* - Remove one of the dual left turn lanes on the northbound approach of North Tryon Street/US-29.

6.3 Turn Lane Recommendations Along North Tryon Street/US-29

6.3.1 Left Turn Lanes

Synchro provides storage length recommendations based on the 95th queue percentile; however, the analysis does not consider light rail operations. Accordingly, VISSIM was used to make recommendations on storage lengths. The VISSIM simulation was examined over several time periods to identify the actual useable storage. In other words, the total length vehicles were observed occupying the turn lanes. In general, left turn movements along North Tryon Street/US-29 are limited to single lanes where the proposed Light Rail Alignment crosses intersections at-grade. Single left turn lanes minimize the intersection footprint and reduce the crossing distance pedestrians must cross, particularly in areas where light rail stations occupy the median of North Tryon Street/US-29. However, this is not the case with the intersections of Shopping Center Drive and McCullough Drive. Turning volumes were particularly high at Shopping Center Drive and dual left turn lanes were required to help minimize the intersection delay. High turn volumes were also present at McCullough Drive on the northbound approach so dual left turn lanes were included there as well. The dual left turn lanes not only reduce intersection delay at McCullough Drive, but also minimize metering that would occur downstream. The pedestrian crossing distance to the station would not be affected by the northbound dual left turn lanes because the park-and-ride facility is located on the opposite side of the intersection.

Based on the 40 mph design speed for North Tryon Street/US-29, NCDOT typically requires a minimum of 330 feet for a turn lane and taper, 100 feet of which would be the taper length. Following discussions with NCDOT, the taper length for a single left turn storage bay was reduced to 50 feet, and it was agreed that the left turn lane lengths would be governed by the recommended storage identified in this traffic analysis plus the 50 feet taken out of the taper length. Dual left turn lanes would have a 100 foot taper. **Table 6.3** displays the results of the left turn analysis. The left turn storage lengths are also illustrated in **Figures 4.12** and **4.13**.

Table 6.3
North Tryon Street/US-29 Left Turn Lane Recommendations

Cross Street	Movement	2008 Conditions		2030 Build		2030 Build Volumes AM (PM)
		Lanes	Existing Storage (ft)	Lanes	Recommended Storage (ft)	
Old Concord Road	NB Left	1	150	1	150	20 (38)
	SB Left	1	225	1	400	112 (137)
	WB Left	1	100	2	350	901 (478)
Orr Road	NB Left	1	150	1	200	75 (162)
	SB Left	1	200	1	400	258 (291)
	WB Left	0	Shared Lane	1	300	359 (20)
Arrowhead Drive	NB Left	1	150	1	400	91 (209)
	SB Left	1	200	1	200	97 (94)
Owen Boulevard	NB Left	1	150	1	200	58 (63)
	SB Left	1	150	1	150	27 (65)
Tom Hunter Road	NB Left	1	200	1	300	251 (279)
	SB Left	1	125	1	150	21 (31)
Orchard Trace Lane	NB Left	1	100	1	150	38 (109)
	SB Left	1	150	1	150	0 (0)
	EB Left	0	Shared Lane	1	150	81 (116)
I-85 Connector	NB Left	1	250*	1	250	78 (126)
	SB Left	1	400*	1	400	18 (44)
	EB Left	2	Drop Lanes[#]*	2	Drop Lanes[#]	848 (1391)
	WB Left	1	175*	1	175	50 (20)
University City Blvd. Park-and-Ride Entrance	NB Left	N/A	N/A	1	150	94 (19)
	SB Left	N/A	N/A	1	150	33 (64)
	EB Left	N/A	N/A	2	Drop Lane[#]	32 (404)
University City Boulevard/NC-49	NB Left	1	300*	1	300	167 (214)
	SB Left	1	225*	1	225	79 (215)
	EB Left	2	275*	2	275	311 (532)
	WB Left	2	425*	2	425	1325 (900)
Shopping Center Drive	NB Left	2	300	2	375	430 (665)
	SB Left	1	300	2	300	92 (252)
	EB Left	2	325	2	325	250 (435)
	WB Left	1	150	1	150	60 (95)
McCullough Drive	NB Left	2	275	2	275	203 (295)
	SB Left	2	250	1	250	10 (30)
	EB Left	1	225	1	225	34 (145)
	WB Left	1	150	1	150	10 (28)

[#]Note: A drop lane is a continuous turn lane from the preceding intersection ending at this intersection.
*Note: These storage lengths will be provided when the “Weave Area” project is constructed.

Table 6.3 (continued)
North Tryon Street/US-29 Left Turn Lane Recommendations

Cross Street	Movement	2008 Conditions		2030 Build		Projected Volumes AM (PM)
		Lanes	Existing Storage (ft)	Lanes	Recommended Storage (ft)	
Ken Hoffman Drive	NB Left	1	125	1	150	25 (30)
	SB Left	1	150	1	150	163 (98)
W.T. Harris Boulevard	NB Left	2	250	2	250	241 (560)
	SB Left	2	325	2	325	295 (532)
	EB Left	2	450	2	450	353 (449)
	WB Left	2	225	2	275	168 (299)
JM Keynes Boulevard	NB Left	1	275	1	275	81 (168)
	SB Left	1	300	1	350	141 (40)
	EB Left	1	Drop Lane#	1	Drop Lane#	28 (74)
JW Clay Boulevard	NB Left	2	350	1	400	170 (205)
	SB Left	1	150	1	300	116 (88)
	EB Left	1	350	1	275	154 (1003)
	WB Left	1	100	1	100	11 (109)
UNCC Research Drive	NB Left	1	200	1	350	78 (352)
	SB Left	1	200	1	200	114 (92)
	EB Left	1	Drop Lane#	1	Drop Lane#	61 (166)
	WB Left	1	Drop Lane#	1	Drop Lane#	11 (109)
Mallard Creek Church Road	NB Left	2	225	2	225	201 (507)
	SB Left	1	250	1	250	320 (186)
	EB Left	2	350	2	350	125 (911)
	WB Left	1	225	2	225	198 (280)

#Note: A drop lane is a continuous turn lane from the preceding intersection ending at this intersection.

6.3.2 Right Turn Lanes

Right turn lanes have been recommended at several intersections throughout the network; either to provide separation between a high volume right turn movement and through traffic or to match the existing geometry of the intersection. The presence of right turn lanes, particularly those at stations, can affect pedestrian comfort and safety because of the extra crossing distance pedestrians must travel. Intersections were evaluated to determine the necessity of right turn lanes, and turning volumes were the basis for either retaining or removing existing right turn lanes. In general, existing right turn lanes were retained if the turning volume exceeded 100 vehicles per hour (vph) during either the a.m. or p.m. peak hour. Subsequent to examining peak hour right turn volumes, intersections with fewer than 100 vph were modeled in VISSIM; with and without the right turn lane to verify that the absent right turn lane did not adversely affect the intersection level of service. In some instances, the right turn volumes were excessively high and dual right turn lanes were warranted. Similar to left turn lanes, the taper for a right turn lane would be 50 feet, while dual right turn lanes would have a 100 foot taper. **Table 6.4** presents the results of the right turn lane analysis. The right turn storage lengths are also illustrated in **Figures 4.12** and **4.13**.

Table 6.4
North Tryon Street/US-29 Right Turn Lane Recommendations

Cross Street	Movement	2008 Conditions		2030 Build		Projected Volumes AM (PM)
		Lanes	Existing Storage (ft)	Lanes	Recommended Storage (ft)	
Old Concord Road	NB Right	1	Drop Lane#	1	Drop Lane#	424 (865)
Arrowhead Drive	NB Right	1	Drop Lane#	0	Through/Right	31 (23)
	SB Right	1	Drop Lane#	0	Through/Right	53 (66)
Heathway Drive	SB Right	1	Drop Lane#	0	Through/Right	0 (3)
Owen Boulevard	NB Right	1	325	0	Through/Right	8 (38)
	SB Right	1	Drop Lane#	0	Through/Right	0 (0)
Tom Hunter Road	SB Right	1	200	1	200	133 (159)
	EB Right	1	300	1	300	230 (280)
I-85 Connector	SB Right	2	350*	2	Drop Lane# / 350	541 (648)
	EB Right	1	200*	1	100	184 (88)
I-85 Service Road	SB Right	1	150	0	Through/Right	40 (11)
University City Boulevard Park-and-Ride Entrance	SB Right	0	N/A	0	Through/Right	308 (28)
	EB Right	N/A	N/A	1	Drop Lane#	7 (95)
Rocky River Road	NB Right	1	425	0	Through/Right	131 (255)
University City Boulevard/NC-49	NB Right	2	250*	2	Drop Lane# / 250	913 (2072)
	SB Right	1	200*	1	150	512 (302)
	EB Right	1	100*	1	100	168 (263)
	WB Right	1	200*	1	200	28 (200)

#Note: A drop lane is a continuous turn lane from the preceding intersection ending at this intersection.

*Note: These storage lengths will be provided when the “Weave Area” project is constructed.

Table 6.4 (continued)
North Tryon Street/US-29 Right Turn Lane Recommendations

Cross Street	Movement	2008 Conditions		2030 Build		Projected Volumes AM (PM)
		Lanes	Existing Storage (ft)	Lanes	Recommended Storage (ft)	
Shopping Center Drive	NB Right	1	200	1	200	38 (146)
	SB Right	1	175	1	Through/Right (200)	340 (300)
	EB Right	1	Drop Lane#	1	Drop Lane#	230 (375)
McCullough Drive	NB Right	1	500	0	Through/Right	19 (39)
	SB Right	1	Drop Lane#	1	900**	186 (68)
	EB Right	1	225	1	225	335 (340)
	WB Right	1	150	1	150	19 (35)
Ken Hoffman Drive	NB Right	0	Through/Right	1	100	19 (58)
	EB Right	1	50	1	50	40 (23)
	WB Right	1	200	1	200	25 (53)
W.T. Harris Boulevard	NB Right	1	Drop Lane#	1	675***	136 (280)
	SB Right	1	500	1	500**	169 (247)
JM Keynes Drive	NB Right	1	150	1	150	131 (59)
	SB Right	1	Drop Lane#	1	900**	120 (73)
	WB Right	1	325	1	325	31 (234)
JW Clay Boulevard	SB Right	1	Drop Lane#	1	850	605 (483)
	EB Right	1	Drop Lane#	1	Drop Lane#	65 (181)
UNCC Research Drive	NB Right	1	300	1	300	85 (80)
Grove Lake Drive	SB Right	1	Drop Lane#	1	Drop Lane#	34 (103)
Barton Creek Drive	SB Right	1	Drop Lane#	1	Drop Lane#	8 (44)
Mallard Creek Church Road	NB Right	1	175	1	175	115 (340)
	SB Right	1	700	1	700	845 (249)
	EB Right	1	175	1	175	415 (521)
	WB Right	1	225	1	225	59 (389)

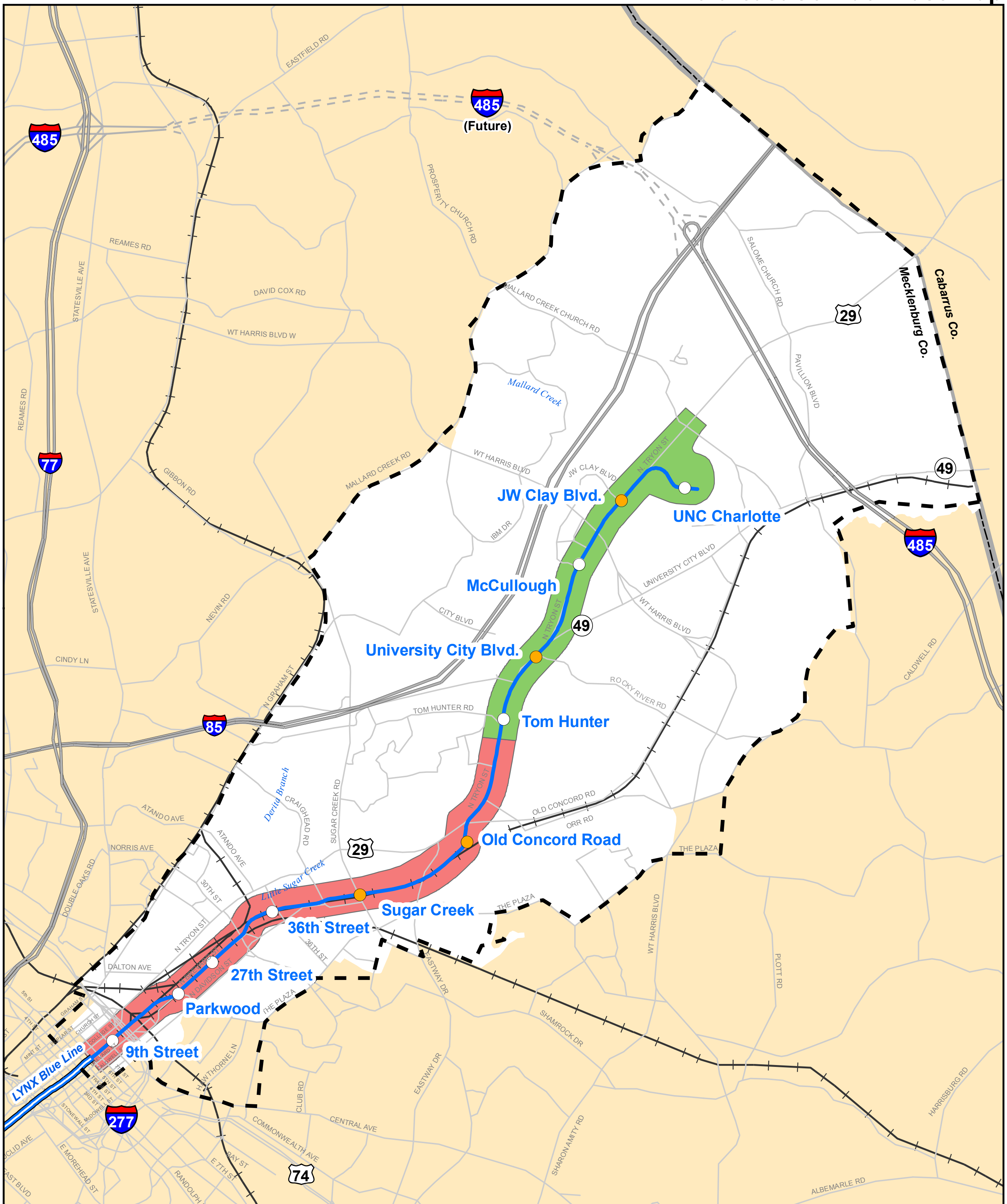
#Note: A drop lane is a continuous turn lane from the preceding intersection ending at this intersection.
**Note: Storage lengths were maximized by extending the turn lane to the upstream intersection. The turn lane would begin after a 50 foot tangent section and a 50 foot taper following the curb return at the upstream intersection.
***Note: Storage lengths were maximized by extending the turn lane to the upstream intersection. The turn lane would begin after a 50 foot tangent section and a 100 foot taper following the curb return at the upstream intersection.

FIGURES

LYNX Rapid Transit Services Blue Line Extension

Figure 1

Northeast Corridor Base Map



Legend

- Northeast Corridor Limits
- Proposed Light Rail Alternative
- Proposed Stations
- Proposed Stations with Park-and-Ride
- LYNX Blue Line
- Highway
- Major Roads
- Highway (Future)
- County Line
- Railroads

Civil Engineering Segments

- Segment 1 (Center City to Owen Blvd)
- Segment 2 (Tom Hunter Rd to Mallard Creek Church Rd)

N

0 0.5 1

Mile

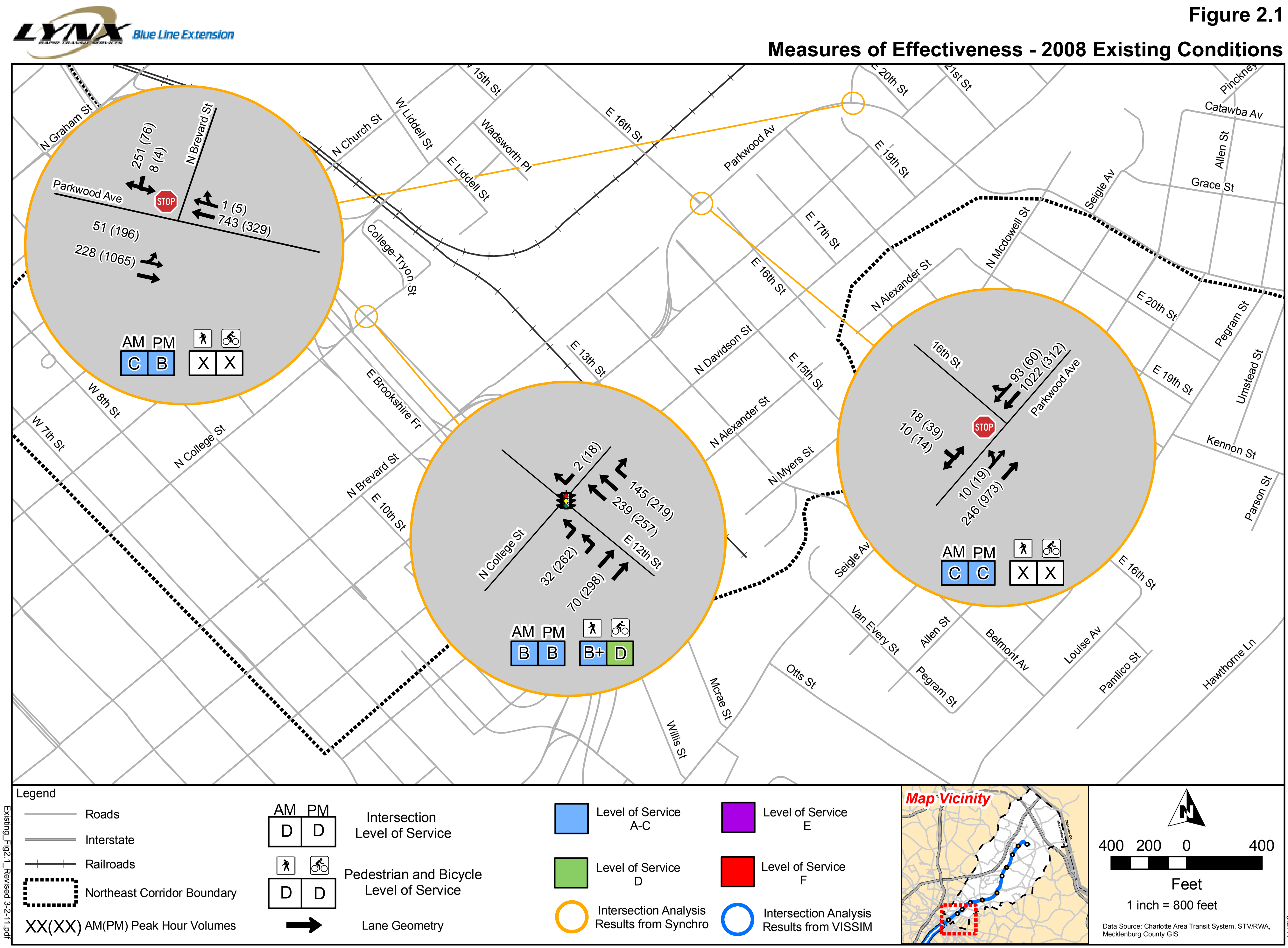
Data Source:
CATS, City of Charlotte GIS, and Mecklenburg County GIS

NE_Corridor_Base_Map_Rev.00.pdf

3.2.11

Figure 2.1

Measures of Effectiveness - 2008 Existing Conditions

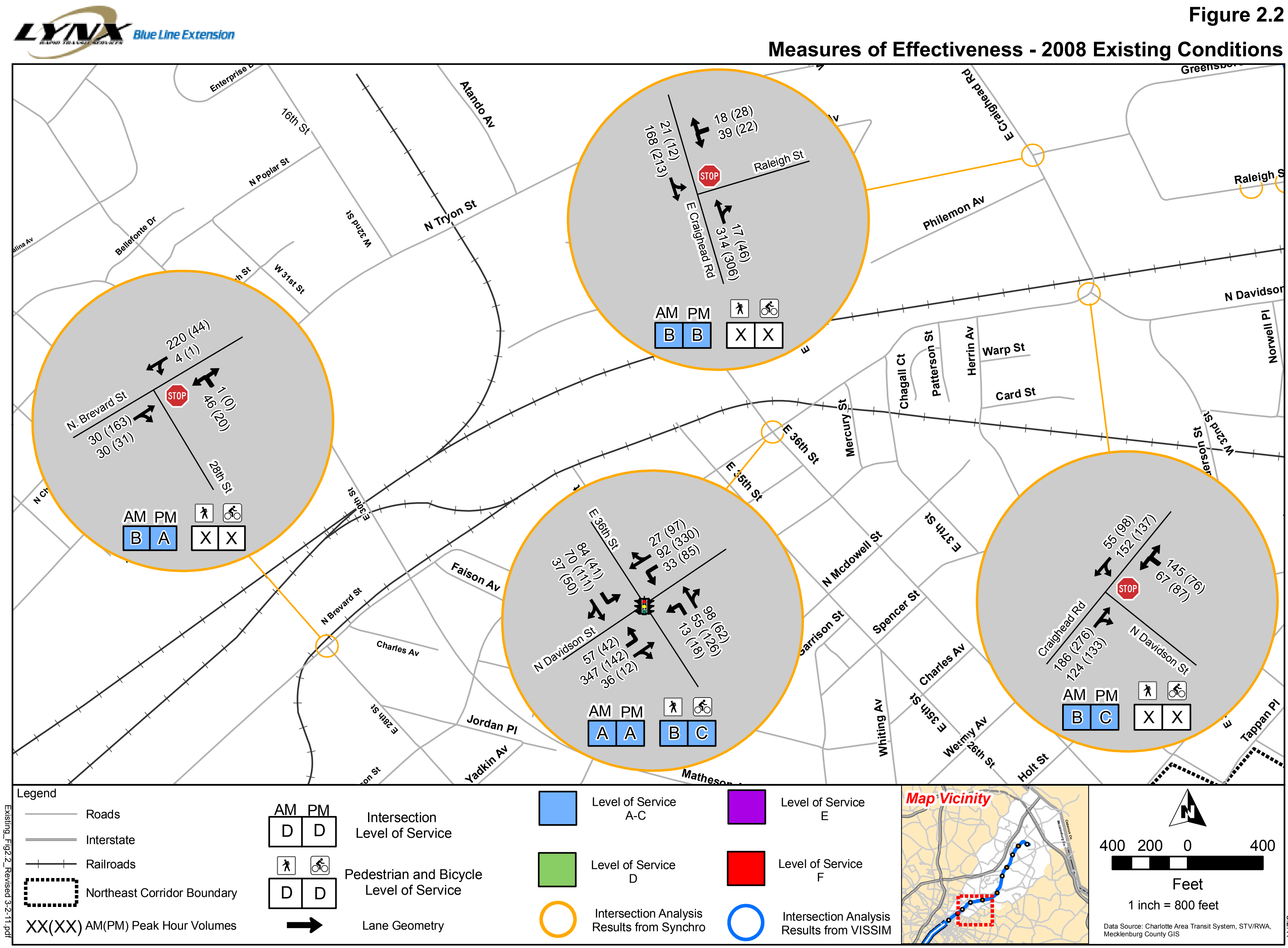


Existing_Fig2.1_Revised 3-2-11.pdf

3.2.11

Figure 2.2

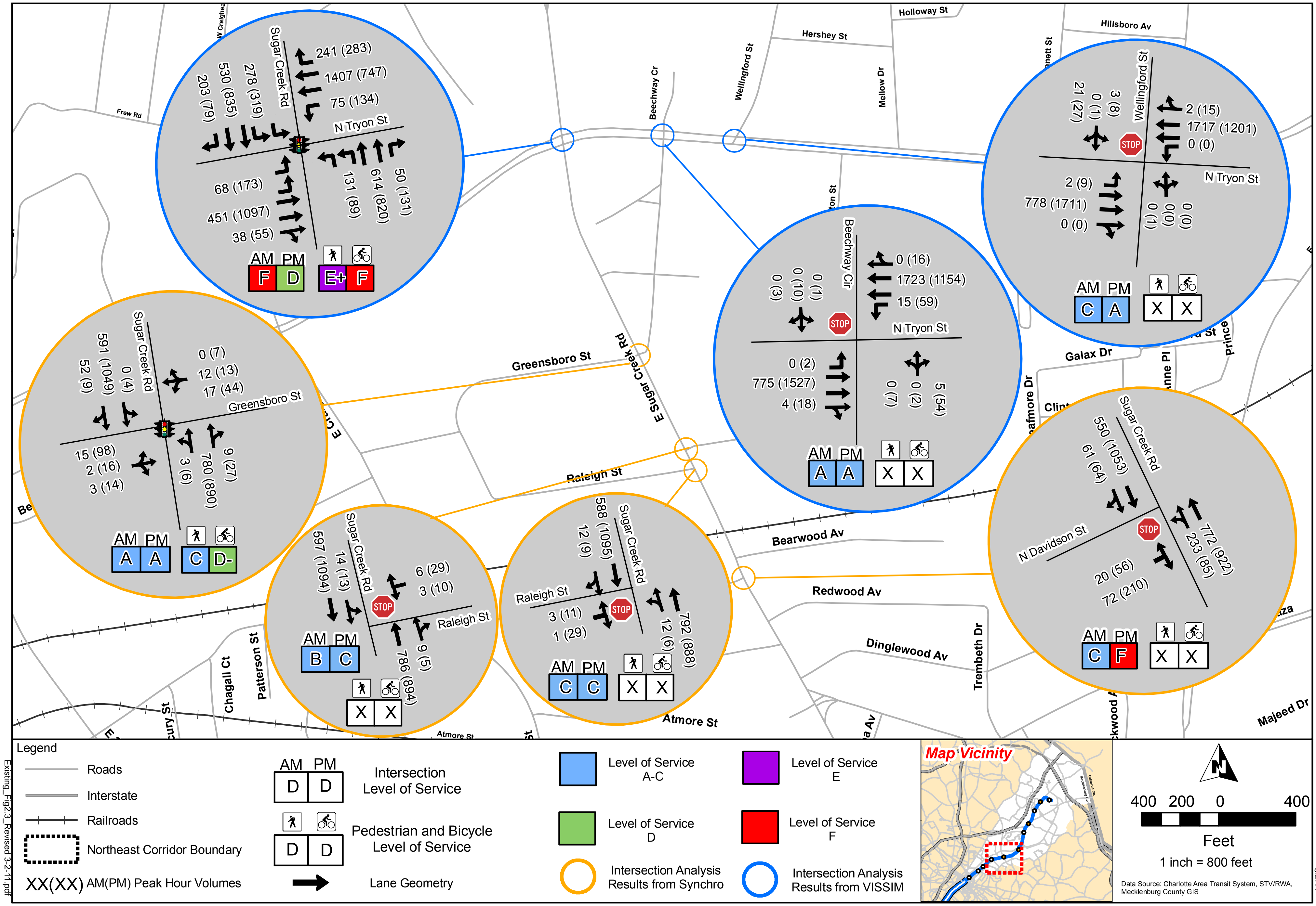
Measures of Effectiveness - 2008 Existing Conditions



LYNX Blue Line Extension

Figure 2.3

Measures of Effectiveness - 2008 Existing Conditions



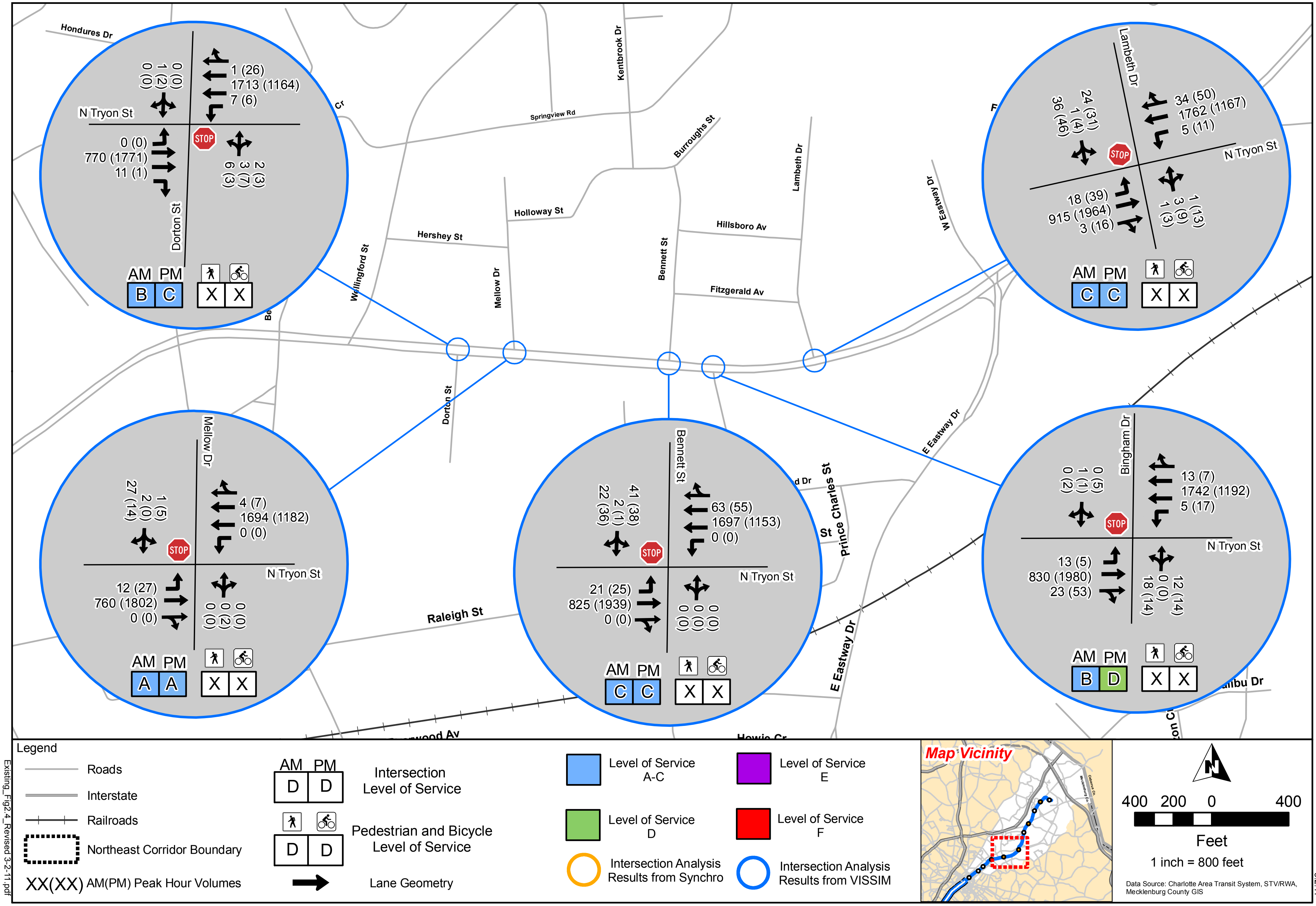
Existing_Fig2.3_Revised 3-2-11.pdf

3.2.11

LYNX Blue Line Extension

Figure 2.4

Measures of Effectiveness - 2008 Existing Conditions



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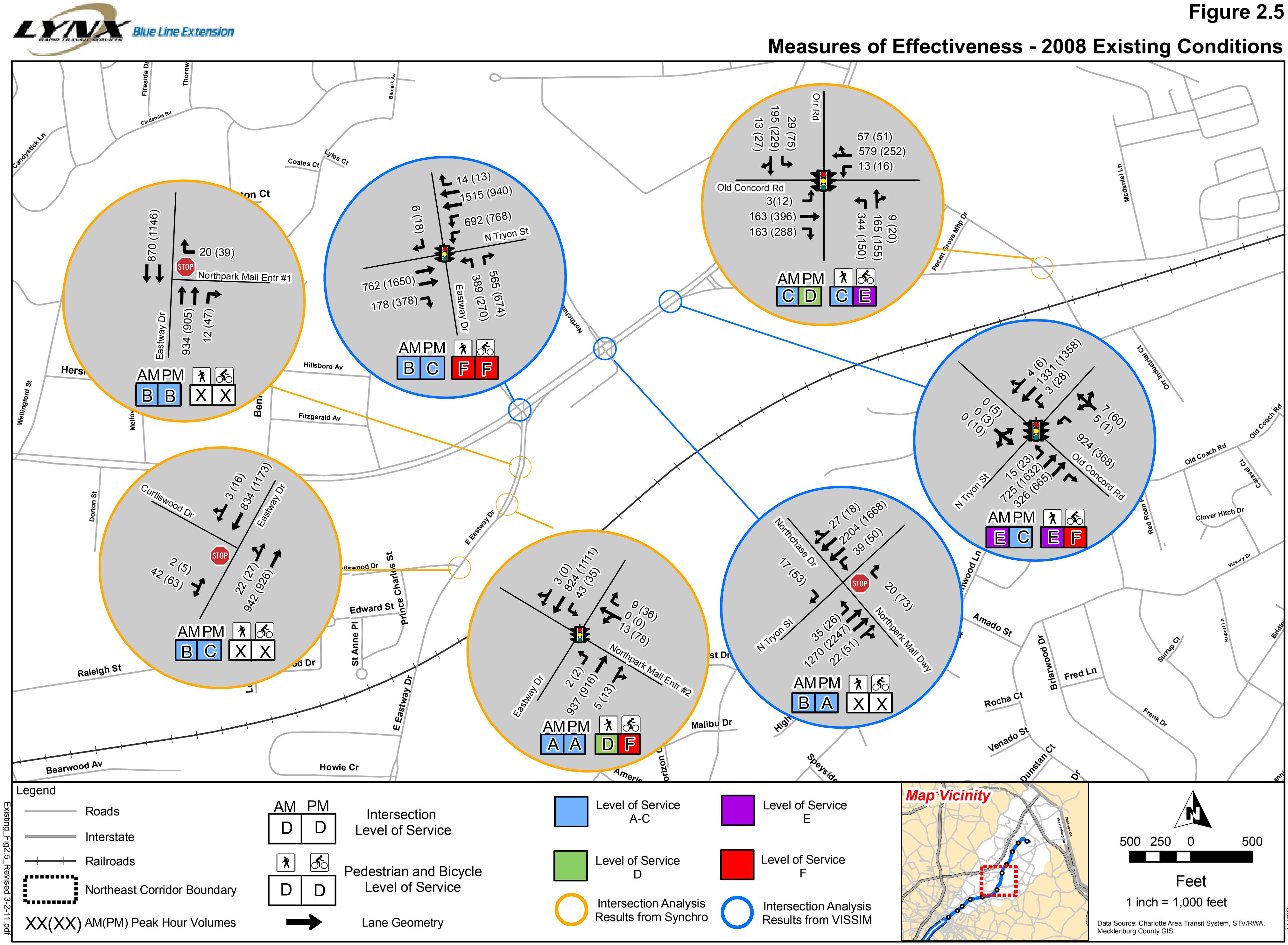
3.2.11

Figure 2.5

Measures of Effectiveness - 2008 Existing Conditions



Existing_Fig2.5_Revised 3-2-11.pdf

3.2.11

Figure 2.6

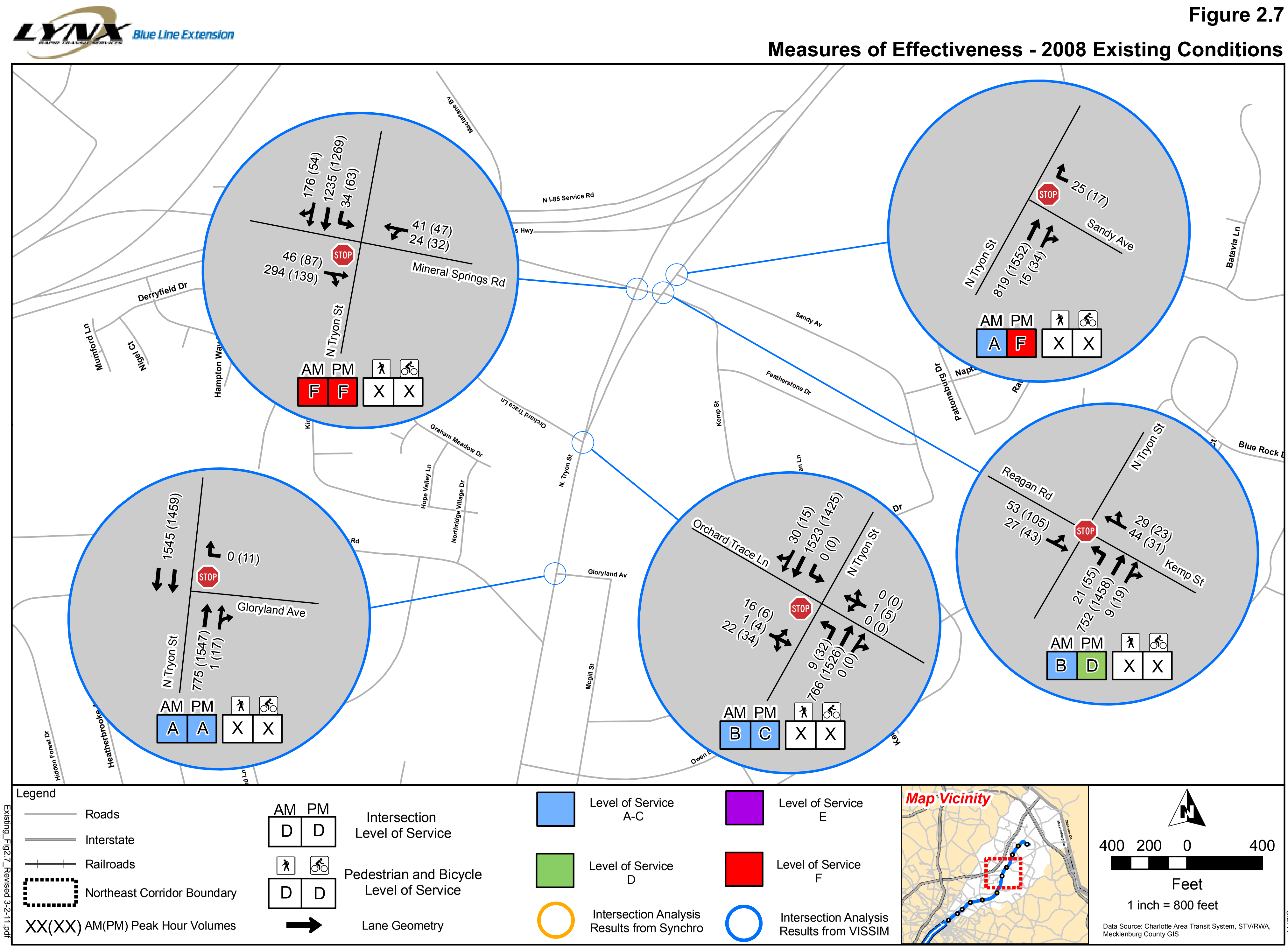
Measures of Effectiveness - 2008 Existing Conditions

Existing_Fig2.6_Revised 3-2-11.pdf

3.2.11

Figure 2.7

Measures of Effectiveness - 2008 Existing Conditions



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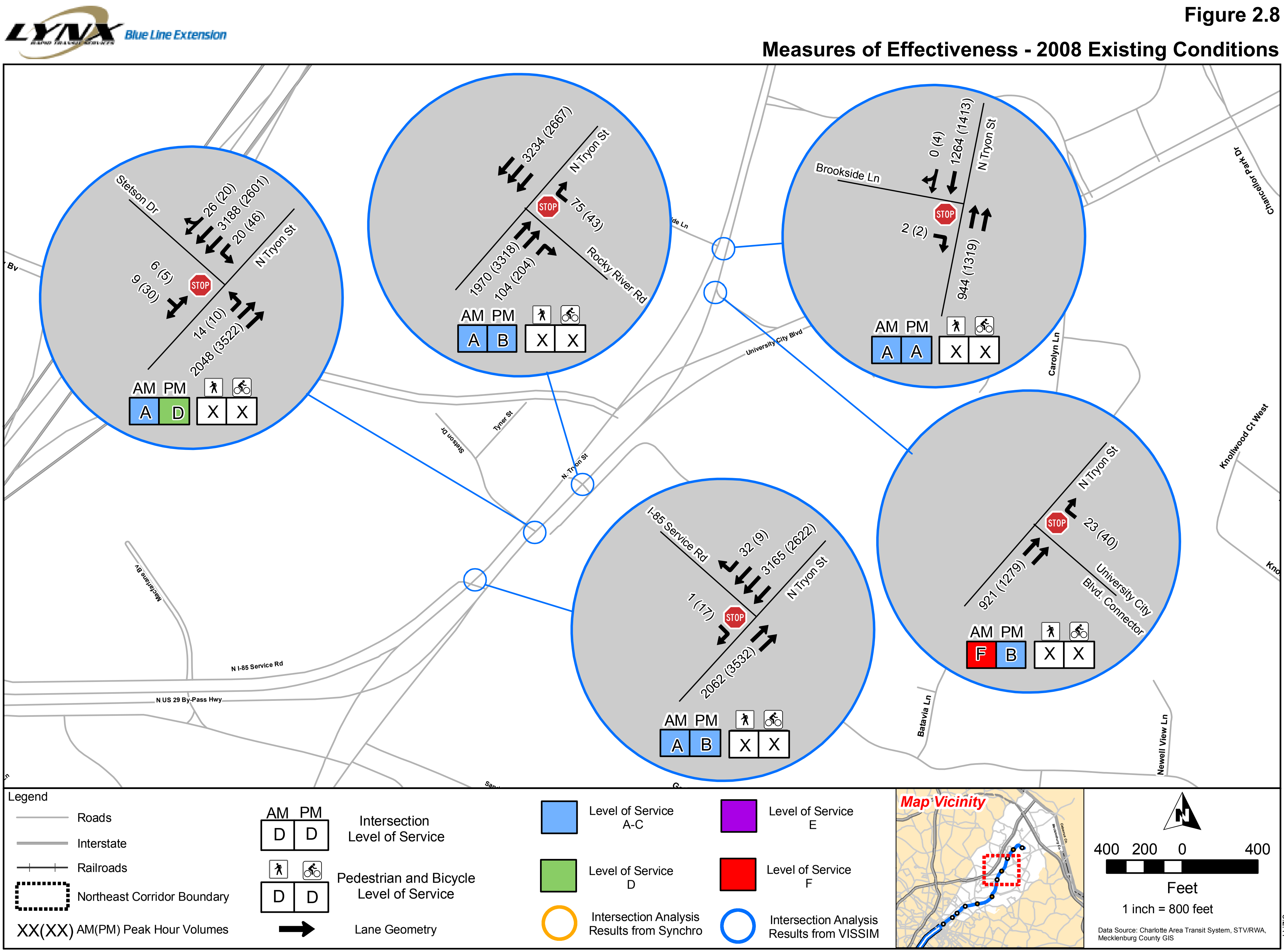
3.2.11

Figure 2.8

Measures of Effectiveness - 2008 Existing Conditions



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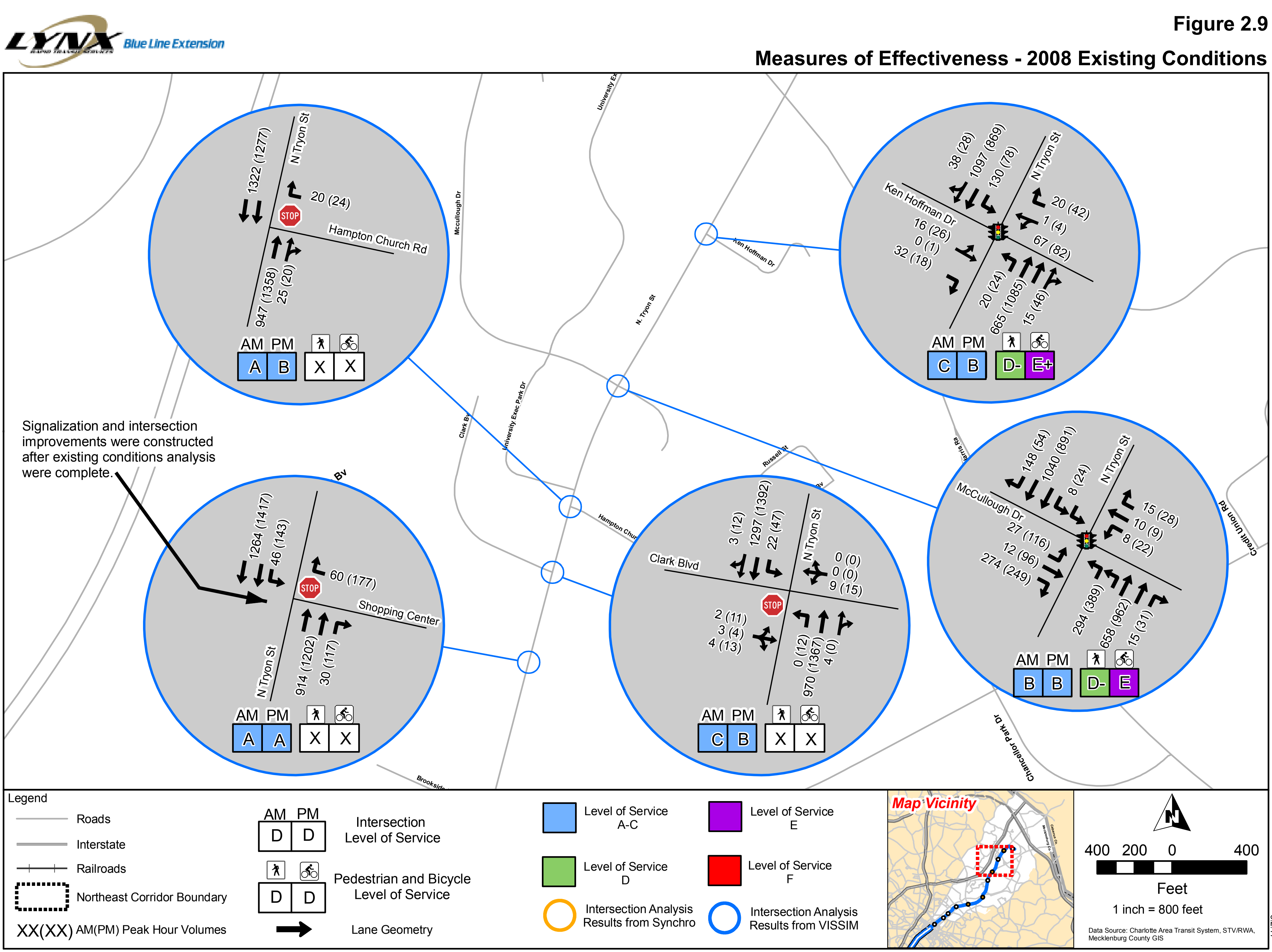
3.2.11

Figure 2.9

Measures of Effectiveness - 2008 Existing Conditions

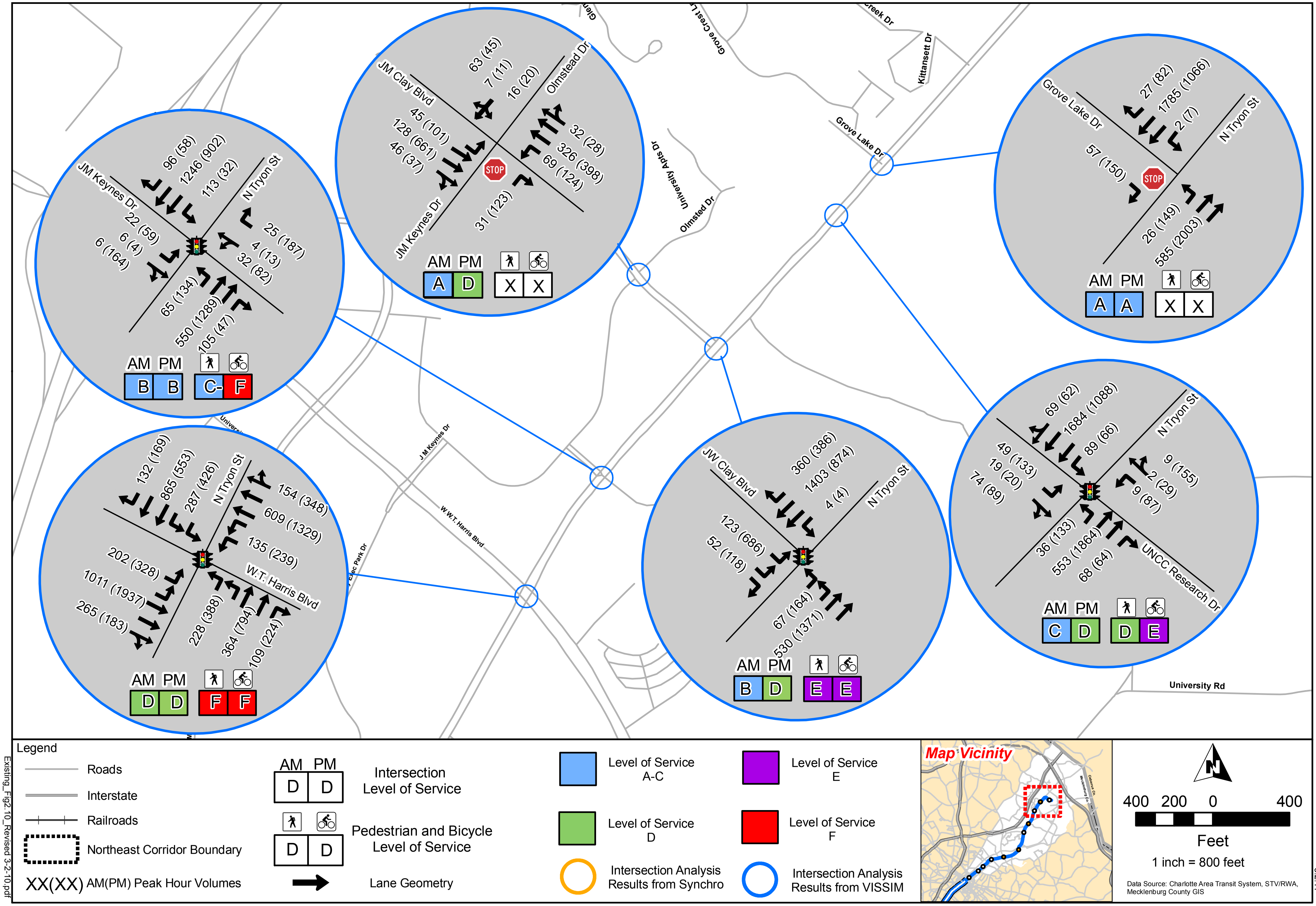


3.2.11

Existing_Fig2.9_Revised 3-2-11.pdf

Figure 2.10

Measures of Effectiveness - 2008 Existing Conditions



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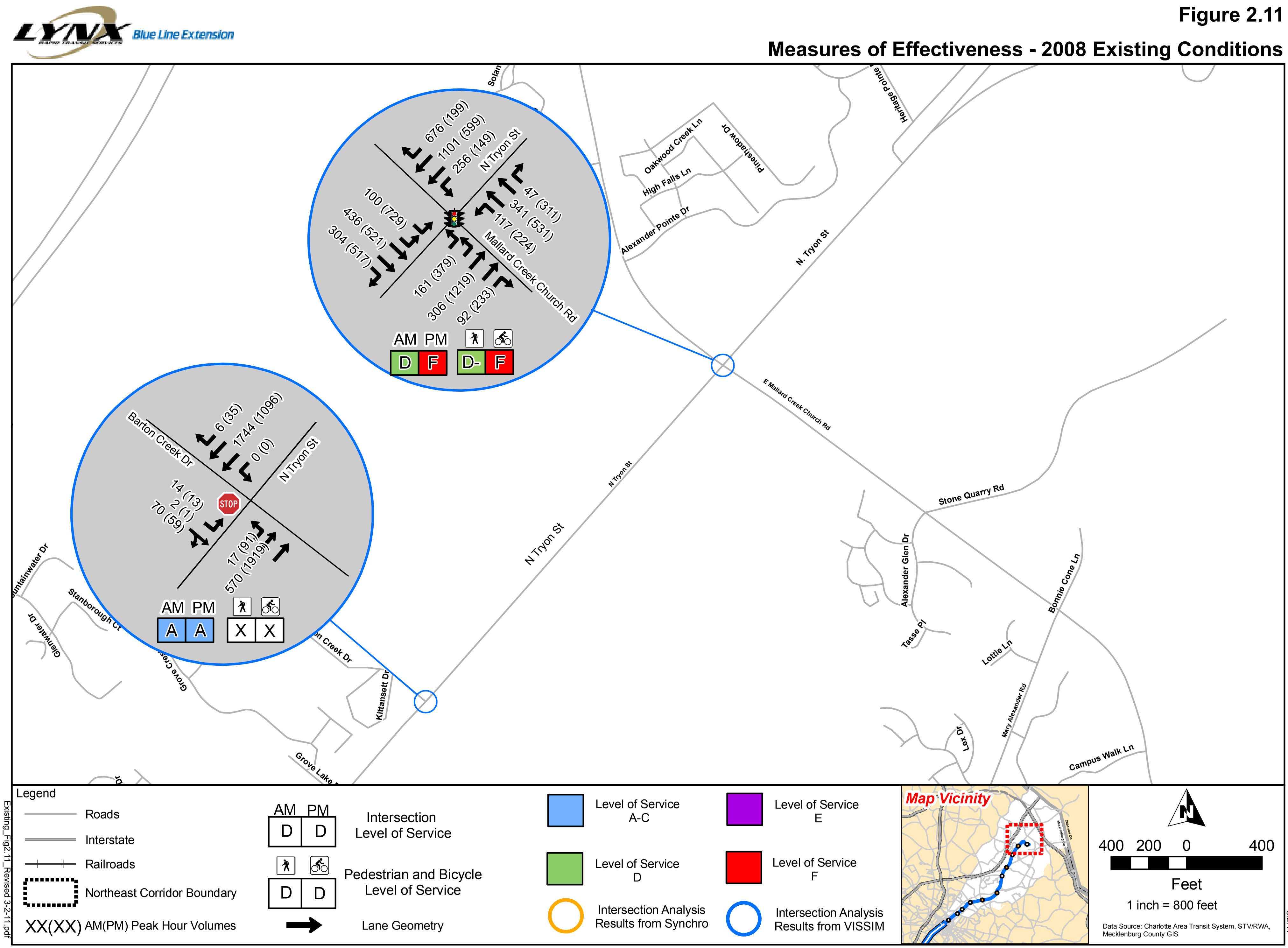
3.2.11

Figure 2.11

Measures of Effectiveness - 2008 Existing Conditions



Existing_Fig2.11_Revised 3-2-11.pdf

3.2.11

Figure 3.1

Measures of Effectiveness - 2030 No-Build Alternative

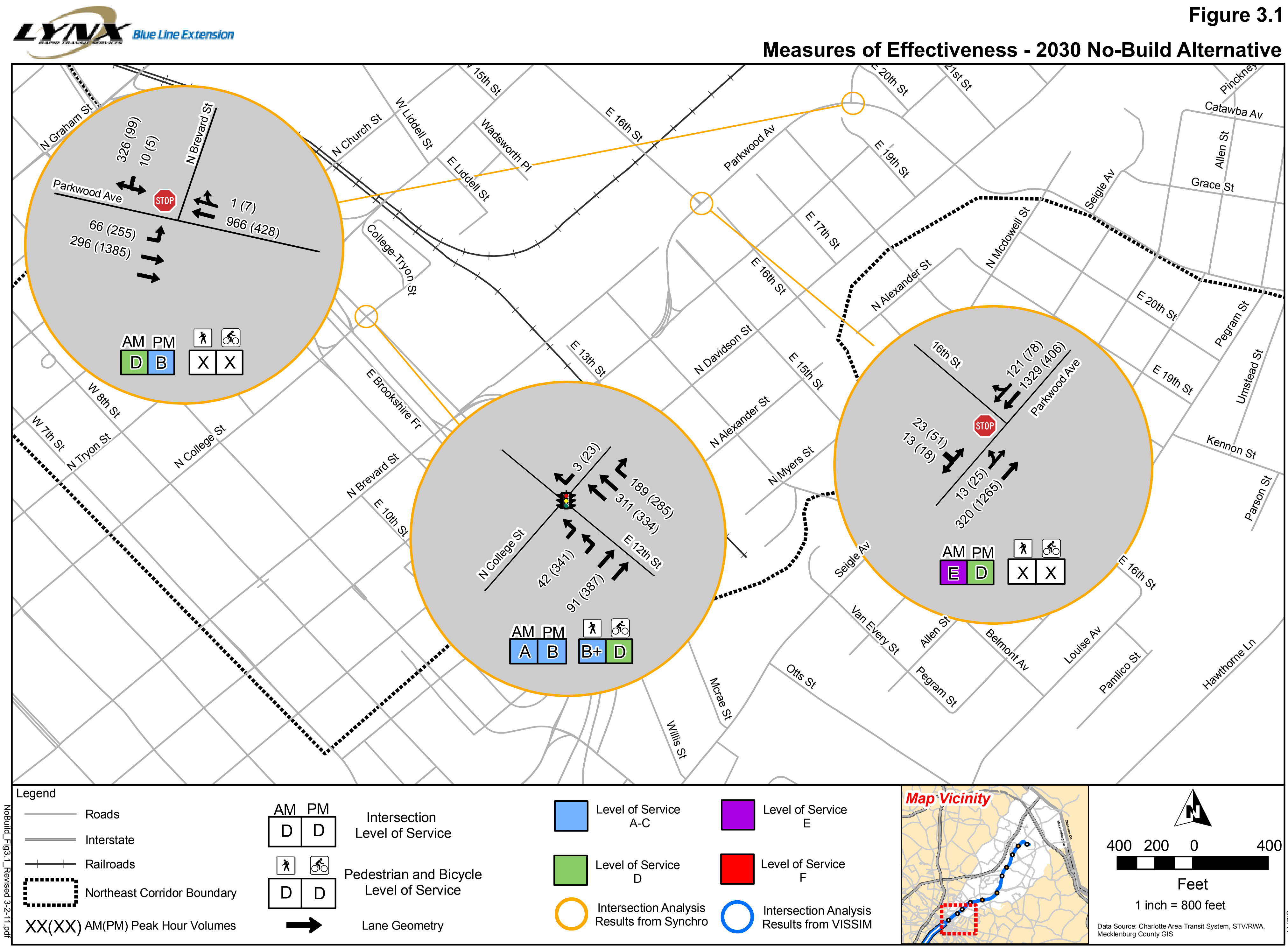
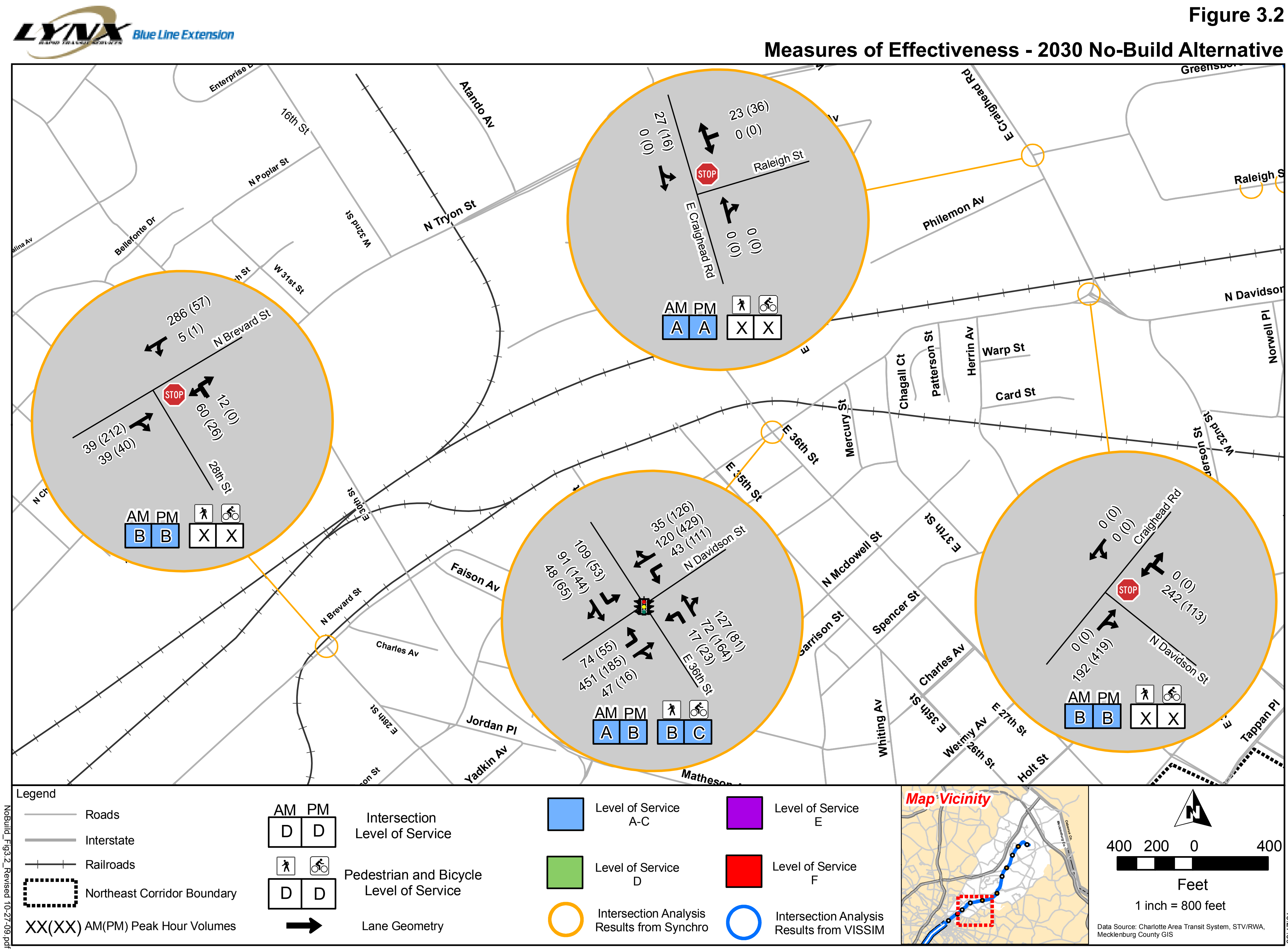


Figure 3.2

Measures of Effectiveness - 2030 No-Build Alternative

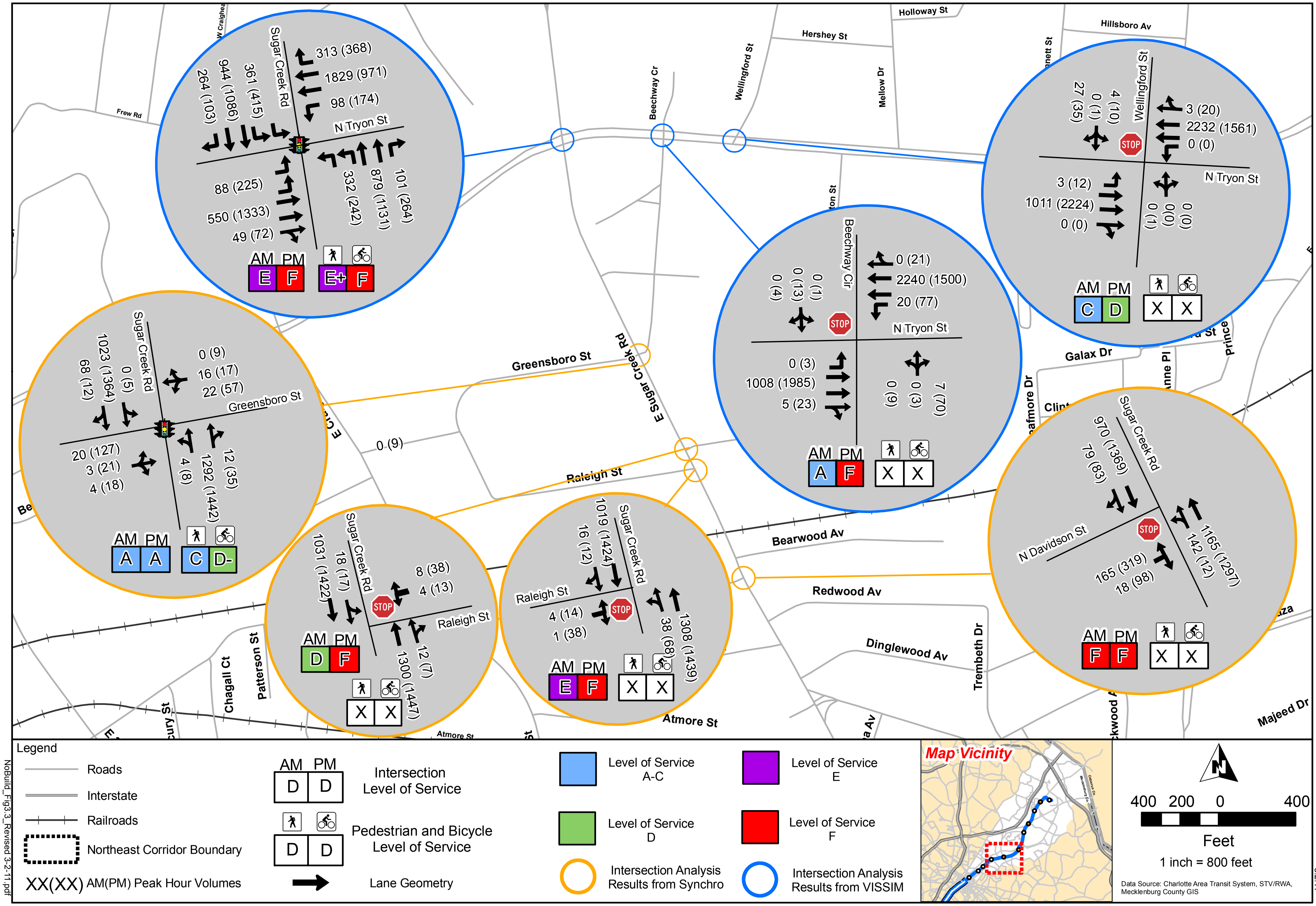


10.27.09

NoBuild_Fig3.2_Revised 10-27-09.pdf

Figure 3.3

Measures of Effectiveness - 2030 No-Build Alternative



NoBuild_Fig3.3_Revised 3-2-11.pdf

3.2.11

Figure 3.4

Measures of Effectiveness - 2030 No-Build Alternatives

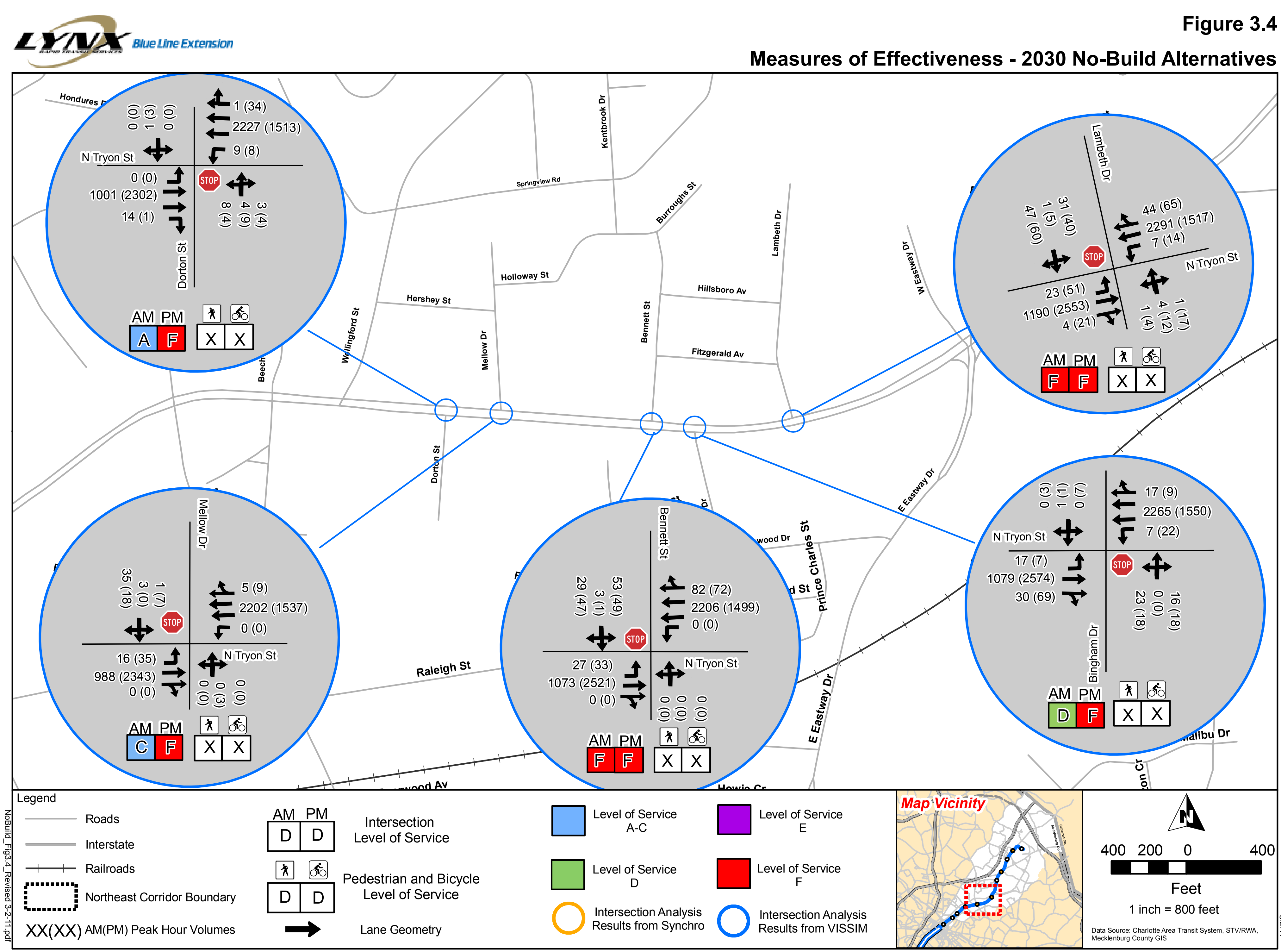
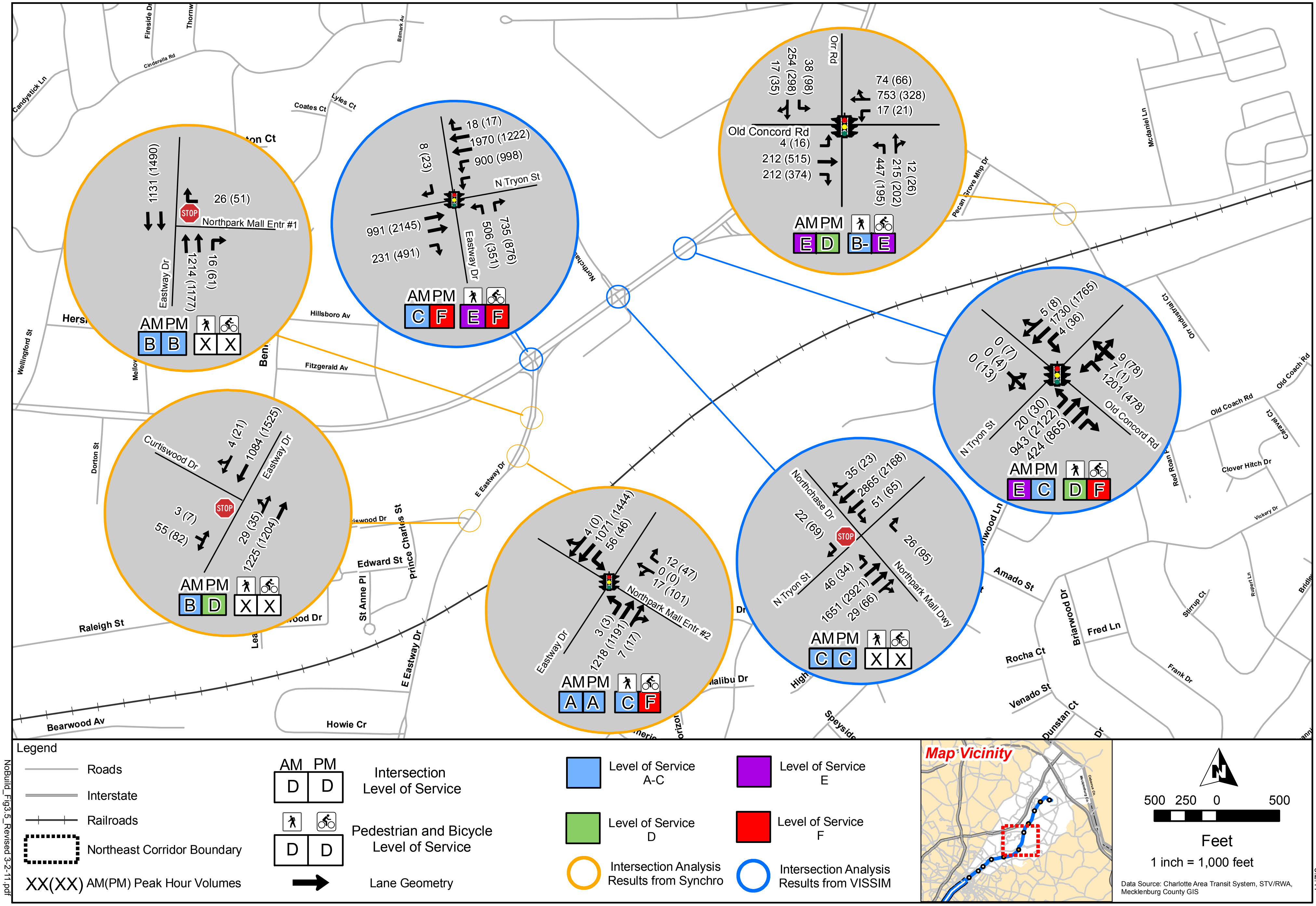


Figure 3.5

Measures of Effectiveness - 2030 No-Build Alternatives



3.2.11

NoBuild_Fig3.5_Revised 3-2-11.pdf

Figure 3.6

Measures of Effectiveness - 2030 No-Build Alternatives

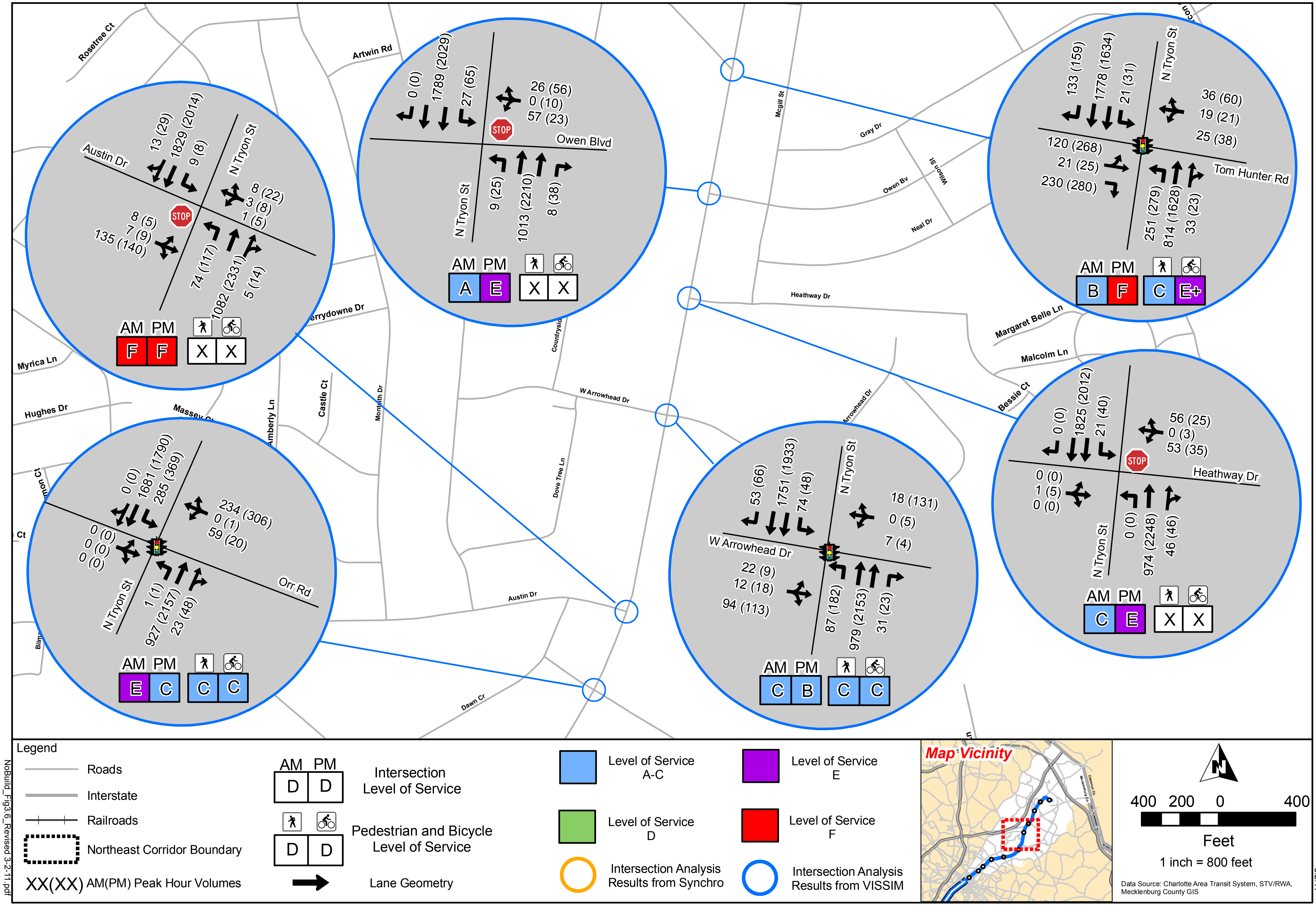
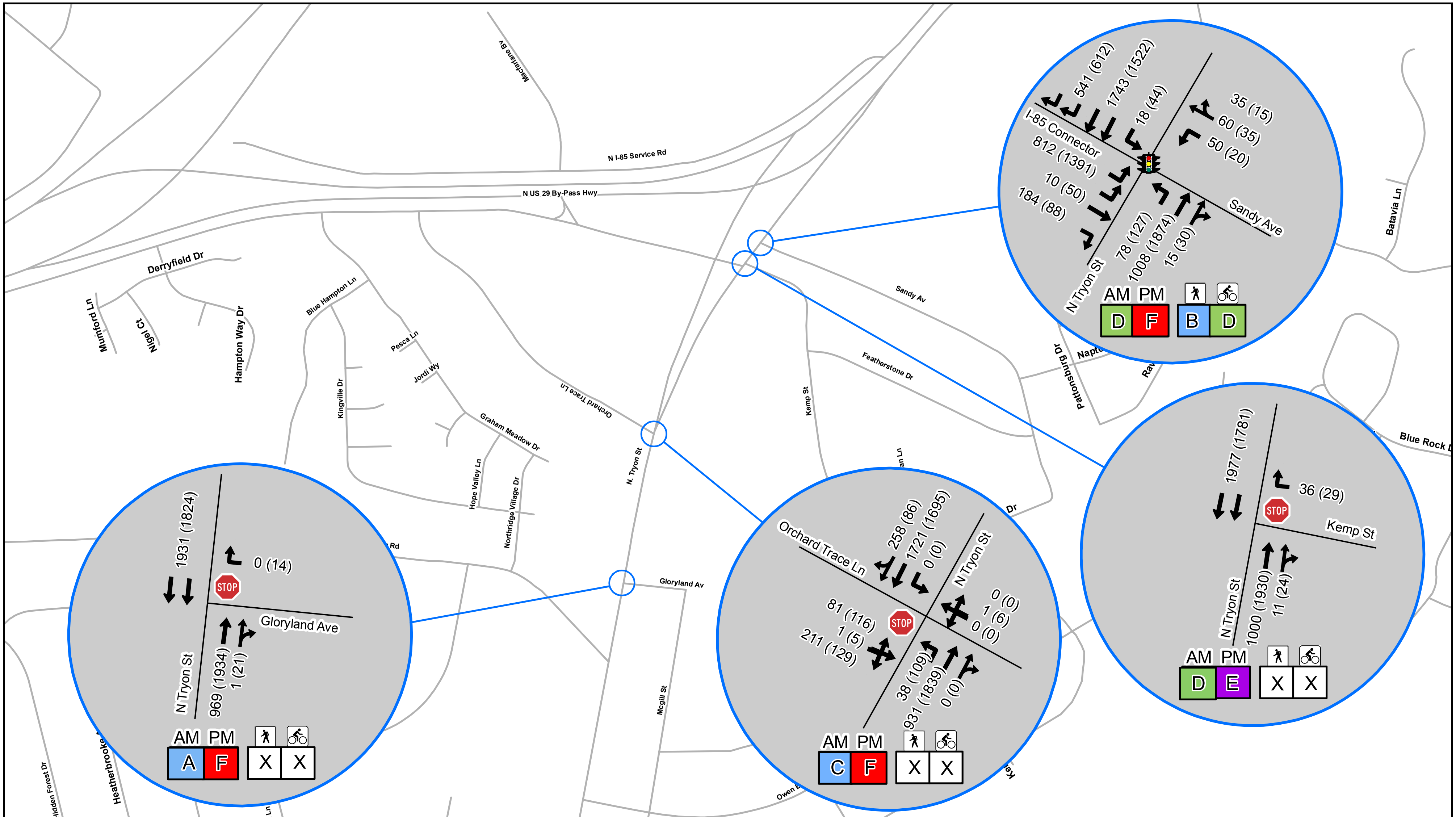


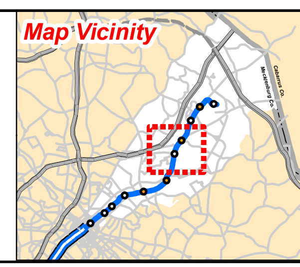
Figure 3.7

Measures of Effectiveness - 2030 No-Build Alternatives



Legend

Roads	
Interstate	
Railroads	
Northeast Corridor Boundary	
XX(XX) AM(PM) Peak Hour Volumes	
AM PM D D	Intersection Level of Service
D D	Pedestrian and Bicycle Level of Service
	Lane Geometry
Level of Service A-C	Level of Service E
Level of Service D	Level of Service F
Intersection Analysis Results from Synchro	Intersection Analysis Results from VISSIM



400 200 0 400

Feet

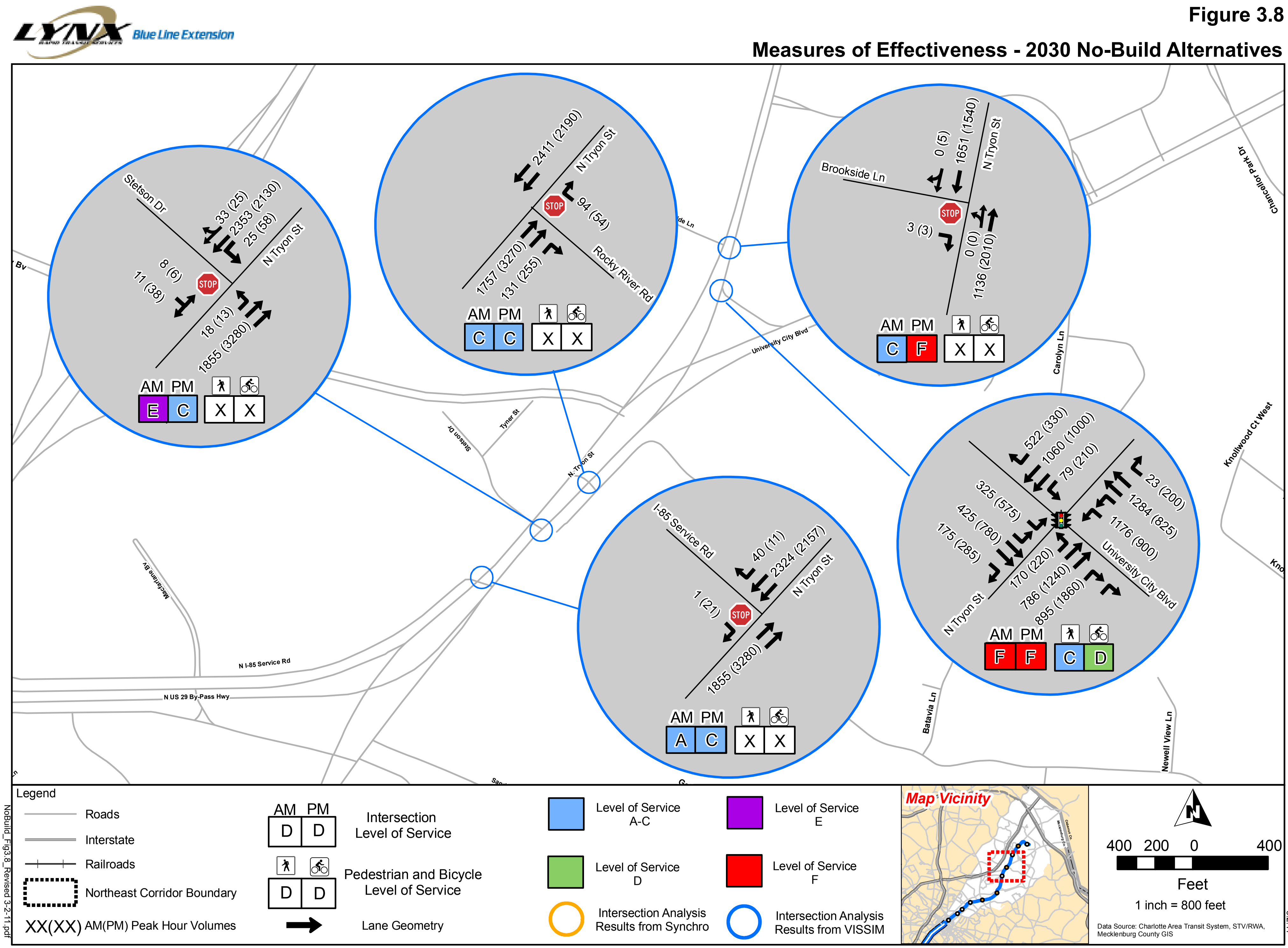
1 inch = 800 feet

Data Source: Charlotte Area Transit System, STV/RWA, Mecklenburg County GIS

3.2.11

Figure 3.8

Measures of Effectiveness - 2030 No-Build Alternatives

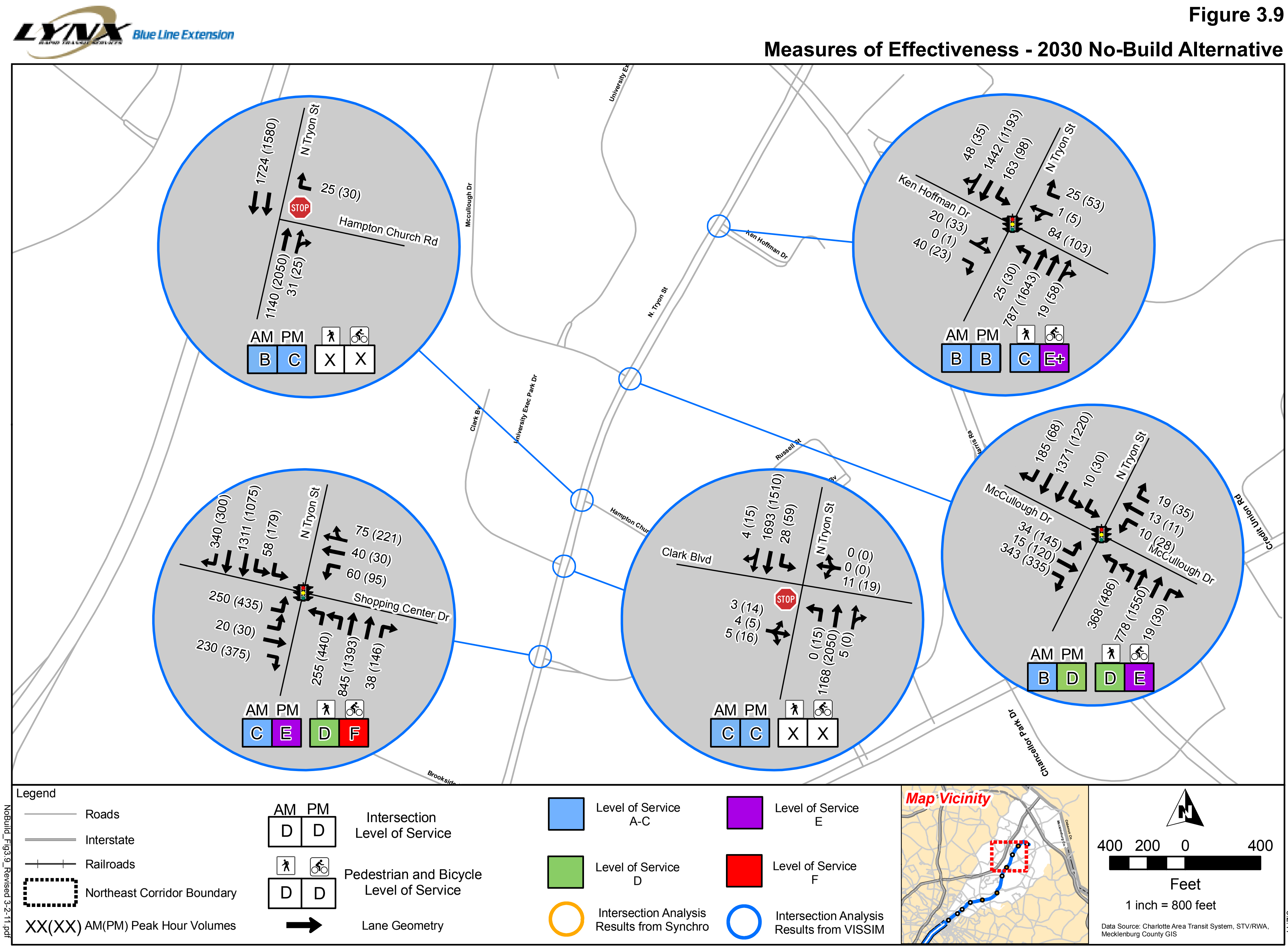


3.2.11

NoBuild_Fig3.8_Revised 3-2-11.pdf

Figure 3.9

Measures of Effectiveness - 2030 No-Build Alternative



3.2.11

NoBuild_Fig3.9_Revised 3-2-11.pdf

Figure 3.10
Measures of Effectiveness - 2030 No-Build Alternative

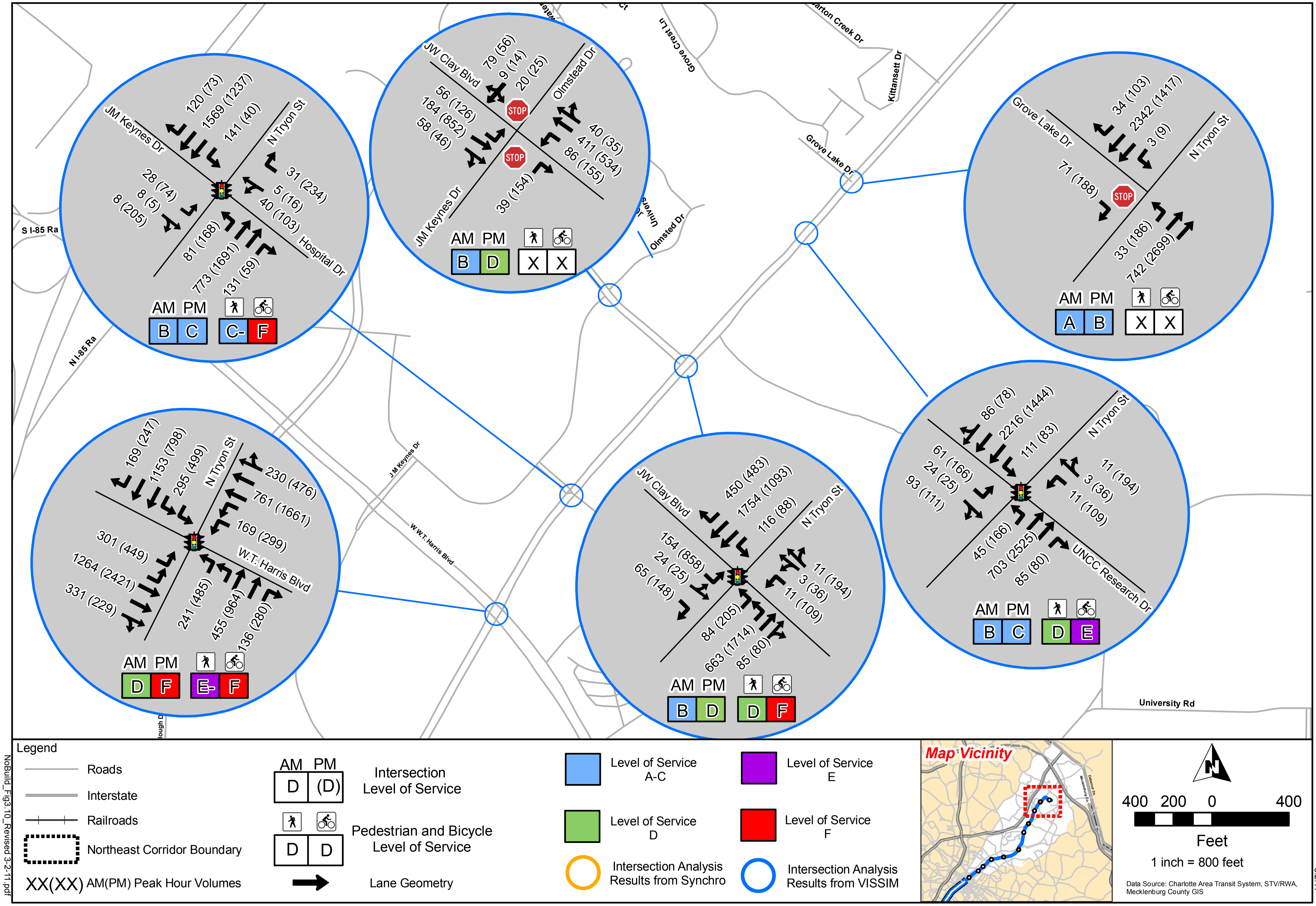
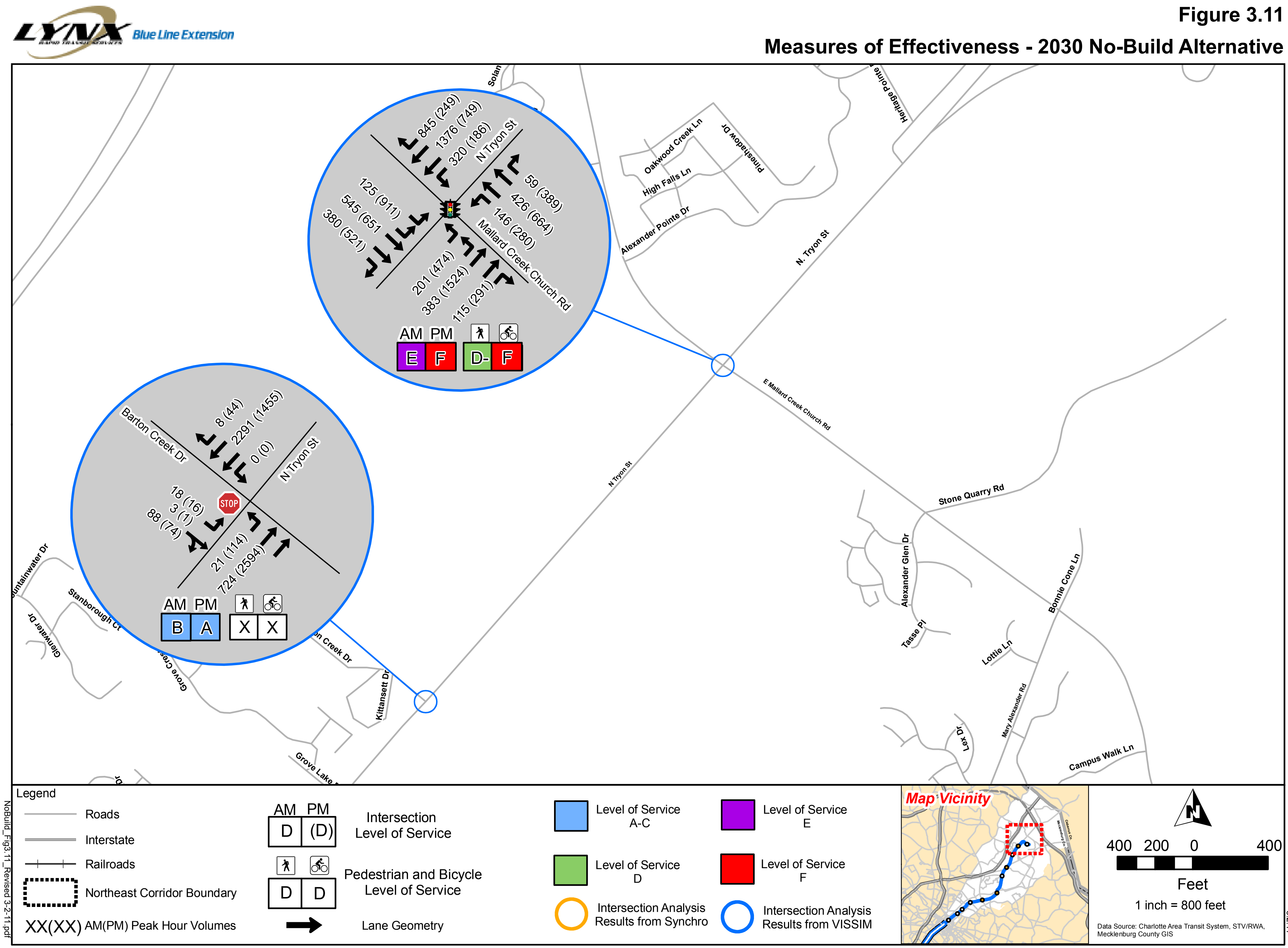


Figure 3.11

Measures of Effectiveness - 2030 No-Build Alternative



Data Source: Charlotte Area Transit System, STV/RWA, Mecklenburg County GIS

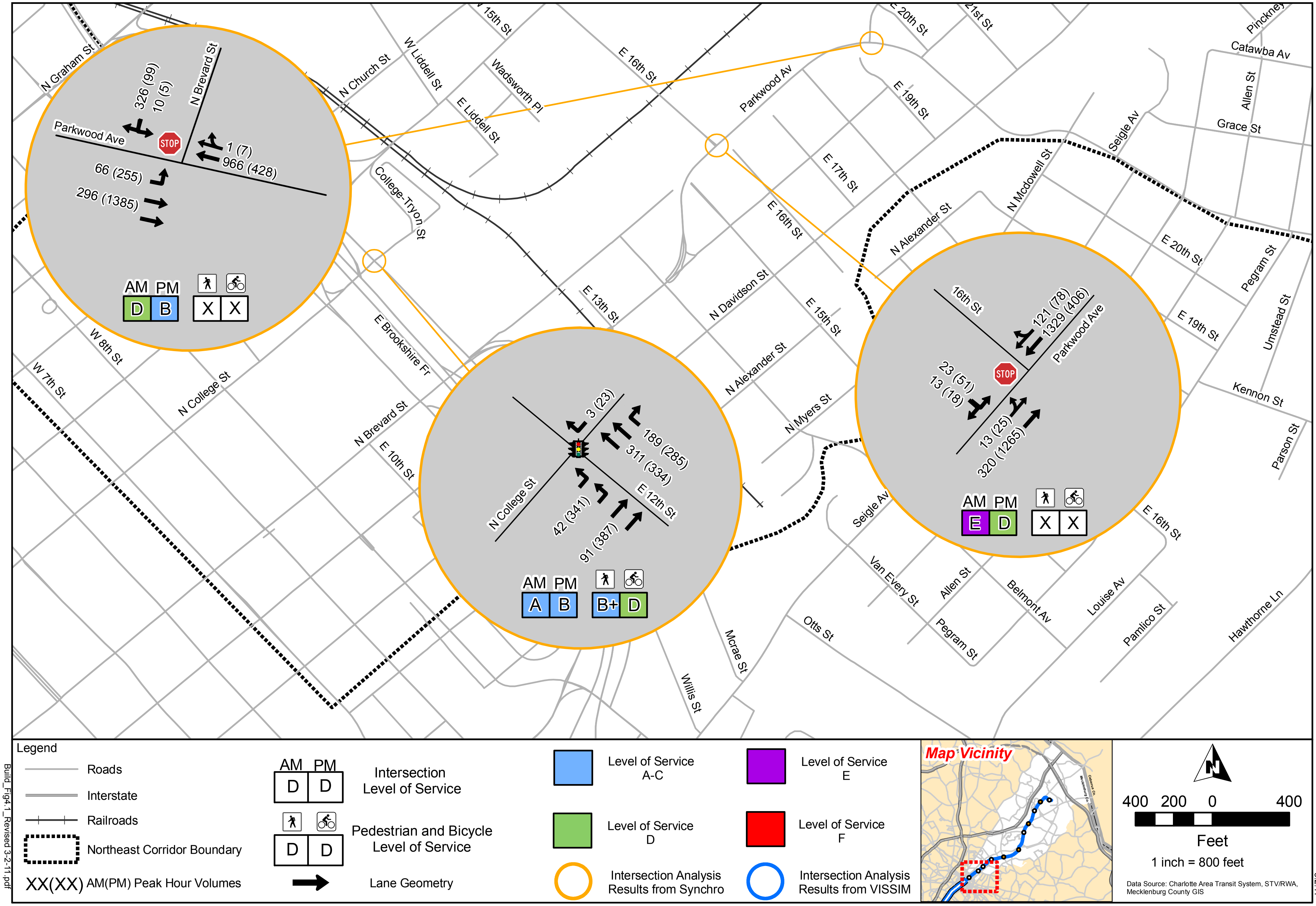
3.2.11

NoBuild_Fig3.11_Revised 3-2-11.pdf

LYNX Blue Line Extension

Figure 4.1

Measures of Effectiveness - 2030 Preferred Alternative



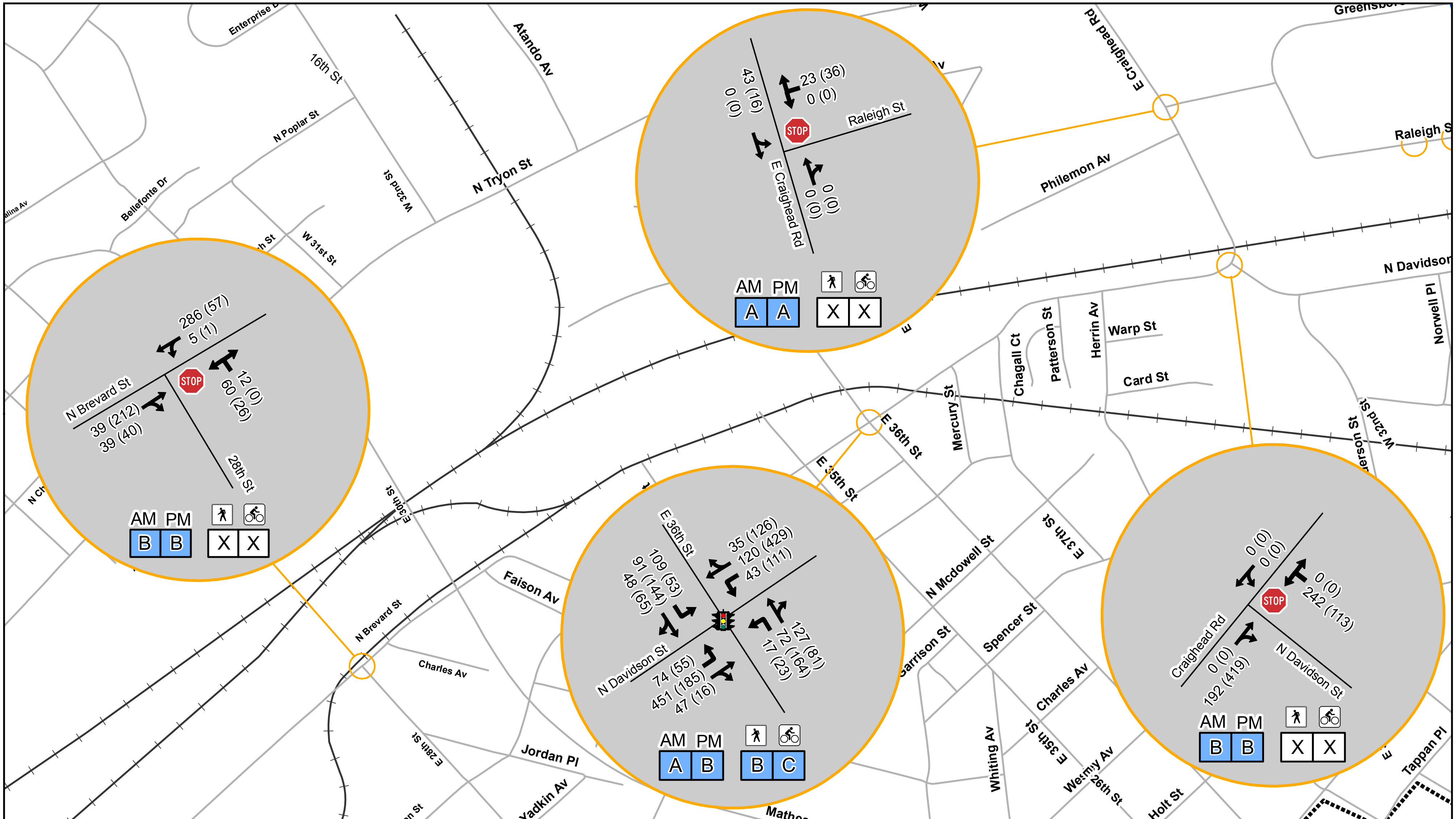
Build_Fig4.1_Revised 3-2-11.pdf

3.2.11

LYNX Blue Line Extension

Figure 4.2

Measures of Effectiveness - 2030 Preferred Alternative



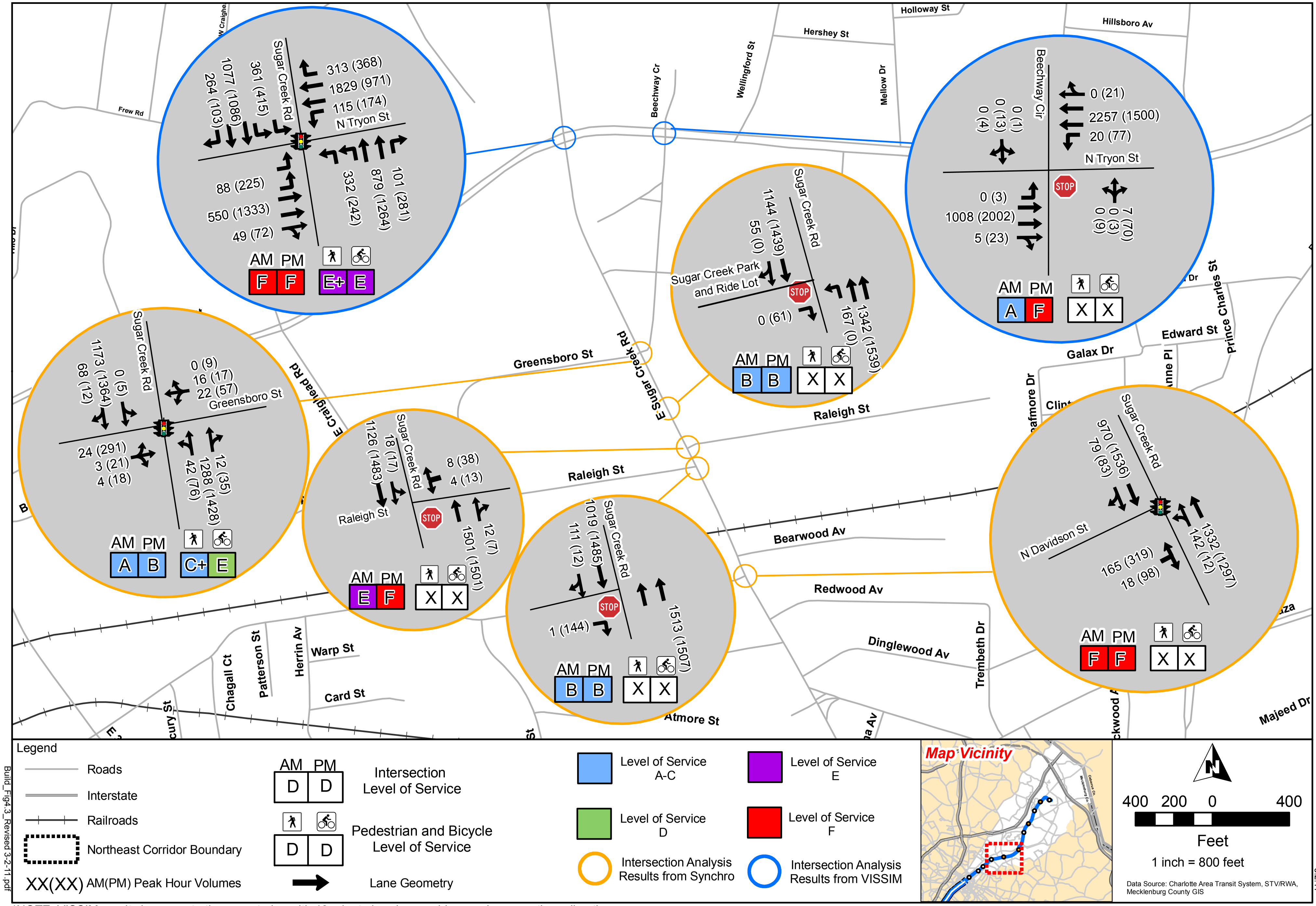
Legend

Roads	
Interstate	
Railroads	
Northeast Corridor Boundary	
XX(XX)	AM(PM) Peak Hour Volumes
AM PM D D	Intersection Level of Service
D D	Pedestrian and Bicycle Level of Service
	Lane Geometry
	Level of Service A-C
	Level of Service D
	Level of Service E
	Level of Service F
	Intersection Analysis Results from Synchro
	Intersection Analysis Results from VISSIM

LYNX Blue Line Extension

Figure 4.3

Measures of Effectiveness - 2030 Preferred Alternative



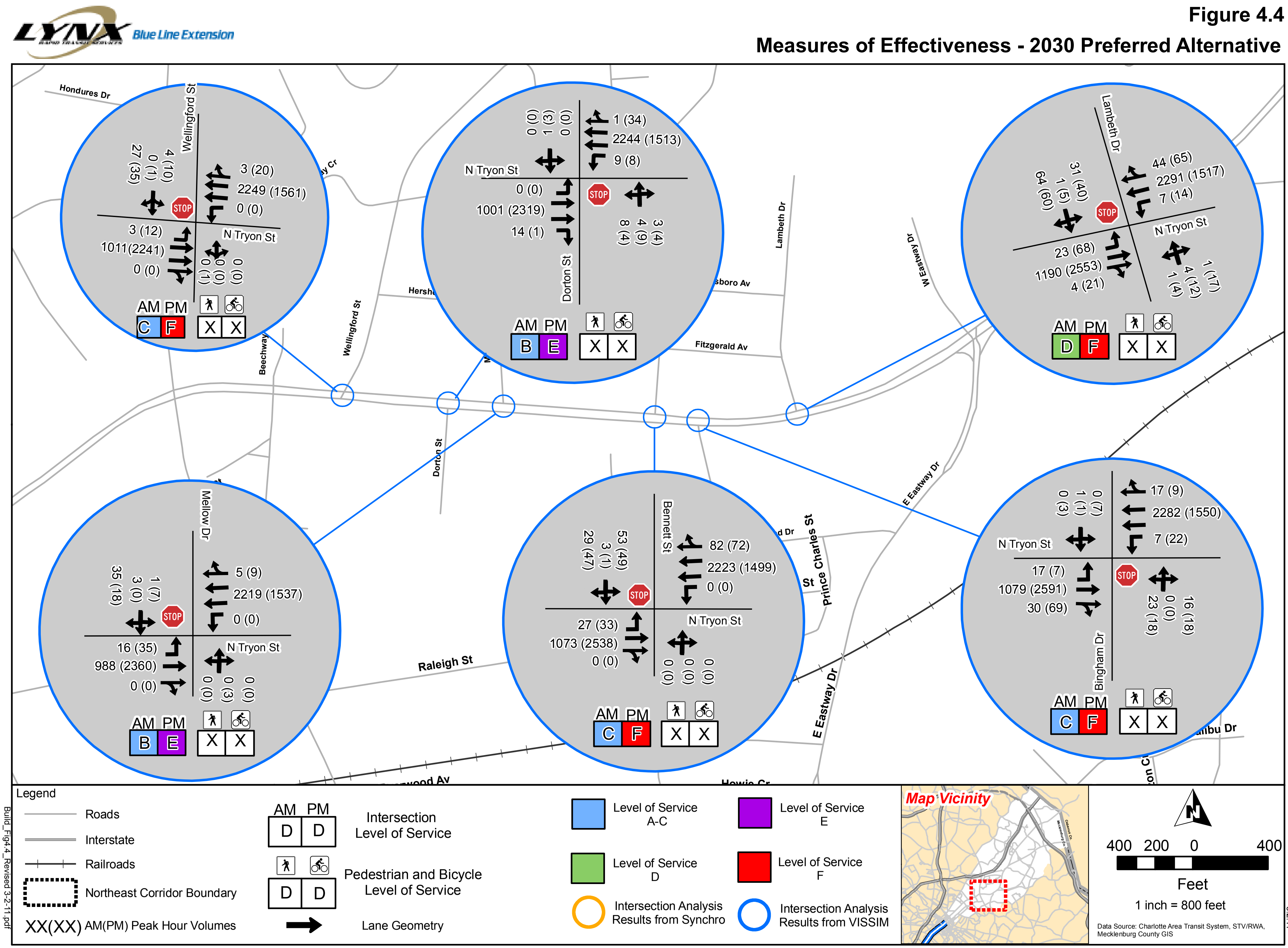
*NOTE: VISSIM results incorporate three-car trains with 10 minute headways wirh a grade separation rail option

Build_Fig4.3_Revised 3-2-11.pdf

3.2.11

Figure 4.4

Measures of Effectiveness - 2030 Preferred Alternative



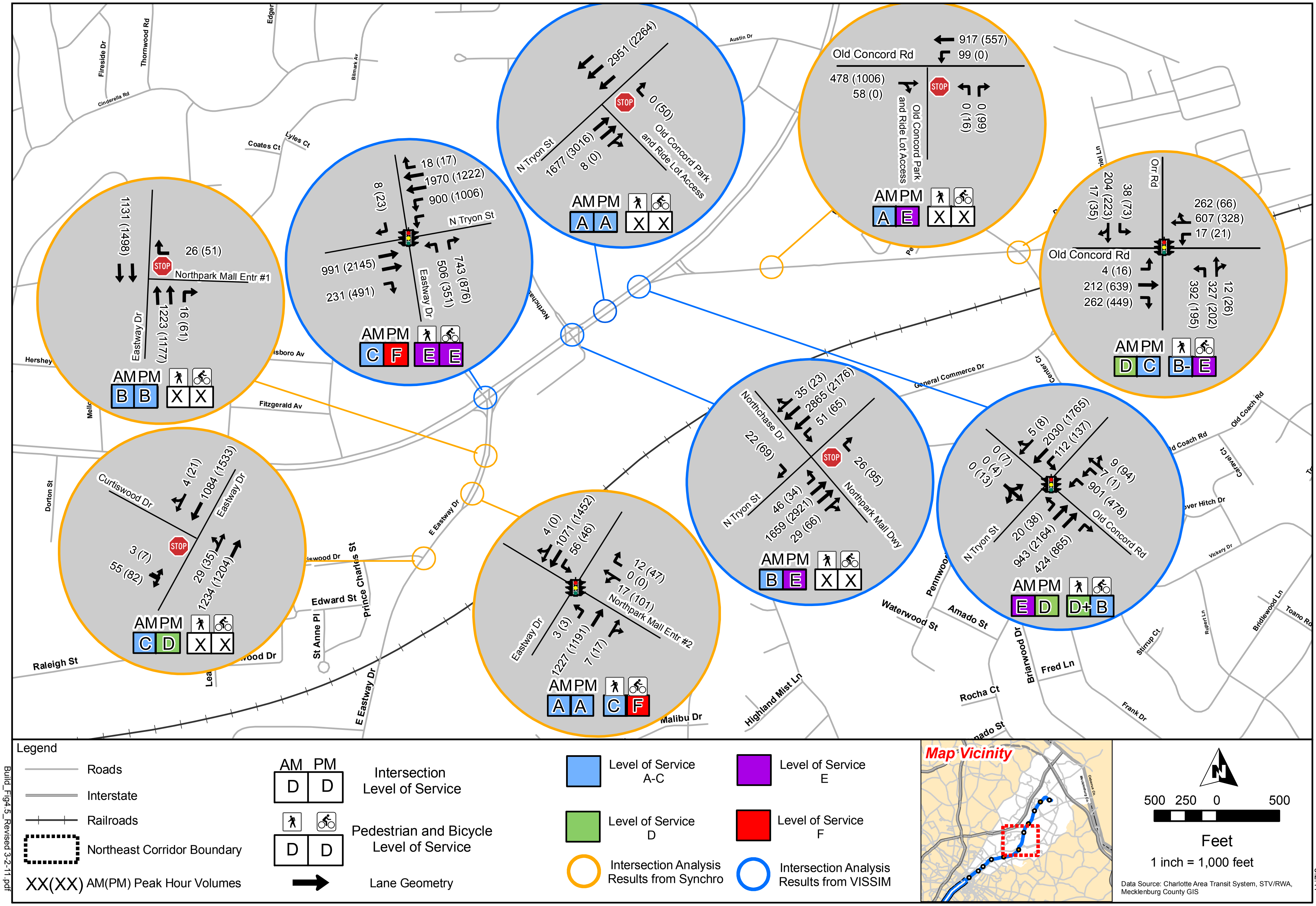
*NOTE: VISSIM results incorporate three-car trains with 10 minute headways wirh a grade separation rail option

Build_Fig4.4_Revised 3-2-11.pdf

3.2.11

Figure 4.5

Measures of Effectiveness - 2030 Preferred Alternative



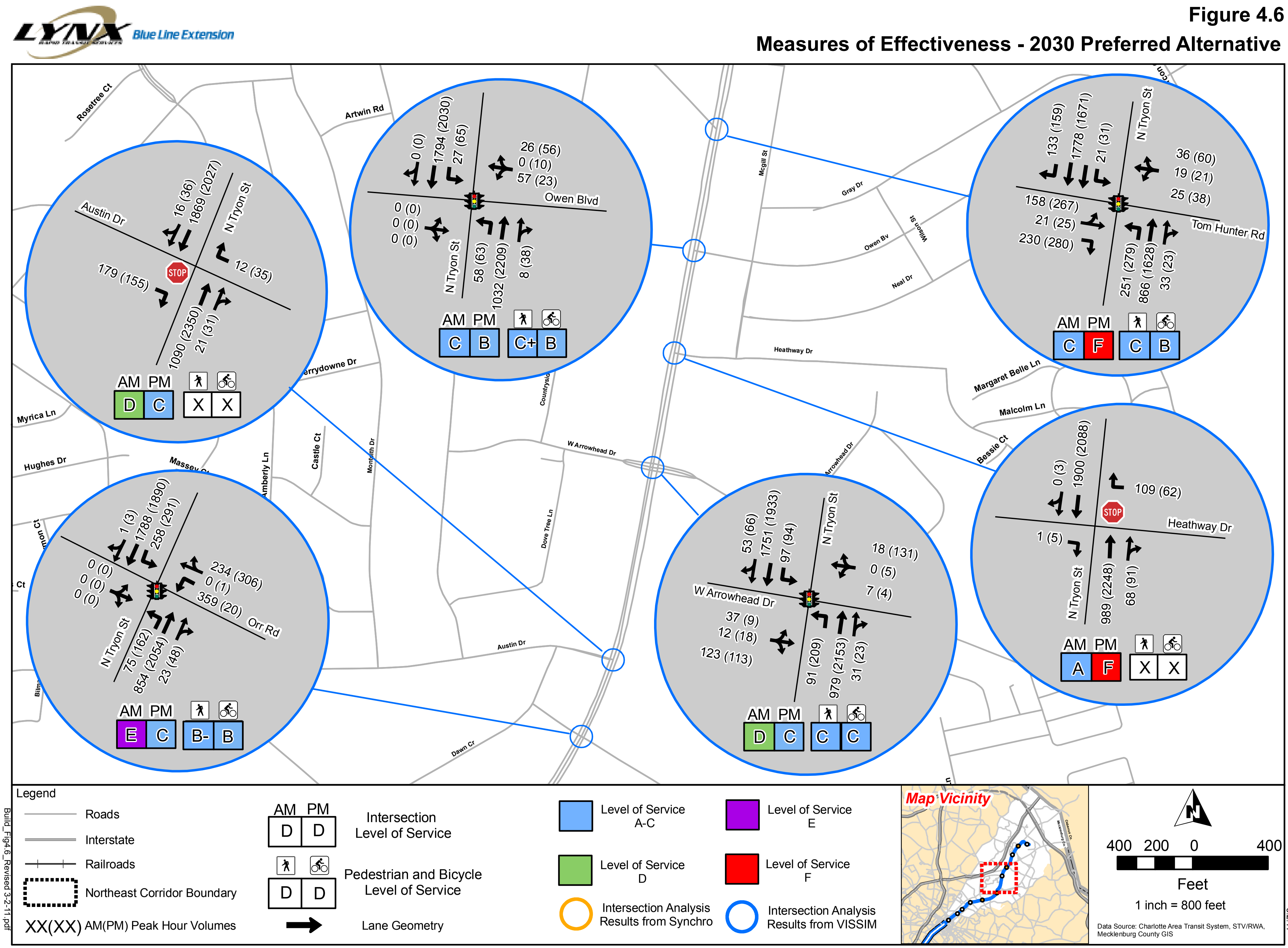
*NOTE: VISSIM results incorporate three-car trains with 10 minute headways wirh a grade separation rail option

Build_Fig4.5_Revised 3-2-11.pdf

3.2.11

Figure 4.6

Measures of Effectiveness - 2030 Preferred Alternative

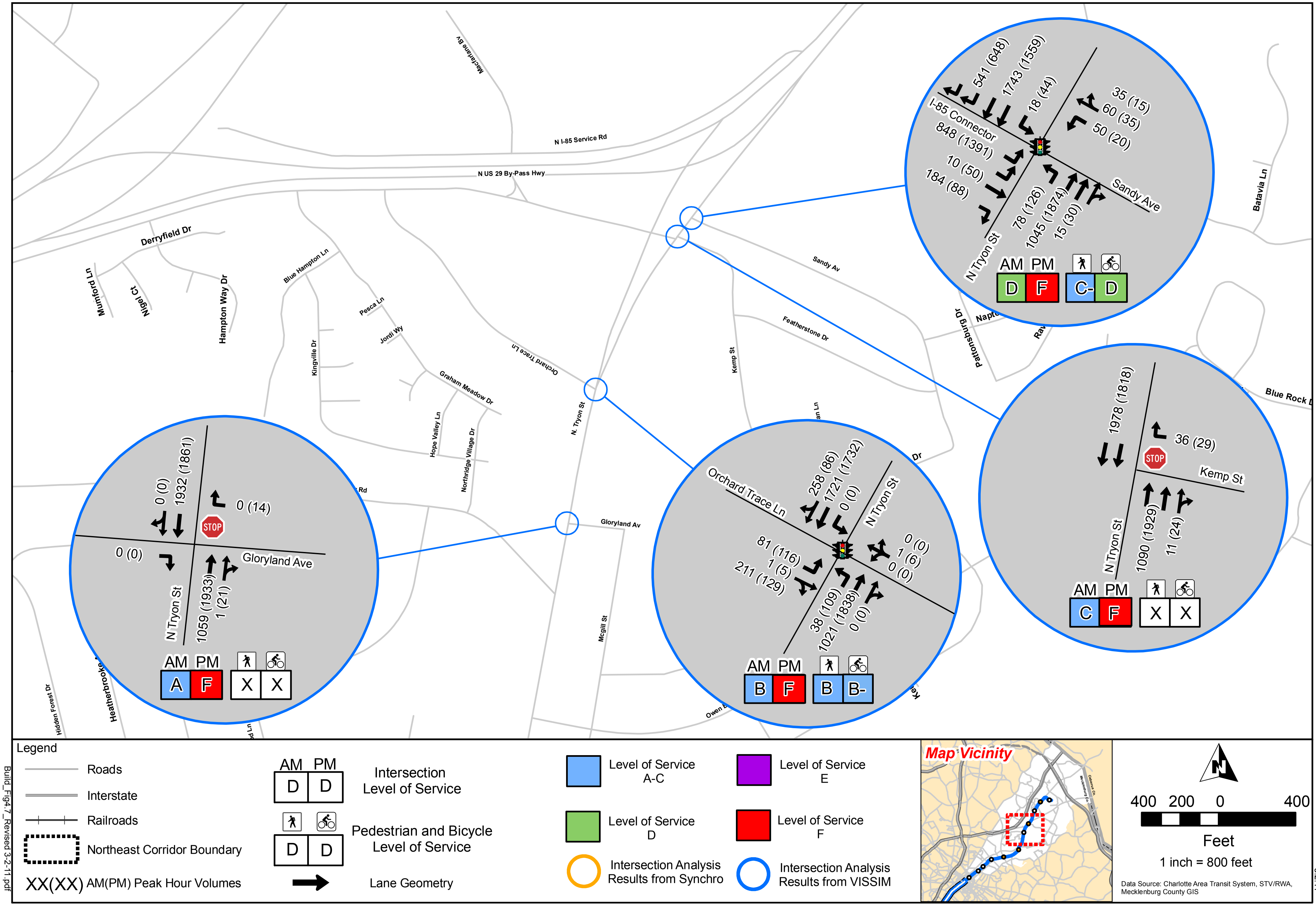


*NOTE: VISSIM results incorporate three-car trains with 10 minute headways wirh a grade separation rail option

Build_Fig4.6_Revised 3-2-11.pdf

3.2.11

Figure 4.7
Measures of Effectiveness - 2030 Preferred Alternative



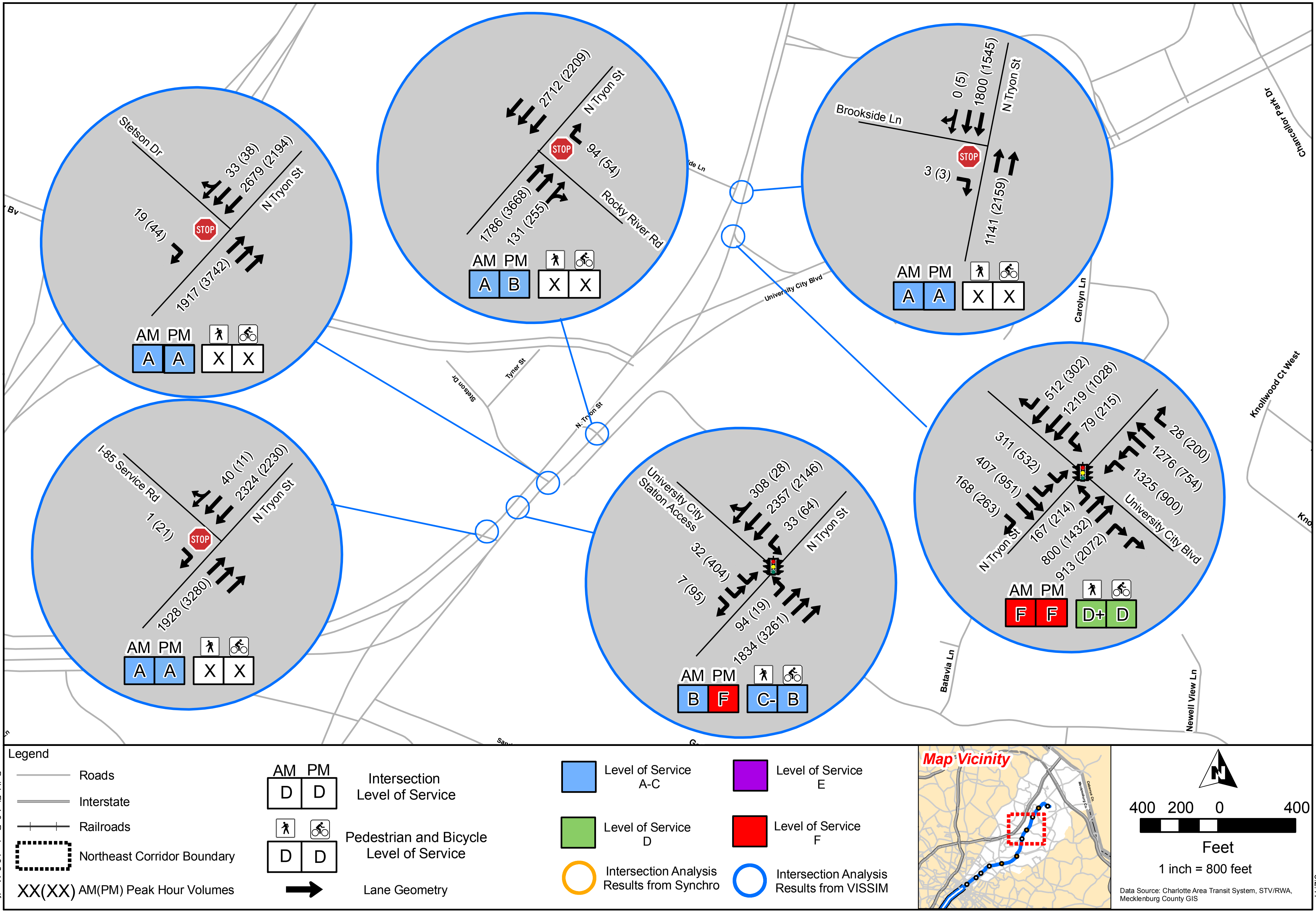
*NOTE: VISSIM results incorporate three-car trains with 10 minute headways wirh a grade separation rail option

Build_Fig4.7_Revised 3-2-11.pdf

3.2.11

Figure 4.8

Measures of Effectiveness - 2030 Preferred Alternative

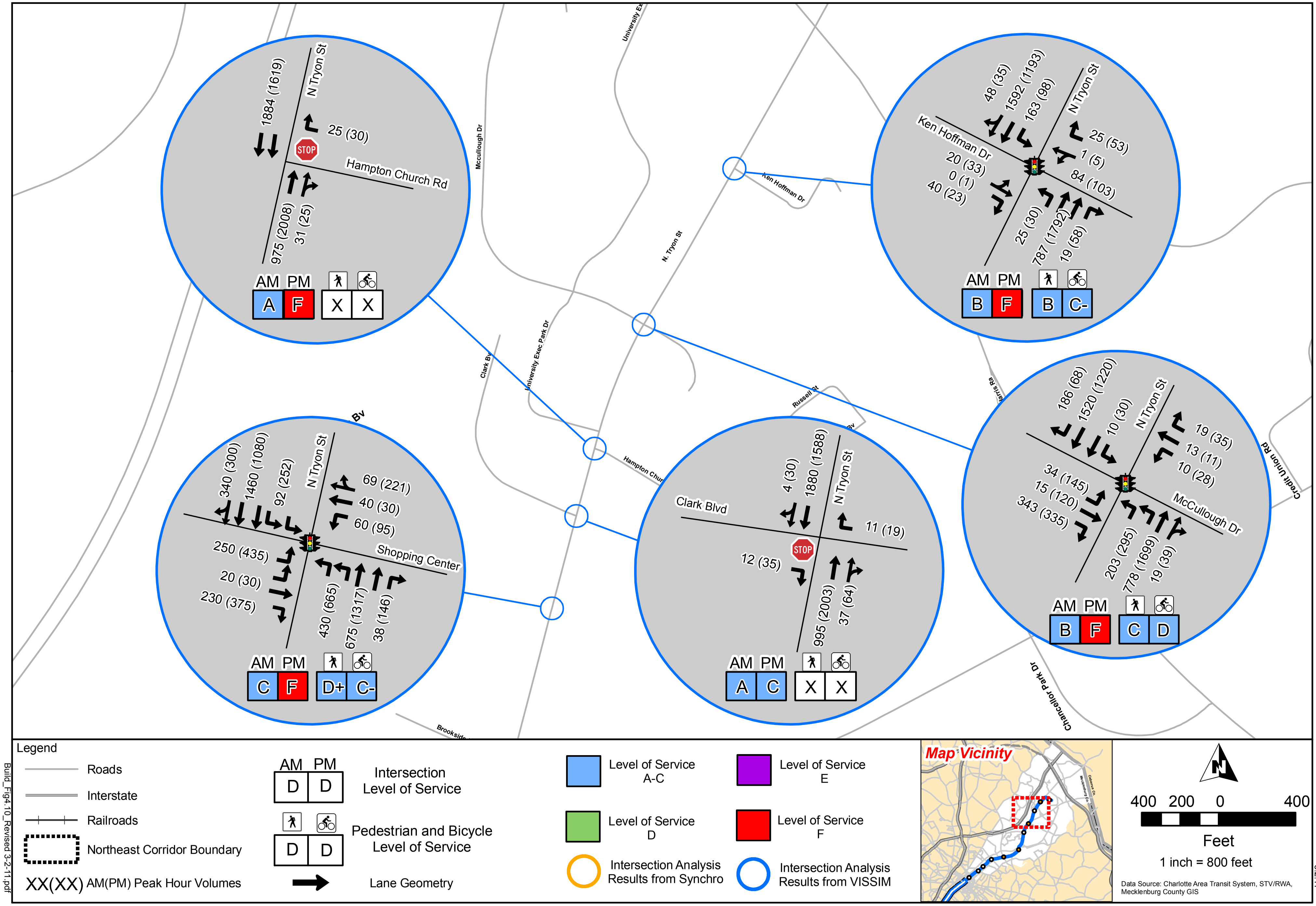


*NOTE: VISSIM results incorporate three-car trains with 10 minute headways wirh a grade separation rail option

LYNX Blue Line Extension

Figure 4.9

Measures of Effectiveness - 2030 Preferred Alternative



*NOTE: VISSIM results incorporate three-car trains with 10 minute headways wirh a grade separation rail option

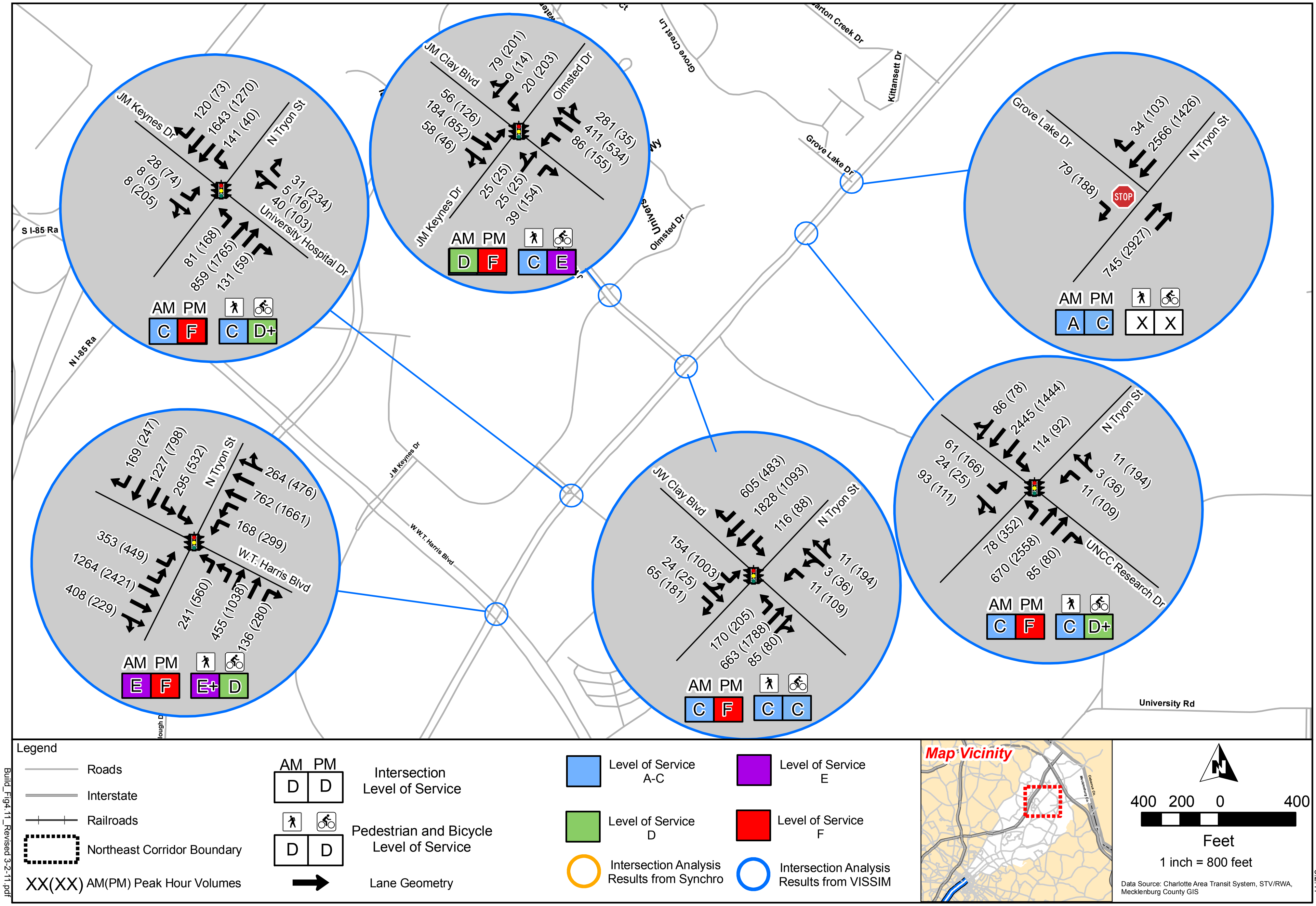
Build_Fig4.10_Revised 3-2-11.pdf

3.2.11

LYNX Blue Line Extension

Figure 4.10

Measures of Effectiveness - 2030 Preferred Alternative



*NOTE: VISSIM results incorporate three-car trains with 10 minute headways wirh a grade separation rail option

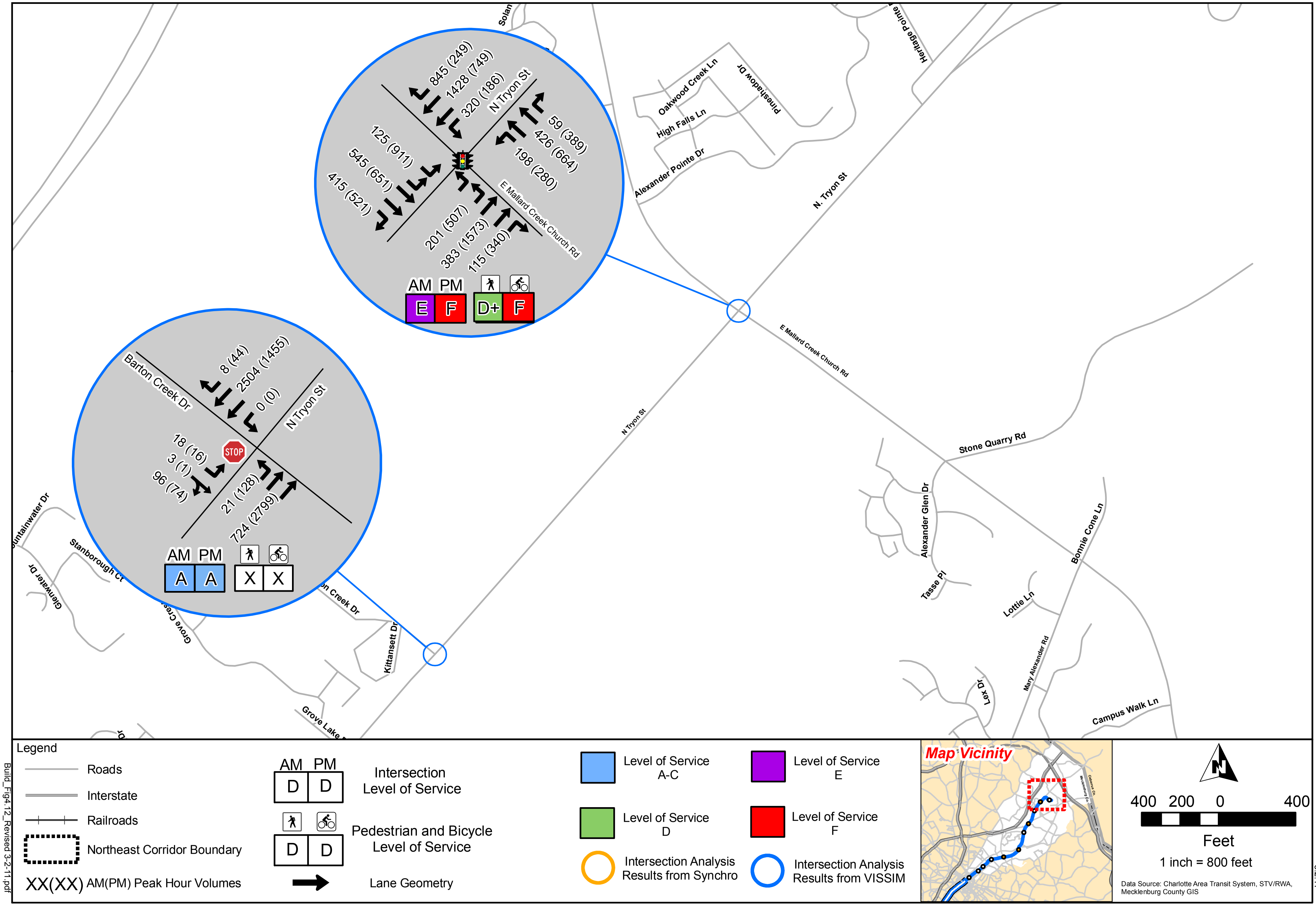
Build_Fig4.11_Revised 3-2-11.pdf

3.2.11

LYNX Blue Line Extension

Figure 4.11

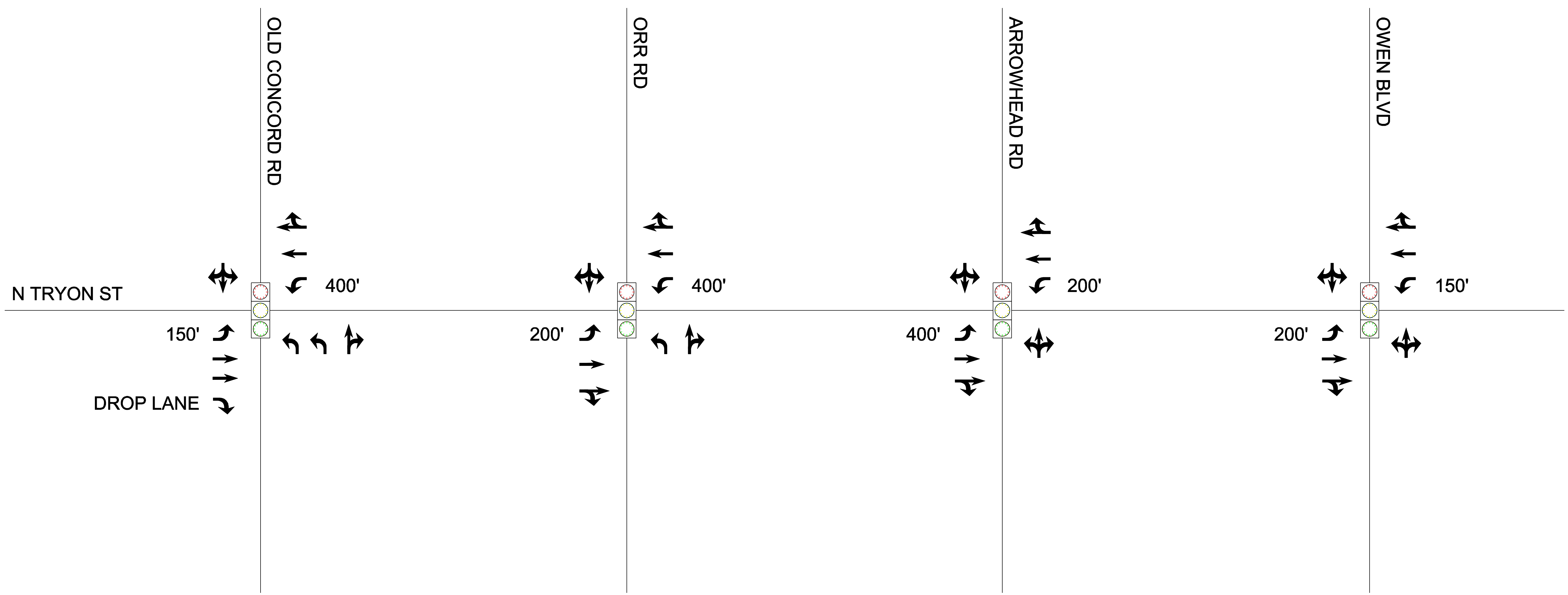
Measures of Effectivness - 2030 Preferred Alternative



*NOTE: VISSIM results incorporate three-car trains with 10 minute headways wirh a grade separation rail option

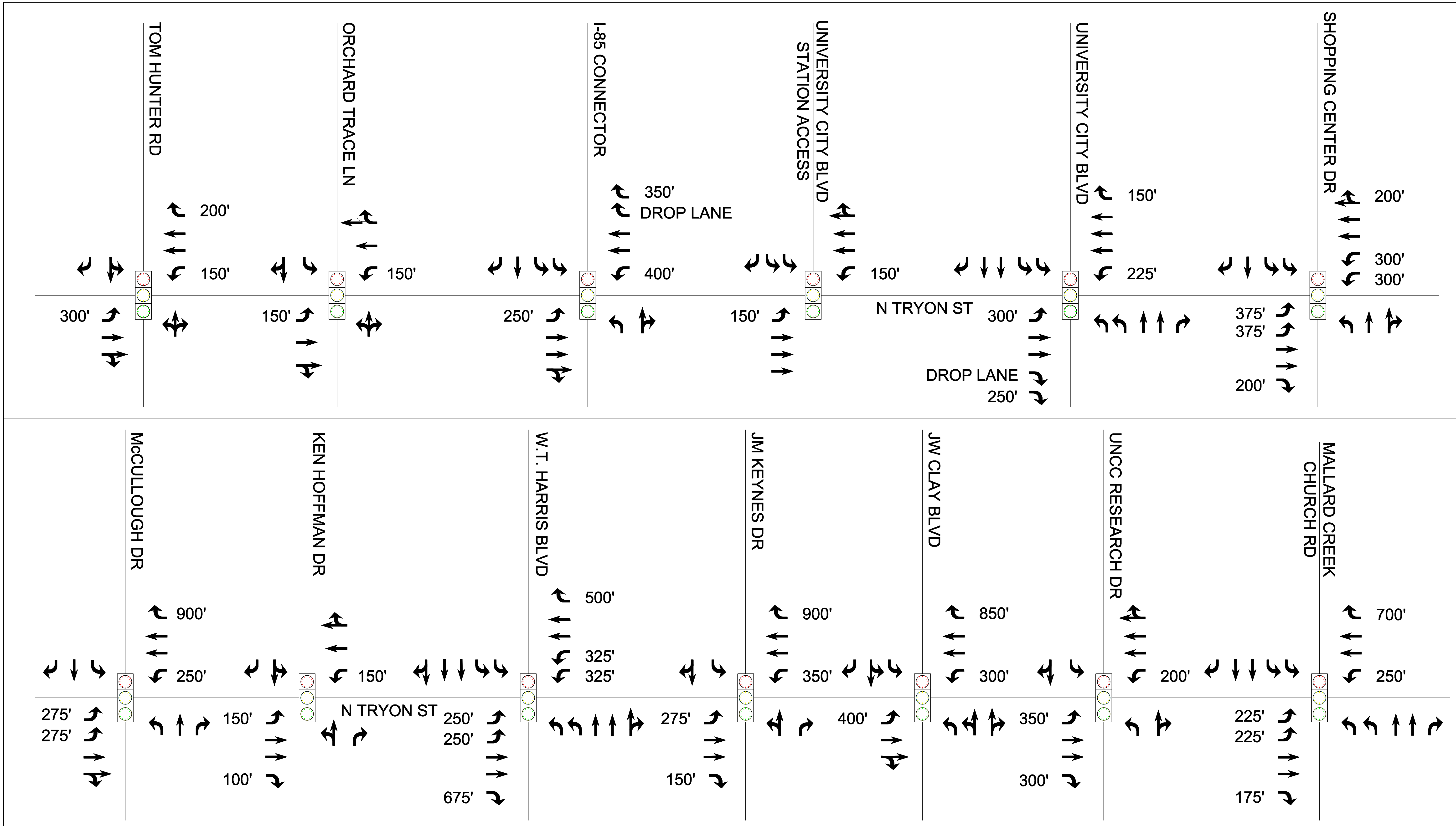
Build_Fig4.12_Revised 3-2-11.pdf

3.2.11



SEGMENT 1 NORTH TRYON STREET/US-29 BUILD STORAGE LENGTH RECOMMENDATIONS

FIGURE 4.12



SEGMENT 2 NORTH TRYON STREET/US-29 BUILD STORAGE LENGTH RECOMMENDATIONS

FIGURE 4.13