Town of Cornelius
Planning Board/Board of Adjustment

Agenda
March 13, 2017
6:30 PM
Cornelius Town Hall - Assembly Room

Pre-Meeting

A. 5:30pm Room 204 Dinner and Code Update Review - Chapter 6

1. **Call To Order**
2. **Determination of Quorum**
3. **Approval of Minutes**
   - **A.** February 27, 2017
4. **Consideration of Approval**
   - **A.** REZ 11-16: Quick Trip
   - **B.** REZ 12-16 Boat Yard Eats
   - **C.** REZ 13-16 Washam Potts Reserve Subdivision
5. **Old Business**
   - **A.** Land Use Plan Amendment - Bailey Rd and NC115 (NE)
6. **New Business**
7. **Next Meeting**
8. **Adjournment**

REQUEST FOR BOARD ACTION

Print

Date of Meeting: March 13, 2017

To: Planning Board Members

From: Wayne Herron, Planning Director

Action Requested:

Continue review of Code update items recommended by the Land Development Code Advisory Board. The Planning Board completed reviews of Chapters 1 through 5 previously. Staff will begin with Chapter 6 at this upcoming session.

Manager's Recommendation:

Review and provide feedback.

ATTACHMENTS:		
Name:	Description:	Type:
No Attachments Available		

REQUEST FOR BOARD ACTION

Print

Date of Meeting: March 13, 2017

To: Planning Board Members

From: Summer Smigelski, Planning Admin.

Action Requested:

Approval of Minutes

Manager's Recommendation:

Approval

ATTACHMENTS:		
Name:	Description:	Type:
Minutes_02-2017_Draft.docx	February 27, 2017 Minutes	Backup Material

Minutes

TOWN OF CORNELIUS PLANNING BOARD

Assembly Room
February 27, 2016
6:30 p.m.

Members Present	**Members Absent**	**Staff Present**
Joseph Dean, Alternate	Lee Peterson	Wayne Herron, Planning Director
Hardy McConnell, Vice Chair	Keith Pickett	Summer Smigelski, Admin. Assistant
Cheryl Crawford, Chair		Jason Pauling, Senior Planner
Susan Johnson		
Keith Eicher		
Michael Osborne, Alternate		
Betty Trautwein		

VISITORS

See Sign-In Sheet

Pre-Meeting- 5:30pm

Mr. Herron gave an overview of the code update. Town Board would like to have this by May. Mr. Herron and the Planning Board discussed Chapter six updates. At 6:15pm the Chair called for a break and asked for everyone to meet in the Assembly Room for the regular Planning Board meeting downstairs.

DETERMINATION OF QUORUM

Chair Crawford re-convened the Planning Board meeting at 6:34 pm and noted there was a quorum present.

Approval of Minutes

Mr. Eicher made a motion of approval for the November 14, 2016 and the December 12, 2016 minutes. Ms. Trautwein seconded. All in favor, motion approved.

In Favor: Mr. Dean, Ms. Trautwein, Mr. Eicher, Mr. McConnell, Ms. Johnson, Mr. Osborne, Ms. Crawford

Opposed: None

Ms. Trautwein made a motion of approval for the January 30, 2017 Joint Meeting minutes. Mr. Eicher seconded. All in favor, motion approved.

In Favor: Mr. Dean, Ms. Trautwein, Mr. Eicher, Mr. McConnell, Ms. Johnson, Mr. Osborne, Ms. Crawford

Opposed: None

DRAFT

REVIEW OF AGENDA ITEMS

Mr. Eicher made a motion to open up the public hearing. Ms. Johnson seconded. All in favor, motion approved.

In Favor: Mr. Dean, Ms. Trautwein, Mr. Eicher, Mr. McConnell, Ms. Johnson, Mr. Osborne, Ms. Crawford

Opposed: None

Chair Crawford called forward anyone wishing to testify to be sworn in by the Board Secretary. The applicant and Town staff was sworn in by Ms. Smigelski.

VAR 07-16 Wendy's

Mr. Pauling presented VAR 07-16 Wendy's: Thank you madam chair, good evening everyone. First case we have before you this evening is VAR 07-16 a variance request for Wendy's Restaurant located at 20410 West Catawba Avenue. The applicants for this request are the Carolina Restaurant Group represented by Gary Miller, who is here with us, and the Isaac Group represented by William Pugh. Properties identified by tax parcel number 00527202. Current zoning is highway commercial; South West intersection of West Catawba and I77. The applicants are asking for a variance from sections in Chapter 6 and Chapter 7 of the Land Development Code to allow parking placement in the front yard in order to meet new drive-through regulations to the greatest extent practical. These ordinances are in conflict with each other in this scenario based on the size, shape, and location of the lot. Staff will present testimony at the hearing that covers the following basic facts and will introduce the Town exhibits into evidence. The subject property is within the Town of Cornelius Zoning jurisdiction and is zoned Highway Commercial (HC). The property is shown on the Zoning Map as Exhibit A, on a Land Use Map as Exhibit B, on an Aerial Vicinity Map as Exhibit C, and on an Aerial Property Map as Exhibit D.

EXHIBIT A: VAR 07-16 Wendy's Zoning Map

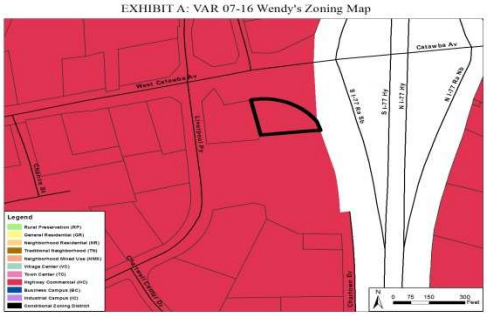


EXHIBIT B: VAR 07-16 Wendy's Land Use Map

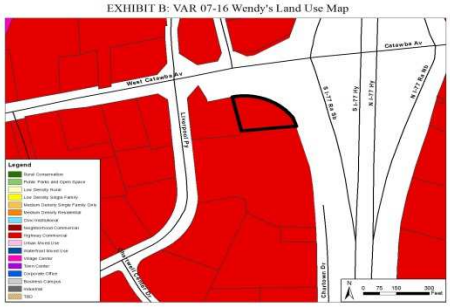


EXHIBIT C: VAR 07-16 Wendy's Aerial Map

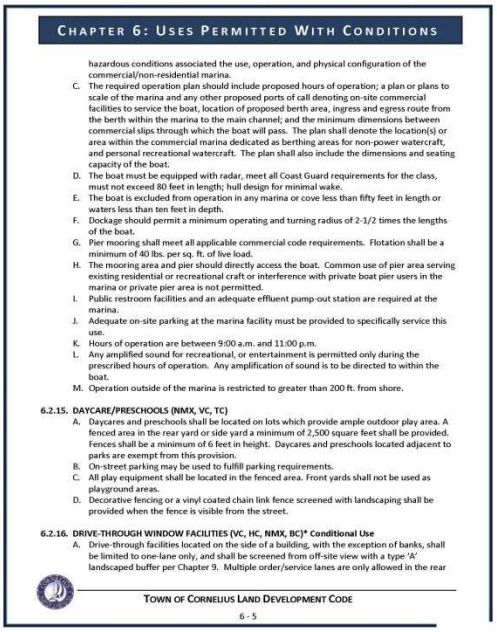


EXHIBIT D: VAR 07-16 Wendy's Property Map



The existing building is non-conforming and does not meet any of the drive-through regulations outlined in Chapter 6, Section 6.2.16, nor does it meet ordinance requirements in Chapter 7. The Town Board adopted new drive-through regulations on November 17, 2014, to eliminate the Conditional Use Permit requirement, and to establish where it is appropriate to allow drive-

through facilities by right, based on appropriate location, traffic circulation, and design standards. As part of Chapter 6, section 6.2.16, the Board established 17 new conditions on drive-through regulations that would have to be met in order to approve them by right. A copy of Chapter 6, section 6.2.16 is included as Exhibit E. Chapter 7 of the Land Development Code includes requirements for parking lots to be located either behind or beside the principal structure, and setback from the building. A copy of chapter 7, section 7.4 with highlighted sections is included as exhibit F.



CHAPTER 6: USES PERMITTED WITH CONDITIONS

hazardous conditions associated the use, operation, and physical configuration of the commercial/non-residential marina.

C. The required operation plan should include proposed hours of operation; a plan or plans to scale of the marina and any other proposed ports of call denoting on-site commercial facilities to service the boat, location of proposed berth area, ingress and egress route from the berth within the marina to the main channel; and the minimum dimensions between commercial slips through which the boat will pass. The plan shall denote the location(s) or area within the commercial marina dedicated as berthing areas for non-power watercraft, and personal recreational watercraft. The plan shall also include the dimensions and seating capacity of the boat.
D. The boat must be equipped with radar, meet all Coast Guard requirements for the class, must not exceed 80 feet in length; hull design for minimal wake.
E. The boat is excluded from operation in any marina or cove less than fifty feet in length or waters less than ten feet in depth.
F. Dockage should permit a minimum operating and turning radius of 2-1/2 times the lengths of the boat.
G. Pier mooring shall meet all applicable commercial code requirements. Flotation shall be a minimum of 40 lbs. per sq. ft. of live load.
H. The mooring area and pier should directly access the boat. Common use of pier area serving existing residential or recreational craft or interference with private boat pier users in the marina or private pier area is not permitted.
I. Public restroom facilities and an adequate effluent pump-out station are required at the marina.
J. Adequate on-site parking at the marina facility must be provided to specifically service this use.
K. Hours of operation are between 9:00 a.m. and 11:00 p.m.
L. Any amplified sound for recreational, or entertainment is permitted only during the prescribed hours of operation. Any amplification of sound is to be directed to within the boat.
M. Operation outside of the marina is restricted to greater than 200 ft. from shore.

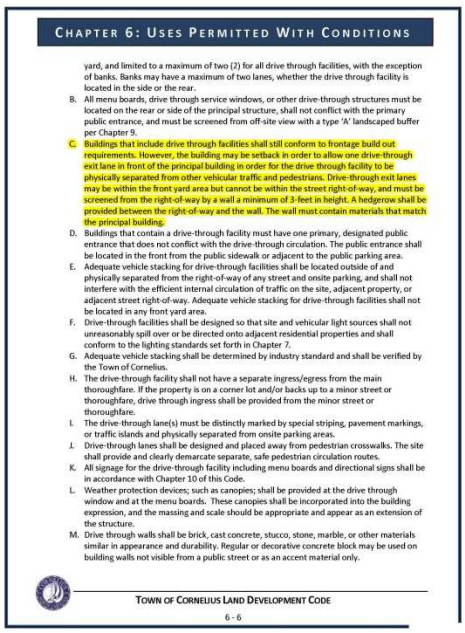
6.2.15. DAYCARE/PRESCHOOLS (NMX, VC, TC)

A. Daycares and preschools shall be located on lots which provide ample outdoor play area. A fenced area in the rear yard or side yard a minimum of 2,500 square feet shall be provided. Fences shall be a minimum of 6 feet in height. Daycares and preschools located adjacent to parks are exempt from this provision.
B. On-street parking may be used to fulfill parking requirements.
C. All play equipment shall be located in the fenced area. Front yards shall not be used as playground areas.
D. Decorative fencing or a vinyl coated chain link fence screened with landscaping shall be provided when the fence is visible from the street.

6.2.16. DRIVE-THROUGH WINDOW FACILITIES (VC, HC, NMX, BC)* Conditional Use

A. Drive-through facilities located on the side of a building, with the exception of banks, shall be limited to one-lane only, and shall be screened from off-site view with a type 'A' landscaped buffer per Chapter 9. Multiple order/service lanes are only allowed in the rear

TOWN OF CORNELIUS LAND DEVELOPMENT CODE
6 - 5

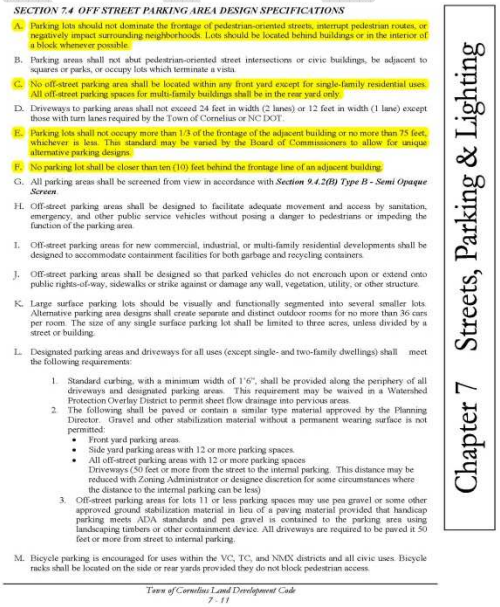


CHAPTER 6: USES PERMITTED WITH CONDITIONS

yard, and limited to a maximum of two (2) for all drive through facilities, with the exception of banks. Banks may have a maximum of two lanes, whether the drive through facility is located in the side or the rear.

B. All menu boards, drive through service windows, or other drive-through structures must be located on the rear or side of the principal structure, shall not conflict with the primary public entrance, and must be screened from off-site view with a type 'A' landscaped buffer per Chapter 9.
C. Buildings that include drive through facilities shall still conform to frontage build out requirements. However, the building may be setback in order to allow one drive-through exit lane in front of the principal building in order for the drive through facility to be physically separated from other vehicular traffic and pedestrians. Drive-through exit lanes may be within the front yard area but cannot be within the street right-of-way, and must be screened from the right-of-way by a wall a minimum of 3-feet in height. A hedgerow shall be provided between the right-of-way and the wall. The wall must contain materials that match the principal building.
D. Buildings that contain a drive-through facility must have one primary, designated public entrance that does not conflict with the drive-through circulation. The public entrance shall be located in the front from the public sidewalk or adjacent to the public parking area.
E. Adequate vehicle stacking for drive-through facilities shall be located outside of and physically separated from the right-of-way of any street and onsite parking, and shall not interfere with the efficient internal circulation of traffic on the site, adjacent property, or adjacent street right-of-way. Adequate vehicle stacking for drive-through facilities shall not be located in any front yard area.
F. Drive-through facilities shall be designed so that site and vehicular light sources shall not unreasonably spill over or be directed onto adjacent residential properties and shall conform to the lighting standards set forth in Chapter 7.
G. Adequate vehicle stacking shall be determined by industry standard and shall be verified by the Town of Cornelius.
H. The drive-through facility shall not have a separate ingress/egress from the main thoroughfare. If the property is on a corner lot and/or backs up to a minor street or thoroughfare, drive through ingress shall be provided from the minor street or thoroughfare.
I. The drive-through lane(s) must be distinctly marked by special striping, pavement markings, or traffic islands and physically separated from onsite parking areas.
J. Drive-through lanes shall be designed and placed away from pedestrian crosswalks. The site shall provide and clearly demarcate separate, safe pedestrian circulation routes.
K. All signage for the drive-through facility including menu boards and directional signs shall be in accordance with Chapter 10 of this Code.
L. Weather protection devices; such as canopies; shall be provided at the drive through window and at the menu boards. These canopies shall be incorporated into the building expression, and the massing and scale should be appropriate and appear as an extension of the structure.
M. Drive through walls shall be brick, cast concrete, stucco, stone, marble, or other materials similar in appearance and durability. Regular or decorative concrete block may be used on building walls not visible from a public street or as an accent material only.

TOWN OF CORNELIUS LAND DEVELOPMENT CODE
6 - 6



SECTION 7.4 OFF STREET PARKING AREA DESIGN SPECIFICATIONS

A. Parking lots should not dominate the frontage of pedestrian-oriented streets, interrupt pedestrian routes, or negatively impact surrounding neighborhoods. Lots should be located behind buildings or in the interior of a block whenever possible.
B. Parking areas shall not abut pedestrian-oriented street intersections or civic buildings, be adjacent to squares or parks, or occupy lots which terminate a vista.
C. No off-street parking area shall be located within any front yard except for single-family residential uses. All off-street parking spaces for multi-family buildings shall be in the rear yard only.
D. Driveways to parking areas shall not exceed 24 feet in width (2 lanes) or 12 feet in width (1 lane) except those with turn lanes required by the Town of Cornelius or NC DOT.
E. Parking lots shall not occupy more than 1/3 of the frontage of the adjacent building or no more than 75 feet, whichever is less. This standard may be varied by the Board of Commissioners to allow for unique alternative parking designs.
F. No parking lot shall be closer than ten (10) feet behind the frontage line of an adjacent building.
G. All parking areas shall be screened from view in accordance with ***Section 9.4.2(B) Type B - Semi Opaque Screen***.
H. Off-street parking areas shall be designed to facilitate adequate movement and access by sanitation, emergency, and other public service vehicles without posing a danger to pedestrians or impeding the function of the parking area.
I. Off-street parking areas for new commercial, industrial, or multi-family residential developments shall be designed to accommodate containment facilities for both garbage and recycling containers.
J. Off-street parking areas shall be designed so that parked vehicles do not encroach upon or extend onto public rights-of-way, sidewalks or strike against or damage any wall, vegetation, utility, or other structure.
K. Large surface parking lots should be visually and functionally segmented into several smaller lots. Alternative parking area designs shall create separate and distinct outdoor rooms for no more than 36 cars per room. The size of any single surface parking lot shall be limited to three acres, unless divided by a street or building.
L. Designated parking areas and driveways for all uses (except single- and two-family dwellings) shall meet the following requirements:
   1. Standard curbing, with a minimum width of 1'6", shall be provided along the periphery of all driveways and designated parking areas. This requirement may be waived in a Watershed Protection Overlay District to permit sheet flow drainage into pervious areas.
   2. The following shall be paved or contain a similar type material approved by the Planning Director. Gravel and other stabilization material without a permanent wearing surface is not permitted:
      - Front yard parking areas.
      - Side yard parking areas with 12 or more parking spaces.
      - All off-street parking areas with 12 or more parking spaces
      Driveways (50 feet or more from the street to the internal parking. This distance may be reduced with Zoning Administrator or designee discretion for some circumstances where the distance to the internal parking can be less)
   3. Off-street parking areas for lots 11 or less parking spaces may use pea gravel or some other approved ground stabilization material in lieu of a paving material provided that handicap parking meets ADA standards and pea gravel is contained to the parking area using landscaping timbers or other containment device. All driveways are required to be paved it 50 feet or more from street to internal parking.
M. Bicycle parking is encouraged for uses within the VC, TC, and NMX districts and all civic uses. Bicycle racks shall be located on the side or rear yards provided they do not block pedestrian access.

Town of Cornelius Land Development Code
7 - 11

Chapter 7 Streets, Parking & Lighting

EXHIBIT E: CHAPTER 6: SEC 6.2.16 (C):

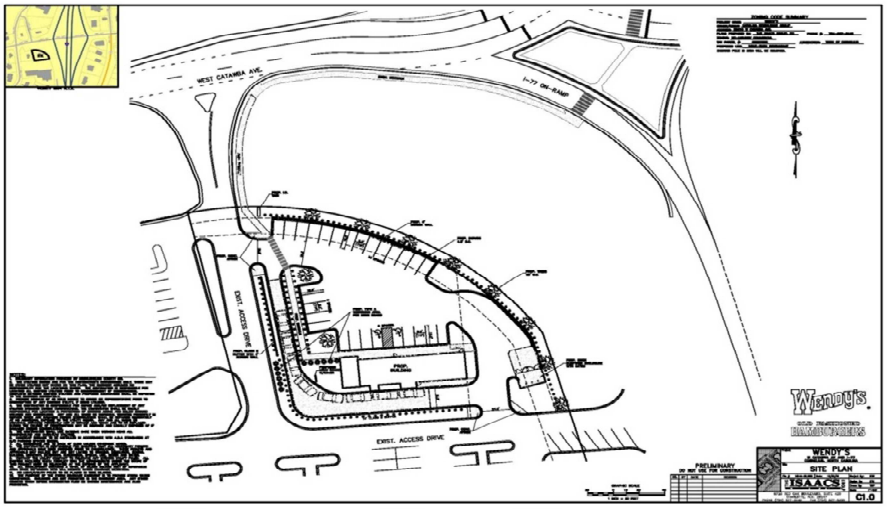
Buildings that include drive through facilities shall still conform to frontage build out requirements. However, the building may be setback in order to allow one drive-through exit lane in front of the principal building in order for the drive through facility to be physically separated from other vehicular traffic and pedestrians. Drive-through exit lanes may be within the front yard area but

cannot be within the street right-of-way, and must be screened from the right-of-way by a wall a minimum of 3-feet in height. A hedgerow shall be provided between the right-of-way and the wall. The wall must contain materials that match the principal building.

EXHIBIT F: CHAPTER 7: SEC 7.4 (A), :

Parking lots should not dominate the frontage of pedestrian-oriented streets, interrupt pedestrian routes, or negatively impact surrounding neighborhoods. Lots should be located behind buildings or in the interior of a block whenever possible. No off-street parking area shall be locate within any front yard except for single-family residential uses. All off-street parking spaces for multi-family buildings shall be in the rear yard only. Parking lots shall not occupy more than 1/3 of the frontage of the adjacent building or no more than 75 feet, whichever is less. This standard may be varied by the Board of Commissioners to allow for unique alternative parking designs

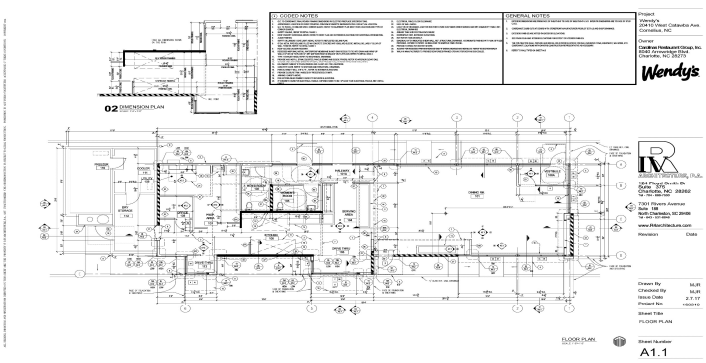
No parking shall be closer than ten (10) feet behind the frontage line of an adjacent building. The Applicants have submitted a Town of Cornelius Variance Application, and a site plan of the proposed new building. The Variance Application is shown as Exhibit G, whereas the applicants are requesting a variance from sections 6.2.16(C), 7.4(A), 7.4(C), 7.4(E), and 7.4(F) of the Land Development Code in order to allow parking in the front yard and to configure the building to hide the drive-through from view. The site plan is shown as Exhibit H.



Photos of the site are also provided as evidence in exhibits I-K

In addition, the applicants have provided floor plans, architectural elevations, and perspective drawings, which have been presented and approved by the Architectural Review Board, and are hereby submitted into evidence as exhibits L through P.







SUMMARY

It is staff's opinion that based on the pie shape of the lot in question, as well as the fact the lot sits well below the elevation of West Catawba Avenue and the south bound entrance ramp to I-77, there is no possibility for the development to meet the standards of both building and parking placement as well as drive-through standards, as applied together, they present a conflict.

The staff did offer advice to the applicant as to which standard carried the most weight or which may be considered more important to the Town. The Town did advise that screening the drive-through and placing it at the rear of the property was deemed more important/critical than having parking in the front yard area. This advice is why the applicant is focusing their variance requests on building and parking placement regulations. That concludes staff presentation.

The board did not have questions for staff. The applicants were asked to come forward.

William Pugh with the Isaac's Group and Gary Miller with the Carolina Restaurant Group, Inc. came forward to give their presentation.

Mr. Pugh: "Basically we arrived at our design working with staff who thinks it will show generations of (inaudible) of the building put on site.

Vice-Chair McConnell: "For clarification for this quasi-judicial, a vote is basically on the approval. My I have a motion to close the public hearing."

Mr. Dean made a motion to close the public hearing. Mr. Pickett seconded. All in favor, motion approved.

In Favor: Mr. Dean, Ms. Trautwein, Mr. Eicher, Mr. McConnell, Ms. Johnson, Mr. Osborne, Ms. Crawford **Opposed:** None

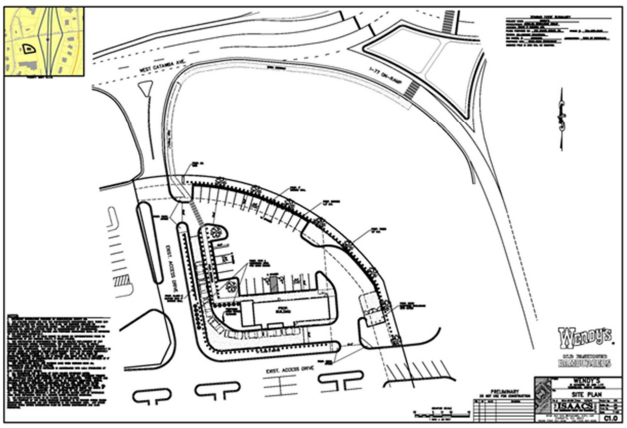
Vice-Chair McConnell: "My question is, with the particular traffic flow and the new building would there be more of a traffic impact?"

Chair Crawford: "Staff was there a need to do a traffic study?"

Mr. Herron: "No, and one reason is they were trying to remodel and looking to meet our code but did not qualify for an impact assessment. We simply just try to work with them."

Chair Cheryl: "Can we pull up exhibit H? I do have a question about the traffic flow."

EXHIBIT H: SITE PLAN



Chair Crawford: "The way its sitting it looks like we are just repositioning to the back of the property, is there some way that instead of the traffic coming around the building to go out is there a way we can flow the traffic out and back through the shopping center from this location? What is the direction that all traffic will flow?

Mr. Pauling: "That is a two ways, 24 foot drive, if you enter the site from that point you would probably have circle back to go through the drive through. If you are exiting from the drive through you would just come out that exit I'm sure. It gives you options, you can come out and go down the access drive or you can come through the parking lot. The good thing about that driveway being there is because the drive through traffic can just go out and would not interfere with the parking.

Chair Crawford: "How many cars can be stacked in that drive through? I like to see you busy but I would like to know where those cars are going to go."

Applicant: "Twelve cars."

Mr. Eicher: "So the only way to get to the drive through is where your top arrow is? That's the only entrance to the drive through?"

Applicant: “You can enter from here but you would have to go all the way around.”

Chair Crawford: “Anything else we need to ask Jason? No questions?”

Ms. Johnson: “I think it looks good.”

Mr. Osborne: “If you are having a fantastic day and you do get backed up with traffic are you going to somehow try and guide people down through the shopping center, up and around to get in line or is that entrance off of West Catawba going to be blocked?”

Mr. Herron: “This is the way it works today, if people get in line it backs up to that road. What they have done here is they have improved that stacking.”

Mr. Eicher: “Could the stack not wrap around in front of the restaurant?”

Mr. Herron: “We do not allow that. When we did our drive through regulations we did not want to allow drive through wraps. The purpose is for appearance and character. The only way we can allow a wrap is by going through conditional zoning.”

Mr. Eicher: “Let’s say I go over there and it’s stacked up, what do I do?”

Mr. Herron: “You would have to sit and wait until you can get in.”

Mr. Eicher: “But that is what we do not allow.”

Mr. Herron: “We don’t allow it by creating a lane for it, if it happens inadvertently that is just good business. We do not plan and allow for the wrap lane.”

Chair Cheryl: “Any other questions? I think it’s a very nice look and thank you for making the changes. At this time if there are no more questions we can move to the findings of facts.

Finding #1: Unnecessary hardship would result from the strict application of the ordinance. It shall not be necessary to demonstrate that, in the absence of the variance, no reasonable use can be made of the property.

Mr. McConnell made a motion to close the public hearing. Mr. Eicher seconded. All in favor, motion approved.

In Favor: Mr. Dean, Ms. Trautwein, Mr. Eicher, Mr. McConnell, Ms. Johnson, Mr. Osborne, Ms. Crawford **Opposed:** None

Finding #2: The hardship results from conditions that is peculiar to the property, such as location, size, or topography. Hardships resulting from personal circumstances, as well as hardships resulting from conditions that are common to the neighborhood or the general public, may not be the basis for granting a variance.

Mr. Eicher made a motion to close the public hearing. Mr. McConnell seconded. All in favor, motion approved.

In Favor: Mr. Dean, Ms. Trautwein, Mr. Eicher, **Opposed:** None

Mr. McConnell, Ms. Johnson, Mr. Osborne,
Ms. Crawford

Finding #3: The hardship did not result from actions taken by the applicant or the property owner. The act of purchasing property with knowledge that circumstances exist that may justify the granting of a variance shall not be regarded as a self-created hardship**.**

Ms. Trautwein made a motion to close the public hearing. Ms. Johnson seconded. All in favor, motion approved.

In Favor: Mr. Dean, Ms. Trautwein, Mr. Eicher, Mr. McConnell, Ms. Johnson, Mr. Osborne, Ms. Crawford **Opposed:** None

Finding #4: The requested variance is consistent with the spirit, purpose, and intent of the ordinance, such that public safety is secured, and substantial justice is achieved.

Mr. Osborne made a motion to close the public hearing. Mr. Dean seconded. All in favor, motion approved.

In Favor: Mr. Dean, Ms. Trautwein, Mr. Eicher, Mr. McConnell, Ms. Johnson, Mr. Osborne, Ms. Crawford **Opposed:** None

REZ 10-16: DB Holdings (Auto Sales Dealership)

Jason Pauling presented DB Holdings to the board. The site is at 18837 Statesville Road. The property is currently zoned highway commercial. Land Use Plan designates it as highway commercial also auto sales overlay. The overall parcel does include two buildings as well as the fitness building. Tax ID number is 00541209. The property is about 5.62 acres. The applicant is proposing Conditional Zoning. Proposed use is automobile sales, service and storage. Mr. Pauling gave an overview of the two phases and discussed the architectural variations.

STAFF RECOMMENDS APPROVAL OF REZ 10-16 SUBJECTS TO THE FOLLOWING CONDITIONS:

1. Town approval is contingent on review and approval by other applicable local, state and federal agencies.
2. The development shall comply with all other applicable requirements of the Town of Cornelius Land Development Code.
3. Town approval incorporates and shall comply with any and all submittals in the case file and correspondence presented to the board in support of this application, including, but not limited to the following: The site/sketch plan, architectural elevations, and any and all traffic information including traffic memos, transportation impact analysis and recommended transportation plans or improvements recommended by the Town and/or NCDOT.
4. Approval of the requested conditional zoning district, includes approval of the following architectural variations:

a. Section 4.6.1(J): Allow for a variation from the requirement that the front façade of the building shall extend parallel to the frontage line of the lot. The proposal sets the building back and at an angle based on the topographic constraints of the site. All parking will be screened from view with a type 'B' buffer including a low wall and shrubs in front. The sales display and storage area (lower lot) will be screened by a type 'A' opaque buffer to the greatest extent practical
b. Section 4.6.3(B)(3): Allow for a variation in the requirement to provide 70% windows and doors in the front façade. The proposal includes 54% in phase 1, and 63% in phase 2. The east elevation, visible from Statesville Road contains 20% glass coverage

5. The short wall shown on the site plan at the front parking area shall be a minimum of four (4) feet in height as required by Section 9.4.2(B)Type B-2.
6. The applicant shall submit a lighting plan based on proposed Chapter 7 lighting standards being considered by the Town Board prior to approval of construction documents for the development.
7. The applicant must either provide a five foot sidewalk along Statesville Road, or provide payment-in-lieu of sidewalk to the Town. If payment-in-lieu is provided, an estimate must be presented to the town prior to approval of the construction documents, and said payment must be received prior to certificate of occupancy.

Mr. Eicher made a motion to close the public hearing. Mr. McConnell seconded. All in favor, motion approved.

In Favor: Mr. Dean, Ms. Trautwein, Mr. Eicher, Mr. McConnell, Ms. Johnson, Mr. Osborne, Ms. Crawford **Opposed:** None

OLD BUSINESS

Wayne gave an update on the Arts District and informed the board that if they have any ideas or standards to let staff know.

The board discussed putting a tour together to discuss projects that are pending.

NEW BUSINESS

NEXT MEETING

Monday March 13, 2016

ADJOURNMENT

Mr. Eicher made a motion to adjourn the meeting at 8:08 p.m. Ms. Trautwein seconds the motion. All in favor and motion approved.

In Favor: Mr. Dean, Ms. Trautwein, Mr. Eicher, Mr. McConnell, Ms. Johnson, Mr. Osborne, Ms. Crawford **Opposed:** None

Respectfully Submitted:

_____	_____	_____	_____
Cheryl Crawford Chair	Date	Summer Smigelski Secretary	Date

DRAFT

REQUEST FOR BOARD ACTION

Print

Date of Meeting: March 13, 2017

To: Planning Board Members

From: Jason T. Pauling, AICP - Senior Planner

Action Requested:

A request by Quick Trip Corporation to develop a new convenience store at the northeast intersection of Catawba Avenue and US 21 (Statesville Road) between Holiday Lane and Burton Street. This request will include a total of five (5) parcels, totaling about 3.16 acres. The intersection of Highway 21 and Catawba Avenue is being redeveloped by NCDOT as a two-lane roundabout, and the quick trip site will border the roundabout. 1.58 acres (half of the site) will be developed, and the other half will remain as open space as well as storm water control. Today, this site consists of a Citgo convenience store and gas station, the Acropolis Greek Restaurant, two single-family homes, and a vacant parcel. Entrances to the site are proposed from Holiday and Burton Lane, but no driveway entrance off of Catawba. The proposed building will back up to the roundabout, whereas the rear elevation will be visible from the roundabout and Catawba Avenue. This elevation will include design features so that it looks like a front, but will not be the primary public entrance. There will be public entrances at the corners and from the parking area. The building will be mostly brick with accents of stone and aluminum fascia.

Manager's Recommendation:

Approval with conditions

ATTACHMENTS:

Name:	Description:	Type:
Application.pdf	Application	Backup Material
QT_Zoning.jpg	Zoning Map	Backup Material
QT_LU.jpg	Land Use Map	Backup Material
QT_Vicinity.jpg	Vicinity Map	Backup Material
QT_Property.jpg	Property Map	Backup Material
QT_Photo_Page.docx	Photo Page	Backup Material
REZ_11-16_(PB)_QT_Staff_Report_(3.13.17).docx	Staff Report	Backup Material
QT_-_Meeting_Minutes.December_2016.wordversion.final.docx	Community Meeting Minutes	Backup Material
Survey.pdf	Existing Site Survey	Backup Material
81-1082_Civil-Landscape.pdf	Landscaping Plan	Backup Material
81-1082_Civil-Rezoning_2017_02_16_(002).pdf	Site Plan & Perspectives	Backup Material
81-1082-BFFE-SPAN.pdf	Revised Elevations	Backup Material
Pump_Canopy_Elevations.pdf	Pump Canopy Elevations	Backup Material
Welcome_Sign.pdf	Welcome Sign	Backup Material
QT_TIA_Cornelius.pdf	TIA	Backup Material

TOWN OF CORNELIUS
Planning Department

PO Box 399 | Cornelius, NC 28031 | Phone: 704-896-2461 | Fax: 704-896-2462

Staff Only:
Date Rec'd: 10/28/16
Rec'd by: TSP
Case #: REZ 11-16

LAND DEVELOPMENT APPLICATION FORM

1. Application Type

	✓	Fee		✓	Fee
• *Sketch Plan/Plat (Major Sub):*	☑	$500.00	• *Conditional Zoning (CZ)*	☑	$1,250.00
• *Preliminary Plat (Major Sub):*	☐		• *Special Use Permit (SUP)*	☐	
• *Final Plat (Major Sub):*	☐		• *Major Architectural Variation*	☐	
• *Construction Documents:*	☐		• *Minor Architectural Variation*	☐	
• *General Rezoning*	☐		• *Other:*	☐	

Fee Total: $1,750.00

2. Project Information

Date of Application: 10/28/16 Name of Project: QuikTrip Store 1082

Location: NE quadrant of Statesville Rd/Catawba Ave Property Size (acres): 3.16 acres # of Units/Lots: _____

Current Zoning: HC, HC (TRD-O), NMX (TRD-O), NR Proposed Zoning: CZ

Current Land Use: Residential (Convenience Store, Restaurant,) Proposed Land Use: Convenience Store as depicted on Plan

Tax Parcel Number(s): 003-192-01, 003-192-04, 003-192-05, 003-192-06, 003-192-16

3. Contact Information (see also attached Exhibit A)

QuikTrip Corporation
Owner, Applicant, or Developer

3701 Arco Corporate Drive, Suite 150
Address

Charlotte, NC 28273
City, State Zip

(704) 559-8000
Telephone Fax 10/26/16

Signature / John DiBernardo / Print Name / Date

Email - jdibern@quiktrip.com

Urban Design Partners
Agent(s) (Engineer, Architect, Etc.)

1318-E6 Central Ave.
Address

Charlotte, NC 28205
City, State Zip

(704) 334-3303
Telephone Fax

Signature 10.26.16 Print Name BRIAN SMITH Date

Email - brian@urbandesignpartners.com

4. The following items shall be considered as part of a complete application, please check this list to ensure all items are included:

☑ **Signed "Original" application**

☑ **Project Fee(s)** – See Fee Schedule

☑ **Written Summary/Description of Request** can be on company letterhead. Shall include requested use or uses, sq. feet of non-residential space, or density and number of units/lots for residential, or any other applicable information. For CZ's, must also describe any variations proposed from the Land Development Code

☑ **Property Survey** (at least one copy), including existing buildings, topography, wetlands, streams, vegetation (trees over 18" in diameter), and other natural features.

☑ **Site/sketch plan** (at least one copy), may contain multiple pages and must be drawn to scale by an engineer or landscape architect. Shall include locations of buildings and/or lots, streets, parking, proposed grading, landscaping/screening, open space, watershed/storm water information, associated storm water measures, and proposed utilities and lighting. Shall also include general information from adjoining lots

☑ **Illustrative (color) site/sketch plan** for presentation purposes with same layers as described above

☑ **Official hard copy of architectural elevations** (at least one copy), which may include multiple pages. Must be drawn to scale by a registered architect, and include all primary and accessory buildings (including all building sides), and any other architectural elements/features of the site such as gazebos, trellis's, garden walls, retaining walls, or other items over 4-feet in height (NOT APPLICABLE FOR SINGLE-FAMILY RESIDENTIAL DEVELOPMENTS).

☑ **Illustrative (color) elevations** for presentation purposes for all items described above, as well as perspective (3D) renderings and photograph examples

☑ **Digital Files** of all items listed above

The undersigned property owner(s) joins in and consents to the filing of the Land Development Application Form by QuikTrip Corporation to rezone the below described property to CZ.

Property Tax Parcel ID: 003-192-04
Property Street Address: 19809 Burton Lane, Cornelius, NC 28031

Kathleen R. Vogel

Edith N. Stinson
Guardian of the Estate of
Edith Stinson

Address:
19809 Burton Lane
Cornelius, NC 28031

The undersigned property owner(s) joins in and consents to the filing of the Land Development Application Form by QuikTrip Corporation to rezone the below described property to CZ.

Property Tax Parcel ID: 003-192-01
Property Street Address: 20671 Catawba Ave., Cornelius, NC 28031

DMC Properties, Inc., a North Carolina corporation

By: _____
Name: Jean G. Dixon
Title: Secretary

Address:
415 Minuet Lane, Suite F
Charlotte NC 28217

By: _____
Name: Miriam A. Dixon
Title: Vice President

Address:
140 Cottage Place
Charlotte NC 28207

By: _____
Name: N. Frank Dixon, III
Title: President

Address:
4018 Melchor Ave
Charlotte NC 28211

The undersigned property owner(s) joins in and consents to the filing of the Land Development Application Form by QuikTrip Corporation to rezone the below described property to CZ.

Property Tax Parcel ID: 003-192-16
Property Street Address: 20659 Catawba Ave., Cornelius, NC 28031

Acropolis Enterprises, LLC, a North Carolina limited liability company

By: Christine Kapakos
Name: Christine Kapakos
Title: Manager

Address:
20659 Catawba Ave.
Cornelius, NC 28031

By: James Kapakos
Name: James G. Kapakos
Title: Manager

Address:
20659 Catawba Ave.
Cornelius, NC 28031

By: Joanne Teis
Name: Joanne Teis
Title: Manager

Address:
20659 Catawba Ave.
Cornelius, NC 28031

The undersigned property owner(s) joins in and consents to the filing of the Land Development Application Form by QuikTrip Corporation to rezone the below described property to CZ.

Property Tax Parcel ID: 003-192-05
Property Tax Parcel ID: 003-192-06
Property Street Address: 19813 & 19819 Burton Lane, Cornelius, NC 28031

Lawrence Patterson

Ella Patterson

Address:
19813 & 19819 Burton Lane
Cornelius, NC 28031

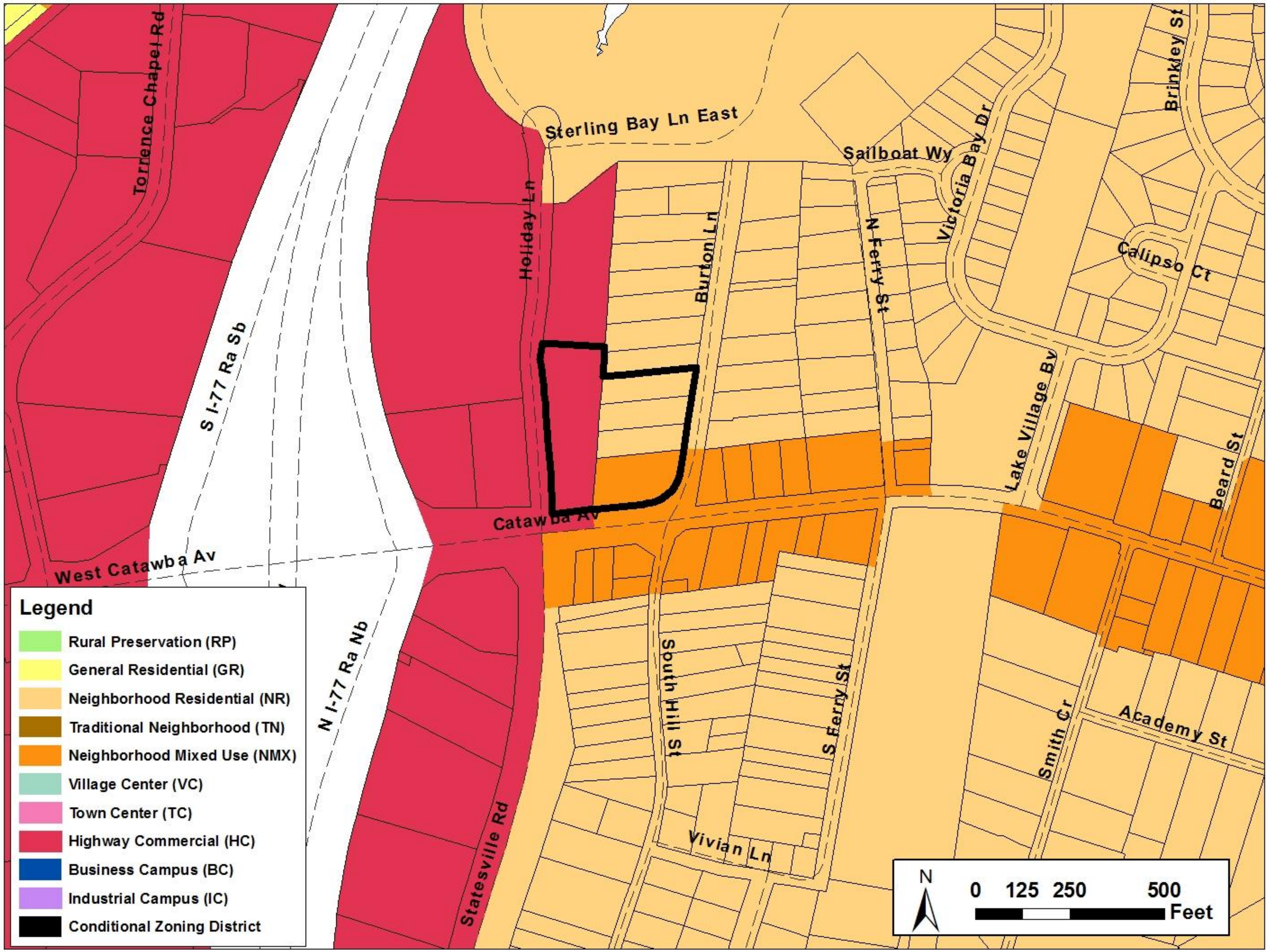
Summary of Request

Quick Trip Corporation

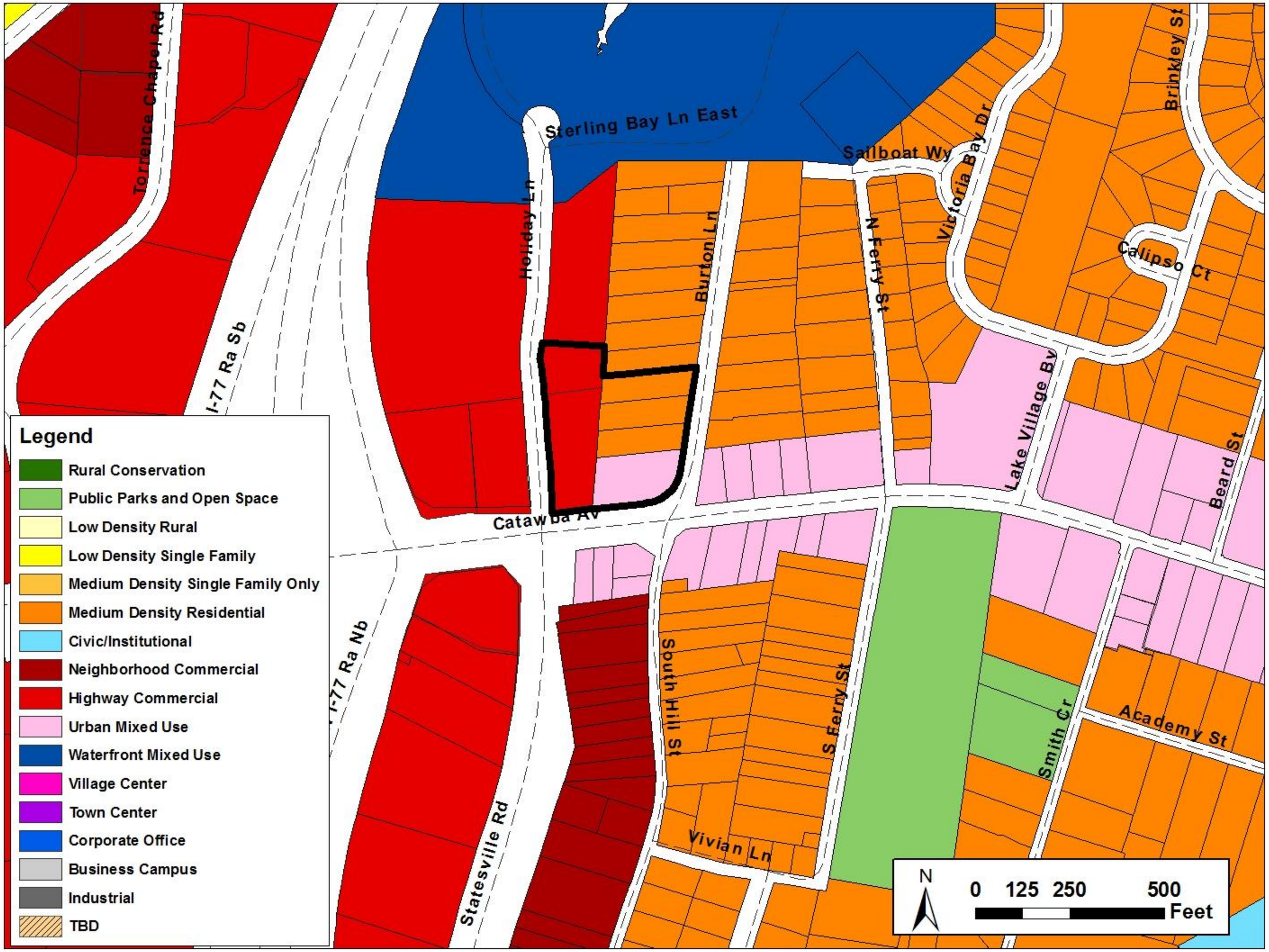
QuikTrip Corporation brings this application for the development of a convenience store as depicted on the attached plan. The Property that is the subject of the application is a 3.16 acre tract comprised of tax parcels 003-192-01, 003-192-04, 003-192-05, 003-192-06, 003-192-16. The existing use of the Property is a restaurant and parking lot which covers 1.38 acres and a convenience store/gas station which covers .596 acres. The Property also includes two residential lots adjacent to the existing convenience store and restaurant.

Quick Trip Corporation proposes to develop an approximately 5,773 square foot convenience store on the 3.16 acre site. Approximately 1.58 acres of the 3.16 acre site will be dedicated to the building and infrastructure and approximately 1.58 acres will remain pervious. The majority of the pervious area is proposed to be situated on the northern portion of the site adjacent to remaining residential lots and includes a 30' buffer area along the northern boundary, which will be planted with Austrian pine trees.

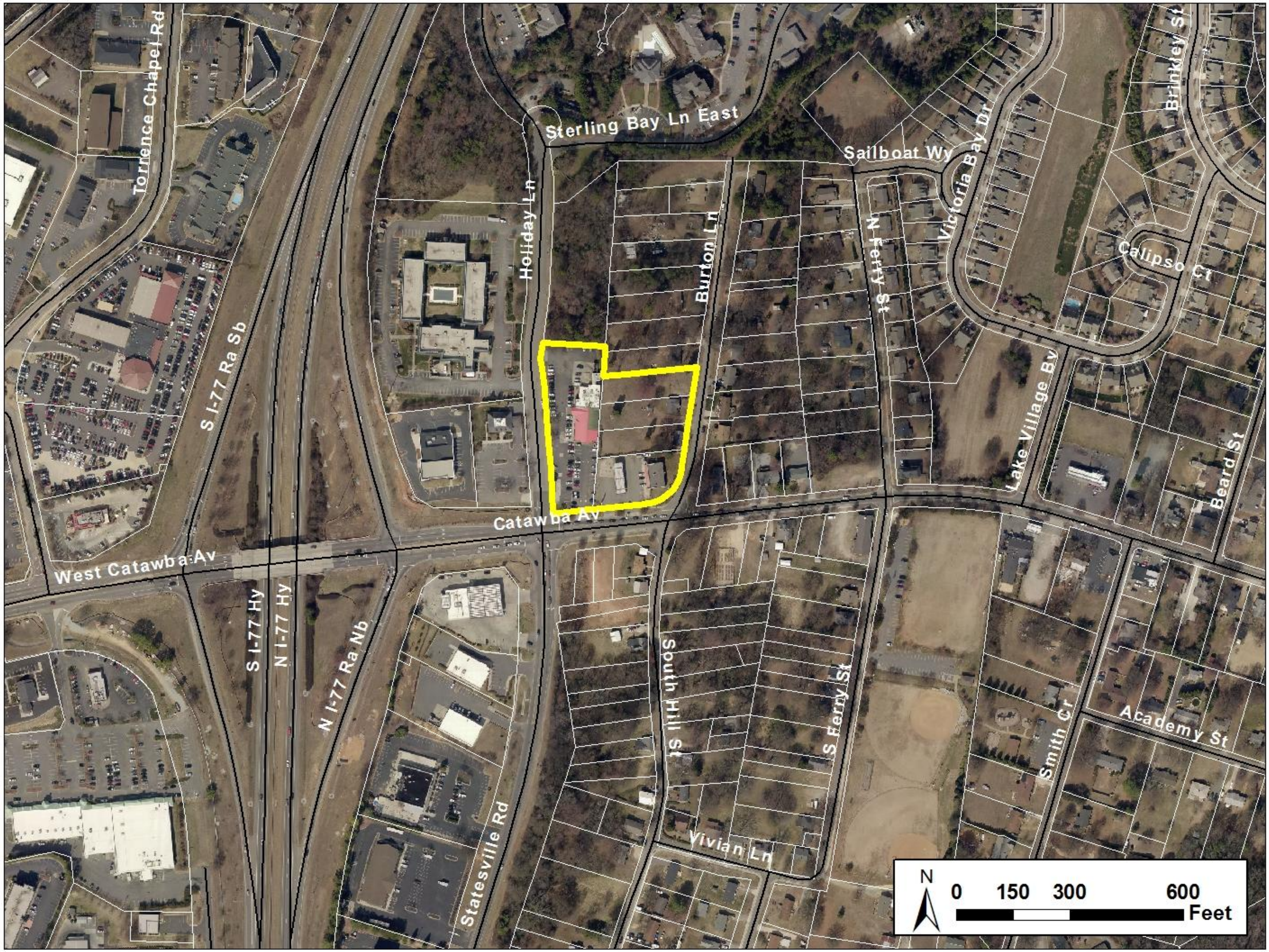
PROPOSED QT SITE



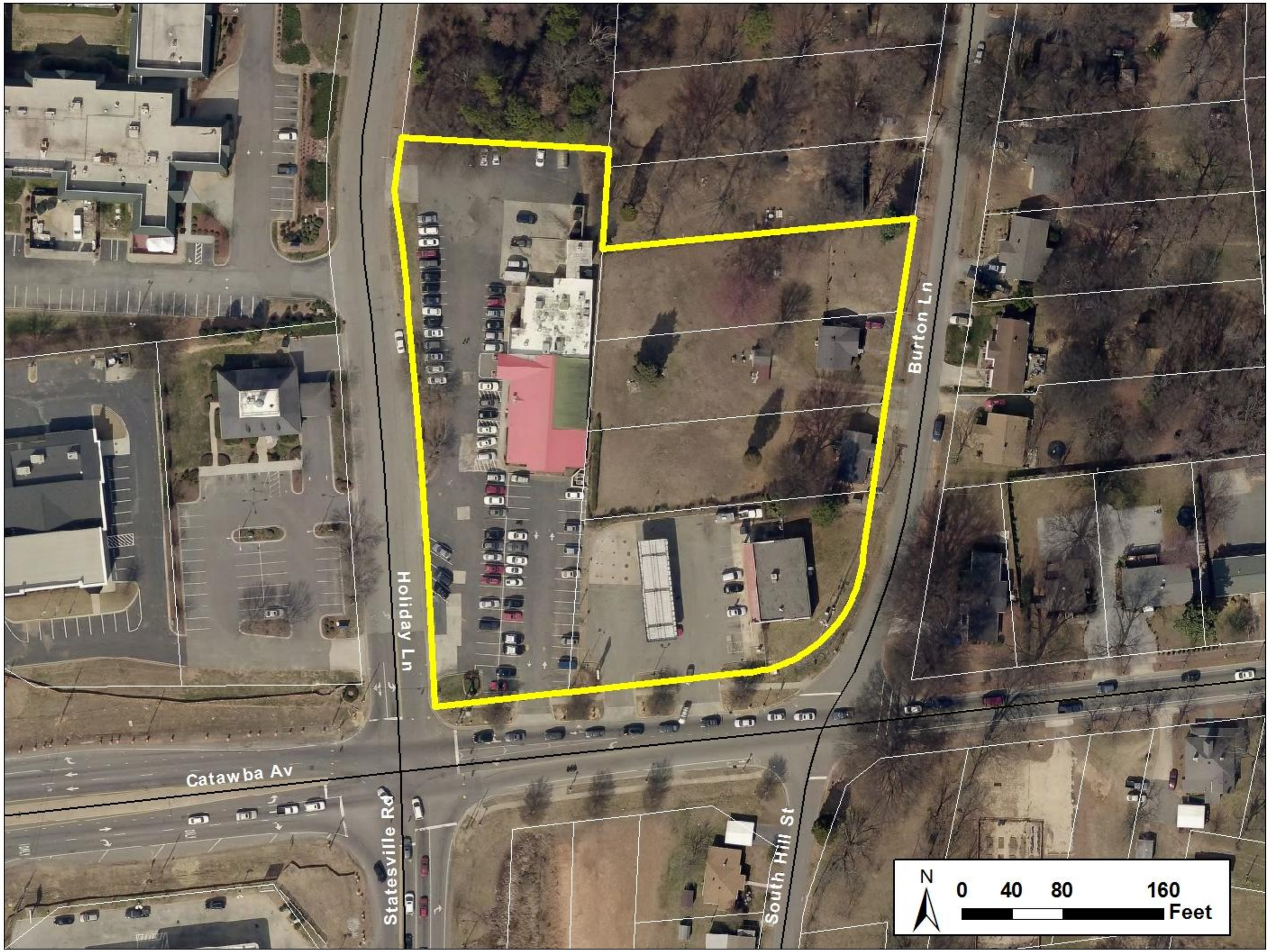
PROPOSED QT SITE



PROPOSED QT SITE



PROPOSED QT SITE



QUICK TRIPS








Days Inn


SOUTH NORTH
77 77
SOUTH NORTH
21 21


Burton Ln


Holiday Ln


Catawba Ave
Catawba Ave

REZ 11-16
Quick Trip #1082

Conditional Zoning Request

Planning Board Meeting
March 13, 2017

OWNER(S):	Acropolis Enterprises LLC 20659 Catawba Ave. Cornelius, NC 28031	DMC Properties, Inc. P.O. Box 111 Statesville, NC 28687
	Edith N. Stinson 19809 Burton Lane Cornelius, NC 28031	Lawrence & Ella Patterson P.O. Box 831 Cornelius, NC 28031
APPLICANT(S):	John DiBernardo QuickTrip Corporation 3701 Arco Corporate Dr., Ste 150 Charlotte, NC 28273	Brian Smith, PE Urban Design Partners 1318-E6 Central Ave. Charlotte, NC 28205

PROPERTY LOCATION: Northeast quadrant of Statesville Road and Catawba Avenue (PID #'s: 00319201, 00319204, 00319205, 00319206, 00319216)

PROPERTY SIZE: 3.16 acres

CURRENT LAND USE: Convenience Store, Restaurant, Single Family, and Vacant

PROPOSED LAND USE: New 5,773 square foot convenience store w/ approximately 20 fueling stations

EXISTING ZONING: Highway Commercial (HC), Neighborhood Mixed Use (NMX), Neighborhood Residential (NR), and Transitional Residential District Overlay (TRD-O)

PROPOSED ZONING: Conditional Zoning (CZ), Elimination of TRD-O

EXISTING CONDITIONS:

1. *Description of Adjoining Zoning and Land Uses* – As shown on the zoning map, this property is bordered by HC zoning to the west and North along Holiday Lane, which includes a bank, mattress store, and hotel site. To the South across Catawba Avenue, the land is zoned NMX and owned by the Town of Cornelius at the corner in order to accommodate the future roundabout at the intersection. Directly east and north east there are existing single family residences along Burton Street.

2. *Topography* – The topography is generally mild and slopes down from Catawba to the north/northeast toward Burton Lane.

3. *Vegetation* – The site is currently developed with the exception of one of the single-family lots on Burton.

4. *Infrastructure* – All utilities are in existence for this property. Utility equipment boxes exist near the intersection of Catawba and Burton Lane, which will most likely be relocated and/or screened. There is also an existing security camera on the utility pole directly behind the existing Citgo station. Staff will add a condition for the applicant(s) to coordinate with the Cornelius Police Department on the relocation of this security system.

5. *Traffic Impact Analysis* – The applicant has completed the code required Traffic Impact Assessment (TIA) for this development proposal. The TIA has been submitted to NCDOT and NCDOT has yet to comment on or approve the findings of the TIA. The original site plan for this rezoning submittal proposed two driveways on Holiday Lane, and one driveway on Burton Lane, all full access. Although no driveways are proposed on Catawba Avenue, and the applicants and staff have been coordinating closely with NCDOT to accommodate the roundabout design at the intersection of Catawba Avenue, Highway 21, and Holiday Lane. The Town's Engineering Consultant performed the TIA and considered several different analyses and future growth conditions.

   The following intersections were studied in the report:

   - I-77 northbound on and off ramps
   - I-77 southbound on and off ramps
   - Us Highway 21 (Statesville Road)/Holiday Lane/Catawba Ave.
     - Existing conditions studied the signalized intersection
     - Future conditions (2018 and 2023) studied this as a signalized intersection as well
     - TIP design year analysis (2030) studied this as a roundabout
   - Catawba Avenue at Burton Lane/South Hill Street

   The proposed driveways into the site from both Holiday and Burton Lane were also studied. The following trip generation table was submitted:

Table ES-1: Trip Generation

LAND USE CODE	LAND USE DESCRIPTION	VARIABLE	DAILY TRIPS (vpd)	AM PEAK HOUR TRIPS (vph)			PM PEAK HOUR TRIPS (vph)		
				TOTAL	IN	OUT	TOTAL	IN	OUT
853	Convenience Market with Gasoline Pumps	20 Fueling Positions	10,850	331	166	165	381	191	190
Existing Site Traffic Reduction			-1,382	*-87*	*-58*	*-29*	*-92*	*-47*	*-45*
Net External Trips			**9,468**	**244**	**108**	**136**	**289**	**144**	**145**
Pass-By Trip Reduction (63% AM / 66% PM)				-154	-77	-77	-153	-77	-76
Net New External Trips				**90**	**31**	**59**	**136**	**67**	**69**

DRAFT

The analysis for the net 9,468 new trips considered 25% of travel to/from the facility from north on 77, 25% to/from south on 77, 40% to/from Catawba (20% east and west), and 10% to/from Statesville Road.

The results indicated that most of the intersections studied in the short term (prior to the roundabout) are operating below their mitigation threshold, therefore the following improvements were recommended by the TIA:

a. Site Driveways – Consolidate site driveways off of Holiday Lane into one access point directly across from the Days Inn access, or modify the first site access off Holiday to allow right-in/right-out only traffic.

b. I-77 north and southbound ramps – no improvements recommended

c. Catawba Ave./US 21/Holiday Intersection (Existing Signalized Intersection) – Restripe the northbound approach to provide dual northbound left-turn lanes and a shared through/right-turn lane with 150-feet of full width storage and appropriate taper on Statesville Road, restripe the southbound approach to provide 200-feet of full width storage and appropriate taper on Holiday Lane, and redesign and retime the traffic signal at the intersection.

d. Catawba Ave./US 21/Holiday (Future Roundabout) – Design the planned roundabout with a southbound exclusive right-turn lane with 200-feet of full-width storage and appropriate taper

e. Catawba Ave. at Burton Lane – Construct a left-turn lane with full width storage that extends from the intersection of Catawba Avenue to the driveway access off of Burton.

The applicant(s) have revised the site plan to accommodate a number of these revisions, and staff and the applicant(s) are currently in discussions with NCDOT on the appropriate steps forward.

STAFF COMMENTS:

1. *District Consistency* – Convenience stores are typically permitted with conditions in the Highway Commercial district, but with all properties considered plus the elimination of the TRD-O, and the unique nature of the design and building layout, conditional zoning is the best option for this request.

2. *Land Use Plan Consistency* **–** The Land Use Plan adopted by the Town Board on January 6, 2014 designates this property as a combination of Highway Commercial and Urban Mixed Use. The Urban Mixed Use designation makes particular reference to walkability, and the incorporation of non-residential development integrated into the design of the neighborhood that serves the needs of the surrounding residents within walking distance. Staff feels that this proposal can achieve both Highway Commercial and Urban Mixed Use goals in its unique design to accommodate both vehicular traffic as well as pedestrians. With the design of the roundabout, there will be a 10-foot multi-use path along Catawba Avenue, and good access is proposed to the building that does not conflict with vehicular traffic.

3. *Pre-Development Review Committee* – An initial plan was presented to the PDRC in October of 2016. Staff receive comments that were generally positive and the applicant made it clear that they would work with the town to provide a desirable site design and architecture. The Committee made reference to the fact that they want to make sure the roundabout details are included in all future

revisions. There were also some comments on the building design, and the look of the screening walls.

4. *Open Space/Water Quality* – This development is within the Lake Norman Critical Watershed Area. High Density development is limited to 50% impervious coverage, and the proposed development includes 48% impervious. A storm water bmp pond area is shown behind the parking lot and closer to the Burton Lane side of the development. The exact size, location, and calculations of the bmp structure will not be known until engineered plans have been reviewed by Mecklenburg County LUESA.

5. *Community Meeting* – The applicant(s) held the required community meeting on December 21, 2016. Approximately 14 residents attended the meeting, most of which residents that lived in the surrounding neighborhood. Most comments/concerns centered on Burton Lane traffic and the difficulty the residents currently have with the congestion at the Burton/Catawba intersection. They were concerned with how close the proposed Burton driveway was located to the intersection, and felt that the QT development would lead to more traffic backups. Some questions were also asked about storm water/drainage impacts on Burton Lane as well. At the time of the meeting, the TIA had not been finished, so it was not known at the time what kinds of improvements would be recommended. The revised plan does show a designated left turn lane and additional pavement on Burton in response to the TIA.

6. *Architectural Review* – The elevations were presented to the Architectural Review Board on December 9, 2016. The Board was in favor conceptually of the direction they were going, but asked that it come back at a later date with more details. Staff mentioned that the applicants would need to specifically call out what architectural variations would be requested as part of the conditional zoning. The board made specific reference to parapet heights making sure not only that rooftop equipment would not be seen, but also that the backs of parapet walls that were unfinished would also not be seen. There were also comments about the back of the building facing the roundabout, and the need to add more windows, accents, change in material or change in place so as not to show too much blank wall even though this is the back of the building with no public entrance. The applicants have submitted revised elevations addressing the back entrance with more windows. In addition, QT will build a "Welcome to Cornelius" monument sign at the gateway intersection to compliment the development of the roundabout.

STAFF RECOMMENDATIONS:

Staff is recommending approval. At this time NCDOT has not completed their review of the submitted TIA and potential road improvements. Staff anticipates that NCDOT will provide final approval prior to the Town Board review and is asking the Planning Board to move forward with the plan as presented due to time constraints for QT. The following conditions are proposed at this time for your consideration.

1. Town approval is contingent on review and approval by other applicable local, state and federal agencies.

2. The development shall comply with all other applicable requirements of the Town of Cornelius Land Development Code.

3. Town approval incorporates and shall comply with any and all submittals in the case file and correspondence presented to the board in support of this application, including, but not limited to the following: The site/sketch plan, architectural elevations, and any other information related to this case or improvements recommended by the Town and/or other agencies.

4. Approval of the requested conditional zoning district, includes approval of the following architectural variations:

    a. Section 4.6.1(D): Allow the primary façade of the building to face the back (canopy/parking lot side)

    b. Section 4.6.1(J): Allow the front of the building to face the rear.

    c. Section 4.6.3(B)(3): Allow a reduction in the window and door coverage requirement on the front rear façade of the building that faces the right-of-way.

    All other requirements of Chapter 4 shall be met.

5. Applicant shall coordinate with NCDOT to dedicate any additional right-of-way necessary for the construction of the roundabout or any other proposed road improvements. The applicant shall also complete the following improvements referenced in the TIA prior to issuance of the Certificate of Occupancy:

    a. Consolidate site driveways off of Holiday Lane into one access point directly across from the Days Inn access, or modify the first site access off Holiday to allow right-in/right-out only traffic.

    b. Restripe the northbound approach on Highway 21 (Statesville Road) to provide dual northbound left-turn lanes and a shared through/right-turn lane with 150-feet of full width storage and appropriate taper

    c. Restripe the southbound approach on Holiday Lane to provide 200-feet of full width storage and appropriate taper, and redesign and retime the traffic signal at the intersection.

    d. Work with NCDOT to ensure that the planned roundabout includes a southbound exclusive right-turn lane with 200-feet of full-width storage and appropriate taper

    e. Construct a left-turn lane on Burton Lane with full width storage that extends from the intersection of Catawba Avenue to the driveway access.

6. Applicant shall provide payment-in-lieu of construction for future improvements within the Catawba Avenue right-of-way, which may include 10-foot multi-use sidewalk and street trees at a minimum, but could also include other improvements deemed necessary by the Town of Cornelius or NCDOT for the future roundabout. An estimate of these proposed improvements shall be submitted and approved as part of the Construction Document review. Payment shall be submitted to the Town prior to Certificate of Occupancy

QuikTrip Community Meeting Minutes

Meeting Date:
December 21, 2016; 6:00 p.m.; Room 204, Cornelius Town Hall.

QuikTrip Representatives:
David Meyer-QuikTrip, Paulette Morin-QuikTrip, Susan Irvin-Irvin Law, PLLC, Brian Smith, Urban Design Partners.

Community Attendees:
808 notices to property owners were sent out by the Town; 14 people attended. See attached sign-in sheet.

Susan Irvin and David Meyer presented the QuikTrip site plan and elevations. These were presented on large boards to allow better visibility and discussion. Community comments/questions included the following:

1. **Burton Lane Traffic:**
   a) Residents discussed traffic impact on Burton Lane. Concerns were expressed about the current difficulty making a left turn from Burton onto Catawba. Discussion followed about the proposed NCDOT road improvements on Catawba and how the proposed design will direct cars from Burton onto the second westbound lane so that they will circle the roundabout and continue east down Catawba, effectively taking the place of a left turn. It was noted that traffic coming from 77 will use the Holiday Lane entrances, so the Burton Lane entrance will mostly be for local traffic. Once the results of the Traffic Report are received, Susan suggested that the traffic engineer and QuikTrip representatives meet with the interested residents of Burton Lane.

2. **Other Comments:**
   a) It was noted that the detention pond in the QuikTrip plan will tie in to the storm system on Burton Lane.
   b) Above ground sand filter dry detention pond. Fence completely around the pond.
   c) The question was raised regarding the Burton Lane exit and whether it is necessary or required.
   d) Susan Irvin will find out if a "Dead End" sign could be placed closer to Catawba, which would eliminate vehicles from driving down Burton Lane and turning around in residents' driveways.
   e) Perspectives shown on pages 4-7 are included with these minutes to address location of NCDOT roundabout and view of property from adjacent property on Burton Lane.

3. **Zoning Schedule:**
   Susan stated that the date of the Planning Board meeting depends on when the transportation analysis is completed. If the transportation analysis is completed in time, the case will go to the Planning Board on February 13, 2017. If not, the Planning Board meeting will likely be on March 13, 2017. The correct dates of the Planning Board meeting and public hearing will be posted on the Town of Cornelius website.

A *Exceptions to Schedule B Section II, First American Title Insurance Company*
File No. 16-1930, Effective Date: July 13, 2016 at 08:00 AM

1. (NOT A SURVEY MATTER)

2. Building restriction lines, easements and other matters shown on plat recorded in Map Book 2095, Page 509, Mecklenburg County Registry. (CURRENT SETBACKS TO BE DETERMINED PER PROPOSED USE AND REZONING)

3. Title to any portion of Land lying within the right of way of Burton Lane. (THE SUBJECT PARCEL LINES ARE CONTIGUOUS WITH THE RIGHT OF WAY OF BURTON LANE)

4. Any discrepancy, conflict, access, shortage in area or boundary lines, encroachment, encumbrance, violation, variation, overlap, setback, easement or claim of easement, riparian right, and title to land within roads, ways, railroads, watercourses, burial grounds, marshes, dredged or filled areas or land below the mean highwater mark or within the bounds of any adjoining body of water, or other adverse circumstance affecting the Title that would be disclosed by a current inspection and accurate and complete land survey of the Land. (CURRENT SURVEY SHOWN HEREON)

B *Exceptions to Schedule B Section II, First American Title Insurance Company*
File No. 16-1933, Effective Date: July 13, 2016 at 08:00 AM

1. (NOT A SURVEY MATTER)

2. Agreement made by and between Dixon Motor Company and Home Federal Savings and Loan Association recorded in Book 4088, Page 945; as amended by Amendment to Agreement recorded in Book 4088, Page(s) 955, Mecklenburg County Registry. (DOES NOT AFFECT THE SUBJECT PARCEL, CURRENT DEDICATED PUBLIC RIGHTS-OF-WAY SHOWN HEREON)

3. Easement reserved in Deed recorded in Book 4089, Page(s) 897, Mecklenburg County Registry. (DOES NOT AFFECT THE SUBJECT PARCEL)

4. Terms, provisions, options, rights of first refusal, covenants, conditions, restrictions, easements, charges, assessments and liens provided for in Deeds recorded in Book 4389, Page 559 and Book 4428, Page 509, Mecklenburg County Registry, and any related maps, plans, bylaws and other document(s) and amendment(s), but omitting any covenants or restrictions, if any, based upon race, color, religion, sex, sexual orientation, familial status, marital status, disability, handicap, national origin, ancestry, or source of income, as set forth in applicable state or federal laws, except to the extent that said covenant or restriction is permitted by applicable law. (AFFECTS SUBJECT PARCEL, NOTHING TO PLOT)

(5.) Deed for Permanent Utility Easement in favor of the Town of Cornelius recorded in Book 5482, Page(s) 761, Mecklenburg County Registry. (DOES NOT AFFECT THE SUBJECT PARCEL EASEMENT RUNS ADJACENT TO THE SUBJECT PARCELS NORTHERN PROPERTY LINE)

6. Right of Way Agreement in favor of the City of Charlotte recorded in Book 5598, Page(s) 973, Mecklenburg County Registry. (DOES NOT AFFECT THE SUBJECT PARCEL)

7. Memorandum of Lease in favor of Acropollis Cafe & Grill, Inc., Tenant recorded in Book 12108, Page(s) 329, Mecklenburg County Registry. (MEMO OF LEASE, NOT A SURVEY MATTER)

8. Assignment of Lessor's Interest recorded in Book 12108, Page 334, Mecklenburg County Registry. (MEMO OF LEASE, NOT A SURVEY MATTER)

9. Building restriction lines, easements and other matters shown on plat recorded in Map Book 2095, Page 509, Mecklenburg County Registry. (CURRENT SETBACKS TO BE DETERMINED PER PROPOSED USE AND REZONING))

10. Title to any portion of Land lying within the right of way of Catawba Avenue and Holiday Lane. (THE SUBJECT PARCEL LINES ARE CONTIGUOUS WITH THE RIGHT OF WAY OF CATAWBA AVENUE)

11. Rights of tenant(s) in possession under unrecorded lease(s). (MEMO OF LEASE, NOT A SURVEY MATTER)

12. The Company does not insure the calculation of the acreage or square footage of the land. (NOT A SURVEY MATTER)

13. Any discrepancy, conflict, access, shortage in area or boundary lines, encroachment, encumbrance, violation, variation, overlap, setback, easement or claim of easement, riparian right, and title to land within roads, ways, railroads, watercourses, burial grounds, marshes, dredged or filled areas or land below the mean highwater mark or within the bounds of any adjoining body of water, or other adverse circumstance affecting the Title that would be disclosed by a current inspection and accurate and complete land survey of the Land. (CURRENT SURVEY SHOWN HEREON)

C *Exceptions to Schedule B Section II, First American Title Insurance Company*
File No. 16-1936, Effective Date: July 13, 2016 at 08:00 AM

1. (NOT A SURVEY MATTER)

2. Building restriction lines, easements and other matters shown on plat recorded in Map Book 2095, Page 509, Mecklenburg County Registry. (CURRENT SETBACKS TO BE DETERMINED PER PROPOSED USE AND REZONING))

3. Title to any portion of Land lying within the right of way of Burton Lane. (THE SUBJECT PARCEL LINES ARE CONTIGUOUS WITH THE RIGHT OF WAY OF BURTON LANE)

4. Rights of tenant(s) in possession under unrecorded lease(s). (MEMO OF LEASE, NOT A SURVEY MATTER)

5. Any discrepancy, conflict, access, shortage in area or boundary lines, encroachment, encumbrance, violation, variation, overlap, setback, easement or claim of easement, riparian right, and title to land within roads, ways, railroads, watercourses, burial grounds, marshes, dredged or filled areas or land below the mean highwater mark or within the bounds of any adjoining body of water, or other adverse circumstance affecting the Title that would be disclosed by a current inspection and accurate and complete land survey of the Land. (CURRENT SURVEY SHOWN HEREON)

D *Exceptions to Schedule B Section II, First American Title Insurance Company*
File No. 16-1937, Effective Date: July 13, 2016 at 08:00 AM

1. (NOT A SURVEY MATTER)

(2.) Condemnation Action evidenced by memorandum of Action recorded in Book 3560, Page(s) 293, Mecklenburg County Registry. (AFFECTS SUBJECT PARCEL, CURRENT RIGHT-OF-WAY SHOWN HEREON)

3. Agreement made by and between Dixon Motor Company and Home Federal Savings and Loan Association recorded in Book 4088, Page(s) 945 as amended by Amendment to Agreement recorded in Book 4088, Page 955, Mecklenburg County Registry. (DOES NOT AFFECT THE SUBJECT PARCEL, CURRENT DEDICATED PUBLIC RIGHTS-OF-WAY SHOWN HEREON)

4. Right of Way Agreement in favor of the City of Charlotte recorded in Book 5598, Page(s) 973, Mecklenburg County Registry. (DOES NOT AFFECT THE SUBJECT PARCEL)

5. Building restriction lines, easements and other matters shown on plat recorded in Map Book 2095, Page 509, Mecklenburg County Registry. (CURRENT SETBACKS TO BE DETERMINED PER PROPOSED USE AND REZONING)

6. Title to any portion of Land lying within the right of way of Catawba Avenue and Burton Lane. (HE SUBJECT PARCEL LINES ARE CONTIGUOUS WITH THE RIGHT OF WAY OF BURTON LANE)

7. The Company does not insure the calculation of the acreage or square footage of the land. (NOT A SURVEY MATTER)

8. Rights of tenant(s) in possession under unrecorded lease(s). (MEMO OF LEASE, NOT A SURVEY MATTER)

9. Any discrepancy, conflict, access, shortage in area or boundary lines, encroachment, encumbrance, violation, variation, overlap, setback, easement or claim of easement, riparian right, and title to land within roads, ways, railroads, watercourses, burial grounds, marshes, dredged or filled areas or land below the mean highwater mark or within the bounds of any adjoining body of water, or other adverse circumstance affecting the Title that would be disclosed by a current inspection and accurate and complete land survey of the Land. (CURRENT SURVEY SHOWN HEREON)

NOTES:

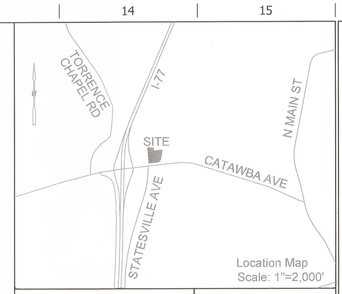
1. NORTH ARROW AND BEARINGS ARE BASED UPON NORTH CAROLINA GRID NAD 83.
2. ELEVATIONS ARE BASED UPON NAVD 88..
3. THIS SURVEY MEETS THE REQUIREMENT FOR A CLASS "A" SURVEY (1:10,000) AS DEFINED FOR THE STANDARDS OF PRACTICE FOR LAND SURVEYING IN THE STATE OF NORTH CAROLINA.
4. THE AREA WAS DETERMINED BY DMD METHOD.
5. ALL HORIZONTAL DISTANCES ARE GROUND DISTANCES.
6. THE UNDERGROUND UTILITIES SHOWN HAVE BEEN LOCATED FROM ONE CALL TICKET NUMBERS A161952851, A161952864, A161952872, A161952877, AND A161952886, FIELD SURVEY INFORMATION, AND EXISTING DRAWINGS. THE SURVEYOR MAKES NO GUARANTEE THAT THE UNDERGROUND UTILITIES SHOWN COMPRISE ALL SUCH UTILITIES IN THE AREA, EITHER IN SERVICE OR ABANDONED. THE SURVEYOR FURTHER DOES NOT WARRANT THAT THE UNDERGROUND UTILITIES SHOWN ARE IN THE EXACT LOCATION INDICATED, ALTHOUGH HE DOES CERTIFY THAT THEY ARE LOCATED AS ACCURATELY AS POSSIBLE FROM INFORMATION AVAILABLE. THE SURVEYOR HAS NOT PHYSICALLY LOCATED THE UNDERGROUND UTILITIES.
7. THE PROPERTY APPEARS TO BE IN FEMA ZONE "X," PER MAP #3710464300K; EFFECTIVE SEPTEMBER 2, 2015.
8. ZONING PROVIDED BY THE CITY OF CORNELIUS TO BE USED FOR INFORMATIONAL PURPOSES ONLY.
9. PARCEL LINES ARE CONTIGUOUS WITH THEIR RESPECTIVE RIGHT-OF-WAY LINES LEAVING NO GAPS OR GORES.
10. NO EVIDENCE OF RECENT OR PROPOSED CONSTRUCTION WAS FOUND ON SITE OR ON THE ADJACENT ROADWAYS. CURRENT RIGHTS-OF-WAY ARE SHOWN HEREON.
11. NO WETLAND SKETCH WAS GIVEN OR FLAGS FOUND AT THE TIME OF THIS SURVEY.

OVERALL PARCEL DESCRIPTION:

ALL THAT TRACT OR PARCEL OF LAND LYING AND BEING IN THE CITY OF CORNELIUS, MECKLENBURG COUNTY, SOUTH CAROLINA AND MORE PARTICULARLY DESCRIBED AS FOLLOWS:

BEGINNING AT AN CONCRETE NAIL AT THE INTERSECTION OF THE NORTHERLY RIGHT-OF-WAY MARGIN OF CATAWBA AVENUE (VARIABLE PUBLIC RIGHT-OF-WAY) AND EASTERLY RIGHT-OF-WAY MARGIN OF HOLIDAY LANE (60 FOOT PUBLIC RIGHT-OF-WAY) HAVING NC GRID COORDINATES OF N 636,297.439, E 1,442,622.796; THENCE ALONG THE EASTERLY MARGIN OF HOLIDAY LANE N03°36'45"E A DISTANCE OF 287.78 FEET TO AN IRON PIN, THENCE N08°58'45"W A DISTANCE OF 62.10 FEET TO AN IRON PIN, THENCE ALONG A CLOCKWISE CURVE FOR 100.83 FEET HAVING A RADIUS OF 342.98 FEET A CHORD BEARING OF N00°27'14"W AND A CHORD DISTANCE OF 100.47 FEET TO AN IRON PIN, THENCE LEAVING SAID RIGHT-OF-WAY S87°25'15"E A DISTANCE OF 162.43 FEET TO AN IRON PIN, THENCE S02°26'07"W A DISTANCE OF 83.88 FEET TO AN IRON PIN, THENCE N83°56'58"E A DISTANCE OF 245.44 FEET TO AN IRON PIPE ON THE WESTERLY RIGHT-OF-WAY MARGIN OF BURTON LANE (60 FOOT PUBLIC RIGHT-OF-WAY), THENCE ALONG SAID RIGHT-OF-WAY S07°39'54"W A DISTANCE OF 246.14 FEET TO AN IRON PIN, THENCE S24°25'21"W A DISTANCE OF 78.07 FEET TO A CONCRETE MONUMENT, THENCE S51°55'29"W A DISTANCE OF 66.10 FEET TO A CONCRETE MONUMENT ON THE NORTHERLY RIGHT-OF-WAY MARGIN OF CATAWBA AVENUE, THENCE ALONG SAID RIGHT-OF-WAY S83°47'12"W A DISTANCE OF 258.56 FEET TO THE POINT OF BEGINNING AND CONTAINING 137,537 S.F. OR 3.157 ACRES MORE OR LESS.

BEING THE SAME PARCELS DESCRIBED IN FIRST AMERICAN TITLE COMMITMENTS NUMBERS 16-1930, 16-1933, 16-1936, AND 16-1937 DATED JULY 13, 2016.



Zoning data	Utility information
ZONED: As noted SETBACK LINES: FRONT: To be determined by SIDE: design plans REAR: MAXIMUM BUILDING HEIGHT:	NC DEPT. OF TRANSPORTATION TEL: 980-523-0000 CONTACT: FRED BURTON WATER: CHAR-MECK UTILITIES TEL: 704-399-2794 ELECTRIC SERVICES: DUKE ENERGY TEL: 800-653-5307 PSNC ENERGY - GAS TEL: 877-776-2427 PLANNING & ZONING DEPT. TEL: 704-336-3813 CONTACT: JOHN MARSHALL TELEPHONE: AT&T TEL: 866-620-2000
Flood information	
FLOOD ZONE "X" PER FEMA MAP NO. 3710464300K EFFECTIVE DATE: SEPTEMBER 2, 2015	
Parking	
REGULAR = NA HANDICAP = NA	

LEGEND

- Property Line
- Adjoiner Line
- Easement Line
- Storm Drainage Manhole
- Catch Basin w/Grate
- Storm Drainage Pipe
- Wire Fence
- Chainlink Fence
- Treeline
- Gas Line
- Overhead Electric
- Overhead Wire
- Overhead Traffic
- Underground Telephone
- Sanitary Sewer Line
- Water Line
- Sanitary Sewer Manhole
- Water Meter
- Valve
- Hydrant
- Utility Pole
- Sign
- Corner Set
- Iron Pipe Found
- Monument Found

RECEIVED
OCT 27 2016

TO: QUIKTRIP CORPORATION, AN OKLAHOMA CORPORATION
FIRST AMERICAN TITLE INSURANCE COMPANY

THIS IS TO CERTIFY THAT THIS MAP OR PLAT AND THE SURVEY ON WHICH IT IS BASED WERE MADE IN ACCORDANCE WITH THE 2016 MINIMUM STANDARD DETAIL REQUIREMENTS FOR ALTA/NSPS LAND TITLE SURVEYS, JOINTLY ESTABLISHED AND ADOPTED BY ALTA AND NSPS, AND INCLUDES ITEMS 1, 2, 3, 4, 5, 6b, 7a, 7b1, 7c, 8, 9, 11, 13, 14, 16, 17, 18, AND 19 OF TABLE A THEREOF. PURSUANT TO THE ACCURACY STANDARDS AS ADOPTED BY ALTA AND NSPS AND IN EFFECT ON THE DATE OF THIS CERTIFICATION, UNDERSIGNED FURTHER CERTIFIES THAT IN MY PROFESSIONAL OPINION, AS A LAND SURVEYOR REGISTERED IN THE STATE OF NORTH CAROLINA, THE RELATIVE POSITIONAL ACCURACY OF THIS SURVEY DOES NOT EXCEED THAT WHICH IS SPECIFIED THEREIN.

NORTH CAROLINA PROFESSIONAL LAND SURVEYOR SEAL L-4737

NICHOLAS L. MANSFIELD DATE: 7/29/2016 REGISTRATION #L-4737

* THE WORDS "CERTIFY", "CERTIFICATES" OR "CERTIFICATION" AS USED HEREON ARE UNDERSTOOD TO BE AN EXPRESSION OF PROFESSIONAL OPINION BY THE SURVEYOR, BASED UPON HIS BEST KNOWLEDGE, INFORMATION AND BELIEF, AS SUCH, DO NOT CONSTITUTE A GUARANTEE NOR A WARRANTY, EXPRESSED OR IMPLIED.

SURVEY MATTERS, LLC
LAND SURVEYING SERVICES
103 East Butler Road, Suite J
Mauldin, South Carolina 29662
(864) 451-0176 NC #P-0869
nick@survey-matters.com

QuikTrip No. 1082

20659 & 20671 CATAWBA AVENUE &
19809, 19813, 19819 BURTON LANE
MECKLENBURG COUNTY, CORNELIUS, NC

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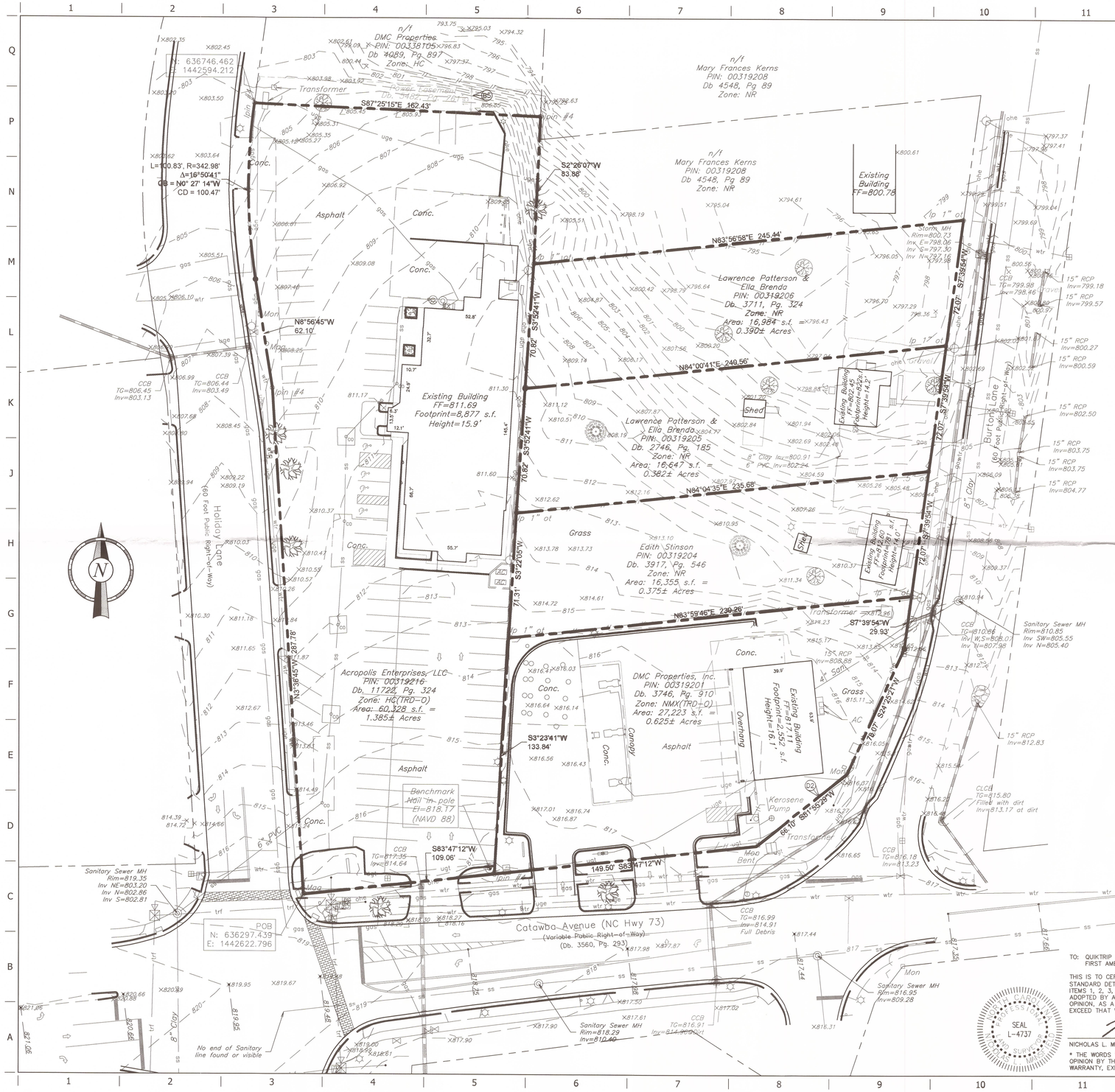
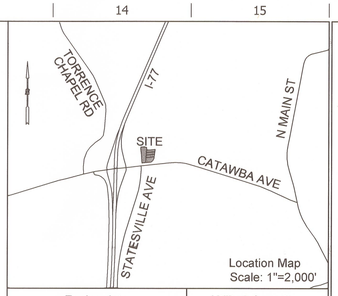
PROTOTYPE: P-74 (2/01/13)
DIVISION:
VERSION: 001
DESIGNED BY:
DRAWN BY: NLM
REVIEWED BY: NLM

REV	DATE	DESCRIPTION
		ORIGINAL ISSUE DATE: 7/29/2016

SHEET TITLE:
ALTA/NSPS
LAND TITLE SURVEY

SHEET NUMBER:
C021





Zoning data	Utility information
ZONED: As noted SETBACK LINES: FRONT: To be determined by SIDE: design plans REAR: MAXIMUM BUILDING HEIGHT:	NC DEPT. OF TRANSPORTATION TEL: 980-523-0000 CONTACT: FRED BURTON WATER: CHAR-MECK UTILITIES TEL: 704-399-2794 ELECTRIC SERVICES: DUKE ENERGY TEL: 800-653-5307 PSNC ENERGY - GAS TEL: 877-776-2427 PLANNING & ZONING DEPT. TEL: 704-336-3813 CONTACT: JOHN MARSHALL TELEPHONE: AT&T TEL: 866-620-2000
Flood information	
FLOOD ZONE "X" PER FEMA MAP NO. 3710464300K EFFECTIVE DATE: SEPTEMBER 2, 2015	
Parking	
REGULAR = NA HANDICAP = NA	

LEGEND

- Property Line
- Adjoiner Line
- Easement Line
- Storm Drainage Manhole
- Catch Basin w/Grate
- Storm Drainage Pipe
- Wire Fence
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- Utility Pole
- Sign
- Corner Set
- Iron Pipe/Pin Found
- Monument Found

TO: QUIKTRIP CORPORATION, AN OKLAHOMA CORPORATION
FIRST AMERICAN TITLE INSURANCE COMPANY

THIS IS TO CERTIFY THAT THIS MAP OR PLAT AND THE SURVEY ON WHICH IT IS BASED WERE MADE IN ACCORDANCE WITH THE 2016 MINIMUM STANDARD DETAIL REQUIREMENTS FOR ALTA/NSPS LAND TITLE SURVEYS, JOINTLY ESTABLISHED AND ADOPTED BY ALTA AND NSPS, AND INCLUDES ITEMS 1, 2, 3, 4, 5, 6b, 7a, 7b1, 7c, 8, 9, 11, 13, 14, 16, 17, 18, AND 19 OF TABLE A THEREOF. PURSUANT TO THE ACCURACY STANDARDS AS ADOPTED BY ALTA AND NSPS AND IN EFFECT ON THE DATE OF THIS CERTIFICATION, UNDERSIGNED FURTHER CERTIFIES THAT IN MY PROFESSIONAL OPINION, AS A LAND SURVEYOR REGISTERED IN THE STATE OF NORTH CAROLINA, THE RELATIVE POSITIONAL ACCURACY OF THIS SURVEY DOES NOT EXCEED THAT WHICH IS SPECIFIED THEREIN.

SEAL L-4737

NICHOLAS L. MANSFIELD — DATE: 7/29/2016 — REGISTRATION #L-4737

* THE WORDS "CERTIFY", "CERTIFICATES" OR "CERTIFICATION" AS USED HEREON ARE UNDERSTOOD TO BE AN EXPRESSION OF PROFESSIONAL OPINION BY THE SURVEYOR, BASED UPON HIS BEST KNOWLEDGE, INFORMATION AND BELIEF, AS SUCH, DO NOT CONSTITUTE A GUARANTEE NOR A WARRANTY, EXPRESSED OR IMPLIED.

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NC #P-0869

QuikTrip No. 1082

20659 & 20671 CATAWBA AVENUE &
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MECKLENBURG COUNTY, CORNELIUS, NC

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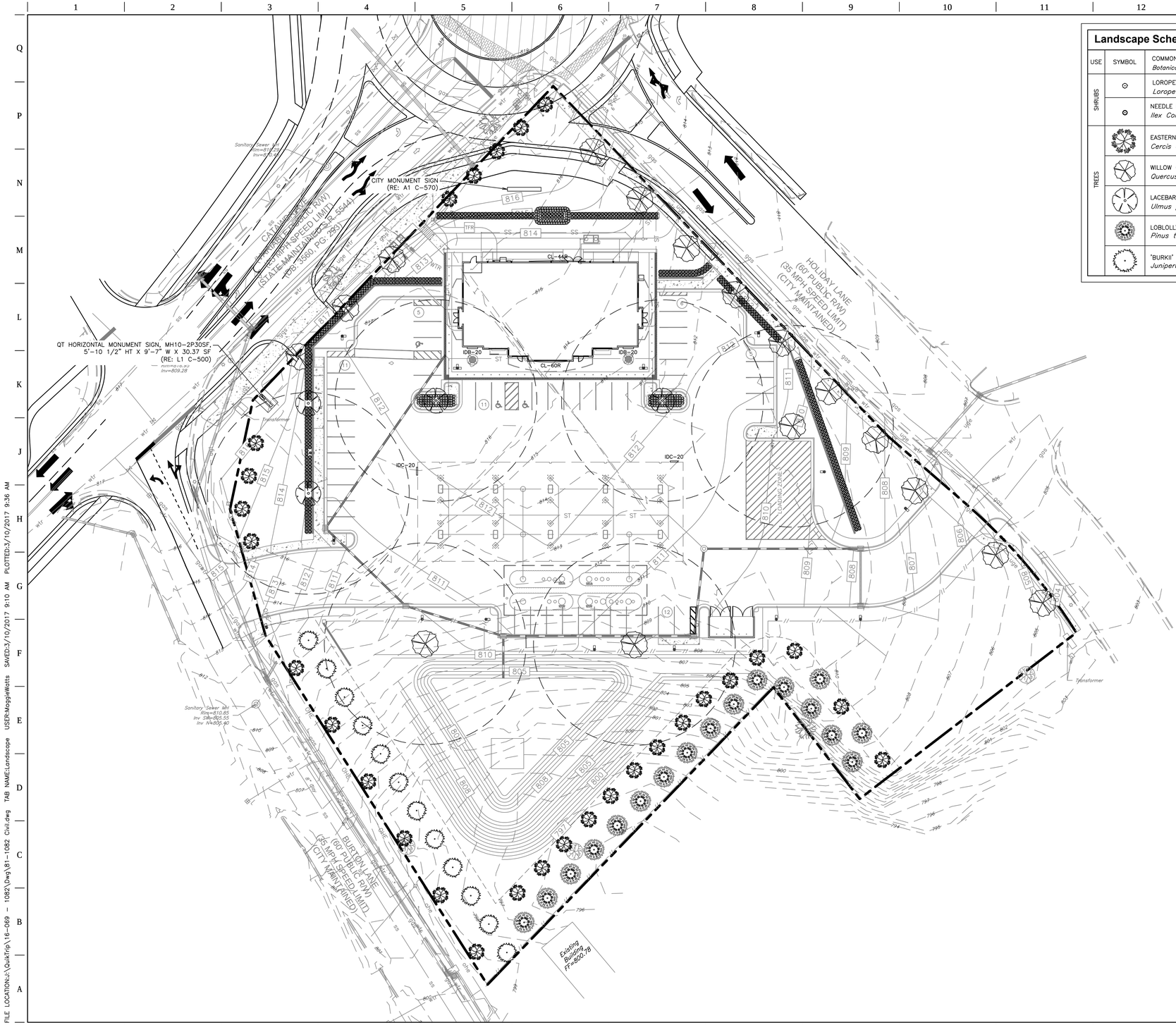
PROTOTYPE:	P-74 (2/01/13)
DIVISION:	
VERSION:	001
DESIGNED BY:	
DRAWN BY:	NLM
REVIEWED BY:	NLM

REV	DATE	DESCRIPTION

ORIGINAL ISSUE DATE: 7/29/2016

SHEET TITLE:
ALTA/NSPS
LAND TITLE SURVEY

SHEET NUMBER:
C021



Landscape Schedule

USE	SYMBOL	COMMON NAME / *Botanical Name*	MINIMUM SIZE/ HEIGHT/SPREAD	QUANTITIES	COMMENTS
SHRUBS	⊙	LOROPETALUM *Loropetalum chinese*	24" X 24" HT MIN	193	SEE LANDSCAPE PLAN AND ASSOCIATED DETAILS FOR LANDSCAPE BED LOCATIONS AND SHRUB SPACING
SHRUBS	⊙	NEEDLE POINT HOLLY *Ilex Cornuta "Needle Point"*	24" X 24" HT MIN	513	
TREES		EASTERN REDBUD *Cercis canadensis*	3" CALIPER (TOTAL) 8' HT	29	SEE LANDSCAPE PLAN AND ASSOCIATED DETAILS FOR TREE PLACEMENT, AND PLANTING SPECIFICATIONS CONTRACTOR TO VERIFY TREE TYPE, LOCATION, SIZE, HEIGHT, AND SPREAD WITH QT REPRESENTATIVE PRIOR TO INSTALLATION
TREES		WILLOW OAK *Quercus Phellos*	3" CALIPER 12' HT	16	
TREES		LACEBARK ELM *Ulmus parvifolia*	3" CALIPER 12' HT	4	
TREES		LOBLOLLY PINE *Pinus taeda*	3" CALIPER 8' MINIMUM HT	17	
TREES		'BURKII' RED CEDAR *Juniperus virginiana 'burkii'*	3" CALIPER 8' MINIMUM HT	12	

30 15 0 30 60

URBAN DESIGN PARTNERS
1318-e6 central ave. p 704.334.3303
charlotte, nc 28205 f 704.334.3305
urbandesignpartners.com

PROJECT NO.: 16-069

QuikTrip No. 1082

Cornelius, NC

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PROTOTYPE:	P-88 (08/01/16)
DIVISION:	CAROLINAS
VERSION:	001
DESIGNED BY:	UDP
DRAWN BY:	GAT
REVIEWED BY:	TK

REV	DATE	DESCRIPTION

ORIGINAL ISSUE DATE: 10/25/2016

SHEET TITLE:

LANDSCAPE PLAN

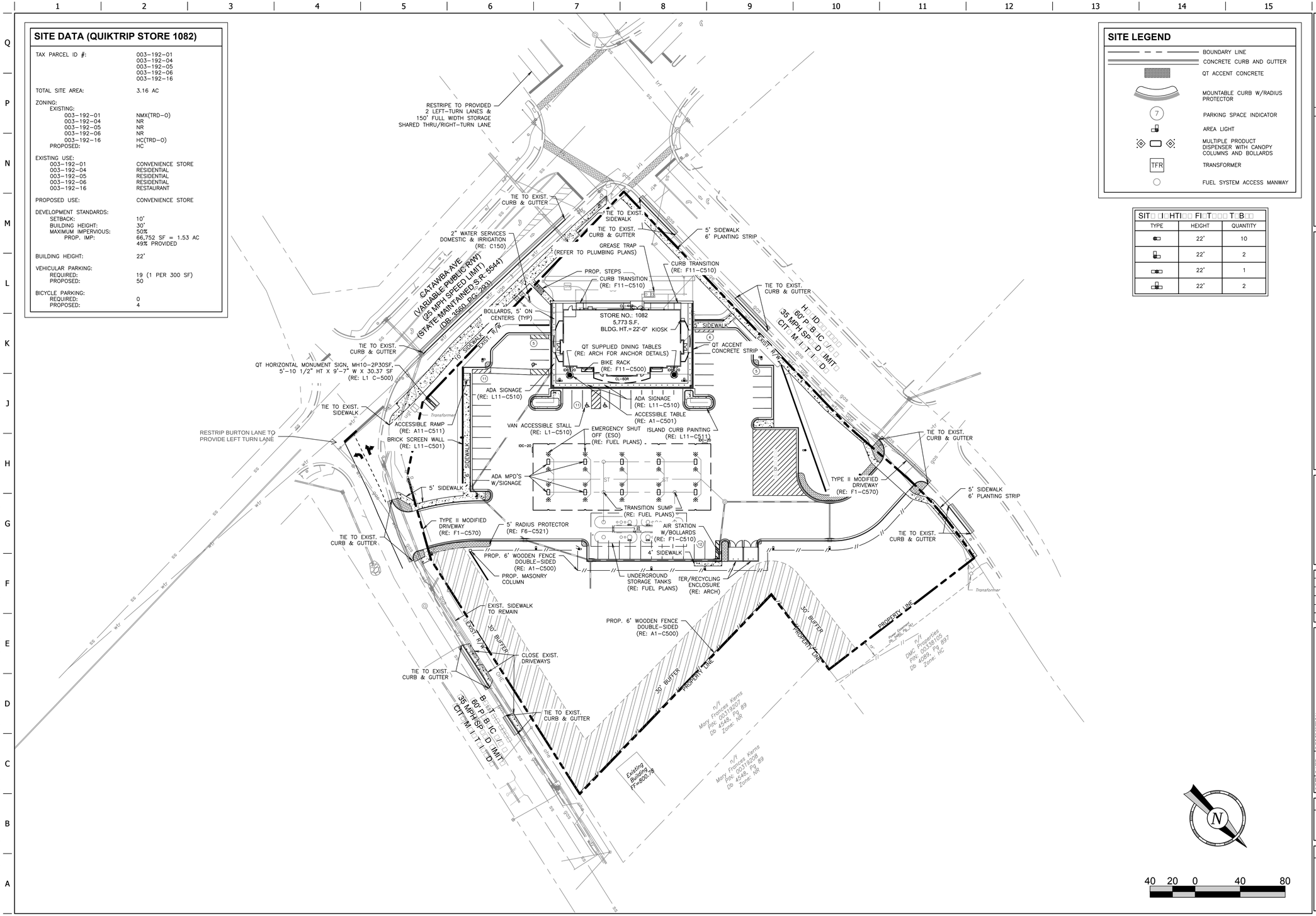
SHEET NUMBER:

L100

FILE LOCATION:J:\QuikTrip\16-069 - 1082\Dwg\81-1082 Civil.dwg TAB NAME:Landscape USER:MaggieWatts SAVED:3/10/2017 9:10 AM PLOTTED:3/10/2017 9:36 AM

SITE DATA (QUIKTRIP STORE 1082)

TAX PARCEL ID #:	003-192-01 003-192-04 003-192-05 003-192-06 003-192-16
TOTAL SITE AREA:	3.16 AC
ZONING:	
EXISTING:	
003-192-01	NMX(TRD-O)
003-192-04	NR
003-192-05	NR
003-192-06	NR
003-192-16	HC(TRD-O)
PROPOSED:	HC
EXISTING USE:	
003-192-01	CONVENIENCE STORE
003-192-04	RESIDENTIAL
003-192-05	RESIDENTIAL
003-192-06	RESIDENTIAL
003-192-16	RESTAURANT
PROPOSED USE:	CONVENIENCE STORE
DEVELOPMENT STANDARDS:	
SETBACK:	10'
BUILDING HEIGHT:	30'
MAXIMUM IMPERVIOUS:	50%
PROP. IMP:	66,752 SF = 1.53 AC 49% PROVIDED
BUILDING HEIGHT:	22'
VEHICULAR PARKING:	
REQUIRED:	19 (1 PER 300 SF)
PROPOSED:	50
BICYCLE PARKING:	
REQUIRED:	0
PROPOSED:	4



SITE LEGEND

- BOUNDARY LINE
- CONCRETE CURB AND GUTTER
- QT ACCENT CONCRETE
- MOUNTABLE CURB W/RADIUS PROTECTOR
- PARKING SPACE INDICATOR
- AREA LIGHT
- MULTIPLE PRODUCT DISPENSER WITH CANOPY COLUMNS AND BOLLARDS
- TFR — TRANSFORMER
- FUEL SYSTEM ACCESS MANWAY

SITE LIGHTING FIXTURE SCHEDULE

TYPE	HEIGHT	QUANTITY
	22'	10
	22'	2
	22'	1
	22'	2

URBAN DESIGN PARTNERS
1318-e6 central ave. p 704.334.3303
charlotte, nc 28205 f 704.334.3305
urbandesignpartners.com

PROJECT NO.:16-069

QuikTrip No. 1082

Cor[illegible], NC

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PROTOTYPE: P-88 [D8|D1|36□
DI□SION: CAROLINAS
□ERSION: 001
DESIGNED BY: UDP
DRAWN BY: GAT
RE□EWED BY: TK

RE□	DATE	DESCRIPTION

ORIGINAL ISSUE DATE: 10|25|2016

SHEET TITLE: SITE PLAN

SHEET NUMBER: C100

40 20 0 40 80

FILE LOCATION:J:\QuikTrip\16-069 - 1082\Dwg\81-1082 Civil.dwg TAB NAME:Site USER:gabeTyson SAVED:2/16/2017 5:52 PM PLOTTED:2/16/2017 6:09 PM

QuikTrip

Store 1082 Cornelius, □C

81-1082-P□10 Date: 02.20.17 B□JK

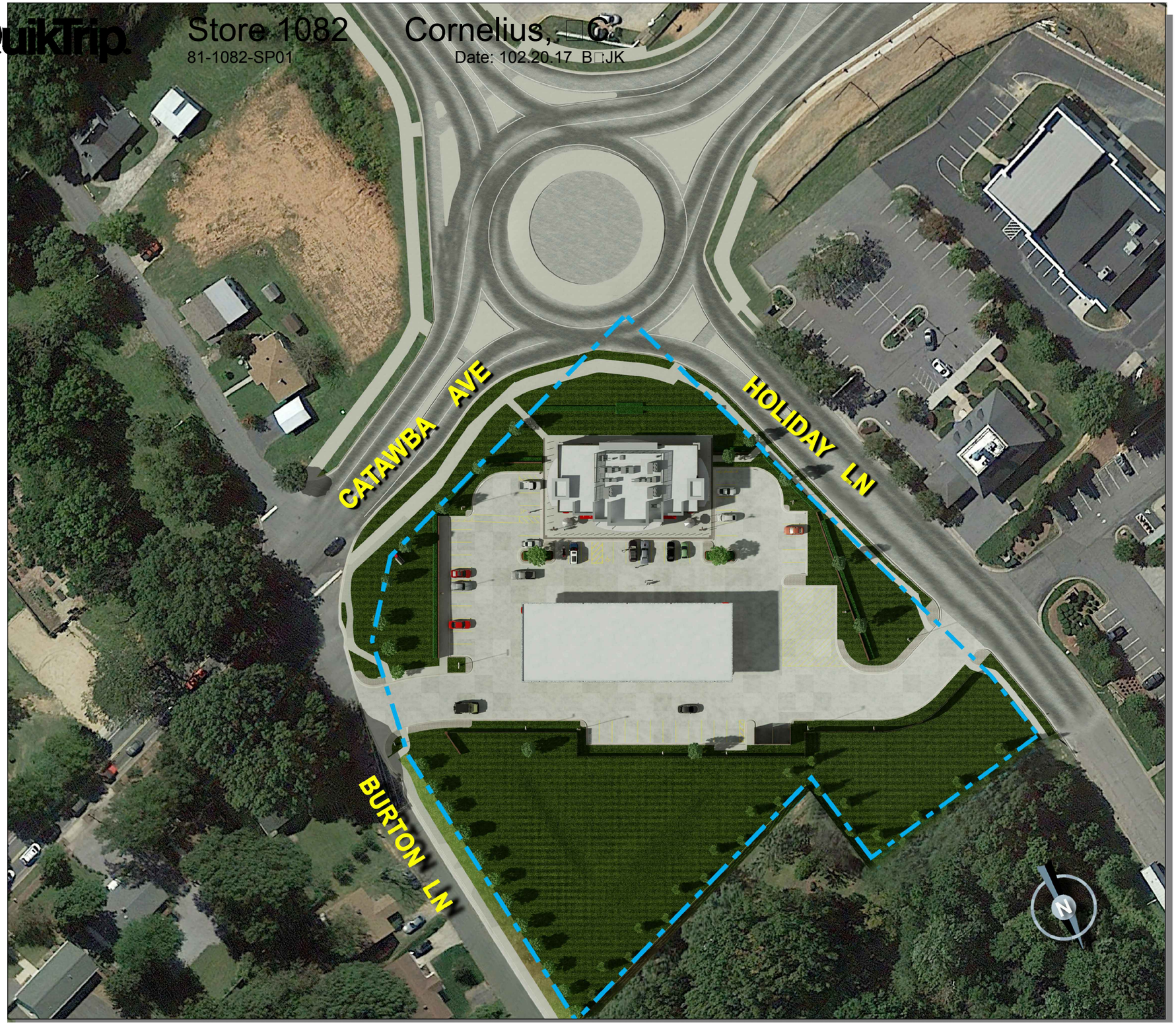


QuikTrip

Store 1082 Cornelius, NC

81-1082-SP01

Date: 10.20.17 BJK



QuikTrip

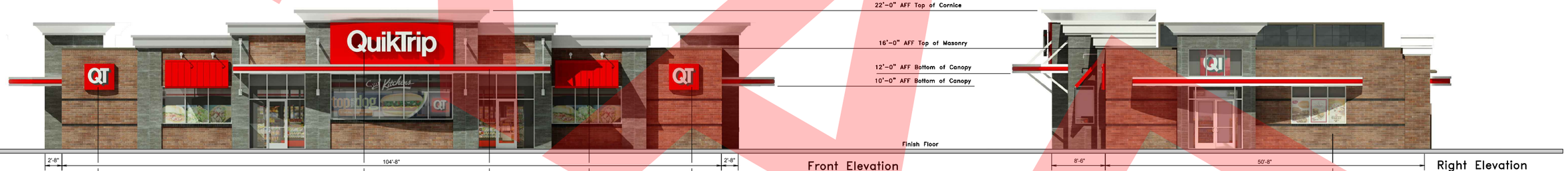
Store 1082 Cornelius, □C

81-1082-P□0□

Date: 12.24.16 B□JK







Front Elevation

Right Elevation



Rear Elevation



Left Elevation

QuikTrip
4705 South 129th East Ave.
Tulsa, OK 74134-7008
P.O. Box 3475
Tulsa, OK 74101-3475
(918) 615-7700

Store #		Address:	City, State:
1082	Flat Entry w/ Faux Rear & Accents	NEC of Catawba & Holiday Ln.	Cornelius, NC

Serial #	Scale:	Issue Date:	Drawn By:	Rev/Notes:
81-1082-BFFE	1/16"=1'-0"	03.09.17	JK	

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#	FINISH	MANUFACTURER	SPECIFICATION
1	BRONZESTONE	INTERSTATE BRICK	ATLAS STRUCTURAL BRICK
2	MIDNIGHT	INTERSTATE BRICK	ATLAS STRUCTURAL BRICK
3	HLZ-ALUMINUM	ALPOLIC	FASCIA
4	QT RED	LANE	STANDING SEAM AWNING
5	RED POLYCARBONATE	ALLEN INDUSTRIES	ILLUMINATED BAND
6	DARK BRONZE	LANE	METAL/PAINT
7	QT BROWN	SHERWIN WILLIAMS	PAINT
8	CL-60R	ALLEN INDUSTRIES	SIGNAGE
9	EVENING VEIL	DALTILE	INVOKE
10	BLACK	ALL COURT FABRICS	POLYPRO 95 MESH
11	IDB-20	ALLEN INDUSTRIES	ILLUMINATED SIGNAGE
12	CUSTOM CL-44R	ALLEN INDUSTRIES	SIGNAGE

RECEIVED
OCT 27 2016

QuikTrip

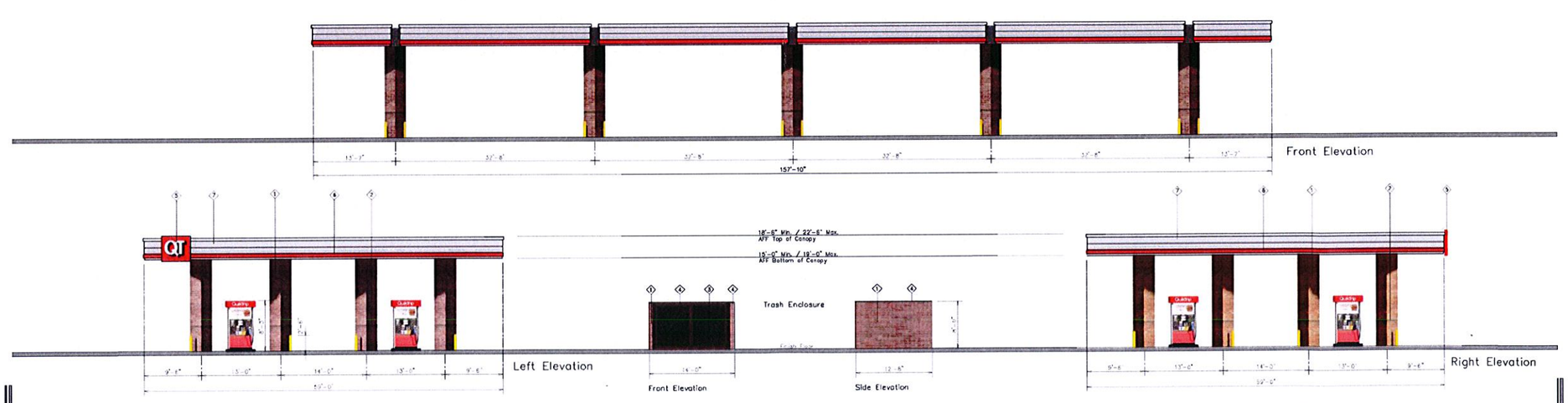
Store 1082
81-1082-PE08

Cornelius, NC
Date: 10.25.16 By:JK



RECEIVED
OCT 27 2016





QT

QuikTrip.

4705 South 129th East Ave.
Tulsa, OK 74134-7008
P.O. Box 3475
Tulsa, OK 74101-3475
(918) 615-7700

Store #	Address:	City, State:
1082 Double Stack 10 Canopy Elevations	12345 S. Main St.	Cornelius, NC

Serial #	Scale:	Issue Date:	Drawn By:	Rev/Notes:
81-1082-GD10	NTS	08/25/16	TR	

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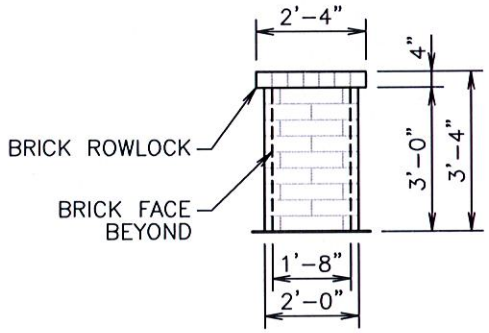
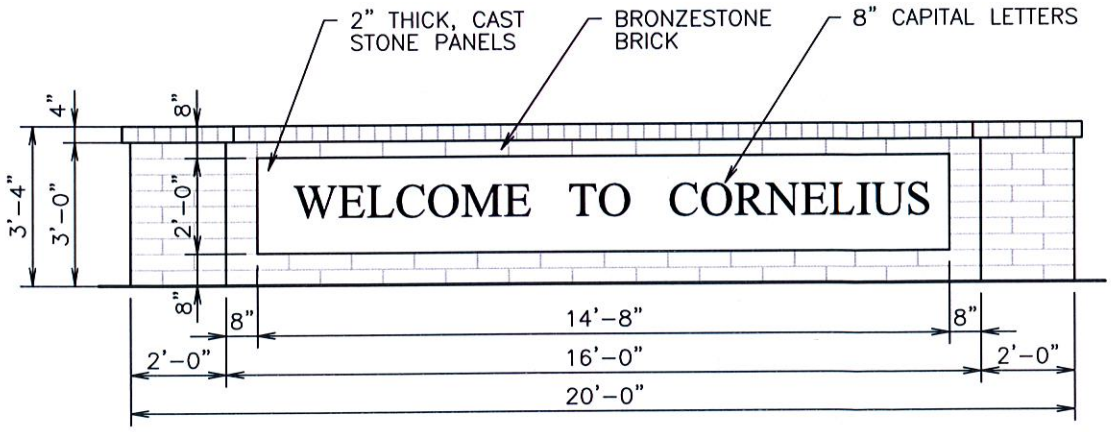
#	FINISH	MANUFACTURER	SPECIFICATION
1	BROWNSTONE	INTERSTATE BRICK	ATLAS STRUCTURAL BRICK
2	MIDNIGHT BLACK	INTERSTATE BRICK	ATLAS STRUCTURAL BRICK
3	BLACK	ALL COURT FABRICS	POLYFAB 95 MESH
4	DARK BRONZE	LANE	METAL/PAINT
5	QC-20	ALLEN INDUSTRIES	ILLUMINATED SIGNAGE
6	RED POLYCARBONATE	ALLEN INDUSTRIES	ILLUMINATED BAND
7	HLZ-ALUMINUM	ALPOLIC	CANOPY



SIGN PERSPECTIVE



SIDE ELEVATION



FRONT ELEVATION

SPECIFICATIONS:

Letters
½" deep channel letters, aluminum construction, painted black. Letters are projected ½" off back panel with lag bolts and stand offs.

Stone Back Panel
2" thick cast stone panel, inset ½" from brick Face.

Structure
Brick Construction using Interstate Bronzestone Brick. Externally Illuminated.

QuikTrip.

Custom City Monument Sign
Brick Encased

NOTES	DRAWN BY	ISSUE D.
Revised text.	JK	

SQUARE FOOTAGE	TYPEFACE	INSIDE CAN	ENTIRE SIGN

SCALE:
1/4" = 1'-0"
SERIAL NUMBER:
81-1082-SIGN-CS
STORE NUMBER:
1082

C:\Vault_QT\81 Carolinas\81-1082\05 Presentation\81-1082-Sign-CS.dwg - L#00 PlotDate: 8/24/2016 10:45 AM - Kim, Joe

QUIKTRIP (QT) TIA
CORNELIUS, MECKLENBURG COUNTY, NC

Traffic Impact Analysis
January 27, 2017

DRAFT

APPLICANT:
David Meyer Jr.
Quik Trip Corporation
3701 Arco Corporate Drive, Suite 150
Charlotte, NC 28273

PREPARED BY:
Matthew Peach, PE, PTOE
A. Morton Thomas and Associates, Inc.
6131 Falls of Neuse Rd, Suite 106
Raleigh, NC 27609
919-855-9989

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AMT Project File 16-0805.001

NC License No: F-1049

DRAFT

EXECUTIVE SUMMARY

The proposed QuikTrip (hereby referred to as QT) Convenience Store and Gas Station is located on the north side of Catawba Avenue between the intersections of Catawba Avenue with US 21 (Statesville Road)/Holiday Lane and Catawba Avenue with Burton Lane/South Hill Street in Cornelius, Mecklenburg County, North Carolina. This intersection is just east of the I-77/US 21 (Catawba Avenue) interchange, which is a diverging diamond interchange (DDI). The site will have two (2) driveways located on Holiday Lane and one (1) driveway located on Burton Lane. Additionally, the intersection of Catawba and Statesville Road / Holiday Lane is an existing State Transportation Improvement Program (STIP or TIP) project #C-5621 and is proposed to be a roundabout completed by 2030. The proposed development is envisioned to be built-out by 2018.

Traffic analysis will consider future build conditions at the build-out year and TIP year. This report summarizes the analyses of 2016 existing conditions, 2018 no-build conditions (without proposed development), 2018 build conditions (with the proposed development in place), and 2018 build-improved conditions (with proposed development and recommended improvements in place) during the AM and PM peak hours. Furthermore, the Town of Cornelius' Land Development Code requires that developments traffic impacts be analyzed five (5) years after the development is completed. As such, this report also contains the analyses of the 2023 no-build conditions, 2023 build conditions and the 2023 build-improved conditions during the AM and PM peak hours. Also, since the roundabout is a current TIP project, analyses will also be completed for the 2030 no-build conditions, 2030 build conditions, and 2030 build-improved conditions during the AM and PM peak hours.

The proposed site will be a 5,773 SF convenience store with 20 fueling positions. Land Use Code 853 from the ITE Trip Generation Manual, 9th edition was used for the trip generation of the site. Even though the NCDOT Congestion Management *Rate vs. Equation* spreadsheet dictates the use of the store square footage to determine the generated trips, through discussion with Congestion Management and the Division 10 Traffic Engineer, the site trips were generated through the amount of fueling positions. Trip generation results in a gross total of 331 trips (166 in, 165 out) generated from the proposed development in the AM peak hour and 381 trips (191 in, 190 out) generated in the PM peak hour. According to NCDOT standards, LUC 853 also allows for the use of pass-by trips for this land use of 63% in the AM peak hour and 66% in the PM peak hour. Therefore, new net trips generated by the proposed development are a total of 122 trips (61 in, 61 out) in the AM peak hour and 130 trips (65 in, 65 out) in the PM peak hour. Trip generation was submitted to the Town and NCDOT for review on October 31st, 2016. The Town approved of the trip generation on November 1st, 2016 and NCDOT approved the trip generation on November 17th, 2016.

Access to the site is proposed to be provided by three (3) full-movement driveways. There are two (2) proposed driveways on Holiday Lane. The first driveway is approximately 275 feet from the intersection with Catawba Avenue. The second is approximately 400 feet from the intersection of Catawba Avenue. There is one (1) proposed driveway on Burton Lane, which is approximately 100 feet from the intersection with Catawba Avenue.

AMT (A. Morton Thomas and Associates, Inc.) was retained to determine the potential traffic impacts of this development in accordance with the Transportation Impact Analysis requirements outlined in Chapter 13 of the Town of Cornelius' Land Development Code and the policies of the North Carolina Department of Transportation (NCDOT) and to recommend the transportation improvements that may be required to accommodate these impacts. This report presents trip generation, distribution, capacity analyses, and recommendations for transportation improvements required to meet anticipated traffic demands. A scoping meeting was held on September 20th, 2016. In attendance were representatives for the Town of Cornelius, NCDOT, AMT, and the applicant (i.e. developer).

As included in the MOU (Memorandum of Understanding), the following four (4) existing intersections are included as part of the area of influence for the development.

- I-77 Northbound On/Off Ramps at Catawba Avenue — *signalized intersection (DDI)*
- I-77 Southbound On/Off Ramps at Catawba Avenue — *signalized intersection (DDI)*
- US 21 (Statesville Road)/Holiday Lane/ Catawba Avenue
    - Existing conditions will study this as a signalized intersection
    - Future conditions (2018 and 2023) will study this as a signalized intersection
    - TIP design year analysis (2030) will study this as a roundabout
- Catawba Avenue at Burton Lane / S. Hill Street — un*signalized intersection*

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Below is a detailed description of the existing study area roadway network. All Average Annual Daily Traffic (AADT) information provided in this description was obtained from NCDOT via the www.ncdot.gov website.

I-77 is an interstate highway that travels north-south through Cornelius. It connects to Charlotte to the south and Mooresville/Statesville to the north. The posted speed on this section of I-77 is 65 miles per hour (mph). NCDOT Functional Classification maps designate I-77 as an interstate route. The AADT on this segment of I-77 north of Catawba Avenue is 92,000 vehicles per day (vpd) within the study area in 2014. The AADT on this segment of I-77 south of Catawba Avenue is 85,000 vpd within the study area in 2014.

Catawba Avenue (signed US 21 from Statesville Road to I-77) is a two-lane undivided roadway facility that travels east-west through Cornelius, providing connectivity between I-77 and NC 115. The land use is a mix of office, residential and commercial land uses. The posted speed through the study area is 35 mph and is lowered to 25 mph east of the study area. According to NCDOT, the AADT on Catawba Avenue in the study area was 9,700 vpd just west of NC 115 in 2014. Catawba Avenue holds three different classifications through the study area. Those classifications are minor arterial on the west side of the I-77 interchange, other principal arterial on the east side of the I-77 interchange, and a local road east of the Statesville Road / Holiday Lane intersection.

US 21 (Statesville Road) is a two-lane undivided roadway facility that travels north-south through Cornelius. It connects to Huntersville and Charlotte to the south from Catawba Avenue. The land use along US 21 is mostly commercial near the project site. The posted speed on this section of US 21 is 35 mph. NCDOT indicates that US 21 in the study area is a minor arterial. The AADT on this segment of US 21 is 9,600 vpd within the study area in 2014.

Holiday Lane is a two-lane undivided roadway facility that travels north-south from Catawba Avenue and terminates at the Bexley at Lake Norman Apartment Complex. The land use along Holiday Lane is primarily commercial and residential. As there is no posted speed limit on Holiday Lane, the speed limit is assumed to be the statutory limit of 35 mph. No AADT data was available.

Burton Lane is a two-lane undivided roadway facility that travels north-south from Catawba Avenue and terminates at the Bexley at Lake Norman Apartment Complex property line but has no access to the complex. The land use along Burton Lane is primarily residential. The posted speed limit on this facility is 25 mph and no AADT data was available.

South Hill Street is a two-lane undivided roadway facility that travels north-south from Catawba Avenue and terminates just south of Weathers Street. The land use along South Hill Street is primarily residential. The posted speed limit on this facility is 25 mph and no AADT data was available.

Data Collection

Traffic counts were performed by Quality Counts on Wednesday, November 30th, 2016. Traditional calendar schools were in session while the data was collected.

All of the existing study intersections analyzed in this report are signalized with the exception of Catawba Avenue at Burton Lane / S. Hill Street. These signals are contained within the Catawba Avenue closed loop system. Timing and coordination for these signals were provided by the NCDOT Division 10 office.

Traffic Volume Development

The site is proposed to be completed by year 2018. Per the MOU and Town of Cornelius TIA Policy, existing traffic volumes were increased by two percent (2%) per year to reflect 2018 background traffic volumes. This growth rate was also used to obtain the 2023 background traffic volumes.

No approved developments were indicated in the area of the proposed QT.

Traffic volumes in 2030 were obtained from traffic simulation models developed as part of the *Cornelius Modified Roundabout Technical Memorandum* (Parsons Brinckerhoff, 2013).

Site Trip Generation and Trip Distribution

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The proposed site will be a 5,773 SF convenience store with 20 fueling positions. Land Use Code 853 from the ITE Trip Generation Manual, 9th edition was used for the trip generation of the site. Even though the NCDOT Congestion Management *Rate vs. Equation* spreadsheet dictates the use of the store square footage to determine the generated trips, through discussion with Congestion Management and the Division 10 Traffic Engineer, the site trips were generated through the amount of fueling positions. Trip generation results in a gross total of 331 trips (166 in, 165 out) generated from the proposed development in the AM peak hour and 381 trips (191 in, 190 out) generated in the PM peak hour.

The proposed development will be replacing the existing gas station and restaurant on the property. To account for this traffic, we collected data at the six (6) existing driveways to the property. This traffic will be kept in the existing and no-build scenarios. The trip generation for the proposed development will be the difference between what is counted at the existing driveways versus what is generated by the site. The counts at the existing intersection resulted in 87 trips (58 in, 29 out) in the AM peak hour and 92 trips (47 in, 45 out). The net trips for the site after this reduction is 244 trips (108 in, 136 out) in the AM peak hour and 289 trips (144 in, 145 out) in the PM peak hour.

According to NCDOT standards, LUC 853 also allows for the use of pass-by trips for this land use of 63% in the AM peak hour and 66% in the PM peak hour. Therefore, new net trips generated by the proposed development are a total of 90 trips (31 in, 59 out) in the AM peak hour and 136 trips (67 in, 69 out) in the PM peak hour. When developing the analyses for the three (3) driveways, the site traffic data collected at the six (6) existing driveways was added back into the analyses since they are a part of the total trips in and out of the proposed driveways. This is captured in the driveway volume adjustment figures.

Table ES-1: Trip Generation

LAND USE CODE	LAND USE DESCRIPTION	VARIABLE	DAILY TRIPS (vpd)	AM PEAK HOUR TRIPS (vph)			PM PEAK HOUR TRIPS (vph)		
				TOTAL	IN	OUT	TOTAL	IN	OUT
853	Convenience Market with Gasoline Pumps	20 Fueling Positions	10,850	331	166	165	381	191	190
Existing Site Traffic Reduction			-1,382	*-87*	*-58*	*-29*	*-92*	*-47*	*-45*
Net External Trips			**9,468**	**244**	**108**	**136**	**289**	**144**	**145**
Pass-By Trip Reduction (63% AM / 66% PM)				-154	-77	-77	-153	-77	-76
Net New External Trips				**90**	**31**	**59**	**136**	**67**	**69**

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It should be noted that daily trips were not calculated beyond the net external trips as pass-by percentages are not provided for off-peak hours. Trip generation was submitted to the Town and NCDOT for review on October 31st, 2016. The Town approved of the trip generation on November 1st, 2016 and NCDOT approved the trip generation on November 17th, 2016.

The site generated trips to and from the proposed site were distributed in accordance with the apparent traffic patterns by the users of the proposed facility and the existing traffic patterns and land uses in the vicinity as follows:

- 25% to/from the North on I-77
- 25% to/from the South on I-77
- 20% to/from the East on Catawba Avenue
- 20% to/from the West on Catawba Avenue
- 10% to/from the South on Statesville Road

The overall trip distribution was submitted to the Town and NCDOT for review in the memorandum of understanding. The Town approved of the trip distribution on November 1st, 2016 and NCDOT approved the trip distribution on November 17th, 2016.

Site Access

Access to the site is proposed to be provided by three (3) full-movement driveways. There are two (2) proposed driveways on Holiday Lane. The first driveway is approximately 275 feet from the intersection with Catawba Avenue. The second is approximately 400 feet from the intersection of Catawba Avenue. There is one (1) proposed driveway on Burton Lane, which is approximately 100 feet from the intersection with Catawba Avenue.

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Analysis Results – 2018 Horizon Year

The following tables summarize the results of the various analyses in the existing (2016) and build-year (2018) horizon years.

Table ES-2: 2018 Analysis Summary

Intersection / Approach Measure of Effectiveness	2016 Existing		2018 No-Build		2018 Build		2018 Build Improved	
	AM	PM	AM	PM	AM	PM	AM	PM
INTERSECTION 1 – I-77 Southbound On/Off Ramps at Catawba Avenue (SIGNALIZED)								
Overall LOS (sec. delay/veh.)	C (27.0)	D (36.3)	C (27.7)	D (41.4)	C (28.1)	D (43.1)		
EB App. LOS (sec. delay/veh.)	B (17.3)	C (24.2)	B (18.7)	C (25.1)	B (19.1)	C (25.3)		
WB App. LOS (sec. delay/veh.)	D (43.2)	D (50.7)	D (42.9)	**E (60.8)**	D (43.2)	**E (64.2)**		
INTERSECTION 2 – I-77 Northbound On/Off Ramps at Catawba Avenue (SIGNALIZED)								
Overall LOS (sec. delay/veh.)	C (20.1)	C (28.5)	C (20.5)	C (28.9)	C (20.3)	C (29.8)		
EB App. LOS (sec. delay/veh.)	C (22.1)	C (29.8)	C (21.7)	C (29.7)	C (21.6)	C (30.8)		
WB App. LOS (sec. delay/veh.)	B (16.2)	C (26.5)	B (18.0)	C (27.9)	B (17.7)	C (28.5)		
INTERSECTION 3 –Catawba Avenue at Statesville Road / Holiday Lane (SIGNALIZED)								
Overall LOS (sec. delay/veh.)	D (49.6)	D (49.2)	D (52.9)	D (51.3)	E (59.0)	E (58.3)	C (34.9)	D (39.3)
EB App. LOS (sec. delay/veh.)	E (59.6)	E (58.6)	E (65.4)	E (61.6)	E (73.5)	E (62.7)	B (13.9)	C (20.7)
WB App. LOS (sec. delay/veh.)	C (28.8)	C (33.8)	C (30.3)	D (36.1)	D (37.4)	E (57.3)	D (42.6)	D (47.7)
NB App. LOS (sec. delay/veh.)	D (49.6)	D (46.6)	D (50.5)	D (47.3)	D (50.4)	D (47.5)	E (57.0)	E (57.7)
SB App. LOS (sec. delay/veh.)	E (60.4)	E (62.7)	E (61.2)	E (63.4)	E (69.2)	E (70.7)	E (74.7)	E (72.8)
INTERSECTION 4 –Catawba Avenue at Burton Lane / S. Hill Street (UNSIGNALIZED)								
EB Left LOS (sec. delay/veh.)	A (8.9)	A (9.3)	A (9.0)	A (9.4)	A (9.1)	A (9.5)	A (9.1)	A (9.5)
WB Left LOS (sec. delay/veh.)	A (9.3)	A (9.4)	A (9.5)	A (9.5)	A (9.5)	A (9.5)	A (9.5)	A (9.5)
NB App. LOS (sec. delay/veh.)	D (29.5)	E (49.9)	D (31.8)	**F (57.0)**	D (34.9)	**F (73.4)**	D (34.9)	**F (73.4)**
SB App. LOS (sec. delay/veh.)	D (29.4)	D (33.9)	D (32.0)	E (37.0)	D (26.7)	E (37.2)	C (22.6)	D (28.6)
INTERSECTION 5 – Holiday Lane at Site Access #1 (UNSIGNALIZED)								
WB App. LOS (sec. delay/veh.)					A (9.2)	A (9.5)		
SB Left LOS (sec. delay/veh.)					A (7.3)	A (7.5)		
INTERSECTION 6 – Holiday Lane at Site Access #2 (UNSIGNALIZED)								
WB App. LOS (sec. delay/veh.)					B (10.2)	B (10.9)		
SB Left LOS (sec. delay/veh.)					A (7.5)	A (7.7)		
INTERSECTION 7 – Burton Lane at Site Access #3 (UNSIGNALIZED)								
EB App. LOS (sec. delay/veh.)					A (8.7)	A (8.7)		
NB Left LOS (sec. delay/veh.)					A (7.3)	A (7.3)		

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The results of this analysis indicate that with the recommended improvements in place, all study area intersections and approaches operate below their mitigation threshold with two exceptions. The first being the northbound approach of S. Hill Street at Catawba Avenue. This is a single-lane approach under stop-control that the development is not contributing traffic to. As such, the increases in delay can be attributed to increases in traffic volume along Catawba Avenue. Additionally, the westbound approach of Catawba Avenue at the I-77 southbound on / off ramps operates at LOS E in the PM peak hour. This is not shown in the above table as no recommendations are provided for this intersection. The justification is twofold. First, the proposed development attributes less than two percent (2%) to the traffic volumes on the approach. Secondly, this approach is to the DDI crossover and the cost to construct an improvement at this location would not be commensurate with the impact the development is responsible for on the approach.

Analysis Results – 2023 Horizon Year

According to the Town of Cornelius' Land Development Code, developments must be analyzed five (5) years after the development is completed. As the QT development is currently envisioned to be completed in 2018, capacity analyses must also be included for the traffic conditions and analysis projected for 2023. The following table summarizes the results of the various analyses in the five years beyond the build-year (2023) horizon years.

Table ES-3: 2023 Analysis Summary

Intersection / Approach Measure of Effectiveness	2023 No-Build		2023 Build		2023 Build Improved	
	AM	PM	AM	PM	AM	PM
INTERSECTION 1 – I-77 Southbound On/Off Ramps at Catawba Avenue (SIGNALIZED)						
Overall LOS (sec. delay/veh.)	C (29.8)	D (50.4)	C (30.2)	D (51.0)		
EB App. LOS (sec. delay/veh.)	C (22.2)	C (27.3)	C (22.5)	C (27.5)		
WB App. LOS (sec. delay/veh.)	D (42.7)	**E (77.9)**	D (43.0)	**E (79.0)**		
INTERSECTION 2 – I-77 Northbound On/Off Ramps at Catawba Avenue (SIGNALIZED)						
Overall LOS (sec. delay/veh.)	C (21.3)	C (32.7)	C (21.1)	D (35.3)		
EB App. LOS (sec. delay/veh.)	C (21.2)	C (34.5)	C (21.2)	D (38.0)		
WB App. LOS (sec. delay/veh.)	C (21.4)	C (30.2)	C (20.8)	C (31.6)		
INTERSECTION 3 –Catawba Avenue at Statesville Road / Holiday Lane (SIGNALIZED)						
Overall LOS (sec. delay/veh.)	E (61.9)	E (58.8)	E (65.5)	E (68.7)	D (40.1)	D (46.4)
EB App. LOS (sec. delay/veh.)	**F (80.5)**	E (66.5)	**F (81.0)**	E (65.3)	B (17.1)	C (23.9)
WB App. LOS (sec. delay/veh.)	D (36.5)	D (54.1)	D (47.7)	**F (90.3)**	D (48.5)	E (66.6)
NB App. LOS (sec. delay/veh.)	D (52.1)	D (48.1)	D (52.1)	D (48.6)	E (66.0)	E (60.5)
SB App. LOS (sec. delay/veh.)	E (62.6)	E (65.6)	E (72.4)	E (75.3)	E (78.0)	E (74.4)
INTERSECTION 4 – Catawba Avenue at Burton Lane / S. Hill Street (UNSIGNALIZED)						
EB Left LOS (sec. delay/veh.)	A (9.3)	A (9.7)	A (9.4)	A (9.9)	A (9.4)	A (9.9)
WB Left LOS (sec. delay/veh.)	A (9.8)	A (9.9)	A (9.8)	A (9.9)	A (9.8)	A (9.9)
NB App. LOS (sec. delay/veh.)	E (41.3)	**F (85.1)**	E (46.7)	**F (117.9)**	E (46.7)	**F (117.9)**
SB App. LOS (sec. delay/veh.)	E (38.5)	E (45.6)	D (33.8)	**F (53.1)**	D (27.0)	E (36.3)
INTERSECTION 5 – Holiday Lane at Site Access #1 (UNSIGNALIZED)						
WB App. LOS (sec. delay/veh.)			A (9.3)	A (9.7)		
SB Left LOS (sec. delay/veh.)			A (7.3)	A (7.5)		
INTERSECTION 6 – Holiday Lane at Site Access #2 (UNSIGNALIZED)						
WB App. LOS (sec. delay/veh.)			B (10.4)	B (11.2)		
SB Left LOS (sec. delay/veh.)			A (7.5)	A (7.8)		
INTERSECTION 7 – Burton Lane at Site Access #3 (UNSIGNALIZED)						
EB App. LOS (sec. delay/veh.)			A (8.7)	A (8.7)		
NB Left LOS (sec. delay/veh.)			A (7.3)	A (7.3)		

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The results of this analysis indicate that with the recommended improvements in place, all study area intersections and approaches operate below their mitigation threshold with two exceptions. The first being the northbound approach of S. Hill Street at Catawba Avenue. This is a single-lane approach under stop-control that the development is not contributing traffic to. As such, the increases in delay can be attributed to increases in traffic volume along Catawba Avenue. Additionally, the westbound approach of Catawba Avenue at the I-77 southbound on / off ramps operates at LOS E in the PM peak hour. This is not shown in the above table as no recommendations are provided for this intersection. The justification is twofold. First, the proposed development attributes less than two percent (2%) to the traffic volumes on the approach. Secondly, this approach is to the DDI crossover and the cost to construct an improvement at this location would not be commensurate with the impact the development is responsible for on the approach.

Analysis Results – 2030 Horizon Year

There is a current TIP project (#C-5621) to improve the intersection of Catawba Avenue and US 21 (Statesville Road)/Holiday Lane to a roundabout. Since this is a current TIP project and is projected to be completed by 2030, analyses will also be completed for the 2030 no-build conditions, 2030 build conditions, and 2030 build-improved conditions during the AM and PM peak hours. The following table summarizes the results of the various analyses in the TIP #C-5621 projected completion year of 2030.

Table ES-4: 2030 Analysis Summary

Intersection / Approach Measure of Effectiveness	2030 No-Build		2030 Build		2030 Build Improved	
	AM	PM	AM	PM	AM	PM
INTERSECTION 1 – I-77 Southbound On/Off Ramps at Catawba Avenue (SIGNALIZED)						
OVERALL	**E (62.22)**	**E (58.98)**	**E (64.79)**	**E (68.48)**		
Eastbound Thru	**F (119.24)**	**F (106.56)**	**F (125.90)**	**F (136.10)**		
Eastbound Right-Turn	**F (132.46)**	**F (117.80)**	**F (140.14)**	**F (152.78)**		
Westbound Left-Turn	B (15.84)	C (20.18)	B (17.00)	B (13.14)		
Westbound Thru	C (20.11)	C (25.71)	C (21.21)	B (18.09)		
Southbound Left-Turn	B (11.75)	B (12.70)	B (11.79)	B (11.95)		
Southbound Right-Turn	B (14.42)	B (11.50)	B (14.86)	B (13.07)		
INTERSECTION 2 – I-77 Northbound On/Off Ramps at Catawba Avenue (SIGNALIZED)						
OVERALL	B (13.80)	B (16.84)	B (14.41)	B (15.82)		
Eastbound Left-Turn	A (2.00)	A (2.86)	A (1.98)	A (2.79)		
Eastbound Thru	B (18.39)	C (22.44)	B (18.66)	B (18.93)		
Westbound Thru	B (18.49)	C (20.30)	C (20.22)	C (21.18)		
Westbound Right-Turn	A (7.37)	C (20.77)	A (7.76)	C (20.06)		
Northbound Left-Turn	A (9.57)	B (12.37)	A (9.44)	B (10.61)		
Northbound Right-Turn	B (15.00)	B (13.39)	B (16.00)	B (15.25)		
INTERSECTION 3 – Catawba Avenue at Statesville Road / Holiday Lane (ROUNDABOUT)						
OVERALL	A (6.32)	B (12.87)	A (8.42)	C (17.16)	A (7.86)	C (17.99)
Eastbound Left-Turn	A (4.47)	A (5.86)	A (5.40)	A (6.66)	A (5.26)	A (6.72)
Eastbound Thru	A (3.70)	A (4.11)	A (4.13)	A (4.47)	A (4.18)	A (4.41)
Eastbound Right-Turn	A (6.20)	A (4.10)	A (6.17)	A (3.87)	A (6.06)	A (3.89)
Westbound Left-Turn	B (10.62)	C (22.67)	B (12.16)	D (28.00)	B (12.05)	D (28.04)
Westbound Thru	A (6.24)	B (13.79)	A (7.37)	C (16.51)	A (7.21)	C (16.63)
Westbound Right-Turn	A (3.37)	A (7.84)	A (3.63)	A (9.18)	A (3.99)	A (8.87)
Northbound Left-Turn	A (7.45)	C (15.26)	A (8.76)	C (19.74)	A (8.75)	C (19.82)
Northbound Thru	A (6.25)	B (14.28)	A (6.55)	C (19.94)	A (7.08)	C (18.88)
Northbound Right-Turn	A (3.42)	A (7.05)	A (3.60)	A (7.55)	A (3.45)	A (8.04)
Southbound Left-Turn	C (21.50)	**F (107.30)**	E (41.96)	**F (133.96)**	E (47.64)	**F (285.13)**
Southbound Thru	C (21.04)	**F (94.94)**	E (45.66)	**F (132.14)**	**F (54.56)**	**F (306.85)**
Southbound Right-Turn	B (10.83)	**F (85.80)**	D (29.24)	**F (113.22)**	A (9.5)	D (27.64)

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Table ES-4: 2030 Analysis Summary (continued)

Intersection / Approach Measure of Effectiveness	2030 No-Build		2030 Build		2030 Build Improved	
	AM	PM	AM	PM	AM	PM
INTERSECTION 4 – Catawba Avenue at Burton Lane / S. Hill Street (UNSIGNALIZED)						
Eastbound Left-Turn	-	B (13.57)	B (10.47)	C (15.20)	A (8.38)	B (14.48)
Westbound Left-Turn	A (5.35)	D (25.60)	B (12.02)	E (49.31)	A (4.9)	**F (87.82)**
Northbound Left-Turn	C (15.96)	**F (57.82)**	C (18.60)	**F (64.3)**	C (18.24)	**F (77.11)**
Northbound Right-Turn	A (8.92)	B (13.20)	B (10.65)	B (12.72)	A (8.94)	C (19.7)
Southbound Left-Turn	-	B (11.76)	B (14.00)	C (21.01)	B (13.11)	C (22.83)
Southbound Right-Turn	A (6.56)	B (13.42)	A (9.99)	C (16.93)	B (10.92)	D (28.91)
INTERSECTION 5 – Holiday Lane at Site Access #1 (UNSIGNALIZED)						
Westbound Approach			C (16.73)	D (25.98)		
Southbound Left-Turn			-	-		
INTERSECTION 6 – Holiday Lane at Site Access #2 (UNSIGNALIZED)						
Westbound Approach			C (24.47)	**F (349.09)**		
Southbound Left-Turn			-	-		
INTERSECTION 7 – Burton Lane at Site Access #3 (UNSIGNALIZED)						
Eastbound Approach			A (6.73)	A (6.99)		
Northbound Left-Turn			A (0.34)	A (0.24)		

The results of the simulation indicate the following intersections and approaches are operating below their mitigation threshold:

- Overall intersection of I-77 southbound on / off ramps at Catawba Avenue in the AM and PM peak hours;
- Eastbound approach of the I-77 southbound on / off ramps at Catawba Avenue intersection in the AM and PM peak hours;
- Southbound left-turn movements at the Catawba Avenue at Statesville Road / Holiday Lane intersection on the PM peak hour;
- Southbound thru movements at the Catawba Avenue at Statesville Road / Holiday Lane intersection in the AM and PM peak hours;
- Northbound left-turn movement at the Catawba Avenue at Burton Lane / S. Hill Street intersection in the PM peak hour; and
- Westbound approach of Site Access #2 at Holiday Lane in the PM peak hour.

The last point can be attributed to queues originating at the intersection of Holiday Lane at Catawba Avenue and extending beyond Site Access #2. The remaining deficiencies are seen in the no-build traffic simulations.

No improvements are recommended at the intersection of Catawba Avenue at I-77 southbound on / off ramps. The justification is twofold. First, the proposed development attributes less than one percent (1%) to the traffic volumes on the approach. Secondly, this approach is to the DDI crossover and the cost to construct an improvement at this location would not be commensurate with the impact the development is responsible for on the approach.

Installation of a southbound right-turn lane at the intersection of Catawba Avenue at Statesville Road / Holiday Lane has a negligible reduction in delays on the southbound left-turn and thru movements. This can be attributed to a scarcity of acceptable gaps in the roundabout. The installation of a right-turn lane does however greatly reduce delays for these movements; which are the dominant movements on the approach.

Lastly, delays shown for the westbound left-turn and the northbound left-turn at the intersection of Catawba Avenue at Burton Lane / S. Hill Street can be attributed to queues originating on the westbound approach to the roundabout extending past Burton Lane and S. Hill Street.

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Comprehensive Conclusions

The proposed QT development is located along Catawba Avenue in Cornelius, Mecklenburg County, North Carolina. The proposed development is envisioned to be built-out by 2018.

The proposed site will be a 5,773 SF convenience store with 20 fueling positions. As the development will be replacing an existing gas station and restaurant, the net new external trips generated by the redevelopment of the site are calculated to be 122 trips (61 in, 61 out) in the AM peak hour and 130 trips (65 in, 65 out) in the PM peak hour.

Access to the site is proposed to be provided by three (3) full-movement driveways. There are two (2) proposed driveways on Holiday Lane. The first driveway is approximately 275 feet from the intersection with Catawba Avenue. The second is approximately 400 feet from the intersection of Catawba Avenue. There is one (1) proposed driveway on Burton Lane, which is approximately 100 feet from the intersection with Catawba Avenue.

The results of the multiple analyses presented here in indicate that the proposed development contributes minimal delay to the study area intersections as a whole. Operational impacts related to the redevelopment of the site are most apparent within close proximity to the proposed development on Holiday Lane and Burton Lane approaches to Catawba Avenue. At the I-77 interchange, traffic volumes generated by the proposed development account for less two percent (2%) of traffic on any given approach during either the AM or PM peak hour. As such, the recommended improvements are isolated to the intersections within close proximity to the site.

Holiday Lane is currently wide enough to provide two (2) southbound lanes as well as one (1) northbound lane extending from Catawba Avenue to Site Access #2. It is recommended to restripe this area to better delineate the storage at the intersection with Catawba Avenue. This paired with restriping the northbound approach of Statesville Road and modifying the traffic signal to remove the current split-phasing will increase the efficiency of the intersection under the 2018 and 2023 build traffic volumes to mitigate the impact of the proposed development at this intersection.

The future roundabout at the intersection of Catawba Avenue and Statesville Road / Holiday Lane will be located east of the current intersection. This relocation may cause queues to extend into and possibly beyond the Catawba Avenue at Burton Lane / S. Hill Street; causing delays on the minor street approaches. Furthermore, it is recommended that the site plan of the proposed development accommodate this future relocation and widening of the intersection.

Heavy northbound left-turn and westbound thru traffic volumes at the Catawba Avenue roundabout cause a scarcity of acceptable gaps in the traffic stream for vehicles on the southbound Holiday Lane approach. This results in long delays as well as long queues on the southbound Holiday Lane approach. It is recommended to design and construct the roundabout with two southbound approach lanes on Holiday Lane. This will aid in managing the queues that will develop on the approach as well as reduce delays for the southbound right-turning traffic; the majority of the traffic on the approach.

The queues discussed above were noted to extend near Site Access #2 in the 2023 horizon year analysis and beyond Site Access #2 in the 2030 horizon year analysis. Additionally, the potential exists for left-turn conflicts to occur between southbound left-turns into Site Access #2 and northbound left-turns in the Days Inn access which is located between Site Accesses #1 and 2. Possible mitigation measures for these two conditions are as follows:

- Consolidate Site Accesses #1 and 2 into one access point directly across from the Days Inn access; and
- Modify Site Access #2 to allow right-in traffic only.

The specific recommendations at each study intersection are discussed in the Comprehensive Recommendations section.

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Comprehensive Recommendations

Based on the findings of this study, specific improvements have been identified and should be completed as part of the proposed development. The NCDOT *Policy on Street and Driveway Access to North Carolina Highways* manual was consulted to determine the appropriate storage for the recommended auxiliary lanes if warranted. It should be noted that the northbound right-turn volume on Holiday Lane at Site Access #2 warrants a northbound right-turn lane according to the nomograph. However, a turn-lane is not recommended at this time due to a low volume of northbound thru traffic at the intersection. Similarly, the northbound left-turn volume on Burton Lane into Site Access #3 may warrant a storage lane. However, this is not recommended due to a low volume of conflicting vehicles.

I-77 Southbound On/Off Ramps at Catawba Avenue

There are no recommended improvements at this intersection.

I-77 Northbound On/Off Ramps at Catawba Avenue

There are no recommended improvements at this intersection.

Catawba Avenue at US 21 (Statesville Road) / Holiday Lane

Existing Signalized Intersection

- Restripe the northbound approach to provide dual northbound left-turn lanes and a shared thru/right-turn lane with 150 feet of full-width storage and appropriate taper on Statesville Road.
- Restripe the southbound approach to provide a 200 feet of full width storage and appropriate taper on Holiday Lane.
- The above recommendations will require the redesign and retiming of the traffic signal at the intersection.

Future Roundabout

- Design the planned roundabout with a southbound exclusive right-turn lane with 200 feet of full-width storage and appropriate taper.

Catawba Avenue at Burton Lane / S. Hill Street

- Construct a left-turn lane with full-width storage that extends from the intersection of Catawba Avenue to Site Access #3 and appropriate taper on southbound Burton Lane.

Holiday Lane at Site Access #1

Access as Shown on Site Plan

- Construct Site Access #1 as a full-movement access point.
- Construct Site Access #1 with one ingress and one egress lane.

Consolidation of Site Accesses 1 and 2

- Construct Site Access #1 as a full-movement access point.
- Construct Site Access #1 with one ingress and one egress lane.
- Locate Site Access #1 approximately 325 feet north of the intersection with Catawba Avenue. This will align Site Access #1 with the existing access to the Days Inn hotel.

Access Alternative 3

- Construct Site Access #1 as a full-movement access point.
- Construct Site Access #1 with one ingress and one egress lane.
- The specific location of Site Access #1 under this access alternative does not need to be specified as it avoids conflicting left-turns on Holiday Lane.

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Holiday Lane at Site Access #2

Access as Shown on Site Plan

- Construct Site Access #2 as a full-movement access point.
- Construct Site Access #2 with one ingress and one egress lane.

Consolidation of Site Accesses 1 and 2

- Site Access #2 would be eliminated.

Access Alternative 3

- Construct Site Access #2 as a right-in only Access point with one ingress lane. No egress traffic or left-turns into the site would be permitted at this access point.

Burton Lane at Site Access #3

- Construct Site Access #3 as a full-movement access point.
- Construct Site Access #3 with one ingress and one egress lane.

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INTRODUCTION

The proposed QuikTrip (hereby referred to as QT) Convenience Store and Gas Station is located on the north side of Catawba Avenue between the intersections of Catawba Avenue with US 21 (Statesville Road)/Holiday Lane and Catawba Avenue with Burton Lane/South Hill Street in Cornelius, Mecklenburg County, North Carolina. This intersection is just east of the I-77/US 21 (Catawba Avenue) interchange, which is a diverging diamond interchange (DDI). The site will have two (2) driveways located on Holiday Lane and one (1) driveway located on Burton Lane. A project in the State Transportation Improvement Program (STIP or TIP) is planned for the intersection of Catawba Avenue at US 21 (Statesville Road) / Holiday Lane. The project number is C-5621 and seeks to convert the existing signalized intersection to a dual-lane roundabout. The design year of this project is 2030.

The proposed development is envisioned to be built-out by 2018. Traffic analysis will consider future build conditions at the build-out year, five (5) years beyond the build-out year and the TIP year. This report summarizes the analyses of 2016 existing conditions, 2018 no-build conditions (without proposed development), 2018 build conditions (with the proposed development in place), and 2018 build-improved conditions (with proposed development and recommended improvements in place) during the AM and PM peak hours. Furthermore, the Town of Cornelius' Land Development Code requires that developments traffic impacts be analyzed five (5) years after the development is completed. As such, this report also contains the analyses of the 2023 no-build conditions, 2023 build conditions and the 2023 build-improved conditions during the AM and PM peak hours. Also, since the roundabout is a current TIP project, analyses will also be completed for the 2030 no-build conditions, 2030 build conditions, and 2030 build-improved conditions during the AM and PM peak hours.

A scoping meeting was held on September 20th, 2016. In attendance were representatives for the Town of Cornelius, NCDOT, AMT, and the applicant (i.e. developer). Please refer to **Appendix A** for a copy of the Memorandum of Understanding signed by all parties in attendance.

STUDY AREA DESCRIPTION

As included in the MOU (Memorandum of Understanding), the following four (4) existing intersections are included as part of the area of influence for the development (**Figure 1**).

- I-77 Northbound On/Off Ramps at Catawba Avenue — *signalized intersection (DDI)*
- I-77 Southbound On/Off Ramps at Catawba Avenue — *signalized intersection (DDI)*
- US 21 (Statesville Road)/Holiday Lane/ Catawba Avenue
    - Existing conditions will study this as a signalized intersection
    - Future conditions (2018 and 2023) will study this as a signalized intersection
    - TIP design year analysis (2030) will study this as a roundabout
- Catawba Avenue at Burton Lane / S. Hill Street — un*signalized intersection*

The proposed site plan is shown in **Figure 2**. Access to the site is proposed to be provided by three (3) full-movement driveways. There are two (2) proposed driveways on Holiday Lane. The first driveway is approximately 275 feet from the intersection with Catawba Avenue. The second is approximately 400 feet from the intersection of Catawba Avenue. There is one (1) proposed driveway on Burton Lane, which is approximately 100 feet from the intersection with Catawba Avenue. The site plan in **Figure 2** is for illustrative purposes only for this traffic study.

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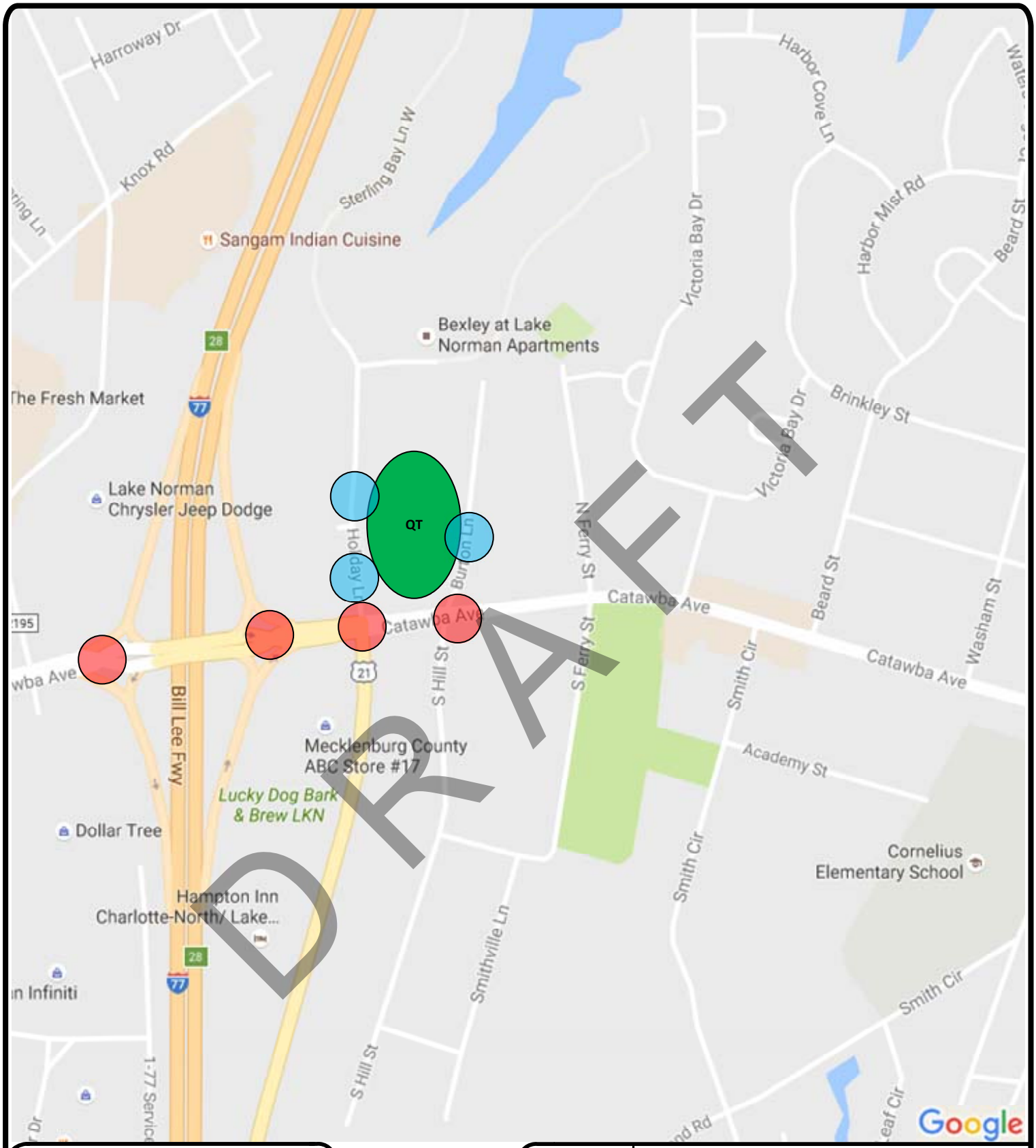


LEGEND

- = External Intersections
- QT
- = Site Access

AMT

N

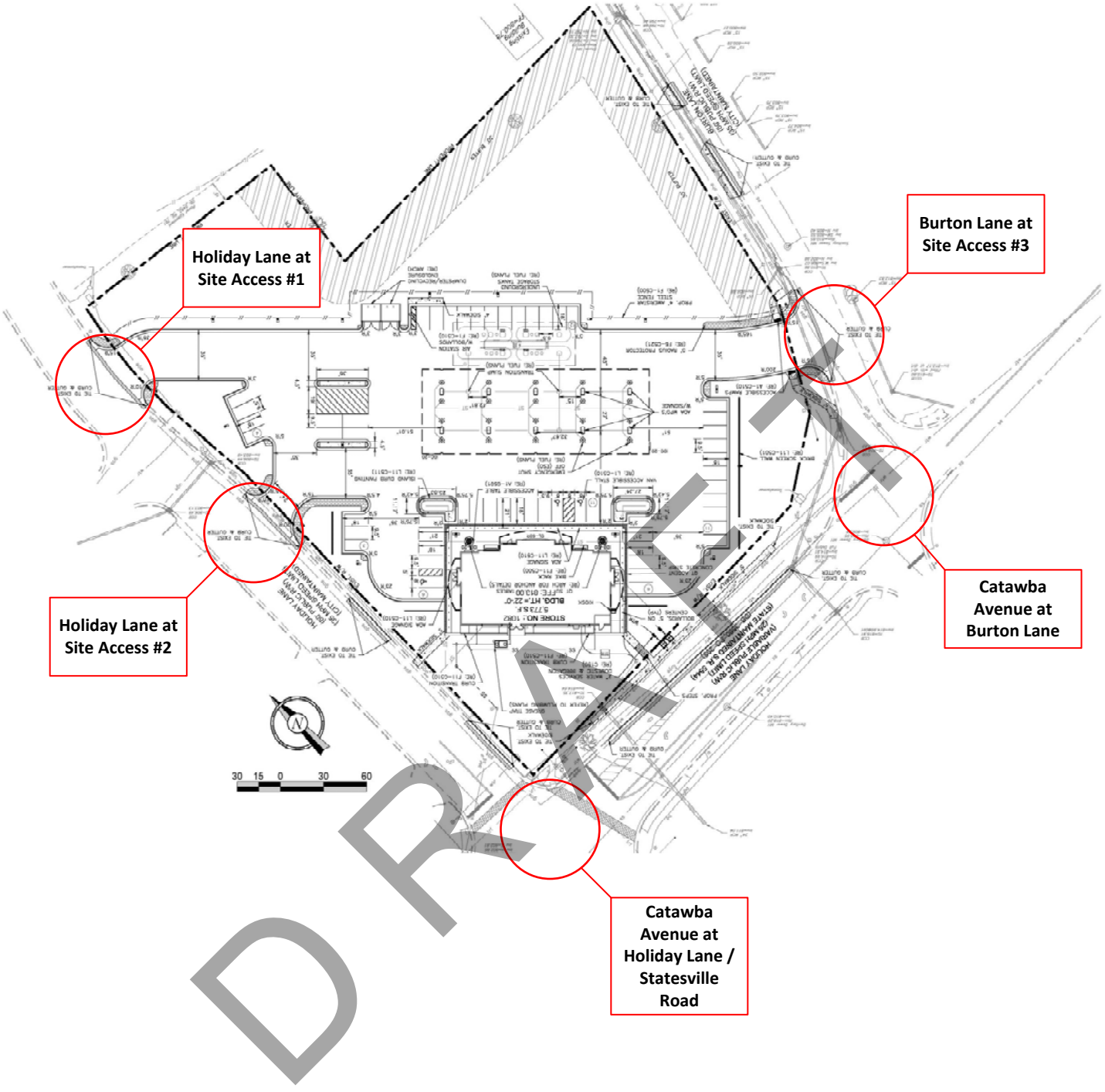
NOT TO SCALE

Cornelius QT
Traffic Impact Study

Site Location Map

DATE: January 2017

Figure 1



	Cornelius QT **Traffic Impact Study**
	Site Plan
NOT TO SCALE	**DATE:** January 2017
	Figure 2

EXISTING ROADWAY CONDITIONS

Below is a detailed description of the existing study area roadway network. All Average Annual Daily Traffic (AADT) information provided in this description was obtained from NCDOT via the www.ncdot.gov website.

I-77 is an interstate highway that travels north-south through Cornelius. It connects to Charlotte to the south and Mooresville/Statesville to the north. The posted speed on this section of I-77 is 65 miles per hour (mph). NCDOT Functional Classification maps designate I-77 as an interstate route. The AADT on this segment of I-77 north of Catawba Avenue is 92,000 vehicles per day (vpd) within the study area in 2014. The AADT on this segment of I-77 south of Catawba Avenue is 85,000 vpd within the study area in 2014.

Catawba Avenue (signed US 21 from Statesville Road to I-77) is a two-lane undivided roadway facility that travels east-west through Cornelius, providing connectivity between I-77 and NC 115. The land use is a mix of office, residential and commercial land uses. The posted speed through the study area is 35 mph and is lowered to 25 mph east of the study area. According to NCDOT, the AADT on Catawba Avenue in the study area was 9,700 vpd just west of NC 115 in 2014. Catawba Avenue holds three different classifications through the study area. Those classifications are minor arterial on the west side of the I-77 interchange, other principal arterial on the east side of the I-77 interchange, and a local road east of the Statesville Road / Holiday Lane intersection.

US 21 (Statesville Road) is a two-lane undivided roadway facility that travels north-south through Cornelius. It connects to Huntersville and Charlotte to the south from Catawba Avenue. The land use along US 21 is mostly commercial near the project site. The posted speed on this section of US 21 is 35 mph. NCDOT indicates that US 21 in the study area is a minor arterial. The AADT on this segment of US 21 is 9,600 vpd within the study area in 2014.

Holiday Lane is a two-lane undivided roadway facility that travels north-south from Catawba Avenue and terminates at the Bexley at Lake Norman Apartment Complex. The land use along Holiday Lane is primarily commercial and residential. As there is no posted speed limit on Holiday Lane, the speed limit is assumed to be the statutory limit of 35 mph. No AADT data was available.

Burton Lane is a two-lane undivided roadway facility that travels north-south from Catawba Avenue and terminates at the Bexley at Lake Norman Apartment Complex property line but has no access to the complex. The land use along Burton Lane is primarily residential. The posted speed limit on this facility is 25 mph and no AADT data was available.

South Hill Street is a two-lane undivided roadway facility that travels north-south from Catawba Avenue and terminates just south of Weathers Street. The land use along South Hill Street is primarily residential. The posted speed limit on this facility is 25 mph and no AADT data was available.

All of the existing study intersections analyzed in this report are signalized with the exception of Catawba Avenue at Burton Lane / S. Hill Street. These signals are contained within the Catawba Avenue closed loop system. Timing and coordination for these signals were provided by the NCDOT Division 10 office. The existing intersection geometrics are shown in **Figure 3**.

The purpose of this Traffic Impact Analysis Report is to assess the traffic carrying capacity of the surrounding roadway network. There are ten (10) types of analyses for the intersections affected by the proposed development. The "Existing Conditions" analysis uses the traffic counts available to evaluate the current intersection operational performance.

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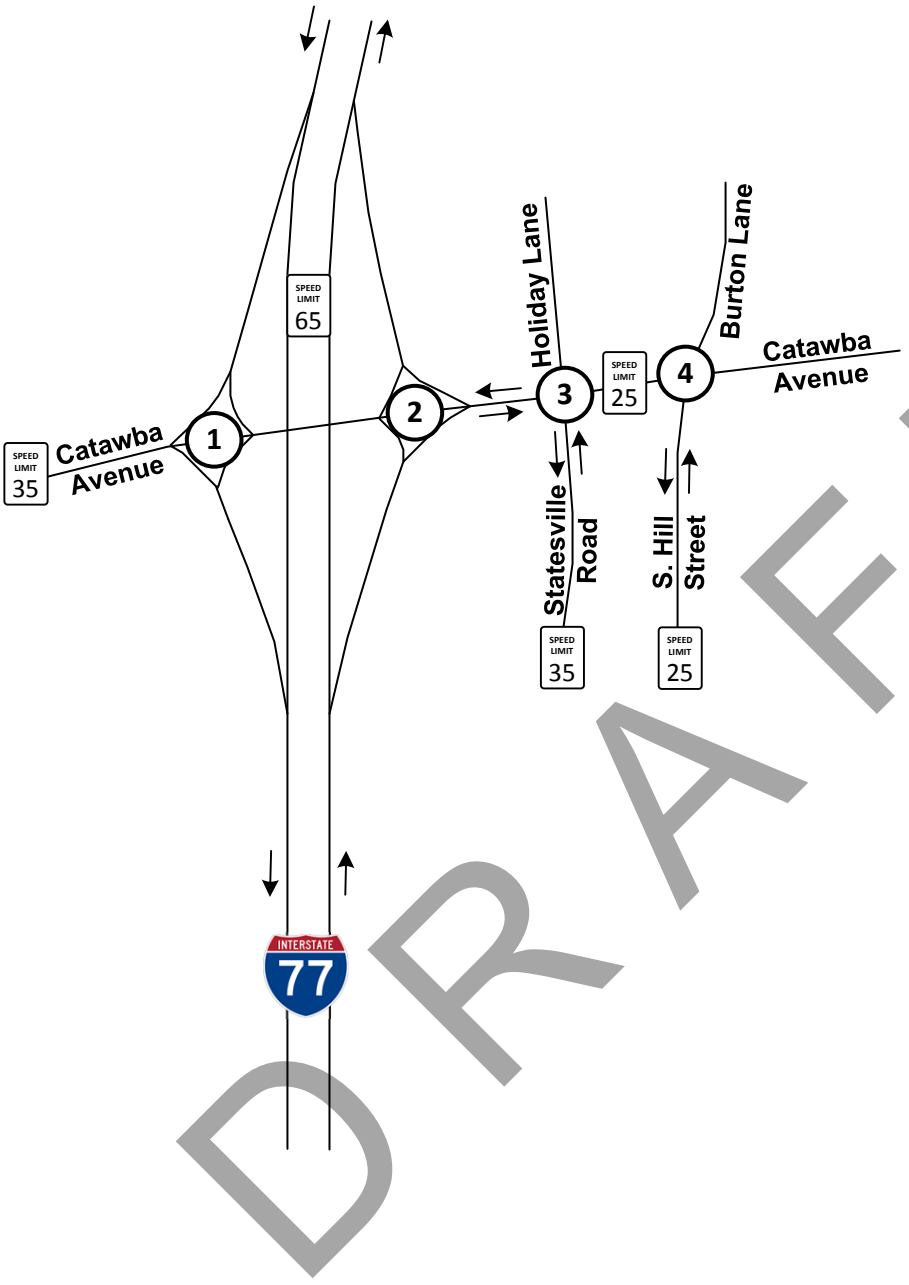

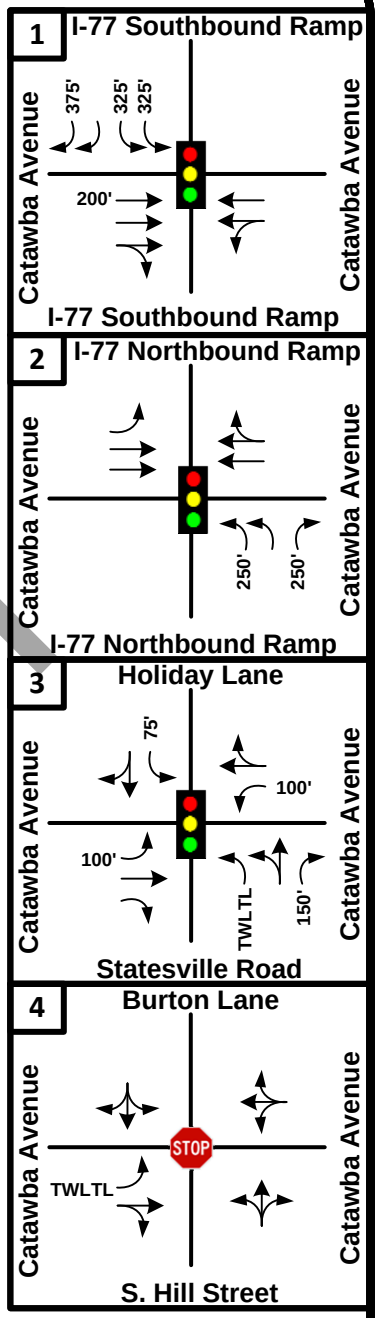

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LEGEND

- STOP + traffic signal: Existing Traffic Control
- Existing Roadway
- XXX' Storage Bay Length
- SPEED LIMIT XX: Existing Posted Speed

N

NOT TO SCALE

Cornelius QT
Traffic Impact Study

Existing Lane Configuration

DATE: January 2017

Figure 3

TRIP GENERATION

The proposed site will be a 5,773 SF convenience store with 20 fueling positions. Land Use Code 853 from the ITE Trip Generation Manual, 9th edition was used for the trip generation of the site. Even though the NCDOT Congestion Management *Rate vs. Equation* spreadsheet dictates the use of the store square footage to determine the generated trips, through discussion with Congestion Management and the Division 10 Traffic Engineer, the site trips were generated through the amount of fueling positions. Trip generation results in a gross total of 331 trips (166 in, 165 out) generated from the proposed development in the AM peak hour and 381 trips (191 in, 190 out) generated in the PM peak hour.

The proposed development will be replacing the existing gas station and restaurant on the property. To account for this traffic, data was collected at the six (6) existing driveways to the property. The trip generation for the proposed development will be the difference between what was counted at the existing driveways versus the trip generation calculations.

During the peak hour of the adjacent street (Catawba Avenue) the counts at the existing driveways resulted in 87 trips (58 in, 29 out) in the AM peak hour and 92 trips (47 in, 45 out). The net trips for the site after this reduction is 244 trips (108 in, 136 out) in the AM peak hour and 289 trips (144 in, 145 out) in the PM peak hour.

According to NCDOT standards, LUC 853 also allows for the use of pass-by trips for this land use of 63% in the AM peak hour and 66% in the PM peak hour. Therefore, the net new trips generated by the proposed development are a total of 90 trips (31 in, 59 out) in the AM peak hour and 136 trips (67 in, 69 out) in the PM peak hour. When developing the analyses for the three (3) driveways, the site traffic data collected at the six (6) existing driveways was added back into the analyses since they are a part of the total trips in and out of the proposed driveways. This is captured in the driveway volume adjustment figures.

Table 1: Trip Generation

LAND USE CODE	LAND USE DESCRIPTION	VARIABLE	DAILY TRIPS (vpd)	AM PEAK HOUR TRIPS (vph)			PM PEAK HOUR TRIPS (vph)		
				TOTAL	IN	OUT	TOTAL	IN	OUT
853	Convenience Market with Gasoline Pumps	20 Fueling Positions	10,850	331	166	165	381	191	190
Existing Site Traffic Reduction			-1,382	*-87*	*-58*	*-29*	*-92*	*-47*	*-45*
Net External Trips			**9,468**	**244**	**108**	**136**	**289**	**144**	**145**
Pass-By Trip Reduction (63% AM / 66% PM)				-154	-77	-77	-153	-77	-76
Net New External Trips				**90**	**31**	**59**	**136**	**67**	**69**

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It should be noted that daily trips were not calculated beyond the net external trips as pass-by percentages are not provided for off-peak hours. Trip generation was submitted to the Town and NCDOT for review on October 31st, 2016. The Town approved of the trip generation on November 1st, 2016 and NCDOT approved the trip generation on November 17th, 2016.

TRIP DISTRIBUTION

The site generated trips to and from the proposed site were distributed in accordance with the apparent traffic patterns by the users of the proposed facility and the existing traffic patterns and land uses in the vicinity as follows:

- 25% to/from the North on I-77
- 25% to/from the South on I-77
- 20% to/from the East on Catawba Avenue
- 20% to/from the West on Catawba Avenue
- 10% to/from the South on Statesville Road

The overall trip distribution was submitted to the Town and NCDOT for review in the memorandum of understanding. The Town approved of the trip distribution on November 1st, 2016 and NCDOT approved the trip distribution on November 17th, 2016.

The trip distribution is shown on **Figure 7** and the site trip assignment is shown on **Figure 8**. The pass-by trip distribution is shown on **Figure 9** and the site pass-by trip assignment is shown on **Figure 10**. The driveway volume adjustment distribution is shown in **Figure 11** and the driveway volume adjustment assignment is shown in **Figure 12.**

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PROJECT TRAFFIC VOLUMES – 2018 HORIZON YEAR

Existing Traffic Volumes

Traffic counts were performed by Quality Counts on Wednesday, November 30th, 2016 for all study intersections as well as the existing site driveways. It should be noted that traditional calendar schools were in session when the counts were performed. The traffic counts were balanced between study intersections. These existing balanced traffic volumes are shown in **Figure 4**. The count data is located in **Appendix B**. The count balancing can be found in **Appendix C** (Traffic Volumes Worksheet).

Historical Growth Traffic (2018 Background Traffic)

Historical growth traffic is the increase in existing traffic volumes due to general usage increases and non-specific growth throughout the area. As specified by Town staff, existing traffic volumes were increased by two percent (2%) per year to reflect background traffic at the buildout year in which construction of the development will be completed. The historical growth traffic volumes for the 2018 horizon year are shown in **Figure 5**.

2018 No-Build Traffic Volumes

The historical growth traffic volumes were then added to the existing volumes to determine the 2018 no-build traffic volumes. The 2018 no-build Traffic Volumes are shown in **Figure 6**.

Proposed Development Traffic

The proposed site will be a 5,773 square-foot convenience store with 20 fueling positions. Land Use Code 853 from the Institute of Transportation Engineers (ITE) Trip Generation Manual, 9th edition was used to perform trip generation. Even though the NCDOT Congestion Management *Rate vs. Equation* spreadsheet dictates the use of the store square footage to determine the generated trips, through discussion with Congestion Management and the Division 10 Traffic Engineer, the site trips were generated through the amount of fueling positions (i.e. 20). Trip generation results in a gross total of 331 trips (166 in, 165 out) generated from the proposed development in the AM peak hour and 381 trips (191 in, 190 out) generated in the PM peak hour.

The proposed development will be replacing the existing gas station and restaurant on the property. To account for this traffic, we collected data at the six (6) existing driveways to the property. This traffic will be kept in the existing and no-build scenarios. The trip generation for the proposed development will be the difference between what is counted at the existing driveways versus what is generated by the site. The counts at the existing driveways resulted in 87 trips (58 in, 29 out) in the AM peak hour and 92 trips (47 in, 45 out). The net trips for the site after this reduction is 244 trips (108 in, 136 out) in the AM peak hour and 289 trips (144 in, 145 out) in the PM peak hour. The trip distribution is shown on **Figure 7** and the site trip assignment is shown on **Figure 8**. The traffic calculations are shown in **Appendix C.**

PASS-BY TRAFFIC

According to NCDOT standards, LUC 853 also allows for the use of pass-by trips for this land use of 63% in the AM peak hour and 66% in the PM peak hour. Therefore, new net trips generated by the proposed development are a total of 90 trips (31 in, 59 out) in the AM peak hour and 136 trips (67 in, 69 out) in the PM peak hour. The pass-by trip distribution is shown on **Figure 9** and the site pass-by trip assignment is shown on **Figure 10**. The traffic calculations are shown in **Appendix C.**

DRIVEWAY ADJUSTMENT TRAFFIC

When developing the analyses for the three (3) driveways, the site traffic data collected at the six (6) existing driveways was added back into the analyses since they are a part of the total trips in and out of the proposed driveways. This is captured in the driveway volume adjustment figures. This adjustment is to ensure that the traffic volumes entering and exiting the proposed site match the unadjusted trip generation calculated using the ITE Trip Generation Manual. The driveway volume adjustment distribution is shown in **Figure 11** and the driveway volume adjustment assignment is shown in **Figure 12.** The traffic calculations are shown in **Appendix C.**

2018 Build-Out Traffic Volumes

The 2018 build-out traffic volumes include the 2018 No-Build traffic and the proposed development traffic. The AM and PM peak-hour 2018 Build Traffic Volumes are shown in **Figure 13.** The traffic calculations are shown in **Appendix C.**

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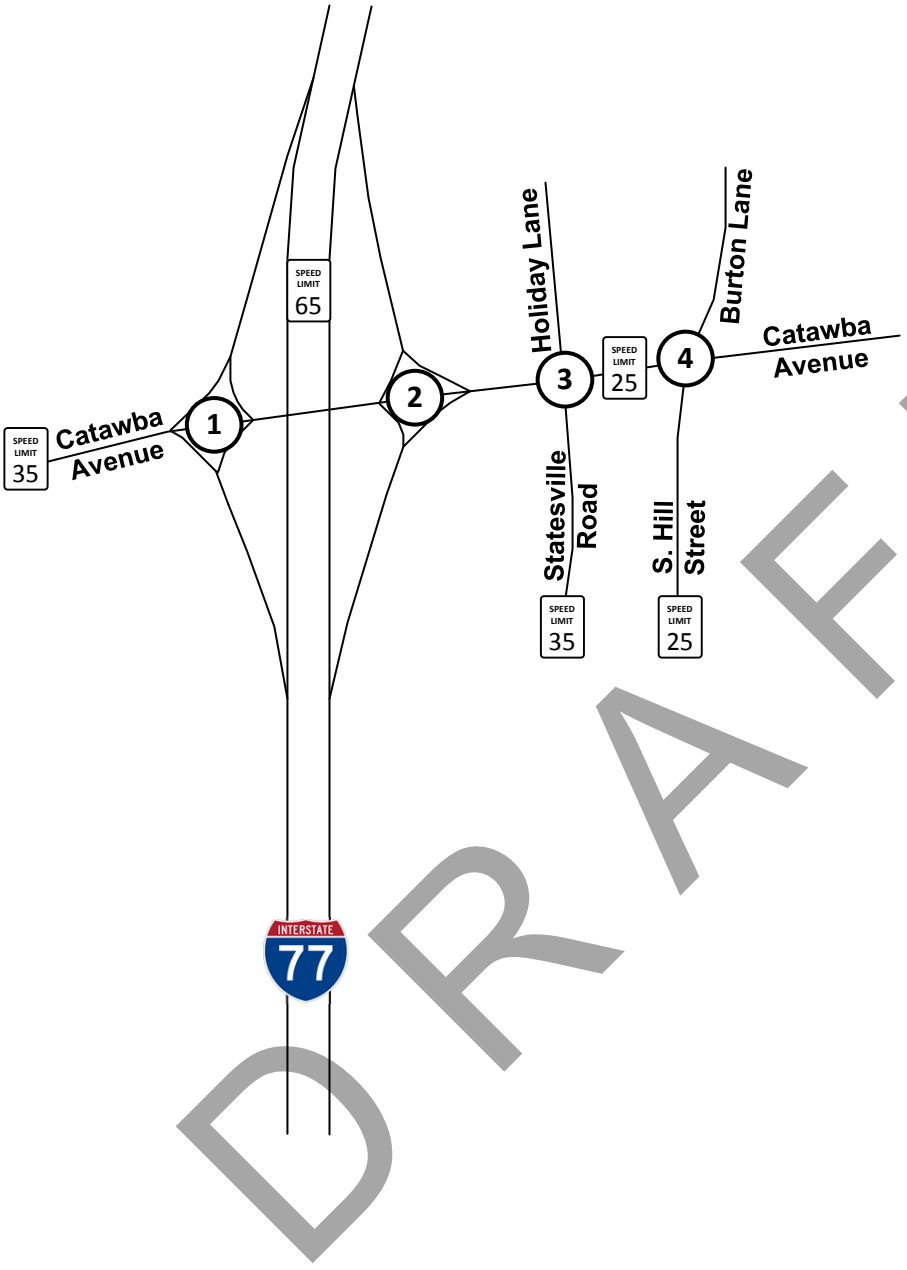

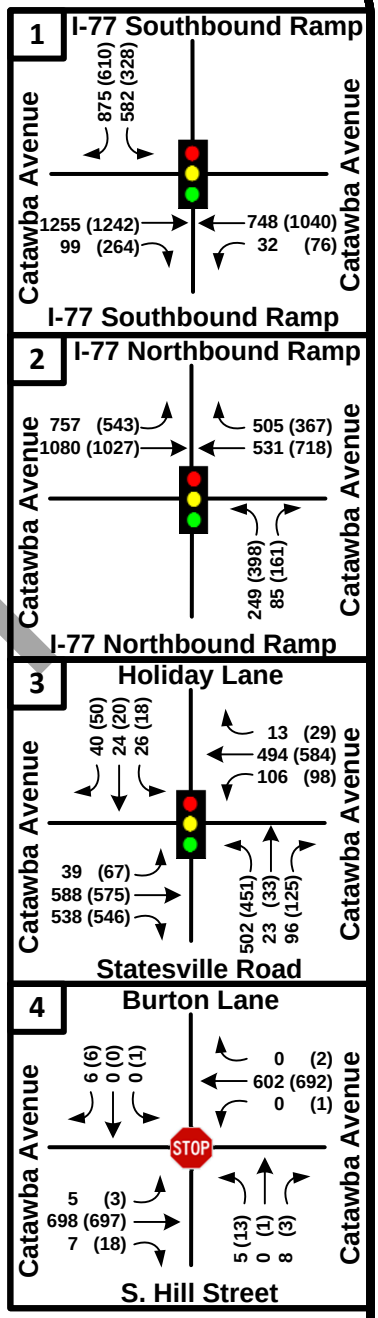

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LEGEND

- Existing Traffic Control
- Existing Roadway
- XX (XX) AM (PM) Peak Hour Volumes
- SPEED LIMIT XX — Existing Posted Speed

N

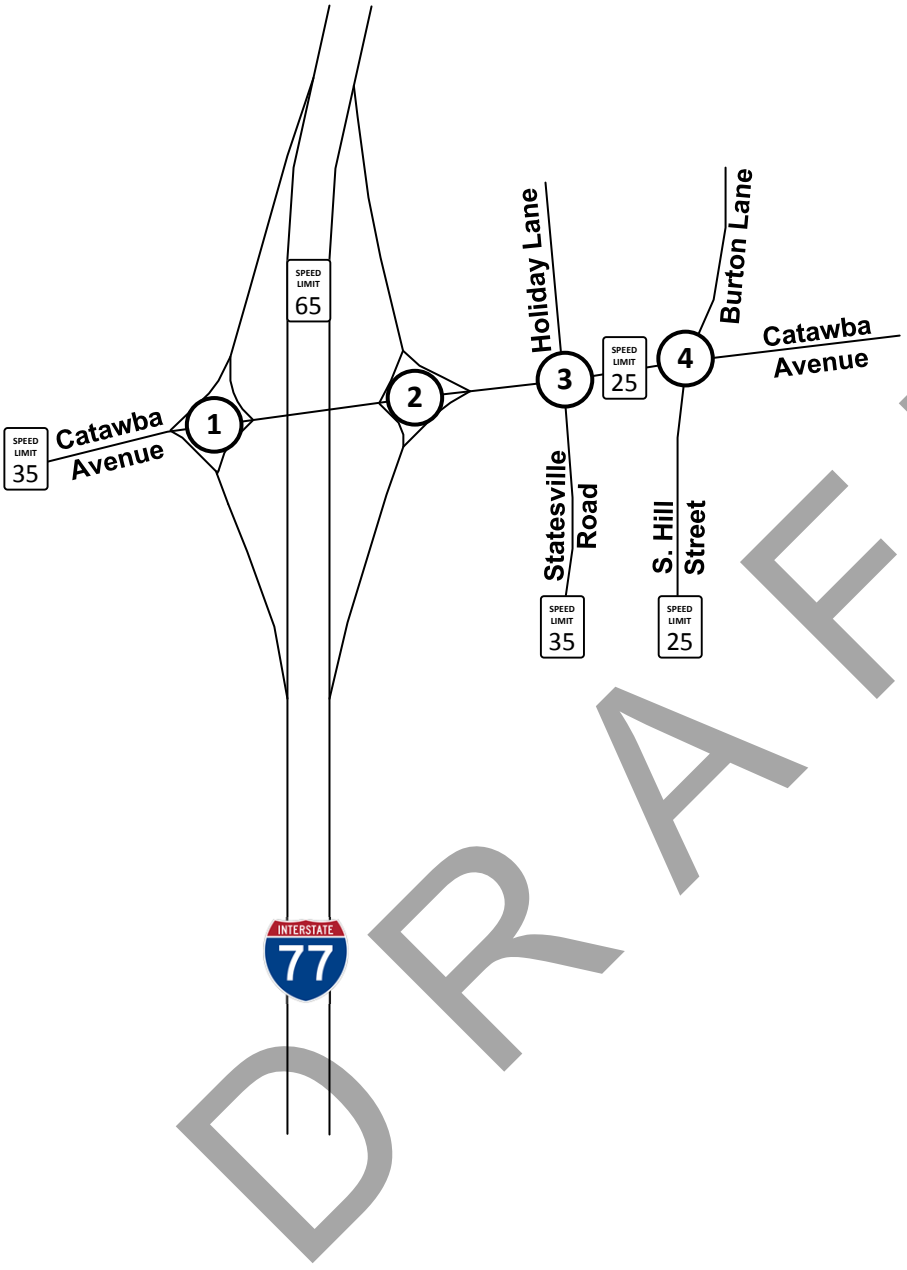
NOT TO SCALE

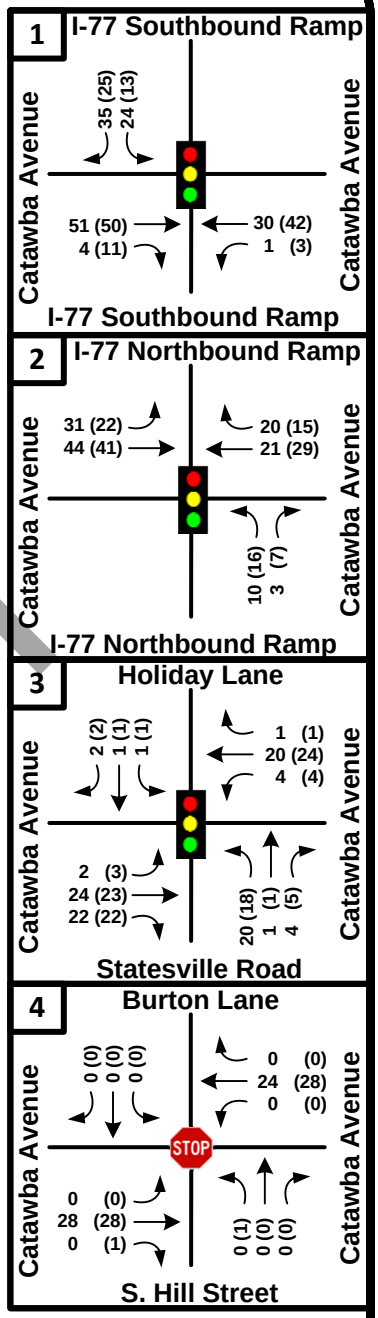
Cornelius QT
Traffic Impact Study

2016 Existing Traffic Volumes

DATE: January 2017

Figure 4





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LEGEND

- Existing Traffic Control
- Existing Roadway
- XX (XX) AM (PM) Peak Hour Volumes
- Existing Posted Speed XX

N

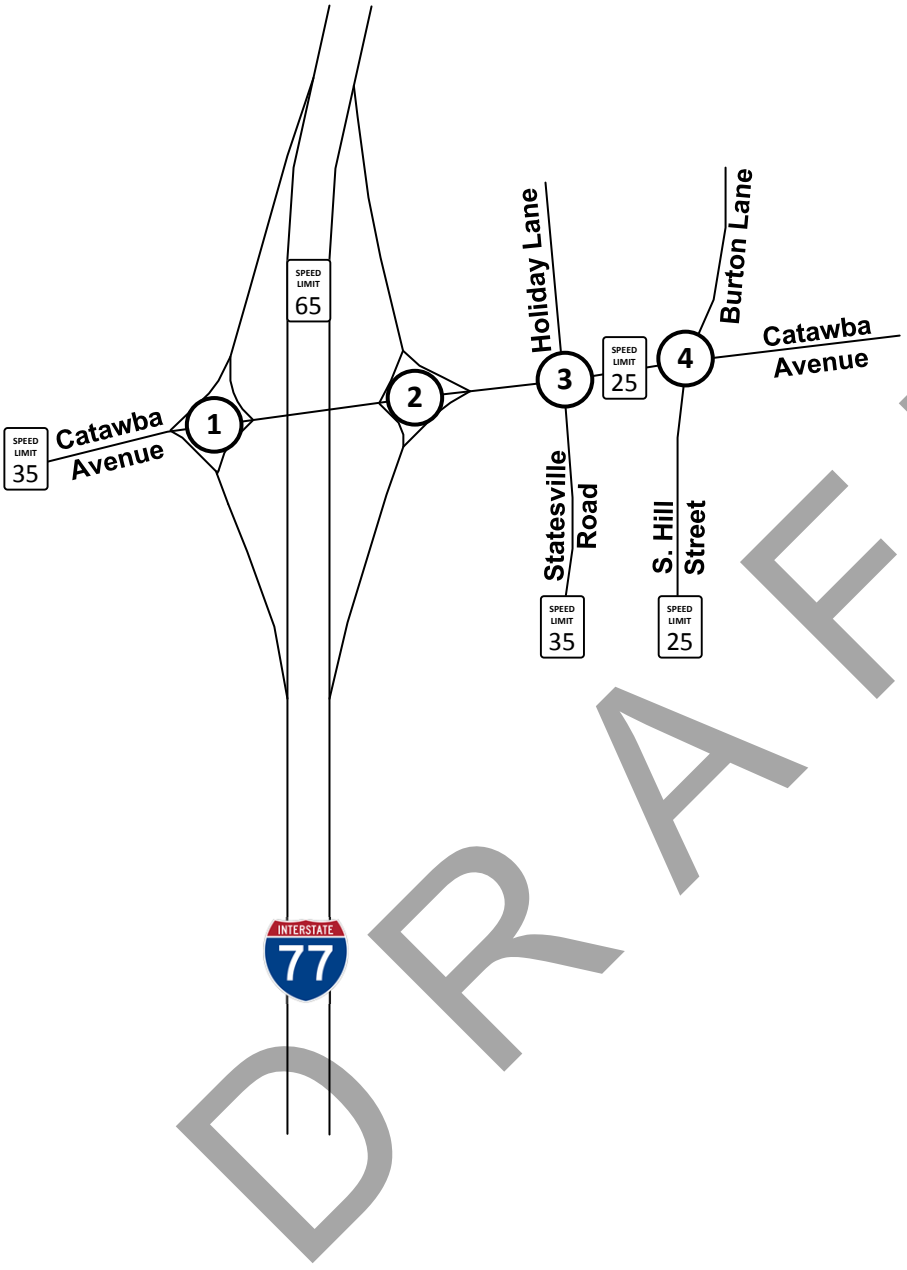
NOT TO SCALE

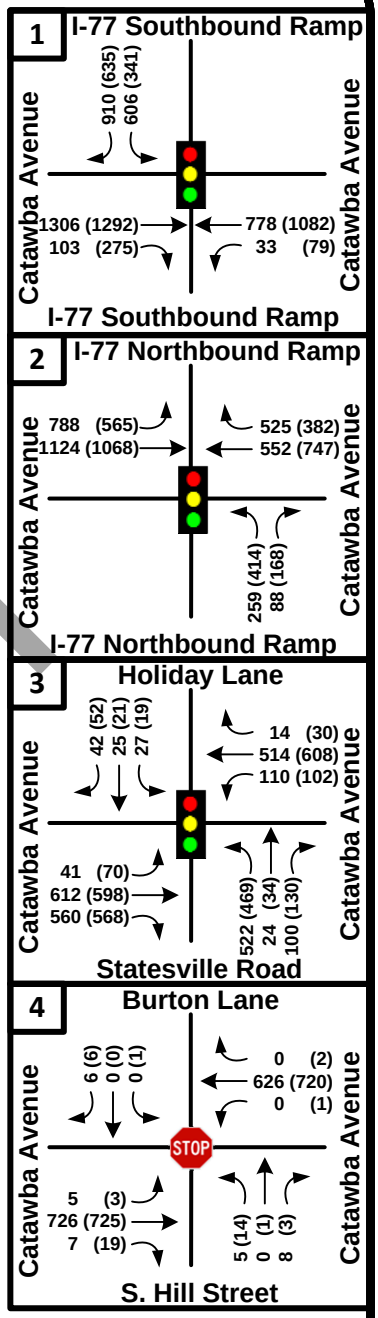
Cornelius QT
Traffic Impact Study

2018 Historical Growth

DATE: January 2017

Figure 5





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LEGEND

- Existing Traffic Control
- Existing Roadway
- XX (XX) AM (PM) Peak Hour Volumes
- Existing Posted Speed XX

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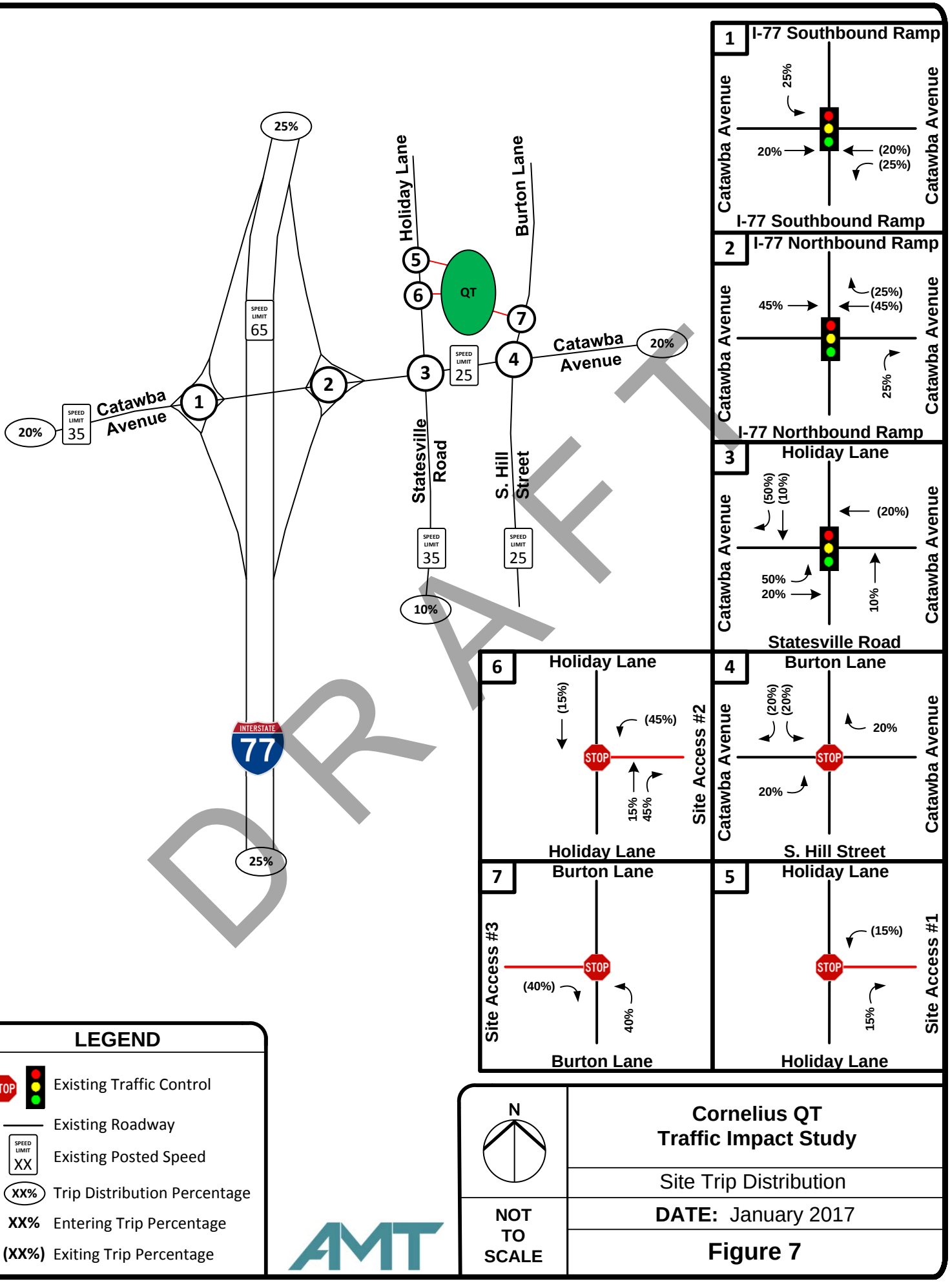
NOT TO SCALE

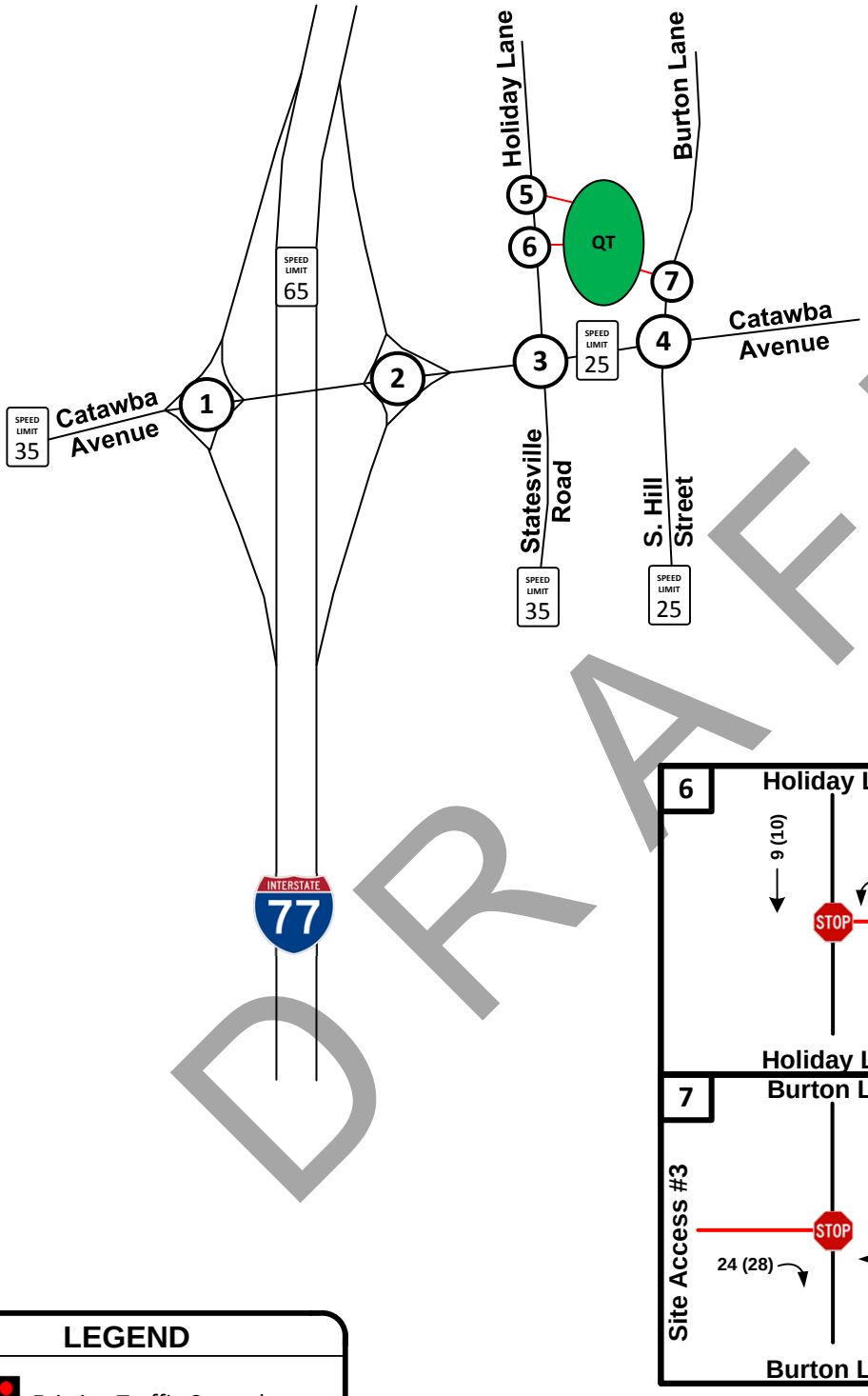
Cornelius QT
Traffic Impact Study

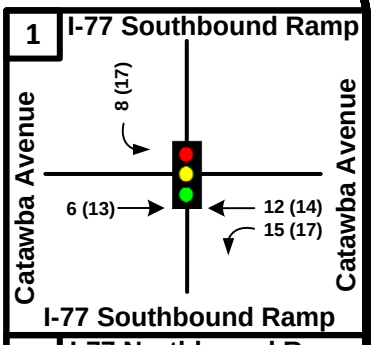
2018 No-Build Traffic Volumes

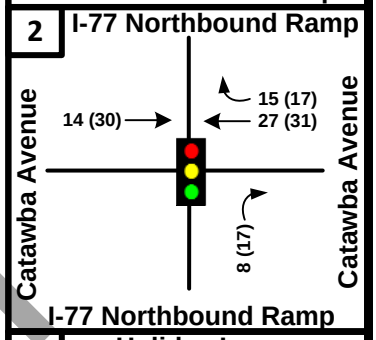
DATE: January 2017

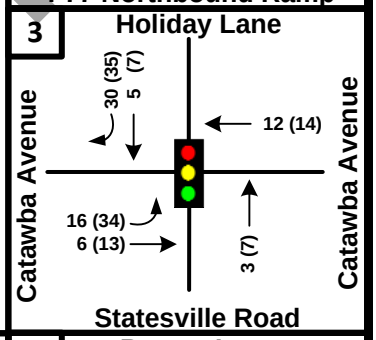
Figure 6

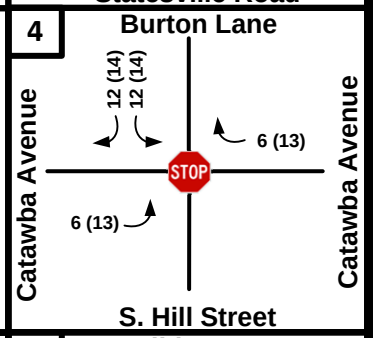

25%
Holiday Lane
Burton Lane
5
6
QT
7
SPEED LIMIT 65
SPEED LIMIT 25
Catawba Avenue
20%
1
2
3
4
SPEED LIMIT 35
Catawba Avenue
20%
Statesville Road
S. Hill Street
SPEED LIMIT 35
SPEED LIMIT 25
10%
INTERSTATE 77
25%
DRAFT
1 I-77 Southbound Ramp
25%
20%
(20%)
(25%)
Catawba Avenue
Catawba Avenue
I-77 Southbound Ramp
2 I-77 Northbound Ramp
45%
(25%)
(45%)
25%
Catawba Avenue
Catawba Avenue
I-77 Northbound Ramp
3 Holiday Lane
(50%)
(10%)
(20%)
50%
20%
10%
Catawba Avenue
Catawba Avenue
Statesville Road
6 Holiday Lane
(15%)
(45%)
STOP
15%
45%
Site Access #2
Holiday Lane
4 Burton Lane
(20%)
(20%)
20%
STOP
20%
Catawba Avenue
Catawba Avenue
S. Hill Street
7 Burton Lane
Site Access #3
STOP
(40%)
40%
Burton Lane
5 Holiday Lane
(15%)
STOP
15%
Site Access #1
Holiday Lane
LEGEND
STOP
Existing Traffic Control
Existing Roadway
SPEED LIMIT XX
Existing Posted Speed
XX%
Trip Distribution Percentage
XX% Entering Trip Percentage
(XX%) Exiting Trip Percentage
N
NOT TO SCALE
Cornelius QT
Traffic Impact Study
Site Trip Distribution
DATE: January 2017
Figure 7

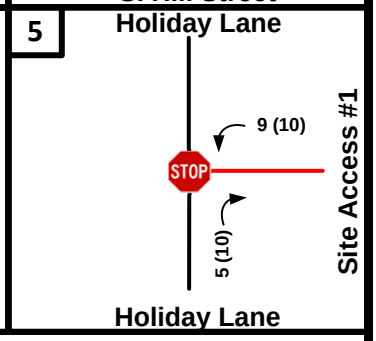












DRAFT

LEGEND

- Existing Traffic Control
- Existing Roadway
- XX (XX) AM (PM) Peak Hour Volumes
- Existing Posted Speed

N

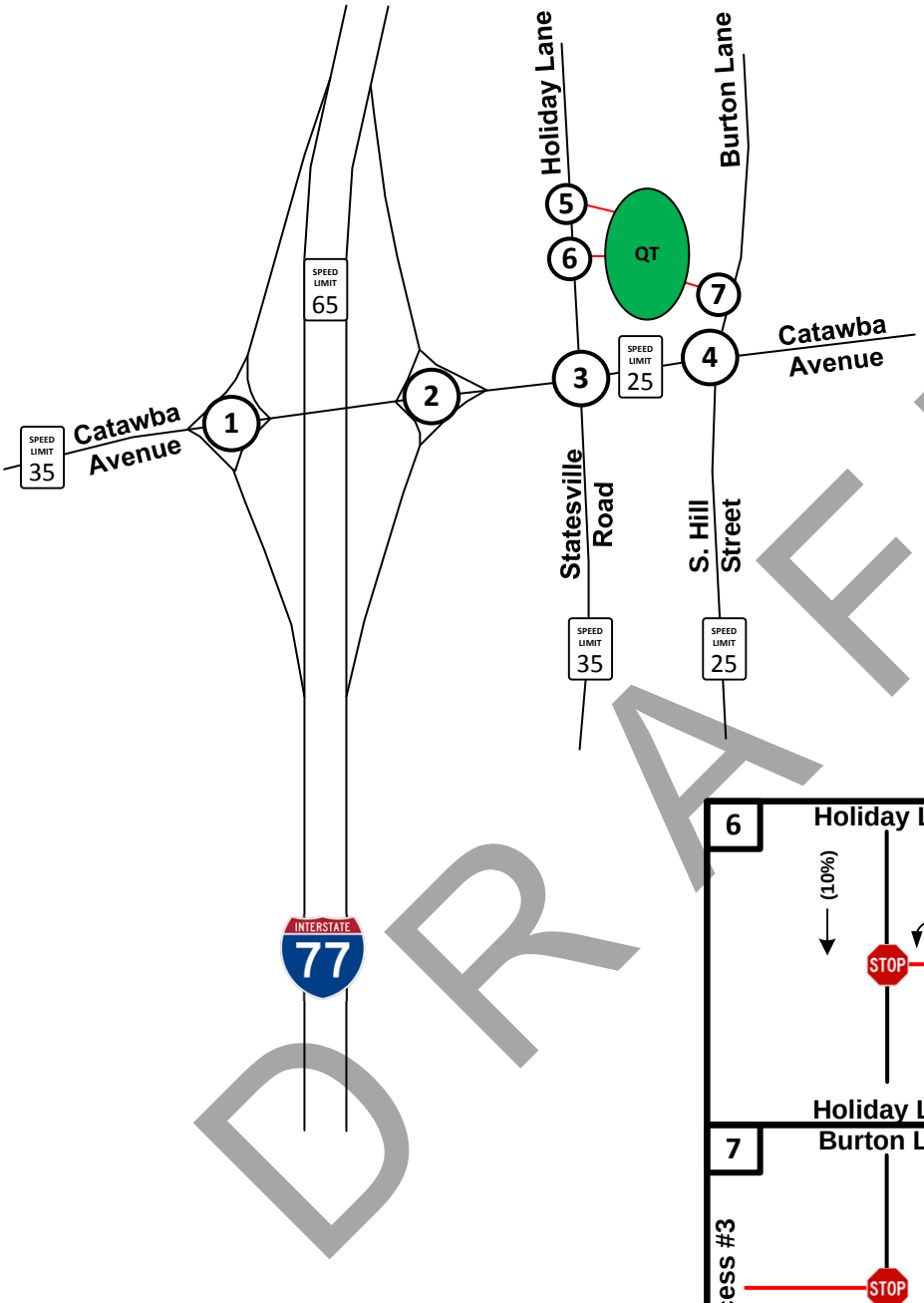
NOT TO SCALE

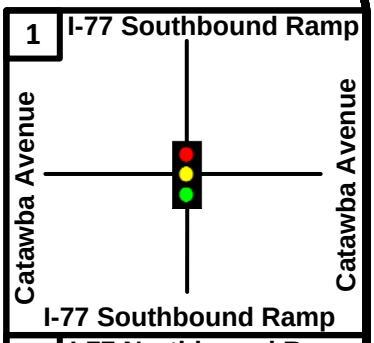
Cornelius QT
Traffic Impact Study

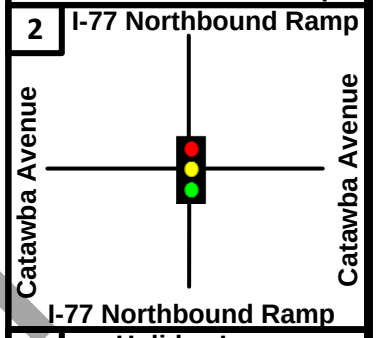
Site Trip Assignment

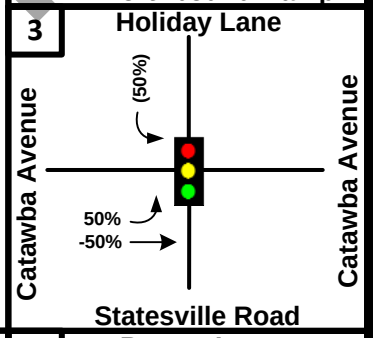
DATE: January 2017

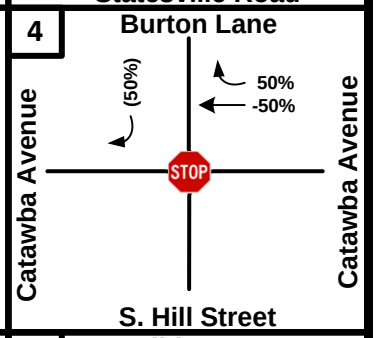
Figure 8

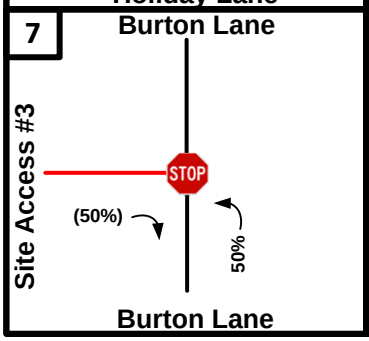


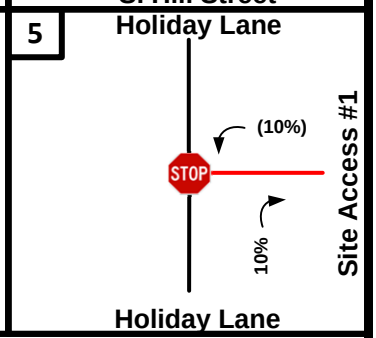












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LEGEND

- STOP — Existing Traffic Control
- Existing Roadway
- SPEED LIMIT XX — Existing Posted Speed
- XX% — Trip Distribution Percentage
- XX% — Entering Trip Percentage
- (XX%) — Exiting Trip Percentage

N

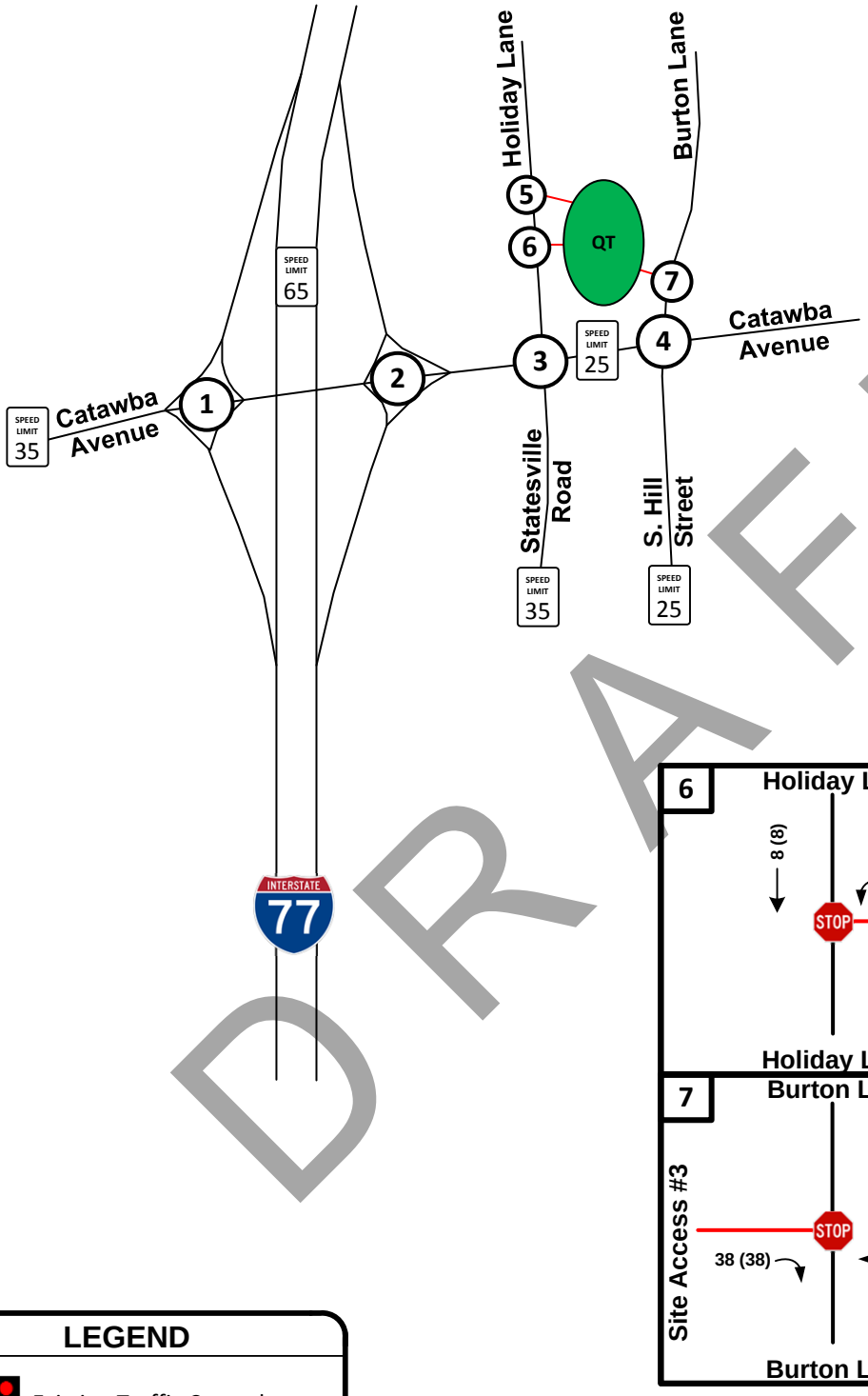
NOT TO SCALE

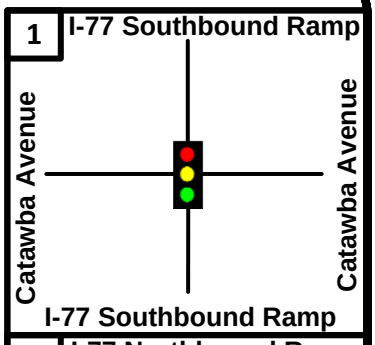
Cornelius QT
Traffic Impact Study

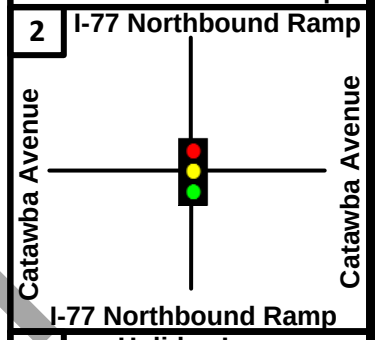
Pass-By Trip Distribution

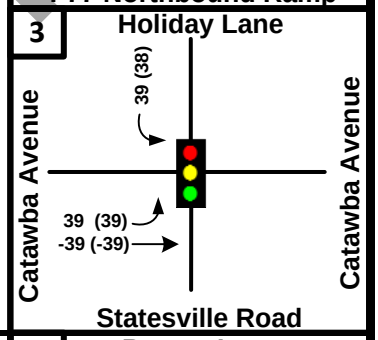
DATE: January 2017

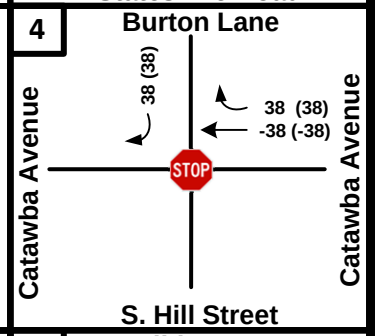
Figure 9

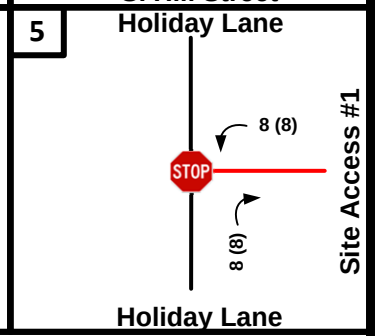












DRAFT

LEGEND

- STOP — Existing Traffic Control
- Existing Roadway
- XX (XX) — AM (PM) Peak Hour Volumes
- SPEED LIMIT XX — Existing Posted Speed

N

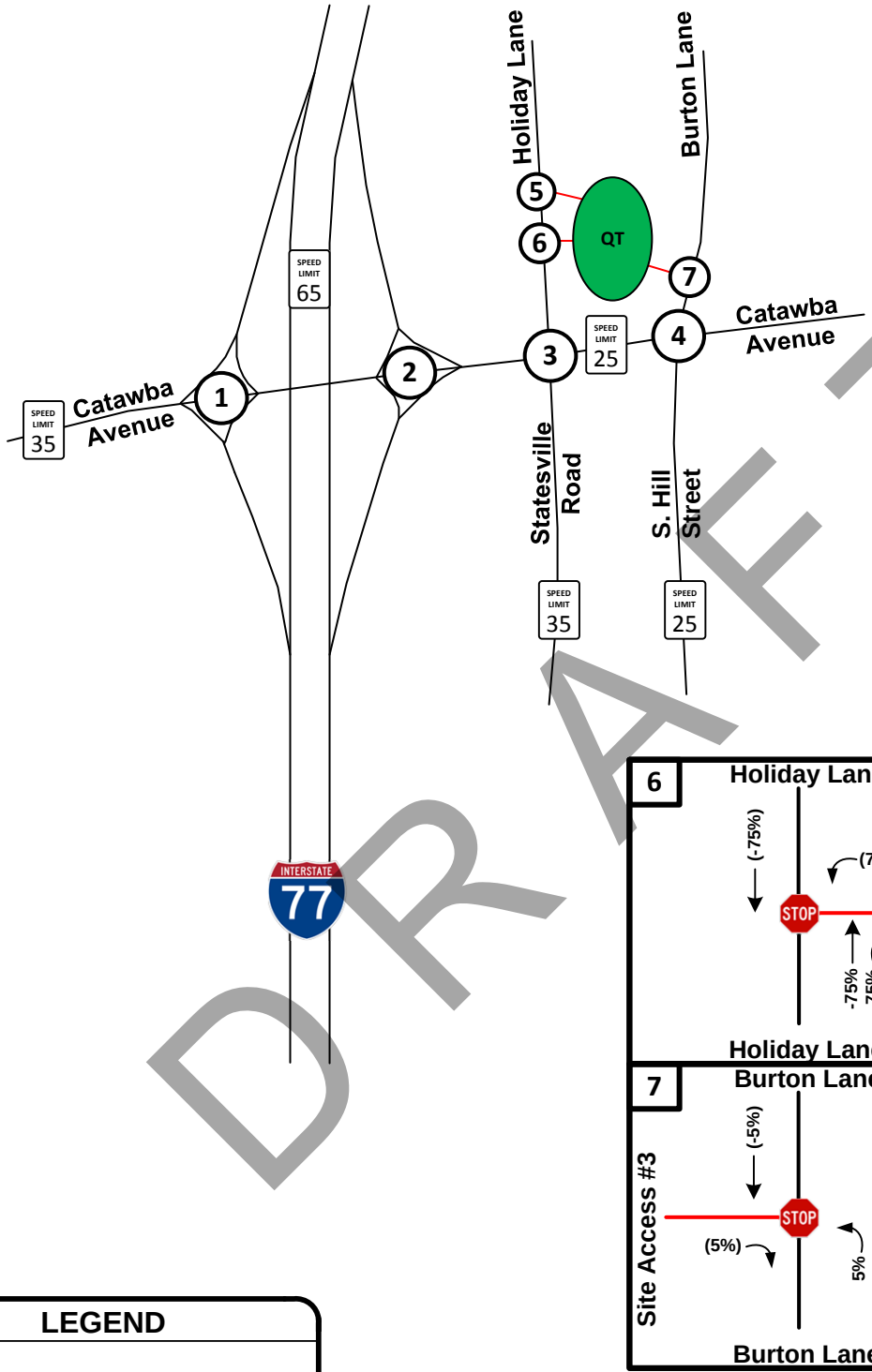
NOT TO SCALE

Cornelius QT
Traffic Impact Study

Pass-By Trip Assignment

DATE: January 2017

Figure 10



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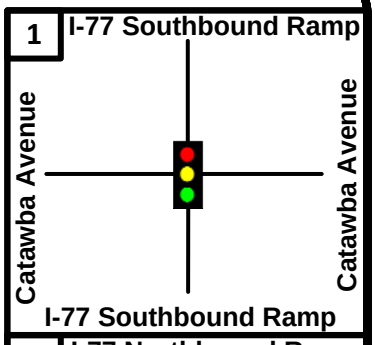
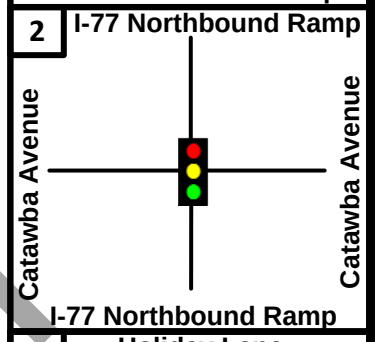
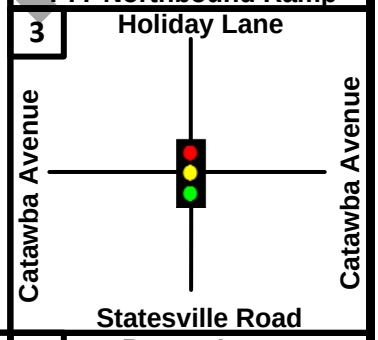
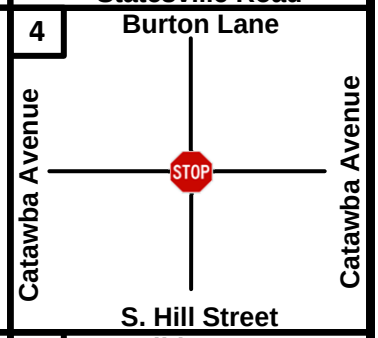
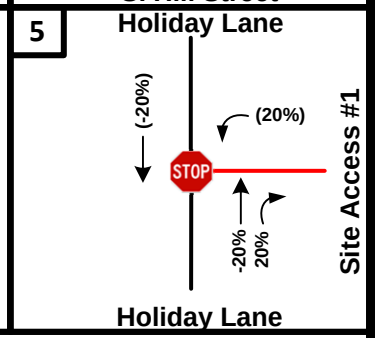










LEGEND

- STOP — Existing Traffic Control
- Existing Roadway
- SPEED LIMIT XX — Existing Posted Speed
- XX% — Entering Trip Percentage
- (XX%) — Exiting Trip Percentage

N

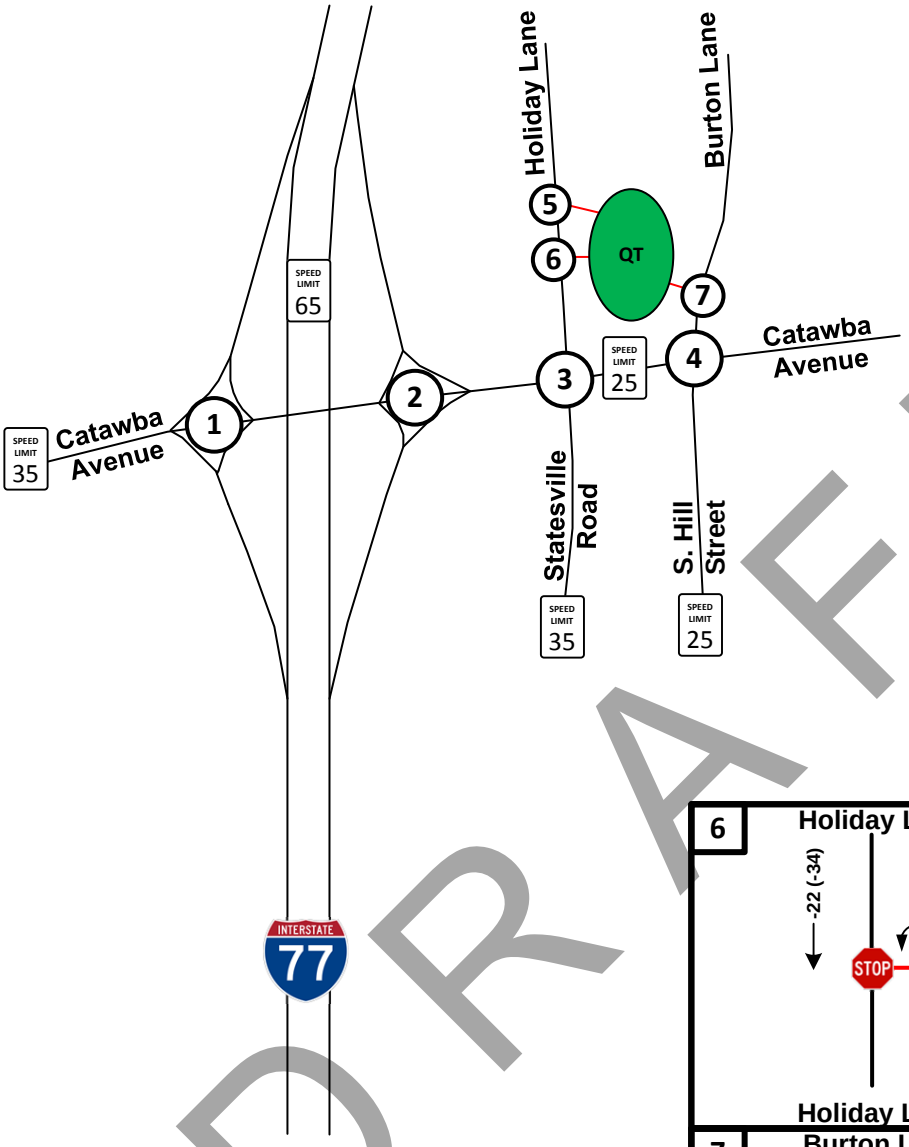
NOT TO SCALE

Cornelius QT
Traffic Impact Study

Driveway Volume Adjustment Distribution

DATE: January 2017

Figure 11



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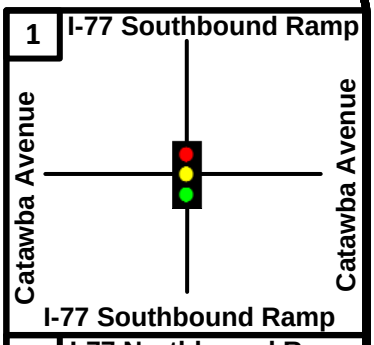
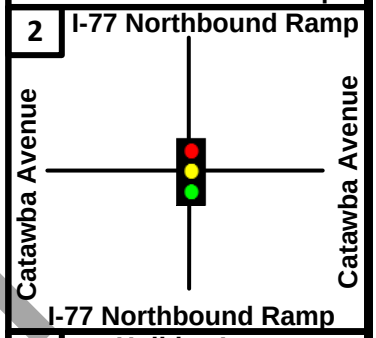
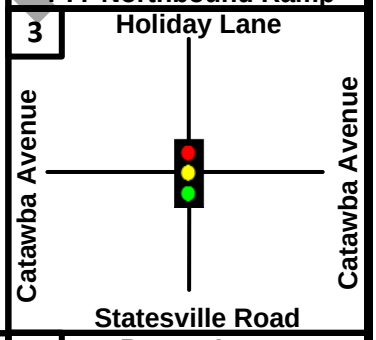
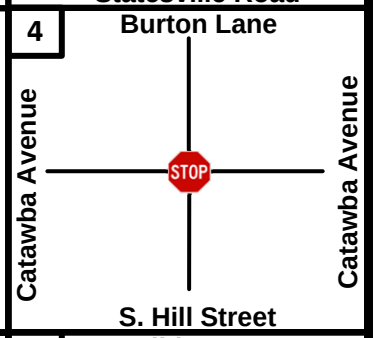
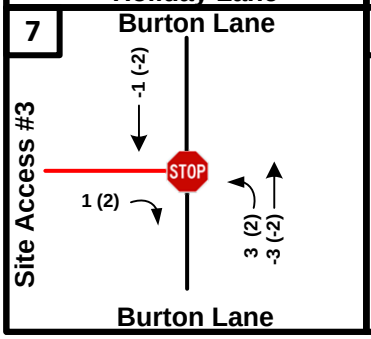
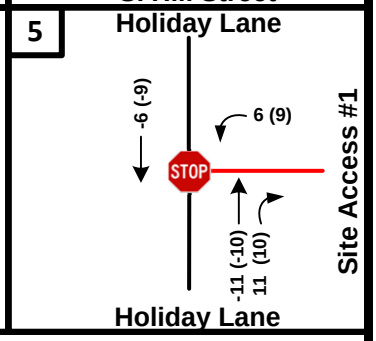












LEGEND

- STOP — Existing Traffic Control
- Existing Roadway
- XX (XX) — AM (PM) Peak Hour Volumes
- SPEED LIMIT XX — Existing Posted Speed

N

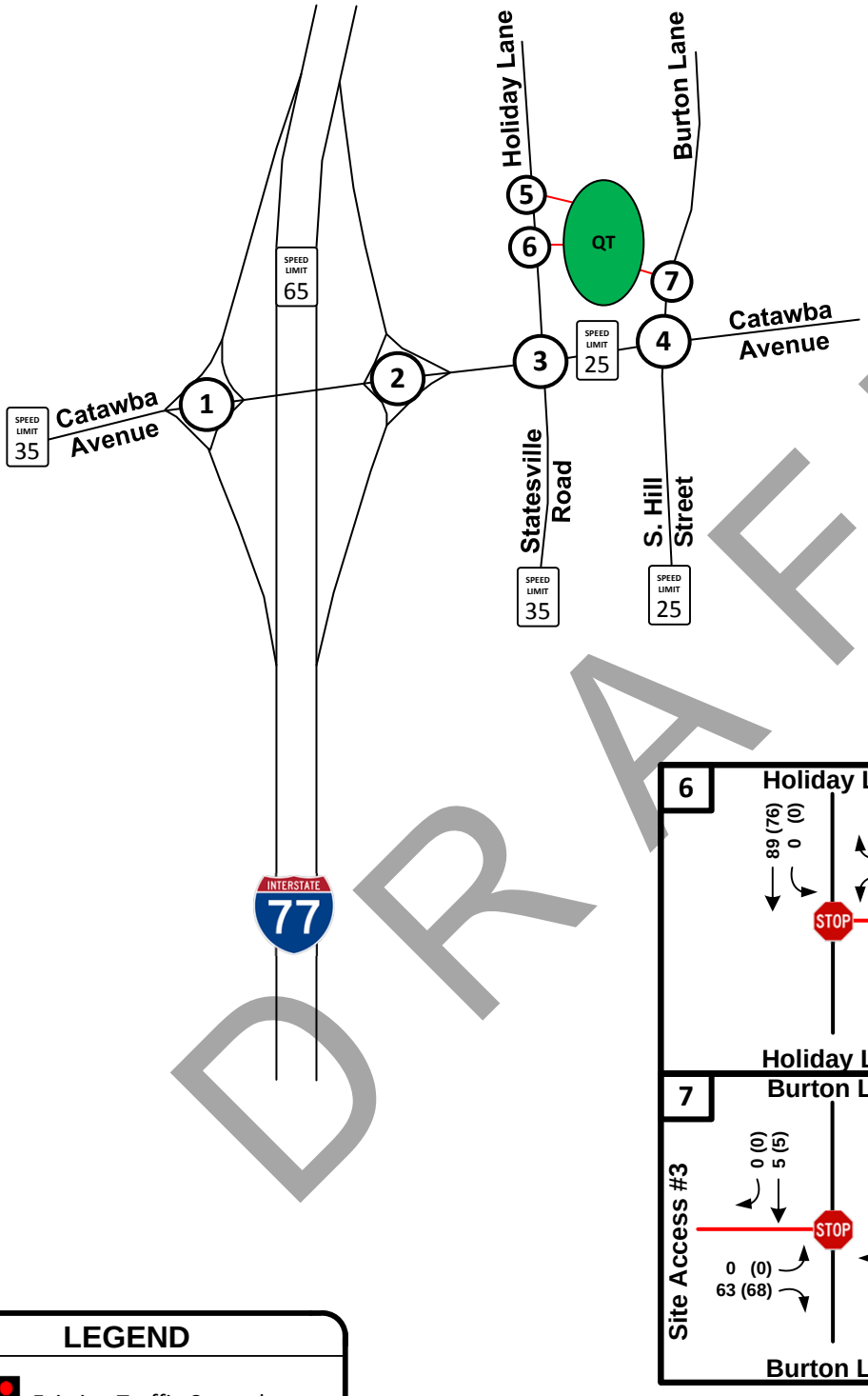
NOT TO SCALE

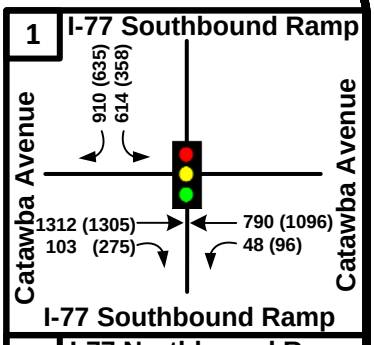
Cornelius QT
Traffic Impact Study

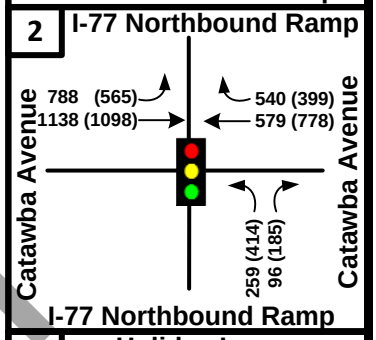
Driveway Volume Adjustment Assignment

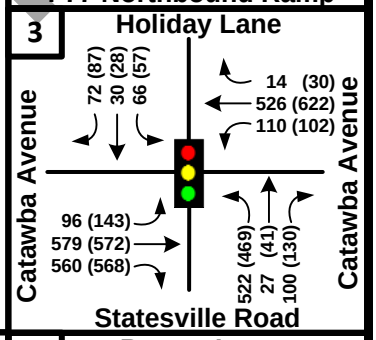
DATE: January 2017

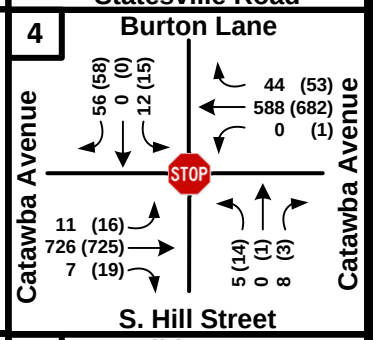
Figure 12

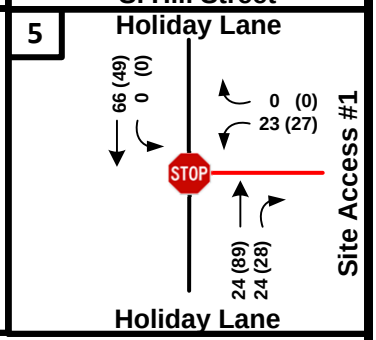












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LEGEND

- STOP — Existing Traffic Control
- Existing Roadway
- XX (XX) — AM (PM) Peak Hour Volumes
- SPEED LIMIT XX — Existing Posted Speed

N

NOT TO SCALE

Cornelius QT
Traffic Impact Study

2018 Build Traffic Volumes

DATE: January 2017

Figure 13

CAPACITY ANALYSIS – 2018 HORIZON YEAR

2016 Existing Analysis

The *Highway Capacity Manual* defines capacity as the maximum suitable flow rate at which vehicles reasonably can be expected to traverse a point during a specified time period. Capacity uses the measure of efficiency, *Level-of-Service* (LOS), to describe the traffic performance at intersections. LOS is defined for the overall intersection delay for signalized intersections. An acceptable LOS for a signalized intersection is considered to be LOS D or better (i.e. A, B, C or D).

At unsignalized intersections, the LOS is defined by the control delay for the movement that must yield right-of-way. It may be typical for stop-controlled minor streets to experience long delays during peak periods, while the majority of the traffic flows through the intersection on the major street experiencing little or no delay.

The procedures outlined in the Highway Capacity Manual, 2010 Update were used as guidelines for the analysis of the study area intersections. This manual provides procedures for the analysis of both signalized and unsignalized intersections. LOS categories range from LOS "A" (best) to "F" (worst) as shown in Table 2.

Table 2: Level of Service Criteria

LEVEL OF SERVICE	SIGNALIZED INTERSECTION CONTROL DELAY (SEC/VEH)	UNSIGNALIZED INTERSECTION CONTROL DELAY (SEC/VEH)	INTERSECTION LEVEL-OF-SERVICE DESCRIPTION
A	≤ 10.0	≤ 10.0	Free flow, insignificant delays.
B	10.1 – 20.0	10.1 – 15.0	Stable operation, minimal delays
C	20.1 – 35.0	15.1 – 25.0	Stable operation, acceptable delays
D	35.1 – 55.0	25.1 - 35.0	Restricted flow, common delays.
E	55.1 -80.0	35.1 – 50.0	Maximum capacity, extended delays. Volumes at or near capacity. Long queues form upstream from intersection.
F	> 80	> 50.0	Forced flow, excessive delays. Represents jammed conditions. Intersection operates below capacity with low volumes. Queues may block upstream intersections.

The Town of Cornelius requires intersection-level LOS to be maintained based upon the thresholds presented in Table 3. The Town of Cornelius Land Development Code (page 13-10) states the following:

If the existing level of service (intersection or approach) is inadequate (i.e. "D", "E", or "F" dependent on the governing zoning district shown in the table [below]), or the existing plus the background growth (not including the site) causes an inadequate level of service, then the developer will be expected to mitigate only the traffic to be generated by the proposed project.

Table 3: LOS Mitigation Thresholds

ZONING DISTRICT	LOS THRESHOLD
RP, GR, NC	C
NMX, VC, HC	D
BC, IC	D
TC, TRD-O, TD-O, TND	E

The intersections of Catawba Avenue at the I-77 on / off ramps are designated highway commercial (HC). As such, the LOS threshold for these intersections is LOS D. The intersection of Catawba Avenue at Statesville Road / Holiday Lane is designated HC, but it is also located in a Transitional Residential District Overlay (TRD-O). Therefore, the LOS threshold for this intersection

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is LOS E. Lastly, the intersection of Catawba Avenue at Burton Lane is designated Neighborhood Mixed Use (NMX), but is also located within TRD-O. As such, the LOS threshold for this intersection is LOS E.

The LOS analysis was completed through the use of Synchro, version 9.1. The software package categorizes the LOS based on HCM methodology and criteria. Synchro is a macroscopic traffic analysis tool that performs the calculations outlined in the Highway Capacity Manual (HCM) for signalized and unsignalized intersection capacity analysis. The software was originally designed to be used with traditional intersection types and is limited in it's capability to analyze alternative intersections and interchanges such as the I-77 / Catawba Avenue DDI. For example, the preferred software programs for the analysis of roundabouts is either Sidra or Vissim as noted in the NCDOT Congestion Management *Capacity Analysis Guidelines*. As such, the simulation results generated by Synchro and SimTraffic may not accurately represent the actual conditions on site. However, the software is sufficient in assessing the impact of traffic generated by the proposed development has on traffic operations at the study intersections.

As requested by the NCDOT Congestion Management unit, the SimTraffic simulation results including the queuing and blocking reports are contained within Appendix F.

Signal plans and traffic signal timing were obtained from NCDOT and can be found in Appendix D.

Table 4 lists the LOS results from the Synchro capacity analysis for the 2016 Existing Traffic Conditions.

Table 4: Level of Service Analysis – 2016 Existing Traffic Conditions

LOCATION	2016 EXISTING TRAFFIC CONDITIONS	
	AM PEAK LOS (delay/veh)	PM PEAK LOS (delay/veh)
INTERSECTION 1 – I-77 Southbound On/Off Ramps at Catawba Avenue (SIGNALIZED)		
OVERALL	C (27.0)	D (36.3)
Eastbound	B (17.3)	C (24.2)
Westbound	D (43.2)	D (50.7)
INTERSECTION 2 – I-77 Northbound On/Off Ramps at Catawba Avenue (SIGNALIZED)		
OVERALL	C (20.1)	C (28.5)
Eastbound	C (22.1)	C (29.8)
Westbound	B (16.2)	C (26.5)
INTERSECTION 3 – Catawba Avenue at Statesville Road / Holiday Lane (SIGNALIZED)		
OVERALL	D (49.6)	D (49.2)
Eastbound	E (59.6)	E (58.6)
Westbound	C (28.8)	C (33.8)
Northbound	D (49.6)	D (46.6)
Southbound	E (60.4)	E (62.7)
INTERSECTION 4 – Catawba Avenue at Burton Lane / S. Hill Street (UNSIGNALIZED)		
Eastbound Left-Turn	A (8.9)	A (9.3)
Westbound Left-turn	A (9.3)	A (9.4)
Northbound Approach	D (29.5)	E (49.9)
Southbound Approach	D (29.4)	D (33.9)

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The results of this analysis indicate that all study area intersections and approaches operate below their mitigation threshold in both the AM and PM peak hours under 2016 existing traffic conditions.

An additional operational concern is queuing. Excessive queues can negatively impact operations at nearby intersections as well as cause safety concerns if the queues exceed the available storage of turn lanes. As such, the 95th percentile queues are reported for each traffic scenario. **Table 5** lists the 95th percentile queues from the Synchro capacity analysis for the 2016 Existing Traffic Conditions.

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Table 5: Synchro 95th Percentile Queue Analysis – 2016 Existing Traffic Conditions

LOCATION	2016 EXISTING TRAFFIC CONDITIONS		
	EXISTING STORAGE LENGTH (ft.)	AM PEAK 95th Percentile Queue (ft.)	PM PEAK 95th Percentile Queue (ft.)
INTERSECTION 1 – I-77 Southbound On/Off Ramps at Catawba Avenue (SIGNALIZED)			
Eastbound Thru	-	316	334
Westbound Thru	-	399	308
INTERSECTION 2 – I-77 Northbound On/Off Ramps at Catawba Avenue (SIGNALIZED)			
Eastbound Thru	-	303	508
Westbound Thru	-	181	259
INTERSECTION 3 – Catawba Avenue at Statesville Road / Holiday Lane (SIGNALIZED)			
Eastbound Left	100	12	78
Eastbound Thru	-	737	723
Eastbound Right	-	601	306
Westbound Left	100	80	75
Westbound Thru-Right	-	522	766
Northbound Left	150	**314**	**292**
Northbound Thru-Left	-	318	287
Northbound Right	150	68	86
Southbound Left	75	52	39
Southbound Thru-Right	-	102	110
INTERSECTION 4 – Catawba Avenue at Burton Lane / S. Hill Street (UNSIGNALIZED)			
Eastbound Left	50	0	0
Westbound Left	-	0	0
Northbound Approach	-	10	20
Southbound Approach	-	7.5	10

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The highlighted cells in the table above indicate storage lanes where the 95th percentile queues reported by Synchro exceed the existing storage length. The Synchro output pages are located in Appendix F.

2018 No-Build Analysis

The site is proposed to be completed by year 2018. Per the MOU and Town of Cornelius TIA Policy, existing traffic volumes were increased by two percent (2%) per year to reflect 2018 background traffic volumes. As such, the 2018 background traffic consists of 2016 existing traffic with the addition of the historic growth traffic. The LOS results from the 2018 No-Build Analysis are displayed in Table 6.

Table 6: Level of Service Analysis – 2018 No-Build Traffic Conditions

LOCATION	2018 NO-BUILD TRAFFIC CONDITIONS	
	AM PEAK LOS (delay/veh)	PM PEAK LOS (delay/veh)
INTERSECTION 1 – I-77 Southbound On/Off Ramps at Catawba Avenue (SIGNALIZED)		
OVERALL	C (27.7)	D (41.4)
Eastbound	B (18.7)	C (25.1)
Westbound	D (42.9)	**E (60.8)**
INTERSECTION 2 – I-77 Northbound On/Off Ramps at Catawba Avenue (SIGNALIZED)		
OVERALL	C (20.5)	C (28.9)
Eastbound	C (21.7)	C (29.7)
Westbound	B (18.0)	C (27.9)
INTERSECTION 3 – Catawba Avenue at Statesville Road / Holiday Lane (SIGNALIZED)		
OVERALL	D (52.9)	D (51.3)
Eastbound	E (65.4)	E (61.6)
Westbound	C (30.3)	D (36.1)
Northbound	D (50.5)	D (47.3)
Southbound	E (61.2)	E (63.4)
INTERSECTION 4 – Catawba Avenue at Burton Lane / S. Hill Street (UNSIGNALIZED)		
Eastbound Left-Turn	A (9.0)	A (9.4)
Westbound Left-turn	A (9.5)	A (9.5)
Northbound Approach	D (31.8)	**F (57.0)**
Southbound Approach	D (32.0)	E (37.0)

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The results of this analysis indicate that all overall intersections operate below their mitigation threshold in both the AM and PM peak hours under 2018 no-build traffic conditions. Two approaches are operating below their mitigation threshold. Specifically, the westbound approach of Catawba Avenue at the I-77 southbound on / off ramps in the PM peak hour and the northbound approach of S. Hill Street at Catawba Avenue in the PM peak hour.

An additional operational concern is queuing. Excessive queues can negatively impact operations at nearby intersections as well as cause safety concerns if the queues exceed the available storage of turn lane. As such, the 95th percentile queues are reported for the auxiliary storage lanes across each traffic scenario. Table 7 lists the 95th percentile queues from the Synchro capacity analysis for the 2018 No-Build Traffic Conditions.

The Synchro output pages are located in Appendix F.

Table 7: Synchro 95th Percentile Queue Analysis – 2018 No-Build Traffic Conditions

LOCATION	2018 NO-BUILD TRAFFIC CONDITIONS		
	EXISTING STORAGE LENGTH (ft.)	AM PEAK 95th Percentile Queue (ft.)	PM PEAK 95th Percentile Queue (ft.)
INTERSECTION 1 – I-77 Southbound On/Off Ramps at Catawba Avenue (SIGNALIZED)			
Eastbound Thru	-	343	352
Westbound Thru	-	413	321
INTERSECTION 2 – I-77 Northbound On/Off Ramps at Catawba Avenue (SIGNALIZED)			
Eastbound Thru	-	314	533
Westbound Thru	-	198	267
INTERSECTION 3 – Catawba Avenue at Statesville Road / Holiday Lane (SIGNALIZED)			
Eastbound Left	100	12	79
Eastbound Thru	-	787	766
Eastbound Right	-	624	329
Westbound Left	100	83	77
Westbound Thru-Right	-	559	818
Northbound Left	150	**329**	**298**
Northbound Thru-Left	-	332	307
Northbound Right	150	70	89
Southbound Left	75	52	41
Southbound Thru-Right	-	107	114
INTERSECTION 4 – Catawba Avenue at Burton Lane / S. Hill Street (UNSIGNALIZED)			
Eastbound Left	50	0	0
Westbound Left	-	0	0
Northbound Approach	-	10	25
Southbound Approach	-	7.5	10

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The highlighted cells in the table above indicate storage lanes where the 95th percentile queues reported by Synchro exceed the existing storage length. The Synchro output pages are located in Appendix F.

2018 Build Analysis

The total future build traffic volumes include both the site traffic and traffic volumes from the no-build analysis. The build analysis evaluates the traffic conditions before any improvements are implemented. Table 8 shows the LOS results for the intersections within the study area.

Table 8: Level of Service Analysis – 2018 Build Traffic Conditions

LOCATION	2018 BUILD TRAFFIC CONDITIONS	
	AM PEAK LOS (delay/veh)	PM PEAK LOS (delay/veh)
INTERSECTION 1 – I-77 Southbound On/Off Ramps at Catawba Avenue (SIGNALIZED)		
OVERALL	C (28.1)	D (43.1)
Eastbound	B (19.1)	C (25.3)
Westbound	D (43.2)	**E (64.2)**
INTERSECTION 2 – I-77 Northbound On/Off Ramps at Catawba Avenue (SIGNALIZED)		
OVERALL	C (20.3)	C (29.8)
Eastbound	C (21.6)	C (30.8)
Westbound	B (17.7)	C (28.5)
INTERSECTION 3 – Catawba Avenue at Statesville Road / Holiday Lane (SIGNALIZED)		
OVERALL	E (59.0)	E (58.3)
Eastbound	E (73.5)	E (62.7)
Westbound	D (37.4)	E (57.3)
Northbound	D (50.4)	D (47.5)
Southbound	E (69.2)	E (70.7)
INTERSECTION 4 – Catawba Avenue at Burton Lane / S. Hill Street (UNSIGNALIZED)		
Eastbound Left-turn	A (9.1)	A (9.5)
Westbound Left-turn	A (9.5)	A (9.5)
Northbound Approach	D (34.9)	**F (73.4)**
Southbound Approach	D (26.7)	E (37.2)
INTERSECTION 5 – Holiday Lane at Site Access #1 (UNSIGNALIZED)		
Westbound Approach	A (9.2)	A (9.5)
Southbound Left-turn	A (7.3)	A (7.5)
INTERSECTION 6 – Holiday Lane at Site Access #2 (UNSIGNALIZED)		
Westbound Approach	B (10.2)	B (10.9)
Southbound Left-turn	A (7.5)	A (7.7)
INTERSECTION 7 – Burton Lane at Site Access #3 (UNSIGNALIZED)		
Eastbound Approach	A (8.7)	A (8.7)
Northbound Left-turn	A (7.3)	A (7.3)

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The results of this analysis indicate that all overall intersections operate below their mitigation threshold in both the AM and PM peak hours under 2018 build traffic conditions. Two approaches are operating below their mitigation threshold. Specifically, the westbound approach of Catawba Avenue at the I-77 southbound on / off ramps in the PM peak hour and the northbound approach of S. Hill Street at Catawba Avenue in the PM peak hour. Both of these approaches were shown to be operating below their mitigation threshold during the PM peak hour under the 2018 no-build traffic conditions.

An additional operational concern is queuing. Excessive queues can negatively impact operations at nearby intersections as well as cause safety concerns if the queues exceed the available storage of turn lane. As such, the 95th percentile queues are

reported for the auxiliary storage lanes across each traffic scenario. Table 9 lists the 95th percentile queues from the Synchro capacity analysis for the 2018 Build Traffic Conditions.

Table 9: Synchro 95th Percentile Queue Analysis – 2018 Build Traffic Conditions

LOCATION	2018 BUILD TRAFFIC CONDITIONS		
	EXISTING STORAGE LENGTH (ft.)	AM PEAK 95th Percentile Queue (ft.)	PM PEAK 95th Percentile Queue (ft.)
INTERSECTION 1 – I-77 Southbound On/Off Ramps at Catawba Avenue (SIGNALIZED)			
Eastbound Thru	-	348	356
Westbound Thru	-	420	331
INTERSECTION 2 – I-77 Northbound On/Off Ramps at Catawba Avenue (SIGNALIZED)			
Eastbound Thru	-	318	553
Westbound Thru	-	213	265
INTERSECTION 3 – Catawba Avenue at Statesville Road / Holiday Lane (SIGNALIZED)			
Eastbound Left	100	31	155
Eastbound Thru	-	718	718
Eastbound Right	-	623	328
Westbound Left	100	83	77
Westbound Thru-Right	-	646	857
Northbound Left	150	**329**	**305**
Northbound Thru-Left	-	335	309
Northbound Right	150	70	89
Southbound Left	75	104	93
Southbound Thru-Right	-	172	204
INTERSECTION 4 – Catawba Avenue at Burton Lane / S. Hill Street (UNSIGNALIZED)			
Eastbound Left	50	0	2.5
Westbound Left	-	0	0
Northbound Approach	-	12.5	30
Southbound Approach	-	35	50
INTERSECTION 5 – Holiday Lane at Site Access #1 (UNSIGNALIZED)			
Westbound Approach	-	2.5	2.5
Southbound Approach	-	0	0
INTERSECTION 6 – Holiday Lane at Site Access #2 (UNSIGNALIZED)			
Westbound Approach	-	10	12.5
Southbound Approach	-	0	0
INTERSECTION 7 – Burton Lane at Site Access #3 (UNSIGNALIZED)			
Eastbound Approach	-	5	5
Northbound Approach	-	2.5	2.5

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The highlighted cells in the table above indicate storage lanes where the 95th percentile queues reported by Synchro exceed the existing storage length. The Synchro output pages are located in Appendix F.

2018 Build Improved Analysis

Geometric improvements such as the installation of turn–lanes are recommended and therefore analyzed in this scenario. The specific items are listed in the Recommendations section. The Warrant for Left and Right-Turn Lanes nomograph for at-grade unsignalized intersections contained within NCDOT's *Policy on Street and Driveway Access to North Carolina Highways* manual was reviewed against the traffic volumes at the site access points.

Table 10 shows the analysis results at the intersections within the study area with the recommended improvements. The specific geometric recommendations analyzed in this scenario are listed in the Recommendations section.

Table 10: Level of Service Analysis – 2018 Build-Improved Traffic Conditions

LOCATION	2018 BUILD-IMPROVED TRAFFIC CONDITIONS	
	AM PEAK LOS (delay/veh)	PM PEAK LOS (delay/veh)
INTERSECTION 3 – Catawba Avenue at Statesville Road / Holiday Lane (UNSIGNALIZED)		
Overall	C (34.9)	D (39.3)
Eastbound Approach	B (13.9)	C (20.7)
Westbound Approach	D (42.6)	D (47.7)
Northbound Approach	E (57.0)	E (57.7)
Southbound Approach	E (74.7)	E (72.8)
INTERSECTION 4 – Catawba Avenue at Burton Lane / S. Hill Street (UNSIGNALIZED)		
Eastbound Left	A (9.1)	A (9.5)
Westbound Left	A (9.5)	A (9.5)
Northbound Approach	D (34.9)	**F (73.4)**
Southbound Left-Turn	C (22.6)	D (28.6)

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The results of this analysis indicate that with the recommended improvements in place, all study area intersections and approaches operate below their mitigation threshold with two exceptions. The first being the northbound approach of S. Hill Street at Catawba Avenue. This is a single-lane approach under stop-control that the development is not contributing traffic to. As such, the increases in delay can be attributed to increases in traffic volume along Catawba Avenue. Additionally, the westbound approach of Catawba Avenue at the I-77 southbound on / off ramps operates at LOS E in the PM peak hour. This is not shown in the above table as no recommendations are provided for this intersection. The justification is twofold. First, the proposed development attributes less than two percent (2%) to the traffic volumes on the approach. Secondly, this approach is to the DDI crossover and the cost to construct an improvement at this location would not be commensurate with the impact the development is responsible for on the approach.

Table 11 lists the 95th percentile queues from the Synchro capacity analysis for the 2018 Build-Improved Traffic Conditions.

Table 11: Synchro 95th Percentile Queue Analysis – 2018 Build-Improved Traffic Conditions

LOCATION	2018 BUILD-IMPROVED TRAFFIC CONDITIONS		
	EXISTING STORAGE LENGTH (ft.)	AM PEAK 95th Percentile Queue (ft.)	PM PEAK 95th Percentile Queue (ft.)
INTERSECTION 3 – Catawba Avenue at Statesville Road / Holiday Lane (UNSIGNALIZED)			
Eastbound Left	100	**115**	**212**
Eastbound Thru	-	86	105
Eastbound Right	-	38	56
Westbound Left	100	**192**	**173**
Westbound Thru-Right	-	531	733
Northbound Dual-Lefts	150 / continuous (proposed)	**314**	**285**
Northbound Thru-Right	150 (proposed)	**156**	**214**
Southbound Left	200 (proposed)	113	94
Southbound Thru-Right	-	172	193
INTERSECTION 4 – Catawba Avenue at Burton Lane / S. Hill Street (UNSIGNALIZED)			
Eastbound Left	50	0	2.5
Westbound Left	-	0	0
Northbound Approach	-	12.5	30
Southbound Left-Turn	75 (proposed)	12.5	20
Southbound Thru-Right	-	15	20

Synchro output pages can be found in Appendix F.

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CONCLUSIONS – 2018 HORIZON YEAR

The proposed QT development is located along Catawba Avenue in Cornelius, Mecklenburg County, North Carolina. The proposed development is envisioned to be built-out by 2018.

The proposed site will be a 5,773 SF convenience store with 20 fueling positions. As the development will be replacing an existing gas station and restaurant, the net new external trips generated by the redevelopment of the site are calculated to be 122 trips (61 in, 61 out) in the AM peak hour and 130 trips (65 in, 65 out) in the PM peak hour.

Access to the site is proposed to be provided by three (3) full-movement driveways. There are two (2) proposed driveways on Holiday Lane. The first driveway is approximately 275 feet from the intersection with Catawba Avenue. The second is approximately 400 feet from the intersection of Catawba Avenue. There is one (1) proposed driveway on Burton Lane, which is approximately 100 feet from the intersection with Catawba Avenue.

The results of the multiple analyses presented here in indicate that the proposed development contributes minimal delay to the study area intersections as a whole. Operational impacts related to the redevelopment of the site are most apparent within close proximity to the proposed development on Holiday Lane and Burton Lane approaches to Catawba Avenue. At the I-77 interchange, traffic volumes generated by the proposed development account for less two percent (2%) of traffic on any given approach during either the AM or PM peak hour. As such, the recommended improvements are isolated to the intersections within close proximity to the site.

Holiday Lane is currently wide enough to provide two (2) southbound lanes as well as one (1) northbound lane extending from Catawba Avenue to Site Access #2. It is recommended to restripe this area to better delineate the storage at the intersection with Catawba Avenue. This paired with restriping the northbound approach of Statesville Road and modifying the traffic signal to remove the current split-phasing will increase the efficiency of the intersection under the 2018 build traffic volumes to mitigate the impact of the proposed development at this intersection.

The potential exists for left-turn conflicts to occur between southbound left-turns into Site Access #2 and northbound left-turns in the Days Inn access which is located between Site Accesses #1 and 2. Possible mitigation measures for these two conditions are as follows:

- Consolidate Site Accesses #1 and 2 into one access point directly across from the Days Inn access; and
- Modify Site Access #2 to allow right-in traffic only.

The specific recommendations at each study intersection are discussed in the Recommendations – 2018 Horizon Year section.

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RECOMMENDATIONS – 2018 HORIZON YEAR

Based on the findings of this study, specific improvements have been identified and should be completed as part of the proposed development. The NCDOT *Policy on Street and Driveway Access to North Carolina Highways* manual was consulted to determine the appropriate storage for the recommended auxiliary lanes if warranted. The nomograph used for the auxiliary lanes at the site access points is included in Appendix G. It should be noted that the northbound right-turn volume on Holiday Lane at Site Access #2 warrants a northbound right-turn lane according to the nomograph. However, a turn-lane is not recommended at this time due to a low volume of northbound thru traffic at the intersection. Similarly, the northbound left-turn volume on Burton Lane into Site Access #3 may warrant a storage lane. However, this is not recommended due to a low volume of conflicting vehicles.

I-77 Southbound On/Off Ramps at Catawba Avenue

There are no recommended improvements at this intersection.

I-77 Northbound On/Off Ramps at Catawba Avenue

There are no recommended improvements at this intersection.

Catawba Avenue at US 21 (Statesville Road) / Holiday Lane

- Restripe the northbound approach to provide dual northbound left-turn lanes and a shared thru/right-turn lane with 150 feet of full-width storage and appropriate taper on Statesville Road.
- Restripe the southbound approach to provide a 200 feet of full width storage and appropriate taper on Holiday Lane.
- The above recommendations will require the redesign and retiming of the traffic signal at the intersection.

Catawba Avenue at Burton Lane / S. Hill Street

- Construct a left-turn lane with full-width storage that extends from the intersection of Catawba Avenue to Site Access #3 and appropriate taper on southbound Burton Lane.

Holiday Lane at Site Access #1

- Construct Site Access #1 as a full-movement access point.
- Construct Site Access #1 with one ingress and one egress lane.

Holiday Lane at Site Access #2

- Construct Site Access #2 as a full-movement access point.
- Construct Site Access #2 with one ingress and one egress lane.

Burton Lane at Site Access #3

- Construct Site Access #3 as a full-movement access point.
- Construct Site Access #3 with one ingress and one egress lane.

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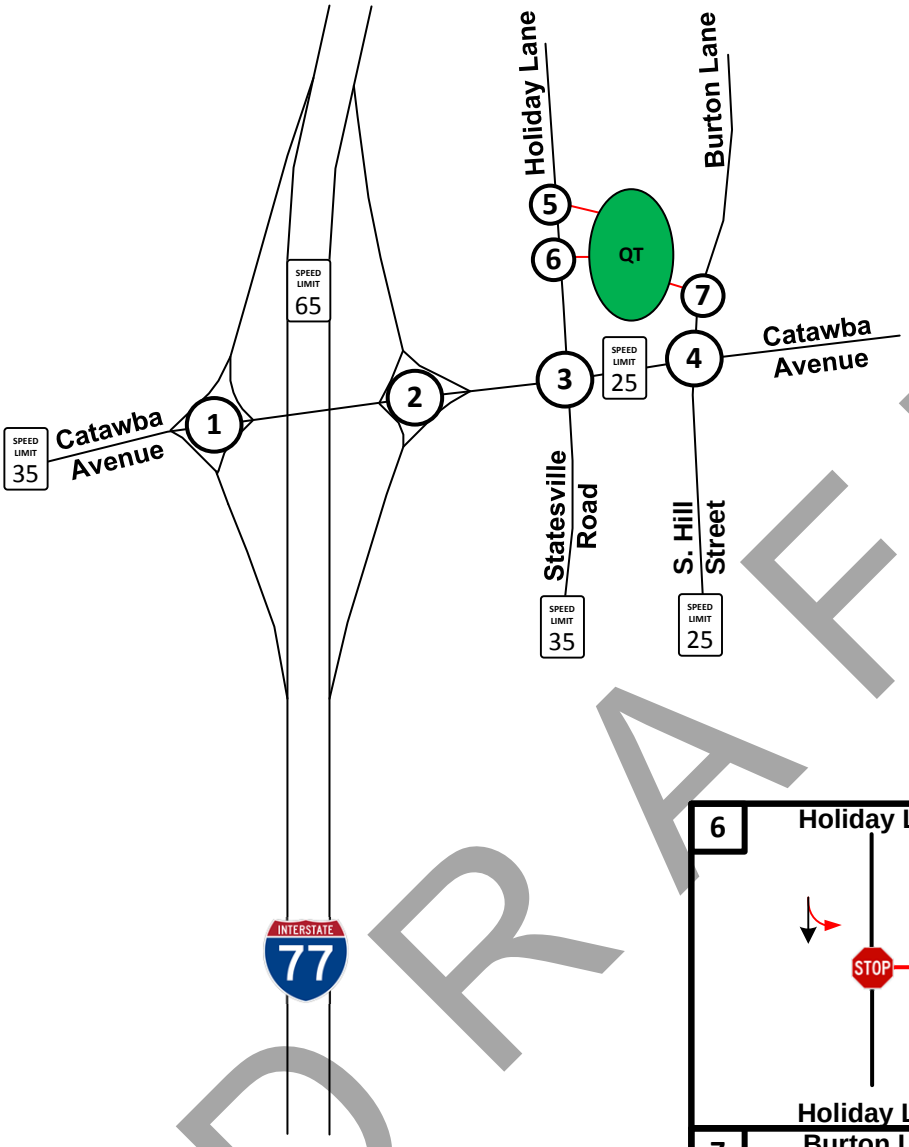

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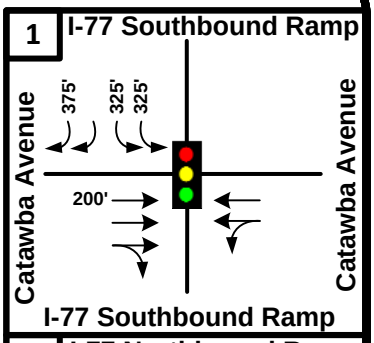

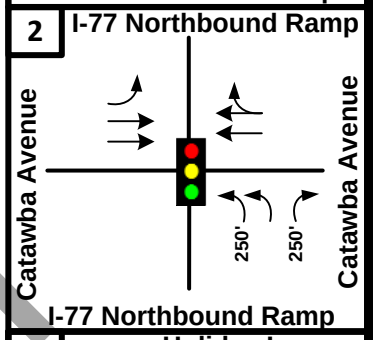

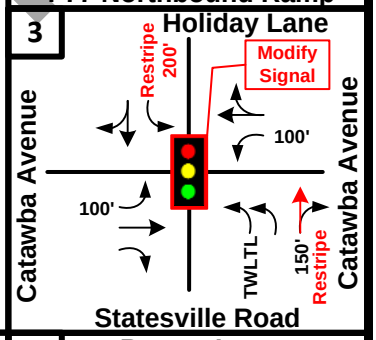

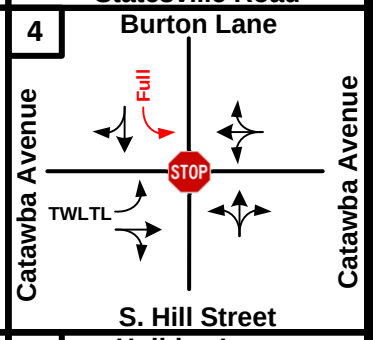

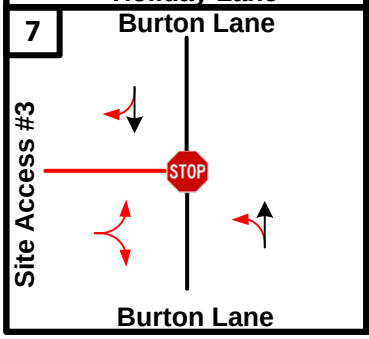

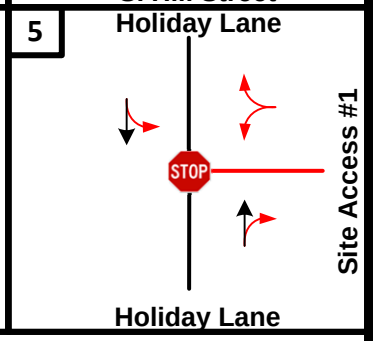

LEGEND

- Existing Traffic Control
- Proposed Traffic Control
- Existing Roadway
- Recommended Access
- Existing Laneage
- Recommended Laneage
- XXX' Storage Bay Length
- XXX' Recommended Storage Bay Length
- SPEED LIMIT XX Existing Posted Speed

N

NOT TO SCALE

Cornelius QT
Traffic Impact Study

2018 Recommended Improvements

DATE: January 2017

Figure 14

PROJECT TRAFFIC VOLUMES – 2023 HORIZON YEAR

According to the Town of Cornelius' Land Development Code, developments must be analyzed five (5) years after the development is completed. As the QT development is currently envisioned to be completed in 2018, the following capacity analyses focus on the traffic conditions and analysis projected for 2023.

Historical Growth Traffic (2023 Background Traffic)

Historical growth traffic is the increase in existing traffic volumes due to general usage increases and non-specific growth throughout the area. As specified by Town staff, existing traffic volumes were increased by two percent (2%) per year to reflect background traffic at five (5) years beyond the buildout year in which construction of the development will be completed. The historical growth traffic volumes for the 2023 horizon year are shown in Figure 15.

2023 No-Build Traffic Volumes

The historical growth traffic volumes were then added to the existing volumes to determine the 2023 no-build traffic volumes. The 2023 no-build traffic volumes are shown in Figure 16.

Proposed Development Traffic

The proposed development traffic was calculated and assigned to the adjacent roadway network as discussed previously. This includes the site trips, the pass-by trips and the driveway adjustment traffic volumes. The trip distribution and assignment can be found on Figures 7 and 8; respectively. The pass-by trip distribution and assignment can be found on Figures 9 and 10; respectively. Lastly, the driveway adjustment trip distribution and assignment can be found on Figures 11 and 12; respectively. The traffic calculations are shown in Appendix C.

2023 Build-Out Traffic Volumes

The 2023 build-out traffic volumes include the 2023 no-build traffic and the proposed development traffic. The AM and PM peak-hour 2023 Build Traffic Volumes are shown in Figure 17.

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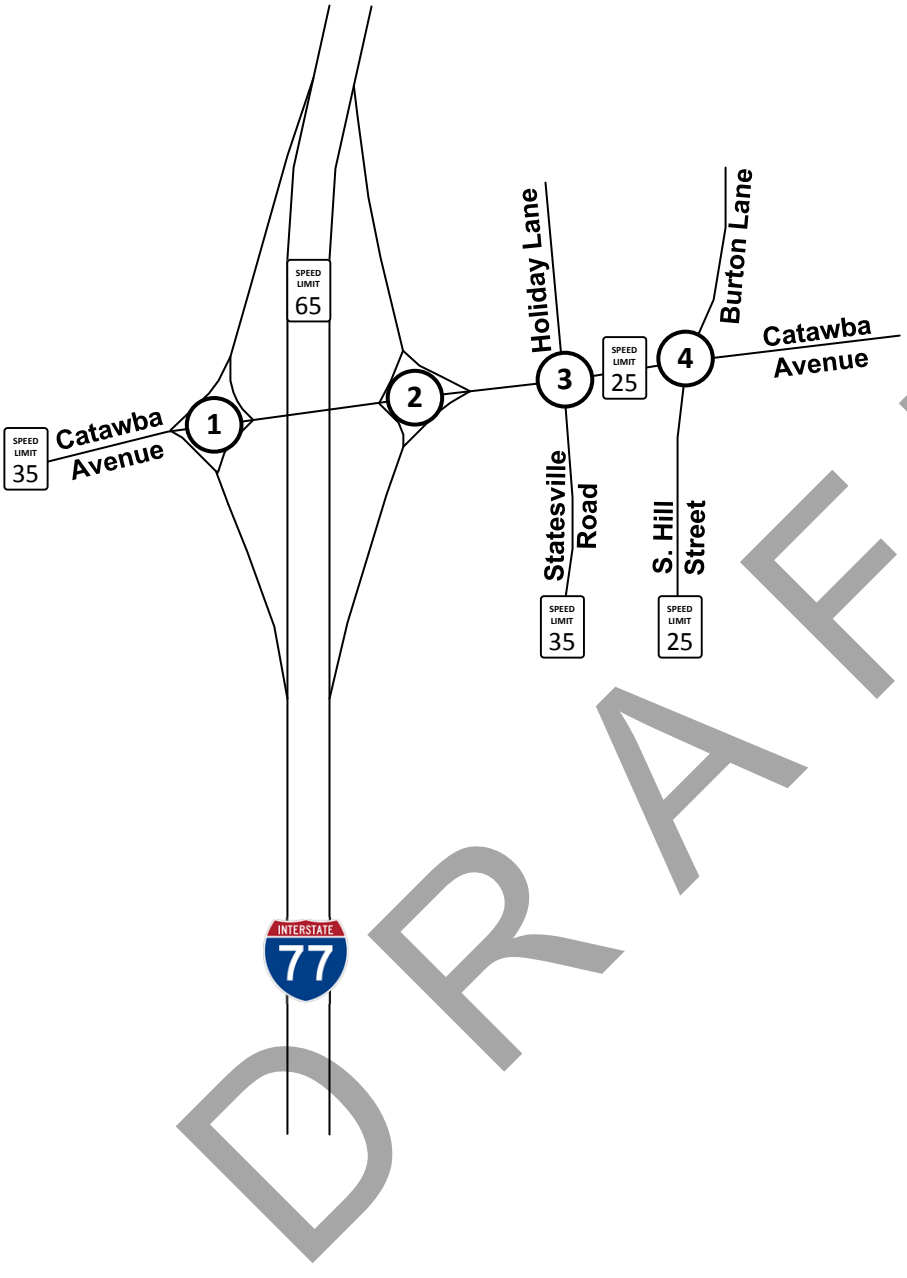

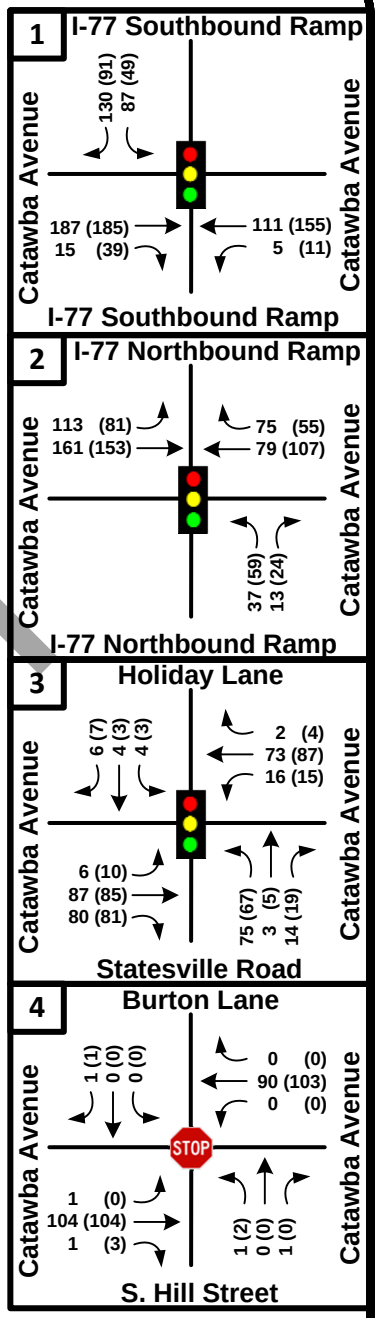

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LEGEND

- Existing Traffic Control
- Existing Roadway
- XX (XX) AM (PM) Peak Hour Volumes
- SPEED LIMIT XX Existing Posted Speed

N

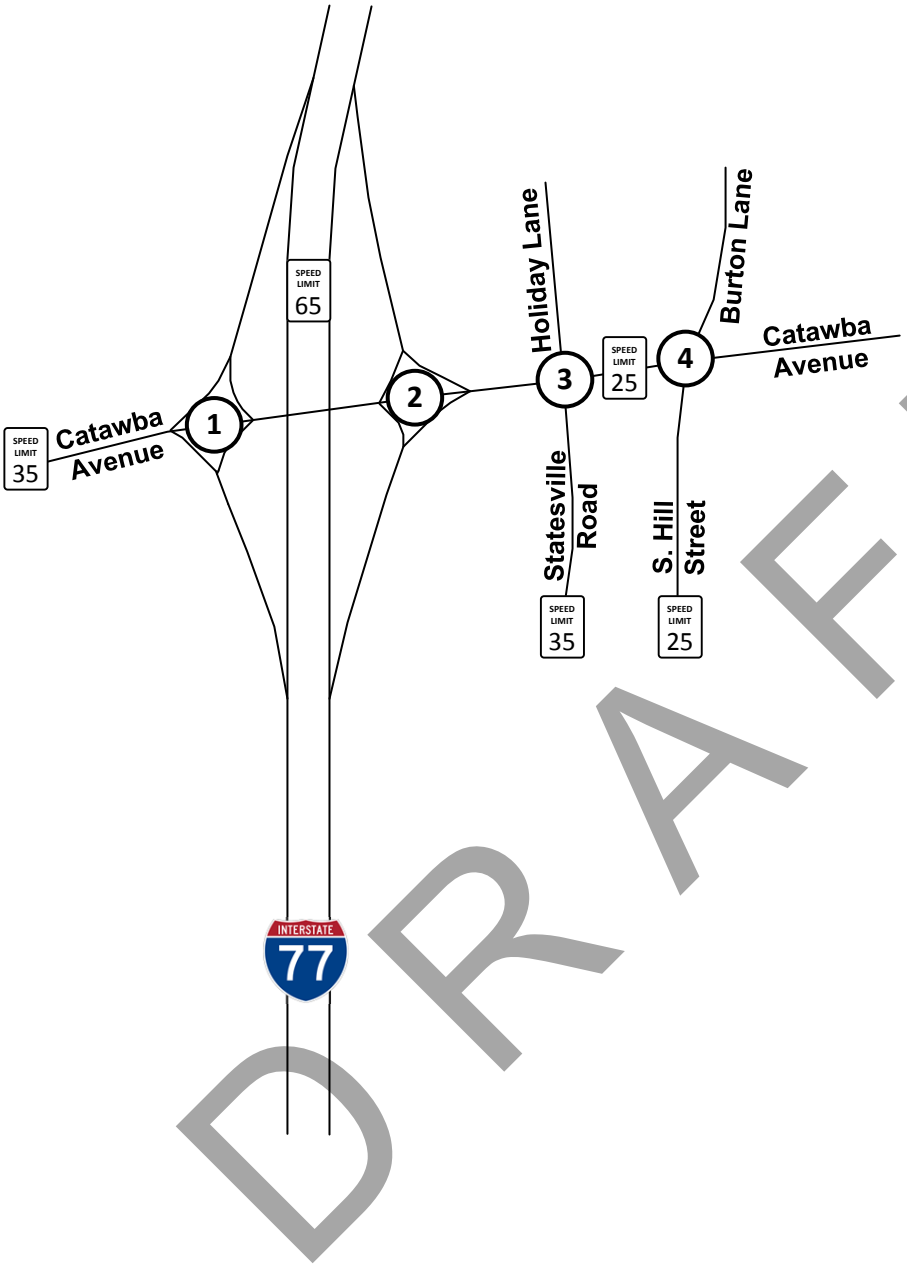
NOT TO SCALE

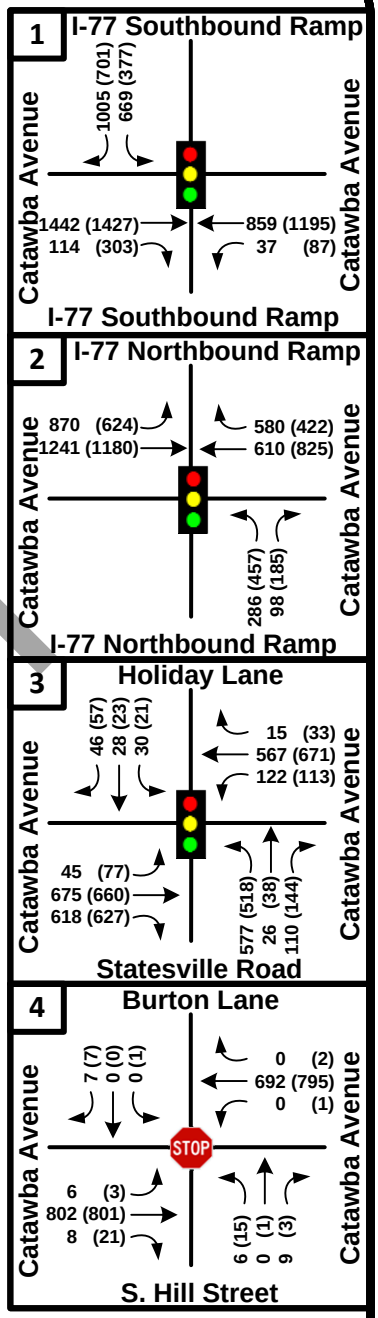
Cornelius QT
Traffic Impact Study

2023 Historical Growth

DATE: January 2017

Figure 15





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LEGEND

- Existing Traffic Control
- Existing Roadway
- XX (XX) AM (PM) Peak Hour Volumes
- SPEED LIMIT XX Existing Posted Speed

N

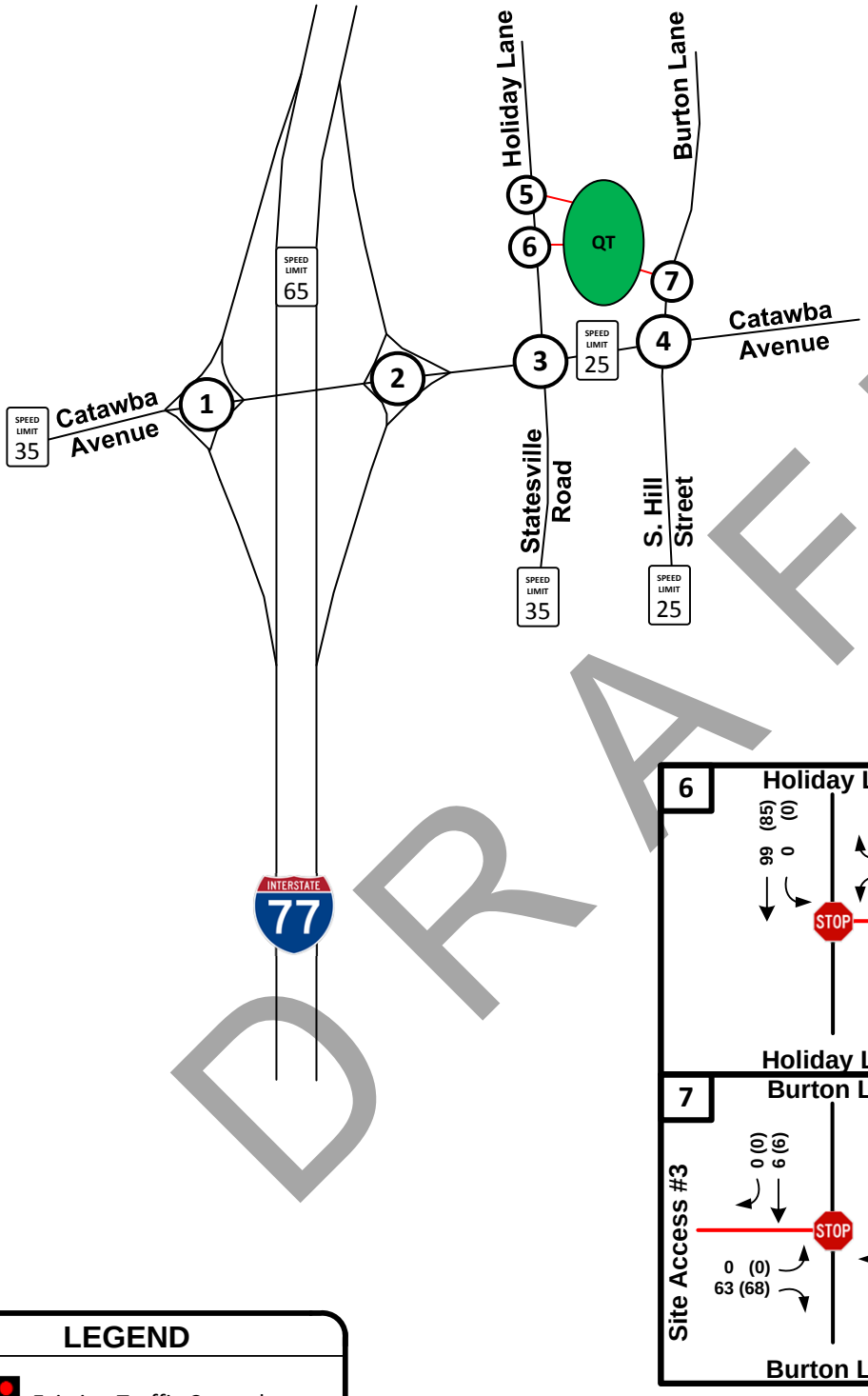
NOT TO SCALE

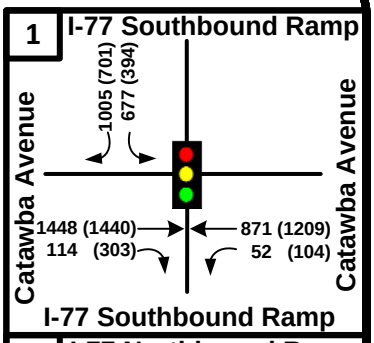
Cornelius QT
Traffic Impact Study

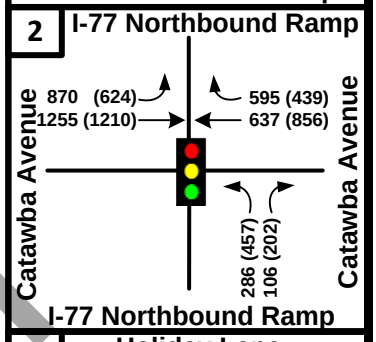
2023 No-Build Traffic Volumes

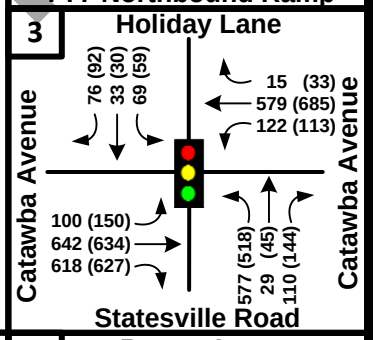
DATE: January 2017

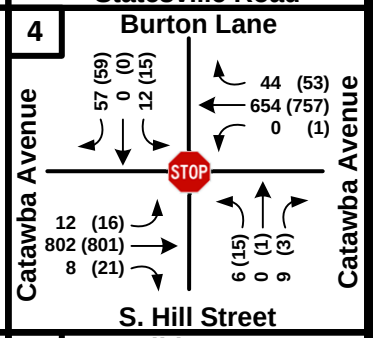
Figure 16

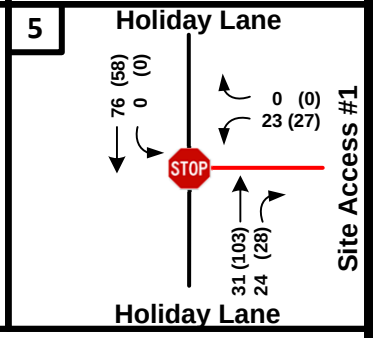












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LEGEND

- STOP — Existing Traffic Control
- Existing Roadway
- XX (XX) — AM (PM) Peak Hour Volumes
- SPEED LIMIT XX — Existing Posted Speed

N

NOT TO SCALE

Cornelius QT
Traffic Impact Study

2023 Build Traffic Volumes

DATE: January 2017

Figure 17

CAPACITY ANALYSIS – 2023 HORIZON YEAR

2023 No-Build Analysis

According to the Town of Cornelius' Land Development Code, developments must be analyzed five (5) years after the development is completed. As the QT development is currently envisioned to be completed in 2018, the following capacity analyses focus on the traffic conditions and analysis projected for 2023. Per the MOU and Town of Cornelius TIA Policy, existing traffic volumes were increased by two percent (2%) per year to reflect 2023 background traffic volumes. As such, the 2023 background traffic consists of 2016 existing traffic with the addition of the historic growth traffic.

The LOS analysis was completed through the use of Synchro, version 9.1. The software package categorizes the LOS based on HCM methodology and criteria. Synchro is a macroscopic traffic analysis tool that performs the calculations outlined in the Highway Capacity Manual (HCM) for signalized and unsignalized intersection capacity analysis. The software was originally designed to be used with traditional intersection types and is limited in it's capability to analyze alternative intersections and interchanges such as the I-77 / Catawba Avenue DDI. For example, the preferred software programs for the analysis of roundabouts is either Sidra or Vissim as noted in the NCDOT Congestion Management *Capacity Analysis Guidelines*. As such, the simulation results generated by Synchro and SimTraffic may not accurately represent the actual conditions on site. However, the software is sufficient in assessing the impact of traffic generated by the proposed development has on traffic operations at the study intersections.

For simplicity of reporting, the approach and overall delays for the DDI intersections are shown for the crossover intersection only. The individual movement and ramp delays / LOS can be found in Appendix F.

As requested by the NCDOT Congestion Management unit, the SimTraffic simulation results including the queuing and blocking reports are contained within Appendix F.

Signal plans and traffic signal timing were obtained from NCDOT and can be found in Appendix D.

The LOS results from the 2023 No-Build Analysis are displayed in Table 12. Synchro output pages can be found in Appendix F.

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Table 12: Level of Service Analysis – 2023 No-Build Traffic Conditions

LOCATION	2023 NO-BUILD TRAFFIC CONDITIONS	
	AM PEAK LOS (delay/veh)	PM PEAK LOS (delay/veh)
INTERSECTION 1 – I-77 Southbound On/Off Ramps at Catawba Avenue (SIGNALIZED)		
OVERALL	C (29.8)	D (50.4)
Eastbound	C (22.2)	C (27.3)
Westbound	D (42.7)	**E (77.9)**
INTERSECTION 2 – I-77 Northbound On/Off Ramps at Catawba Avenue (SIGNALIZED)		
OVERALL	C (21.3)	C (32.7)
Eastbound	C (21.2)	C (34.5)
Westbound	C (21.4)	C (30.2)
INTERSECTION 3 – Catawba Avenue at Statesville Road / Holiday Lane (SIGNALIZED)		
OVERALL	E (61.9)	E (58.8)
Eastbound	**F (80.5)**	E (66.5)
Westbound	D (36.5)	D (54.1)
Northbound	D (52.1)	D (48.1)
Southbound	E (62.6)	E (65.6)
INTERSECTION 4 – Catawba Avenue at Burton Lane / S. Hill Street (UNSIGNALIZED)		
Eastbound Left-Turn	A (9.3)	A (9.7)
Westbound Left-turn	A (9.8)	A (9.9)
Northbound Approach	E (41.3)	**F (85.1)**
Southbound Approach	E (38.5)	E (45.6)

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The results of this analysis indicate that all study intersections and approaches operate at an acceptable LOS with three exceptions. Specifically, the westbound approach of Catawba Avenue at the I-77 southbound on / off ramps in the PM peak hour, the eastbound approach of Catawba Avenue at Statesville Road / Holiday Lane in the AM peak hour and the northbound approach of S. Hill Street at Catawba Avenue.

An additional operational concern is queuing. Excessive queues can negatively impact operations at nearby intersections as well as cause safety concerns if the queues exceed the available storage of turn lanes. As such, the 95th percentile queues are reported for each traffic scenario. Table 13 lists the 95th percentile queues from the Synchro capacity analysis for the 2023 no-build traffic conditions.

Table 13: Synchro 95th Percentile Queue Analysis – 2023 No-Build Traffic Conditions

LOCATION	2023 NO-BUILD TRAFFIC CONDITIONS		
	EXISTING STORAGE LENGTH (ft.)	AM PEAK 95th Percentile Queue (ft.)	PM PEAK 95th Percentile Queue (ft.)
INTERSECTION 1 – I-77 Southbound On/Off Ramps at Catawba Avenue (SIGNALIZED)			
Eastbound Thru	-	408	402
Westbound Thru	-	391	403
INTERSECTION 2 – I-77 Northbound On/Off Ramps at Catawba Avenue (SIGNALIZED)			
Eastbound Thru	-	349	604
Westbound Thru	-	232	277
INTERSECTION 3 – Catawba Avenue at Statesville Road / Holiday Lane (SIGNALIZED)			
Eastbound Left	150	11	76
Eastbound Thru	-	905	887
Eastbound Right	150	**682**	**384**
Westbound Left	100	**124**	**115**
Westbound Thru-Right	-	690	952
Northbound Left	150	**373**	**333**
Northbound Thru-Left	-	381	342
Northbound Right	150	76	98
Southbound Left	75	57	43
Southbound Thru-Right	-	115	123
INTERSECTION 4 – Catawba Avenue at Burton Lane / S. Hill Street (UNSIGNALIZED)			
Eastbound Approach	-	0	0
Westbound Approach	-	0	0
Northbound Approach	-	15	35
Southbound Approach	-	12.5	12.5

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2023 Build Analysis

The total future build traffic volumes include both the site traffic and the traffic volumes from the no-build analysis. The build analysis evaluates the traffic conditions before any improvements are implemented in response to traffic generated by the proposed development. Table 14 shows the LOS results for the intersections within the study area. Synchro output pages can be found in Appendix F.

Table 14: Level of Service Analysis – 2023 Build Traffic Conditions

LOCATION	2023 BUILD TRAFFIC CONDITIONS	
	AM PEAK LOS (delay/veh)	PM PEAK LOS (delay/veh)
INTERSECTION 1 – I-77 Southbound On/Off Ramps at Catawba Avenue (SIGNALIZED)		
OVERALL	C (30.2)	D (51.0)
Eastbound	C (22.5)	C (27.5)
Westbound	D (43.0)	**E (79.0)**
INTERSECTION 2 – I-77 Northbound On/Off Ramps at Catawba Avenue (SIGNALIZED)		
OVERALL	C (21.1)	D (35.3)
Eastbound	C (21.2)	D (38.0)
Westbound	C (20.8)	C (31.6)
INTERSECTION 3 – Catawba Avenue at Statesville Road / Holiday Lane (SIGNALIZED)		
OVERALL	E (65.5)	E (68.7)
Eastbound	**F (81.0)**	E (65.3)
Westbound	D (47.7)	**F (90.3)**
Northbound	D (52.1)	D (48.6)
Southbound	E (72.4)	E (75.3)
INTERSECTION 4 – Catawba Avenue at Burton Lane / S. Hill Street (UNSIGNALIZED)		
Eastbound Left-Turn	A (9.4)	A (9.9)
Westbound Left-turn	A (9.8)	A (9.9)
Northbound Approach	E (46.7)	**F (117.9)**
Southbound Approach	D (33.8)	**F (53.1)**
INTERSECTION 5 – Holiday Lane at Site Access #1 (UNSIGNALIZED)		
Westbound Approach	A (9.3)	A (9.7)
Southbound Left-Turn	A (7.3)	A (7.5)
INTERSECTION 6 – Holiday Lane at Site Access #2 (UNSIGNALIZED)		
Westbound Approach	B (10.4)	B (11.2)
Southbound Left-Turn	A (7.5)	A (7.8)
INTERSECTION 7 – Burton Lane at Site Access #3 (UNSIGNALIZED)		
Eastbound Approach	A (8.7)	A (8.7)
Northbound Left-Turn	A (7.3)	A (7.3)

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The results of this analysis indicate that all study intersections and approaches operate at an acceptable LOS with five exceptions:

- Westbound approach of Catawba Avenue at the I-77 southbound on / off ramps in the PM peak hour;
- Eastbound approach of Catawba Avenue at Statesville Road / Holiday Lane in the AM peak hour;
- Westbound approach of Catawba Avenue at Statesville Road / Holiday Lane in the PM peak hour;
- Northbound approach of S. Hill Street at Catawba Avenue in the PM peak hour; and
- The southbound approach of Burton Lane at Catawba Avenue.

An additional operational concern is queuing. Excessive queues can negatively impact operations at nearby intersections as well as cause safety concerns if the queues exceed the available storage of turn lanes. As such, the 95th percentile queues are reported for each traffic scenario. Table 15 lists the 95th percentile queues from the Synchro capacity analysis for the 2023 build traffic conditions.

Table 15: Synchro 95th Percentile Queue Analysis – 2023 Build Traffic Conditions

LOCATION	2023 BUILD TRAFFIC CONDITIONS		
	EXISTING STORAGE LENGTH (ft.)	AM PEAK 95th Percentile Queue (ft.)	PM PEAK 95th Percentile Queue (ft.)
INTERSECTION 1 – I-77 Southbound On/Off Ramps at Catawba Avenue (SIGNALIZED)			
Eastbound Thru	-	410	407
Westbound Thru	-	458	433
INTERSECTION 2 – I-77 Northbound On/Off Ramps at Catawba Avenue (SIGNALIZED)			
Eastbound Thru	-	353	624
Westbound Thru	-	235	273
INTERSECTION 3 – Catawba Avenue at Statesville Road / Holiday Lane (SIGNALIZED)			
Eastbound Left	150	40	150
Eastbound Thru	-	843	839
Eastbound Right	150	**681**	**368**
Westbound Left	100	**122**	**109**
Westbound Thru-Right	-	747	984
Northbound Left	150	**373**	**341**
Northbound Thru-Left	-	394	345
Northbound Right	150	76	98
Southbound Left	75	**108**	**95**
Southbound Thru-Right	-	188	218
INTERSECTION 4 – Catawba Avenue at Burton Lane / S. Hill Street (UNSIGNALIZED)			
Eastbound Approach	-	0	2.5
Westbound Approach	-	0	0
Northbound Approach	-	17.5	45
Southbound Approach	-	45	70
INTERSECTION 5 – Holiday Lane at Site Access #1 (UNSIGNALIZED)			
Westbound Approach	-	2.5	2.5
Southbound Left-Turn	-	0	0
INTERSECTION 6 – Holiday Lane at Site Access #2 (UNSIGNALIZED)			
Westbound Approach	-	10	15
Southbound Left-Turn	-	0	0
INTERSECTION 7 – Burton Lane at Site Access #3 (UNSIGNALIZED)			
Eastbound Approach	-	5	5
Northbound Left-Turn	-	2.5	2.5

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2023 Build-Improved Analysis

Geometric improvements such as the installation of turn–lanes are recommended and therefore analyzed in this scenario. The specific items are listed in the Recommendations section. The Warrant for Left and Right-Turn Lanes nomograph for at-grade unsignalized intersections contained within NCDOT's *Policy on Street and Driveway Access to North Carolina Highways* manual was reviewed against the traffic volumes at the site access points.

Table 16: Level of Service Analysis – 2023 Build-Improved Traffic Conditions

LOCATION	2023 BUILD-IMPROVED TRAFFIC CONDITIONS	
	AM PEAK LOS (delay/veh)	PM PEAK LOS (delay/veh)
INTERSECTION 3 – Catawba Avenue at Statesville Road / Holiday Lane (UNSIGNALIZED)		
Overall	D (40.1)	D (46.4)
Eastbound Approach	B (17.1)	C (23.9)
Westbound Approach	D (48.5)	E (66.6)
Northbound Approach	E (66.0)	E (60.5)
Southbound Approach	E (78.0)	E (74.4)
INTERSECTION 4 – Catawba Avenue at Burton Lane / S. Hill Street (UNSIGNALIZED)		
Eastbound Left-Turn	A (9.4)	A (9.9)
Westbound Left-Turn	A (9.8)	A (9.9)
Northbound Approach	E (46.7)	**F (117.9)**
Southbound Approach	D (27.0)	E (36.3)

The results of this analysis indicate that with the recommended improvements in place, all study area intersections and approaches operate below their mitigation threshold with two exceptions. The first being the northbound approach of S. Hill Street at Catawba Avenue. This is a single-lane approach under stop-control that the development is not contributing traffic to. As such, the increases in delay can be attributed to increases in traffic volume along Catawba Avenue. Additionally, the westbound approach of Catawba Avenue at the I-77 southbound on / off ramps operates at LOS E in the PM peak hour. This is not shown in the above table as no recommendations are provided for this intersection. The justification is twofold. First, the proposed development attributes less than two percent (2%) to the traffic volumes on the approach. Secondly, this approach is to the DDI crossover and the cost to construct an improvement at this location would not be commensurate with the impact the development is responsible for on the approach.

Table 17 lists the 95th percentile queues from the Synchro capacity analysis for the 2023 build-improved traffic conditions.

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Table 17: Synchro 95th Percentile Queue Analysis – 2023 Build-Improved Traffic Conditions

LOCATION	2023 BUILD-IMPROVED TRAFFIC CONDITIONS		
	EXISTING STORAGE LENGTH (ft.)	AM PEAK 95th Percentile Queue (ft.)	PM PEAK 95th Percentile Queue (ft.)
INTERSECTION 3 – Catawba Avenue at Statesville Road / Holiday Lane (UNSIGNALIZED)			
Eastbound Left	100	**110**	**201**
Eastbound Thru	-	694	292
Eastbound Right	-	82	88
Westbound Left	100	**220**	**211**
Westbound Thru-Right	-	614	873
Northbound Left	150 / continuous (proposed)	**368**	**323**
Northbound Thru-Right	150 (proposed)	**170**	**239**
Southbound Left	200 (proposed)	121	95
Southbound Thru-Right	-	188	208
INTERSECTION 4 – Catawba Avenue at Burton Lane / S. Hill Street (UNSIGNALIZED)			
Eastbound Left	50	0	2.5
Westbound Left	-	0	0
Northbound Left-Thru-Right	-	17.5	45
Southbound Left	75 (proposed)	17.5	27.5
Southbound Thru-Right	-	17.5	25

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CONCLUSIONS – 2023 HORIZON YEAR

The proposed QT development is located along Catawba Avenue in Cornelius, Mecklenburg County, North Carolina. The proposed development is envisioned to be built-out by 2018.

The proposed site will be a 5,773 SF convenience store with 20 fueling positions. As the development will be replacing an existing gas station and restaurant, the net new external trips generated by the redevelopment of the site are calculated to be 122 trips (61 in, 61 out) in the AM peak hour and 130 trips (65 in, 65 out) in the PM peak hour.

Access to the site is proposed to be provided by three (3) full-movement driveways. There are two (2) proposed driveways on Holiday Lane. The first driveway is approximately 275 feet from the intersection with Catawba Avenue. The second is approximately 400 feet from the intersection of Catawba Avenue. There is one (1) proposed driveway on Burton Lane, which is approximately 100 feet from the intersection with Catawba Avenue.

The results of the multiple analyses presented here in indicate that the proposed development contributes minimal delay to the study area intersections as a whole. Operational impacts related to the redevelopment of the site are most apparent within close proximity to the proposed development on Holiday Lane and Burton Lane approaches to Catawba Avenue. At the I-77 interchange, traffic volumes generated by the proposed development account for less two percent (2%) of traffic on any given approach during either the AM or PM peak hour. As such, the recommended improvements are isolated to the intersections within close proximity to the site.

Holiday Lane is currently wide enough to provide two (2) southbound lanes as well as one (1) northbound lane extending from Catawba Avenue to Site Access #2. It is recommended to restripe this area to better delineate the storage at the intersection with Catawba Avenue. This paired with restriping the northbound approach of Statesville Road and modifying the traffic signal to remove the current split-phasing will increase the efficiency of the intersection under the 2023 build traffic volumes to mitigate the impact of the proposed development at this intersection.

The potential exists for left-turn conflicts to occur between southbound left-turns into Site Access #2 and northbound left-turns in the Days Inn access which is located between Site Accesses #1 and 2. Possible mitigation measures for these two conditions are as follows:

- Consolidate Site Accesses #1 and 2 into one access point directly across from the Days Inn access; and
- Modify Site Access #2 to allow right-in traffic only.

The specific recommendations at each study intersection are discussed in the Recommendations – 2023 Horizon Year section.

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RECOMMENDATIONS – 2023 HORIZON YEAR

Based on the findings of this study, specific improvements have been identified and should be completed as part of the proposed development. The NCDOT *Policy on Street and Driveway Access to North Carolina Highways* manual was consulted to determine the appropriate storage for the recommended auxiliary lanes if warranted. The nomograph used for the auxiliary lanes at the site access points is included in Appendix G. It should be noted that the northbound right-turn volume on Holiday Lane at Site Access #2 warrants a northbound right-turn lane according to the nomograph. However, a turn-lane is not recommended at this time due to a low volume of northbound thru traffic at the intersection. Similarly, the northbound left-turn volume on Burton Lane into Site Access #3 may warrant a storage lane. However, this is not recommended due to a low volume of conflicting vehicles.

I-77 Southbound On/Off Ramps at Catawba Avenue

There are no recommended improvements at this intersection.

I-77 Northbound On/Off Ramps at Catawba Avenue

There are no recommended improvements at this intersection.

Catawba Avenue at US 21 (Statesville Road) / Holiday Lane

- Restripe the northbound approach to provide dual northbound left-turn lanes and a shared thru/right-turn lane with 150 feet of full-width storage and appropriate taper on Statesville Road.
- Restripe the southbound approach to provide a 200 feet of full width storage and appropriate taper on Holiday Lane.
- The above recommendations will require the redesign and retiming of the traffic signal at the intersection.

Catawba Avenue at Burton Lane / S. Hill Street

- Construct a left-turn lane with full-width storage that extends from the intersection of Catawba Avenue to Site Access #3 and appropriate taper on southbound Burton Lane.

Holiday Lane at Site Access #1

- Construct Site Access #1 as a full-movement access point.
- Construct Site Access #1 with one ingress and one egress lane.

Holiday Lane at Site Access #2

- Construct Site Access #2 as a full-movement access point.
- Construct Site Access #2 with one ingress and one egress lane.

Burton Lane at Site Access #3

- Construct Site Access #3 as a full-movement access point.
- Construct Site Access #3 with one ingress and one egress lane.

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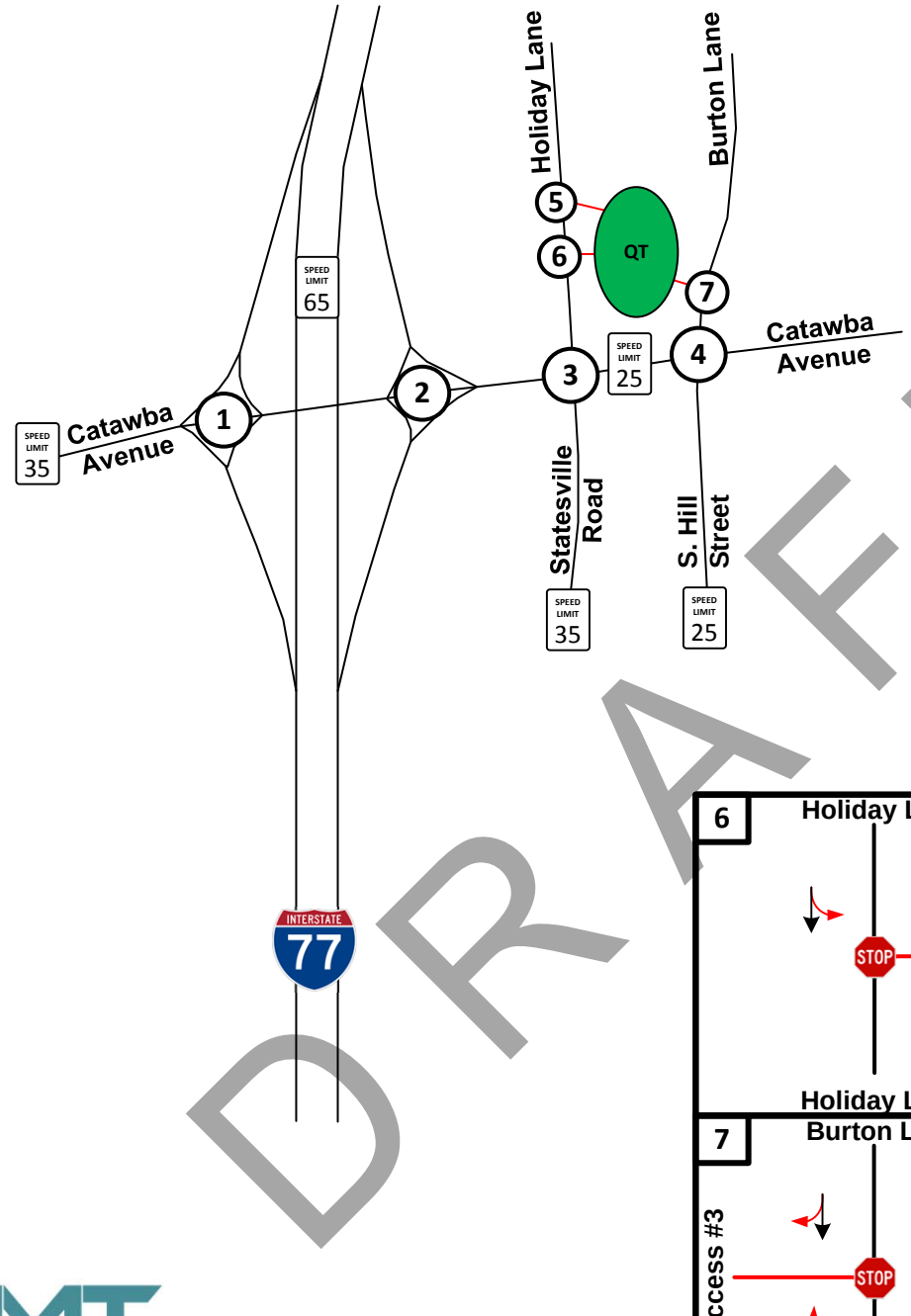

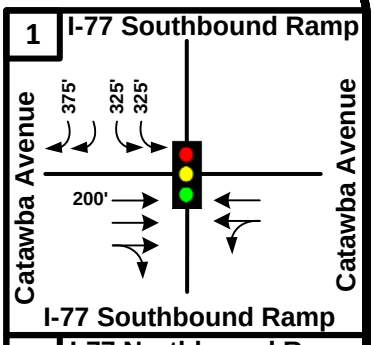

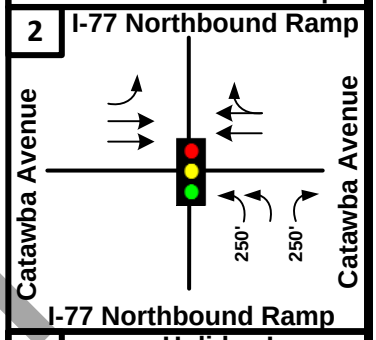

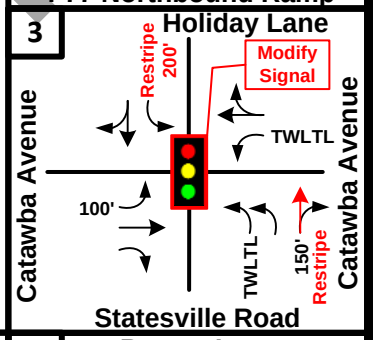

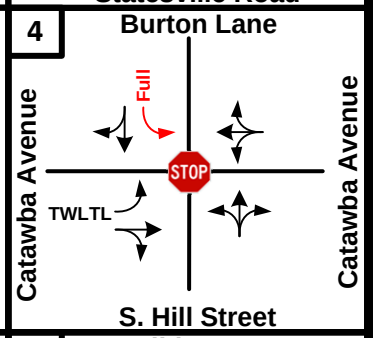

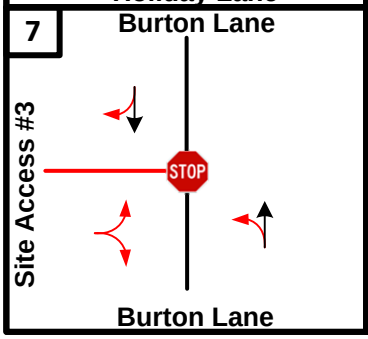

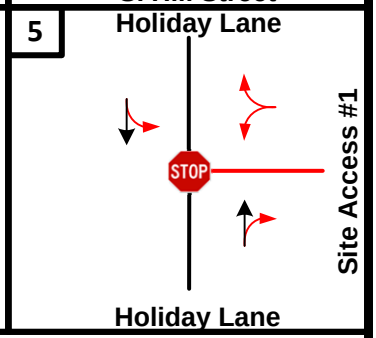

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AMT

LEGEND

- Existing Traffic Control
- Existing Roadway
- Existing Laneage
- XXX' Storage Bay Length
- Existing Posted Speed
- Proposed Traffic Control
- Recommended Access
- Recommended Laneage
- XXX' Recommended Storage Bay Length

N

NOT TO SCALE

Cornelius QT
Traffic Impact Study

2023 Recommended Improvements

DATE: January 2017

Figure 18

PROJECT TRAFFIC VOLUMES – 2030 HORIZON YEAR

The NCDOT Congestion Management Capacity Analysis Guidelines requires that a TIP Design Year analysis be performed for any traffic study that impacts a TIP project during:

- The project planning phase;
- The project design phase;
- The project construction phase; or
- Within five (5) years after the construction of project.

The subject TIP project is C-5621 and seeks to replace the existing signalized intersection of Catawba Avenue at Statesville Road / Holiday Lane with a dual-lane roundabout. The *Cornelius Modified Roundabout Technical Memorandum* (Parsons Brinckerhoff, 2013) was provided by NCDOT for use with this traffic study. The roundabout has a design year of 2030 as specified in the technical memorandum. A copy of the aforementioned document can be found in **Appendix E**. The 2030 lane configuration as shown in the simulation files provided are illustrated in **Figure 19**.

The following sections discuss the traffic volume development for the TIP horizon year of 2030.

2030 No-Build Traffic Volumes

Traffic volumes for the 2030 no-build conditions were taken from the microscopic traffic simulation files (i.e. Vissim). It should be noted that the technical memorandum did not provide any volumes figures. According to the memorandum, these volumes were developed from counts taken in 2010 and 2012; which were then grown at a rate of 1.5 percent (1.5%) per year to 2030. The 2030 no-build traffic volumes are shown in **Figure 20**.

Proposed Development Traffic

The proposed development traffic was calculated and assigned to the adjacent roadway network as discussed previously. This includes the site trips, the pass-by trips and the driveway adjustment traffic volumes.

One modification was made to the driveway adjustment traffic volumes. The specific adjustment was made based upon the 2016 traffic counts collected for this study. When applying the driveway adjustment to the volumes used in the *Cornelius Modified Roundabout Technical Memorandum* (Parsons Brinckerhoff, 2013), this yielded a small negative volume for the northbound thru movement at the Burton Lane / Site Access #3 intersection in the AM peak hour. In an effort to remain consistent across the horizon years and to be conservative, this negative volume was revised to be zero (0).

The trip distribution and assignment can be found on **Figures 7** and **8**; respectively. The pass-by trip distribution and assignment can be found on **Figures 9** and **10**; respectively. Lastly, the driveway adjustment trip distribution and assignment can be found on **Figures 11** and **12**; respectively. The traffic calculations are shown in **Appendix C**.

2030 Build-Out Traffic Volumes

The 2030 build-out traffic volumes include the 2030 no-build traffic and the proposed development traffic. The AM and PM peak-hour 2030 build traffic volumes are shown in **Figure 21.**

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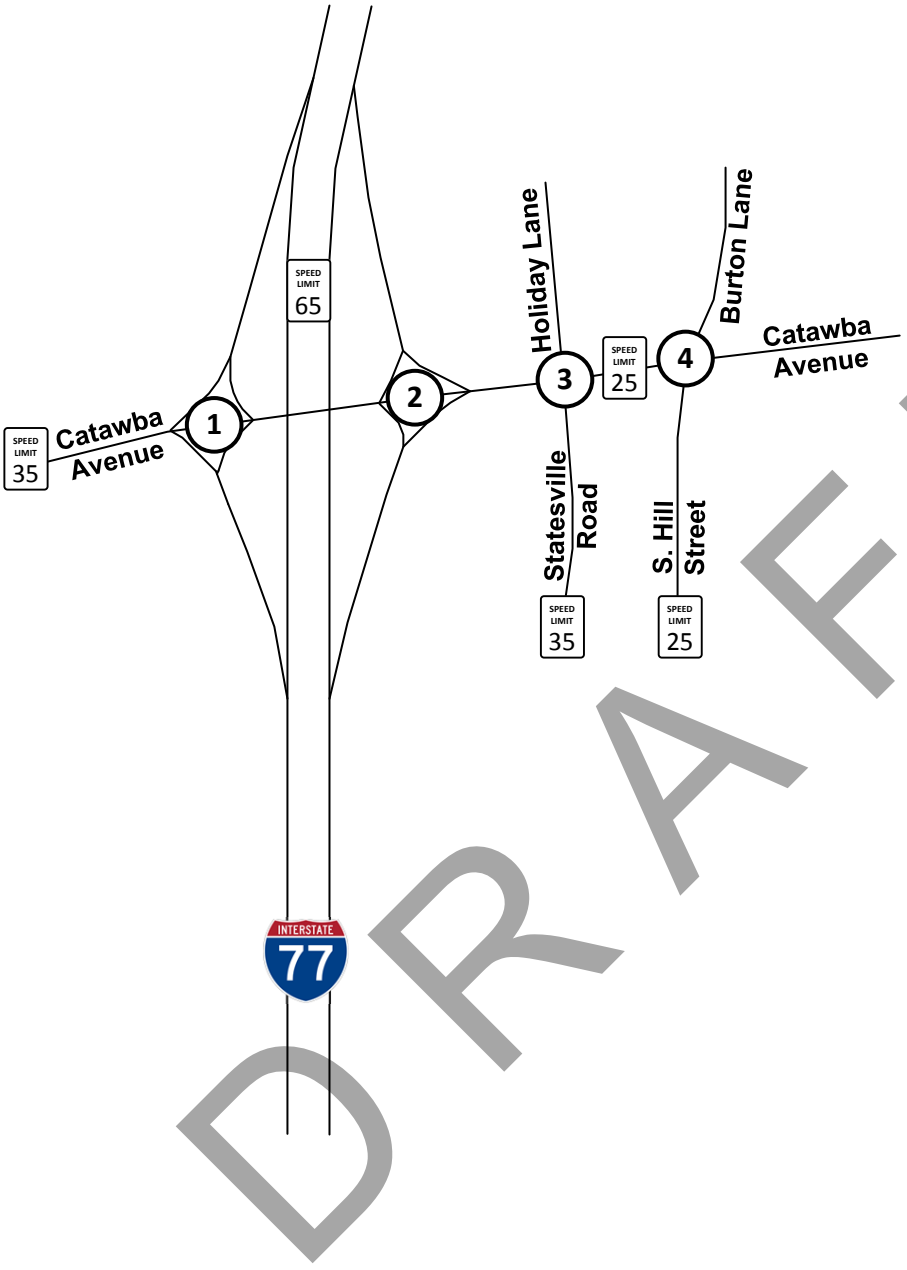

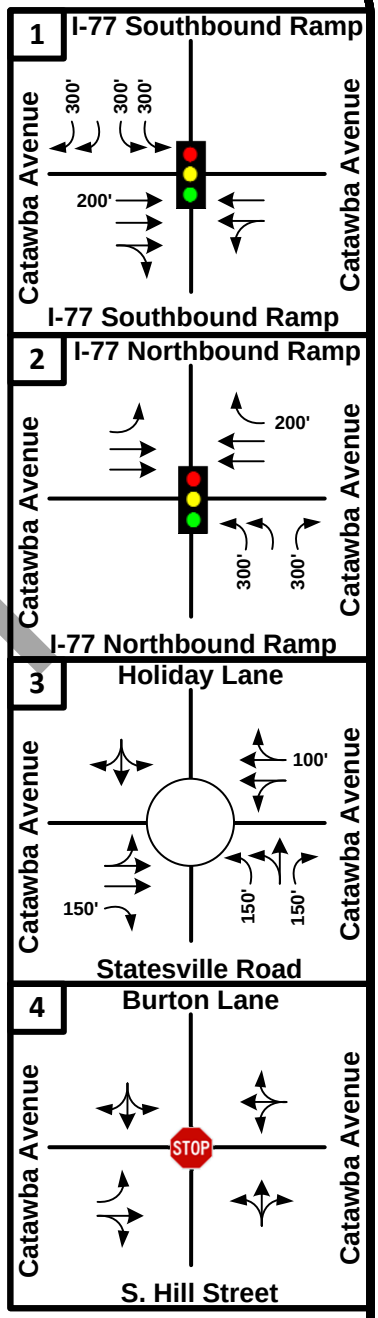

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LEGEND

- Existing Traffic Control
- Existing Roadway
- XXX' Storage Bay Length
- Existing Posted Speed

N

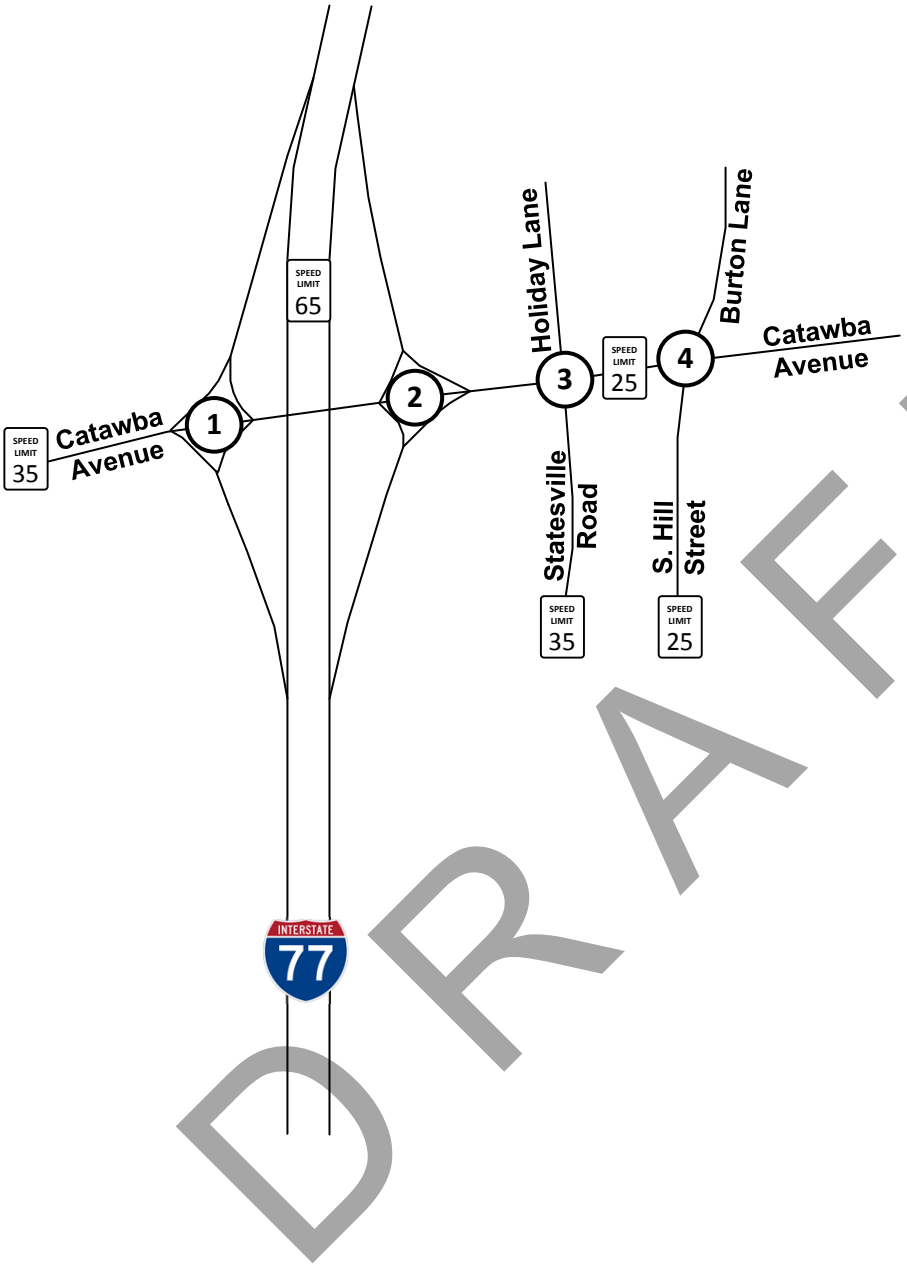
NOT TO SCALE

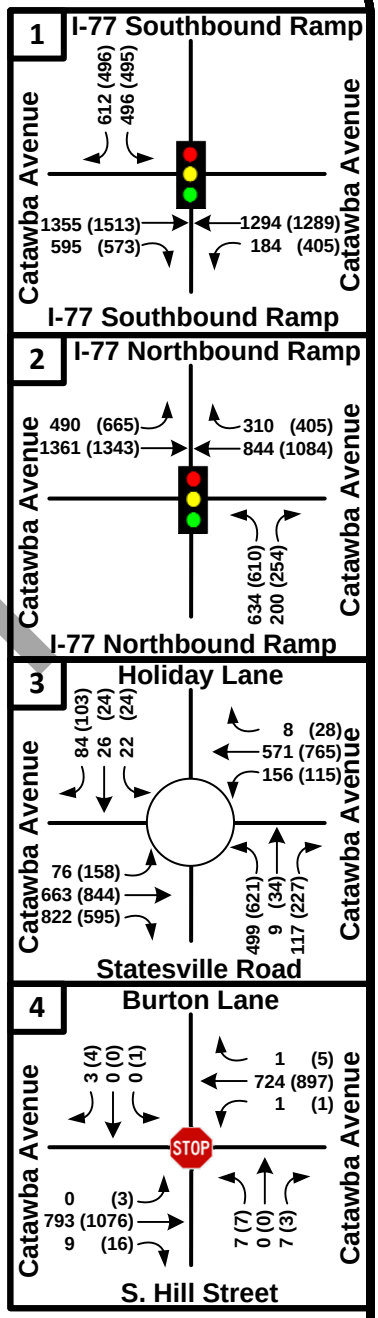
Cornelius QT
Traffic Impact Study

2030 Lane Configuration

DATE: January 2017

Figure 19





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LEGEND

- Existing Traffic Control
- Existing Roadway
- XX (XX) AM (PM) Peak Hour Volumes
- SPEED LIMIT XX Existing Posted Speed

N

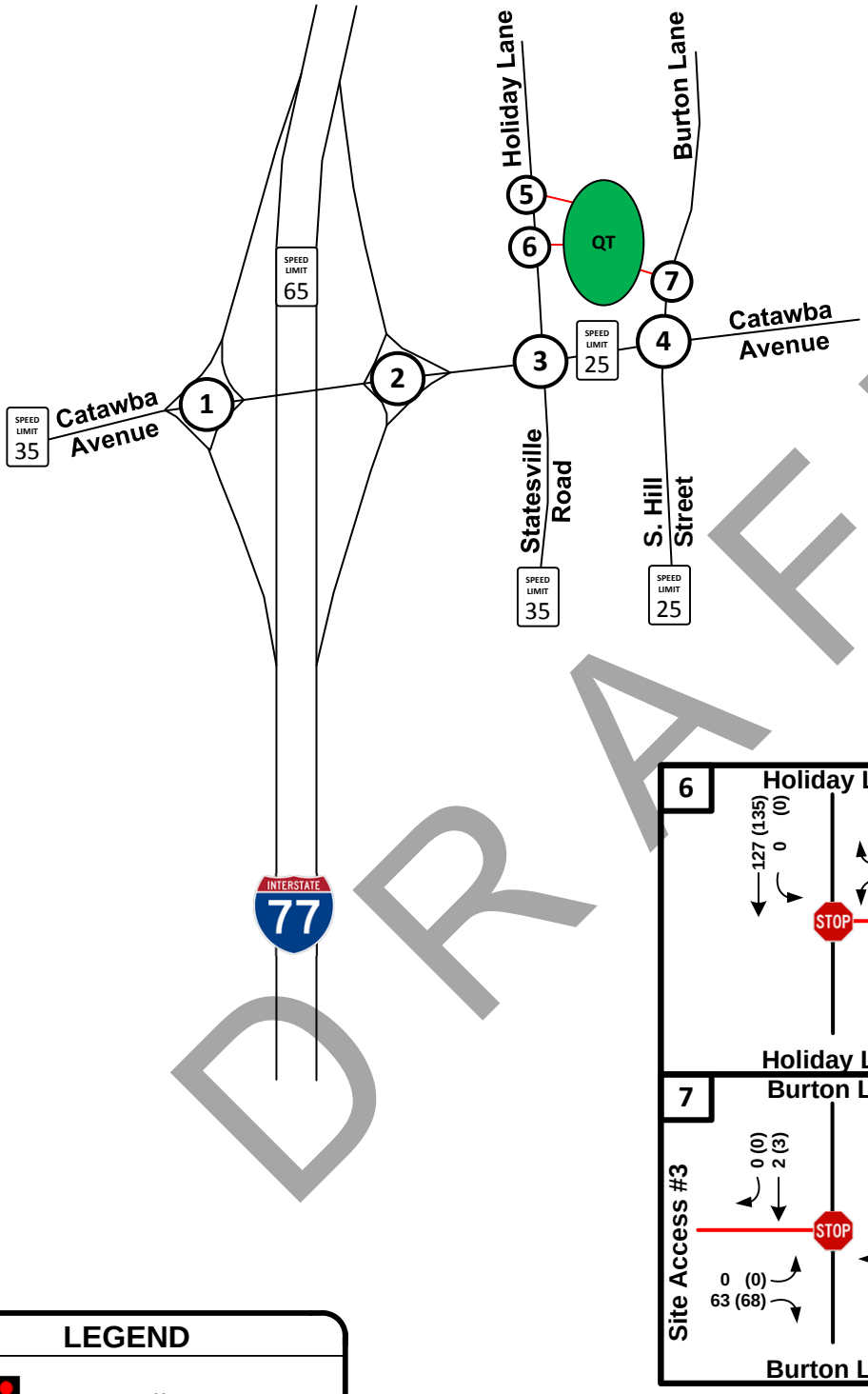
NOT TO SCALE

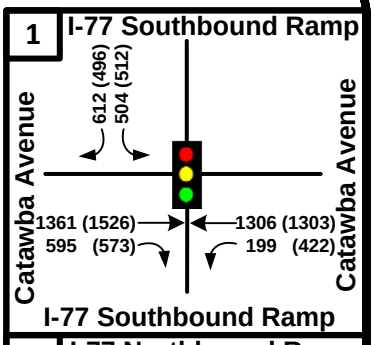
Cornelius QT
Traffic Impact Study

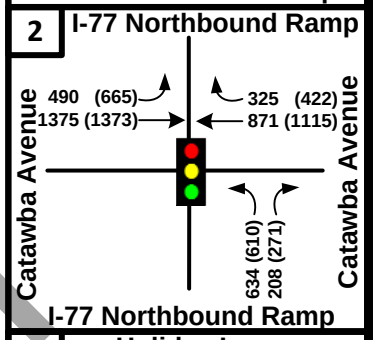
2030 No-Build Traffic Volumes

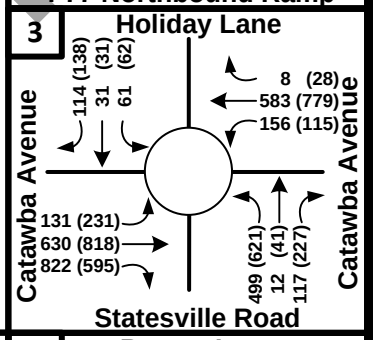
DATE: January 2017

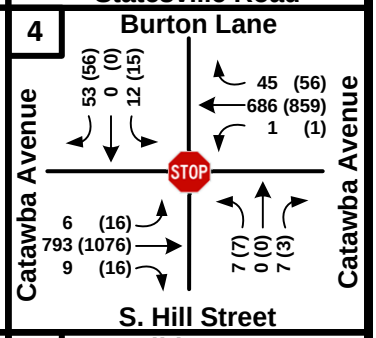
Figure 20

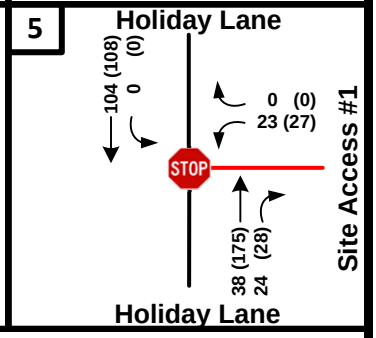












LEGEND

- Existing Traffic Control
- Existing Roadway
- XX (XX) AM (PM) Peak Hour Volumes
- Existing Posted Speed

N

NOT TO SCALE

Cornelius QT
Traffic Impact Study

2030 Build Traffic Volumes

DATE: January 2017

Figure 21

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CAPACITY ANALYSIS – 2030 HORIZON YEAR

2030 No-Build Analysis

The NCDOT Congestion Management *Capacity Analysis Guidelines* requires that a TIP Design Year analysis be performed for any traffic study that impacts a TIP project during:

- The project planning phase;
- The project design phase;
- The project construction phase; or
- Within five (5) years after the construction of project.

The subject TIP project is C-5621 and seeks to replace the existing signalized intersection of Catawba Avenue at Statesville Road / Holiday Lane with a dual-lane roundabout. The *Cornelius Modified Roundabout Technical Memorandum* (Parsons Brinckerhoff, 2013) was provided by NCDOT for use with this traffic study. The roundabout has a design year of 2030 as specified in the technical memorandum. A copy of the aforementioned document can be found in Appendix E.

The following capacity analyses focus on the traffic conditions and analysis projected for 2030. Analysis files developed for the TIP project were provided by Parsons Brinckerhoff. These files were developed using Vissim microscopic traffic simulation software. Developed to model individual driver behavior, the software is able to model alternative intersections and interchanges more accurately than other software packages. The results presented herein represent ten (10) simulation runs. Vissim output tables are provided in Appendix F.

The LOS results from the 2030 no-build analysis are displayed in Table 18. It should be noted that due to the software's output format, the results are reported by lane and not by approach. However, an overall intersection LOS is still provided.

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Table 18: Level of Service Analysis – 2030 No-Build Traffic Conditions

LOCATION	2030 NO-BUILD TRAFFIC CONDITIONS	
	AM PEAK LOS (delay/veh)	PM PEAK LOS (delay/veh)
INTERSECTION 1 – I-77 Southbound On/Off Ramps at Catawba Avenue (SIGNALIZED)		
OVERALL	**E (62.22)**	**E (58.98)**
Eastbound Thru	**F (119.24)**	**F (106.56)**
Eastbound Right-Turn	**F (132.46)**	**F (117.80)**
Westbound Left-Turn	B (15.84)	C (20.18)
Westbound Thru	C (20.11)	C (25.71)
Southbound Left-Turn	B (11.75)	B (12.70)
Southbound Right-Turn	B (14.42)	B (11.50)
INTERSECTION 2 – I-77 Northbound On/Off Ramps at Catawba Avenue (SIGNALIZED)		
OVERALL	B (13.80)	B (16.84)
Eastbound Left-Turn	A (2.00)	A (2.86)
Eastbound Thru	B (18.39)	C (22.44)
Westbound Thru	B (18.49)	C (20.30)
Westbound Right-Turn	A (7.37)	C (20.77)
Northbound Left-Turn	A (9.57)	B (12.37)
Northbound Right-Turn	B (15.00)	B (13.39)
INTERSECTION 3 – Catawba Avenue at Statesville Road / Holiday Lane (ROUNDABOUT)		
OVERALL	A (6.32)	B (12.87)
Eastbound Left-Turn	A (4.47)	A (5.86)
Eastbound Thru	A (3.70)	A (4.11)
Eastbound Right-Turn	A (6.20)	A (4.10)
Westbound Left-Turn	B (10.62)	C (22.67)
Westbound Thru	A (6.24)	B (13.79)
Westbound Right-Turn	A (3.37)	A (7.84)
Northbound Left-Turn	A (7.45)	C (15.26)
Northbound Thru	A (6.25)	B (14.28)
Northbound Right-Turn	A (3.42)	A (7.05)
Southbound Left-Turn	C (21.50)	**F (107.30)**
Southbound Thru	C (21.04)	**F (94.94)**
Southbound Right-Turn	B (10.83)	**F (85.80)**
INTERSECTION 4 – Catawba Avenue at Burton Lane / S. Hill Street (UNSIGNALIZED)		
Eastbound Left-Turn	-	B (13.57)
Westbound Left-Turn	A (5.35)	D (25.60)
Northbound Left-Turn	C (15.96)	**F (57.82)**
Northbound Right-Turn	A (8.92)	B (13.20)
Southbound Left-Turn	-	B (11.76)
Southbound Right-Turn	A (6.56)	B (13.42)

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The results of the simulation indicate the following intersections and approaches are operating below their mitigation threshold:

- Overall intersection of I-77 southbound on / off ramps at Catawba Avenue in the AM and PM peak hours;
- Eastbound approach of the I-77 southbound on / off ramps at Catawba Avenue intersection in the AM and PM peak hours;
- Southbound approach of the Catawba Avenue at Statesville Road / Holiday Lane intersection in the PM peak hour; and
- Northbound left-turn movement at the Catawba Avenue at Burton Lane / S. Hill Street intersection in the PM peak hour.

An additional operational concern is queuing. Excessive queues can negatively impact operations at nearby intersections as well as cause safety concerns if the queues exceed the available storage of turn lanes. As such, the maximum observed queueing averaged across the ten (10) simulation runs are reported for each traffic scenario. Table 19 lists the maximum observed queues from the Vissim simulation runs for the 2030 no-build traffic conditions. Vissim outputs can be found in Appendix F.

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Table 19: Vissim Maximum Observed Queues – 2023 No-Build Traffic Conditions

LOCATION	2030 NO-BUILD TRAFFIC CONDITIONS		
	EXISTING STORAGE LENGTH (ft.)	AM PEAK Maximum Observed (ft.)	PM PEAK Maximum Observed (ft.)
INTERSECTION 1 – I-77 Southbound On/Off Ramps at Catawba Avenue (SIGNALIZED)			
Eastbound Thru	225	**1,615**	**1,627.08**
Eastbound Right-Turn	-	1,561.46	1,663.11
Westbound Left-Turn	-	525.97	575.08
Westbound Thru	-	513.39	562.49
Southbound Dual Left	300	195.13	181.94
Southbound Dual Right	300	224.40	208.98
INTERSECTION 2 – I-77 Northbound On/Off Ramps at Catawba Avenue (SIGNALIZED)			
Eastbound Left-Turn	-	449.17	424.48
Eastbound Thru	-	449.17	424.48
Westbound Thru	-	254.20	351
Westbound Right-Turn	200	149.55	**340.87**
Northbound Dual Left-Turn	300	165.95	170.11
Northbound Right-Turn	300	165.95	170.11
INTERSECTION 3 – Catawba Avenue at Statesville Road / Holiday Lane (ROUNDABOUT)			
Eastbound Thru/Left-Turn	-	157.78	143.53
Eastbound Right-Turn	150	**180.26**	145.01
Westbound Left-Turn	-	200.17	332.64
Westbound Thru/Right-Turn	100	**200.17**	**332.64**
Northbound Left-Turn	150	94.60	**259.05**
Northbound Thru	-	94.60	259.05
Northbound Right-Turn	150	115.32	**300.28**
Southbound Approach	-	125.87	336.81
INTERSECTION 4 – Catawba Avenue at Burton Lane / S. Hill Street (UNSIGNALIZED)			
Eastbound Left-Turn	-	87.85	113.42
Westbound Left-Turn	-	131.48	806.3
Northbound Approach	-	43.69	44.96
Southbound Approach	-	40.42	43.57

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2030 Build Analysis

The total future build traffic volumes include both the site traffic and the traffic volumes from the no-build analysis. The build analysis evaluates the traffic conditions before any improvements are implemented in response to traffic generated by the proposed development. Table 20 shows the LOS results averaged across the ten (10) simulation runs for the intersections within the study area. Vissim outputs can be found in Appendix F.

Table 20: Level of Service Analysis – 2030 Build Traffic Conditions

LOCATION	2030 BUILD TRAFFIC CONDITIONS	
	AM PEAK LOS (delay/veh)	PM PEAK LOS (delay/veh)
INTERSECTION 1 – I-77 Southbound On/Off Ramps at Catawba Avenue (SIGNALIZED)		
OVERALL	**E (64.79)**	**E (68.48)**
Eastbound Thru	**F (125.90)**	**F (136.10)**
Eastbound Right-Turn	**F (140.14)**	**F (152.78)**
Westbound Left-Turn	B (17.00)	B (13.14)
Westbound Thru	C (21.21)	B (18.09)
Southbound Left-Turn	B (11.79)	B (11.95)
Southbound Right-Turn	B (14.86)	B (13.07)
INTERSECTION 2 – I-77 Northbound On/Off Ramps at Catawba Avenue (SIGNALIZED)		
OVERALL	B (14.41)	B (15.82)
Eastbound Left-Turn	A (1.98)	A (2.79)
Eastbound Thru	B (18.66)	B (18.93)
Westbound Thru	C (20.22)	C (21.18)
Westbound Right-Turn	A (7.76)	C (20.06)
Northbound Left-Turn	A (9.44)	B (10.61)
Northbound Right-Turn	B (16.00)	B (15.25)
INTERSECTION 3 – Catawba Avenue at Statesville Road / Holiday Lane (ROUNDABOUT)		
OVERALL	A (8.42)	C (17.16)
Eastbound Left-Turn	A (5.40)	A (6.66)
Eastbound Thru	A (4.13)	A (4.47)
Eastbound Right-Turn	A (6.17)	A (3.87)
Westbound Left-Turn	B (12.16)	D (28.00)
Westbound Thru	A (7.37)	C (16.51)
Westbound Right-Turn	A (3.63)	A (9.18)
Northbound Left-Turn	A (8.76)	C (19.74)
Northbound Thru	A (6.55)	C (19.94)
Northbound Right-Turn	A (3.60)	A (7.55)
Southbound Left-Turn	E (41.96)	**F (133.96)**
Southbound Thru	E (45.66)	**F (132.14)**
Southbound Right-Turn	D (29.24)	**F (113.22)**
INTERSECTION 4 – Catawba Avenue at Burton Lane / S. Hill Street (UNSIGNALIZED)		
Eastbound Left-Turn	B (10.47)	C (15.20)
Westbound Left-Turn	B (12.02)	E (49.31)
Northbound Left-Turn	C (18.60)	**F (64.3)**
Northbound Right-Turn	B (10.65)	B (12.72)
Southbound Left-Turn	B (14.00)	C (21.01)
Southbound Right-Turn	A (9.99)	C (16.93)

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Table 20: Level of Service Analysis – 2030 Build Traffic Conditions (continued)

LOCATION	2030 BUILD TRAFFIC CONDITIONS	
	AM PEAK LOS (delay/veh)	PM PEAK LOS (delay/veh)
INTERSECTION 5 – Holiday Lane at Site Access #1 (UNSIGNALIZED)		
Westbound Approach	C (16.73)	D (25.98)
Southbound Left-Turn	-	-
INTERSECTION 6 – Holiday Lane at Site Access #2 (UNSIGNALIZED)		
Westbound Approach	C (24.47)	**F (349.09)**
Southbound Left-Turn	-	-
INTERSECTION 7 – Burton Lane at Site Access #3 (UNSIGNALIZED)		
Eastbound Approach	A (6.73)	A (6.99)
Northbound Left-Turn	A (0.34)	A (0.24)

The results of the simulation indicate the following intersections and approaches are operating below their mitigation threshold:

- Overall intersection of I-77 southbound on / off ramps at Catawba Avenue in the AM and PM peak hours;
- Eastbound approach of the I-77 southbound on / off ramps at Catawba Avenue intersection in the AM and PM peak hours;
- Southbound approach of the Catawba Avenue at Statesville Road / Holiday Lane intersection in the PM peak hour;
- Northbound left-turn movement at the Catawba Avenue at Burton Lane / S. Hill Street intersection in the PM peak hour; and
- Westbound approach of Site Access #2 at Holiday Lane in the PM peak hour.

The last point can be attributed to queues originating at the intersection of Holiday Lane at Catawba Avenue and extending beyond Site Access #2. The remaining deficiencies are seen in the no-build traffic simulations.

An additional operational concern is queuing. Excessive queues can negatively impact operations at nearby intersections as well as cause safety concerns if the queues exceed the available storage of turn lanes. As such, the maximum observed queueing averaged across the ten (10) simulation runs are reported for each traffic scenario. Table 21 lists the maximum observed queues from the Vissim simulation runs for the 2030 build traffic conditions. Vissim outputs can be found in Appendix F.

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Table 21: VISSIM Maximum Observed Queue – 2030 Build Traffic Conditions

LOCATION	2030 BUILD TRAFFIC CONDITIONS		
	EXISTING STORAGE LENGTH (ft.)	AM PEAK Maximum Observed (ft.)	PM PEAK Maximum Observed (ft.)
INTERSECTION 1 – I-77 Southbound On/Off Ramps at Catawba Avenue (SIGNALIZED)			
Eastbound Thru	225	**1,612.73**	**1,639.46**
Eastbound Right-Turn	-	1620.52	1669.06
Westbound Left-Turn	-	544.90	573.83
Westbound Thru	-	532.31	561.24
Southbound Dual Left	300	193.36	174.26
Southbound Dual Right	300	222.98	203.88
INTERSECTION 2 – I-77 Northbound On/Off Ramps at Catawba Avenue (SIGNALIZED)			
Eastbound Left-Turn	-	459.17	382.96
Eastbound Thru	-	459.17	382.96
Westbound Thru	-	294.31	354.56
Westbound Right-Turn	200	169.45	**402.06**
Northbound Dual Left-Turn	300	145.23	160.55
Northbound Right-Turn	300	145.23	160.55
INTERSECTION 3 – Catawba Avenue at Statesville Road / Holiday Lane (ROUNDABOUT)			
Eastbound Thru/Left-Turn	-	160.43	156.41
Eastbound Right-Turn	150	**181.98**	**156.41**
Westbound Left-Turn	-	210.40	337.46
Westbound Thru/Right-Turn	100	**210.40**	**337.46**
Northbound Left-Turn	150	92.78	**304.60**
Northbound Thru	-	92.78	304.60
Northbound Right-Turn	150	132.83	**359.89**
Southbound Approach	-	237.30	273.15
INTERSECTION 4 – Catawba Avenue at Burton Lane / S. Hill Street (UNSIGNALIZED)			
Eastbound Left-Turn	-	103.32	121.47
Westbound Left-Turn	-	142.28	1363.07
Northbound Approach	-	46.59	44.10
Southbound Approach	-	68.65	83.19
INTERSECTION 5 – Holiday Lane at Site Access #1 (UNSIGNALIZED)			
Westbound Approach	-	47.37	50.54
Southbound Left-Turn	-	30.86	92.12
INTERSECTION 6 – Holiday Lane at Site Access #2 (UNSIGNALIZED)			
Westbound Approach	-	89.93	229.78
Southbound Left-Turn	-	56.63	229.32
INTERSECTION 7 – Burton Lane at Site Access #3 (UNSIGNALIZED)			
Eastbound Approach	-	64.75	61.67
Northbound Left-Turn	-	0	0

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2030 Build-Improved Analysis

Geometric improvements such as the installation of turn–lanes are recommended and therefore analyzed in this scenario. The specific items are listed in the Recommendations section. The Warrant for Left and Right-Turn Lanes nomograph for at-grade unsignalized intersections contained within NCDOT's *Policy on Street and Driveway Access to North Carolina Highways* manual was reviewed against the traffic volumes at the site access points. Table 22 shows the LOS results averaged across the ten (10) simulation runs for the intersections within the study area. Vissim outputs can be found in Appendix F.

Table 22: Level of Service Analysis – 2030 Build-Improved Traffic Conditions

LOCATION	2030 BUILD IMPROVED TRAFFIC CONDITIONS	
	AM PEAK LOS (delay/veh)	PM PEAK LOS (delay/veh)
INTERSECTION 3 – Catawba Avenue at Statesville Road / Holiday Lane (ROUNDABOUT)		
OVERALL	A (7.86)	C (17.99)
Eastbound Left-Turn	A (5.26)	A (6.72)
Eastbound Thru	A (4.18)	A (4.41)
Eastbound Right-Turn	A (6.06)	A (3.89)
Westbound Left-Turn	B (12.05)	D (28.04)
Westbound Thru	A (7.21)	C (16.63)
Westbound Right-Turn	A (3.99)	A (8.87)
Northbound Left-Turn	A (8.75)	C (19.82)
Northbound Thru	A (7.08)	C (18.88)
Northbound Right-Turn	A (3.45)	A (8.04)
Southbound Left-Turn	E (47.64)	**F (285.13)**
Southbound Thru	**F (54.56)**	**F (306.85)**
Southbound Right-Turn	A (9.5)	D (27.64)
INTERSECTION 4 – Catawba Avenue at Burton Lane / S. Hill Street (UNSIGNALIZED)		
Eastbound Left-Turn	A (8.38)	B (14.48)
Westbound Left-Turn	A (4.9)	**F (87.82)**
Northbound Left-Turn	C (18.24)	**F (77.11)**
Northbound Right-Turn	A (8.94)	C (19.7)
Southbound Left-Turn	B (13.11)	C (22.83)
Southbound Right-Turn	B (10.92)	D (28.91)

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The results of the simulation indicate the following intersections and approaches are operating below their mitigation threshold:

- Overall intersection of I-77 southbound on / off ramps at Catawba Avenue in the AM and PM peak hours;
- Eastbound approach of the I-77 southbound on / off ramps at Catawba Avenue intersection in the AM and PM peak hours;
- Southbound left-turn movements at the Catawba Avenue at Statesville Road / Holiday Lane intersection on the PM peak hour;
- Southbound thru movements at the Catawba Avenue at Statesville Road / Holiday Lane intersection in the AM and PM peak hours;
- Northbound left-turn movement at the Catawba Avenue at Burton Lane / S. Hill Street intersection in the PM peak hour; and
- Westbound approach of Site Access #2 at Holiday Lane in the PM peak hour.

The last point can be attributed to queues originating at the intersection of Holiday Lane at Catawba Avenue and extending beyond Site Access #2. The remaining deficiencies are seen in the no-build traffic simulations.

No improvements are recommended at the intersection of Catawba Avenue at I-77 southbound on / off ramps. The justification is twofold. First, the proposed development attributes less than one percent (1%) to the traffic volumes on the approach. Secondly, this approach is to the DDI crossover and the cost to construct an improvement at this location would not be commensurate with the impact the development is responsible for on the approach.

Installation of a southbound right-turn lane at the intersection of Catawba Avenue at Statesville Road / Holiday Lane has a negligible reduction in delays on the southbound left-turn and thru movements. This can be attributed to a scarcity of acceptable gaps in the roundabout. The installation of a right-turn lane does however greatly reduce delays for these movements; which are the dominant movements on the approach.

Lastly, delays shown for the westbound left-turn and the northbound left-turn at the intersection of Catawba Avenue at Burton Lane / S. Hill Street can be attributed to queues originating on the westbound approach to the roundabout extending past Burton Lane and S. Hill Street.

An additional operational concern is queuing. Excessive queues can negatively impact operations at nearby intersections as well as cause safety concerns if the queues exceed the available storage of turn lanes. As such, the maximum observed queueing averaged across the ten (10) simulation runs are reported for each traffic scenario. Table 23 lists the maximum observed queues from the Vissim simulation runs for the 2030 build-improved traffic conditions. Vissim outputs can be found in Appendix F.

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Table 23: VISSIM Maximum Observed Queue – 2030 Build Improved Traffic Conditions

LOCATION	2030 BUILD IMPROVED TRAFFIC CONDITIONS		
	EXISTING STORAGE LENGTH (ft.)	AM PEAK Maximum Observed (ft.)	PM PEAK Maximum Observed (ft.)
INTERSECTION 3 – Catawba Avenue at Statesville Road / Holiday Lane (ROUNDABOUT)			
Eastbound Thru/Left-Turn	-	187.42	143.68
Eastbound Right-Turn	150	**199.75**	144.07
Westbound Left-Turn	-	199.05	334.13
Westbound Thru/Right-Turn	100	**199.05**	**334.13**
Northbound Left-Turn	150	98.06	**355.99**
Northbound Thru	-	98.06	355.99
Northbound Right-Turn	150	133.75	**414.10**
Southbound Left-Turn/Thru	-	154.74	268.88
Southbound Right-Turn	200 (proposed)	169.87	**280.74**
INTERSECTION 4 – Catawba Avenue at Burton Lane / S. Hill Street (UNSIGNALIZED)			
Eastbound Left-Turn	-	92.94	161.02
Westbound Left-Turn	-	166.18	1,477.70
Northbound Approach	-	44.49	45.07
Southbound Left-Turn	75 (proposed)	50.89	63.92
Southbound Thru/Right-Turn	-	59.54	72.62

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CONCLUSIONS – 2030 HORIZON YEAR

The proposed QT development is located along Catawba Avenue in Cornelius, Mecklenburg County, North Carolina. The proposed development is envisioned to be built-out by 2018.

The proposed site will be a 5,773 SF convenience store with 20 fueling positions. As the development will be replacing an existing gas station and restaurant, the net new external trips generated by the redevelopment of the site are calculated to be 122 trips (61 in, 61 out) in the AM peak hour and 130 trips (65 in, 65 out) in the PM peak hour.

Access to the site is proposed to be provided by three (3) full-movement driveways. There are two (2) proposed driveways on Holiday Lane. The first driveway is approximately 275 feet from the intersection with Catawba Avenue. The second is approximately 400 feet from the intersection of Catawba Avenue. There is one (1) proposed driveway on Burton Lane, which is approximately 100 feet from the intersection with Catawba Avenue.

The results of the multiple analyses presented here in indicate that the proposed development contributes minimal delay to the study area intersections as a whole. Operational impacts related to the redevelopment of the site are most apparent within close proximity to the proposed development on Holiday Lane and Burton Lane approaches to Catawba Avenue. At the I-77 interchange, traffic volumes generated by the proposed development account for less two percent (2%) of traffic on any given approach during either the AM or PM peak hour. As such, the recommended improvements are isolated to the intersections within close proximity to the site.

The future roundabout at the intersection of Catawba Avenue and Statesville Road / Holiday Lane will be located east of the current intersection. This relocation may cause queues to extend into and possibly beyond the Catawba Avenue at Burton Lane / S. Hill Street; causing delays on the minor street approaches. Furthermore, it is recommended that the site plan of the proposed development accommodate this future relocation and widening of the intersection.

Heavy northbound left-turn and westbound thru traffic volumes at the Catawba Avenue roundabout cause a scarcity of acceptable gaps in the traffic stream for vehicles on the southbound Holiday Lane approach. This results in long delays as well as long queues on the southbound Holiday Lane approach. It is recommended to design and construct the roundabout with two southbound approach lanes on Holiday Lane. This will aid in managing the queues that will develop on the approach as well as reduce delays for the southbound right-turning traffic; the majority of the traffic on the approach.

The queues discussed above were noted to extend near Site Access #2 in the 2023 horizon year analysis and beyond Site Access #2 in the 2030 horizon year analysis. Additionally, the potential exists for left-turn conflicts to occur between southbound left-turns into Site Access #2 and northbound left-turns in the Days Inn access which is located between Site Accesses #1 and 2. Possible mitigation measures for these two conditions are as follows:

- Consolidate Site Accesses #1 and 2 into one access point directly across from the Days Inn access; and
- Modify Site Access #2 to allow right-in traffic only.

The specific recommendations at each study intersection are discussed in the Recommendations – 2030 Horizon Year section.

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RECOMMENDATIONS – 2030 HORIZON YEAR

Based on the findings of this study, specific improvements have been identified and should be completed as part of the proposed development. The NCDOT *Policy on Street and Driveway Access to North Carolina Highways* manual was consulted to determine the appropriate storage for the recommended auxiliary lanes if warranted. The nomograph used for the auxiliary lanes at the site access points is included in Appendix G. It should be noted that the northbound right-turn volume on Holiday Lane at Site Access #2 warrants a northbound right-turn lane according to the nomograph. However, a turn-lane is not recommended at this time due to a low volume of northbound thru traffic at the intersection. Similarly, the northbound left-turn volume on Burton Lane into Site Access #3 may warrant a storage lane. However, this is not recommended due to a low volume of conflicting vehicles.

I-77 Southbound On/Off Ramps at Catawba Avenue

There are no recommended improvements at this intersection.

I-77 Northbound On/Off Ramps at Catawba Avenue

There are no recommended improvements at this intersection.

Catawba Avenue at US 21 (Statesville Road) / Holiday Lane

- Design the planned roundabout with a southbound exclusive right-turn lane with 200 feet of full-width storage and appropriate taper.

Catawba Avenue at Burton Lane / S. Hill Street

- Construct a left-turn lane with full-width storage that extends from the intersection of Catawba Avenue to Site Access #3 and appropriate taper on southbound Burton Lane.

Holiday Lane at Site Access #1

- Construct Site Access #1 as a full-movement access point.
- Construct Site Access #1 with one ingress and one egress lane.

Holiday Lane at Site Access #2

- Construct Site Access #2 as a full-movement access point.
- Construct Site Access #2 with one ingress and one egress lane.

Burton Lane at Site Access #3

- Construct Site Access #3 as a full-movement access point.
- Construct Site Access #3 with one ingress and one egress lane.

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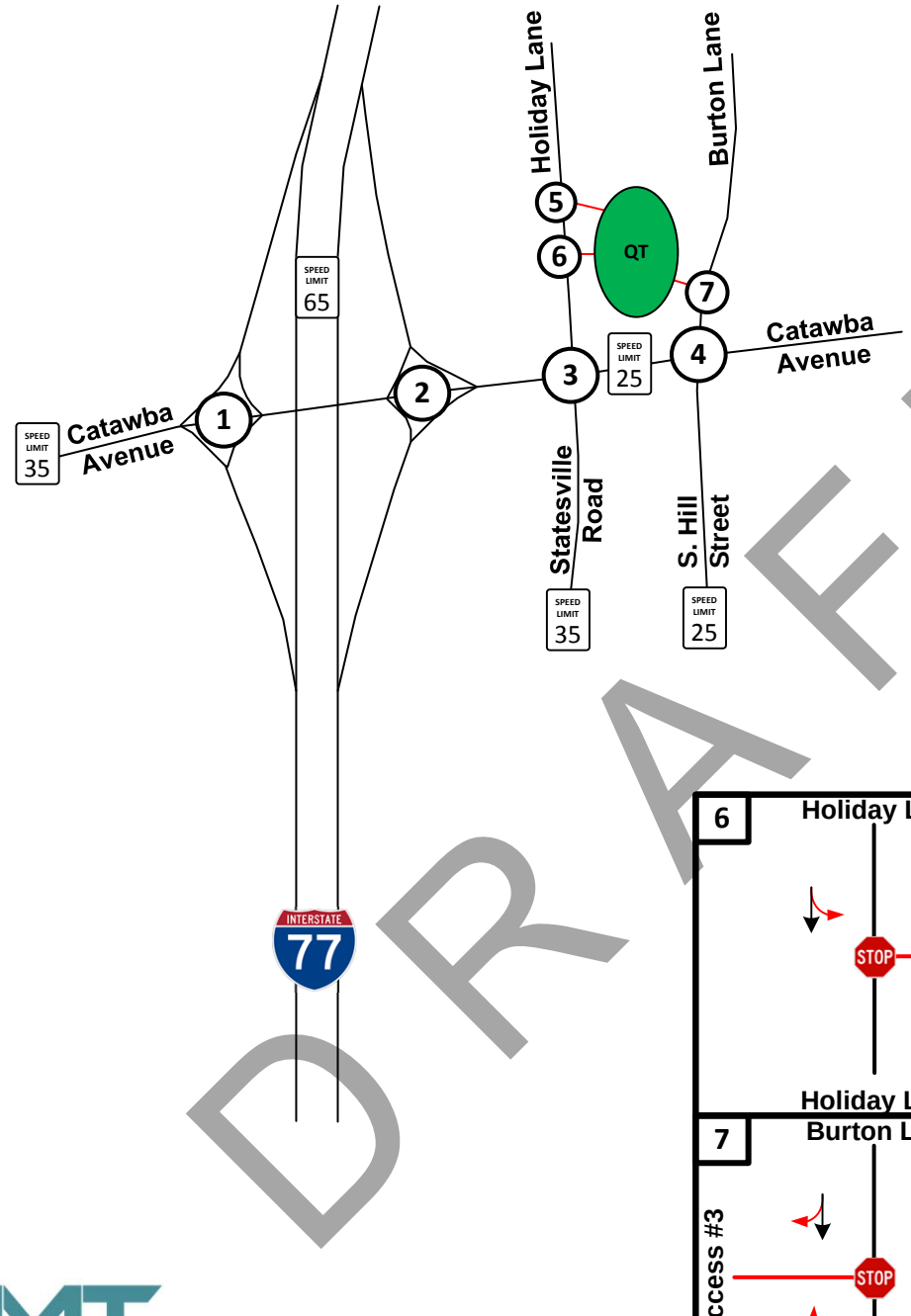

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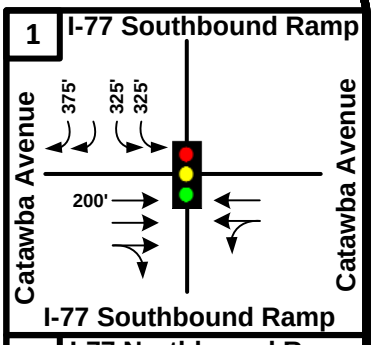
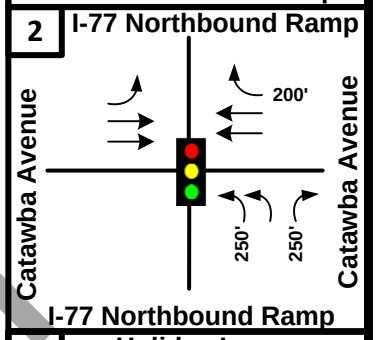
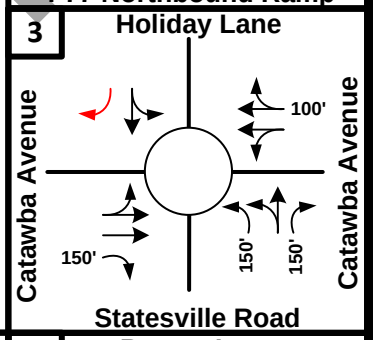
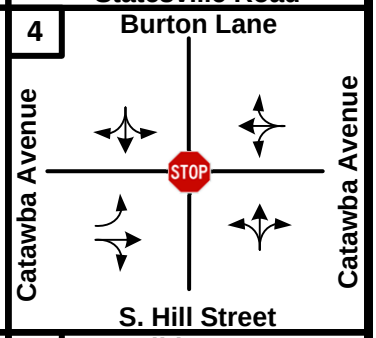
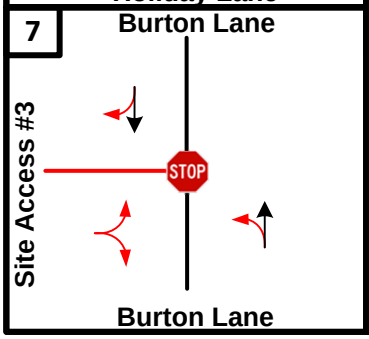
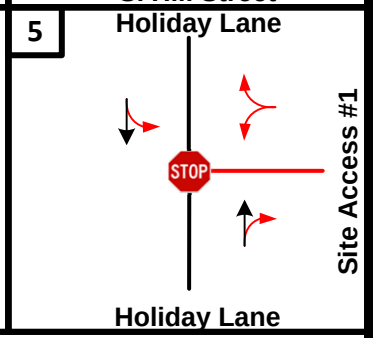












LEGEND

- Existing Traffic Control
- Proposed Traffic Control
- Existing Roadway
- Recommended Access
- Existing Laneage
- Recommended Laneage
- XXX' Storage Bay Length
- XXX' Recommended Storage Bay Length
- SPEED LIMIT XX Existing Posted Speed

N

NOT TO SCALE

Cornelius QT
Traffic Impact Study

2030 Recommended Improvements

DATE: January 2017

Figure 22

CRASH SUMMARY

The NCDOT Traffic Safety Unit provided the crash data used in this report. Specifically, the unit provided a preliminary after period crash analysis on the I-77/Catawba Avenue interchange and the nearby intersections from Torrence Chapel Road/Liverpool Parkway to Statesville Road/Holiday Lane. The report analyzes crash patterns for a period of three (3) years before construction of the new interchange began and crash patterns for a period of ten months (11/1/2014 to 8/31/2015) after construction of the new interchange finished. The results presented herein represent the data provided by NCDOT for the "after" period. The full report can be found in **Appendix H**.

One intersection not covered by the aforementioned preliminary after period crash analysis is Catawba Avenue at Burton Lane / S. Hill Street. As such, the Traffic Safety Unit has provided an intersection analysis report. This report covers all reported crashes for a three-year period beginning November 1, 2013 until October 31, 2016. This is located in **Appendix H**.

The following sections discuss provided crash data with respect to each intersection continued in the study area of this study.

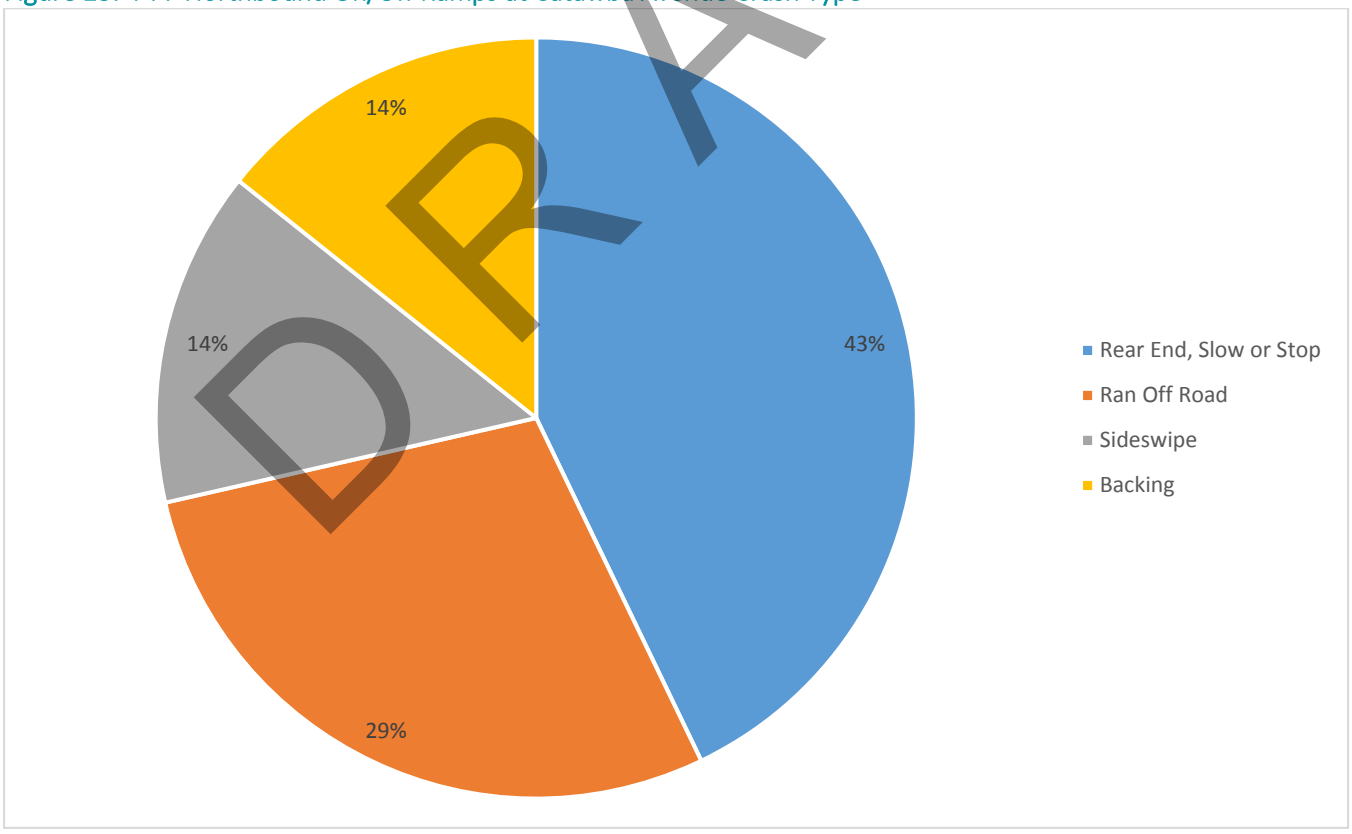
I-77 Southbound On/Off Ramps at Catawba Avenue

Three (3) crashes were reported at this intersection. The two (2) rear-end crashes and one (1) sideswipe crash resulted in property damage only (PDO) severity crashes.

I-77 Northbound On/Off Ramps at Catawba Avenue

Seven (7) crashes were reported during the study duration at this intersection; all of which resulted in PDO. The most common crash type was rear end crashes; accounting for three (3) of the seven (7) total crashes. Two (2) crashes occurred when vehicles ran off the road at separate points. Lastly, one (1) sideswipe and one (1) backing type crash occurred. **Figure 23** illustrates each observed crash type's share of the total observed crashes at the intersection.

Figure 23: I-77 Northbound On/Off Ramps at Catawba Avenue Crash Type



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Catawba Avenue at Statesville Road / Holiday Lane

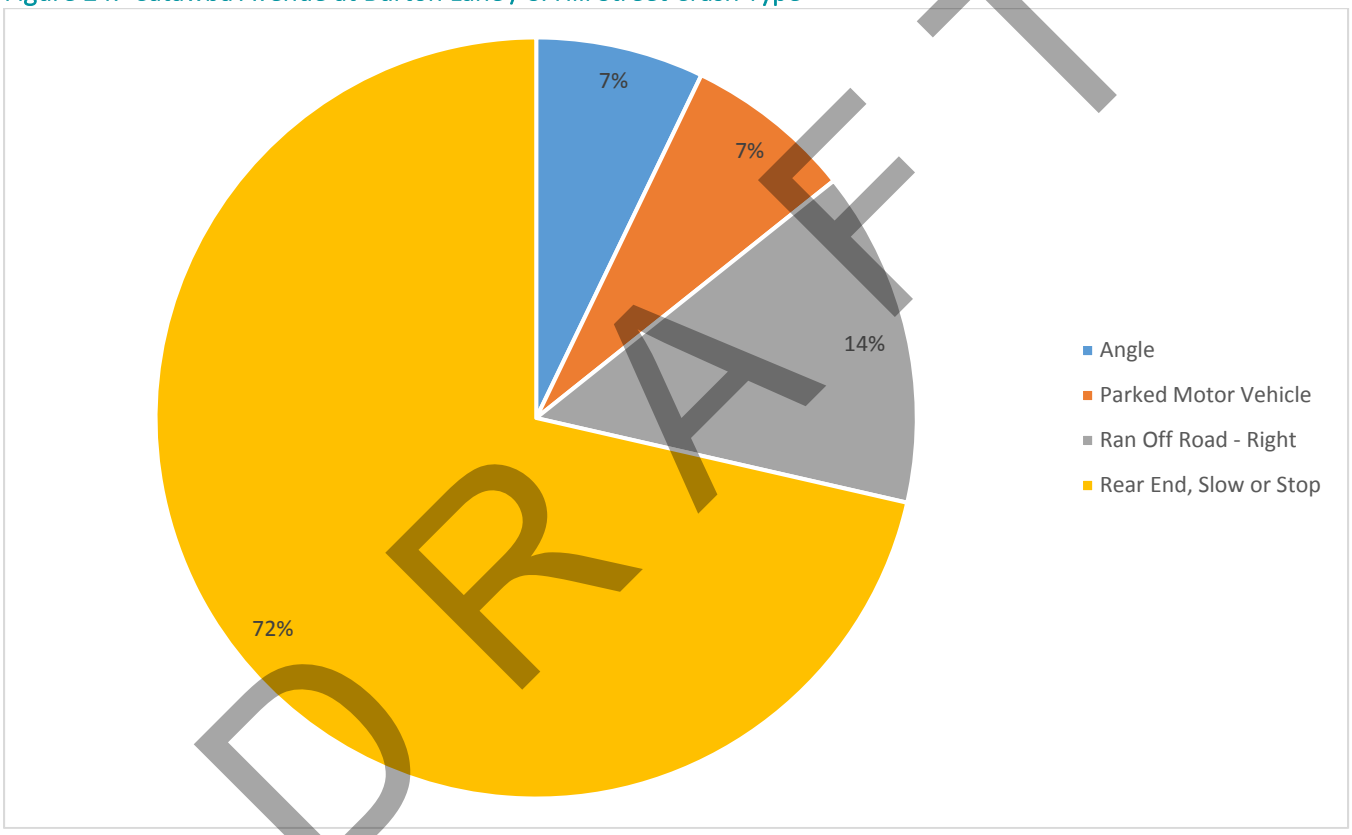
Three (3) crashes were reported at this intersection. The two (2) rear-end crashes and one (1) turning-type crash resulted in PDO.

Catawba Avenue at Burton Lane / S. Hill Street

Fourteen (14) crashes were reported at this intersection during the study duration. Of these crashes, none resulted in fatalities, one (1) resulted in a class C injury. It should be noted that class C is the least severe of the three injury classifications. The remaining thirteen (13) crashes resulted in PDO.

The most common crash type was shown to be rear end collisions. Ten (10) of the recorded crashes at the intersection were classified as rear end during the study duration. This crash type represents more than seventy percent of the total crashes at the intersection. The total crash rate at this intersection is 82.41 crashes per 100 million vehicles entered. **Figure 24** illustrates each observed crash type's share of the total observed crashes at the intersection.

Figure 24: Catawba Avenue at Burton Lane / S. Hill Street Crash Type



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COMPLIANCE WITH ADOPTED PLANS

The below two (2) sections discuss the proposed development within the context of the Town's adopted transportation plan and land use plan. In brief, the proposed development as shown in this report is found to be consistent with both the Centennial Transportation Plan and the 2014 Land Use Plan Update.

Cornelius Centennial Transportation Plan

Catawba Avenue between NC 115 and US 21 is designed two travel lanes with bike lanes and on-street parking. To preserve capacity and operations of Catawba Avenue, the Transportation Plan makes the following recommendations to preserve capacity:

- Install a closed loop traffic signal system on Catawba Avenue, interconnecting the signalized intersections and optimizing corridor timings;
- Monitor traffic volumes on Catawba Avenue periodically to evaluate capacity;
- Concentrate major driveway connections on side streets to minimize the number of conflict points; and
- Continue to require additional right-of-way on the north side of Catawba Avenue per the Board of Commissioners policy to allow for potential future widening.

2014 Land Use Plan Update

The 2014 Land Use Plan Update, adopted on January 6, 2014, includes desired land uses and intensities. The area of the proposed development is cited for both Highway Commercial and Urban Mixed Use.

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COMPREHENSIVE CONCLUSIONS

The proposed QT development is located along Catawba Avenue in Cornelius, Mecklenburg County, North Carolina. The proposed development is envisioned to be built-out by 2018.

The proposed site will be a 5,773 SF convenience store with 20 fueling positions. As the development will be replacing an existing gas station and restaurant, the net new external trips generated by the redevelopment of the site are calculated to be 122 trips (61 in, 61 out) in the AM peak hour and 130 trips (65 in, 65 out) in the PM peak hour.

Access to the site is proposed to be provided by three (3) full-movement driveways. There are two (2) proposed driveways on Holiday Lane. The first driveway is approximately 275 feet from the intersection with Catawba Avenue. The second is approximately 400 feet from the intersection of Catawba Avenue. There is one (1) proposed driveway on Burton Lane, which is approximately 100 feet from the intersection with Catawba Avenue.

The results of the multiple analyses presented here in indicate that the proposed development contributes minimal delay to the study area intersections as a whole. Operational impacts related to the redevelopment of the site are most apparent within close proximity to the proposed development on Holiday Lane and Burton Lane approaches to Catawba Avenue. At the I-77 interchange, traffic volumes generated by the proposed development account for less two percent (2%) of traffic on any given approach during either the AM or PM peak hour. As such, the recommended improvements are isolated to the intersections within close proximity to the site.

Holiday Lane is currently wide enough to provide two (2) southbound lanes as well as one (1) northbound lane extending from Catawba Avenue to Site Access #2. It is recommended to restripe this area to better delineate the storage at the intersection with Catawba Avenue. This paired with restriping the northbound approach of Statesville Road and modifying the traffic signal to remove the current split-phasing will increase the efficiency of the intersection under the 2018 and 2023 build traffic volumes to mitigate the impact of the proposed development at this intersection.

The future roundabout at the intersection of Catawba Avenue and Statesville Road / Holiday Lane will be located east of the current intersection. This relocation may cause queues to extend into and possibly beyond the Catawba Avenue at Burton Lane / S. Hill Street; causing delays on the minor street approaches. Furthermore, it is recommended that the site plan of the proposed development accommodate this future relocation and widening of the intersection.

Heavy northbound left-turn and westbound thru traffic volumes at the Catawba Avenue roundabout cause a scarcity of acceptable gaps in the traffic stream for vehicles on the southbound Holiday Lane approach. This results in long delays as well as long queues on the southbound Holiday Lane approach. It is recommended to design and construct the roundabout with two southbound approach lanes on Holiday Lane. This will aid in managing the queues that will develop on the approach as well as reduce delays for the southbound right-turning traffic; the majority of the traffic on the approach.

The queues discussed above were noted to extend near Site Access #2 in the 2023 horizon year analysis and beyond Site Access #2 in the 2030 horizon year analysis. Additionally, the potential exists for left-turn conflicts to occur between southbound left-turns into Site Access #2 and northbound left-turns in the Days Inn access which is located between Site Accesses #1 and 2. Possible mitigation measures for these two conditions are as follows:

- Consolidate Site Accesses #1 and 2 into one access point directly across from the Days Inn access; and
- Modify Site Access #2 to allow right-in traffic only.

The specific recommendations at each study intersection are discussed in the Comprehensive Recommendations section.

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COMPREHENSIVE RECOMMENDATIONS

Based on the findings of this study, specific improvements have been identified and should be completed as part of the proposed development. The NCDOT *Policy on Street and Driveway Access to North Carolina Highways* manual was consulted to determine the appropriate storage for the recommended auxiliary lanes if warranted. The nomograph used for the auxiliary lanes at the site access points is included in Appendix F. It should be noted that the northbound right-turn volume on Holiday Lane at Site Access #2 warrants a northbound right-turn lane according to the nomograph. However, a turn-lane is not recommended at this time due to a low volume of northbound thru traffic at the intersection. Similarly, the northbound left-turn volume on Burton Lane into Site Access #3 may warrant a storage lane. However, this is not recommended due to a low volume of conflicting vehicles.

I-77 Southbound On/Off Ramps at Catawba Avenue

There are no recommended improvements at this intersection.

I-77 Northbound On/Off Ramps at Catawba Avenue

There are no recommended improvements at this intersection.

Catawba Avenue at US 21 (Statesville Road) / Holiday Lane

Existing Signalized Intersection

- Restripe the northbound approach to provide dual northbound left-turn lanes and a shared thru/right-turn lane with 150 feet of full-width storage and appropriate taper on Statesville Road.
- Restripe the southbound approach to provide a 200 feet of full width storage and appropriate taper on Holiday Lane.
- The above recommendations will require the redesign and retiming of the traffic signal at the intersection.

Future Roundabout

- Design the planned roundabout with a southbound exclusive right-turn lane with 200 feet of full-width storage and appropriate taper.

Catawba Avenue at Burton Lane / S. Hill Street

- Construct a left-turn lane with full-width storage that extends from the intersection of Catawba Avenue to Site Access #3 and appropriate taper on southbound Burton Lane.

Holiday Lane at Site Access #1

Access as Shown on Site Plan

- Construct Site Access #1 as a full-movement access point.
- Construct Site Access #1 with one ingress and one egress lane.

Consolidation of Site Accesses 1 and 2

- Construct Site Access #1 as a full-movement access point.
- Construct Site Access #1 with one ingress and one egress lane.
- Locate Site Access #1 approximately 325 feet north of the intersection with Catawba Avenue. This will align Site Access #1 with the existing access to the Days Inn hotel.

Access Alternative 3

- Construct Site Access #1 as a full-movement access point.
- Construct Site Access #1 with one ingress and one egress lane.
- The specific location of Site Access #1 under this access alternative does not need to be specified as it avoids conflicting left-turns on Holiday Lane.

Holiday Lane at Site Access #2

Access as Shown on Site Plan

- Construct Site Access #2 as a full-movement access point.
- Construct Site Access #2 with one ingress and one egress lane.

Consolidation of Site Accesses 1 and 2

- Site Access #2 would be eliminated.

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Access Alternative 3

- Construct Site Access #2 as a right-in only Access point with one ingress lane. No egress traffic or left-turns into the site would be permitted at this access point.

Burton Lane at Site Access #3

- Construct Site Access #3 as a full-movement access point.
- Construct Site Access #3 with one ingress and one egress lane.

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APPENDIX A:
MEMORANDUM OF UNDERSTANDING

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Project Information

Project Name: QT Cornelius

Project Location: Catawba Ave/Holiday Ln

Project Owner: David Meyer, Jr.

Case Number: REZ 11-16

Applicant Information

Applicant Name: Quik Trip Corporation

Applicant Telephone: 704-559-8013

Applicant Address: 3701 Arco Corporate Dr Suite 150, Charlotte, NC

Applicant Email: jdibern@quiktrip.com

The Town of Cornelius and the applicant hereby agree that the transportation consultant selected for the Transportation Impact Analysis (TIA) will submit sufficient information, as determined by the Town in the TIA report for applicable sections of the report outline required by Chapter 13 of the Town of Cornelius Land Development Code that are specified as required in the following agreement.

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I. COVER/SIGNATURE PAGE

Includes the project name, location, name of the applicant, contact information for the applicant, and date of the study. The name, contact information, registration number, signature, and seal of a duly qualified and registered professional engineer in the State of North Carolina are also required to appear on this page.

II. TABLE OF CONTENTS

Include a list of all section headings, figures, and tables included in the TIA report. Page numbers will denote the location of all information in the TIA report

III. EXECUTIVE SUMMARY

Include a clear, concise description of the study findings. It should include a general description of the project scope, study horizon years, existing conditions, probable impacts of the project, capacity analysis and conclusions, mitigation measures, and recommendations. Technical publications, calculations, documentation, data reporting, and detailed design should not be included in this section. The executive summary should not be longer than two pages and not be dependent on supplementary data.

IV. PROJECT DESCRIPTION

Identify the requested project and provide a brief description of the location of the site within the Town's planning jurisdiction. Also provide a detailed description of the project, including size of the parcel(s), anticipated completion dates (including phasing), and existing and

proposed uses for the site. This information should include the square footage of each use or the number and size of dwelling units proposed.

V. STUDY AREA

A narrative describing the study area will identify the location of the proposed project within the planning jurisdiction, existing and future land uses in the immediate area, and any unique transportation plans or policies applicable to the area. As part of the description, a vicinity map will be provided, which should show the boundary of the study area, include natural features and major and minor roadways within the study area, and show existing intersections and type of control, as well as linear distances between major roadways.

VI. SITE DESCRIPTION

Include a brief summary for key physical characteristics of the site, including general terrain, development size, existing zoning and use(s), proposed use(s), internal streets, parking, sidewalks and bicycle facilities, driveway locations, and designated loading and unloading areas. Similar information for adjoining properties will also be provided to evaluate opportunities for connectivity. A half-size (11"x17") site plan to scale illustrating the project as proposed at full build out will be included with the TIA report. Information presented in the TIA report will be identical in every respect to the site plan submitted for approval.

VII. EXISTING CONDITIONS

Provide a description of the existing transportation system within the study area. A narrative and map will be prepared that presents peak hour turning movement volumes for all intersection (signalized and unsignalized) identified for study by the Town. A separate narrative and map will be prepared to describe the characteristics of surrounding major roadways, including functional classification, number of lanes, posted speed limit, existing average daily traffic volumes, and typical cross sections.

VIII. FUTURE CONDITIONS

Provide a description of the future year(s) transportation system within the study area. A narrative and map will be prepared that presents peak hour turning movement volumes for all intersections (signalized and unsignalized) identified for study by the Town. Future year traffic volumes will be forecasted using historical growth rate information and transportation impact analysis reports for development approved by the town but not yet built. Turning movement volume development sheets will be included in the appendix of the TIA report. Town staff will provide both annual growth rate information, and a list of approved developments to include in the analysis to the transportation consultant at the mandatory scoping meeting.

Transportation improvements assumed in the future conditions analysis will include those with an expected completion date concurrent with that of the development and funded through either the Town's Capital Improvements Plan (CIP), NCDOT's Transportation Improvement Program (TIP), or indicated as a condition of approval from another nearby

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application. Prior approval from the Town must be obtained before including other transportation improvements in this study.

IX. PROJECT TRAFFIC

Project traffic will be generated for the proposed development using the traditional three step process of trip generation, distribution, and assignment.

A. Trip Generation – A trip generation table summarizing all trip generation calculations for the project must be included. The ITE trip generation rate used for the TIA must be described, including choice of peak hour or adjacent street traffic, choice of independent variable, and choice of average rate versus equation. If local trip generation rates are used, provide documentation to the satisfaction of Town and NCDOT staff for supporting such rates. Must also indicate any trip reductions that could be incorporated into the calculations such as pass by trips, mode split, etc. and the methodology and supporting documentation used for making such trip reductions.

B. Trip Distribution – Estimates of percentage distribution for trips to and from the development site will be clearly summarized in the TIA report using north, south, east and west cardinal directions. Trip distribution percentages proposed for the surrounding transportation network should be discussed and approved by the Town and NCDOT during the mandatory scoping meeting. A map showing the percentage of site traffic on each street included in the study area will be included in the TIA report. Must also describe the methodology and resulting trip distribution percentages that will be used in the TIA.

C. Trip Assignment – Project traffic will be distributed to the surrounding transportation system based on the site's trip generation estimates and trip distribution percentages. Traffic forecasts will be presented in both tabular and graphic formats for all peak hour conditions at all intersections included in the study area. If project will be built in phases, traffic assignments will be reported for each phase. Pass by traffic will be included at the driveways and access points for evaluating driveway volumes.

X. CAPACITY ANALYSIS

Level of Service (LOS) is the primary measurement for impacts to the transportation system, and is defined by the most current edition of the Highway Capacity Manual. LOS for signalized intersections shall be determined using existing signal timing plans provided by either the Town or NCDOT. Existing signal timing plans should be included in the appendix of the TIA report. If a traffic signal is part of a coordinated system it must be analyzed as such under all conditions. Other standard practices and default input values for evaluating signalized intersections should be consistent with the most recent guidelines published by the NCDOT, Traffic Engineering and Safety Systems Branch, Congestion Management Unit ("Capacity Analysis Guidelines"). The Town may also require safety, traffic simulation, gap and/or other analyses appropriate for evaluating a development application. Additional analyses and/or

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traffic capacity or simulation tools (such as VISSIM) required for the TIA shall be identified during the scoping meeting. Capacity analyses shall be conducted to determine levels of service in each peak hour for all intersections, and their approaches, identified for study using methodologies contained in the most current edition of the Highway Capacity Manual. Capacity calculations should be included for the existing and all future year scenarios. Impacts from the proposed project shall be measured by comparing the Future year build year and the Future year no-build year conditions. All TIA reports submitted to the Town shall use SYNCHRO, SimTraffic or VISSIM Software, for signalized and unsignalized intersections, or Sidra Software, for roundabouts, consistent with policies released by the NCDOT. A narrative, table, and map shall be prepared that summarizes the methodology and measured conditions at the intersections reported in level of service (LOS A – F), approach delay for unsignalized intersections or intersection signal delay for signalized intersections, and 95th percentile queue lengths for all intersections Capacity analysis worksheets and turn lane warrants should be included in the appendix of the TIA report.

XI. QUEUING ANALYSIS

A queuing analysis will be required by the Town for projects that include drive-through facilities of entrance gates to ensure that vehicle stacking will not adversely impact the public transportation system. 95th percentile and simulation analysis of future year queues shall be consistent with NCDOT's Traffic Engineering and Safety Systems Branch, Congestion Management Unit current practices and published Capacity Analysis Guidelines. Turn lanes for unsignalized driveways serving the site shall be identified using volume thresholds published in the NCDOT's Policy on Street and Driveway Access to North Carolina Highways (see Warrant for Left- and Right-Turn Lanes Nomograph, pg. 80). Recommendations for left and right turn lanes serving the site shall be designed to meet future year capacity needs identified in the TIA report. For projects that include drive-through facilities or entrance gates, a queuing analysis may be required by the Town to ensure that vehicle stacking will not adversely impact the public transportation system. The queuing analysis must be performed using accepted transportation engineering procedures approved by the Town. This analysis shall be required for all drive-through facilities. If a TIA is required for a new school site, the consultant must model the internal circulation and ingress/egress of the site using a "dummy signal" in the SYNCHRO software as prescribed by NCDOT Municipal School Transportation Assistance (MSTA) department.

XII. COLLISION ANALYSIS

A summary of crash data (type, number, and severity) for the most recent 3-year period at each study location is required. Traffic Engineering Accident Analysis System reports will be provided by the Town and should be included in the appendix of the TIA report. For locations with prevalent crash types and/or frequency, a discussion shall be included describing factors that may be contributing to the incidents. At a minimum, the proposed development features shall not contribute to factors potentially involved in collision rates. If contributing factors are identified, recommendations to eliminate these features shall be included.

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XIII. TRAFFIC SIGNAL WARRANTS

The need for installing a traffic signal or signals at a new location will be based on the application of warrants criteria contained in the most current edition of the Manual on Uniform Traffic Control Devices (MUTCD) and engineering judgment. Traffic signal warrants should be included in the appendix of the TIA report. Additionally, spacing of traffic signals within the Town must adhere to NCDOT requirements. Pedestrian movements must be considered in the evaluation and adequate pedestrian clearance provided in the signal cycle split assumptions. If a signal warrant analysis is recommended in the TIA, the Town and/or NCDOT may decide to defer a signal warrant analysis until after the development has opened in order to use actual turning movement counts at an intersection. The TIA recommendations must clearly state that this analysis shall occur at a specified date following the opening of the development. The applicant must issue a bond or letter of credit in the name of the Town for the estimated cost of the signal warrant analysis and resulting signal prior to final approval of the TIA. The cost shall be established based on an engineer's estimate provided by the engineer of record for the applicant, however final approval of the dollar amount rests with the Town.

XIV. SITE ACCESS

Inventory and describe the number and type of driveways, their locations, distances between driveways and intersections, types of driveways, and traffic controls at driveways. The design, number and location of access points to thoroughfares immediately adjacent to the site will be fully analyzed. The number of access points will be kept to a minimum and be designed to be consistent with the type of road facility. Left and right turns serving the site will be recommended and designed to meet future year capacity needs identified in the TIA report. Driveways serving the site from state roads should be designed in accordance with the NCDOT's Policy on Street and Driveway Access when to North Carolina Highways, and/or the Town or Mecklenburg County's standards, as applicable

XV. MITIGATION MEASURES

Describe the location, nature, extent, and phasing of all transportation improvements required of the applicant by the Town and NCDOT to improve and/or maintain minimum level of service (LOS) conditions through phasing and build-out of the project. Attach additional pages if needed.

The expectation for the TIA is to maintain intersection LOS measurements based on the thresholds in the following table:

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ZONING DISTRICT	LOS Threshold
RP, GR, NC	C
NMX, VC, HC	D
BC, IC	D
TC, TRD-O, TD-O, TND	E

A narrative and table shall be prepared that summarizes the methodology and measured conditions at the intersections reported in level of service (LOS A–F) and seconds of stop delay for the intersection and approach. If the existing level of service (intersection or approach) is inadequate (i.e., "E" or "F"), or the existing plus the background growth (not including the site) causes an inadequate level of service, then the developer will be expected to mitigate only the traffic to be generated by the proposed project. Town staff and NCDOT will review the recommendations in the final version of the TIA and will have the ultimate determination in the scope of the required mitigation measures.

For multi-phase developments, the capacity analyses scenarios shall address the phasing of improvements for a build out plus 5 year scenario. A narrative and map shall also be prepared that describes and illustrates recommended mitigations, by phase if necessary, for maintaining the integrity of the transportation system.

XVI. COMPLIANCE WITH ADOPTED TRANSPORTATION PLANS

Include a statement of compliance with plans, programs, and policies adopted by the Town of Cornelius for maintaining a safe and efficient multimodal transportation system. The Town will provide the applicant and the consultant with a copy of all relevant plans and studies.

XVII. RECOMMENDATIONS

Provide a clear, concise description of the study's findings regarding impacts of the proposed project on the existing and proposed transportation system, and provide a list of required improvements and a phasing plan (if appropriate) to maintain minimum future year conditions through the build out of the proposed project. The recommendation will end with a statement by the qualified traffic engineer responsible for the TIA that indicates whether or not the proposed project will meet minimum standards described herein through build out of the project.

XVIII. SUBMITTAL REQUIREMENTS

The applicant will submit a digital copy of the TIA report for concurrent review by the Town and NCDOT. The TIA report is anticipated from the transportation consultant for initial review by the Town at least two weeks prior to the anticipated Planning Board hearing, if the project requires conditional review, or within 30 days if the project only requires standard land development review.

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AGREEMENT BY ALL PARTIES

The undersigned hereby agree to the methodology described in the Memorandum of Understanding (MOU) for completing the required transportation impact analysis (TIA) supportive of the development application identified herein. Any changes to the above methodology contemplated by the applicant must be submitted to the Town in writing, and a revised MOU executed before such changes will be accepted for the TIA report. Any additional services incurred by the consultant in addition to the MOU must be approved by the Town, and process between the applicant and the transportation consultant.

Agreed to the 1st Day of November, 2016

APPLICANT

(signature)

David Meyer Jr.
(Print Name)

TOWN OF CORNELIUS

(signature)

Wayne Herron
(Print Name)

Reviewed and approved by the North Carolina Department of Transportation on this the 17 day of November, 2016.

DISTRICT ENGINEER

(signature)

Wendy Taylor
(Print Name)

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TIA SCOPE:

Trip Generation: use *ITE Trip Generation Handbook*, current edition. The variable of vehicle fueling positions and the average rate is to be used for daily trips, AM peak hour of adjacent street trips and PM peak hour of adjacent street trips.

Proposed Land Use: Convenience Market with Gasoline Pumps. (Land Use Code 853)

Size: 10 pumps (20 fueling positions)
Daily Total Trips: 10,852 unadjusted daily trips
Pass by: 63% AM peak hour, 66% PM peak hour (LUC 853)
Internal Capture: 0%

Land Use Code	Land Use Description	Variable	Daily Trips	AM Peak Trips			PM Peak Trips		
				Total	In	Out	Total	In	Out
853	Convenience Market w/ Gasoline Pumps	20 FP	10,852	331	166	165	381	191	190
	Pass-By Trip Reduction		*-460*	*-209*	*-105*	*-104*	*-251*	*-126*	*-125*
	Net New External Trips		***10,392***	***122***	***61***	***61***	***130***	***65***	***65***

Existing Land Use Traffic: The proposed development will be replacing the existing gas station and restaurant on the property. To account for this traffic, we propose to collect data at the six driveways to the property. We'll keep this traffic in the existing and no-build analysis scenarios. The trip generation for the proposed development will be the difference between what is counted at the existing driveways versus what is generated above.

Peak Hours:

☒ 7:00am- 9:00 am ☐ 11:00am- 1:00pm ☒ 4:00pm- 6:00pm

Proposed Study Intersections:

1. Site Access #1- Holiday Ln — unsignalized intersection
2. Site Access #2- Holiday Ln — unsignalized intersection
3. Site Access #3- Burton Ln — unsignalized intersection
4. US-21/Holiday Ln/ Catawba Ave
   a. Existing conditions will study this as a signalized intersection
   b. Future conditions will study this as a roundabout
   c. TIP design year analysis (2030) will study this as a roundabout
5. I-77 NB On/Off Ramps - Catawba Ave — signalized intersection (DDI)
6. I-77 SB On/Off Ramps - Catawba Ave — signalized intersection (DDI)
7. Catawba Ave/Burton Ln — unsignalized intersection

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Scenarios to be analyzed:

Existing:

☒ Existing Conditions Present Year: 2016

Build (2018) Horizon Year:

☒ Future No Build: 2018
☒ Future Build: 2018
☒ Future Build with improvements (if any): 2018

TIP Design (2030) Horizon Year:

☒ Future Design Year, NCDOT TIP Project C-5621 No-Build: 2030
☒ Future Design Year, NCDOT TIP Project C-5621 Build: 2030
☒ Future Design Year, NCDOT TIP Project C-5621 Build with improvements (if any): 2030

Proposed Growth Rate: 2% short-term growth rate / 1.5% long-term growth rate for TIP Year

Note: The 2030 traffic volumes will be taken from the provided Vissim/Transmodeler files developed for the funded TIP project.

Approved Developments (within area of influence): None

Funded TIP Projects: C-5621 Roundabout at US-21/Catawba Ave

Note: All study intersections as stated above page will be included in the TIP design year analysis.

Additional Exhibits:

A. Study Area
B. Site Plan
C. Trip Distribution

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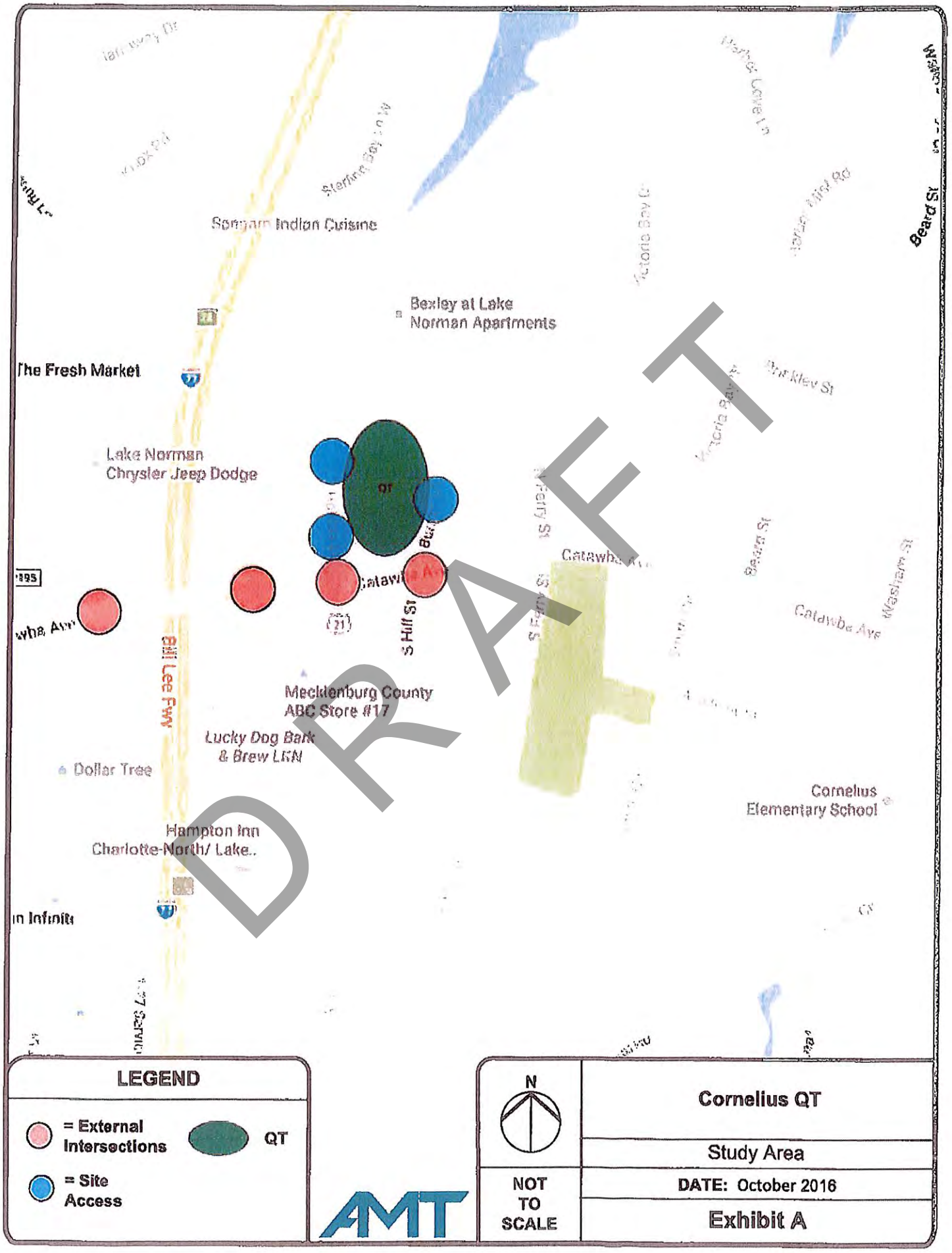
Sangam Indian Cuisine
Bexley at Lake Norman Apartments
The Fresh Market
Lake Norman Chrysler Jeep Dodge
Catawba Ave
S Hill St
Bill Lee Fwy
Mecklenburg County ABC Store #17
Lucky Dog Bark & Brew LKN
Dollar Tree
Hampton Inn Charlotte-North/ Lake..
Cornelius Elementary School
Beard St
Washam St
Prickley St
Victoria Bay Dr
Sterling Bay Ln W
Harbor Cove Ln
LEGEND
= External Intersections
= Site Access
QT
N
NOT TO SCALE
Cornelius QT
Study Area
DATE: October 2016
Exhibit A
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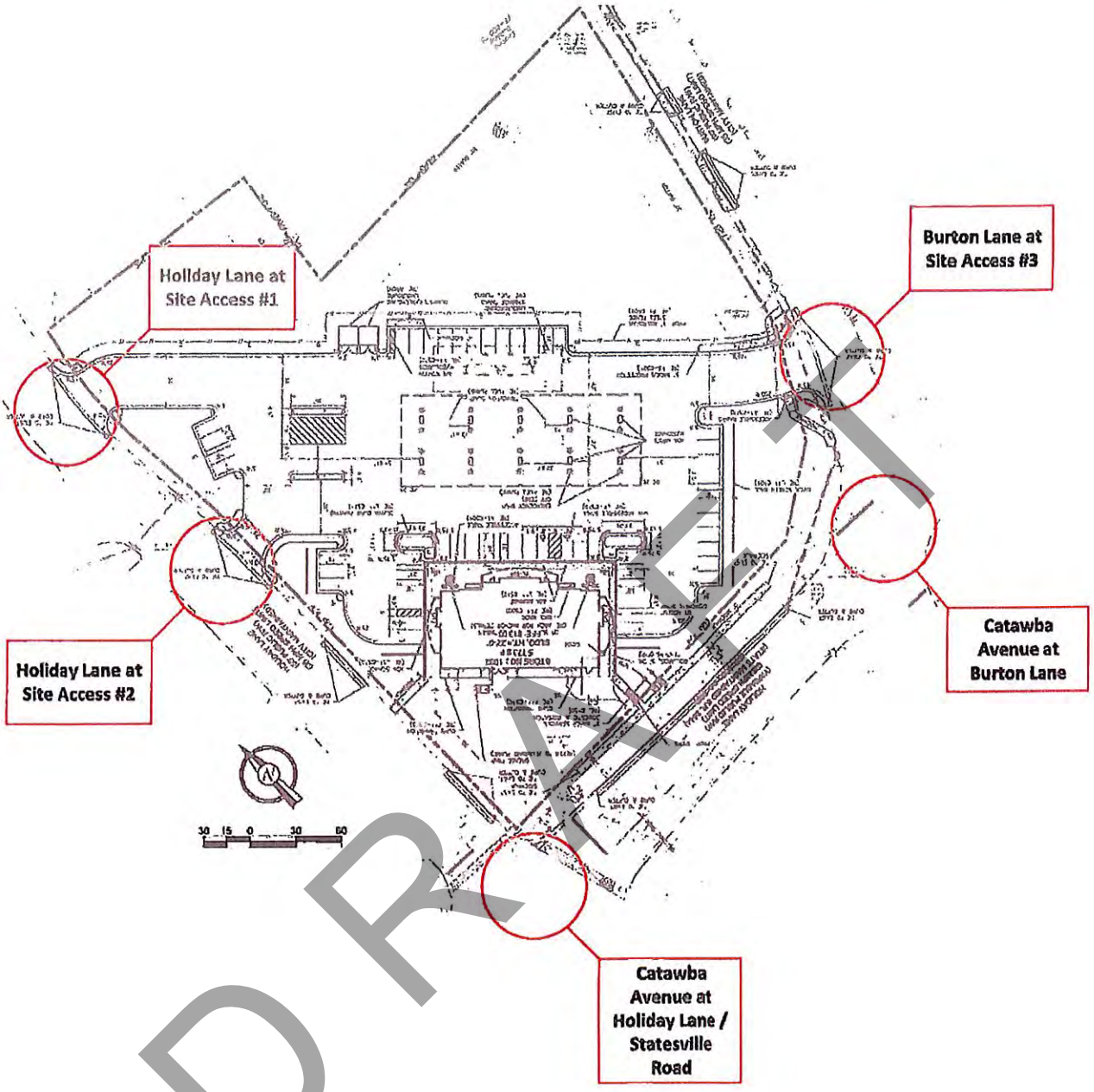

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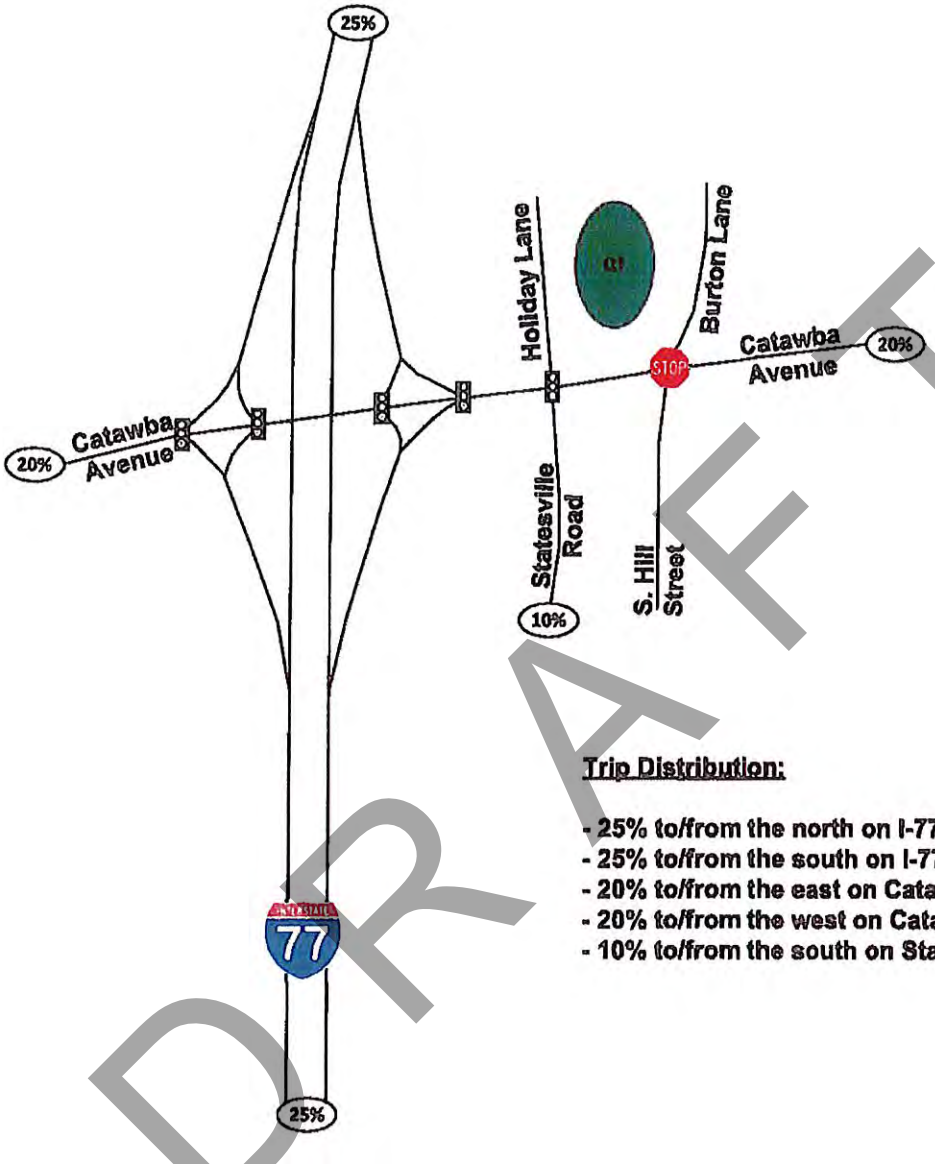
N	Cornelius QT
	Site Plan
NOT TO SCALE	DATE: October 2016
	Exhibit B

AMT



Trip Distribution:

- 25% to/from the north on I-77
- 25% to/from the south on I-77
- 20% to/from the east on Catawba Avenue
- 20% to/from the west on Catawba Avenue
- 10% to/from the south on Statesville Road

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LEGEND

- STOP — Existing Traffic Control
- Existing Roadway
- XX% — Trip Distribution Percentage

N

NOT TO SCALE

Cornelius QT

Trip Distribution

DATE: October 2016

Exhibit C

APPENDIX B:
TRAFFIC COUNTS

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APPENDIX B-1:
TRAFFIC COUNTS

2016 EXISTING TURNING MOVEMENTS

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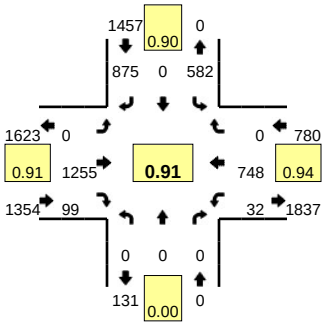
Type of peak hour being reported: Intersection Peak

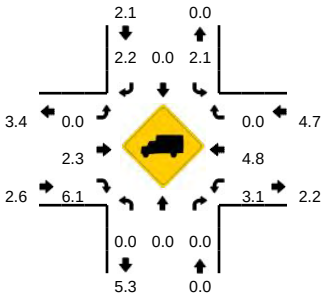
Method for determining peak hour: Total Entering Volume

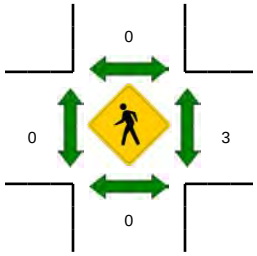
LOCATION: I-77 SB Ramps -- Catawba Ave
CITY/STATE: Cornelius, NC

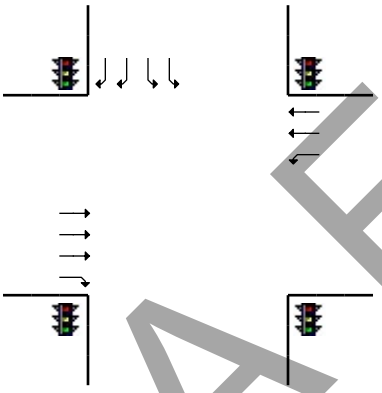
QC JOB #: 14071201
DATE: Wed, Nov 30 2016

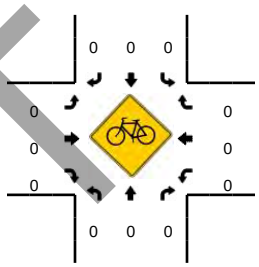


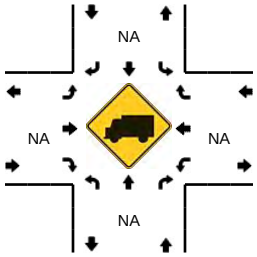
Peak-Hour: 7:30 AM -- 8:30 AM
Peak 15-Min: 8:15 AM -- 8:30 AM

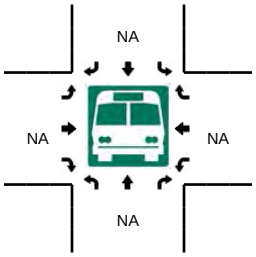












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15-Min Count Period Beginning At	I-77 SB Ramps (Northbound)				I-77 SB Ramps (Southbound)				Catawba Ave (Eastbound)				Catawba Ave (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
7:00 AM	0	0	0	0	102	0	141	0	0	240	20	0	15	126	0	0	644	
7:15 AM	0	0	0	0	127	0	205	0	0	253	17	0	6	132	0	0	740	
7:30 AM	0	0	0	0	193	0	212	0	0	307	25	0	6	146	0	0	889	
7:45 AM	0	0	0	0	144	0	254	0	0	344	28	0	6	171	0	0	947	3220
8:00 AM	0	0	0	0	112	0	160	0	0	268	16	0	9	199	0	0	764	3340
8:15 AM	0	0	0	0	133	0	249	0	0	336	30	0	11	232	0	0	991	3591
8:30 AM	0	0	0	0	82	0	173	0	0	263	29	0	6	247	0	0	800	3502
8:45 AM	0	0	0	0	89	0	176	0	0	271	64	0	7	249	0	0	856	3411

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	0	0	0	0	532	0	996	0	0	1344	120	0	44	928	0	0	3964
Heavy Trucks	0	0	0		16	0	28		0	48	0		0	28	0		120
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

Report generated on 12/7/2016 2:44 PM

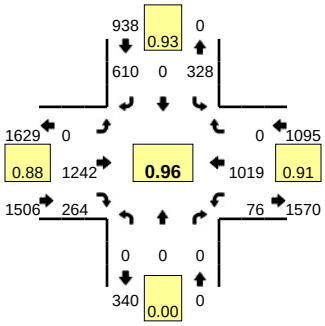
SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

Type of peak hour being reported: Intersection Peak

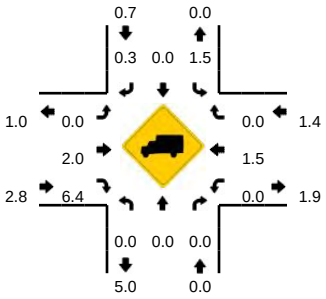
Method for determining peak hour: Total Entering Volume

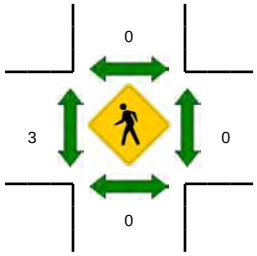
LOCATION: I-77 SB Ramps -- Catawba Ave
CITY/STATE: Cornelius, NC

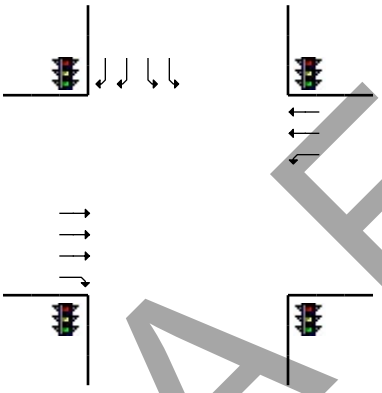
QC JOB #: 14071202
DATE: Wed, Nov 30 2016

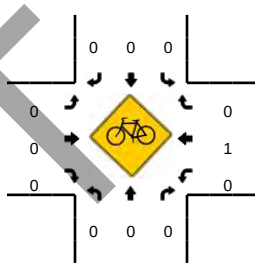


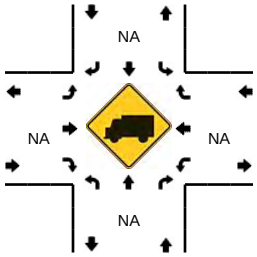
Peak-Hour: 4:45 PM -- 5:45 PM
Peak 15-Min: 5:15 PM -- 5:30 PM

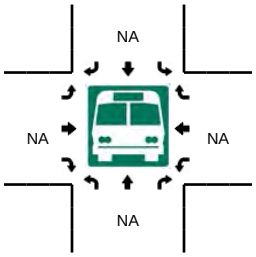












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15-Min Count Period Beginning At	I-77 SB Ramps (Northbound)				I-77 SB Ramps (Southbound)				Catawba Ave (Eastbound)				Catawba Ave (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
4:30 PM	0	0	0	0	72	0	139	0	0	248	86	0	18	274	0	0	837	
4:45 PM	0	0	0	0	70	0	155	0	0	343	50	0	24	251	0	0	893	
5:00 PM	0	0	0	0	86	0	152	0	0	280	78	0	14	268	0	0	878	
5:15 PM	0	0	0	0	79	0	179	0	0	362	68	0	22	216	0	0	926	3534
5:30 PM	0	0	0	0	93	0	124	0	0	257	68	0	16	284	0	0	842	3539
5:45 PM	0	0	0	0	84	0	160	0	0	279	58	0	16	235	0	0	832	3478
6:00 PM	0	0	0	0	89	0	127	0	0	251	59	0	9	257	0	0	792	3392
6:15 PM	0	0	0	0	68	0	159	0	0	283	54	0	10	218	0	0	792	3258

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	0	0	0	0	316	0	716	0	0	1448	272	0	88	864	0	0	3704
Heavy Trucks	0	0	0		4	0	0		0	28	16		0	12	0		60
Pedestrians		0				0				12				0			12
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

Report generated on 12/7/2016 2:44 PM

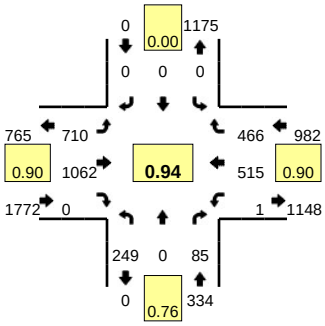
SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

Type of peak hour being reported: Intersection Peak

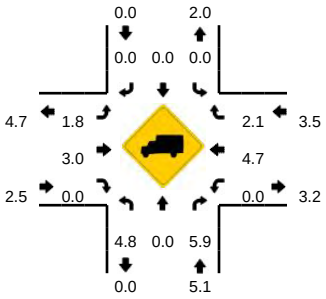
Method for determining peak hour: Total Entering Volume

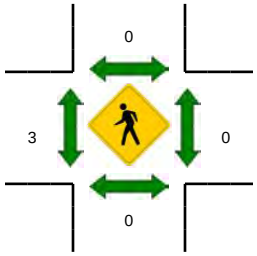
LOCATION: I-77 NB Ramps -- Catawba Ave
CITY/STATE: Cornelius, NC

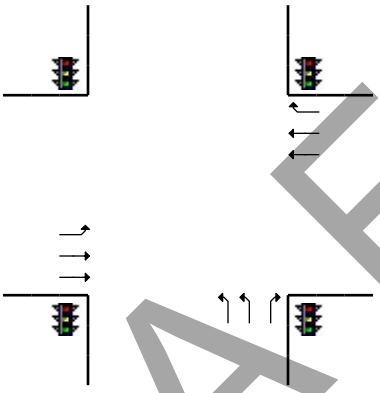
QC JOB #: 14071203
DATE: Wed, Nov 30 2016

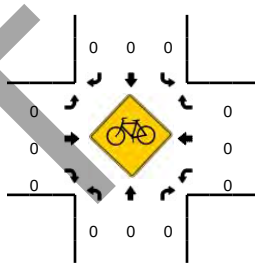


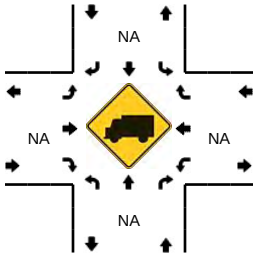
Peak-Hour: 7:30 AM -- 8:30 AM
Peak 15-Min: 7:45 AM -- 8:00 AM

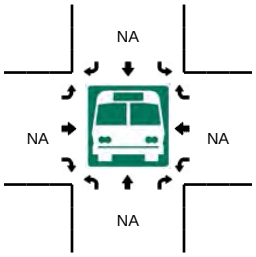












15-Min Count Period Beginning At	I-77 NB Ramps (Northbound)				I-77 NB Ramps (Southbound)				Catawba Ave (Eastbound)				Catawba Ave (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
7:00 AM	40	0	28	0	0	0	0	0	157	190	0	0	0	90	83	0	588	
7:15 AM	68	0	30	0	0	0	0	0	149	218	0	0	0	87	91	0	643	
7:30 AM	61	0	22	0	0	0	0	0	217	273	0	0	0	80	109	0	762	
7:45 AM	59	0	18	0	0	0	0	0	215	268	0	0	0	128	137	0	825	2818
8:00 AM	53	0	22	0	0	0	0	0	154	229	0	0	0	131	109	1	699	2929
8:15 AM	76	0	23	0	0	0	0	0	123	292	0	1	0	176	111	0	802	3088
8:30 AM	89	0	27	0	0	0	0	0	109	271	0	0	0	126	95	0	717	3043
8:45 AM	108	0	35	0	0	0	0	0	133	216	0	0	0	199	84	0	775	2993

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	236	0	72	0	0	0	0	0	860	1072	0	0	0	512	548	0	3300
Heavy Trucks	16	0	4		0	0	0		8	12	0		0	36	12		88
Pedestrians		0				0				4				0			4
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

DRAFT

Report generated on 12/7/2016 2:44 PM

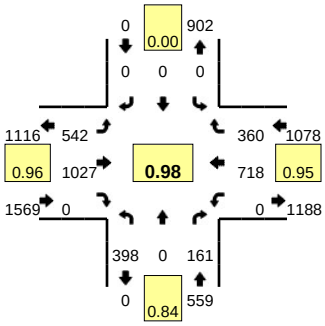
SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

Type of peak hour being reported: Intersection Peak

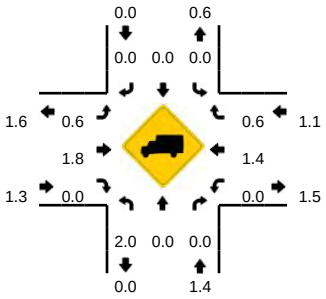
Method for determining peak hour: Total Entering Volume

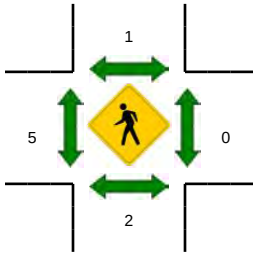
LOCATION: I-77 NB Ramps -- Catawba Ave
CITY/STATE: Cornelius, NC

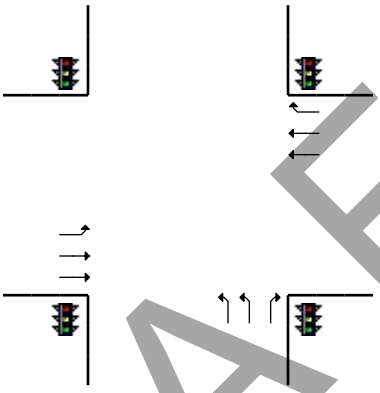
QC JOB #: 14071204
DATE: Wed, Nov 30 2016

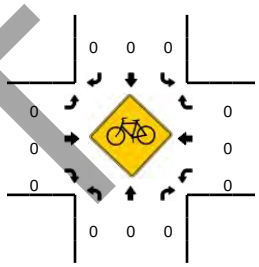


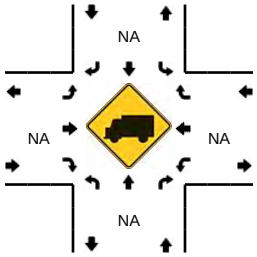
Peak-Hour: 4:45 PM -- 5:45 PM
Peak 15-Min: 5:15 PM -- 5:30 PM

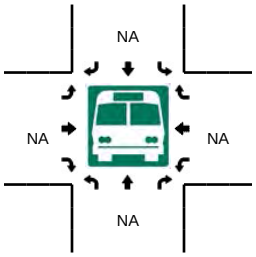












Quality Counts
TRANSPORTATION DATA COLLECTION SERVICES

DRAFT

15-Min Count Period Beginning At	I-77 NB Ramps (Northbound)				I-77 NB Ramps (Southbound)				Catawba Ave (Eastbound)				Catawba Ave (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
4:30 PM	98	0	37	0	0	0	0	0	122	228	0	0	0	167	74	0	726	
4:45 PM	107	0	38	0	0	0	0	0	140	225	0	0	0	196	76	0	782	
5:00 PM	94	0	31	0	0	0	0	0	132	263	0	0	0	169	114	0	803	
5:15 PM	95	0	57	0	0	0	0	0	156	253	0	0	0	168	90	0	819	3130
5:30 PM	102	0	35	0	0	0	0	0	114	286	0	0	0	185	80	0	802	3206
5:45 PM	124	0	50	0	0	0	0	0	113	232	0	0	0	171	70	0	760	3184
6:00 PM	71	0	41	0	0	0	0	0	127	252	0	0	0	158	62	0	711	3092
6:15 PM	97	0	34	0	0	0	0	0	113	221	0	0	0	155	56	0	676	2949

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	380	0	228	0	0	0	0	0	624	1012	0	0	0	672	360	0	3276
Heavy Trucks	4	0	0		0	0	0		0	16	0		0	8	0		28
Pedestrians		0				0				8				0			8
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

Report generated on 12/7/2016 2:44 PM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

Type of peak hour being reported: Intersection Peak

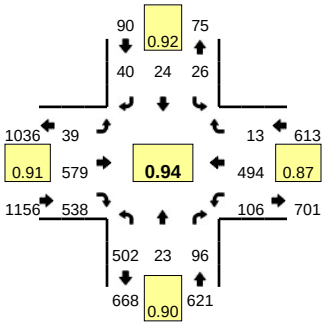
Method for determining peak hour: Total Entering Volume

LOCATION: Holiday Ln/US 21 -- Catawba Ave

QC JOB #: 14071205

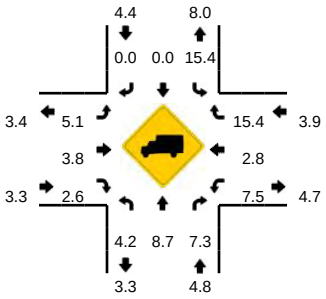
CITY/STATE: Cornelius, NC

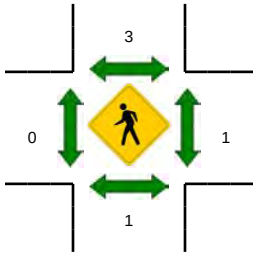
DATE: Wed, Nov 30 2016

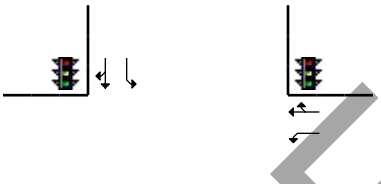


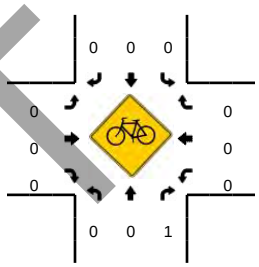
Peak-Hour: 7:45 AM -- 8:45 AM

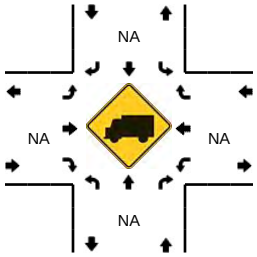
Peak 15-Min: 8:15 AM -- 8:30 AM

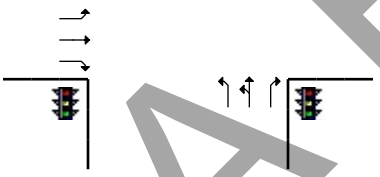


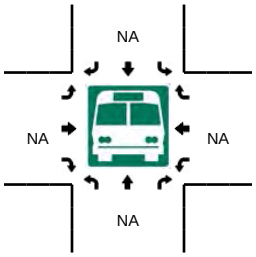












Quality Counts
TRANSPORTATION DATA COLLECTION SERVICES

DRAFT

15-Min Count Period Beginning At	Holiday Ln/US 21 (Northbound)				Holiday Ln/US 21 (Southbound)				Catawba Ave (Eastbound)				Catawba Ave (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
7:00 AM	71	1	30	0	1	9	17	0	5	102	122	0	30	98	1	0	487	
7:15 AM	70	2	22	0	6	7	12	0	3	116	116	1	21	89	1	0	466	
7:30 AM	79	3	16	0	2	7	9	0	8	141	170	1	19	95	3	0	553	
7:45 AM	134	11	27	0	4	8	6	0	12	138	132	0	17	124	3	0	616	2122
8:00 AM	129	4	24	0	9	5	12	0	6	126	125	0	30	104	6	0	580	2215
8:15 AM	127	4	24	0	6	6	12	0	12	146	149	0	30	145	1	0	662	2411
8:30 AM	112	4	21	0	7	5	10	0	9	169	132	0	29	121	3	0	622	2480
8:45 AM	83	0	17	0	2	8	17	0	10	110	124	0	27	160	3	0	561	2425

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	508	16	96	0	24	24	48	0	48	584	596	0	120	580	4	0	2648
Heavy Trucks	24	0	12		8	0	0		4	32	20		4	8	0		112
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad Stopped Buses																	

Comments:

Report generated on 12/7/2016 2:44 PM

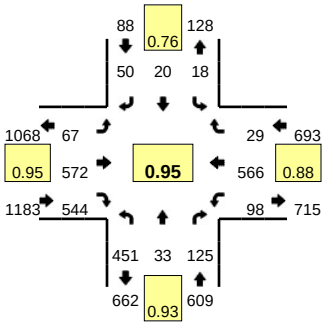
SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

Type of peak hour being reported: Intersection Peak

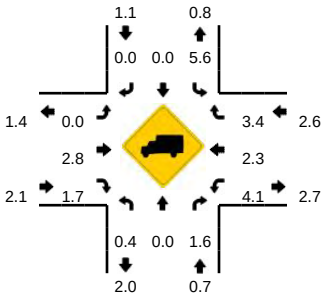
Method for determining peak hour: Total Entering Volume

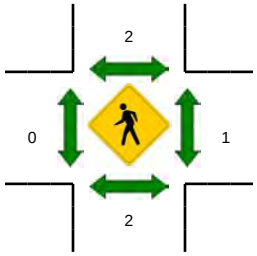
LOCATION: Holiday Ln/US 21 -- Catawba Ave
CITY/STATE: Cornelius, NC

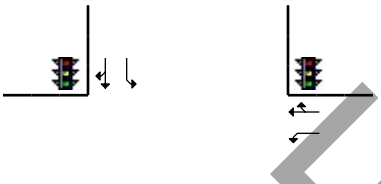
QC JOB #: 14071206
DATE: Wed, Nov 30 2016

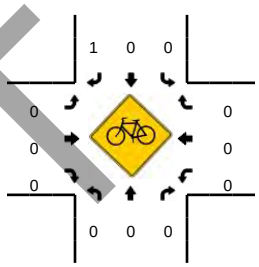


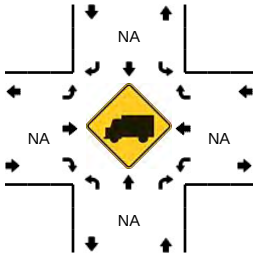
Peak-Hour: 4:45 PM -- 5:45 PM
Peak 15-Min: 5:30 PM -- 5:45 PM

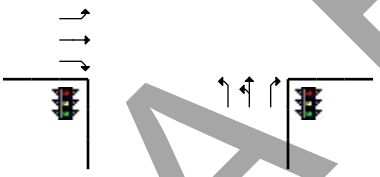


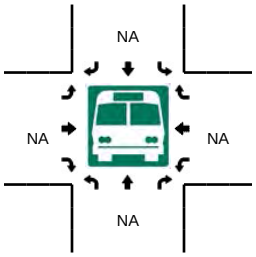












DRAFT

15-Min Count Period Beginning At	Holiday Ln/US 21 (Northbound)				Holiday Ln/US 21 (Southbound)				Catawba Ave (Eastbound)				Catawba Ave (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
4:30 PM	72	6	28	0	8	1	11	0	17	133	127	1	36	161	4	0	605	
4:45 PM	106	10	26	0	5	3	17	0	11	140	116	0	21	147	6	0	608	
5:00 PM	124	5	36	0	3	4	9	0	17	143	125	0	20	140	6	0	632	
5:15 PM	116	11	32	0	5	5	8	0	19	141	153	1	30	129	8	0	658	2503
5:30 PM	105	7	31	0	5	8	16	0	19	148	150	0	27	150	9	0	675	2573
5:45 PM	99	8	40	0	5	4	7	0	19	122	146	1	27	121	5	0	604	2569
6:00 PM	101	9	28	0	3	4	11	0	21	127	142	0	19	109	4	0	578	2515
6:15 PM	98	6	34	0	3	2	8	0	20	118	116	0	19	99	4	0	527	2384

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	420	28	124	0	20	32	64	0	76	592	600	0	108	600	36	0	2700
Heavy Trucks	4	0	0		0	0	0		0	16	4		8	0	0		32
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

Report generated on 12/7/2016 2:44 PM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

Type of peak hour being reported: Intersection Peak

Method for determining peak hour: Total Entering Volume

LOCATION: Burton Ln/S Hill St -- Catawba Ave

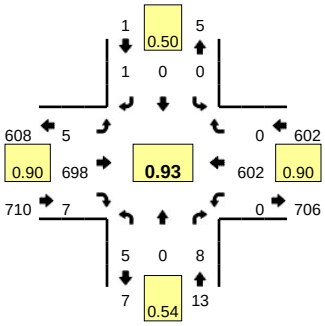
CITY/STATE: Cornelius, NC

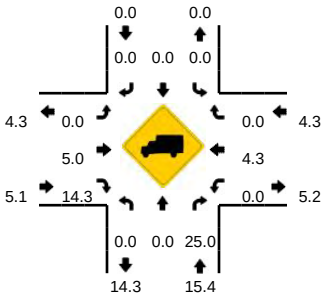
QC JOB #: 14071207

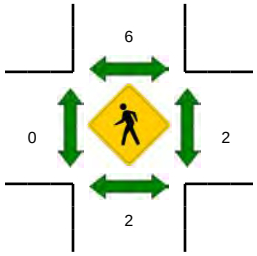
DATE: Wed, Nov 30 2016

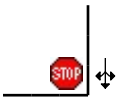
Peak-Hour: 7:45 AM -- 8:45 AM

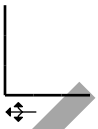
Peak 15-Min: 8:30 AM -- 8:45 AM

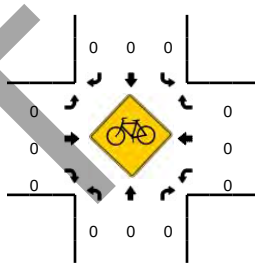


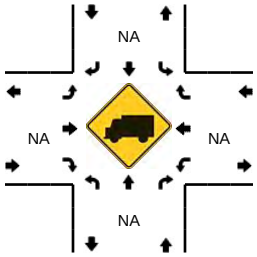


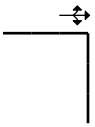


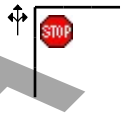


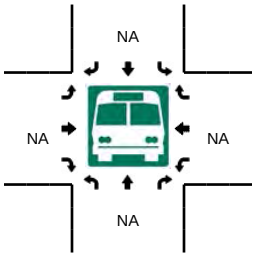












15-Min Count Period Beginning At	Burton Ln/S Hill St (Northbound)				Burton Ln/S Hill St (Southbound)				Catawba Ave (Eastbound)				Catawba Ave (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
7:00 AM	1	0	1	0	0	0	1	0	0	133	1	0	0	130	1	0	268	
7:15 AM	1	0	0	0	0	0	0	0	1	149	0	0	0	107	1	0	259	
7:30 AM	1	0	1	0	0	0	0	0	0	157	2	0	0	126	0	0	287	
7:45 AM	0	0	3	0	0	0	0	0	1	170	2	0	0	138	0	0	314	1128
8:00 AM	2	0	0	0	0	0	1	0	2	157	3	0	0	140	0	0	305	1165
8:15 AM	2	0	4	0	0	0	0	0	1	176	0	0	0	167	0	0	350	1256
8:30 AM	1	0	1	0	0	0	0	0	1	195	2	0	0	157	0	0	357	1326
8:45 AM	1	0	2	0	0	0	1	0	0	130	1	0	1	176	1	0	313	1325

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	4	0	4	0	0	0	0	0	4	780	8	0	0	628	0	0	1428
Heavy Trucks	0	0	4		0	0	0		0	36	0		0	32	0		72
Pedestrians		0				8				0				8			16
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

DRAFT

Report generated on 12/7/2016 2:44 PM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

Type of peak hour being reported: Intersection Peak

Method for determining peak hour: Total Entering Volume

LOCATION: Burton Ln/S Hill St -- Catawba Ave

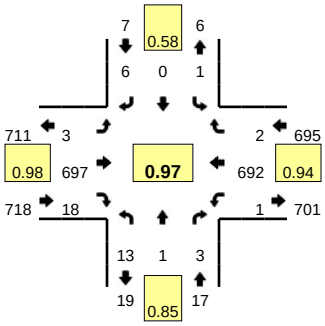
CITY/STATE: Cornelius, NC

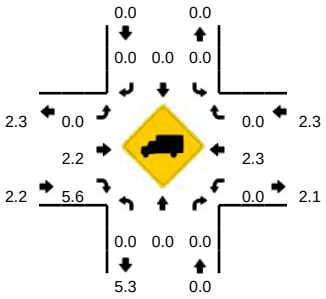
QC JOB #: 14071208

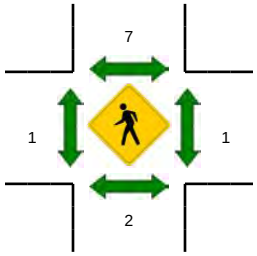
DATE: Wed, Nov 30 2016

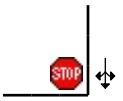
Peak-Hour: 4:45 PM -- 5:45 PM

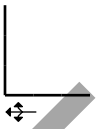
Peak 15-Min: 5:30 PM -- 5:45 PM

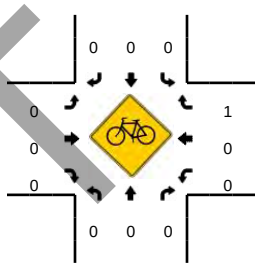


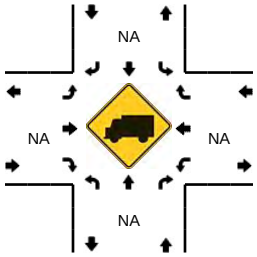


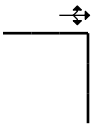


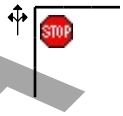


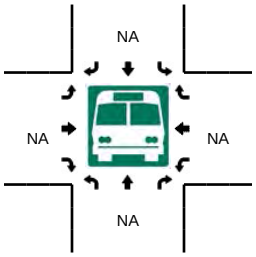












15-Min Count Period Beginning At	Burton Ln/S Hill St (Northbound)				Burton Ln/S Hill St (Southbound)				Catawba Ave (Eastbound)				Catawba Ave (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
4:30 PM	1	0	0	0	0	0	1	0	0	163	5	0	0	180	1	0	351	
4:45 PM	2	0	1	0	1	0	2	0	1	173	3	0	1	184	0	0	368	
5:00 PM	3	0	1	0	0	0	1	0	2	164	8	0	0	162	1	0	342	
5:15 PM	4	0	1	0	0	0	1	0	0	179	4	0	0	168	0	0	357	1418
5:30 PM	4	1	0	0	0	0	2	0	0	181	3	0	0	178	1	0	370	1437
5:45 PM	1	0	0	0	0	0	0	0	1	166	0	0	0	158	0	0	326	1395
6:00 PM	1	0	1	0	0	1	1	0	0	152	2	0	1	121	0	0	280	1333
6:15 PM	2	0	0	0	0	0	1	0	1	151	4	0	0	138	0	0	297	1273

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	16	4	0	0	0	0	8	0	0	724	12	0	0	712	4	0	1480
Heavy Trucks	0	0	0		0	0	0		0	12	0		0	8	0		20
Pedestrians		4				0				0				0			4
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

DRAFT

Report generated on 12/7/2016 2:44 PM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

APPENDIX B-2:
TRAFFIC COUNTS

2016 EXISTING DRIVEWAY VOLUMES

DRAFT

LOCATION: Holiday Ln North Dwy
SPECIFIC LOCATION: Holiday Ln North Dwy
CITY/STATE: Cornelius, NC

QC JOB #: 14071209
DIRECTION: EB
DATE: Nov 30 2016 - Nov 30 2016

Start Time	Mon	Tue	Wed 30-Nov-16	Thu	Fri	Average Weekday Hourly Traffic	Sat	Sun	Average Week Hourly Traffic	Average Week Profile
12:00 AM			1			1			1	
1:00 AM			0			0			0	
2:00 AM			0			0			0	
3:00 AM			1			1			1	
4:00 AM			0			0			0	
5:00 AM			0			0			0	
6:00 AM			0			0			0	
7:00 AM			0			0			0	
8:00 AM			**3**			**3**			**3**	
9:00 AM			3			3			3	
10:00 AM			0			0			0	
11:00 AM			2			2			2	
12:00 PM			1			1			1	
1:00 PM			1			1			1	
2:00 PM			4			4			4	
3:00 PM			1			1			1	
4:00 PM			1			1			1	
5:00 PM			1			1			1	
6:00 PM			3			3			3	
7:00 PM			**5**			**5**			**5**	
8:00 PM			1			1			1	
9:00 PM			0			0			0	
10:00 PM			0			0			0	
11:00 PM			1			1			1	
Day Total			29			29			29	
% Weekday Average			100.0%							
% Week Average			100.0%			100.0%				
AM Peak Volume			8:00 AM 3			8:00 AM 3			8:00 AM 3	
PM Peak Volume			7:00 PM 5			7:00 PM 5			7:00 PM 5	

Comments:

DRAFT

Quality Counts
TRANSPORTATION DATA COLLECTION

LOCATION: Holiday Ln North Dwy
SPECIFIC LOCATION: Holiday Ln North Dwy
CITY/STATE: Cornelius, NC

QC JOB #: 14071209
DIRECTION: WB
DATE: Nov 30 2016 - Nov 30 2016

Start Time	Mon	Tue	Wed 30-Nov-16	Thu	Fri	Average Weekday Hourly Traffic	Sat	Sun	Average Week Hourly Traffic	Average Week Profile
12:00 AM			0			0			0	
1:00 AM			0			0			0	
2:00 AM			0			0			0	
3:00 AM			0			0			0	
4:00 AM			0			0			0	
5:00 AM			0			0			0	
6:00 AM			0			0			0	
7:00 AM			1			1			1	
8:00 AM			5			5			5	
9:00 AM			**10**			**10**			**10**	
10:00 AM			4			4			4	
11:00 AM			5			5			5	
12:00 PM			7			7			7	
1:00 PM			7			7			7	
2:00 PM			6			6			6	
3:00 PM			5			5			5	
4:00 PM			4			4			4	
5:00 PM			4			4			4	
6:00 PM			8			8			8	
7:00 PM			**9**			**9**			**9**	
8:00 PM			5			5			5	
9:00 PM			4			4			4	
10:00 PM			3			3			3	
11:00 PM			0			0			0	
Day Total			87			87			87	
% Weekday Average			100.0%							
% Week Average			100.0%			100.0%				
AM Peak Volume			9:00 AM 10			9:00 AM 10			9:00 AM 10	
PM Peak Volume			7:00 PM 9			7:00 PM 9			7:00 PM 9	

Comments:

DRAFT

Quality Counts
TRANSPORTATION DATA COLLECTION

LOCATION: Holiday Ln Mid Dwy
SPECIFIC LOCATION: Holiday Ln Mid Dwy
CITY/STATE: Cornelius, NC

QC JOB #: 14071210
DIRECTION: EB
DATE: Nov 30 2016 - Nov 30 2016

Start Time	Mon	Tue	Wed 30-Nov-16	Thu	Fri	Average Weekday Hourly Traffic	Sat	Sun	Average Week Hourly Traffic	Average Week Profile
12:00 AM			0			0			0	
1:00 AM			0			0			0	
2:00 AM			0			0			0	
3:00 AM			0			0			0	
4:00 AM			0			0			0	
5:00 AM			0			0			0	
6:00 AM			1			1			1	
7:00 AM			12			12			12	
8:00 AM			8			8			8	
9:00 AM			5			5			5	
10:00 AM			**21**			**21**			**21**	
11:00 AM			13			13			13	
12:00 PM			**20**			**20**			**20**	
1:00 PM			11			11			11	
2:00 PM			4			4			4	
3:00 PM			3			3			3	
4:00 PM			9			9			9	
5:00 PM			13			13			13	
6:00 PM			18			18			18	
7:00 PM			7			7			7	
8:00 PM			4			4			4	
9:00 PM			1			1			1	
10:00 PM			1			1			1	
11:00 PM			0			0			0	
Day Total			151			151			151	
% Weekday Average			100.0%							
% Week Average			100.0%			100.0%				
AM Peak Volume			10:00 AM 21			10:00 AM 21			10:00 AM 21	
PM Peak Volume			12:00 PM 20			12:00 PM 20			12:00 PM 20	

Comments:

DRAFT

Quality Counts
TRANSPORTATION DATA COLLECTION

LOCATION: Holiday Ln Mid Dwy
SPECIFIC LOCATION: Holiday Ln Mid Dwy
CITY/STATE: Cornelius, NC

QC JOB #: 14071210
DIRECTION: WB
DATE: Nov 30 2016 - Nov 30 2016

Start Time	Mon	Tue	Wed 30-Nov-16	Thu	Fri	Average Weekday Hourly Traffic	Sat	Sun	Average Week Hourly Traffic	Average Week Profile
12:00 AM			0			0			0	
1:00 AM			0			0			0	
2:00 AM			1			1			1	
3:00 AM			1			1			1	
4:00 AM			0			0			0	
5:00 AM			0			0			0	
6:00 AM			1			1			1	
7:00 AM			0			0			0	
8:00 AM			3			3			3	
9:00 AM			**19**			**19**			**19**	
10:00 AM			16			16			16	
11:00 AM			10			10			10	
12:00 PM			24			24			24	
1:00 PM			26			26			26	
2:00 PM			**28**			**28**			**28**	
3:00 PM			3			3			3	
4:00 PM			8			8			8	
5:00 PM			11			11			11	
6:00 PM			19			19			19	
7:00 PM			21			21			21	
8:00 PM			12			12			12	
9:00 PM			9			9			9	
10:00 PM			3			3			3	
11:00 PM			4			4			4	
Day Total			219			219			219	
% Weekday Average			100.0%							
% Week Average			100.0%			100.0%				
AM Peak Volume			9:00 AM 19			9:00 AM 19			9:00 AM 19	
PM Peak Volume			2:00 PM 28			2:00 PM 28			2:00 PM 28	

Comments:

DRAFT

Quality Counts
TRANSPORTATION DATA COLLECTION

LOCATION: Holiday Ln South Dwy
SPECIFIC LOCATION: Holiday Ln South Dwy
CITY/STATE: Cornelius, NC

QC JOB #: 14071211
DIRECTION: EB
DATE: Nov 30 2016 - Nov 30 2016

Start Time	Mon	Tue	Wed 30-Nov-16	Thu	Fri	Average Weekday Hourly Traffic	Sat	Sun	Average Week Hourly Traffic	Average Week Profile
12:00 AM			0			0			0	
1:00 AM			0			0			0	
2:00 AM			0			0			0	
3:00 AM			0			0			0	
4:00 AM			0			0			0	
5:00 AM			2			2			2	
6:00 AM			8			8			8	
7:00 AM			**18**			**18**			**18**	
8:00 AM			3			3			3	
9:00 AM			10			10			10	
10:00 AM			5			5			5	
11:00 AM			8			8			8	
12:00 PM			4			4			4	
1:00 PM			2			2			2	
2:00 PM			5			5			5	
3:00 PM			6			6			6	
4:00 PM			6			6			6	
5:00 PM			1			1			1	
6:00 PM			**9**			**9**			**9**	
7:00 PM			3			3			3	
8:00 PM			3			3			3	
9:00 PM			1			1			1	
10:00 PM			1			1			1	
11:00 PM			1			1			1	
Day Total			96			96			96	
% Weekday Average			100.0%							
% Week Average			100.0%			100.0%				
AM Peak			7:00 AM			7:00 AM			7:00 AM	
Volume			18			18			18	
PM Peak			6:00 PM			6:00 PM			6:00 PM	
Volume			9			9			9	

Comments:

DRAFT

Quality Counts
TRANSPORTATION DATA COLLECTION

LOCATION: Holiday Ln South Dwy
SPECIFIC LOCATION: Holiday Ln South Dwy
CITY/STATE: Cornelius, NC

QC JOB #: 14071211
DIRECTION: WB
DATE: Nov 30 2016 - Nov 30 2016

Start Time	Mon	Tue	Wed 30-Nov-16	Thu	Fri	Average Weekday Hourly Traffic	Sat	Sun	Average Week Hourly Traffic	Average Week Profile
12:00 AM			0			0			0	
1:00 AM			1			1			1	
2:00 AM			0			0			0	
3:00 AM			1			1			1	
4:00 AM			0			0			0	
5:00 AM			0			0			0	
6:00 AM			0			0			0	
7:00 AM			2			2			2	
8:00 AM			2			2			2	
9:00 AM			2			2			2	
10:00 AM			**7**			**7**			**7**	
11:00 AM			3			3			3	
12:00 PM			2			2			2	
1:00 PM			0			0			0	
2:00 PM			1			1			1	
3:00 PM			0			0			0	
4:00 PM			0			0			0	
5:00 PM			0			0			0	
6:00 PM			1			1			1	
7:00 PM			1			1			1	
8:00 PM			0			0			0	
9:00 PM			**5**			**5**			**5**	
10:00 PM			0			0			0	
11:00 PM			0			0			0	
Day Total			28			28			28	
% Weekday Average			100.0%							
% Week Average			100.0%			100.0%				
AM Peak			10:00 AM			10:00 AM			10:00 AM	
Volume			7			7			7	
PM Peak			9:00 PM			9:00 PM			9:00 PM	
Volume			5			5			5	

Comments:

DRAFT
Quality Counts
TRANSPORTATION DATA COLLECTION

LOCATION: Catawba Ave East Dwy
SPECIFIC LOCATION: Catawba Ave East Dwy
CITY/STATE: Cornelius, NC

QC JOB #: 14071212
DIRECTION: NB
DATE: Nov 30 2016 - Nov 30 2016

Start Time	Mon	Tue	Wed 30-Nov-16	Thu	Fri	Average Weekday Hourly Traffic	Sat	Sun	Average Week Hourly Traffic	Average Week Profile
12:00 AM			1			1			1	
1:00 AM			0			0			0	
2:00 AM			0			0			0	
3:00 AM			0			0			0	
4:00 AM			1			1			1	
5:00 AM			1			1			1	
6:00 AM			9			9			9	
7:00 AM			17			17			17	
8:00 AM			19			19			19	
9:00 AM			14			14			14	
10:00 AM			15			15			15	
11:00 AM			**22**			**22**			**22**	
12:00 PM			**26**			**26**			**26**	
1:00 PM			25			25			25	
2:00 PM			18			18			18	
3:00 PM			14			14			14	
4:00 PM			26			26			26	
5:00 PM			25			25			25	
6:00 PM			20			20			20	
7:00 PM			13			13			13	
8:00 PM			6			6			6	
9:00 PM			9			9			9	
10:00 PM			0			0			0	
11:00 PM			0			0			0	
Day Total			281			281			281	
% Weekday Average			100.0%							
% Week Average			100.0%			100.0%				
AM Peak			11:00 AM			11:00 AM			11:00 AM	
Volume			22			22			22	
PM Peak			12:00 PM			12:00 PM			12:00 PM	
Volume			26			26			26	

Comments:

DRAFT

Quality Counts
TRANSPORTATION DATA COLLECTION

LOCATION: Catawba Ave East Dwy
SPECIFIC LOCATION: Catawba Ave East Dwy
CITY/STATE: Cornelius, NC

QC JOB #: 14071212
DIRECTION: SB
DATE: Nov 30 2016 - Nov 30 2016

Start Time	Mon	Tue	Wed 30-Nov-16	Thu	Fri	Average Weekday Hourly Traffic	Sat	Sun	Average Week Hourly Traffic	Average Week Profile
12:00 AM			0			0			0	
1:00 AM			0			0			0	
2:00 AM			0			0			0	
3:00 AM			1			1			1	
4:00 AM			0			0			0	
5:00 AM			0			0			0	
6:00 AM			7			7			7	
7:00 AM			6			6			6	
8:00 AM			**12**			**12**			**12**	
9:00 AM			12			12			12	
10:00 AM			3			3			3	
11:00 AM			4			4			4	
12:00 PM			**18**			**18**			**18**	
1:00 PM			18			18			18	
2:00 PM			13			13			13	
3:00 PM			11			11			11	
4:00 PM			17			17			17	
5:00 PM			15			15			15	
6:00 PM			13			13			13	
7:00 PM			8			8			8	
8:00 PM			11			11			11	
9:00 PM			6			6			6	
10:00 PM			0			0			0	
11:00 PM			0			0			0	
Day Total			175			175			175	
% Weekday Average			100.0%							
% Week Average			100.0%			100.0%				
AM Peak Volume			8:00 AM 12			8:00 AM 12			8:00 AM 12	
PM Peak Volume			12:00 PM 18			12:00 PM 18			12:00 PM 18	

Comments:

DRAFT

Quality Counts
TRANSPORTATION DATA COLLECTION

LOCATION: Catawba Ave Mid Dwy
SPECIFIC LOCATION: Catawba Ave Mid Dwy
CITY/STATE: Cornelius, NC

QC JOB #: 14071213
DIRECTION: NB
DATE: Nov 30 2016 - Nov 30 2016

Start Time	Mon	Tue	Wed 30-Nov-16	Thu	Fri	Average Weekday Hourly Traffic	Sat	Sun	Average Week Hourly Traffic	Average Week Profile
12:00 AM			0			0			0	
1:00 AM			0			0			0	
2:00 AM			0			0			0	
3:00 AM			0			0			0	
4:00 AM			0			0			0	
5:00 AM			0			0			0	
6:00 AM			0			0			0	
7:00 AM			**1**			**1**			**1**	
8:00 AM			1			1			1	
9:00 AM			1			1			1	
10:00 AM			1			1			1	
11:00 AM			0			0			0	
12:00 PM			3			3			3	
1:00 PM			1			1			1	
2:00 PM			1			1			1	
3:00 PM			2			2			2	
4:00 PM			0			0			0	
5:00 PM			1			1			1	
6:00 PM			3			3			3	
7:00 PM			2			2			2	
8:00 PM			**7**			**7**			**7**	
9:00 PM			2			2			2	
10:00 PM			0			0			0	
11:00 PM			0			0			0	
Day Total			26			26			26	
% Weekday Average			100.0%							
% Week Average			100.0%			100.0%				
AM Peak Volume			7:00 AM 1			7:00 AM 1			7:00 AM 1	
PM Peak Volume			8:00 PM 7			8:00 PM 7			8:00 PM 7	

Comments:

DRAFT

Quality Counts
TRANSPORTATION DATA COLLECTION

LOCATION: Catawba Ave Mid Dwy
SPECIFIC LOCATION: Catawba Ave Mid Dwy
CITY/STATE: Cornelius, NC

QC JOB #: 14071213
DIRECTION: SB
DATE: Nov 30 2016 - Nov 30 2016

Start Time	Mon	Tue	Wed 30-Nov-16	Thu	Fri	Average Weekday Hourly Traffic	Sat	Sun	Average Week Hourly Traffic	Average Week Profile
12:00 AM			1			1			1	
1:00 AM			0			0			0	
2:00 AM			1			1			1	
3:00 AM			0			0			0	
4:00 AM			1			1			1	
5:00 AM			0			0			0	
6:00 AM			2			2			2	
7:00 AM			11			11			11	
8:00 AM			6			6			6	
9:00 AM			5			5			5	
10:00 AM			12			12			12	
11:00 AM			**13**			**13**			**13**	
12:00 PM			11			11			11	
1:00 PM			10			10			10	
2:00 PM			**12**			**12**			**12**	
3:00 PM			4			4			4	
4:00 PM			9			9			9	
5:00 PM			10			10			10	
6:00 PM			11			11			11	
7:00 PM			8			8			8	
8:00 PM			2			2			2	
9:00 PM			6			6			6	
10:00 PM			3			3			3	
11:00 PM			0			0			0	
Day Total			138			138			138	
% Weekday Average			100.0%							
% Week Average			100.0%			100.0%				
AM Peak			11:00 AM			11:00 AM			11:00 AM	
Volume			13			13			13	
PM Peak			2:00 PM			2:00 PM			2:00 PM	
Volume			12			12			12	

Comments:

DRAFT

Quality Counts
TRANSPORTATION DATA COLLECTION

LOCATION: Catawba Ave West Dwy
SPECIFIC LOCATION: Catawba Ave West Dwy
CITY/STATE: Cornelius, NC

QC JOB #: 14071214
DIRECTION: NB
DATE: Nov 30 2016 - Nov 30 2016

Start Time	Mon	Tue	Wed 30-Nov-16	Thu	Fri	Average Weekday Hourly Traffic	Sat	Sun	Average Week Hourly Traffic	Average Week Profile
12:00 AM			0			0			0	
1:00 AM			1			1			1	
2:00 AM			1			1			1	
3:00 AM			0			0			0	
4:00 AM			0			0			0	
5:00 AM			1			1			1	
6:00 AM			0			0			0	
7:00 AM			4			4			4	
8:00 AM			6			6			6	
9:00 AM			7			7			7	
10:00 AM			4			4			4	
11:00 AM			**8**			**8**			**8**	
12:00 PM			9			9			9	
1:00 PM			4			4			4	
2:00 PM			6			6			6	
3:00 PM			3			3			3	
4:00 PM			3			3			3	
5:00 PM			6			6			6	
6:00 PM			**18**			**18**			**18**	
7:00 PM			3			3			3	
8:00 PM			3			3			3	
9:00 PM			0			0			0	
10:00 PM			0			0			0	
11:00 PM			1			1			1	
Day Total			88			88			88	
% Weekday Average			100.0%							
% Week Average			100.0%			100.0%				
AM Peak Volume			11:00 AM 8			11:00 AM 8			11:00 AM 8	
PM Peak Volume			6:00 PM 18			6:00 PM 18			6:00 PM 18	

Comments:

DRAFT
Quality Counts
TRANSPORTATION DATA COLLECTION

LOCATION: Catawba Ave West Dwy
SPECIFIC LOCATION: Catawba Ave West Dwy
CITY/STATE: Cornelius, NC

QC JOB #: 14071214
DIRECTION: SB
DATE: Nov 30 2016 - Nov 30 2016

Start Time	Mon	Tue	Wed 30-Nov-16	Thu	Fri	Average Weekday Hourly Traffic	Sat	Sun	Average Week Hourly Traffic	Average Week Profile
12:00 AM			1			1			1	
1:00 AM			1			1			1	
2:00 AM			0			0			0	
3:00 AM			0			0			0	
4:00 AM			0			0			0	
5:00 AM			1			1			1	
6:00 AM			2			2			2	
7:00 AM			1			1			1	
8:00 AM			1			1			1	
9:00 AM			4			4			4	
10:00 AM			**5**			**5**			**5**	
11:00 AM			4			4			4	
12:00 PM			**11**			**11**			**11**	
1:00 PM			5			5			5	
2:00 PM			2			2			2	
3:00 PM			6			6			6	
4:00 PM			1			1			1	
5:00 PM			1			1			1	
6:00 PM			2			2			2	
7:00 PM			4			4			4	
8:00 PM			5			5			5	
9:00 PM			5			5			5	
10:00 PM			1			1			1	
11:00 PM			1			1			1	
Day Total			64			64			64	
% Weekday Average			100.0%							
% Week Average			100.0%			100.0%				
AM Peak			10:00 AM			10:00 AM			10:00 AM	
Volume			5			5			5	
PM Peak			12:00 PM			12:00 PM			12:00 PM	
Volume			11			11			11	

Comments:

DRAFT
Quality Counts
TRANSPORTATION DATA COLLECTION

APPENDIX C:
TRAFFIC VOLUMES WORKSHEET

DRAFT

QT Cornelius

	Counted Volumes (2016)		Volume Balancing		Existing (2016)		Background (2018)		Historical Growth (2018)		No Build (2018)		Trip Distribution		Trip Assignment		Pass-By Trip Distribution		Pass-By Trip Assignment		Driveway Volume Adjustment Distribution		Driveway Volume Adjustment Assignment		Build (2018)	
	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	Enter	Exit	AM	PM	Enter	Exit	AM	PM	Enter	Exit	AM	PM	AM	PM
Intersection 1 - Catawba Avenue at I-77 Southbound Ramp																										
EBT	1,255	1,242			1,255	1,242	1,306	1,292	51	50	1,306	1,292	20%		6	13			0	0			0	0	1,312	1,305
EBR	99	264			99	264	103	275	4	11	103	275			0	0			0	0			0	0	103	275
WBL	32	76			32	76	33	79	1	3	33	79		25%	15	17			0	0			0	0	48	96
WBT	748	1,019		21	748	1,040	778	1,082	30	42	778	1,082		20%	12	14			0	0			0	0	790	1,096
SBL	582	328			582	328	606	341	24	13	606	341	25%		8	17			0	0			0	0	614	358
SBR	875	610			875	610	910	635	35	25	910	635			0	0			0	0			0	0	910	635
Intersection 2 - Catawba Avenue at I-77 Northbound Ramp																										
EBL	710	542	47	1	757	543	788	565	31	22	788	565			0	0			0	0			0	0	788	565
EBT	1,062	1,027	18		1,080	1,027	1,124	1,068	44	41	1,124	1,068	45%		14	30			0	0			0	0	1,138	1,098
WBT	515	718	16		531	718	552	747	21	29	552	747		45%	27	31			0	0			0	0	579	778
WBR	466	360	39	7	505	367	525	382	20	15	525	382		25%	15	17			0	0			0	0	540	399
NBL	249	398			249	398	259	414	10	16	259	414			0	0			0	0			0	0	259	414
NBR	85	161			85	161	88	168	3	7	88	168	25%		8	17			0	0			0	0	96	185
Intersection 3- Catawba Avenue at Holiday Lane/Stateville Road																										
EBL	39	67			39	67	41	70	2	3	41	70	50%		16	34	50%		39	39			0	0	96	143
EBT	579	572	9	3	588	575	612	598	24	23	612	598	20%		6	13	-50%		-39	-39			0	0	579	572
EBR	538	544		2	538	546	560	568	22	22	560	568			0	0			0	0			0	0	560	568
WBL	106	98			106	98	110	102	4	4	110	102			0	0			0	0			0	0	110	102
WBT	494	566		18	494	584	514	608	20	24	514	608		20%	12	14			0	0			0	0	526	622
WBR	13	29			13	29	14	30	1	1	14	30			0	0			0	0			0	0	14	30
NBL	502	451			502	451	522	469	20	18	522	469			0	0			0	0			0	0	522	469
NBT	23	33			23	33	24	34	1	1	24	34	10%		3	7			0	0			0	0	27	41
NBR	96	125			96	125	100	130	4	5	100	130			0	0			0	0			0	0	100	130
SBL	26	18			26	18	27	19	1	1	27	19			0	0		50%	39	38			0	0	66	57
SBT	24	20			24	20	25	21	1	1	25	21		10%	5	7			0	0			0	0	30	28
SBR	40	50			40	50	42	52	2	2	42	52		50%	30	35			0	0			0	0	72	87
Intersection 4 - Catawba Avenue at Burton Lane/S. Hill Street																										
EBL	5	3			5	3	5	3	0	0	5	3	20%		6	13			0	0			0	0	11	16
EBT	698	697			698	697	726	725	28	28	726	725			0	0			0	0			0	0	726	725
EBR	7	18			7	18	7	19	0	1	7	19			0	0			0	0			0	0	7	19
WBL	0	1			0	1	0	1	0	0	0	1			0	0			0	0			0	0	0	1
WBT	602	692			602	692	626	720	24	28	626	720			0	0	-50%		-38	-38			0	0	588	682
WBR	0	2			0	2	0	2	0	0	0	2	20%		6	13	50%		38	38			0	0	44	53
NBL	5	13			5	13	5	14	0	1	5	14			0	0			0	0			0	0	5	14
NBT	0	1			0	1	0	1	0	0	0	1			0	0			0	0			0	0	0	1
NBR	8	3			8	3	8	3	0	0	8	3			0	0			0	0			0	0	8	3
SBL	0	1			0	1	0	1	0	0	0	1		20%	12	14			0	0			0	0	12	15
SBT	0	0			0	0	0	0	0	0	0	0			0	0			0	0			0	0	0	0
SBR	1	6	5		6	6	6	6	0	0	6	6		20%	12	14		50%	38	38			0	0	56	58

DRAFT

QT Cornelius

	Counted Volumes (2016)		Volume Balancing		Existing (2016)		Background (2018)		Historical Growth (2018)		No Build (2018)		Trip Distribution		Trip Assignment		Pass-By Trip Distribution		Pass-By Trip Assignment		Driveway Volume Adjustment Distribution		Driveway Volume Adjustment Assignment		Build (2018)	
	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	Enter	Exit	AM	PM	Enter	Exit	AM	PM	Enter	Exit	AM	PM	AM	PM
Intersection 5 - Holiday Lane at Site Access #1																										
WBL														15%	9	10		10%	8	8		20%	6	9	23	27
WBR															0	0			0	0			0	0	0	0
NBT	75	129	0	0	75	129	79	134	4	5	79	134			0	0			0	0	-20%		-11	-10	68	124
NBR													15%		5	10	10%		8	8	20%		11	10	24	28
SBL															0	0			0	0			0	0	0	0
SBT	90	88	0	0	90	88	94	92	4	4	94	92			0	0			0	0		-20%	-6	-9	88	83
Intersection 6 - Holiday Lane at Site Access #2																										
WBL														45%	26	31		40%	31	30		75%	22	34	79	95
WBR															0	0			0	0			0	0	0	0
NBT	75	129	0	0	75	129	79	134	4	5	79	134	15%		5	10	10%		8	8	-75%		-44	-35	48	117
NBR													45%		14	30	40%		31	31	75%		44	35	89	96
SBL															0	0			0	0			0	0	0	0
SBT	90	88	0	0	90	88	94	92	4	4	94	92		15%	9	10		10%	8	8		-75%	-22	-34	89	76
Intersection 7 - Burton Lane at Site Access #3																										
EBL															0	0			0	0			0	0	0	0
EBR														40%	24	28		50%	38	38		5%	1	2	63	68
NBL													40%		12	27	50%		38	38	5%		3	2	53	67
NBT	5	6	0	0	5	6	5	6	0	0	5	6			0	0			0	0	-5%		-3	-2	2	4
SBT	1	7	5	0	6	7	6	7	0	0	6	7			0	0			0	0		-5%	-1	-2	5	5
SBR															0	0			0	0			0	0	0	0

DRAFT

QT Cornelius

	Counted Volumes (2016)		Volume Balancing		Existing (2016)		Background (2023)		Historical Growth (2023)		No Build (2023)		Trip Distribution		Trip Assignment		Pass-By Trip Distribution		Pass-By Trip Assignment		Driveway Volume Adjustment Distribution		Driveway Volume Adjustment Assignment		Build (2023)	
	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	Enter	Exit	AM	PM	AM	PM	AM	PM	Enter	Exit	AM	PM	AM	PM
Intersection 1 - Catawba Avenue at I-77 Southbound Ramp																										
EBT	1,255	1,242	0	0	1,255	1,242	1,442	1,427	187	185	1,442	1,427	20%	0%	6	13	0%	0%	0	0	0%	0%	0	0	1,448	1,440
EBR	99	264	0	0	99	264	114	303	15	39	114	303	0%	0%	0	0	0%	0%	0	0	0%	0%	0	0	114	303
WBL	32	76	0	0	32	76	37	87	5	11	37	87	0%	25%	15	17	0%	0%	0	0	0%	0%	0	0	52	104
WBT	748	1,019	0	21	748	1,040	859	1,195	111	155	859	1,195	0%	20%	12	14	0%	0%	0	0	0%	0%	0	0	871	1,209
SBL	582	328	0	0	582	328	669	377	87	49	669	377	25%	0%	8	17	0%	0%	0	0	0%	0%	0	0	677	394
SBR	875	610	0	0	875	610	1,005	701	130	91	1,005	701	0%	0%	0	0	0%	0%	0	0	0%	0%	0	0	1,005	701
Intersection 2 - Catawba Avenue at I-77 Northbound Ramp																										
EBL	710	542	47	1	757	543	870	624	113	81	870	624	0%	0%	0	0	0%	0%	0	0	0%	0%	0	0	870	624
EBT	1,062	1,027	18	0	1,080	1,027	1,241	1,180	161	153	1,241	1,180	45%	0%	14	30	0%	0%	0	0	0%	0%	0	0	1,255	1,210
WBT	515	718	16	0	531	718	610	825	79	107	610	825	0%	45%	27	31	0%	0%	0	0	0%	0%	0	0	637	856
WBR	466	360	39	7	505	367	580	422	75	55	580	422	0%	25%	15	17	0%	0%	0	0	0%	0%	0	0	595	439
NBL	249	398	0	0	249	398	286	457	37	59	286	457	0%	0%	0	0	0%	0%	0	0	0%	0%	0	0	286	457
NBR	85	161	0	0	85	161	98	185	13	24	98	185	25%	0%	8	17	0%	0%	0	0	0%	0%	0	0	106	202
Intersection 3- Catawba Avenue at Holiday Lane																										
EBL	39	67	0	0	39	67	45	77	6	10	45	77	50%	0%	16	34	50%	0%	39	39	0%	0%	0	0	100	150
EBT	579	572	9	3	588	575	675	660	87	85	675	660	20%	0%	6	13	-50%	0%	-39	-39	0%	0%	0	0	642	634
EBR	538	544	0	2	538	546	618	627	80	81	618	627	0%	0%	0	0	0%	0%	0	0	0%	0%	0	0	618	627
WBL	106	98	0	0	106	98	122	113	16	15	122	113	0%	0%	0	0	0%	0%	0	0	0%	0%	0	0	122	113
WBT	494	566	0	18	494	584	567	671	73	87	567	671	0%	20%	12	14	0%	0%	0	0	0%	0%	0	0	579	685
WBR	13	29	0	0	13	29	15	33	2	4	15	33	0%	0%	0	0	0%	0%	0	0	0%	0%	0	0	15	33
NBL	502	451	0	0	502	451	577	518	75	67	577	518	0%	0%	0	0	0%	0%	0	0	0%	0%	0	0	577	518
NBT	23	33	0	0	23	33	26	38	3	5	26	38	10%	0%	3	7	0%	0%	0	0	0%	0%	0	0	29	45
NBR	96	125	0	0	96	125	110	144	14	19	110	144	0%	0%	0	0	0%	0%	0	0	0%	0%	0	0	110	144
SBL	26	18	0	0	26	18	30	21	4	3	30	21	0%	0%	0	0	0%	50%	39	38	0%	0%	0	0	69	59
SBT	24	20	0	0	24	20	28	23	4	3	28	23	0%	10%	5	7	0%	0%	0	0	0%	0%	0	0	33	30
SBR	40	50	0	0	40	50	46	57	6	7	46	57	0%	50%	30	35	0%	0%	0	0	0%	0%	0	0	76	92
Intersection 4 - Catawba Avenue at Burton Lane																										
EBL	5	3	0	0	5	3	6	3	1	0	6	3	20%	0%	6	13	0%	0%	0	0	0%	0%	0	0	12	16
EBT	698	697	0	0	698	697	802	801	104	104	802	801	0%	0%	0	0	0%	0%	0	0	0%	0%	0	0	802	801
EBR	7	18	0	0	7	18	8	21	1	3	8	21	0%	0%	0	0	0%	0%	0	0	0%	0%	0	0	8	21
WBL	0	1	0	0	0	1	0	1	0	0	0	1	0%	0%	0	0	0%	0%	0	0	0%	0%	0	0	0	1
WBT	602	692	0	0	602	692	692	795	90	103	692	795	0%	0%	0	0	-50%	0%	-38	-38	0%	0%	0	0	654	757
WBR	0	2	0	0	0	2	0	2	0	0	0	2	20%	0%	6	13	50%	0%	38	38	0%	0%	0	0	44	53
NBL	5	13	0	0	5	13	6	15	1	2	6	15	0%	0%	0	0	0%	0%	0	0	0%	0%	0	0	6	15
NBT	0	1	0	0	0	1	0	1	0	0	0	1	0%	0%	0	0	0%	0%	0	0	0%	0%	0	0	0	1
NBR	8	3	0	0	8	3	9	3	1	0	9	3	0%	0%	0	0	0%	0%	0	0	0%	0%	0	0	9	3
SBL	0	1	0	0	0	1	0	1	0	0	0	1	0%	20%	12	14	0%	0%	0	0	0%	0%	0	0	12	15
SBT	0	0	0	0	0	0	0	0	0	0	0	0	0%	0%	0	0	0%	0%	0	0	0%	0%	0	0	0	0
SBR	1	6	5	0	6	6	7	7	1	1	7	7	0%	20%	12	14	0%	50%	38	38	0%	0%	0	0	57	59

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QT Cornelius

	Counted Volumes (2016)		Volume Balancing		Existing (2016)		Background (2023)		Historical Growth (2023)		No Build (2023)		Trip Distribution		Trip Assignment		Pass-By Trip Distribution		Pass-By Trip Assignment		Driveway Volume Adjustment Distribution		Driveway Volume Adjustment Assignment		Build (2023)	
	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	Enter	Exit	AM	PM	AM	PM	AM	PM	Enter	Exit	AM	PM	AM	PM
Intersection 5 - Holiday Lane at Site Access #1																										
WBL	0	0	0	0	0	0							0%	15%	9	10	0%	10%	8	8	0%	20%	6	9	23	27
WBR	0	0	0	0	0	0							0%	0%	0	0	0%	0%	0	0	0%	0%	0	0	0	0
NBT	75	129	0	0	75	129	86	148	11	19	86	148	0%	0%	0	0	0%	0%	0	0	-20%	0%	-11	-10	75	138
NBR	0	0	0	0	0	0							15%	0%	5	10	10%	0%	8	8	20%	0%	11	10	24	28
SBL	0	0	0	0	0	0							0%	0%	0	0	0%	0%	0	0	0%	0%	0	0	0	0
SBT	90	88	0	0	90	88	104	101	14	13	104	101	0%	0%	0	0	0%	0%	0	0	0%	-20%	-6	-9	98	92
Intersection 6 - Holiday Lane at Site Access #2																										
WBL	0	0	0	0	0	0							0%	45%	26	31	0%	40%	31	30	0%	75%	22	34	79	95
WBR	0	0	0	0	0	0							0%	0%	0	0	0%	0%	0	0	0%	0%	0	0	0	0
NBT	75	129	0	0	75	129	86	148	11	19	86	148	15%	0%	5	10	10%	0%	8	8	-75%	0%	-44	-35	55	131
NBR	0	0	0	0	0	0							45%	0%	14	30	40%	0%	31	31	75%	0%	44	35	89	96
SBL	0	0	0	0	0	0							0%	0%	0	0	0%	0%	0	0	0%	0%	0	0	0	0
SBT	90	88	0	0	90	88	104	101	14	13	104	101	0%	15%	9	10	0%	10%	8	8	0%	-75%	-22	-34	99	85
Intersection 7 - Burton Lane at Site Access #3																										
EBL	0	0	0	0	0	0							0%	0%	0	0	0%	0%	0	0	0%	0%	0	0	0	0
EBR	0	0	0	0	0	0							0%	40%	24	28	0%	50%	38	38	0%	5%	1	2	63	68
NBL	0	0	0	0	0	0							40%	0%	12	27	50%	0%	38	38	5%	0%	3	2	53	67
NBT	5	6	0	0	5	6	6	6	1	0	6	6	0%	0%	0	0	0%	0%	0	0	-5%	0%	-3	-2	3	4
SBT	1	7	5	0	6	7	7	8	1	1	7	8	0%	0%	0	0	0%	0%	0	0	0%	-5%	-1	-2	6	6
SBR	0	0	0	0	0	0							0%	0%	0	0	0%	0%	0	0	0%	0%	0	0	0	0

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QT Cornelius

	No Build (2030)		Trip Distribution		Trip Assignment		Pass-By Trip Distribution		Pass-By Trip Assignment		Driveway Volume Adjustment Distribution		Driveway Volume Adjustment Assignment		Build (2030)	
	AM	PM	Enter	Exit	AM	PM	AM	PM	AM	PM	Enter	Exit	AM	PM	AM	PM
Intersection 1 - Catawba Avenue at I-77 Southbound Ramp																
EBT	1,355	1,513	20%	0%	6	13	0%	0%	0	0	0%	0%	0	0	1,361	1,526
EBR	595	573	0%	0%	0	0	0%	0%	0	0	0%	0%	0	0	595	573
WBL	184	405	0%	25%	15	17	0%	0%	0	0	0%	0%	0	0	199	422
WBT	1,294	1,289	0%	20%	12	14	0%	0%	0	0	0%	0%	0	0	1,306	1,303
SBL	496	495	25%	0%	8	17	0%	0%	0	0	0%	0%	0	0	504	512
SBR	612	496	0%	0%	0	0	0%	0%	0	0	0%	0%	0	0	612	496
Intersection 2 - Catawba Avenue at I-77 Northbound Ramp																
EBL	490	665	0%	0%	0	0	0%	0%	0	0	0%	0%	0	0	490	665
EBT	1,361	1,343	45%	0%	14	30	0%	0%	0	0	0%	0%	0	0	1,375	1,373
WBT	844	1,084	0%	45%	27	31	0%	0%	0	0	0%	0%	0	0	871	1,115
WBR	310	405	0%	25%	15	17	0%	0%	0	0	0%	0%	0	0	325	422
NBL	634	610	0%	0%	0	0	0%	0%	0	0	0%	0%	0	0	634	610
NBR	200	254	25%	0%	8	17	0%	0%	0	0	0%	0%	0	0	208	271
Intersection 3- Catawba Avenue at Holiday Lane																
EBL	76	158	50%	0%	16	34	50%	0%	39	39	0%	0%	0	0	131	231
EBT	663	844	20%	0%	6	13	-50%	0%	-39	-39	0%	0%	0	0	630	818
EBR	822	595	0%	0%	0	0	0%	0%	0	0	0%	0%	0	0	822	595
WBL	156	115	0%	0%	0	0	0%	0%	0	0	0%	0%	0	0	156	115
WBT	571	765	0%	20%	12	14	0%	0%	0	0	0%	0%	0	0	583	779
WBR	8	28	0%	0%	0	0	0%	0%	0	0	0%	0%	0	0	8	28
NBL	499	621	0%	0%	0	0	0%	0%	0	0	0%	0%	0	0	499	621
NBT	9	34	10%	0%	3	7	0%	0%	0	0	0%	0%	0	0	12	41
NBR	117	227	0%	0%	0	0	0%	0%	0	0	0%	0%	0	0	117	227
SBL	22	24	0%	0%	0	0	0%	50%	39	38	0%	0%	0	0	61	62
SBT	26	24	0%	10%	5	7	0%	0%	0	0	0%	0%	0	0	31	31
SBR	84	103	0%	50%	30	35	0%	0%	0	0	0%	0%	0	0	114	138

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QT Cornelius

	No Build (2030)		Trip Distribution		Trip Assignment		Pass-By Trip Distribution		Pass-By Trip Assignment		Driveway Volume Adjustment Distribution		Driveway Volume Adjustment Assignment		Build (2030)	
	AM	PM	Enter	Exit	AM	PM	AM	PM	AM	PM	Enter	Exit	AM	PM	AM	PM
Intersection 4 - Catawba Avenue at Burton Lane																
EBL	0	3	20%	0%	6	13	0%	0%	0	0	0%	0%	0	0	6	16
EBT	793	1,076	0%	0%	0	0	0%	0%	0	0	0%	0%	0	0	793	1,076
EBR	9	16	0%	0%	0	0	0%	0%	0	0	0%	0%	0	0	9	16
WBL	1	1	0%	0%	0	0	0%	0%	0	0	0%	0%	0	0	1	1
WBT	724	897	0%	0%	0	0	-50%	0%	-38	-38	0%	0%	0	0	686	859
WBR	1	5	20%	0%	6	13	50%	0%	38	38	0%	0%	0	0	45	56
NBL	7	7	0%	0%	0	0	0%	0%	0	0	0%	0%	0	0	7	7
NBT	0	0	0%	0%	0	0	0%	0%	0	0	0%	0%	0	0	0	0
NBR	7	3	0%	0%	0	0	0%	0%	0	0	0%	0%	0	0	7	3
SBL	0	1	0%	20%	12	14	0%	0%	0	0	0%	0%	0	0	12	15
SBT	0	0	0%	0%	0	0	0%	0%	0	0	0%	0%	0	0	0	0
SBR	3	4	0%	20%	12	14	0%	50%	38	38	0%	0%	0	0	53	56
Intersection 5 - Holiday Lane at Site Access #1																
WBL			0%	15%	9	10	0%	10%	8	8	0%	20%	6	9	23	27
WBR			0%	0%	0	0	0%	0%	0	0	0%	0%	0	0	0	0
NBT	93	220	0%	0%	0	0	0%	0%	0	0	-20%	0%	-11	-10	82	210
NBR			15%	0%	5	10	10%	0%	8	8	20%	0%	11	10	24	28
SBL			0%	0%	0	0	0%	0%	0	0	0%	0%	0	0	0	0
SBT	132	151	0%	0%	0	0	0%	0%	0	0	0%	-20%	-6	-9	126	142
Intersection 6 - Holiday Lane at Site Access #2																
WBL			0%	45%	26	31	0%	40%	31	30	0%	75%	22	34	79	95
WBR			0%	0%	0	0	0%	0%	0	0	0%	0%	0	0	0	0
NBT	93	220	15%	0%	5	10	10%	0%	8	8	-75%	0%	-44	-35	62	203
NBR			45%	0%	14	30	40%	0%	31	31	75%	0%	44	35	89	96
SBL			0%	0%	0	0	0%	0%	0	0	0%	0%	0	0	0	0
SBT	132	151	0%	15%	9	10	0%	10%	8	8	0%	-75%	-22	-34	127	135
Intersection 7 - Burton Lane at Site Access #3																
EBL			0%	0%	0	0	0%	0%	0	0	0%	0%	0	0	0	0
EBR			0%	40%	24	28	0%	50%	38	38	0%	5%	1	2	63	68
NBL			40%	0%	12	27	50%	0%	38	38	5%	0%	3	2	53	67
NBT	1	8	0%	0%	0	0	0%	0%	0	0	-5%	0%	-1	-2	0	6
SBT	3	5	0%	0%	0	0	0%	0%	0	0	0%	-5%	-1	-2	2	3
SBR			0%	0%	0	0	0%	0%	0	0	0%	0%	0	0	0	0

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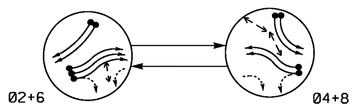
APPENDIX D:
TRAFFIC SIGNAL PLANS

DRAFT

PROJECT REFERENCE NO.	SHEET NO.
I-4733	Sig.11

PHASING DIAGRAM

Program all phases for "Red Rest"



PHASING DIAGRAM DETECTION LEGEND

- DETECTED MOVEMENT
- UNDETECTED MOVEMENT (OVERLAP)
- UNSIGNALIZED MOVEMENT
- PEDESTRIAN MOVEMENT

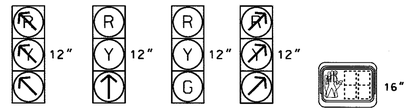
TABLE OF OPERATION

SIGNAL FACE	PHASE Ø2+6	PHASE Ø4+8	FLASH
21, 22, 23	↑	R	R
24, 25	↖	↖	↖
41, 42	R	G	R
43, 44	↖	↖	↖
61, 62	G	R	R
63, 64	↗	↗	↗
81, 82	R	↑	R
83, 84	↗	↗	↗
P21, P22	W	DW	DRK
P41, P42	DW	W	DRK
P81, P82	DW	W	DRK

W - Walk
DW - Don't Walk
DRK - Dark

SIGNAL FACE I.D.

All Heads L.E.D.



24, 25 43, 44 | 21, 22, 23 81, 82 | 41, 42 61, 62 | 63, 64 83, 84 | P21, P22 P41, P42 P81, P82

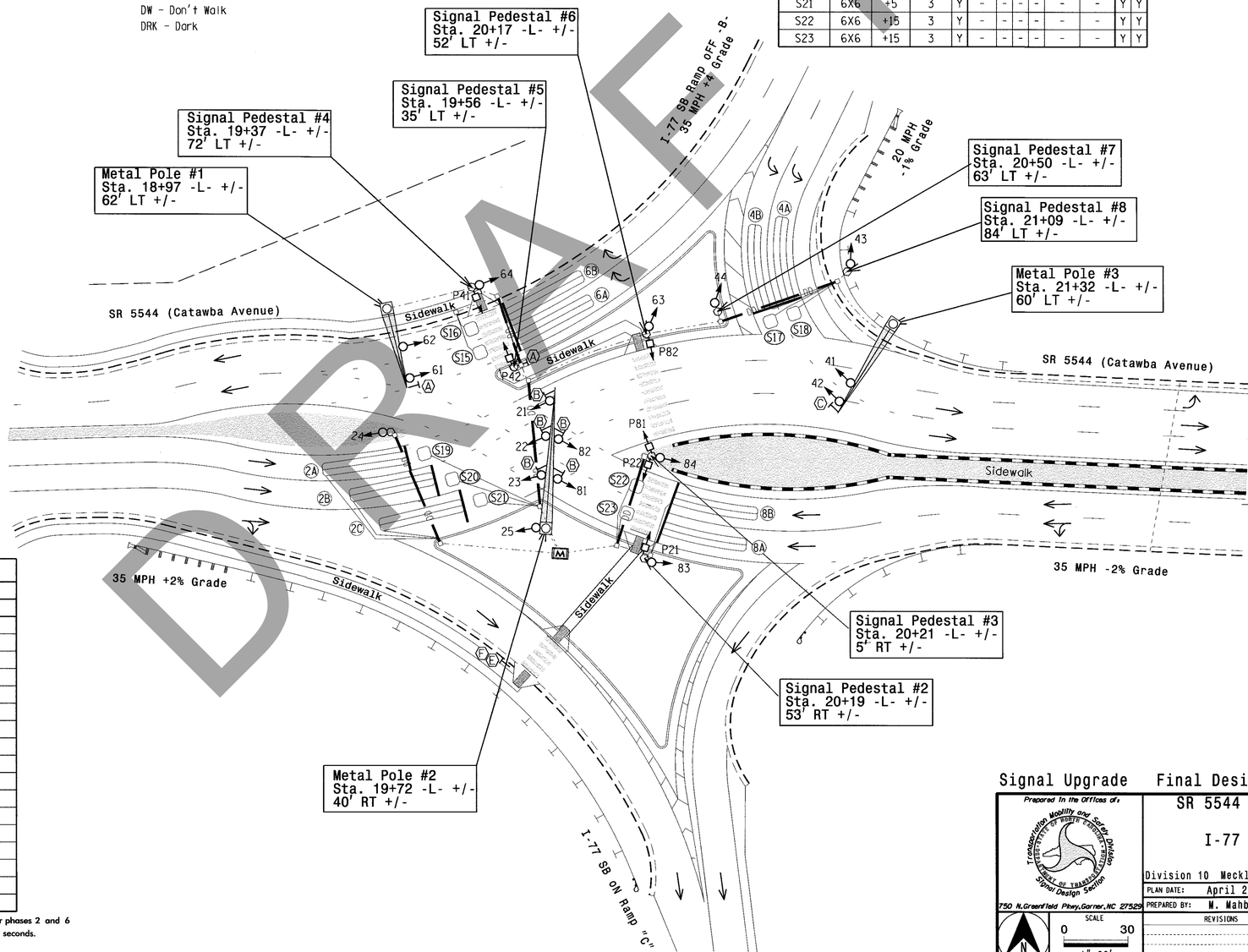
OASIS 2070L LOOP & DETECTOR INSTALLATION CHART

INDUCTIVE LOOPS					DETECTOR PROGRAMMING						
LOOP	SIZE (FT)	DISTANCE FROM STOPBAR (FT)	TURNS	NEW LOOP	PHASE	CALLING	EXTENSION	FULL TIME DELAY	STRETCH TIME	DELAY TIME	SYSTEM LOOP	NEW CARD
2A	6X40	0	2-4-2	Y	2	Y	Y	-	-	-	-	Y
2B	6X40	0	2-4-2	Y	2	Y	Y	-	-	-	-	Y
2C	6X40	0	2-4-2	Y	2	Y	Y	-	-	-	-	Y
4A	6X40	0	2-4-2	-	4	Y	Y	-	-	-	-	Y
4B	6X40	0	2-4-2	-	4	Y	Y	-	-	-	-	Y
6A	6X40	0	2-4-2	-	6	Y	Y	-	-	-	-	Y
6B	6X40	0	2-4-2	-	6	Y	Y	-	-	-	-	Y
8A	6X40	0	2-4-2	Y	8	Y	Y	-	-	-	-	Y
8B	6X40	0	2-4-2	Y	8	Y	Y	-	-	-	-	Y
S15	6X6	+15	3	Y	-	-	-	-	-	-	Y	Y
S16	6X6	+15	3	Y	-	-	-	-	-	-	Y	Y
S17	6X6	+3	3	Y	-	-	-	-	-	-	Y	Y
S18	6X6	+3	3	Y	-	-	-	-	-	-	Y	Y
S19	6X6	+5	3	Y	-	-	-	-	-	-	Y	Y
S20	6X6	+5	3	Y	-	-	-	-	-	-	Y	Y
S21	6X6	+5	3	Y	-	-	-	-	-	-	Y	Y
S22	6X6	+15	3	Y	-	-	-	-	-	-	Y	Y
S23	6X6	+15	3	Y	-	-	-	-	-	-	Y	Y

2 Phase
Fully Actuated
Catawba Avenue CLS

NOTES

1. Refer to "Roadway Standard Drawings NCDOT" dated January 2012 and "Standard Specifications for Roads and Structures" dated January 2012.
2. Do not program signal for late night flashing operation.
3. Set all detector units to presence mode.
4. Locate new cabinet so as not to obstruct sight distance of vehicles turning right on red.
5. Omit "WALK" and flashing "DON'T WALK" with no pedestrian calls.
6. Program pedestrian heads to countdown the flashing "Don't Walk" time only.
7. Program all phases for "Red Rest".
8. Maximum times shown in timing chart are for free-run operation only. Coordinated signal system timing values supersede these values.
9. Closed loop system data: Controller Asset #1342.



LEGEND

PROPOSED		EXISTING
○→	Traffic Signal Head	●→
◐→	Modified Signal Head	N/A
⊣	Sign	⊣
▯↓	Pedestrian Signal Head With Push Button & Sign	■↓
○→ ○↓	Signal Pole with Guy	●→ ●↓
○→ ○↓	Signal Pole with Sidewalk Guy	●→ ●↓
▭	Inductive Loop Detector	▭
M	Master Controller & Cabinet	M
□	Junction Box	■
·····	2-in Underground Conduit	·····
N/A	Right of Way	-----
→	Directional Arrow	→
DD	Directional Drill	N/A
N/A	Guardrail	⊥⊥⊥
○→	Metal Pole with Mastarm	●→
⬡	Signal Pedestal	●
N/A	Wheelchair Ramp	♿
Ⓐ	No Left Turn Sign (R3-2)	Ⓐ
Ⓑ	Through Arrow "ONLY" Sign (R3-5A)	Ⓑ
Ⓒ	No Right Turn Sign (R3-1)	Ⓒ
Ⓓ	Signal Ahead Sign (W3-3)	Ⓓ
Ⓔ	Pedestrian Crossing (W11-2)	Ⓔ
Ⓕ	Diagonal Downward Arrow Sign (W16-7P)	Ⓕ

OASIS 2070L TIMING CHART

FEATURE	PHASE 2	PHASE 4	PHASE 6	PHASE 8
Min Green 1 *	10	10	10	10
Extension 1 *	3.0	3.0	3.0	3.0
Max Green 1 *	50	30	50	30
Yellow Clearance	3.7	4.0	3.7	4.0
Red Clearance	5.6	4.1	5.6	4.1
Red Revert	5.6	5.0	5.6	5.0
Walk 1 *	7	7	-	7
Don't Walk 1	8	6	-	11
Seconds Per Actuation *	-	-	-	-
Max Variable Initial *	-	-	-	-
Time Before Reduction *	-	-	-	-
Time To Reduce *	-	-	-	-
Minimum Gap	-	-	-	-
Recall Mode	-	-	-	-
Vehicle Call Memory	-	-	-	-
Dual Entry	ON	ON	ON	ON
Simultaneous Gap	ON	ON	ON	ON

* These values may be field adjusted. Do not adjust Min Green and Extension times for phases 2 and 6 lower than what is shown. Min Green for all other phases should not be lower than 4 seconds.

Signal Upgrade Final Design

Prepared in the Offices of:
Transportation Mobility and Safety Division
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
Signal Design Section
750 N.Greenfield Pkwy,Garner,NC 27529

SR 5544 (Catawba Avenue) at I-77 SB Ramps B, C

Division 10 Mecklenburg County Cornelius

PLAN DATE: April 2013 REVIEWED BY: T. Williams
PREPARED BY: W. Mahbooba REVIEWED BY:

SCALE 0 30 1"=30'

REVISIONS	INIT.	DATE

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 24393 ENGINEER TIMOTHY J. WILLIAMS

SIGNATURE 4/30/13 DATE

SIG. INVENTORY NO. 10-1342

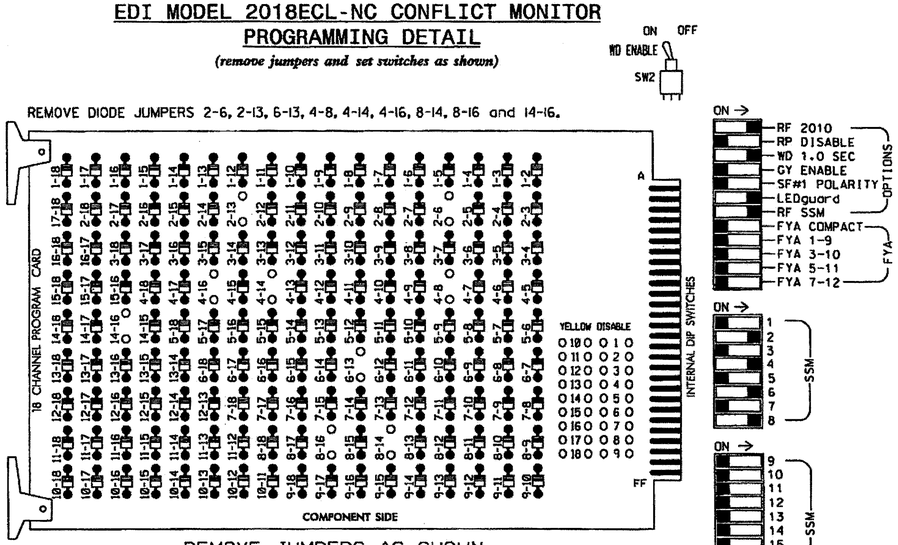
DRAFT

06-MAY-2013 15:48
R:\traffic\signal\e$design$\signal$*10-1342*10-1342_sig_dsn_20130430.dgn
mmoore

PROJECT REFERENCE NO.	SHEET NO.
I-4733	Sig.12

EDI MODEL 2018ECL-NC CONFLICT MONITOR PROGRAMMING DETAIL

(remove jumpers and set switches as shown)



REMOVE JUMPERS AS SHOWN

■ = DENOTES POSITION OF SWITCH

NOTES:

1. Card is provided with all diode jumpers in place. Removal of any jumper allows its channels to run concurrently.
2. Ensure jumpers SEL2-SEL5 and SEL9 are present on the monitor board.
3. Ensure that Red Enable is active at all times during normal operation.
4. Connect serial cable from conflict monitor to comm. port 1 of 2070 controller. Ensure conflict monitor communicates with 2070.

NOTES

1. To prevent "flash-conflict" problems, insert red flash program blocks for all unused vehicle load switches in the output file. The installer shall verify that signal heads flash in accordance with the Signal Plans.
2. Program phases 2, 4, 6 and 8 for Dual Entry.
3. Enable Simultaneous Gap-Out for all phases.
4. Program phases 2, 4, 6 and 8 for Red Rest.
5. Program phases 2 and 6 for Startup Red Clear.
6. Program phases 2 and 6 as First Phases.
7. Program phases 2, 4 and 8 for 'STARTUP PED CALL'.
8. The cabinet and controller are part of the Catawba Avenue Closed Loop System.

EQUIPMENT INFORMATION

CONTROLLER.....2070L
CABINET.....332
SOFTWARE.....ECONOLITE OASIS
CABINET MOUNT.....BASE
OUTPUT FILE POSITIONS...12
LOAD SWITCHES USED.....S2,S3,S5,S6,S8,S11,S12
PHASES USED.....2,2 PED,4,4 PED,6,8,8 PED
OVERLAPS.....NONE

SIGNAL HEAD HOOK-UP CHART

LOAD SWITCH NO.	S1	S2		S3	S4	S5		S6	S7	S8		S9	S10	S11		S12
CMU CHANNEL NO.	1	2		13	3	4		14	5	6		15	7	8		16
PHASE	1	2		2 PED	3	4		4 PED	5	6		6 PED	7	8		8 PED
SIGNAL HEAD NO.	NU	21, 22,23	24,25	P21, P22	NU	41,42	43,44	P41, P42	NU	61,62	63,64	NU	NU	81,82	83,84	P81, P82
RED		128				101				134				107		
YELLOW		129				102				135				108		
GREEN						103				136						
RED ARROW			128				101				134				107	
YELLOW ARROW			129				102				135				108	
GREEN ARROW		130	130				103				136			109	109	
✋				113				104								110
🚶				115				106								112

NU = Not Used

COUNTDOWN PEDESTRIAN SIGNAL OPERATION

Countdown Ped Signals are required to display timing only during Ped Clearance Interval. Consult Ped Signal Module user's manual for instructions on selecting this feature.

INPUT FILE POSITION LAYOUT

(front view)

		1	2	3	4	5	6	7	8	9	10	11	12	13	14
FILE "I"	U	SLOT EMPTY	Ø2 2A	Ø2 2C	SLOT EMPTY	SLOT EMPTY	Ø4 4A	SYS. DET. S18	SLOT EMPTY	SYS. DET. S19	SLOT EMPTY	SLOT EMPTY	Ø2 PED DC ISOLATOR	NOT USED	FS DC ISOLATOR
	L		Ø2 2B	NOT USED			Ø4 4B	SYS. DET. S17		SYS. DET. S20			Ø4 PED DC ISOLATOR	Ø8 PED DC ISOLATOR	ST DC ISOLATOR
FILE "J"	U	SLOT EMPTY	Ø6 6A	SYS. DET. S15	SLOT EMPTY	SLOT EMPTY	Ø8 8A	SYS. DET. S23	SLOT EMPTY	SYS. DET. S21	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY
	L		Ø6 6B	SYS. DET. S16			Ø8 8B	SYS. DET. S22		NOT USED					

EX.: 1A, 2A, ETC. = LOOP NO.'S

FS = FLASH SENSE
ST = STOP TIME

INPUT FILE CONNECTION & PROGRAMMING CHART

LOOP NO.	LOOP TERMINAL	INPUT FILE POS.	PIN NO.	INPUT ASSIGNMENT NO.	DETECTOR NO.	NEMA PHASE	CALL	EXTEND	FULL TIME DELAY	STRETCH TIME	DELAY TIME
2A	TB2-5,6	I2U	39	1	2	2	Y	Y			
2B	TB2-7,8	I2L	43	5	12	2	Y	Y			
2C	TB2-9,10	I3U	63	25	32	2	Y	Y			
4A	TB4-9,10	I6U	41	3	4	4	Y	Y			
4B	TB4-11,12	I6L	45	7	14	4	Y	Y			
6A	TB3-5,6	J2U	40	2	6	6	Y	Y			
6B	TB3-7,8	J2L	44	6	16	6	Y	Y			
8A	TB5-9,10	J6U	42	4	8	8	Y	Y			
8B	TB5-11,12	J6L	46	8	18	8	Y	Y			
*S15	TB3-9,10	J3U	64	26	36	SYS					
*S16	TB3-11,12	J3L	77	39	46	SYS					
*S17	TB6-3,4	I7L	78	40	44	SYS					
*S18	TB6-1,2	I7U	65	27	34	SYS					
*S19	TB6-9,10	I9U	60	22	11	SYS					
*S20	TB6-11,12	I9L	62	24	13	SYS					
*S21	TB7-9,10	J9U	59	21	15	SYS					
*S22	TB7-3,4	J7L	79	41	48	SYS					
*S23	TB7-1,2	J7U	66	28	38	SYS					
PED PUSH BUTTONS											
P21,P22	TB8-4,6	I12U	67	29	PED 2	2 PED					
P41,P42	TB8-5,6	I12L	69	31	PED 4	4 PED					
P81,P82	TB8-8,9	I13L	70	32	PED 8	8 PED					

NOTE:
INSTALL DC ISOLATORS IN INPUT FILE SLOTS I12 AND I13.

* System detector only. Remove the vehicle phase assigned to this detector in the default programming.

INPUT FILE POSITION LEGEND: J2L
FILE J
SLOT 2
LOWER

THIS ELECTRICAL DETAIL IS FOR
THE SIGNAL DESIGN: 10-1342
DESIGNED: April 2013
SEALED: 4/30/13
REVISED: N/A

Electrical Detail

ELECTRICAL AND PROGRAMMING DETAILS FOR:

Prepared in the Offices of:
Transportation Mobility and Planning Division
North Carolina Department of Transportation
Signal Management Section
750 N.Greenfield Pkwy.,Garner,NC 27529

SR 5544 (Catawba Avenue)
at
I-77 SB Ramps B, C

Division 10 | Mecklenburg County | Cornelius

PLAN DATE: April 2013 | REVIEWED BY: T. Ugm
PREPARED BY: C. Strickland | REVIEWED BY:

REVISIONS	INIT.	DATE

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 022013 ENGINEER GEORGE C. BROWN

SIGNATURE | DATE 5/2/13

SIG. INVENTORY NO. 10-1342

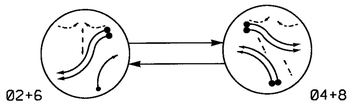
DRAFT

01-MAY-2013 15:22
S:\MTS\SAM\TS-Signals\HQGroups\Sig Mgmt\Strickland\101342_sm_ele_xxx.dgn
cestrickland

PROJECT REFERENCE NO.	SHEET NO.
I-4733	Sig.19

PHASING DIAGRAM

Program all phases for 'Red Rest'.



PHASING DIAGRAM DETECTION LEGEND

- DETECTED MOVEMENT
- UNDETECTED MOVEMENT (OVERLAP)
- UNSIGNALIZED MOVEMENT
- PEDESTRIAN MOVEMENT

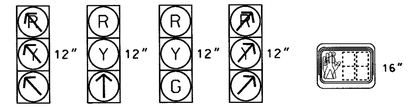
TABLE OF OPERATION

SIGNAL FACE	PHASE Ø2+6	PHASE Ø4+8	FLASH
21, 22	G	R	R
23, 24	↗	↗	↗
41, 42	R	↑	R
43, 44	↗	↗	↗
61, 62	↑	R	R
63, 64	↖	↖	↖
81, 82	R	G	R
83, 84	↖	↖	↖
P41, P42	DW	W	DRK
P61, P62	W	DW	DRK
P81, P82	DW	W	DRK

W - Walk
DW - Don't Walk
DRK - Dark

SIGNAL FACE I.D.

All Heads L.E.D.



63, 64 83, 84 | 41, 42 61, 62 | 21, 22 81, 82 | 23, 24 43, 44 | P41, P42 P61, P62 P81, P82

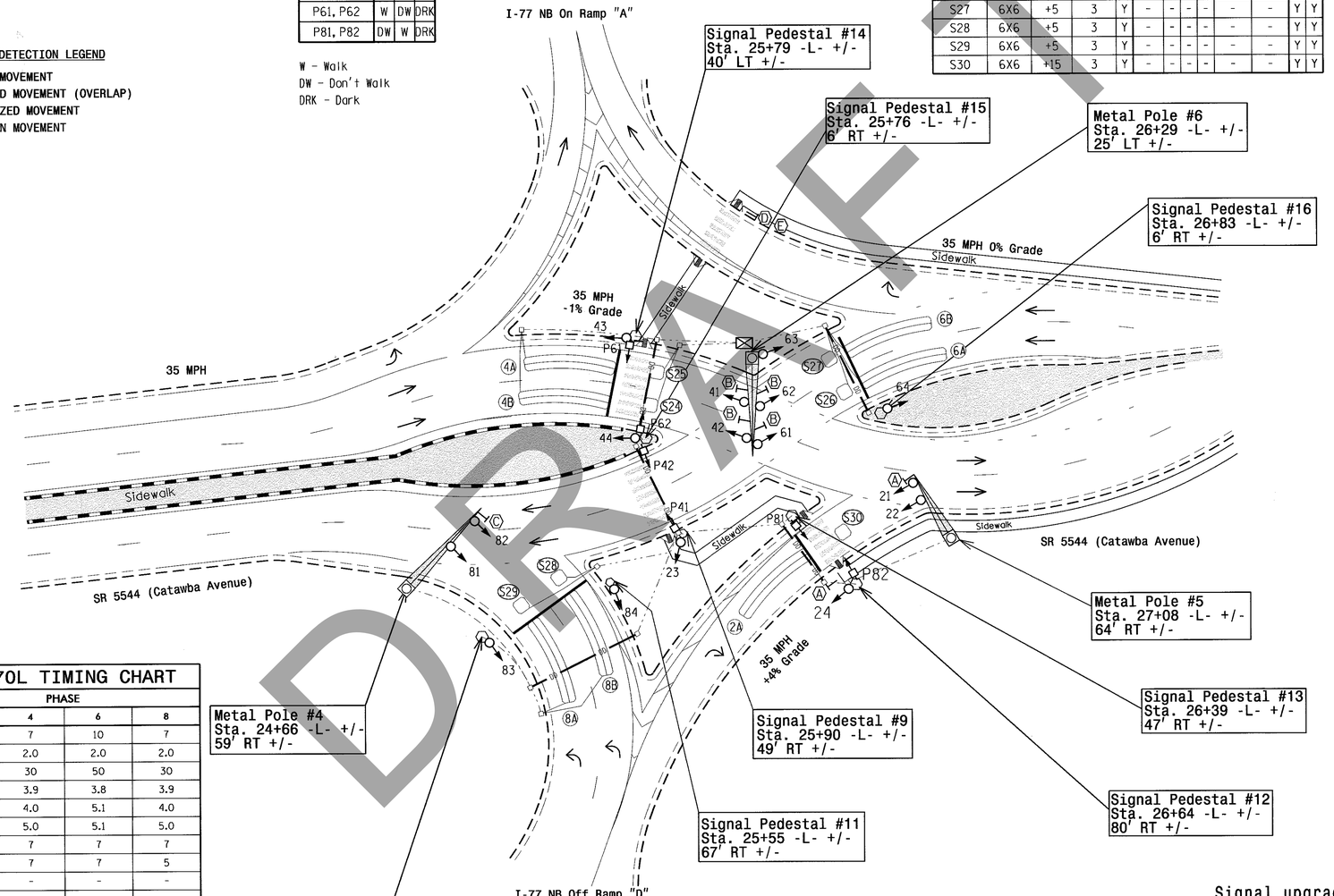
OASIS 2070L LOOP & DETECTOR INSTALLATION CHART

INDUCTIVE LOOPS					DETECTOR PROGRAMMING							
LOOP	SIZE (FT)	DISTANCE FROM STOPBAR (FT)	TURNS	NEW LOOP	PHASE	CALLING	EXTENSION	FULL TIME DELAY	STRETCH TIME	DELAY TIME	SYSTEM LOOP	NEW CARD
2A	6X40	0	2-4-2	Y	2	Y	Y	-	-	-	-	Y
4A	6X40	0	2-4-2	Y	4	Y	Y	-	-	-	-	Y
4B	6X40	0	2-4-2	Y	4	Y	Y	-	-	-	-	Y
6A	6X40	0	2-4-2	Y	6	Y	Y	-	-	-	-	Y
6B	6X40	0	2-4-2	Y	6	Y	Y	-	-	-	-	Y
8A	6X40	0	2-4-2	Y	8	Y	Y	-	-	-	-	Y
8B	6X40	0	2-4-2	Y	8	Y	Y	-	-	-	-	Y
S24	6X6	+15	3	Y	-	-	-	-	-	-	Y	Y
S25	6X6	+15	3	Y	-	-	-	-	-	-	Y	Y
S26	6X6	+5	3	Y	-	-	-	-	-	-	Y	Y
S27	6X6	+5	3	Y	-	-	-	-	-	-	Y	Y
S28	6X6	+5	3	Y	-	-	-	-	-	-	Y	Y
S29	6X6	+5	3	Y	-	-	-	-	-	-	Y	Y
S30	6X6	+15	3	Y	-	-	-	-	-	-	Y	Y

2 Phase
Fully Actuated
Catawba Avenue CLS

NOTES

1. Refer to "Roadway Standard Drawings NCDOT" dated January 2012 and "Standard Specifications for Roads and Structures" dated January 2012.
2. Do not program signal for late night flashing operation.
3. Set all detector units to presence mode.
4. Locate new cabinet so as not to obstruct sight distance of vehicles turning right on red.
5. Omit "WALK" and flashing "DON'T WALK" with no pedestrian calls.
6. Program pedestrian heads to countdown the flashing "Don't Walk" time only.
7. Program all phases for "Red Rest".
8. Maximum times shown in timing chart are for free-run operation only. Coordinated signal system timing values supersede these values.
9. Closed loop system data: Controller Asset #0967.



LEGEND

PROPOSED		EXISTING
	Traffic Signal Head	
	Modified Signal Head	N/A
	Sign	
	Pedestrian Signal Head With Push Button & Sign	
	Signal Pole with Guy	
	Signal Pole with Sidewalk Guy	
	Inductive Loop Detector	
	Controller & Cabinet	
	Junction Box	
	2-in Underground Conduit	
N/A	Right of Way	
	Directional Arrow	
	Metal Pole with Mastarm	
	Signal Pedestal	
N/A	Wheelchair Ramp	
DD	Directional Drill	N/A
Ⓐ	No Left Turn Sign (R3-2)	Ⓐ
Ⓑ	Through Arrow "ONLY" Sign (R3-5A)	Ⓑ
Ⓒ	No Right Turn Sign (R3-1)	Ⓒ
Ⓓ	Pedestrian Crossing (W11-2)	Ⓓ
Ⓔ	Diagonal Downward Arrow Sign (W16-7P)	Ⓔ

OASIS 2070L TIMING CHART

FEATURE	PHASE 2	4	6	8
Min Green 1 *	10	7	10	7
Extension 1 *	2.0	2.0	2.0	2.0
Max Green 1 *	50	30	50	30
Yellow Clearance	3.8	3.9	3.8	3.9
Red Clearance	5.1	4.0	5.1	4.0
Red Revert	5.1	5.0	5.1	5.0
Walk 1 *	-	7	7	7
Don't Walk 1	-	7	7	5
Seconds Per Actuation *	-	-	-	-
Max Variable Initial *	-	-	-	-
Time Before Reduction *	-	-	-	-
Time To Reduce *	-	-	-	-
Minimum Gap	-	-	-	-
Recall Mode	-	-	-	-
Vehicle Call Memory	-	-	-	-
Dual Entry	ON	ON	ON	ON
Simultaneous Gap	ON	ON	ON	ON

* These values may be field adjusted. Do not adjust Min Green and Extension times for phases 2 and 6 lower than what is shown. Min Green for all other phases should not be lower than 4 seconds.

DRAFT

Signal upgrade - Final Design

Prepared in the Offices of:
Transportation Mobility and Safety Division
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
Signal Design Section
750 N.Greenfield Pkwy,Garner,NC 27529

SR 5544 (Catawba Avenue)
at
I-77 NB Ramps A, D

Division 10 Mecklenburg County Cornelius

PLAN DATE:	April 2013	REVIEWED BY:	T. Williams
PREPARED BY:	W. Mahbooba	REVIEWED BY:	

SCALE 0 30 1"=30'

REVISIONS	INIT.	DATE

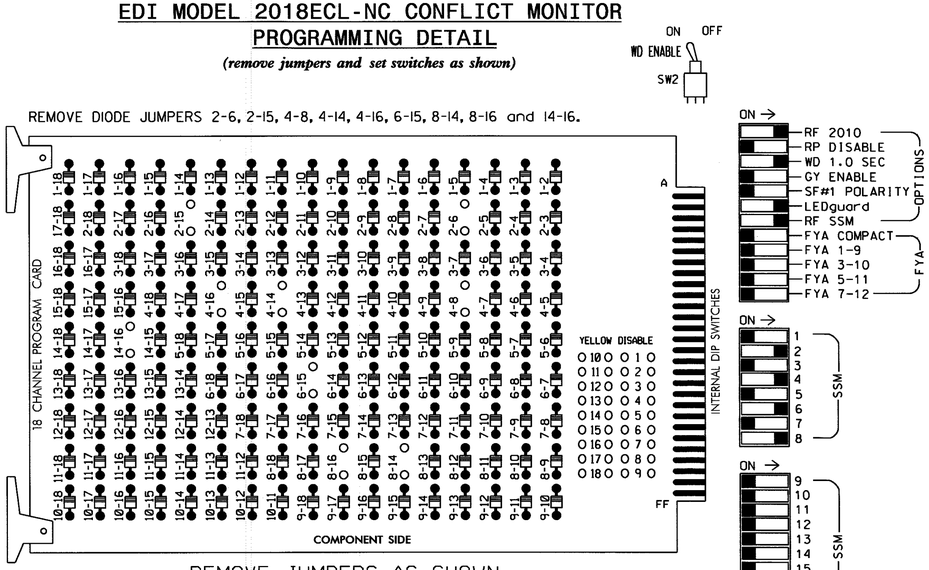
SEAL
NORTH CAROLINA PROFESSIONAL SEAL 24393 ENGINEER TIMOTHY C. WILLIAMS
SIGNATURE 4/30/13. DATE
SIG. INVENTORY NO. 10-0967

06-MAY-2013 15:47
R:\Traffic\Signal\Design\Signals\10-0967\100967_sig_dsn_20130430.dgn
mahbooba

PROJECT REFERENCE NO.	SHEET NO.
I-4733	Sig. 20

EDI MODEL 2018ECL-NC CONFLICT MONITOR PROGRAMMING DETAIL

(remove jumpers and set switches as shown)



REMOVE JUMPERS AS SHOWN

NOTES:

1. Card is provided with all diode jumpers in place. Removal of any jumper allows its channels to run concurrently.
2. Ensure jumpers SEL2-SEL5 and SEL9 are present on the monitor board.
3. Ensure that Red Enable is active at all times during normal operation.
4. Connect serial cable from conflict monitor to comm. port 1 of 2070 controller. Ensure conflict monitor communicates with 2070.

■ = DENOTES POSITION OF SWITCH

NOTES

1. To prevent "flash-conflict" problems, insert red flash program blocks for all unused vehicle load switches in the output file. The installer shall verify that signal heads flash in accordance with the Signal Plans.
2. Program phases 2, 4, 6 and 8 for Dual Entry.
3. Enable Simultaneous Gap-Out for all phases.
4. Program phases 2, 4, 6 and 8 for Red Rest.
5. Program phases 2 and 6 for Startup Red Clear.
6. Program phases 4, 6 and 8 for 'STARTUP PED CALL'.
7. Program phases 2 and 6 as First Phases.
8. The cabinet and controller are part of the Catawba Avenue Closed Loop System.

EQUIPMENT INFORMATION

CONTROLLER.....2070L
CABINET.....332
SOFTWARE.....ECONOLITE OASIS
CABINET MOUNT.....BASE
OUTPUT FILE POSITIONS...12
LOAD SWITCHES USED..... S2,S5,S6,S8,S9,S11,S12
PHASES USED.....2,4,4 PED,6,6 PED,8,8 PED
OVERLAPS.....NONE

SIGNAL HEAD HOOK-UP CHART

LOAD SWITCH NO.	S1	S2		S3	S4	S5		S6	S7	S8		S9	S10	S11		S12
CMU CHANNEL NO.	1	2		13	3	4		14	5	6		15	7	8		16
PHASE	1	2		2 PED	3	4		4 PED	5	6		6 PED	7	8		8 PED
SIGNAL HEAD NO.	NU	21,22	23,24	NU	NU	41,42	43,44	P41, P42	NU	61,62	63,64	P61, P62	NU	81,82	83,84	P81, P82
RED		128				101				134				107		
YELLOW		129				102				135				108		
GREEN		130												109		
RED ARROW			128				101				134				107	
YELLOW ARROW			129				102				135				108	
GREEN ARROW			130			103	103			136	136				109	
✋								104				119				110
🚶								106				121				112

NU = Not Used

COUNTDOWN PEDESTRIAN SIGNAL OPERATION

Countdown Ped Signals are required to display timing only during Ped Clearance Interval. Consult Ped Signal Module user's manual for instructions on selecting this feature.

INPUT FILE POSITION LAYOUT

(front view)

		1	2	3	4	5	6	7	8	9	10	11	12	13	14
FILE "I"	U	SLOT EMPTY	Ø2 2A	SYS. DET. S30	SLOT EMPTY	SLOT EMPTY	Ø4 4A	SYS. DET. S25	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	NOT USED	Ø6 PED DC ISOLATOR	FS DC ISOLATOR
	L		NOT USED	NOT USED			Ø4 4B	SYS. DET. S24					Ø4 PED DC ISOLATOR	Ø8 PED DC ISOLATOR	ST DC ISOLATOR
FILE "J"	U	SLOT EMPTY	Ø6 6A	SYS. DET. S26	SLOT EMPTY	SLOT EMPTY	Ø8 8A	SYS. DET. S29	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY
	L		Ø6 6B	SYS. DET. S27			Ø8 8B	SYS. DET. S28							

EX.: 1A, 2A, ETC. = LOOP NO.'S

FS = FLASH SENSE
ST = STOP TIME

INPUT FILE CONNECTION & PROGRAMMING CHART

LOOP NO.	LOOP TERMINAL	INPUT FILE POS.	PIN NO.	INPUT ASSIGNMENT NO.	DETECTOR NO.	NEMA PHASE	CALL	EXTEND	FULL TIME DELAY	STRETCH TIME	DELAY TIME
2A	TB2-5,6	I2U	39	1	2	2	Y	Y			
4A	TB4-9,10	I6U	41	3	4	4	Y	Y			
4B	TB4-11,12	I6L	45	7	14	4	Y	Y			
6A	TB3-5,6	J2U	40	2	6	6	Y	Y			
6B	TB3-7,8	J2L	44	6	16	6	Y	Y			
8A	TB5-9,10	J6U	42	4	8	8	Y	Y			
8B	TB5-11,12	J6L	46	8	18	8	Y	Y			
*S24	TB6-3,4	I7L	78	40	44	SYS					
*S25	TB6-1,2	I7U	65	27	34	SYS					
*S26	TB3-9,10	J3U	64	26	36	SYS					
*S27	TB3-11,12	J3L	77	39	46	SYS					
*S28	TB7-3,4	J7L	79	41	48	SYS					
*S29	TB7-1,2	J7U	66	28	38	SYS					
*S30	TB2-9,10	I3U	63	25	32	SYS					
PED PUSH BUTTONS											
P41,P42	TB8-5,6	I12L	69	31	PED 4	4 PED					
P61,P62	TB8-7,9	I13U	68	30	PED 6	6 PED					
P81,P82	TB8-8,9	I13L	70	32	PED 8	8 PED					

NOTE:
INSTALL DC ISOLATORS IN INPUT FILE SLOTS I12 AND I13.

* System detector only. Remove the vehicle phase assigned to this detector in the default programming.

INPUT FILE POSITION LEGEND: J2L
FILE J
SLOT 2
LOWER

DRAFT

THIS ELECTRICAL DETAIL IS FOR
THE SIGNAL DESIGN: 10-0967
DESIGNED: April 2013
SEALED: 4/30/13
REVISED: N/A

Electrical Detail

ELECTRICAL AND PROGRAMMING DETAILS FOR:

SR 5544 (Catawba Avenue)
at
I-77 NB Ramps A,D

Division 10 Mecklenburg County Cornelius

PLAN DATE: April 2013 REVIEWED BY: T. Lyon
PREPARED BY: C. Strickland REVIEWED BY:

REVISIONS	INIT.	DATE

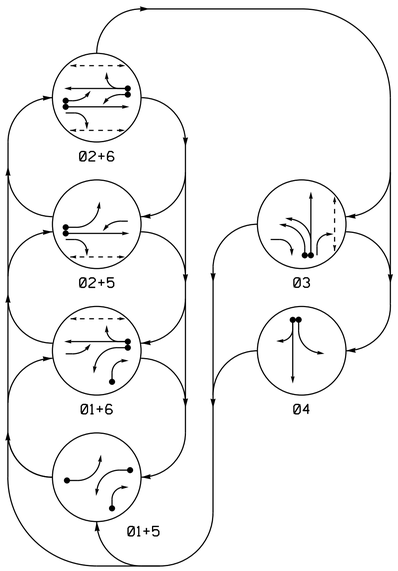
Prepared in the Offices of:
Transportation Mobility and Safety Division
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
Signals Management Section
750 N.Greenfield Pkwy.,Garner,NC 27529

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 022013 ENGINEER GEORGE C. BROWN
SIGNATURE 5/1/13 DATE
SIG. INVENTORY NO. 10-0967

01-MAY-2013 11:56
S:\Signals\TS\Signals\Workgroups\Sig Mgmt\Strickland\10967_smlete_xxx.dgn
User:cestrickland

PROJECT REFERENCE NO.	SHEET NO.
POR	Sig.1

PHASING DIAGRAM



PHASING DIAGRAM DETECTION LEGEND

- DETECTED MOVEMENT
- UNDETECTED MOVEMENT (OVERLAP)
- UNSIGNALIZED MOVEMENT
- PEDESTRIAN MOVEMENT

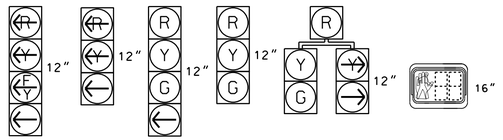
TABLE OF OPERATION

SIGNAL FACE	PHASE 01+5	01+6	02+5	02+6	03	04	FLASH
11	←-	←-	F Y	F Y	~~R~~	~~R~~	~~Y~~
21	R	R	G	G	R	R	Y
22	R	R	G	G	R/←-	R	Y
31	~~R~~	~~R~~	~~R~~	~~R~~	~~R~~	~~R~~	~~R~~
32	R	R	R	R	G ←-	R	R
33	R/→-	R/→-	R	R	G	R	R
41	R	R	R	R	R	G	R
42	R	R	R	R	R	G	R
51	←-	F Y	←-	F Y	~~R~~	~~R~~	~~Y~~
61, 62	R	G	R	G	R	R	Y
P21, P22	DW	DW	W	W	DW	DW	DRK
P31, P32	DW	DW	DW	DW	W	DW	DRK
P61, P62	DW	W	DW	W	DW	DW	DRK

W - Walk
DW - Don't Walk
DRK - Dark

SIGNAL FACE I.D.

All Heads L.E.D.



11, 51 | 31 | 32, 41 | 21, 42, 61, 62 | 22, 33 | P21, P22, P31, P32, P61, P62

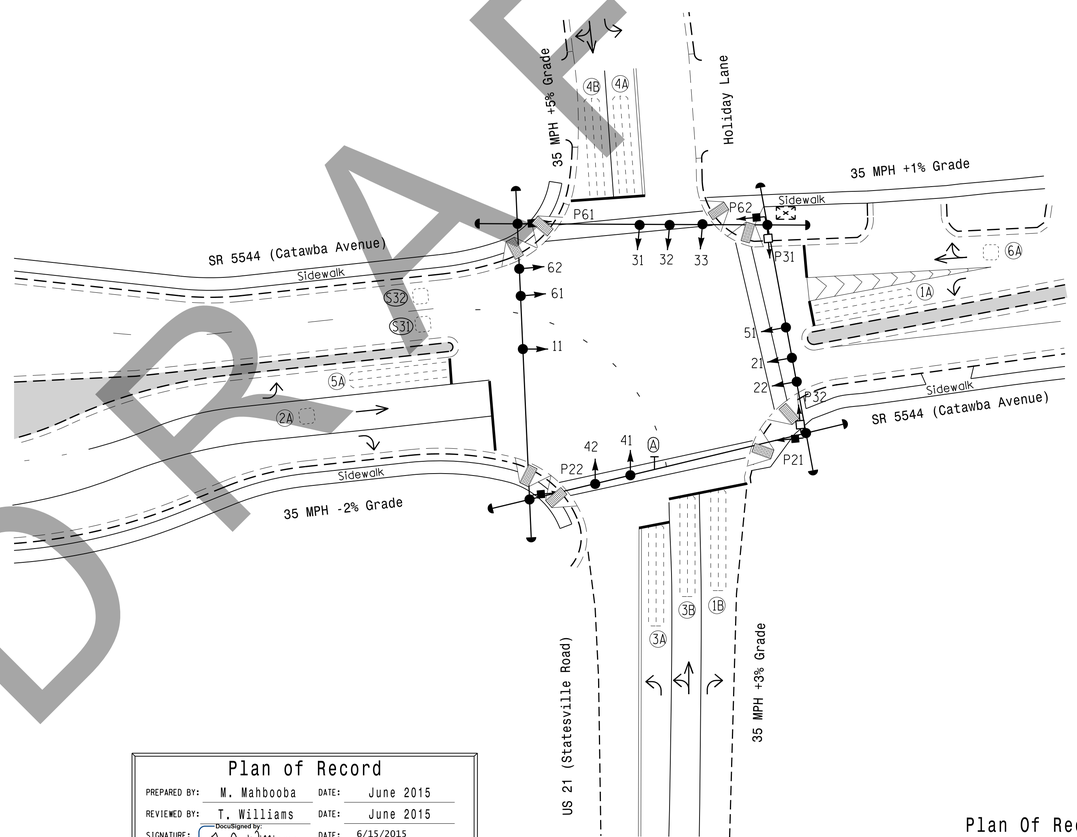
OASIS 2070L LOOP & DETECTOR INSTALLATION CHART

INDUCTIVE LOOPS						DETECTOR PROGRAMMING							
LOOP	SIZE (FT)	DISTANCE FROM STOPBAR (FT)	TURNS	NEW LOOP		PHASE	CALLING	EXTENSION	FULL TIME DELAY	STRETCH TIME	DELAY TIME	SYSTEM LOOP	NEW CARD
1A	6X40	0	2-4-2	-		1	Y	Y	-	-	15	-	-
						6	Y	Y	-	-	-	-	-
1B	6X40	0	2-4-2	-		1	Y	Y	-	-	15	-	-
2A	6X6	70	4	-		2	Y	Y	-	-	-	-	-
3A	6X40	0	2-4-2	-		3	Y	Y	-	-	3	-	-
3B	6X40	0	2-4-2	-		3	Y	Y	-	-	-	-	-
4A	6X40	0	2-4-2	-		4	Y	Y	-	-	3	-	-
4B	6X40	0	2-4-2	-		4	Y	Y	-	-	10	-	-
5A	6X40	0	2-4-2	-		5	Y	Y	-	-	15	-	-
						2	Y	Y	-	-	-	-	-
6A	6X6	70	3	-		6	Y	Y	-	-	-	-	-
S31	6X6	+150	3	-		-	-	-	-	-	-	Y	-
S32	6X6	+150	3	-		-	-	-	-	-	-	Y	-

6 Phase
Fully Actuated
Catawba Avenue CLS

NOTES

1. Refer to "Roadway Standard Drawings NCDOT" dated January 2012 and "Standard Specifications for Roads and Structures" dated January 2012.
2. Do not program signal for late night flashing operation unless otherwise directed by the Engineer.
3. Phase 1 and/or phase 5 may be lagged.
4. The order of phase 3 and phase 4 may be reversed.
5. Set all detector units to presence mode.
6. Pavement Markings are existing
7. Omit "WALK" and flashing "DON'T WALK" with no pedestrian calls.
8. Program pedestrian heads to countdown the flashing "Don't Walk" time only.
9. Maximum times shown in timing chart are for free-run operation only. Coordinated signal system timing values supersede these values.
10. Closed loop system data: Controller Asset #0885.



LEGEND

PROPOSED		EXISTING
○→	Traffic Signal Head	●→
◐→	Modified Signal Head	N/A
⊣	Sign	⊣
▭↓	Pedestrian Signal Head With Push Button & Sign	■↓
○—	Signal Pole with Guy	●—
○‿	Signal Pole with Sidewalk Guy	●‿
▭	Inductive Loop Detector	▭
⊠	Controller & Cabinet	⊡
□	Junction Box	■
·-·-·	2-in Underground Conduit	·-·-·
N/A	Right of Way	- - - - -
→	Directional Arrow	→
Ⓐ	Left Arrow "ONLY" Sign (R3-5L)	Ⓐ

OASIS 2070L TIMING CHART

FEATURE	PHASE 1	2	3	4	5	6
Min Green 1 *	7	10	7	7	7	10
Extension 1	2.0	3.0	2.0	2.0	2.0	3.0
Max Green 1 *	15	40	20	15	25	40
Yellow Clearance	3.0	4.0	3.7	3.6	3.0	4.0
Red Clearance	3.2	2.4	2.6	2.3	3.3	2.4
Red Revert	2.0	2.0	2.0	2.0	2.0	2.0
Walk 1 *	-	7	7	-	-	7
Don't Walk 1	-	18	15	-	-	15
Seconds Per Actuation *	-	-	-	-	-	-
Max Variable Initial *	-	-	-	-	-	-
Time Before Reduction *	-	-	-	-	-	-
Time To Reduce *	-	-	-	-	-	-
Minimum Gap	-	-	-	-	-	-
Recall Mode	-	MIN RECALL	-	-	-	MIN RECALL
Vehicle Call Memory	-	YELLOW	-	-	-	YELLOW
Dual Entry	-	-	-	-	-	-
Simultaneous Gap	ON	ON	ON	ON	ON	ON

* These values may be field adjusted. Do not adjust Min Green and Extension times for phases 2 and 6 lower than what is shown. Min Green for all other phases should not be lower than 4 seconds.

DRAFT

Plan of Record

PREPARED BY: M. Mahbooba DATE: June 2015
REVIEWED BY: T. Williams DATE: June 2015
SIGNATURE: Docusigned by: J. J. Williams 97AD792EBE934CA... DATE: 6/15/2015

COMMENTS
Removed pedestrian heads & crosswalk from phase 4.

This plan of record reflects existing field conditions as submitted by field personnel. This plan may have been modified from its original state.

Plan Of Record

Prepared in the Offices of:
Transportation Mobility and Safety Division
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
Signal Design Section
750 N.Greenfield Pkwy.Garner,NC 27529

SR 5544 (Catawba Avenue)
at
US 21 (Statesville Road) / Holiday Lane

Division 10 Mecklenburg County Cornelius

PLAN DATE: April 2013 REVIEWED BY: T. Williams
PREPARED BY: M. Mahbooba REVIEWED BY:

REVISIONS	INIT.	DATE

SCALE 0 30 1"=30'

Not a certified document. This document originally issued and sealed by TImothy J.Williams,PE 024393 on 4/30/2013 THis document shall not be considered a certified document.

SIG. INVENTORY NO. 10-0885

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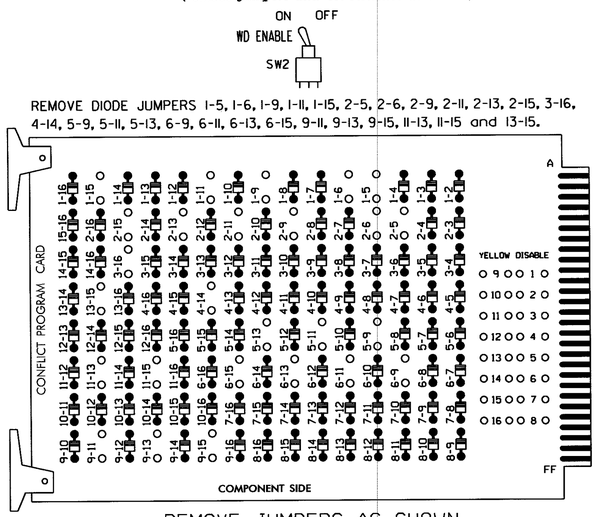
mmahbooba

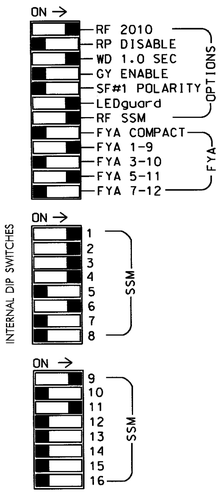
PROJECT REFERENCE NO.	SHEET NO.
I-4733	Sig. 27

EDI MODEL 2010ECL-NC CONFLICT MONITOR PROGRAMMING DETAIL

(remove jumpers and set switches as shown)



REMOVE JUMPERS AS SHOWN



■ = DENOTES POSITION OF SWITCH

NOTES:

1. Card is provided with all diode jumpers in place. Removal of any jumper allows its channels to run concurrently.
2. Make sure jumpers SEL2-SEL5 are present on the monitor board.

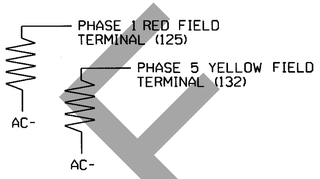
EQUIPMENT INFORMATION

CONTROLLER.....2070L
CABINET.....332 /W/ AUX
SOFTWARE.....ECONOLITE OASIS
CABINET MOUNT.....BASE
OUTPUT FILE POSITIONS...18 WITH AUX. OUTPUT FILE
LOAD SWITCHES USED.....S1,S2,S2P,S3,S4,S4P,S5,S6, S6P,S8P,S9,S12
PHASES USED.....1,2,2 PED,3,3 PED,4,4 PED, 5,6,6 PED
OVERLAP "A".....1+2
OVERLAP "B".....NOT USED
OVERLAP "C".....5+6
OVERLAP "D".....NOT USED

LOAD RESISTOR INSTALLATION DETAIL

(install resistors as shown below)

ACCEPTABLE VALUES	
VALUE (ohms)	WATTAGE
1.5K - 1.9K	25W (min)
2.0K - 3.0K	10W (min)



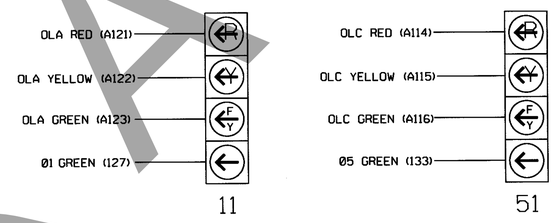
SIGNAL HEAD HOOK-UP CHART

LOAD SWITCH NO.	S1		S2	S2P	S3				S4		S4P	S5	S6	S6P	S7	S8	S8P	S9	S10	S11	S12	S13	S14
PHASE	1		2	2 PED	3				4		4 PED	5	6	6 PED	7	8	3 PED	OLA	OLB	SPARE	OLC	OLD	SPARE
SIGNAL HEAD NO.	11★	33	21,22	P21, P22	22	31	32	33	41	42	P41, P42	51★	61,62	P61, P62	NU	NU	P31, P32	11★	NU	NU	51★	NU	NU
RED		✱	128				116	116	101	101			134										
YELLOW			129				117	117	102	102		✱	135										
GREEN			130				118	118	103	103			136										
RED ARROW						116												A121			A114		
YELLOW ARROW		126			117	117												A122			A115		
FLASHING YELLOW ARROW																		A123			A116		
GREEN ARROW	127	127			118	118	118		103			133											
✋				113							104			119			110						
🚶				115							106			121			112						

NU = Not Used
✱ Denotes install load resistor. See load resistor installation detail this sheet.
★ See pictorial of head wiring in detail below.

4 SECTION FYA PPLT SIGNAL WIRING DETAIL

(wire signal heads as shown)



NOTE

1. The sequence display for this signal requires special logic programming. See sheet 2 of 2 for programming instructions.

NOTES

1. To prevent "flash-conflict" problems, insert red flash program blocks for all unused vehicle load switches in the output file. The installer shall verify that signal heads flash in accordance with the Signal Plans.
2. Ensure that Red Enable is active at all times during normal operation. To prevent Red Failures on unused monitor channels, tie unused red monitor inputs 5,7, 8,10,12,13,14,15 & 16 to load switch AC+ per the cabinet manufacturer's instructions.
3. Enable Simultaneous Gap-Out for all phases.
4. Program phases 2 and 6 for Start Up In Green.
5. Program phases 2, 3, 4 and 6 for 'STARTUP PED CALL'.
6. Program phases 2 and 6 for Yellow Flash, and overlap 1 as Wag Overlaps.
7. The cabinet and controller are part of the Catawba Avenue Closed Loop System.

INPUT FILE CONNECTION & PROGRAMMING CHART

LOOP NO.	LOOP TERMINAL	INPUT FILE POS.	PIN NO.	INPUT ASSIGNMENT NO.	DETECTOR NO.	NEMA PHASE	CALL	EXTEND	FULL TIME DELAY	STRETCH TIME	DELAY TIME
1A[1]	TB2-1,2	I1U	56	18	1	1	Y	Y			15
	-	J4U	48	10	26	6	Y	Y			
1B	TB2-11,12	I3L	76	38	42	1	Y	Y			15
2A	TB2-9,10	I3U	63	25	32	2	Y	Y			
3A	TB4-9,10	I6U	41	3	4	3	Y	Y			3
3B	TB4-11,12	I6L	45	7	14	3	Y	Y			
4A	TB6-1,2	I7U	65	27	34	4	Y	Y			3
4B	TB6-3,4	I7L	78	40	44	4	Y	Y			10
5A[2]	TB3-1,2	J1U	55	17	5	5	Y	Y			15
	-	I4U	47	9	22	2	Y	Y			
6A	TB3-5,6	J2U	40	2	6	6	Y	Y			
✱S31	TB6-9,10	I9U	60	22	11	SYS					
✱S32	TB6-11,12	I9L	62	24	13	SYS					
PED PUSH BUTTONS											
P21,P22	TB8-4,6	I12U	67	29	PED 2	2 PED					
P31,P32	TB8-8,9	I13L	70	32	PED 8	3 PED					
P41,P42	TB8-5,6	I12L	69	31	PED 4	4 PED					
P61,P62	TB8-7,9	I13U	68	30	PED 6	6 PED					

NOTE: INSTALL DC ISOLATORS IN INPUT FILE SLOTS I12 AND I13.

✱ System detector only. Remove the vehicle phase assigned to this detector in the default programming.

[1] Add jumper from I1-W to J4-W, on rear of input file.

[2] Add jumper from J1-W to I4-W, on rear of input file.

INPUT FILE POSITION LEGEND: J2L
FILE J
SLOT 2
LOWER

INPUT FILE POSITION LAYOUT

(front view)

		1	2	3	4	5	6	7	8	9	10	11	12	13	14
FILE "I"	U	Ø1 1A	SLOT EMPTY	Ø2 2A	WIRED INPUT ⊗	SLOT EMPTY	Ø3 3A	Ø4 4A	SLOT EMPTY	SYS. DET. S31	SLOT EMPTY	SLOT EMPTY	Ø2 PED DC ISOLATOR	Ø6 PED DC ISOLATOR	FS DC ISOLATOR
	L	NOT USED		Ø1 1B			Ø3 3B	Ø4 4B		SYS. DET. S32			Ø4 PED DC ISOLATOR	Ø3 PED DC ISOLATOR	ST DC ISOLATOR
FILE "J"	U	Ø5 5A	Ø6 6A	SLOT EMPTY	WIRED INPUT ⊗	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY	SLOT EMPTY
	L	NOT USED	NOT USED												

EX.: 1A, 2A, ETC. = LOOP NO.'S

FS = FLASH SENSE
ST = STOP TIME

⊗ Wired Input - Do not populate slot with detector card

COUNTDOWN PEDESTRIAN SIGNAL OPERATION

Countdown Ped Signals are required to display timing only during Ped Clearance Interval. Consult Ped Signal Module user's manual for instructions on selecting this feature.

THIS ELECTRICAL DETAIL IS FOR THE SIGNAL DESIGN: 10-0885
DESIGNED: April 2013
SEALED: 4/30/13
REVISED: N/A

Electrical Detail - Sheet 1 of 2

ELECTRICAL AND PROGRAMMING DETAILS FOR:	SR 5544 (Catawba Avenue) at US 21 (Statesville Road)/ Holiday Lane	SEAL
Prepared in the Offices of: Transportation Mobility and Safety Division, Traffic Engineering Branch, Signal Management Section, NC Department of Transportation	Division 10 Mecklenburg County Cornelius	NORTH CAROLINA PROFESSIONAL SEAL 022013 ENGINEER GEORGE C. BROWN
750 N.Greenfield Pkwy,Garner,NC 27529	PLAN DATE: April 2013 REVIEWED BY: T. Ugo	SIGNATURE DATE 5/1/13
	PREPARED BY: C. Strickland REVIEWED BY:	SIG. INVENTORY NO. 10-0885
	REVISIONS / INIT. / DATE	

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cstrickland

PROJECT REFERENCE NO.	SHEET NO.
I-4733	Sig.28

LOGICAL I/O PROCESSOR PROGRAMMING DETAIL
TO PRODUCE SPECIAL FYA-PPLT SIGNAL SEQUENCE

(program controller as shown below)

1. FROM MAIN MENU PRESS '2' (PHASE CONTROL). THEN '1' (PHASE CONTROL FUNCTIONS). SCROLL TO THE BOTTOM OF THE MENU AND ENABLE ACT LOGIC COMMANDS 1, 2, 3, 4, 5 AND 6.

2. FROM MAIN MENU PRESS '6' (OUTPUTS). THEN '3' (LOGICAL I/O PROCESSOR).

```
LOGICAL I/O COMMAND #1  (+/-COMMAND#)
IF  ACTIVE PHASE      #1  IS ON
AND RED CLEAR ON PHASE #1  IS ON

        SCROLL DOWN

THEN:
SET OUTPUT  ASSIGNMENT #50 ON
SET OUTPUT  ASSIGNMENT #51 OFF
```

NOTE: LOGIC FOR PHASE 1 RED CLEAR WHEN TRANSITIONING FROM PHASE 1 TO PHASE 2 (HEAD 11).

PRESS '+'

```
LOGICAL I/O COMMAND #2  (+/-COMMAND#)
IF  ACTIVE PHASE      #1  IS ON

        SCROLL DOWN

THEN:
SET OUTPUT  ASSIGNMENT #52 OFF
```

NOTE: LOGIC FOR SWITCHING FLASHING YELLOW ARROW "OFF" DURING PHASE 1 (HEAD 11).

PRESS '+'

```
LOGICAL I/O COMMAND #3  (+/-COMMAND#)
IF  YELLOW ON PHASE   #1  IS ON

        SCROLL DOWN

THEN:
SET OUTPUT  ASSIGNMENT #51 ON
```

NOTE: LOGIC FOR YELLOW ARROW CLEARANCE FROM PHASE 1 (HEAD 11).

PRESS '+'

```
LOGICAL I/O COMMAND #4  (+/-COMMAND#)
IF  ACTIVE PHASE      #5  IS ON
AND RED CLEAR ON PHASE #5  IS ON

        SCROLL DOWN

THEN:
SET OUTPUT  ASSIGNMENT #42 ON
SET OUTPUT  ASSIGNMENT #43 OFF
```

NOTE: LOGIC FOR PHASE 5 RED CLEAR WHEN TRANSITIONING FROM PHASE 5 TO PHASE 6 (HEAD 51).

PRESS '+'

```
LOGICAL I/O COMMAND #5  (+/-COMMAND#)
IF  ACTIVE PHASE      #5  IS ON

        SCROLL DOWN

THEN:
SET OUTPUT  ASSIGNMENT #44 OFF
```

NOTE: LOGIC FOR SWITCHING FLASHING YELLOW ARROW "OFF" DURING PHASE 5 (HEAD 51).

PRESS '+'

```
LOGICAL I/O COMMAND #6  (+/-COMMAND#)
IF  YELLOW ON PHASE   #5  IS ON

        SCROLL DOWN

THEN:
SET OUTPUT  ASSIGNMENT #43 ON
```

NOTE: LOGIC FOR YELLOW ARROW CLEARANCE FROM PHASE 5 (HEAD 51).

LOGIC I/O PROCESSOR PROGRAMMING COMPLETE

OUTPUT REFERENCE SCHEDULE

OUTPUT 42 = Overlap C Red
OUTPUT 43 = Overlap C Yellow
OUTPUT 44 = Overlap C Green
OUTPUT 50 = Overlap A Red
OUTPUT 51 = Overlap A Yellow
OUTPUT 52 = Overlap A Green

OVERLAP PROGRAMMING DETAIL

(program controller as shown below)

FROM MAIN MENU PRESS '8' (OVERLAPS). THEN '1' (VEHICLE OVERLAP SETTINGS).

```
 PAGE 1: VEHICLE OVERLAP 'A' SETTINGS
 PHASE:          |12345678910111213141516
VEH OVL PARENTS: |XX
VEH OVL NOT VEH: |
VEH OVL NOT PED: |
VEH OVL GRN EXT: |
STARTUP COLOR:  _ RED  _ YELLOW  _ GREEN
FLASH COLORS:   _ RED  _ YELLOW  X GREEN
SELECT VEHICLE OVERLAP OPTIONS:   (Y/N)
FLASH YELLOW IN CONTROLLER FLASH?...Y
GREEN EXTENSION (0-255 SEC).........0
YELLOW CLEAR (0=PARENT,3-25.5 SEC)..0.0
RED CLEAR (0=PARENT,0.1-25.5 SEC)...0.0
OUTPUT AS PHASE # (0=NONE, 1-16)....0
```

← NOTICE GREEN FLASH

PRESS '+' TWICE

```
 PAGE 1: VEHICLE OVERLAP 'C' SETTINGS
 PHASE:          |12345678910111213141516
VEH OVL PARENTS: |   XX
VEH OVL NOT VEH: |
VEH OVL NOT PED: |
VEH OVL GRN EXT: |
STARTUP COLOR:  _ RED  _ YELLOW  _ GREEN
FLASH COLORS:   _ RED  _ YELLOW  X GREEN
SELECT VEHICLE OVERLAP OPTIONS:   (Y/N)
FLASH YELLOW IN CONTROLLER FLASH?...Y
GREEN EXTENSION (0-255 SEC).........0
YELLOW CLEAR (0=PARENT,3-25.5 SEC)..0.0
RED CLEAR (0=PARENT,0.1-25.5 SEC)...0.0
OUTPUT AS PHASE # (0=NONE, 1-16)....0
```

← NOTICE GREEN FLASH

OVERLAP PROGRAMMING COMPLETE

PED 3 PROGRAMMING DETAIL

(program controller as shown below)

CHANGING OUTPUT ASSIGNMENTS

1. FROM MAIN MENU SELECT '6' (OUTPUTS). THEN '1' (OUTPUT ASSIGNMENTS)
2. ENTER 17 (PHASE 8 DW) FOR OUTPUT ASSIGNMENT #.
3. SCROLL DOWN TO 'PEDESTRIAN PHASE' AND ENTER 'Y' <u>REGARDLESS OF DEFAULT PROGRAMMING</u>
4. ENTER '3' FOR 'SELECT PEDESTRIAN PHASE'. NO CHANGE NEEDED FOR 'SELECT COLOR'
5. BACKUP TO 'OUTPUT ASSIGNMENTS AND SETTINGS MENU:' BY PRESSING THE 'ESC' BUTTON ON KEYBOARD.
6. SELECT '1' (OUTPUT ASSIGNMENTS)
7. ENTER 18 (PHASE 8 W) FOR OUTPUT ASSIGNMENT #.
8. REPEAT STEPS # 3 AND # 4.

CHANGING INPUT ASSIGNMENTS

1. FROM MAIN MENU SELECT '7' (DETECTORS). THEN '2' (PEDESTRIAN DETECTOR ASSIGNMENTS)
2. CYCLE TO PED DETECTOR #8 BY REPEATEDLY DEPRESSING '+' KEY
3. MODIFY PHASE ASSIGNED TO PED DETECTOR # 8 FROM PHASE 8 TO PHASE 3

PROGRAMMING COMPLETE

DRAFT

THIS ELECTRICAL DETAIL IS FOR THE SIGNAL DESIGN: 10-0885
DESIGNED: April 2013
SEALED: 4/30/13
REVISED: N/A

ELECTRICAL AND PROGRAMMING DETAILS FOR:

Prepared in the Offices of:
Transportation Mobility and Safety Division
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
Signal Management Section
750 N.Greenfield Pkwy.Garner,NC 27529

SR 5544 (Catawba Avenue)
at
US 21 (Statesville Road)/
Holiday Lane

Division 10 | Mecklenburg County | Cornelius
PLAN DATE: April 2013 | REVIEWED BY: T. Wyatt
PREPARED BY: C. Strickland | REVIEWED BY:

REVISIONS	INIT.	DATE

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 022013 ENGINEER GEORGE C. BROWN
George C. Brown 5/1/13
SIGNATURE DATE
SIG. INVENTORY NO. 10-0885

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APPENDIX E:
CORNELIUS MODIFIED ROUNDABOUT TECHNICAL MEMORANDUM

DRAFT

Cornelius Modified Roundabout Technical Memorandum

Cornelius, NC

DRAFT

3/18/2013
Parsons Brinckerhoff
Jason Gorrie, PE

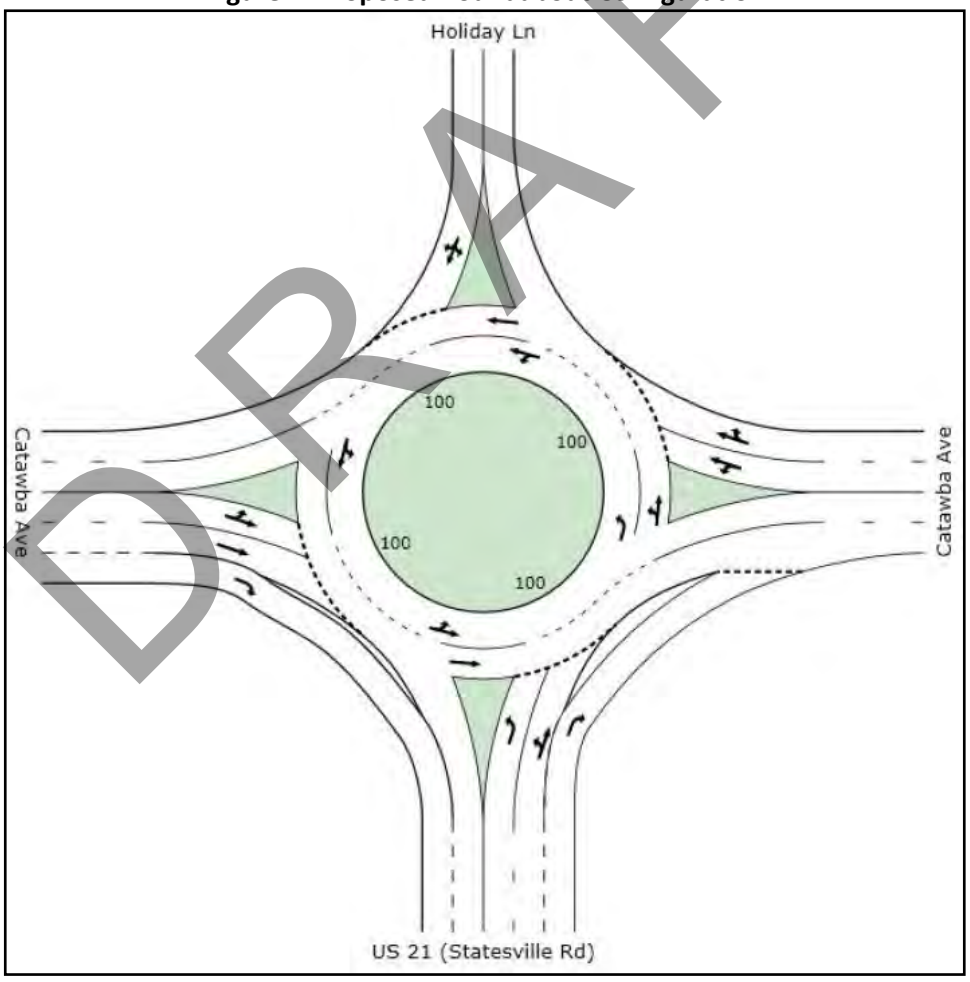


PURPOSE OF THE STUDY

Parsons Brinckerhoff was retained to determine the conceptual design alternative that would provide an acceptable level of service for the intersection of W. Catawba Avenue and US-21 (Statesville Road)/Holiday Lane in Cornelius, NC. The design alternative was analyzed with the Diverging Diamond Interchange (DDI) improvements that are proposed for W. Catawba Avenue and I-77. The No-Build Alterative network for this study reflects the laneage shown in the proposed pavement marking plans for the DDI provided by the NCDOT Congestion Management Unit.

The preferred conceptual design alternative for the intersection of W. Catawba Avenue and US-21/Holiday Lane was a 2-lane roundabout with slilp lanes after considering other options, which included a single lane roundabout, a traditional 2-lane roundabout and paper clip design. Build Alternative 1 includes a proposed two-lane roundabout with eastbound and northbound slip lanes as shown in **Figure 1**. Build Alternative 2 uses the same roundabout design but also includes a westbound right turn lane on W. Catawba Avenue at the I-77 Northbound ramp. There is currently a right turn lane at this location but this lane is not included in the proposed pavement marking plans for the DDI so it was not included in the No-Build network.

Figure 1: Proposed Roundabout Configuration



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INTERSECTION COUNTS

Traffic counts were conducted at the following three (3) intersections within the study area:

- W. Catawba Avenue & US 21/Holiday Lane (Signalized)
- W. Catawba Avenue & S. Hill Street/Burton Lane (Unsignalized)
- W. Catawba Avenue & Ferry Street (Unsignalized)

Counts were conducted on Wednesday, September 12, 2012 during the PM peak travel period (4:30 – 6:30 PM) and Thursday, September 13, 2012 during the AM peak travel period (6:30 – 8:30 AM). A review of the traffic counts revealed that the network had a morning peak hour of 7:30 – 8:30 AM and an afternoon peak hour of 5:00 – 6:00 PM.

Kimley-Horn and Associates (KHA) provided SYNCHRO files with 2010 balanced traffic counts during the AM and PM peak hours. These counts were used for the remaining three (3) intersections within the study area as follows:

- W. Catawba Avenue & Liverpool Parkway/Torrence Chapel Road (Signalized)
- W. Catawba Avenue & I-77 Southbound Ramps (Signalized)
- W. Catawba Avenue & I-77 Northbound Ramps (Signalized)

A background growth rate of 2 percent annually was assumed for the study area between 2010 and the present. Therefore, a yearly 2 percent growth rate was applied to these three intersections along W. Catawba Avenue between Liverpool Parkway/Torrence Chapel Road and I-77 Northbound Ramps. The adjusted volumes were then balanced using the intersection count at W. Catawba Avenue and US 21/Holiday Lane for both peak periods.

FUTURE TRAFFIC VOLUMES

For the future 2030 traffic volumes, a background growth rate of 1.5 percent per year was assumed for the study area. An annual growth rate of 1.5 percent coincides with other traffic projections in the area.

CAPACITY ANALYSIS METHODOLOGY

The traffic operations analysis was performed for the following scenarios:

- 2030 No-Build
- 2030 Build Alternative 1
- 2030 Build Alternative 2

The signal timings remained the same during each peak hour for all signalized intersections within the study area. For signalized intersections, the splits and offsets were optimized for the AM and PM peak hour during the No-Build scenario to provide coordination along W. Catawba Avenue with the proposed DDI configuration. These timings were not changed for either Build Alternative to provide consistency in the capacity analysis.

VISSIM was used to analyze the signalized intersections and roundabouts in the study area for these scenarios. The results give a level of service (LOS) for the intersections. The LOS is an important measure of roadway congestion. The LOS is determined by calculating the delay for the intersection and converting it to a letter. The LOS ranges from A (no congestion) to F (severe congestion). The LOS criteria for signalized and unsignalized intersections are shown in **Table 1**.

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Table 1: Level of Service Criteria

Signalized Intersections		Unsignalized Intersections	
LOS	Delay per Vehicle (seconds)	LOS	Delay per Vehicle (seconds)
A	≤10	A	
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

CAPACITY ANALYSIS RESULTS

W. Catawba Avenue & Liverpool Parkway/Torrence Chapel Road

This intersection is currently signalized and operates at LOS D during the AM peak hour and LOS F during the PM peak hour. Both Build Alternative 1 and Build Alternative 2 degrade the intersection to LOS E during the AM peak hour which can be attributed to the increase of throughput on W. Catawba Avenue with the proposed DDI and roundabout configuration. The intersection improves to LOS E and the delay decreases significantly during the PM Peak in both Build Alternatives. The levels of service and delay results for the intersection are presented below in **Table 2** and the average queue lengths for each approach are shown in **Table 3**.

Table 2: W. Catawba Ave & Liverpool Pkwy/Torrence Chapel Rd LOS Results

	2030 No-Build	2030 Alternative 1	2030 Alternative 2
LOS	D (F)	E (E)	E (E)
Delay (sec)	40.0 (93.4)	56.1 (58.4)	61.6 (57.6)

Note: AM (PM)

Table 3: W. Catawba Ave & Liverpool Pkwy/Torrence Chapel Rd Average Queue Lengths

	2030 No-Build	2030 Alternative 1	2030 Alternative 2
W. Catawba Ave EB	188 ft (696 ft)	466 ft (228 ft)	559 ft (217 ft)
W. Catawba Ave WB	197 ft (129 ft)	198 ft (132 ft)	196 ft (133 ft)
Liverpool Pkwy NB	74 ft (821 ft)	79 ft (740 ft)	81 ft (739 ft)
Torrence Chapel Rd SB	104 ft (136 ft)	115 ft (97 ft)	119 ft (97 ft)

Note: AM (PM)

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W. Catawba Avenue & I-77 Southbound Ramps

This signalized intersection is located on the western end of the proposed DDI interchange. The intersection operates at LOS B during the AM peak hour and LOS C during the PM peak hour. The level of service is maintained in both Build Alternatives during the PM peak hour and degrades to LOS C during the AM peak hour, even though the delay increases by less than 3 seconds. The LOS was on the threshold of a B and C during the No-Build. The levels of service and delay results for the intersection are presented below in **Table 4** and the average queue lengths for each approach are shown in **Table 5**.

Table 4: W. Catawba Ave & I-77 SB Ramps LOS Results

	2030 No-Build	2030 Alternative 1	2030 Alternative 2
LOS	B (C)	C (C)	C (C)
Delay (sec)	20.0 (29.6)	22.4 (21.1)	22.4 (23.2)

Note: AM (PM)

Table 5: W. Catawba Ave & I-77 SB Ramps Average Queue Lengths

	2030 No-Build	2030 Alternative 1	2030 Alternative 2
W. Catawba Ave EB	126 ft (238 ft)	188 ft (158 ft)	190 ft (162 ft)
W. Catawba Ave WB	92 ft (145 ft)	95 ft (124 ft)	90 ft (191 ft)
I-77 Off-Ramp SB	36 ft (40 ft)	37 ft (32 ft)	37 ft (32 ft)

Note: AM (PM)

W. Catawba Avenue & I-77 Northbound Ramps

This signalized intersection is located on the eastern end of the proposed DDI interchange. The intersection operates at LOS C during both peak hours. The variation in Build Alternative 1 and Build Alternative 2 occurs at this intersection as a westbound right turn lane is added on W. Catawba Avenue in the Build Alternative 2 scenario. The intersection operates at LOS B for both Build Alternatives during the AM peak, and the delay slightly decreases for Build Alternative 2. The intersection improves to operate at LOS B for Build Alterative 2 during the PM peak when the westbound right turn is added. The average queue lengths on W. Catawba Avenue are also shorter in the westbound direction during this alternative, especially during the PM peak hour. The levels of service and delay results for the intersection are presented below in **Table 6** and the average queue lengths for each approach are shown in **Table 7**.

Table 6: W. Catawba Ave & I-77 NB Ramps LOS Results

	2030 No-Build	2030 Alternative 1	2030 Alternative 2
LOS	C (C)	B (C)	B (B)
Delay (sec)	20.4 (29.4)	16.2 (20.8)	13.9 (17.8)

Note: AM (PM)

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Table 7: W. Catawba Ave & I-77 NB Ramps Average Queue Lengths

	2030 No-Build	2030 Alternative 1	2030 Alternative 2
W. Catawba Ave EB	109 ft (323 ft)	93 ft (93 ft)	95 ft (107 ft)
W. Catawba Ave WB	118 ft (164 ft)	88 ft (320 ft)	47 ft (85 ft)
I-77 Off-Ramp NB	32 ft (33 ft)	28 ft (32 ft)	28 ft (33 ft)

Note: AM (PM)

W. Catawba Avenue & US-21

This intersection is currently signalized in the No-Build scenario and operates at LOS C during the AM peak hour and LOS F during the PM peak hour. Both Build Alternatives propose a two-lane roundabout with eastbound and northbound slip lanes at this intersection. For Build Alternative 1, the intersection improves to LOS A during the AM peak hour but remains at LOS F during the PM peak hour even though delay decreases significantly. The intersection improves to operate at an acceptable LOS C for Build Alternative 2 during the PM peak hour. The average queue lengths for all of the approaches are less than 160 feet in the Build Alternative 2 scenario. The queue lengths indicate that the proposed roundabout decreases the queue on W. Catawba Avenue so it does not extend into the DDI and also decreases the queue on northbound US-21. The levels of service and delay results for the intersection are presented below in **Table 8** and the average queue lengths for each approach are shown in **Table 9**.

Table 8: W. Catawba Ave & US-21 LOS Results

	2030 No-Build	2030 Alternative 1	2030 Alternative 2
LOS	C (F)	A (F)	A (C)
Delay (sec)	33.7 (115.0)	7.1 (58.7)	6.1 (19.1)

Note: AM (PM)

Table 9: W. Catawba Ave & US-21 Average Queue Lengths

	2030 No-Build	2030 Alternative 1	2030 Alternative 2
W. Catawba Ave EB	138 ft (155 ft)	2 ft (3 ft)	2 ft (3 ft)
W. Catawba Ave WB	127 ft (1,440 ft)	1 ft (672 ft)	1 ft (158 ft)
US-21 NB	110 ft (1,095 ft)	1 ft (123 ft)	1 ft (13 ft)
Holiday Ln SB	35 ft (58 ft)	10 ft (477 ft)	7 ft (46 ft)

Note: AM (PM)

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NETWORK PERFORMANCE RESULTS

During the simulation, VISSIM can keep track of every vehicle that crosses between a certain pair of starting and ending locations coded in the network. At the end of the simulation, the program reports the total vehicles that finished traveling through each individual segment along with the average amount of time it took to cross that segment. VISSIM does not report average travel speeds directly, but average speeds can be computed based on the VISSIM reported average travel times and the VISSIM reported lengths of the defined segments.

Two travel time segments were coded into the VISSIM models to determine AM and PM peak hour travel times along W. Catawba Avenue. The eastbound travel time segment was coded on W. Catawba Avenue between Chance Street and Lake Village Boulevard. The westbound travel time segment was coded on W. Catawba Avenue between Lake Village Boulevard and Chance Street. The average travel times and average speeds for these segments are provided in **Table 10**.

Table 10: Average Travel Time and Speed Results

	2030 No-Build	2030 Alternative 1	2030 Alternative 2
EB Average Travel Time (sec)	203 (316)	227 (203)	233 (202)
EB Average Speed (mph)	12.1 (7.8)	10.9 (12.2)	10.6 (12.3)
WB Average Travel Time (sec)	177 (298)	161 (243)	154 (198)
WB Average Speed (mph)	13.9 (8.3)	15.4 (10.2)	16.1 (12.5)

Note: AM (PM)

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CONCLUSION AND RECOMMENDATIONS

The preferred conceptual design alternative for the intersection of W. Catawba Avenue and US-21/Holiday Lane was a two-lane roundabout with eastbound and northbound slip lanes. Based on the capacity analysis using VISSIM, it was determined that Build Alterative 2 provides an acceptable LOS for this intersection during both peak hours. As a result, we recommend providing a westbound right turn lane on W. Catawba Avenue at the I-77 Northbound ramp. Along with improving LOS, the two-lane roundabout decreases the queue on W. Catawba Avenue so it does not extend into the DDI and also decreases the queue on northbound US-21.

The signal timings remained the same within each peak hour for the No-Build and Build Alternatives. These timings were not changed for either Build Alternative as part of the methodology of the study to provide consistency in the capacity analysis. We recommend making field adjustments to the signal timings so that the DDI signals operate efficiently with the roundabout.

The proposed DDI plans shorten the westbound left turn lane on W. Catawba Avenue at Liverpool Parkway. The simulation shows that the storage for this lane is at times inadequate and that the queue spills over into the westbound through lane, especially during the AM peak hour. We recommend a further analysis of this intersection to improve the operation of this movement and the intersection as a whole, as the operations of this intersection are integral to the successful operations of the DDI.

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APPENDIX F:
CAPACITY ANALYSIS RESULTS

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APPENDIX F-1:
CAPACITY ANALYSIS RESULTS

2016 EXISTING CONDITIONS
AM PEAK HOUR

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Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Traffic Volume (vph)	0	1255	0	0	0	0	0	0	0	0	748	0
Future Volume (vph)	0	1255	0	0	0	0	0	0	0	0	748	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		2%			0%			0%			-2%	
Lane Util. Factor	1.00	0.91	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00
Frt												
Flt Protected												
Satd. Flow (prot)	0	5034	0	0	0	0	0	0	0	0	3575	0
Flt Permitted												
Satd. Flow (perm)	0	5034	0	0	0	0	0	0	0	0	3575	0
Right Turn on Red	No		No			No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)		35			35			35			35	
Link Distance (ft)		142			217			115			211	
Travel Time (s)		2.8			4.2			2.2			4.1	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	1394	0	0	0	0	0	0	0	0	831	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	1394	0	0	0	0	0	0	0	0	831	0
Turn Type		NA									NA	
Protected Phases		2									8	
Permitted Phases												
Detector Phase		2									8	
Switch Phase												
Minimum Initial (s)		10.0									10.0	
Minimum Split (s)		24.3									26.1	
Total Split (s)		60.0									60.0	
Total Split (%)		50.0%									50.0%	
Yellow Time (s)		3.7									4.0	
All-Red Time (s)		5.6									4.1	
Lost Time Adjust (s)		-4.3									-3.1	
Total Lost Time (s)		5.0									5.0	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode		C-Max									None	
Act Effct Green (s)		67.9									42.1	
Actuated g/C Ratio		0.57									0.35	
v/c Ratio		0.49									0.66	
Control Delay		17.3									43.0	
Queue Delay		0.0									0.2	
Total Delay		17.3									43.2	
LOS		B									D	
Approach Delay		17.3									43.2	
Approach LOS		B									D	
Queue Length 50th (ft)		225									343	
Queue Length 95th (ft)		316									399	
Internal Link Dist (ft)		62			137			35			131	
Turn Bay Length (ft)												

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Lane Group	Ø4	Ø6
Lane Configurations		
Traffic Volume (vph)		
Future Volume (vph)		
Ideal Flow (vphpl)		
Grade (%)		
Lane Util. Factor		
Frt		
Flt Protected		
Satd. Flow (prot)		
Flt Permitted		
Satd. Flow (perm)		
Right Turn on Red		
Satd. Flow (RTOR)		
Link Speed (mph)		
Link Distance (ft)		
Travel Time (s)		
Peak Hour Factor		
Adj. Flow (vph)		
Shared Lane Traffic (%)		
Lane Group Flow (vph)		
Turn Type		
Protected Phases	4	6
Permitted Phases		
Detector Phase		
Switch Phase		
Minimum Initial (s)	10.0	10.0
Minimum Split (s)	21.1	19.3
Total Split (s)	60.0	60.0
Total Split (%)	50%	50%
Yellow Time (s)	4.0	3.7
All-Red Time (s)	4.1	5.6
Lost Time Adjust (s)		
Total Lost Time (s)		
Lead/Lag		
Lead-Lag Optimize?		
Recall Mode	None	C-Max
Act Effct Green (s)		
Actuated g/C Ratio		
v/c Ratio		
Control Delay		
Queue Delay		
Total Delay		
LOS		
Approach Delay		
Approach LOS		
Queue Length 50th (ft)		
Queue Length 95th (ft)		
Internal Link Dist (ft)		
Turn Bay Length (ft)		

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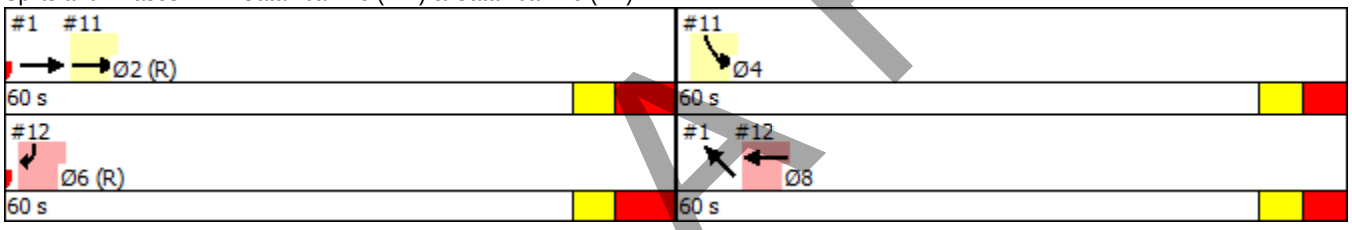
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Base Capacity (vph)		2847									1638	
Starvation Cap Reductn		0									221	
Spillback Cap Reductn		0									0	
Storage Cap Reductn		0									0	
Reduced v/c Ratio		0.49									0.59	

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 70 (58%), Referenced to phase 2:EBT and 6:, Start of Green
Natural Cycle: 60
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.67
Intersection Signal Delay: 27.0 Intersection LOS: C
Intersection Capacity Utilization 59.6% ICU Level of Service B
Analysis Period (min) 15

Splits and Phases: 1: Catawba Ave (WB) & Catawba Ave (EB)



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Lane Group	Ø4	Ø6
Base Capacity (vph)		
Starvation Cap Reductn		
Spillback Cap Reductn		
Storage Cap Reductn		
Reduced v/c Ratio		

Intersection Summary

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Lane Group	EBL	EBT	WBT	WBR	SBL	SBR	Ø6	Ø8
Lane Configurations								
Traffic Volume (vph)	0	1255	0	0	582	0		
Future Volume (vph)	0	1255	0	0	582	0		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900		
Grade (%)		2%	0%		-1%			
Lane Util. Factor	1.00	0.91	1.00	1.00	0.97	1.00		
Frt								
Flt Protected					0.950			
Satd. Flow (prot)	0	5034	0	0	3450	0		
Flt Permitted					0.950			
Satd. Flow (perm)	0	5034	0	0	3450	0		
Right Turn on Red				No	No	No		
Satd. Flow (RTOR)								
Link Speed (mph)		35	35		35			
Link Distance (ft)		217	199		185			
Travel Time (s)		4.2	3.9		3.6			
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90		
Adj. Flow (vph)	0	1394	0	0	647	0		
Shared Lane Traffic (%)								
Lane Group Flow (vph)	0	1394	0	0	647	0		
Turn Type		NA			Prot			
Protected Phases		2			4		6	8
Permitted Phases								
Detector Phase		2			4			
Switch Phase								
Minimum Initial (s)		10.0			10.0		10.0	10.0
Minimum Split (s)		24.3			21.1		19.3	26.1
Total Split (s)		60.0			60.0		60.0	60.0
Total Split (%)		50.0%			50.0%		50%	50%
Yellow Time (s)		3.7			4.0		3.7	4.0
All-Red Time (s)		5.6			4.1		5.6	4.1
Lost Time Adjust (s)		-4.3			-3.1			
Total Lost Time (s)		5.0			5.0			
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode		C-Max			None		C-Max	None
Act Effct Green (s)		67.9			42.1			
Actuated g/C Ratio		0.57			0.35			
v/c Ratio		0.49			0.53			
Control Delay		2.3			32.1			
Queue Delay		0.0			0.0			
Total Delay		2.4			32.1			
LOS		A			C			
Approach Delay		2.4			32.1			
Approach LOS		A			C			
Queue Length 50th (ft)		15			205			
Queue Length 95th (ft)		16			229			
Internal Link Dist (ft)		137	119		105			
Turn Bay Length (ft)								

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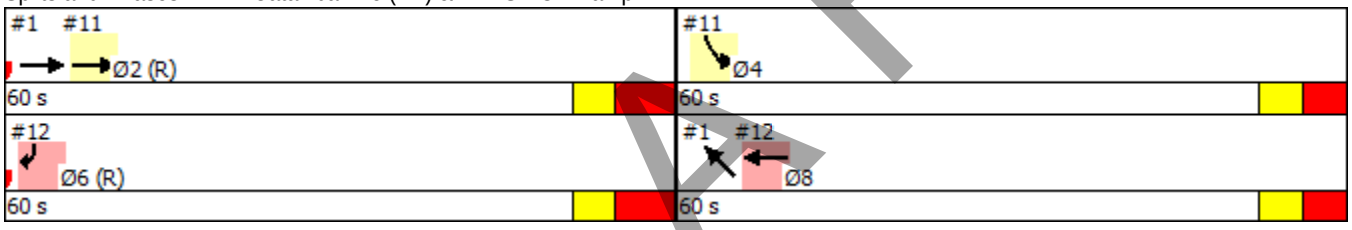
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR	Ø6	Ø8
Base Capacity (vph)		2847			1581			
Starvation Cap Reductn		36			0			
Spillback Cap Reductn		181			0			
Storage Cap Reductn		0			0			
Reduced v/c Ratio		0.52			0.41			

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 70 (58%), Referenced to phase 2:EBT and 6:, Start of Green
Natural Cycle: 60
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.67
Intersection Signal Delay: 11.8 Intersection LOS: B
Intersection Capacity Utilization 62.4% ICU Level of Service B
Analysis Period (min) 15

Splits and Phases: 11: Catawba Ave (EB) & I-77 SB Off-Ramp



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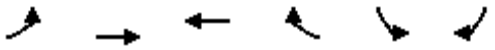

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR	Ø2	Ø4
Lane Configurations								
Traffic Volume (vph)	0	0	748	0	0	875		
Future Volume (vph)	0	0	748	0	0	875		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900		
Grade (%)		0%	0%		4%			
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.88		
Frt						0.850		
Flt Protected								
Satd. Flow (prot)	0	0	3539	0	0	2731		
Flt Permitted								
Satd. Flow (perm)	0	0	3539	0	0	2731		
Right Turn on Red				No		No		
Satd. Flow (RTOR)								
Link Speed (mph)		35	35		35			
Link Distance (ft)		202	115		181			
Travel Time (s)		3.9	2.2		3.5			
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90		
Adj. Flow (vph)	0	0	831	0	0	972		
Shared Lane Traffic (%)								
Lane Group Flow (vph)	0	0	831	0	0	972		
Turn Type			NA			Prot		
Protected Phases			8			6	2	4
Permitted Phases								
Detector Phase			8			6		
Switch Phase								
Minimum Initial (s)			10.0			10.0	10.0	10.0
Minimum Split (s)			26.1			19.3	24.3	21.1
Total Split (s)			60.0			60.0	60.0	60.0
Total Split (%)			50.0%			50.0%	50%	50%
Yellow Time (s)			4.0			3.7	3.7	4.0
All-Red Time (s)			4.1			5.6	5.6	4.1
Lost Time Adjust (s)			-3.1			-4.3		
Total Lost Time (s)			5.0			5.0		
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode			None			C-Max	C-Max	None
Act Effct Green (s)			42.1			67.9		
Actuated g/C Ratio			0.35			0.57		
v/c Ratio			0.67			0.63		
Control Delay			3.1			21.2		
Queue Delay			0.0			0.0		
Total Delay			3.1			21.2		
LOS			A			C		
Approach Delay			3.1		21.2			
Approach LOS			A		C			
Queue Length 50th (ft)			2			273		
Queue Length 95th (ft)			2			418		
Internal Link Dist (ft)		122	35		101			
Turn Bay Length (ft)								

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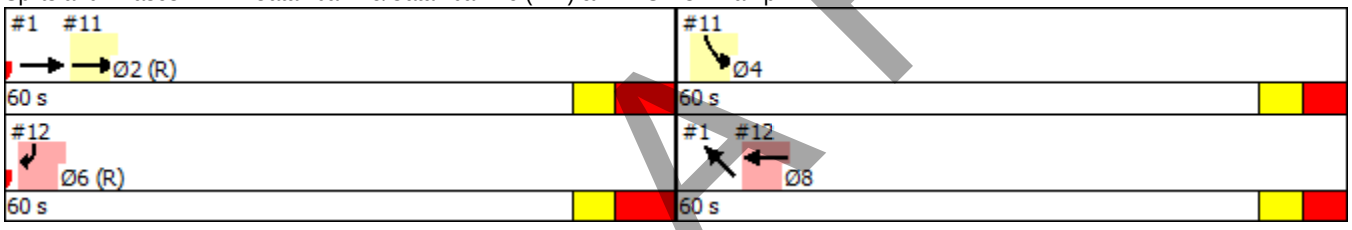
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR	Ø2	Ø4
Base Capacity (vph)			1622			1544		
Starvation Cap Reductn			5			0		
Spillback Cap Reductn			0			0		
Storage Cap Reductn			0			0		
Reduced v/c Ratio			0.51			0.63		

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 70 (58%), Referenced to phase 2:EBT and 6:, Start of Green
Natural Cycle: 60
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.67
Intersection Signal Delay: 12.9 Intersection LOS: B
Intersection Capacity Utilization 59.6% ICU Level of Service B
Analysis Period (min) 15

Splits and Phases: 12: Catawba Ave/Catawba Ave (WB) & I-77 SB Off-Ramp



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Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	0	531	0	0	0	0	0	1080	0
Future Volume (vph)	0	0	0	0	531	0	0	0	0	0	1080	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		0%			0%			0%			-1%	
Lane Util. Factor	1.00	1.00	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00	0.95	1.00
Frt												
Flt Protected												
Satd. Flow (prot)	0	0	0	0	3539	0	0	0	0	0	3557	0
Flt Permitted												
Satd. Flow (perm)	0	0	0	0	3539	0	0	0	0	0	3557	0
Right Turn on Red			No	No		No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)		35			35			35			35	
Link Distance (ft)		182			125			128			169	
Travel Time (s)		3.5			2.4			2.5			3.3	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	0	0	0	590	0	0	0	0	0	1200	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	0	590	0	0	0	0	0	1200	0
Turn Type					NA						NA	
Protected Phases					6						4	
Permitted Phases												
Detector Phase					6						4	
Switch Phase												
Minimum Initial (s)					7.0						7.0	
Minimum Split (s)					19.9						21.9	
Total Split (s)					50.0						70.0	
Total Split (%)					41.7%						58.3%	
Yellow Time (s)					3.9						3.9	
All-Red Time (s)					4.0						4.0	
Lost Time Adjust (s)					-2.0						-2.9	
Total Lost Time (s)					5.9						5.0	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode					C-Max						None	
Act Effct Green (s)					54.3						54.8	
Actuated g/C Ratio					0.45						0.46	
v/c Ratio					0.37						0.74	
Control Delay					16.2						22.0	
Queue Delay					0.0						0.1	
Total Delay					16.2						22.1	
LOS					B						C	
Approach Delay					16.2						22.1	
Approach LOS					B						C	
Queue Length 50th (ft)					106						257	
Queue Length 95th (ft)					181						303	
Internal Link Dist (ft)		102			45			48			89	
Turn Bay Length (ft)												

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Lane Group	Ø2	Ø8
Lane Configurations		
Traffic Volume (vph)		
Future Volume (vph)		
Ideal Flow (vphpl)		
Grade (%)		
Lane Util. Factor		
Frt		
Flt Protected		
Satd. Flow (prot)		
Flt Permitted		
Satd. Flow (perm)		
Right Turn on Red		
Satd. Flow (RTOR)		
Link Speed (mph)		
Link Distance (ft)		
Travel Time (s)		
Peak Hour Factor		
Adj. Flow (vph)		
Shared Lane Traffic (%)		
Lane Group Flow (vph)		
Turn Type		
Protected Phases	2	8
Permitted Phases		
Detector Phase		
Switch Phase		
Minimum Initial (s)	10.0	7.0
Minimum Split (s)	18.9	19.9
Total Split (s)	50.0	70.0
Total Split (%)	42%	58%
Yellow Time (s)	3.8	3.9
All-Red Time (s)	5.1	4.0
Lost Time Adjust (s)		
Total Lost Time (s)		
Lead/Lag		
Lead-Lag Optimize?		
Recall Mode	C-Max	None
Act Effct Green (s)		
Actuated g/C Ratio		
v/c Ratio		
Control Delay		
Queue Delay		
Total Delay		
LOS		
Approach Delay		
Approach LOS		
Queue Length 50th (ft)		
Queue Length 95th (ft)		
Internal Link Dist (ft)		
Turn Bay Length (ft)		

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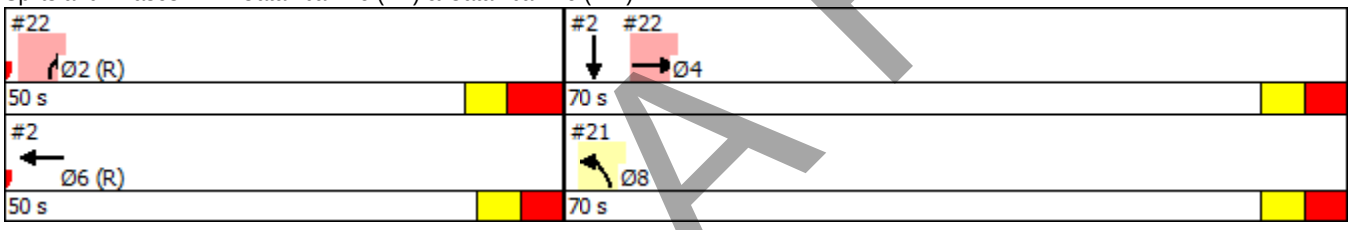
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Base Capacity (vph)					1601						1926	
Starvation Cap Reductn					0						103	
Spillback Cap Reductn					0						0	
Storage Cap Reductn					0						0	
Reduced v/c Ratio					0.37						0.66	

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 65 (54%), Referenced to phase 2:NBR and 6:, Start of Green
Natural Cycle: 45
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.74
Intersection Signal Delay: 20.1 Intersection LOS: C
Intersection Capacity Utilization 53.6% ICU Level of Service A
Analysis Period (min) 15

Splits and Phases: 2: Catawba Ave (EB) & Catawba Ave (WB)



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Lane Group	Ø2	Ø8
Base Capacity (vph)		
Starvation Cap Reductn		
Spillback Cap Reductn		
Storage Cap Reductn		
Reduced v/c Ratio		

Intersection Summary

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Lane Group	EBL	EBR	NBL	NBR	SWL	SWR	Ø2	Ø4	Ø6
Lane Configurations									
Traffic Volume (vph)	0	0	249	0	0	531			
Future Volume (vph)	0	0	249	0	0	531			
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900			
Lane Util. Factor	1.00	1.00	0.97	1.00	1.00	0.88			
Frt						0.850			
Flt Protected			0.950						
Satd. Flow (prot)	0	0	3433	0	0	2787			
Flt Permitted			0.950						
Satd. Flow (perm)	0	0	3433	0	0	2787			
Right Turn on Red		No	No	No		No			
Satd. Flow (RTOR)									
Link Speed (mph)	35		35		35				
Link Distance (ft)	209		215		182				
Travel Time (s)	4.1		4.2		3.5				
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90			
Adj. Flow (vph)	0	0	277	0	0	590			
Shared Lane Traffic (%)									
Lane Group Flow (vph)	0	0	277	0	0	590			
Turn Type			Prot			custom			
Protected Phases			8!			Free!	2	4	6
Permitted Phases									
Detector Phase			8						
Switch Phase									
Minimum Initial (s)			7.0				10.0	7.0	7.0
Minimum Split (s)			19.9				18.9	21.9	19.9
Total Split (s)			70.0				50.0	70.0	50.0
Total Split (%)			58.3%				42%	58%	42%
Yellow Time (s)			3.9				3.8	3.9	3.9
All-Red Time (s)			4.0				5.1	4.0	4.0
Lost Time Adjust (s)			-2.9						
Total Lost Time (s)			5.0						
Lead/Lag									
Lead-Lag Optimize?									
Recall Mode			None				C-Max	None	C-Max
Act Effct Green (s)			54.8			120.0			
Actuated g/C Ratio			0.46			1.00			
v/c Ratio			0.18			0.21			
Control Delay			18.7			1.1			
Queue Delay			0.0			0.0			
Total Delay			18.7			1.1			
LOS			B			A			
Approach Delay			18.7		1.1				
Approach LOS			B		A				
Queue Length 50th (ft)			63			17			
Queue Length 95th (ft)			78			32			
Internal Link Dist (ft)	129		135		102				
Turn Bay Length (ft)									
Base Capacity (vph)			1859			2787			

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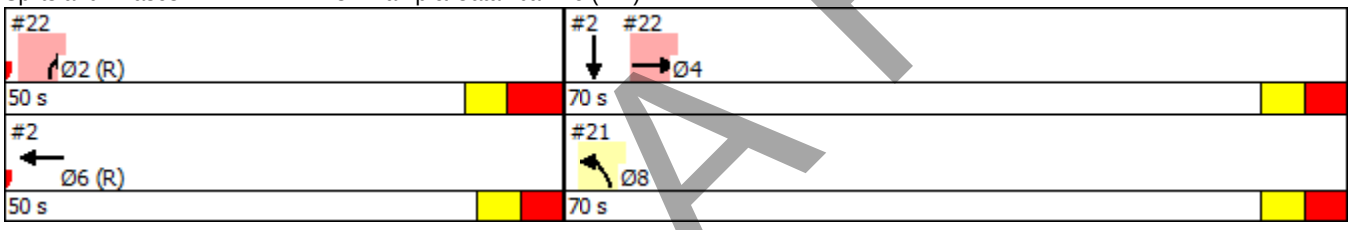
Lane Group	EBL	EBR	NBL	NBR	SWL	SWR	Ø2	Ø4	Ø6
Starvation Cap Reductn			0			0			
Spillback Cap Reductn			410			333			
Storage Cap Reductn			0			0			
Reduced v/c Ratio			0.19			0.24			

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 65 (54%), Referenced to phase 2:NBR and 6:, Start of Green
Natural Cycle: 45
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.74
Intersection Signal Delay: 6.7 Intersection LOS: A
Intersection Capacity Utilization 17.4% ICU Level of Service A
Analysis Period (min) 15
! Phase conflict between lane groups.

Splits and Phases: 21: I-77 NB Off-Ramp & Catawba Ave (WB)



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Lane Group	EBT	EBR	WBL	WBT	NBL	NBR	Ø6	Ø8
Lane Configurations								
Traffic Volume (vph)	1080	0	0	0	0	85		
Future Volume (vph)	1080	0	0	0	0	85		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900		
Grade (%)	0%			0%	4%			
Lane Util. Factor	0.95	1.00	1.00	1.00	1.00	1.00		
Frt						0.865		
Flt Protected								
Satd. Flow (prot)	3539	0	0	0	0	1579		
Flt Permitted								
Satd. Flow (perm)	3539	0	0	0	0	1579		
Right Turn on Red		No				No		
Satd. Flow (RTOR)								
Link Speed (mph)	35			35	35			
Link Distance (ft)	128			116	197			
Travel Time (s)	2.5			2.3	3.8			
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90		
Adj. Flow (vph)	1200	0	0	0	0	94		
Shared Lane Traffic (%)								
Lane Group Flow (vph)	1200	0	0	0	0	94		
Turn Type	NA					Prot		
Protected Phases	4					2	6	8
Permitted Phases								
Detector Phase	4					2		
Switch Phase								
Minimum Initial (s)	7.0					10.0	7.0	7.0
Minimum Split (s)	21.9					18.9	19.9	19.9
Total Split (s)	70.0					50.0	50.0	70.0
Total Split (%)	58.3%					41.7%	42%	58%
Yellow Time (s)	3.9					3.8	3.9	3.9
All-Red Time (s)	4.0					5.1	4.0	4.0
Lost Time Adjust (s)	-2.9					-3.9		
Total Lost Time (s)	5.0					5.0		
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None					C-Max	C-Max	None
Act Effct Green (s)	54.8					55.2		
Actuated g/C Ratio	0.46					0.46		
v/c Ratio	0.74					0.13		
Control Delay	3.2					21.3		
Queue Delay	0.0					0.0		
Total Delay	3.2					21.3		
LOS	A					C		
Approach Delay	3.2				21.3			
Approach LOS	A				C			
Queue Length 50th (ft)	5					41		
Queue Length 95th (ft)	6					85		
Internal Link Dist (ft)	48			36	117			
Turn Bay Length (ft)								

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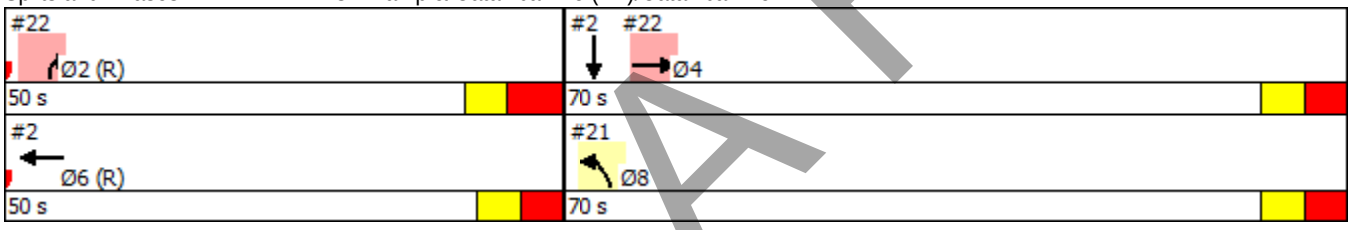
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR	Ø6	Ø8
Base Capacity (vph)	1916					726		
Starvation Cap Reductn	14					0		
Spillback Cap Reductn	0					0		
Storage Cap Reductn	0					0		
Reduced v/c Ratio	0.63					0.13		

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 65 (54%), Referenced to phase 2:NBR and 6:, Start of Green
Natural Cycle: 45
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.74
Intersection Signal Delay: 4.6 Intersection LOS: A
Intersection Capacity Utilization 53.6% ICU Level of Service A
Analysis Period (min) 15

Splits and Phases: 22: I-77 NB Off-Ramp & Catawba Ave (EB)/Catawba Ave



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Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	39	588	538	106	494	13	502	23	96	26	24	40
Future Volume (vph)	39	588	538	106	494	13	502	23	96	26	24	40
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		-2%			1%			3%			5%	
Storage Length (ft)	100		0	100		0	150		150	75		0
Storage Lanes	1		1	1		0	1		1	1		0
Taper Length (ft)	100			100			100			100		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	1.00	1.00	1.00	1.00
Frt			0.850		0.996				0.850		0.907	
Flt Protected	0.950			0.950			0.950	0.956		0.950		
Satd. Flow (prot)	1787	1881	1599	1761	1846	0	1656	1666	1560	1725	1647	0
Flt Permitted	0.270			0.146			0.950	0.956		0.950		
Satd. Flow (perm)	508	1881	1599	271	1846	0	1656	1666	1560	1725	1647	0
Right Turn on Red			No			No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)		35			35			35			35	
Link Distance (ft)		229			323			537			507	
Travel Time (s)		4.5			6.3			10.5			9.9	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	43	653	598	118	549	14	558	26	107	29	27	44
Shared Lane Traffic (%)							48%					
Lane Group Flow (vph)	43	653	598	118	563	0	290	294	107	29	71	0
Turn Type	pm+pt	NA	pm+ov	pm+pt	NA		Split	NA	pm+ov	Split	NA	
Protected Phases	5	2	3	1	6		3	3	1	4	4	
Permitted Phases	2		2	6					3			
Detector Phase	5	2	3	1	6		3	3	1	4	4	
Switch Phase												
Minimum Initial (s)	7.0	10.0	7.0	7.0	10.0		7.0	7.0	7.0	7.0	7.0	
Minimum Split (s)	13.3	31.4	28.3	13.2	28.4		28.3	28.3	13.2	12.9	12.9	
Total Split (s)	17.0	49.0	37.0	17.0	49.0		37.0	37.0	17.0	17.0	17.0	
Total Split (%)	14.2%	40.8%	30.8%	14.2%	40.8%		30.8%	30.8%	14.2%	14.2%	14.2%	
Yellow Time (s)	3.0	4.0	3.7	3.0	4.0		3.7	3.7	3.0	3.6	3.6	
All-Red Time (s)	3.3	2.4	2.6	3.2	2.4		2.6	2.6	3.2	2.3	2.3	
Lost Time Adjust (s)	-1.3	-1.4	-1.4	-1.2	-1.4		-1.3	-1.3	-1.2	-0.9	-0.9	
Total Lost Time (s)	5.0	5.0	4.9	5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Lead/Lag	Lead	Lag	Lead	Lead	Lag		Lead	Lead	Lead	Lag	Lag	
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	
Recall Mode	None	C-Max	None	None	C-Max		None	None	None	None	None	
Act Effct Green (s)	62.5	54.1	87.2	66.5	58.3		28.0	28.0	38.9	10.6	10.6	
Actuated g/C Ratio	0.52	0.45	0.73	0.55	0.49		0.23	0.23	0.32	0.09	0.09	
v/c Ratio	0.12	0.77	0.52	0.43	0.63		0.75	0.76	0.21	0.19	0.49	
Control Delay	4.3	28.6	23.7	19.1	30.8		55.1	55.4	18.9	53.1	63.4	
Queue Delay	0.0	51.6	17.4	0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Total Delay	4.3	80.2	41.1	19.1	30.8		55.1	55.4	18.9	53.1	63.4	
LOS	A	F	D	B	C		E	E	B	D	E	
Approach Delay		59.6			28.8			49.6			60.4	
Approach LOS		E			C			D			E	
Queue Length 50th (ft)	6	533	485	44	358		215	218	42	21	53	

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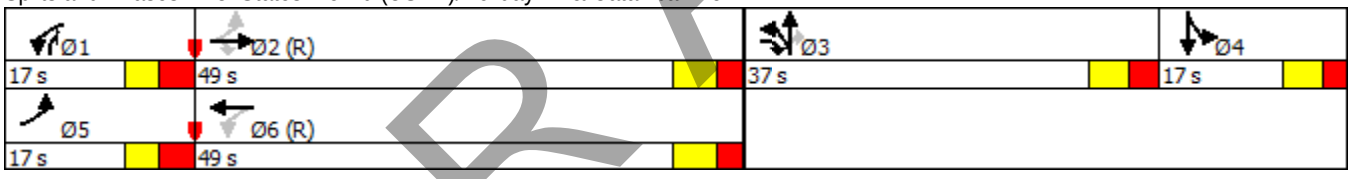
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 95th (ft)	m12	#737	601	80	522		314	318	68	52	102	
Internal Link Dist (ft)		149			243			457			427	
Turn Bay Length (ft)	100			100			150		150	75		
Base Capacity (vph)	407	847	1214	302	896		441	444	533	172	164	
Starvation Cap Reductn	0	276	610	0	0		0	0	0	0	0	
Spillback Cap Reductn	0	0	0	0	0		0	0	0	0	0	
Storage Cap Reductn	0	0	0	0	0		0	0	0	0	0	
Reduced v/c Ratio	0.11	1.14	0.99	0.39	0.63		0.66	0.66	0.20	0.17	0.43	

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 35 (29%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.77
Intersection Signal Delay: 49.6 Intersection LOS: D
Intersection Capacity Utilization 70.5% ICU Level of Service C
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 3: Statesville Rd (US 21)/Holiday Ln & Catawba Ave



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Intersection

Int Delay, s/veh 0.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	5	698	7	4	602	4	5	4	8	4	4	6
Future Vol, veh/h	5	698	7	4	602	4	5	4	8	4	4	6
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	50	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	6	776	8	4	669	4	6	4	9	4	4	7

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	673	0	0	783	0	0	1477	1473	779	1477	1474	671
Stage 1	-	-	-	-	-	-	791	791	-	680	680	-
Stage 2	-	-	-	-	-	-	686	682	-	797	794	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	918	-	-	835	-	-	104	127	396	104	127	456
Stage 1	-	-	-	-	-	-	383	401	-	441	451	-
Stage 2	-	-	-	-	-	-	438	450	-	380	400	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	918	-	-	835	-	-	99	125	396	98	125	456
Mov Cap-2 Maneuver	-	-	-	-	-	-	99	125	-	98	125	-
Stage 1	-	-	-	-	-	-	380	398	-	438	447	-
Stage 2	-	-	-	-	-	-	424	446	-	365	397	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.1	0.1	29.5	29.4
HCM LOS			D	D

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	166	918	-	-	835	-	-	163
HCM Lane V/C Ratio	0.114	0.006	-	-	0.005	-	-	0.095
HCM Control Delay (s)	29.5	8.9	-	-	9.3	0	-	29.4
HCM Lane LOS	D	A	-	-	A	A	-	D
HCM 95th %tile Q(veh)	0.4	0	-	-	0	-	-	0.3

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Summary of All Intervals

Run Number	1	2	3	4	5	Avg
Start Time	6:50	6:50	6:50	6:50	6:50	6:50
End Time	8:00	8:00	8:00	8:00	8:00	8:00
Total Time (min)	70	70	70	70	70	70
Time Recorded (min)	60	60	60	60	60	60
# of Intervals	5	5	5	5	5	5
# of Recorded Intervals	4	4	4	4	4	4
Vehs Entered	4363	4441	4534	2159	4402	3980
Vehs Exited	4353	4456	4500	1933	4382	3924
Starting Vehs	129	166	149	122	135	135
Ending Vehs	139	151	183	348	155	192
Travel Distance (mi)	1815	1849	1888	821	1816	1638
Travel Time (hr)	228.2	237.9	198.6	922.4	255.6	368.5
Total Delay (hr)	164.7	173.1	132.6	893.5	192.1	311.2
Total Stops	7005	7224	7242	3080	7102	6331
Fuel Used (gal)	109.5	112.4	104.7	235.1	116.3	135.6

Interval #0 Information Seeding

Start Time	6:50
End Time	7:00
Total Time (min)	10

Volumes adjusted by Growth Factors.
No data recorded this interval.

Interval #1 Information 1

Start Time	7:00
End Time	7:15
Total Time (min)	15

Volumes adjusted by Growth Factors, Anti PHF.

Run Number	1	2	3	4	5	Avg
Vehs Entered	1138	1133	1094	1102	1110	1115
Vehs Exited	1116	1142	1097	1088	1067	1102
Starting Vehs	129	166	149	122	135	135
Ending Vehs	151	157	146	136	178	152
Travel Distance (mi)	471	469	457	456	446	460
Travel Time (hr)	40.1	38.7	36.5	34.4	36.6	37.3
Total Delay (hr)	23.7	22.4	20.5	18.6	21.1	21.3
Total Stops	1851	1641	1627	1489	1603	1641
Fuel Used (gal)	23.6	23.4	22.2	21.7	22.3	22.6

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Interval #2 Information 2

Start Time 7:15
End Time 7:30
Total Time (min) 15
Volumes adjusted by PHF, Growth Factors.

Run Number	1	2	3	4	5	Avg
Vehs Entered	1126	1162	1207	920	1145	1113
Vehs Exited	1116	1136	1158	751	1140	1060
Starting Vehs	151	157	146	136	178	152
Ending Vehs	161	183	195	305	183	201
Travel Distance (mi)	464	480	491	322	470	445
Travel Time (hr)	53.6	54.2	51.0	78.2	62.2	59.8
Total Delay (hr)	37.3	37.4	33.7	66.7	45.6	44.1
Total Stops	1810	2048	1887	1425	2009	1831
Fuel Used (gal)	27.1	27.5	27.2	27.5	29.4	27.7

Interval #3 Information 3

Start Time 7:30
End Time 7:45
Total Time (min) 15
Volumes adjusted by Growth Factors, Anti PHF.

Run Number	1	2	3	4	5	Avg
Vehs Entered	1054	1034	1095	103	1064	869
Vehs Exited	1024	1050	1146	71	1088	876
Starting Vehs	161	183	195	305	183	201
Ending Vehs	191	167	144	337	159	195
Travel Distance (mi)	431	429	469	34	451	363
Travel Time (hr)	62.8	72.6	60.0	275.7	83.6	110.9
Total Delay (hr)	47.6	57.5	43.6	274.6	67.9	98.2
Total Stops	1689	1693	1922	113	1829	1449
Fuel Used (gal)	28.1	30.1	28.6	63.8	33.4	36.8

Interval #4 Information 4

Start Time 7:45
End Time 8:00
Total Time (min) 15
Volumes adjusted by Growth Factors, Anti PHF.

Run Number	1	2	3	4	5	Avg
Vehs Entered	1045	1112	1138	34	1083	878
Vehs Exited	1097	1128	1099	23	1087	885
Starting Vehs	191	167	144	337	159	195
Ending Vehs	139	151	183	348	155	192
Travel Distance (mi)	449	472	471	9	449	370
Travel Time (hr)	71.8	72.4	51.0	534.0	73.2	160.5
Total Delay (hr)	56.1	55.8	34.7	533.7	57.6	147.6
Total Stops	1655	1842	1806	53	1661	1402
Fuel Used (gal)	30.7	31.3	26.7	122.1	31.2	48.4

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Intersection: 1: Catawba Ave (WB) & Catawba Ave (EB)

Movement	EB	EB	EB	NW	NW
Directions Served	T	T	T	T	T
Maximum Queue (ft)	190	173	172	149	141
Average Queue (ft)	151	113	94	115	116
95th Queue (ft)	245	193	182	184	180
Link Distance (ft)	60	60	60	46	46
Upstream Blk Time (%)	45	40	19	35	42
Queuing Penalty (veh)	189	167	79	131	158
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 2: Catawba Ave (EB) & Catawba Ave (WB)

Movement	WB	WB	SB	SB
Directions Served	T	T	T	T
Maximum Queue (ft)	157	147	176	165
Average Queue (ft)	130	104	156	130
95th Queue (ft)	161	155	170	213
Link Distance (ft)	74	74	86	86
Upstream Blk Time (%)	44	36	53	30
Queuing Penalty (veh)	117	97	285	162
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 3: Statesville Rd (US 21)/Holiday Ln & Catawba Ave

Movement	EB	EB	EB	WB	WB	NB	NB	NB	SB	SB
Directions Served	L	T	R	L	TR	L	LT	R	L	TR
Maximum Queue (ft)	169	244	228	199	339	249	494	250	69	190
Average Queue (ft)	45	202	158	81	220	166	326	90	19	96
95th Queue (ft)	142	284	293	179	351	299	508	267	51	279
Link Distance (ft)		170	170		245		487			459
Upstream Blk Time (%)	0	26	10		17		13			7
Queuing Penalty (veh)	0	153	60		105		0			0
Storage Bay Dist (ft)	100			100		150		150	75	
Storage Blk Time (%)	0	29		2	35	2	52		1	22
Queuing Penalty (veh)	0	11		8	37	7	179		0	6

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Intersection: 4: Hill St/Burton Ln & Catawba Ave

Movement	EB	EB	WB	NB	SB
Directions Served	L	TR	LTR	LTR	LTR
Maximum Queue (ft)	31	4	249	65	53
Average Queue (ft)	2	0	79	24	13
95th Queue (ft)	16	3	370	83	55
Link Distance (ft)		245	536	466	423
Upstream Blk Time (%)			12		
Queuing Penalty (veh)			0		
Storage Bay Dist (ft)	50				
Storage Blk Time (%)	0				
Queuing Penalty (veh)	0				

Intersection: 11: Catawba Ave (EB) & I-77 SB Off-Ramp

Movement	EB	EB	EB	SB	SB
Directions Served	T	T	T	L	L
Maximum Queue (ft)	86	121	72	174	179
Average Queue (ft)	60	40	14	140	139
95th Queue (ft)	105	99	51	181	192
Link Distance (ft)	40	40	40	89	89
Upstream Blk Time (%)	41	30	5	43	37
Queuing Penalty (veh)	174	128	23	125	107
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 12: Catawba Ave/Catawba Ave (WB) & I-77 SB Off-Ramp

Movement	WB	WB	SB	SB
Directions Served	T	T	R	R
Maximum Queue (ft)	14	43	185	149
Average Queue (ft)	1	6	140	104
95th Queue (ft)	7	26	218	178
Link Distance (ft)	56	56	89	89
Upstream Blk Time (%)		1	35	16
Queuing Penalty (veh)		3	154	72
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

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Intersection: 14: Catawba Ave (EB) & I-77 NB On-Ramp

Movement	EB	EB	EB
Directions Served	L	T	T
Maximum Queue (ft)	89	250	244
Average Queue (ft)	8	154	71
95th Queue (ft)	51	291	190
Link Distance (ft)	143	143	143
Upstream Blk Time (%)		26	5
Queuing Penalty (veh)		164	31
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 15: Catawba Ave

Movement	WB	WB	NE	NE
Directions Served	T	T	R	R
Maximum Queue (ft)	88	193	134	132
Average Queue (ft)	35	49	83	47
95th Queue (ft)	172	182	161	141
Link Distance (ft)	170	170	61	61
Upstream Blk Time (%)	12	13	24	6
Queuing Penalty (veh)	62	66	140	33
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 17: I-77 SB On-Ramp & Catawba Ave (WB)

Movement	WB	WB
Directions Served	LT	T
Maximum Queue (ft)	194	252
Average Queue (ft)	104	134
95th Queue (ft)	198	255
Link Distance (ft)	139	139
Upstream Blk Time (%)	6	9
Queuing Penalty (veh)	22	37
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

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Intersection: 18: I-77 NB On-Ramp

Movement	EB	WB
Directions Served	L	R
Maximum Queue (ft)	207	145
Average Queue (ft)	74	43
95th Queue (ft)	191	144
Link Distance (ft)	143	71
Upstream Blk Time (%)	3	1
Queuing Penalty (veh)	26	6
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 19: I-77 SB On-Ramp

Movement	SB	SE
Directions Served	T	R
Maximum Queue (ft)	158	151
Average Queue (ft)	12	7
95th Queue (ft)	90	76
Link Distance (ft)	111	137
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 21: I-77 NB Off-Ramp & Catawba Ave (WB)

Movement	NB	NB	SW	SW
Directions Served	L	L	R	R
Maximum Queue (ft)	125	170	33	29
Average Queue (ft)	33	80	2	1
95th Queue (ft)	101	148	21	17
Link Distance (ft)	116	116	78	78
Upstream Blk Time (%)	1	3	1	1
Queuing Penalty (veh)	1	4	3	3
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

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Intersection: 22: I-77 NB Off-Ramp & Catawba Ave (EB)/Catawba Ave

Movement	EB	EB	NB
Directions Served	T	T	R
Maximum Queue (ft)	163	163	150
Average Queue (ft)	99	31	68
95th Queue (ft)	204	111	148
Link Distance (ft)	86	86	110
Upstream Blk Time (%)	26	4	14
Queuing Penalty (veh)	139	21	11
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 24: I-77 SB On-Ramp & Catawba Ave/Catawba Ave (EB)

Movement	EB	EB	EB
Directions Served	T	T	TR
Maximum Queue (ft)	114	195	122
Average Queue (ft)	94	165	12
95th Queue (ft)	157	221	69
Link Distance (ft)		115	115
Upstream Blk Time (%)	22	45	1
Queuing Penalty (veh)	0	304	4
Storage Bay Dist (ft)	50		
Storage Blk Time (%)	40	15	
Queuing Penalty (veh)	170	63	

Intersection: 26: Catawba Ave

Movement	EB	EB
Directions Served	T	T
Maximum Queue (ft)	610	587
Average Queue (ft)	478	289
95th Queue (ft)	812	745
Link Distance (ft)	578	578
Upstream Blk Time (%)	48	5
Queuing Penalty (veh)	0	0
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

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Intersection: 27: I-77 SB Off-Ramp

Movement	SB	SB	SB	SB
Directions Served	L	L	R	R
Maximum Queue (ft)	231	197	415	276
Average Queue (ft)	98	78	249	91
95th Queue (ft)	329	322	642	245
Link Distance (ft)			909	
Upstream Blk Time (%)			10	
Queuing Penalty (veh)			0	
Storage Bay Dist (ft)	450	450		450
Storage Blk Time (%)	11	11		0
Queuing Penalty (veh)	91	92		0

Intersection: 28: I-77 NB Off-Ramp

Movement	NB	NB	NB
Directions Served	L	L	R
Maximum Queue (ft)	120	164	60
Average Queue (ft)	19	51	30
95th Queue (ft)	179	355	173
Link Distance (ft)		801	
Upstream Blk Time (%)		4	
Queuing Penalty (veh)		0	
Storage Bay Dist (ft)	500		500
Storage Blk Time (%)	0	6	
Queuing Penalty (veh)	0	12	

Intersection: 29: Bend

Movement	NB	NB
Directions Served	T	
Maximum Queue (ft)	342	336
Average Queue (ft)	189	34
95th Queue (ft)	458	196
Link Distance (ft)	275	275
Upstream Blk Time (%)	8	0
Queuing Penalty (veh)	52	3
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

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Intersection: 30: Catawba Ave (WB)/Catawba Ave & I-77 NB On-Ramp

Movement	WB	WB
Directions Served	T	TR
Maximum Queue (ft)	106	114
Average Queue (ft)	43	47
95th Queue (ft)	113	126
Link Distance (ft)	59	59
Upstream Blk Time (%)	16	18
Queuing Penalty (veh)	85	94
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Network Summary

Network wide Queuing Penalty: 4481

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APPENDIX F-2:
CAPACITY ANALYSIS RESULTS

2016 EXISTING CONDITIONS
PM PEAK HOUR

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Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Traffic Volume (vph)	0	1242	0	0	0	0	0	0	0	0	1040	0
Future Volume (vph)	0	1242	0	0	0	0	0	0	0	0	1040	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		2%			0%			0%			-2%	
Lane Util. Factor	1.00	0.91	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00
Frt												
Flt Protected												
Satd. Flow (prot)	0	5034	0	0	0	0	0	0	0	0	3575	0
Flt Permitted												
Satd. Flow (perm)	0	5034	0	0	0	0	0	0	0	0	3575	0
Right Turn on Red	No		No			No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)		35			35			35			35	
Link Distance (ft)		142			217			115			211	
Travel Time (s)		2.8			4.2			2.2			4.1	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	1380	0	0	0	0	0	0	0	0	1156	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	1380	0	0	0	0	0	0	0	0	1156	0
Turn Type		NA									NA	
Protected Phases		2									8	
Permitted Phases												
Detector Phase		2									8	
Switch Phase												
Minimum Initial (s)		10.0									10.0	
Minimum Split (s)		24.3									26.1	
Total Split (s)		60.0									60.0	
Total Split (%)		50.0%									50.0%	
Yellow Time (s)		3.7									4.0	
All-Red Time (s)		5.6									4.1	
Lost Time Adjust (s)		-4.3									-3.1	
Total Lost Time (s)		5.0									5.0	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode		C-Max									None	
Act Effct Green (s)		57.3									52.7	
Actuated g/C Ratio		0.48									0.44	
v/c Ratio		0.57									0.74	
Control Delay		24.2									27.3	
Queue Delay		0.0									23.4	
Total Delay		24.2									50.7	
LOS		C									D	
Approach Delay		24.2									50.7	
Approach LOS		C									D	
Queue Length 50th (ft)		285									273	
Queue Length 95th (ft)		334									308	
Internal Link Dist (ft)		62			137			35			131	
Turn Bay Length (ft)												

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Lane Group	Ø4	Ø6
Lane Configurations		
Traffic Volume (vph)		
Future Volume (vph)		
Ideal Flow (vphpl)		
Grade (%)		
Lane Util. Factor		
Frt		
Flt Protected		
Satd. Flow (prot)		
Flt Permitted		
Satd. Flow (perm)		
Right Turn on Red		
Satd. Flow (RTOR)		
Link Speed (mph)		
Link Distance (ft)		
Travel Time (s)		
Peak Hour Factor		
Adj. Flow (vph)		
Shared Lane Traffic (%)		
Lane Group Flow (vph)		
Turn Type		
Protected Phases	4	6
Permitted Phases		
Detector Phase		
Switch Phase		
Minimum Initial (s)	10.0	10.0
Minimum Split (s)	21.1	19.3
Total Split (s)	60.0	60.0
Total Split (%)	50%	50%
Yellow Time (s)	4.0	3.7
All-Red Time (s)	4.1	5.6
Lost Time Adjust (s)		
Total Lost Time (s)		
Lead/Lag		
Lead-Lag Optimize?		
Recall Mode	None	C-Max
Act Effct Green (s)		
Actuated g/C Ratio		
v/c Ratio		
Control Delay		
Queue Delay		
Total Delay		
LOS		
Approach Delay		
Approach LOS		
Queue Length 50th (ft)		
Queue Length 95th (ft)		
Internal Link Dist (ft)		
Turn Bay Length (ft)		

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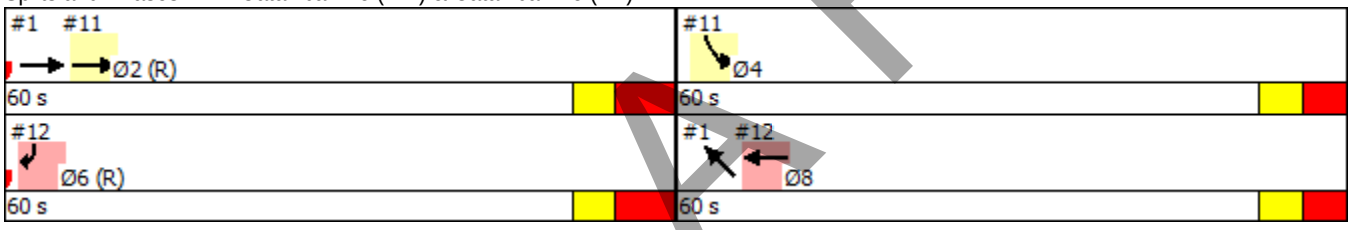
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Base Capacity (vph)		2403									1638	
Starvation Cap Reductn		0									519	
Spillback Cap Reductn		0									0	
Storage Cap Reductn		0									0	
Reduced v/c Ratio		0.57									1.03	

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 70 (58%), Referenced to phase 2:EBT and 6:, Start of Green
Natural Cycle: 55
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.74
Intersection Signal Delay: 36.3 Intersection LOS: D
Intersection Capacity Utilization 61.1% ICU Level of Service B
Analysis Period (min) 15

Splits and Phases: 1: Catawba Ave (WB) & Catawba Ave (EB)



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Lane Group	Ø4	Ø6
Base Capacity (vph)		
Starvation Cap Reductn		
Spillback Cap Reductn		
Storage Cap Reductn		
Reduced v/c Ratio		

Intersection Summary

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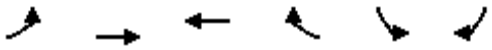

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR	Ø6	Ø8
Lane Configurations								
Traffic Volume (vph)	0	1242	0	0	328	0		
Future Volume (vph)	0	1242	0	0	328	0		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900		
Grade (%)		2%	0%		-1%			
Lane Util. Factor	1.00	0.91	1.00	1.00	0.97	1.00		
Frt								
Flt Protected					0.950			
Satd. Flow (prot)	0	5034	0	0	3450	0		
Flt Permitted					0.950			
Satd. Flow (perm)	0	5034	0	0	3450	0		
Right Turn on Red				No	No	No		
Satd. Flow (RTOR)								
Link Speed (mph)		35	35		35			
Link Distance (ft)		217	199		185			
Travel Time (s)		4.2	3.9		3.6			
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90		
Adj. Flow (vph)	0	1380	0	0	364	0		
Shared Lane Traffic (%)								
Lane Group Flow (vph)	0	1380	0	0	364	0		
Turn Type		NA			Prot			
Protected Phases		2			4		6	8
Permitted Phases								
Detector Phase		2			4			
Switch Phase								
Minimum Initial (s)		10.0			10.0		10.0	10.0
Minimum Split (s)		24.3			21.1		19.3	26.1
Total Split (s)		60.0			60.0		60.0	60.0
Total Split (%)		50.0%			50.0%		50%	50%
Yellow Time (s)		3.7			4.0		3.7	4.0
All-Red Time (s)		5.6			4.1		5.6	4.1
Lost Time Adjust (s)		-4.3			-3.1			
Total Lost Time (s)		5.0			5.0			
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode		C-Max			None		C-Max	None
Act Effct Green (s)		57.3			52.7			
Actuated g/C Ratio		0.48			0.44			
v/c Ratio		0.57			0.24			
Control Delay		3.0			21.2			
Queue Delay		0.4			0.0			
Total Delay		3.4			21.2			
LOS		A			C			
Approach Delay		3.4			21.2			
Approach LOS		A			C			
Queue Length 50th (ft)		14			86			
Queue Length 95th (ft)		16			118			
Internal Link Dist (ft)		137	119		105			
Turn Bay Length (ft)								

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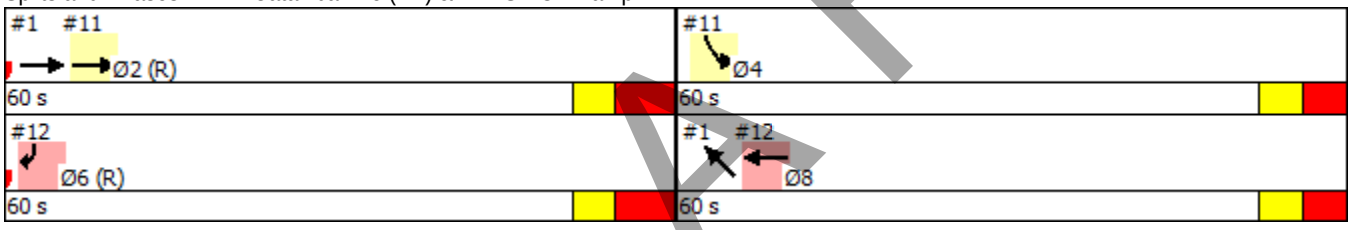
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR	Ø6	Ø8
Base Capacity (vph)		2403			1581			
Starvation Cap Reductn		0			0			
Spillback Cap Reductn		454			0			
Storage Cap Reductn		0			0			
Reduced v/c Ratio		0.71			0.23			

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 70 (58%), Referenced to phase 2:EBT and 6:, Start of Green
Natural Cycle: 55
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.74
Intersection Signal Delay: 7.1 Intersection LOS: A
Intersection Capacity Utilization 52.8% ICU Level of Service A
Analysis Period (min) 15

Splits and Phases: 11: Catawba Ave (EB) & I-77 SB Off-Ramp



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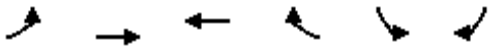

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR	Ø2	Ø4
Lane Configurations								
Traffic Volume (vph)	0	0	1040	0	0	610		
Future Volume (vph)	0	0	1040	0	0	610		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900		
Grade (%)		0%	0%		4%			
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.88		
Frt						0.850		
Flt Protected								
Satd. Flow (prot)	0	0	3539	0	0	2731		
Flt Permitted								
Satd. Flow (perm)	0	0	3539	0	0	2731		
Right Turn on Red				No		No		
Satd. Flow (RTOR)								
Link Speed (mph)		35	35		35			
Link Distance (ft)		202	115		181			
Travel Time (s)		3.9	2.2		3.5			
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90		
Adj. Flow (vph)	0	0	1156	0	0	678		
Shared Lane Traffic (%)								
Lane Group Flow (vph)	0	0	1156	0	0	678		
Turn Type			NA			Prot		
Protected Phases			8			6	2	4
Permitted Phases								
Detector Phase			8			6		
Switch Phase								
Minimum Initial (s)			10.0			10.0	10.0	10.0
Minimum Split (s)			26.1			19.3	24.3	21.1
Total Split (s)			60.0			60.0	60.0	60.0
Total Split (%)			50.0%			50.0%	50%	50%
Yellow Time (s)			4.0			3.7	3.7	4.0
All-Red Time (s)			4.1			5.6	5.6	4.1
Lost Time Adjust (s)			-3.1			-4.3		
Total Lost Time (s)			5.0			5.0		
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode			None			C-Max	C-Max	None
Act Effct Green (s)			52.7			57.3		
Actuated g/C Ratio			0.44			0.48		
v/c Ratio			0.74			0.52		
Control Delay			3.4			24.1		
Queue Delay			0.0			0.0		
Total Delay			3.4			24.1		
LOS			A			C		
Approach Delay			3.4		24.1			
Approach LOS			A		C			
Queue Length 50th (ft)			8			209		
Queue Length 95th (ft)			10			273		
Internal Link Dist (ft)		122	35		101			
Turn Bay Length (ft)								

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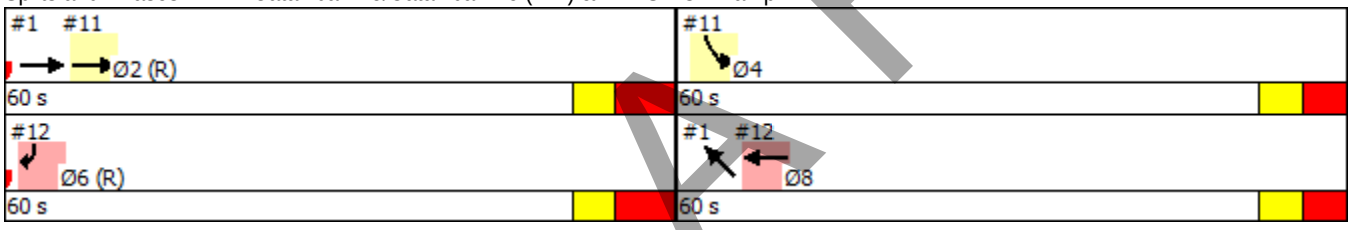
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR	Ø2	Ø4
Base Capacity (vph)			1622			1303		
Starvation Cap Reductn			6			0		
Spillback Cap Reductn			0			0		
Storage Cap Reductn			0			0		
Reduced v/c Ratio			0.72			0.52		

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 70 (58%), Referenced to phase 2:EBT and 6:, Start of Green
Natural Cycle: 55
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.74
Intersection Signal Delay: 11.1 Intersection LOS: B
Intersection Capacity Utilization 61.1% ICU Level of Service B
Analysis Period (min) 15

Splits and Phases: 12: Catawba Ave/Catawba Ave (WB) & I-77 SB Off-Ramp



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Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	0	718	0	0	0	0	0	1027	0
Future Volume (vph)	0	0	0	0	718	0	0	0	0	0	1027	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		0%			0%			0%			-1%	
Lane Util. Factor	1.00	1.00	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00	0.95	1.00
Frt												
Flt Protected												
Satd. Flow (prot)	0	0	0	0	3539	0	0	0	0	0	3557	0
Flt Permitted												
Satd. Flow (perm)	0	0	0	0	3539	0	0	0	0	0	3557	0
Right Turn on Red			No	No		No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)		35			35			35			35	
Link Distance (ft)		182			125			128			169	
Travel Time (s)		3.5			2.4			2.5			3.3	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	0	0	0	798	0	0	0	0	0	1141	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	0	798	0	0	0	0	0	1141	0
Turn Type					NA						NA	
Protected Phases					6						4	
Permitted Phases												
Detector Phase					6						4	
Switch Phase												
Minimum Initial (s)					7.0						7.0	
Minimum Split (s)					19.9						21.9	
Total Split (s)					60.0						60.0	
Total Split (%)					50.0%						50.0%	
Yellow Time (s)					3.9						3.9	
All-Red Time (s)					4.0						4.0	
Lost Time Adjust (s)					-2.0						-2.9	
Total Lost Time (s)					5.9						5.0	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode					C-Max						None	
Act Effct Green (s)					59.5						49.6	
Actuated g/C Ratio					0.50						0.41	
v/c Ratio					0.46						0.78	
Control Delay					25.8						29.1	
Queue Delay					0.7						0.7	
Total Delay					26.5						29.8	
LOS					C						C	
Approach Delay					26.5						29.8	
Approach LOS					C						C	
Queue Length 50th (ft)					191						434	
Queue Length 95th (ft)					259						508	
Internal Link Dist (ft)		102			45			48			89	
Turn Bay Length (ft)												

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Lane Group	Ø2	Ø8
Lane Configurations		
Traffic Volume (vph)		
Future Volume (vph)		
Ideal Flow (vphpl)		
Grade (%)		
Lane Util. Factor		
Frt		
Flt Protected		
Satd. Flow (prot)		
Flt Permitted		
Satd. Flow (perm)		
Right Turn on Red		
Satd. Flow (RTOR)		
Link Speed (mph)		
Link Distance (ft)		
Travel Time (s)		
Peak Hour Factor		
Adj. Flow (vph)		
Shared Lane Traffic (%)		
Lane Group Flow (vph)		
Turn Type		
Protected Phases	2	8
Permitted Phases		
Detector Phase		
Switch Phase		
Minimum Initial (s)	10.0	7.0
Minimum Split (s)	18.9	19.9
Total Split (s)	60.0	60.0
Total Split (%)	50%	50%
Yellow Time (s)	3.8	3.9
All-Red Time (s)	5.1	4.0
Lost Time Adjust (s)		
Total Lost Time (s)		
Lead/Lag		
Lead-Lag Optimize?		
Recall Mode	C-Max	None
Act Effct Green (s)		
Actuated g/C Ratio		
v/c Ratio		
Control Delay		
Queue Delay		
Total Delay		
LOS		
Approach Delay		
Approach LOS		
Queue Length 50th (ft)		
Queue Length 95th (ft)		
Internal Link Dist (ft)		
Turn Bay Length (ft)		

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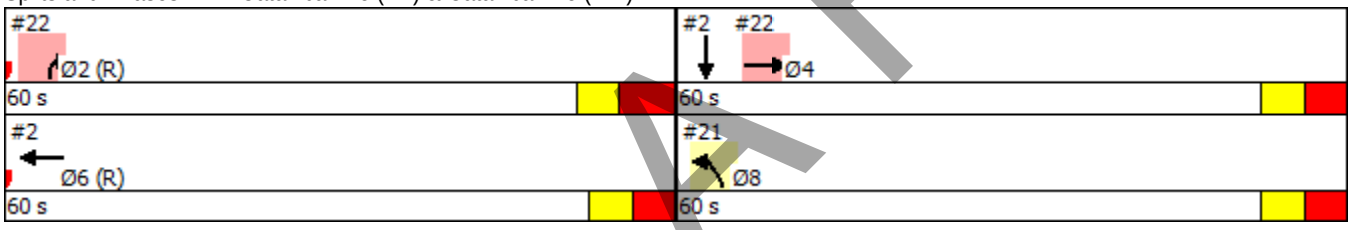
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Base Capacity (vph)					1753						1630	
Starvation Cap Reductn					565						196	
Spillback Cap Reductn					0						0	
Storage Cap Reductn					0						0	
Reduced v/c Ratio					0.67						0.80	

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 20 (17%), Referenced to phase 2:NBR and 6:, Start of Green
Natural Cycle: 50
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.78
Intersection Signal Delay: 28.5 Intersection LOS: C
Intersection Capacity Utilization 57.3% ICU Level of Service B
Analysis Period (min) 15

Splits and Phases: 2: Catawba Ave (EB) & Catawba Ave (WB)



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Lane Group	Ø2	Ø8
Base Capacity (vph)		
Starvation Cap Reductn		
Spillback Cap Reductn		
Storage Cap Reductn		
Reduced v/c Ratio		

Intersection Summary

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Lane Group	EBL	EBR	NBL	NBR	SWL	SWR	Ø2	Ø4	Ø6
Lane Configurations									
Traffic Volume (vph)	0	0	398	0	0	718			
Future Volume (vph)	0	0	398	0	0	718			
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900			
Lane Util. Factor	1.00	1.00	0.97	1.00	1.00	0.88			
Frt						0.850			
Flt Protected			0.950						
Satd. Flow (prot)	0	0	3433	0	0	2787			
Flt Permitted			0.950						
Satd. Flow (perm)	0	0	3433	0	0	2787			
Right Turn on Red		No	No	No		No			
Satd. Flow (RTOR)									
Link Speed (mph)	35		35		35				
Link Distance (ft)	209		215		182				
Travel Time (s)	4.1		4.2		3.5				
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90			
Adj. Flow (vph)	0	0	442	0	0	798			
Shared Lane Traffic (%)									
Lane Group Flow (vph)	0	0	442	0	0	798			
Turn Type			Prot			custom			
Protected Phases			8!			Free!	2	4	6
Permitted Phases									
Detector Phase			8						
Switch Phase									
Minimum Initial (s)			7.0				10.0	7.0	7.0
Minimum Split (s)			19.9				18.9	21.9	19.9
Total Split (s)			60.0				60.0	60.0	60.0
Total Split (%)			50.0%				50%	50%	50%
Yellow Time (s)			3.9				3.8	3.9	3.9
All-Red Time (s)			4.0				5.1	4.0	4.0
Lost Time Adjust (s)			-2.9						
Total Lost Time (s)			5.0						
Lead/Lag									
Lead-Lag Optimize?									
Recall Mode			None				C-Max	None	C-Max
Act Effct Green (s)			49.6			120.0			
Actuated g/C Ratio			0.41			1.00			
v/c Ratio			0.31			0.29			
Control Delay			23.7			1.7			
Queue Delay			0.0			0.0			
Total Delay			23.7			1.7			
LOS			C			A			
Approach Delay			23.7		1.7				
Approach LOS			C		A				
Queue Length 50th (ft)			114			36			
Queue Length 95th (ft)			143			43			
Internal Link Dist (ft)	129		135		102				
Turn Bay Length (ft)									
Base Capacity (vph)			1573			2787			

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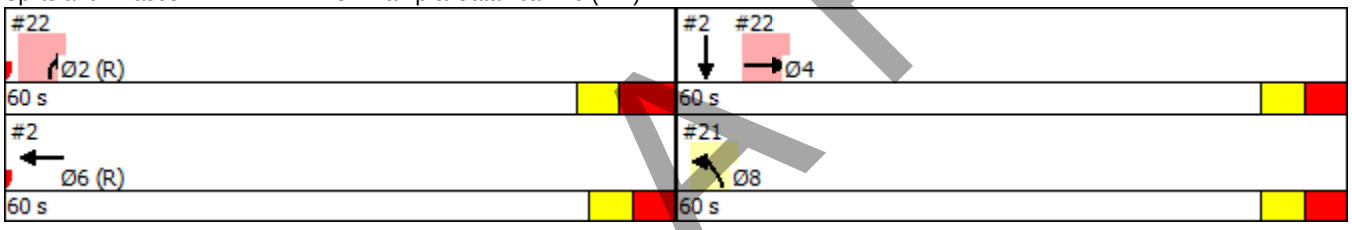
Lane Group	EBL	EBR	NBL	NBR	SWL	SWR	Ø2	Ø4	Ø6
Starvation Cap Reductn			0			0			
Spillback Cap Reductn			0			41			
Storage Cap Reductn			0			0			
Reduced v/c Ratio			0.28			0.29			

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 20 (17%), Referenced to phase 2:NBR and 6:, Start of Green
Natural Cycle: 50
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.78
Intersection Signal Delay: 9.6 Intersection LOS: A
Intersection Capacity Utilization 21.7% ICU Level of Service A
Analysis Period (min) 15
! Phase conflict between lane groups.

Splits and Phases: 21: I-77 NB Off-Ramp & Catawba Ave (WB)



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Lane Group	EBT	EBR	WBL	WBT	NBL	NBR	Ø6	Ø8
Lane Configurations								
Traffic Volume (vph)	1027	0	0	0	0	161		
Future Volume (vph)	1027	0	0	0	0	161		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900		
Grade (%)	0%			0%	4%			
Lane Util. Factor	0.95	1.00	1.00	1.00	1.00	1.00		
Frt						0.865		
Flt Protected								
Satd. Flow (prot)	3539	0	0	0	0	1579		
Flt Permitted								
Satd. Flow (perm)	3539	0	0	0	0	1579		
Right Turn on Red		No				No		
Satd. Flow (RTOR)								
Link Speed (mph)	35			35	35			
Link Distance (ft)	128			116	197			
Travel Time (s)	2.5			2.3	3.8			
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90		
Adj. Flow (vph)	1141	0	0	0	0	179		
Shared Lane Traffic (%)								
Lane Group Flow (vph)	1141	0	0	0	0	179		
Turn Type	NA					Prot		
Protected Phases	4					2	6	8
Permitted Phases								
Detector Phase	4					2		
Switch Phase								
Minimum Initial (s)	7.0					10.0	7.0	7.0
Minimum Split (s)	21.9					18.9	19.9	19.9
Total Split (s)	60.0					60.0	60.0	60.0
Total Split (%)	50.0%					50.0%	50%	50%
Yellow Time (s)	3.9					3.8	3.9	3.9
All-Red Time (s)	4.0					5.1	4.0	4.0
Lost Time Adjust (s)	-2.9					-3.9		
Total Lost Time (s)	5.0					5.0		
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None					C-Max	C-Max	None
Act Effct Green (s)	49.6					60.4		
Actuated g/C Ratio	0.41					0.50		
v/c Ratio	0.78					0.23		
Control Delay	3.7					18.8		
Queue Delay	0.0					0.0		
Total Delay	3.7					18.8		
LOS	A					B		
Approach Delay	3.7				18.8			
Approach LOS	A				B			
Queue Length 50th (ft)	7					77		
Queue Length 95th (ft)	0					134		
Internal Link Dist (ft)	48			36	117			
Turn Bay Length (ft)								

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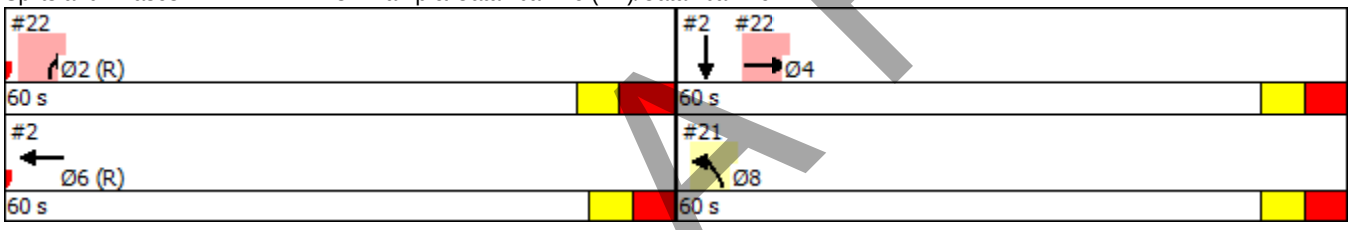
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR	Ø6	Ø8
Base Capacity (vph)	1622					794		
Starvation Cap Reductn	15					0		
Spillback Cap Reductn	0					0		
Storage Cap Reductn	0					0		
Reduced v/c Ratio	0.71					0.23		

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 20 (17%), Referenced to phase 2:NBR and 6:, Start of Green
Natural Cycle: 50
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.78
Intersection Signal Delay: 5.8 Intersection LOS: A
Intersection Capacity Utilization 57.3% ICU Level of Service B
Analysis Period (min) 15

Splits and Phases: 22: I-77 NB Off-Ramp & Catawba Ave (EB)/Catawba Ave



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Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	67	575	546	98	584	29	451	33	125	18	20	50
Future Volume (vph)	67	575	546	98	584	29	451	33	125	18	20	50
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		-2%			1%			3%			5%	
Storage Length (ft)	100		0	100		0	150		150	75		0
Storage Lanes	1		1	1		0	1		1	1		0
Taper Length (ft)	100			100			100			100		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	1.00	1.00	1.00	1.00
Frt			0.850		0.993				0.850		0.892	
Flt Protected	0.950			0.950			0.950	0.959		0.950		
Satd. Flow (prot)	1787	1881	1599	1761	1840	0	1656	1672	1560	1725	1620	0
Flt Permitted	0.165			0.167			0.950	0.959		0.950		
Satd. Flow (perm)	310	1881	1599	310	1840	0	1656	1672	1560	1725	1620	0
Right Turn on Red			No			No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)		35			35			35			35	
Link Distance (ft)		229			323			537			507	
Travel Time (s)		4.5			6.3			10.5			9.9	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	74	639	607	109	649	32	501	37	139	20	22	56
Shared Lane Traffic (%)							46%					
Lane Group Flow (vph)	74	639	607	109	681	0	271	267	139	20	78	0
Turn Type	pm+pt	NA	pm+ov	pm+pt	NA		Split	NA	pm+ov	Split	NA	
Protected Phases	5	2	3	1	6		3	3	1	4	4	
Permitted Phases	2		2	6					3			
Detector Phase	5	2	3	1	6		3	3	1	4	4	
Switch Phase												
Minimum Initial (s)	7.0	10.0	7.0	7.0	10.0		7.0	7.0	7.0	7.0	7.0	
Minimum Split (s)	13.3	31.4	28.3	13.2	28.4		28.3	28.3	13.2	12.9	12.9	
Total Split (s)	17.0	49.0	37.0	17.0	49.0		37.0	37.0	17.0	17.0	17.0	
Total Split (%)	14.2%	40.8%	30.8%	14.2%	40.8%		30.8%	30.8%	14.2%	14.2%	14.2%	
Yellow Time (s)	3.0	4.0	3.7	3.0	4.0		3.7	3.7	3.0	3.6	3.6	
All-Red Time (s)	3.3	2.4	2.6	3.2	2.4		2.6	2.6	3.2	2.3	2.3	
Lost Time Adjust (s)	-1.3	-1.4	-1.4	-1.2	-1.4		-1.3	-1.3	-1.2	-0.9	-0.9	
Total Lost Time (s)	5.0	5.0	4.9	5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Lead/Lag	Lead	Lag	Lead	Lead	Lag		Lead	Lead	Lead	Lag	Lag	
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	
Recall Mode	None	C-Max	None	None	C-Max		None	None	None	None	None	
Act Effct Green (s)	63.8	54.9	87.2	66.4	58.3		27.2	27.2	37.9	10.8	10.8	
Actuated g/C Ratio	0.53	0.46	0.73	0.55	0.49		0.23	0.23	0.32	0.09	0.09	
v/c Ratio	0.27	0.74	0.52	0.38	0.76		0.72	0.71	0.28	0.13	0.53	
Control Delay	26.3	55.6	16.3	17.8	36.4		53.9	52.7	20.6	51.4	65.6	
Queue Delay	0.0	46.5	0.5	0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Total Delay	26.3	102.1	16.8	17.8	36.4		53.9	52.7	20.6	51.4	65.6	
LOS	C	F	B	B	D		D	D	C	D	E	
Approach Delay		58.6			33.8			46.6			62.7	
Approach LOS		E			C			D			E	
Queue Length 50th (ft)	52	523	218	40	472		202	197	57	14	58	

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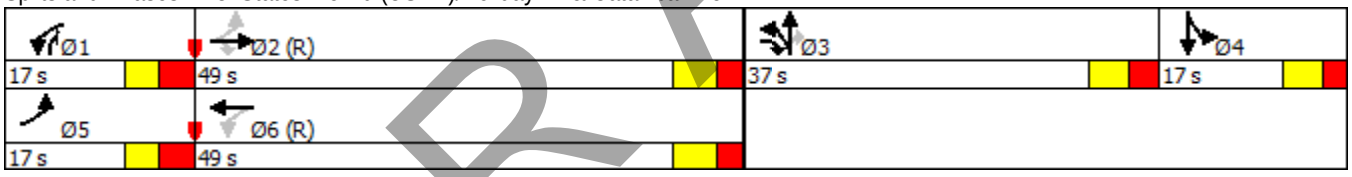
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 95th (ft)	m78	#723	306	75	#766		292	287	86	39	110	
Internal Link Dist (ft)		149			243			457			427	
Turn Bay Length (ft)	100			100			150		150	75		
Base Capacity (vph)	320	860	1238	320	894		441	445	522	172	162	
Starvation Cap Reductn	0	272	271	0	0		0	0	0	0	0	
Spillback Cap Reductn	0	0	0	0	0		0	0	0	0	0	
Storage Cap Reductn	0	0	0	0	0		0	0	0	0	0	
Reduced v/c Ratio	0.23	1.09	0.63	0.34	0.76		0.61	0.60	0.27	0.12	0.48	

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 35 (29%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.76
Intersection Signal Delay: 49.2 Intersection LOS: D
Intersection Capacity Utilization 70.9% ICU Level of Service C
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 3: Statesville Rd (US 21)/Holiday Ln & Catawba Ave



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Intersection

Int Delay, s/veh 1.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	4	697	18	4	692	4	13	4	4	4	4	6
Future Vol, veh/h	4	697	18	4	692	4	13	4	4	4	4	6
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	50	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	4	774	20	4	769	4	14	4	4	4	4	7

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	773	0	0	794	0	0	1579	1575	784	1578	1583	771
Stage 1	-	-	-	-	-	-	793	793	-	780	780	-
Stage 2	-	-	-	-	-	-	786	782	-	798	803	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	842	-	-	827	-	-	88	110	393	89	109	400
Stage 1	-	-	-	-	-	-	382	400	-	388	406	-
Stage 2	-	-	-	-	-	-	385	405	-	380	396	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	842	-	-	827	-	-	83	109	393	84	108	400
Mov Cap-2 Maneuver	-	-	-	-	-	-	83	109	-	84	108	-
Stage 1	-	-	-	-	-	-	380	398	-	386	403	-
Stage 2	-	-	-	-	-	-	371	402	-	370	394	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.1	0.1	49.9	33.9
HCM LOS			E	D

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	103	842	-	-	827	-	-	140
HCM Lane V/C Ratio	0.227	0.005	-	-	0.005	-	-	0.111
HCM Control Delay (s)	49.9	9.3	-	-	9.4	0	-	33.9
HCM Lane LOS	E	A	-	-	A	A	-	D
HCM 95th %tile Q(veh)	0.8	0	-	-	0	-	-	0.4

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Summary of All Intervals

Run Number	1	2	3	4	5	Avg
Start Time	4:50	4:50	4:50	4:50	4:50	4:50
End Time	6:00	6:00	6:00	6:00	6:00	6:00
Total Time (min)	70	70	70	70	70	70
Time Recorded (min)	60	60	60	60	60	60
# of Intervals	5	5	5	5	5	5
# of Recorded Intervals	4	4	4	4	4	4
Vehs Entered	1745	904	2919	2858	846	1853
Vehs Exited	1427	762	2821	2768	776	1710
Starting Vehs	133	212	190	184	282	200
Ending Vehs	451	354	288	274	352	342
Travel Distance (mi)	613	317	1191	1180	317	724
Travel Time (hr)	1111.9	1746.8	992.6	999.8	1913.3	1352.9
Total Delay (hr)	1090.4	1735.5	950.3	957.8	1901.9	1327.2
Total Stops	2166	1199	5080	4441	1393	2855
Fuel Used (gal)	271.5	407.8	263.3	263.9	446.4	330.6

Interval #0 Information Seeding

Start Time	4:50
End Time	5:00
Total Time (min)	10

Volumes adjusted by Growth Factors.
No data recorded this interval.

Interval #1 Information 1

Start Time	5:00
End Time	5:15
Total Time (min)	15

Volumes adjusted by Growth Factors, Anti PHF.

Run Number	1	2	3	4	5	Avg
Vehs Entered	1003	763	777	763	601	779
Vehs Exited	1003	679	723	733	605	748
Starting Vehs	133	212	190	184	282	200
Ending Vehs	133	296	244	214	278	232
Travel Distance (mi)	418	285	300	309	247	312
Travel Time (hr)	33.4	92.6	87.1	95.4	124.2	86.5
Total Delay (hr)	18.9	82.5	76.6	84.4	115.4	75.6
Total Stops	1254	991	1232	915	1058	1088
Fuel Used (gal)	20.2	29.6	29.0	30.8	36.0	29.1

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Interval #2 Information 2

Start Time 5:15
End Time 5:30
Total Time (min) 15
Volumes adjusted by PHF, Growth Factors.

Run Number	1	2	3	4	5	Avg
Vehs Entered	684	130	714	785	227	508
Vehs Exited	412	82	672	713	169	409
Starting Vehs	133	296	244	214	278	232
Ending Vehs	405	344	286	286	336	332
Travel Distance (mi)	190	32	294	311	68	179
Travel Time (hr)	115.6	280.0	203.8	192.8	326.0	223.6
Total Delay (hr)	108.7	278.9	193.3	181.7	323.4	217.2
Total Stops	840	198	1201	1257	320	765
Fuel Used (gal)	31.6	64.9	55.6	53.3	76.5	56.4

Interval #3 Information 3

Start Time 5:30
End Time 5:45
Total Time (min) 15
Volumes adjusted by Growth Factors, Anti PHF.

Run Number	1	2	3	4	5	Avg
Vehs Entered	55	3	779	608	12	288
Vehs Exited	12	1	777	609	2	280
Starting Vehs	405	344	286	286	336	332
Ending Vehs	448	346	288	285	346	340
Travel Distance (mi)	5	0	321	260	1	117
Travel Time (hr)	351.3	550.7	307.1	306.5	601.4	423.4
Total Delay (hr)	351.1	550.7	295.7	297.3	601.4	419.2
Total Stops	69	1	1483	1093	10	528
Fuel Used (gal)	80.2	125.5	80.1	78.1	137.2	100.2

Interval #4 Information 4

Start Time 5:45
End Time 6:00
Total Time (min) 15
Volumes adjusted by Growth Factors, Anti PHF.

Run Number	1	2	3	4	5	Avg
Vehs Entered	3	8	649	702	6	271
Vehs Exited	0	0	649	713	0	272
Starting Vehs	448	346	288	285	346	340
Ending Vehs	451	354	288	274	352	342
Travel Distance (mi)	0	0	277	300	0	116
Travel Time (hr)	611.6	823.4	394.6	405.0	861.7	619.3
Total Delay (hr)	611.6	823.4	384.7	394.4	861.7	615.2
Total Stops	3	9	1164	1176	5	472
Fuel Used (gal)	139.5	187.8	98.7	101.8	196.6	144.9

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Intersection: 1: Catawba Ave (WB) & Catawba Ave (EB)

Movement	EB	EB	EB	NW	NW
Directions Served	T	T	T	T	T
Maximum Queue (ft)	183	185	191	133	147
Average Queue (ft)	82	163	53	76	94
95th Queue (ft)	213	210	155	162	187
Link Distance (ft)	60	60	60	46	46
Upstream Blk Time (%)	20	81	8	29	33
Queuing Penalty (veh)	84	336	33	153	173
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 2: Catawba Ave (EB) & Catawba Ave (WB)

Movement	WB	WB	SB	SB
Directions Served	T	T	T	T
Maximum Queue (ft)	142	140	170	167
Average Queue (ft)	128	127	147	84
95th Queue (ft)	142	158	172	207
Link Distance (ft)	74	74	86	86
Upstream Blk Time (%)	96	96	84	20
Queuing Penalty (veh)	346	345	434	103
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 3: Statesville Rd (US 21)/Holiday Ln & Catawba Ave

Movement	EB	EB	EB	WB	WB	NB	NB	NB	SB	SB
Directions Served	L	T	R	L	TR	L	LT	R	L	TR
Maximum Queue (ft)	160	239	220	162	334	218	499	152	85	467
Average Queue (ft)	55	222	88	13	325	101	466	13	14	391
95th Queue (ft)	145	246	238	83	353	206	578	96	62	594
Link Distance (ft)		170	170		245		487			459
Upstream Blk Time (%)	0	68	5		95		93			73
Queuing Penalty (veh)	0	407	32		674		0			0
Storage Bay Dist (ft)	100			100		150		150	75	
Storage Blk Time (%)	20	52		0	96	29	96		2	95
Queuing Penalty (veh)	113	35		2	94	110	335		2	17

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Intersection: 4: Hill St/Burton Ln & Catawba Ave

Movement	EB	WB	NB	SB
Directions Served	L	LTR	LTR	LTR
Maximum Queue (ft)	18	551	363	252
Average Queue (ft)	11	512	189	109
95th Queue (ft)	38	691	411	243
Link Distance (ft)		536	466	423
Upstream Blk Time (%)		92	2	
Queuing Penalty (veh)		0	0	
Storage Bay Dist (ft)	50			
Storage Blk Time (%)	29			
Queuing Penalty (veh)	209			

Intersection: 11: Catawba Ave (EB) & I-77 SB Off-Ramp

Movement	EB	EB	EB	SB	SB
Directions Served	T	T	T	L	L
Maximum Queue (ft)	80	163	56	153	162
Average Queue (ft)	17	80	6	125	75
95th Queue (ft)	66	147	37	179	171
Link Distance (ft)	40	40	40	89	89
Upstream Blk Time (%)	10	79	1	57	22
Queuing Penalty (veh)	39	328	5	94	36
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 12: Catawba Ave/Catawba Ave (WB) & I-77 SB Off-Ramp

Movement	WB	WB	SB	SB
Directions Served	T	T	R	R
Maximum Queue (ft)	17	20	164	140
Average Queue (ft)	1	2	93	61
95th Queue (ft)	9	15	207	142
Link Distance (ft)	56	56	89	89
Upstream Blk Time (%)		0	16	5
Queuing Penalty (veh)		0	48	16
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

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Intersection: 14: Catawba Ave (EB) & I-77 NB On-Ramp

Movement	EB	EB
Directions Served	T	T
Maximum Queue (ft)	256	208
Average Queue (ft)	181	49
95th Queue (ft)	275	166
Link Distance (ft)	143	143
Upstream Blk Time (%)	73	2
Queuing Penalty (veh)	383	13
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 15: Catawba Ave

Movement	WB	WB	NE	NE
Directions Served	T	T	R	R
Maximum Queue (ft)	219	203	126	131
Average Queue (ft)	202	176	111	13
95th Queue (ft)	282	230	123	68
Link Distance (ft)	170	170	61	61
Upstream Blk Time (%)	91	93	67	2
Queuing Penalty (veh)	493	505	401	11
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 17: I-77 SB On-Ramp & Catawba Ave (WB)

Movement	WB	WB
Directions Served	LT	T
Maximum Queue (ft)	168	208
Average Queue (ft)	44	61
95th Queue (ft)	165	168
Link Distance (ft)	139	139
Upstream Blk Time (%)	13	14
Queuing Penalty (veh)	71	78
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

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Intersection: 18: I-77 NB On-Ramp

Movement	WB
Directions Served	R
Maximum Queue (ft)	86
Average Queue (ft)	32
95th Queue (ft)	130
Link Distance (ft)	71
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 19: I-77 SB On-Ramp

Movement	SE
Directions Served	R
Maximum Queue (ft)	103
Average Queue (ft)	5
95th Queue (ft)	66
Link Distance (ft)	137
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 21: I-77 NB Off-Ramp & Catawba Ave (WB)

Movement	NB	NB	SW	SW
Directions Served	L	L	R	R
Maximum Queue (ft)	143	186	14	15
Average Queue (ft)	69	103	1	1
95th Queue (ft)	169	220	14	11
Link Distance (ft)	116	116	78	78
Upstream Blk Time (%)	12	19	0	0
Queuing Penalty (veh)	24	38	1	0
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

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Intersection: 22: I-77 NB Off-Ramp & Catawba Ave (EB)/Catawba Ave

Movement	EB	EB	NB
Directions Served	T	T	R
Maximum Queue (ft)	164	74	180
Average Queue (ft)	157	5	131
95th Queue (ft)	185	33	207
Link Distance (ft)	86	86	110
Upstream Blk Time (%)	85	1	53
Queuing Penalty (veh)	438	4	85
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 24: I-77 SB On-Ramp & Catawba Ave/Catawba Ave (EB)

Movement	EB	EB	EB
Directions Served	T	T	TR
Maximum Queue (ft)	103	181	134
Average Queue (ft)	47	143	14
95th Queue (ft)	137	234	81
Link Distance (ft)		115	115
Upstream Blk Time (%)	4	68	1
Queuing Penalty (veh)	0	516	7
Storage Bay Dist (ft)	50		
Storage Blk Time (%)	9	70	
Queuing Penalty (veh)	38	291	

Intersection: 26: Catawba Ave

Movement	EB	EB
Directions Served	T	T
Maximum Queue (ft)	607	594
Average Queue (ft)	475	449
95th Queue (ft)	848	818
Link Distance (ft)	578	578
Upstream Blk Time (%)	68	41
Queuing Penalty (veh)	0	0
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

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Intersection: 28: I-77 NB Off-Ramp

Movement	NB	NB	NB
Directions Served	L	L	R
Maximum Queue (ft)	360	520	333
Average Queue (ft)	89	326	220
95th Queue (ft)	423	956	629
Link Distance (ft)		801	
Upstream Blk Time (%)		35	
Queuing Penalty (veh)		0	
Storage Bay Dist (ft)	500		500
Storage Blk Time (%)	9	24	24
Queuing Penalty (veh)	32	86	93

Intersection: 30: Catawba Ave (WB)/Catawba Ave & I-77 NB On-Ramp

Movement	WB	WB
Directions Served	T	TR
Maximum Queue (ft)	107	110
Average Queue (ft)	101	96
95th Queue (ft)	124	108
Link Distance (ft)	59	59
Upstream Blk Time (%)	94	94
Queuing Penalty (veh)	514	514
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 610: I-77 SB Off-Ramp

Movement	SB	SB	SB	SB
Directions Served	L	L	R	R
Maximum Queue (ft)	307	359	661	379
Average Queue (ft)	206	219	398	35
95th Queue (ft)	581	640	1068	226
Link Distance (ft)			909	
Upstream Blk Time (%)			36	
Queuing Penalty (veh)			0	
Storage Bay Dist (ft)	450	450		450
Storage Blk Time (%)	38	38	28	0
Queuing Penalty (veh)	231	231	180	2

Network Summary

Network wide Queuing Penalty: 9878

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APPENDIX F-3:
CAPACITY ANALYSIS RESULTS

2018 NO-BUILD CONDITIONS
AM PEAK HOUR

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Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations		↑↑↑									↑↑	
Traffic Volume (vph)	0	1306	0	0	0	0	0	0	0	0	778	0
Future Volume (vph)	0	1306	0	0	0	0	0	0	0	0	778	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		2%			0%			0%			-2%	
Lane Util. Factor	1.00	0.91	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00
Frt												
Flt Protected												
Satd. Flow (prot)	0	5034	0	0	0	0	0	0	0	0	3575	0
Flt Permitted												
Satd. Flow (perm)	0	5034	0	0	0	0	0	0	0	0	3575	0
Right Turn on Red	No		No			No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)		35			35			35			35	
Link Distance (ft)		142			217			115			211	
Travel Time (s)		2.8			4.2			2.2			4.1	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	1451	0	0	0	0	0	0	0	0	864	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	1451	0	0	0	0	0	0	0	0	864	0
Turn Type		NA									NA	
Protected Phases		2									8	
Permitted Phases												
Detector Phase		2									8	
Switch Phase												
Minimum Initial (s)		10.0									10.0	
Minimum Split (s)		24.3									26.1	
Total Split (s)		60.0									60.0	
Total Split (%)		50.0%									50.0%	
Yellow Time (s)		3.7									4.0	
All-Red Time (s)		5.6									4.1	
Lost Time Adjust (s)		-4.3									-3.1	
Total Lost Time (s)		5.0									5.0	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode		C-Max									None	
Act Effct Green (s)		66.3									43.7	
Actuated g/C Ratio		0.55									0.36	
v/c Ratio		0.52									0.66	
Control Delay		18.7									42.7	
Queue Delay		0.0									0.2	
Total Delay		18.7									42.9	
LOS		B									D	
Approach Delay		18.7									42.9	
Approach LOS		B									D	
Queue Length 50th (ft)		247									356	
Queue Length 95th (ft)		343									413	
Internal Link Dist (ft)		62			137			35			131	
Turn Bay Length (ft)												

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Lane Group	Ø4	Ø6
Lane Configurations		
Traffic Volume (vph)		
Future Volume (vph)		
Ideal Flow (vphpl)		
Grade (%)		
Lane Util. Factor		
Frt		
Flt Protected		
Satd. Flow (prot)		
Flt Permitted		
Satd. Flow (perm)		
Right Turn on Red		
Satd. Flow (RTOR)		
Link Speed (mph)		
Link Distance (ft)		
Travel Time (s)		
Peak Hour Factor		
Adj. Flow (vph)		
Shared Lane Traffic (%)		
Lane Group Flow (vph)		
Turn Type		
Protected Phases	4	6
Permitted Phases		
Detector Phase		
Switch Phase		
Minimum Initial (s)	10.0	10.0
Minimum Split (s)	21.1	19.3
Total Split (s)	60.0	60.0
Total Split (%)	50%	50%
Yellow Time (s)	4.0	3.7
All-Red Time (s)	4.1	5.6
Lost Time Adjust (s)		
Total Lost Time (s)		
Lead/Lag		
Lead-Lag Optimize?		
Recall Mode	None	C-Max
Act Effct Green (s)		
Actuated g/C Ratio		
v/c Ratio		
Control Delay		
Queue Delay		
Total Delay		
LOS		
Approach Delay		
Approach LOS		
Queue Length 50th (ft)		
Queue Length 95th (ft)		
Internal Link Dist (ft)		
Turn Bay Length (ft)		

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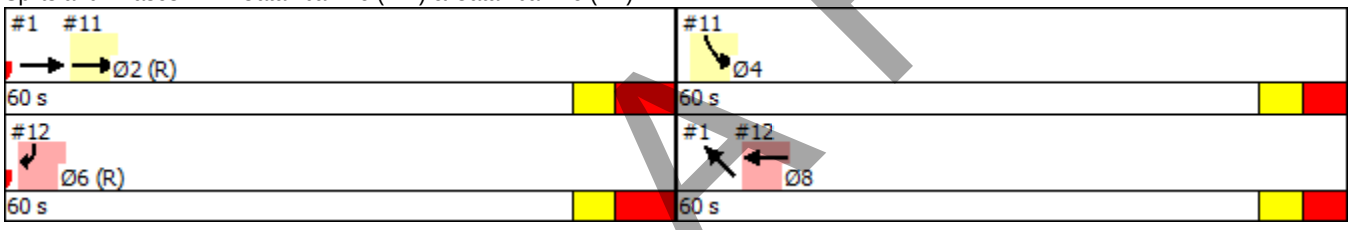
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Base Capacity (vph)		2782									1638	
Starvation Cap Reductn		0									230	
Spillback Cap Reductn		0									0	
Storage Cap Reductn		0									0	
Reduced v/c Ratio		0.52									0.61	

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 70 (58%), Referenced to phase 2:EBT and 6:, Start of Green
Natural Cycle: 60
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.67
Intersection Signal Delay: 27.7 Intersection LOS: C
Intersection Capacity Utilization 61.7% ICU Level of Service B
Analysis Period (min) 15

Splits and Phases: 1: Catawba Ave (WB) & Catawba Ave (EB)



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Lane Group	Ø4	Ø6
Base Capacity (vph)		
Starvation Cap Reductn		
Spillback Cap Reductn		
Storage Cap Reductn		
Reduced v/c Ratio		

Intersection Summary

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Lane Group	EBL	EBT	WBT	WBR	SBL	SBR	Ø6	Ø8
Lane Configurations								
Traffic Volume (vph)	0	1306	0	0	606	0		
Future Volume (vph)	0	1306	0	0	606	0		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900		
Grade (%)		2%	0%		-1%			
Lane Util. Factor	1.00	0.91	1.00	1.00	0.97	1.00		
Frt								
Flt Protected					0.950			
Satd. Flow (prot)	0	5034	0	0	3450	0		
Flt Permitted					0.950			
Satd. Flow (perm)	0	5034	0	0	3450	0		
Right Turn on Red				No	No	No		
Satd. Flow (RTOR)								
Link Speed (mph)		35	35		35			
Link Distance (ft)		217	199		185			
Travel Time (s)		4.2	3.9		3.6			
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90		
Adj. Flow (vph)	0	1451	0	0	673	0		
Shared Lane Traffic (%)								
Lane Group Flow (vph)	0	1451	0	0	673	0		
Turn Type		NA			Prot			
Protected Phases		2			4		6	8
Permitted Phases								
Detector Phase		2			4			
Switch Phase								
Minimum Initial (s)		10.0			10.0		10.0	10.0
Minimum Split (s)		24.3			21.1		19.3	26.1
Total Split (s)		60.0			60.0		60.0	60.0
Total Split (%)		50.0%			50.0%		50%	50%
Yellow Time (s)		3.7			4.0		3.7	4.0
All-Red Time (s)		5.6			4.1		5.6	4.1
Lost Time Adjust (s)		-4.3			-3.1			
Total Lost Time (s)		5.0			5.0			
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode		C-Max			None		C-Max	None
Act Effct Green (s)		66.3			43.7			
Actuated g/C Ratio		0.55			0.36			
v/c Ratio		0.52			0.54			
Control Delay		2.5			31.2			
Queue Delay		0.1			0.0			
Total Delay		2.5			31.2			
LOS		A			C			
Approach Delay		2.5			31.2			
Approach LOS		A			C			
Queue Length 50th (ft)		15			210			
Queue Length 95th (ft)		17			234			
Internal Link Dist (ft)		137	119		105			
Turn Bay Length (ft)								

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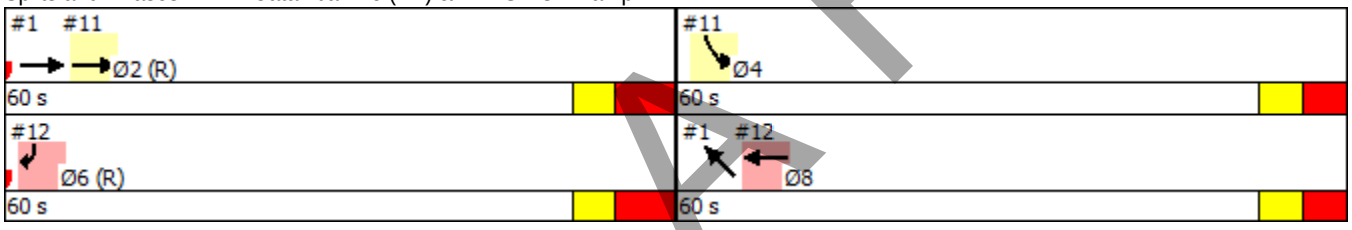
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR	Ø6	Ø8
Base Capacity (vph)		2782			1581			
Starvation Cap Reductn		0			0			
Spillback Cap Reductn		244			0			
Storage Cap Reductn		0			0			
Reduced v/c Ratio		0.57			0.43			

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 70 (58%), Referenced to phase 2:EBT and 6:, Start of Green
Natural Cycle: 60
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.67
Intersection Signal Delay: 11.6 Intersection LOS: B
Intersection Capacity Utilization 64.6% ICU Level of Service C
Analysis Period (min) 15

Splits and Phases: 11: Catawba Ave (EB) & I-77 SB Off-Ramp



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Lane Group	EBL	EBT	WBT	WBR	SBL	SBR	Ø2	Ø4
Lane Configurations			↑↑			↱↱		
Traffic Volume (vph)	0	0	778	0	0	910		
Future Volume (vph)	0	0	778	0	0	910		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900		
Grade (%)		0%	0%		4%			
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.88		
Frt						0.850		
Flt Protected								
Satd. Flow (prot)	0	0	3539	0	0	2731		
Flt Permitted								
Satd. Flow (perm)	0	0	3539	0	0	2731		
Right Turn on Red				No		No		
Satd. Flow (RTOR)								
Link Speed (mph)		35	35		35			
Link Distance (ft)		202	115		181			
Travel Time (s)		3.9	2.2		3.5			
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90		
Adj. Flow (vph)	0	0	864	0	0	1011		
Shared Lane Traffic (%)								
Lane Group Flow (vph)	0	0	864	0	0	1011		
Turn Type			NA			Prot		
Protected Phases			8			6	2	4
Permitted Phases								
Detector Phase			8			6		
Switch Phase								
Minimum Initial (s)			10.0			10.0	10.0	10.0
Minimum Split (s)			26.1			19.3	24.3	21.1
Total Split (s)			60.0			60.0	60.0	60.0
Total Split (%)			50.0%			50.0%	50%	50%
Yellow Time (s)			4.0			3.7	3.7	4.0
All-Red Time (s)			4.1			5.6	5.6	4.1
Lost Time Adjust (s)			-3.1			-4.3		
Total Lost Time (s)			5.0			5.0		
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode			None			C-Max	C-Max	None
Act Effct Green (s)			43.7			66.3		
Actuated g/C Ratio			0.36			0.55		
v/c Ratio			0.67			0.67		
Control Delay			3.0			23.2		
Queue Delay			0.0			0.0		
Total Delay			3.0			23.2		
LOS			A			C		
Approach Delay			3.0		23.2			
Approach LOS			A		C			
Queue Length 50th (ft)			3			302		
Queue Length 95th (ft)			2			456		
Internal Link Dist (ft)		122	35		101			
Turn Bay Length (ft)								

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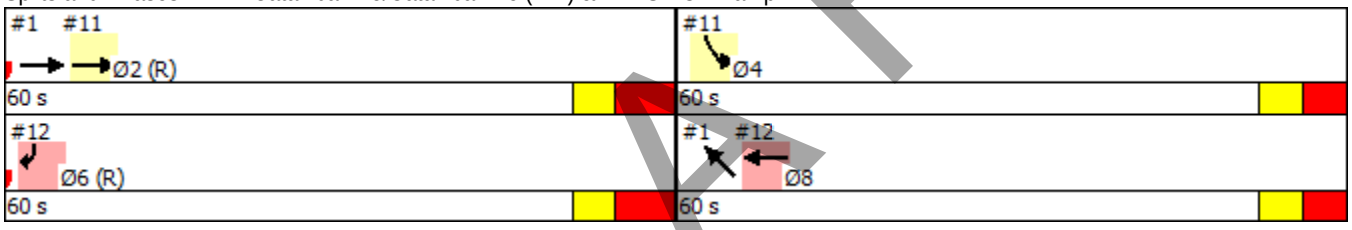
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR	Ø2	Ø4
Base Capacity (vph)			1622			1509		
Starvation Cap Reductn			6			0		
Spillback Cap Reductn			0			0		
Storage Cap Reductn			0			0		
Reduced v/c Ratio			0.53			0.67		

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 70 (58%), Referenced to phase 2:EBT and 6:, Start of Green
Natural Cycle: 60
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.67
Intersection Signal Delay: 13.9 Intersection LOS: B
Intersection Capacity Utilization 61.7% ICU Level of Service B
Analysis Period (min) 15

Splits and Phases: 12: Catawba Ave/Catawba Ave (WB) & I-77 SB Off-Ramp



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Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	0	552	0	0	0	0	0	1124	0
Future Volume (vph)	0	0	0	0	552	0	0	0	0	0	1124	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		0%			0%			0%			-1%	
Lane Util. Factor	1.00	1.00	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00	0.95	1.00
Frt												
Flt Protected												
Satd. Flow (prot)	0	0	0	0	3539	0	0	0	0	0	3557	0
Flt Permitted												
Satd. Flow (perm)	0	0	0	0	3539	0	0	0	0	0	3557	0
Right Turn on Red			No	No		No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)		35			35			35			35	
Link Distance (ft)		182			125			128			169	
Travel Time (s)		3.5			2.4			2.5			3.3	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	0	0	0	613	0	0	0	0	0	1249	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	0	613	0	0	0	0	0	1249	0
Turn Type					NA						NA	
Protected Phases					6						4	
Permitted Phases												
Detector Phase					6						4	
Switch Phase												
Minimum Initial (s)					7.0						7.0	
Minimum Split (s)					19.9						21.9	
Total Split (s)					50.0						70.0	
Total Split (%)					41.7%						58.3%	
Yellow Time (s)					3.9						3.9	
All-Red Time (s)					4.0						4.0	
Lost Time Adjust (s)					-2.0						-2.9	
Total Lost Time (s)					5.9						5.0	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode					C-Max						None	
Act Effct Green (s)					52.6						56.5	
Actuated g/C Ratio					0.44						0.47	
v/c Ratio					0.40						0.75	
Control Delay					17.7						21.6	
Queue Delay					0.3						0.1	
Total Delay					18.0						21.7	
LOS					B						C	
Approach Delay					18.0						21.7	
Approach LOS					B						C	
Queue Length 50th (ft)					115						270	
Queue Length 95th (ft)					198						314	
Internal Link Dist (ft)		102			45			48			89	
Turn Bay Length (ft)												

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Lane Group	Ø2	Ø8
Lane Configurations		
Traffic Volume (vph)		
Future Volume (vph)		
Ideal Flow (vphpl)		
Grade (%)		
Lane Util. Factor		
Frt		
Flt Protected		
Satd. Flow (prot)		
Flt Permitted		
Satd. Flow (perm)		
Right Turn on Red		
Satd. Flow (RTOR)		
Link Speed (mph)		
Link Distance (ft)		
Travel Time (s)		
Peak Hour Factor		
Adj. Flow (vph)		
Shared Lane Traffic (%)		
Lane Group Flow (vph)		
Turn Type		
Protected Phases	2	8
Permitted Phases		
Detector Phase		
Switch Phase		
Minimum Initial (s)	10.0	7.0
Minimum Split (s)	18.9	19.9
Total Split (s)	50.0	70.0
Total Split (%)	42%	58%
Yellow Time (s)	3.8	3.9
All-Red Time (s)	5.1	4.0
Lost Time Adjust (s)		
Total Lost Time (s)		
Lead/Lag		
Lead-Lag Optimize?		
Recall Mode	C-Max	None
Act Effct Green (s)		
Actuated g/C Ratio		
v/c Ratio		
Control Delay		
Queue Delay		
Total Delay		
LOS		
Approach Delay		
Approach LOS		
Queue Length 50th (ft)		
Queue Length 95th (ft)		
Internal Link Dist (ft)		
Turn Bay Length (ft)		

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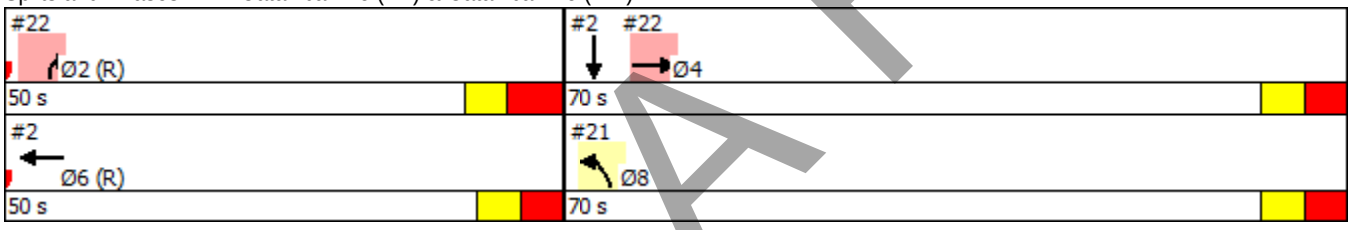
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Base Capacity (vph)					1551						1926	
Starvation Cap Reductn					396						102	
Spillback Cap Reductn					0						0	
Storage Cap Reductn					0						0	
Reduced v/c Ratio					0.53						0.68	

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 65 (54%), Referenced to phase 2:NBR and 6:, Start of Green
Natural Cycle: 50
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.75
Intersection Signal Delay: 20.5 Intersection LOS: C
Intersection Capacity Utilization 55.4% ICU Level of Service B
Analysis Period (min) 15

Splits and Phases: 2: Catawba Ave (EB) & Catawba Ave (WB)



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Lane Group	Ø2	Ø8
Base Capacity (vph)		
Starvation Cap Reductn		
Spillback Cap Reductn		
Storage Cap Reductn		
Reduced v/c Ratio		

Intersection Summary

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Lane Group	EBL	EBR	NBL	NBR	SWL	SWR	Ø2	Ø4	Ø6
Lane Configurations									
Traffic Volume (vph)	0	0	259	0	0	552			
Future Volume (vph)	0	0	259	0	0	552			
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900			
Lane Util. Factor	1.00	1.00	0.97	1.00	1.00	0.88			
Frt						0.850			
Flt Protected			0.950						
Satd. Flow (prot)	0	0	3433	0	0	2787			
Flt Permitted			0.950						
Satd. Flow (perm)	0	0	3433	0	0	2787			
Right Turn on Red		No	No	No		No			
Satd. Flow (RTOR)									
Link Speed (mph)	35		35		35				
Link Distance (ft)	209		215		182				
Travel Time (s)	4.1		4.2		3.5				
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90			
Adj. Flow (vph)	0	0	288	0	0	613			
Shared Lane Traffic (%)									
Lane Group Flow (vph)	0	0	288	0	0	613			
Turn Type			Prot			custom			
Protected Phases			8!			Free!	2	4	6
Permitted Phases									
Detector Phase			8						
Switch Phase									
Minimum Initial (s)			7.0				10.0	7.0	7.0
Minimum Split (s)			19.9				18.9	21.9	19.9
Total Split (s)			70.0				50.0	70.0	50.0
Total Split (%)			58.3%				42%	58%	42%
Yellow Time (s)			3.9				3.8	3.9	3.9
All-Red Time (s)			4.0				5.1	4.0	4.0
Lost Time Adjust (s)			-2.9						
Total Lost Time (s)			5.0						
Lead/Lag									
Lead-Lag Optimize?									
Recall Mode			None				C-Max	None	C-Max
Act Effct Green (s)			56.5			120.0			
Actuated g/C Ratio			0.47			1.00			
v/c Ratio			0.18			0.22			
Control Delay			17.8			1.3			
Queue Delay			0.1			0.0			
Total Delay			17.9			1.3			
LOS			B			A			
Approach Delay			17.9		1.3				
Approach LOS			B		A				
Queue Length 50th (ft)			64			20			
Queue Length 95th (ft)			79			38			
Internal Link Dist (ft)	129		135		102				
Turn Bay Length (ft)									
Base Capacity (vph)			1859			2787			

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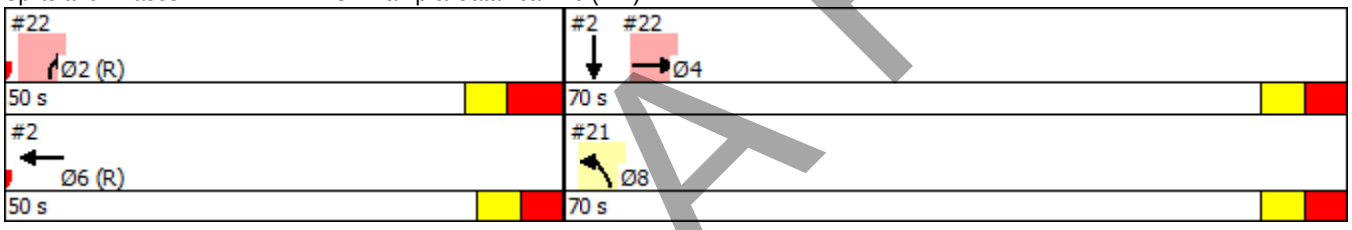
Lane Group	EBL	EBR	NBL	NBR	SWL	SWR	Ø2	Ø4	Ø6
Starvation Cap Reductn			0			0			
Spillback Cap Reductn			640			519			
Storage Cap Reductn			0			0			
Reduced v/c Ratio			0.24			0.27			

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 65 (54%), Referenced to phase 2:NBR and 6:, Start of Green
Natural Cycle: 50
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.75
Intersection Signal Delay: 6.6 Intersection LOS: A
Intersection Capacity Utilization 17.7% ICU Level of Service A
Analysis Period (min) 15
! Phase conflict between lane groups.

Splits and Phases: 21: I-77 NB Off-Ramp & Catawba Ave (WB)



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Lane Group	EBT	EBR	WBL	WBT	NBL	NBR	Ø6	Ø8
Lane Configurations								
Traffic Volume (vph)	1124	0	0	0	0	88		
Future Volume (vph)	1124	0	0	0	0	88		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900		
Grade (%)	0%			0%	4%			
Lane Util. Factor	0.95	1.00	1.00	1.00	1.00	1.00		
Frt						0.865		
Flt Protected								
Satd. Flow (prot)	3539	0	0	0	0	1579		
Flt Permitted								
Satd. Flow (perm)	3539	0	0	0	0	1579		
Right Turn on Red		No				No		
Satd. Flow (RTOR)								
Link Speed (mph)	35			35	35			
Link Distance (ft)	128			116	197			
Travel Time (s)	2.5			2.3	3.8			
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90		
Adj. Flow (vph)	1249	0	0	0	0	98		
Shared Lane Traffic (%)								
Lane Group Flow (vph)	1249	0	0	0	0	98		
Turn Type	NA					Prot		
Protected Phases	4					2	6	8
Permitted Phases								
Detector Phase	4					2		
Switch Phase								
Minimum Initial (s)	7.0					10.0	7.0	7.0
Minimum Split (s)	21.9					18.9	19.9	19.9
Total Split (s)	70.0					50.0	50.0	70.0
Total Split (%)	58.3%					41.7%	42%	58%
Yellow Time (s)	3.9					3.8	3.9	3.9
All-Red Time (s)	4.0					5.1	4.0	4.0
Lost Time Adjust (s)	-2.9					-3.9		
Total Lost Time (s)	5.0					5.0		
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None					C-Max	C-Max	None
Act Effct Green (s)	56.5					53.5		
Actuated g/C Ratio	0.47					0.45		
v/c Ratio	0.75					0.14		
Control Delay	3.2					22.4		
Queue Delay	0.0					0.0		
Total Delay	3.2					22.4		
LOS	A					C		
Approach Delay	3.2				22.4			
Approach LOS	A				C			
Queue Length 50th (ft)	6					44		
Queue Length 95th (ft)	6					90		
Internal Link Dist (ft)	48			36	117			
Turn Bay Length (ft)								

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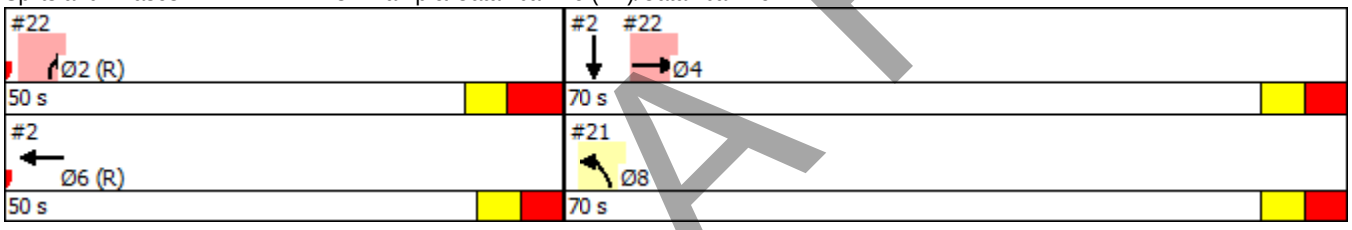
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR	Ø6	Ø8
Base Capacity (vph)	1916					704		
Starvation Cap Reductn	15					0		
Spillback Cap Reductn	0					0		
Storage Cap Reductn	0					0		
Reduced v/c Ratio	0.66					0.14		

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 65 (54%), Referenced to phase 2:NBR and 6:, Start of Green
Natural Cycle: 50
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.75
Intersection Signal Delay: 4.6 Intersection LOS: A
Intersection Capacity Utilization 55.4% ICU Level of Service B
Analysis Period (min) 15

Splits and Phases: 22: I-77 NB Off-Ramp & Catawba Ave (EB)/Catawba Ave



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Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	41	612	560	110	514	14	522	24	100	27	25	42
Future Volume (vph)	41	612	560	110	514	14	522	24	100	27	25	42
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		-2%			1%			3%			5%	
Storage Length (ft)	100		0	100		0	150		150	75		0
Storage Lanes	1		1	1		0	1		1	1		0
Taper Length (ft)	100			100			100			100		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	1.00	1.00	1.00	1.00
Frt			0.850		0.996				0.850		0.906	
Flt Protected	0.950			0.950			0.950	0.956		0.950		
Satd. Flow (prot)	1787	1881	1599	1761	1846	0	1656	1666	1560	1725	1645	0
Flt Permitted	0.246			0.117			0.950	0.956		0.950		
Satd. Flow (perm)	463	1881	1599	217	1846	0	1656	1666	1560	1725	1645	0
Right Turn on Red			No			No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)		35			35			35			35	
Link Distance (ft)		229			323			537			507	
Travel Time (s)		4.5			6.3			10.5			9.9	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	46	680	622	122	571	16	580	27	111	30	28	47
Shared Lane Traffic (%)							48%					
Lane Group Flow (vph)	46	680	622	122	587	0	302	305	111	30	75	0
Turn Type	pm+pt	NA	pm+ov	pm+pt	NA		Split	NA	pm+ov	Split	NA	
Protected Phases	5	2	3	1	6		3	3	1	4	4	
Permitted Phases	2		2	6					3			
Detector Phase	5	2	3	1	6		3	3	1	4	4	
Switch Phase												
Minimum Initial (s)	7.0	10.0	7.0	7.0	10.0		7.0	7.0	7.0	7.0	7.0	
Minimum Split (s)	13.3	31.4	28.3	13.2	28.4		28.3	28.3	13.2	12.9	12.9	
Total Split (s)	17.0	49.0	37.0	17.0	49.0		37.0	37.0	17.0	17.0	17.0	
Total Split (%)	14.2%	40.8%	30.8%	14.2%	40.8%		30.8%	30.8%	14.2%	14.2%	14.2%	
Yellow Time (s)	3.0	4.0	3.7	3.0	4.0		3.7	3.7	3.0	3.6	3.6	
All-Red Time (s)	3.3	2.4	2.6	3.2	2.4		2.6	2.6	3.2	2.3	2.3	
Lost Time Adjust (s)	-1.3	-1.4	-1.4	-1.2	-1.4		-1.3	-1.3	-1.2	-0.9	-0.9	
Total Lost Time (s)	5.0	5.0	4.9	5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Lead/Lag	Lead	Lag	Lead	Lead	Lag		Lead	Lead	Lead	Lag	Lag	
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	
Recall Mode	None	C-Max	None	None	C-Max		None	None	None	None	None	
Act Effct Green (s)	61.9	53.4	86.9	66.1	57.7		28.4	28.4	39.4	10.7	10.7	
Actuated g/C Ratio	0.52	0.44	0.72	0.55	0.48		0.24	0.24	0.33	0.09	0.09	
v/c Ratio	0.14	0.81	0.54	0.49	0.66		0.77	0.77	0.22	0.20	0.51	
Control Delay	4.6	30.8	24.4	21.2	32.2		56.2	56.4	18.8	53.1	64.4	
Queue Delay	0.0	50.9	27.7	0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Total Delay	4.6	81.7	52.1	21.2	32.2		56.2	56.4	18.8	53.1	64.4	
LOS	A	F	D	C	C		E	E	B	D	E	
Approach Delay		65.4			30.3			50.5			61.2	
Approach LOS		E			C			D			E	
Queue Length 50th (ft)	7	563	504	47	387		225	227	43	22	56	

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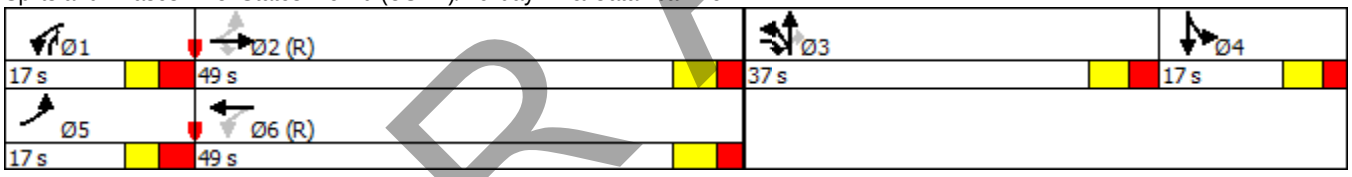
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 95th (ft)	m12	#787	624	83	#559		329	332	70	52	107	
Internal Link Dist (ft)		149			243			457			427	
Turn Bay Length (ft)	100			100			150		150	75		
Base Capacity (vph)	384	837	1206	276	888		441	444	538	172	164	
Starvation Cap Reductn	0	254	602	0	0		0	0	0	0	0	
Spillback Cap Reductn	0	0	0	0	0		0	0	0	0	0	
Storage Cap Reductn	0	0	0	0	0		0	0	0	0	0	
Reduced v/c Ratio	0.12	1.17	1.03	0.44	0.66		0.68	0.69	0.21	0.17	0.46	

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 35 (29%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.81
Intersection Signal Delay: 52.9 Intersection LOS: D
Intersection Capacity Utilization 72.6% ICU Level of Service C
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 3: Statesville Rd (US 21)/Holiday Ln & Catawba Ave



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Intersection

Int Delay, s/veh 0.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	5	726	7	4	626	4	5	4	8	4	4	6
Future Vol, veh/h	5	726	7	4	626	4	5	4	8	4	4	6
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	50	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	6	807	8	4	696	4	6	4	9	4	4	7

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	700	0	0	814	0	0	1534	1531	811	1535	1533	698
Stage 1	-	-	-	-	-	-	822	822	-	707	707	-
Stage 2	-	-	-	-	-	-	712	709	-	828	826	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	897	-	-	813	-	-	95	117	379	95	116	440
Stage 1	-	-	-	-	-	-	368	388	-	426	438	-
Stage 2	-	-	-	-	-	-	423	437	-	365	387	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	897	-	-	813	-	-	90	115	379	89	114	440
Mov Cap-2 Maneuver	-	-	-	-	-	-	90	115	-	89	114	-
Stage 1	-	-	-	-	-	-	366	385	-	423	434	-
Stage 2	-	-	-	-	-	-	409	434	-	350	384	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.1	0.1	31.8	32
HCM LOS			D	D

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	153	897	-	-	813	-	-	149
HCM Lane V/C Ratio	0.123	0.006	-	-	0.005	-	-	0.104
HCM Control Delay (s)	31.8	9	-	-	9.5	0	-	32
HCM Lane LOS	D	A	-	-	A	A	-	D
HCM 95th %tile Q(veh)	0.4	0	-	-	0	-	-	0.3

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Summary of All Intervals

Run Number	1	2	3	4	5	Avg
Start Time	6:50	6:50	6:50	6:50	6:50	6:50
End Time	8:00	8:00	8:00	8:00	8:00	8:00
Total Time (min)	70	70	70	70	70	70
Time Recorded (min)	60	60	60	60	60	60
# of Intervals	5	5	5	5	5	5
# of Recorded Intervals	4	4	4	4	4	4
Vehs Entered	4576	4590	4618	4527	4611	4584
Vehs Exited	4548	4607	4602	4474	4595	4565
Starting Vehs	142	169	160	125	149	146
Ending Vehs	170	152	176	178	165	168
Travel Distance (mi)	1886	1915	1916	1870	1920	1901
Travel Time (hr)	178.8	240.3	253.4	227.1	272.1	234.3
Total Delay (hr)	112.5	173.2	186.0	161.4	204.9	167.6
Total Stops	7047	8044	7687	7487	7656	7584
Fuel Used (gal)	100.4	116.1	118.4	111.3	124.1	114.1

Interval #0 Information Seeding

Start Time	6:50
End Time	7:00
Total Time (min)	10

Volumes adjusted by Growth Factors.
No data recorded this interval.

Interval #1 Information 1

Start Time	7:00
End Time	7:15
Total Time (min)	15

Volumes adjusted by Growth Factors, Anti PHF.

Run Number	1	2	3	4	5	Avg
Vehs Entered	1122	1139	1157	1130	1147	1137
Vehs Exited	1129	1136	1153	1068	1111	1120
Starting Vehs	142	169	160	125	149	146
Ending Vehs	135	172	164	187	185	166
Travel Distance (mi)	466	474	481	454	469	469
Travel Time (hr)	37.0	43.1	40.5	36.6	50.9	41.6
Total Delay (hr)	20.7	26.5	23.6	20.8	34.5	25.2
Total Stops	1598	1937	1761	1608	1903	1761
Fuel Used (gal)	23.1	24.9	24.3	22.3	26.5	24.2

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Interval #2 Information 2

Start Time 7:15
End Time 7:30
Total Time (min) 15
Volumes adjusted by PHF, Growth Factors.

Run Number	1	2	3	4	5	Avg
Vehs Entered	1219	1249	1210	1192	1193	1212
Vehs Exited	1171	1215	1198	1185	1191	1192
Starting Vehs	135	172	164	187	185	166
Ending Vehs	183	206	176	194	187	186
Travel Distance (mi)	490	512	497	493	494	497
Travel Time (hr)	42.8	61.8	64.0	59.1	68.2	59.2
Total Delay (hr)	25.4	43.8	46.6	41.6	50.7	41.6
Total Stops	1867	2293	2085	2070	2090	2077
Fuel Used (gal)	24.9	30.9	30.6	29.5	31.8	29.6

Interval #3 Information 3

Start Time 7:30
End Time 7:45
Total Time (min) 15
Volumes adjusted by Growth Factors, Anti PHF.

Run Number	1	2	3	4	5	Avg
Vehs Entered	1139	1094	1160	1119	1155	1134
Vehs Exited	1151	1136	1157	1156	1173	1154
Starting Vehs	183	206	176	194	187	186
Ending Vehs	171	164	179	157	169	166
Travel Distance (mi)	473	461	484	478	489	477
Travel Time (hr)	49.5	70.1	74.5	66.4	79.9	68.1
Total Delay (hr)	32.8	53.9	57.5	49.7	62.8	51.4
Total Stops	1886	1994	2034	1979	1967	1972
Fuel Used (gal)	26.4	30.7	32.3	30.4	34.1	30.8

Interval #4 Information 4

Start Time 7:45
End Time 8:00
Total Time (min) 15
Volumes adjusted by Growth Factors, Anti PHF.

Run Number	1	2	3	4	5	Avg
Vehs Entered	1096	1108	1091	1086	1116	1099
Vehs Exited	1097	1120	1094	1065	1120	1098
Starting Vehs	171	164	179	157	169	166
Ending Vehs	170	152	176	178	165	168
Travel Distance (mi)	457	468	454	446	468	458
Travel Time (hr)	49.6	65.3	74.4	65.0	73.2	65.5
Total Delay (hr)	33.6	49.0	58.4	49.2	56.9	49.4
Total Stops	1696	1820	1807	1830	1696	1768
Fuel Used (gal)	25.9	29.6	31.3	29.1	31.6	29.5

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Intersection: 1: Catawba Ave (WB) & Catawba Ave (EB)

Movement	EB	EB	EB	NW	NW
Directions Served	T	T	T	T	T
Maximum Queue (ft)	198	176	182	154	146
Average Queue (ft)	172	101	106	129	130
95th Queue (ft)	200	187	183	149	138
Link Distance (ft)	60	60	60	46	46
Upstream Blk Time (%)	51	29	20	39	46
Queuing Penalty (veh)	224	127	88	153	178
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 2: Catawba Ave (EB) & Catawba Ave (WB)

Movement	WB	WB	SB	SB
Directions Served	T	T	T	T
Maximum Queue (ft)	162	150	168	167
Average Queue (ft)	133	110	154	146
95th Queue (ft)	171	163	173	182
Link Distance (ft)	74	74	86	86
Upstream Blk Time (%)	40	27	42	33
Queuing Penalty (veh)	110	76	239	186
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 3: Statesville Rd (US 21)/Holiday Ln & Catawba Ave

Movement	EB	EB	EB	WB	WB	NB	NB	NB	SB	SB
Directions Served	L	T	R	L	TR	L	LT	R	L	TR
Maximum Queue (ft)	169	231	232	200	339	250	512	250	68	132
Average Queue (ft)	48	210	188	84	211	197	320	95	20	63
95th Queue (ft)	149	270	272	177	340	295	492	262	51	111
Link Distance (ft)		170	170		245		487			459
Upstream Blk Time (%)	0	17	12		7		4			
Queuing Penalty (veh)	0	104	75		47		0			
Storage Bay Dist (ft)	100			100		150		150	75	
Storage Blk Time (%)	0	20		3	27	2	51		1	14
Queuing Penalty (veh)	0	8		15	30	10	185		0	4

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Intersection: 4: Hill St/Burton Ln & Catawba Ave

Movement	EB	EB	WB	NB	SB
Directions Served	L	TR	LTR	LTR	LTR
Maximum Queue (ft)	21	6	174	53	30
Average Queue (ft)	2	0	18	12	7
95th Queue (ft)	12	4	91	38	23
Link Distance (ft)		245	536	466	423
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)	50				
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 11: Catawba Ave (EB) & I-77 SB Off-Ramp

Movement	EB	EB	EB	SB	SB
Directions Served	T	T	T	L	L
Maximum Queue (ft)	90	111	58	163	182
Average Queue (ft)	69	32	13	141	139
95th Queue (ft)	94	87	44	177	195
Link Distance (ft)	40	40	40	89	89
Upstream Blk Time (%)	46	17	4	34	29
Queuing Penalty (veh)	200	76	18	105	89
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 12: Catawba Ave/Catawba Ave (WB) & I-77 SB Off-Ramp

Movement	WB	WB	SB	SB
Directions Served	T	T	R	R
Maximum Queue (ft)	13	32	173	156
Average Queue (ft)	1	6	153	118
95th Queue (ft)	7	22	171	163
Link Distance (ft)	56	56	89	89
Upstream Blk Time (%)		0	40	19
Queuing Penalty (veh)		0	181	89
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

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Intersection: 14: Catawba Ave (EB) & I-77 NB On-Ramp

Movement	EB	EB	EB
Directions Served	L	T	T
Maximum Queue (ft)	97	239	232
Average Queue (ft)	12	124	84
95th Queue (ft)	57	258	201
Link Distance (ft)	143	143	143
Upstream Blk Time (%)		13	5
Queuing Penalty (veh)		85	29
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 15: Catawba Ave

Movement	WB	WB	NE	NE
Directions Served	T	T	R	R
Maximum Queue (ft)	117	171	126	151
Average Queue (ft)	7	27	86	62
95th Queue (ft)	47	108	160	158
Link Distance (ft)	170	170	61	61
Upstream Blk Time (%)	0	0	14	8
Queuing Penalty (veh)	1	2	87	48
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 17: I-77 SB On-Ramp & Catawba Ave (WB)

Movement	WB	WB
Directions Served	LT	T
Maximum Queue (ft)	201	246
Average Queue (ft)	123	162
95th Queue (ft)	196	255
Link Distance (ft)	139	139
Upstream Blk Time (%)	6	12
Queuing Penalty (veh)	27	49
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

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Intersection: 18: I-77 NB On-Ramp

Movement	EB	WB
Directions Served	L	R
Maximum Queue (ft)	211	151
Average Queue (ft)	101	51
95th Queue (ft)	217	156
Link Distance (ft)	143	71
Upstream Blk Time (%)	6	2
Queuing Penalty (veh)	48	11
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 19: I-77 SB On-Ramp

Movement	SB	SE
Directions Served	T	R
Maximum Queue (ft)	40	51
Average Queue (ft)	4	2
95th Queue (ft)	50	36
Link Distance (ft)	111	137
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 21: I-77 NB Off-Ramp & Catawba Ave (WB)

Movement	NB	NB	SW	SW
Directions Served	L	L	R	R
Maximum Queue (ft)	115	178	56	35
Average Queue (ft)	41	88	3	1
95th Queue (ft)	111	158	26	17
Link Distance (ft)	116	116	78	78
Upstream Blk Time (%)	0	4	1	0
Queuing Penalty (veh)	0	5	2	1
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

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Intersection: 22: I-77 NB Off-Ramp & Catawba Ave (EB)/Catawba Ave

Movement	EB	EB	NB
Directions Served	T	T	R
Maximum Queue (ft)	170	167	129
Average Queue (ft)	90	46	56
95th Queue (ft)	197	137	112
Link Distance (ft)	86	86	110
Upstream Blk Time (%)	15	5	1
Queuing Penalty (veh)	84	29	1
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 24: I-77 SB On-Ramp & Catawba Ave/Catawba Ave (EB)

Movement	EB	EB	EB
Directions Served	T	T	TR
Maximum Queue (ft)	114	194	104
Average Queue (ft)	107	167	10
95th Queue (ft)	135	221	52
Link Distance (ft)		115	115
Upstream Blk Time (%)	25	38	0
Queuing Penalty (veh)	0	272	1
Storage Bay Dist (ft)	50		
Storage Blk Time (%)	47	4	
Queuing Penalty (veh)	203	16	

Intersection: 26: Catawba Ave

Movement	EB	EB
Directions Served	T	T
Maximum Queue (ft)	620	597
Average Queue (ft)	516	414
95th Queue (ft)	830	811
Link Distance (ft)	578	578
Upstream Blk Time (%)	48	8
Queuing Penalty (veh)	0	0
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

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Intersection: 27: I-77 SB Off-Ramp

Movement	SB	SB	SB	SB
Directions Served	L	L	R	R
Maximum Queue (ft)	160	146	305	259
Average Queue (ft)	50	28	182	121
95th Queue (ft)	129	94	293	265
Link Distance (ft)			909	
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)	450	450		450
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 28: I-77 NB Off-Ramp

Movement	NB
Directions Served	L
Maximum Queue (ft)	4
Average Queue (ft)	0
95th Queue (ft)	3
Link Distance (ft)	801
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 29: Bend

Movement	NB	NB
Directions Served	T	
Maximum Queue (ft)	348	346
Average Queue (ft)	244	46
95th Queue (ft)	485	232
Link Distance (ft)	275	275
Upstream Blk Time (%)	13	1
Queuing Penalty (veh)	86	9
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

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Intersection: 30: Catawba Ave (WB)/Catawba Ave & I-77 NB On-Ramp

Movement	WB	WB
Directions Served	T	TR
Maximum Queue (ft)	110	120
Average Queue (ft)	49	50
95th Queue (ft)	111	128
Link Distance (ft)	59	59
Upstream Blk Time (%)	7	8
Queuing Penalty (veh)	39	43
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Network Summary

Network wide Queuing Penalty: 3792

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APPENDIX F-4:
CAPACITY ANALYSIS RESULTS

2018 NO-BUILD CONDITIONS
PM PEAK HOUR

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Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations		↑↑↑									↑↑	
Traffic Volume (vph)	0	1292	0	0	0	0	0	0	0	0	1082	0
Future Volume (vph)	0	1292	0	0	0	0	0	0	0	0	1082	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		2%			0%			0%			-2%	
Lane Util. Factor	1.00	0.91	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00
Frt												
Flt Protected												
Satd. Flow (prot)	0	5034	0	0	0	0	0	0	0	0	3575	0
Flt Permitted												
Satd. Flow (perm)	0	5034	0	0	0	0	0	0	0	0	3575	0
Right Turn on Red	No		No			No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)		35			35			35			35	
Link Distance (ft)		142			217			115			211	
Travel Time (s)		2.8			4.2			2.2			4.1	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	1436	0	0	0	0	0	0	0	0	1202	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	1436	0	0	0	0	0	0	0	0	1202	0
Turn Type		NA									NA	
Protected Phases		2									8	
Permitted Phases												
Detector Phase		2									8	
Switch Phase												
Minimum Initial (s)		10.0									10.0	
Minimum Split (s)		24.3									26.1	
Total Split (s)		60.0									60.0	
Total Split (%)		50.0%									50.0%	
Yellow Time (s)		3.7									4.0	
All-Red Time (s)		5.6									4.1	
Lost Time Adjust (s)		-4.3									-3.1	
Total Lost Time (s)		5.0									5.0	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode		C-Max									None	
Act Effct Green (s)		56.6									53.4	
Actuated g/C Ratio		0.47									0.44	
v/c Ratio		0.61									0.76	
Control Delay		25.1									27.2	
Queue Delay		0.0									33.5	
Total Delay		25.1									60.8	
LOS		C									E	
Approach Delay		25.1									60.8	
Approach LOS		C									E	
Queue Length 50th (ft)		301									281	
Queue Length 95th (ft)		352									321	
Internal Link Dist (ft)		62			137			35			131	
Turn Bay Length (ft)												

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Lane Group	Ø4	Ø6
Lane Configurations		
Traffic Volume (vph)		
Future Volume (vph)		
Ideal Flow (vphpl)		
Grade (%)		
Lane Util. Factor		
Frt		
Flt Protected		
Satd. Flow (prot)		
Flt Permitted		
Satd. Flow (perm)		
Right Turn on Red		
Satd. Flow (RTOR)		
Link Speed (mph)		
Link Distance (ft)		
Travel Time (s)		
Peak Hour Factor		
Adj. Flow (vph)		
Shared Lane Traffic (%)		
Lane Group Flow (vph)		
Turn Type		
Protected Phases	4	6
Permitted Phases		
Detector Phase		
Switch Phase		
Minimum Initial (s)	10.0	10.0
Minimum Split (s)	21.1	19.3
Total Split (s)	60.0	60.0
Total Split (%)	50%	50%
Yellow Time (s)	4.0	3.7
All-Red Time (s)	4.1	5.6
Lost Time Adjust (s)		
Total Lost Time (s)		
Lead/Lag		
Lead-Lag Optimize?		
Recall Mode	None	C-Max
Act Effct Green (s)		
Actuated g/C Ratio		
v/c Ratio		
Control Delay		
Queue Delay		
Total Delay		
LOS		
Approach Delay		
Approach LOS		
Queue Length 50th (ft)		
Queue Length 95th (ft)		
Internal Link Dist (ft)		
Turn Bay Length (ft)		

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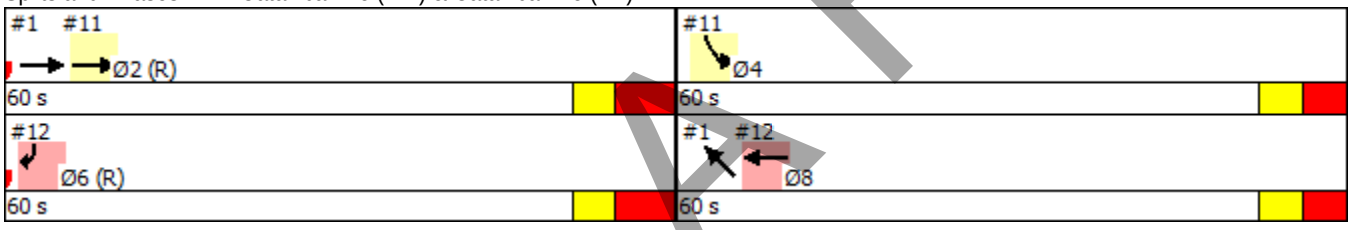
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Base Capacity (vph)		2372									1638	
Starvation Cap Reductn		0									506	
Spillback Cap Reductn		0									0	
Storage Cap Reductn		0									0	
Reduced v/c Ratio		0.61									1.06	

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 70 (58%), Referenced to phase 2:EBT and 6:, Start of Green
Natural Cycle: 55
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.76
Intersection Signal Delay: 41.4 Intersection LOS: D
Intersection Capacity Utilization 63.2% ICU Level of Service B
Analysis Period (min) 15

Splits and Phases: 1: Catawba Ave (WB) & Catawba Ave (EB)



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Lane Group	Ø4	Ø6
Base Capacity (vph)		
Starvation Cap Reductn		
Spillback Cap Reductn		
Storage Cap Reductn		
Reduced v/c Ratio		

Intersection Summary

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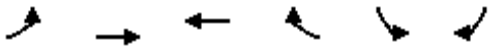

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR	Ø6	Ø8
Lane Configurations								
Traffic Volume (vph)	0	1292	0	0	341	0		
Future Volume (vph)	0	1292	0	0	341	0		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900		
Grade (%)		2%	0%		-1%			
Lane Util. Factor	1.00	0.91	1.00	1.00	0.97	1.00		
Frt								
Flt Protected					0.950			
Satd. Flow (prot)	0	5034	0	0	3450	0		
Flt Permitted					0.950			
Satd. Flow (perm)	0	5034	0	0	3450	0		
Right Turn on Red				No	No	No		
Satd. Flow (RTOR)								
Link Speed (mph)		35	35		35			
Link Distance (ft)		217	199		185			
Travel Time (s)		4.2	3.9		3.6			
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90		
Adj. Flow (vph)	0	1436	0	0	379	0		
Shared Lane Traffic (%)								
Lane Group Flow (vph)	0	1436	0	0	379	0		
Turn Type		NA			Prot			
Protected Phases		2			4		6	8
Permitted Phases								
Detector Phase		2			4			
Switch Phase								
Minimum Initial (s)		10.0			10.0		10.0	10.0
Minimum Split (s)		24.3			21.1		19.3	26.1
Total Split (s)		60.0			60.0		60.0	60.0
Total Split (%)		50.0%			50.0%		50%	50%
Yellow Time (s)		3.7			4.0		3.7	4.0
All-Red Time (s)		5.6			4.1		5.6	4.1
Lost Time Adjust (s)		-4.3			-3.1			
Total Lost Time (s)		5.0			5.0			
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode		C-Max			None		C-Max	None
Act Effct Green (s)		56.6			53.4			
Actuated g/C Ratio		0.47			0.44			
v/c Ratio		0.61			0.25			
Control Delay		3.1			20.9			
Queue Delay		0.5			0.0			
Total Delay		3.6			20.9			
LOS		A			C			
Approach Delay		3.6			20.9			
Approach LOS		A			C			
Queue Length 50th (ft)		15			90			
Queue Length 95th (ft)		17			123			
Internal Link Dist (ft)		137	119		105			
Turn Bay Length (ft)								

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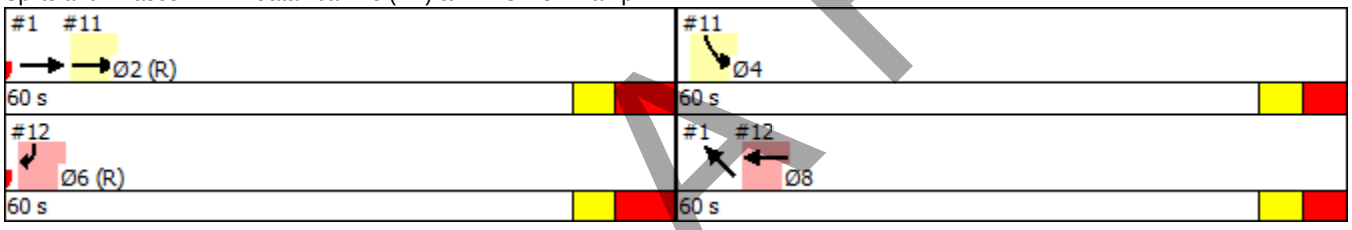
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR	Ø6	Ø8
Base Capacity (vph)		2372			1581			
Starvation Cap Reductn		0			0			
Spillback Cap Reductn		470			0			
Storage Cap Reductn		0			0			
Reduced v/c Ratio		0.75			0.24			

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 70 (58%), Referenced to phase 2:EBT and 6:, Start of Green
Natural Cycle: 55
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.76
Intersection Signal Delay: 7.3 Intersection LOS: A
Intersection Capacity Utilization 54.7% ICU Level of Service A
Analysis Period (min) 15

Splits and Phases: 11: Catawba Ave (EB) & I-77 SB Off-Ramp



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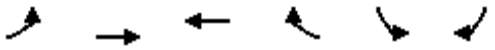

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR	Ø2	Ø4
Lane Configurations								
Traffic Volume (vph)	0	0	1082	0	0	645		
Future Volume (vph)	0	0	1082	0	0	645		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900		
Grade (%)		0%	0%		4%			
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.88		
Frt						0.850		
Flt Protected								
Satd. Flow (prot)	0	0	3539	0	0	2731		
Flt Permitted								
Satd. Flow (perm)	0	0	3539	0	0	2731		
Right Turn on Red				No		No		
Satd. Flow (RTOR)								
Link Speed (mph)		35	35		35			
Link Distance (ft)		202	115		181			
Travel Time (s)		3.9	2.2		3.5			
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90		
Adj. Flow (vph)	0	0	1202	0	0	717		
Shared Lane Traffic (%)								
Lane Group Flow (vph)	0	0	1202	0	0	717		
Turn Type			NA			Prot		
Protected Phases			8			6	2	4
Permitted Phases								
Detector Phase			8			6		
Switch Phase								
Minimum Initial (s)			10.0			10.0	10.0	10.0
Minimum Split (s)			26.1			19.3	24.3	21.1
Total Split (s)			60.0			60.0	60.0	60.0
Total Split (%)			50.0%			50.0%	50%	50%
Yellow Time (s)			4.0			3.7	3.7	4.0
All-Red Time (s)			4.1			5.6	5.6	4.1
Lost Time Adjust (s)			-3.1			-4.3		
Total Lost Time (s)			5.0			5.0		
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode			None			C-Max	C-Max	None
Act Effct Green (s)			53.4			56.6		
Actuated g/C Ratio			0.44			0.47		
v/c Ratio			0.76			0.56		
Control Delay			3.7			25.2		
Queue Delay			0.0			0.0		
Total Delay			3.7			25.2		
LOS			A			C		
Approach Delay			3.7		25.2			
Approach LOS			A		C			
Queue Length 50th (ft)			8			226		
Queue Length 95th (ft)			18			293		
Internal Link Dist (ft)		122	35		101			
Turn Bay Length (ft)								

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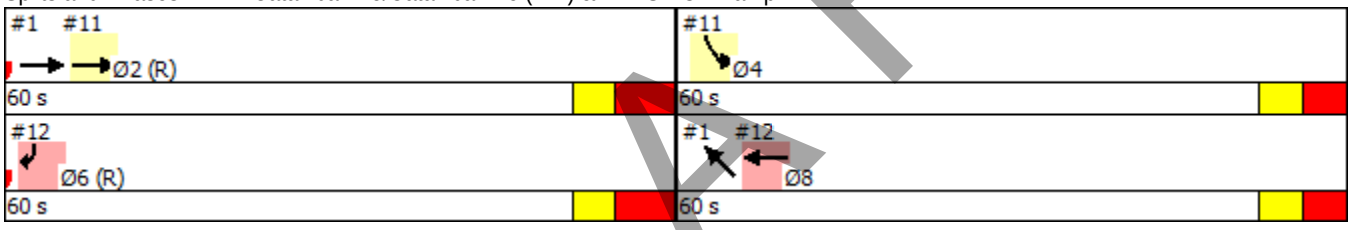
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR	Ø2	Ø4
Base Capacity (vph)			1622			1287		
Starvation Cap Reductn			6			0		
Spillback Cap Reductn			0			0		
Storage Cap Reductn			0			0		
Reduced v/c Ratio			0.74			0.56		

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 70 (58%), Referenced to phase 2:EBT and 6:, Start of Green
Natural Cycle: 55
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.76
Intersection Signal Delay: 11.7 Intersection LOS: B
Intersection Capacity Utilization 63.2% ICU Level of Service B
Analysis Period (min) 15

Splits and Phases: 12: Catawba Ave/Catawba Ave (WB) & I-77 SB Off-Ramp



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Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	0	747	0	0	0	0	0	1068	0
Future Volume (vph)	0	0	0	0	747	0	0	0	0	0	1068	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		0%			0%			0%			-1%	
Lane Util. Factor	1.00	1.00	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00	0.95	1.00
Frt												
Flt Protected												
Satd. Flow (prot)	0	0	0	0	3539	0	0	0	0	0	3557	0
Flt Permitted												
Satd. Flow (perm)	0	0	0	0	3539	0	0	0	0	0	3557	0
Right Turn on Red			No	No		No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)		35			35			35			35	
Link Distance (ft)		182			125			128			169	
Travel Time (s)		3.5			2.4			2.5			3.3	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	0	0	0	830	0	0	0	0	0	1187	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	0	830	0	0	0	0	0	1187	0
Turn Type					NA						NA	
Protected Phases					6						4	
Permitted Phases												
Detector Phase					6						4	
Switch Phase												
Minimum Initial (s)					7.0						7.0	
Minimum Split (s)					19.9						21.9	
Total Split (s)					60.0						60.0	
Total Split (%)					50.0%						50.0%	
Yellow Time (s)					3.9						3.9	
All-Red Time (s)					4.0						4.0	
Lost Time Adjust (s)					-2.0						-2.9	
Total Lost Time (s)					5.9						5.0	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode					C-Max						None	
Act Effct Green (s)					58.1						51.0	
Actuated g/C Ratio					0.48						0.42	
v/c Ratio					0.48						0.79	
Control Delay					27.1						28.7	
Queue Delay					0.8						1.0	
Total Delay					27.9						29.7	
LOS					C						C	
Approach Delay					27.9						29.7	
Approach LOS					C						C	
Queue Length 50th (ft)					208						450	
Queue Length 95th (ft)					267						533	
Internal Link Dist (ft)		102			45			48			89	
Turn Bay Length (ft)												

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Lane Group	Ø2	Ø8
Lane Configurations		
Traffic Volume (vph)		
Future Volume (vph)		
Ideal Flow (vphpl)		
Grade (%)		
Lane Util. Factor		
Frt		
Flt Protected		
Satd. Flow (prot)		
Flt Permitted		
Satd. Flow (perm)		
Right Turn on Red		
Satd. Flow (RTOR)		
Link Speed (mph)		
Link Distance (ft)		
Travel Time (s)		
Peak Hour Factor		
Adj. Flow (vph)		
Shared Lane Traffic (%)		
Lane Group Flow (vph)		
Turn Type		
Protected Phases	2	8
Permitted Phases		
Detector Phase		
Switch Phase		
Minimum Initial (s)	10.0	7.0
Minimum Split (s)	18.9	19.9
Total Split (s)	60.0	60.0
Total Split (%)	50%	50%
Yellow Time (s)	3.8	3.9
All-Red Time (s)	5.1	4.0
Lost Time Adjust (s)		
Total Lost Time (s)		
Lead/Lag		
Lead-Lag Optimize?		
Recall Mode	C-Max	None
Act Effct Green (s)		
Actuated g/C Ratio		
v/c Ratio		
Control Delay		
Queue Delay		
Total Delay		
LOS		
Approach Delay		
Approach LOS		
Queue Length 50th (ft)		
Queue Length 95th (ft)		
Internal Link Dist (ft)		
Turn Bay Length (ft)		

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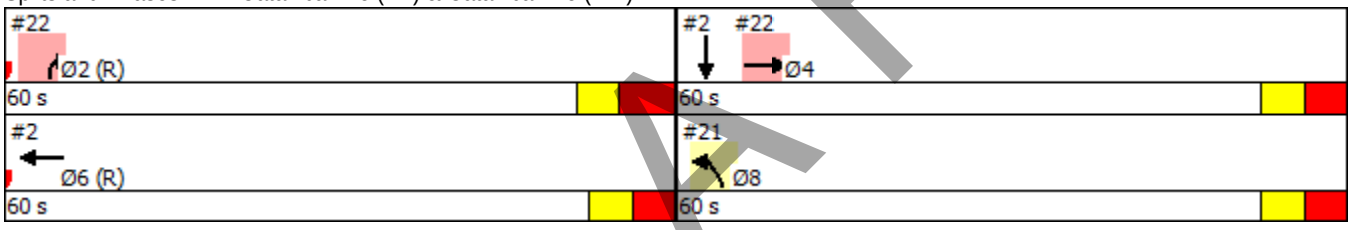
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Base Capacity (vph)					1714						1630	
Starvation Cap Reductn					541						209	
Spillback Cap Reductn					0						0	
Storage Cap Reductn					0						0	
Reduced v/c Ratio					0.71						0.84	

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 20 (17%), Referenced to phase 2:NBR and 6:, Start of Green
Natural Cycle: 50
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.79
Intersection Signal Delay: 28.9 Intersection LOS: C
Intersection Capacity Utilization 59.3% ICU Level of Service B
Analysis Period (min) 15

Splits and Phases: 2: Catawba Ave (EB) & Catawba Ave (WB)



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Lane Group	Ø2	Ø8
Base Capacity (vph)		
Starvation Cap Reductn		
Spillback Cap Reductn		
Storage Cap Reductn		
Reduced v/c Ratio		

Intersection Summary

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Lane Group	EBL	EBR	NBL	NBR	SWL	SWR	Ø2	Ø4	Ø6
Lane Configurations									
Traffic Volume (vph)	0	0	414	0	0	747			
Future Volume (vph)	0	0	414	0	0	747			
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900			
Lane Util. Factor	1.00	1.00	0.97	1.00	1.00	0.88			
Frt						0.850			
Flt Protected			0.950						
Satd. Flow (prot)	0	0	3433	0	0	2787			
Flt Permitted			0.950						
Satd. Flow (perm)	0	0	3433	0	0	2787			
Right Turn on Red		No	No	No		No			
Satd. Flow (RTOR)									
Link Speed (mph)	35		35		35				
Link Distance (ft)	209		215		182				
Travel Time (s)	4.1		4.2		3.5				
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90			
Adj. Flow (vph)	0	0	460	0	0	830			
Shared Lane Traffic (%)									
Lane Group Flow (vph)	0	0	460	0	0	830			
Turn Type			Prot			custom			
Protected Phases			8!			Free!	2	4	6
Permitted Phases									
Detector Phase			8						
Switch Phase									
Minimum Initial (s)			7.0				10.0	7.0	7.0
Minimum Split (s)			19.9				18.9	21.9	19.9
Total Split (s)			60.0				60.0	60.0	60.0
Total Split (%)			50.0%				50%	50%	50%
Yellow Time (s)			3.9				3.8	3.9	3.9
All-Red Time (s)			4.0				5.1	4.0	4.0
Lost Time Adjust (s)			-2.9						
Total Lost Time (s)			5.0						
Lead/Lag									
Lead-Lag Optimize?									
Recall Mode			None				C-Max	None	C-Max
Act Effct Green (s)			51.0			120.0			
Actuated g/C Ratio			0.42			1.00			
v/c Ratio			0.32			0.30			
Control Delay			23.1			1.9			
Queue Delay			0.0			0.0			
Total Delay			23.1			1.9			
LOS			C			A			
Approach Delay			23.1		1.9				
Approach LOS			C		A				
Queue Length 50th (ft)			117			40			
Queue Length 95th (ft)			150			45			
Internal Link Dist (ft)	129		135		102				
Turn Bay Length (ft)									
Base Capacity (vph)			1573			2787			

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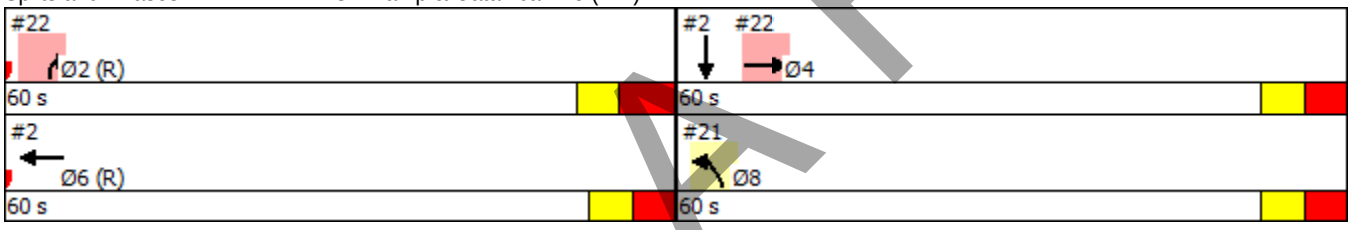
Lane Group	EBL	EBR	NBL	NBR	SWL	SWR	Ø2	Ø4	Ø6
Starvation Cap Reductn			0			0			
Spillback Cap Reductn			0			37			
Storage Cap Reductn			0			0			
Reduced v/c Ratio			0.29			0.30			

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 20 (17%), Referenced to phase 2:NBR and 6:, Start of Green
Natural Cycle: 50
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.79
Intersection Signal Delay: 9.4 Intersection LOS: A
Intersection Capacity Utilization 22.1% ICU Level of Service A
Analysis Period (min) 15
! Phase conflict between lane groups.

Splits and Phases: 21: I-77 NB Off-Ramp & Catawba Ave (WB)



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Lane Group	EBT	EBR	WBL	WBT	NBL	NBR	Ø6	Ø8
Lane Configurations								
Traffic Volume (vph)	1068	0	0	0	0	168		
Future Volume (vph)	1068	0	0	0	0	168		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900		
Grade (%)	0%			0%	4%			
Lane Util. Factor	0.95	1.00	1.00	1.00	1.00	1.00		
Frt						0.865		
Flt Protected								
Satd. Flow (prot)	3539	0	0	0	0	1579		
Flt Permitted								
Satd. Flow (perm)	3539	0	0	0	0	1579		
Right Turn on Red		No				No		
Satd. Flow (RTOR)								
Link Speed (mph)	35			35	35			
Link Distance (ft)	128			116	197			
Travel Time (s)	2.5			2.3	3.8			
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90		
Adj. Flow (vph)	1187	0	0	0	0	187		
Shared Lane Traffic (%)								
Lane Group Flow (vph)	1187	0	0	0	0	187		
Turn Type	NA					Prot		
Protected Phases	4					2	6	8
Permitted Phases								
Detector Phase	4					2		
Switch Phase								
Minimum Initial (s)	7.0					10.0	7.0	7.0
Minimum Split (s)	21.9					18.9	19.9	19.9
Total Split (s)	60.0					60.0	60.0	60.0
Total Split (%)	50.0%					50.0%	50%	50%
Yellow Time (s)	3.9					3.8	3.9	3.9
All-Red Time (s)	4.0					5.1	4.0	4.0
Lost Time Adjust (s)	-2.9					-3.9		
Total Lost Time (s)	5.0					5.0		
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None					C-Max	C-Max	None
Act Effct Green (s)	51.0					59.0		
Actuated g/C Ratio	0.42					0.49		
v/c Ratio	0.79					0.24		
Control Delay	3.6					19.6		
Queue Delay	0.0					0.0		
Total Delay	3.6					19.6		
LOS	A					B		
Approach Delay	3.6				19.6			
Approach LOS	A				B			
Queue Length 50th (ft)	6					83		
Queue Length 95th (ft)	0					139		
Internal Link Dist (ft)	48			36	117			
Turn Bay Length (ft)								

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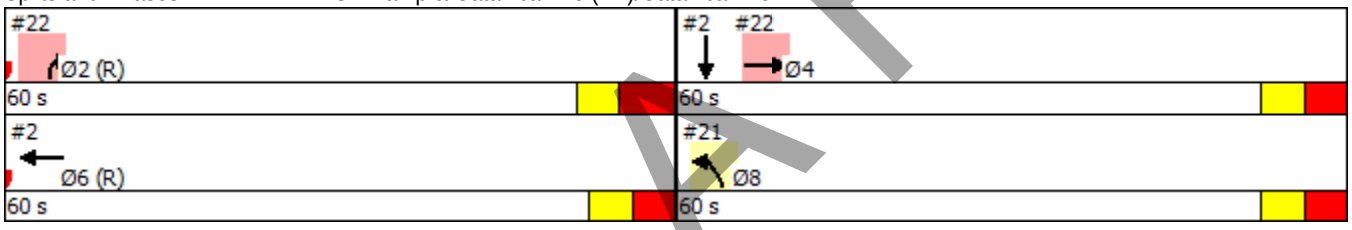
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR	Ø6	Ø8
Base Capacity (vph)	1622					776		
Starvation Cap Reductn	15					0		
Spillback Cap Reductn	0					0		
Storage Cap Reductn	0					0		
Reduced v/c Ratio	0.74					0.24		

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 20 (17%), Referenced to phase 2:NBR and 6:, Start of Green
Natural Cycle: 50
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.79
Intersection Signal Delay: 5.8 Intersection LOS: A
Intersection Capacity Utilization 59.3% ICU Level of Service B
Analysis Period (min) 15

Splits and Phases: 22: I-77 NB Off-Ramp & Catawba Ave (EB)/Catawba Ave



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Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	70	598	568	102	608	30	469	34	130	19	21	52
Future Volume (vph)	70	598	568	102	608	30	469	34	130	19	21	52
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		-2%			1%			3%			5%	
Storage Length (ft)	100		0	100		0	150		150	75		0
Storage Lanes	1		1	1		0	1		1	1		0
Taper Length (ft)	100			100			100			100		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	1.00	1.00	1.00	1.00
Frt			0.850		0.993				0.850		0.893	
Flt Protected	0.950			0.950			0.950	0.959		0.950		
Satd. Flow (prot)	1787	1881	1599	1761	1840	0	1656	1672	1560	1725	1622	0
Flt Permitted	0.136			0.142			0.950	0.959		0.950		
Satd. Flow (perm)	256	1881	1599	263	1840	0	1656	1672	1560	1725	1622	0
Right Turn on Red			No			No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)		35			35			35			35	
Link Distance (ft)		229			323			537			507	
Travel Time (s)		4.5			6.3			10.5			9.9	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	78	664	631	113	676	33	521	38	144	21	23	58
Shared Lane Traffic (%)							47%					
Lane Group Flow (vph)	78	664	631	113	709	0	276	283	144	21	81	0
Turn Type	pm+pt	NA	pm+ov	pm+pt	NA		Split	NA	pm+ov	Split	NA	
Protected Phases	5	2	3	1	6		3	3	1	4	4	
Permitted Phases	2		2	6					3			
Detector Phase	5	2	3	1	6		3	3	1	4	4	
Switch Phase												
Minimum Initial (s)	7.0	10.0	7.0	7.0	10.0		7.0	7.0	7.0	7.0	7.0	
Minimum Split (s)	13.3	31.4	28.3	13.2	28.4		28.3	28.3	13.2	12.9	12.9	
Total Split (s)	17.0	49.0	37.0	17.0	49.0		37.0	37.0	17.0	17.0	17.0	
Total Split (%)	14.2%	40.8%	30.8%	14.2%	40.8%		30.8%	30.8%	14.2%	14.2%	14.2%	
Yellow Time (s)	3.0	4.0	3.7	3.0	4.0		3.7	3.7	3.0	3.6	3.6	
All-Red Time (s)	3.3	2.4	2.6	3.2	2.4		2.6	2.6	3.2	2.3	2.3	
Lost Time Adjust (s)	-1.3	-1.4	-1.4	-1.2	-1.4		-1.3	-1.3	-1.2	-0.9	-0.9	
Total Lost Time (s)	5.0	5.0	4.9	5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Lead/Lag	Lead	Lag	Lead	Lead	Lag		Lead	Lead	Lead	Lag	Lag	
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	
Recall Mode	None	C-Max	None	None	C-Max		None	None	None	None	None	
Act Effct Green (s)	63.4	54.4	87.0	66.0	57.8		27.5	27.5	38.3	10.9	10.9	
Actuated g/C Ratio	0.53	0.45	0.72	0.55	0.48		0.23	0.23	0.32	0.09	0.09	
v/c Ratio	0.31	0.78	0.54	0.42	0.80		0.73	0.74	0.29	0.13	0.55	
Control Delay	26.5	56.4	16.9	19.1	38.8		53.8	54.5	20.5	51.6	66.5	
Queue Delay	0.0	51.3	0.6	0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Total Delay	26.5	107.6	17.5	19.1	38.8		53.8	54.5	20.5	51.6	66.5	
LOS	C	F	B	B	D		D	D	C	D	E	
Approach Delay		61.6			36.1			47.3			63.4	
Approach LOS		E			D			D			E	
Queue Length 50th (ft)	55	545	232	42	510		205	211	59	15	60	

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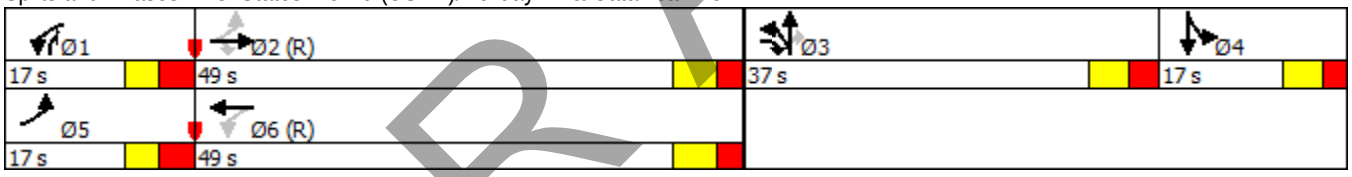
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 95th (ft)	m79	#766	329	77	#818		298	307	89	41	114	
Internal Link Dist (ft)		149			243			457			427	
Turn Bay Length (ft)	100			100			150		150	75		
Base Capacity (vph)	294	852	1218	297	886		441	445	527	173	162	
Starvation Cap Reductn	0	260	261	0	0		0	0	0	0	0	
Spillback Cap Reductn	0	0	0	0	0		0	0	0	0	0	
Storage Cap Reductn	0	0	0	0	0		0	0	0	0	0	
Reduced v/c Ratio	0.27	1.12	0.66	0.38	0.80		0.63	0.64	0.27	0.12	0.50	

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 35 (29%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.80
Intersection Signal Delay: 51.3 Intersection LOS: D
Intersection Capacity Utilization 72.7% ICU Level of Service C
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 3: Statesville Rd (US 21)/Holiday Ln & Catawba Ave



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Intersection

Int Delay, s/veh 1.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	4	725	19	4	720	4	14	4	4	4	4	6
Future Vol, veh/h	4	725	19	4	720	4	14	4	4	4	4	6
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	50	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	4	806	21	4	800	4	16	4	4	4	4	7

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	804	0	0	827	0	0	1642	1638	816	1640	1647	802
Stage 1	-	-	-	-	-	-	825	825	-	811	811	-
Stage 2	-	-	-	-	-	-	817	813	-	829	836	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	820	-	-	804	-	-	80	100	377	80	99	384
Stage 1	-	-	-	-	-	-	367	387	-	373	393	-
Stage 2	-	-	-	-	-	-	370	392	-	365	382	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	820	-	-	804	-	-	75	99	377	76	98	384
Mov Cap-2 Maneuver	-	-	-	-	-	-	75	99	-	76	98	-
Stage 1	-	-	-	-	-	-	365	385	-	371	389	-
Stage 2	-	-	-	-	-	-	356	388	-	355	380	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.1	0.1	57	37
HCM LOS			F	E

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	93	820	-	-	804	-	-	128
HCM Lane V/C Ratio	0.263	0.005	-	-	0.006	-	-	0.122
HCM Control Delay (s)	57	9.4	-	-	9.5	0	-	37
HCM Lane LOS	F	A	-	-	A	A	-	E
HCM 95th %tile Q(veh)	1	0	-	-	0	-	-	0.4

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Summary of All Intervals

Run Number	1	2	3	4	5	Avg
Start Time	4:50	4:50	4:50	4:50	4:50	4:50
End Time	6:00	6:00	6:00	6:00	6:00	6:00
Total Time (min)	70	70	70	70	70	70
Time Recorded (min)	60	60	60	60	60	60
# of Intervals	5	5	5	5	5	5
# of Recorded Intervals	4	4	4	4	4	4
Vehs Entered	626	307	265	227	2847	852
Vehs Exited	478	214	166	137	2785	756
Starting Vehs	207	292	273	265	219	250
Ending Vehs	355	385	372	355	281	345
Travel Distance (mi)	197	83	63	55	1186	317
Travel Time (hr)	2192.6	2421.1	2551.5	2572.8	1144.8	2176.6
Total Delay (hr)	2185.5	2418.0	2549.3	2570.9	1102.7	2165.3
Total Stops	773	368	326	284	4904	1332
Fuel Used (gal)	506.1	554.2	583.5	588.9	297.9	506.1

Interval #0 Information Seeding

Start Time	4:50
End Time	5:00
Total Time (min)	10

Volumes adjusted by Growth Factors.
No data recorded this interval.

Interval #1 Information 1

Start Time	5:00
End Time	5:15
Total Time (min)	15

Volumes adjusted by Growth Factors, Anti PHF.

Run Number	1	2	3	4	5	Avg
Vehs Entered	587	278	228	199	733	406
Vehs Exited	453	210	154	128	679	325
Starting Vehs	207	292	273	265	219	250
Ending Vehs	341	360	347	336	273	330
Travel Distance (mi)	191	82	60	52	289	135
Travel Time (hr)	137.0	181.2	195.3	207.9	103.8	165.0
Total Delay (hr)	130.1	178.1	193.2	206.1	93.5	160.2
Total Stops	733	343	298	261	1126	549
Fuel Used (gal)	36.9	43.9	46.4	49.2	32.4	41.7

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Interval #2 Information 2

Start Time 5:15
End Time 5:30
Total Time (min) 15
Volumes adjusted by PHF, Growth Factors.

Run Number	1	2	3	4	5	Avg
Vehs Entered	19	8	11	6	747	158
Vehs Exited	18	2	4	3	721	148
Starting Vehs	341	360	347	336	273	330
Ending Vehs	342	366	354	339	299	339
Travel Distance (mi)	4	1	1	1	314	64
Travel Time (hr)	385.8	461.5	491.1	503.0	222.8	412.9
Total Delay (hr)	385.6	461.5	491.0	503.0	211.6	410.6
Total Stops	24	7	9	5	1247	258
Fuel Used (gal)	88.2	105.3	112.0	115.0	60.3	96.1

Interval #3 Information 3

Start Time 5:30
End Time 5:45
Total Time (min) 15
Volumes adjusted by Growth Factors, Anti PHF.

Run Number	1	2	3	4	5	Avg
Vehs Entered	12	9	17	13	666	144
Vehs Exited	3	1	5	2	686	140
Starting Vehs	342	366	354	339	299	339
Ending Vehs	351	374	366	350	279	342
Travel Distance (mi)	1	0	1	1	284	57
Travel Time (hr)	693.1	751.2	789.9	794.0	354.1	676.5
Total Delay (hr)	693.1	751.2	789.9	793.9	344.0	674.4
Total Stops	10	8	14	12	1239	255
Fuel Used (gal)	158.2	171.2	180.0	181.2	89.7	156.1

Interval #4 Information 4

Start Time 5:45
End Time 6:00
Total Time (min) 15
Volumes adjusted by Growth Factors, Anti PHF.

Run Number	1	2	3	4	5	Avg
Vehs Entered	8	12	9	9	701	146
Vehs Exited	4	1	3	4	699	142
Starting Vehs	351	374	366	350	279	342
Ending Vehs	355	385	372	355	281	345
Travel Distance (mi)	1	0	1	1	299	60
Travel Time (hr)	976.7	1027.2	1075.2	1067.9	464.0	922.2
Total Delay (hr)	976.7	1027.2	1075.2	1067.9	453.5	920.1
Total Stops	6	10	5	6	1292	263
Fuel Used (gal)	222.8	233.9	245.0	243.6	115.4	212.2

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Intersection: 1: Catawba Ave (WB) & Catawba Ave (EB)

Movement	EB	EB	EB	NW	NW
Directions Served	T	T	T	T	T
Maximum Queue (ft)	111	179	97	130	140
Average Queue (ft)	64	170	23	36	43
95th Queue (ft)	198	176	100	121	142
Link Distance (ft)	60	60	60	46	46
Upstream Blk Time (%)	28	96	4	8	10
Queuing Penalty (veh)	119	415	19	43	52
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 2: Catawba Ave (EB) & Catawba Ave (WB)

Movement	WB	WB	SB	SB
Directions Served	T	T	T	T
Maximum Queue (ft)	129	131	147	139
Average Queue (ft)	129	131	145	38
95th Queue (ft)	139	146	159	143
Link Distance (ft)	74	74	86	86
Upstream Blk Time (%)	100	100	95	9
Queuing Penalty (veh)	374	374	505	48
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 3: Statesville Rd (US 21)/Holiday Ln & Catawba Ave

Movement	EB	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	T	R	L	TR	L	LT	L	TR
Maximum Queue (ft)	74	220	162	3	323	187	492	66	468
Average Queue (ft)	45	211	36	3	323	167	490	21	428
95th Queue (ft)	137	224	153	12	338	249	503	86	562
Link Distance (ft)		170	170		245		487		459
Upstream Blk Time (%)	0	87	2		100		100		83
Queuing Penalty (veh)	0	535	12		740		0		0
Storage Bay Dist (ft)	100			100		150		75	
Storage Blk Time (%)	19	68			100	80	100	20	100
Queuing Penalty (veh)	116	47			102	319	364	15	19

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Intersection: 4: Hill St/Burton Ln & Catawba Ave

Movement	EB	WB	NB	SB
Directions Served	L	LTR	LTR	LTR
Maximum Queue (ft)	9	535	393	349
Average Queue (ft)	3	532	204	175
95th Queue (ft)	15	543	430	362
Link Distance (ft)		536	466	423
Upstream Blk Time (%)		100	3	0
Queuing Penalty (veh)		0	0	0
Storage Bay Dist (ft)	50			
Storage Blk Time (%)	2			
Queuing Penalty (veh)	14			

Intersection: 11: Catawba Ave (EB) & I-77 SB Off-Ramp

Movement	EB	EB	EB	SB	SB
Directions Served	T	T	T	L	L
Maximum Queue (ft)	50	104	26	149	97
Average Queue (ft)	21	73	3	140	25
95th Queue (ft)	69	126	25	176	97
Link Distance (ft)	40	40	40	89	89
Upstream Blk Time (%)	25	95	1	84	4
Queuing Penalty (veh)	106	412	3	144	6
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 12: Catawba Ave/Catawba Ave (WB) & I-77 SB Off-Ramp

Movement	SB	SB
Directions Served	R	R
Maximum Queue (ft)	159	128
Average Queue (ft)	52	30
95th Queue (ft)	162	104
Link Distance (ft)	89	89
Upstream Blk Time (%)	8	2
Queuing Penalty (veh)	26	7
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

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Intersection: 14: Catawba Ave (EB) & I-77 NB On-Ramp

Movement	EB	EB
Directions Served	T	T
Maximum Queue (ft)	213	76
Average Queue (ft)	177	19
95th Queue (ft)	245	105
Link Distance (ft)	143	143
Upstream Blk Time (%)	91	1
Queuing Penalty (veh)	496	7
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 15: Catawba Ave

Movement	WB	WB	NE	NE
Directions Served	T	T	R	R
Maximum Queue (ft)	159	240	103	42
Average Queue (ft)	159	240	101	6
95th Queue (ft)	264	281	112	47
Link Distance (ft)	170	170	61	61
Upstream Blk Time (%)	80	100	86	1
Queuing Penalty (veh)	452	565	533	4
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 17: I-77 SB On-Ramp & Catawba Ave (WB)

Movement	WB	WB
Directions Served	LT	T
Maximum Queue (ft)	81	113
Average Queue (ft)	9	20
95th Queue (ft)	52	88
Link Distance (ft)	139	139
Upstream Blk Time (%)	0	0
Queuing Penalty (veh)	0	2
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

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Intersection: 18: I-77 NB On-Ramp

Movement	
Directions Served	
Maximum Queue (ft)	
Average Queue (ft)	
95th Queue (ft)	
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 19: I-77 SB On-Ramp

Movement	SE
Directions Served	R
Maximum Queue (ft)	50
Average Queue (ft)	2
95th Queue (ft)	36
Link Distance (ft)	137
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 21: I-77 NB Off-Ramp & Catawba Ave (WB)

Movement	NB	NB
Directions Served	L	L
Maximum Queue (ft)	130	192
Average Queue (ft)	28	40
95th Queue (ft)	104	146
Link Distance (ft)	116	116
Upstream Blk Time (%)	0	4
Queuing Penalty (veh)	1	9
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

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Intersection: 22: I-77 NB Off-Ramp & Catawba Ave (EB)/Catawba Ave

Movement	EB	EB	NB
Directions Served	T	T	R
Maximum Queue (ft)	159	17	172
Average Queue (ft)	156	3	154
95th Queue (ft)	167	28	207
Link Distance (ft)	86	86	110
Upstream Blk Time (%)	95	0	81
Queuing Penalty (veh)	506	0	136
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 24: I-77 SB On-Ramp & Catawba Ave/Catawba Ave (EB)

Movement	EB	EB	EB
Directions Served	T	T	TR
Maximum Queue (ft)	65	168	39
Average Queue (ft)	40	159	6
95th Queue (ft)	123	180	53
Link Distance (ft)		115	115
Upstream Blk Time (%)	22	89	1
Queuing Penalty (veh)	0	701	4
Storage Bay Dist (ft)	50		
Storage Blk Time (%)	25	91	
Queuing Penalty (veh)	106	390	

Intersection: 26: Catawba Ave

Movement	EB	EB
Directions Served	T	T
Maximum Queue (ft)	592	418
Average Queue (ft)	561	335
95th Queue (ft)	724	681
Link Distance (ft)	578	578
Upstream Blk Time (%)	90	4
Queuing Penalty (veh)	0	0
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

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Intersection: 28: I-77 NB Off-Ramp

Movement	NB	NB	NB
Directions Served	L	L	R
Maximum Queue (ft)	516	693	252
Average Queue (ft)	46	585	232
95th Queue (ft)	300	1143	444
Link Distance (ft)		801	
Upstream Blk Time (%)		68	
Queuing Penalty (veh)		0	
Storage Bay Dist (ft)	500		500
Storage Blk Time (%)	0	72	
Queuing Penalty (veh)	0	271	

Intersection: 30: Catawba Ave (WB)/Catawba Ave & I-77 NB On-Ramp

Movement	WB	WB
Directions Served	T	TR
Maximum Queue (ft)	104	99
Average Queue (ft)	104	99
95th Queue (ft)	109	110
Link Distance (ft)	59	59
Upstream Blk Time (%)	100	100
Queuing Penalty (veh)	565	565
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 610: I-77 SB Off-Ramp

Movement	SB	SB	SB	SB
Directions Served	L	L	R	R
Maximum Queue (ft)	407	448	785	451
Average Queue (ft)	337	390	652	28
95th Queue (ft)	634	771	1274	199
Link Distance (ft)			909	
Upstream Blk Time (%)			67	
Queuing Penalty (veh)			0	
Storage Bay Dist (ft)	450	450		450
Storage Blk Time (%)	50	69	32	0
Queuing Penalty (veh)	318	442	214	0

Network Summary

Network wide Queuing Penalty: 11222

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APPENDIX F-5:
CAPACITY ANALYSIS RESULTS

2018 BUILD CONDITIONS
AM PEAK HOUR

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Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations		↑↑↑									↑↑	
Traffic Volume (vph)	0	1312	0	0	0	0	0	0	0	0	790	0
Future Volume (vph)	0	1312	0	0	0	0	0	0	0	0	790	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		2%			0%			0%			-2%	
Lane Util. Factor	1.00	0.91	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00
Frt												
Flt Protected												
Satd. Flow (prot)	0	5034	0	0	0	0	0	0	0	0	3575	0
Flt Permitted												
Satd. Flow (perm)	0	5034	0	0	0	0	0	0	0	0	3575	0
Right Turn on Red	No		No			No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)		35			35			35			35	
Link Distance (ft)		142			217			115			211	
Travel Time (s)		2.8			4.2			2.2			4.1	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	1458	0	0	0	0	0	0	0	0	878	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	1458	0	0	0	0	0	0	0	0	878	0
Turn Type		NA									NA	
Protected Phases		2									8	
Permitted Phases												
Detector Phase		2									8	
Switch Phase												
Minimum Initial (s)		10.0									10.0	
Minimum Split (s)		24.3									26.1	
Total Split (s)		60.0									60.0	
Total Split (%)		50.0%									50.0%	
Yellow Time (s)		3.7									4.0	
All-Red Time (s)		5.6									4.1	
Lost Time Adjust (s)		-4.3									-3.1	
Total Lost Time (s)		5.0									5.0	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode		C-Max									None	
Act Effct Green (s)		65.7									44.3	
Actuated g/C Ratio		0.55									0.37	
v/c Ratio		0.53									0.67	
Control Delay		19.1									42.9	
Queue Delay		0.0									0.3	
Total Delay		19.1									43.2	
LOS		B									D	
Approach Delay		19.1									43.2	
Approach LOS		B									D	
Queue Length 50th (ft)		251									362	
Queue Length 95th (ft)		348									420	
Internal Link Dist (ft)		62			137			35			131	
Turn Bay Length (ft)												

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Lane Group	Ø4	Ø6
Lane Configurations		
Traffic Volume (vph)		
Future Volume (vph)		
Ideal Flow (vphpl)		
Grade (%)		
Lane Util. Factor		
Frt		
Flt Protected		
Satd. Flow (prot)		
Flt Permitted		
Satd. Flow (perm)		
Right Turn on Red		
Satd. Flow (RTOR)		
Link Speed (mph)		
Link Distance (ft)		
Travel Time (s)		
Peak Hour Factor		
Adj. Flow (vph)		
Shared Lane Traffic (%)		
Lane Group Flow (vph)		
Turn Type		
Protected Phases	4	6
Permitted Phases		
Detector Phase		
Switch Phase		
Minimum Initial (s)	10.0	10.0
Minimum Split (s)	21.1	19.3
Total Split (s)	60.0	60.0
Total Split (%)	50%	50%
Yellow Time (s)	4.0	3.7
All-Red Time (s)	4.1	5.6
Lost Time Adjust (s)		
Total Lost Time (s)		
Lead/Lag		
Lead-Lag Optimize?		
Recall Mode	None	C-Max
Act Effct Green (s)		
Actuated g/C Ratio		
v/c Ratio		
Control Delay		
Queue Delay		
Total Delay		
LOS		
Approach Delay		
Approach LOS		
Queue Length 50th (ft)		
Queue Length 95th (ft)		
Internal Link Dist (ft)		
Turn Bay Length (ft)		

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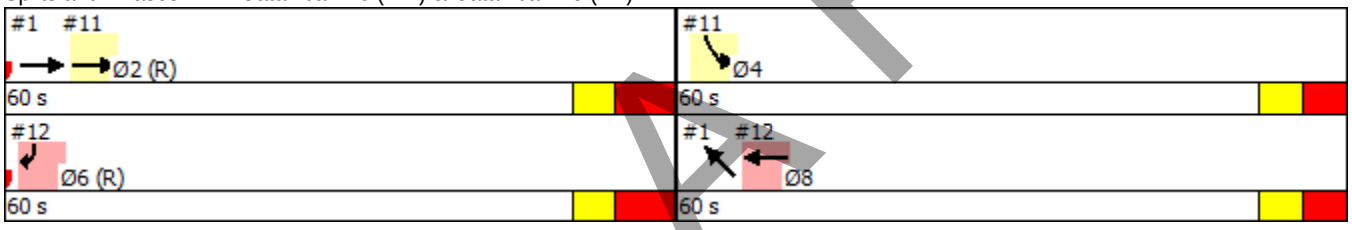
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Base Capacity (vph)		2757									1638	
Starvation Cap Reductn		0									232	
Spillback Cap Reductn		0									0	
Storage Cap Reductn		0									0	
Reduced v/c Ratio		0.53									0.62	

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 70 (58%), Referenced to phase 2:EBT and 6:, Start of Green
Natural Cycle: 60
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.68
Intersection Signal Delay: 28.1 Intersection LOS: C
Intersection Capacity Utilization 62.0% ICU Level of Service B
Analysis Period (min) 15

Splits and Phases: 1: Catawba Ave (WB) & Catawba Ave (EB)



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Lane Group	Ø4	Ø6
Base Capacity (vph)		
Starvation Cap Reductn		
Spillback Cap Reductn		
Storage Cap Reductn		
Reduced v/c Ratio		

Intersection Summary

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Lane Group	EBL	EBT	WBT	WBR	SBL	SBR	Ø6	Ø8
Lane Configurations								
Traffic Volume (vph)	0	1312	0	0	614	0		
Future Volume (vph)	0	1312	0	0	614	0		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900		
Grade (%)		2%	0%		-1%			
Lane Util. Factor	1.00	0.91	1.00	1.00	0.97	1.00		
Frt								
Flt Protected					0.950			
Satd. Flow (prot)	0	5034	0	0	3450	0		
Flt Permitted					0.950			
Satd. Flow (perm)	0	5034	0	0	3450	0		
Right Turn on Red				No	No	No		
Satd. Flow (RTOR)								
Link Speed (mph)		35	35		35			
Link Distance (ft)		217	199		185			
Travel Time (s)		4.2	3.9		3.6			
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90		
Adj. Flow (vph)	0	1458	0	0	682	0		
Shared Lane Traffic (%)								
Lane Group Flow (vph)	0	1458	0	0	682	0		
Turn Type		NA			Prot			
Protected Phases		2			4		6	8
Permitted Phases								
Detector Phase		2			4			
Switch Phase								
Minimum Initial (s)		10.0			10.0		10.0	10.0
Minimum Split (s)		24.3			21.1		19.3	26.1
Total Split (s)		60.0			60.0		60.0	60.0
Total Split (%)		50.0%			50.0%		50%	50%
Yellow Time (s)		3.7			4.0		3.7	4.0
All-Red Time (s)		5.6			4.1		5.6	4.1
Lost Time Adjust (s)		-4.3			-3.1			
Total Lost Time (s)		5.0			5.0			
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode		C-Max			None		C-Max	None
Act Effct Green (s)		65.7			44.3			
Actuated g/C Ratio		0.55			0.37			
v/c Ratio		0.53			0.54			
Control Delay		2.5			30.8			
Queue Delay		0.1			0.0			
Total Delay		2.6			30.8			
LOS		A			C			
Approach Delay		2.6			30.8			
Approach LOS		A			C			
Queue Length 50th (ft)		15			212			
Queue Length 95th (ft)		17			236			
Internal Link Dist (ft)		137	119		105			
Turn Bay Length (ft)								

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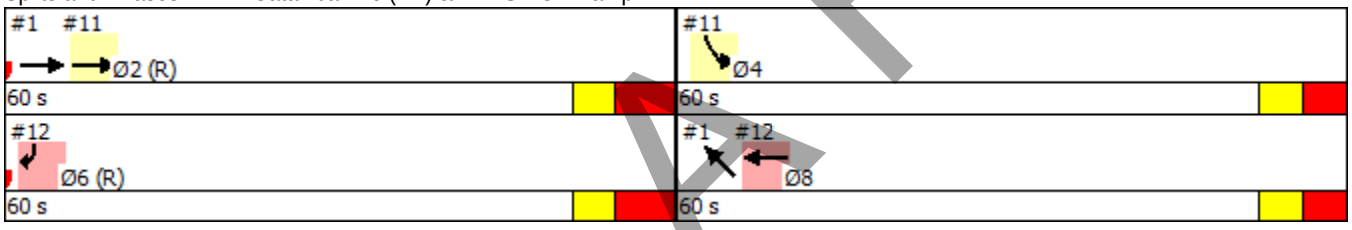
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR	Ø6	Ø8
Base Capacity (vph)		2757			1581			
Starvation Cap Reductn		0			0			
Spillback Cap Reductn		265			0			
Storage Cap Reductn		0			0			
Reduced v/c Ratio		0.59			0.43			

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 70 (58%), Referenced to phase 2:EBT and 6:, Start of Green
Natural Cycle: 60
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.68
Intersection Signal Delay: 11.6 Intersection LOS: B
Intersection Capacity Utilization 64.7% ICU Level of Service C
Analysis Period (min) 15

Splits and Phases: 11: Catawba Ave (EB) & I-77 SB Off-Ramp



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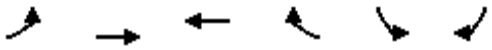

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR	Ø2	Ø4
Lane Configurations								
Traffic Volume (vph)	0	0	790	0	0	910		
Future Volume (vph)	0	0	790	0	0	910		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900		
Grade (%)		0%	0%		4%			
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.88		
Frt						0.850		
Flt Protected								
Satd. Flow (prot)	0	0	3539	0	0	2731		
Flt Permitted								
Satd. Flow (perm)	0	0	3539	0	0	2731		
Right Turn on Red				No		No		
Satd. Flow (RTOR)								
Link Speed (mph)		35	35		35			
Link Distance (ft)		202	115		181			
Travel Time (s)		3.9	2.2		3.5			
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90		
Adj. Flow (vph)	0	0	878	0	0	1011		
Shared Lane Traffic (%)								
Lane Group Flow (vph)	0	0	878	0	0	1011		
Turn Type			NA			Prot		
Protected Phases			8			6	2	4
Permitted Phases								
Detector Phase			8			6		
Switch Phase								
Minimum Initial (s)			10.0			10.0	10.0	10.0
Minimum Split (s)			26.1			19.3	24.3	21.1
Total Split (s)			60.0			60.0	60.0	60.0
Total Split (%)			50.0%			50.0%	50%	50%
Yellow Time (s)			4.0			3.7	3.7	4.0
All-Red Time (s)			4.1			5.6	5.6	4.1
Lost Time Adjust (s)			-3.1			-4.3		
Total Lost Time (s)			5.0			5.0		
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode			None			C-Max	C-Max	None
Act Effct Green (s)			44.3			65.7		
Actuated g/C Ratio			0.37			0.55		
v/c Ratio			0.67			0.68		
Control Delay			3.0			23.7		
Queue Delay			0.0			0.0		
Total Delay			3.0			23.7		
LOS			A			C		
Approach Delay			3.0		23.7			
Approach LOS			A		C			
Queue Length 50th (ft)			3			305		
Queue Length 95th (ft)			2			460		
Internal Link Dist (ft)		122	35		101			
Turn Bay Length (ft)								

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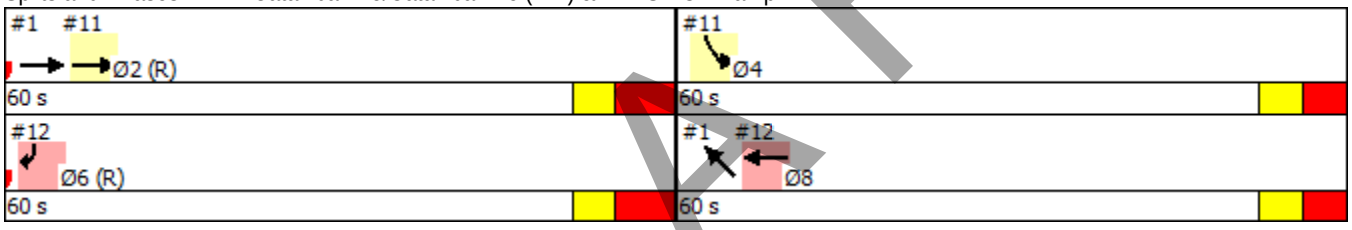
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR	Ø2	Ø4
Base Capacity (vph)			1622			1496		
Starvation Cap Reductn			5			0		
Spillback Cap Reductn			0			0		
Storage Cap Reductn			0			0		
Reduced v/c Ratio			0.54			0.68		

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 70 (58%), Referenced to phase 2:EBT and 6:, Start of Green
Natural Cycle: 60
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.68
Intersection Signal Delay: 14.1 Intersection LOS: B
Intersection Capacity Utilization 62.0% ICU Level of Service B
Analysis Period (min) 15

Splits and Phases: 12: Catawba Ave/Catawba Ave (WB) & I-77 SB Off-Ramp



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Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	0	579	0	0	0	0	0	1138	0
Future Volume (vph)	0	0	0	0	579	0	0	0	0	0	1138	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		0%			0%			0%			-1%	
Lane Util. Factor	1.00	1.00	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00	0.95	1.00
Frt												
Flt Protected												
Satd. Flow (prot)	0	0	0	0	3539	0	0	0	0	0	3557	0
Flt Permitted												
Satd. Flow (perm)	0	0	0	0	3539	0	0	0	0	0	3557	0
Right Turn on Red			No	No		No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)		35			35			35			35	
Link Distance (ft)		182			125			128			169	
Travel Time (s)		3.5			2.4			2.5			3.3	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	0	0	0	643	0	0	0	0	0	1264	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	0	643	0	0	0	0	0	1264	0
Turn Type					NA						NA	
Protected Phases					6						4	
Permitted Phases												
Detector Phase					6						4	
Switch Phase												
Minimum Initial (s)					7.0						7.0	
Minimum Split (s)					19.9						21.9	
Total Split (s)					50.0						70.0	
Total Split (%)					41.7%						58.3%	
Yellow Time (s)					3.9						3.9	
All-Red Time (s)					4.0						4.0	
Lost Time Adjust (s)					-2.0						-2.9	
Total Lost Time (s)					5.9						5.0	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode					C-Max						None	
Act Effct Green (s)					52.0						57.1	
Actuated g/C Ratio					0.43						0.48	
v/c Ratio					0.42						0.75	
Control Delay					17.4						21.4	
Queue Delay					0.3						0.1	
Total Delay					17.7						21.6	
LOS					B						C	
Approach Delay					17.7						21.6	
Approach LOS					B						C	
Queue Length 50th (ft)					119						272	
Queue Length 95th (ft)					213						318	
Internal Link Dist (ft)		102			45			48			89	
Turn Bay Length (ft)												

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Lane Group	Ø2	Ø8
Lane Configurations		
Traffic Volume (vph)		
Future Volume (vph)		
Ideal Flow (vphpl)		
Grade (%)		
Lane Util. Factor		
Frt		
Flt Protected		
Satd. Flow (prot)		
Flt Permitted		
Satd. Flow (perm)		
Right Turn on Red		
Satd. Flow (RTOR)		
Link Speed (mph)		
Link Distance (ft)		
Travel Time (s)		
Peak Hour Factor		
Adj. Flow (vph)		
Shared Lane Traffic (%)		
Lane Group Flow (vph)		
Turn Type		
Protected Phases	2	8
Permitted Phases		
Detector Phase		
Switch Phase		
Minimum Initial (s)	10.0	7.0
Minimum Split (s)	18.9	19.9
Total Split (s)	50.0	70.0
Total Split (%)	42%	58%
Yellow Time (s)	3.8	3.9
All-Red Time (s)	5.1	4.0
Lost Time Adjust (s)		
Total Lost Time (s)		
Lead/Lag		
Lead-Lag Optimize?		
Recall Mode	C-Max	None
Act Effct Green (s)		
Actuated g/C Ratio		
v/c Ratio		
Control Delay		
Queue Delay		
Total Delay		
LOS		
Approach Delay		
Approach LOS		
Queue Length 50th (ft)		
Queue Length 95th (ft)		
Internal Link Dist (ft)		
Turn Bay Length (ft)		

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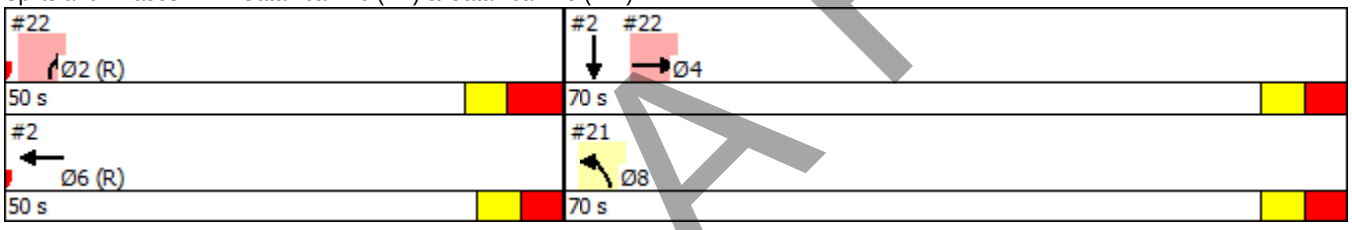
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Base Capacity (vph)					1533						1926	
Starvation Cap Reductn					380						101	
Spillback Cap Reductn					0						0	
Storage Cap Reductn					0						0	
Reduced v/c Ratio					0.56						0.69	

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 65 (54%), Referenced to phase 2:NBR and 6:, Start of Green
Natural Cycle: 50
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.75
Intersection Signal Delay: 20.3 Intersection LOS: C
Intersection Capacity Utilization 56.5% ICU Level of Service B
Analysis Period (min) 15

Splits and Phases: 2: Catawba Ave (EB) & Catawba Ave (WB)



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Lane Group	Ø2	Ø8
Base Capacity (vph)		
Starvation Cap Reductn		
Spillback Cap Reductn		
Storage Cap Reductn		
Reduced v/c Ratio		

Intersection Summary

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Lane Group	EBL	EBR	NBL	NBR	SWL	SWR	Ø2	Ø4	Ø6
Lane Configurations									
Traffic Volume (vph)	0	0	259	0	0	579			
Future Volume (vph)	0	0	259	0	0	579			
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900			
Lane Util. Factor	1.00	1.00	0.97	1.00	1.00	0.88			
Frt						0.850			
Flt Protected			0.950						
Satd. Flow (prot)	0	0	3433	0	0	2787			
Flt Permitted			0.950						
Satd. Flow (perm)	0	0	3433	0	0	2787			
Right Turn on Red		No	No	No		No			
Satd. Flow (RTOR)									
Link Speed (mph)	35		35		35				
Link Distance (ft)	209		215		182				
Travel Time (s)	4.1		4.2		3.5				
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90			
Adj. Flow (vph)	0	0	288	0	0	643			
Shared Lane Traffic (%)									
Lane Group Flow (vph)	0	0	288	0	0	643			
Turn Type			Prot			custom			
Protected Phases			8!			Free!	2	4	6
Permitted Phases									
Detector Phase			8						
Switch Phase									
Minimum Initial (s)			7.0				10.0	7.0	7.0
Minimum Split (s)			19.9				18.9	21.9	19.9
Total Split (s)			70.0				50.0	70.0	50.0
Total Split (%)			58.3%				42%	58%	42%
Yellow Time (s)			3.9				3.8	3.9	3.9
All-Red Time (s)			4.0				5.1	4.0	4.0
Lost Time Adjust (s)			-2.9						
Total Lost Time (s)			5.0						
Lead/Lag									
Lead-Lag Optimize?									
Recall Mode			None				C-Max	None	C-Max
Act Effct Green (s)			57.1			120.0			
Actuated g/C Ratio			0.48			1.00			
v/c Ratio			0.18			0.23			
Control Delay			17.5			1.3			
Queue Delay			0.1			0.0			
Total Delay			17.6			1.4			
LOS			B			A			
Approach Delay			17.6		1.4				
Approach LOS			B		A				
Queue Length 50th (ft)			63			22			
Queue Length 95th (ft)			78			42			
Internal Link Dist (ft)	129		135		102				
Turn Bay Length (ft)									
Base Capacity (vph)			1859			2787			

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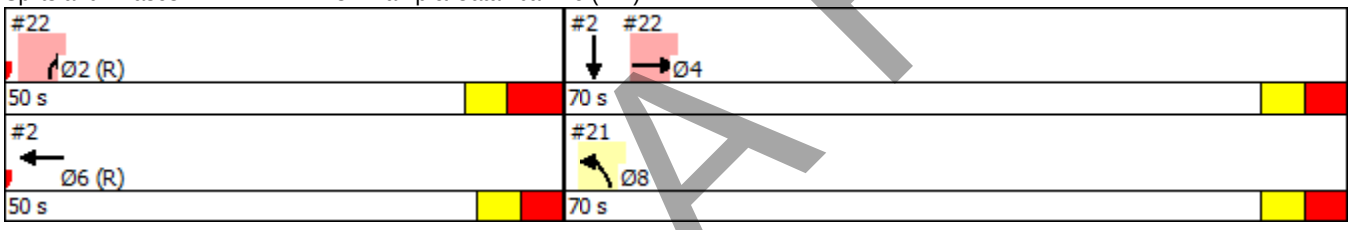
Lane Group	EBL	EBR	NBL	NBR	SWL	SWR	Ø2	Ø4	Ø6
Starvation Cap Reductn			0			0			
Spillback Cap Reductn			746			605			
Storage Cap Reductn			0			0			
Reduced v/c Ratio			0.26			0.29			

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 65 (54%), Referenced to phase 2:NBR and 6:, Start of Green
Natural Cycle: 50
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.75
Intersection Signal Delay: 6.4 Intersection LOS: A
Intersection Capacity Utilization 17.7% ICU Level of Service A
Analysis Period (min) 15
! Phase conflict between lane groups.

Splits and Phases: 21: I-77 NB Off-Ramp & Catawba Ave (WB)



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Lane Group	EBT	EBR	WBL	WBT	NBL	NBR	Ø6	Ø8
Lane Configurations								
Traffic Volume (vph)	1138	0	0	0	0	96		
Future Volume (vph)	1138	0	0	0	0	96		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900		
Grade (%)	0%			0%	4%			
Lane Util. Factor	0.95	1.00	1.00	1.00	1.00	1.00		
Frt						0.865		
Flt Protected								
Satd. Flow (prot)	3539	0	0	0	0	1579		
Flt Permitted								
Satd. Flow (perm)	3539	0	0	0	0	1579		
Right Turn on Red		No				No		
Satd. Flow (RTOR)								
Link Speed (mph)	35			35	35			
Link Distance (ft)	128			116	197			
Travel Time (s)	2.5			2.3	3.8			
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90		
Adj. Flow (vph)	1264	0	0	0	0	107		
Shared Lane Traffic (%)								
Lane Group Flow (vph)	1264	0	0	0	0	107		
Turn Type	NA					Prot		
Protected Phases	4					2	6	8
Permitted Phases								
Detector Phase	4					2		
Switch Phase								
Minimum Initial (s)	7.0					10.0	7.0	7.0
Minimum Split (s)	21.9					18.9	19.9	19.9
Total Split (s)	70.0					50.0	50.0	70.0
Total Split (%)	58.3%					41.7%	42%	58%
Yellow Time (s)	3.9					3.8	3.9	3.9
All-Red Time (s)	4.0					5.1	4.0	4.0
Lost Time Adjust (s)	-2.9					-3.9		
Total Lost Time (s)	5.0					5.0		
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None					C-Max	C-Max	None
Act Effct Green (s)	57.1					52.9		
Actuated g/C Ratio	0.48					0.44		
v/c Ratio	0.75					0.15		
Control Delay	3.1					22.8		
Queue Delay	0.0					0.0		
Total Delay	3.1					22.8		
LOS	A					C		
Approach Delay	3.1				22.8			
Approach LOS	A				C			
Queue Length 50th (ft)	6					49		
Queue Length 95th (ft)	6					97		
Internal Link Dist (ft)	48			36	117			
Turn Bay Length (ft)								

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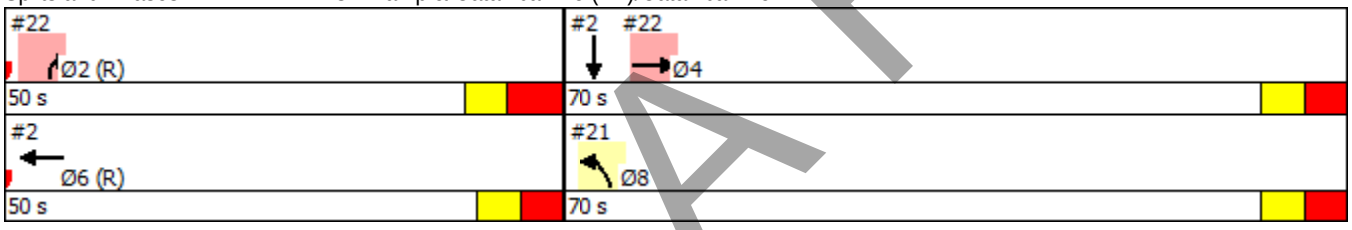
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR	Ø6	Ø8
Base Capacity (vph)	1916					695		
Starvation Cap Reductn	15					0		
Spillback Cap Reductn	0					0		
Storage Cap Reductn	0					0		
Reduced v/c Ratio	0.66					0.15		

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 65 (54%), Referenced to phase 2:NBR and 6:, Start of Green
Natural Cycle: 50
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.75
Intersection Signal Delay: 4.7 Intersection LOS: A
Intersection Capacity Utilization 56.5% ICU Level of Service B
Analysis Period (min) 15

Splits and Phases: 22: I-77 NB Off-Ramp & Catawba Ave (EB)/Catawba Ave



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Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	96	579	560	110	526	14	522	27	100	66	30	72
Future Volume (vph)	96	579	560	110	526	14	522	27	100	66	30	72
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		-2%			1%			3%			5%	
Storage Length (ft)	100		0	100		0	150		150	75		0
Storage Lanes	1		1	1		0	1		1	1		0
Taper Length (ft)	100			100			100			100		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	1.00	1.00	1.00	1.00
Frt			0.850		0.996				0.850		0.894	
Flt Protected	0.950			0.950			0.950	0.957		0.950		
Satd. Flow (prot)	1787	1881	1599	1761	1846	0	1656	1668	1560	1725	1624	0
Flt Permitted	0.175			0.128			0.950	0.957		0.950		
Satd. Flow (perm)	329	1881	1599	237	1846	0	1656	1668	1560	1725	1624	0
Right Turn on Red			No			No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)		35			35			35			35	
Link Distance (ft)		229			323			537			298	
Travel Time (s)		4.5			6.3			10.5			5.8	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	107	643	622	122	584	16	580	30	111	73	33	80
Shared Lane Traffic (%)							48%					
Lane Group Flow (vph)	107	643	622	122	600	0	302	308	111	73	113	0
Turn Type	pm+pt	NA	pm+ov	pm+pt	NA		Split	NA	pm+ov	Split	NA	
Protected Phases	5	2	3	1	6		3	3	1	4	4	
Permitted Phases	2		2	6					3			
Detector Phase	5	2	3	1	6		3	3	1	4	4	
Switch Phase												
Minimum Initial (s)	7.0	10.0	7.0	7.0	10.0		7.0	7.0	7.0	7.0	7.0	
Minimum Split (s)	13.3	31.4	28.3	13.2	28.4		28.3	28.3	13.2	12.9	12.9	
Total Split (s)	17.0	49.0	37.0	17.0	49.0		37.0	37.0	17.0	17.0	17.0	
Total Split (%)	14.2%	40.8%	30.8%	14.2%	40.8%		30.8%	30.8%	14.2%	14.2%	14.2%	
Yellow Time (s)	3.0	4.0	3.7	3.0	4.0		3.7	3.7	3.0	3.6	3.6	
All-Red Time (s)	3.3	2.4	2.6	3.2	2.4		2.6	2.6	3.2	2.3	2.3	
Lost Time Adjust (s)	-1.3	-1.4	-1.4	-1.2	-1.4		-1.3	-1.3	-1.2	-0.9	-0.9	
Total Lost Time (s)	5.0	5.0	4.9	5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Lead/Lag	Lead	Lag	Lead	Lead	Lag		Lead	Lead	Lead	Lag	Lag	
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	
Recall Mode	None	C-Max	None	None	C-Max		None	None	None	None	None	
Act Effct Green (s)	59.3	49.5	83.1	60.0	49.9		28.5	28.5	38.6	11.9	11.9	
Actuated g/C Ratio	0.49	0.41	0.69	0.50	0.42		0.24	0.24	0.32	0.10	0.10	
v/c Ratio	0.38	0.83	0.56	0.49	0.78		0.77	0.78	0.22	0.43	0.71	
Control Delay	8.4	32.9	26.4	22.3	40.5		55.9	56.6	18.0	59.0	75.8	
Queue Delay	0.0	51.0	47.5	0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Total Delay	8.4	83.9	73.9	22.3	40.5		55.9	56.6	18.0	59.0	75.8	
LOS	A	F	E	C	D		E	E	B	E	E	
Approach Delay		73.5			37.4			50.4			69.2	
Approach LOS		E			D			D			E	
Queue Length 50th (ft)	21	517	504	48	416		224	229	42	53	85	

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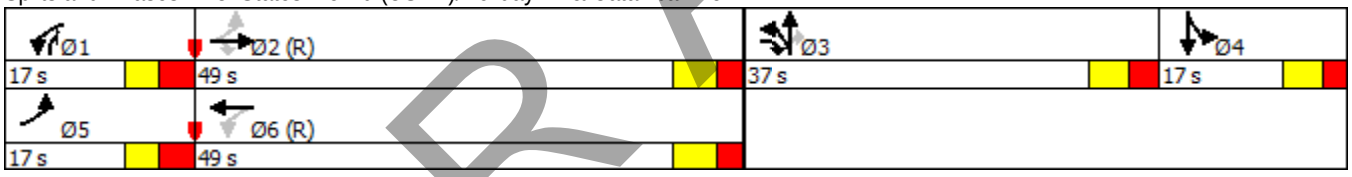
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 95th (ft)	m31	#718	623	83	#646		329	335	70	104	#172	
Internal Link Dist (ft)		149			243			457			218	
Turn Bay Length (ft)	100			100			150		150	75		
Base Capacity (vph)	314	776	1154	274	767		441	444	526	177	167	
Starvation Cap Reductn	0	243	581	0	0		0	0	0	0	0	
Spillback Cap Reductn	0	0	0	0	0		0	0	0	0	0	
Storage Cap Reductn	0	0	0	0	0		0	0	0	0	0	
Reduced v/c Ratio	0.34	1.21	1.09	0.45	0.78		0.68	0.69	0.21	0.41	0.68	

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 35 (29%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.83
Intersection Signal Delay: 59.0 Intersection LOS: E
Intersection Capacity Utilization 70.9% ICU Level of Service C
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 3: Statesville Rd (US 21)/Holiday Ln & Catawba Ave



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Intersection

Int Delay, s/veh 1.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	11	726	7	4	588	44	5	4	8	12	4	56
Future Vol, veh/h	11	726	7	4	588	44	5	4	8	12	4	56
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	50	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	12	807	8	4	653	49	6	4	9	13	4	62

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	702	0	0	814	0	0	1555	1546	811	1529	1526	678
Stage 1	-	-	-	-	-	-	835	835	-	687	687	-
Stage 2	-	-	-	-	-	-	720	711	-	842	839	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	895	-	-	813	-	-	92	114	379	96	118	452
Stage 1	-	-	-	-	-	-	362	383	-	437	447	-
Stage 2	-	-	-	-	-	-	419	436	-	359	381	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	895	-	-	813	-	-	76	112	379	89	115	452
Mov Cap-2 Maneuver	-	-	-	-	-	-	76	112	-	89	115	-
Stage 1	-	-	-	-	-	-	357	378	-	431	443	-
Stage 2	-	-	-	-	-	-	355	433	-	342	376	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.1	0.1	34.9	26.7
HCM LOS			D	D

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	139	895	-	-	813	-	-	245
HCM Lane V/C Ratio	0.136	0.014	-	-	0.005	-	-	0.327
HCM Control Delay (s)	34.9	9.1	-	-	9.5	0	-	26.7
HCM Lane LOS	D	A	-	-	A	A	-	D
HCM 95th %tile Q(veh)	0.5	0	-	-	0	-	-	1.4

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Intersection	
Int Delay, s/veh	1.9

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	23	4	24	24	4	66
Future Vol, veh/h	23	4	24	24	4	66
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	5
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	26	4	27	27	4	73

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	122	40	0	0	53	0
Stage 1	40	-	-	-	-	-
Stage 2	82	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	873	1031	-	-	1553	-
Stage 1	982	-	-	-	-	-
Stage 2	941	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	870	1031	-	-	1553	-
Mov Cap-2 Maneuver	870	-	-	-	-	-
Stage 1	982	-	-	-	-	-
Stage 2	938	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	9.2	0	0.4
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	891	1553	-
HCM Lane V/C Ratio	-	-	0.034	0.003	-
HCM Control Delay (s)	-	-	9.2	7.3	0
HCM Lane LOS	-	-	A	A	A
HCM 95th %tile Q(veh)	-	-	0.1	0	-

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Intersection

Int Delay, s/veh 2.8

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	79	4	48	89	4	89
Future Vol, veh/h	79	4	48	89	4	89
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	5
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	88	4	53	99	4	99

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	211	103	0	0	152	0
Stage 1	103	-	-	-	-	-
Stage 2	108	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	777	952	-	-	1429	-
Stage 1	921	-	-	-	-	-
Stage 2	916	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	775	952	-	-	1429	-
Mov Cap-2 Maneuver	775	-	-	-	-	-
Stage 1	921	-	-	-	-	-
Stage 2	913	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	10.2	0	0.3
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	782	1429	-
HCM Lane V/C Ratio	-	-	0.118	0.003	-
HCM Control Delay (s)	-	-	10.2	7.5	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	0.4	0	-

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Intersection						
Int Delay, s/veh	7.2					

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	4	63	53	4	6	4
Future Vol, veh/h	4	63	53	4	6	4
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	4	70	59	4	7	4

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	131	9	11	0	-	0
Stage 1	9	-	-	-	-	-
Stage 2	122	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	863	1073	1608	-	-	-
Stage 1	1014	-	-	-	-	-
Stage 2	903	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	831	1073	1608	-	-	-
Mov Cap-2 Maneuver	831	-	-	-	-	-
Stage 1	1014	-	-	-	-	-
Stage 2	870	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	8.7	6.8	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1608	-	1055	-	-
HCM Lane V/C Ratio	0.037	-	0.071	-	-
HCM Control Delay (s)	7.3	0	8.7	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0.1	-	0.2	-	-

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Summary of All Intervals

Run Number	1	2	3	4	5	Avg
Start Time	6:50	6:50	6:50	6:50	6:50	6:50
End Time	8:00	8:00	8:00	8:00	8:00	8:00
Total Time (min)	70	70	70	70	70	70
Time Recorded (min)	60	60	60	60	60	60
# of Intervals	5	5	5	5	5	5
# of Recorded Intervals	4	4	4	4	4	4
Vehs Entered	4746	4701	4760	4785	3899	4579
Vehs Exited	4734	4690	4739	4763	3603	4504
Starting Vehs	171	166	152	139	150	152
Ending Vehs	183	177	173	161	446	225
Travel Distance (mi)	1940	1926	1931	1951	1499	1849
Travel Time (hr)	249.5	221.2	233.3	188.1	406.2	259.7
Total Delay (hr)	180.6	153.0	164.7	118.8	352.9	194.0
Total Stops	8366	7841	8263	8077	6472	7803
Fuel Used (gal)	119.3	112.1	115.5	105.7	140.9	118.7

Interval #0 Information Seeding

Start Time	6:50
End Time	7:00
Total Time (min)	10

Volumes adjusted by Growth Factors.
No data recorded this interval.

Interval #1 Information 1

Start Time	7:00
End Time	7:15
Total Time (min)	15

Volumes adjusted by Growth Factors, Anti PHF.

Run Number	1	2	3	4	5	Avg
Vehs Entered	1163	1153	1180	1139	1224	1174
Vehs Exited	1169	1172	1169	1129	1200	1167
Starting Vehs	171	166	152	139	150	152
Ending Vehs	165	147	163	149	174	157
Travel Distance (mi)	482	480	480	463	495	480
Travel Time (hr)	41.2	42.1	46.4	37.0	42.0	41.7
Total Delay (hr)	24.1	25.2	29.4	20.6	24.5	24.8
Total Stops	1878	1931	2105	1727	1882	1904
Fuel Used (gal)	24.3	24.7	25.9	22.9	25.2	24.6

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Interval #2 Information 2

Start Time 7:15
End Time 7:30
Total Time (min) 15
Volumes adjusted by PHF, Growth Factors.

Run Number	1	2	3	4	5	Avg
Vehs Entered	1271	1250	1226	1281	1248	1255
Vehs Exited	1241	1200	1182	1229	1233	1216
Starting Vehs	165	147	163	149	174	157
Ending Vehs	195	197	207	201	189	197
Travel Distance (mi)	508	502	489	509	509	503
Travel Time (hr)	62.5	52.4	52.6	50.7	63.8	56.4
Total Delay (hr)	44.4	34.6	35.1	32.6	45.7	38.5
Total Stops	2257	2096	2106	2168	2085	2143
Fuel Used (gal)	31.0	28.3	28.0	27.9	31.5	29.3

Interval #3 Information 3

Start Time 7:30
End Time 7:45
Total Time (min) 15
Volumes adjusted by Growth Factors, Anti PHF.

Run Number	1	2	3	4	5	Avg
Vehs Entered	1178	1109	1130	1206	1196	1164
Vehs Exited	1182	1149	1171	1226	1022	1148
Starting Vehs	195	197	207	201	189	197
Ending Vehs	191	157	166	181	363	213
Travel Distance (mi)	482	463	466	498	439	470
Travel Time (hr)	72.2	64.9	67.6	53.5	76.7	67.0
Total Delay (hr)	55.1	48.5	51.1	35.9	61.1	50.3
Total Stops	2177	1788	2017	2153	2219	2071
Fuel Used (gal)	32.4	29.7	30.4	28.5	31.4	30.5

Interval #4 Information 4

Start Time 7:45
End Time 8:00
Total Time (min) 15
Volumes adjusted by Growth Factors, Anti PHF.

Run Number	1	2	3	4	5	Avg
Vehs Entered	1134	1189	1224	1159	231	987
Vehs Exited	1142	1169	1217	1179	148	972
Starting Vehs	191	157	166	181	363	213
Ending Vehs	183	177	173	161	446	225
Travel Distance (mi)	469	480	495	482	55	396
Travel Time (hr)	73.6	61.8	66.7	46.9	223.7	94.5
Total Delay (hr)	56.9	44.7	49.1	29.8	221.6	80.4
Total Stops	2054	2026	2035	2029	286	1689
Fuel Used (gal)	31.6	29.4	31.2	26.4	52.8	34.3

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Intersection: 1: Catawba Ave (WB) & Catawba Ave (EB)

Movement	EB	EB	EB	NW	NW
Directions Served	T	T	T	T	T
Maximum Queue (ft)	185	178	186	154	154
Average Queue (ft)	165	103	118	125	130
95th Queue (ft)	220	185	204	155	142
Link Distance (ft)	60	60	60	46	46
Upstream Blk Time (%)	50	31	23	43	50
Queuing Penalty (veh)	218	134	100	172	199
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 2: Catawba Ave (EB) & Catawba Ave (WB)

Movement	WB	WB	SB	SB
Directions Served	T	T	T	T
Maximum Queue (ft)	156	151	177	172
Average Queue (ft)	129	106	153	145
95th Queue (ft)	170	160	178	202
Link Distance (ft)	74	74	86	86
Upstream Blk Time (%)	41	31	45	35
Queuing Penalty (veh)	120	90	256	203
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 3: Statesville Rd (US 21)/Holiday Ln & Catawba Ave

Movement	EB	EB	EB	WB	WB	NB	NB	NB	SB	SB
Directions Served	L	T	R	L	TR	L	LT	R	L	TR
Maximum Queue (ft)	170	241	243	200	352	250	502	250	136	184
Average Queue (ft)	89	209	192	104	268	206	348	120	51	89
95th Queue (ft)	195	270	288	225	387	294	518	303	103	165
Link Distance (ft)		170	170		245		487			217
Upstream Blk Time (%)	0	20	14		20		7			4
Queuing Penalty (veh)	0	125	88		128		0			7
Storage Bay Dist (ft)	100			100		150		150	75	
Storage Blk Time (%)	1	24		3	40	8	54		10	26
Queuing Penalty (veh)	6	23		19	44	29	195		10	17

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Intersection: 4: Hill St/Burton Ln & Catawba Ave

Movement	EB	EB	WB	NB	SB
Directions Served	L	TR	LTR	LTR	LTR
Maximum Queue (ft)	35	64	248	51	89
Average Queue (ft)	6	15	54	14	37
95th Queue (ft)	25	110	260	37	81
Link Distance (ft)		245	531	466	86
Upstream Blk Time (%)		6	5		7
Queuing Penalty (veh)		41	0		5
Storage Bay Dist (ft)	50				
Storage Blk Time (%)	0	6			
Queuing Penalty (veh)	1	1			

Intersection: 5: Holiday Ln & Site Access #1

Movement	WB	SB
Directions Served	LR	LT
Maximum Queue (ft)	49	40
Average Queue (ft)	9	5
95th Queue (ft)	31	50
Link Distance (ft)	184	157
Upstream Blk Time (%)		2
Queuing Penalty (veh)		0
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 6: Holiday Ln & Site Access #2

Movement	WB	SB
Directions Served	LR	LT
Maximum Queue (ft)	87	25
Average Queue (ft)	36	3
95th Queue (ft)	68	28
Link Distance (ft)	96	76
Upstream Blk Time (%)	3	3
Queuing Penalty (veh)	0	3
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

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Intersection: 7: Burton Ln & Site Acess #3

Movement	EB	NB	SB
Directions Served	LR	LT	TR
Maximum Queue (ft)	74	18	10
Average Queue (ft)	25	1	1
95th Queue (ft)	58	8	10
Link Distance (ft)	101	86	267
Upstream Blk Time (%)	3		
Queuing Penalty (veh)	0		
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 11: Catawba Ave (EB) & I-77 SB Off-Ramp

Movement	EB	EB	EB	SB	SB
Directions Served	T	T	T	L	L
Maximum Queue (ft)	89	123	64	161	180
Average Queue (ft)	66	38	11	145	136
95th Queue (ft)	103	103	43	177	205
Link Distance (ft)	40	40	40	89	89
Upstream Blk Time (%)	45	21	5	39	29
Queuing Penalty (veh)	196	90	21	120	89
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 12: Catawba Ave/Catawba Ave (WB) & I-77 SB Off-Ramp

Movement	WB	WB	SB	SB
Directions Served	T	T	R	R
Maximum Queue (ft)	16	30	174	156
Average Queue (ft)	1	7	150	117
95th Queue (ft)	7	23	194	171
Link Distance (ft)	56	56	89	89
Upstream Blk Time (%)		0	39	19
Queuing Penalty (veh)		0	177	87
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

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Intersection: 14: Catawba Ave (EB) & I-77 NB On-Ramp

Movement	EB	EB	EB
Directions Served	L	T	T
Maximum Queue (ft)	88	251	227
Average Queue (ft)	6	124	103
95th Queue (ft)	42	251	228
Link Distance (ft)	143	143	143
Upstream Blk Time (%)		16	8
Queuing Penalty (veh)		102	53
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 15: Catawba Ave

Movement	WB	WB	NE	NE
Directions Served	T	T	R	R
Maximum Queue (ft)	102	203	139	151
Average Queue (ft)	17	39	87	75
95th Queue (ft)	100	149	166	177
Link Distance (ft)	170	170	61	61
Upstream Blk Time (%)	7	7	18	10
Queuing Penalty (veh)	36	39	109	63
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 17: I-77 SB On-Ramp & Catawba Ave (WB)

Movement	WB	WB
Directions Served	LT	T
Maximum Queue (ft)	204	250
Average Queue (ft)	128	158
95th Queue (ft)	194	241
Link Distance (ft)	139	139
Upstream Blk Time (%)	14	18
Queuing Penalty (veh)	59	75
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

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Intersection: 18: I-77 NB On-Ramp

Movement	EB	WB
Directions Served	L	R
Maximum Queue (ft)	211	152
Average Queue (ft)	98	55
95th Queue (ft)	213	157
Link Distance (ft)	143	71
Upstream Blk Time (%)	5	1
Queuing Penalty (veh)	38	7
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 19: I-77 SB On-Ramp

Movement	SB	SE
Directions Served	T	R
Maximum Queue (ft)	117	48
Average Queue (ft)	7	2
95th Queue (ft)	66	35
Link Distance (ft)	111	137
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 21: I-77 NB Off-Ramp & Catawba Ave (WB)

Movement	NB	NB	SW	SW
Directions Served	L	L	R	R
Maximum Queue (ft)	128	172	61	46
Average Queue (ft)	46	95	12	9
95th Queue (ft)	132	169	56	49
Link Distance (ft)	116	116	78	78
Upstream Blk Time (%)	7	10	8	7
Queuing Penalty (veh)	9	13	22	20
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

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Intersection: 22: I-77 NB Off-Ramp & Catawba Ave (EB)/Catawba Ave

Movement	EB	EB	NB
Directions Served	T	T	R
Maximum Queue (ft)	167	151	150
Average Queue (ft)	94	61	59
95th Queue (ft)	190	163	126
Link Distance (ft)	86	86	110
Upstream Blk Time (%)	18	8	4
Queuing Penalty (veh)	103	44	4
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 24: I-77 SB On-Ramp & Catawba Ave/Catawba Ave (EB)

Movement	EB	EB	EB
Directions Served	T	T	TR
Maximum Queue (ft)	114	193	131
Average Queue (ft)	104	168	21
95th Queue (ft)	145	216	95
Link Distance (ft)		115	115
Upstream Blk Time (%)	27	41	1
Queuing Penalty (veh)	0	289	7
Storage Bay Dist (ft)	50		
Storage Blk Time (%)	45	7	
Queuing Penalty (veh)	200	29	

Intersection: 26: Catawba Ave

Movement	EB	EB
Directions Served	T	T
Maximum Queue (ft)	626	603
Average Queue (ft)	513	374
95th Queue (ft)	822	802
Link Distance (ft)	578	578
Upstream Blk Time (%)	47	6
Queuing Penalty (veh)	0	0
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

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Intersection: 27: I-77 SB Off-Ramp

Movement	SB	SB	SB	SB
Directions Served	L	L	R	R
Maximum Queue (ft)	259	241	434	266
Average Queue (ft)	84	56	207	114
95th Queue (ft)	252	243	470	260
Link Distance (ft)			909	
Upstream Blk Time (%)			4	
Queuing Penalty (veh)			0	
Storage Bay Dist (ft)	450	450		450
Storage Blk Time (%)	4	0		
Queuing Penalty (veh)	36	0		

Intersection: 28: I-77 NB Off-Ramp

Movement	NB	NB	NB
Directions Served	L	L	R
Maximum Queue (ft)	120	175	127
Average Queue (ft)	27	35	6
95th Queue (ft)	208	271	92
Link Distance (ft)		801	
Upstream Blk Time (%)		2	
Queuing Penalty (veh)		0	
Storage Bay Dist (ft)	500		500
Storage Blk Time (%)	2	3	
Queuing Penalty (veh)	5	6	

Intersection: 29: Bend

Movement	NB	NB
Directions Served	T	
Maximum Queue (ft)	351	347
Average Queue (ft)	244	21
95th Queue (ft)	485	156
Link Distance (ft)	275	275
Upstream Blk Time (%)	12	0
Queuing Penalty (veh)	76	3
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

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Intersection: 30: Catawba Ave (WB)/Catawba Ave & I-77 NB On-Ramp

Movement	WB	WB
Directions Served	T	TR
Maximum Queue (ft)	108	114
Average Queue (ft)	44	47
95th Queue (ft)	110	126
Link Distance (ft)	59	59
Upstream Blk Time (%)	12	13
Queuing Penalty (veh)	69	70
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Network Summary

Network wide Queuing Penalty: 4599

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APPENDIX F-6:
CAPACITY ANALYSIS RESULTS

2018 BUILD CONDITIONS
PM PEAK HOUR

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Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations		↑↑↑									↑↑	
Traffic Volume (vph)	0	1305	0	0	0	0	0	0	0	0	1096	0
Future Volume (vph)	0	1305	0	0	0	0	0	0	0	0	1096	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		2%			0%			0%			-2%	
Lane Util. Factor	1.00	0.91	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00
Frt												
Flt Protected												
Satd. Flow (prot)	0	5034	0	0	0	0	0	0	0	0	3575	0
Flt Permitted												
Satd. Flow (perm)	0	5034	0	0	0	0	0	0	0	0	3575	0
Right Turn on Red	No		No			No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)		35			35			35			35	
Link Distance (ft)		142			217			115			211	
Travel Time (s)		2.8			4.2			2.2			4.1	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	1450	0	0	0	0	0	0	0	0	1218	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	1450	0	0	0	0	0	0	0	0	1218	0
Turn Type		NA									NA	
Protected Phases		2									8	
Permitted Phases												
Detector Phase		2									8	
Switch Phase												
Minimum Initial (s)		10.0									10.0	
Minimum Split (s)		24.3									26.1	
Total Split (s)		60.0									60.0	
Total Split (%)		50.0%									50.0%	
Yellow Time (s)		3.7									4.0	
All-Red Time (s)		5.6									4.1	
Lost Time Adjust (s)		-4.3									-3.1	
Total Lost Time (s)		5.0									5.0	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode		C-Max									None	
Act Effct Green (s)		56.4									53.6	
Actuated g/C Ratio		0.47									0.45	
v/c Ratio		0.61									0.76	
Control Delay		25.3									28.5	
Queue Delay		0.0									35.6	
Total Delay		25.3									64.2	
LOS		C									E	
Approach Delay		25.3									64.2	
Approach LOS		C									E	
Queue Length 50th (ft)		305									284	
Queue Length 95th (ft)		356									331	
Internal Link Dist (ft)		62			137			35			131	
Turn Bay Length (ft)												

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Lane Group	Ø4	Ø6
Lane Configurations		
Traffic Volume (vph)		
Future Volume (vph)		
Ideal Flow (vphpl)		
Grade (%)		
Lane Util. Factor		
Frt		
Flt Protected		
Satd. Flow (prot)		
Flt Permitted		
Satd. Flow (perm)		
Right Turn on Red		
Satd. Flow (RTOR)		
Link Speed (mph)		
Link Distance (ft)		
Travel Time (s)		
Peak Hour Factor		
Adj. Flow (vph)		
Shared Lane Traffic (%)		
Lane Group Flow (vph)		
Turn Type		
Protected Phases	4	6
Permitted Phases		
Detector Phase		
Switch Phase		
Minimum Initial (s)	10.0	10.0
Minimum Split (s)	21.1	19.3
Total Split (s)	60.0	60.0
Total Split (%)	50%	50%
Yellow Time (s)	4.0	3.7
All-Red Time (s)	4.1	5.6
Lost Time Adjust (s)		
Total Lost Time (s)		
Lead/Lag		
Lead-Lag Optimize?		
Recall Mode	None	C-Max
Act Effct Green (s)		
Actuated g/C Ratio		
v/c Ratio		
Control Delay		
Queue Delay		
Total Delay		
LOS		
Approach Delay		
Approach LOS		
Queue Length 50th (ft)		
Queue Length 95th (ft)		
Internal Link Dist (ft)		
Turn Bay Length (ft)		

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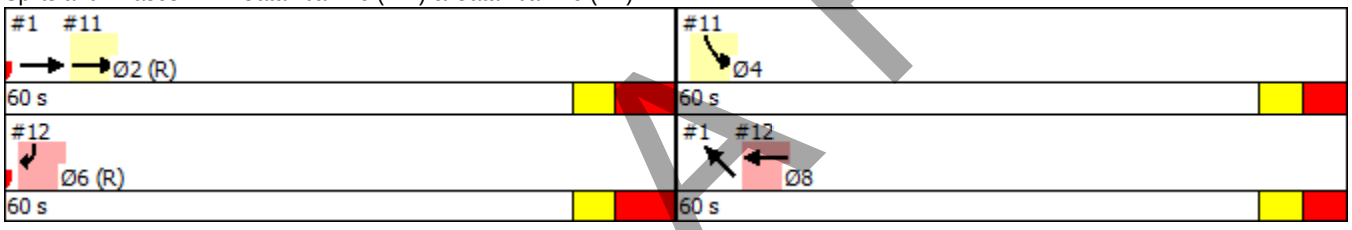
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Base Capacity (vph)		2367									1638	
Starvation Cap Reductn		0									497	
Spillback Cap Reductn		0									0	
Storage Cap Reductn		0									0	
Reduced v/c Ratio		0.61									1.07	

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 70 (58%), Referenced to phase 2:EBT and 6:, Start of Green
Natural Cycle: 55
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.77
Intersection Signal Delay: 43.1 Intersection LOS: D
Intersection Capacity Utilization 63.8% ICU Level of Service B
Analysis Period (min) 15

Splits and Phases: 1: Catawba Ave (WB) & Catawba Ave (EB)



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Lane Group	Ø4	Ø6
Base Capacity (vph)		
Starvation Cap Reductn		
Spillback Cap Reductn		
Storage Cap Reductn		
Reduced v/c Ratio		

Intersection Summary

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Lane Group	EBL	EBT	WBT	WBR	SBL	SBR	Ø6	Ø8
Lane Configurations								
Traffic Volume (vph)	0	1305	0	0	358	0		
Future Volume (vph)	0	1305	0	0	358	0		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900		
Grade (%)		2%	0%		-1%			
Lane Util. Factor	1.00	0.91	1.00	1.00	0.97	1.00		
Frt								
Flt Protected					0.950			
Satd. Flow (prot)	0	5034	0	0	3450	0		
Flt Permitted					0.950			
Satd. Flow (perm)	0	5034	0	0	3450	0		
Right Turn on Red				No	No	No		
Satd. Flow (RTOR)								
Link Speed (mph)		35	35		35			
Link Distance (ft)		217	199		185			
Travel Time (s)		4.2	3.9		3.6			
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90		
Adj. Flow (vph)	0	1450	0	0	398	0		
Shared Lane Traffic (%)								
Lane Group Flow (vph)	0	1450	0	0	398	0		
Turn Type		NA			Prot			
Protected Phases		2			4		6	8
Permitted Phases								
Detector Phase		2			4			
Switch Phase								
Minimum Initial (s)		10.0			10.0		10.0	10.0
Minimum Split (s)		24.3			21.1		19.3	26.1
Total Split (s)		60.0			60.0		60.0	60.0
Total Split (%)		50.0%			50.0%		50%	50%
Yellow Time (s)		3.7			4.0		3.7	4.0
All-Red Time (s)		5.6			4.1		5.6	4.1
Lost Time Adjust (s)		-4.3			-3.1			
Total Lost Time (s)		5.0			5.0			
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode		C-Max			None		C-Max	None
Act Effct Green (s)		56.4			53.6			
Actuated g/C Ratio		0.47			0.45			
v/c Ratio		0.61			0.26			
Control Delay		3.1			21.0			
Queue Delay		0.7			0.0			
Total Delay		3.8			21.0			
LOS		A			C			
Approach Delay		3.8			21.0			
Approach LOS		A			C			
Queue Length 50th (ft)		15			94			
Queue Length 95th (ft)		17			129			
Internal Link Dist (ft)		137	119		105			
Turn Bay Length (ft)								

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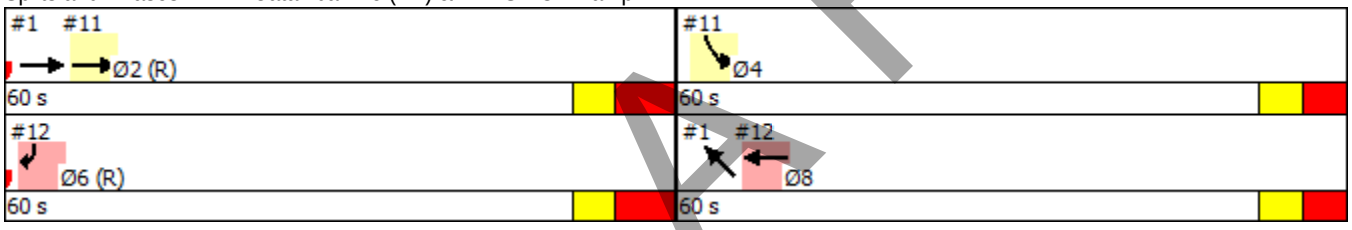
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR	Ø6	Ø8
Base Capacity (vph)		2367			1581			
Starvation Cap Reductn		0			0			
Spillback Cap Reductn		514			0			
Storage Cap Reductn		0			0			
Reduced v/c Ratio		0.78			0.25			

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 70 (58%), Referenced to phase 2:EBT and 6:, Start of Green
Natural Cycle: 55
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.77
Intersection Signal Delay: 7.5 Intersection LOS: A
Intersection Capacity Utilization 54.9% ICU Level of Service A
Analysis Period (min) 15

Splits and Phases: 11: Catawba Ave (EB) & I-77 SB Off-Ramp



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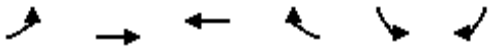

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR	Ø2	Ø4
Lane Configurations								
Traffic Volume (vph)	0	0	1096	0	0	635		
Future Volume (vph)	0	0	1096	0	0	635		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900		
Grade (%)		0%	0%		4%			
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.88		
Frt						0.850		
Flt Protected								
Satd. Flow (prot)	0	0	3539	0	0	2731		
Flt Permitted								
Satd. Flow (perm)	0	0	3539	0	0	2731		
Right Turn on Red				No		No		
Satd. Flow (RTOR)								
Link Speed (mph)		35	35		35			
Link Distance (ft)		202	115		181			
Travel Time (s)		3.9	2.2		3.5			
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90		
Adj. Flow (vph)	0	0	1218	0	0	706		
Shared Lane Traffic (%)								
Lane Group Flow (vph)	0	0	1218	0	0	706		
Turn Type			NA			Prot		
Protected Phases			8			6	2	4
Permitted Phases								
Detector Phase			8			6		
Switch Phase								
Minimum Initial (s)			10.0			10.0	10.0	10.0
Minimum Split (s)			26.1			19.3	24.3	21.1
Total Split (s)			60.0			60.0	60.0	60.0
Total Split (%)			50.0%			50.0%	50%	50%
Yellow Time (s)			4.0			3.7	3.7	4.0
All-Red Time (s)			4.1			5.6	5.6	4.1
Lost Time Adjust (s)			-3.1			-4.3		
Total Lost Time (s)			5.0			5.0		
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode			None			C-Max	C-Max	None
Act Effct Green (s)			53.6			56.4		
Actuated g/C Ratio			0.45			0.47		
v/c Ratio			0.77			0.55		
Control Delay			3.9			25.1		
Queue Delay			0.0			0.0		
Total Delay			3.9			25.1		
LOS			A			C		
Approach Delay			3.9		25.1			
Approach LOS			A		C			
Queue Length 50th (ft)			8			221		
Queue Length 95th (ft)			17			288		
Internal Link Dist (ft)		122	35		101			
Turn Bay Length (ft)								

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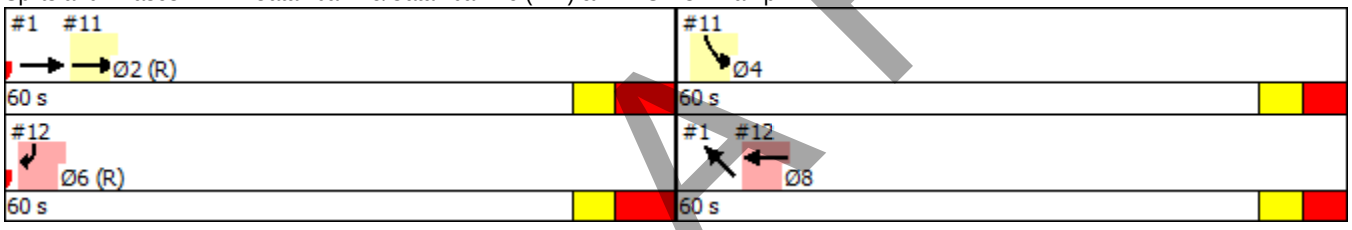
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR	Ø2	Ø4
Base Capacity (vph)			1622			1283		
Starvation Cap Reductn			6			0		
Spillback Cap Reductn			0			0		
Storage Cap Reductn			0			0		
Reduced v/c Ratio			0.75			0.55		

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 70 (58%), Referenced to phase 2:EBT and 6:, Start of Green
Natural Cycle: 55
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.77
Intersection Signal Delay: 11.7 Intersection LOS: B
Intersection Capacity Utilization 63.8% ICU Level of Service B
Analysis Period (min) 15

Splits and Phases: 12: Catawba Ave/Catawba Ave (WB) & I-77 SB Off-Ramp



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Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	0	778	0	0	0	0	0	1098	0
Future Volume (vph)	0	0	0	0	778	0	0	0	0	0	1098	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		0%			0%			0%			-1%	
Lane Util. Factor	1.00	1.00	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00	0.95	1.00
Frt												
Flt Protected												
Satd. Flow (prot)	0	0	0	0	3539	0	0	0	0	0	3557	0
Flt Permitted												
Satd. Flow (perm)	0	0	0	0	3539	0	0	0	0	0	3557	0
Right Turn on Red			No	No		No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)		35			35			35			35	
Link Distance (ft)		182			125			128			169	
Travel Time (s)		3.5			2.4			2.5			3.3	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	0	0	0	864	0	0	0	0	0	1220	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	0	864	0	0	0	0	0	1220	0
Turn Type					NA						NA	
Protected Phases					6						4	
Permitted Phases												
Detector Phase					6						4	
Switch Phase												
Minimum Initial (s)					7.0						7.0	
Minimum Split (s)					19.9						21.9	
Total Split (s)					60.0						60.0	
Total Split (%)					50.0%						50.0%	
Yellow Time (s)					3.9						3.9	
All-Red Time (s)					4.0						4.0	
Lost Time Adjust (s)					-2.0						-2.9	
Total Lost Time (s)					5.9						5.0	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode					C-Max						None	
Act Effct Green (s)					57.5						51.6	
Actuated g/C Ratio					0.48						0.43	
v/c Ratio					0.51						0.80	
Control Delay					27.5						29.4	
Queue Delay					1.0						1.4	
Total Delay					28.5						30.8	
LOS					C						C	
Approach Delay					28.5						30.8	
Approach LOS					C						C	
Queue Length 50th (ft)					241						468	
Queue Length 95th (ft)					m265						553	
Internal Link Dist (ft)		102			45			48			89	
Turn Bay Length (ft)												

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Lane Group	Ø2	Ø8
Lane Configurations		
Traffic Volume (vph)		
Future Volume (vph)		
Ideal Flow (vphpl)		
Grade (%)		
Lane Util. Factor		
Frt		
Flt Protected		
Satd. Flow (prot)		
Flt Permitted		
Satd. Flow (perm)		
Right Turn on Red		
Satd. Flow (RTOR)		
Link Speed (mph)		
Link Distance (ft)		
Travel Time (s)		
Peak Hour Factor		
Adj. Flow (vph)		
Shared Lane Traffic (%)		
Lane Group Flow (vph)		
Turn Type		
Protected Phases	2	8
Permitted Phases		
Detector Phase		
Switch Phase		
Minimum Initial (s)	10.0	7.0
Minimum Split (s)	18.9	19.9
Total Split (s)	60.0	60.0
Total Split (%)	50%	50%
Yellow Time (s)	3.8	3.9
All-Red Time (s)	5.1	4.0
Lost Time Adjust (s)		
Total Lost Time (s)		
Lead/Lag		
Lead-Lag Optimize?		
Recall Mode	C-Max	None
Act Effct Green (s)		
Actuated g/C Ratio		
v/c Ratio		
Control Delay		
Queue Delay		
Total Delay		
LOS		
Approach Delay		
Approach LOS		
Queue Length 50th (ft)		
Queue Length 95th (ft)		
Internal Link Dist (ft)		
Turn Bay Length (ft)		

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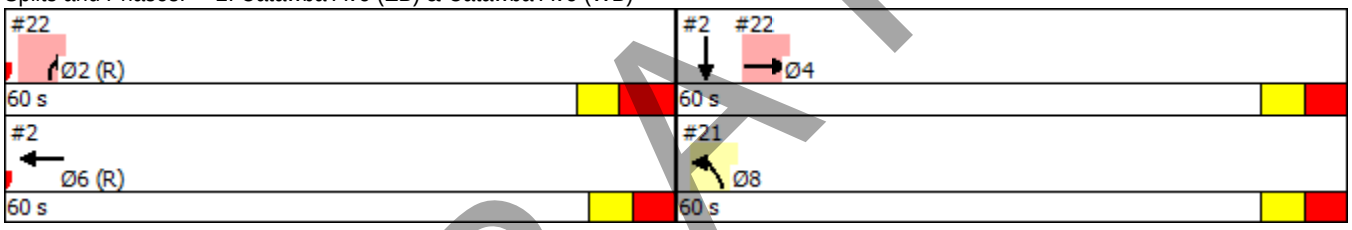
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Base Capacity (vph)					1695						1630	
Starvation Cap Reductn					532						219	
Spillback Cap Reductn					0						0	
Storage Cap Reductn					0						0	
Reduced v/c Ratio					0.74						0.86	

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 20 (17%), Referenced to phase 2:NBR and 6:, Start of Green
Natural Cycle: 50
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.80
Intersection Signal Delay: 29.8 Intersection LOS: C
Intersection Capacity Utilization 60.9% ICU Level of Service B
Analysis Period (min) 15
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 2: Catawba Ave (EB) & Catawba Ave (WB)



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Lane Group	Ø2	Ø8
Base Capacity (vph)		
Starvation Cap Reductn		
Spillback Cap Reductn		
Storage Cap Reductn		
Reduced v/c Ratio		

Intersection Summary

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Lane Group	EBL	EBR	NBL	NBR	SWL	SWR	Ø2	Ø4	Ø6
Lane Configurations									
Traffic Volume (vph)	0	0	414	0	0	778			
Future Volume (vph)	0	0	414	0	0	778			
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900			
Lane Util. Factor	1.00	1.00	0.97	1.00	1.00	0.88			
Frt						0.850			
Flt Protected			0.950						
Satd. Flow (prot)	0	0	3433	0	0	2787			
Flt Permitted			0.950						
Satd. Flow (perm)	0	0	3433	0	0	2787			
Right Turn on Red		No	No	No		No			
Satd. Flow (RTOR)									
Link Speed (mph)	35		35		35				
Link Distance (ft)	209		215		182				
Travel Time (s)	4.1		4.2		3.5				
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90			
Adj. Flow (vph)	0	0	460	0	0	864			
Shared Lane Traffic (%)									
Lane Group Flow (vph)	0	0	460	0	0	864			
Turn Type			Prot			custom			
Protected Phases			8!			Free!	2	4	6
Permitted Phases									
Detector Phase			8						
Switch Phase									
Minimum Initial (s)			7.0				10.0	7.0	7.0
Minimum Split (s)			19.9				18.9	21.9	19.9
Total Split (s)			60.0				60.0	60.0	60.0
Total Split (%)			50.0%				50%	50%	50%
Yellow Time (s)			3.9				3.8	3.9	3.9
All-Red Time (s)			4.0				5.1	4.0	4.0
Lost Time Adjust (s)			-2.9						
Total Lost Time (s)			5.0						
Lead/Lag									
Lead-Lag Optimize?									
Recall Mode			None				C-Max	None	C-Max
Act Effct Green (s)			51.6			120.0			
Actuated g/C Ratio			0.43			1.00			
v/c Ratio			0.31			0.31			
Control Delay			22.7			1.9			
Queue Delay			0.0			0.0			
Total Delay			22.7			1.9			
LOS			C			A			
Approach Delay			22.7		1.9				
Approach LOS			C		A				
Queue Length 50th (ft)			115			51			
Queue Length 95th (ft)			150			49			
Internal Link Dist (ft)	129		135		102				
Turn Bay Length (ft)									
Base Capacity (vph)			1573			2787			

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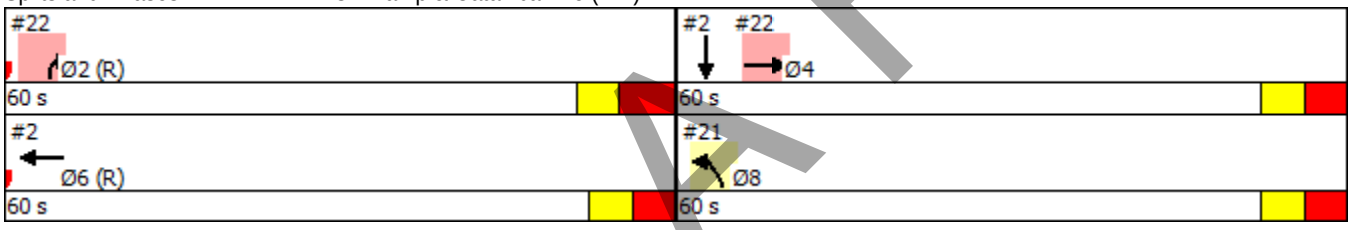
Lane Group	EBL	EBR	NBL	NBR	SWL	SWR	Ø2	Ø4	Ø6
Starvation Cap Reductn			0			0			
Spillback Cap Reductn			47			139			
Storage Cap Reductn			0			0			
Reduced v/c Ratio			0.30			0.33			

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 20 (17%), Referenced to phase 2:NBR and 6:, Start of Green
Natural Cycle: 50
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.80
Intersection Signal Delay: 9.1 Intersection LOS: A
Intersection Capacity Utilization 22.1% ICU Level of Service A
Analysis Period (min) 15
! Phase conflict between lane groups.

Splits and Phases: 21: I-77 NB Off-Ramp & Catawba Ave (WB)



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Lane Group	EBT	EBR	WBL	WBT	NBL	NBR	Ø6	Ø8
Lane Configurations								
Traffic Volume (vph)	1098	0	0	0	0	185		
Future Volume (vph)	1098	0	0	0	0	185		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900		
Grade (%)	0%			0%	4%			
Lane Util. Factor	0.95	1.00	1.00	1.00	1.00	1.00		
Frt						0.865		
Flt Protected								
Satd. Flow (prot)	3539	0	0	0	0	1579		
Flt Permitted								
Satd. Flow (perm)	3539	0	0	0	0	1579		
Right Turn on Red		No				No		
Satd. Flow (RTOR)								
Link Speed (mph)	35			35	35			
Link Distance (ft)	128			116	197			
Travel Time (s)	2.5			2.3	3.8			
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90		
Adj. Flow (vph)	1220	0	0	0	0	206		
Shared Lane Traffic (%)								
Lane Group Flow (vph)	1220	0	0	0	0	206		
Turn Type	NA					Prot		
Protected Phases	4					2	6	8
Permitted Phases								
Detector Phase	4					2		
Switch Phase								
Minimum Initial (s)	7.0					10.0	7.0	7.0
Minimum Split (s)	21.9					18.9	19.9	19.9
Total Split (s)	60.0					60.0	60.0	60.0
Total Split (%)	50.0%					50.0%	50%	50%
Yellow Time (s)	3.9					3.8	3.9	3.9
All-Red Time (s)	4.0					5.1	4.0	4.0
Lost Time Adjust (s)	-2.9					-3.9		
Total Lost Time (s)	5.0					5.0		
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None					C-Max	C-Max	None
Act Effct Green (s)	51.6					58.4		
Actuated g/C Ratio	0.43					0.49		
v/c Ratio	0.80					0.27		
Control Delay	3.5					20.2		
Queue Delay	0.0					0.0		
Total Delay	3.6					20.2		
LOS	A					C		
Approach Delay	3.6				20.2			
Approach LOS	A				C			
Queue Length 50th (ft)	4					94		
Queue Length 95th (ft)	0					153		
Internal Link Dist (ft)	48			36	117			
Turn Bay Length (ft)								

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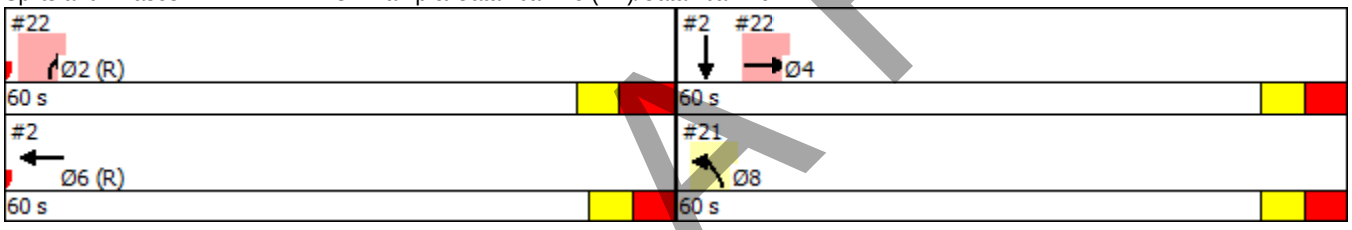
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR	Ø6	Ø8
Base Capacity (vph)	1622					768		
Starvation Cap Reductn	14					0		
Spillback Cap Reductn	0					0		
Storage Cap Reductn	0					0		
Reduced v/c Ratio	0.76					0.27		

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 20 (17%), Referenced to phase 2:NBR and 6:, Start of Green
Natural Cycle: 50
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.80
Intersection Signal Delay: 6.0 Intersection LOS: A
Intersection Capacity Utilization 60.9% ICU Level of Service B
Analysis Period (min) 15

Splits and Phases: 22: I-77 NB Off-Ramp & Catawba Ave (EB)/Catawba Ave



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Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	143	572	568	102	622	30	469	41	130	57	28	87
Future Volume (vph)	143	572	568	102	622	30	469	41	130	57	28	87
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		-2%			1%			3%			5%	
Storage Length (ft)	100		0	100		0	150		150	75		0
Storage Lanes	1		1	1		0	1		1	1		0
Taper Length (ft)	100			100			100			100		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	1.00	1.00	1.00	1.00
Frt			0.850		0.993				0.850		0.886	
Flt Protected	0.950			0.950			0.950	0.960		0.950		
Satd. Flow (prot)	1787	1881	1599	1761	1840	0	1656	1673	1560	1725	1609	0
Flt Permitted	0.081			0.140			0.950	0.960		0.950		
Satd. Flow (perm)	152	1881	1599	259	1840	0	1656	1673	1560	1725	1609	0
Right Turn on Red			No			No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)		35			35			35			35	
Link Distance (ft)		229			323			537			298	
Travel Time (s)		4.5			6.3			10.5			5.8	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	159	636	631	113	691	33	521	46	144	63	31	97
Shared Lane Traffic (%)							46%					
Lane Group Flow (vph)	159	636	631	113	724	0	281	286	144	63	128	0
Turn Type	pm+pt	NA	pm+ov	pm+pt	NA		Split	NA	pm+ov	Split	NA	
Protected Phases	5	2	3	1	6		3	3	1	4	4	
Permitted Phases	2		2	6					3			
Detector Phase	5	2	3	1	6		3	3	1	4	4	
Switch Phase												
Minimum Initial (s)	7.0	10.0	7.0	7.0	10.0		7.0	7.0	7.0	7.0	7.0	
Minimum Split (s)	13.3	31.4	28.3	13.2	28.4		28.3	28.3	13.2	12.9	12.9	
Total Split (s)	17.0	49.0	37.0	17.0	49.0		37.0	37.0	17.0	17.0	17.0	
Total Split (%)	14.2%	40.8%	30.8%	14.2%	40.8%		30.8%	30.8%	14.2%	14.2%	14.2%	
Yellow Time (s)	3.0	4.0	3.7	3.0	4.0		3.7	3.7	3.0	3.6	3.6	
All-Red Time (s)	3.3	2.4	2.6	3.2	2.4		2.6	2.6	3.2	2.3	2.3	
Lost Time Adjust (s)	-1.3	-1.4	-1.4	-1.2	-1.4		-1.3	-1.3	-1.2	-0.9	-0.9	
Total Lost Time (s)	5.0	5.0	4.9	5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Lead/Lag	Lead	Lag	Lead	Lead	Lag		Lead	Lead	Lead	Lag	Lag	
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	
Recall Mode	None	C-Max	None	None	C-Max		None	None	None	None	None	
Act Effct Green (s)	60.5	49.7	82.4	58.6	48.7		27.6	27.6	37.5	12.8	12.8	
Actuated g/C Ratio	0.50	0.41	0.69	0.49	0.41		0.23	0.23	0.31	0.11	0.11	
v/c Ratio	0.71	0.82	0.57	0.45	0.97		0.74	0.74	0.30	0.34	0.75	
Control Delay	41.2	60.2	18.5	21.2	62.9		54.5	54.7	19.4	55.4	78.2	
Queue Delay	0.0	51.1	0.7	0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Total Delay	41.2	111.2	19.3	21.2	62.9		54.5	54.7	19.4	55.4	78.2	
LOS	D	F	B	C	E		D	D	B	E	E	
Approach Delay		62.7			57.3			47.5			70.7	
Approach LOS		E			E			D			E	
Queue Length 50th (ft)	114	523	238	45	~622		209	213	55	45	96	

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Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 95th (ft)	m155	#718	328	77	#857		305	309	89	93	#204	
Internal Link Dist (ft)		149			243			457			218	
Turn Bay Length (ft)	100			100			150		150	75		
Base Capacity (vph)	241	778	1156	281	747		441	446	515	186	174	
Starvation Cap Reductn	0	234	242	0	0		0	0	0	0	0	
Spillback Cap Reductn	0	0	0	0	0		0	0	0	0	0	
Storage Cap Reductn	0	0	0	0	0		0	0	0	0	0	
Reduced v/c Ratio	0.66	1.17	0.69	0.40	0.97		0.64	0.64	0.28	0.34	0.74	

Intersection Summary

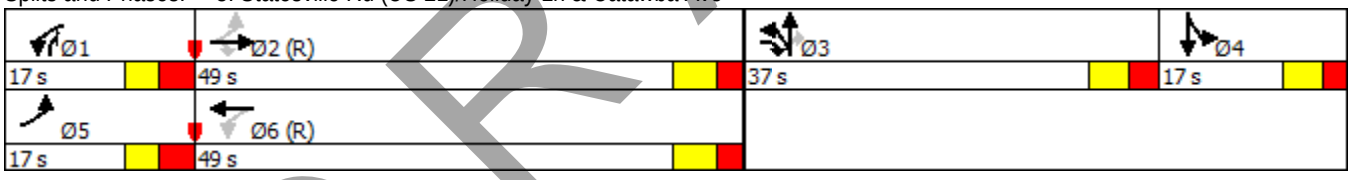
Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 35 (29%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green
Natural Cycle: 100
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.97
Intersection Signal Delay: 58.3 Intersection LOS: E
Intersection Capacity Utilization 75.7% ICU Level of Service D
Analysis Period (min) 15

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 3: Statesville Rd (US 21)/Holiday Ln & Catawba Ave



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Intersection

Int Delay, s/veh 2.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	16	725	19	4	682	53	14	4	4	15	4	58
Future Vol, veh/h	16	725	19	4	682	53	14	4	4	15	4	58
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	50	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	18	806	21	4	758	59	16	4	4	17	4	64

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	817	0	0	827	0	0	1683	1678	816	1652	1658	787
Stage 1	-	-	-	-	-	-	852	852	-	796	796	-
Stage 2	-	-	-	-	-	-	831	826	-	856	862	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	811	-	-	804	-	-	75	95	377	79	98	392
Stage 1	-	-	-	-	-	-	354	376	-	380	399	-
Stage 2	-	-	-	-	-	-	364	387	-	352	372	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	811	-	-	804	-	-	59	92	377	73	95	392
Mov Cap-2 Maneuver	-	-	-	-	-	-	59	92	-	73	95	-
Stage 1	-	-	-	-	-	-	346	368	-	372	395	-
Stage 2	-	-	-	-	-	-	298	384	-	336	364	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.2	0.1	73.4	37.2
HCM LOS			F	E

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	76	811	-	-	804	-	-	195
HCM Lane V/C Ratio	0.322	0.022	-	-	0.006	-	-	0.439
HCM Control Delay (s)	73.4	9.5	-	-	9.5	0	-	37.2
HCM Lane LOS	F	A	-	-	A	A	-	E
HCM 95th %tile Q(veh)	1.2	0.1	-	-	0	-	-	2

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Intersection	
Int Delay, s/veh	1.6

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	27	4	89	28	4	49
Future Vol, veh/h	27	4	89	28	4	49
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	5
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	30	4	99	31	4	54

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	177	114	0	0	130	0
Stage 1	114	-	-	-	-	-
Stage 2	63	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	813	939	-	-	1455	-
Stage 1	911	-	-	-	-	-
Stage 2	960	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	811	939	-	-	1455	-
Mov Cap-2 Maneuver	811	-	-	-	-	-
Stage 1	911	-	-	-	-	-
Stage 2	957	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	9.5	0	0.6
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	826	1455	-
HCM Lane V/C Ratio	-	-	0.042	0.003	-
HCM Control Delay (s)	-	-	9.5	7.5	0
HCM Lane LOS	-	-	A	A	A
HCM 95th %tile Q(veh)	-	-	0.1	0	-

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Intersection

Int Delay, s/veh 2.8

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	95	4	117	96	4	76
Future Vol, veh/h	95	4	117	96	4	76
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	5
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	106	4	130	107	4	84

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	276	183	0	0	237	0
Stage 1	183	-	-	-	-	-
Stage 2	93	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	714	859	-	-	1330	-
Stage 1	848	-	-	-	-	-
Stage 2	931	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	712	859	-	-	1330	-
Mov Cap-2 Maneuver	712	-	-	-	-	-
Stage 1	848	-	-	-	-	-
Stage 2	928	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	10.9	0	0.4
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	717	1330	-
HCM Lane V/C Ratio	-	-	0.153	0.003	-
HCM Control Delay (s)	-	-	10.9	7.7	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	0.5	0	-

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Intersection						
Int Delay, s/veh	7.3					

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	4	68	67	4	5	4
Future Vol, veh/h	4	68	67	4	5	4
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	4	76	74	4	6	4

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	161	8	10	0	-	0
Stage 1	8	-	-	-	-	-
Stage 2	153	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	830	1074	1610	-	-	-
Stage 1	1015	-	-	-	-	-
Stage 2	875	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	792	1074	1610	-	-	-
Mov Cap-2 Maneuver	792	-	-	-	-	-
Stage 1	1015	-	-	-	-	-
Stage 2	835	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	8.7	6.9	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1610	-	1053	-	-
HCM Lane V/C Ratio	0.046	-	0.076	-	-
HCM Control Delay (s)	7.3	0	8.7	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0.1	-	0.2	-	-

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Summary of All Intervals

Run Number	1	2	3	4	5	Avg
Start Time	4:50	4:50	4:50	4:50	4:50	4:50
End Time	6:00	6:00	6:00	6:00	6:00	6:00
Total Time (min)	70	70	70	70	70	70
Time Recorded (min)	60	60	60	60	60	60
# of Intervals	5	5	5	5	5	5
# of Recorded Intervals	4	4	4	4	4	4
Vehs Entered	303	360	710	1585	800	749
Vehs Exited	215	129	558	1440	535	575
Starting Vehs	281	275	223	242	163	236
Ending Vehs	369	506	375	387	428	411
Travel Distance (mi)	82	59	236	609	231	244
Travel Time (hr)	2631.1	2662.4	2206.4	1650.2	2144.8	2259.0
Total Delay (hr)	2628.1	2660.1	2197.9	1628.3	2136.5	2250.2
Total Stops	353	428	1070	2634	1044	1106
Fuel Used (gal)	601.8	609.0	510.5	394.3	496.3	522.4

Interval #0 Information Seeding

Start Time	4:50
End Time	5:00
Total Time (min)	10

Volumes adjusted by Growth Factors.
No data recorded this interval.

Interval #1 Information 1

Start Time	5:00
End Time	5:15
Total Time (min)	15

Volumes adjusted by Growth Factors, Anti PHF.

Run Number	1	2	3	4	5	Avg
Vehs Entered	279	332	627	725	767	544
Vehs Exited	215	125	505	680	514	406
Starting Vehs	281	275	223	242	163	236
Ending Vehs	345	482	345	287	416	372
Travel Distance (mi)	82	58	218	291	226	175
Travel Time (hr)	202.3	204.9	137.1	123.3	93.2	152.2
Total Delay (hr)	199.3	202.7	129.3	112.8	85.1	145.8
Total Stops	332	408	963	1190	1012	779
Fuel Used (gal)	48.6	48.4	37.8	37.1	27.9	39.9

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Interval #2 Information 2

Start Time 5:15
End Time 5:30
Total Time (min) 15
Volumes adjusted by PHF, Growth Factors.

Run Number	1	2	3	4	5	Avg
Vehs Entered	14	13	71	695	22	163
Vehs Exited	0	1	51	647	19	144
Starting Vehs	345	482	345	287	416	372
Ending Vehs	359	494	365	335	419	391
Travel Distance (mi)	0	0	17	274	5	59
Travel Time (hr)	506.6	513.9	386.2	267.4	365.5	407.9
Total Delay (hr)	506.6	513.9	385.6	257.6	365.3	405.8
Total Stops	12	10	97	1227	23	274
Fuel Used (gal)	115.5	117.3	88.7	69.2	83.6	94.9

Interval #3 Information 3

Start Time 5:30
End Time 5:45
Total Time (min) 15
Volumes adjusted by Growth Factors, Anti PHF.

Run Number	1	2	3	4	5	Avg
Vehs Entered	5	8	3	159	2	34
Vehs Exited	0	1	1	113	0	23
Starting Vehs	359	494	365	335	419	391
Ending Vehs	364	501	367	381	421	404
Travel Distance (mi)	0	0	0	45	0	9
Travel Time (hr)	813.8	825.6	698.6	485.2	693.9	703.4
Total Delay (hr)	813.8	825.6	698.6	483.6	693.9	703.1
Total Stops	5	7	2	212	2	45
Fuel Used (gal)	185.4	188.3	159.4	111.8	158.4	160.7

Interval #4 Information 4

Start Time 5:45
End Time 6:00
Total Time (min) 15
Volumes adjusted by Growth Factors, Anti PHF.

Run Number	1	2	3	4	5	Avg
Vehs Entered	5	7	9	6	9	7
Vehs Exited	0	2	1	0	2	1
Starting Vehs	364	501	367	381	421	404
Ending Vehs	369	506	375	387	428	411
Travel Distance (mi)	0	0	0	0	0	0
Travel Time (hr)	1108.4	1118.0	984.6	774.3	992.2	995.5
Total Delay (hr)	1108.4	1117.9	984.5	774.3	992.2	995.5
Total Stops	4	3	8	5	7	5
Fuel Used (gal)	252.3	255.0	224.6	176.2	226.5	226.9

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Intersection: 1: Catawba Ave (WB) & Catawba Ave (EB)

Movement	EB	EB	EB	NW	NW
Directions Served	T	T	T	T	T
Maximum Queue (ft)	110	184	156	131	137
Average Queue (ft)	39	170	44	73	74
95th Queue (ft)	152	179	149	169	170
Link Distance (ft)	60	60	60	46	46
Upstream Blk Time (%)	16	97	22	44	46
Queuing Penalty (veh)	70	422	97	243	252
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 2: Catawba Ave (EB) & Catawba Ave (WB)

Movement	WB	WB	SB	SB
Directions Served	T	T	T	T
Maximum Queue (ft)	134	138	154	160
Average Queue (ft)	124	121	145	57
95th Queue (ft)	130	148	159	175
Link Distance (ft)	74	74	86	86
Upstream Blk Time (%)	99	98	96	27
Queuing Penalty (veh)	385	383	529	149
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 3: Statesville Rd (US 21)/Holiday Ln & Catawba Ave

Movement	EB	EB	EB	WB	WB	NB	NB	NB	SB	SB
Directions Served	L	T	R	L	TR	L	LT	R	L	TR
Maximum Queue (ft)	132	217	215	109	331	226	511	200	82	220
Average Queue (ft)	84	208	69	19	325	118	489	10	22	216
95th Queue (ft)	154	225	223	82	359	247	540	87	75	240
Link Distance (ft)		170	170		245		487			217
Upstream Blk Time (%)	0	91	21		98		97			97
Queuing Penalty (veh)	0	586	133		740		0			165
Storage Bay Dist (ft)	100			100		150		150	75	
Storage Blk Time (%)	52	61			99	35	99		20	99
Queuing Penalty (veh)	298	88			100	142	359		23	56

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Intersection: 4: Hill St/Burton Ln & Catawba Ave

Movement	EB	EB	WB	NB	SB
Directions Served	L	TR	LTR	LTR	LTR
Maximum Queue (ft)	45	23	540	428	86
Average Queue (ft)	36	1	523	239	84
95th Queue (ft)	74	17	627	440	104
Link Distance (ft)		245	531	466	86
Upstream Blk Time (%)			98	2	96
Queuing Penalty (veh)			0	0	70
Storage Bay Dist (ft)	50				
Storage Blk Time (%)	72				
Queuing Penalty (veh)	536				

Intersection: 5: Holiday Ln & Site Access #1

Movement	WB	SB
Directions Served	LR	LT
Maximum Queue (ft)	199	165
Average Queue (ft)	149	137
95th Queue (ft)	258	204
Link Distance (ft)	184	157
Upstream Blk Time (%)	66	85
Queuing Penalty (veh)	0	0
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 6: Holiday Ln & Site Access #2

Movement	WB	SB
Directions Served	LR	LT
Maximum Queue (ft)	104	76
Average Queue (ft)	90	73
95th Queue (ft)	115	96
Link Distance (ft)	96	76
Upstream Blk Time (%)	95	94
Queuing Penalty (veh)	0	72
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

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Intersection: 7: Burton Ln & Site Acess #3

Movement	EB	NB	SB
Directions Served	LR	LT	TR
Maximum Queue (ft)	110	6	150
Average Queue (ft)	95	0	69
95th Queue (ft)	133	5	162
Link Distance (ft)	101	86	267
Upstream Blk Time (%)	88		
Queuing Penalty (veh)	0		
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 11: Catawba Ave (EB) & I-77 SB Off-Ramp

Movement	EB	EB	EB	SB	SB
Directions Served	T	T	T	L	L
Maximum Queue (ft)	35	123	45	152	165
Average Queue (ft)	10	95	10	145	83
95th Queue (ft)	46	150	39	168	206
Link Distance (ft)	40	40	40	89	89
Upstream Blk Time (%)	13	97	20	91	42
Queuing Penalty (veh)	54	422	88	164	75
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 12: Catawba Ave/Catawba Ave (WB) & I-77 SB Off-Ramp

Movement	WB	SB	SB
Directions Served	T	R	R
Maximum Queue (ft)	9	157	129
Average Queue (ft)	0	43	28
95th Queue (ft)	5	153	102
Link Distance (ft)	56	89	89
Upstream Blk Time (%)		8	2
Queuing Penalty (veh)		26	7
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

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Intersection: 14: Catawba Ave (EB) & I-77 NB On-Ramp

Movement	EB	EB
Directions Served	T	T
Maximum Queue (ft)	219	179
Average Queue (ft)	203	45
95th Queue (ft)	272	159
Link Distance (ft)	143	143
Upstream Blk Time (%)	94	21
Queuing Penalty (veh)	521	115
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 15: Catawba Ave

Movement	WB	WB	NE	NE
Directions Served	T	T	R	R
Maximum Queue (ft)	168	220	115	58
Average Queue (ft)	138	204	99	14
95th Queue (ft)	250	260	126	58
Link Distance (ft)	170	170	61	61
Upstream Blk Time (%)	43	98	91	18
Queuing Penalty (veh)	251	575	582	117
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 17: I-77 SB On-Ramp & Catawba Ave (WB)

Movement	WB	WB
Directions Served	LT	T
Maximum Queue (ft)	128	185
Average Queue (ft)	64	96
95th Queue (ft)	181	259
Link Distance (ft)	139	139
Upstream Blk Time (%)	37	38
Queuing Penalty (veh)	223	229
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

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Intersection: 18: I-77 NB On-Ramp

Movement	EB	WB
Directions Served	L	R
Maximum Queue (ft)	12	58
Average Queue (ft)	0	29
95th Queue (ft)	9	122
Link Distance (ft)	143	71
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 19: I-77 SB On-Ramp

Movement	SE
Directions Served	R
Maximum Queue (ft)	51
Average Queue (ft)	0
95th Queue (ft)	0
Link Distance (ft)	137
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 21: I-77 NB Off-Ramp & Catawba Ave (WB)

Movement	NB	NB	SW	SW
Directions Served	L	L	R	R
Maximum Queue (ft)	156	192	43	24
Average Queue (ft)	88	96	17	24
95th Queue (ft)	222	233	72	101
Link Distance (ft)	116	116	78	78
Upstream Blk Time (%)	37	39	20	20
Queuing Penalty (veh)	76	82	79	78
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

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Intersection: 22: I-77 NB Off-Ramp & Catawba Ave (EB)/Catawba Ave

Movement	EB	EB	NB
Directions Served	T	T	R
Maximum Queue (ft)	130	7	181
Average Queue (ft)	125	0	144
95th Queue (ft)	229	6	216
Link Distance (ft)	86	86	110
Upstream Blk Time (%)	77		70
Queuing Penalty (veh)	420		129
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 24: I-77 SB On-Ramp & Catawba Ave/Catawba Ave (EB)

Movement	EB	EB	EB
Directions Served	T	T	TR
Maximum Queue (ft)	68	174	80
Average Queue (ft)	19	160	37
95th Queue (ft)	82	191	149
Link Distance (ft)		115	115
Upstream Blk Time (%)	1	93	20
Queuing Penalty (veh)	0	733	154
Storage Bay Dist (ft)	50		
Storage Blk Time (%)	14	94	
Queuing Penalty (veh)	59	408	

Intersection: 26: Catawba Ave

Movement	EB	EB
Directions Served	T	T
Maximum Queue (ft)	612	495
Average Queue (ft)	555	430
95th Queue (ft)	739	761
Link Distance (ft)	578	578
Upstream Blk Time (%)	91	39
Queuing Penalty (veh)	0	0
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

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Intersection: 27: I-77 SB Off-Ramp

Movement	SB	SB	SB	SB
Directions Served	L	L	R	R
Maximum Queue (ft)	459	543	922	446
Average Queue (ft)	368	426	709	27
95th Queue (ft)	623	776	1273	193
Link Distance (ft)			909	
Upstream Blk Time (%)			72	
Queuing Penalty (veh)			0	
Storage Bay Dist (ft)	450	450		450
Storage Blk Time (%)	58	76	16	0
Queuing Penalty (veh)	369	481	111	1

Intersection: 28: I-77 NB Off-Ramp

Movement	NB	NB	NB
Directions Served	L	L	R
Maximum Queue (ft)	597	809	390
Average Queue (ft)	171	621	200
95th Queue (ft)	560	1128	473
Link Distance (ft)		801	
Upstream Blk Time (%)		70	
Queuing Penalty (veh)		0	
Storage Bay Dist (ft)	500		500
Storage Blk Time (%)	18	68	8
Queuing Penalty (veh)	71	268	33

Intersection: 30: Catawba Ave (WB)/Catawba Ave & I-77 NB On-Ramp

Movement	WB	WB
Directions Served	T	TR
Maximum Queue (ft)	106	102
Average Queue (ft)	102	97
95th Queue (ft)	119	103
Link Distance (ft)	59	59
Upstream Blk Time (%)	98	98
Queuing Penalty (veh)	577	578
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Network Summary

Network wide Queuing Penalty: 14055

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APPENDIX F-7:
CAPACITY ANALYSIS RESULTS

2018 BUILD-IMPROVED CONDITIONS
AM PEAK HOUR

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Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	96	579	560	110	526	14	522	27	100	66	30	72
Future Volume (vph)	96	579	560	110	526	14	522	27	100	66	30	72
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		-2%			1%			3%			5%	
Storage Length (ft)	100		0	100		0	150		150	200		0
Storage Lanes	1		1	1		0	1		1	1		0
Taper Length (ft)	100			100			100			100		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.97	1.00	1.00	1.00	1.00	1.00
Frt			0.850		0.996			0.882			0.894	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1787	1881	1599	1761	1846	0	3382	1618	0	1725	1624	0
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	1787	1881	1599	1761	1846	0	3382	1618	0	1725	1624	0
Right Turn on Red			No			No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)		35			35			35			35	
Link Distance (ft)		229			323			537			298	
Travel Time (s)		4.5			6.3			10.5			5.8	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	107	643	622	122	584	16	580	30	111	73	33	80
Shared Lane Traffic (%)												
Lane Group Flow (vph)	107	643	622	122	600	0	580	141	0	73	113	0
Turn Type	Prot	NA	pm+ov	Prot	NA		Prot	NA		Prot	NA	
Protected Phases	5	2	3	1	6		3	8		7	4	
Permitted Phases			2									
Detector Phase	5	2	3	1	6		3	8		7	4	
Switch Phase												
Minimum Initial (s)	7.0	10.0	7.0	7.0	10.0		7.0	7.0		7.0	7.0	
Minimum Split (s)	14.0	32.0	29.0	14.0	29.0		29.0	29.0		14.0	14.0	
Total Split (s)	17.0	58.0	29.0	16.0	57.0		29.0	32.0		14.0	17.0	
Total Split (%)	14.2%	48.3%	24.2%	13.3%	47.5%		24.2%	26.7%		11.7%	14.2%	
Yellow Time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0		5.0	5.0	
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0		2.0	2.0		2.0	2.0	
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0	-2.0		-2.0	-2.0		-2.0	-2.0	
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0		5.0	5.0	
Lead/Lag	Lead	Lead	Lead	Lag	Lag		Lead	Lag		Lead	Lag	
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes		Yes	Yes		Yes	Yes	
Recall Mode	None	C-Max	None	None	C-Max		None	None		None	None	
Act Effct Green (s)	11.3	53.4	77.3	11.0	53.1		23.8	29.4		9.0	11.7	
Actuated g/C Ratio	0.09	0.44	0.64	0.09	0.44		0.20	0.24		0.08	0.10	
v/c Ratio	0.64	0.77	0.60	0.76	0.74		0.86	0.36		0.57	0.72	
Control Delay	83.6	11.6	3.6	81.7	34.6		60.7	41.9		71.1	77.0	
Queue Delay	0.0	0.6	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	83.6	12.2	3.6	81.7	34.6		60.7	41.9		71.1	77.0	
LOS	F	B	A	F	C		E	D		E	E	
Approach Delay		13.9			42.6			57.0			74.7	
Approach LOS		B			D			E			E	
Queue Length 50th (ft)	68	50	34	94	383		225	93		56	86	

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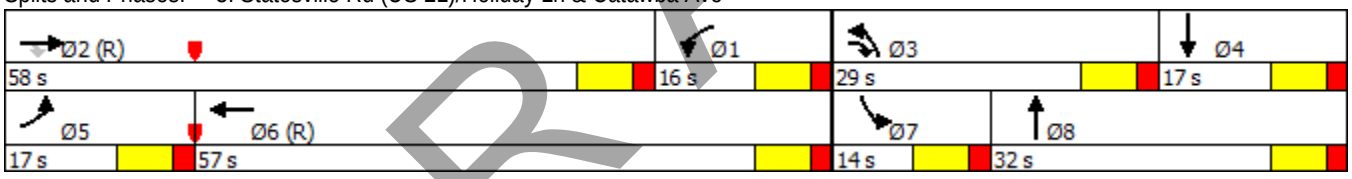
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 95th (ft)	m115	86	38	#192	531		#314	156		#113	#172	
Internal Link Dist (ft)		149			243			457			218	
Turn Bay Length (ft)	100			100			150			200		
Base Capacity (vph)	178	837	1032	161	816		676	396		129	162	
Starvation Cap Reductn	0	40	0	0	0		0	0		0	0	
Spillback Cap Reductn	0	0	0	0	0		0	0		0	0	
Storage Cap Reductn	0	0	0	0	0		0	0		0	0	
Reduced v/c Ratio	0.60	0.81	0.60	0.76	0.74		0.86	0.36		0.57	0.70	

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 20 (17%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.86
Intersection Signal Delay: 34.9 Intersection LOS: C
Intersection Capacity Utilization 74.1% ICU Level of Service D
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 3: Statesville Rd (US 21)/Holiday Ln & Catawba Ave



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Intersection

Int Delay, s/veh 1.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	11	726	7	4	588	44	5	4	8	12	4	56
Future Vol, veh/h	11	726	7	4	588	44	5	4	8	12	4	56
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	50	-	-	-	-	-	-	-	-	0	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	12	807	8	4	653	49	6	4	9	13	4	62

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	702	0	0	814	0	0	1555	1546	811	1529	1526	678
Stage 1	-	-	-	-	-	-	835	835	-	687	687	-
Stage 2	-	-	-	-	-	-	720	711	-	842	839	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	895	-	-	813	-	-	92	114	379	96	118	452
Stage 1	-	-	-	-	-	-	362	383	-	437	447	-
Stage 2	-	-	-	-	-	-	419	436	-	359	381	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	895	-	-	813	-	-	76	112	379	89	115	452
Mov Cap-2 Maneuver	-	-	-	-	-	-	76	112	-	89	115	-
Stage 1	-	-	-	-	-	-	357	378	-	431	443	-
Stage 2	-	-	-	-	-	-	355	433	-	342	376	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.1	0.1	34.9	22.6
HCM LOS			D	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	139	895	-	-	813	-	-	89	378
HCM Lane V/C Ratio	0.136	0.014	-	-	0.005	-	-	0.15	0.176
HCM Control Delay (s)	34.9	9.1	-	-	9.5	0	-	52.4	16.6
HCM Lane LOS	D	A	-	-	A	A	-	F	C
HCM 95th %tile Q(veh)	0.5	0	-	-	0	-	-	0.5	0.6

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Summary of All Intervals

Run Number	1	2	3	4	5	Avg
Start Time	6:50	6:50	6:50	6:50	6:50	6:50
End Time	8:00	8:00	8:00	8:00	8:00	8:00
Total Time (min)	70	70	70	70	70	70
Time Recorded (min)	60	60	60	60	60	60
# of Intervals	5	5	5	5	5	5
# of Recorded Intervals	4	4	4	4	4	4
Vehs Entered	4890	4800	4771	4737	4730	4783
Vehs Exited	4855	4797	4738	4770	4696	4770
Starting Vehs	143	163	128	191	149	152
Ending Vehs	178	166	161	158	183	167
Travel Distance (mi)	1983	1970	1946	1945	1935	1956
Travel Time (hr)	225.7	232.4	247.9	255.5	243.5	241.0
Total Delay (hr)	155.4	162.8	179.2	186.4	174.9	171.7
Total Stops	7698	7587	7577	7758	7246	7577
Fuel Used (gal)	115.9	116.3	118.3	119.5	117.6	117.5

Interval #0 Information Seeding

Start Time	6:50
End Time	7:00
Total Time (min)	10

Volumes adjusted by Growth Factors.
No data recorded this interval.

Interval #1 Information 1

Start Time	7:00
End Time	7:15
Total Time (min)	15

Volumes adjusted by Growth Factors, Anti PHF.

Run Number	1	2	3	4	5	Avg
Vehs Entered	1232	1194	1183	1178	1181	1194
Vehs Exited	1192	1201	1179	1218	1180	1193
Starting Vehs	143	163	128	191	149	152
Ending Vehs	183	156	132	151	150	150
Travel Distance (mi)	491	486	485	488	488	488
Travel Time (hr)	43.9	44.6	40.0	41.6	40.5	42.1
Total Delay (hr)	26.7	27.5	22.8	24.4	23.3	24.9
Total Stops	1778	1860	1645	1767	1780	1765
Fuel Used (gal)	25.5	25.6	24.1	24.4	24.6	24.8

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Interval #2 Information 2

Start Time 7:15
End Time 7:30
Total Time (min) 15
Volumes adjusted by PHF, Growth Factors.

Run Number	1	2	3	4	5	Avg
Vehs Entered	1258	1297	1274	1250	1261	1266
Vehs Exited	1244	1246	1190	1212	1196	1216
Starting Vehs	183	156	132	151	150	150
Ending Vehs	197	207	216	189	215	202
Travel Distance (mi)	510	520	501	502	499	506
Travel Time (hr)	65.9	56.2	61.2	60.6	57.7	60.3
Total Delay (hr)	47.7	37.9	43.5	42.7	39.9	42.3
Total Stops	2093	2027	2022	1969	1965	2011
Fuel Used (gal)	31.8	29.9	29.8	29.6	29.3	30.1

Interval #3 Information 3

Start Time 7:30
End Time 7:45
Total Time (min) 15
Volumes adjusted by Growth Factors, Anti PHF.

Run Number	1	2	3	4	5	Avg
Vehs Entered	1245	1173	1170	1176	1142	1178
Vehs Exited	1239	1223	1231	1189	1200	1217
Starting Vehs	197	207	216	189	215	202
Ending Vehs	203	157	155	176	157	165
Travel Distance (mi)	507	498	491	480	481	491
Travel Time (hr)	60.3	63.8	76.9	74.9	67.8	68.8
Total Delay (hr)	42.5	46.3	59.5	57.9	50.8	51.4
Total Stops	2001	1925	2033	2048	1773	1956
Fuel Used (gal)	30.4	30.5	33.5	32.5	31.0	31.6

Interval #4 Information 4

Start Time 7:45
End Time 8:00
Total Time (min) 15
Volumes adjusted by Growth Factors, Anti PHF.

Run Number	1	2	3	4	5	Avg
Vehs Entered	1155	1136	1144	1133	1146	1140
Vehs Exited	1180	1127	1138	1151	1120	1142
Starting Vehs	203	157	155	176	157	165
Ending Vehs	178	166	161	158	183	167
Travel Distance (mi)	476	465	469	476	467	471
Travel Time (hr)	55.6	67.7	69.8	78.3	77.4	69.8
Total Delay (hr)	38.5	51.2	53.3	61.4	60.8	53.0
Total Stops	1826	1775	1877	1974	1728	1834
Fuel Used (gal)	28.3	30.3	30.9	33.0	32.6	31.0

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Intersection: 1: Catawba Ave (WB) & Catawba Ave (EB)

Movement	EB	EB	EB	NW	NW
Directions Served	T	T	T	T	T
Maximum Queue (ft)	187	180	191	149	142
Average Queue (ft)	172	99	109	127	131
95th Queue (ft)	180	177	191	155	140
Link Distance (ft)	60	60	60	46	46
Upstream Blk Time (%)	53	27	20	39	46
Queuing Penalty (veh)	230	118	86	156	180
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 2: Catawba Ave (EB) & Catawba Ave (WB)

Movement	WB	WB	SB	SB
Directions Served	T	T	T	T
Maximum Queue (ft)	152	146	174	175
Average Queue (ft)	124	86	154	146
95th Queue (ft)	175	146	176	191
Link Distance (ft)	74	74	86	86
Upstream Blk Time (%)	27	14	35	32
Queuing Penalty (veh)	79	41	199	180
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 3: Statesville Rd (US 21)/Holiday Ln & Catawba Ave

Movement	EB	EB	EB	WB	WB	NB	NB	NB	SB	SB
Directions Served	L	T	R	L	TR	L	L	TR	L	TR
Maximum Queue (ft)	157	222	214	200	346	250	524	250	160	201
Average Queue (ft)	87	121	91	109	274	224	408	187	62	103
95th Queue (ft)	147	231	196	216	394	289	581	340	140	194
Link Distance (ft)		164	164		241		487			219
Upstream Blk Time (%)	0	10	4		16		20		0	3
Queuing Penalty (veh)	0	63	22		108		0		0	6
Storage Bay Dist (ft)	100			100		150		150	200	
Storage Blk Time (%)	15	21		7	38	15	67	2	0	5
Queuing Penalty (veh)	88	20		37	42	56	260	9	0	4

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Intersection: 4: Hill St/Burton Ln & Catawba Ave

Movement	EB	EB	WB	NB	SB	SB
Directions Served	L	TR	LTR	LTR	L	TR
Maximum Queue (ft)	43	15	187	48	37	82
Average Queue (ft)	8	1	33	14	9	27
95th Queue (ft)	30	11	126	38	28	67
Link Distance (ft)		241	526	466	90	90
Upstream Blk Time (%)						0
Queuing Penalty (veh)						0
Storage Bay Dist (ft)	50					
Storage Blk Time (%)	0	0				
Queuing Penalty (veh)	3	0				

Intersection: 5: Holiday Ln & Site Access #1

Movement	WB	SB
Directions Served	LR	LT
Maximum Queue (ft)	21	10
Average Queue (ft)	7	0
95th Queue (ft)	18	8
Link Distance (ft)	184	157
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 6: Holiday Ln & Site Access #2

Movement	WB	NB	SB
Directions Served	LR	R	LT
Maximum Queue (ft)	76	10	40
Average Queue (ft)	31	0	3
95th Queue (ft)	63	8	27
Link Distance (ft)	89		76
Upstream Blk Time (%)	2		1
Queuing Penalty (veh)	0		1
Storage Bay Dist (ft)		100	
Storage Blk Time (%)			
Queuing Penalty (veh)			

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Intersection: 7: Burton Ln & Site Acess #3

Movement	EB	NB
Directions Served	LR	LT
Maximum Queue (ft)	63	18
Average Queue (ft)	30	1
95th Queue (ft)	53	8
Link Distance (ft)	103	90
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 11: Catawba Ave (EB) & I-77 SB Off-Ramp

Movement	EB	EB	EB	SB	SB
Directions Served	T	T	T	L	L
Maximum Queue (ft)	82	89	74	172	175
Average Queue (ft)	69	28	12	144	138
95th Queue (ft)	94	70	51	178	195
Link Distance (ft)	40	40	40	89	89
Upstream Blk Time (%)	48	13	5	35	30
Queuing Penalty (veh)	209	54	21	107	92
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 12: Catawba Ave/Catawba Ave (WB) & I-77 SB Off-Ramp

Movement	WB	WB	SB	SB
Directions Served	T	T	R	R
Maximum Queue (ft)	18	34	170	153
Average Queue (ft)	1	6	155	118
95th Queue (ft)	8	24	162	161
Link Distance (ft)	56	56	89	89
Upstream Blk Time (%)		0	40	17
Queuing Penalty (veh)		0	183	79
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

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Intersection: 14: Catawba Ave (EB) & I-77 NB On-Ramp

Movement	EB	EB	EB
Directions Served	L	T	T
Maximum Queue (ft)	77	248	237
Average Queue (ft)	9	117	92
95th Queue (ft)	44	245	212
Link Distance (ft)	143	143	143
Upstream Blk Time (%)		9	6
Queuing Penalty (veh)		57	38
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 15: Catawba Ave

Movement	WB	WB	NE	NE
Directions Served	T	T	R	R
Maximum Queue (ft)	25	99	119	47
Average Queue (ft)	1	6	11	1
95th Queue (ft)	10	42	62	14
Link Distance (ft)	164	164	61	61
Upstream Blk Time (%)		0	1	0
Queuing Penalty (veh)		0	8	1
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 17: I-77 SB On-Ramp & Catawba Ave (WB)

Movement	WB	WB
Directions Served	LT	T
Maximum Queue (ft)	203	244
Average Queue (ft)	133	167
95th Queue (ft)	204	256
Link Distance (ft)	139	139
Upstream Blk Time (%)	8	12
Queuing Penalty (veh)	35	52
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

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Intersection: 18: I-77 NB On-Ramp

Movement	EB	WB
Directions Served	L	R
Maximum Queue (ft)	216	145
Average Queue (ft)	142	37
95th Queue (ft)	240	120
Link Distance (ft)	143	71
Upstream Blk Time (%)	8	1
Queuing Penalty (veh)	63	8
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 19: I-77 SB On-Ramp

Movement	SB	SE
Directions Served	T	R
Maximum Queue (ft)	117	102
Average Queue (ft)	6	5
95th Queue (ft)	59	65
Link Distance (ft)	111	137
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 21: I-77 NB Off-Ramp & Catawba Ave (WB)

Movement	NB	NB	SW	SW
Directions Served	L	L	R	R
Maximum Queue (ft)	115	190	66	46
Average Queue (ft)	43	93	5	3
95th Queue (ft)	117	166	34	25
Link Distance (ft)	116	116	78	78
Upstream Blk Time (%)	0	4	1	0
Queuing Penalty (veh)	0	5	2	1
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

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Intersection: 22: I-77 NB Off-Ramp & Catawba Ave (EB)/Catawba Ave

Movement	EB	EB	NB
Directions Served	T	T	R
Maximum Queue (ft)	120	69	149
Average Queue (ft)	17	10	55
95th Queue (ft)	64	37	112
Link Distance (ft)	86	86	110
Upstream Blk Time (%)	1	0	1
Queuing Penalty (veh)	6	0	1
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 24: I-77 SB On-Ramp & Catawba Ave/Catawba Ave (EB)

Movement	EB	EB	EB
Directions Served	T	T	TR
Maximum Queue (ft)	114	189	149
Average Queue (ft)	108	170	20
95th Queue (ft)	128	213	91
Link Distance (ft)		115	115
Upstream Blk Time (%)	27	39	1
Queuing Penalty (veh)	0	277	8
Storage Bay Dist (ft)	50		
Storage Blk Time (%)	49	2	
Queuing Penalty (veh)	213	9	

Intersection: 26: Catawba Ave

Movement	EB	EB
Directions Served	T	T
Maximum Queue (ft)	625	601
Average Queue (ft)	512	392
95th Queue (ft)	799	818
Link Distance (ft)	578	578
Upstream Blk Time (%)	46	8
Queuing Penalty (veh)	0	0
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

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Intersection: 27: I-77 SB Off-Ramp

Movement	SB	SB	SB	SB
Directions Served	L	L	R	R
Maximum Queue (ft)	210	138	307	252
Average Queue (ft)	65	30	181	126
95th Queue (ft)	161	99	286	259
Link Distance (ft)			909	
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)	450	450		450
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 28: I-77 NB Off-Ramp

Movement	NB	NB
Directions Served	L	R
Maximum Queue (ft)	37	8
Average Queue (ft)	2	0
95th Queue (ft)	17	6
Link Distance (ft)	801	
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		500
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 29: Bend

Movement	NB	NB
Directions Served	T	
Maximum Queue (ft)	353	329
Average Queue (ft)	275	24
95th Queue (ft)	481	163
Link Distance (ft)	275	275
Upstream Blk Time (%)	11	0
Queuing Penalty (veh)	71	3
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

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Intersection: 30: Catawba Ave (WB)/Catawba Ave & I-77 NB On-Ramp

Movement	WB	WB
Directions Served	T	TR
Maximum Queue (ft)	105	105
Average Queue (ft)	29	20
95th Queue (ft)	84	78
Link Distance (ft)	59	59
Upstream Blk Time (%)	3	2
Queuing Penalty (veh)	15	12
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Network Summary

Network wide Queuing Penalty: 3619

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APPENDIX F-8:
CAPACITY ANALYSIS RESULTS

2018 BUILD-IMPROVED CONDITIONS
PM PEAK HOUR

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Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	143	572	568	102	622	30	469	41	130	57	28	87
Future Volume (vph)	143	572	568	102	622	30	469	41	130	57	28	87
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		-2%			1%			3%			5%	
Storage Length (ft)	100		0	100		0	150		150	200		0
Storage Lanes	1		1	1		0	1		1	1		0
Taper Length (ft)	100			100			100			100		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.97	1.00	1.00	1.00	1.00	1.00
Frt			0.850		0.993			0.886			0.886	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1787	1881	1599	1761	1840	0	3382	1626	0	1725	1609	0
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	1787	1881	1599	1761	1840	0	3382	1626	0	1725	1609	0
Right Turn on Red			No			No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)		35			35			35			35	
Link Distance (ft)		229			323			537			298	
Travel Time (s)		4.5			6.3			10.5			5.8	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	159	636	631	113	691	33	521	46	144	63	31	97
Shared Lane Traffic (%)												
Lane Group Flow (vph)	159	636	631	113	724	0	521	190	0	63	128	0
Turn Type	Prot	NA	pm+ov	Prot	NA		Prot	NA		Prot	NA	
Protected Phases	5	2	3	1	6		3	8		7	4	
Permitted Phases			2									
Detector Phase	5	2	3	1	6		3	8		7	4	
Switch Phase												
Minimum Initial (s)	7.0	10.0	7.0	7.0	10.0		7.0	7.0		7.0	7.0	
Minimum Split (s)	14.0	32.0	14.0	14.0	29.0		14.0	29.0		14.0	14.0	
Total Split (s)	16.0	59.0	27.0	16.0	59.0		27.0	29.0		16.0	18.0	
Total Split (%)	13.3%	49.2%	22.5%	13.3%	49.2%		22.5%	24.2%		13.3%	15.0%	
Yellow Time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0		5.0	5.0	
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0		2.0	2.0		2.0	2.0	
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0	-2.0		-2.0	-2.0		-2.0	-2.0	
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0		5.0	5.0	
Lead/Lag	Lead	Lead	Lead	Lag	Lag		Lead	Lag		Lead	Lag	
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes		Yes	Yes		Yes	Yes	
Recall Mode	None	C-Max	None	None	C-Max		None	None		None	None	
Act Effct Green (s)	11.4	54.4	76.3	11.0	54.0		21.9	27.0		10.4	12.7	
Actuated g/C Ratio	0.10	0.45	0.64	0.09	0.45		0.18	0.22		0.09	0.11	
v/c Ratio	0.94	0.75	0.62	0.70	0.87		0.84	0.52		0.42	0.75	
Control Delay	119.3	11.7	4.1	76.2	43.2		61.1	48.3		60.7	78.7	
Queue Delay	0.0	0.9	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	119.3	12.6	4.1	76.2	43.2		61.1	48.3		60.7	78.7	
LOS	F	B	A	E	D		E	D		E	E	
Approach Delay		20.7			47.7			57.7			72.8	
Approach LOS		C			D			E			E	
Queue Length 50th (ft)	117	82	54	86	498		202	135		47	98	

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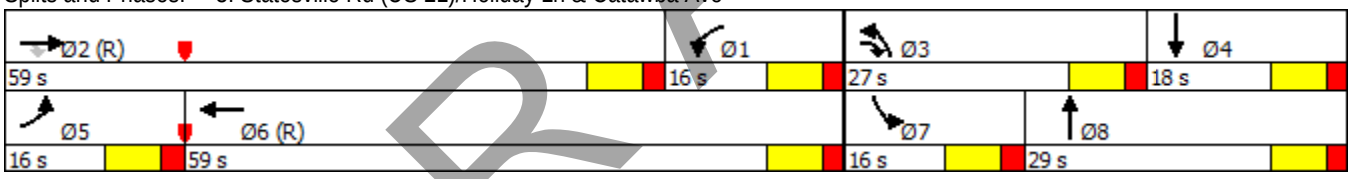
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 95th (ft)	m#212	105	56	#173	#733		#285	214		94	#193	
Internal Link Dist (ft)		149			243			457			218	
Turn Bay Length (ft)	100			100			150			200		
Base Capacity (vph)	169	852	1017	161	828		620	365		158	174	
Starvation Cap Reductn	0	61	4	0	0		0	0		0	0	
Spillback Cap Reductn	0	0	0	0	0		0	0		0	0	
Storage Cap Reductn	0	0	0	0	0		0	0		0	0	
Reduced v/c Ratio	0.94	0.80	0.62	0.70	0.87		0.84	0.52		0.40	0.74	

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 100 (83%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 100
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.94
Intersection Signal Delay: 39.3 Intersection LOS: D
Intersection Capacity Utilization 79.4% ICU Level of Service D
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 3: Statesville Rd (US 21)/Holiday Ln & Catawba Ave



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Intersection

Int Delay, s/veh 2.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	16	725	19	4	682	53	14	4	4	15	4	58
Future Vol, veh/h	16	725	19	4	682	53	14	4	4	15	4	58
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	50	-	-	-	-	-	-	-	-	0	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	18	806	21	4	758	59	16	4	4	17	4	64

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	817	0	0	827	0	0	1683	1678	816	1652	1658	787
Stage 1	-	-	-	-	-	-	852	852	-	796	796	-
Stage 2	-	-	-	-	-	-	831	826	-	856	862	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	811	-	-	804	-	-	75	95	377	79	98	392
Stage 1	-	-	-	-	-	-	354	376	-	380	399	-
Stage 2	-	-	-	-	-	-	364	387	-	352	372	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	811	-	-	804	-	-	59	92	377	73	95	392
Mov Cap-2 Maneuver	-	-	-	-	-	-	59	92	-	73	95	-
Stage 1	-	-	-	-	-	-	346	368	-	372	395	-
Stage 2	-	-	-	-	-	-	298	384	-	336	364	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.2	0.1	73.4	28.6
HCM LOS			F	D

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	76	811	-	-	804	-	-	73	326
HCM Lane V/C Ratio	0.322	0.022	-	-	0.006	-	-	0.228	0.211
HCM Control Delay (s)	73.4	9.5	-	-	9.5	0	-	68.3	19
HCM Lane LOS	F	A	-	-	A	A	-	F	C
HCM 95th %tile Q(veh)	1.2	0.1	-	-	0	-	-	0.8	0.8

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Summary of All Intervals

Run Number	1	2	3	4	5	Avg
Start Time	4:50	4:50	4:50	4:50	4:50	4:50
End Time	6:00	6:00	6:00	6:00	6:00	6:00
Total Time (min)	70	70	70	70	70	70
Time Recorded (min)	60	60	60	60	60	60
# of Intervals	5	5	5	5	5	5
# of Recorded Intervals	4	4	4	4	4	4
Vehs Entered	4861	4687	4708	4889	4932	4812
Vehs Exited	4834	4671	4714	4856	4920	4798
Starting Vehs	164	131	169	142	142	148
Ending Vehs	191	147	163	175	154	160
Travel Distance (mi)	1990	1923	1951	2008	2020	1979
Travel Time (hr)	223.5	154.2	180.7	192.9	193.1	188.9
Total Delay (hr)	153.3	86.5	112.2	122.4	122.1	119.3
Total Stops	7644	5768	6679	6499	7050	6725
Fuel Used (gal)	112.8	94.2	101.3	106.0	107.4	104.4

Interval #0 Information Seeding

Start Time	4:50
End Time	5:00
Total Time (min)	10

Volumes adjusted by Growth Factors.
No data recorded this interval.

Interval #1 Information 1

Start Time	5:00
End Time	5:15
Total Time (min)	15

Volumes adjusted by Growth Factors, Anti PHF.

Run Number	1	2	3	4	5	Avg
Vehs Entered	1248	1130	1136	1125	1207	1168
Vehs Exited	1238	1170	1165	1128	1181	1174
Starting Vehs	164	131	169	142	142	148
Ending Vehs	174	91	140	139	168	138
Travel Distance (mi)	506	474	478	464	489	482
Travel Time (hr)	41.3	36.8	42.0	35.9	40.0	39.2
Total Delay (hr)	23.5	20.1	25.2	19.6	22.8	22.2
Total Stops	1598	1385	1651	1375	1555	1509
Fuel Used (gal)	24.8	23.0	24.1	22.5	24.2	23.7

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Interval #2 Information 2

Start Time 5:15
End Time 5:30
Total Time (min) 15
Volumes adjusted by PHF, Growth Factors.

Run Number	1	2	3	4	5	Avg
Vehs Entered	1325	1282	1294	1368	1319	1318
Vehs Exited	1244	1155	1208	1262	1269	1228
Starting Vehs	174	91	140	139	168	138
Ending Vehs	255	218	226	245	218	228
Travel Distance (mi)	525	498	510	537	527	520
Travel Time (hr)	54.4	41.7	54.6	51.6	59.4	52.3
Total Delay (hr)	35.9	24.3	36.7	32.7	40.9	34.1
Total Stops	2049	1586	2026	1810	2113	1918
Fuel Used (gal)	28.4	24.6	28.4	28.1	30.3	28.0

Interval #3 Information 3

Start Time 5:30
End Time 5:45
Total Time (min) 15
Volumes adjusted by Growth Factors, Anti PHF.

Run Number	1	2	3	4	5	Avg
Vehs Entered	1142	1141	1112	1186	1249	1164
Vehs Exited	1178	1219	1216	1239	1293	1228
Starting Vehs	255	218	226	245	218	228
Ending Vehs	219	140	122	192	174	170
Travel Distance (mi)	483	488	492	502	525	498
Travel Time (hr)	65.4	39.8	48.4	57.9	53.8	53.1
Total Delay (hr)	48.3	22.6	31.2	40.3	35.3	35.5
Total Stops	2081	1468	1649	1719	1895	1761
Fuel Used (gal)	30.4	24.4	26.4	29.0	29.1	27.8

Interval #4 Information 4

Start Time 5:45
End Time 6:00
Total Time (min) 15
Volumes adjusted by Growth Factors, Anti PHF.

Run Number	1	2	3	4	5	Avg
Vehs Entered	1146	1134	1166	1210	1157	1162
Vehs Exited	1174	1127	1125	1227	1177	1164
Starting Vehs	219	140	122	192	174	170
Ending Vehs	191	147	163	175	154	160
Travel Distance (mi)	475	463	472	504	479	479
Travel Time (hr)	62.5	35.9	35.7	47.5	39.9	44.3
Total Delay (hr)	45.6	19.5	19.2	29.8	23.1	27.4
Total Stops	1916	1329	1353	1595	1487	1536
Fuel Used (gal)	29.2	22.3	22.5	26.4	23.9	24.9

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Intersection: 1: Catawba Ave (WB) & Catawba Ave (EB)

Movement	EB	EB	EB	NW	NW
Directions Served	T	T	T	T	T
Maximum Queue (ft)	193	190	179	158	150
Average Queue (ft)	167	157	135	131	132
95th Queue (ft)	205	217	194	150	141
Link Distance (ft)	60	60	60	46	46
Upstream Blk Time (%)	47	46	33	43	48
Queuing Penalty (veh)	207	199	145	238	264
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 2: Catawba Ave (EB) & Catawba Ave (WB)

Movement	WB	WB	SB	SB
Directions Served	T	T	T	T
Maximum Queue (ft)	150	159	169	160
Average Queue (ft)	130	110	149	131
95th Queue (ft)	162	156	183	184
Link Distance (ft)	74	74	86	86
Upstream Blk Time (%)	22	22	48	33
Queuing Penalty (veh)	85	84	264	181
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 3: Statesville Rd (US 21)/Holiday Ln & Catawba Ave

Movement	EB	EB	EB	WB	WB	NB	NB	NB	SB	SB
Directions Served	L	T	R	L	TR	L	L	TR	L	TR
Maximum Queue (ft)	164	220	210	200	375	250	492	250	175	221
Average Queue (ft)	121	164	87	129	318	189	291	152	52	125
95th Queue (ft)	180	260	193	237	415	288	460	298	123	230
Link Distance (ft)		164	164		241		487			218
Upstream Blk Time (%)	5	23	2		31		1		0	6
Queuing Penalty (veh)	0	151	15		240		0		0	11
Storage Bay Dist (ft)	100			100		150		150	200	
Storage Blk Time (%)	46	24		14	45	8	51	3	0	9
Queuing Penalty (veh)	262	34		90	46	33	205	13	0	6

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Intersection: 4: Hill St/Burton Ln & Catawba Ave

Movement	EB	EB	WB	NB	SB	SB
Directions Served	L	TR	LTR	LTR	L	TR
Maximum Queue (ft)	70	160	526	154	74	102
Average Queue (ft)	19	10	167	44	22	55
95th Queue (ft)	57	79	488	142	68	118
Link Distance (ft)		241	526	466	90	90
Upstream Blk Time (%)		0	6		10	33
Queuing Penalty (veh)		1	0		4	12
Storage Bay Dist (ft)	50					
Storage Blk Time (%)	15	0				
Queuing Penalty (veh)	117	0				

Intersection: 5: Holiday Ln & Site Access #1

Movement	WB	SB
Directions Served	LR	LT
Maximum Queue (ft)	35	12
Average Queue (ft)	9	0
95th Queue (ft)	24	6
Link Distance (ft)	184	157
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 6: Holiday Ln & Site Access #2

Movement	WB	SB
Directions Served	LR	LT
Maximum Queue (ft)	97	45
Average Queue (ft)	42	8
95th Queue (ft)	78	41
Link Distance (ft)	97	76
Upstream Blk Time (%)	2	1
Queuing Penalty (veh)	0	1
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

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Intersection: 7: Burton Ln & Site Acess #3

Movement	EB	NB	SB
Directions Served	LR	LT	TR
Maximum Queue (ft)	122	18	32
Average Queue (ft)	58	1	3
95th Queue (ft)	124	9	21
Link Distance (ft)	103	90	267
Upstream Blk Time (%)	24		
Queuing Penalty (veh)	0		
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 11: Catawba Ave (EB) & I-77 SB Off-Ramp

Movement	EB	EB	EB	SB	SB
Directions Served	T	T	T	L	L
Maximum Queue (ft)	81	137	48	154	161
Average Queue (ft)	43	48	9	103	82
95th Queue (ft)	87	121	32	163	149
Link Distance (ft)	40	40	40	89	89
Upstream Blk Time (%)	30	25	2	16	9
Queuing Penalty (veh)	130	109	7	28	16
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 12: Catawba Ave/Catawba Ave (WB) & I-77 SB Off-Ramp

Movement	WB	WB	SB	SB
Directions Served	T	T	R	R
Maximum Queue (ft)	42	66	172	145
Average Queue (ft)	8	16	152	94
95th Queue (ft)	30	49	171	134
Link Distance (ft)	56	56	89	89
Upstream Blk Time (%)	0	1	37	9
Queuing Penalty (veh)	2	7	119	28
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

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Intersection: 14: Catawba Ave (EB) & I-77 NB On-Ramp

Movement	EB	EB
Directions Served	T	T
Maximum Queue (ft)	245	189
Average Queue (ft)	120	35
95th Queue (ft)	277	120
Link Distance (ft)	143	143
Upstream Blk Time (%)	11	1
Queuing Penalty (veh)	62	5
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 15: Catawba Ave

Movement	WB	WB	NE	NE
Directions Served	T	T	R	R
Maximum Queue (ft)	11	48	106	19
Average Queue (ft)	0	4	31	1
95th Queue (ft)	8	23	100	10
Link Distance (ft)	164	164	61	61
Upstream Blk Time (%)			11	0
Queuing Penalty (veh)			70	0
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 17: I-77 SB On-Ramp & Catawba Ave (WB)

Movement	WB	WB
Directions Served	LT	T
Maximum Queue (ft)	177	247
Average Queue (ft)	107	151
95th Queue (ft)	178	242
Link Distance (ft)	139	139
Upstream Blk Time (%)	2	11
Queuing Penalty (veh)	14	66
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

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Intersection: 18: I-77 NB On-Ramp

Movement	EB	WB
Directions Served	L	R
Maximum Queue (ft)	13	145
Average Queue (ft)	0	11
95th Queue (ft)	7	75
Link Distance (ft)	143	71
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 19: I-77 SB On-Ramp

Movement	SE
Directions Served	R
Maximum Queue (ft)	261
Average Queue (ft)	41
95th Queue (ft)	193
Link Distance (ft)	137
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 21: I-77 NB Off-Ramp & Catawba Ave (WB)

Movement	NB	NB	SW	SW
Directions Served	L	L	R	R
Maximum Queue (ft)	116	197	51	66
Average Queue (ft)	88	145	2	5
95th Queue (ft)	146	209	24	33
Link Distance (ft)	116	116	78	78
Upstream Blk Time (%)	1	15	0	0
Queuing Penalty (veh)	2	32	0	0
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

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Intersection: 22: I-77 NB Off-Ramp & Catawba Ave (EB)/Catawba Ave

Movement	EB	EB	NB
Directions Served	T	T	R
Maximum Queue (ft)	111	74	182
Average Queue (ft)	52	9	101
95th Queue (ft)	115	45	183
Link Distance (ft)	86	86	110
Upstream Blk Time (%)	12	1	14
Queuing Penalty (veh)	65	6	26
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 24: I-77 SB On-Ramp & Catawba Ave/Catawba Ave (EB)

Movement	EB	EB	EB
Directions Served	T	T	TR
Maximum Queue (ft)	114	190	172
Average Queue (ft)	91	132	66
95th Queue (ft)	149	237	180
Link Distance (ft)		115	115
Upstream Blk Time (%)	8	22	7
Queuing Penalty (veh)	0	178	57
Storage Bay Dist (ft)	50		
Storage Blk Time (%)	26	17	
Queuing Penalty (veh)	113	75	

Intersection: 26: Catawba Ave

Movement	EB	EB
Directions Served	T	T
Maximum Queue (ft)	601	548
Average Queue (ft)	230	166
95th Queue (ft)	647	579
Link Distance (ft)	578	578
Upstream Blk Time (%)	12	5
Queuing Penalty (veh)	0	0
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

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Intersection: 27: I-77 SB Off-Ramp

Movement	SB	SB	SB	SB
Directions Served	L	L	R	R
Maximum Queue (ft)	51	25	242	200
Average Queue (ft)	5	1	117	43
95th Queue (ft)	30	13	216	154
Link Distance (ft)			909	
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)	450	450		450
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 28: I-77 NB Off-Ramp

Movement	NB	NB
Directions Served	L	R
Maximum Queue (ft)	89	132
Average Queue (ft)	11	11
95th Queue (ft)	51	70
Link Distance (ft)	801	
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		500
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 29: Bend

Movement	NB
Directions Served	T
Maximum Queue (ft)	129
Average Queue (ft)	5
95th Queue (ft)	68
Link Distance (ft)	275
Upstream Blk Time (%)	0
Queuing Penalty (veh)	1
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

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Intersection: 30: Catawba Ave (WB)/Catawba Ave & I-77 NB On-Ramp

Movement	WB	WB
Directions Served	T	TR
Maximum Queue (ft)	103	108
Average Queue (ft)	24	29
95th Queue (ft)	74	94
Link Distance (ft)	59	59
Upstream Blk Time (%)	1	3
Queuing Penalty (veh)	8	17
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Network Summary

Network wide Queuing Penalty: 4148

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APPENDIX F-9:
CAPACITY ANALYSIS RESULTS

2023 NO-BUILD CONDITIONS
AM PEAK HOUR

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Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations		↑↑↑									↑↑	
Traffic Volume (vph)	0	1442	0	0	0	0	0	0	0	0	859	0
Future Volume (vph)	0	1442	0	0	0	0	0	0	0	0	859	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		2%			0%			0%			-2%	
Lane Util. Factor	1.00	0.91	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00
Frt												
Flt Protected												
Satd. Flow (prot)	0	5034	0	0	0	0	0	0	0	0	3575	0
Flt Permitted												
Satd. Flow (perm)	0	5034	0	0	0	0	0	0	0	0	3575	0
Right Turn on Red	No		No			No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)		35			35			35			35	
Link Distance (ft)		142			217			115			211	
Travel Time (s)		2.8			4.2			2.2			4.1	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	1602	0	0	0	0	0	0	0	0	954	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	1602	0	0	0	0	0	0	0	0	954	0
Turn Type		NA									NA	
Protected Phases		2									8	
Permitted Phases												
Detector Phase		2									8	
Switch Phase												
Minimum Initial (s)		10.0									10.0	
Minimum Split (s)		24.3									26.1	
Total Split (s)		60.0									60.0	
Total Split (%)		50.0%									50.0%	
Yellow Time (s)		3.7									4.0	
All-Red Time (s)		5.6									4.1	
Lost Time Adjust (s)		-4.3									-3.1	
Total Lost Time (s)		5.0									5.0	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode		C-Max									None	
Act Effct Green (s)		62.8									47.2	
Actuated g/C Ratio		0.52									0.39	
v/c Ratio		0.61									0.68	
Control Delay		22.2									42.3	
Queue Delay		0.0									0.3	
Total Delay		22.2									42.7	
LOS		C									D	
Approach Delay		22.2									42.7	
Approach LOS		C									D	
Queue Length 50th (ft)		309									391	
Queue Length 95th (ft)		408									452	
Internal Link Dist (ft)		62			137			35			131	
Turn Bay Length (ft)												

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Lane Group	Ø4	Ø6
Lane Configurations		
Traffic Volume (vph)		
Future Volume (vph)		
Ideal Flow (vphpl)		
Grade (%)		
Lane Util. Factor		
Frt		
Flt Protected		
Satd. Flow (prot)		
Flt Permitted		
Satd. Flow (perm)		
Right Turn on Red		
Satd. Flow (RTOR)		
Link Speed (mph)		
Link Distance (ft)		
Travel Time (s)		
Peak Hour Factor		
Adj. Flow (vph)		
Shared Lane Traffic (%)		
Lane Group Flow (vph)		
Turn Type		
Protected Phases	4	6
Permitted Phases		
Detector Phase		
Switch Phase		
Minimum Initial (s)	10.0	10.0
Minimum Split (s)	21.1	19.3
Total Split (s)	60.0	60.0
Total Split (%)	50%	50%
Yellow Time (s)	4.0	3.7
All-Red Time (s)	4.1	5.6
Lost Time Adjust (s)		
Total Lost Time (s)		
Lead/Lag		
Lead-Lag Optimize?		
Recall Mode	None	C-Max
Act Effct Green (s)		
Actuated g/C Ratio		
v/c Ratio		
Control Delay		
Queue Delay		
Total Delay		
LOS		
Approach Delay		
Approach LOS		
Queue Length 50th (ft)		
Queue Length 95th (ft)		
Internal Link Dist (ft)		
Turn Bay Length (ft)		

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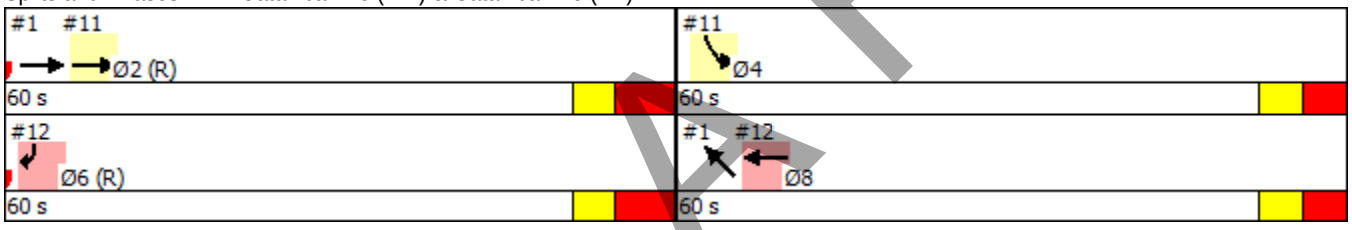
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Base Capacity (vph)		2633									1638	
Starvation Cap Reductn		0									231	
Spillback Cap Reductn		0									0	
Storage Cap Reductn		0									0	
Reduced v/c Ratio		0.61									0.68	

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 70 (58%), Referenced to phase 2:EBT and 6:, Start of Green
Natural Cycle: 60
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.78
Intersection Signal Delay: 29.8 Intersection LOS: C
Intersection Capacity Utilization 67.2% ICU Level of Service C
Analysis Period (min) 15

Splits and Phases: 1: Catawba Ave (WB) & Catawba Ave (EB)



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Lane Group	Ø4	Ø6
Base Capacity (vph)		
Starvation Cap Reductn		
Spillback Cap Reductn		
Storage Cap Reductn		
Reduced v/c Ratio		

Intersection Summary

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Lane Group	EBL	EBT	WBT	WBR	SBL	SBR	Ø6	Ø8
Lane Configurations								
Traffic Volume (vph)	0	1442	0	0	669	0		
Future Volume (vph)	0	1442	0	0	669	0		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900		
Grade (%)		2%	0%		-1%			
Lane Util. Factor	1.00	0.91	1.00	1.00	0.97	1.00		
Frt								
Flt Protected					0.950			
Satd. Flow (prot)	0	5034	0	0	3450	0		
Flt Permitted					0.950			
Satd. Flow (perm)	0	5034	0	0	3450	0		
Right Turn on Red				No	No	No		
Satd. Flow (RTOR)								
Link Speed (mph)		35	35		35			
Link Distance (ft)		217	199		185			
Travel Time (s)		4.2	3.9		3.6			
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90		
Adj. Flow (vph)	0	1602	0	0	743	0		
Shared Lane Traffic (%)								
Lane Group Flow (vph)	0	1602	0	0	743	0		
Turn Type		NA			Prot			
Protected Phases		2			4		6	8
Permitted Phases								
Detector Phase		2			4			
Switch Phase								
Minimum Initial (s)		10.0			10.0		10.0	10.0
Minimum Split (s)		24.3			21.1		19.3	26.1
Total Split (s)		60.0			60.0		60.0	60.0
Total Split (%)		50.0%			50.0%		50%	50%
Yellow Time (s)		3.7			4.0		3.7	4.0
All-Red Time (s)		5.6			4.1		5.6	4.1
Lost Time Adjust (s)		-4.3			-3.1			
Total Lost Time (s)		5.0			5.0			
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode		C-Max			None		C-Max	None
Act Effct Green (s)		62.8			47.2			
Actuated g/C Ratio		0.52			0.39			
v/c Ratio		0.61			0.55			
Control Delay		2.8			29.2			
Queue Delay		0.3			0.0			
Total Delay		3.1			29.2			
LOS		A			C			
Approach Delay		3.1			29.2			
Approach LOS		A			C			
Queue Length 50th (ft)		17			224			
Queue Length 95th (ft)		19			253			
Internal Link Dist (ft)		137	119		105			
Turn Bay Length (ft)								

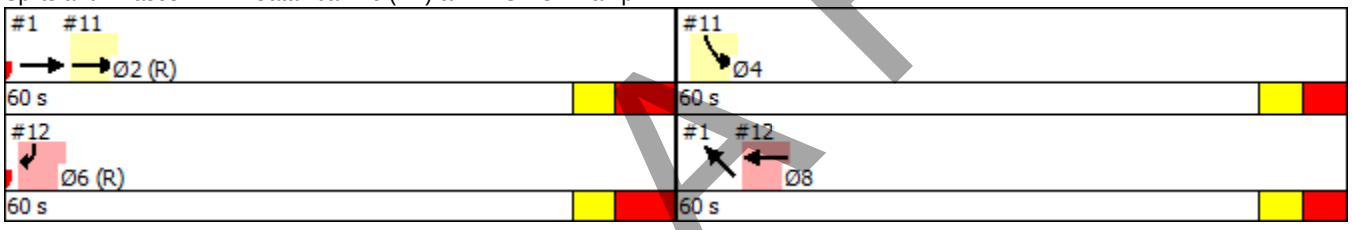
DRAFT

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR	Ø6	Ø8
Base Capacity (vph)		2633			1581			
Starvation Cap Reductn		0			0			
Spillback Cap Reductn		419			0			
Storage Cap Reductn		0			0			
Reduced v/c Ratio		0.72			0.47			

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 70 (58%), Referenced to phase 2:EBT and 6:, Start of Green
Natural Cycle: 60
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.78
Intersection Signal Delay: 11.4 Intersection LOS: B
Intersection Capacity Utilization 70.5% ICU Level of Service C
Analysis Period (min) 15

Splits and Phases: 11: Catawba Ave (EB) & I-77 SB Off-Ramp



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Lane Group	EBL	EBT	WBT	WBR	SBL	SBR	Ø2	Ø4
Lane Configurations			↑↑			↱↱		
Traffic Volume (vph)	0	0	859	0	0	1005		
Future Volume (vph)	0	0	859	0	0	1005		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900		
Grade (%)		0%	0%		4%			
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.88		
Frt						0.850		
Flt Protected								
Satd. Flow (prot)	0	0	3539	0	0	2731		
Flt Permitted								
Satd. Flow (perm)	0	0	3539	0	0	2731		
Right Turn on Red				No		No		
Satd. Flow (RTOR)								
Link Speed (mph)		35	35		35			
Link Distance (ft)		202	115		181			
Travel Time (s)		3.9	2.2		3.5			
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90		
Adj. Flow (vph)	0	0	954	0	0	1117		
Shared Lane Traffic (%)								
Lane Group Flow (vph)	0	0	954	0	0	1117		
Turn Type			NA			Prot		
Protected Phases			8			6	2	4
Permitted Phases								
Detector Phase			8			6		
Switch Phase								
Minimum Initial (s)			10.0			10.0	10.0	10.0
Minimum Split (s)			26.1			19.3	24.3	21.1
Total Split (s)			60.0			60.0	60.0	60.0
Total Split (%)			50.0%			50.0%	50%	50%
Yellow Time (s)			4.0			3.7	3.7	4.0
All-Red Time (s)			4.1			5.6	5.6	4.1
Lost Time Adjust (s)			-3.1			-4.3		
Total Lost Time (s)			5.0			5.0		
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode			None			C-Max	C-Max	None
Act Effct Green (s)			47.2			62.8		
Actuated g/C Ratio			0.39			0.52		
v/c Ratio			0.68			0.78		
Control Delay			2.8			29.3		
Queue Delay			0.0			0.0		
Total Delay			2.9			29.3		
LOS			A			C		
Approach Delay			2.9		29.3			
Approach LOS			A		C			
Queue Length 50th (ft)			3			386		
Queue Length 95th (ft)			3			#595		
Internal Link Dist (ft)		122	35		101			
Turn Bay Length (ft)								

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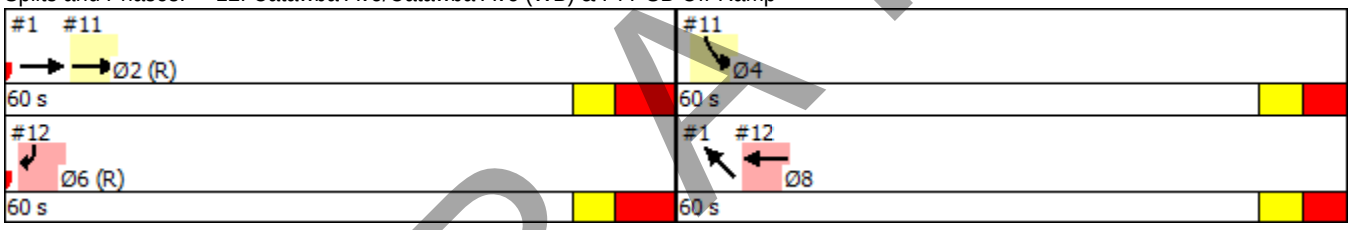
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR	Ø2	Ø4
Base Capacity (vph)			1622			1428		
Starvation Cap Reductn			6			0		
Spillback Cap Reductn			0			0		
Storage Cap Reductn			0			0		
Reduced v/c Ratio			0.59			0.78		

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 70 (58%), Referenced to phase 2:EBT and 6:, Start of Green
Natural Cycle: 60
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.78
Intersection Signal Delay: 17.1 Intersection LOS: B
Intersection Capacity Utilization 67.2% ICU Level of Service C
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 12: Catawba Ave/Catawba Ave (WB) & I-77 SB Off-Ramp



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Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	0	610	0	0	0	0	0	1241	0
Future Volume (vph)	0	0	0	0	610	0	0	0	0	0	1241	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		0%			0%			0%			-1%	
Lane Util. Factor	1.00	1.00	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00	0.95	1.00
Frt												
Flt Protected												
Satd. Flow (prot)	0	0	0	0	3539	0	0	0	0	0	3557	0
Flt Permitted												
Satd. Flow (perm)	0	0	0	0	3539	0	0	0	0	0	3557	0
Right Turn on Red			No	No		No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)		35			35			35			35	
Link Distance (ft)		182			125			128			169	
Travel Time (s)		3.5			2.4			2.5			3.3	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	0	0	0	678	0	0	0	0	0	1379	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	0	678	0	0	0	0	0	1379	0
Turn Type					NA						NA	
Protected Phases					6						4	
Permitted Phases												
Detector Phase					6						4	
Switch Phase												
Minimum Initial (s)					7.0						7.0	
Minimum Split (s)					19.9						21.9	
Total Split (s)					50.0						70.0	
Total Split (%)					41.7%						58.3%	
Yellow Time (s)					3.9						3.9	
All-Red Time (s)					4.0						4.0	
Lost Time Adjust (s)					-2.0						-2.9	
Total Lost Time (s)					5.9						5.0	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode					C-Max						None	
Act Effct Green (s)					48.9						60.2	
Actuated g/C Ratio					0.41						0.50	
v/c Ratio					0.47						0.77	
Control Delay					21.0						21.1	
Queue Delay					0.4						0.2	
Total Delay					21.4						21.2	
LOS					C						C	
Approach Delay					21.4						21.2	
Approach LOS					C						C	
Queue Length 50th (ft)					148						303	
Queue Length 95th (ft)					232						349	
Internal Link Dist (ft)		102			45			48			89	
Turn Bay Length (ft)												

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Lane Group	Ø2	Ø8
Lane Configurations		
Traffic Volume (vph)		
Future Volume (vph)		
Ideal Flow (vphpl)		
Grade (%)		
Lane Util. Factor		
Frt		
Flt Protected		
Satd. Flow (prot)		
Flt Permitted		
Satd. Flow (perm)		
Right Turn on Red		
Satd. Flow (RTOR)		
Link Speed (mph)		
Link Distance (ft)		
Travel Time (s)		
Peak Hour Factor		
Adj. Flow (vph)		
Shared Lane Traffic (%)		
Lane Group Flow (vph)		
Turn Type		
Protected Phases	2	8
Permitted Phases		
Detector Phase		
Switch Phase		
Minimum Initial (s)	10.0	7.0
Minimum Split (s)	18.9	19.9
Total Split (s)	50.0	70.0
Total Split (%)	42%	58%
Yellow Time (s)	3.8	3.9
All-Red Time (s)	5.1	4.0
Lost Time Adjust (s)		
Total Lost Time (s)		
Lead/Lag		
Lead-Lag Optimize?		
Recall Mode	C-Max	None
Act Effct Green (s)		
Actuated g/C Ratio		
v/c Ratio		
Control Delay		
Queue Delay		
Total Delay		
LOS		
Approach Delay		
Approach LOS		
Queue Length 50th (ft)		
Queue Length 95th (ft)		
Internal Link Dist (ft)		
Turn Bay Length (ft)		

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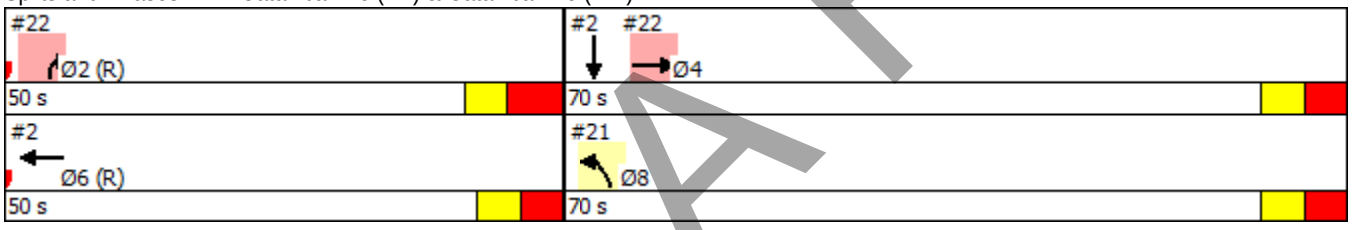
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Base Capacity (vph)					1441						1926	
Starvation Cap Reductn					318						84	
Spillback Cap Reductn					0						0	
Storage Cap Reductn					0						0	
Reduced v/c Ratio					0.60						0.75	

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 65 (54%), Referenced to phase 2:NBR and 6:, Start of Green
Natural Cycle: 55
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.78
Intersection Signal Delay: 21.3 Intersection LOS: C
Intersection Capacity Utilization 60.2% ICU Level of Service B
Analysis Period (min) 15

Splits and Phases: 2: Catawba Ave (EB) & Catawba Ave (WB)



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Lane Group	Ø2	Ø8
Base Capacity (vph)		
Starvation Cap Reductn		
Spillback Cap Reductn		
Storage Cap Reductn		
Reduced v/c Ratio		

Intersection Summary

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Lane Group	EBL	EBR	NBL	NBR	SWL	SWR	Ø2	Ø4	Ø6
Lane Configurations									
Traffic Volume (vph)	0	0	286	0	0	610			
Future Volume (vph)	0	0	286	0	0	610			
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900			
Lane Util. Factor	1.00	1.00	0.97	1.00	1.00	0.88			
Frt						0.850			
Flt Protected			0.950						
Satd. Flow (prot)	0	0	3433	0	0	2787			
Flt Permitted			0.950						
Satd. Flow (perm)	0	0	3433	0	0	2787			
Right Turn on Red		No	No	No		No			
Satd. Flow (RTOR)									
Link Speed (mph)	35		35		35				
Link Distance (ft)	209		215		182				
Travel Time (s)	4.1		4.2		3.5				
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90			
Adj. Flow (vph)	0	0	318	0	0	678			
Shared Lane Traffic (%)									
Lane Group Flow (vph)	0	0	318	0	0	678			
Turn Type			Prot			custom			
Protected Phases			8!			Free!	2	4	6
Permitted Phases									
Detector Phase			8						
Switch Phase									
Minimum Initial (s)			7.0				10.0	7.0	7.0
Minimum Split (s)			19.9				18.9	21.9	19.9
Total Split (s)			70.0				50.0	70.0	50.0
Total Split (%)			58.3%				42%	58%	42%
Yellow Time (s)			3.9				3.8	3.9	3.9
All-Red Time (s)			4.0				5.1	4.0	4.0
Lost Time Adjust (s)			-2.9						
Total Lost Time (s)			5.0						
Lead/Lag									
Lead-Lag Optimize?									
Recall Mode			None				C-Max	None	C-Max
Act Effct Green (s)			60.2			120.0			
Actuated g/C Ratio			0.50			1.00			
v/c Ratio			0.18			0.24			
Control Delay			16.1			1.6			
Queue Delay			0.2			0.1			
Total Delay			16.3			1.6			
LOS			B			A			
Approach Delay			16.3		1.6				
Approach LOS			B		A				
Queue Length 50th (ft)			65			31			
Queue Length 95th (ft)			86			46			
Internal Link Dist (ft)	129		135		102				
Turn Bay Length (ft)									
Base Capacity (vph)			1859			2787			

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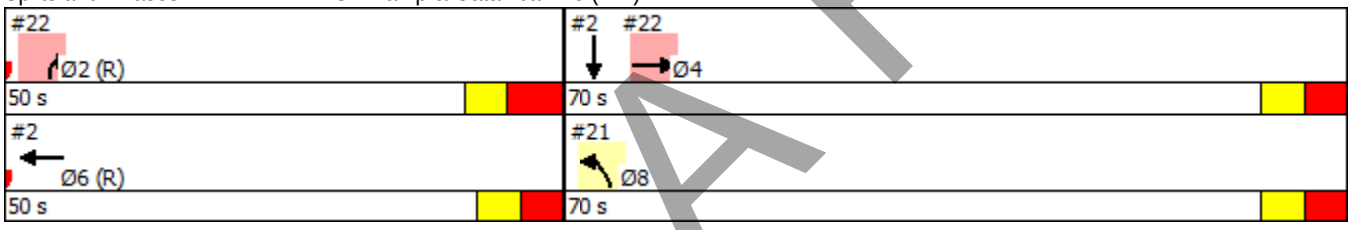
Lane Group	EBL	EBR	NBL	NBR	SWL	SWR	Ø2	Ø4	Ø6
Starvation Cap Reductn			0			0			
Spillback Cap Reductn			861			707			
Storage Cap Reductn			0			0			
Reduced v/c Ratio			0.32			0.33			

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 65 (54%), Referenced to phase 2:NBR and 6:, Start of Green
Natural Cycle: 55
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.78
Intersection Signal Delay: 6.3 Intersection LOS: A
Intersection Capacity Utilization 18.5% ICU Level of Service A
Analysis Period (min) 15
! Phase conflict between lane groups.

Splits and Phases: 21: I-77 NB Off-Ramp & Catawba Ave (WB)



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Lane Group	EBT	EBR	WBL	WBT	NBL	NBR	Ø6	Ø8
Lane Configurations								
Traffic Volume (vph)	1241	0	0	0	0	98		
Future Volume (vph)	1241	0	0	0	0	98		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900		
Grade (%)	0%			0%	4%			
Lane Util. Factor	0.95	1.00	1.00	1.00	1.00	1.00		
Frt						0.865		
Flt Protected								
Satd. Flow (prot)	3539	0	0	0	0	1579		
Flt Permitted								
Satd. Flow (perm)	3539	0	0	0	0	1579		
Right Turn on Red		No				No		
Satd. Flow (RTOR)								
Link Speed (mph)	35			35	35			
Link Distance (ft)	128			116	197			
Travel Time (s)	2.5			2.3	3.8			
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90		
Adj. Flow (vph)	1379	0	0	0	0	109		
Shared Lane Traffic (%)								
Lane Group Flow (vph)	1379	0	0	0	0	109		
Turn Type	NA					Prot		
Protected Phases	4					2	6	8
Permitted Phases								
Detector Phase	4					2		
Switch Phase								
Minimum Initial (s)	7.0					10.0	7.0	7.0
Minimum Split (s)	21.9					18.9	19.9	19.9
Total Split (s)	70.0					50.0	50.0	70.0
Total Split (%)	58.3%					41.7%	42%	58%
Yellow Time (s)	3.9					3.8	3.9	3.9
All-Red Time (s)	4.0					5.1	4.0	4.0
Lost Time Adjust (s)	-2.9					-3.9		
Total Lost Time (s)	5.0					5.0		
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None					C-Max	C-Max	None
Act Effct Green (s)	60.2					49.8		
Actuated g/C Ratio	0.50					0.42		
v/c Ratio	0.78					0.17		
Control Delay	3.1					24.4		
Queue Delay	0.0					0.0		
Total Delay	3.1					24.4		
LOS	A					C		
Approach Delay	3.1				24.4			
Approach LOS	A				C			
Queue Length 50th (ft)	6					53		
Queue Length 95th (ft)	7					99		
Internal Link Dist (ft)	48			36	117			
Turn Bay Length (ft)								

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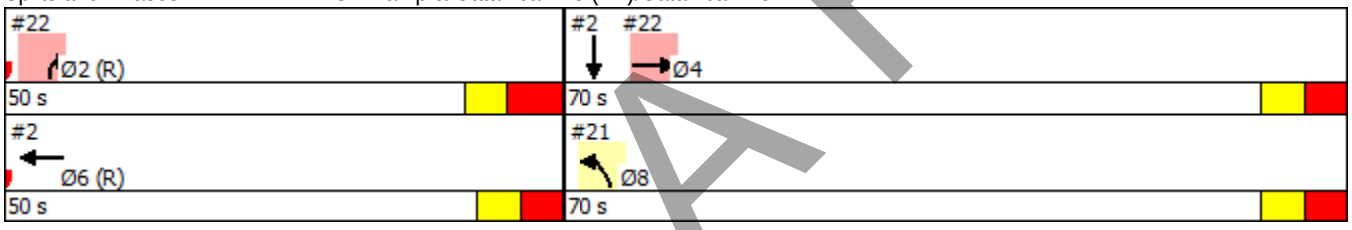
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR	Ø6	Ø8
Base Capacity (vph)	1916					655		
Starvation Cap Reductn	14					0		
Spillback Cap Reductn	0					0		
Storage Cap Reductn	0					0		
Reduced v/c Ratio	0.73					0.17		

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 65 (54%), Referenced to phase 2:NBR and 6:, Start of Green
Natural Cycle: 55
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.78
Intersection Signal Delay: 4.7 Intersection LOS: A
Intersection Capacity Utilization 60.2% ICU Level of Service B
Analysis Period (min) 15

Splits and Phases: 22: I-77 NB Off-Ramp & Catawba Ave (EB)/Catawba Ave



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Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	45	675	618	122	567	15	577	26	110	30	28	46
Future Volume (vph)	45	675	618	122	567	15	577	26	110	30	28	46
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		-2%			1%			3%			5%	
Storage Length (ft)	100		0	100		0	150		150	75		0
Storage Lanes	1		1	1		0	1		1	1		0
Taper Length (ft)	100			100			100			100		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	1.00	1.00	1.00	1.00
Frt			0.850		0.996				0.850		0.907	
Flt Protected	0.950			0.950			0.950	0.956		0.950		
Satd. Flow (prot)	1787	1881	1599	1761	1846	0	1656	1666	1560	1725	1647	0
Flt Permitted	0.177			0.075			0.950	0.956		0.950		
Satd. Flow (perm)	333	1881	1599	139	1846	0	1656	1666	1560	1725	1647	0
Right Turn on Red			No			No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)		35			35			35			35	
Link Distance (ft)		229			323			537			507	
Travel Time (s)		4.5			6.3			10.5			9.9	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	50	750	687	136	630	17	641	29	122	33	31	51
Shared Lane Traffic (%)							48%					
Lane Group Flow (vph)	50	750	687	136	647	0	333	337	122	33	82	0
Turn Type	pm+pt	NA	pm+ov	pm+pt	NA		Split	NA	pm+ov	Split	NA	
Protected Phases	5	2	3	1	6		3	3	1	4	4	
Permitted Phases	2		2	6					3			
Detector Phase	5	2	3	1	6		3	3	1	4	4	
Switch Phase												
Minimum Initial (s)	7.0	10.0	7.0	7.0	10.0		7.0	7.0	7.0	7.0	7.0	
Minimum Split (s)	13.3	31.4	28.3	13.2	28.4		28.3	28.3	13.2	12.9	12.9	
Total Split (s)	17.0	49.0	37.0	17.0	49.0		37.0	37.0	17.0	17.0	17.0	
Total Split (%)	14.2%	40.8%	30.8%	14.2%	40.8%		30.8%	30.8%	14.2%	14.2%	14.2%	
Yellow Time (s)	3.0	4.0	3.7	3.0	4.0		3.7	3.7	3.0	3.6	3.6	
All-Red Time (s)	3.3	2.4	2.6	3.2	2.4		2.6	2.6	3.2	2.3	2.3	
Lost Time Adjust (s)	-1.3	-1.4	-1.4	-1.2	-1.4		-1.3	-1.3	-1.2	-0.9	-0.9	
Total Lost Time (s)	5.0	5.0	4.9	5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Lead/Lag	Lead	Lag	Lead	Lead	Lag		Lead	Lead	Lead	Lag	Lag	
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	
Recall Mode	None	C-Max	None	None	C-Max		None	None	None	None	None	
Act Effct Green (s)	60.0	51.5	86.5	64.8	56.0		29.9	29.9	41.2	10.8	10.8	
Actuated g/C Ratio	0.50	0.43	0.72	0.54	0.47		0.25	0.25	0.34	0.09	0.09	
v/c Ratio	0.19	0.93	0.60	0.64	0.75		0.81	0.81	0.23	0.21	0.55	
Control Delay	5.3	40.6	26.3	35.5	36.7		58.1	58.4	18.3	53.4	66.4	
Queue Delay	0.0	46.2	52.7	0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Total Delay	5.3	86.8	79.1	35.5	36.7		58.1	58.4	18.3	53.4	66.4	
LOS	A	F	E	D	D		E	E	B	D	E	
Approach Delay		80.5			36.5			52.1			62.6	
Approach LOS		F			D			D			E	
Queue Length 50th (ft)	8	~657	560	56	459		249	253	45	24	61	

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Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 95th (ft)	m11	#905	682	124	#690		#373	#381	76	57	115	
Internal Link Dist (ft)		149			243			457			427	
Turn Bay Length (ft)	100			100			150		150	75		
Base Capacity (vph)	321	807	1180	238	861		441	444	557	172	164	
Starvation Cap Reductn	0	209	580	0	0		0	0	0	0	0	
Spillback Cap Reductn	0	0	0	0	0		0	0	0	0	0	
Storage Cap Reductn	0	0	0	0	0		0	0	0	0	0	
Reduced v/c Ratio	0.16	1.25	1.15	0.57	0.75		0.76	0.76	0.22	0.19	0.50	

Intersection Summary

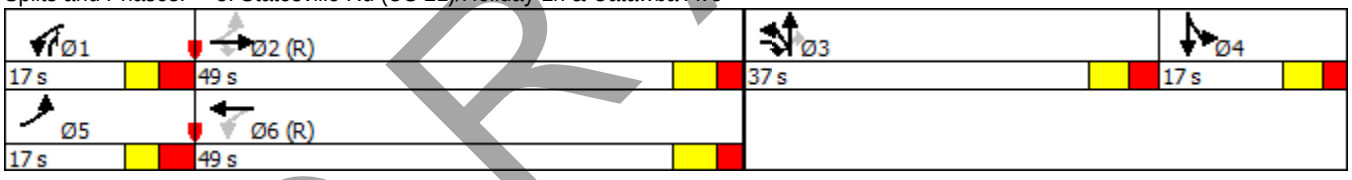
Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 35 (29%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green
Natural Cycle: 100
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.93
Intersection Signal Delay: 61.9 Intersection LOS: E
Intersection Capacity Utilization 78.1% ICU Level of Service D
Analysis Period (min) 15

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 3: Statesville Rd (US 21)/Holiday Ln & Catawba Ave



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Intersection

Int Delay, s/veh 1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	6	802	8	4	692	4	6	4	9	4	4	7
Future Vol, veh/h	6	802	8	4	692	4	6	4	9	4	4	7
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	50	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	7	891	9	4	769	4	7	4	10	4	4	8

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	773	0	0	900	0	0	1695	1691	896	1696	1693	771
Stage 1	-	-	-	-	-	-	909	909	-	780	780	-
Stage 2	-	-	-	-	-	-	786	782	-	916	913	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	842	-	-	755	-	-	73	93	339	73	93	400
Stage 1	-	-	-	-	-	-	329	354	-	388	406	-
Stage 2	-	-	-	-	-	-	385	405	-	326	352	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	842	-	-	755	-	-	68	91	339	67	91	400
Mov Cap-2 Maneuver	-	-	-	-	-	-	68	91	-	67	91	-
Stage 1	-	-	-	-	-	-	326	351	-	385	402	-
Stage 2	-	-	-	-	-	-	370	401	-	310	349	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.1	0.1	41.3	38.5
HCM LOS			E	E

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	120	842	-	-	755	-	-	124
HCM Lane V/C Ratio	0.176	0.008	-	-	0.006	-	-	0.134
HCM Control Delay (s)	41.3	9.3	-	-	9.8	0	-	38.5
HCM Lane LOS	E	A	-	-	A	A	-	E
HCM 95th %tile Q(veh)	0.6	0	-	-	0	-	-	0.5

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Summary of All Intervals

Run Number	1	2	3	4	5	Avg
Start Time	6:50	6:50	6:50	6:50	6:50	6:50
End Time	8:00	8:00	8:00	8:00	8:00	8:00
Total Time (min)	70	70	70	70	70	70
Time Recorded (min)	60	60	60	60	60	60
# of Intervals	5	5	5	5	5	5
# of Recorded Intervals	4	4	4	4	4	4
Vehs Entered	4859	2879	4797	513	4847	3577
Vehs Exited	4906	2656	4818	288	4813	3494
Starting Vehs	213	181	207	233	183	203
Ending Vehs	166	404	186	458	217	282
Travel Distance (mi)	2025	1108	2000	131	2010	1455
Travel Time (hr)	397.4	912.9	375.9	2584.8	350.5	924.3
Total Delay (hr)	326.0	873.7	305.8	2580.3	280.0	873.2
Total Stops	8908	4825	8632	739	8801	6380
Fuel Used (gal)	157.4	245.0	150.8	593.2	145.6	258.4

Interval #0 Information Seeding

Start Time	6:50
End Time	7:00
Total Time (min)	10

Volumes adjusted by Growth Factors.
No data recorded this interval.

Interval #1 Information 1

Start Time	7:00
End Time	7:15
Total Time (min)	15

Volumes adjusted by Growth Factors, Anti PHF.

Run Number	1	2	3	4	5	Avg
Vehs Entered	1174	1224	1191	451	1213	1049
Vehs Exited	1150	1188	1222	287	1204	1010
Starting Vehs	213	181	207	233	183	203
Ending Vehs	237	217	176	397	192	246
Travel Distance (mi)	485	497	503	127	507	424
Travel Time (hr)	79.1	68.3	60.1	166.2	48.4	84.4
Total Delay (hr)	62.1	50.9	42.6	161.8	30.8	69.6
Total Stops	2321	2124	2191	674	2051	1874
Fuel Used (gal)	33.9	31.9	29.7	41.9	27.5	33.0

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Interval #2 Information 2

Start Time 7:15
End Time 7:30
Total Time (min) 15
Volumes adjusted by PHF, Growth Factors.

Run Number	1	2	3	4	5	Avg
Vehs Entered	1259	1186	1253	44	1240	996
Vehs Exited	1305	1138	1243	0	1227	981
Starting Vehs	237	217	176	397	192	246
Ending Vehs	191	265	186	441	205	257
Travel Distance (mi)	532	470	520	3	512	407
Travel Time (hr)	92.8	101.4	87.3	488.0	72.9	168.5
Total Delay (hr)	74.1	84.7	69.0	487.9	54.8	154.1
Total Stops	2350	1995	2223	49	2119	1746
Fuel Used (gal)	38.8	38.5	37.0	111.4	33.4	51.8

Interval #3 Information 3

Start Time 7:30
End Time 7:45
Total Time (min) 15
Volumes adjusted by Growth Factors, Anti PHF.

Run Number	1	2	3	4	5	Avg
Vehs Entered	1242	462	1185	9	1251	830
Vehs Exited	1222	330	1168	0	1193	780
Starting Vehs	191	265	186	441	205	257
Ending Vehs	211	397	203	450	263	304
Travel Distance (mi)	508	141	488	0	507	329
Travel Time (hr)	107.8	229.9	105.1	812.5	103.6	271.8
Total Delay (hr)	89.9	224.8	88.1	812.5	85.9	260.2
Total Stops	2107	700	2233	9	2337	1477
Fuel Used (gal)	41.4	57.3	39.7	185.2	40.4	72.8

Interval #4 Information 4

Start Time 7:45
End Time 8:00
Total Time (min) 15
Volumes adjusted by Growth Factors, Anti PHF.

Run Number	1	2	3	4	5	Avg
Vehs Entered	1184	7	1168	9	1143	700
Vehs Exited	1229	0	1185	1	1189	720
Starting Vehs	211	397	203	450	263	304
Ending Vehs	166	404	186	458	217	282
Travel Distance (mi)	501	0	489	0	484	295
Travel Time (hr)	117.7	513.3	123.4	1118.1	125.7	399.6
Total Delay (hr)	99.8	513.3	106.2	1118.1	108.6	389.2
Total Stops	2130	6	1985	7	2294	1281
Fuel Used (gal)	43.3	117.3	44.4	254.7	44.4	100.8

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Intersection: 1: Catawba Ave (WB) & Catawba Ave (EB)

Movement	EB	EB	EB	NW	NW
Directions Served	T	T	T	T	T
Maximum Queue (ft)	183	178	180	138	134
Average Queue (ft)	128	131	83	126	125
95th Queue (ft)	252	210	188	148	138
Link Distance (ft)	60	60	60	46	46
Upstream Blk Time (%)	42	56	16	58	64
Queuing Penalty (veh)	203	269	77	250	273
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 2: Catawba Ave (EB) & Catawba Ave (WB)

Movement	WB	WB	SB	SB
Directions Served	T	T	T	T
Maximum Queue (ft)	152	146	176	164
Average Queue (ft)	142	118	157	109
95th Queue (ft)	165	161	174	218
Link Distance (ft)	74	74	86	86
Upstream Blk Time (%)	65	51	71	23
Queuing Penalty (veh)	197	155	441	140
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 3: Statesville Rd (US 21)/Holiday Ln & Catawba Ave

Movement	EB	EB	EB	WB	WB	NB	NB	NB	SB	SB
Directions Served	L	T	R	L	TR	L	LT	R	L	TR
Maximum Queue (ft)	169	237	237	162	341	248	515	250	86	268
Average Queue (ft)	43	214	138	84	284	167	449	107	21	166
95th Queue (ft)	129	257	291	208	392	331	597	297	60	430
Link Distance (ft)		170	170		245		487			459
Upstream Blk Time (%)	0	44	9		44		51			21
Queuing Penalty (veh)	0	294	63		309		0			0
Storage Bay Dist (ft)	100			100		150		150	75	
Storage Blk Time (%)	0	46		4	56	6	75	0	0	42
Queuing Penalty (veh)	1	20		21	68	25	297	0	0	12

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Intersection: 4: Hill St/Burton Ln & Catawba Ave

Movement	EB	EB	WB	NB	SB
Directions Served	L	TR	LTR	LTR	LTR
Maximum Queue (ft)	22	57	488	142	120
Average Queue (ft)	3	3	230	63	35
95th Queue (ft)	15	37	636	250	115
Link Distance (ft)		245	536	466	423
Upstream Blk Time (%)			32	1	
Queuing Penalty (veh)			0	0	
Storage Bay Dist (ft)	50				
Storage Blk Time (%)		0			
Queuing Penalty (veh)		0			

Intersection: 11: Catawba Ave (EB) & I-77 SB Off-Ramp

Movement	EB	EB	EB	SB	SB
Directions Served	T	T	T	L	L
Maximum Queue (ft)	86	151	66	158	173
Average Queue (ft)	54	80	7	147	134
95th Queue (ft)	108	154	42	171	208
Link Distance (ft)	40	40	40	89	89
Upstream Blk Time (%)	40	62	2	57	42
Queuing Penalty (veh)	193	297	11	190	141
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 12: Catawba Ave/Catawba Ave (WB) & I-77 SB Off-Ramp

Movement	WB	WB	SB	SB
Directions Served	T	T	R	R
Maximum Queue (ft)	30	46	162	162
Average Queue (ft)	2	7	116	103
95th Queue (ft)	19	31	226	205
Link Distance (ft)	56	56	89	89
Upstream Blk Time (%)	1	1	34	22
Queuing Penalty (veh)	3	3	170	112
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

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Intersection: 14: Catawba Ave (EB) & I-77 NB On-Ramp

Movement	EB	EB	EB
Directions Served	L	T	T
Maximum Queue (ft)	78	250	202
Average Queue (ft)	9	197	57
95th Queue (ft)	48	289	179
Link Distance (ft)	143	143	143
Upstream Blk Time (%)		51	4
Queuing Penalty (veh)		362	27
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 15: Catawba Ave

Movement	WB	WB	NE	NE
Directions Served	T	T	R	R
Maximum Queue (ft)	196	228	134	134
Average Queue (ft)	89	106	104	40
95th Queue (ft)	262	275	147	132
Link Distance (ft)	170	170	61	61
Upstream Blk Time (%)	29	33	44	5
Queuing Penalty (veh)	170	194	291	31
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 17: I-77 SB On-Ramp & Catawba Ave (WB)

Movement	WB	WB
Directions Served	LT	T
Maximum Queue (ft)	230	244
Average Queue (ft)	149	189
95th Queue (ft)	212	262
Link Distance (ft)	139	139
Upstream Blk Time (%)	40	43
Queuing Penalty (veh)	176	192
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

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Intersection: 18: I-77 NB On-Ramp

Movement	EB	WB
Directions Served	L	R
Maximum Queue (ft)	173	121
Average Queue (ft)	81	52
95th Queue (ft)	213	154
Link Distance (ft)	143	71
Upstream Blk Time (%)	5	3
Queuing Penalty (veh)	47	17
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 19: I-77 SB On-Ramp

Movement	SE
Directions Served	R
Maximum Queue (ft)	51
Average Queue (ft)	2
95th Queue (ft)	38
Link Distance (ft)	137
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 21: I-77 NB Off-Ramp & Catawba Ave (WB)

Movement	NB	NB	SW	SW
Directions Served	L	L	R	R
Maximum Queue (ft)	158	198	91	81
Average Queue (ft)	82	123	16	14
95th Queue (ft)	202	216	69	60
Link Distance (ft)	116	116	78	78
Upstream Blk Time (%)	28	34	13	13
Queuing Penalty (veh)	40	48	38	38
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

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Intersection: 22: I-77 NB Off-Ramp & Catawba Ave (EB)/Catawba Ave

Movement	EB	EB	NB
Directions Served	T	T	R
Maximum Queue (ft)	172	117	150
Average Queue (ft)	146	33	91
95th Queue (ft)	211	117	181
Link Distance (ft)	86	86	110
Upstream Blk Time (%)	53	4	28
Queuing Penalty (veh)	330	23	27
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 24: I-77 SB On-Ramp & Catawba Ave/Catawba Ave (EB)

Movement	EB	EB	EB
Directions Served	T	T	TR
Maximum Queue (ft)	114	185	121
Average Queue (ft)	82	169	12
95th Queue (ft)	162	185	64
Link Distance (ft)		115	115
Upstream Blk Time (%)	22	61	0
Queuing Penalty (veh)	0	474	4
Storage Bay Dist (ft)	50		
Storage Blk Time (%)	40	31	
Queuing Penalty (veh)	192	149	

Intersection: 26: Catawba Ave

Movement	EB	EB
Directions Served	T	T
Maximum Queue (ft)	620	598
Average Queue (ft)	594	508
95th Queue (ft)	609	766
Link Distance (ft)	578	578
Upstream Blk Time (%)	73	17
Queuing Penalty (veh)	0	0
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

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Intersection: 27: I-77 SB Off-Ramp

Movement	SB	SB	SB	SB
Directions Served	L	L	R	R
Maximum Queue (ft)	331	338	554	345
Average Queue (ft)	178	177	378	115
95th Queue (ft)	473	552	900	280
Link Distance (ft)			909	
Upstream Blk Time (%)			26	
Queuing Penalty (veh)			0	
Storage Bay Dist (ft)	450	450		450
Storage Blk Time (%)	26	26		
Queuing Penalty (veh)	258	259		

Intersection: 28: I-77 NB Off-Ramp

Movement	NB	NB	NB
Directions Served	L	L	R
Maximum Queue (ft)	272	413	92
Average Queue (ft)	128	193	65
95th Queue (ft)	494	719	291
Link Distance (ft)		801	
Upstream Blk Time (%)		20	
Queuing Penalty (veh)		0	
Storage Bay Dist (ft)	500		500
Storage Blk Time (%)	14	22	
Queuing Penalty (veh)	34	51	

Intersection: 29: Bend

Movement	NB	NB
Directions Served	T	
Maximum Queue (ft)	284	279
Average Queue (ft)	203	38
95th Queue (ft)	469	211
Link Distance (ft)	275	275
Upstream Blk Time (%)	12	1
Queuing Penalty (veh)	88	8
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

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Intersection: 30: Catawba Ave (WB)/Catawba Ave & I-77 NB On-Ramp

Movement	WB	WB
Directions Served	T	TR
Maximum Queue (ft)	115	115
Average Queue (ft)	79	73
95th Queue (ft)	139	146
Link Distance (ft)	59	59
Upstream Blk Time (%)	42	40
Queuing Penalty (veh)	248	232
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Network Summary

Network wide Queuing Penalty: 8286

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APPENDIX F-10:
CAPACITY ANALYSIS RESULTS

2023 NO-BUILD CONDITIONS
PM PEAK HOUR

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Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations		↑↑↑									↑↑	
Traffic Volume (vph)	0	1427	0	0	0	0	0	0	0	0	1195	0
Future Volume (vph)	0	1427	0	0	0	0	0	0	0	0	1195	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		2%			0%			0%			-2%	
Lane Util. Factor	1.00	0.91	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00
Frt												
Flt Protected												
Satd. Flow (prot)	0	5034	0	0	0	0	0	0	0	0	3575	0
Flt Permitted												
Satd. Flow (perm)	0	5034	0	0	0	0	0	0	0	0	3575	0
Right Turn on Red	No		No			No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)		35			35			35			35	
Link Distance (ft)		142			217			115			211	
Travel Time (s)		2.8			4.2			2.2			4.1	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	1586	0	0	0	0	0	0	0	0	1328	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	1586	0	0	0	0	0	0	0	0	1328	0
Turn Type		NA									NA	
Protected Phases		2									8	
Permitted Phases												
Detector Phase		2									8	
Switch Phase												
Minimum Initial (s)		10.0									10.0	
Minimum Split (s)		24.3									26.1	
Total Split (s)		60.0									60.0	
Total Split (%)		50.0%									50.0%	
Yellow Time (s)		3.7									4.0	
All-Red Time (s)		5.6									4.1	
Lost Time Adjust (s)		-4.3									-3.1	
Total Lost Time (s)		5.0									5.0	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode		C-Max									None	
Act Effct Green (s)		55.4									54.6	
Actuated g/C Ratio		0.46									0.46	
v/c Ratio		0.68									0.82	
Control Delay		27.3									29.7	
Queue Delay		0.0									48.2	
Total Delay		27.3									77.9	
LOS		C									E	
Approach Delay		27.3									77.9	
Approach LOS		C									E	
Queue Length 50th (ft)		347									307	
Queue Length 95th (ft)		402									403	
Internal Link Dist (ft)		62			137			35			131	
Turn Bay Length (ft)												

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Lane Group	Ø4	Ø6
Lane Configurations		
Traffic Volume (vph)		
Future Volume (vph)		
Ideal Flow (vphpl)		
Grade (%)		
Lane Util. Factor		
Frt		
Flt Protected		
Satd. Flow (prot)		
Flt Permitted		
Satd. Flow (perm)		
Right Turn on Red		
Satd. Flow (RTOR)		
Link Speed (mph)		
Link Distance (ft)		
Travel Time (s)		
Peak Hour Factor		
Adj. Flow (vph)		
Shared Lane Traffic (%)		
Lane Group Flow (vph)		
Turn Type		
Protected Phases	4	6
Permitted Phases		
Detector Phase		
Switch Phase		
Minimum Initial (s)	10.0	10.0
Minimum Split (s)	21.1	19.3
Total Split (s)	60.0	60.0
Total Split (%)	50%	50%
Yellow Time (s)	4.0	3.7
All-Red Time (s)	4.1	5.6
Lost Time Adjust (s)		
Total Lost Time (s)		
Lead/Lag		
Lead-Lag Optimize?		
Recall Mode	None	C-Max
Act Effct Green (s)		
Actuated g/C Ratio		
v/c Ratio		
Control Delay		
Queue Delay		
Total Delay		
LOS		
Approach Delay		
Approach LOS		
Queue Length 50th (ft)		
Queue Length 95th (ft)		
Internal Link Dist (ft)		
Turn Bay Length (ft)		

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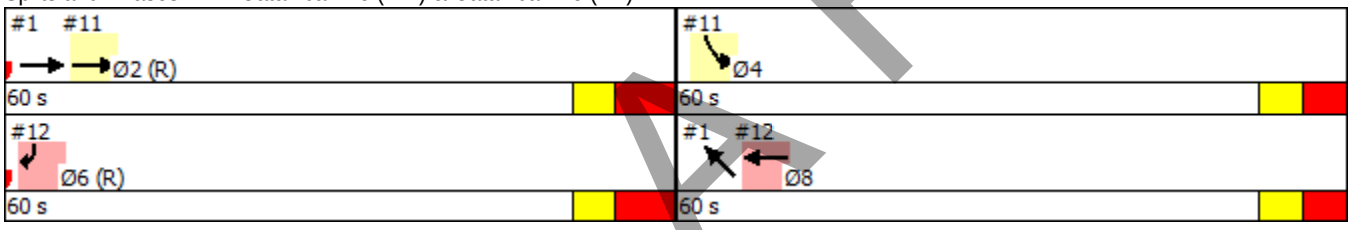
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Base Capacity (vph)		2325									1638	
Starvation Cap Reductn		0									468	
Spillback Cap Reductn		0									0	
Storage Cap Reductn		0									0	
Reduced v/c Ratio		0.68									1.14	

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 70 (58%), Referenced to phase 2:EBT and 6:, Start of Green
Natural Cycle: 55
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.82
Intersection Signal Delay: 50.4 Intersection LOS: D
Intersection Capacity Utilization 68.9% ICU Level of Service C
Analysis Period (min) 15

Splits and Phases: 1: Catawba Ave (WB) & Catawba Ave (EB)



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Lane Group	Ø4	Ø6
Base Capacity (vph)		
Starvation Cap Reductn		
Spillback Cap Reductn		
Storage Cap Reductn		
Reduced v/c Ratio		

Intersection Summary

DRAFT

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR	Ø6	Ø8
Lane Configurations								
Traffic Volume (vph)	0	1427	0	0	377	0		
Future Volume (vph)	0	1427	0	0	377	0		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900		
Grade (%)		2%	0%		-1%			
Lane Util. Factor	1.00	0.91	1.00	1.00	0.97	1.00		
Frt								
Flt Protected					0.950			
Satd. Flow (prot)	0	5034	0	0	3450	0		
Flt Permitted					0.950			
Satd. Flow (perm)	0	5034	0	0	3450	0		
Right Turn on Red				No	No	No		
Satd. Flow (RTOR)								
Link Speed (mph)		35	35		35			
Link Distance (ft)		217	199		185			
Travel Time (s)		4.2	3.9		3.6			
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90		
Adj. Flow (vph)	0	1586	0	0	419	0		
Shared Lane Traffic (%)								
Lane Group Flow (vph)	0	1586	0	0	419	0		
Turn Type		NA			Prot			
Protected Phases		2			4		6	8
Permitted Phases								
Detector Phase		2			4			
Switch Phase								
Minimum Initial (s)		10.0			10.0		10.0	10.0
Minimum Split (s)		24.3			21.1		19.3	26.1
Total Split (s)		60.0			60.0		60.0	60.0
Total Split (%)		50.0%			50.0%		50%	50%
Yellow Time (s)		3.7			4.0		3.7	4.0
All-Red Time (s)		5.6			4.1		5.6	4.1
Lost Time Adjust (s)		-4.3			-3.1			
Total Lost Time (s)		5.0			5.0			
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode		C-Max			None		C-Max	None
Act Effct Green (s)		55.4			54.6			
Actuated g/C Ratio		0.46			0.46			
v/c Ratio		0.68			0.27			
Control Delay		3.4			20.8			
Queue Delay		2.0			0.0			
Total Delay		5.4			20.8			
LOS		A			C			
Approach Delay		5.4			20.8			
Approach LOS		A			C			
Queue Length 50th (ft)		16			100			
Queue Length 95th (ft)		18			136			
Internal Link Dist (ft)		137	119		105			
Turn Bay Length (ft)								

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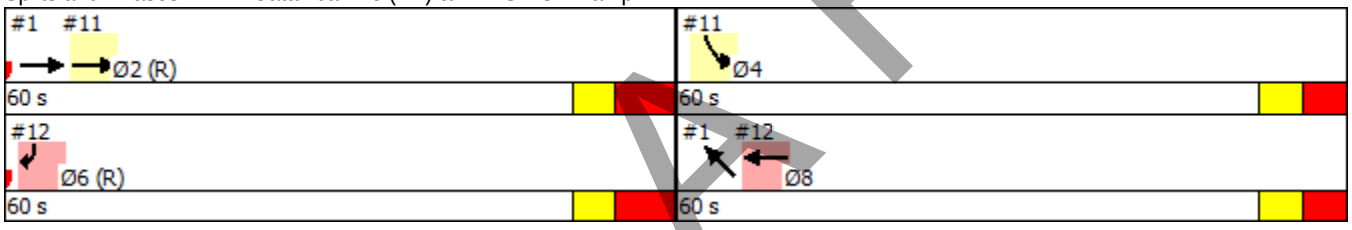
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR	Ø6	Ø8
Base Capacity (vph)		2325			1581			
Starvation Cap Reductn		0			0			
Spillback Cap Reductn		554			0			
Storage Cap Reductn		0			0			
Reduced v/c Ratio		0.90			0.27			

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 70 (58%), Referenced to phase 2:EBT and 6:, Start of Green
Natural Cycle: 55
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.82
Intersection Signal Delay: 8.6 Intersection LOS: A
Intersection Capacity Utilization 59.6% ICU Level of Service B
Analysis Period (min) 15

Splits and Phases: 11: Catawba Ave (EB) & I-77 SB Off-Ramp



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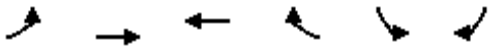

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR	Ø2	Ø4
Lane Configurations								
Traffic Volume (vph)	0	0	1195	0	0	701		
Future Volume (vph)	0	0	1195	0	0	701		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900		
Grade (%)		0%	0%		4%			
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.88		
Frt						0.850		
Flt Protected								
Satd. Flow (prot)	0	0	3539	0	0	2731		
Flt Permitted								
Satd. Flow (perm)	0	0	3539	0	0	2731		
Right Turn on Red				No		No		
Satd. Flow (RTOR)								
Link Speed (mph)		35	35		35			
Link Distance (ft)		202	115		181			
Travel Time (s)		3.9	2.2		3.5			
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90		
Adj. Flow (vph)	0	0	1328	0	0	779		
Shared Lane Traffic (%)								
Lane Group Flow (vph)	0	0	1328	0	0	779		
Turn Type			NA			Prot		
Protected Phases			8			6	2	4
Permitted Phases								
Detector Phase			8			6		
Switch Phase								
Minimum Initial (s)			10.0			10.0	10.0	10.0
Minimum Split (s)			26.1			19.3	24.3	21.1
Total Split (s)			60.0			60.0	60.0	60.0
Total Split (%)			50.0%			50.0%	50%	50%
Yellow Time (s)			4.0			3.7	3.7	4.0
All-Red Time (s)			4.1			5.6	5.6	4.1
Lost Time Adjust (s)			-3.1			-4.3		
Total Lost Time (s)			5.0			5.0		
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode			None			C-Max	C-Max	None
Act Effct Green (s)			54.6			55.4		
Actuated g/C Ratio			0.46			0.46		
v/c Ratio			0.82			0.62		
Control Delay			4.2			27.1		
Queue Delay			0.0			0.0		
Total Delay			4.2			27.1		
LOS			A			C		
Approach Delay			4.2		27.1			
Approach LOS			A		C			
Queue Length 50th (ft)			8			253		
Queue Length 95th (ft)			18			327		
Internal Link Dist (ft)		122	35		101			
Turn Bay Length (ft)								

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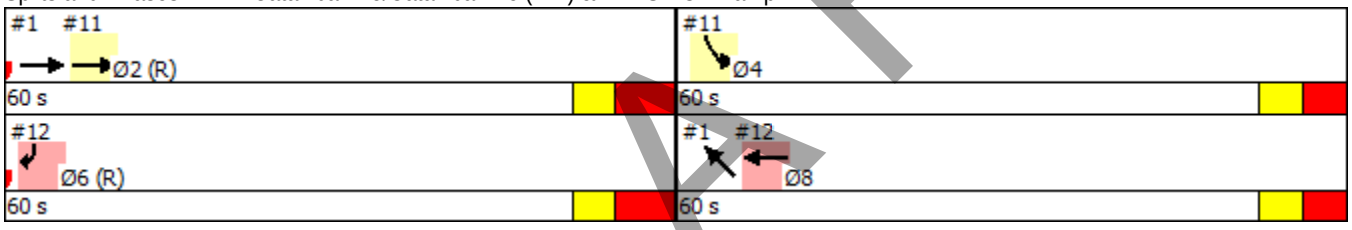
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR	Ø2	Ø4
Base Capacity (vph)			1622			1261		
Starvation Cap Reductn			6			0		
Spillback Cap Reductn			0			0		
Storage Cap Reductn			0			0		
Reduced v/c Ratio			0.82			0.62		

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 70 (58%), Referenced to phase 2:EBT and 6:, Start of Green
Natural Cycle: 55
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.82
Intersection Signal Delay: 12.7 Intersection LOS: B
Intersection Capacity Utilization 68.9% ICU Level of Service C
Analysis Period (min) 15

Splits and Phases: 12: Catawba Ave/Catawba Ave (WB) & I-77 SB Off-Ramp



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Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	0	825	0	0	0	0	0	1180	0
Future Volume (vph)	0	0	0	0	825	0	0	0	0	0	1180	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		0%			0%			0%			-1%	
Lane Util. Factor	1.00	1.00	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00	0.95	1.00
Frt												
Flt Protected												
Satd. Flow (prot)	0	0	0	0	3539	0	0	0	0	0	3557	0
Flt Permitted												
Satd. Flow (perm)	0	0	0	0	3539	0	0	0	0	0	3557	0
Right Turn on Red			No	No		No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)		35			35			35			35	
Link Distance (ft)		182			125			128			169	
Travel Time (s)		3.5			2.4			2.5			3.3	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	0	0	0	917	0	0	0	0	0	1311	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	0	917	0	0	0	0	0	1311	0
Turn Type					NA						NA	
Protected Phases					6						4	
Permitted Phases												
Detector Phase					6						4	
Switch Phase												
Minimum Initial (s)					7.0						7.0	
Minimum Split (s)					19.9						21.9	
Total Split (s)					60.0						60.0	
Total Split (%)					50.0%						50.0%	
Yellow Time (s)					3.9						3.9	
All-Red Time (s)					4.0						4.0	
Lost Time Adjust (s)					-2.0						-2.9	
Total Lost Time (s)					5.9						5.0	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode					C-Max						None	
Act Effct Green (s)					56.0						53.1	
Actuated g/C Ratio					0.47						0.44	
v/c Ratio					0.56						0.83	
Control Delay					28.7						29.3	
Queue Delay					1.5						5.1	
Total Delay					30.2						34.5	
LOS					C						C	
Approach Delay					30.2						34.5	
Approach LOS					C						C	
Queue Length 50th (ft)					248						515	
Queue Length 95th (ft)					m277						604	
Internal Link Dist (ft)		102			45			48			89	
Turn Bay Length (ft)												

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Lane Group	Ø2	Ø8
Lane Configurations		
Traffic Volume (vph)		
Future Volume (vph)		
Ideal Flow (vphpl)		
Grade (%)		
Lane Util. Factor		
Frt		
Flt Protected		
Satd. Flow (prot)		
Flt Permitted		
Satd. Flow (perm)		
Right Turn on Red		
Satd. Flow (RTOR)		
Link Speed (mph)		
Link Distance (ft)		
Travel Time (s)		
Peak Hour Factor		
Adj. Flow (vph)		
Shared Lane Traffic (%)		
Lane Group Flow (vph)		
Turn Type		
Protected Phases	2	8
Permitted Phases		
Detector Phase		
Switch Phase		
Minimum Initial (s)	10.0	7.0
Minimum Split (s)	18.9	19.9
Total Split (s)	60.0	60.0
Total Split (%)	50%	50%
Yellow Time (s)	3.8	3.9
All-Red Time (s)	5.1	4.0
Lost Time Adjust (s)		
Total Lost Time (s)		
Lead/Lag		
Lead-Lag Optimize?		
Recall Mode	C-Max	None
Act Effct Green (s)		
Actuated g/C Ratio		
v/c Ratio		
Control Delay		
Queue Delay		
Total Delay		
LOS		
Approach Delay		
Approach LOS		
Queue Length 50th (ft)		
Queue Length 95th (ft)		
Internal Link Dist (ft)		
Turn Bay Length (ft)		

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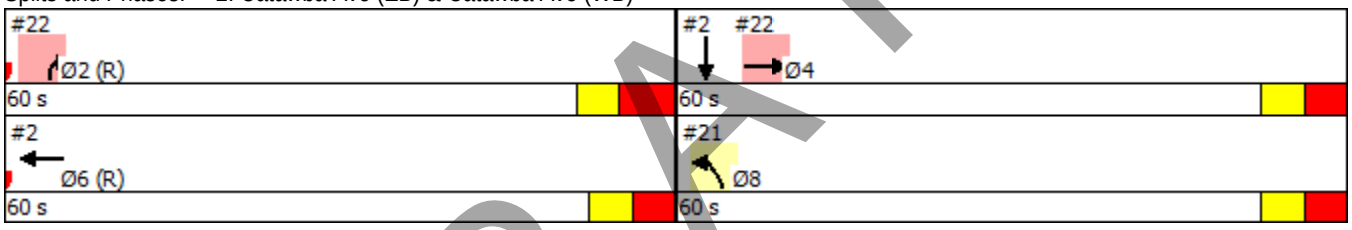
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Base Capacity (vph)					1650						1630	
Starvation Cap Reductn					508						259	
Spillback Cap Reductn					0						0	
Storage Cap Reductn					0						0	
Reduced v/c Ratio					0.80						0.96	

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 20 (17%), Referenced to phase 2:NBR and 6:, Start of Green
Natural Cycle: 55
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.84
Intersection Signal Delay: 32.7 Intersection LOS: C
Intersection Capacity Utilization 64.5% ICU Level of Service C
Analysis Period (min) 15
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 2: Catawba Ave (EB) & Catawba Ave (WB)



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Lane Group	Ø2	Ø8
Base Capacity (vph)		
Starvation Cap Reductn		
Spillback Cap Reductn		
Storage Cap Reductn		
Reduced v/c Ratio		

Intersection Summary

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Lane Group	EBL	EBR	NBL	NBR	SWL	SWR	Ø2	Ø4	Ø6
Lane Configurations									
Traffic Volume (vph)	0	0	457	0	0	825			
Future Volume (vph)	0	0	457	0	0	825			
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900			
Lane Util. Factor	1.00	1.00	0.97	1.00	1.00	0.88			
Frt						0.850			
Flt Protected			0.950						
Satd. Flow (prot)	0	0	3433	0	0	2787			
Flt Permitted			0.950						
Satd. Flow (perm)	0	0	3433	0	0	2787			
Right Turn on Red		No	No	No		No			
Satd. Flow (RTOR)									
Link Speed (mph)	35		35		35				
Link Distance (ft)	209		215		182				
Travel Time (s)	4.1		4.2		3.5				
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90			
Adj. Flow (vph)	0	0	508	0	0	917			
Shared Lane Traffic (%)									
Lane Group Flow (vph)	0	0	508	0	0	917			
Turn Type			Prot			custom			
Protected Phases			8!			Free!	2	4	6
Permitted Phases									
Detector Phase			8						
Switch Phase									
Minimum Initial (s)			7.0				10.0	7.0	7.0
Minimum Split (s)			19.9				18.9	21.9	19.9
Total Split (s)			60.0				60.0	60.0	60.0
Total Split (%)			50.0%				50%	50%	50%
Yellow Time (s)			3.9				3.8	3.9	3.9
All-Red Time (s)			4.0				5.1	4.0	4.0
Lost Time Adjust (s)			-2.9						
Total Lost Time (s)			5.0						
Lead/Lag									
Lead-Lag Optimize?									
Recall Mode			None				C-Max	None	C-Max
Act Effct Green (s)			53.1			120.0			
Actuated g/C Ratio			0.44			1.00			
v/c Ratio			0.33			0.33			
Control Delay			22.3			2.3			
Queue Delay			0.1			0.0			
Total Delay			22.4			2.3			
LOS			C			A			
Approach Delay			22.4		2.3				
Approach LOS			C		A				
Queue Length 50th (ft)			125			53			
Queue Length 95th (ft)			165			52			
Internal Link Dist (ft)	129		135		102				
Turn Bay Length (ft)									
Base Capacity (vph)			1573			2787			

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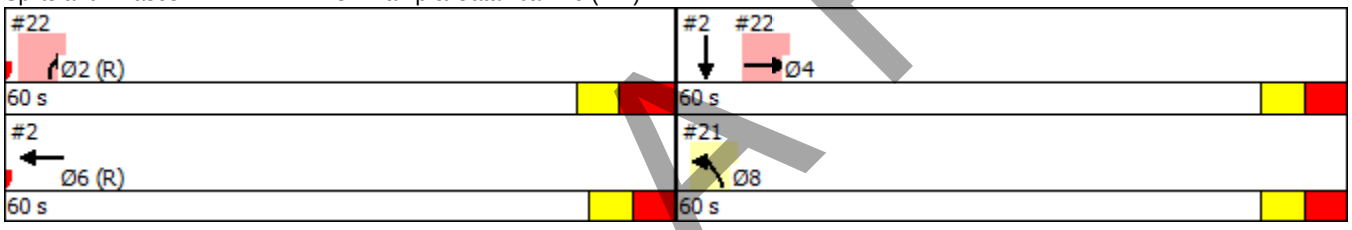
Lane Group	EBL	EBR	NBL	NBR	SWL	SWR	Ø2	Ø4	Ø6
Starvation Cap Reductn			0			0			
Spillback Cap Reductn			252			317			
Storage Cap Reductn			0			0			
Reduced v/c Ratio			0.38			0.37			

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 20 (17%), Referenced to phase 2:NBR and 6:, Start of Green
Natural Cycle: 55
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.84
Intersection Signal Delay: 9.5 Intersection LOS: A
Intersection Capacity Utilization 23.4% ICU Level of Service A
Analysis Period (min) 15
! Phase conflict between lane groups.

Splits and Phases: 21: I-77 NB Off-Ramp & Catawba Ave (WB)



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Lane Group	EBT	EBR	WBL	WBT	NBL	NBR	Ø6	Ø8
Lane Configurations								
Traffic Volume (vph)	1180	0	0	0	0	185		
Future Volume (vph)	1180	0	0	0	0	185		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900		
Grade (%)	0%			0%	4%			
Lane Util. Factor	0.95	1.00	1.00	1.00	1.00	1.00		
Frt						0.865		
Flt Protected								
Satd. Flow (prot)	3539	0	0	0	0	1579		
Flt Permitted								
Satd. Flow (perm)	3539	0	0	0	0	1579		
Right Turn on Red		No				No		
Satd. Flow (RTOR)								
Link Speed (mph)	35			35	35			
Link Distance (ft)	128			116	197			
Travel Time (s)	2.5			2.3	3.8			
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90		
Adj. Flow (vph)	1311	0	0	0	0	206		
Shared Lane Traffic (%)								
Lane Group Flow (vph)	1311	0	0	0	0	206		
Turn Type	NA					Prot		
Protected Phases	4					2	6	8
Permitted Phases								
Detector Phase	4					2		
Switch Phase								
Minimum Initial (s)	7.0					10.0	7.0	7.0
Minimum Split (s)	21.9					18.9	19.9	19.9
Total Split (s)	60.0					60.0	60.0	60.0
Total Split (%)	50.0%					50.0%	50%	50%
Yellow Time (s)	3.9					3.8	3.9	3.9
All-Red Time (s)	4.0					5.1	4.0	4.0
Lost Time Adjust (s)	-2.9					-3.9		
Total Lost Time (s)	5.0					5.0		
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None					C-Max	C-Max	None
Act Effct Green (s)	53.1					56.9		
Actuated g/C Ratio	0.44					0.47		
v/c Ratio	0.84					0.28		
Control Delay	3.7					20.9		
Queue Delay	0.1					0.0		
Total Delay	3.8					20.9		
LOS	A					C		
Approach Delay	3.8				20.9			
Approach LOS	A				C			
Queue Length 50th (ft)	2					97		
Queue Length 95th (ft)	3					153		
Internal Link Dist (ft)	48			36	117			
Turn Bay Length (ft)								

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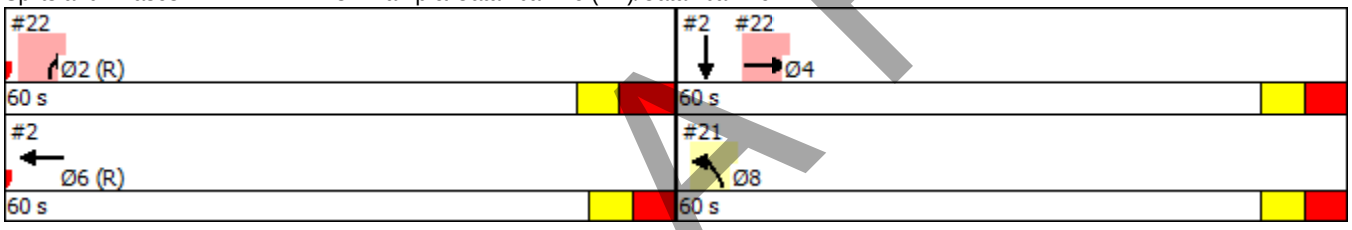
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR	Ø6	Ø8
Base Capacity (vph)	1622					748		
Starvation Cap Reductn	15					0		
Spillback Cap Reductn	0					0		
Storage Cap Reductn	0					0		
Reduced v/c Ratio	0.82					0.28		

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 20 (17%), Referenced to phase 2:NBR and 6:, Start of Green
Natural Cycle: 55
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.84
Intersection Signal Delay: 6.2 Intersection LOS: A
Intersection Capacity Utilization 64.5% ICU Level of Service C
Analysis Period (min) 15

Splits and Phases: 22: I-77 NB Off-Ramp & Catawba Ave (EB)/Catawba Ave



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Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	77	660	627	113	671	33	518	38	144	21	23	57
Future Volume (vph)	77	660	627	113	671	33	518	38	144	21	23	57
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		-2%			1%			3%			5%	
Storage Length (ft)	100		0	100		0	150		150	75		0
Storage Lanes	1		1	1		0	1		1	1		0
Taper Length (ft)	100			100			100			100		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	1.00	1.00	1.00	1.00
Frt			0.850		0.993				0.850		0.894	
Flt Protected	0.950			0.950			0.950	0.959		0.950		
Satd. Flow (prot)	1787	1881	1599	1761	1840	0	1656	1672	1560	1725	1624	0
Flt Permitted	0.080			0.077			0.950	0.959		0.950		
Satd. Flow (perm)	151	1881	1599	143	1840	0	1656	1672	1560	1725	1624	0
Right Turn on Red			No			No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)		35			35			35			35	
Link Distance (ft)		229			323			537			507	
Travel Time (s)		4.5			6.3			10.5			9.9	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	86	733	697	126	746	37	576	42	160	23	26	63
Shared Lane Traffic (%)							47%					
Lane Group Flow (vph)	86	733	697	126	783	0	305	313	160	23	89	0
Turn Type	pm+pt	NA	pm+ov	pm+pt	NA		Split	NA	pm+ov	Split	NA	
Protected Phases	5	2	3	1	6		3	3	1	4	4	
Permitted Phases	2		2	6					3			
Detector Phase	5	2	3	1	6		3	3	1	4	4	
Switch Phase												
Minimum Initial (s)	7.0	10.0	7.0	7.0	10.0		7.0	7.0	7.0	7.0	7.0	
Minimum Split (s)	13.3	31.4	28.3	13.2	28.4		28.3	28.3	13.2	12.9	12.9	
Total Split (s)	17.0	49.0	37.0	17.0	49.0		37.0	37.0	17.0	17.0	17.0	
Total Split (%)	14.2%	40.8%	30.8%	14.2%	40.8%		30.8%	30.8%	14.2%	14.2%	14.2%	
Yellow Time (s)	3.0	4.0	3.7	3.0	4.0		3.7	3.7	3.0	3.6	3.6	
All-Red Time (s)	3.3	2.4	2.6	3.2	2.4		2.6	2.6	3.2	2.3	2.3	
Lost Time Adjust (s)	-1.3	-1.4	-1.4	-1.2	-1.4		-1.3	-1.3	-1.2	-0.9	-0.9	
Total Lost Time (s)	5.0	5.0	4.9	5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Lead/Lag	Lead	Lag	Lead	Lead	Lag		Lead	Lead	Lead	Lag	Lag	
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	
Recall Mode	None	C-Max	None	None	C-Max		None	None	None	None	None	
Act Effct Green (s)	59.1	49.8	83.9	62.0	53.4		29.0	29.0	39.2	11.0	11.0	
Actuated g/C Ratio	0.49	0.42	0.70	0.52	0.44		0.24	0.24	0.33	0.09	0.09	
v/c Ratio	0.43	0.94	0.62	0.60	0.96		0.76	0.78	0.31	0.15	0.60	
Control Delay	28.1	68.9	19.6	33.0	57.5		55.2	56.0	19.4	51.8	69.2	
Queue Delay	0.0	45.8	1.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Total Delay	28.1	114.6	20.7	33.0	57.5		55.2	56.0	19.4	51.8	69.2	
LOS	C	F	C	C	E		E	E	B	D	E	
Approach Delay		66.5			54.1			48.1			65.6	
Approach LOS		E			D			D			E	
Queue Length 50th (ft)	61	~621	264	50	~678		224	230	62	17	67	

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Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 95th (ft)	m76	#887	384	113	#952		333	342	98	43	123	
Internal Link Dist (ft)		149			243			457			427	
Turn Bay Length (ft)	100			100			150		150	75		
Base Capacity (vph)	241	781	1158	237	819		441	445	532	172	162	
Starvation Cap Reductn	0	225	231	0	0		0	0	0	0	0	
Spillback Cap Reductn	0	0	0	0	0		0	0	0	0	0	
Storage Cap Reductn	0	0	0	0	0		0	0	0	0	0	
Reduced v/c Ratio	0.36	1.32	0.75	0.53	0.96		0.69	0.70	0.30	0.13	0.55	

Intersection Summary

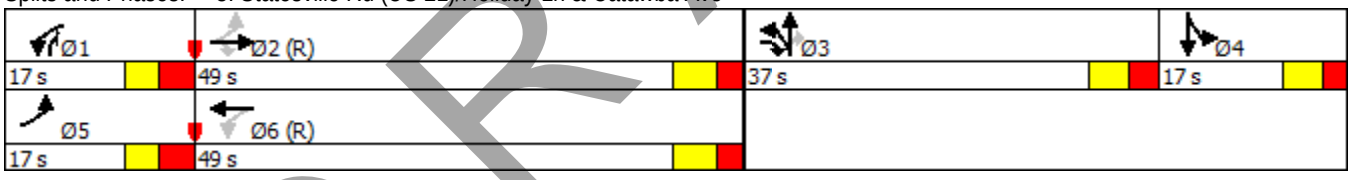
Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 35 (29%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green
Natural Cycle: 100
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.96
Intersection Signal Delay: 58.8 Intersection LOS: E
Intersection Capacity Utilization 77.7% ICU Level of Service D
Analysis Period (min) 15

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 3: Statesville Rd (US 21)/Holiday Ln & Catawba Ave



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Intersection

Int Delay, s/veh 1.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	4	801	21	4	795	4	15	4	4	4	4	7
Future Vol, veh/h	4	801	21	4	795	4	15	4	4	4	4	7
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	50	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	4	890	23	4	883	4	17	4	4	4	4	8

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	888	0	0	913	0	0	1812	1808	902	1809	1816	886
Stage 1	-	-	-	-	-	-	911	911	-	894	894	-
Stage 2	-	-	-	-	-	-	901	897	-	915	922	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	763	-	-	746	-	-	61	79	336	61	78	343
Stage 1	-	-	-	-	-	-	328	353	-	336	360	-
Stage 2	-	-	-	-	-	-	333	358	-	327	349	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	763	-	-	746	-	-	56	78	336	57	77	343
Mov Cap-2 Maneuver	-	-	-	-	-	-	56	78	-	57	77	-
Stage 1	-	-	-	-	-	-	326	351	-	334	356	-
Stage 2	-	-	-	-	-	-	318	354	-	317	347	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0	85.1	45.6
HCM LOS			F	E

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	69	763	-	-	746	-	-	105
HCM Lane V/C Ratio	0.37	0.006	-	-	0.006	-	-	0.159
HCM Control Delay (s)	85.1	9.7	-	-	9.9	0	-	45.6
HCM Lane LOS	F	A	-	-	A	A	-	E
HCM 95th %tile Q(veh)	1.4	0	-	-	0	-	-	0.5

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Summary of All Intervals

Run Number	1	2	3	4	5	Avg
Start Time	4:50	4:50	4:50	4:50	4:50	4:50
End Time	6:00	6:00	6:00	6:00	6:00	6:00
Total Time (min)	70	70	70	70	70	70
Time Recorded (min)	60	60	60	60	60	60
# of Intervals	5	5	5	5	5	5
# of Recorded Intervals	4	4	4	4	4	4
Vehs Entered	220	3065	770	486	2828	1474
Vehs Exited	155	3006	637	290	2724	1361
Starting Vehs	284	232	236	169	237	229
Ending Vehs	349	291	369	365	341	343
Travel Distance (mi)	57	1269	271	124	1153	575
Travel Time (hr)	2917.2	1342.0	2384.6	2424.5	1429.5	2099.6
Total Delay (hr)	2915.1	1296.7	2374.9	2420.0	1388.3	2079.0
Total Stops	260	5365	1204	554	4988	2474
Fuel Used (gal)	666.8	345.0	551.7	556.2	362.2	496.4

Interval #0 Information Seeding

Start Time	4:50
End Time	5:00
Total Time (min)	10

Volumes adjusted by Growth Factors.
No data recorded this interval.

Interval #1 Information 1

Start Time	5:00
End Time	5:15
Total Time (min)	15

Volumes adjusted by Growth Factors, Anti PHF.

Run Number	1	2	3	4	5	Avg
Vehs Entered	193	841	675	456	794	590
Vehs Exited	153	801	580	286	729	508
Starting Vehs	284	232	236	169	237	229
Ending Vehs	324	272	331	339	302	314
Travel Distance (mi)	55	337	248	122	305	214
Travel Time (hr)	236.6	117.2	157.1	143.1	123.5	155.5
Total Delay (hr)	234.5	105.2	148.3	138.6	112.6	147.9
Total Stops	236	1495	1060	525	1375	935
Fuel Used (gal)	55.6	37.1	43.4	36.2	37.7	42.0

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Interval #2 Information 2

Start Time 5:15
End Time 5:30
Total Time (min) 15
Volumes adjusted by PHF, Growth Factors.

Run Number	1	2	3	4	5	Avg
Vehs Entered	16	731	81	11	671	301
Vehs Exited	0	721	57	2	706	298
Starting Vehs	324	272	331	339	302	314
Ending Vehs	340	282	355	348	267	318
Travel Distance (mi)	1	308	22	1	295	125
Travel Time (hr)	567.2	262.6	423.9	441.2	284.8	395.9
Total Delay (hr)	567.2	251.5	423.1	441.2	274.1	391.4
Total Stops	17	1197	131	10	1231	516
Fuel Used (gal)	129.4	69.1	97.4	100.6	74.1	94.1

Interval #3 Information 3

Start Time 5:30
End Time 5:45
Total Time (min) 15
Volumes adjusted by Growth Factors, Anti PHF.

Run Number	1	2	3	4	5	Avg
Vehs Entered	6	738	9	10	658	285
Vehs Exited	0	719	0	0	638	270
Starting Vehs	340	282	355	348	267	318
Ending Vehs	346	301	364	358	287	329
Travel Distance (mi)	0	307	0	0	274	116
Travel Time (hr)	900.6	419.7	749.1	768.3	449.9	657.5
Total Delay (hr)	900.6	408.8	749.1	768.3	440.1	653.4
Total Stops	6	1379	9	10	1181	517
Fuel Used (gal)	205.4	105.2	170.7	175.1	111.3	153.6

Interval #4 Information 4

Start Time 5:45
End Time 6:00
Total Time (min) 15
Volumes adjusted by Growth Factors, Anti PHF.

Run Number	1	2	3	4	5	Avg
Vehs Entered	5	755	5	9	705	294
Vehs Exited	2	765	0	2	651	283
Starting Vehs	346	301	364	358	287	329
Ending Vehs	349	291	369	365	341	343
Travel Distance (mi)	0	317	0	1	278	119
Travel Time (hr)	1212.8	542.4	1054.4	1072.0	571.4	890.6
Total Delay (hr)	1212.8	531.2	1054.4	1071.9	561.4	886.4
Total Stops	1	1294	4	9	1201	501
Fuel Used (gal)	276.3	133.6	240.2	244.3	139.1	206.7

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Intersection: 1: Catawba Ave (WB) & Catawba Ave (EB)

Movement	EB	EB	EB	NW	NW
Directions Served	T	T	T	T	T
Maximum Queue (ft)	147	182	129	131	130
Average Queue (ft)	102	172	48	57	66
95th Queue (ft)	236	190	155	150	170
Link Distance (ft)	60	60	60	46	46
Upstream Blk Time (%)	43	94	8	15	17
Queuing Penalty (veh)	204	445	38	90	104
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 2: Catawba Ave (EB) & Catawba Ave (WB)

Movement	WB	WB	SB	SB
Directions Served	T	T	T	T
Maximum Queue (ft)	132	140	176	174
Average Queue (ft)	125	132	159	70
95th Queue (ft)	130	150	192	193
Link Distance (ft)	74	74	86	86
Upstream Blk Time (%)	99	99	90	17
Queuing Penalty (veh)	409	408	531	99
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 3: Statesville Rd (US 21)/Holiday Ln & Catawba Ave

Movement	EB	EB	EB	WB	WB	NB	NB	NB	SB	SB
Directions Served	L	T	R	L	TR	L	LT	R	L	TR
Maximum Queue (ft)	103	226	221	87	334	176	493	150	44	466
Average Queue (ft)	65	214	67	11	323	107	482	11	5	426
95th Queue (ft)	180	227	211	56	336	211	491	95	43	553
Link Distance (ft)		170	170		245		487			459
Upstream Blk Time (%)	18	75	5		99		99			64
Queuing Penalty (veh)	0	514	32		811		0			0
Storage Bay Dist (ft)	100			100		150		150	75	
Storage Blk Time (%)	21	57			99	41	99		1	99
Queuing Penalty (veh)	139	44			113	182	401		0	21

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Intersection: 4: Hill St/Burton Ln & Catawba Ave

Movement	EB	EB	WB	NB	SB
Directions Served	L	TR	LTR	LTR	LTR
Maximum Queue (ft)	26	31	556	464	343
Average Queue (ft)	11	1	536	246	199
95th Queue (ft)	42	23	573	489	377
Link Distance (ft)		245	536	466	423
Upstream Blk Time (%)			99	5	2
Queuing Penalty (veh)			0	0	0
Storage Bay Dist (ft)	50				
Storage Blk Time (%)	23	0			
Queuing Penalty (veh)	187	0			

Intersection: 11: Catawba Ave (EB) & I-77 SB Off-Ramp

Movement	EB	EB	EB	SB	SB
Directions Served	T	T	T	L	L
Maximum Queue (ft)	69	131	33	159	164
Average Queue (ft)	33	79	5	137	74
95th Queue (ft)	90	130	28	180	181
Link Distance (ft)	40	40	40	89	89
Upstream Blk Time (%)	34	92	1	72	25
Queuing Penalty (veh)	165	437	5	136	47
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 12: Catawba Ave/Catawba Ave (WB) & I-77 SB Off-Ramp

Movement	WB	WB	SB	SB
Directions Served	T	T	R	R
Maximum Queue (ft)	9	8	166	133
Average Queue (ft)	0	0	78	48
95th Queue (ft)	6	4	202	127
Link Distance (ft)	56	56	89	89
Upstream Blk Time (%)			16	4
Queuing Penalty (veh)			54	14
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

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Intersection: 14: Catawba Ave (EB) & I-77 NB On-Ramp

Movement	EB	EB
Directions Served	T	T
Maximum Queue (ft)	242	194
Average Queue (ft)	207	45
95th Queue (ft)	262	166
Link Distance (ft)	143	143
Upstream Blk Time (%)	83	2
Queuing Penalty (veh)	501	14
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 15: Catawba Ave

Movement	WB	WB	NE	NE
Directions Served	T	T	R	R
Maximum Queue (ft)	230	189	112	95
Average Queue (ft)	209	176	107	13
95th Queue (ft)	285	193	120	66
Link Distance (ft)	170	170	61	61
Upstream Blk Time (%)	95	98	74	2
Queuing Penalty (veh)	596	613	507	13
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 17: I-77 SB On-Ramp & Catawba Ave (WB)

Movement	WB	WB
Directions Served	LT	T
Maximum Queue (ft)	93	144
Average Queue (ft)	22	41
95th Queue (ft)	96	134
Link Distance (ft)	139	139
Upstream Blk Time (%)	1	1
Queuing Penalty (veh)	4	7
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

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Intersection: 18: I-77 NB On-Ramp

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 19: I-77 SB On-Ramp

Movement	SE
Directions Served	R
Maximum Queue (ft)	100
Average Queue (ft)	4
95th Queue (ft)	52
Link Distance (ft)	137
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 21: I-77 NB Off-Ramp & Catawba Ave (WB)

Movement	NB	NB
Directions Served	L	L
Maximum Queue (ft)	129	170
Average Queue (ft)	46	71
95th Queue (ft)	133	196
Link Distance (ft)	116	116
Upstream Blk Time (%)	0	8
Queuing Penalty (veh)	1	18
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

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Intersection: 22: I-77 NB Off-Ramp & Catawba Ave (EB)/Catawba Ave

Movement	EB	EB	NB
Directions Served	T	T	R
Maximum Queue (ft)	167	38	178
Average Queue (ft)	151	3	141
95th Queue (ft)	170	21	209
Link Distance (ft)	86	86	110
Upstream Blk Time (%)	90	0	63
Queuing Penalty (veh)	531	0	116
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 24: I-77 SB On-Ramp & Catawba Ave/Catawba Ave (EB)

Movement	EB	EB	EB
Directions Served	T	T	TR
Maximum Queue (ft)	90	185	120
Average Queue (ft)	66	168	25
95th Queue (ft)	154	185	103
Link Distance (ft)		115	115
Upstream Blk Time (%)	24	84	1
Queuing Penalty (veh)	0	724	10
Storage Bay Dist (ft)	50		
Storage Blk Time (%)	31	84	
Queuing Penalty (veh)	146	400	

Intersection: 26: Catawba Ave

Movement	EB	EB
Directions Served	T	T
Maximum Queue (ft)	606	593
Average Queue (ft)	578	559
95th Queue (ft)	680	713
Link Distance (ft)	578	578
Upstream Blk Time (%)	85	67
Queuing Penalty (veh)	0	0
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

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Intersection: 28: I-77 NB Off-Ramp

Movement	NB	NB	NB
Directions Served	L	L	R
Maximum Queue (ft)	360	563	248
Average Queue (ft)	29	423	182
95th Queue (ft)	235	1066	456
Link Distance (ft)		801	
Upstream Blk Time (%)		49	
Queuing Penalty (veh)		0	
Storage Bay Dist (ft)	500		500
Storage Blk Time (%)	0	52	
Queuing Penalty (veh)	0	215	

Intersection: 30: Catawba Ave (WB)/Catawba Ave & I-77 NB On-Ramp

Movement	WB	WB
Directions Served	T	TR
Maximum Queue (ft)	102	99
Average Queue (ft)	100	95
95th Queue (ft)	114	101
Link Distance (ft)	59	59
Upstream Blk Time (%)	99	99
Queuing Penalty (veh)	617	616
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 610: I-77 SB Off-Ramp

Movement	SB	SB	SB	SB
Directions Served	L	L	R	R
Maximum Queue (ft)	360	418	666	343
Average Queue (ft)	266	283	505	27
95th Queue (ft)	615	709	1170	161
Link Distance (ft)			909	
Upstream Blk Time (%)			48	
Queuing Penalty (veh)			0	
Storage Bay Dist (ft)	450	450		450
Storage Blk Time (%)	33	50	1	0
Queuing Penalty (veh)	236	353	5	0

Network Summary

Network wide Queuing Penalty: 11873

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APPENDIX F-11:
CAPACITY ANALYSIS RESULTS

2023 BUILD CONDITIONS
AM PEAK HOUR

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Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Traffic Volume (vph)	0	1448	0	0	0	0	0	0	0	0	871	0
Future Volume (vph)	0	1448	0	0	0	0	0	0	0	0	871	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		2%			0%			0%			-2%	
Lane Util. Factor	1.00	0.91	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00
Frt												
Flt Protected												
Satd. Flow (prot)	0	5034	0	0	0	0	0	0	0	0	3575	0
Flt Permitted												
Satd. Flow (perm)	0	5034	0	0	0	0	0	0	0	0	3575	0
Right Turn on Red	No		No			No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)		35			35			35			35	
Link Distance (ft)		142			217			115			211	
Travel Time (s)		2.8			4.2			2.2			4.1	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	1609	0	0	0	0	0	0	0	0	968	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	1609	0	0	0	0	0	0	0	0	968	0
Turn Type		NA									NA	
Protected Phases		2									8	
Permitted Phases												
Detector Phase		2									8	
Switch Phase												
Minimum Initial (s)		10.0									10.0	
Minimum Split (s)		24.3									26.1	
Total Split (s)		60.0									60.0	
Total Split (%)		50.0%									50.0%	
Yellow Time (s)		3.7									4.0	
All-Red Time (s)		5.6									4.1	
Lost Time Adjust (s)		-4.3									-3.1	
Total Lost Time (s)		5.0									5.0	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode		C-Max									None	
Act Effct Green (s)		62.4									47.6	
Actuated g/C Ratio		0.52									0.40	
v/c Ratio		0.61									0.68	
Control Delay		22.5									42.6	
Queue Delay		0.0									0.4	
Total Delay		22.5									43.0	
LOS		C									D	
Approach Delay		22.5									43.0	
Approach LOS		C									D	
Queue Length 50th (ft)		314									397	
Queue Length 95th (ft)		410									458	
Internal Link Dist (ft)		62			137			35			131	
Turn Bay Length (ft)												

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Lane Group	Ø4	Ø6
Lane Configurations		
Traffic Volume (vph)		
Future Volume (vph)		
Ideal Flow (vphpl)		
Grade (%)		
Lane Util. Factor		
Frt		
Flt Protected		
Satd. Flow (prot)		
Flt Permitted		
Satd. Flow (perm)		
Right Turn on Red		
Satd. Flow (RTOR)		
Link Speed (mph)		
Link Distance (ft)		
Travel Time (s)		
Peak Hour Factor		
Adj. Flow (vph)		
Shared Lane Traffic (%)		
Lane Group Flow (vph)		
Turn Type		
Protected Phases	4	6
Permitted Phases		
Detector Phase		
Switch Phase		
Minimum Initial (s)	10.0	10.0
Minimum Split (s)	21.1	19.3
Total Split (s)	60.0	60.0
Total Split (%)	50%	50%
Yellow Time (s)	4.0	3.7
All-Red Time (s)	4.1	5.6
Lost Time Adjust (s)		
Total Lost Time (s)		
Lead/Lag		
Lead-Lag Optimize?		
Recall Mode	None	C-Max
Act Effct Green (s)		
Actuated g/C Ratio		
v/c Ratio		
Control Delay		
Queue Delay		
Total Delay		
LOS		
Approach Delay		
Approach LOS		
Queue Length 50th (ft)		
Queue Length 95th (ft)		
Internal Link Dist (ft)		
Turn Bay Length (ft)		

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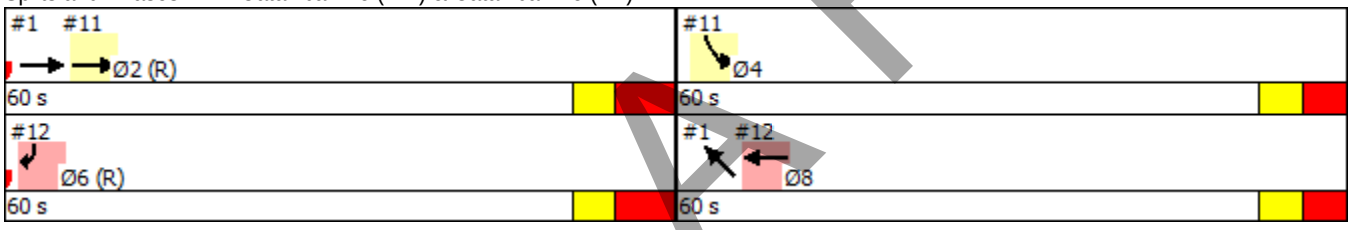
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Base Capacity (vph)		2618									1638	
Starvation Cap Reductn		0									230	
Spillback Cap Reductn		0									0	
Storage Cap Reductn		0									0	
Reduced v/c Ratio		0.61									0.69	

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 70 (58%), Referenced to phase 2:EBT and 6:, Start of Green
Natural Cycle: 60
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.79
Intersection Signal Delay: 30.2 Intersection LOS: C
Intersection Capacity Utilization 67.6% ICU Level of Service C
Analysis Period (min) 15

Splits and Phases: 1: Catawba Ave (WB) & Catawba Ave (EB)



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Lane Group	Ø4	Ø6
Base Capacity (vph)		
Starvation Cap Reductn		
Spillback Cap Reductn		
Storage Cap Reductn		
Reduced v/c Ratio		

Intersection Summary

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Lane Group	EBL	EBT	WBT	WBR	SBL	SBR	Ø6	Ø8
Lane Configurations								
Traffic Volume (vph)	0	1448	0	0	677	0		
Future Volume (vph)	0	1448	0	0	677	0		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900		
Grade (%)		2%	0%		-1%			
Lane Util. Factor	1.00	0.91	1.00	1.00	0.97	1.00		
Frt								
Flt Protected					0.950			
Satd. Flow (prot)	0	5034	0	0	3450	0		
Flt Permitted					0.950			
Satd. Flow (perm)	0	5034	0	0	3450	0		
Right Turn on Red				No	No	No		
Satd. Flow (RTOR)								
Link Speed (mph)		35	35		35			
Link Distance (ft)		217	199		185			
Travel Time (s)		4.2	3.9		3.6			
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90		
Adj. Flow (vph)	0	1609	0	0	752	0		
Shared Lane Traffic (%)								
Lane Group Flow (vph)	0	1609	0	0	752	0		
Turn Type		NA			Prot			
Protected Phases		2			4		6	8
Permitted Phases								
Detector Phase		2			4			
Switch Phase								
Minimum Initial (s)		10.0			10.0		10.0	10.0
Minimum Split (s)		24.3			21.1		19.3	26.1
Total Split (s)		60.0			60.0		60.0	60.0
Total Split (%)		50.0%			50.0%		50%	50%
Yellow Time (s)		3.7			4.0		3.7	4.0
All-Red Time (s)		5.6			4.1		5.6	4.1
Lost Time Adjust (s)		-4.3			-3.1			
Total Lost Time (s)		5.0			5.0			
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode		C-Max			None		C-Max	None
Act Effct Green (s)		62.4			47.6			
Actuated g/C Ratio		0.52			0.40			
v/c Ratio		0.61			0.55			
Control Delay		2.9			29.0			
Queue Delay		0.4			0.0			
Total Delay		3.2			29.0			
LOS		A			C			
Approach Delay		3.3			29.0			
Approach LOS		A			C			
Queue Length 50th (ft)		17			226			
Queue Length 95th (ft)		19			257			
Internal Link Dist (ft)		137	119		105			
Turn Bay Length (ft)								

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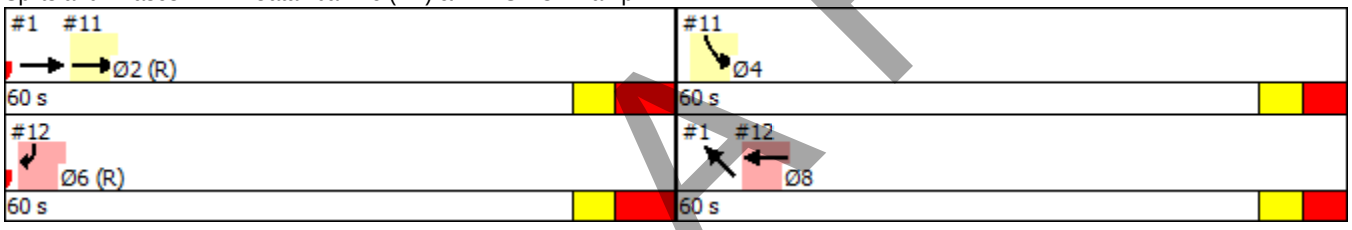
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR	Ø6	Ø8
Base Capacity (vph)		2618			1581			
Starvation Cap Reductn		0			0			
Spillback Cap Reductn		450			2			
Storage Cap Reductn		0			0			
Reduced v/c Ratio		0.74			0.48			

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 70 (58%), Referenced to phase 2:EBT and 6:, Start of Green
Natural Cycle: 60
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.79
Intersection Signal Delay: 11.5 Intersection LOS: B
Intersection Capacity Utilization 70.6% ICU Level of Service C
Analysis Period (min) 15

Splits and Phases: 11: Catawba Ave (EB) & I-77 SB Off-Ramp



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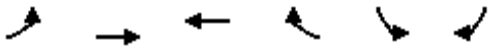

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR	Ø2	Ø4
Lane Configurations			↑↑			↱↱		
Traffic Volume (vph)	0	0	871	0	0	1005		
Future Volume (vph)	0	0	871	0	0	1005		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900		
Grade (%)		0%	0%		4%			
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.88		
Frt						0.850		
Flt Protected								
Satd. Flow (prot)	0	0	3539	0	0	2731		
Flt Permitted								
Satd. Flow (perm)	0	0	3539	0	0	2731		
Right Turn on Red				No		No		
Satd. Flow (RTOR)								
Link Speed (mph)		35	35		35			
Link Distance (ft)		202	115		181			
Travel Time (s)		3.9	2.2		3.5			
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90		
Adj. Flow (vph)	0	0	968	0	0	1117		
Shared Lane Traffic (%)								
Lane Group Flow (vph)	0	0	968	0	0	1117		
Turn Type			NA			Prot		
Protected Phases			8			6	2	4
Permitted Phases								
Detector Phase			8			6		
Switch Phase								
Minimum Initial (s)			10.0			10.0	10.0	10.0
Minimum Split (s)			26.1			19.3	24.3	21.1
Total Split (s)			60.0			60.0	60.0	60.0
Total Split (%)			50.0%			50.0%	50%	50%
Yellow Time (s)			4.0			3.7	3.7	4.0
All-Red Time (s)			4.1			5.6	5.6	4.1
Lost Time Adjust (s)			-3.1			-4.3		
Total Lost Time (s)			5.0			5.0		
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode			None			C-Max	C-Max	None
Act Effct Green (s)			47.6			62.4		
Actuated g/C Ratio			0.40			0.52		
v/c Ratio			0.69			0.79		
Control Delay			2.9			29.7		
Queue Delay			0.0			0.0		
Total Delay			2.9			29.7		
LOS			A			C		
Approach Delay			2.9		29.7			
Approach LOS			A		C			
Queue Length 50th (ft)			3			389		
Queue Length 95th (ft)			3			#595		
Internal Link Dist (ft)		122	35		101			
Turn Bay Length (ft)								

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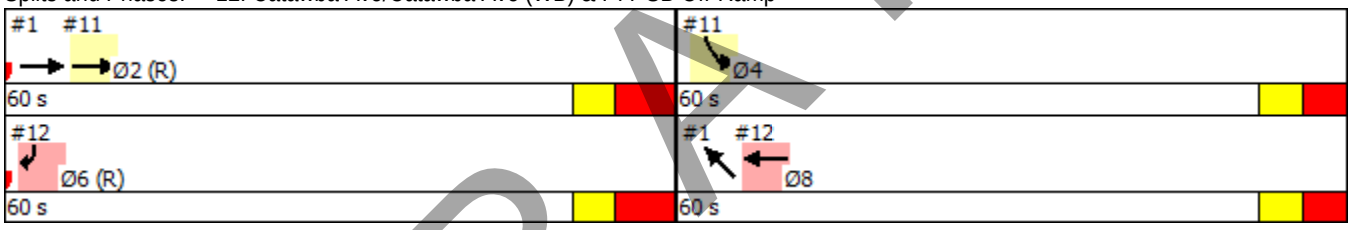
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR	Ø2	Ø4
Base Capacity (vph)			1622			1420		
Starvation Cap Reductn			6			0		
Spillback Cap Reductn			0			0		
Storage Cap Reductn			0			0		
Reduced v/c Ratio			0.60			0.79		

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 70 (58%), Referenced to phase 2:EBT and 6:, Start of Green
Natural Cycle: 60
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.79
Intersection Signal Delay: 17.2 Intersection LOS: B
Intersection Capacity Utilization 67.6% ICU Level of Service C
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 12: Catawba Ave/Catawba Ave (WB) & I-77 SB Off-Ramp



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Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	0	637	0	0	0	0	0	1255	0
Future Volume (vph)	0	0	0	0	637	0	0	0	0	0	1255	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		0%			0%			0%			-1%	
Lane Util. Factor	1.00	1.00	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00	0.95	1.00
Frt												
Flt Protected												
Satd. Flow (prot)	0	0	0	0	3539	0	0	0	0	0	3557	0
Flt Permitted												
Satd. Flow (perm)	0	0	0	0	3539	0	0	0	0	0	3557	0
Right Turn on Red			No	No		No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)		35			35			35			35	
Link Distance (ft)		182			125			128			169	
Travel Time (s)		3.5			2.4			2.5			3.3	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	0	0	0	708	0	0	0	0	0	1394	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	0	708	0	0	0	0	0	1394	0
Turn Type					NA						NA	
Protected Phases					6						4	
Permitted Phases												
Detector Phase					6						4	
Switch Phase												
Minimum Initial (s)					7.0						7.0	
Minimum Split (s)					19.9						21.9	
Total Split (s)					50.0						70.0	
Total Split (%)					41.7%						58.3%	
Yellow Time (s)					3.9						3.9	
All-Red Time (s)					4.0						4.0	
Lost Time Adjust (s)					-2.0						-2.9	
Total Lost Time (s)					5.9						5.0	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode					C-Max						None	
Act Effct Green (s)					48.5						60.6	
Actuated g/C Ratio					0.40						0.50	
v/c Ratio					0.50						0.78	
Control Delay					20.4						21.1	
Queue Delay					0.4						0.2	
Total Delay					20.8						21.2	
LOS					C						C	
Approach Delay					20.8						21.2	
Approach LOS					C						C	
Queue Length 50th (ft)					157						305	
Queue Length 95th (ft)					m235						353	
Internal Link Dist (ft)		102			45			48			89	
Turn Bay Length (ft)												

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Lane Group	Ø2	Ø8
Lane Configurations		
Traffic Volume (vph)		
Future Volume (vph)		
Ideal Flow (vphpl)		
Grade (%)		
Lane Util. Factor		
Frt		
Flt Protected		
Satd. Flow (prot)		
Flt Permitted		
Satd. Flow (perm)		
Right Turn on Red		
Satd. Flow (RTOR)		
Link Speed (mph)		
Link Distance (ft)		
Travel Time (s)		
Peak Hour Factor		
Adj. Flow (vph)		
Shared Lane Traffic (%)		
Lane Group Flow (vph)		
Turn Type		
Protected Phases	2	8
Permitted Phases		
Detector Phase		
Switch Phase		
Minimum Initial (s)	10.0	7.0
Minimum Split (s)	18.9	19.9
Total Split (s)	50.0	70.0
Total Split (%)	42%	58%
Yellow Time (s)	3.8	3.9
All-Red Time (s)	5.1	4.0
Lost Time Adjust (s)		
Total Lost Time (s)		
Lead/Lag		
Lead-Lag Optimize?		
Recall Mode	C-Max	None
Act Effct Green (s)		
Actuated g/C Ratio		
v/c Ratio		
Control Delay		
Queue Delay		
Total Delay		
LOS		
Approach Delay		
Approach LOS		
Queue Length 50th (ft)		
Queue Length 95th (ft)		
Internal Link Dist (ft)		
Turn Bay Length (ft)		

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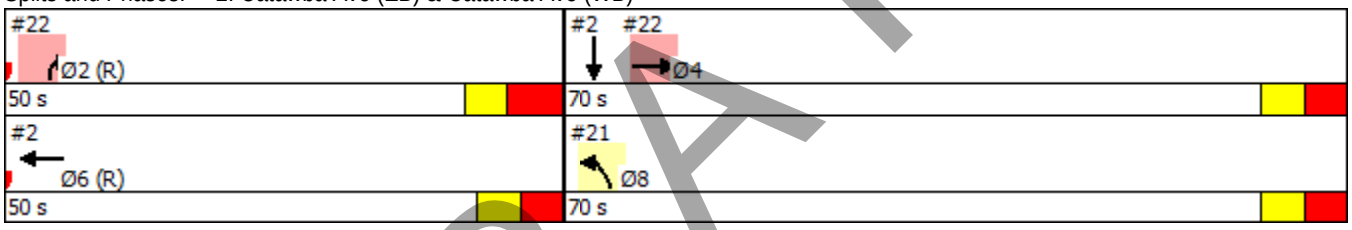
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Base Capacity (vph)					1430						1926	
Starvation Cap Reductn					303						80	
Spillback Cap Reductn					0						0	
Storage Cap Reductn					0						0	
Reduced v/c Ratio					0.63						0.76	

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 65 (54%), Referenced to phase 2:NBR and 6:, Start of Green
Natural Cycle: 55
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.78
Intersection Signal Delay: 21.1 Intersection LOS: C
Intersection Capacity Utilization 61.4% ICU Level of Service B
Analysis Period (min) 15
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 2: Catawba Ave (EB) & Catawba Ave (WB)



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Lane Group	Ø2	Ø8
Base Capacity (vph)		
Starvation Cap Reductn		
Spillback Cap Reductn		
Storage Cap Reductn		
Reduced v/c Ratio		

Intersection Summary

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Lane Group	EBL	EBR	NBL	NBR	SWL	SWR	Ø2	Ø4	Ø6
Lane Configurations									
Traffic Volume (vph)	0	0	286	0	0	637			
Future Volume (vph)	0	0	286	0	0	637			
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900			
Lane Util. Factor	1.00	1.00	0.97	1.00	1.00	0.88			
Frt						0.850			
Flt Protected			0.950						
Satd. Flow (prot)	0	0	3433	0	0	2787			
Flt Permitted			0.950						
Satd. Flow (perm)	0	0	3433	0	0	2787			
Right Turn on Red		No	No	No		No			
Satd. Flow (RTOR)									
Link Speed (mph)	35		35		35				
Link Distance (ft)	209		215		182				
Travel Time (s)	4.1		4.2		3.5				
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90			
Adj. Flow (vph)	0	0	318	0	0	708			
Shared Lane Traffic (%)									
Lane Group Flow (vph)	0	0	318	0	0	708			
Turn Type			Prot			custom			
Protected Phases			8!			Free!	2	4	6
Permitted Phases									
Detector Phase			8						
Switch Phase									
Minimum Initial (s)			7.0				10.0	7.0	7.0
Minimum Split (s)			19.9				18.9	21.9	19.9
Total Split (s)			70.0				50.0	70.0	50.0
Total Split (%)			58.3%				42%	58%	42%
Yellow Time (s)			3.9				3.8	3.9	3.9
All-Red Time (s)			4.0				5.1	4.0	4.0
Lost Time Adjust (s)			-2.9						
Total Lost Time (s)			5.0						
Lead/Lag									
Lead-Lag Optimize?									
Recall Mode			None				C-Max	None	C-Max
Act Effct Green (s)			60.6			120.0			
Actuated g/C Ratio			0.50			1.00			
v/c Ratio			0.18			0.25			
Control Delay			15.9			1.7			
Queue Delay			0.2			0.1			
Total Delay			16.1			1.8			
LOS			B			A			
Approach Delay			16.1		1.8				
Approach LOS			B		A				
Queue Length 50th (ft)			64			34			
Queue Length 95th (ft)			86			50			
Internal Link Dist (ft)	129		135		102				
Turn Bay Length (ft)									
Base Capacity (vph)			1859			2787			

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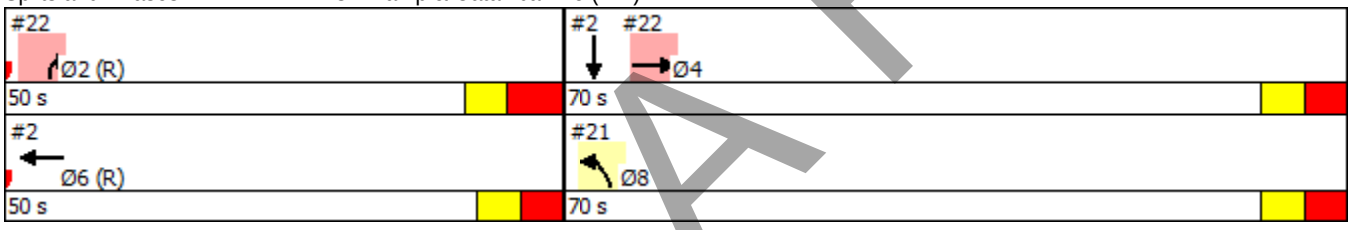
Lane Group	EBL	EBR	NBL	NBR	SWL	SWR	Ø2	Ø4	Ø6
Starvation Cap Reductn			0			0			
Spillback Cap Reductn			869			724			
Storage Cap Reductn			0			0			
Reduced v/c Ratio			0.32			0.34			

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 65 (54%), Referenced to phase 2:NBR and 6:, Start of Green
Natural Cycle: 55
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.78
Intersection Signal Delay: 6.2 Intersection LOS: A
Intersection Capacity Utilization 18.5% ICU Level of Service A
Analysis Period (min) 15
! Phase conflict between lane groups.

Splits and Phases: 21: I-77 NB Off-Ramp & Catawba Ave (WB)



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Lane Group	EBT	EBR	WBL	WBT	NBL	NBR	Ø6	Ø8
Lane Configurations								
Traffic Volume (vph)	1255	0	0	0	0	106		
Future Volume (vph)	1255	0	0	0	0	106		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900		
Grade (%)	0%			0%	4%			
Lane Util. Factor	0.95	1.00	1.00	1.00	1.00	1.00		
Frt						0.865		
Flt Protected								
Satd. Flow (prot)	3539	0	0	0	0	1579		
Flt Permitted								
Satd. Flow (perm)	3539	0	0	0	0	1579		
Right Turn on Red		No				No		
Satd. Flow (RTOR)								
Link Speed (mph)	35			35	35			
Link Distance (ft)	128			116	197			
Travel Time (s)	2.5			2.3	3.8			
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90		
Adj. Flow (vph)	1394	0	0	0	0	118		
Shared Lane Traffic (%)								
Lane Group Flow (vph)	1394	0	0	0	0	118		
Turn Type	NA					Prot		
Protected Phases	4					2	6	8
Permitted Phases								
Detector Phase	4					2		
Switch Phase								
Minimum Initial (s)	7.0					10.0	7.0	7.0
Minimum Split (s)	21.9					18.9	19.9	19.9
Total Split (s)	70.0					50.0	50.0	70.0
Total Split (%)	58.3%					41.7%	42%	58%
Yellow Time (s)	3.9					3.8	3.9	3.9
All-Red Time (s)	4.0					5.1	4.0	4.0
Lost Time Adjust (s)	-2.9					-3.9		
Total Lost Time (s)	5.0					5.0		
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None					C-Max	C-Max	None
Act Effct Green (s)	60.6					49.4		
Actuated g/C Ratio	0.50					0.41		
v/c Ratio	0.78					0.18		
Control Delay	3.1					24.8		
Queue Delay	0.0					0.0		
Total Delay	3.1					24.8		
LOS	A					C		
Approach Delay	3.1				24.8			
Approach LOS	A				C			
Queue Length 50th (ft)	6					59		
Queue Length 95th (ft)	7					106		
Internal Link Dist (ft)	48			36	117			
Turn Bay Length (ft)								

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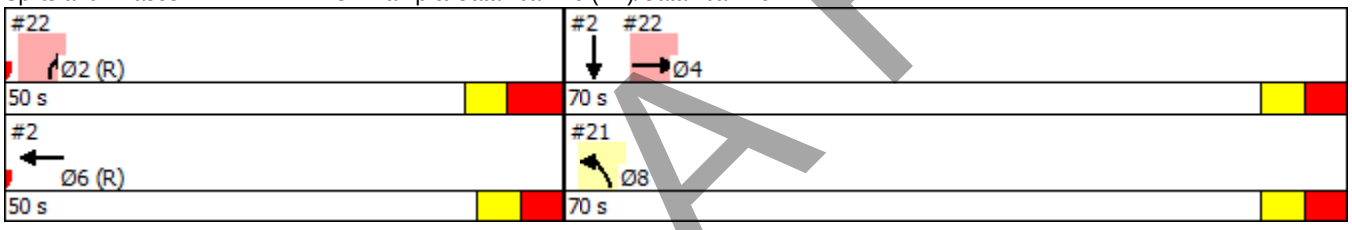
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR	Ø6	Ø8
Base Capacity (vph)	1916					650		
Starvation Cap Reductn	14					0		
Spillback Cap Reductn	0					0		
Storage Cap Reductn	0					0		
Reduced v/c Ratio	0.73					0.18		

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 65 (54%), Referenced to phase 2:NBR and 6:, Start of Green
Natural Cycle: 55
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.78
Intersection Signal Delay: 4.8 Intersection LOS: A
Intersection Capacity Utilization 61.4% ICU Level of Service B
Analysis Period (min) 15

Splits and Phases: 22: I-77 NB Off-Ramp & Catawba Ave (EB)/Catawba Ave



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Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	100	642	618	122	579	15	577	29	110	69	33	76
Future Volume (vph)	100	642	618	122	579	15	577	29	110	69	33	76
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		-2%			1%			3%			5%	
Storage Length (ft)	100		0	100		0	150		150	75		0
Storage Lanes	1		1	1		0	1		1	1		0
Taper Length (ft)	100			100			100			100		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	1.00	1.00	1.00	1.00
Frt			0.850		0.996				0.850		0.896	
Flt Protected	0.950			0.950			0.950	0.957		0.950		
Satd. Flow (prot)	1787	1881	1599	1761	1846	0	1656	1668	1560	1725	1627	0
Flt Permitted	0.100			0.083			0.950	0.957		0.950		
Satd. Flow (perm)	188	1881	1599	154	1846	0	1656	1668	1560	1725	1627	0
Right Turn on Red			No			No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)		35			35			35			35	
Link Distance (ft)		229			323			537			298	
Travel Time (s)		4.5			6.3			10.5			5.8	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	111	713	687	136	643	17	641	32	122	77	37	84
Shared Lane Traffic (%)							48%					
Lane Group Flow (vph)	111	713	687	136	660	0	333	340	122	77	121	0
Turn Type	pm+pt	NA	pm+ov	pm+pt	NA		Split	NA	pm+ov	Split	NA	
Protected Phases	5	2	3	1	6		3	3	1	4	4	
Permitted Phases	2		2	6					3			
Detector Phase	5	2	3	1	6		3	3	1	4	4	
Switch Phase												
Minimum Initial (s)	7.0	10.0	7.0	7.0	10.0		7.0	7.0	7.0	7.0	7.0	
Minimum Split (s)	13.3	31.4	28.3	13.2	28.4		28.3	28.3	13.2	12.9	12.9	
Total Split (s)	17.0	49.0	37.0	17.0	49.0		37.0	37.0	17.0	17.0	17.0	
Total Split (%)	14.2%	40.8%	30.8%	14.2%	40.8%		30.8%	30.8%	14.2%	14.2%	14.2%	
Yellow Time (s)	3.0	4.0	3.7	3.0	4.0		3.7	3.7	3.0	3.6	3.6	
All-Red Time (s)	3.3	2.4	2.6	3.2	2.4		2.6	2.6	3.2	2.3	2.3	
Lost Time Adjust (s)	-1.3	-1.4	-1.4	-1.2	-1.4		-1.3	-1.3	-1.2	-0.9	-0.9	
Total Lost Time (s)	5.0	5.0	4.9	5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Lead/Lag	Lead	Lag	Lead	Lead	Lag		Lead	Lead	Lead	Lag	Lag	
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	
Recall Mode	None	C-Max	None	None	C-Max		None	None	None	None	None	
Act Effct Green (s)	57.6	47.7	82.8	58.6	48.2		30.0	30.0	40.4	11.9	11.9	
Actuated g/C Ratio	0.48	0.40	0.69	0.49	0.40		0.25	0.25	0.34	0.10	0.10	
v/c Ratio	0.50	0.95	0.62	0.64	0.89		0.81	0.82	0.23	0.45	0.75	
Control Delay	18.8	45.9	28.6	35.6	50.2		57.9	58.8	17.6	59.9	80.4	
Queue Delay	0.0	44.0	53.2	0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Total Delay	18.8	89.9	81.8	35.6	50.2		57.9	58.8	17.6	59.9	80.4	
LOS	B	F	F	D	D		E	E	B	E	F	
Approach Delay		81.0			47.7			52.1			72.4	
Approach LOS		F			D			D			E	
Queue Length 50th (ft)	20	~595	559	54	483		249	255	45	57	93	

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Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 95th (ft)	m40	#843	681	122	#747		#373	#394	76	108	#188	
Internal Link Dist (ft)		149			243			457			218	
Turn Bay Length (ft)	100			100			150		150	75		
Base Capacity (vph)	253	747	1130	237	742		441	444	545	176	166	
Starvation Cap Reductn	0	206	574	0	0		0	0	0	0	0	
Spillback Cap Reductn	0	0	0	0	0		0	0	0	0	0	
Storage Cap Reductn	0	0	0	0	0		0	0	0	0	0	
Reduced v/c Ratio	0.44	1.32	1.24	0.57	0.89		0.76	0.77	0.22	0.44	0.73	

Intersection Summary

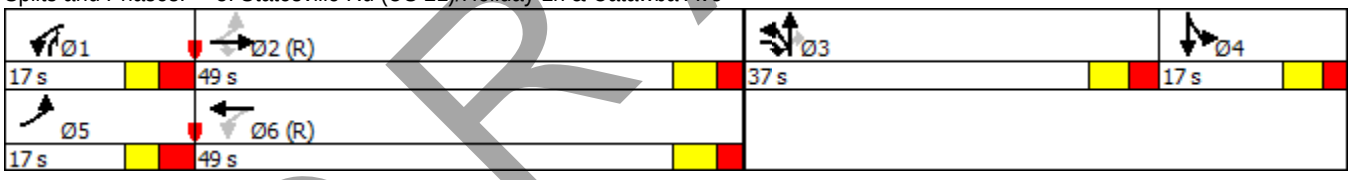
Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 35 (29%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.95
Intersection Signal Delay: 65.5 Intersection LOS: E
Intersection Capacity Utilization 76.5% ICU Level of Service D
Analysis Period (min) 15

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 3: Statesville Rd (US 21)/Holiday Ln & Catawba Ave



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Intersection

Int Delay, s/veh 2.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	12	802	8	4	654	44	6	4	9	12	4	57
Future Vol, veh/h	12	802	8	4	654	44	6	4	9	12	4	57
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	50	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	13	891	9	4	727	49	7	4	10	13	4	63

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	776	0	0	900	0	0	1716	1706	896	1689	1687	751
Stage 1	-	-	-	-	-	-	922	922	-	760	760	-
Stage 2	-	-	-	-	-	-	794	784	-	929	927	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	840	-	-	755	-	-	71	91	339	74	94	411
Stage 1	-	-	-	-	-	-	324	349	-	398	414	-
Stage 2	-	-	-	-	-	-	381	404	-	321	347	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	840	-	-	755	-	-	57	89	339	68	92	411
Mov Cap-2 Maneuver	-	-	-	-	-	-	57	89	-	68	92	-
Stage 1	-	-	-	-	-	-	319	344	-	392	410	-
Stage 2	-	-	-	-	-	-	316	400	-	303	342	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.1	0.1	46.7	33.8
HCM LOS			E	D

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	107	840	-	-	755	-	-	204
HCM Lane V/C Ratio	0.197	0.016	-	-	0.006	-	-	0.398
HCM Control Delay (s)	46.7	9.4	-	-	9.8	0	-	33.8
HCM Lane LOS	E	A	-	-	A	A	-	D
HCM 95th %tile Q(veh)	0.7	0	-	-	0	-	-	1.8

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Intersection

Int Delay, s/veh 1.7

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	23	4	31	24	4	76
Future Vol, veh/h	23	4	31	24	4	76
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	5
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	26	4	34	27	4	84

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	141	48	0	0	61	0
Stage 1	48	-	-	-	-	-
Stage 2	93	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	852	1021	-	-	1542	-
Stage 1	974	-	-	-	-	-
Stage 2	931	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	849	1021	-	-	1542	-
Mov Cap-2 Maneuver	849	-	-	-	-	-
Stage 1	974	-	-	-	-	-
Stage 2	928	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	9.3	0	0.4
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	871	1542	-
HCM Lane V/C Ratio	-	-	0.034	0.003	-
HCM Control Delay (s)	-	-	9.3	7.3	0
HCM Lane LOS	-	-	A	A	A
HCM 95th %tile Q(veh)	-	-	0.1	0	-

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Intersection

Int Delay, s/veh 2.7

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	79	4	55	89	4	99
Future Vol, veh/h	79	4	55	89	4	99
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	5
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	88	4	61	99	4	110

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	230	111	0	0	160	0
Stage 1	111	-	-	-	-	-
Stage 2	119	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	758	942	-	-	1419	-
Stage 1	914	-	-	-	-	-
Stage 2	906	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	756	942	-	-	1419	-
Mov Cap-2 Maneuver	756	-	-	-	-	-
Stage 1	914	-	-	-	-	-
Stage 2	903	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	10.4	0	0.3
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	763	1419	-
HCM Lane V/C Ratio	-	-	0.121	0.003	-
HCM Control Delay (s)	-	-	10.4	7.5	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	0.4	0	-

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Intersection						
Int Delay, s/veh	7.2					

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	4	63	53	4	6	4
Future Vol, veh/h	4	63	53	4	6	4
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	4	70	59	4	7	4

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	131	9	11	0	-	0
Stage 1	9	-	-	-	-	-
Stage 2	122	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	863	1073	1608	-	-	-
Stage 1	1014	-	-	-	-	-
Stage 2	903	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	831	1073	1608	-	-	-
Mov Cap-2 Maneuver	831	-	-	-	-	-
Stage 1	1014	-	-	-	-	-
Stage 2	870	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	8.7	6.8	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1608	-	1055	-	-
HCM Lane V/C Ratio	0.037	-	0.071	-	-
HCM Control Delay (s)	7.3	0	8.7	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0.1	-	0.2	-	-

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Summary of All Intervals

Run Number	1	2	3	4	5	Avg
Start Time	6:50	6:50	6:50	6:50	6:50	6:50
End Time	8:00	8:00	8:00	8:00	8:00	8:00
Total Time (min)	70	70	70	70	70	70
Time Recorded (min)	60	60	60	60	60	60
# of Intervals	5	5	5	5	5	5
# of Recorded Intervals	4	4	4	4	4	4
Vehs Entered	5039	4909	3886	2244	5102	4233
Vehs Exited	5027	4910	3624	2072	5075	4143
Starting Vehs	174	189	193	201	178	184
Ending Vehs	186	188	455	373	205	281
Travel Distance (mi)	2050	2004	1491	854	2072	1694
Travel Time (hr)	396.4	421.0	680.2	1307.4	419.8	645.0
Total Delay (hr)	323.6	349.6	627.0	1276.9	346.3	584.7
Total Stops	9204	9047	7081	3928	9330	7718
Fuel Used (gal)	158.5	161.9	203.6	325.8	164.3	202.8

Interval #0 Information Seeding

Start Time	6:50
End Time	7:00
Total Time (min)	10

Volumes adjusted by Growth Factors.
No data recorded this interval.

Interval #1 Information 1

Start Time	7:00
End Time	7:15
Total Time (min)	15

Volumes adjusted by Growth Factors, Anti PHF.

Run Number	1	2	3	4	5	Avg
Vehs Entered	1327	1274	1234	1167	1306	1260
Vehs Exited	1268	1267	1239	1164	1251	1240
Starting Vehs	174	189	193	201	178	184
Ending Vehs	233	196	188	204	233	208
Travel Distance (mi)	523	516	505	481	520	509
Travel Time (hr)	56.5	55.1	67.0	65.0	58.9	60.5
Total Delay (hr)	38.0	36.8	49.2	47.8	40.8	42.5
Total Stops	2350	2259	2319	2182	2357	2293
Fuel Used (gal)	29.9	29.7	31.6	30.4	30.4	30.4

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Interval #2 Information 2

Start Time 7:15
End Time 7:30
Total Time (min) 15
Volumes adjusted by PHF, Growth Factors.

Run Number	1	2	3	4	5	Avg
Vehs Entered	1259	1246	1266	967	1218	1190
Vehs Exited	1294	1228	1226	838	1262	1170
Starting Vehs	233	196	188	204	233	208
Ending Vehs	198	214	228	333	189	231
Travel Distance (mi)	524	500	503	341	508	475
Travel Time (hr)	90.1	90.6	105.0	133.6	95.8	103.0
Total Delay (hr)	71.5	72.6	87.0	121.4	77.7	86.0
Total Stops	2383	2214	2320	1609	2281	2163
Fuel Used (gal)	38.2	37.0	40.3	41.6	38.7	39.1

Interval #3 Information 3

Start Time 7:30
End Time 7:45
Total Time (min) 15
Volumes adjusted by Growth Factors, Anti PHF.

Run Number	1	2	3	4	5	Avg
Vehs Entered	1227	1198	1132	105	1345	1004
Vehs Exited	1206	1195	1011	70	1314	958
Starting Vehs	198	214	228	333	189	231
Ending Vehs	219	217	349	368	220	273
Travel Distance (mi)	491	490	420	32	537	394
Travel Time (hr)	115.5	129.4	160.6	394.7	130.0	186.0
Total Delay (hr)	97.9	111.9	145.6	393.6	110.9	172.0
Total Stops	2282	2385	2091	132	2399	1855
Fuel Used (gal)	42.9	45.9	50.4	91.0	47.6	55.5

Interval #4 Information 4

Start Time 7:45
End Time 8:00
Total Time (min) 15
Volumes adjusted by Growth Factors, Anti PHF.

Run Number	1	2	3	4	5	Avg
Vehs Entered	1226	1191	254	5	1233	780
Vehs Exited	1259	1220	148	0	1248	776
Starting Vehs	219	217	349	368	220	273
Ending Vehs	186	188	455	373	205	281
Travel Distance (mi)	512	498	63	0	507	316
Travel Time (hr)	134.4	146.0	347.5	714.1	135.1	295.4
Total Delay (hr)	116.2	128.2	345.2	714.1	117.0	284.2
Total Stops	2189	2189	351	5	2293	1401
Fuel Used (gal)	47.6	49.4	81.2	162.9	47.6	77.7

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Intersection: 1: Catawba Ave (WB) & Catawba Ave (EB)

Movement	EB	EB	EB	NW	NW
Directions Served	T	T	T	T	T
Maximum Queue (ft)	179	177	189	152	144
Average Queue (ft)	159	117	100	112	115
95th Queue (ft)	228	204	200	180	181
Link Distance (ft)	60	60	60	46	46
Upstream Blk Time (%)	57	44	19	42	45
Queuing Penalty (veh)	277	210	91	182	198
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 2: Catawba Ave (EB) & Catawba Ave (WB)

Movement	WB	WB	SB	SB
Directions Served	T	T	T	T
Maximum Queue (ft)	164	155	183	176
Average Queue (ft)	139	117	158	120
95th Queue (ft)	160	167	170	214
Link Distance (ft)	74	74	86	86
Upstream Blk Time (%)	60	44	67	24
Queuing Penalty (veh)	190	139	418	152
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 3: Statesville Rd (US 21)/Holiday Ln & Catawba Ave

Movement	EB	EB	EB	WB	WB	NB	NB	NB	SB	SB
Directions Served	L	T	R	L	TR	L	LT	R	L	TR
Maximum Queue (ft)	170	247	235	200	360	250	514	250	138	195
Average Queue (ft)	75	223	160	103	304	198	438	129	56	116
95th Queue (ft)	179	252	297	219	389	333	585	321	109	217
Link Distance (ft)		170	170		245		487			217
Upstream Blk Time (%)	0	36	12		39		36			17
Queuing Penalty (veh)	0	241	81		282		0			30
Storage Bay Dist (ft)	100			100		150		150	75	
Storage Blk Time (%)	1	39		4	54	6	70		24	41
Queuing Penalty (veh)	9	38		26	66	26	277		26	28

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Intersection: 4: Hill St/Burton Ln & Catawba Ave

Movement	EB	EB	WB	NB	SB
Directions Served	L	TR	LTR	LTR	LTR
Maximum Queue (ft)	41	95	458	87	95
Average Queue (ft)	6	24	172	26	57
95th Queue (ft)	26	162	507	79	108
Link Distance (ft)		245	531	466	86
Upstream Blk Time (%)		6	18		32
Queuing Penalty (veh)		50	0		22
Storage Bay Dist (ft)	50				
Storage Blk Time (%)	0	7			
Queuing Penalty (veh)	4	1			

Intersection: 5: Holiday Ln & Site Access #1

Movement	WB	SB
Directions Served	LR	LT
Maximum Queue (ft)	81	66
Average Queue (ft)	25	22
95th Queue (ft)	103	107
Link Distance (ft)	184	157
Upstream Blk Time (%)	6	12
Queuing Penalty (veh)	0	0
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 6: Holiday Ln & Site Access #2

Movement	WB	SB
Directions Served	LR	LT
Maximum Queue (ft)	85	53
Average Queue (ft)	39	13
95th Queue (ft)	77	60
Link Distance (ft)	96	76
Upstream Blk Time (%)	14	16
Queuing Penalty (veh)	0	15
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

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Intersection: 7: Burton Ln & Site Acess #3

Movement	EB	NB	SB
Directions Served	LR	LT	TR
Maximum Queue (ft)	87	20	49
Average Queue (ft)	41	1	9
95th Queue (ft)	95	11	47
Link Distance (ft)	101	86	267
Upstream Blk Time (%)	18		
Queuing Penalty (veh)	0		
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 11: Catawba Ave (EB) & I-77 SB Off-Ramp

Movement	EB	EB	EB	SB	SB
Directions Served	T	T	T	L	L
Maximum Queue (ft)	92	154	42	164	163
Average Queue (ft)	65	76	9	147	124
95th Queue (ft)	99	151	35	171	209
Link Distance (ft)	40	40	40	89	89
Upstream Blk Time (%)	54	59	2	50	29
Queuing Penalty (veh)	260	282	11	167	99
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 12: Catawba Ave/Catawba Ave (WB) & I-77 SB Off-Ramp

Movement	WB	WB	SB	SB
Directions Served	T	T	R	R
Maximum Queue (ft)	23	48	177	156
Average Queue (ft)	2	9	135	121
95th Queue (ft)	14	31	221	201
Link Distance (ft)	56	56	89	89
Upstream Blk Time (%)	0	0	40	28
Queuing Penalty (veh)	1	0	200	140
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

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Intersection: 14: Catawba Ave (EB) & I-77 NB On-Ramp

Movement	EB	EB	EB
Directions Served	L	T	T
Maximum Queue (ft)	59	260	199
Average Queue (ft)	6	207	65
95th Queue (ft)	35	308	180
Link Distance (ft)	143	143	143
Upstream Blk Time (%)		45	3
Queuing Penalty (veh)		321	24
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 15: Catawba Ave

Movement	WB	WB	NE	NE
Directions Served	T	T	R	R
Maximum Queue (ft)	192	233	132	141
Average Queue (ft)	59	79	109	57
95th Queue (ft)	199	225	142	159
Link Distance (ft)	170	170	61	61
Upstream Blk Time (%)	20	21	35	8
Queuing Penalty (veh)	119	127	240	56
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 17: I-77 SB On-Ramp & Catawba Ave (WB)

Movement	WB	WB
Directions Served	LT	T
Maximum Queue (ft)	210	251
Average Queue (ft)	132	159
95th Queue (ft)	227	276
Link Distance (ft)	139	139
Upstream Blk Time (%)	20	24
Queuing Penalty (veh)	92	111
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

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Intersection: 18: I-77 NB On-Ramp

Movement	EB	WB
Directions Served	L	R
Maximum Queue (ft)	211	152
Average Queue (ft)	98	43
95th Queue (ft)	228	137
Link Distance (ft)	143	71
Upstream Blk Time (%)	6	2
Queuing Penalty (veh)	52	11
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 19: I-77 SB On-Ramp

Movement	SB	SE
Directions Served	T	R
Maximum Queue (ft)	155	98
Average Queue (ft)	8	2
95th Queue (ft)	73	36
Link Distance (ft)	111	137
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 21: I-77 NB Off-Ramp & Catawba Ave (WB)

Movement	NB	NB	SW	SW
Directions Served	L	L	R	R
Maximum Queue (ft)	141	189	103	81
Average Queue (ft)	61	98	17	11
95th Queue (ft)	152	189	68	55
Link Distance (ft)	116	116	78	78
Upstream Blk Time (%)	7	13	5	4
Queuing Penalty (veh)	9	18	15	12
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

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Intersection: 22: I-77 NB Off-Ramp & Catawba Ave (EB)/Catawba Ave

Movement	EB	EB	NB
Directions Served	T	T	R
Maximum Queue (ft)	179	158	168
Average Queue (ft)	150	44	81
95th Queue (ft)	201	134	167
Link Distance (ft)	86	86	110
Upstream Blk Time (%)	48	4	20
Queuing Penalty (veh)	299	28	21
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 24: I-77 SB On-Ramp & Catawba Ave/Catawba Ave (EB)

Movement	EB	EB	EB
Directions Served	T	T	TR
Maximum Queue (ft)	114	195	124
Average Queue (ft)	102	172	14
95th Queue (ft)	140	186	65
Link Distance (ft)		115	115
Upstream Blk Time (%)	21	56	1
Queuing Penalty (veh)	0	438	4
Storage Bay Dist (ft)	50		
Storage Blk Time (%)	54	14	
Queuing Penalty (veh)	259	64	

Intersection: 26: Catawba Ave

Movement	EB	EB
Directions Served	T	T
Maximum Queue (ft)	630	600
Average Queue (ft)	579	471
95th Queue (ft)	729	818
Link Distance (ft)	578	578
Upstream Blk Time (%)	68	23
Queuing Penalty (veh)	0	0
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

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Intersection: 27: I-77 SB Off-Ramp

Movement	SB	SB	SB	SB
Directions Served	L	L	R	R
Maximum Queue (ft)	311	344	543	378
Average Queue (ft)	131	107	310	147
95th Queue (ft)	362	419	738	303
Link Distance (ft)			909	
Upstream Blk Time (%)			15	
Queuing Penalty (veh)			0	
Storage Bay Dist (ft)	450	450		450
Storage Blk Time (%)	11	15	1	0
Queuing Penalty (veh)	107	148	7	1

Intersection: 28: I-77 NB Off-Ramp

Movement	NB	NB	NB
Directions Served	L	L	R
Maximum Queue (ft)	265	367	129
Average Queue (ft)	42	99	46
95th Queue (ft)	268	487	218
Link Distance (ft)		801	
Upstream Blk Time (%)		6	
Queuing Penalty (veh)		0	
Storage Bay Dist (ft)	500		500
Storage Blk Time (%)	2	10	
Queuing Penalty (veh)	4	24	

Intersection: 29: Bend

Movement	NB	NB
Directions Served	T	
Maximum Queue (ft)	350	330
Average Queue (ft)	221	38
95th Queue (ft)	479	205
Link Distance (ft)	275	275
Upstream Blk Time (%)	13	0
Queuing Penalty (veh)	97	3
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

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Intersection: 30: Catawba Ave (WB)/Catawba Ave & I-77 NB On-Ramp

Movement	WB	WB
Directions Served	T	TR
Maximum Queue (ft)	110	112
Average Queue (ft)	74	68
95th Queue (ft)	136	143
Link Distance (ft)	59	59
Upstream Blk Time (%)	31	28
Queuing Penalty (veh)	191	172
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Network Summary

Network wide Queuing Penalty: 7313

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APPENDIX F-12:
CAPACITY ANALYSIS RESULTS

2023 BUILD CONDITIONS
PM PEAK HOUR

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Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Traffic Volume (vph)	0	1440	0	0	0	0	0	0	0	0	1209	0
Future Volume (vph)	0	1440	0	0	0	0	0	0	0	0	1209	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		2%			0%			0%			-2%	
Lane Util. Factor	1.00	0.91	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00
Frt												
Flt Protected												
Satd. Flow (prot)	0	5034	0	0	0	0	0	0	0	0	3575	0
Flt Permitted												
Satd. Flow (perm)	0	5034	0	0	0	0	0	0	0	0	3575	0
Right Turn on Red	No		No			No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)		35			35			35			35	
Link Distance (ft)		142			217			115			211	
Travel Time (s)		2.8			4.2			2.2			4.1	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	1600	0	0	0	0	0	0	0	0	1343	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	1600	0	0	0	0	0	0	0	0	1343	0
Turn Type		NA									NA	
Protected Phases		2									8	
Permitted Phases												
Detector Phase		2									8	
Switch Phase												
Minimum Initial (s)		10.0									10.0	
Minimum Split (s)		24.3									26.1	
Total Split (s)		60.0									60.0	
Total Split (%)		50.0%									50.0%	
Yellow Time (s)		3.7									4.0	
All-Red Time (s)		5.6									4.1	
Lost Time Adjust (s)		-4.3									-3.1	
Total Lost Time (s)		5.0									5.0	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode		C-Max									None	
Act Effct Green (s)		55.4									54.6	
Actuated g/C Ratio		0.46									0.46	
v/c Ratio		0.69									0.83	
Control Delay		27.5									30.9	
Queue Delay		0.0									48.1	
Total Delay		27.5									79.0	
LOS		C									E	
Approach Delay		27.5									79.0	
Approach LOS		C									E	
Queue Length 50th (ft)		352									314	
Queue Length 95th (ft)		407									433	
Internal Link Dist (ft)		62			137			35			131	
Turn Bay Length (ft)												

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Lane Group	Ø4	Ø6
Lane Configurations		
Traffic Volume (vph)		
Future Volume (vph)		
Ideal Flow (vphpl)		
Grade (%)		
Lane Util. Factor		
Frt		
Flt Protected		
Satd. Flow (prot)		
Flt Permitted		
Satd. Flow (perm)		
Right Turn on Red		
Satd. Flow (RTOR)		
Link Speed (mph)		
Link Distance (ft)		
Travel Time (s)		
Peak Hour Factor		
Adj. Flow (vph)		
Shared Lane Traffic (%)		
Lane Group Flow (vph)		
Turn Type		
Protected Phases	4	6
Permitted Phases		
Detector Phase		
Switch Phase		
Minimum Initial (s)	10.0	10.0
Minimum Split (s)	21.1	19.3
Total Split (s)	60.0	60.0
Total Split (%)	50%	50%
Yellow Time (s)	4.0	3.7
All-Red Time (s)	4.1	5.6
Lost Time Adjust (s)		
Total Lost Time (s)		
Lead/Lag		
Lead-Lag Optimize?		
Recall Mode	None	C-Max
Act Effct Green (s)		
Actuated g/C Ratio		
v/c Ratio		
Control Delay		
Queue Delay		
Total Delay		
LOS		
Approach Delay		
Approach LOS		
Queue Length 50th (ft)		
Queue Length 95th (ft)		
Internal Link Dist (ft)		
Turn Bay Length (ft)		

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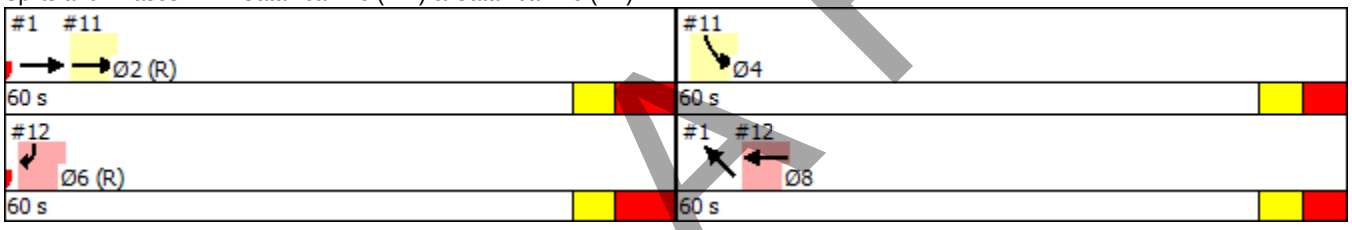
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Base Capacity (vph)		2322									1638	
Starvation Cap Reductn		0									461	
Spillback Cap Reductn		0									0	
Storage Cap Reductn		0									0	
Reduced v/c Ratio		0.69									1.14	

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 70 (58%), Referenced to phase 2:EBT and 6:, Start of Green
Natural Cycle: 55
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.83
Intersection Signal Delay: 51.0 Intersection LOS: D
Intersection Capacity Utilization 69.6% ICU Level of Service C
Analysis Period (min) 15

Splits and Phases: 1: Catawba Ave (WB) & Catawba Ave (EB)



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Lane Group	Ø4	Ø6
Base Capacity (vph)		
Starvation Cap Reductn		
Spillback Cap Reductn		
Storage Cap Reductn		
Reduced v/c Ratio		

Intersection Summary

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Lane Group	EBL	EBT	WBT	WBR	SBL	SBR	Ø6	Ø8
Lane Configurations								
Traffic Volume (vph)	0	1440	0	0	394	0		
Future Volume (vph)	0	1440	0	0	394	0		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900		
Grade (%)		2%	0%		-1%			
Lane Util. Factor	1.00	0.91	1.00	1.00	0.97	1.00		
Frt								
Flt Protected					0.950			
Satd. Flow (prot)	0	5034	0	0	3450	0		
Flt Permitted					0.950			
Satd. Flow (perm)	0	5034	0	0	3450	0		
Right Turn on Red				No	No	No		
Satd. Flow (RTOR)								
Link Speed (mph)		35	35		35			
Link Distance (ft)		217	199		185			
Travel Time (s)		4.2	3.9		3.6			
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90		
Adj. Flow (vph)	0	1600	0	0	438	0		
Shared Lane Traffic (%)								
Lane Group Flow (vph)	0	1600	0	0	438	0		
Turn Type		NA			Prot			
Protected Phases		2			4		6	8
Permitted Phases								
Detector Phase		2			4			
Switch Phase								
Minimum Initial (s)		10.0			10.0		10.0	10.0
Minimum Split (s)		24.3			21.1		19.3	26.1
Total Split (s)		60.0			60.0		60.0	60.0
Total Split (%)		50.0%			50.0%		50%	50%
Yellow Time (s)		3.7			4.0		3.7	4.0
All-Red Time (s)		5.6			4.1		5.6	4.1
Lost Time Adjust (s)		-4.3			-3.1			
Total Lost Time (s)		5.0			5.0			
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode		C-Max			None		C-Max	None
Act Effct Green (s)		55.4			54.6			
Actuated g/C Ratio		0.46			0.46			
v/c Ratio		0.69			0.28			
Control Delay		3.5			20.9			
Queue Delay		2.9			0.0			
Total Delay		6.4			20.9			
LOS		A			C			
Approach Delay		6.4			20.9			
Approach LOS		A			C			
Queue Length 50th (ft)		17			105			
Queue Length 95th (ft)		19			142			
Internal Link Dist (ft)		137	119		105			
Turn Bay Length (ft)								

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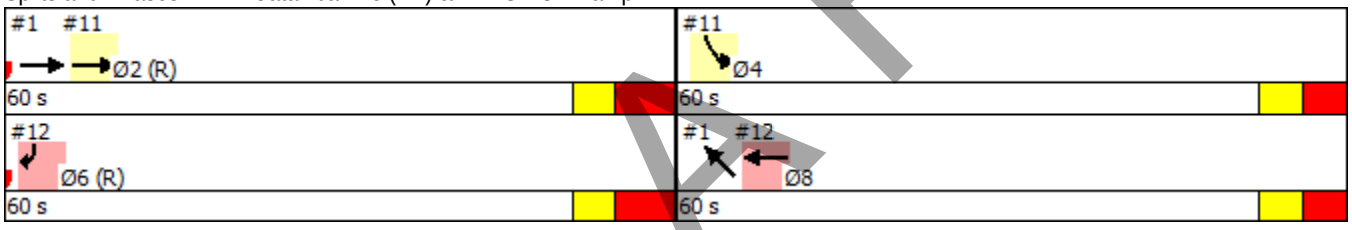
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR	Ø6	Ø8
Base Capacity (vph)		2322			1581			
Starvation Cap Reductn		0			0			
Spillback Cap Reductn		589			0			
Storage Cap Reductn		0			0			
Reduced v/c Ratio		0.92			0.28			

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 70 (58%), Referenced to phase 2:EBT and 6:, Start of Green
Natural Cycle: 55
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.83
Intersection Signal Delay: 9.5 Intersection LOS: A
Intersection Capacity Utilization 59.8% ICU Level of Service B
Analysis Period (min) 15

Splits and Phases: 11: Catawba Ave (EB) & I-77 SB Off-Ramp



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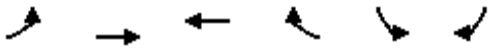

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR	Ø2	Ø4
Lane Configurations								
Traffic Volume (vph)	0	0	1209	0	0	701		
Future Volume (vph)	0	0	1209	0	0	701		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900		
Grade (%)		0%	0%		4%			
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.88		
Frt						0.850		
Flt Protected								
Satd. Flow (prot)	0	0	3539	0	0	2731		
Flt Permitted								
Satd. Flow (perm)	0	0	3539	0	0	2731		
Right Turn on Red				No		No		
Satd. Flow (RTOR)								
Link Speed (mph)		35	35		35			
Link Distance (ft)		202	115		181			
Travel Time (s)		3.9	2.2		3.5			
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90		
Adj. Flow (vph)	0	0	1343	0	0	779		
Shared Lane Traffic (%)								
Lane Group Flow (vph)	0	0	1343	0	0	779		
Turn Type			NA			Prot		
Protected Phases			8			6	2	4
Permitted Phases								
Detector Phase			8			6		
Switch Phase								
Minimum Initial (s)			10.0			10.0	10.0	10.0
Minimum Split (s)			26.1			19.3	24.3	21.1
Total Split (s)			60.0			60.0	60.0	60.0
Total Split (%)			50.0%			50.0%	50%	50%
Yellow Time (s)			4.0			3.7	3.7	4.0
All-Red Time (s)			4.1			5.6	5.6	4.1
Lost Time Adjust (s)			-3.1			-4.3		
Total Lost Time (s)			5.0			5.0		
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode			None			C-Max	C-Max	None
Act Effct Green (s)			54.6			55.4		
Actuated g/C Ratio			0.46			0.46		
v/c Ratio			0.83			0.62		
Control Delay			4.5			27.1		
Queue Delay			0.0			0.0		
Total Delay			4.5			27.1		
LOS			A			C		
Approach Delay			4.5		27.1			
Approach LOS			A		C			
Queue Length 50th (ft)			10			253		
Queue Length 95th (ft)			17			327		
Internal Link Dist (ft)		122	35		101			
Turn Bay Length (ft)								

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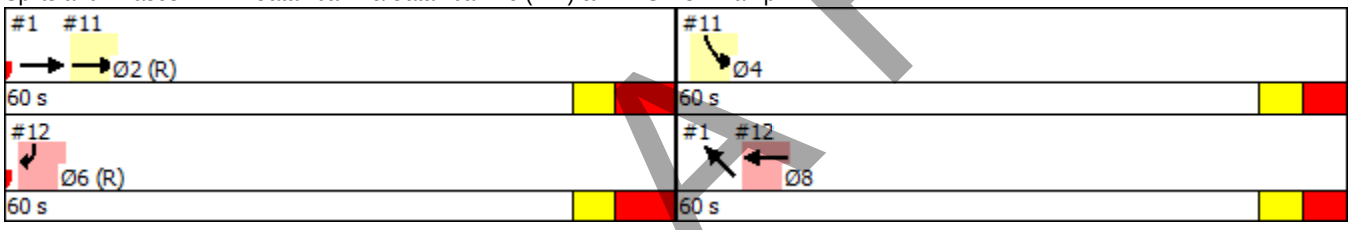
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR	Ø2	Ø4
Base Capacity (vph)			1622			1259		
Starvation Cap Reductn			6			0		
Spillback Cap Reductn			0			0		
Storage Cap Reductn			0			0		
Reduced v/c Ratio			0.83			0.62		

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 70 (58%), Referenced to phase 2:EBT and 6:, Start of Green
Natural Cycle: 55
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.83
Intersection Signal Delay: 12.8 Intersection LOS: B
Intersection Capacity Utilization 69.6% ICU Level of Service C
Analysis Period (min) 15

Splits and Phases: 12: Catawba Ave/Catawba Ave (WB) & I-77 SB Off-Ramp



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Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	0	856	0	0	0	0	0	1210	0
Future Volume (vph)	0	0	0	0	856	0	0	0	0	0	1210	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		0%			0%			0%			-1%	
Lane Util. Factor	1.00	1.00	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00	0.95	1.00
Frt												
Flt Protected												
Satd. Flow (prot)	0	0	0	0	3539	0	0	0	0	0	3557	0
Flt Permitted												
Satd. Flow (perm)	0	0	0	0	3539	0	0	0	0	0	3557	0
Right Turn on Red			No	No		No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)		35			35			35			35	
Link Distance (ft)		182			125			128			169	
Travel Time (s)		3.5			2.4			2.5			3.3	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	0	0	0	951	0	0	0	0	0	1344	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	0	951	0	0	0	0	0	1344	0
Turn Type					NA						NA	
Protected Phases					6						4	
Permitted Phases												
Detector Phase					6						4	
Switch Phase												
Minimum Initial (s)					7.0						7.0	
Minimum Split (s)					19.9						21.9	
Total Split (s)					60.0						60.0	
Total Split (%)					50.0%						50.0%	
Yellow Time (s)					3.9						3.9	
All-Red Time (s)					4.0						4.0	
Lost Time Adjust (s)					-2.0						-2.9	
Total Lost Time (s)					5.9						5.0	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode					C-Max						None	
Act Effct Green (s)					55.6						53.5	
Actuated g/C Ratio					0.46						0.45	
v/c Ratio					0.58						0.85	
Control Delay					29.6						30.5	
Queue Delay					2.0						7.5	
Total Delay					31.6						38.0	
LOS					C						D	
Approach Delay					31.6						38.0	
Approach LOS					C						D	
Queue Length 50th (ft)					265						533	
Queue Length 95th (ft)					m273						624	
Internal Link Dist (ft)		102			45			48			89	
Turn Bay Length (ft)												

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Lane Group	Ø2	Ø8
Lane Configurations		
Traffic Volume (vph)		
Future Volume (vph)		
Ideal Flow (vphpl)		
Grade (%)		
Lane Util. Factor		
Frt		
Flt Protected		
Satd. Flow (prot)		
Flt Permitted		
Satd. Flow (perm)		
Right Turn on Red		
Satd. Flow (RTOR)		
Link Speed (mph)		
Link Distance (ft)		
Travel Time (s)		
Peak Hour Factor		
Adj. Flow (vph)		
Shared Lane Traffic (%)		
Lane Group Flow (vph)		
Turn Type		
Protected Phases	2	8
Permitted Phases		
Detector Phase		
Switch Phase		
Minimum Initial (s)	10.0	7.0
Minimum Split (s)	18.9	19.9
Total Split (s)	60.0	60.0
Total Split (%)	50%	50%
Yellow Time (s)	3.8	3.9
All-Red Time (s)	5.1	4.0
Lost Time Adjust (s)		
Total Lost Time (s)		
Lead/Lag		
Lead-Lag Optimize?		
Recall Mode	C-Max	None
Act Effct Green (s)		
Actuated g/C Ratio		
v/c Ratio		
Control Delay		
Queue Delay		
Total Delay		
LOS		
Approach Delay		
Approach LOS		
Queue Length 50th (ft)		
Queue Length 95th (ft)		
Internal Link Dist (ft)		
Turn Bay Length (ft)		

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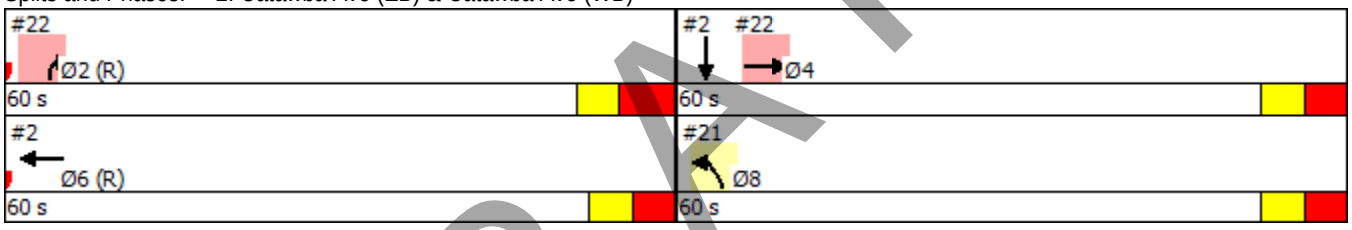
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Base Capacity (vph)					1640						1630	
Starvation Cap Reductn					508						255	
Spillback Cap Reductn					0						0	
Storage Cap Reductn					0						0	
Reduced v/c Ratio					0.84						0.98	

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 20 (17%), Referenced to phase 2:NBR and 6:, Start of Green
Natural Cycle: 60
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.85
Intersection Signal Delay: 35.3 Intersection LOS: D
Intersection Capacity Utilization 66.2% ICU Level of Service C
Analysis Period (min) 15
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 2: Catawba Ave (EB) & Catawba Ave (WB)



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Lane Group	Ø2	Ø8
Base Capacity (vph)		
Starvation Cap Reductn		
Spillback Cap Reductn		
Storage Cap Reductn		
Reduced v/c Ratio		

Intersection Summary

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Lane Group	EBL	EBR	NBL	NBR	SWL	SWR	Ø2	Ø4	Ø6
Lane Configurations									
Traffic Volume (vph)	0	0	457	0	0	856			
Future Volume (vph)	0	0	457	0	0	856			
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900			
Lane Util. Factor	1.00	1.00	0.97	1.00	1.00	0.88			
Frt						0.850			
Flt Protected			0.950						
Satd. Flow (prot)	0	0	3433	0	0	2787			
Flt Permitted			0.950						
Satd. Flow (perm)	0	0	3433	0	0	2787			
Right Turn on Red		No	No	No		No			
Satd. Flow (RTOR)									
Link Speed (mph)	35		35		35				
Link Distance (ft)	209		215		182				
Travel Time (s)	4.1		4.2		3.5				
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90			
Adj. Flow (vph)	0	0	508	0	0	951			
Shared Lane Traffic (%)									
Lane Group Flow (vph)	0	0	508	0	0	951			
Turn Type			Prot			custom			
Protected Phases			8!			Free!	2	4	6
Permitted Phases									
Detector Phase			8						
Switch Phase									
Minimum Initial (s)			7.0				10.0	7.0	7.0
Minimum Split (s)			19.9				18.9	21.9	19.9
Total Split (s)			60.0				60.0	60.0	60.0
Total Split (%)			50.0%				50%	50%	50%
Yellow Time (s)			3.9				3.8	3.9	3.9
All-Red Time (s)			4.0				5.1	4.0	4.0
Lost Time Adjust (s)			-2.9						
Total Lost Time (s)			5.0						
Lead/Lag									
Lead-Lag Optimize?									
Recall Mode			None				C-Max	None	C-Max
Act Effct Green (s)			53.5			120.0			
Actuated g/C Ratio			0.45			1.00			
v/c Ratio			0.33			0.34			
Control Delay			22.1			2.3			
Queue Delay			0.1			0.0			
Total Delay			22.2			2.4			
LOS			C			A			
Approach Delay			22.2		2.4				
Approach LOS			C		A				
Queue Length 50th (ft)			125			59			
Queue Length 95th (ft)			165			56			
Internal Link Dist (ft)	129		135		102				
Turn Bay Length (ft)									
Base Capacity (vph)			1573			2787			

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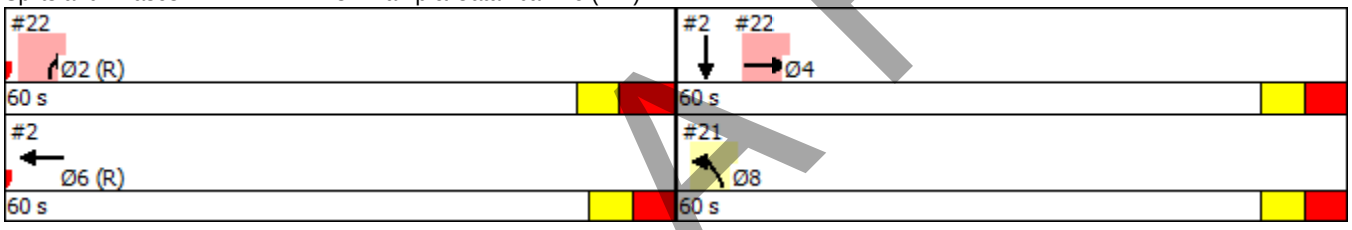
Lane Group	EBL	EBR	NBL	NBR	SWL	SWR	Ø2	Ø4	Ø6
Starvation Cap Reductn			0			0			
Spillback Cap Reductn			304			368			
Storage Cap Reductn			0			0			
Reduced v/c Ratio			0.40			0.39			

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 20 (17%), Referenced to phase 2:NBR and 6:, Start of Green
Natural Cycle: 60
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.85
Intersection Signal Delay: 9.3 Intersection LOS: A
Intersection Capacity Utilization 23.4% ICU Level of Service A
Analysis Period (min) 15
! Phase conflict between lane groups.

Splits and Phases: 21: I-77 NB Off-Ramp & Catawba Ave (WB)



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Lane Group	EBT	EBR	WBL	WBT	NBL	NBR	Ø6	Ø8
Lane Configurations								
Traffic Volume (vph)	1210	0	0	0	0	202		
Future Volume (vph)	1210	0	0	0	0	202		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900		
Grade (%)	0%			0%	4%			
Lane Util. Factor	0.95	1.00	1.00	1.00	1.00	1.00		
Frt						0.865		
Flt Protected								
Satd. Flow (prot)	3539	0	0	0	0	1579		
Flt Permitted								
Satd. Flow (perm)	3539	0	0	0	0	1579		
Right Turn on Red		No				No		
Satd. Flow (RTOR)								
Link Speed (mph)	35			35	35			
Link Distance (ft)	128			116	197			
Travel Time (s)	2.5			2.3	3.8			
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90		
Adj. Flow (vph)	1344	0	0	0	0	224		
Shared Lane Traffic (%)								
Lane Group Flow (vph)	1344	0	0	0	0	224		
Turn Type	NA					Prot		
Protected Phases	4					2	6	8
Permitted Phases								
Detector Phase	4					2		
Switch Phase								
Minimum Initial (s)	7.0					10.0	7.0	7.0
Minimum Split (s)	21.9					18.9	19.9	19.9
Total Split (s)	60.0					60.0	60.0	60.0
Total Split (%)	50.0%					50.0%	50%	50%
Yellow Time (s)	3.9					3.8	3.9	3.9
All-Red Time (s)	4.0					5.1	4.0	4.0
Lost Time Adjust (s)	-2.9					-3.9		
Total Lost Time (s)	5.0					5.0		
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None					C-Max	C-Max	None
Act Effct Green (s)	53.5					56.5		
Actuated g/C Ratio	0.45					0.47		
v/c Ratio	0.85					0.30		
Control Delay	4.2					21.4		
Queue Delay	0.1					0.0		
Total Delay	4.3					21.4		
LOS	A					C		
Approach Delay	4.3				21.4			
Approach LOS	A				C			
Queue Length 50th (ft)	2					107		
Queue Length 95th (ft)	18					167		
Internal Link Dist (ft)	48			36	117			
Turn Bay Length (ft)								

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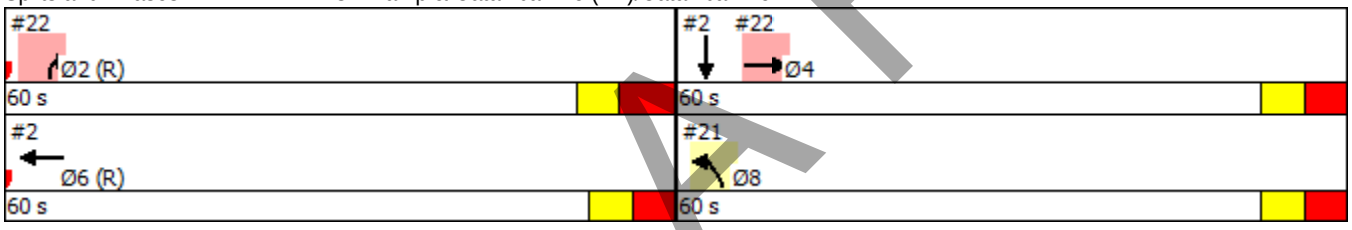
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR	Ø6	Ø8
Base Capacity (vph)	1622					743		
Starvation Cap Reductn	15					0		
Spillback Cap Reductn	0					0		
Storage Cap Reductn	0					0		
Reduced v/c Ratio	0.84					0.30		

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 20 (17%), Referenced to phase 2:NBR and 6:, Start of Green
Natural Cycle: 60
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.85
Intersection Signal Delay: 6.8 Intersection LOS: A
Intersection Capacity Utilization 66.2% ICU Level of Service C
Analysis Period (min) 15

Splits and Phases: 22: I-77 NB Off-Ramp & Catawba Ave (EB)/Catawba Ave



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Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	150	634	627	113	685	33	518	45	144	59	30	92
Future Volume (vph)	150	634	627	113	685	33	518	45	144	59	30	92
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		-2%			1%			3%			5%	
Storage Length (ft)	100		0	100		0	150		150	75		0
Storage Lanes	1		1	1		0	1		1	1		0
Taper Length (ft)	100			100			100			100		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	1.00	1.00	1.00	1.00
Frt			0.850		0.993				0.850		0.887	
Flt Protected	0.950			0.950			0.950	0.960		0.950		
Satd. Flow (prot)	1787	1881	1599	1761	1840	0	1656	1673	1560	1725	1611	0
Flt Permitted	0.083			0.085			0.950	0.960		0.950		
Satd. Flow (perm)	156	1881	1599	158	1840	0	1656	1673	1560	1725	1611	0
Right Turn on Red			No			No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)		35			35			35			35	
Link Distance (ft)		229			323			537			298	
Travel Time (s)		4.5			6.3			10.5			5.8	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	167	704	697	126	761	37	576	50	160	66	33	102
Shared Lane Traffic (%)							46%					
Lane Group Flow (vph)	167	704	697	126	798	0	311	315	160	66	135	0
Turn Type	pm+pt	NA	pm+ov	pm+pt	NA		Split	NA	pm+ov	Split	NA	
Protected Phases	5	2	3	1	6		3	3	1	4	4	
Permitted Phases	2		2	6					3			
Detector Phase	5	2	3	1	6		3	3	1	4	4	
Switch Phase												
Minimum Initial (s)	7.0	10.0	7.0	7.0	10.0		7.0	7.0	7.0	7.0	7.0	
Minimum Split (s)	13.3	31.4	28.3	13.2	28.4		28.3	28.3	13.2	12.9	12.9	
Total Split (s)	17.0	49.0	37.0	17.0	49.0		37.0	37.0	17.0	17.0	17.0	
Total Split (%)	14.2%	40.8%	30.8%	14.2%	40.8%		30.8%	30.8%	14.2%	14.2%	14.2%	
Yellow Time (s)	3.0	4.0	3.7	3.0	4.0		3.7	3.7	3.0	3.6	3.6	
All-Red Time (s)	3.3	2.4	2.6	3.2	2.4		2.6	2.6	3.2	2.3	2.3	
Lost Time Adjust (s)	-1.3	-1.4	-1.4	-1.2	-1.4		-1.3	-1.3	-1.2	-0.9	-0.9	
Total Lost Time (s)	5.0	5.0	4.9	5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Lead/Lag	Lead	Lag	Lead	Lead	Lag		Lead	Lead	Lead	Lag	Lag	
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	
Recall Mode	None	C-Max	None	None	C-Max		None	None	None	None	None	
Act Effct Green (s)	59.1	48.1	82.2	57.7	47.4		29.0	29.0	39.3	12.6	12.6	
Actuated g/C Ratio	0.49	0.40	0.68	0.48	0.40		0.24	0.24	0.33	0.10	0.10	
v/c Ratio	0.74	0.93	0.64	0.59	1.10		0.78	0.78	0.31	0.36	0.80	
Control Delay	41.0	68.7	19.8	32.4	99.4		56.2	56.2	19.0	56.5	84.5	
Queue Delay	0.0	46.3	1.2	0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Total Delay	41.0	115.0	21.0	32.4	99.4		56.2	56.2	19.0	56.5	84.5	
LOS	D	F	C	C	F		E	E	B	E	F	
Approach Delay		65.3			90.3			48.6			75.3	
Approach LOS		E			F			D			E	
Queue Length 50th (ft)	120	581	266	50	~743		229	232	62	49	104	

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Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 95th (ft)	m150	#839	m368	109	#984		341	345	98	95	#218	
Internal Link Dist (ft)		149			243			457			218	
Turn Bay Length (ft)	100			100			150		150	75		
Base Capacity (vph)	241	754	1135	238	726		441	446	533	181	170	
Starvation Cap Reductn	0	223	233	0	0		0	0	0	0	0	
Spillback Cap Reductn	0	0	0	0	0		0	0	0	0	0	
Storage Cap Reductn	0	0	0	0	0		0	0	0	0	0	
Reduced v/c Ratio	0.69	1.33	0.77	0.53	1.10		0.71	0.71	0.30	0.36	0.79	

Intersection Summary

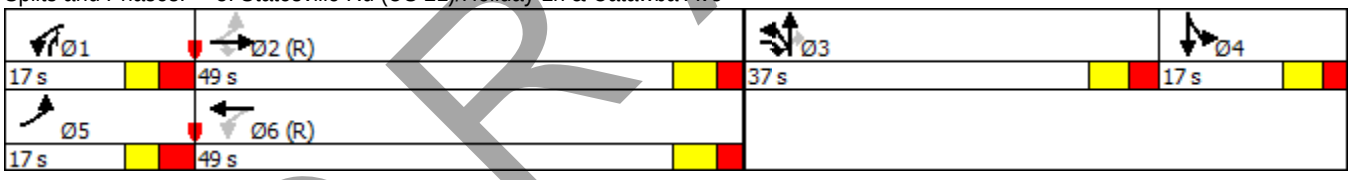
Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 35 (29%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green
Natural Cycle: 110
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.10
Intersection Signal Delay: 68.7 Intersection LOS: E
Intersection Capacity Utilization 85.8% ICU Level of Service E
Analysis Period (min) 15

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 3: Statesville Rd (US 21)/Holiday Ln & Catawba Ave



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Intersection

Int Delay, s/veh 4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	16	801	21	4	757	53	15	4	4	15	4	59
Future Vol, veh/h	16	801	21	4	757	53	15	4	4	15	4	59
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	50	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	18	890	23	4	841	59	17	4	4	17	4	66

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	900	0	0	913	0	0	1851	1846	902	1821	1828	871
Stage 1	-	-	-	-	-	-	937	937	-	879	879	-
Stage 2	-	-	-	-	-	-	914	909	-	942	949	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	755	-	-	746	-	-	57	75	336	60	77	350
Stage 1	-	-	-	-	-	-	318	343	-	342	365	-
Stage 2	-	-	-	-	-	-	327	354	-	316	339	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	755	-	-	746	-	-	43	72	336	55	74	350
Mov Cap-2 Maneuver	-	-	-	-	-	-	43	72	-	55	74	-
Stage 1	-	-	-	-	-	-	310	335	-	334	361	-
Stage 2	-	-	-	-	-	-	260	350	-	300	331	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.2	0	117.9	53.1
HCM LOS			F	F

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	55	755	-	-	746	-	-	157
HCM Lane V/C Ratio	0.465	0.024	-	-	0.006	-	-	0.552
HCM Control Delay (s)	117.9	9.9	-	-	9.9	0	-	53.1
HCM Lane LOS	F	A	-	-	A	A	-	F
HCM 95th %tile Q(veh)	1.8	0.1	-	-	0	-	-	2.8

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Intersection

Int Delay, s/veh 1.5

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	27	4	103	28	4	58
Future Vol, veh/h	27	4	103	28	4	58
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	5
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	30	4	114	31	4	64

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	203	130	0	0	146	0
Stage 1	130	-	-	-	-	-
Stage 2	73	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	786	920	-	-	1436	-
Stage 1	896	-	-	-	-	-
Stage 2	950	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	784	920	-	-	1436	-
Mov Cap-2 Maneuver	784	-	-	-	-	-
Stage 1	896	-	-	-	-	-
Stage 2	947	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	9.7	0	0.5
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	799	1436	-
HCM Lane V/C Ratio	-	-	0.043	0.003	-
HCM Control Delay (s)	-	-	9.7	7.5	0
HCM Lane LOS	-	-	A	A	A
HCM 95th %tile Q(veh)	-	-	0.1	0	-

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Intersection

Int Delay, s/veh 2.7

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	95	4	131	96	4	85
Future Vol, veh/h	95	4	131	96	4	85
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	5
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	106	4	146	107	4	94

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	302	199	0	0	252	0
Stage 1	199	-	-	-	-	-
Stage 2	103	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	690	842	-	-	1313	-
Stage 1	835	-	-	-	-	-
Stage 2	921	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	688	842	-	-	1313	-
Mov Cap-2 Maneuver	688	-	-	-	-	-
Stage 1	835	-	-	-	-	-
Stage 2	918	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	11.2	0	0.3
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	693	1313	-
HCM Lane V/C Ratio	-	-	0.159	0.003	-
HCM Control Delay (s)	-	-	11.2	7.8	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	0.6	0	-

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Intersection						
Int Delay, s/veh	7.3					

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	4	68	67	4	6	4
Future Vol, veh/h	4	68	67	4	6	4
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	4	76	74	4	7	4

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	162	9	11	0	-	0
Stage 1	9	-	-	-	-	-
Stage 2	153	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	829	1073	1608	-	-	-
Stage 1	1014	-	-	-	-	-
Stage 2	875	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	791	1073	1608	-	-	-
Mov Cap-2 Maneuver	791	-	-	-	-	-
Stage 1	1014	-	-	-	-	-
Stage 2	835	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	8.7	6.9	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1608	-	1052	-	-
HCM Lane V/C Ratio	0.046	-	0.076	-	-
HCM Control Delay (s)	7.3	0	8.7	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0.1	-	0.2	-	-

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Summary of All Intervals

Run Number	1	2	3	4	5	Avg
Start Time	4:50	4:50	4:50	4:50	4:50	4:50
End Time	6:00	6:00	6:00	6:00	6:00	6:00
Total Time (min)	70	70	70	70	70	70
Time Recorded (min)	60	60	60	60	60	60
# of Intervals	5	5	5	5	5	5
# of Recorded Intervals	4	4	4	4	4	4
Vehs Entered	1128	242	400	208	2227	840
Vehs Exited	998	156	263	75	1997	698
Starting Vehs	262	301	274	324	263	283
Ending Vehs	392	387	411	457	493	427
Travel Distance (mi)	415	61	105	35	853	294
Travel Time (hr)	2188.5	3036.1	2794.8	2980.5	1758.2	2551.6
Total Delay (hr)	2173.5	3033.9	2791.0	2979.2	1727.4	2541.0
Total Stops	1889	343	447	222	3767	1333
Fuel Used (gal)	511.0	694.0	640.6	679.9	427.2	590.6

Interval #0 Information Seeding

Start Time	4:50
End Time	5:00
Total Time (min)	10

Volumes adjusted by Growth Factors.
No data recorded this interval.

Interval #1 Information 1

Start Time	5:00
End Time	5:15
Total Time (min)	15

Volumes adjusted by Growth Factors, Anti PHF.

Run Number	1	2	3	4	5	Avg
Vehs Entered	772	214	382	197	738	458
Vehs Exited	732	154	262	72	709	386
Starting Vehs	262	301	274	324	263	283
Ending Vehs	302	361	394	449	292	358
Travel Distance (mi)	308	60	104	34	296	161
Travel Time (hr)	156.4	246.8	200.0	241.4	149.4	198.8
Total Delay (hr)	145.3	244.6	196.2	240.2	138.8	193.0
Total Stops	1427	319	433	216	1258	733
Fuel Used (gal)	45.0	58.1	48.8	56.0	43.1	50.2

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Interval #2 Information 2

Start Time 5:15
End Time 5:30
Total Time (min) 15
Volumes adjusted by PHF, Growth Factors.

Run Number	1	2	3	4	5	Avg
Vehs Entered	345	14	12	6	765	228
Vehs Exited	265	2	1	2	768	206
Starting Vehs	302	361	394	449	292	358
Ending Vehs	382	373	405	453	289	379
Travel Distance (mi)	107	1	0	0	323	86
Travel Time (hr)	357.0	586.2	520.6	579.9	326.9	474.2
Total Delay (hr)	353.1	586.2	520.6	579.9	315.3	471.0
Total Stops	455	11	11	2	1330	363
Fuel Used (gal)	84.5	133.6	118.9	132.1	84.6	110.7

Interval #3 Information 3

Start Time 5:30
End Time 5:45
Total Time (min) 15
Volumes adjusted by Growth Factors, Anti PHF.

Run Number	1	2	3	4	5	Avg
Vehs Entered	9	8	6	2	665	138
Vehs Exited	0	0	0	1	489	96
Starting Vehs	382	373	405	453	289	379
Ending Vehs	391	381	411	454	465	420
Travel Distance (mi)	0	0	0	0	225	45
Travel Time (hr)	673.2	944.3	874.7	921.1	505.6	783.8
Total Delay (hr)	673.2	944.3	874.7	921.1	497.5	782.2
Total Stops	7	8	3	1	1102	225
Fuel Used (gal)	153.2	215.4	199.5	209.7	122.1	180.0

Interval #4 Information 4

Start Time 5:45
End Time 6:00
Total Time (min) 15
Volumes adjusted by Growth Factors, Anti PHF.

Run Number	1	2	3	4	5	Avg
Vehs Entered	2	6	0	3	59	14
Vehs Exited	1	0	0	0	31	6
Starting Vehs	391	381	411	454	465	420
Ending Vehs	392	387	411	457	493	427
Travel Distance (mi)	0	0	0	0	10	2
Travel Time (hr)	1001.9	1258.7	1199.4	1238.0	776.3	1094.9
Total Delay (hr)	1001.9	1258.7	1199.4	1238.0	775.9	1094.8
Total Stops	0	5	0	3	77	17
Fuel Used (gal)	228.3	287.0	273.4	282.1	177.4	249.6

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Intersection: 1: Catawba Ave (WB) & Catawba Ave (EB)

Movement	EB	EB	EB	NW	NW
Directions Served	T	T	T	T	T
Maximum Queue (ft)	140	153	98	133	135
Average Queue (ft)	65	147	16	67	67
95th Queue (ft)	197	218	82	168	168
Link Distance (ft)	60	60	60	46	46
Upstream Blk Time (%)	31	98	3	35	35
Queuing Penalty (veh)	148	468	14	209	213
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 2: Catawba Ave (EB) & Catawba Ave (WB)

Movement	WB	WB	SB	SB
Directions Served	T	T	T	T
Maximum Queue (ft)	132	133	156	80
Average Queue (ft)	127	127	148	35
95th Queue (ft)	140	141	160	134
Link Distance (ft)	74	74	86	86
Upstream Blk Time (%)	99	99	95	13
Queuing Penalty (veh)	426	425	577	79
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 3: Statesville Rd (US 21)/Holiday Ln & Catawba Ave

Movement	EB	EB	EB	WB	WB	NB	NB	NB	SB	SB
Directions Served	L	T	R	L	TR	L	LT	R	L	TR
Maximum Queue (ft)	133	218	133	14	337	193	489	100	53	220
Average Queue (ft)	101	212	27	9	335	175	482	16	17	217
95th Queue (ft)	192	226	124	42	355	276	491	103	73	220
Link Distance (ft)		170	170		245		487			217
Upstream Blk Time (%)	20	89	1		99		99			100
Queuing Penalty (veh)	0	627	7		825		0			179
Storage Bay Dist (ft)	100			100		150		150	75	
Storage Blk Time (%)	56	69			99	60	100	7	21	100
Queuing Penalty (veh)	357	104			112	270	402	35	25	59

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Intersection: 4: Hill St/Burton Ln & Catawba Ave

Movement	EB	EB	WB	NB	SB
Directions Served	L	TR	LTR	LTR	LTR
Maximum Queue (ft)	47	81	535	426	86
Average Queue (ft)	36	25	528	258	86
95th Queue (ft)	105	143	537	483	87
Link Distance (ft)		245	531	466	86
Upstream Blk Time (%)		8	99	12	100
Queuing Penalty (veh)		62	0	0	74
Storage Bay Dist (ft)	50				
Storage Blk Time (%)	60	0			
Queuing Penalty (veh)	493	0			

Intersection: 5: Holiday Ln & Site Access #1

Movement	WB	SB
Directions Served	LR	LT
Maximum Queue (ft)	195	166
Average Queue (ft)	149	134
95th Queue (ft)	256	213
Link Distance (ft)	184	157
Upstream Blk Time (%)	69	79
Queuing Penalty (veh)	0	0
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 6: Holiday Ln & Site Access #2

Movement	WB	SB
Directions Served	LR	LT
Maximum Queue (ft)	90	80
Average Queue (ft)	79	75
95th Queue (ft)	88	92
Link Distance (ft)	96	76
Upstream Blk Time (%)	58	95
Queuing Penalty (veh)	0	81
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

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Intersection: 7: Burton Ln & Site Acess #3

Movement	EB	SB
Directions Served	LR	TR
Maximum Queue (ft)	102	194
Average Queue (ft)	94	110
95th Queue (ft)	104	257
Link Distance (ft)	101	267
Upstream Blk Time (%)	97	16
Queuing Penalty (veh)	0	0
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 11: Catawba Ave (EB) & I-77 SB Off-Ramp

Movement	EB	EB	EB	SB	SB
Directions Served	T	T	T	L	L
Maximum Queue (ft)	62	103	21	147	136
Average Queue (ft)	23	86	1	140	111
95th Queue (ft)	77	162	16	163	208
Link Distance (ft)	40	40	40	89	89
Upstream Blk Time (%)	27	97	0	88	65
Queuing Penalty (veh)	130	464	2	173	128
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 12: Catawba Ave/Catawba Ave (WB) & I-77 SB Off-Ramp

Movement	WB	WB	SB	SB
Directions Served	T	T	R	R
Maximum Queue (ft)	2	10	159	144
Average Queue (ft)	0	1	51	37
95th Queue (ft)	2	9	168	123
Link Distance (ft)	56	56	89	89
Upstream Blk Time (%)		0	11	4
Queuing Penalty (veh)		0	39	16
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

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Intersection: 14: Catawba Ave (EB) & I-77 NB On-Ramp

Movement	EB	EB
Directions Served	T	T
Maximum Queue (ft)	247	80
Average Queue (ft)	236	14
95th Queue (ft)	261	82
Link Distance (ft)	143	143
Upstream Blk Time (%)	92	1
Queuing Penalty (veh)	565	3
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 15: Catawba Ave

Movement	WB	WB	NE	NE
Directions Served	T	T	R	R
Maximum Queue (ft)	234	220	109	22
Average Queue (ft)	217	203	105	1
95th Queue (ft)	278	258	115	18
Link Distance (ft)	170	170	61	61
Upstream Blk Time (%)	99	99	89	0
Queuing Penalty (veh)	639	640	625	1
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 17: I-77 SB On-Ramp & Catawba Ave (WB)

Movement	WB	WB
Directions Served	LT	T
Maximum Queue (ft)	127	176
Average Queue (ft)	53	85
95th Queue (ft)	169	251
Link Distance (ft)	139	139
Upstream Blk Time (%)	27	28
Queuing Penalty (veh)	176	179
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

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Intersection: 18: I-77 NB On-Ramp

Movement	EB	WB
Directions Served	L	R
Maximum Queue (ft)	24	11
Average Queue (ft)	1	0
95th Queue (ft)	17	8
Link Distance (ft)	143	71
Upstream Blk Time (%)		0
Queuing Penalty (veh)		0
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 19: I-77 SB On-Ramp

Movement	SE
Directions Served	R
Maximum Queue (ft)	106
Average Queue (ft)	4
95th Queue (ft)	56
Link Distance (ft)	137
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 21: I-77 NB Off-Ramp & Catawba Ave (WB)

Movement	NB	NB	SW	SW
Directions Served	L	L	R	R
Maximum Queue (ft)	148	163	19	33
Average Queue (ft)	71	87	6	11
95th Queue (ft)	191	229	40	76
Link Distance (ft)	116	116	78	78
Upstream Blk Time (%)	27	31	7	7
Queuing Penalty (veh)	60	70	29	29
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

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Intersection: 22: I-77 NB Off-Ramp & Catawba Ave (EB)/Catawba Ave

Movement	EB	NB
Directions Served	T	R
Maximum Queue (ft)	163	175
Average Queue (ft)	146	158
95th Queue (ft)	189	202
Link Distance (ft)	86	110
Upstream Blk Time (%)	96	84
Queuing Penalty (veh)	578	170
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 24: I-77 SB On-Ramp & Catawba Ave/Catawba Ave (EB)

Movement	EB	EB	EB
Directions Served	T	T	TR
Maximum Queue (ft)	90	176	60
Average Queue (ft)	44	165	4
95th Queue (ft)	132	179	33
Link Distance (ft)		115	115
Upstream Blk Time (%)	23	93	0
Queuing Penalty (veh)	0	811	0
Storage Bay Dist (ft)	50		
Storage Blk Time (%)	26	74	
Queuing Penalty (veh)	124	357	

Intersection: 26: Catawba Ave

Movement	EB	EB
Directions Served	T	T
Maximum Queue (ft)	599	453
Average Queue (ft)	580	384
95th Queue (ft)	620	764
Link Distance (ft)	578	578
Upstream Blk Time (%)	94	29
Queuing Penalty (veh)	0	0
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

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Intersection: 27: I-77 SB Off-Ramp

Movement	SB	SB	SB	SB
Directions Served	L	L	R	R
Maximum Queue (ft)	456	543	923	540
Average Queue (ft)	357	405	689	54
95th Queue (ft)	634	773	1250	273
Link Distance (ft)			909	
Upstream Blk Time (%)			68	
Queuing Penalty (veh)			0	
Storage Bay Dist (ft)	450	450		450
Storage Blk Time (%)	60	71	23	0
Queuing Penalty (veh)	417	493	168	1

Intersection: 28: I-77 NB Off-Ramp

Movement	NB	NB	NB
Directions Served	L	L	R
Maximum Queue (ft)	537	814	412
Average Queue (ft)	93	603	312
95th Queue (ft)	355	1149	600
Link Distance (ft)		801	
Upstream Blk Time (%)		70	
Queuing Penalty (veh)		0	
Storage Bay Dist (ft)	500		500
Storage Blk Time (%)	0	73	18
Queuing Penalty (veh)	0	316	84

Intersection: 29: Bend

Movement	NB
Directions Served	T
Maximum Queue (ft)	66
Average Queue (ft)	2
95th Queue (ft)	48
Link Distance (ft)	275
Upstream Blk Time (%)	0
Queuing Penalty (veh)	0
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

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Intersection: 30: Catawba Ave (WB)/Catawba Ave & I-77 NB On-Ramp

Movement	WB	WB
Directions Served	T	TR
Maximum Queue (ft)	107	100
Average Queue (ft)	105	96
95th Queue (ft)	109	102
Link Distance (ft)	59	59
Upstream Blk Time (%)	99	99
Queuing Penalty (veh)	643	642
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Network Summary

Network wide Queuing Penalty: 15045

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APPENDIX F-13:
CAPACITY ANALYSIS RESULTS

2023 BUILD-IMPROVED CONDITIONS
AM PEAK HOUR

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Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	100	642	618	122	579	15	577	29	110	69	33	76
Future Volume (vph)	100	642	618	122	579	15	577	29	110	69	33	76
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		-2%			1%			3%			5%	
Storage Length (ft)	100		0	100		0	150		150	200		0
Storage Lanes	1		1	1		0	1		1	1		0
Taper Length (ft)	100			100			100			100		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.97	1.00	1.00	1.00	1.00	1.00
Frt			0.850		0.996			0.881			0.896	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1787	1881	1599	1761	1846	0	3382	1616	0	1725	1627	0
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	1787	1881	1599	1761	1846	0	3382	1616	0	1725	1627	0
Right Turn on Red			No			No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)		35			35			35			35	
Link Distance (ft)		229			323			537			298	
Travel Time (s)		4.5			6.3			10.5			5.8	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	111	713	687	136	643	17	641	32	122	77	37	84
Shared Lane Traffic (%)												
Lane Group Flow (vph)	111	713	687	136	660	0	641	154	0	77	121	0
Turn Type	Prot	NA	pm+ov	Prot	NA		Prot	NA		Prot	NA	
Protected Phases	5	2	3	1	6		3	8		7	4	
Permitted Phases			2									
Detector Phase	5	2	3	1	6		3	8		7	4	
Switch Phase												
Minimum Initial (s)	7.0	10.0	7.0	7.0	10.0		7.0	7.0		7.0	7.0	
Minimum Split (s)	14.0	32.0	29.0	14.0	29.0		29.0	29.0		14.0	14.0	
Total Split (s)	17.0	58.0	29.0	16.0	57.0		29.0	32.0		14.0	17.0	
Total Split (%)	14.2%	48.3%	24.2%	13.3%	47.5%		24.2%	26.7%		11.7%	14.2%	
Yellow Time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0		5.0	5.0	
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0		2.0	2.0		2.0	2.0	
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0	-2.0		-2.0	-2.0		-2.0	-2.0	
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0		5.0	5.0	
Lead/Lag	Lead	Lead	Lead	Lag	Lag		Lead	Lag		Lead	Lag	
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes		Yes	Yes		Yes	Yes	
Recall Mode	None	C-Max	None	None	C-Max		None	None		None	None	
Act Effct Green (s)	11.4	53.1	77.1	11.0	52.8		24.0	29.7		9.0	11.9	
Actuated g/C Ratio	0.10	0.44	0.64	0.09	0.44		0.20	0.25		0.08	0.10	
v/c Ratio	0.66	0.86	0.67	0.84	0.81		0.95	0.39		0.60	0.76	
Control Delay	83.5	16.9	4.8	93.3	39.2		71.7	42.5		73.2	81.0	
Queue Delay	0.0	1.7	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	83.5	18.6	4.8	93.3	39.2		71.7	42.5		73.2	81.0	
LOS	F	B	A	F	D		E	D		E	F	
Approach Delay		17.1			48.5			66.0			78.0	
Approach LOS		B			D			E			E	
Queue Length 50th (ft)	73	72	48	105	443		254	103		59	93	

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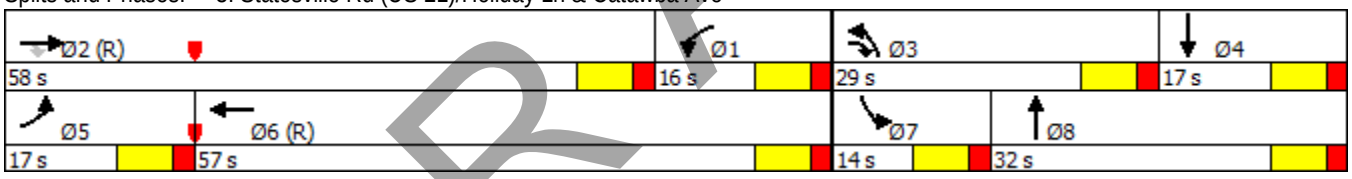
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 95th (ft)	m110	#694	82	#220	#614		#368	170		#121	#188	
Internal Link Dist (ft)		149			243			457			218	
Turn Bay Length (ft)	100			100			150			200		
Base Capacity (vph)	178	832	1028	161	811		676	399		129	162	
Starvation Cap Reductn	0	38	0	0	0		0	0		0	0	
Spillback Cap Reductn	0	0	0	0	0		0	0		0	0	
Storage Cap Reductn	0	0	0	0	0		0	0		0	0	
Reduced v/c Ratio	0.62	0.90	0.67	0.84	0.81		0.95	0.39		0.60	0.75	

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 20 (17%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.95
Intersection Signal Delay: 40.1 Intersection LOS: D
Intersection Capacity Utilization 80.1% ICU Level of Service D
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 3: Statesville Rd (US 21)/Holiday Ln & Catawba Ave



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Intersection

Int Delay, s/veh 1.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	12	802	8	4	654	44	6	4	9	12	4	57
Future Vol, veh/h	12	802	8	4	654	44	6	4	9	12	4	57
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	50	-	-	-	-	-	-	-	-	0	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	13	891	9	4	727	49	7	4	10	13	4	63

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	776	0	0	900	0	0	1716	1706	896	1689	1687	751
Stage 1	-	-	-	-	-	-	922	922	-	760	760	-
Stage 2	-	-	-	-	-	-	794	784	-	929	927	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	840	-	-	755	-	-	71	91	339	74	94	411
Stage 1	-	-	-	-	-	-	324	349	-	398	414	-
Stage 2	-	-	-	-	-	-	381	404	-	321	347	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	840	-	-	755	-	-	57	89	339	68	92	411
Mov Cap-2 Maneuver	-	-	-	-	-	-	57	89	-	68	92	-
Stage 1	-	-	-	-	-	-	319	344	-	392	410	-
Stage 2	-	-	-	-	-	-	316	400	-	303	342	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.1	0.1	46.7	27
HCM LOS			E	D

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	107	840	-	-	755	-	-	68	335
HCM Lane V/C Ratio	0.197	0.016	-	-	0.006	-	-	0.196	0.202
HCM Control Delay (s)	46.7	9.4	-	-	9.8	0	-	70.4	18.5
HCM Lane LOS	E	A	-	-	A	A	-	F	C
HCM 95th %tile Q(veh)	0.7	0	-	-	0	-	-	0.7	0.7

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Summary of All Intervals

Run Number	1	2	3	4	5	Avg
Start Time	6:50	6:50	6:50	6:50	6:50	6:50
End Time	8:00	8:00	8:00	8:00	8:00	8:00
Total Time (min)	70	70	70	70	70	70
Time Recorded (min)	60	60	60	60	60	60
# of Intervals	5	5	5	5	5	5
# of Recorded Intervals	4	4	4	4	4	4
Vehs Entered	4976	5069	4927	5026	5128	5023
Vehs Exited	4989	5041	4929	5017	5128	5020
Starting Vehs	194	184	195	196	199	193
Ending Vehs	181	212	193	205	199	196
Travel Distance (mi)	2025	2063	1999	2040	2093	2044
Travel Time (hr)	379.6	360.7	437.4	394.2	330.5	380.4
Total Delay (hr)	307.6	287.6	366.1	321.6	256.3	307.8
Total Stops	8209	8415	8020	8152	8389	8232
Fuel Used (gal)	153.2	149.4	165.6	157.9	145.0	154.2

Interval #0 Information Seeding

Start Time	6:50
End Time	7:00
Total Time (min)	10

Volumes adjusted by Growth Factors.
No data recorded this interval.

Interval #1 Information 1

Start Time	7:00
End Time	7:15
Total Time (min)	15

Volumes adjusted by Growth Factors, Anti PHF.

Run Number	1	2	3	4	5	Avg
Vehs Entered	1271	1275	1193	1279	1276	1257
Vehs Exited	1279	1290	1201	1299	1279	1268
Starting Vehs	194	184	195	196	199	193
Ending Vehs	186	169	187	176	196	181
Travel Distance (mi)	520	519	488	524	520	514
Travel Time (hr)	54.8	53.0	64.2	52.8	57.3	56.4
Total Delay (hr)	36.5	34.7	47.0	34.3	39.1	38.3
Total Stops	2107	2036	2012	1985	2151	2056
Fuel Used (gal)	29.4	28.7	30.5	29.3	30.0	29.6

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Interval #2 Information 2

Start Time 7:15
End Time 7:30
Total Time (min) 15
Volumes adjusted by PHF, Growth Factors.

Run Number	1	2	3	4	5	Avg
Vehs Entered	1316	1332	1291	1312	1334	1317
Vehs Exited	1298	1282	1284	1276	1298	1286
Starting Vehs	186	169	187	176	196	181
Ending Vehs	204	219	194	212	232	208
Travel Distance (mi)	532	533	523	522	537	529
Travel Time (hr)	81.7	84.7	99.9	79.9	76.4	84.5
Total Delay (hr)	62.8	65.7	81.2	61.3	57.3	65.7
Total Stops	2223	2122	2027	2213	2155	2146
Fuel Used (gal)	36.5	37.0	40.0	35.8	35.5	36.9

Interval #3 Information 3

Start Time 7:30
End Time 7:45
Total Time (min) 15
Volumes adjusted by Growth Factors, Anti PHF.

Run Number	1	2	3	4	5	Avg
Vehs Entered	1242	1248	1196	1218	1272	1232
Vehs Exited	1237	1282	1216	1235	1277	1249
Starting Vehs	204	219	194	212	232	208
Ending Vehs	209	185	174	195	227	196
Travel Distance (mi)	502	524	490	499	517	506
Travel Time (hr)	110.6	106.1	120.0	116.9	92.2	109.2
Total Delay (hr)	92.8	87.8	102.5	99.2	73.9	91.2
Total Stops	2066	2169	1960	2004	2086	2054
Fuel Used (gal)	41.8	41.5	43.6	43.3	38.4	41.7

Interval #4 Information 4

Start Time 7:45
End Time 8:00
Total Time (min) 15
Volumes adjusted by Growth Factors, Anti PHF.

Run Number	1	2	3	4	5	Avg
Vehs Entered	1147	1214	1247	1217	1246	1213
Vehs Exited	1175	1187	1228	1207	1274	1215
Starting Vehs	209	185	174	195	227	196
Ending Vehs	181	212	193	205	199	196
Travel Distance (mi)	471	487	498	495	518	494
Travel Time (hr)	132.4	116.9	153.3	144.5	104.5	130.3
Total Delay (hr)	115.5	99.4	135.5	126.9	86.0	112.6
Total Stops	1813	2088	2021	1950	1997	1971
Fuel Used (gal)	45.6	42.2	51.6	49.5	41.1	46.0

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Intersection: 1: Catawba Ave (WB) & Catawba Ave (EB)

Movement	EB	EB	EB	NW	NW
Directions Served	T	T	T	T	T
Maximum Queue (ft)	192	178	182	146	148
Average Queue (ft)	172	98	111	126	130
95th Queue (ft)	182	177	185	148	138
Link Distance (ft)	60	60	60	46	46
Upstream Blk Time (%)	56	28	24	40	46
Queuing Penalty (veh)	270	137	116	176	202
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 2: Catawba Ave (EB) & Catawba Ave (WB)

Movement	WB	WB	SB	SB
Directions Served	T	T	T	T
Maximum Queue (ft)	157	144	176	168
Average Queue (ft)	132	92	154	145
95th Queue (ft)	168	153	181	187
Link Distance (ft)	74	74	86	86
Upstream Blk Time (%)	36	15	34	32
Queuing Penalty (veh)	116	48	214	198
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 3: Statesville Rd (US 21)/Holiday Ln & Catawba Ave

Movement	EB	EB	EB	WB	WB	NB	NB	NB	SB	SB
Directions Served	L	T	R	L	TR	L	L	TR	L	TR
Maximum Queue (ft)	163	216	211	200	361	250	540	250	146	188
Average Queue (ft)	84	125	92	146	298	242	486	201	61	100
95th Queue (ft)	148	237	190	233	403	285	566	343	118	178
Link Distance (ft)		164	164		241		487			218
Upstream Blk Time (%)	0	10	2		23		43		0	0
Queuing Penalty (veh)	0	70	17		164		0		0	0
Storage Bay Dist (ft)	100			100		150		150	200	
Storage Blk Time (%)	13	22		28	41	26	75	2	0	1
Queuing Penalty (veh)	81	22		166	50	112	319	12	0	0

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Intersection: 4: Hill St/Burton Ln & Catawba Ave

Movement	EB	WB	NB	SB	SB
Directions Served	L	LTR	LTR	L	TR
Maximum Queue (ft)	46	283	54	42	95
Average Queue (ft)	9	61	16	10	29
95th Queue (ft)	32	202	42	32	66
Link Distance (ft)		526	466	90	90
Upstream Blk Time (%)					1
Queuing Penalty (veh)					0
Storage Bay Dist (ft)	50				
Storage Blk Time (%)	3				
Queuing Penalty (veh)	25				

Intersection: 5: Holiday Ln & Site Access #1

Movement	WB	SB
Directions Served	LR	LT
Maximum Queue (ft)	12	12
Average Queue (ft)	7	0
95th Queue (ft)	16	4
Link Distance (ft)	184	157
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 6: Holiday Ln & Site Access #2

Movement	WB	SB
Directions Served	LR	LT
Maximum Queue (ft)	63	12
Average Queue (ft)	33	1
95th Queue (ft)	56	8
Link Distance (ft)	97	76
Upstream Blk Time (%)	0	
Queuing Penalty (veh)	0	
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

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Intersection: 7: Burton Ln & Site Acess #3

Movement	EB	NB
Directions Served	LR	LT
Maximum Queue (ft)	62	19
Average Queue (ft)	29	1
95th Queue (ft)	51	9
Link Distance (ft)	103	90
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 11: Catawba Ave (EB) & I-77 SB Off-Ramp

Movement	EB	EB	EB	SB	SB
Directions Served	T	T	T	L	L
Maximum Queue (ft)	93	78	50	171	167
Average Queue (ft)	74	23	11	145	143
95th Queue (ft)	89	62	41	177	193
Link Distance (ft)	40	40	40	89	89
Upstream Blk Time (%)	53	9	5	35	31
Queuing Penalty (veh)	254	46	26	119	105
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 12: Catawba Ave/Catawba Ave (WB) & I-77 SB Off-Ramp

Movement	WB	WB	SB	SB
Directions Served	T	T	R	R
Maximum Queue (ft)	12	36	176	170
Average Queue (ft)	1	7	155	135
95th Queue (ft)	5	26	166	171
Link Distance (ft)	56	56	89	89
Upstream Blk Time (%)		0	44	27
Queuing Penalty (veh)		0	223	138
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

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Intersection: 14: Catawba Ave (EB) & I-77 NB On-Ramp

Movement	EB	EB	EB
Directions Served	L	T	T
Maximum Queue (ft)	100	248	233
Average Queue (ft)	13	105	82
95th Queue (ft)	60	221	192
Link Distance (ft)	143	143	143
Upstream Blk Time (%)		7	5
Queuing Penalty (veh)		49	38
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 15: Catawba Ave

Movement	WB	WB	NE	NE
Directions Served	T	T	R	R
Maximum Queue (ft)	41	128	91	32
Average Queue (ft)	2	12	11	2
95th Queue (ft)	25	63	55	15
Link Distance (ft)	164	164	61	61
Upstream Blk Time (%)		0	2	0
Queuing Penalty (veh)		1	10	0
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 17: I-77 SB On-Ramp & Catawba Ave (WB)

Movement	WB	WB
Directions Served	LT	T
Maximum Queue (ft)	209	252
Average Queue (ft)	139	178
95th Queue (ft)	201	260
Link Distance (ft)	139	139
Upstream Blk Time (%)	10	14
Queuing Penalty (veh)	47	66
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

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Intersection: 18: I-77 NB On-Ramp

Movement	EB	WB
Directions Served	L	R
Maximum Queue (ft)	212	144
Average Queue (ft)	162	57
95th Queue (ft)	239	141
Link Distance (ft)	143	71
Upstream Blk Time (%)	11	2
Queuing Penalty (veh)	93	15
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 19: I-77 SB On-Ramp

Movement	SB	SE
Directions Served	T	R
Maximum Queue (ft)	153	98
Average Queue (ft)	9	5
95th Queue (ft)	78	63
Link Distance (ft)	111	137
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 21: I-77 NB Off-Ramp & Catawba Ave (WB)

Movement	NB	NB	SW	SW
Directions Served	L	L	R	R
Maximum Queue (ft)	116	190	54	48
Average Queue (ft)	49	97	4	3
95th Queue (ft)	124	170	25	23
Link Distance (ft)	116	116	78	78
Upstream Blk Time (%)	0	6		0
Queuing Penalty (veh)	0	8		0
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

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Intersection: 22: I-77 NB Off-Ramp & Catawba Ave (EB)/Catawba Ave

Movement	EB	EB	NB
Directions Served	T	T	R
Maximum Queue (ft)	122	63	146
Average Queue (ft)	19	11	61
95th Queue (ft)	68	40	119
Link Distance (ft)	86	86	110
Upstream Blk Time (%)	1	0	1
Queuing Penalty (veh)	4	0	2
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 24: I-77 SB On-Ramp & Catawba Ave/Catawba Ave (EB)

Movement	EB	EB	EB
Directions Served	T	T	TR
Maximum Queue (ft)	114	198	115
Average Queue (ft)	110	175	14
95th Queue (ft)	121	186	72
Link Distance (ft)		115	115
Upstream Blk Time (%)	28	45	1
Queuing Penalty (veh)	0	349	4
Storage Bay Dist (ft)	50		
Storage Blk Time (%)	53	2	
Queuing Penalty (veh)	255	11	

Intersection: 26: Catawba Ave

Movement	EB	EB
Directions Served	T	T
Maximum Queue (ft)	623	603
Average Queue (ft)	596	485
95th Queue (ft)	621	812
Link Distance (ft)	578	578
Upstream Blk Time (%)	61	10
Queuing Penalty (veh)	0	0
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

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Intersection: 27: I-77 SB Off-Ramp

Movement	SB	SB	SB	SB
Directions Served	L	L	R	R
Maximum Queue (ft)	197	150	302	272
Average Queue (ft)	61	36	191	150
95th Queue (ft)	152	106	267	247
Link Distance (ft)			909	
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)	450	450		450
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 28: I-77 NB Off-Ramp

Movement	NB	NB
Directions Served	L	R
Maximum Queue (ft)	34	4
Average Queue (ft)	2	0
95th Queue (ft)	18	3
Link Distance (ft)	801	
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		500
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 29: Bend

Movement	NB	NB
Directions Served	T	
Maximum Queue (ft)	363	339
Average Queue (ft)	289	36
95th Queue (ft)	479	204
Link Distance (ft)	275	275
Upstream Blk Time (%)	13	1
Queuing Penalty (veh)	95	4
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

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Intersection: 30: Catawba Ave (WB)/Catawba Ave & I-77 NB On-Ramp

Movement	WB	WB
Directions Served	T	TR
Maximum Queue (ft)	104	105
Average Queue (ft)	32	31
95th Queue (ft)	86	103
Link Distance (ft)	59	59
Upstream Blk Time (%)	3	4
Queuing Penalty (veh)	21	24
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Network Summary

Network wide Queuing Penalty: 4525

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APPENDIX F-14:
CAPACITY ANALYSIS RESULTS

2023 BUILD-IMPROVED CONDITIONS
PM PEAK HOUR

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Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	150	634	627	113	685	33	518	45	144	59	30	92
Future Volume (vph)	150	634	627	113	685	33	518	45	144	59	30	92
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		-2%			1%			3%			5%	
Storage Length (ft)	100		0	100		0	150		150	200		0
Storage Lanes	1		1	1		0	1		1	1		0
Taper Length (ft)	100			100			100			100		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.97	1.00	1.00	1.00	1.00	1.00
Frt			0.850		0.993			0.886			0.887	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1787	1881	1599	1761	1840	0	3382	1626	0	1725	1611	0
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	1787	1881	1599	1761	1840	0	3382	1626	0	1725	1611	0
Right Turn on Red			No			No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)		35			35			35			35	
Link Distance (ft)		229			323			537			298	
Travel Time (s)		4.5			6.3			10.5			5.8	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	167	704	697	126	761	37	576	50	160	66	33	102
Shared Lane Traffic (%)												
Lane Group Flow (vph)	167	704	697	126	798	0	576	210	0	66	135	0
Turn Type	Prot	NA	pm+ov	Prot	NA		Prot	NA		Prot	NA	
Protected Phases	5	2	3	1	6		3	8		7	4	
Permitted Phases			2									
Detector Phase	5	2	3	1	6		3	8		7	4	
Switch Phase												
Minimum Initial (s)	7.0	10.0	7.0	7.0	10.0		7.0	7.0		7.0	7.0	
Minimum Split (s)	14.0	32.0	29.0	14.0	29.0		29.0	29.0		14.0	14.0	
Total Split (s)	16.0	59.0	28.0	15.0	58.0		28.0	28.0		18.0	18.0	
Total Split (%)	13.3%	49.2%	23.3%	12.5%	48.3%		23.3%	23.3%		15.0%	15.0%	
Yellow Time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0		5.0	5.0	
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0		2.0	2.0		2.0	2.0	
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0	-2.0		-2.0	-2.0		-2.0	-2.0	
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0		5.0	5.0	
Lead/Lag	Lead	Lead	Lead	Lag	Lag		Lead	Lag		Lead	Lag	
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes		Yes	Yes		Yes	Yes	
Recall Mode	None	C-Max	None	None	C-Max		None	None		None	None	
Act Effct Green (s)	11.2	54.2	77.2	10.0	53.0		23.0	27.2		11.5	12.8	
Actuated g/C Ratio	0.09	0.45	0.64	0.08	0.44		0.19	0.23		0.10	0.11	
v/c Ratio	1.01	0.83	0.68	0.86	0.98		0.89	0.57		0.40	0.78	
Control Delay	130.0	15.7	4.5	99.8	61.3		64.3	50.2		58.1	82.3	
Queue Delay	0.0	2.1	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	130.0	17.8	4.6	99.8	61.3		64.3	50.2		58.1	82.3	
LOS	F	B	A	F	E		E	D		E	F	
Approach Delay		23.9			66.6			60.5			74.4	
Approach LOS		C			E			E			E	
Queue Length 50th (ft)	~124	91	60	98	597		226	151		49	103	

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Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 95th (ft)	m#201	#292	m88	#211	#873		#323	239		95	#208	
Internal Link Dist (ft)		149			243			457			218	
Turn Bay Length (ft)	100			100			150			200		
Base Capacity (vph)	165	848	1028	146	812		648	368		186	174	
Starvation Cap Reductn	0	59	3	0	0		0	0		0	0	
Spillback Cap Reductn	0	0	0	0	0		0	0		0	0	
Storage Cap Reductn	0	0	0	0	0		0	0		0	0	
Reduced v/c Ratio	1.01	0.89	0.68	0.86	0.98		0.89	0.57		0.35	0.78	

Intersection Summary

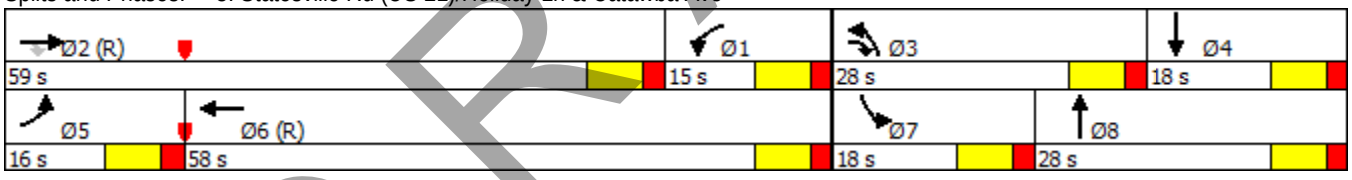
Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 101 (84%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 100
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.01
Intersection Signal Delay: 46.4 Intersection LOS: D
Intersection Capacity Utilization 85.0% ICU Level of Service E
Analysis Period (min) 15

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 3: Statesville Rd (US 21)/Holiday Ln & Catawba Ave



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Intersection

Int Delay, s/veh 3.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	16	801	21	4	757	53	15	4	4	15	4	59
Future Vol, veh/h	16	801	21	4	757	53	15	4	4	15	4	59
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	50	-	-	-	-	-	-	-	-	0	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	18	890	23	4	841	59	17	4	4	17	4	66

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	900	0	0	913	0	0	1851	1846	902	1821	1828	871
Stage 1	-	-	-	-	-	-	937	937	-	879	879	-
Stage 2	-	-	-	-	-	-	914	909	-	942	949	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	755	-	-	746	-	-	57	75	336	60	77	350
Stage 1	-	-	-	-	-	-	318	343	-	342	365	-
Stage 2	-	-	-	-	-	-	327	354	-	316	339	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	755	-	-	746	-	-	43	72	336	55	74	350
Mov Cap-2 Maneuver	-	-	-	-	-	-	43	72	-	55	74	-
Stage 1	-	-	-	-	-	-	310	335	-	334	361	-
Stage 2	-	-	-	-	-	-	260	350	-	300	331	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.2	0	117.9	36.3
HCM LOS			F	E

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	55	755	-	-	746	-	-	55	283
HCM Lane V/C Ratio	0.465	0.024	-	-	0.006	-	-	0.303	0.247
HCM Control Delay (s)	117.9	9.9	-	-	9.9	0	-	96.7	21.9
HCM Lane LOS	F	A	-	-	A	A	-	F	C
HCM 95th %tile Q(veh)	1.8	0.1	-	-	0	-	-	1.1	1

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Summary of All Intervals

Run Number	1	2	3	4	5	Avg
Start Time	4:50	4:50	4:50	4:50	4:50	4:50
End Time	6:00	6:00	6:00	6:00	6:00	6:00
Total Time (min)	70	70	70	70	70	70
Time Recorded (min)	60	60	60	60	60	60
# of Intervals	5	5	5	5	5	5
# of Recorded Intervals	4	4	4	4	4	4
Vehs Entered	4861	4687	4708	4889	4932	4812
Vehs Exited	4834	4671	4714	4856	4920	4798
Starting Vehs	164	131	169	142	142	148
Ending Vehs	191	147	163	175	154	160
Travel Distance (mi)	1990	1923	1951	2008	2020	1979
Travel Time (hr)	223.5	154.2	180.7	192.9	193.1	188.9
Total Delay (hr)	153.3	86.5	112.2	122.4	122.1	119.3
Total Stops	7644	5768	6679	6499	7050	6725
Fuel Used (gal)	112.8	94.2	101.3	106.0	107.4	104.4

Interval #0 Information Seeding

Start Time	4:50
End Time	5:00
Total Time (min)	10

Volumes adjusted by Growth Factors.
No data recorded this interval.

Interval #1 Information 1

Start Time	5:00
End Time	5:15
Total Time (min)	15

Volumes adjusted by Growth Factors, Anti PHF.

Run Number	1	2	3	4	5	Avg
Vehs Entered	1248	1130	1136	1125	1207	1168
Vehs Exited	1238	1170	1165	1128	1181	1174
Starting Vehs	164	131	169	142	142	148
Ending Vehs	174	91	140	139	168	138
Travel Distance (mi)	506	474	478	464	489	482
Travel Time (hr)	41.3	36.8	42.0	35.9	40.0	39.2
Total Delay (hr)	23.5	20.1	25.2	19.6	22.8	22.2
Total Stops	1598	1385	1651	1375	1555	1509
Fuel Used (gal)	24.8	23.0	24.1	22.5	24.2	23.7

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Interval #2 Information 2

Start Time 5:15
End Time 5:30
Total Time (min) 15
Volumes adjusted by PHF, Growth Factors.

Run Number	1	2	3	4	5	Avg
Vehs Entered	1325	1282	1294	1368	1319	1318
Vehs Exited	1244	1155	1208	1262	1269	1228
Starting Vehs	174	91	140	139	168	138
Ending Vehs	255	218	226	245	218	228
Travel Distance (mi)	525	498	510	537	527	520
Travel Time (hr)	54.4	41.7	54.6	51.6	59.4	52.3
Total Delay (hr)	35.9	24.3	36.7	32.7	40.9	34.1
Total Stops	2049	1586	2026	1810	2113	1918
Fuel Used (gal)	28.4	24.6	28.4	28.1	30.3	28.0

Interval #3 Information 3

Start Time 5:30
End Time 5:45
Total Time (min) 15
Volumes adjusted by Growth Factors, Anti PHF.

Run Number	1	2	3	4	5	Avg
Vehs Entered	1142	1141	1112	1186	1249	1164
Vehs Exited	1178	1219	1216	1239	1293	1228
Starting Vehs	255	218	226	245	218	228
Ending Vehs	219	140	122	192	174	170
Travel Distance (mi)	483	488	492	502	525	498
Travel Time (hr)	65.4	39.8	48.4	57.9	53.8	53.1
Total Delay (hr)	48.3	22.6	31.2	40.3	35.3	35.5
Total Stops	2081	1468	1649	1719	1895	1761
Fuel Used (gal)	30.4	24.4	26.4	29.0	29.1	27.8

Interval #4 Information 4

Start Time 5:45
End Time 6:00
Total Time (min) 15
Volumes adjusted by Growth Factors, Anti PHF.

Run Number	1	2	3	4	5	Avg
Vehs Entered	1146	1134	1166	1210	1157	1162
Vehs Exited	1174	1127	1125	1227	1177	1164
Starting Vehs	219	140	122	192	174	170
Ending Vehs	191	147	163	175	154	160
Travel Distance (mi)	475	463	472	504	479	479
Travel Time (hr)	62.5	35.9	35.7	47.5	39.9	44.3
Total Delay (hr)	45.6	19.5	19.2	29.8	23.1	27.4
Total Stops	1916	1329	1353	1595	1487	1536
Fuel Used (gal)	29.2	22.3	22.5	26.4	23.9	24.9

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Intersection: 1: Catawba Ave (WB) & Catawba Ave (EB)

Movement	EB	EB	EB	NW	NW
Directions Served	T	T	T	T	T
Maximum Queue (ft)	193	190	179	158	150
Average Queue (ft)	167	157	135	131	132
95th Queue (ft)	205	217	194	150	141
Link Distance (ft)	60	60	60	46	46
Upstream Blk Time (%)	47	46	33	43	48
Queuing Penalty (veh)	207	199	145	238	264
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 2: Catawba Ave (EB) & Catawba Ave (WB)

Movement	WB	WB	SB	SB
Directions Served	T	T	T	T
Maximum Queue (ft)	150	159	169	160
Average Queue (ft)	130	110	149	131
95th Queue (ft)	162	156	183	184
Link Distance (ft)	74	74	86	86
Upstream Blk Time (%)	22	22	48	33
Queuing Penalty (veh)	85	84	264	181
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 3: Statesville Rd (US 21)/Holiday Ln & Catawba Ave

Movement	EB	EB	EB	WB	WB	NB	NB	NB	SB	SB
Directions Served	L	T	R	L	TR	L	L	TR	L	TR
Maximum Queue (ft)	164	220	210	200	375	250	492	250	175	221
Average Queue (ft)	121	164	87	129	318	189	291	152	52	125
95th Queue (ft)	180	260	193	237	415	288	460	298	123	230
Link Distance (ft)		164	164		241		487			218
Upstream Blk Time (%)	5	23	2		31		1		0	6
Queuing Penalty (veh)	0	151	15		240		0		0	11
Storage Bay Dist (ft)	100			100		150		150	200	
Storage Blk Time (%)	46	24		14	45	8	51	3	0	9
Queuing Penalty (veh)	262	34		90	46	33	205	13	0	6

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Intersection: 4: Hill St/Burton Ln & Catawba Ave

Movement	EB	EB	WB	NB	SB	SB
Directions Served	L	TR	LTR	LTR	L	TR
Maximum Queue (ft)	70	160	526	154	74	102
Average Queue (ft)	19	10	167	44	22	55
95th Queue (ft)	57	79	488	142	68	118
Link Distance (ft)		241	526	466	90	90
Upstream Blk Time (%)		0	6		10	33
Queuing Penalty (veh)		1	0		4	12
Storage Bay Dist (ft)	50					
Storage Blk Time (%)	15	0				
Queuing Penalty (veh)	117	0				

Intersection: 5: Holiday Ln & Site Access #1

Movement	WB	SB
Directions Served	LR	LT
Maximum Queue (ft)	35	12
Average Queue (ft)	9	0
95th Queue (ft)	24	6
Link Distance (ft)	184	157
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 6: Holiday Ln & Site Access #2

Movement	WB	SB
Directions Served	LR	LT
Maximum Queue (ft)	97	45
Average Queue (ft)	42	8
95th Queue (ft)	78	41
Link Distance (ft)	97	76
Upstream Blk Time (%)	2	1
Queuing Penalty (veh)	0	1
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

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Intersection: 7: Burton Ln & Site Acess #3

Movement	EB	NB	SB
Directions Served	LR	LT	TR
Maximum Queue (ft)	122	18	32
Average Queue (ft)	58	1	3
95th Queue (ft)	124	9	21
Link Distance (ft)	103	90	267
Upstream Blk Time (%)	24		
Queuing Penalty (veh)	0		
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 11: Catawba Ave (EB) & I-77 SB Off-Ramp

Movement	EB	EB	EB	SB	SB
Directions Served	T	T	T	L	L
Maximum Queue (ft)	81	137	48	154	161
Average Queue (ft)	43	48	9	103	82
95th Queue (ft)	87	121	32	163	149
Link Distance (ft)	40	40	40	89	89
Upstream Blk Time (%)	30	25	2	16	9
Queuing Penalty (veh)	130	109	7	28	16
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 12: Catawba Ave/Catawba Ave (WB) & I-77 SB Off-Ramp

Movement	WB	WB	SB	SB
Directions Served	T	T	R	R
Maximum Queue (ft)	42	66	172	145
Average Queue (ft)	8	16	152	94
95th Queue (ft)	30	49	171	134
Link Distance (ft)	56	56	89	89
Upstream Blk Time (%)	0	1	37	9
Queuing Penalty (veh)	2	7	119	28
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

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Intersection: 14: Catawba Ave (EB) & I-77 NB On-Ramp

Movement	EB	EB
Directions Served	T	T
Maximum Queue (ft)	245	189
Average Queue (ft)	120	35
95th Queue (ft)	277	120
Link Distance (ft)	143	143
Upstream Blk Time (%)	11	1
Queuing Penalty (veh)	62	5
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 15: Catawba Ave

Movement	WB	WB	NE	NE
Directions Served	T	T	R	R
Maximum Queue (ft)	11	48	106	19
Average Queue (ft)	0	4	31	1
95th Queue (ft)	8	23	100	10
Link Distance (ft)	164	164	61	61
Upstream Blk Time (%)			11	0
Queuing Penalty (veh)			70	0
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 17: I-77 SB On-Ramp & Catawba Ave (WB)

Movement	WB	WB
Directions Served	LT	T
Maximum Queue (ft)	177	247
Average Queue (ft)	107	151
95th Queue (ft)	178	242
Link Distance (ft)	139	139
Upstream Blk Time (%)	2	11
Queuing Penalty (veh)	14	66
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

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Intersection: 18: I-77 NB On-Ramp

Movement	EB	WB
Directions Served	L	R
Maximum Queue (ft)	13	145
Average Queue (ft)	0	11
95th Queue (ft)	7	75
Link Distance (ft)	143	71
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 19: I-77 SB On-Ramp

Movement	SE
Directions Served	R
Maximum Queue (ft)	261
Average Queue (ft)	41
95th Queue (ft)	193
Link Distance (ft)	137
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 21: I-77 NB Off-Ramp & Catawba Ave (WB)

Movement	NB	NB	SW	SW
Directions Served	L	L	R	R
Maximum Queue (ft)	116	197	51	66
Average Queue (ft)	88	145	2	5
95th Queue (ft)	146	209	24	33
Link Distance (ft)	116	116	78	78
Upstream Blk Time (%)	1	15	0	0
Queuing Penalty (veh)	2	32	0	0
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

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Intersection: 22: I-77 NB Off-Ramp & Catawba Ave (EB)/Catawba Ave

Movement	EB	EB	NB
Directions Served	T	T	R
Maximum Queue (ft)	111	74	182
Average Queue (ft)	52	9	101
95th Queue (ft)	115	45	183
Link Distance (ft)	86	86	110
Upstream Blk Time (%)	12	1	14
Queuing Penalty (veh)	65	6	26
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 24: I-77 SB On-Ramp & Catawba Ave/Catawba Ave (EB)

Movement	EB	EB	EB
Directions Served	T	T	TR
Maximum Queue (ft)	114	190	172
Average Queue (ft)	91	132	66
95th Queue (ft)	149	237	180
Link Distance (ft)		115	115
Upstream Blk Time (%)	8	22	7
Queuing Penalty (veh)	0	178	57
Storage Bay Dist (ft)	50		
Storage Blk Time (%)	26	17	
Queuing Penalty (veh)	113	75	

Intersection: 26: Catawba Ave

Movement	EB	EB
Directions Served	T	T
Maximum Queue (ft)	601	548
Average Queue (ft)	230	166
95th Queue (ft)	647	579
Link Distance (ft)	578	578
Upstream Blk Time (%)	12	5
Queuing Penalty (veh)	0	0
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

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Intersection: 27: I-77 SB Off-Ramp

Movement	SB	SB	SB	SB
Directions Served	L	L	R	R
Maximum Queue (ft)	51	25	242	200
Average Queue (ft)	5	1	117	43
95th Queue (ft)	30	13	216	154
Link Distance (ft)			909	
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)	450	450		450
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 28: I-77 NB Off-Ramp

Movement	NB	NB
Directions Served	L	R
Maximum Queue (ft)	89	132
Average Queue (ft)	11	11
95th Queue (ft)	51	70
Link Distance (ft)	801	
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		500
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 29: Bend

Movement	NB
Directions Served	T
Maximum Queue (ft)	129
Average Queue (ft)	5
95th Queue (ft)	68
Link Distance (ft)	275
Upstream Blk Time (%)	0
Queuing Penalty (veh)	1
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

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Intersection: 30: Catawba Ave (WB)/Catawba Ave & I-77 NB On-Ramp

Movement	WB	WB
Directions Served	T	TR
Maximum Queue (ft)	103	108
Average Queue (ft)	24	29
95th Queue (ft)	74	94
Link Distance (ft)	59	59
Upstream Blk Time (%)	1	3
Queuing Penalty (veh)	8	17
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Network Summary

Network wide Queuing Penalty: 4148

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APPENDIX F-15:
CAPACITY ANALYSIS RESULTS

2030 NO-BUILD CONDITIONS
AM PEAK HOUR

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$VISION

$MOVEMI	TIMEINT	MOVEMENT		MOVEMENT DESCRIPTION	VEHDELAY(ALL)
AVG	900-4500	1-59: Catawba Avenue EB@219.3-17: Catawba Avenue EB@18.9		EB APPROACH	119.24
AVG	900-4500	1-10004@56.1-35: I-77 SB On-Ramp@2.9		EB RIGHT-TURN	132.46
AVG	900-4500	1-10052@41.8-35: I-77 SB On-Ramp@2.9		WB LEFT-TURN	15.84
AVG	900-4500	1-19: Catawba Avenue WB@483.1-6: Catawba Avenue WB@11.2		WB THRU	20.11
AVG	900-4500	1-34: I-77 SB Off-Ramp@288.2-17: Catawba Avenue EB@18.9		SB LEFT	11.75
AVG	900-4500	1-34: I-77 SB Off-Ramp@288.2-6: Catawba Avenue WB@11.2		SB RIGHT	14.42
AVG	900-4500		1	OVERALL	62.22
AVG	900-4500	2-17: Catawba Avenue EB@451.8-32: I-77 NB On-Ramp@3.3		EB LEFT-TURN	2.00
AVG	900-4500	2-17: Catawba Avenue EB@451.8-21: Catawba Avenue EB@8.9		EB THRU	18.39
AVG	900-4500	2-23: Catawba Avenue WB@292.6-19: Catawba Avenue WB@6.3		WB THRU	18.49
AVG	900-4500	2-10058@37.9-32: I-77 NB On-Ramp@3.3		WB RIGHT-TURN	7.37
AVG	900-4500	2-31: I-77 NB Off-Ramp@294.9-19: Catawba Avenue WB@6.3		NB LEFT-TURN	9.57
AVG	900-4500	2-31: I-77 NB Off-Ramp@294.9-21: Catawba Avenue EB@8.9		NB RIGHT-TURN	15.00
AVG	900-4500		2	OVERALL	13.80
AVG	900-4500	3-22: Catawba Avenue EB@133.1-23: Catawba Avenue WB@8.6		EB U-TURN	
AVG	900-4500	3-22: Catawba Avenue EB@133.1-45: Holiday Lane NB@13.9		EB LEFT-TURN	4.47
AVG	900-4500	3-22: Catawba Avenue EB@133.1-37: Catawba Avenue EB@57.6		EB THRU	3.70
AVG	900-4500	3-22: Catawba Avenue EB@133.1-41: US-21 SB@27.0		EB RIGHT-TURN	6.20
AVG	900-4500	3-39: Catawba Avenue WB@35.5-37: Catawba Avenue EB@57.6		WB U-TURN	
AVG	900-4500	3-39: Catawba Avenue WB@35.5-41: US-21 SB@27.0		WB LEFT-TURN	10.62
AVG	900-4500	3-39: Catawba Avenue WB@35.5-23: Catawba Avenue WB@8.6		WB THRU	6.24
AVG	900-4500	3-39: Catawba Avenue WB@35.5-45: Holiday Lane NB@13.9		WB RIGHT-TURN	3.37
AVG	900-4500	3-42: US-21 NB@138.6-41: US-21 SB@27.0		NB U-TURN	
AVG	900-4500	3-42: US-21 NB@138.6-23: Catawba Avenue WB@8.6		NB LEFT-TURN	7.45
AVG	900-4500	3-42: US-21 NB@138.6-45: Holiday Lane NB@13.9		NB THRU	6.25
AVG	900-4500	3-42: US-21 NB@138.6-37: Catawba Avenue EB@57.6		NB RIGHT-TURN	3.42
AVG	900-4500	3-44: Holiday Lane SB@124.1-45: Holiday Lane NB@13.9		SB U-TURN	
AVG	900-4500	3-44: Holiday Lane SB@124.1-37: Catawba Avenue EB@57.6		SB LEFT-TURN	21.50
AVG	900-4500	3-44: Holiday Lane SB@124.1-41: US-21 SB@27.0		SB THRU	21.04
AVG	900-4500	3-44: Holiday Lane SB@124.1-23: Catawba Avenue WB@8.6		SB RIGHT-TURN	10.83
AVG	900-4500		3	OVERALL	6.32
AVG	900-4500	4-37: Catawba Avenue EB@218.6-52: Burton Lane NB@5.3		EB LEFT-TURN	
AVG	900-4500	4-37: Catawba Avenue EB@218.6-46: Catawba Avenue EB@18.7		EB THRU	0.92
AVG	900-4500	4-37: Catawba Avenue EB@218.6-51: S Hill Street SB@20.3		EB RIGHT-TURN	0.87
AVG	900-4500	4-47: Catawba Avenue WB@497.1-51: S Hill Street SB@20.3		WB LEFT-TURN	5.35
AVG	900-4500	4-47: Catawba Avenue WB@497.1-38: Catawba Avenue WB@3.4		WB THRU	3.24
AVG	900-4500	4-47: Catawba Avenue WB@497.1-52: Burton Lane NB@5.3		WB RIGHT-TURN	2.47
AVG	900-4500	4-50: S Hill Street NB@768.4-38: Catawba Avenue WB@3.4		NB LEFT-TURN	15.96
AVG	900-4500	4-50: S Hill Street NB@768.4-52: Burton Lane NB@5.3		NB THRU	
AVG	900-4500	4-50: S Hill Street NB@768.4-46: Catawba Avenue EB@18.7		NB RIGHT-TURN	8.92
AVG	900-4500	4-53: Burton Lane SB@895.9-46: Catawba Avenue EB@18.7		SB LEFT-TURN	
AVG	900-4500	4-53: Burton Lane SB@895.9-51: S Hill Street SB@20.3		SB THRU	
AVG	900-4500	4-53: Burton Lane SB@895.9-38: Catawba Avenue WB@3.4		SB RIGHT-TURN	6.56
AVG	900-4500		4	OVERALL	2.12

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$VISION

$MOVEM	TIMEINT	MOVEMENT		MOVEMENT DESCRIPTION	QLENMAX	VEHS(ALL)
AVG	900-4500	1-59: Catawba Avenue EB@219.3-17: Catawba Avenue EB@18.9		EB APPROACH	1615	1335
AVG	900-4500	1-10004@56.1-35: I-77 SB On-Ramp@2.9		EB RIGHT-TURN	1561.46	584
AVG	900-4500	1-10052@41.8-35: I-77 SB On-Ramp@2.9		WB LEFT-TURN	525.97	188
AVG	900-4500	1-19: Catawba Avenue WB@483.1-6: Catawba Avenue WB@11.2		WB THRU	513.39	1278
AVG	900-4500	1-34: I-77 SB Off-Ramp@288.2-17: Catawba Avenue EB@18.9		SB LEFT	195.13	494
AVG	900-4500	1-34: I-77 SB Off-Ramp@288.2-6: Catawba Avenue WB@11.2		SB RIGHT	224.4	615
AVG	900-4500		1	OVERALL	1620.34	4493
AVG	900-4500	2-17: Catawba Avenue EB@451.8-32: I-77 NB On-Ramp@3.3		EB LEFT-TURN	449.17	485
AVG	900-4500	2-17: Catawba Avenue EB@451.8-21: Catawba Avenue EB@8.9		EB THRU	449.17	1346
AVG	900-4500	2-23: Catawba Avenue WB@292.6-19: Catawba Avenue WB@6.3		WB THRU	254.2	835
AVG	900-4500	2-10058@37.9-32: I-77 NB On-Ramp@3.3		WB RIGHT-TURN	149.55	310
AVG	900-4500	2-31: I-77 NB Off-Ramp@294.9-19: Catawba Avenue WB@6.3		NB LEFT-TURN	165.95	629
AVG	900-4500	2-31: I-77 NB Off-Ramp@294.9-21: Catawba Avenue EB@8.9		NB RIGHT-TURN	165.95	204
AVG	900-4500		2	OVERALL	449.17	3810
AVG	900-4500	3-22: Catawba Avenue EB@133.1-23: Catawba Avenue WB@8.6		EB U-TURN	157.78	0
AVG	900-4500	3-22: Catawba Avenue EB@133.1-45: Holiday Lane NB@13.9		EB LEFT-TURN	157.78	72
AVG	900-4500	3-22: Catawba Avenue EB@133.1-37: Catawba Avenue EB@57.6		EB THRU	157.78	666
AVG	900-4500	3-22: Catawba Avenue EB@133.1-41: US-21 SB@27.0		EB RIGHT-TURN	180.26	813
AVG	900-4500	3-39: Catawba Avenue WB@35.5-37: Catawba Avenue EB@57.6		WB U-TURN	200.17	0
AVG	900-4500	3-39: Catawba Avenue WB@35.5-41: US-21 SB@27.0		WB LEFT-TURN	200.17	155
AVG	900-4500	3-39: Catawba Avenue WB@35.5-23: Catawba Avenue WB@8.6		WB THRU	200.17	571
AVG	900-4500	3-39: Catawba Avenue WB@35.5-45: Holiday Lane NB@13.9		WB RIGHT-TURN	200.17	8
AVG	900-4500	3-42: US-21 NB@138.6-41: US-21 SB@27.0		NB U-TURN	94.6	0
AVG	900-4500	3-42: US-21 NB@138.6-23: Catawba Avenue WB@8.6		NB LEFT-TURN	94.6	498
AVG	900-4500	3-42: US-21 NB@138.6-45: Holiday Lane NB@13.9		NB THRU	94.6	10
AVG	900-4500	3-42: US-21 NB@138.6-37: Catawba Avenue EB@57.6		NB RIGHT-TURN	115.32	116
AVG	900-4500	3-44: Holiday Lane SB@124.1-45: Holiday Lane NB@13.9		SB U-TURN	125.87	0
AVG	900-4500	3-44: Holiday Lane SB@124.1-37: Catawba Avenue EB@57.6		SB LEFT-TURN	125.87	23
AVG	900-4500	3-44: Holiday Lane SB@124.1-41: US-21 SB@27.0		SB THRU	125.87	28
AVG	900-4500	3-44: Holiday Lane SB@124.1-23: Catawba Avenue WB@8.6		SB RIGHT-TURN	125.87	79
AVG	900-4500		3	OVERALL	238.77	3038
AVG	900-4500	4-37: Catawba Avenue EB@218.6-52: Burton Lane NB@5.3		EB LEFT-TURN	87.85	0
AVG	900-4500	4-37: Catawba Avenue EB@218.6-46: Catawba Avenue EB@18.7		EB THRU	64.08	796
AVG	900-4500	4-37: Catawba Avenue EB@218.6-51: S Hill Street SB@20.3		EB RIGHT-TURN	64.08	9
AVG	900-4500	4-47: Catawba Avenue WB@497.1-51: S Hill Street SB@20.3		WB LEFT-TURN	131.48	1
AVG	900-4500	4-47: Catawba Avenue WB@497.1-38: Catawba Avenue WB@3.4		WB THRU	87.75	724
AVG	900-4500	4-47: Catawba Avenue WB@497.1-52: Burton Lane NB@5.3		WB RIGHT-TURN	87.75	1
AVG	900-4500	4-50: S Hill Street NB@768.4-38: Catawba Avenue WB@3.4		NB LEFT-TURN	43.69	7
AVG	900-4500	4-50: S Hill Street NB@768.4-52: Burton Lane NB@5.3		NB THRU	43.06	0
AVG	900-4500	4-50: S Hill Street NB@768.4-46: Catawba Avenue EB@18.7		NB RIGHT-TURN	42.26	6
AVG	900-4500	4-53: Burton Lane SB@895.9-46: Catawba Avenue EB@18.7		SB LEFT-TURN	35.91	0
AVG	900-4500	4-53: Burton Lane SB@895.9-51: S Hill Street SB@20.3		SB THRU	36.13	0
AVG	900-4500	4-53: Burton Lane SB@895.9-38: Catawba Avenue WB@3.4		SB RIGHT-TURN	40.42	2
AVG	900-4500		4	OVERALL	137.49	1547

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APPENDIX F-16:
CAPACITY ANALYSIS RESULTS

2030 NO-BUILD CONDITIONS
PM PEAK HOUR

DRAFT

$VISION

$MOVEN	TIMEINT	MOVEMENT		MOVEMENT DESCRIPTION	VEHDELAY(ALL)
AVG	900-4500	1-59: Catawba Avenue EB@219.3-17: Catawba Avenue EB@18.9		EB THRU	106.56
AVG	900-4500	1-10004@56.1-35: I-77 SB On-Ramp@2.9		EB RIGHT-TURN	117.8
AVG	900-4500	1-10052@41.8-35: I-77 SB On-Ramp@2.9		WB LEFT-TURN	20.18
AVG	900-4500	1-19: Catawba Avenue WB@483.1-6: Catawba Avenue WB@11.2		WB THRU	25.71
AVG	900-4500	1-34: I-77 SB Off-Ramp@288.2-17: Catawba Avenue EB@18.9		SB LEFT	12.7
AVG	900-4500	1-34: I-77 SB Off-Ramp@288.2-6: Catawba Avenue WB@11.2		SB RIGHT	11.5
AVG	900-4500		1	OVERALL	58.98
AVG	900-4500	2-17: Catawba Avenue EB@451.8-32: I-77 NB On-Ramp@3.3		EB LEFT-TURN	2.86
AVG	900-4500	2-17: Catawba Avenue EB@451.8-21: Catawba Avenue EB@8.9		EB THRU	22.44
AVG	900-4500	2-23: Catawba Avenue WB@292.6-19: Catawba Avenue WB@6.3		WB THRU	20.3
AVG	900-4500	2-10058@37.9-32: I-77 NB On-Ramp@3.3		WB RIGHT-TURN	20.77
AVG	900-4500	2-31: I-77 NB Off-Ramp@294.9-19: Catawba Avenue WB@6.3		NB LEFT-TURN	12.37
AVG	900-4500	2-31: I-77 NB Off-Ramp@294.9-21: Catawba Avenue EB@8.9		NB RIGHT-TURN	13.39
AVG	900-4500		2	OVERALL	16.84
AVG	900-4500	3-22: Catawba Avenue EB@133.1-23: Catawba Avenue WB@8.6		EB U-TURN	
AVG	900-4500	3-22: Catawba Avenue EB@133.1-45: Holiday Lane NB@13.9		EB LEFT-TURN	5.86
AVG	900-4500	3-22: Catawba Avenue EB@133.1-37: Catawba Avenue EB@57.6		EB THRU	4.11
AVG	900-4500	3-22: Catawba Avenue EB@133.1-41: US-21 SB@27.0		EB RIGHT-TURN	4.1
AVG	900-4500	3-39: Catawba Avenue WB@35.5-37: Catawba Avenue EB@57.6		WB U-TURN	
AVG	900-4500	3-39: Catawba Avenue WB@35.5-41: US-21 SB@27.0		WB LEFT-TURN	22.67
AVG	900-4500	3-39: Catawba Avenue WB@35.5-23: Catawba Avenue WB@8.6		WB THRU	13.79
AVG	900-4500	3-39: Catawba Avenue WB@35.5-45: Holiday Lane NB@13.9		WB RIGHT-TURN	7.84
AVG	900-4500	3-42: US-21 NB@138.6-41: US-21 SB@27.0		NB U-TURN	
AVG	900-4500	3-42: US-21 NB@138.6-23: Catawba Avenue WB@8.6		NB LEFT-TURN	15.26
AVG	900-4500	3-42: US-21 NB@138.6-45: Holiday Lane NB@13.9		NB THRU	14.28
AVG	900-4500	3-42: US-21 NB@138.6-37: Catawba Avenue EB@57.6		NB RIGHT-TURN	7.05
AVG	900-4500	3-44: Holiday Lane SB@124.1-45: Holiday Lane NB@13.9		SB U-TURN	
AVG	900-4500	3-44: Holiday Lane SB@124.1-37: Catawba Avenue EB@57.6		SB LEFT-TURN	107.3
AVG	900-4500	3-44: Holiday Lane SB@124.1-41: US-21 SB@27.0		SB THRU	94.94
AVG	900-4500	3-44: Holiday Lane SB@124.1-23: Catawba Avenue WB@8.6		SB RIGHT-TURN	85.8
AVG	900-4500		3	OVERALL	12.87
AVG	900-4500	4-37: Catawba Avenue EB@200.2-52: Burton Lane NB@11.1		EB LEFT-TURN	13.57
AVG	900-4500	4-37: Catawba Avenue EB@200.2-46: Catawba Avenue EB@35.0		EB THRU	1.46
AVG	900-4500	4-37: Catawba Avenue EB@200.2-51: S Hill Street SB@21.8		EB RIGHT-TURN	1.02
AVG	900-4500	4-47: Catawba Avenue WB@481.1-51: S Hill Street SB@21.8		WB LEFT-TURN	25.6
AVG	900-4500	4-47: Catawba Avenue WB@481.1-38: Catawba Avenue WB@24.1		WB THRU	23.59
AVG	900-4500	4-47: Catawba Avenue WB@481.1-52: Burton Lane NB@11.1		WB RIGHT-TURN	18.99
AVG	900-4500	4-50: S Hill Street NB@767.5-38: Catawba Avenue WB@24.1		NB LEFT-TURN	57.82
AVG	900-4500	4-50: S Hill Street NB@767.5-52: Burton Lane NB@11.1		NB THRU	
AVG	900-4500	4-50: S Hill Street NB@767.5-46: Catawba Avenue EB@35.0		NB RIGHT-TURN	13.2
AVG	900-4500	4-53: Burton Lane SB@893.4-46: Catawba Avenue EB@35.0		SB LEFT-TURN	11.76
AVG	900-4500	4-53: Burton Lane SB@893.4-51: S Hill Street SB@21.8		SB THRU	
AVG	900-4500	4-53: Burton Lane SB@893.4-38: Catawba Avenue WB@24.1		SB RIGHT-TURN	13.42
AVG	900-4500		4	OVERALL	11.62

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$VISION

$MOVEM	TIMEINT	MOVEMENT	MOVEMENT DESCRIPTION	QLENMAX	VEHS(ALL)
AVG	900-4500	1-59: Catawba Avenue EB@219.3-17: Catawba Avenue EB@18.9	EB APPROACH	1627.08	1505
AVG	900-4500	1-10004@56.1-35: I-77 SB On-Ramp@2.9	EB RIGHT-TURN	1663.11	567
AVG	900-4500	1-10052@41.8-35: I-77 SB On-Ramp@2.9	WB LEFT-TURN	575.08	406
AVG	900-4500	1-19: Catawba Avenue WB@483.1-6: Catawba Avenue WB@11.2	WB THRU	562.49	1282
AVG	900-4500	1-34: I-77 SB Off-Ramp@288.2-17: Catawba Avenue EB@18.9	SB LEFT	181.94	498
AVG	900-4500	1-34: I-77 SB Off-Ramp@288.2-6: Catawba Avenue WB@11.2	SB RIGHT	208.98	493
AVG	900-4500		1 OVERALL	1663.11	4751
AVG	900-4500	2-17: Catawba Avenue EB@451.8-32: I-77 NB On-Ramp@3.3	EB LEFT-TURN	424.48	665
AVG	900-4500	2-17: Catawba Avenue EB@451.8-21: Catawba Avenue EB@8.9	EB THRU	424.48	1337
AVG	900-4500	2-23: Catawba Avenue WB@292.6-19: Catawba Avenue WB@6.3	WB THRU	351	1082
AVG	900-4500	2-10058@37.9-32: I-77 NB On-Ramp@3.3	WB RIGHT-TURN	340.87	409
AVG	900-4500	2-31: I-77 NB Off-Ramp@294.9-19: Catawba Avenue WB@6.3	NB LEFT-TURN	170.11	606
AVG	900-4500	2-31: I-77 NB Off-Ramp@294.9-21: Catawba Avenue EB@8.9	NB RIGHT-TURN	170.11	256
AVG	900-4500		2 OVERALL	446.15	4356
AVG	900-4500	3-22: Catawba Avenue EB@133.1-23: Catawba Avenue WB@8.6	EB U-TURN	143.53	0
AVG	900-4500	3-22: Catawba Avenue EB@133.1-45: Holiday Lane NB@13.9	EB LEFT-TURN	143.53	162
AVG	900-4500	3-22: Catawba Avenue EB@133.1-37: Catawba Avenue EB@57.6	EB THRU	143.53	850
AVG	900-4500	3-22: Catawba Avenue EB@133.1-41: US-21 SB@27.0	EB RIGHT-TURN	145.01	582
AVG	900-4500	3-39: Catawba Avenue WB@35.5-37: Catawba Avenue EB@57.6	WB U-TURN	332.64	0
AVG	900-4500	3-39: Catawba Avenue WB@35.5-41: US-21 SB@27.0	WB LEFT-TURN	332.64	112
AVG	900-4500	3-39: Catawba Avenue WB@35.5-23: Catawba Avenue WB@8.6	WB THRU	332.64	767
AVG	900-4500	3-39: Catawba Avenue WB@35.5-45: Holiday Lane NB@13.9	WB RIGHT-TURN	332.64	27
AVG	900-4500	3-42: US-21 NB@138.6-41: US-21 SB@27.0	NB U-TURN	259.05	0
AVG	900-4500	3-42: US-21 NB@138.6-23: Catawba Avenue WB@8.6	NB LEFT-TURN	259.05	629
AVG	900-4500	3-42: US-21 NB@138.6-45: Holiday Lane NB@13.9	NB THRU	259.05	31
AVG	900-4500	3-42: US-21 NB@138.6-37: Catawba Avenue EB@57.6	NB RIGHT-TURN	300.28	223
AVG	900-4500	3-44: Holiday Lane SB@124.1-45: Holiday Lane NB@13.9	SB U-TURN	336.81	0
AVG	900-4500	3-44: Holiday Lane SB@124.1-37: Catawba Avenue EB@57.6	SB LEFT-TURN	336.81	26
AVG	900-4500	3-44: Holiday Lane SB@124.1-41: US-21 SB@27.0	SB THRU	336.81	25
AVG	900-4500	3-44: Holiday Lane SB@124.1-23: Catawba Avenue WB@8.6	SB RIGHT-TURN	336.81	98
AVG	900-4500		3 OVERALL	467.32	3530
AVG	900-4500	4-37: Catawba Avenue EB@200.2-52: Burton Lane NB@11.1	EB LEFT-TURN	113.42	3
AVG	900-4500	4-37: Catawba Avenue EB@200.2-46: Catawba Avenue EB@35.0	EB THRU	75.89	1079
AVG	900-4500	4-37: Catawba Avenue EB@200.2-51: S Hill Street SB@21.8	EB RIGHT-TURN	75.89	16
AVG	900-4500	4-47: Catawba Avenue WB@481.1-51: S Hill Street SB@21.8	WB LEFT-TURN	806.3	1
AVG	900-4500	4-47: Catawba Avenue WB@481.1-38: Catawba Avenue WB@24.1	WB THRU	743.57	897
AVG	900-4500	4-47: Catawba Avenue WB@481.1-52: Burton Lane NB@11.1	WB RIGHT-TURN	743.57	6
AVG	900-4500	4-50: S Hill Street NB@767.5-38: Catawba Avenue WB@24.1	NB LEFT-TURN	44.96	6
AVG	900-4500	4-50: S Hill Street NB@767.5-52: Burton Lane NB@11.1	NB THRU	44.32	0
AVG	900-4500	4-50: S Hill Street NB@767.5-46: Catawba Avenue EB@35.0	NB RIGHT-TURN	43.52	3
AVG	900-4500	4-53: Burton Lane SB@893.4-46: Catawba Avenue EB@35.0	SB LEFT-TURN	39.06	2
AVG	900-4500	4-53: Burton Lane SB@893.4-51: S Hill Street SB@21.8	SB THRU	39.28	0
AVG	900-4500	4-53: Burton Lane SB@893.4-38: Catawba Avenue WB@24.1	SB RIGHT-TURN	43.57	3
AVG	900-4500		4 OVERALL	806.3	2016

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APPENDIX F-17:
CAPACITY ANALYSIS RESULTS

2030 BUILD CONDITIONS
AM PEAK HOUR

DRAFT

$VISION

$MOVEM	TIMEINT	MOVEMENT		MOVEMENT DESCRIPTION	VEHS(ALL)	VEHDELAY(ALL)
AVG	900-4500	1-59: Catawba Avenue EB@219.3-17: Catawba Avenue EB@18.9		EB APPROACH	1466	136.1
AVG	900-4500	1-10004@56.1-35: I-77 SB On-Ramp@2.9		EB RIGHT-TURN	552	152.78
AVG	900-4500	1-10052@41.8-35: I-77 SB On-Ramp@2.9		WB LEFT-TURN	430	13.14
AVG	900-4500	1-19: Catawba Avenue WB@483.1-6: Catawba Avenue WB@11.2		WB THRU	1299	18.09
AVG	900-4500	1-34: I-77 SB Off-Ramp@288.2-17: Catawba Avenue EB@18.9		SB LEFT	507	11.95
AVG	900-4500	1-34: I-77 SB Off-Ramp@288.2-6: Catawba Avenue WB@11.2		SB RIGHT	500	13.07
AVG	900-4500		1	OVERALL	4753	68.48
AVG	900-4500	2-17: Catawba Avenue EB@451.8-32: I-77 NB On-Ramp@3.3		EB LEFT-TURN	653	2.79
AVG	900-4500	2-17: Catawba Avenue EB@451.8-21: Catawba Avenue EB@8.9		EB THRU	1319	18.93
AVG	900-4500	2-23: Catawba Avenue WB@292.6-19: Catawba Avenue WB@6.3		WB THRU	1113	21.18
AVG	900-4500	2-10058@37.9-32: I-77 NB On-Ramp@3.3		WB RIGHT-TURN	427	20.06
AVG	900-4500	2-31: I-77 NB Off-Ramp@294.9-19: Catawba Avenue WB@6.3		NB LEFT-TURN	619	10.61
AVG	900-4500	2-31: I-77 NB Off-Ramp@294.9-21: Catawba Avenue EB@8.9		NB RIGHT-TURN	262	15.25
AVG	900-4500		2	OVERALL	4393	15.82
AVG	900-4500	3-22: Catawba Avenue EB@133.4-23: Catawba Avenue WB@8.3		EB U-TURN	0	
AVG	900-4500	3-22: Catawba Avenue EB@133.4-45: Holiday Lane NB@14.0		EB LEFT-TURN	204	6.66
AVG	900-4500	3-22: Catawba Avenue EB@133.4-37: Catawba Avenue EB@58.0		EB THRU	798	4.47
AVG	900-4500	3-22: Catawba Avenue EB@133.4-41: US-21 SB@27.0		EB RIGHT-TURN	580	3.87
AVG	900-4500	3-39: Catawba Avenue WB@35.2-37: Catawba Avenue EB@58.0		WB U-TURN	0	
AVG	900-4500	3-39: Catawba Avenue WB@35.2-41: US-21 SB@27.0		WB LEFT-TURN	113	28
AVG	900-4500	3-39: Catawba Avenue WB@35.2-23: Catawba Avenue WB@8.3		WB THRU	786	16.51
AVG	900-4500	3-39: Catawba Avenue WB@35.2-45: Holiday Lane NB@14.0		WB RIGHT-TURN	27	9.18
AVG	900-4500	3-42: US-21 NB@138.6-41: US-21 SB@27.0		NB U-TURN	0	
AVG	900-4500	3-42: US-21 NB@138.6-23: Catawba Avenue WB@8.3		NB LEFT-TURN	635	19.74
AVG	900-4500	3-42: US-21 NB@138.6-45: Holiday Lane NB@14.0		NB THRU	32	19.94
AVG	900-4500	3-42: US-21 NB@138.6-37: Catawba Avenue EB@58.0		NB RIGHT-TURN	225	7.55
AVG	900-4500	3-44: Holiday Lane SB@124.1-45: Holiday Lane NB@14.0		SB U-TURN	0	
AVG	900-4500	3-44: Holiday Lane SB@124.1-37: Catawba Avenue EB@58.0		SB LEFT-TURN	53	133.96
AVG	900-4500	3-44: Holiday Lane SB@124.1-41: US-21 SB@27.0		SB THRU	24	132.14
AVG	900-4500	3-44: Holiday Lane SB@124.1-23: Catawba Avenue WB@8.3		SB RIGHT-TURN	117	113.22
AVG	900-4500		3	OVERALL	3594	17.16
AVG	900-4500	4-37: Catawba Avenue EB@200.7-52: Burton Lane NB@11.3		EB LEFT-TURN	3	15.2
AVG	900-4500	4-37: Catawba Avenue EB@200.7-46: Catawba Avenue EB@35.5		EB THRU	1058	1.47
AVG	900-4500	4-37: Catawba Avenue EB@200.7-51: S Hill Street SB@21.6		EB RIGHT-TURN	15	1.25
AVG	900-4500	4-47: Catawba Avenue WB@480.6-51: S Hill Street SB@21.6		WB LEFT-TURN	1	49.31
AVG	900-4500	4-47: Catawba Avenue WB@480.6-38: Catawba Avenue WB@23.6		WB THRU	866	63.05
AVG	900-4500	4-47: Catawba Avenue WB@480.6-52: Burton Lane NB@11.3		WB RIGHT-TURN	41	60.36
AVG	900-4500	4-50: S Hill Street NB@767.7-38: Catawba Avenue WB@23.6		NB LEFT-TURN	6	64.3
AVG	900-4500	4-50: S Hill Street NB@767.7-52: Burton Lane NB@11.3		NB THRU	0	
AVG	900-4500	4-50: S Hill Street NB@767.7-46: Catawba Avenue EB@35.5		NB RIGHT-TURN	3	12.72
AVG	900-4500	4-53: Burton Lane SB@893.2-46: Catawba Avenue EB@35.5		SB LEFT-TURN	13	21.01
AVG	900-4500	4-53: Burton Lane SB@893.2-51: S Hill Street SB@21.6		SB THRU	0	
AVG	900-4500	4-53: Burton Lane SB@893.2-38: Catawba Avenue WB@23.6		SB RIGHT-TURN	57	16.93
AVG	900-4500		4	OVERALL	2064	29.26
AVG	900-4500	5-101: Site Access 1 WB@180.8-43: Holiday Lane SB@579.4		WB LEFT-TURN	25	25.98
AVG	900-4500	5-101: Site Access 1 WB@180.8-45: Holiday Lane NB@410.0		WB RIGHT-TURN	0	
AVG	900-4500	5-43: Holiday Lane SB@512.5-201: Site Access 1 EB@18.7		SB LEFT-TURN	0	
AVG	900-4500	5-43: Holiday Lane SB@512.5-43: Holiday Lane SB@579.4		SB THRU	108	13.29
AVG	900-4500	5-45: Holiday Lane NB@342.9-45: Holiday Lane NB@410.0		NB THRU	154	0.09
AVG	900-4500	5-45: Holiday Lane NB@342.9-201: Site Access 1 EB@18.7		NB RIGHT-TURN	22	0.51
AVG	900-4500		5	OVERALL	309	6.93
AVG	900-4500	6-102: Site Access 2 WB@186.5-10066@24.8		WB LEFT-TURN	64	349.09
AVG	900-4500	6-102: Site Access 2 WB@186.5-45: Holiday Lane NB@233.8		WB RIGHT-TURN	0	
AVG	900-4500	6-45: Holiday Lane NB@165.6-45: Holiday Lane NB@233.8		NB THRU	176	1.7
AVG	900-4500	6-45: Holiday Lane NB@165.6-202: Site Access 2 EB@14.3		NB RIGHT-TURN	87	1.06
AVG	900-4500	6-43: Holiday Lane SB@692.0-202: Site Access 2 EB@14.3		SB LEFT-TURN	0	
AVG	900-4500	6-43: Holiday Lane SB@692.0-10066@24.8		SB THRU	132	73.57
AVG	900-4500		6	OVERALL	459	67.81
AVG	900-4500	7-103: Site Access 3 EB@179.5-52: Burton Lane NB@97.0		EB LEFT-TURN	0	
AVG	900-4500	7-103: Site Access 3 EB@179.5-53: Burton Lane SB@853.6		EB RIGHT-TURN	68	6.99
AVG	900-4500	7-52: Burton Lane NB@43.8-203: Site Access 3 WB@20.9		NB LEFT-TURN	41	0.24
AVG	900-4500	7-52: Burton Lane NB@43.8-52: Burton Lane NB@97.0		NB THRU	4	0.25
AVG	900-4500	7-53: Burton Lane SB@800.2-53: Burton Lane SB@853.6		SB THRU	2	0.3
AVG	900-4500	7-53: Burton Lane SB@800.2-203: Site Access 3 WB@20.9		SB RIGHT-TURN	0	
AVG	900-4500		7	OVERALL	115	4.24

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$MOVEM	TIMEINT	MOVEMENT		MOVEMENT DESCRIPTION	QLENMAX	VEHS(ALL)
AVG	900-4500	1-59: Catawba Avenue EB@219.3-17: Catawba Avenue EB@18.9		EB APPROACH	1612.73	1328
AVG	900-4500	1-10004@56.1-35: I-77 SB On-Ramp@2.9		EB RIGHT-TURN	1620.52	578
AVG	900-4500	1-10052@41.8-35: I-77 SB On-Ramp@2.9		WB LEFT-TURN	544.9	212
AVG	900-4500	1-19: Catawba Avenue WB@483.1-6: Catawba Avenue WB@11.2		WB THRU	532.31	1307
AVG	900-4500	1-34: I-77 SB Off-Ramp@288.2-17: Catawba Avenue EB@18.9		SB LEFT	193.36	502
AVG	900-4500	1-34: I-77 SB Off-Ramp@288.2-6: Catawba Avenue WB@11.2		SB RIGHT	222.98	616
AVG	900-4500		1	OVERALL	1621.96	4542
AVG	900-4500	2-17: Catawba Avenue EB@451.8-32: I-77 NB On-Ramp@3.3		EB LEFT-TURN	459.17	481
AVG	900-4500	2-17: Catawba Avenue EB@451.8-21: Catawba Avenue EB@8.9		EB THRU	459.17	1350
AVG	900-4500	2-23: Catawba Avenue WB@292.6-19: Catawba Avenue WB@6.3		WB THRU	294.31	891
AVG	900-4500	2-10058@37.9-32: I-77 NB On-Ramp@3.3		WB RIGHT-TURN	169.45	333
AVG	900-4500	2-31: I-77 NB Off-Ramp@294.9-19: Catawba Avenue WB@6.3		NB LEFT-TURN	145.23	628
AVG	900-4500	2-31: I-77 NB Off-Ramp@294.9-21: Catawba Avenue EB@8.9		NB RIGHT-TURN	145.23	212
AVG	900-4500		2	OVERALL	464.08	3894
AVG	900-4500	3-22: Catawba Avenue EB@134.3-23: Catawba Avenue WB@7.4		EB U-TURN	160.43	0
AVG	900-4500	3-22: Catawba Avenue EB@134.3-45: Holiday Lane NB@14.2		EB LEFT-TURN	160.43	93
AVG	900-4500	3-22: Catawba Avenue EB@134.3-37: Catawba Avenue EB@58.9		EB THRU	160.43	660
AVG	900-4500	3-22: Catawba Avenue EB@134.3-41: US-21 SB@26.8		EB RIGHT-TURN	181.98	808
AVG	900-4500	3-39: Catawba Avenue WB@34.3-37: Catawba Avenue EB@58.9		WB U-TURN	210.4	0
AVG	900-4500	3-39: Catawba Avenue WB@34.3-41: US-21 SB@26.8		WB LEFT-TURN	210.4	162
AVG	900-4500	3-39: Catawba Avenue WB@34.3-23: Catawba Avenue WB@7.4		WB THRU	210.4	615
AVG	900-4500	3-39: Catawba Avenue WB@34.3-45: Holiday Lane NB@14.2		WB RIGHT-TURN	210.4	8
AVG	900-4500	3-42: US-21 NB@138.9-41: US-21 SB@26.8		NB U-TURN	92.78	0
AVG	900-4500	3-42: US-21 NB@138.9-23: Catawba Avenue WB@7.4		NB LEFT-TURN	92.78	498
AVG	900-4500	3-42: US-21 NB@138.9-45: Holiday Lane NB@14.2		NB THRU	92.78	12
AVG	900-4500	3-42: US-21 NB@138.9-37: Catawba Avenue EB@58.9		NB RIGHT-TURN	132.83	116
AVG	900-4500	3-44: Holiday Lane SB@123.8-45: Holiday Lane NB@14.2		SB U-TURN	237.3	0
AVG	900-4500	3-44: Holiday Lane SB@123.8-37: Catawba Avenue EB@58.9		SB LEFT-TURN	237.3	61
AVG	900-4500	3-44: Holiday Lane SB@123.8-41: US-21 SB@26.8		SB THRU	237.3	29
AVG	900-4500	3-44: Holiday Lane SB@123.8-23: Catawba Avenue WB@7.4		SB RIGHT-TURN	237.3	111
AVG	900-4500		3	OVERALL	258.84	3173
AVG	900-4500	4-37: Catawba Avenue EB@218.6-52: Burton Lane NB@5.3		EB LEFT-TURN	103.32	3
AVG	900-4500	4-37: Catawba Avenue EB@218.6-46: Catawba Avenue EB@18.7		EB THRU	79.55	826
AVG	900-4500	4-37: Catawba Avenue EB@218.6-51: S Hill Street SB@20.3		EB RIGHT-TURN	79.55	9
AVG	900-4500	4-47: Catawba Avenue WB@497.1-51: S Hill Street SB@20.3		WB LEFT-TURN	142.28	1
AVG	900-4500	4-47: Catawba Avenue WB@497.1-38: Catawba Avenue WB@3.4		WB THRU	95.59	725
AVG	900-4500	4-47: Catawba Avenue WB@497.1-52: Burton Lane NB@5.3		WB RIGHT-TURN	95.59	7
AVG	900-4500	4-50: S Hill Street NB@768.4-38: Catawba Avenue WB@3.4		NB LEFT-TURN	46.59	7
AVG	900-4500	4-50: S Hill Street NB@768.4-52: Burton Lane NB@5.3		NB THRU	45.96	0
AVG	900-4500	4-50: S Hill Street NB@768.4-46: Catawba Avenue EB@18.7		NB RIGHT-TURN	45.16	6
AVG	900-4500	4-53: Burton Lane SB@895.9-46: Catawba Avenue EB@18.7		SB LEFT-TURN	64.23	11
AVG	900-4500	4-53: Burton Lane SB@895.9-51: S Hill Street SB@20.3		SB THRU	64.45	0
AVG	900-4500	4-53: Burton Lane SB@895.9-38: Catawba Avenue WB@3.4		SB RIGHT-TURN	68.65	54
AVG	900-4500		4	OVERALL	145.5	1646
AVG	900-4500	5-101: Site Access 1 WB@185.7-43: Holiday Lane SB@576.3		WB LEFT-TURN	46.06	21
AVG	900-4500	5-101: Site Access 1 WB@185.7-45: Holiday Lane NB@413.0		WB RIGHT-TURN	47.37	0
AVG	900-4500	5-45: Holiday Lane NB@345.9-45: Holiday Lane NB@413.0		NB THRU	0	28
AVG	900-4500	5-45: Holiday Lane NB@345.9-201: Site Access 1 EB@13.8		NB RIGHT-TURN	0	21
AVG	900-4500	5-43: Holiday Lane SB@509.4-201: Site Access 1 EB@13.8		SB LEFT-TURN	30.86	0
AVG	900-4500	5-43: Holiday Lane SB@509.4-43: Holiday Lane SB@576.3		SB THRU	26.91	103
AVG	900-4500		5	OVERALL	67.6	173
AVG	900-4500	6-102: Site Access 2 WB@191.4-10066@21.1		WB LEFT-TURN	89.93	77
AVG	900-4500	6-102: Site Access 2 WB@191.4-45: Holiday Lane NB@237.5		WB RIGHT-TURN	88.3	0
AVG	900-4500	6-45: Holiday Lane NB@169.3-45: Holiday Lane NB@237.5		NB THRU	9.24	49
AVG	900-4500	6-45: Holiday Lane NB@169.3-202: Site Access 2 EB@9.4		NB RIGHT-TURN	9.24	65
AVG	900-4500	6-43: Holiday Lane SB@688.3-202: Site Access 2 EB@9.4		SB LEFT-TURN	56.63	0
AVG	900-4500	6-43: Holiday Lane SB@688.3-10066@21.1		SB THRU	30.53	124
AVG	900-4500		6	OVERALL	96.39	315
AVG	900-4500	7-103: Site Access 3 EB@175.0-52: Burton Lane NB@99.8		EB LEFT-TURN	64.75	0
AVG	900-4500	7-103: Site Access 3 EB@175.0-53: Burton Lane SB@850.7		EB RIGHT-TURN	64.02	63
AVG	900-4500	7-52: Burton Lane NB@46.7-203: Site Access 3 WB@25.3		NB LEFT-TURN	0	7
AVG	900-4500	7-52: Burton Lane NB@46.7-52: Burton Lane NB@99.8		NB THRU	0	0
AVG	900-4500	7-53: Burton Lane SB@797.4-53: Burton Lane SB@850.7		SB THRU	0	2
AVG	900-4500	7-53: Burton Lane SB@797.4-203: Site Access 3 WB@25.3		SB RIGHT-TURN	0	0
AVG	900-4500		7	OVERALL	64.75	71

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APPENDIX F-18:
CAPACITY ANALYSIS RESULTS

2030 BUILD CONDITIONS
PM PEAK HOUR

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$MOVEM	TIMEINT	MOVEMENT		MOVEMENT DESCRIPTION	VEHS(ALL)	VEHDELAY(ALL)
AVG	900-4500	1-59: Catawba Avenue EB@219.3-17: Catawba Avenue EB@18.9		EB APPROACH	1466	136.1
AVG	900-4500	1-10004@56.1-35: I-77 SB On-Ramp@2.9		EB RIGHT-TURN	552	152.78
AVG	900-4500	1-10052@41.8-35: I-77 SB On-Ramp@2.9		WB LEFT-TURN	430	13.14
AVG	900-4500	1-19: Catawba Avenue WB@483.1-6: Catawba Avenue WB@11.2		WB THRU	1299	18.09
AVG	900-4500	1-34: I-77 SB Off-Ramp@288.2-17: Catawba Avenue EB@18.9		SB LEFT	507	11.95
AVG	900-4500	1-34: I-77 SB Off-Ramp@288.2-6: Catawba Avenue WB@11.2		SB RIGHT	500	13.07
AVG	900-4500		1	OVERALL	4753	68.48
AVG	900-4500	2-17: Catawba Avenue EB@451.8-32: I-77 NB On-Ramp@3.3		EB LEFT-TURN	653	2.79
AVG	900-4500	2-17: Catawba Avenue EB@451.8-21: Catawba Avenue EB@8.9		EB THRU	1319	18.93
AVG	900-4500	2-23: Catawba Avenue WB@292.6-19: Catawba Avenue WB@6.3		WB THRU	1113	21.18
AVG	900-4500	2-10058@37.9-32: I-77 NB On-Ramp@3.3		WB RIGHT-TURN	427	20.06
AVG	900-4500	2-31: I-77 NB Off-Ramp@294.9-19: Catawba Avenue WB@6.3		NB LEFT-TURN	619	10.61
AVG	900-4500	2-31: I-77 NB Off-Ramp@294.9-21: Catawba Avenue EB@8.9		NB RIGHT-TURN	262	15.25
AVG	900-4500		2	OVERALL	4393	15.82
AVG	900-4500	3-22: Catawba Avenue EB@133.4-23: Catawba Avenue WB@8.3		EB U-TURN	0	
AVG	900-4500	3-22: Catawba Avenue EB@133.4-45: Holiday Lane NB@14.0		EB LEFT-TURN	204	6.66
AVG	900-4500	3-22: Catawba Avenue EB@133.4-37: Catawba Avenue EB@58.0		EB THRU	798	4.47
AVG	900-4500	3-22: Catawba Avenue EB@133.4-41: US-21 SB@27.0		EB RIGHT-TURN	580	3.87
AVG	900-4500	3-39: Catawba Avenue WB@35.2-37: Catawba Avenue EB@58.0		WB U-TURN	0	
AVG	900-4500	3-39: Catawba Avenue WB@35.2-41: US-21 SB@27.0		WB LEFT-TURN	113	28
AVG	900-4500	3-39: Catawba Avenue WB@35.2-23: Catawba Avenue WB@8.3		WB THRU	786	16.51
AVG	900-4500	3-39: Catawba Avenue WB@35.2-45: Holiday Lane NB@14.0		WB RIGHT-TURN	27	9.18
AVG	900-4500	3-42: US-21 NB@138.6-41: US-21 SB@27.0		NB U-TURN	0	
AVG	900-4500	3-42: US-21 NB@138.6-23: Catawba Avenue WB@8.3		NB LEFT-TURN	635	19.74
AVG	900-4500	3-42: US-21 NB@138.6-45: Holiday Lane NB@14.0		NB THRU	32	19.94
AVG	900-4500	3-42: US-21 NB@138.6-37: Catawba Avenue EB@58.0		NB RIGHT-TURN	225	7.55
AVG	900-4500	3-44: Holiday Lane SB@124.1-45: Holiday Lane NB@14.0		SB U-TURN	0	
AVG	900-4500	3-44: Holiday Lane SB@124.1-37: Catawba Avenue EB@58.0		SB LEFT-TURN	53	133.96
AVG	900-4500	3-44: Holiday Lane SB@124.1-41: US-21 SB@27.0		SB THRU	24	132.14
AVG	900-4500	3-44: Holiday Lane SB@124.1-23: Catawba Avenue WB@8.3		SB RIGHT-TURN	117	113.22
AVG	900-4500		3	OVERALL	3594	17.16
AVG	900-4500	4-37: Catawba Avenue EB@200.7-52: Burton Lane NB@11.3		EB LEFT-TURN	3	15.2
AVG	900-4500	4-37: Catawba Avenue EB@200.7-46: Catawba Avenue EB@35.5		EB THRU	1058	1.47
AVG	900-4500	4-37: Catawba Avenue EB@200.7-51: S Hill Street SB@21.6		EB RIGHT-TURN	15	1.25
AVG	900-4500	4-47: Catawba Avenue WB@480.6-51: S Hill Street SB@21.6		WB LEFT-TURN	1	49.31
AVG	900-4500	4-47: Catawba Avenue WB@480.6-38: Catawba Avenue WB@23.6		WB THRU	866	63.05
AVG	900-4500	4-47: Catawba Avenue WB@480.6-52: Burton Lane NB@11.3		WB RIGHT-TURN	41	60.36
AVG	900-4500	4-50: S Hill Street NB@767.7-38: Catawba Avenue WB@23.6		NB LEFT-TURN	6	64.3
AVG	900-4500	4-50: S Hill Street NB@767.7-52: Burton Lane NB@11.3		NB THRU	0	
AVG	900-4500	4-50: S Hill Street NB@767.7-46: Catawba Avenue EB@35.5		NB RIGHT-TURN	3	12.72
AVG	900-4500	4-53: Burton Lane SB@893.2-46: Catawba Avenue EB@35.5		SB LEFT-TURN	13	21.01
AVG	900-4500	4-53: Burton Lane SB@893.2-51: S Hill Street SB@21.6		SB THRU	0	
AVG	900-4500	4-53: Burton Lane SB@893.2-38: Catawba Avenue WB@23.6		SB RIGHT-TURN	57	16.93
AVG	900-4500		4	OVERALL	2064	29.26
AVG	900-4500	5-101: Site Access 1 WB@180.8-43: Holiday Lane SB@579.4		WB LEFT-TURN	25	25.98
AVG	900-4500	5-101: Site Access 1 WB@180.8-45: Holiday Lane NB@410.0		WB RIGHT-TURN	0	
AVG	900-4500	5-43: Holiday Lane SB@512.5-201: Site Access 1 EB@18.7		SB LEFT-TURN	0	
AVG	900-4500	5-43: Holiday Lane SB@512.5-43: Holiday Lane SB@579.4		SB THRU	108	13.29
AVG	900-4500	5-45: Holiday Lane NB@342.9-45: Holiday Lane NB@410.0		NB THRU	154	0.09
AVG	900-4500	5-45: Holiday Lane NB@342.9-201: Site Access 1 EB@18.7		NB RIGHT-TURN	22	0.51
AVG	900-4500		5	OVERALL	309	6.93
AVG	900-4500	6-102: Site Access 2 WB@186.5-10066@24.8		WB LEFT-TURN	64	349.09
AVG	900-4500	6-102: Site Access 2 WB@186.5-45: Holiday Lane NB@233.8		WB RIGHT-TURN	0	
AVG	900-4500	6-45: Holiday Lane NB@165.6-45: Holiday Lane NB@233.8		NB THRU	176	1.7
AVG	900-4500	6-45: Holiday Lane NB@165.6-202: Site Access 2 EB@14.3		NB RIGHT-TURN	87	1.06
AVG	900-4500	6-43: Holiday Lane SB@692.0-202: Site Access 2 EB@14.3		SB LEFT-TURN	0	
AVG	900-4500	6-43: Holiday Lane SB@692.0-10066@24.8		SB THRU	132	73.57
AVG	900-4500		6	OVERALL	459	67.81
AVG	900-4500	7-103: Site Access 3 EB@179.5-52: Burton Lane NB@97.0		EB LEFT-TURN	0	
AVG	900-4500	7-103: Site Access 3 EB@179.5-53: Burton Lane SB@853.6		EB RIGHT-TURN	68	6.99
AVG	900-4500	7-52: Burton Lane NB@43.8-203: Site Access 3 WB@20.9		NB LEFT-TURN	41	0.24
AVG	900-4500	7-52: Burton Lane NB@43.8-52: Burton Lane NB@97.0		NB THRU	4	0.25
AVG	900-4500	7-53: Burton Lane SB@800.2-53: Burton Lane SB@853.6		SB THRU	2	0.3
AVG	900-4500	7-53: Burton Lane SB@800.2-203: Site Access 3 WB@20.9		SB RIGHT-TURN	0	
AVG	900-4500		7	OVERALL	115	4.24

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$MOVEM	TIMEINT	MOVEMENT		MOVEMENT DESCRIPTION	QLENMAX	VEHS(ALL)
AVG	900-4500	1-59: Catawba Avenue EB@219.3-17: Catawba Avenue EB@18.9		EB APPROACH	1639.46	1466
AVG	900-4500	1-10004@56.1-35: I-77 SB On-Ramp@2.9		EB RIGHT-TURN	1669.06	552
AVG	900-4500	1-10052@41.8-35: I-77 SB On-Ramp@2.9		WB LEFT-TURN	573.83	430
AVG	900-4500	1-19: Catawba Avenue WB@483.1-6: Catawba Avenue WB@11.2		WB THRU	561.24	1299
AVG	900-4500	1-34: I-77 SB Off-Ramp@288.2-17: Catawba Avenue EB@18.9		SB LEFT	174.26	507
AVG	900-4500	1-34: I-77 SB Off-Ramp@288.2-6: Catawba Avenue WB@11.2		SB RIGHT	203.88	500
AVG	900-4500		1	OVERALL	1669.08	4753
AVG	900-4500	2-17: Catawba Avenue EB@451.8-32: I-77 NB On-Ramp@3.3		EB LEFT-TURN	382.96	653
AVG	900-4500	2-17: Catawba Avenue EB@451.8-21: Catawba Avenue EB@8.9		EB THRU	382.96	1319
AVG	900-4500	2-23: Catawba Avenue WB@292.6-19: Catawba Avenue WB@6.3		WB THRU	354.56	1113
AVG	900-4500	2-10058@37.9-32: I-77 NB On-Ramp@3.3		WB RIGHT-TURN	402.06	427
AVG	900-4500	2-31: I-77 NB Off-Ramp@294.9-19: Catawba Avenue WB@6.3		NB LEFT-TURN	160.55	619
AVG	900-4500	2-31: I-77 NB Off-Ramp@294.9-21: Catawba Avenue EB@8.9		NB RIGHT-TURN	160.55	262
AVG	900-4500		2	OVERALL	466.99	4393
AVG	900-4500	3-22: Catawba Avenue EB@133.4-23: Catawba Avenue WB@8.3		EB U-TURN	156.41	0
AVG	900-4500	3-22: Catawba Avenue EB@133.4-45: Holiday Lane NB@14.0		EB LEFT-TURN	156.41	204
AVG	900-4500	3-22: Catawba Avenue EB@133.4-37: Catawba Avenue EB@58.0		EB THRU	156.41	798
AVG	900-4500	3-22: Catawba Avenue EB@133.4-41: US-21 SB@27.0		EB RIGHT-TURN	156.41	580
AVG	900-4500	3-39: Catawba Avenue WB@35.2-37: Catawba Avenue EB@58.0		WB U-TURN	337.46	0
AVG	900-4500	3-39: Catawba Avenue WB@35.2-41: US-21 SB@27.0		WB LEFT-TURN	337.46	113
AVG	900-4500	3-39: Catawba Avenue WB@35.2-23: Catawba Avenue WB@8.3		WB THRU	337.46	786
AVG	900-4500	3-39: Catawba Avenue WB@35.2-45: Holiday Lane NB@14.0		WB RIGHT-TURN	337.46	27
AVG	900-4500	3-42: US-21 NB@138.6-41: US-21 SB@27.0		NB U-TURN	304.6	0
AVG	900-4500	3-42: US-21 NB@138.6-23: Catawba Avenue WB@8.3		NB LEFT-TURN	304.6	635
AVG	900-4500	3-42: US-21 NB@138.6-45: Holiday Lane NB@14.0		NB THRU	304.6	32
AVG	900-4500	3-42: US-21 NB@138.6-37: Catawba Avenue EB@58.0		NB RIGHT-TURN	359.89	225
AVG	900-4500	3-44: Holiday Lane SB@124.1-45: Holiday Lane NB@14.0		SB U-TURN	273.15	0
AVG	900-4500	3-44: Holiday Lane SB@124.1-37: Catawba Avenue EB@58.0		SB LEFT-TURN	273.15	53
AVG	900-4500	3-44: Holiday Lane SB@124.1-41: US-21 SB@27.0		SB THRU	273.15	24
AVG	900-4500	3-44: Holiday Lane SB@124.1-23: Catawba Avenue WB@8.3		SB RIGHT-TURN	273.15	117
AVG	900-4500		3	OVERALL	415.7	3594
AVG	900-4500	4-37: Catawba Avenue EB@200.7-52: Burton Lane NB@11.3		EB LEFT-TURN	121.47	3
AVG	900-4500	4-37: Catawba Avenue EB@200.7-46: Catawba Avenue EB@35.5		EB THRU	79.99	1058
AVG	900-4500	4-37: Catawba Avenue EB@200.7-51: S Hill Street SB@21.6		EB RIGHT-TURN	79.99	15
AVG	900-4500	4-47: Catawba Avenue WB@480.6-51: S Hill Street SB@21.6		WB LEFT-TURN	1363.07	1
AVG	900-4500	4-47: Catawba Avenue WB@480.6-38: Catawba Avenue WB@23.6		WB THRU	1319.52	866
AVG	900-4500	4-47: Catawba Avenue WB@480.6-52: Burton Lane NB@11.3		WB RIGHT-TURN	1319.52	41
AVG	900-4500	4-50: S Hill Street NB@767.7-38: Catawba Avenue WB@23.6		NB LEFT-TURN	44.1	6
AVG	900-4500	4-50: S Hill Street NB@767.7-52: Burton Lane NB@11.3		NB THRU	43.46	0
AVG	900-4500	4-50: S Hill Street NB@767.7-46: Catawba Avenue EB@35.5		NB RIGHT-TURN	42.67	3
AVG	900-4500	4-53: Burton Lane SB@893.2-46: Catawba Avenue EB@35.5		SB LEFT-TURN	83.19	13
AVG	900-4500	4-53: Burton Lane SB@893.2-51: S Hill Street SB@21.6		SB THRU	74.92	0
AVG	900-4500	4-53: Burton Lane SB@893.2-38: Catawba Avenue WB@23.6		SB RIGHT-TURN	80.04	57
AVG	900-4500		4	OVERALL	1364.86	2064
AVG	900-4500	5-101: Site Access 1 WB@180.8-43: Holiday Lane SB@579.4		WB LEFT-TURN	50.54	25
AVG	900-4500	5-101: Site Access 1 WB@180.8-45: Holiday Lane NB@410.0		WB RIGHT-TURN	49.29	0
AVG	900-4500	5-43: Holiday Lane SB@512.5-201: Site Access 1 EB@18.7		SB LEFT-TURN	92.12	0
AVG	900-4500	5-43: Holiday Lane SB@512.5-43: Holiday Lane SB@579.4		SB THRU	60.61	108
AVG	900-4500	5-45: Holiday Lane NB@342.9-45: Holiday Lane NB@410.0		NB THRU	0	154
AVG	900-4500	5-45: Holiday Lane NB@342.9-201: Site Access 1 EB@18.7		NB RIGHT-TURN	0	22
AVG	900-4500		5	OVERALL	103.87	309
AVG	900-4500	6-102: Site Access 2 WB@186.5-10066@24.8		WB LEFT-TURN	229.78	64
AVG	900-4500	6-102: Site Access 2 WB@186.5-45: Holiday Lane NB@233.8		WB RIGHT-TURN	227.7	0
AVG	900-4500	6-45: Holiday Lane NB@165.6-45: Holiday Lane NB@233.8		NB THRU	103.91	176
AVG	900-4500	6-45: Holiday Lane NB@165.6-202: Site Access 2 EB@14.3		NB RIGHT-TURN	103.91	87
AVG	900-4500	6-43: Holiday Lane SB@692.0-202: Site Access 2 EB@14.3		SB LEFT-TURN	229.32	0
AVG	900-4500	6-43: Holiday Lane SB@692.0-10066@24.8		SB THRU	182.67	132
AVG	900-4500		6	OVERALL	261.85	459
AVG	900-4500	7-103: Site Access 3 EB@179.5-52: Burton Lane NB@97.0		EB LEFT-TURN	61.67	0
AVG	900-4500	7-103: Site Access 3 EB@179.5-53: Burton Lane SB@853.6		EB RIGHT-TURN	60.01	68
AVG	900-4500	7-52: Burton Lane NB@43.8-203: Site Access 3 WB@20.9		NB LEFT-TURN	0	41
AVG	900-4500	7-52: Burton Lane NB@43.8-52: Burton Lane NB@97.0		NB THRU	0	4
AVG	900-4500	7-53: Burton Lane SB@800.2-53: Burton Lane SB@853.6		SB THRU	0	2
AVG	900-4500	7-53: Burton Lane SB@800.2-203: Site Access 3 WB@20.9		SB RIGHT-TURN	0	0
AVG	900-4500		7	OVERALL	61.67	115

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APPENDIX F-19:
CAPACITY ANALYSIS RESULTS

2030 BUILD-IMPROVED CONDITIONS
AM PEAK HOUR

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$MOVEM	TIMEINT	MOVEMENT		MOVEMENT DESCRIPTION	VEHDELAY(ALL)	VEHS(ALL)
AVG	900-4500	1-59: Catawba Avenue EB@219.3-17: Catawba Avenue EB@18.9		EB APPROACH	124.64	1335
AVG	900-4500	1-10004@56.1-35: I-77 SB On-Ramp@2.9		EB RIGHT-TURN	138.33	580
AVG	900-4500	1-10052@41.8-35: I-77 SB On-Ramp@2.9		WB LEFT-TURN	17.67	213
AVG	900-4500	1-19: Catawba Avenue WB@483.1-6: Catawba Avenue WB@11.2		WB THRU	21.24	1305
AVG	900-4500	1-34: I-77 SB Off-Ramp@288.2-17: Catawba Avenue EB@18.9		SB LEFT	12.08	502
AVG	900-4500	1-34: I-77 SB Off-Ramp@288.2-6: Catawba Avenue WB@11.2		SB RIGHT	14.91	616
AVG	900-4500		1	OVERALL	64.46	4550
AVG	900-4500	2-17: Catawba Avenue EB@451.8-32: I-77 NB On-Ramp@3.3		EB LEFT-TURN	1.92	483
AVG	900-4500	2-17: Catawba Avenue EB@451.8-21: Catawba Avenue EB@8.9		EB THRU	19.17	1356
AVG	900-4500	2-23: Catawba Avenue WB@292.6-19: Catawba Avenue WB@6.3		WB THRU	20.72	891
AVG	900-4500	2-10058@37.9-32: I-77 NB On-Ramp@3.3		WB RIGHT-TURN	7.72	333
AVG	900-4500	2-31: I-77 NB Off-Ramp@294.9-19: Catawba Avenue WB@6.3		NB LEFT-TURN	9.9	628
AVG	900-4500	2-31: I-77 NB Off-Ramp@294.9-21: Catawba Avenue EB@8.9		NB RIGHT-TURN	16.1	212
AVG	900-4500		2	OVERALL	14.77	3903
AVG	900-4500	3-22: Catawba Avenue EB@134.3-23: Catawba Avenue WB@7.4		EB U-TURN		0
AVG	900-4500	3-22: Catawba Avenue EB@134.3-45: Holiday Lane NB@14.2		EB LEFT-TURN	5.26	93
AVG	900-4500	3-22: Catawba Avenue EB@134.3-37: Catawba Avenue EB@58.9		EB THRU	4.18	662
AVG	900-4500	3-22: Catawba Avenue EB@134.3-41: US-21 SB@26.8		EB RIGHT-TURN	6.06	813
AVG	900-4500	3-39: Catawba Avenue WB@34.3-37: Catawba Avenue EB@58.9		WB U-TURN		0
AVG	900-4500	3-39: Catawba Avenue WB@34.3-41: US-21 SB@26.8		WB LEFT-TURN	12.05	162
AVG	900-4500	3-39: Catawba Avenue WB@34.3-23: Catawba Avenue WB@7.4		WB THRU	7.21	615
AVG	900-4500	3-39: Catawba Avenue WB@34.3-45: Holiday Lane NB@14.2		WB RIGHT-TURN	3.99	8
AVG	900-4500	3-42: US-21 NB@138.9-41: US-21 SB@26.8		NB U-TURN		0
AVG	900-4500	3-42: US-21 NB@138.9-23: Catawba Avenue WB@7.4		NB LEFT-TURN	8.75	499
AVG	900-4500	3-42: US-21 NB@138.9-45: Holiday Lane NB@14.2		NB THRU	7.08	12
AVG	900-4500	3-42: US-21 NB@138.9-37: Catawba Avenue EB@58.9		NB RIGHT-TURN	3.45	116
AVG	900-4500	3-44: Holiday Lane SB@172.2-45: Holiday Lane NB@14.2		SB U-TURN		0
AVG	900-4500	3-44: Holiday Lane SB@172.2-37: Catawba Avenue EB@58.9		SB LEFT-TURN	47.64	61
AVG	900-4500	3-44: Holiday Lane SB@172.2-41: US-21 SB@26.8		SB THRU	54.56	29
AVG	900-4500	3-44: Holiday Lane SB@172.2-23: Catawba Avenue WB@7.4		SB RIGHT-TURN	9.5	112
AVG	900-4500		3	OVERALL	7.86	3182
AVG	900-4500	4-37: Catawba Avenue EB@218.6-52: Burton Lane NB@5.3		EB LEFT-TURN	8.38	3
AVG	900-4500	4-37: Catawba Avenue EB@218.6-46: Catawba Avenue EB@18.7		EB THRU	0.95	830
AVG	900-4500	4-37: Catawba Avenue EB@218.6-51: S Hill Street SB@20.3		EB RIGHT-TURN	0.89	9
AVG	900-4500	4-47: Catawba Avenue WB@497.1-51: S Hill Street SB@20.3		WB LEFT-TURN	4.9	1
AVG	900-4500	4-47: Catawba Avenue WB@497.1-38: Catawba Avenue WB@3.4		WB THRU	3.75	724
AVG	900-4500	4-47: Catawba Avenue WB@497.1-52: Burton Lane NB@5.3		WB RIGHT-TURN	2.01	7
AVG	900-4500	4-50: S Hill Street NB@768.4-38: Catawba Avenue WB@3.4		NB LEFT-TURN	18.24	7
AVG	900-4500	4-50: S Hill Street NB@768.4-52: Burton Lane NB@5.3		NB THRU		0
AVG	900-4500	4-50: S Hill Street NB@768.4-46: Catawba Avenue EB@18.7		NB RIGHT-TURN	8.94	6
AVG	900-4500	4-5: Burton Lane SB@48.1-46: Catawba Avenue EB@18.7		SB LEFT-TURN	13.11	11
AVG	900-4500	4-5: Burton Lane SB@48.1-51: S Hill Street SB@20.3		SB THRU		0
AVG	900-4500	4-5: Burton Lane SB@48.1-38: Catawba Avenue WB@3.4		SB RIGHT-TURN	10.92	54
AVG	900-4500		4	OVERALL	2.71	1649
AVG	900-4500	5-101: Site Access 1 WB@185.7-43: Holiday Lane SB@576.3		WB LEFT-TURN	7.58	21
AVG	900-4500	5-101: Site Access 1 WB@185.7-45: Holiday Lane NB@413.0		WB RIGHT-TURN		0
AVG	900-4500	5-45: Holiday Lane NB@345.9-45: Holiday Lane NB@413.0		NB THRU	0.04	29
AVG	900-4500	5-45: Holiday Lane NB@345.9-201: Site Access 1 EB@13.8		NB RIGHT-TURN	0.42	21
AVG	900-4500	5-43: Holiday Lane SB@509.4-201: Site Access 1 EB@13.8		SB LEFT-TURN		0
AVG	900-4500	5-43: Holiday Lane SB@509.4-43: Holiday Lane SB@576.3		SB THRU	0.14	103
AVG	900-4500		5	OVERALL	1.07	174
AVG	900-4500	6-102: Site Access 2 WB@191.4-44: Holiday Lane SB@19.0		WB LEFT-TURN	9.87	78
AVG	900-4500	6-102: Site Access 2 WB@191.4-45: Holiday Lane NB@237.5		WB RIGHT-TURN		0
AVG	900-4500	6-43: Holiday Lane SB@688.3-202: Site Access 2 EB@9.4		SB LEFT-TURN		0
AVG	900-4500	6-43: Holiday Lane SB@688.3-44: Holiday Lane SB@19.0		SB THRU	2.09	125
AVG	900-4500	6-45: Holiday Lane NB@169.3-45: Holiday Lane NB@237.5		NB THRU	0.3	49
AVG	900-4500	6-45: Holiday Lane NB@169.3-202: Site Access 2 EB@9.4		NB RIGHT-TURN	0.57	65
AVG	900-4500		6	OVERALL	3.42	316
AVG	900-4500	7-103: Site Access 3 EB@175.0-52: Burton Lane NB@99.8		EB LEFT-TURN		0
AVG	900-4500	7-103: Site Access 3 EB@175.0-5: Burton Lane SB@1.5		EB RIGHT-TURN	6.76	63
AVG	900-4500	7-52: Burton Lane NB@46.7-203: Site Access 3 WB@25.3		NB LEFT-TURN	0.34	7
AVG	900-4500	7-52: Burton Lane NB@46.7-52: Burton Lane NB@99.8		NB THRU		0
AVG	900-4500	7-53: Burton Lane SB@797.4-5: Burton Lane SB@1.5		SB THRU	1.18	2
AVG	900-4500	7-53: Burton Lane SB@797.4-203: Site Access 3 WB@25.3		SB RIGHT-TURN		0
AVG	900-4500		7	OVERALL	6	71

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$MOVEM	TIMEINT	MOVEMENT		MOVEMENT DESCRIPTION	QLENMAX	VEHS(ALL)
AVG	900-4500	1-59: Catawba Avenue EB@219.3-17: Catawba Avenue EB@18.9		EB APPROACH	1664.7	1335
AVG	900-4500	1-10004@56.1-35: I-77 SB On-Ramp@2.9		EB RIGHT-TURN	1662.88	580
AVG	900-4500	1-10052@41.8-35: I-77 SB On-Ramp@2.9		WB LEFT-TURN	547.02	213
AVG	900-4500	1-19: Catawba Avenue WB@483.1-6: Catawba Avenue WB@11.2		WB THRU	534.44	1305
AVG	900-4500	1-34: I-77 SB Off-Ramp@288.2-17: Catawba Avenue EB@18.9		SB LEFT	191.08	502
AVG	900-4500	1-34: I-77 SB Off-Ramp@288.2-6: Catawba Avenue WB@11.2		SB RIGHT	220.71	616
AVG	900-4500		1	OVERALL	1664.75	4550
AVG	900-4500	2-17: Catawba Avenue EB@451.8-32: I-77 NB On-Ramp@3.3		EB LEFT-TURN	465.03	483
AVG	900-4500	2-17: Catawba Avenue EB@451.8-21: Catawba Avenue EB@8.9		EB THRU	465.03	1356
AVG	900-4500	2-23: Catawba Avenue WB@292.6-19: Catawba Avenue WB@6.3		WB THRU	291.37	891
AVG	900-4500	2-10058@37.9-32: I-77 NB On-Ramp@3.3		WB RIGHT-TURN	184.15	333
AVG	900-4500	2-31: I-77 NB Off-Ramp@294.9-19: Catawba Avenue WB@6.3		NB LEFT-TURN	147.42	628
AVG	900-4500	2-31: I-77 NB Off-Ramp@294.9-21: Catawba Avenue EB@8.9		NB RIGHT-TURN	147.42	212
AVG	900-4500		2	OVERALL	468.16	3903
AVG	900-4500	3-22: Catawba Avenue EB@134.3-23: Catawba Avenue WB@7.4		EB U-TURN	187.42	0
AVG	900-4500	3-22: Catawba Avenue EB@134.3-45: Holiday Lane NB@14.2		EB LEFT-TURN	187.42	93
AVG	900-4500	3-22: Catawba Avenue EB@134.3-37: Catawba Avenue EB@58.9		EB THRU	187.42	662
AVG	900-4500	3-22: Catawba Avenue EB@134.3-41: US-21 SB@26.8		EB RIGHT-TURN	199.75	813
AVG	900-4500	3-39: Catawba Avenue WB@34.3-37: Catawba Avenue EB@58.9		WB U-TURN	199.05	0
AVG	900-4500	3-39: Catawba Avenue WB@34.3-41: US-21 SB@26.8		WB LEFT-TURN	199.05	162
AVG	900-4500	3-39: Catawba Avenue WB@34.3-23: Catawba Avenue WB@7.4		WB THRU	199.05	615
AVG	900-4500	3-39: Catawba Avenue WB@34.3-45: Holiday Lane NB@14.2		WB RIGHT-TURN	199.05	8
AVG	900-4500	3-42: US-21 NB@138.9-41: US-21 SB@26.8		NB U-TURN	98.06	0
AVG	900-4500	3-42: US-21 NB@138.9-23: Catawba Avenue WB@7.4		NB LEFT-TURN	98.06	499
AVG	900-4500	3-42: US-21 NB@138.9-45: Holiday Lane NB@14.2		NB THRU	98.06	12
AVG	900-4500	3-42: US-21 NB@138.9-37: Catawba Avenue EB@58.9		NB RIGHT-TURN	133.75	116
AVG	900-4500	3-44: Holiday Lane SB@172.2-45: Holiday Lane NB@14.2		SB U-TURN	154.74	0
AVG	900-4500	3-44: Holiday Lane SB@172.2-37: Catawba Avenue EB@58.9		SB LEFT-TURN	154.74	61
AVG	900-4500	3-44: Holiday Lane SB@172.2-41: US-21 SB@26.8		SB THRU	154.74	29
AVG	900-4500	3-44: Holiday Lane SB@172.2-23: Catawba Avenue WB@7.4		SB RIGHT-TURN	169.87	112
AVG	900-4500		3	OVERALL	258.39	3182
AVG	900-4500	4-37: Catawba Avenue EB@218.6-52: Burton Lane NB@5.3		EB LEFT-TURN	92.94	3
AVG	900-4500	4-37: Catawba Avenue EB@218.6-46: Catawba Avenue EB@18.7		EB THRU	69.17	830
AVG	900-4500	4-37: Catawba Avenue EB@218.6-51: S Hill Street SB@20.3		EB RIGHT-TURN	69.17	9
AVG	900-4500	4-47: Catawba Avenue WB@497.1-51: S Hill Street SB@20.3		WB LEFT-TURN	166.18	1
AVG	900-4500	4-47: Catawba Avenue WB@497.1-38: Catawba Avenue WB@3.4		WB THRU	124.56	724
AVG	900-4500	4-47: Catawba Avenue WB@497.1-52: Burton Lane NB@5.3		WB RIGHT-TURN	124.56	7
AVG	900-4500	4-50: S Hill Street NB@768.4-38: Catawba Avenue WB@3.4		NB LEFT-TURN	44.49	7
AVG	900-4500	4-50: S Hill Street NB@768.4-52: Burton Lane NB@5.3		NB THRU	43.85	0
AVG	900-4500	4-50: S Hill Street NB@768.4-46: Catawba Avenue EB@18.7		NB RIGHT-TURN	43.06	6
AVG	900-4500	4-5: Burton Lane SB@48.1-46: Catawba Avenue EB@18.7		SB LEFT-TURN	50.89	11
AVG	900-4500	4-5: Burton Lane SB@48.1-51: S Hill Street SB@20.3		SB THRU	59.54	0
AVG	900-4500	4-5: Burton Lane SB@48.1-38: Catawba Avenue WB@3.4		SB RIGHT-TURN	59.31	54
AVG	900-4500		4	OVERALL	176.42	1649
AVG	900-4500	5-101: Site Access 1 WB@185.7-43: Holiday Lane SB@576.3		WB LEFT-TURN	38.76	21
AVG	900-4500	5-101: Site Access 1 WB@185.7-45: Holiday Lane NB@413.0		WB RIGHT-TURN	40.08	0
AVG	900-4500	5-45: Holiday Lane NB@345.9-45: Holiday Lane NB@413.0		NB THRU	0	29
AVG	900-4500	5-45: Holiday Lane NB@345.9-201: Site Access 1 EB@13.8		NB RIGHT-TURN	0	21
AVG	900-4500	5-43: Holiday Lane SB@509.4-201: Site Access 1 EB@13.8		SB LEFT-TURN	0	0
AVG	900-4500	5-43: Holiday Lane SB@509.4-43: Holiday Lane SB@576.3		SB THRU	0	103
AVG	900-4500		5	OVERALL	40.08	174
AVG	900-4500	6-102: Site Access 2 WB@191.4-44: Holiday Lane SB@19.0		WB LEFT-TURN	78.6	78
AVG	900-4500	6-102: Site Access 2 WB@191.4-45: Holiday Lane NB@237.5		WB RIGHT-TURN	76.97	0
AVG	900-4500	6-43: Holiday Lane SB@688.3-202: Site Access 2 EB@9.4		SB LEFT-TURN	26.4	0
AVG	900-4500	6-43: Holiday Lane SB@688.3-44: Holiday Lane SB@19.0		SB THRU	17.95	125
AVG	900-4500	6-45: Holiday Lane NB@169.3-45: Holiday Lane NB@237.5		NB THRU	0	49
AVG	900-4500	6-45: Holiday Lane NB@169.3-202: Site Access 2 EB@9.4		NB RIGHT-TURN	0	65
AVG	900-4500		6	OVERALL	87.8	316
AVG	900-4500	7-103: Site Access 3 EB@175.0-52: Burton Lane NB@99.8		EB LEFT-TURN	64.32	0
AVG	900-4500	7-103: Site Access 3 EB@175.0-5: Burton Lane SB@1.5		EB RIGHT-TURN	63.6	63
AVG	900-4500	7-52: Burton Lane NB@46.7-203: Site Access 3 WB@25.3		NB LEFT-TURN	0	7
AVG	900-4500	7-52: Burton Lane NB@46.7-52: Burton Lane NB@99.8		NB THRU	0	0
AVG	900-4500	7-53: Burton Lane SB@797.4-5: Burton Lane SB@1.5		SB THRU	0	2
AVG	900-4500	7-53: Burton Lane SB@797.4-203: Site Access 3 WB@25.3		SB RIGHT-TURN	0	0
AVG	900-4500		7	OVERALL	64.32	71

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APPENDIX F-20:
CAPACITY ANALYSIS RESULTS

2030 BUILD-IMPROVED CONDITIONS
PM PEAK HOUR

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$VISION

$MOVEM	TIMEINT	MOVEMENT		MOVEMENT DESCRIPTION	VEHS(ALL)	VEHDELAY(ALL)
AVG	900-4500	1-59: Catawba Avenue EB@219.3-17: Catawba Avenue EB@18.9		EB APPROACH	1473	132.31
AVG	900-4500	1-10004@56.1-35: I-77 SB On-Ramp@2.9		EB RIGHT-TURN	556	146.66
AVG	900-4500	1-10052@41.8-35: I-77 SB On-Ramp@2.9		WB LEFT-TURN	430	13.87
AVG	900-4500	1-19: Catawba Avenue WB@483.1-6: Catawba Avenue WB@11.2		WB THRU	1298	18.18
AVG	900-4500	1-34: I-77 SB Off-Ramp@288.2-17: Catawba Avenue EB@18.9		SB LEFT	507	11.97
AVG	900-4500	1-34: I-77 SB Off-Ramp@288.2-6: Catawba Avenue WB@11.2		SB RIGHT	500	13.08
AVG	900-4500		1	OVERALL	4765	66.89
AVG	900-4500	2-17: Catawba Avenue EB@451.8-32: I-77 NB On-Ramp@3.3		EB LEFT-TURN	656	2.84
AVG	900-4500	2-17: Catawba Avenue EB@451.8-21: Catawba Avenue EB@8.9		EB THRU	1327	19.07
AVG	900-4500	2-23: Catawba Avenue WB@292.6-19: Catawba Avenue WB@6.3		WB THRU	1109	21.1
AVG	900-4500	2-10058@37.9-32: I-77 NB On-Ramp@3.3		WB RIGHT-TURN	428	19.38
AVG	900-4500	2-31: I-77 NB Off-Ramp@294.9-19: Catawba Avenue WB@6.3		NB LEFT-TURN	619	10.61
AVG	900-4500	2-31: I-77 NB Off-Ramp@294.9-21: Catawba Avenue EB@8.9		NB RIGHT-TURN	261	15.41
AVG	900-4500		2	OVERALL	4401	15.79
AVG	900-4500	3-22: Catawba Avenue EB@133.4-23: Catawba Avenue WB@8.3		EB U-TURN	0	
AVG	900-4500	3-22: Catawba Avenue EB@133.4-45: Holiday Lane NB@14.0		EB LEFT-TURN	205	6.72
AVG	900-4500	3-22: Catawba Avenue EB@133.4-37: Catawba Avenue EB@58.0		EB THRU	800	4.41
AVG	900-4500	3-22: Catawba Avenue EB@133.4-41: US-21 SB@27.0		EB RIGHT-TURN	581	3.89
AVG	900-4500	3-39: Catawba Avenue WB@35.2-37: Catawba Avenue EB@58.0		WB U-TURN	0	
AVG	900-4500	3-39: Catawba Avenue WB@35.2-41: US-21 SB@27.0		WB LEFT-TURN	112	28.04
AVG	900-4500	3-39: Catawba Avenue WB@35.2-23: Catawba Avenue WB@8.3		WB THRU	783	16.63
AVG	900-4500	3-39: Catawba Avenue WB@35.2-45: Holiday Lane NB@14.0		WB RIGHT-TURN	27	8.87
AVG	900-4500	3-42: US-21 NB@138.6-41: US-21 SB@27.0		NB U-TURN	0	
AVG	900-4500	3-42: US-21 NB@138.6-23: Catawba Avenue WB@8.3		NB LEFT-TURN	634	19.82
AVG	900-4500	3-42: US-21 NB@138.6-45: Holiday Lane NB@14.0		NB THRU	32	18.88
AVG	900-4500	3-42: US-21 NB@138.6-37: Catawba Avenue EB@58.0		NB RIGHT-TURN	225	8.04
AVG	900-4500	3-44: Holiday Lane SB@169.3-45: Holiday Lane NB@14.0		SB U-TURN	0	
AVG	900-4500	3-44: Holiday Lane SB@169.3-37: Catawba Avenue EB@58.0		SB LEFT-TURN	55	285.13
AVG	900-4500	3-44: Holiday Lane SB@169.3-41: US-21 SB@27.0		SB THRU	24	306.85
AVG	900-4500	3-44: Holiday Lane SB@169.3-23: Catawba Avenue WB@8.3		SB RIGHT-TURN	122	27.64
AVG	900-4500		3	OVERALL	3599	17.99
AVG	900-4500	4-5: Burton Lane SB@40.5-46: Catawba Avenue EB@35.5		SB LEFT-TURN	13	22.83
AVG	900-4500	4-5: Burton Lane SB@40.5-51: S Hill Street SB@21.6		SB THRU	0	
AVG	900-4500	4-5: Burton Lane SB@40.5-38: Catawba Avenue WB@23.6		SB RIGHT-TURN	57	28.91
AVG	900-4500	4-37: Catawba Avenue EB@200.7-52: Burton Lane NB@11.3		EB LEFT-TURN	3	14.48
AVG	900-4500	4-37: Catawba Avenue EB@200.7-46: Catawba Avenue EB@35.5		EB THRU	1061	1.65
AVG	900-4500	4-37: Catawba Avenue EB@200.7-51: S Hill Street SB@21.6		EB RIGHT-TURN	15	1.32
AVG	900-4500	4-47: Catawba Avenue WB@480.6-51: S Hill Street SB@21.6		WB LEFT-TURN	1	87.82
AVG	900-4500	4-47: Catawba Avenue WB@480.6-38: Catawba Avenue WB@23.6		WB THRU	859	62.06
AVG	900-4500	4-47: Catawba Avenue WB@480.6-52: Burton Lane NB@11.3		WB RIGHT-TURN	41	57.01
AVG	900-4500	4-50: S Hill Street NB@767.7-38: Catawba Avenue WB@23.6		NB LEFT-TURN	6	77.11
AVG	900-4500	4-50: S Hill Street NB@767.7-52: Burton Lane NB@11.3		NB THRU	0	
AVG	900-4500	4-50: S Hill Street NB@767.7-46: Catawba Avenue EB@35.5		NB RIGHT-TURN	3	19.7
AVG	900-4500		4	OVERALL	2060	29.12
AVG	900-4500	5-101: Site Access 1 WB@180.8-43: Holiday Lane SB@579.4		WB LEFT-TURN	25	20.19
AVG	900-4500	5-101: Site Access 1 WB@180.8-45: Holiday Lane NB@410.0		WB RIGHT-TURN	0	
AVG	900-4500	5-43: Holiday Lane SB@512.5-201: Site Access 1 EB@18.7		SB LEFT-TURN	0	
AVG	900-4500	5-43: Holiday Lane SB@512.5-43: Holiday Lane SB@579.4		SB THRU	106	11
AVG	900-4500	5-45: Holiday Lane NB@342.9-45: Holiday Lane NB@410.0		NB THRU	155	0.07
AVG	900-4500	5-45: Holiday Lane NB@342.9-201: Site Access 1 EB@18.7		NB RIGHT-TURN	22	0.49
AVG	900-4500		5	OVERALL	308	5.57
AVG	900-4500	6-102: Site Access 2 WB@186.5-44: Holiday Lane SB@19.7		WB LEFT-TURN	75	279.88
AVG	900-4500	6-102: Site Access 2 WB@186.5-45: Holiday Lane NB@233.8		WB RIGHT-TURN	0	
AVG	900-4500	6-43: Holiday Lane SB@692.0-202: Site Access 2 EB@14.3		SB LEFT-TURN	0	
AVG	900-4500	6-43: Holiday Lane SB@692.0-44: Holiday Lane SB@19.7		SB THRU	130	63.34
AVG	900-4500	6-45: Holiday Lane NB@165.6-45: Holiday Lane NB@233.8		NB THRU	176	0.97
AVG	900-4500	6-45: Holiday Lane NB@165.6-202: Site Access 2 EB@14.3		NB RIGHT-TURN	87	0.92
AVG	900-4500		6	OVERALL	468	60.8
AVG	900-4500	7-103: Site Access 3 EB@179.7-52: Burton Lane NB@97.4		EB LEFT-TURN	0	
AVG	900-4500	7-103: Site Access 3 EB@179.7-10115: Burton Lane SB@0.2		EB RIGHT-TURN	68	6.66
AVG	900-4500	7-52: Burton Lane NB@44.3-203: Site Access 3 WB@20.6		NB LEFT-TURN	41	0.24
AVG	900-4500	7-52: Burton Lane NB@44.3-52: Burton Lane NB@97.4		NB THRU	4	0.24
AVG	900-4500	7-53: Burton Lane SB@799.8-10115: Burton Lane SB@0.2		SB THRU	2	0.95
AVG	900-4500	7-53: Burton Lane SB@799.8-203: Site Access 3 WB@20.6		SB RIGHT-TURN	0	
AVG	900-4500		7	OVERALL	115	4.06

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$MOVEM	TIMEINT	MOVEMENT		MOVEMENT DESCRIPTION	QLENMAX	VEHS(ALL)
AVG	900-4500	1-59: Catawba Avenue EB@219.3-17: Catawba Avenue EB@18.9		EB APPROACH	1640.63	1473
AVG	900-4500	1-10004@56.1-35: I-77 SB On-Ramp@2.9		EB RIGHT-TURN	1662.85	556
AVG	900-4500	1-10052@41.8-35: I-77 SB On-Ramp@2.9		WB LEFT-TURN	566.43	430
AVG	900-4500	1-19: Catawba Avenue WB@483.1-6: Catawba Avenue WB@11.2		WB THRU	553.84	1298
AVG	900-4500	1-34: I-77 SB Off-Ramp@288.2-17: Catawba Avenue EB@18.9		SB LEFT	175.92	507
AVG	900-4500	1-34: I-77 SB Off-Ramp@288.2-6: Catawba Avenue WB@11.2		SB RIGHT	205.35	500
AVG	900-4500		1	OVERALL	1664.63	4765
AVG	900-4500	2-17: Catawba Avenue EB@451.8-32: I-77 NB On-Ramp@3.3		EB LEFT-TURN	374.35	656
AVG	900-4500	2-17: Catawba Avenue EB@451.8-21: Catawba Avenue EB@8.9		EB THRU	374.35	1327
AVG	900-4500	2-23: Catawba Avenue WB@292.6-19: Catawba Avenue WB@6.3		WB THRU	365.67	1109
AVG	900-4500	2-10058@37.9-32: I-77 NB On-Ramp@3.3		WB RIGHT-TURN	344.92	428
AVG	900-4500	2-31: I-77 NB Off-Ramp@294.9-19: Catawba Avenue WB@6.3		NB LEFT-TURN	152.05	619
AVG	900-4500	2-31: I-77 NB Off-Ramp@294.9-21: Catawba Avenue EB@8.9		NB RIGHT-TURN	152.05	261
AVG	900-4500		2	OVERALL	422.31	4401
AVG	900-4500	3-22: Catawba Avenue EB@133.4-23: Catawba Avenue WB@8.3		EB U-TURN	143.68	0
AVG	900-4500	3-22: Catawba Avenue EB@133.4-45: Holiday Lane NB@14.0		EB LEFT-TURN	143.68	205
AVG	900-4500	3-22: Catawba Avenue EB@133.4-37: Catawba Avenue EB@58.0		EB THRU	143.68	800
AVG	900-4500	3-22: Catawba Avenue EB@133.4-41: US-21 SB@27.0		EB RIGHT-TURN	144.07	581
AVG	900-4500	3-39: Catawba Avenue WB@35.2-37: Catawba Avenue EB@58.0		WB U-TURN	334.13	0
AVG	900-4500	3-39: Catawba Avenue WB@35.2-41: US-21 SB@27.0		WB LEFT-TURN	334.13	112
AVG	900-4500	3-39: Catawba Avenue WB@35.2-23: Catawba Avenue WB@8.3		WB THRU	334.13	783
AVG	900-4500	3-39: Catawba Avenue WB@35.2-45: Holiday Lane NB@14.0		WB RIGHT-TURN	334.13	27
AVG	900-4500	3-42: US-21 NB@138.6-41: US-21 SB@27.0		NB U-TURN	355.99	0
AVG	900-4500	3-42: US-21 NB@138.6-23: Catawba Avenue WB@8.3		NB LEFT-TURN	355.99	634
AVG	900-4500	3-42: US-21 NB@138.6-45: Holiday Lane NB@14.0		NB THRU	355.99	32
AVG	900-4500	3-42: US-21 NB@138.6-37: Catawba Avenue EB@58.0		NB RIGHT-TURN	414.1	225
AVG	900-4500	3-44: Holiday Lane SB@169.3-45: Holiday Lane NB@14.0		SB U-TURN	268.88	0
AVG	900-4500	3-44: Holiday Lane SB@169.3-37: Catawba Avenue EB@58.0		SB LEFT-TURN	268.88	55
AVG	900-4500	3-44: Holiday Lane SB@169.3-41: US-21 SB@27.0		SB THRU	268.88	24
AVG	900-4500	3-44: Holiday Lane SB@169.3-23: Catawba Avenue WB@8.3		SB RIGHT-TURN	280.74	122
AVG	900-4500		3	OVERALL	475.77	3599
AVG	900-4500	4-5: Burton Lane SB@40.5-46: Catawba Avenue EB@35.5		SB LEFT-TURN	63.92	13
AVG	900-4500	4-5: Burton Lane SB@40.5-51: S Hill Street SB@21.6		SB THRU	72.62	0
AVG	900-4500	4-5: Burton Lane SB@40.5-38: Catawba Avenue WB@23.6		SB RIGHT-TURN	72.41	57
AVG	900-4500	4-37: Catawba Avenue EB@200.7-52: Burton Lane NB@11.3		EB LEFT-TURN	161.02	3
AVG	900-4500	4-37: Catawba Avenue EB@200.7-46: Catawba Avenue EB@35.5		EB THRU	129.91	1061
AVG	900-4500	4-37: Catawba Avenue EB@200.7-51: S Hill Street SB@21.6		EB RIGHT-TURN	129.91	15
AVG	900-4500	4-47: Catawba Avenue WB@480.6-51: S Hill Street SB@21.6		WB LEFT-TURN	1477.7	1
AVG	900-4500	4-47: Catawba Avenue WB@480.6-38: Catawba Avenue WB@23.6		WB THRU	1452.61	859
AVG	900-4500	4-47: Catawba Avenue WB@480.6-52: Burton Lane NB@11.3		WB RIGHT-TURN	1452.61	41
AVG	900-4500	4-50: S Hill Street NB@767.7-38: Catawba Avenue WB@23.6		NB LEFT-TURN	45.07	6
AVG	900-4500	4-50: S Hill Street NB@767.7-52: Burton Lane NB@11.3		NB THRU	44.43	0
AVG	900-4500	4-50: S Hill Street NB@767.7-46: Catawba Avenue EB@35.5		NB RIGHT-TURN	43.64	3
AVG	900-4500		4	OVERALL	1479.7	2060
AVG	900-4500	5-101: Site Access 1 WB@180.8-43: Holiday Lane SB@579.4		WB LEFT-TURN	59.59	25
AVG	900-4500	5-101: Site Access 1 WB@180.8-45: Holiday Lane NB@410.0		WB RIGHT-TURN	58.33	0
AVG	900-4500	5-43: Holiday Lane SB@512.5-201: Site Access 1 EB@18.7		SB LEFT-TURN	119.53	0
AVG	900-4500	5-43: Holiday Lane SB@512.5-43: Holiday Lane SB@579.4		SB THRU	86.03	106
AVG	900-4500	5-45: Holiday Lane NB@342.9-45: Holiday Lane NB@410.0		NB THRU	0	155
AVG	900-4500	5-45: Holiday Lane NB@342.9-201: Site Access 1 EB@18.7		NB RIGHT-TURN	0	22
AVG	900-4500		5	OVERALL	131.51	308
AVG	900-4500	6-102: Site Access 2 WB@186.5-44: Holiday Lane SB@19.7		WB LEFT-TURN	230.47	75
AVG	900-4500	6-102: Site Access 2 WB@186.5-45: Holiday Lane NB@233.8		WB RIGHT-TURN	228.39	0
AVG	900-4500	6-43: Holiday Lane SB@692.0-202: Site Access 2 EB@14.3		SB LEFT-TURN	235.22	0
AVG	900-4500	6-43: Holiday Lane SB@692.0-44: Holiday Lane SB@19.7		SB THRU	188.57	130
AVG	900-4500	6-45: Holiday Lane NB@165.6-45: Holiday Lane NB@233.8		NB THRU	68.08	176
AVG	900-4500	6-45: Holiday Lane NB@165.6-202: Site Access 2 EB@14.3		NB RIGHT-TURN	68.08	87
AVG	900-4500		6	OVERALL	251.22	468
AVG	900-4500	7-103: Site Access 3 EB@179.7-52: Burton Lane NB@97.4		EB LEFT-TURN	63.03	0
AVG	900-4500	7-103: Site Access 3 EB@179.7-10115: Burton Lane SB@0.2		EB RIGHT-TURN	61.34	68
AVG	900-4500	7-52: Burton Lane NB@44.3-203: Site Access 3 WB@20.6		NB LEFT-TURN	0	41
AVG	900-4500	7-52: Burton Lane NB@44.3-52: Burton Lane NB@97.4		NB THRU	0	4
AVG	900-4500	7-53: Burton Lane SB@799.8-10115: Burton Lane SB@0.2		SB THRU	0	2
AVG	900-4500	7-53: Burton Lane SB@799.8-203: Site Access 3 WB@20.6		SB RIGHT-TURN	0	0
AVG	900-4500		7	OVERALL	63.03	115

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APPENDIX G:
TURN LANE WARRANTS

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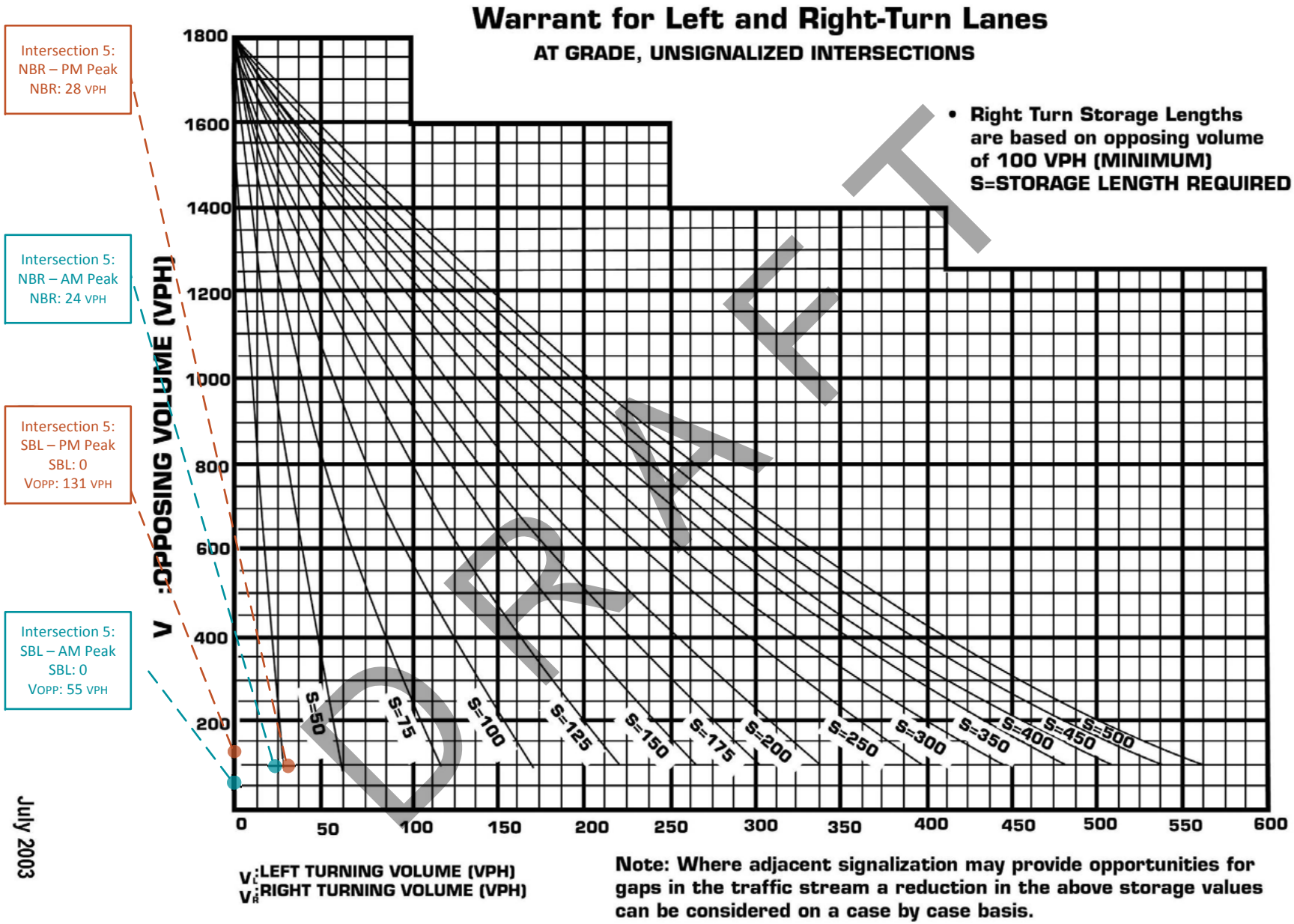
Intersection 5:
NBR – PM Peak
NBR: 28 VPH

Intersection 5:
NBR – AM Peak
NBR: 24 VPH

Intersection 5:
SBL – PM Peak
SBL: 0
VOPP: 131 VPH

Intersection 5:
SBL – AM Peak
SBL: 0
VOPP: 55 VPH



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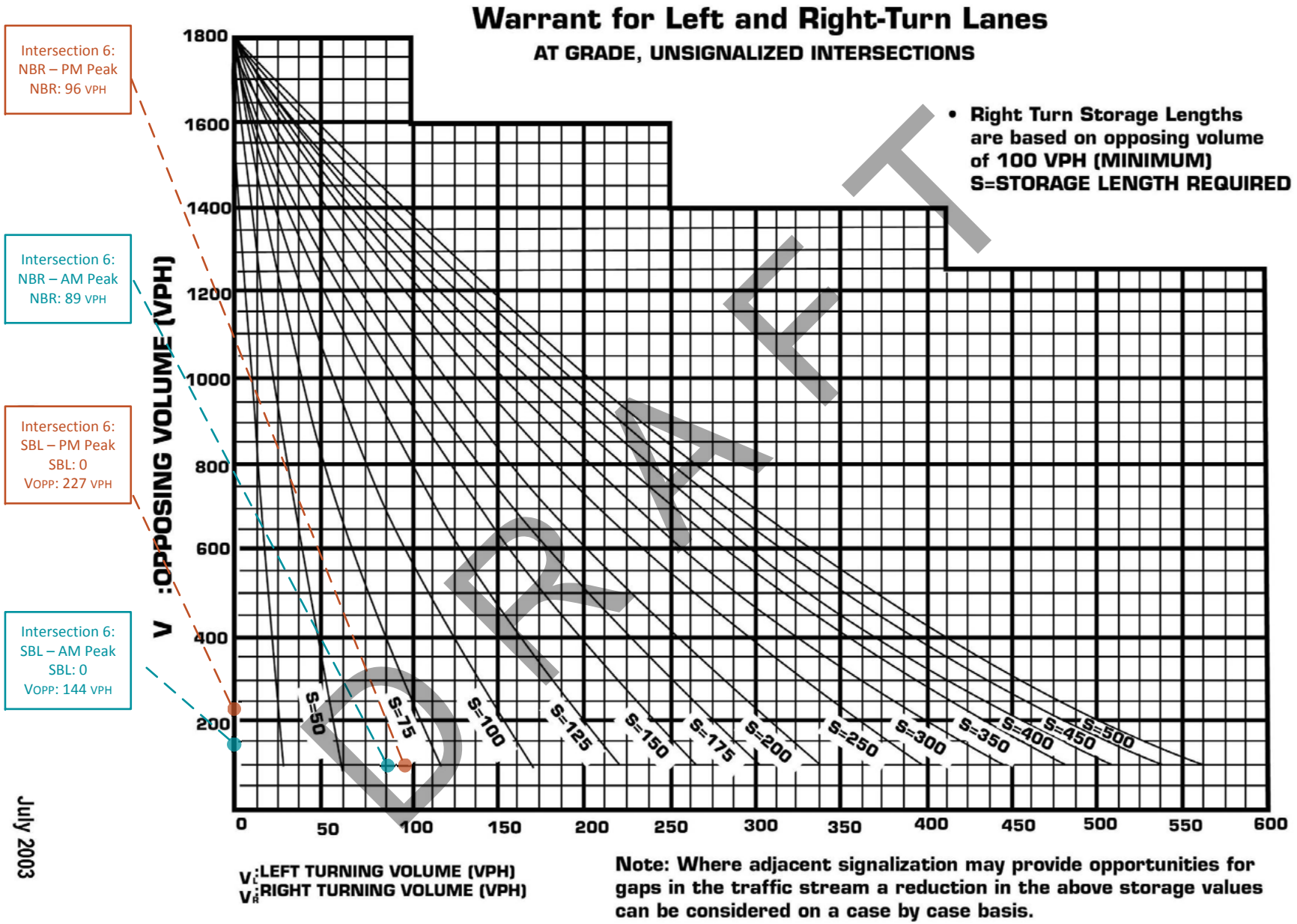
Intersection 6:
NBR – PM Peak
NBR: 96 VPH

Intersection 6:
NBR – AM Peak
NBR: 89 VPH

Intersection 6:
SBL – PM Peak
SBL: 0
VOPP: 227 VPH

Intersection 6:
SBL – AM Peak
SBL: 0
VOPP: 144 VPH



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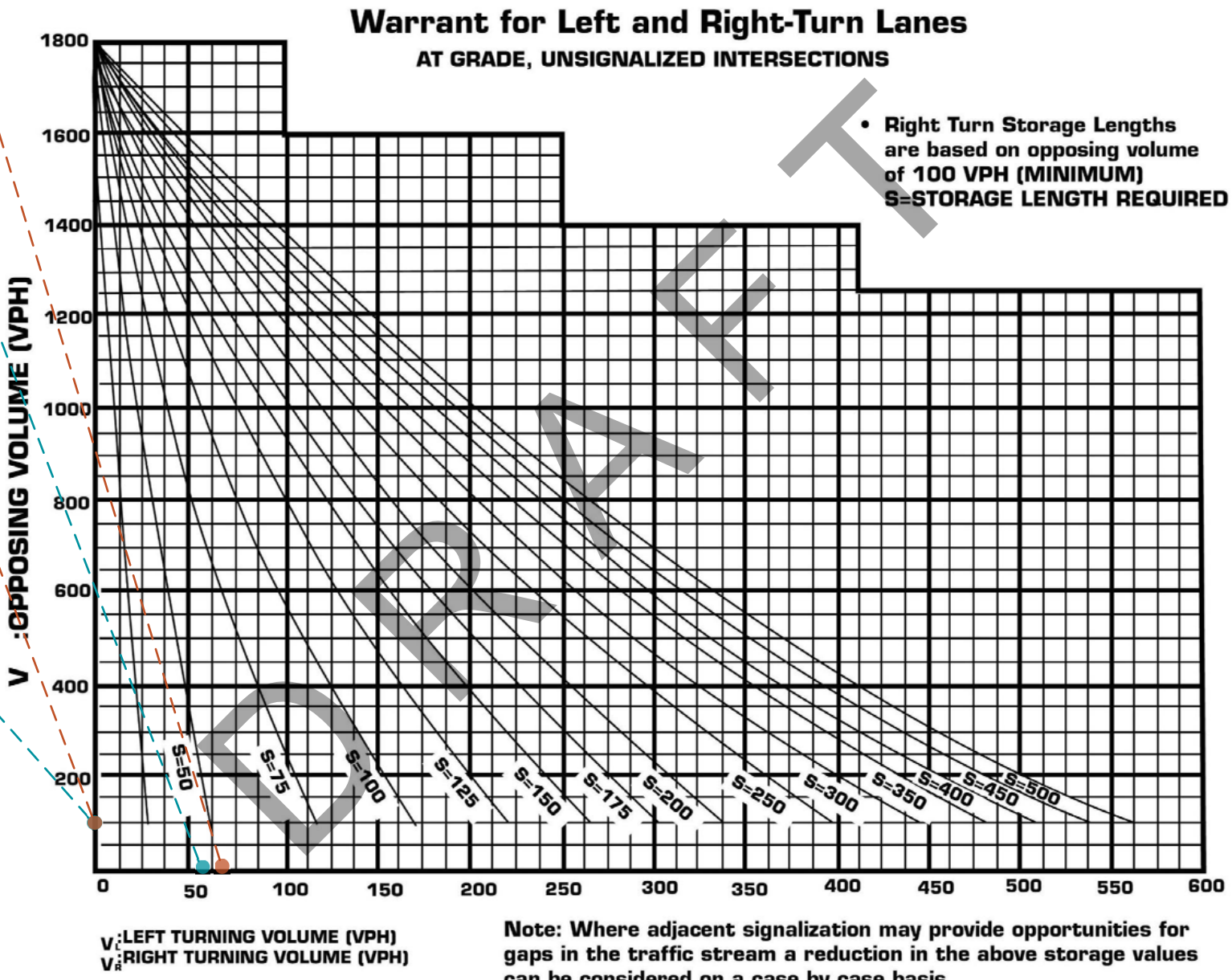
Intersection 7:
NBL – PM Peak
NBL: 67 VPH
VOPP: 6 VPH

Intersection 7:
NBL – AM Peak
NBL: 53 VPH
VOPP: 6 VPH

Intersection 7:
SBR – PM Peak
SBR: 0

Intersection 7:
SBR – AM Peak
SBR: 0



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Note: Where adjacent signalization may provide opportunities for gaps in the traffic stream a reduction in the above storage values can be considered on a case by case basis.

APPENDIX H:
TRAFFIC ENGINEERING ACCIDENT ANALYSIS SYSTEM (TEAAS) REPORTS

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Order-41000037687: Catawba Avenue DDI: 0.83-Year

10/26/2015

US-21 / SR 5544 (Catawba Avenue) at I-77 Interchange (Exit 28)
Mecklenburg County, City of Cornelius

The Safety Evaluation Group has completed a preliminary after period crash analysis on the segment of US-21 / SR 5544 (Catawba Avenue) from 150-feet west of SR 2195 (Torrence Chapel Road) / Liverpool Parkway to 150-feet east of US-21 (Statesville Road) / Holiday Lane, City of Cornelius in Mecklenburg County. This segment was converted from a standard interchange with two signalized ramp intersections to a Diverging Diamond Interchange (DDI).



BEFORE Period Segment Layout – Mecklenburg County GIS



AFTER Period Segment Layout – Google Images

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Jason Schronce, PE
Phone: 919-773-2967

Traffic Safety Engineer
NCDOT- Mobility & Safety

Total Segment Milepost: 3.272 to 3.627 Length = 0.355 Mile
Intersection-1: Torrence Chapel / Liverpool MP 3.272 – 3.328
Intersection-2: Southbound I-77 Ramp Terminal MP 3.394 – 3.450
Intersection-3: Northbound I-77 Ramp Terminal MP 3.492 – 3.548
Intersection-4: US-21 (Statesville) / Holiday MP 3.571 – 3.627

A summary table of the crash analysis is attached:
BEFORE Period: 10/1/2010 – 9/30/2013 3.0-Years
CONSTRUCTION: 10/1/2013 – 10/31/2014
AFTER Period: 11/1/2014 – 8/31/2015 0.83-Year

Treatment Information	**Before 3.0 Yrs**	**After 0.83 Yr**	**Percent Reduction (-) Percent Increase (+)**
Total Segment Crashes – 0.355 mile	137	23	N/A
Total Severity Index	2.84	2.61	- 8.1 %
Total Segment Crashes per Year	**45.7 CPY**	**27.7 CPY**	**- 39.4 %**
Int-1: Torrence Chapel / Liverpool	31	6	N/A
Intersection-1 Crashes per Year	**10.3 CPY**	**7.2 CPY**	**- 30.1 %**
Int-2: Southbound I-77 Ramp Terminal	42	3	N/A
Intersection-2 Crashes per Year	**14.0 CPY**	**3.6 CPY**	**- 74.3 %**
Int-3: Northbound I-77 Ramp Terminal	42	7	N/A
Intersection-3 Crashes per Year	**14.0 CPY**	**8.4 CPY**	**- 40.0 %**
Int-4: US-21 / Statesville / Holiday	19	4	N/A
Intersection-4 Crashes per Year	**6.3 CPY**	**4.8 CPY**	**- 23.8 %**

Attached are Collision Diagrams for the four signalized intersections:



We will continue to monitor with a 2.0-Year After Period update.

Jason Schronce, PE
Phone: 919-773-2967
Traffic Safety Engineer
NCDOT- Mobility & Safety

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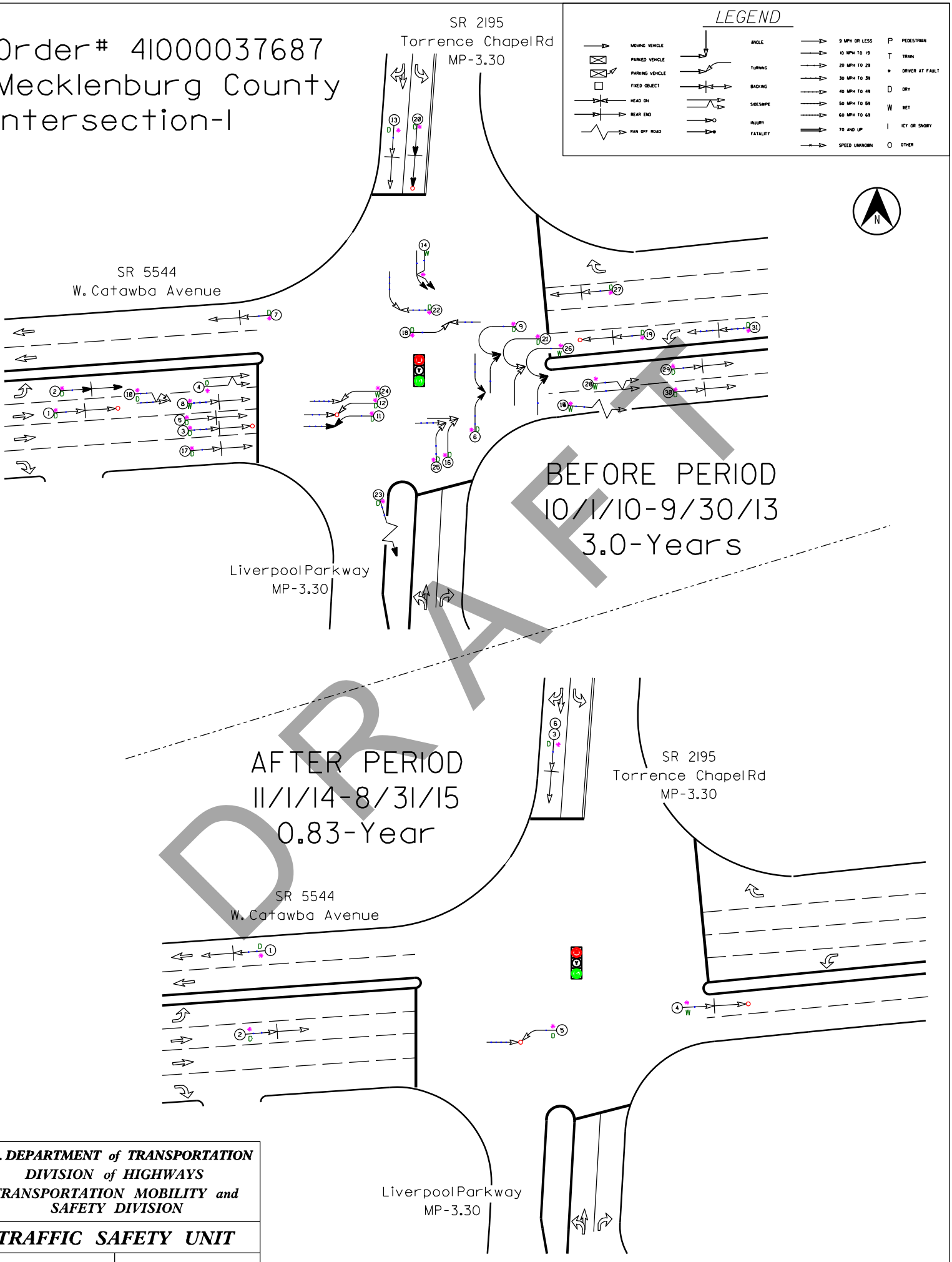
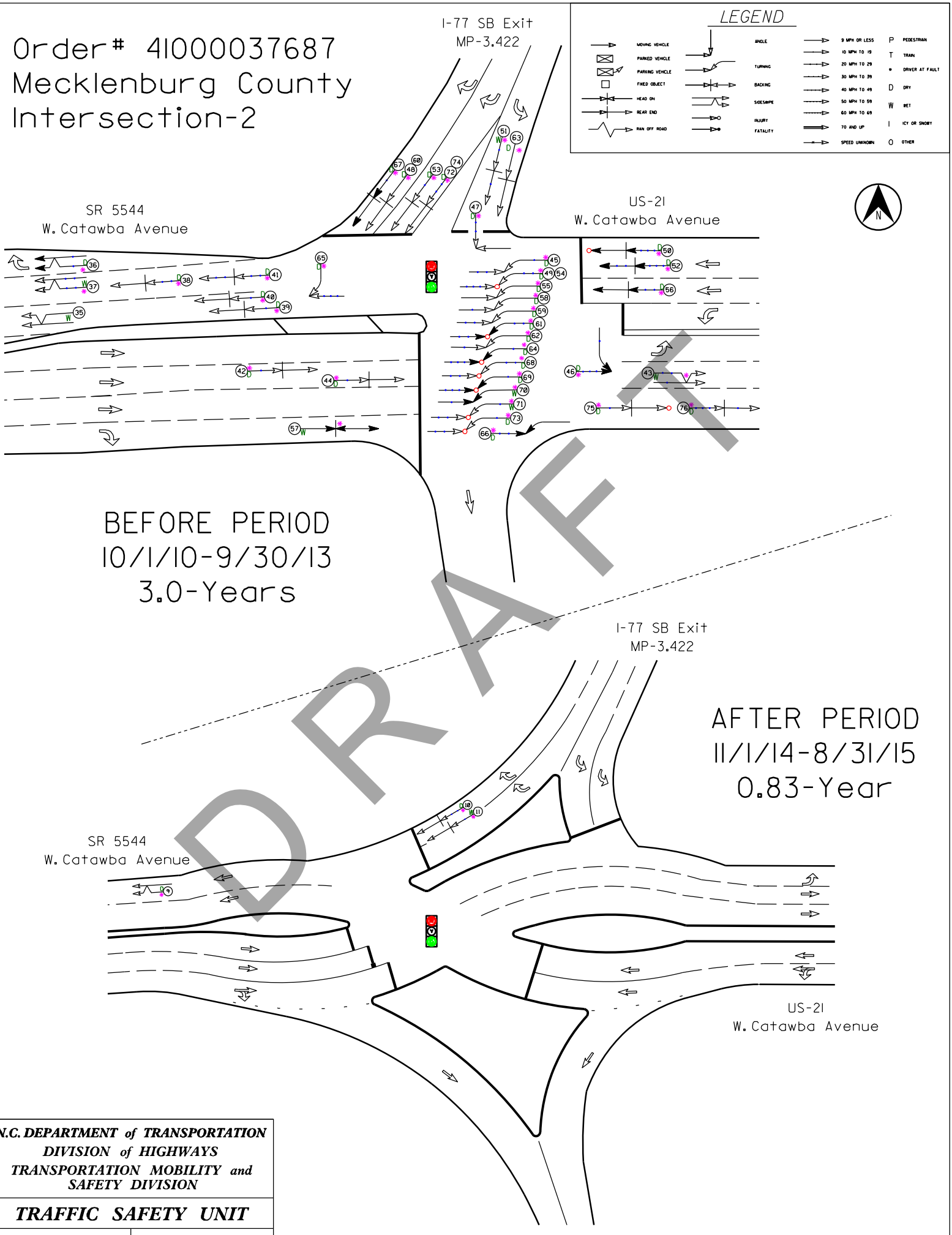
Order# 41000037687
Mecklenburg County
Intersection-1



N.C. DEPARTMENT of TRANSPORTATION DIVISION of HIGHWAYS TRANSPORTATION MOBILITY and SAFETY DIVISION	
TRAFFIC SAFETY UNIT	
Date: 10–23–2015	Prepared By: J. Schronce

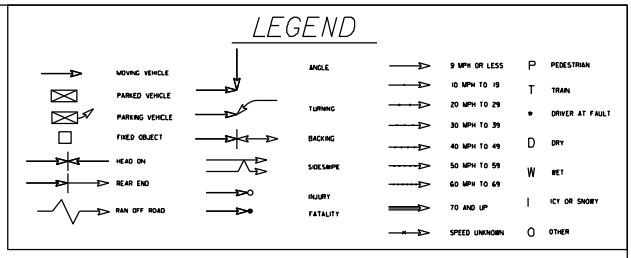
Order# 4100037687
Mecklenburg County
Intersection-2

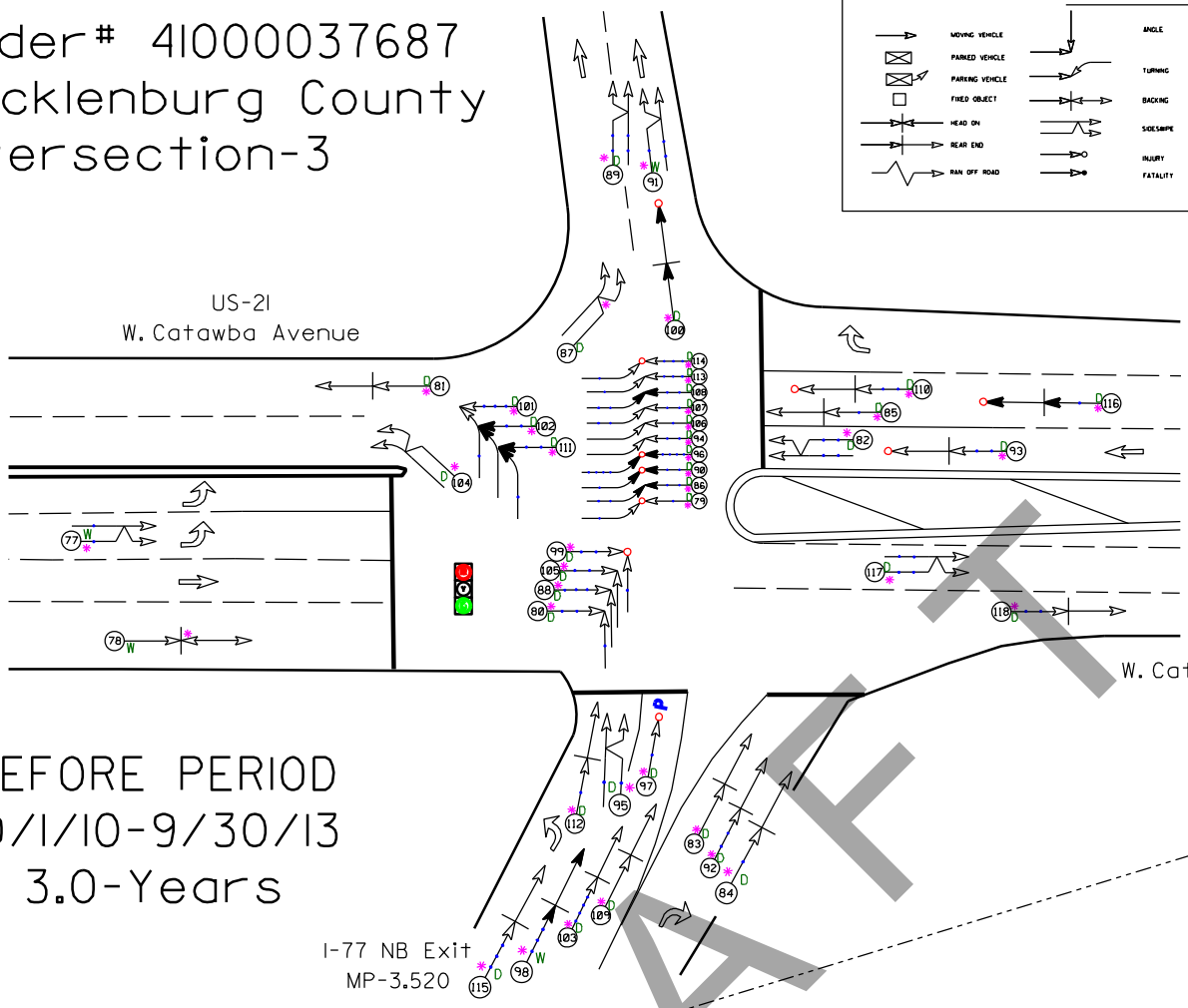


DRAFT

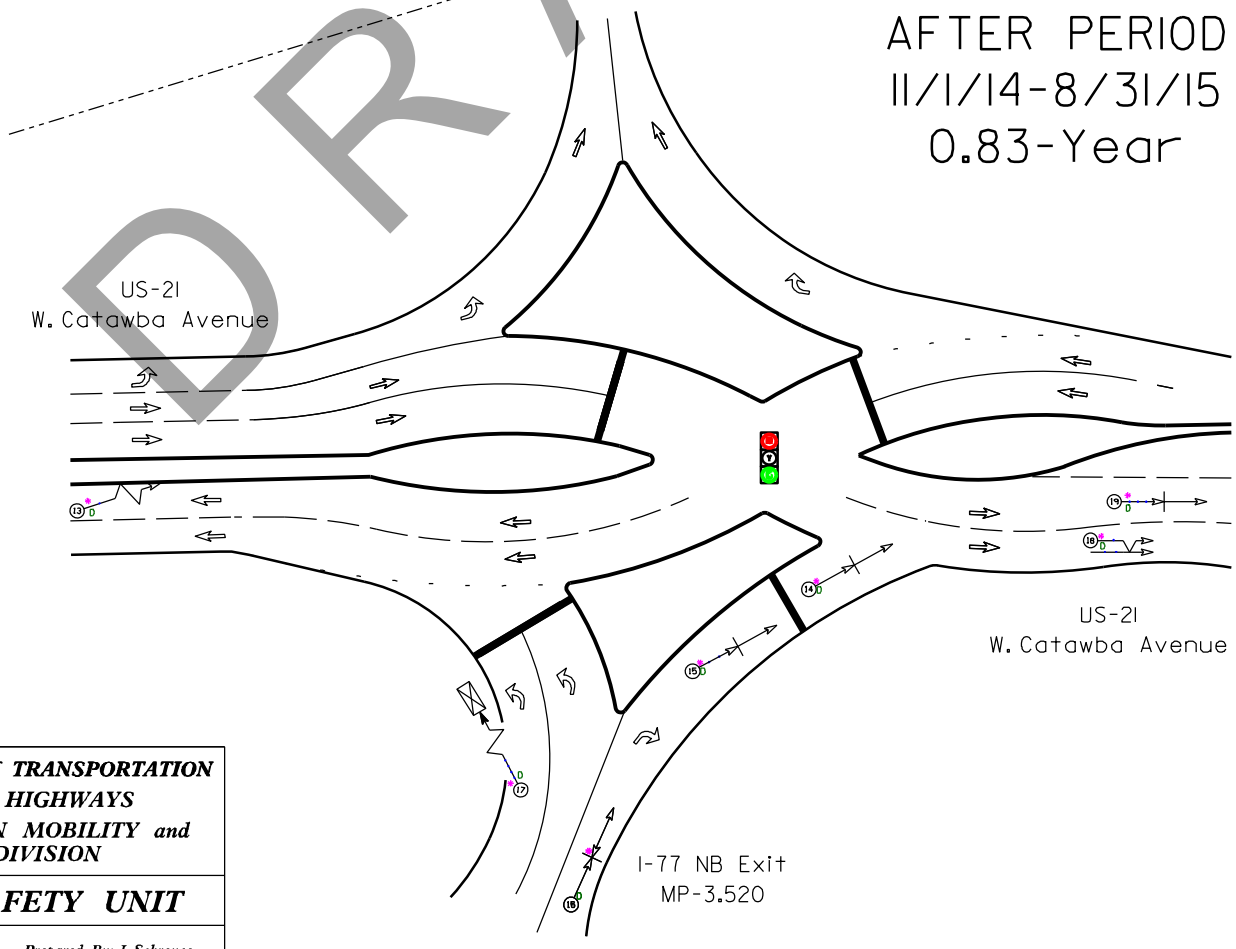
N.C. DEPARTMENT of TRANSPORTATION
DIVISION of HIGHWAYS
TRANSPORTATION MOBILITY and SAFETY DIVISION
TRAFFIC SAFETY UNIT
Date: 10–23–2015 | ***Prepared By: J. Schronce***

Order# 41000037687
Mecklenburg County
Intersection-3





BEFORE PERIOD
10/1/10-9/30/13
3.0-Years

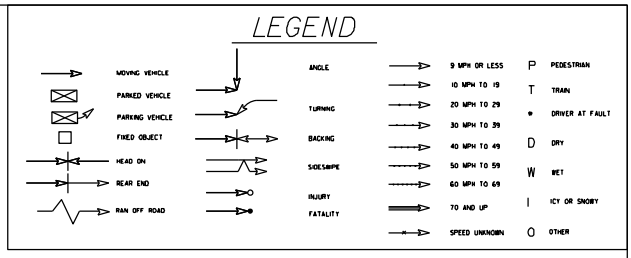


AFTER PERIOD
11/1/14-8/31/15
0.83-Year

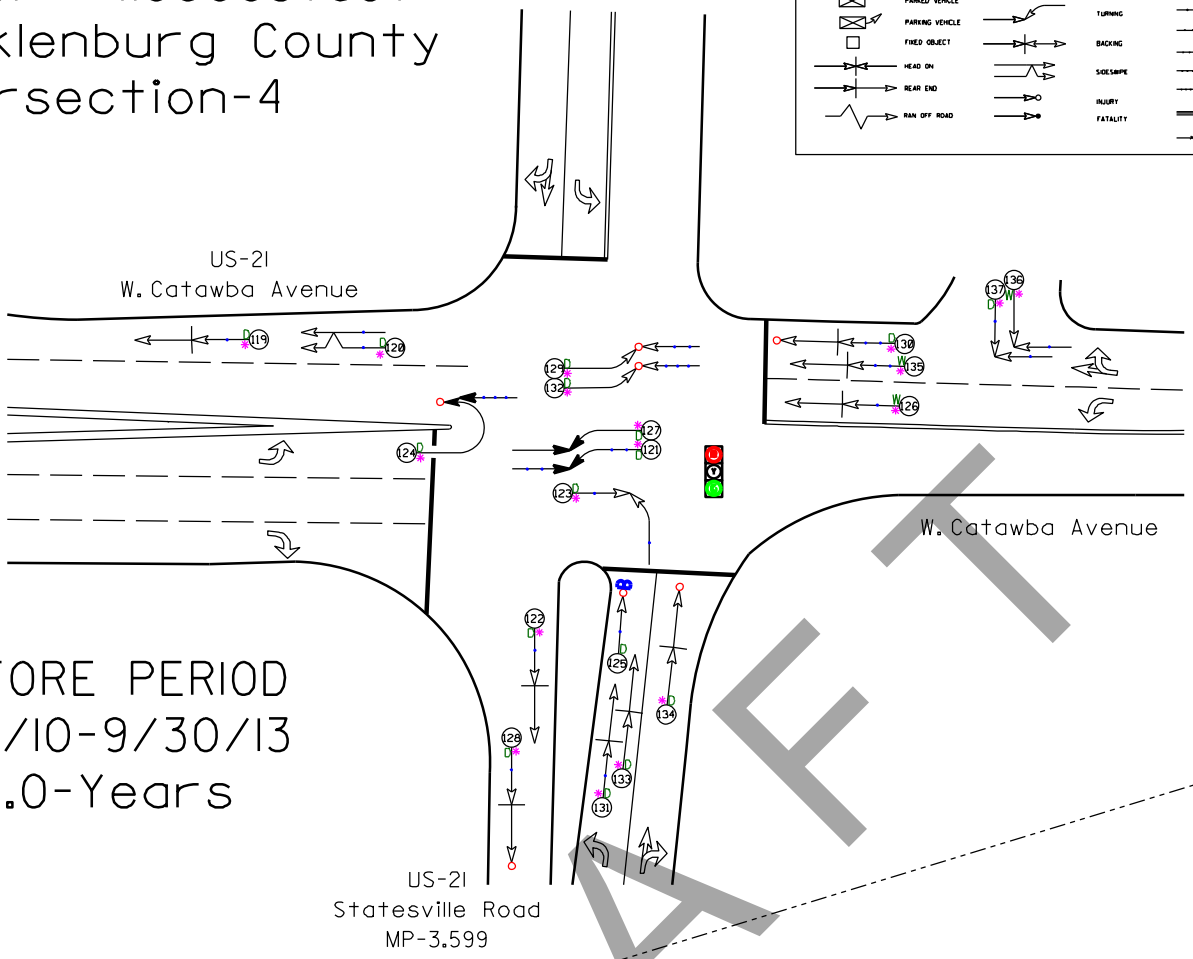
DRAFT

N.C. DEPARTMENT of TRANSPORTATION DIVISION of HIGHWAYS TRANSPORTATION MOBILITY and SAFETY DIVISION	
TRAFFIC SAFETY UNIT	
Date: 10–23–2015	Prepared By: J. Schronce

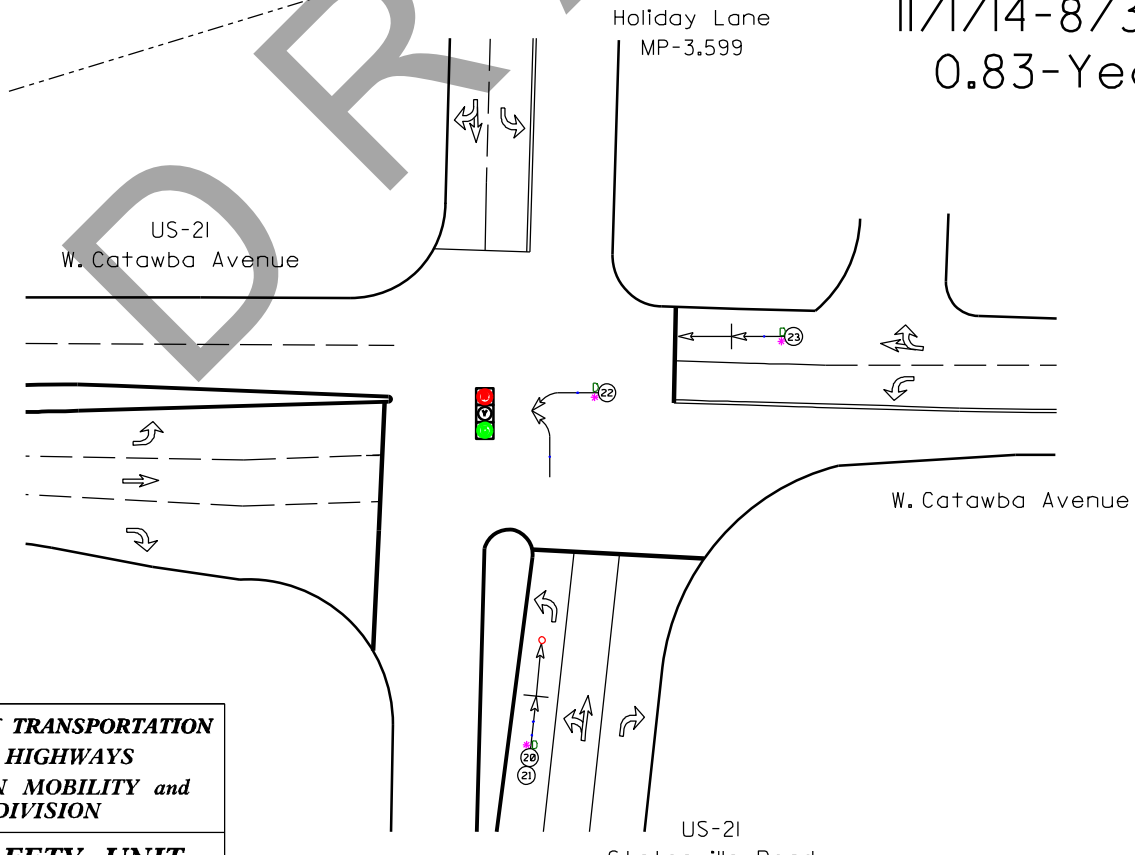
Order# 41000037687
Mecklenburg County
Intersection-4







BEFORE PERIOD
10/1/10-9/30/13
3.0-Years



AFTER PERIOD
11/1/14-8/31/15
0.83-Year

DRAFT

N.C. DEPARTMENT of TRANSPORTATION DIVISION of HIGHWAYS TRANSPORTATION MOBILITY and SAFETY DIVISION	
TRAFFIC SAFETY UNIT	
Date: 10–23–2015	Prepared By: J. Schronce

North Carolina Department of Transportation
Traffic Engineering Accident Analysis System
Intersection Analysis Report

Study Criteria Summary

County: MECKLENBURG **City:** All and Rural
Date: 11/01/2013 **to** 10/31/2016 **Study:** 41000044237
Location: Catawba Ave at Burton Ln / South Hill St

Report Details

Acc No	Crash ID	Date	Accident Type	Total Damage	Injuries F	A	B	C	Condition R	L	W	Road Ch	Ci	Trfc Ctl Dv	Op
1	**103922118**	11/08/2013 17:44	REAR END, SLOW OR STOP	$ 2800	0	0	0	0	1	4	1	1	0		
Unit	**1 :** 4	**Alchl/Drgs:** 0	**Speed:** 10 MPH	**Dir:** W	**Veh Mnvr / Ped Actn:** 4		**Obj Strk:**								
Unit	**2 :** 1	**Alchl/Drgs:** 0	**Speed:** 0 MPH	**Dir:** W	**Veh Mnvr / Ped Actn:** 1		**Obj Strk:**								
Unit	**3 :** 1	**Alchl/Drgs:** 0	**Speed:** 0 MPH	**Dir:** W	**Veh Mnvr / Ped Actn:** 1		**Obj Strk:**								
2	**103939705**	11/09/2013 01:23	PARKED MOTOR VEHICLE	$ 5000	0	0	0	0	1	4	1	1	0		
Unit	**1 :** 32	**Alchl/Drgs:** 7	**Speed:** 10 MPH	**Dir:** S	**Veh Mnvr / Ped Actn:** 4		**Obj Strk:** 20								
Unit	**2 :** 2	**Alchl/Drgs:** 7	**Speed:** 0 MPH	**Dir:** N	**Veh Mnvr / Ped Actn:** 2		**Obj Strk:** 20								
3	**103941749**	11/27/2013 01:31	RAN OFF ROAD - RIGHT	$ 9000	0	0	0	0	2	4	3	1	0		
Unit	**1 :** 1	**Alchl/Drgs:** 1	**Speed:** 35 MPH	**Dir:** W	**Veh Mnvr / Ped Actn:** 4		**Obj Strk:** 34								
4	**104114590**	07/01/2014 09:41	REAR END, SLOW OR STOP	$ 3000	0	0	0	0	1	1	1	1	0	0	
Unit	**1 :** 2	**Alchl/Drgs:** 0	**Speed:** 20 MPH	**Dir:** W	**Veh Mnvr / Ped Actn:** 11		**Obj Strk:**								
Unit	**2 :** 2	**Alchl/Drgs:** 0	**Speed:** 0 MPH	**Dir:** W	**Veh Mnvr / Ped Actn:** 11		**Obj Strk:**								
5	**104202480**	10/22/2014 13:27	REAR END, SLOW OR STOP	$ 5000	0	0	0	0	1	1	1	1	0	0	
Unit	**1 :** 3	**Alchl/Drgs:** 0	**Speed:** 0 MPH	**Dir:** E	**Veh Mnvr / Ped Actn:** 1		**Obj Strk:**								
Unit	**2 :** 1	**Alchl/Drgs:** 0	**Speed:** 20 MPH	**Dir:** E	**Veh Mnvr / Ped Actn:** 4		**Obj Strk:**								
6	**104242102**	12/05/2014 09:17	REAR END, SLOW OR STOP	$ 13500	0	0	0	1	2	1	3	1	0		
Unit	**1 :** 4	**Alchl/Drgs:** 0	**Speed:** 35 MPH	**Dir:** W	**Veh Mnvr / Ped Actn:** 4		**Obj Strk:**								
Unit	**2 :** 4	**Alchl/Drgs:** 0	**Speed:** 0 MPH	**Dir:** W	**Veh Mnvr / Ped Actn:** 1		**Obj Strk:**								
Unit	**3 :** 5	**Alchl/Drgs:** 0	**Speed:** 0 MPH	**Dir:** W	**Veh Mnvr / Ped Actn:** 1		**Obj Strk:**								
7	**104438083**	07/08/2015 06:51	REAR END, SLOW OR STOP	$ 2300	0	0	0	0	1	1	2	1	0	0	
Unit	**1 :** 4	**Alchl/Drgs:** 0	**Speed:** 20 MPH	**Dir:** W	**Veh Mnvr / Ped Actn:** 11		**Obj Strk:**								
Unit	**2 :** 1	**Alchl/Drgs:** 0	**Speed:** 5 MPH	**Dir:** W	**Veh Mnvr / Ped Actn:** 11		**Obj Strk:**								

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North Carolina Department of Transportation
Traffic Engineering Accident Analysis System
Intersection Analysis Report

Acc No	Crash ID	Date	Accident Type	Total Damage	Injuries F	A	B	C	Condition R	L	W	Road Ch	Ci	Trfc Ctl Dv	Op
8	**104451743**	07/15/2015 16:41	REAR END, SLOW OR STOP	$ 6500	0	0	0	0	1	1	1	1	0	3	1
Unit	**1 :** 1	**Alchl/Drgs:** 0	**Speed:** 35 MPH	**Dir:** W	**Veh Mnvr / Ped Actn:** 4		**Obj Strk:**								
Unit	**2 :** 1	**Alchl/Drgs:** 0	**Speed:** 0 MPH	**Dir:** W	**Veh Mnvr / Ped Actn:** 1		**Obj Strk:**								
Unit	**3 :** 2	**Alchl/Drgs:** 0	**Speed:** 0 MPH	**Dir:** W	**Veh Mnvr / Ped Actn:** 1		**Obj Strk:**								
Unit	**4 :** 4	**Alchl/Drgs:** 0	**Speed:** 0 MPH	**Dir:** W	**Veh Mnvr / Ped Actn:** 1		**Obj Strk:**								
9	**104538134**	10/19/2015 05:53	RAN OFF ROAD - RIGHT	$ 3500	0	0	0	0	1	4	1	1	0	0	
Unit	**1 :** 32	**Alchl/Drgs:** 0	**Speed:** 15 MPH	**Dir:** NE	**Veh Mnvr / Ped Actn:** 8		**Obj Strk:** 35								
10	**104647515**	01/27/2016 15:51	REAR END, SLOW OR STOP	$ 3500	0	0	0	0	1	1	1	1	0	0	
Unit	**1 :** 1	**Alchl/Drgs:** 0	**Speed:** 25 MPH	**Dir:** W	**Veh Mnvr / Ped Actn:** 4		**Obj Strk:**								
Unit	**2 :** 2	**Alchl/Drgs:** 0	**Speed:** 0 MPH	**Dir:** W	**Veh Mnvr / Ped Actn:** 1		**Obj Strk:**								
11	**104669880**	02/12/2016 17:23	REAR END, SLOW OR STOP	$ 6500	0	0	0	0	1	1	2	1	0	0	
Unit	**1 :** 4	**Alchl/Drgs:** 0	**Speed:** 20 MPH	**Dir:** W	**Veh Mnvr / Ped Actn:** 4		**Obj Strk:**								
Unit	**2 :** 4	**Alchl/Drgs:** 0	**Speed:** 0 MPH	**Dir:** W	**Veh Mnvr / Ped Actn:** 1		**Obj Strk:**								
12	**104669900**	02/19/2016 12:56	ANGLE	$ 3300	0	0	0	0	1	1	1	1	0	0	
Unit	**1 :** 4	**Alchl/Drgs:** 0	**Speed:** 10 MPH	**Dir:** SE	**Veh Mnvr / Ped Actn:** 8		**Obj Strk:**								
Unit	**2 :** 2	**Alchl/Drgs:** 0	**Speed:** 15 MPH	**Dir:** W	**Veh Mnvr / Ped Actn:** 4		**Obj Strk:**								
13	**104808496**	07/13/2016 17:40	REAR END, SLOW OR STOP	$ 5800	0	0	0	0	1	1	1	1	0	0	2
Unit	**1 :** 1	**Alchl/Drgs:** 0	**Speed:** 20 MPH	**Dir:** W	**Veh Mnvr / Ped Actn:** 4		**Obj Strk:**								
Unit	**2 :** 4	**Alchl/Drgs:** 0	**Speed:** 0 MPH	**Dir:** W	**Veh Mnvr / Ped Actn:** 1		**Obj Strk:**								
14	**104868396**	09/19/2016 15:49	REAR END, SLOW OR STOP	$ 2200	0	0	0	0	1	1	1	1	0	0	
Unit	**1 :** 2	**Alchl/Drgs:** 0	**Speed:** 15 MPH	**Dir:** W	**Veh Mnvr / Ped Actn:** 4		**Obj Strk:**								
Unit	**2 :** 1	**Alchl/Drgs:** 0	**Speed:** 0 MPH	**Dir:** W	**Veh Mnvr / Ped Actn:** 4		**Obj Strk:**								
Unit	**3 :** 2	**Alchl/Drgs:** 0	**Speed:** 0 MPH	**Dir:** W	**Veh Mnvr / Ped Actn:** 11		**Obj Strk:**								

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Legend for Report Details:

Acc No - Accident Number
Injuries: F - Fatal, A - Class A, B - Class B, C - Class C
Condition: R - Road Surface, L - Ambient Light, W - Weather
Rd Ch - Road Character
Rd Ci - Roadway Contributing Circumstances
Trfc Ctl - Traffic Control: Dv - Device, Op - Operating
Alchl/Drgs - Alcohol Drugs Suspected
Veh Mnvr/Ped Actn - Vehicle Maneuver/Pedestrian Action
Obj Strk - Object Struck

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Summary Statistics

High Level Crash Summary

Crash Type	Number of Crashes	Percent of Total
Total Crashes	14	100.00
Fatal Crashes	0	0.00
Non-Fatal Injury Crashes	1	7.14
Total Injury Crashes	1	7.14
Property Damage Only Crashes	13	92.86
Night Crashes	4	28.57
Wet Crashes	2	14.29
Alcohol/Drugs Involvement Crashes	1	7.14

Crash Severity Summary

Crash Type	Number of Crashes	Percent of Total
Total Crashes	14	100.00
Fatal Crashes	0	0.00
Class A Crashes	0	0.00
Class B Crashes	0	0.00
Class C Crashes	1	7.14
Property Damage Only Crashes	13	92.86

Vehicle Exposure Statistics

Annual ADT = 15500

Total Vehicle Exposure = 16.99 (MEV)

Crash Rate	Crashes Per 100 Million Vehicles Entered
Total Crash Rate	82.41
Fatal Crash Rate	0.00
Non Fatal Crash Rate	5.89
Night Crash Rate	23.55
Wet Crash Rate	11.77
EPDO Rate	125.97

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Miscellaneous Statistics

Severity Index =	1.53
EPDO Crash Index =	21.40
Estimated Property Damage Total = $	71900.00

Accident Type Summary

Accident Type	Number of Crashes	Percent of Total
ANGLE	1	7.14
PARKED MOTOR VEHICLE	1	7.14
RAN OFF ROAD - RIGHT	2	14.29
REAR END, SLOW OR STOP	10	71.43

Injury Summary

Injury Type	Number of Injuries	Percent of Total
Fatal Injuries	0	0.00
Class A Injuries	0	0.00
Class B Injuries	0	0.00
Class C Injuries	1	100.00
Total Non-Fatal Injuries	1	100.00
Total Injuries	1	100.00

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Monthly Summary

Month	Number of Crashes	Percent of Total
Jan	1	7.14
Feb	2	14.29
Mar	0	0.00
Apr	0	0.00
May	0	0.00
Jun	0	0.00
Jul	4	28.57
Aug	0	0.00
Sep	1	7.14
Oct	2	14.29
Nov	3	21.43
Dec	1	7.14

Daily Summary

Day	Number of Crashes	Percent of Total
Mon	2	14.29
Tue	1	7.14
Wed	6	42.86
Thu	0	0.00
Fri	4	28.57
Sat	1	7.14
Sun	0	0.00

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Hourly Summary

Hour	Number of Crashes	Percent of Total
0000-0059	0	0.00
0100-0159	2	14.29
0200-0259	0	0.00
0300-0359	0	0.00
0400-0459	0	0.00
0500-0559	1	7.14
0600-0659	1	7.14
0700-0759	0	0.00
0800-0859	0	0.00
0900-0959	2	14.29
1000-1059	0	0.00
1100-1159	0	0.00
1200-1259	1	7.14
1300-1359	1	7.14
1400-1459	0	0.00
1500-1559	2	14.29
1600-1659	1	7.14
1700-1759	3	21.43
1800-1859	0	0.00
1900-1959	0	0.00
2000-2059	0	0.00
2100-2159	0	0.00
2200-2259	0	0.00
2300-2359	0	0.00

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Light and Road Conditions Summary

Condition	Dry	Wet	Other	Total
Day	9	1	0	10
Dark	3	1	0	4
Other	0	0	0	0
Total	12	2	0	14

Object Struck Summary

Object Type	Times Struck	Percent of Total
LUMINAIRE POLE NON-BREAKAWAY	1	25.00
PARKED MOTOR VEHICLE	2	50.00
UTILITY POLE	1	25.00

Vehicle Type Summary

Vehicle Type	Number Involved	Percent of Total
LIGHT TRUCK (MINI-VAN, PANEL)	1	3.23
PASSENGER CAR	10	32.26
PICKUP	8	25.81
SPORT UTILITY	9	29.03
UNKNOWN	2	6.45
VAN	1	3.23

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Yearly Totals Summary

Accident Totals

Year	Total Accidents	Fatal Accidents	Injury Accidents	Property Damage Only Accidents
2013	3	0	0	3
2014	3	0	1	2
2015	3	0	0	3
2016	5	0	0	5
Total	14	0	1	13

Injury Totals

Year	Fatal Injuries	Class A, B, or C Injuries
2013	0	0
2014	0	1
2015	0	0
2016	0	0
Total	0	1

Miscellaneous Totals

Year	Property Damage	EPDO Index
2013	$ 16800	3.00
2014	$ 21500	10.40
2015	$ 12300	3.00
2016	$ 21300	5.00
Total	$ 71900	21.40

Type of Accident Totals

Year	Left Turn	Right Turn	Rear End	Run Off Road & Fixed Object	Angle	Side Swipe	Other
2013	0	0	1	1	0	0	1
2014	0	0	3	0	0	0	0
2015	0	0	2	1	0	0	0
2016	0	0	4	0	1	0	0
Total	0	0	10	2	1	0	1

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Study Criteria

Study Name	Log No.	PH No.	TIP No.	K/A Cf.	B/C Cf.	ADT	ADT Route
41000044237				76.8	8.4	15500	

Request Date	Courier Service	Phone No.	Ext.	Fax No.

County			Municipality					
Name	Code	Div.	Name	Code	Y-Line Ft.	Begin Date	End Date	Years
MECKLENBURG	60	10	All and Rural		150	11/01/2013	10/31/2016	3.00

Location Text	Requestor
Catawba Ave at Burton Ln / South Hill St	

Included Accidents

104808496
104669900
104202480

Excluded Accidents

104693065
104318244

Fiche Roads

Name	Code
CATAWBA	50005331
BURTON	50004403
HILL	50014016
US 21	20000021
SR 5544	40005544

Intersection Road Combinations

Name	Code	Code	Name
CATAWBA	50005331	50004403	BURTON
CATAWBA	50005331	50014016	HILL

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REQUEST FOR BOARD ACTION

Print

Date of Meeting: March 13, 2017

To: Planning Board Members

From: Will Washam - Senior Planner

Action Requested:

Old Swan Development, LLC (Joe and David Stockwell) are requesting a zoning map amendment to allow the establishment of a restaurant with food trucks, outdoor seating and entertainment area on 3.6 acres at the site of the existing Anchorage Marine building at the intersection of US 21 and Westmoreland Road.

Manager's Recommendation:

Approval with conditions.

ATTACHMENTS:		
Name:	Description:	Type:
Single_Application_(12-5-16).pdf	Application	Backup Material
Boatyard_Eats_Vicinity.jpg	Vicinity Map	Backup Material
Boatyard_Eats_Property.jpg	Property Map	Backup Material
Boatyard_Eats_LU.jpg	Land Use Map	Backup Material
Boatyard_Eats_Zoning.jpg	Zoning Map	Backup Material
REZ_12-16_(PB)_Boat_Yard_Eats_Staff_Report.docx	Staff Report	Backup Material
Boatyard_Eats_REZ_(2.23.17).pdf	Site plan package	Backup Material
Community_meeting_sign_in_and_notes.docx	Community Meeting Minutes	Backup Material
PDRC_Minutes.030816.DRAFT.pdf	PDRC minutes	Backup Material
Capture007.pdf	Site Information	Backup Material

TOWN OF CORNELIUS
Planning Department

PO Box 399 | Cornelius, NC 28031 | Phone: 704-896-2461 | Fax: 704-896-2462

LAND DEVELOPMENT APPLICATION FORM | **Case #:**

1. Application Type

	✓	Fee
Subdivision:		
Major Subdivision Plat		
Sketch Plan/Plat	☐	____
Preliminary Plat	☐	____
Construction Documents	☐	____
Minor Subdivision Plat	☐	____
Rezoning:		
Standard Rezoning	☐	____
Conditional Zoning	☒	____
Parallel Conditional District	☐	____
Conditional District Amendment	☐	____

	✓	Fee
Site Plan:		
Major Site Plan	☐	____
Minor Site Plan	☐	____
Conditional Use Permit	☑	1250
Conditional Use Amendment	☐	____
Construction Documents	☐	____
Vested Rights	☐	____
Vested Rights Amendment	☐	____
Uniform Sign Plan:	☐	____
Text Amendment:	☐	____
Other: ____	☐	____
Fee Total		1250

2. Project Information

Date of Application: ____ Name of Project: BOAT YARD EATS Phase: ____

Location: 18418 STATESVILLE ROAD Property Size (acres): 3.6 # of Units (residential): 1

Current Zoning: HC Proposed Zoning: CZ

Current Land Use: HC Proposed Land Use: RESTAURANT

Tax Parcel Number(s): 00514108

3. Contact Information

OLD SWAN DEVELOPMENT, LLC - JOSEPH STOCKWELL
Applicant/Developer

84303 WINSLOW — DAVID Stockwell - 336-253-7192
Address — City, State Zip

CHAPEL Hill — NC — 27517
Telephone — Fax — Email

919-265-8338 — JOSEPHSTOCKWELL48@GMAIL.COM
Signature — Print Name — Date

Chris McIntyre Amicus Partners
Agent (Registered Engineer, Designer, Surveyor, etc.)

331 Cobb Market Dr. Ste 110
Address

Concord, NC 28027
City, State Zip

704-573-1621
Telephone — Fax

CC McIntyre — Chris McIntyre — 11/5/16
Signature — Print Name — Date

Email - cmcintyre@amicuseng.com

OLD SWAN DEVELOPMENT, LLC
Property Owner

84303 WINSLOW
Address

CHAPEL Hill NC 27517
City, State Zip

919-265-8338
Telephone — Fax

Joseph Stockwell — JOSEPH Stockwell — 10/10/16
Signature — Print Name — Date

Email -

4. Description of Project

Briefly explain the nature of this request.

WE ARE CONVERTING EXISTING BUILDING TO A RESTAURANT WITH ENTERTAINMENT AND SERVICED BY FOOD TRUCKS.

Reasons for Conditional Use Permit (if applicable):

- REQUIRED by Code
-
-
-

Note: ***The review process will be delayed if the project submittal is not complete with the following:***

☐ **Signed "original" application** – *must include signatures of all project partners, applicants and property owners*

☐ **One (1) official hard copy of property survey and site/sketch plan drawn to scale by a professional engineer or landscape architect** – *survey shall include existing buildings, topography, wetlands, streams, vegetation, and other natural features. Site/Sketch plan shall include general locations of buildings, lots, streets, parking, proposed grading, landscaping and screening, open space, watershed/storm water calculations on plans (if applicable), associated storm water measures (if applicable), and general locations of proposed utilities and lighting*

☐ **Project Fee(s)** – *see fee schedule. Required fees may include application fee, and additional fees to prepare TIA based on scoping meeting*

☐ **One (1) official hard copy of illustrative elevations & floor plans (exception: single-family residential projects) drawn to scale** - *drawn to scale for all buildings and on all sides, and all retaining walls, garden walls, fences, gazebo's, trellis's or other items over 4-feet tall, also include floor plans.*

☐ **Digital files of all items** *(Application; survey, elevations, copy of site/sketch plan, floor plans, storm water concept plan, and preliminary landscaping plan*

➢ **PLEASE NOTE:**
Once a complete application is submitted, the Planning Director shall determine the need for a Traffic Impact Analysis (TIA) in accordance with chapter 13 of the LDC. If a TIA is required, a scoping meeting will be held between the Town, applicant(s), and the Town's selected traffic consultant. A fee equal to an estimate of consultant fees submitted by the consultant for preparation of the TIA and any additional services incurred by the consultant shall be paid by the applicant in full to the Town before the Town can release the work to the consultant.

Office Use Only:

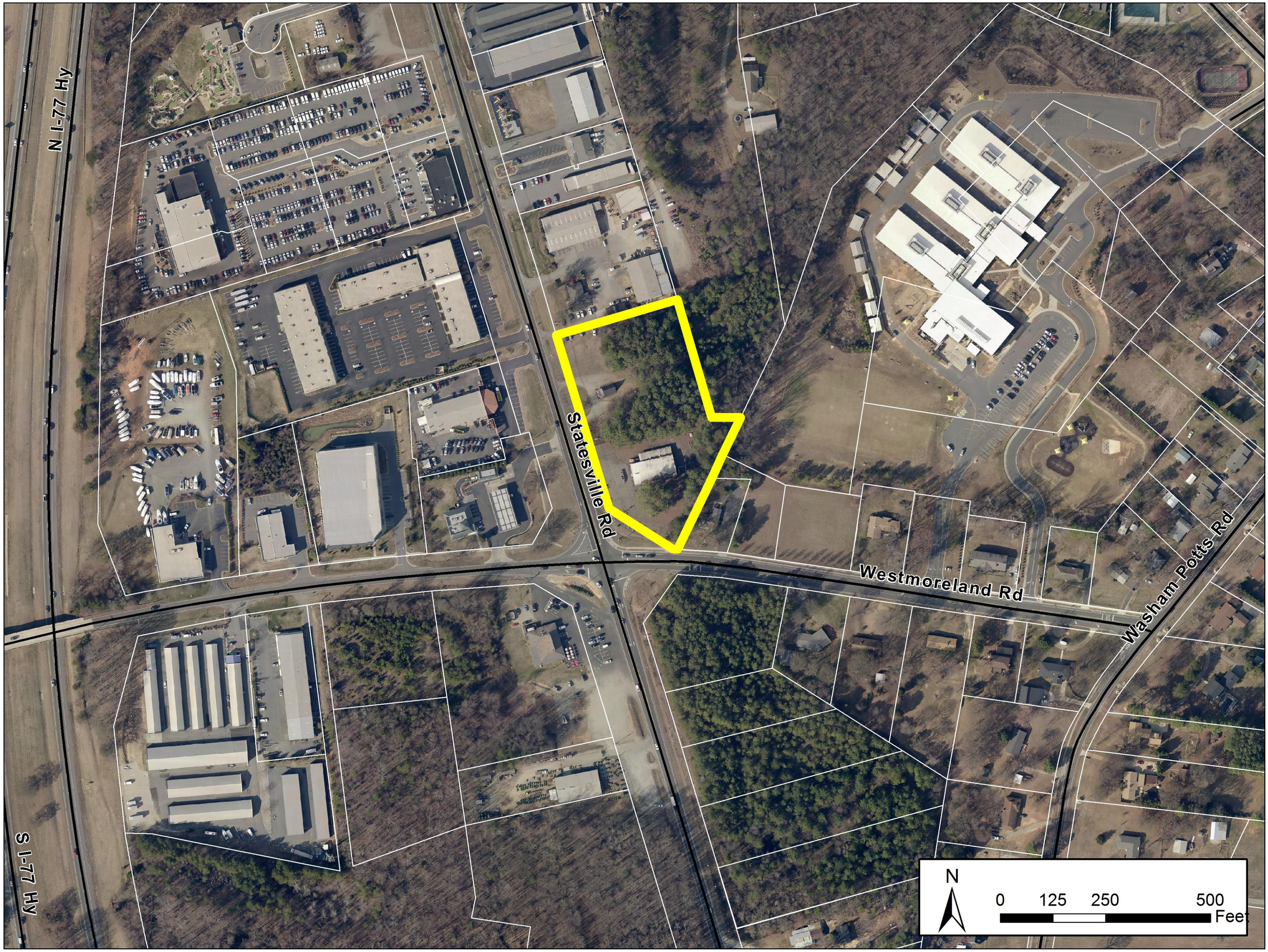
Received by: _____ Date: _____

Review Dates:

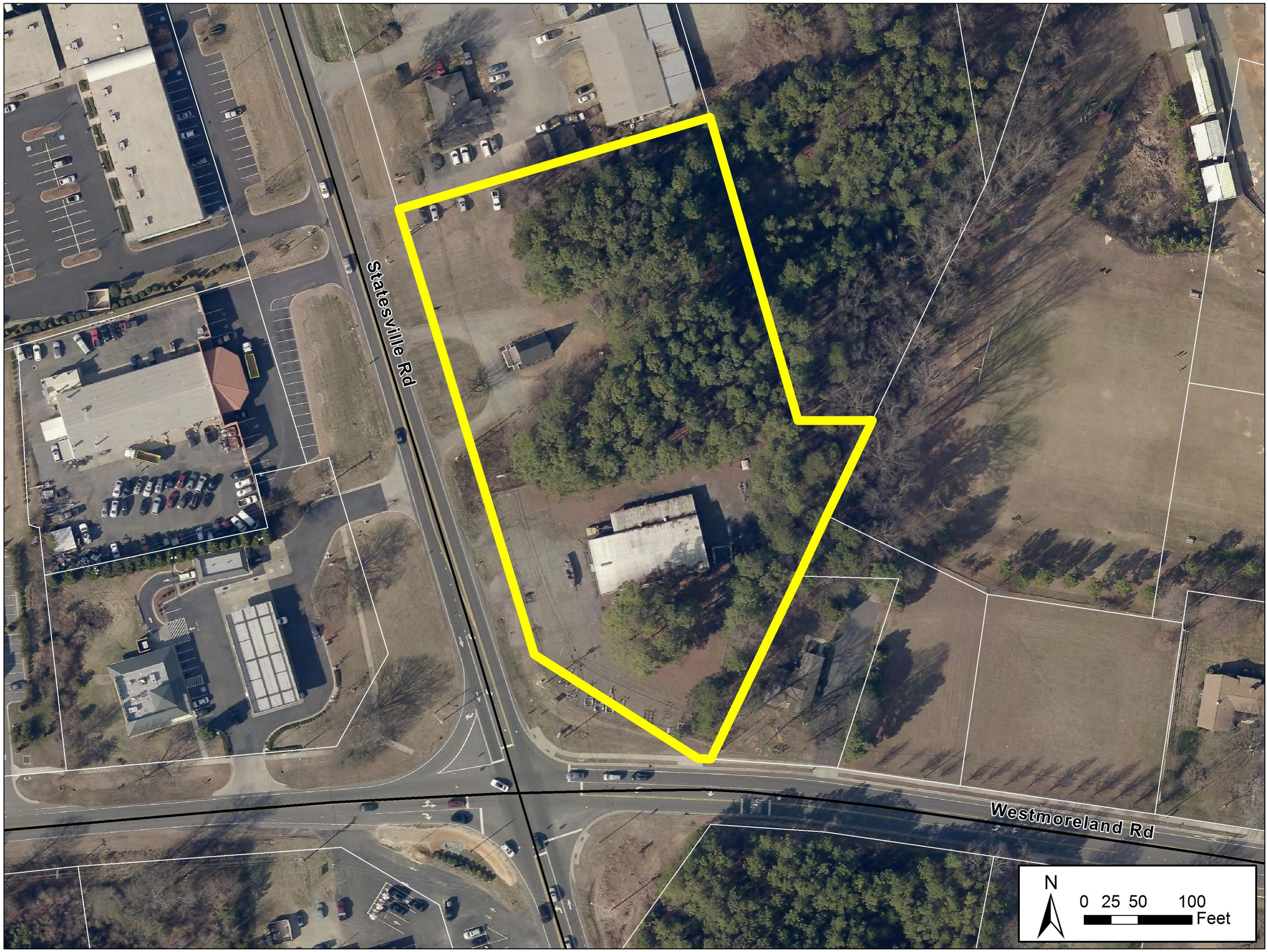
Pre-Development: _____ TIA Scoping Meeting: _____ TRC: _____ ARB: _____

Comm. Mtg (CZ's Only): _____ Planning Board: _____ Town Board: _____

Boatyard Eats Proposal



Boatyard Eats Proposal



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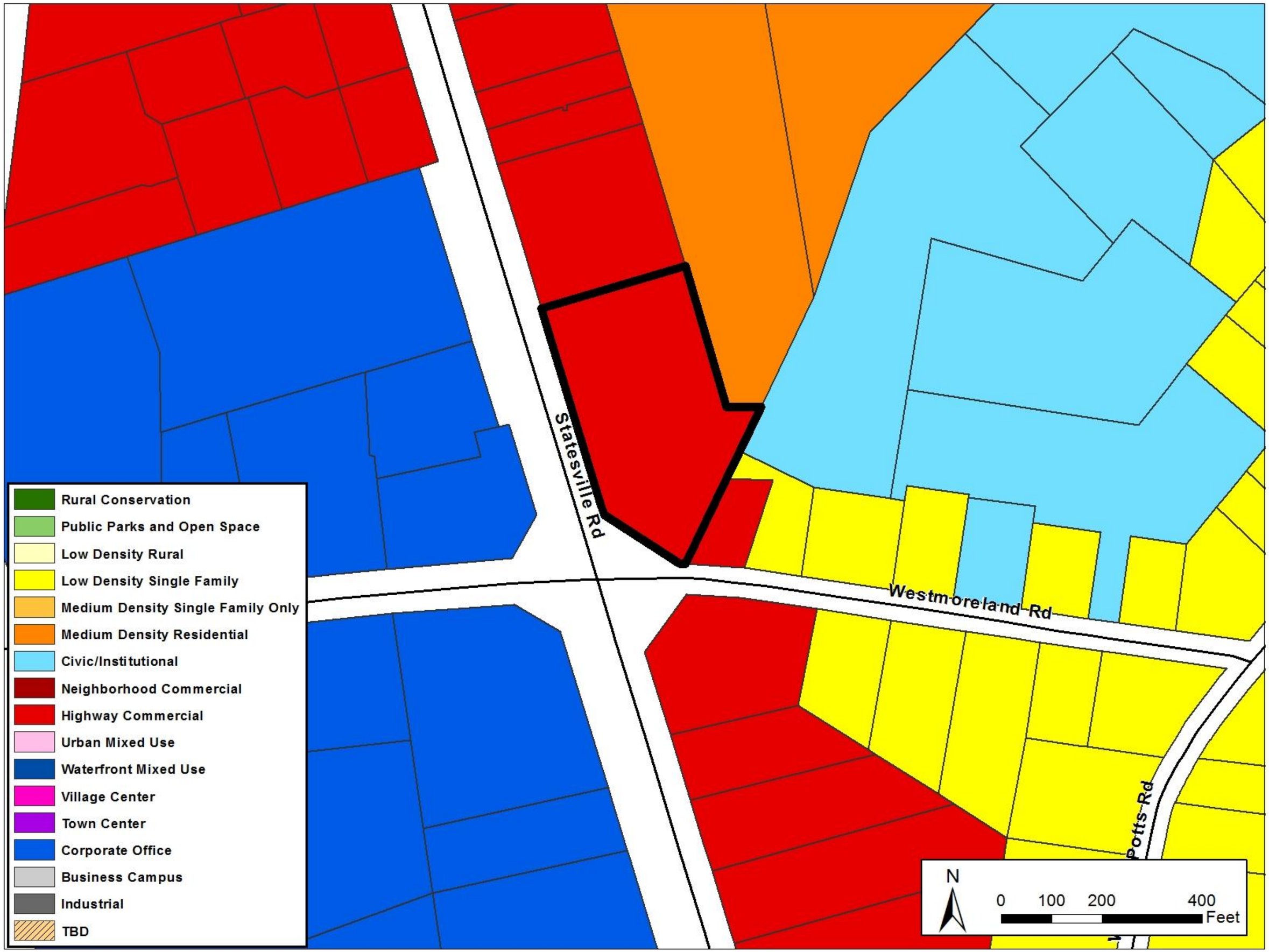

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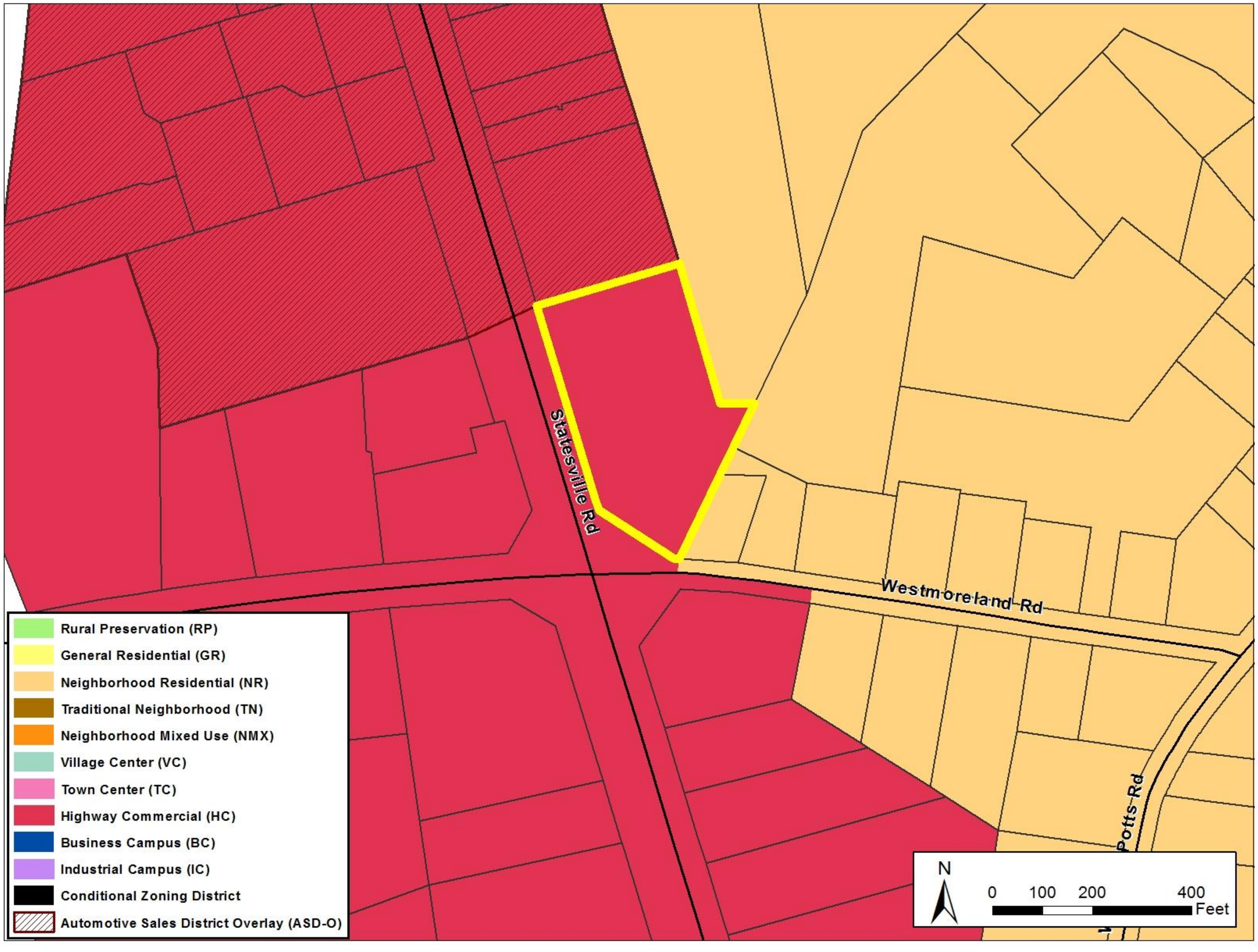

REZ 12-16
Boat Yard Eats
Conditional Zoning Request

Planning Board Meeting
March 13, 2017

OWNER(S):	Old Swan Development, LLC 84303 Winslow Chapel Hill, NC 27517
APPLICANT:	Old Swan Development, LLC 84303 Winslow Chapel Hill, NC27517
PROPERTY LOCATION:	The North East corner of the intersection of Westmorelan Rd and US 21 (PID: 00514108)
PROPERTY SIZE:	3.64 acres
CURRENT LAND USE:	Commercial/Vacant
PROPOSED LAND USE:	Restaurant
EXISTING ZONING:	HC (Highway Commercial)
PROPOSED ZONING:	CZ (Conditional Zoning

EXISTING CONDITIONS:

1. *Description of Adjoining Zoning and Land Uses* – As shown on the Town of Cornelius zoning map, this property is currently zoned HC (Highway Commercial). This property is bordered by HC zoning (within the Automotive Sales District Overlay) to the North, and NR (Neighborhood Residential) zoning to the East. The property to the North contains a car rental business. A small portion of the subject property borders the grounds (Athletic fields) of JV Washam Elementary School. The property directly to the East houses a small commercial building.

2. *Topography* – The topography is generally flat. There is an existing berm that rises ~4'-6' along the eastern edge of the property which borders the CMC property and the existing commercial building that fronts Westmoreland Rd.

3. *Vegetation* – Generally, the entire site outside of the existing buildings and parking lot is wooded.

4. *Infrastructure* – Utilities are readily available for this site. This site currently contains two buildings. There is a small single tenant commercial building on the North end of the property (nail salon, ~1,000 sq. ft.) and a ~7,000 sq. ft. commercial building (used for boat storage and sales) near the corner of Westmoreland and US 21. Boat Yard Eats will be using the existing ~7,000 sq. ft. building to house the seating area for the restaurant use.

5. *Traffic* – The applicant has had preliminary coordination with NCDOT to determine derive locations and configuration. The applicant is moving forward at this time with two driveway accesses for the Boat Yard Eats restaurant. The Boat Yard Eats driveway on Westmoreland Rd will be right in-right out and portable curb with bollards (www.qwickkurb.com) will be used to restrict left turns. On US 21 there are currently three existing driveway cuts on the entire site. This project will consolidate two of these driveways into a new driveway for access to Boat Yard Eats on US 21. This drive way also be restricted to right-in-right-out using the same portable curd that is proposed on Westmoreland Rd. Placement of the portable curb will be on the centerline of Westmoreland Rd and US 21 where used. NCDOT is allowing the use of the portable curb and bollards to mitigate the loss of permanent infrastructure during the upcoming widening of US 21. The other existing driveway which accesses the nail salon will remain un-changed. All driveways for this project are subject to NCDOT driveway permitting which occurs during the approval of construction documents



STAFF COMMENTS:

1. *Project Overview –* Boat Yard Eats is a restaurant based around a rotating lineup of food truck offerings. The old Anchor Marine building is proposed to be repurposed to house this use, along with upgrades to the grounds. The building itself will house a kitchen which will serve a very limited menu offering a signature dish that will be served every day, along with seating. There will be three permanent parking spaces (complete with electrical hookups) for food trucks in the rear of the site. There is also outdoor seating proposed under an existing canopy that is attached to the building. Along with the food offerings, there is an outdoor entertainment area with a stage proposed in the rear of the site on the existing pavement.

2. *District Consistency* – Restaurants are typically permitted with conditions in the Highway Commercial district. However, with the inclusion of the outdoor entertainment area conditional zoning is the best option for this request.

3. *Land Use Plan Consistency* **–** The Land Use Plan adopted by the Town Board on January 6, 2014 designates this property as Highway Commercial. Restaurants are one of the primary land uses found in this land use designation.

4. *Pre-Development Review Committee* – An initial concept plan was presented to the PDRC on March 8th 2016. Staff received comments that were very positive.

5. *Open Space/Water Quality* – This development is not required to provide open space. However, the applicant is proposing to provide the town with a 30' greenway easement along the eastern border of their property for the future Smithville to JV Washam greenway. The need for any storm water retention facilities will be assessed by Mecklenburg County LUESA during the concept plan and construction document submittal.

6. *Community Meeting* – The applicant held the required community meeting on Wednesday, January 11, 2016. A list of the attendees and a summary of the meeting is attached to your agenda packet.

STAFF RECOMMENDATIONS:

Staff is recommending approval of this project subject to the following conditions

1. Town approval is contingent on review and approval by other applicable local, state and federal agencies.

2. The development shall comply with all other applicable requirements of the Town of Cornelius Land Development Code.

3. Town approval incorporates and shall comply with any and all submittals in the case file and correspondence presented to the board in support of this application, including, but not limited to the following: The site/sketch plan, architectural elevations, and any other information related to this case or improvements recommended by the Town and/or other agencies.

4. The materials for the proposed cooler addition shall match and be consistent with the current building materials.

5. Payment for the installation of the 10' sidewalk along US 21 and Westmoreland Rd must be received by the town prior to the issuance of a certificate of occupancy.

6. The 30' greenway easement shown on the site plan must be granted to the town prior to the approval of construction documents. If in the future the town disturbs the landscape buffer area within the 30' greenway easement, the town will replace the buffer with comparable plantings that meet the type A buffer requirements.

7. Any pole sign within the right-of-way must be removed on or before the approval of construction documents. All other signage must meet the requirements of chapter 10 of the Town of Cornelius Land Development Code and must be permitted separately.

PROPOSED BOATYARD EATS CORNELIUS, NC

NOTES:

1. ALL PARCEL INFORMATION, PROPERTY DIMENSIONS AND COORDINATES FOR THIS PROPERTY REFERENCED FROM A SURVEY COMPLETED BY SOUTHPOINT SURVEYING PLLC. TOPOGRAPHIC INFORMATION REFERENCED FROM A SURVEY COMPLETED BY SOUTHPOINT SURVEYING PLLC.

2. THE UTILITIES SHOWN ARE FOR THE CONTRACTOR'S CONVENIENCE ONLY. THERE MAY BE OTHER UTILITIES NOT SHOWN ON THIS PLAN. AMICUS PARTNERS, PLLC ASSUMES NO RESPONSIBILITY FOR THE LOCATIONS SHOWN. THE CONTRACTOR IS RESPONSIBLE FOR LOCATING ALL EXISTING UTILITIES PRIOR TO COMMENCEMENT OF CONSTRUCTION. ANY CONFLICTS CONCERNING UTILITIES THAT ARISE DURING CONSTRUCTION SHOULD BE IMMEDIATELY REPORTED TO THE ENGINEER.

3. THE CONTRACTOR MUST CONTACT THE APPROPRIATE UTILITY COMPANY AT LEAST 48 HOURS PRIOR TO THE BEGINNING OF CONSTRUCTION TO REQUEST THE EXACT FIELD LOCATIONS OF ALL UTILITIES. THE CONTRACTOR IS RESPONSIBLE FOR ANY DAMAGE TO UTILITIES OCCURRING DURING CONSTRUCTION AND MUST PROVIDE 48 HOURS NOTICE PRIOR TO THE REPAIR OR REPLACEMENT OF SAID UTILITIES.

4. ANY EROSION AND SEDIMENT CONTROL MEASURES MUST CONFORM TO THE REQUIREMENTS SET FORTH BY MECKLENBURG COUNTY AND THE NORTH CAROLINA DEPARTMENT OF ENVIRONMENT QUALITY.

5. THE CONTRACTOR IS RESPONSIBLE FOR ENSURING THAT ALL PERMITS AND APPROVALS HAVE BEEN OBTAINED FROM THE NECESSARY REGULATORY AUTHORITIES PRIOR TO CONSTRUCTION. IN THE EVENT THE CONTRACTOR IS UNCERTAIN ABOUT PERMITTING REQUIREMENTS DURING ANY PHASE OF CONSTRUCTION, THE CONTRACTOR SHOULD IMMEDIATELY CONTACT THE ENGINEER, MECKLENBURG COUNTY, OR THE TOWN OF CORNELIUS PLANNING DEVELOPMENT PRIOR TO PROCEEDING.

6. IF EXISTING CONDITIONS PROVIDED ON THE PLAN DIFFER FROM THOSE AT THE SITE, CONTACT THE ENGINEER BEFORE DEVIATING FROM THE DESIGNED AND APPROVED LAYOUT.

7. THE CONTRACTOR SHALL TAKE MEASURES TO PROTECT ANY ADJACENT PROPERTY, PUBLIC UTILITY, ROADWAY, RAILWAY, AND THE SAFETY OF THE GENERAL PUBLIC. CONTRACTOR IS RESPONSIBLE FOR ANY DAMAGES AND REPERCUSSIONS OCCURRING FROM THOSE DAMAGES.

8. NO FORMAL GEOTECHNICAL OR ENVIRONMENTAL INVESTIGATION WAS PERFORMED BY AMICUS PARTNERS, PLLC TO EVALUATE WHETHER OR NOT ANY HAZARDOUS, TOXIC, OR HARMFUL MATERIALS EXIST OR ARE CONTAINED WITHIN THE LIMITS OF THE PROPERTY. AMICUS ENGINEERING ASSUMES NO RESPONSIBILITY FOR ANY REMEDIAL ACTION THAT MAY ARISE IF SAID MATERIALS ARE DISCOVERED DURING THE COURSE OF CONSTRUCTION NOR IS AMICUS PARTNERS, PLLC LIABLE FOR ANY LEGAL RAMIFICATIONS THAT MAY ARISE SHOULD AN ENVIRONMENTAL LAW BE VIOLATED BASED ON THE DISCOVERY OF SAID MATERIAL.

GRAPHIC SCALE

LEGEND

678	SUBJECT PROPERTY BOUNDARY
	EXISTING TOPOGRAPHY
	ADJACENT / EXISTING PARCELS
	EXISTING ROAD CENTERLINE
P P P P	EXISTING OVERHEAD POWER LINE
GAS GAS GAS	EXISTING GAS LINE
	EXISTING STORM STRUCTURE
EOP	EDGE OF PAVEMENT

BEFORE YOU DIG STOP. CALL THE NC ONE-CALL CENTER AT 811.

IT'S THE LAW.

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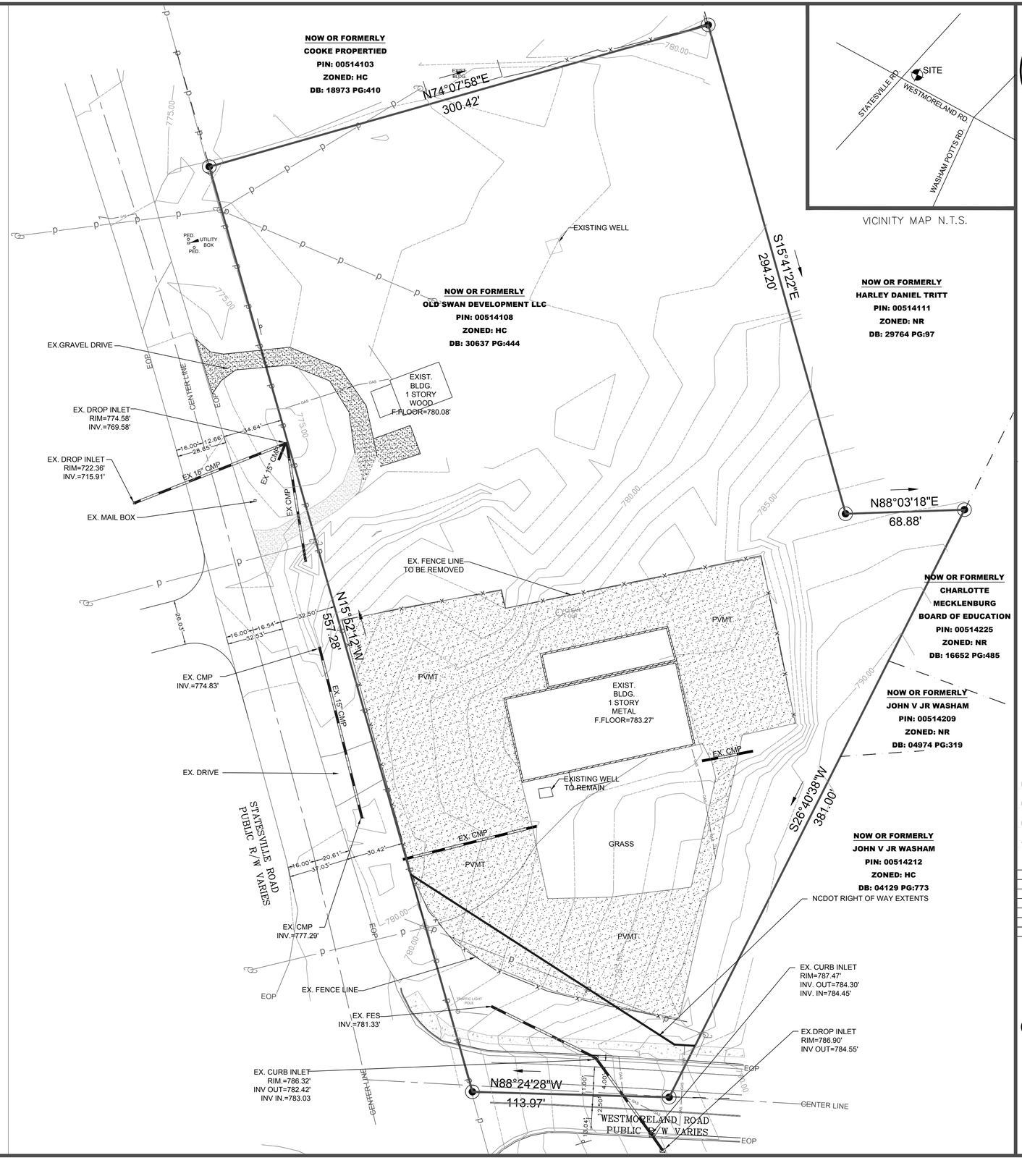


Amicus Partners, PLLC
Firm License # P-1191
331 Coddle Market Drive
Suite 110
Concord, NC 28027
Civil Site Design
Low Impact Development
Small-Scale Building Design
Telephone: 704.573.1621
Facsimile: 704.248.7951

Seals:

PROPOSED BOATYARD EATS
CORNELIUS, NORTH CAROLINA
FOR:
OLD SWAN DEVELOPMENT

Project Number: 17.16.121
Date: 02/23/2017
Drawn By: CM
Checked By: NRP

Revisions:

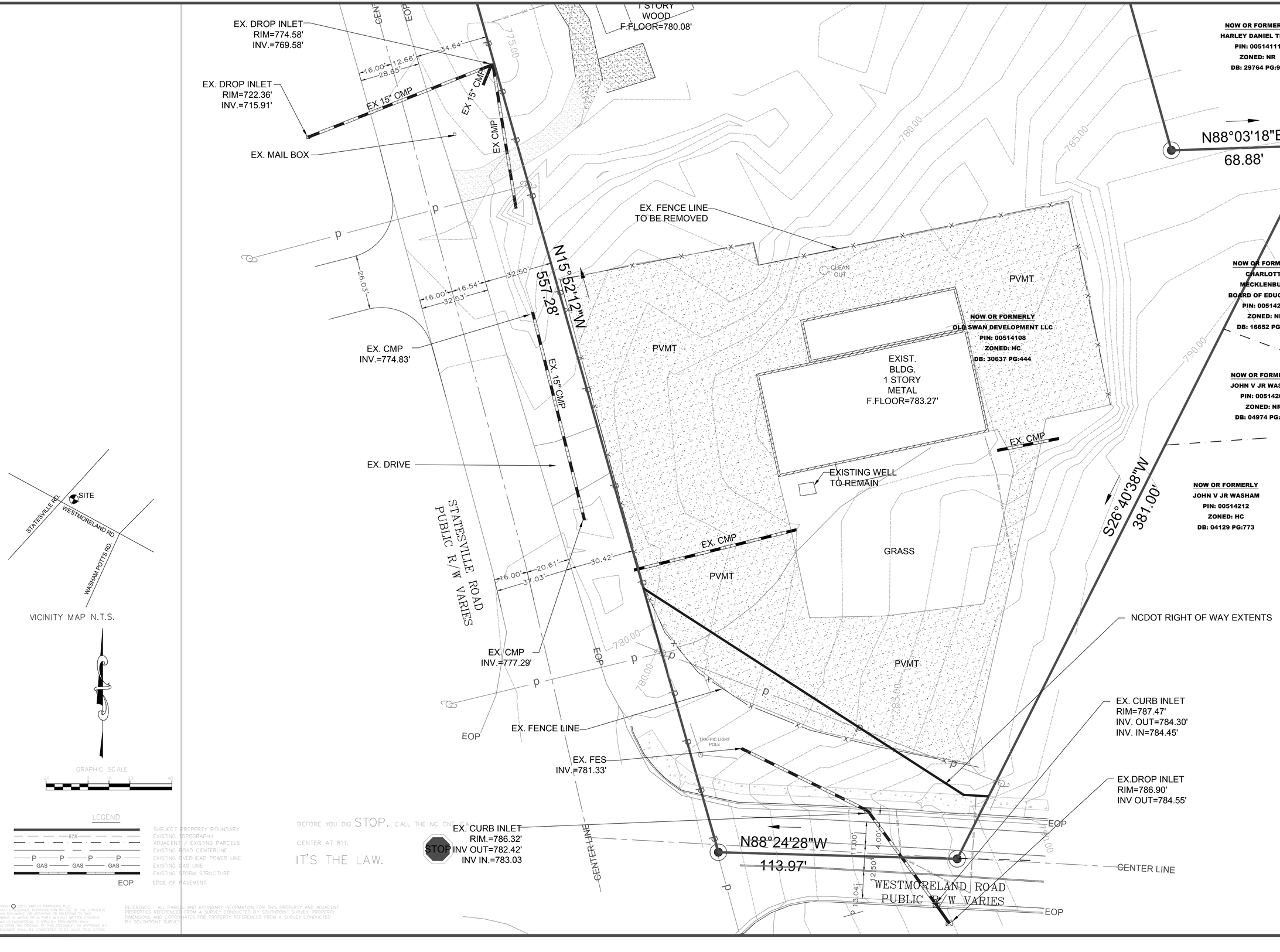
02/23/17	ORIGINAL SUBMITTAL

Sheet Title:

EXISTING CONDITIONS

Sheet No:

C-0.0



VICINITY MAP N.T.S.

GRAPHIC SCALE

LEGEND

SUBJECT PROPERTY BOUNDARY
EXISTING TOPOGRAPHY
ADJACENT / EXISTING PARCELS
EXISTING ROAD CENTERLINE
EXISTING OVERHEAD POWER LINE
EXISTING GAS LINE
EXISTING STORM STRUCTURE
EDGE OF PAVEMENT

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CORNELIUS, NORTH CAROLINA
FOR:
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Sheet Title:
EXISTING CONDITIONS (WORK EXTENTS)

Sheet No:
C-0.1

ACCESSIBLE PARKING (FROM APPENDIX B)

Lot or Parking Area	Total # of Parking Spaces		# of Accessible Spaces Provided		Total = Accessible Provided
	Required	Provided	Regular with 5' Access Aisle	Regular with 8' Access Aisle	
Microbrewery & Reataurant/ Brewpub	59	60	0	1	3

a. Required number of parking spaces based on Cornelius Land Development Code.
b. MINIMUM (1 space per 3 seats) (175 seats)/(3) = 59 parking spaces required.
c. Required number of accessible spaces based on City of Charlotte Land Development Standards Manual Detail #50.10A.
d. 51-75 parking spaces requires 3 accessible spaces with 1 of the 3 being van accessible.

PRE-CONSTRUCTION NOTES:

1. CONTACT THE UTILITY COMPANY TO RELOCATE ANY EXISTING UTILITY POLES. ALL EXISTING FACILITIES WHICH CONFLICT WITH THE IMPROVEMENTS UNDER THE SCOPE OF THIS PROJECT MUST BE RELOCATED AT THE EXPENSE OF THE APPLICANT.
2. ALL DEVELOPMENT CREATING A TOTAL OF 20,000 SQUARE FEET OF IMPERVIOUS AREA SINCE SEPTEMBER 1978 WILL REQUIRE STORM DRAINAGE DETENTION.
3. SURVEYOR TO VERIFY RIGHT-OF-WAY LOCATION PRIOR TO CONSTRUCTION. ALL PROPOSED IMPROVEMENTS AND CONSTRUCTION WITHIN A MAINTAINED RIGHT-OF-WAY IS DONE IN ACCORDANCE WITH MECKLENBURG COUNTY DEVELOPMENT STANDARDS.

BEFORE YOU DIG STOP. CALL THE NC ONE-CALL CENTER AT 811. IT'S THE LAW.

STOP

GENEARL SITE PLAN NOTES:

1. ALL SIGNAGE WILL BE APPROVED AND PERMITTED SEPARATELY. ALL SIGNS MUST MEET THE REQUIREMENTS SET FORTH BY THE TOWN OF CORNELIUS ZONING ORDINANCE AND ANY COVENANCE THAT MAY APPLY FOR THE AREA.

2. SIDEWALKS SHALL BE CONSTRUCTED OF NOT LESS THAN 3,600 PSI CONCRETE AND SHALL BE 4 INCHES THICK, CONSTRUCTED ON AN ADEQUATELY GRADED BASE, EXCEPT WHERE A SIDEWALK CROSSES A DRIVEWAY IT SHALL BE 6 INCHES THICK. SUBGRADE SHALL BE COMPACTED TO 95% OF THE MAXIMUM DENSITY OBTAINABLE WITH THE STANDARD PROCTOR TEST. THE SURFACE OF THE SIDEWALK SHALL BE STEEL TROWEL AND LIGHT BROOM FINISH AND CURED WITH AN ACCEPTABLE CURING COMPOUND. TOOLED JOINTS SHALL BE PROVIDED AT INTERVALS OF NOT LESS THAN 5 FEET AND EXPANSION JOINTS AT INTERVALS OF NOT MORE THAN 45 FEET. THE SIDEWALK SHALL HAVE A LATERAL SLOPE OF (1/4) INCH PER FOOT.

3. ALL PARKING SPACES SHALL BE AT LEAST 9 FT WIDE AND 19 FT DEEP. SUBGRADE FOR PARKING LOT AND LOADING AREAS TO BE COMPACTED TO 100% MAXIMUM DENSITY OBTAINABLE WITH A STANDARD PROCTOR TEST. SEE DETAILS SHEET FOR PAVEMENT REQUIREMENTS IN LOADING AND PARKING AREAS.

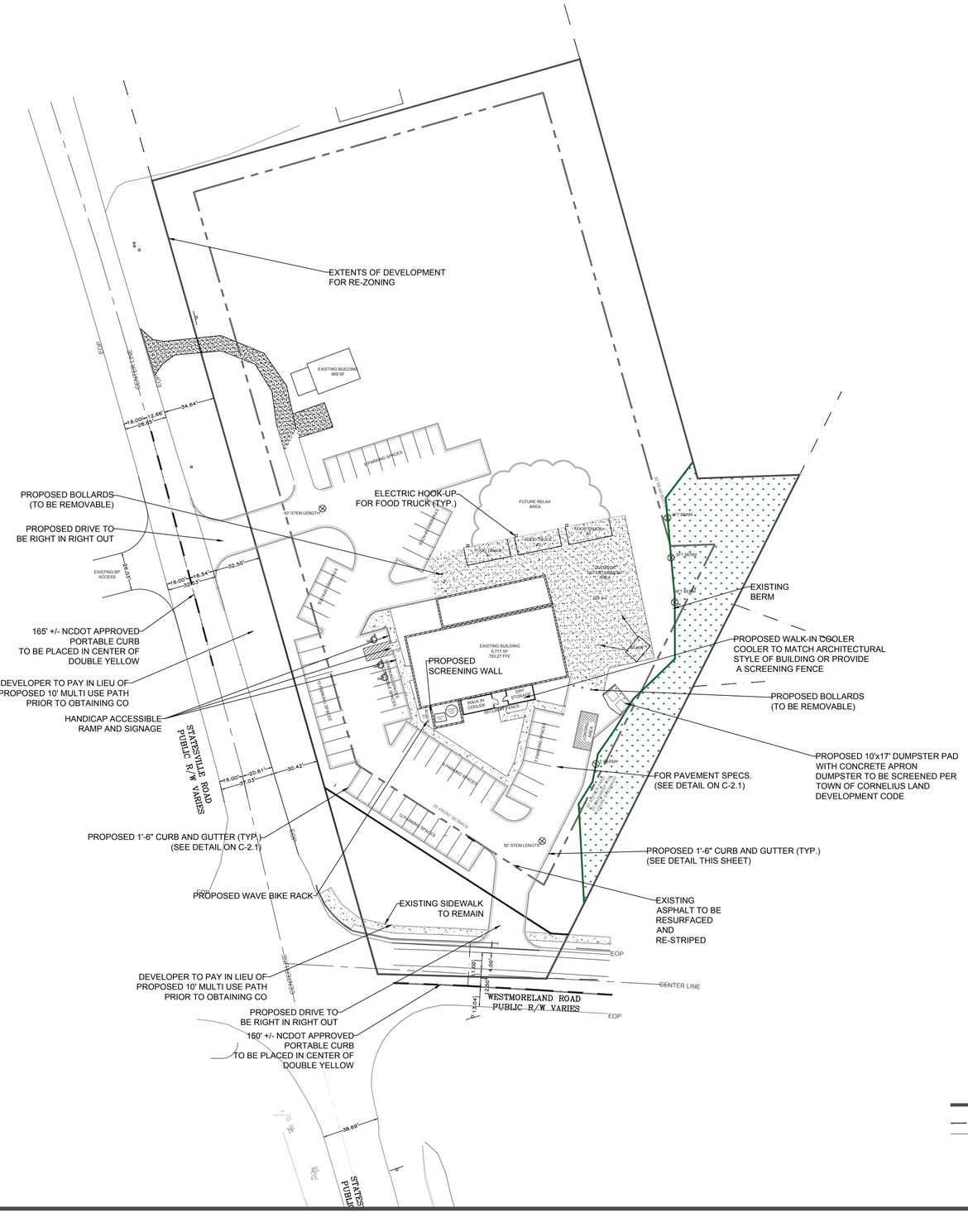
4. ADDRESS MUST BE POSTED IN VISIBLE LOCATION WITH 6-INCH NUMBERS.

5. HVAC AND SIMILAR TYPES OF INCIDENTAL MACHINERY OR EQUIPMENT SHALL BE SCREENED FROM VIEW OR LOCATED IN SUCH A MANNER AS TO NOT BE VISIBLE FROM THE STREET. TRASH RECEPTACLES, DUMPSTERS, UTILITY METERS, ABOVE-GROUND TANKS, SATELLITE DISHES, AND ANTENNAS SHALL BE SIMILARLY SCREENED.

6. ALL MEASUREMENTS ARE TAKEN FROM BACK OF CURB, UNLESS OTHERWISE NOTED.

ADDITIONAL SITE PLAN AND LAYOUT NOTES:

THESE NOTES ARE STANDARD SITE DEVELOPMENT NOTES AND SOME OF THESE NOTES MAY NOT APPLY TO THIS SPECIFIC SITE.
1. COORDINATE ALL CURB AND STREET GRADES IN INTERSECTION WITH INSPECTOR.
2. ALL ROAD IMPROVEMENTS AT STATESVILLE ROAD AND WESTMORELAND ROAD TO BE COORDINATED WITH JURISDICTIONAL INSPECTIONS DEPARTMENT PRIOR TO CONSTRUCTION.
3. DEVELOPER WILL PROVIDE STREET SIGNS (IF REQUIRED) IN CONJUNCTION WITH STATE AND LOCAL REQUIREMENTS.
4. SIGHT TRIANGLES SHOWN ARE THE MINIMUM REQUIRED.
5. IN ROLLING AND HILLY TERRAINS, SWEEPING OF THE STONE BASE AND/OR APPLICATION OF A TACK COAT MAY BE REQUIRED NEAR INTERSECTIONS. THESE REQUIREMENTS WILL BE ESTABLISHED BY THE INSPECTOR BASED ON FIELD CONDITIONS.
6. APPROVAL OF THIS PLAN IS NOT AN AUTHORIZATION TO GRADE ADJACENT PROPERTIES. WHEN FIELD CONDITIONS WARRANT OFF-SITE GRADING, PERMISSION MUST BE OBTAINED FROM THE AFFECTED PROPERTY OWNERS.
7. IN ORDER TO ENSURE PROPER DRAINAGE, KEEP A MINIMUM OF 0.5% SLOPE ON THE CURB.
8. SUBSURFACE DRAINAGE FACILITIES MAY BE REQUIRED IN THE STREET RIGHT-OR-WAY IF DEEMED NECESSARY BY THE LOCAL INSPECTOR.
9. CURB AND GUTTER ON PLANS ALONG STATESVILLE ROAD AND WESTMORELAND ROAD MAY BE ADJUSTED BASED UPON FIELD STAKING BY CITY/COUNTY ENGINEERING. ASSOCIATED STORM DRAINAGE MAY ALSO REQUIRE MODIFICATION BASED UPON FIELD CONDITIONS.
10. THE PURPOSE OF A STORM DRAINAGE EASEMENT IS TO PROVIDE STORM WATER CONVEYANCE AND ANY STRUCTURES AND/OR OBSTRUCTION TO STORM WATER FLOW IS PROHIBITED.
11. HIGH DENSITY POLYETHYLENE (HDPE) STORM DRAINAGE PIPE INSTALLED WITHIN EXISTING OR PROPOSED PUBLIC STREET RIGHT-OF-WAY MUST BE APPROVED BY THE CITY'S INSPECTOR PRIOR TO ANY BACKFILL BEING PLACED. BACKFILL MATERIAL MUST BE APPROVED BY THE CITY INSPECTOR PRIOR TO PLACEMENT OF THE MATERIAL WITHIN THE PUBLIC RIGHT-OF-WAY.
12. THE DEVELOPER SHALL MAINTAIN EACH STREAM, CREEK, OR BACKWASH CHANNEL IN AN UNOBSTRUCTED STATE AND SHALL REMOVE FROM THE CHANNEL AND BANKS OF THE STREAM ALL DEBRIS, LOGS, TIMBER, JUNK AND OTHER ACCUMULATIONS.
13. ANY BUILDING WITHIN THE 100+1 BUILDING RESTRICTION FLOODLINE IS SUBJECT TO THE RESTRICTIONS OF LOCAL FLOODPLAIN REQUIREMENTS AND RESTRICTIONS.
14. ALL OPENINGS (E.G., DOORS, WINDOWS, VENTS) IN STRUCTURE BUILT ON LOT SHOULD BE LOCATED A MINIMUM OF ONE FOOT ABOVE THE ADJACENT FINISHED GROUND SURFACE (APPLIES TO LOTS WHICH MAY EXPERIENCE SIGNIFICANT OVERLAND FLOW NOT CONSIDERED IN THE 100+1 FLOOD ANALYSIS).
15. P.E. SEALED SHOP DRAWINGS FOR ANY RETAINING WALLS MUST BE SUBMITTED TO CITY/COUNTY ENGINEER PRIOR TO CONSTRUCTION.
16. "AS BUILT" DRAWINGS AND PLANS OF THE STORM DRAINAGE SYSTEM, INCLUDING DESIGNED DITCHES, MUST BE SUBMITTED PRIOR TO FINAL INSPECTION TO THE CITY/COUNTY ENGINEERING DEPARTMENT IN ACCORDANCE WITH THE CITY/COUNTY ZONING ORDINANCE.
18. PRIOR TO INSTALLATION, PE SEALED SHOP DRAWINGS FOR UNDERGROUND DETENTION SYSTEMS MUST BE FURNISHED FOR APPROVAL (IF APPLICABLE).
19. PRIOR TO CO, SURVEYOR SEALED AS-BUILT DRAWINGS OF UNDERGROUND DETENTION SYSTEMS MUST BE PROVIDED (IF APPLICABLE).
20. NON-STANDARD ITEMS (IE: PAVERS, IRRIGATION SYSTEMS, ETC.) IN THE RIGHT-OF-WAY REQUIRE A RIGHT-OF-WAY ENCROACHMENT AGREEMENT WITH THE (NORTH CAROLINA DEPARTMENT OF TRANSPORTATION) BEFORE INSTALLATION.



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Seals:

PRELIMINARY NOT FOR CONSTRUCTION

PROPOSED BOATYARD EATS
CORNELIUS, NORTH CAROLINA
FOR:
OLD SWAN DEVELOPMENT

Project Number: 17.16.121
Date: 02/23/2017
Drawn By: CM
Checked By: NRP

Revisions:

	02/23/17	ORIGINAL SUBMITTAL

Sheet Title:

SITE PLAN

Sheet No:

C-2.0

ACCESSIBLE PARKING (FROM APPENDIX B)

Lot or Parking Area	Total # of Parking Spaces		# of Accessible Spaces Provided		Total = Accessible Provided
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2. SIDEWALKS SHALL BE CONSTRUCTED OF NOT LESS THAN 3,600 PSI CONCRETE AND SHALL BE 4 INCHES THICK, CONSTRUCTED ON AN ADEQUATELY GRADED BASE, EXCEPT WHERE A SIDEWALK CROSSES A DRIVEWAY IT SHALL BE 6 INCHES THICK. SUBGRADE SHALL BE COMPACTED TO 95% OF THE MAXIMUM DENSITY OBTAINABLE WITH THE STANDARD PROCTOR TEST. THE SURFACE OF THE SIDEWALK SHALL BE STEEL TROWEL AND LIGHT BROOM FINISH AND CURED WITH AN ACCEPTABLE CURING COMPOUND. TOOLED JOINTS SHALL BE PROVIDED AT INTERVALS OF NOT LESS THAN 5 FEET AND EXPANSION JOINTS AT INTERVALS OF NOT MORE THAN 45 FEET. THE SIDEWALK SHALL HAVE A LATERAL SLOPE OF (1/4) INCH PER FOOT.

3. ALL PARKING SPACES SHALL BE AT LEAST 9 FT WIDE AND 19 FT DEEP. SUBGRADE FOR PARKING LOT AND LOADING AREAS TO BE COMPACTED TO 100% MAXIMUM DENSITY OBTAINABLE WITH A STANDARD PROCTOR TEST. SEE DETAILS SHEET FOR PAVEMENT REQUIREMENTS IN LOADING AND PARKING AREAS.

4. ADDRESS MUST BE POSTED IN VISIBLE LOCATION WITH 6-INCH NUMBERS.

5. HVAC AND SIMILAR TYPES OF INCIDENTAL MACHINERY OR EQUIPMENT SHALL BE SCREENED FROM VIEW OR LOCATED IN SUCH A MANNER AS TO NOT BE VISIBLE FROM THE STREET. TRASH RECEPTACLES, DUMPSTERS, UTILITY METERS, ABOVE-GROUND TANKS, SATELLITE DISHES, AND ANTENNAS SHALL BE SIMILARLY SCREENED.

6. ALL MEASUREMENTS ARE TAKEN FROM BACK OF CURB, UNLESS OTHERWISE NOTED.

ADDITIONAL SITE PLAN AND LAYOUT NOTES:

THESE NOTES ARE STANDARD SITE DEVELOPMENT NOTES AND SOME OF THESE NOTES MAY NOT APPLY TO THIS SPECIFIC SITE.
1. COORDINATE ALL CURB AND STREET GRADES IN INTERSECTION WITH INSPECTOR.
2. ALL ROAD IMPROVEMENTS AT STATESVILLE ROAD AND WESTMORELAND ROAD TO BE COORDINATED WITH JURISDICTIONAL INSPECTIONS DEPARTMENT PRIOR TO CONSTRUCTION.
3. DEVELOPER WILL PROVIDE STREET SIGNS (IF REQUIRED) IN CONJUNCTION WITH STATE AND LOCAL REQUIREMENTS.
4. SIGHT TRIANGLES SHOWN ARE THE MINIMUM REQUIRED.
5. IN ROLLING AND HILLY TERRAINS, SWEEPING OF THE STONE BASE AND/OR APPLICATION OF A TACK COAT MAY BE REQUIRED NEAR INTERSECTIONS. THESE REQUIREMENTS WILL BE ESTABLISHED BY THE INSPECTOR BASED ON FIELD CONDITIONS.
6. APPROVAL OF THIS PLAN IS NOT AN AUTHORIZATION TO GRADE ADJACENT PROPERTIES. WHEN FIELD CONDITIONS WARRANT OFF-SITE GRADING, PERMISSION MUST BE OBTAINED FROM THE AFFECTED PROPERTY OWNERS.
7. IN ORDER TO ENSURE PROPER DRAINAGE, KEEP A MINIMUM OF 0.5% SLOPE ON THE CURB.
8. SUBSURFACE DRAINAGE FACILITIES MAY BE REQUIRED IN THE STREET RIGHT-OR-WAY IF DEEMED NECESSARY BY THE LOCAL INSPECTOR.
9. CURB AND GUTTER ON PLANS ALONG STATESVILLE ROAD AND WESTMORELAND ROAD MAY BE ADJUSTED BASED UPON FIELD STAKING BY CITY/COUNTY ENGINEERING. ASSOCIATED STORM DRAINAGE MAY ALSO REQUIRE MODIFICATION BASED UPON FIELD CONDITIONS.
10. THE PURPOSE OF A STORM DRAINAGE EASEMENT IS TO PROVIDE STORM WATER CONVEYANCE AND ANY STRUCTURES AND/OR OBSTRUCTION TO STORM WATER FLOW IS PROHIBITED.
11. HIGH DENSITY POLYETHYLENE (HDPE) STORM DRAINAGE PIPE INSTALLED WITHIN EXISTING OR PROPOSED PUBLIC STREET RIGHT-OF-WAY MUST BE APPROVED BY THE CITY'S INSPECTOR PRIOR TO ANY BACKFILL BEING PLACED. BACKFILL MATERIAL MUST BE APPROVED BY THE CITY INSPECTOR PRIOR TO PLACEMENT OF THE MATERIAL WITHIN THE PUBLIC RIGHT-OF-WAY.
12. THE DEVELOPER SHALL MAINTAIN EACH STREAM, CREEK, OR BACKWASH CHANNEL IN AN UNOBSTRUCTED STATE AND SHALL REMOVE FROM THE CHANNEL AND BANKS OF THE STREAM ALL DEBRIS, LOGS, TIMBER, JUNK AND OTHER ACCUMULATIONS.
13. ANY BUILDING WITHIN THE 100+1 BUILDING RESTRICTION FLOODLINE IS SUBJECT TO THE RESTRICTIONS OF LOCAL FLOODPLAIN REQUIREMENTS AND RESTRICTIONS.
14. ALL OPENINGS (E.G., DOORS, WINDOWS, VENTS) IN STRUCTURE BUILT ON LOT SHOULD BE LOCATED A MINIMUM OF ONE FOOT ABOVE THE ADJACENT FINISHED GROUND SURFACE (APPLIES TO LOTS WHICH MAY EXPERIENCE SIGNIFICANT OVERLAND FLOW NOT CONSIDERED IN THE 100+1 FLOOD ANALYSIS).
15. P.E. SEALED SHOP DRAWINGS FOR ANY RETAINING WALLS MUST BE SUBMITTED TO CITY/COUNTY ENGINEER PRIOR TO CONSTRUCTION.
16. "AS BUILT" DRAWINGS AND PLANS OF THE STORM DRAINAGE SYSTEM, INCLUDING DESIGNED DITCHES, MUST BE SUBMITTED PRIOR TO FINAL INSPECTION TO THE CITY/COUNTY ENGINEERING DEPARTMENT IN ACCORDANCE WITH THE CITY/COUNTY ZONING ORDINANCE.
18. PRIOR TO INSTALLATION, PE SEALED SHOP DRAWINGS FOR UNDERGROUND DETENTION SYSTEMS MUST BE FURNISHED FOR APPROVAL (IF APPLICABLE).
19. PRIOR TO CO, SURVEYOR SEALED AS-BUILT DRAWINGS OF UNDERGROUND DETENTION SYSTEMS MUST BE PROVIDED (IF APPLICABLE).
20. NON-STANDARD ITEMS (IE: PAVERS, IRRIGATION SYSTEMS, ETC.) IN THE RIGHT-OF-WAY REQUIRE A RIGHT-OF-WAY ENCROACHMENT AGREEMENT WITH THE (NORTH CAROLINA DEPARTMENT OF TRANSPORTATION) BEFORE INSTALLATION.
21. PER CHAPTER 6 OF CORNELIUS LAND DEVELOPMENT CODE: DRIVE-THROUGH FACILITIES LOCATED ON THE SIDE OF A BUILDING, WITH THE EXCEPTION OF BANKS, SHALL BE LIMITED TO ONE-LANE ONLY, AND SHALL BE SCREENED FROM OFF-SITE VIEW WITH A TYPE 'A' LANDSCAPED BUFFER PER CHAPTER 9.
22. ALL MENU BOARDS, DRIVE THROUGH SERVICE WINDOWS, OR OTHER DRIVE-THROUGH STRUCTURES MUST BE LOCATED ON THE REAR OR SIDE OF THE PRINCIPAL STRUCTURE, SHALL NOT CONFLICT WITH THE PRIMARY PUBLIC ENTRANCE, AND MUST BE SCREENED FROM OFF-SITE VIEW WITH A TYPE 'A' LANDSCAPED BUFFER PER CHAPTER 9.
23. BUILDINGS THAT INCLUDE DRIVE THROUGH FACILITIES SHALL STILL CONFORM TO FRONTAGE BUILD OUT REQUIREMENTS. HOWEVER, THE BUILDING MAY BE SETBACK IN ORDER TO ALLOW ONE DRIVE-THROUGH EXIT LANE IN FRONT OF THE PRINCIPAL BUILDING IN ORDER FOR THE DRIVE THROUGH FACILITY TO BE PHYSICALLY SEPARATED FROM OTHER VEHICULAR TRAFFIC AND PEDESTRIANS. DRIVE-THROUGH EXIT LANES MAY BE WITHIN THE FRONT YARD AREA BUT CANNOT BE WITHIN THE STREET RIGHT-OF-WAY, AND MUST BE SCREENED FROM THE RIGHT-OF-WAY BY A WALL A MINIMUM OF 3-FEET IN HEIGHT. A HEDGEROW SHALL BE PROVIDED BETWEEN THE RIGHT-OF-WAY AND THE WALL. THE WALL MUST CONTAIN MATERIALS THAT MATCH THE PRINCIPAL BUILDING.
24. THE DRIVE-THROUGH LANE(S) MUST BE DISTINCTLY MARKED BY SPECIAL STRIPING, PAVEMENT MARKINGS, OR TRAFFIC ISLANDS AND PHYSICALLY SEPARATED FROM ONSITE PARKING AREAS.

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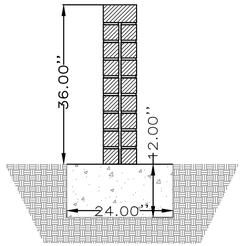
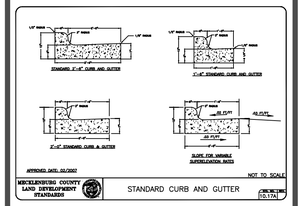
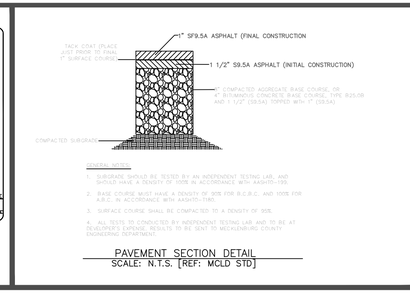
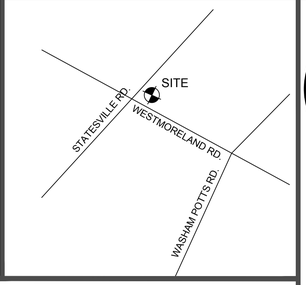


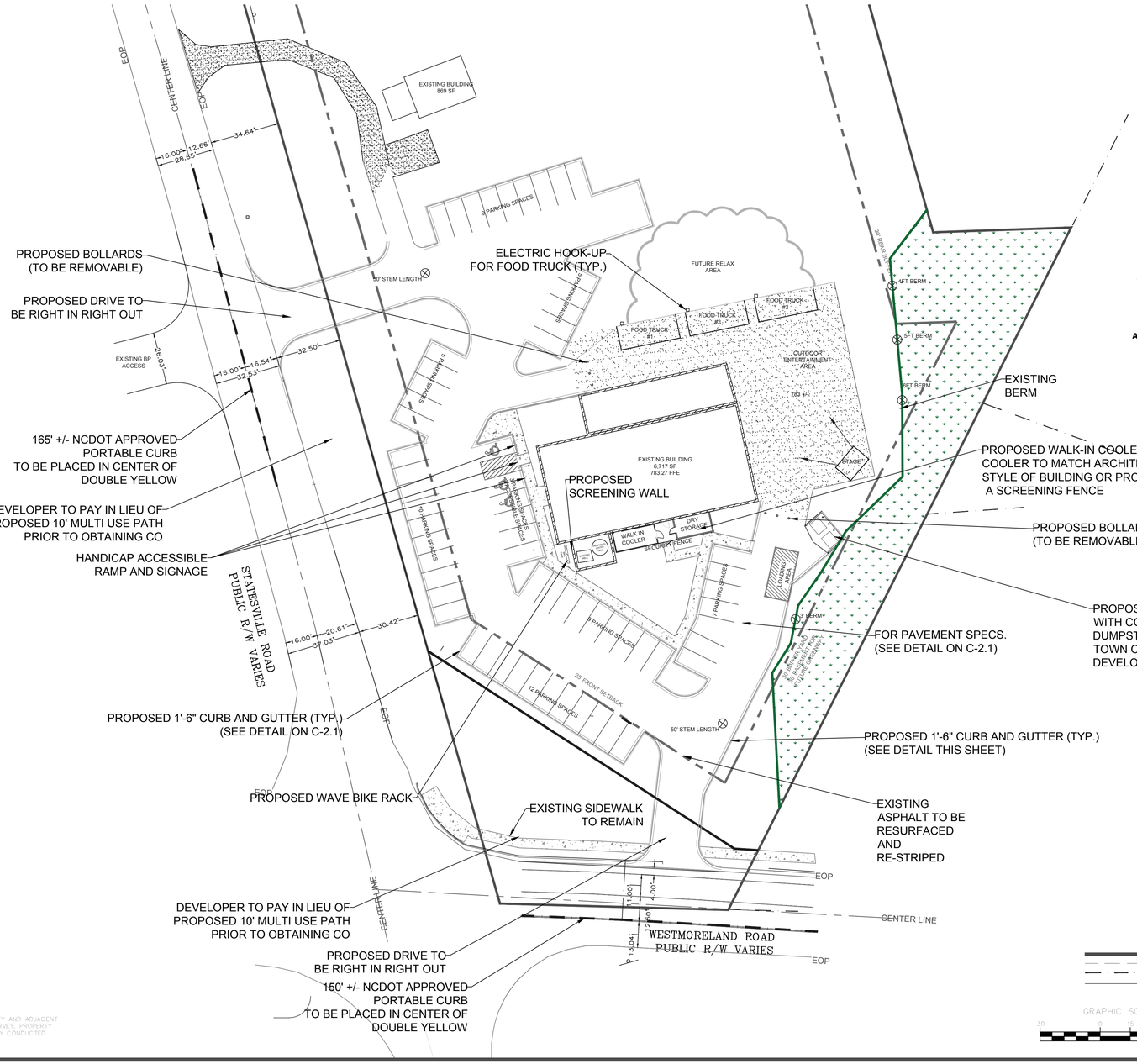
3' HIGH WALL DETAIL
NOT TO SCALE







VICINITY MAP N.T.S.



ZONING CODE SUMMARY

PROJECT NAME: BOATYARD EATS CORNELIUS
PROPERTY OWNER: OLD SWAN DEVELOPMENT, LLC
PARCEL P.I.N. 00514108
CIVIL PLANS PREPARED BY: AMICUS PARTNERS, PLLC
PHONE: 704-573-1621
ZONING: HC JURISDICTION: CITY OF CORNELIUS
BUFFER (REAR AT RC ZONED PROP.): 30 FT
MIN. FRONT YARD (S): 25 FT
MIN. SIDE YARD (S): 15 FT
MIN. REAR YARD: 30 FT
PARCEL SIZE: 158,581/3.64SQ. FT/ACRES
PROPOSED USE: RESTAURANT
PARKING PROVIDED: 60 SPACES
HANDICAPPED PARKING PROVIDED: 3 SPACES
EXISTING BUILDING FOOTPRINT COVERAGE: 7,586 SQ. FT
PROPOSED BUILDING FOOTPRINT COVERAGE: 505 SQ. FT
TOTAL PROPOSED BUILDING FOOTPRINT COVERAGE: 8,091 SQ. FT
AREA OF EXISTING PARKING AND DRIVE COVERAGE: 35,779 SQ.FT
AREA OF PROPOSED PARKING AND DRIVE: 32,370 SQ. FT
AREA OF EXISTING SIDEWALK/FLATWORK COVERAGE: 1,217 SQ.FT
AREA OF PROPOSED SIDEWALK/FLATWORK COVERAGE: 1,451 SQ.FT
AREA OF TOTAL SIDEWALK/FLATWORK COVERAGE: 2,668 SQ.FT
TOTAL EXISTING IMPERVIOUS AREA: 44,582 SQ.FT
TOTAL PROPOSED IMPERVIOUS AREA: 43,129 SQ.FT
PERCENT EXISTING IMPERVIOUS AREA: 28%
PERCENT PROPOSED IMPERVIOUS AREA: 27%
NET INCREASE IN IMPERVIOUS: -1%

Amicus Partners, PLLC
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331 Coddle Market Drive
Suite 110
Concord, NC 28027
Civil Site Design
Low Impact Development
Small-Scale Building Design
Telephone: 704.573.1621
Facsimile: 704.248.7951

Seals:

PROPOSED BOATYARD EATS
CORNELIUS, NORTH CAROLINA
FOR:
OLD SWAN DEVELOPMENT

Project Number: 17.16.121
Date: 02/23/2017
Drawn By: CM
Checked By: NRP

Revisions:

02/23/17	ORIGINAL SUBMITTAL

Sheet Title:
SITE PLAN (WORK EXTENTS)

Sheet No:
C-2.1



GRAPHIC SCALE

50 0 25 50 100

LEGEND

SUBJECT PROPERTY BOUNDARY

ADJACENT / EXISTING PARCELS
EXISTING ROAD CENTERLINE

BEFORE YOU DIG STOP. CALL THE NC ONE-CALL CENTER AT 811.
IT'S THE LAW.

STOP

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LANDSCAPING PLAN

Sheet No:

C-3.0

LANDSCAPING NOTES:

1. LANDSCAPING SHOULD BE OF SUFFICIENT SIZE SO THAT MATURE APPEARANCE WILL BE ACHIEVED WITHIN 3-5 YEARS OF INSTALLATION.

2. ALL TREES TO BE PLANTED SHALL BE AT LEAST 8' ABOVE GROUND LEVEL AND AT LEAST 2.5" IN CALIPER AT THE TIME OF INSTALLATION, AND SHALL HAVE AN EXPECTED MATURE HEIGHT OF AT LEAST 20'.

3. ALL SHRUBS TO BE PLANTED SHALL BE MEASURED AT LEAST 5 GALLONS IN CONTAINER SIZE AND 3' ABOVE GROUND LEVEL AND SHALL REACH THE HEIGHT REQUIRED FOR PERFORMANCE WITHIN 3 YEARS OF INSTALLATION.

4. THE SELECTION OF PLANTS, PLANTING METHODS, MINIMUM HEIGHT, ROOT BALL AND CONTAINER SIZE, NUMBER OF BRANCHES, AND WIDTH, SHALL CONFORM WITH THE AMERICAN STANDARD FOR NURSERY STOCK PUBLISHED BY THE AMERICAN ASSOCIATION OF NURSERYMEN FOR THAT TYPE OF TREE OR SHRUB AT THE TIME ON INSTALLATION.

5. GROUND COVER MAY BE ORGANIC AND INORGANIC. ORGANIC GROUND COVERS SHALL PROVIDE 100 PERCENT COVERAGE ON THE GROUND WITHIN (3) YEARS OF INSTALLATION. EXCEPT FOR SEEDING, GRASS OR TURF SHALL PROVIDE 100 PERCENT COVERAGE UPON INSTALLATION. ORGANIC MULCH MAY BE USED AROUND PLANTING TO MAINTAIN SOIL MOISTURE AND PREVENT THE GROWTH OF WEEDS. INORGANIC GROUND COVERS CONSISTING OF RIVER ROCK OR SIMILAR MATERIALS MAY BE USED PROVIDED THEY DO NOT EXCEED 20 PERCENT COVERAGE OR THE REQUIRED LANDSCAPE PLANTING AREA.

6. EQUIPMENT, WOOD AND SIMILAR OBJECTS SHALL NOT BE STORED OR LAID UPON THE CRITICAL ROOT ZONE AREA DURING OR AFTER CONSTRUCTION. CHEMICALS AND LIQUID CONSTRUCTION WASTES SHALL NOT BE DUMPED, POURED, OR SPILLED IN THE AREA OF ANY PLANT MATERIALS. WASHING OF CONCRETE MIXERS SHALL NOT BE DONE NEAR THE SITE.

8. EXCAVATE PITS WITH VERTICAL SIDES APPROXIMATELY THE DEPTH OF THE ROOTBALL AND WITH A CIRCULAR OUTLINE WHICH SHALL BE APPROXIMATELY 2 TO 3 TIMES WIDER THAN THE ROOTBALL. FOR PLANTING PITS, BEDS OR TRENCHES WHICH ARE TO BE DEVELOPED WHEN PAVING EXISTED PREVIOUSLY, ALL PAVING AND BASE STONE SHALL BE REMOVED AS PART OF THE EXCAVATION.

9. REMOVE ROCK, DEBRIS, INORGANIC COMPOSITIONS, AND CHEMICAL RESIDUES FROM SOIL IN PLANTING PITS.

10. CULTIVATE SHRUB PLANTING PITS TO MINIMUM DEPTH OF 18-INCHES GROUND COVER AND VINE PLANTING PITS SHALL BE CULTIVATED TO A MINIMUM DEPTH OF 12-INCHES.

11. INSTALL ROOT BALL ON A FLAT, COMPACTED SURFACE OR UNDISTURBED SOIL AND REMOVE ANY INORGANIC TIES ON TOP OF ROOT BALL. REMOVE THE TOP 1/3 OF WIRE BASKETS. LEAVE THE TOP OF THE ROOT BALL EXPOSED, TO BE COVERED BY MULCH ONLY.

12. FINISH THE PLANTING WITH A MINIMUM 3-INCH LAYER OF MULCH OF PINE NEEDLES, TREE BARK, OR SIMILAR MATERIALS DISTRIBUTED AROUND THE TREE TRUNK.

13. PREPARE SOIL, PLANT, FERTILIZE, MULCH, AND CONTROL INSECTS AND DISEASE IN CONFORMANCE WITH THE NORTH CAROLINA COOPERATIVE EXTENSION SERVICE, LANDSCAPE MANAGEMENT CALENDAR.

14. RE-ESTABLISH NATIVE PLANTS SALVAGED FROM THE SITE OR RELOCATE AS A RESULT OF GRADING IN CONFORMANCE WITH THE RECOMMENDATIONS OF THE NORTH CAROLINA COOPERATIVE EXTENSION SERVICE.

15. SUPPORT TREES AND SHRUBS ADEQUATELY WHEN PLANTED IN ORDER TO AVOID INTERFERENCE WITH THEIR TYPICAL GROWTH PATTERNS. GUYING AND STAKING SHALL BE 2X2 INCH HARDWOOD STAKES AND SHALL BE REMOVED AFTER ONE YEAR.

16. LANDSCAPE CONTRACTOR TO VERIFY TREE AND SHRUB SELECTION WITH OWNER PRIOR TO PLACEMENT. LANDSCAPE CONTRACTOR TO CROSS REFERENCE TOWN OF CORNELIUS APPROVED PLANTS WITH WATER TOLERANT PLANTS LISTED IN THE MANUAL OF STORMWATER BEST MANAGEMENT PRACTICES BY NCDEQ.

PROPOSED PLANTING CHART

Type of Yard	Required Plantings	Approximate Length	Proposed Plantings
TYPE-A (6)(7)		605 ft	
Large Maturing Tree	2.5 per 100		0
Small Maturing Tree	5 per 100'		0
Shrubs	20 per 100'		0
TYPE-B (a) (2)(3)		326 ft	
Deciduous Trees (1)	1.675 per 100'		6
Evergreen Trees (1)	3.35 per 100'		11
Shrubs	13.4 per 100'		66
TYPE-C (b)			
Large Maturing Tree	no parking space more than 60' from base of tree	n/a	6
Small Maturing Tree	optional		0
Shrubs (4)	optional		13
TYPE-D (c)			
Large Maturing Tree	1 per 40' or	262 ft	0(5)
Small Maturing Tree	1 per 20'		0(5)
Shrubs	optional		0(5)

a.) THIS TYPE FUNCTIONS AS A SEMI-OPAQUE SCREEN FROM THE GROUND TO AT LEAST A HEIGHT OF 4' FOR SCREENING OF CAR LIGHTS AND GLARE. INTERMITTENT PLANTING OF DECIDUOUS AND EVERGREEN TREES SHALL OBTAIN A HEIGHT AT MATURITY OF NO LESS THAN 20'. AT LEAST 75% OF THE REQUIRED SHRUBS SHALL BE EVERGREEN SPECIES LOCALLY ADAPTED TO THE AREA.

b.) THIS TYPE FUNCTIONS AS A TREE CEILING OVER A PARKING AREA PROVIDING SHELTER FROM THE SUN AND RAIN.

c.) THIS TYPE FUNCTIONS AS A UNIFYING ELEMENT ALONG ALL STREET FRONTAGES BY ESTABLISHING AN ATTRACTIVE AND CONSISTENT STREETSCAPE AND SCALE. TREE SELECTIONS SHALL BE PROVIDED FOR IN ACCORDANCE WITH THE TOWN OF CORNELIUS STREET TREE SELECTION POLICY.

1) DECIDUOUS TREES AND EVERGREEN TO BE SMALL MATURING DUE TO EXISTING OVERHEAD UTILITIES
2) SCREENING HAS BEEN REDUCED TO 5' WIDE DUE TO EXISTING NATURE OF SITE PER CONVERSATIONS WITH THE PLANNING DEPARTMENT. A MASONRY WALL ALONG PERIMETER HAS NOT BEEN INCLUDED DUE TO CONFLICTS WITH EXISTING UTILITIES AND EXISTING STORMWATER PRESENT ON AND OFF-SITE.
3) SHRUBS HAVE BEEN PROVIDED BASED ON THE REQUIREMENTS OF TYPE B-2
4) SHRUBS TO BE USED TO SCREEN PROPOSED COOLER
5) OWNER TO PAY IN LIEU OF STREET TREES ALONG WEST MORELAND AND STATESVILLE RD
6) AN EXISTING HEAVILY VEGETATED BERM WILL BE USED IN PLACE OF TYPE A-2 BUFFER. EXISTING PLANTINGS TO BE USED IN LIEU OF PROPOSED PLANTINGS.
7) 30 FT BUFFER YARD TO ALSO ACT AS A 30 FT EASEMENT FOR THE TOWNS FUTURE GREENWAY MASTER PLAN.

PLANT LEGEND

60-FT SHADE RADIUS

PROPOSED EVERGREEN SHRUB

PROPOSED SMALL MATURING TREE

PROPOSED EVERGREEN TREE

PROPOSED LARGE MATURING TREE

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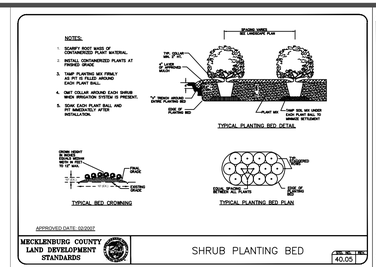

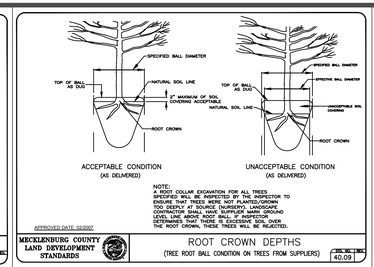

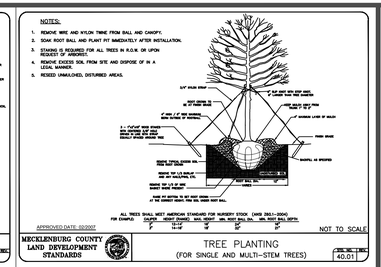



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LANDSCAPING PLAN (WORK EXTENTS)

Sheet No:

C-3.1

Attendees from BoatYard Eats: David Stockwell, Samantha Stockwell, Audrey Stockwell, Quinn Stockwell, Joseph Stockwell, Joli Stockwell

Town of Cornelius attendees: Will Washam, Chuck Travis

Introduction and power point presentation by David Stockwell

Question: will the music be inside or outside the building?
Answer: We will have a stage outside in the rear of the building and a stage inside the building.

Question: What will be the hours of operation?
Answer: We will open at eleven AM and close at midnight. Hours might change.

Question: When will you open?
Answer: Once we secure all permits and approvals we would anticipate opening summer 2017.

Question: How do you enter and exit the property?
Answer: Currently we have multiple curb cuts but NCDOT will control how we enter and exit the property. We would like an entrance and exit on Statesville Road and on Westmoreland.

Question: Will you give entertainers the opportunity to use the property?
Answer: Yes, we will connect with the community and we will have times for local entertainment to showcase their talent.

Question: You will be a restaurant but you will not serve food?
Answer: We are building a kitchen and we will have one or two key food items but we are going to have rotating food trucks that will showcase their menus.

Question: What age group are you targeting?
Answer: That's a good question. We believe that all age groups will enjoy our: food truck menus, our varied entertainment, and our featured micro breweries. It will be a family friendly gathering place for our town.

Question: How will we know what the menu will be?
Answer: We have a web site and we will have a calendar showing what food trucks are being featured. We also know that some people will just pop by without consulting our calendar.

Question: How will you pick the food trucks?
Answer: Another good question. Over time we will know from our customers which food trucks are the most popular. Customers will vote with the their dollars. It will take us time to evaluate the best food trucks in the are.

Question: How many food trucks.
Answer: Three food trucks but we might have events occasionally and have extra food vendors, such as a chili cook off.

Question: What will be the capacity?
Answer: Couple of hundred.

Question: Did you purchase the property?
Answer: Yes, last year in March.

Question: What criteria will you use to select food trucks?
Answer: We have already been to events and have been sampling the food. I think over time our customers will let us know which food items they want and their I put will guide us in the selection process.

Question: How is this concept family friendly?
Answer: It's casual, it's inside and outside, the entertainment will be varied, we expect the town's walking path to connect to the rear of the property, and we will allow dogs outside the building.

Question: How long before the greenway will be their?
Answer: We don't know but we have assured the town that we will grant them an easement through the rear of our property.

Question: What are the benefits to the town?
Answer: We would like to feature some of the history of the town, it will be a local gathering place, we will keep people local and we will be dog friendly, and we want to help tie in the greenway.

Question: Besides bands what other entertainment do you anticipate.
Answer: With a stage we could feature local entertainment: comics, short plays, musical events, holiday events, school events. I think we are open to almost anything.

Minutes
TOWN OF CORNELIUS
PRE-DEVELOPMENT REVIEW COMMITTEE
March 8, 2016
12:00 pm

Members Present	Members Absent	Staff Present
David Gilroy		Jason Pauling, Senior Planner
Joe Harris		Jody Clark, Planning Admin
Wayne Herron		Frances Tucker, Planning Intern
Anthony Roberts		
Brian Simmons		
Karen Tovar		
Woody Washam (Arrived @ 12:26)		

VISITORS
See Sign-In Sheet

DETERMINATION OF QUORUM
The meeting of the Pre-Development Review Committee began at 12:05 p.m.

REVIEW & RECOMMENDATION ON AGENDA ITEMS
HOTEL/CONVENTION CENTER
Mr. Herron welcomed everyone and gave a brief overview of PDRC. Following introductions, Mr. Herron briefly reviewed the proposed hotel/convention center. The first map is our zoning map. You will note that the property outlined is split with two residential zoning districts (GR & NR). Any changes as we normally do would go through a Conditional Zoning process. The next page is our Land Use Plan. In 2014 we adopted an updated Land Use Plan. We have three new categories along the waterfront called Waterfront Mixed Use. The Land Use Plan says we would hope to get development that provides a mix of uses that may include single-family, waterfront non-residential, and also non-residential along West Catawba that mix together to create more of a synergy and have waterfront uses. We realize that anything of that nature is going to take a number of years. With that being said, Dr. Nara understands that he has this Waterfront Mixed Use category that is in the Land Use Plan and he realizes that he has residential zoning. He would like to present a plan to you. While we have certain parameters in the Land Use Plan, it's a policy and guide of where we want to be. There's been a lot of discussion about balance tax base or trying to get more balance in the tax base. Right now we are at 83% residential and 17% non-residential. We are really striving to move on the non-residential side. We are limited on what land we have for development. We also talk about being very careful before we consider an approved residential development that we don't give up any opportunities that we might have for quality non-residential development. The applicant hopes to present their concept to you today, get some feedback, and make a decision down the road whether or not it is viable to file an application.

Jeremy Millingen, Architect
Dr. Sreeramulu Nara, Property Owner
Mr. Millingen welcomed everyone and talked about how they propose to use the site. He shared a preliminary proposal of the Lake Norman Hotel. Design elements include gardens and hidden

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parking. There is also a plan for a pool. He noted that the project has been planned so that all shadows will fall north of the site and not east or west on the neighbors.
Mr. Herron asked for comments from committee members.

Mr. Roberts asked him to talk about the height and how he envisions the layout with the convention center.

Mr. Gilroy asked his preference as far as floors.

Mr. Millingen responded and said that his architectural preference would be 6-8 stories and it would sit on the convention center.

Mr. Washam inquired about the target number of rooms.

Mr. Millingen said, “150-300…We are still doing market study.”

Mr. Gilroy inquired about the brands that are looking.

Mr. Millingen said that he is not at liberty to say.

Mr. Roberts noted if it is on the water, it would be more of a Class A type hotel.

Mr. Millingen said, “That is correct. They want to know the area will support it financially.”

Mr. Simmons said, “This is a game-changing facility. It’s a Class A facility that companies will utilize.”

Mr. Harris feels that it has to be more of a low-rise village concept and in the water. He encouraged embracing the lake.

Mr. Gilroy said, “This is an asset that we are really interested in and if 6-8 is a deal breaker, I think we should keep talking about it.”

Mr. Washam agreed.

Mr. Grant stated that as they develop their plan to keep in mind that public access is really important and it is noted in our Comprehensive Master Plan.

Expanding the lake was mentioned. Mr. Millingen plans to talk with Duke about creating more water front.

Mr. Washam recommended that they also touch base with Sally Ashworth at Visit Lake Norman as they will have a wealth of knowledge.

Mr. Gilroy thanked the applicants and said, “We are very interested in this plan.”

Mr. Herron and Mr. Roberts expressed to attendees that they appreciate comments and they would have an opportunity to talk and be heard at future public meetings. There is a process to include a Community Meeting.

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BOATYARD EATS
David Stockwell, Presenter

Mr. Herron introduced David Stockwell. He serves on our Historic Preservation Committee. He lives in Cornelius. Just a little background information from the Town's standpoint...The property is located at the corner of US 21 and Westmoreland. This is where the Anchorage Marine building is located. Our Land Use Plan calls for Highway Commercial uses and this fits right in. With that, he turned the meeting over to Mr. Stockwell.

Mr. Stockwell thanked everyone. He introduced his wife and said they live in Cornelius and have two children. They are both from North Carolina. David is from Chapel Hill and his wife is from Greensboro. They have lived here for five years now. He presented their plan for BoatYard Eats. He said, "At BoatYard Eats, it's all about the people getting together, having a good time, and enjoying themselves. BoatYard Eats is experiential dining. We offer an authentic rotating food truck experience that delivers a high quality and unique eating experience to Cornelius. BoatYard Eats is a place to gather with your family and friends. It's the community's place to enjoy live music, food trucks, and local beers, wines, and spirits. Whether our customers visit us in flip flops or loafers, each BoatYard Eats location will create an inviting and relaxed environment meant for everyone to enjoy. BoatYard Eats looks to pay tribute to the "life's better at the lake" mentality and will showcase historical photographs and pieces from Cornelius, Lake Norman and surrounding towns. Customers will be able to walk down memory lane while enjoying a modern cuisine and local brews." Mr. Stockwell shared a copy of the layout, as well as materials to be used to include the use of rope, wood and stained metal.

Mr. Roberts said, "I like it. Looks good."

Mr. Gilroy said it is super creative.

Mr. Washam said, "I think it's pretty cool."

Mr. Simmons added that it is unique and different. He thinks it would be a nice asset to the community.

Mr. Herron asked for additional comments. With there being none, he adjourned the meeting.

ADJOURNMENT

The meeting adjourned at 1:28 p.m.

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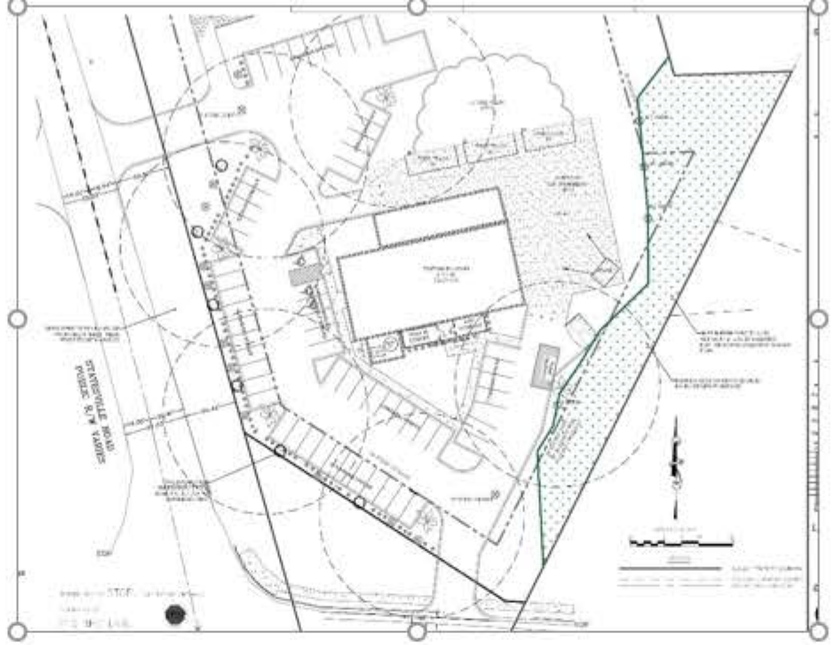
BOATYARD EATS (HWY 21 & WESTMORELAND)

- **3.6 Acres**
- **Existing Zoning: HC**
- **Proposed Zoning: CZ**
- **Proposed Use: Restaurant & Events Venue**
- **Town Board Public Hearing: April 3rd**









REQUEST FOR BOARD ACTION

Print

Date of Meeting: March 13, 2017

To: Planning Board Members

From: Jason T. Pauling, AICP - Senior Planner

Action Requested:

A request by Classica Homes, LLC to rezone 7.32 acres from NR (Neighborhood Residential) to CZ-Washam Potts Reserve to develop a 22-lot single family subdivision located on Washam Potts Road, just northeast of the Washam Potts-Westmoreland Road intersection. The overall density proposed for the development is 3.0 dwelling units per acre, and the applicants are proposing 20% open space.

Manager's Recommendation:

Approval with conditions.

ATTACHMENTS:

Name:	Description:	Type:
Application.pdf	Application	Backup Material
Classica_WP_Zoning.jpg	Zoning Map	Backup Material
Classica_WP_LU.jpg	Land Use Map	Backup Material
Classica_WP_Vicinity.jpg	Vicinity Map	Backup Material
Classica_WP_Property.jpg	Property Map	Backup Material
Bird_s_Eye.JPG	Bird's Eye	Backup Material
Street_View_1.JPG	Street View 1	Backup Material
Street_View_2.JPG	Street View 2	Backup Material
REZ_13-16_(PB)_Washam_Potts_Reserve_Staff_Analysis_(3.13.17).docx	Staff Report	Backup Material
Survey_Washam_Potts_12-29-16.pdf	Survey	Backup Material
POTTS_CONSENT_SIGNED.pdf	Potts Buffer Consent (Signed)	Backup Material
WASHAM_POTTS_RESERVE_SK-100_R_2-27-17.pdf	Sketch Plan	Backup Material
Proposed_Privacy_Wall.pdf	Proposed Privacy Wall	Backup Material

TOWN OF CORNELIUS
Planning Department
PO Box 399 | Cornelius, NC 28031 | Phone: 704-896-2461 | Fax: 704-896-2462

Staff Only:
Date Rec'd: _____
Rec'd by: _____
Case #: Rez 13-16

LAND DEVELOPMENT APPLICATION FORM

1. Application Type

	✓	Fee		✓	Fee
• *Sketch Plan/Plat (Major Sub)*	☐	_____	• *Conditional Zoning (CZ)*	☑	$1150.00
• *Preliminary Plat (Major Sub)*	☐	_____	• *Special Use Permit (SUP)*	☐	_____
• *Final Plat (Major Sub)*	☐	_____	• *Major Architectural Variation*	☐	_____
• *Construction Documents*	☐	_____	• *Minor Architectural Variation*	☐	_____
• *General Rezoning*	☐	_____	• *Other*: _____	☐	_____

Fee Total: $1250.00

2. Project Information

Date of Application: 12/30/16 Name of Project: Washam Potts Reserve
Location: Washam Potts Rd + Westmoreland Property Size (acres): 7.32 # of Units/Lots: 27
Current Zoning: NR Proposed Zoning: (CZ) - NR
Current Land Use: Vacant Proposed Land Use: Single Family Residential
Tax Parcel Number(s): 00509116 + A PORTION OF 00509106

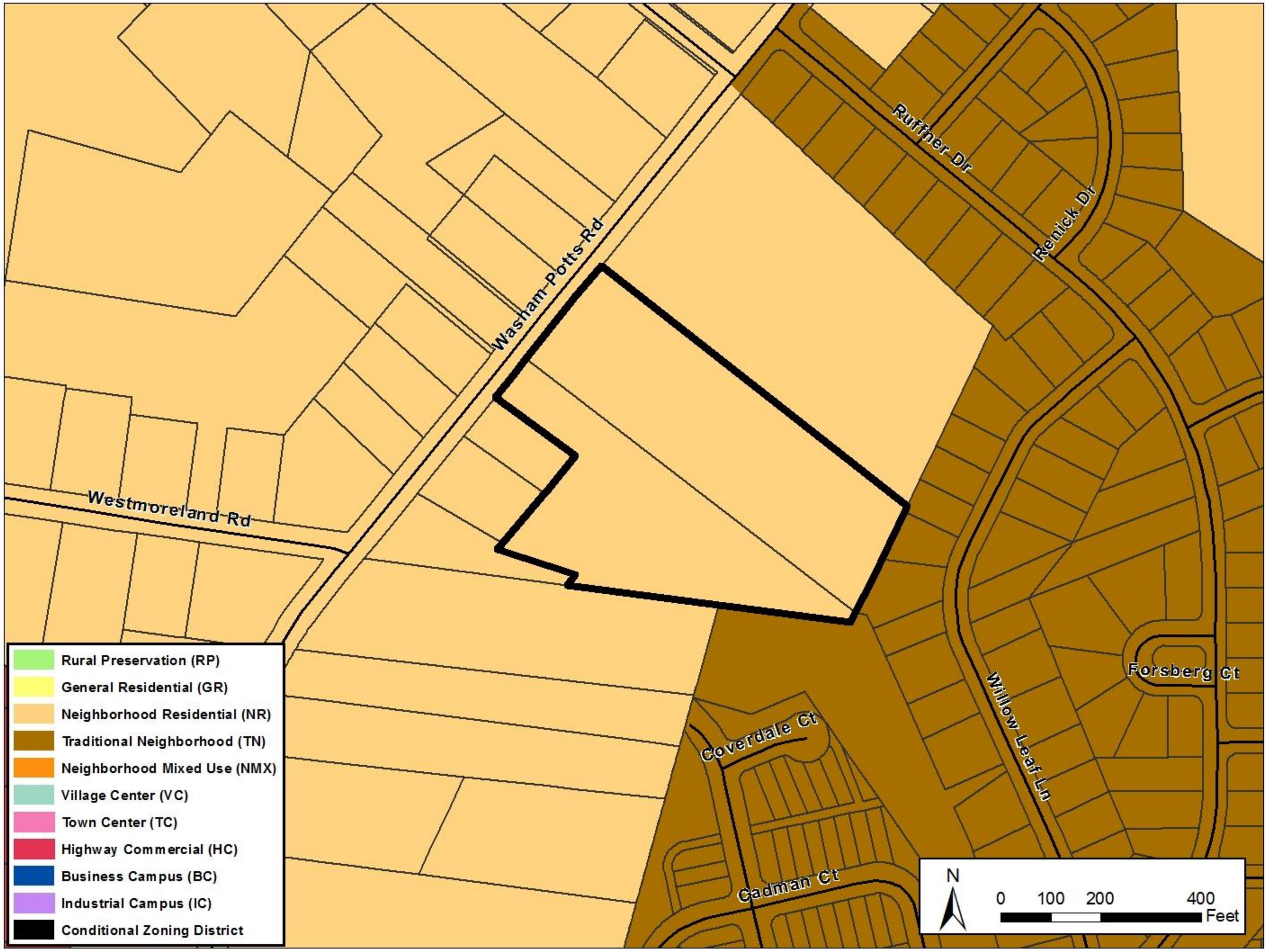
3. Contact Information

Owner, Applicant, or Developer	Agent(s) (Engineer, Architect, Etc.)
CLASSICA HOMES, LLC	Landworks Design Group, P.A.
2215 Ardsley Town Blvd #G	7621 Little Ave, Suite #111
Address	Address
Charlotte, NC 28273	Charlotte, NC 28226
City, State Zip	City, State Zip
704-201-8976 704-940-3909	704-841-1604 704-841-1604
Telephone Fax	Telephone Fax
Rick Jasinski 12/30/16	Matt Langston Matt Langston 12/20/16
Signature Print Name Date	Signature Print Name Date
Email - RJasinski@ClassicaHomes.com	Email - mlangston@landworkspa.com

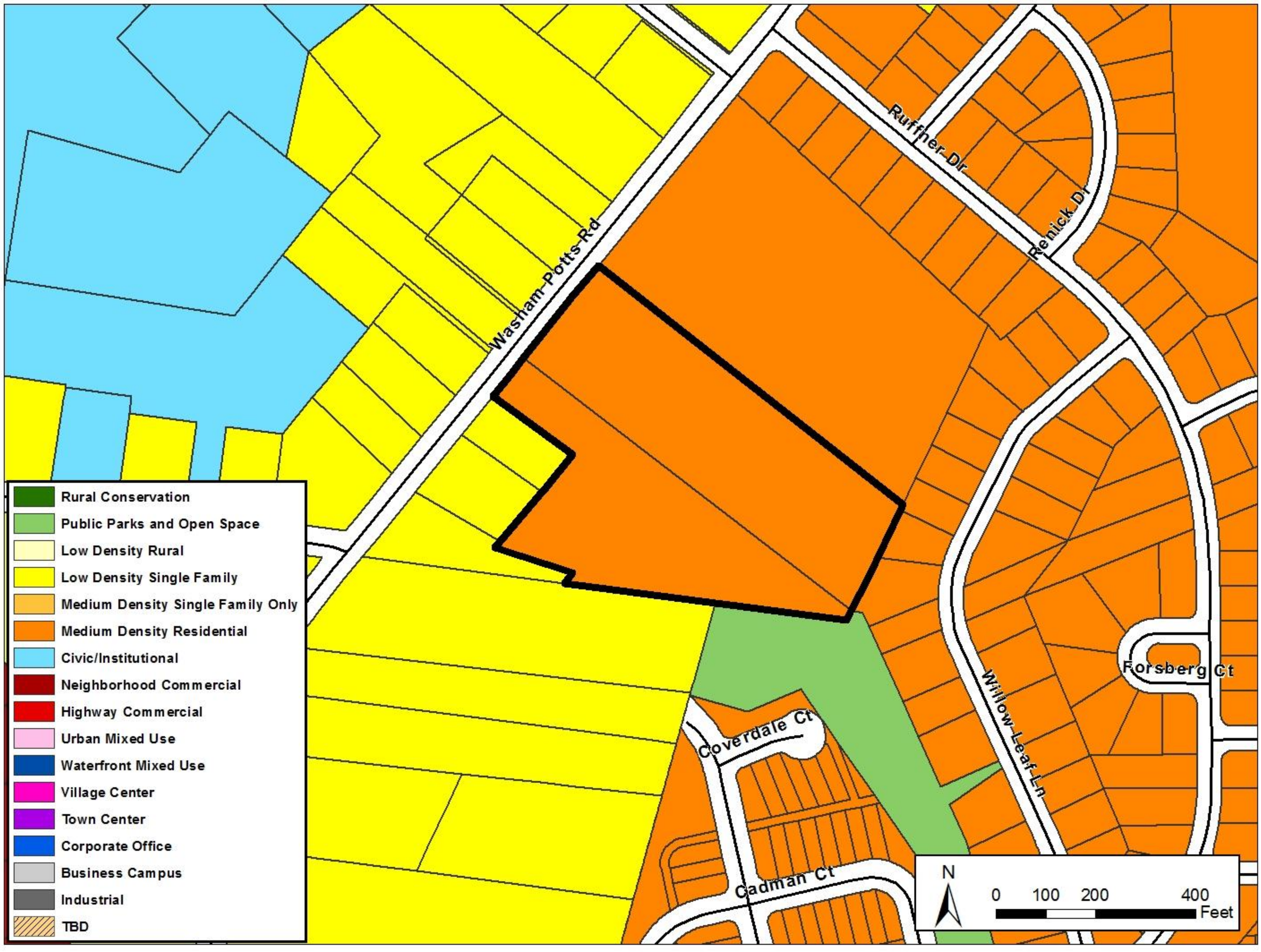
4. The following items shall be considered as part of a complete application, please check this list to ensure all items are included:

- ☐ **Signed "Original" application**
- ☐ **Project Fee(s)** – See Fee Schedule
- ☐ **Written Summary/Description of Request** can be on company letterhead. Shall include requested use or uses, sq. feet of non-residential space, or density and number of units/lots for residential, or any other applicable information. For CZ's, must also describe any variations proposed from the Land Development Code
- ☐ **Property Survey** (at least one copy), including existing buildings, topography, wetlands, streams, vegetation (trees over 18" in diameter), and other natural features.
- ☐ **Site/sketch plan** (at least one copy), may contain multiple pages and must be drawn to scale by an engineer or landscape architect. Shall include locations of buildings and/or lots, streets, parking, proposed grading, landscaping/screening, open space, watershed/storm water information, associated storm water measures, and proposed utilities and lighting. Shall also include general information from adjoining lots
- ☐ **Illustrative (color) site/sketch plan** for presentation purposes with same layers as described above
- ☐ **Official hard copy of architectural elevations** (at least one copy), which may include multiple pages. Must be drawn to scale by a registered architect, and include all primary and accessory buildings (including all building sides), and any other architectural elements/features of the site such as gazebos, trellis's, garden walls, retaining walls, or other items over 4-feet in height (NOT APPLICABLE FOR SINGLE-FAMILY RESIDENTIAL DEVELOPMENTS).
- ☐ **Illustrative (color) elevations** for presentation purposes for all items described above, as well as perspective (3D) renderings and photograph examples
- ☐ **Digital Files** of all items listed above

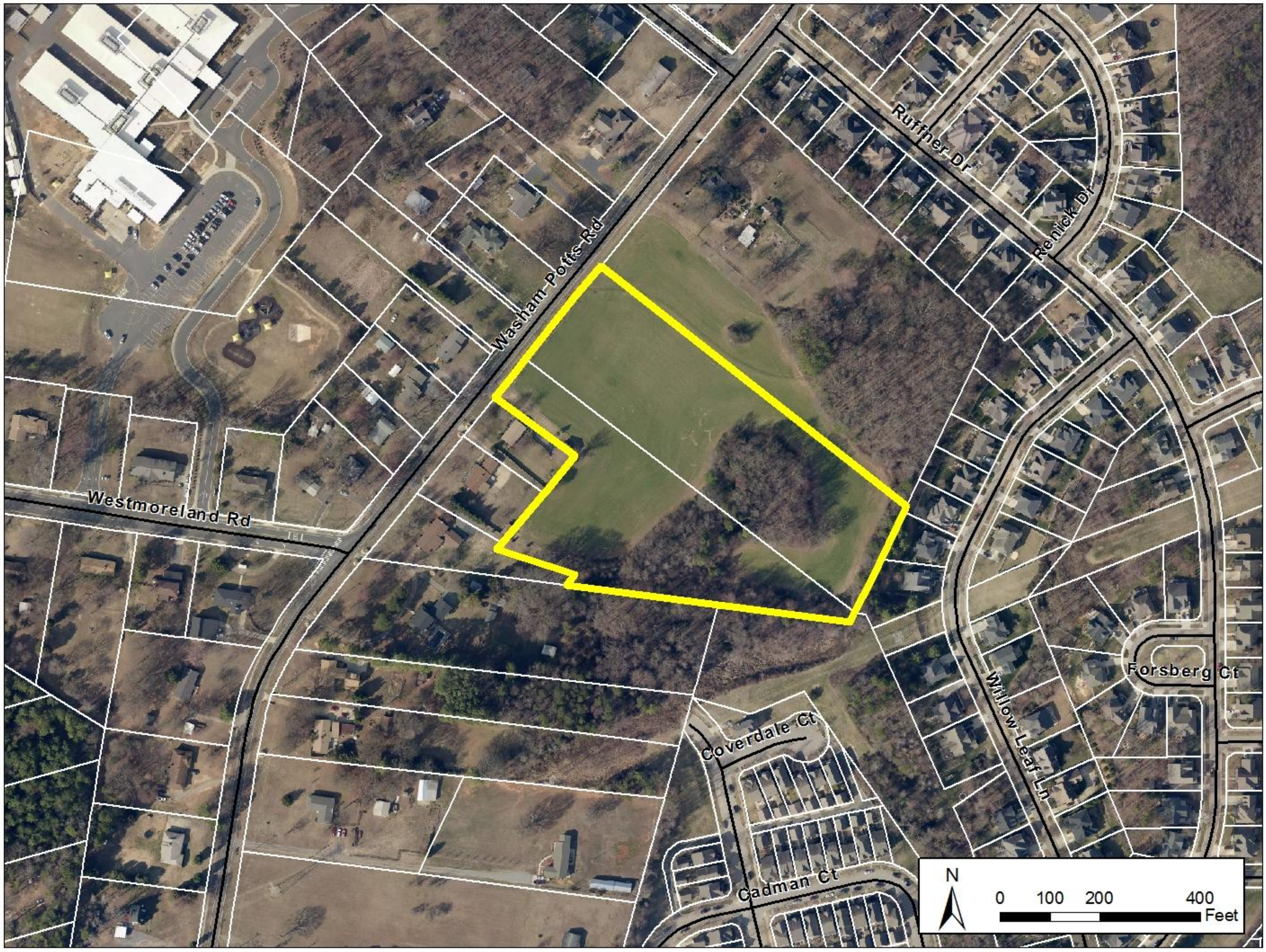
Washam Potts - Classica Homes Proposal



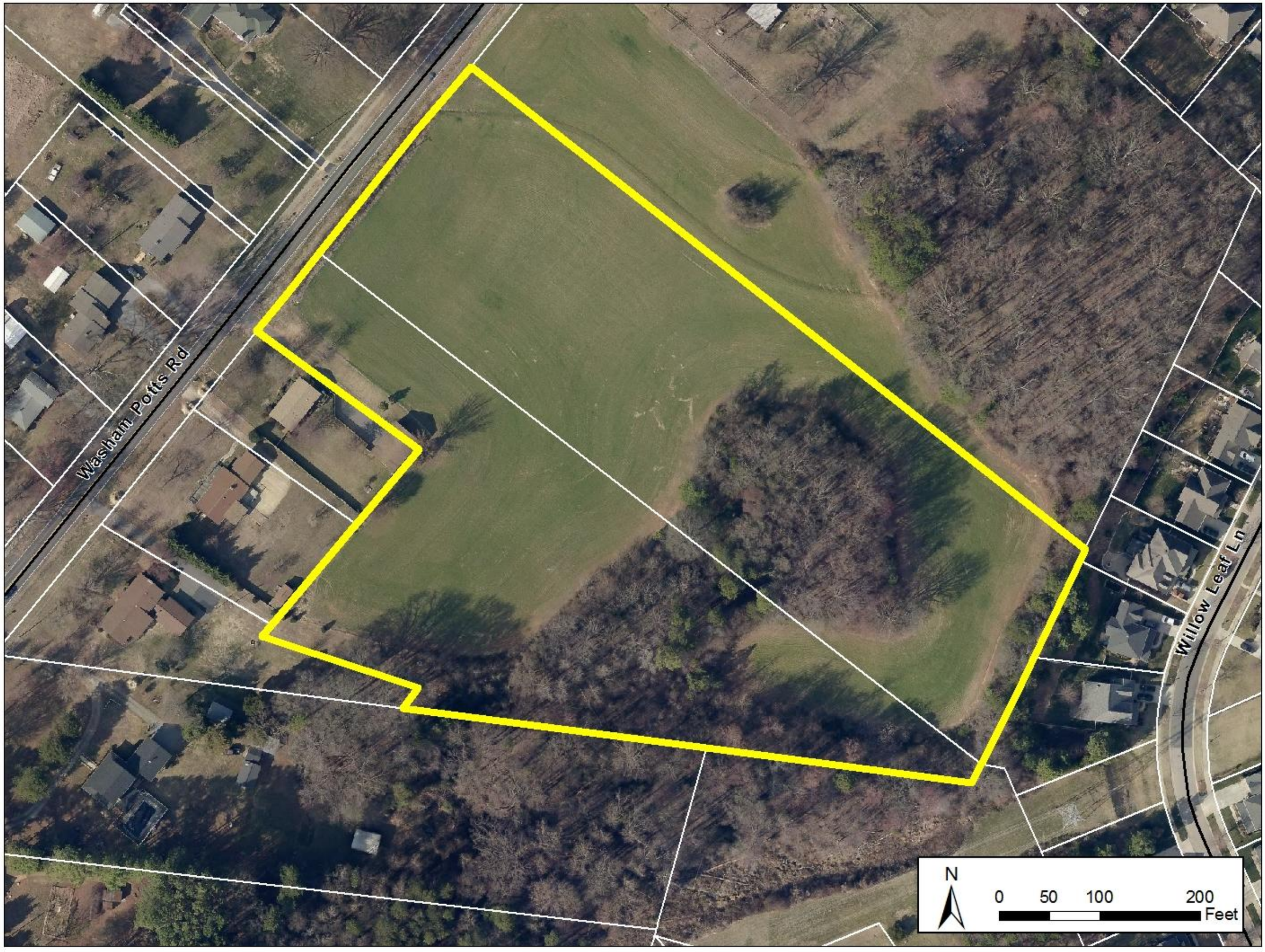
Washam Potts - Classica Homes Proposal



Washam Potts - Classica Homes Proposal



Washam Potts - Classica Homes Proposal




Washam Potts Rd
Ruffner Dr
moreland Rd
9910 WASHAM POTTS RD
CORNELIUS NC 28031
+
−


Washam Potts Rd


Washam Potts Rd

REZ 13-16
Washam Potts Reserve Subdivision

Conditional Zoning Request

Planning Board Meeting
March 13, 2017

OWNER(S): Rachel Anne Potts
15316 Black Farms Road
Huntersville, NC 28078

APPLICANT(S):

Rick Jasinski
Classica Homes, LLC
2215 Ayrsley Town Blvd, Suite G
Charlotte, NC 28273

Matt Langston
Landworks Design Group
7621 Little Ave, Suite 111
Charlotte, NC 28226

PROPERTY LOCATION: 9904 & 9910 (portion) Washam Potts Road (PID# 00509116, and portion of 00509106)

PROPERTY SIZE: Approximately 7.32 Acres

CURRENT LAND USE: Vacant

PROPOSED LAND USE: 22-lot single family detached subdivision.

EXISTING ZONING: Neighborhood Residential (NR)

PROPOSED ZONING: Neighborhood Residential – Conditional Zoning (NR-CZ)

EXISTING CONDITIONS:

1. *Description of Adjoining Zoning and Land Uses* – This property is bordered on the northeast and southeast by the Oakhurst subdivision, which is zoned Traditional Neighborhood (TN), and also bordered by other single family homes zoned neighborhood residential directly north, and southwest. The proposed entrance to this proposed subdivision will be approximately 550' from the Washam Potts-Westmoreland intersection.

2. *Topography* – The site gently slopes at an average of 3.5 to 4% from Washam Potts Road to the southwestern corner of the property

3. *Vegetation* – The site is mostly an open, agricultural field, but also contains existing tree canopy and vegetation along the edges of the property, and also some existing trees toward the center of the site.

4. *Infrastructure* – The property should have access to water and sewer services from Washam Potts Road. The applicants are proposing a new public street connection to Washam Potts Road approximately 550-feet north of the Westmoreland Intersection, 660-feet south of the Oakbranch-Washam Potts intersection, and just over 750-feet south of the Washam Potts-Ruffner Drive intersection. The site plan shows two street stubs to the north and south for future connectivity.

STAFF COMMENTS:

1. *District Consistency* – According to the Land Development Code, major subdivisions require conditional zoning approval in all zoning districts. The Neighborhood Residential District maximum density is 3 dwelling units per acre.

2. *Land Use Plan Consistency* – The Land Use Plan adopted by the Town Board on January 6, 2014 designates this property as Medium Density Residential. Medium density residential neighborhoods support a mix of housing options ranging from two to four dwelling units per acre with sufficient open space, and sufficient buffering from existing/older single family homes and neighborhoods.

3. *Sketch Plan* – The applicant(s) are proposing a twenty-two (22) lot single-family subdivision, which equates to a density right at three (3) units per acre. The average lot size is around 7,500 square feet with most lot widths between 60 and 65-feet. The applicants are proposing a 15-foot front and rear yard setback, and a minimum side setback of three (3) feet. The site will include one primary street entrance off Washam Potts, and two streets that provide a stub connection to the adjoining properties should they redevelop in the future.

4. *Storm Water/Water Quality* – This site is not located within a Watershed District, but is subject to post construction regulations. The impervious limits for the entire property as well as per lot are not listed on the sketch plan, but the plan does include a potential water quality area indicating that the project will be high density from a storm water and water quality perspective.

5. *Open Space* – The site plan indicates that 1.47 acres of open space is proposed, which is 20% of the site and meets the requirements of Chapter 8. A central green area is included as part of the improved open space, which can be easily accessed by all lots within the development. The mail kiosk is included within the central open space. Improved open space in both the central park and other areas combine for a total of 22,063 square feet, which is 25% of the total required open space also meeting Chapter 8 standards. The water quality/storm water bmp area does not appear to be included in the open space calculation.

6. *Screening and Landscaping* – The site plan proposes a variety of different buffer options to conform to recently adopted Chapter 9 standards, including a 50+-foot undisturbed buffer at the back (south end) of the site adjoining the adjacent residential homes in Oakhurst, a 30-foot buffer with a 6-foot brick wall behind lots 16 through 22 also adjoining existing residential, and a 10-foot undisturbed, wooded buffer behind lots 13 through 15. There is not a buffer proposed behind lots 1 through 9 as part of the negotiation with the Potts property.

The 30-foot buffer behind lots 16 through 22, the brick wall will be placed 20 feet from the adjoining property, and 10 feet from the new lots. On the side adjoining the existing residential homes, there will be a combination of evergreen and deciduous trees, and on the new development side there will be shrubs.

7. *Traffic/Transportation* – As part of staff's review of this proposal, the sketch plan was sent to NCDOT Division 10 and District staff to provide their input on the proposed subdivision. NCDOT requested a left turn lane into the site with at least 100-feet of storage, which has been added to the latest plan. Staff has also requested modifications to the Washam Potts street cross section, which will include a sidewalk and bike lane in front of the development.

8. *Pre-Development Review Committee* – This proposed rezoning was presented to the PDRC on December 8, 2016. The lot layout was similar, but the original plan included 30 lots at a density closer to 4 dwelling units per acre. The developer also included elevations, and spoke about the buffers and proposed price point. Board members encouraged the applicants to try to reduce the density, but were in favor of the requested rezoning as it is consistent with the future land use plan.

9. *Community Meeting* – The applicant(s) held the required community meeting on February 1, 2017 at Town Hall in room 204. There were about 15 people in attendance, including two Town Board members. There were a few concerns raised regarding the increase in traffic on Washam Potts, but generally, those that were in attendance were predominately in favor of the request, and stated that they would rather this property be approved for residential development versus commercial. Most residents that adjoined this development were also pleased with the proposed buffers, and asked about connectivity and price points. The subdivision was 27 lots at that time.

STAFF RECOMMENDATIONS:

Staff recommends approval of the requested conditional zoning, subject to the following conditions:

1. Town approval is contingent on review and approval by other applicable local, state and federal agencies.

2. The development shall comply with all other applicable requirements of the Town of Cornelius Land Development Code.

3. Town approval incorporates and shall comply with any and all submittals in the case file and correspondence presented to the board in support of this application, including, but not limited to the following: The site/sketch plan, architectural elevations, and any and all traffic information including traffic memos, transportation impact analysis and recommended transportation plans or improvements recommended by the Town and/or NCDOT.

4. Final approval of the cross-section and details for the proposed new streets is required by the Town of Cornelius Public Works Department and by Mecklenburg County prior to construction document approvals.

5. The US Postal Service has notified the Town that all future subdivision approvals must utilize a community mail delivery system. Locations and details of the proposed community mailboxes must be included in the Construction Documents, and must be reviewed and approved by the Post Master for this area. The applicant(s) must provide the Town with written confirmation that the local Post Master is in agreement with the proposed box locations.

LINE TABLE

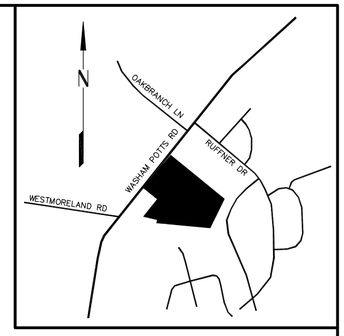
LINE	BEARING	DISTANCE
L1	N 12°07'02" E	22.76'

AREA SUMMARY

TAX PARCEL 005-091-16	3.338 ACRES
PORTION OF TAX PARCEL 005-091-06	4.003 ACRES
COMBINED TOTAL AREA	7.341 ACRES

LEGEND

EIP	EXISTING IRON PIN	SS	SANITARY SEWER LINE
UP	UTILITY POLE	OE	OVERHEAD ELECTRIC
	STORM MANHOLE	WM	WATER METER
	SEPTIC TANK COVER	LP	LIGHT POLE
SM	SEWER MANHOLE		TREE LINE
WV	WATER VALVE	CT	CLEAN-OUT
SB	TELEPHONE PEDESTAL	EM	ELECTRIC SERVICE METER
CP	CONCRETE PAD	RCP	REINFORCED CONCRETE PIPE
FH	FIRE HYDRANT	HDPE	
	ROAD SIGN	CV	CATV CABLE PEDESTAL
UT	UNDERGROUND TELEPHONE	UE	UNDERGROUND ELECTRIC
WL	WATERLINE	#990	PHYSICAL ADDRESS



VICINITY MAP

GENERAL NOTES:

1. BOUNDARY SURVEY IS BASED ON EXISTING PHYSICAL EVIDENCE OBSERVED IN FIELD ON DATE(s) OF SURVEY.
2. NORTH ORIENTATION IS BASED DEED BOOK 6088, PAGE 11, RECORDED IN THE MECKLENBURG COUNTY REGISTRY.
3. ALL DISTANCE SHOWN HEREON ARE HORIZONTAL GROUND DISTANCES UNLESS OTHERWISE NOTED. ALL AREAS WERE CALCULATED USING THE COORDINATE METHOD.
4. THE LOCATIONS OF UTILITIES SHOWN HEREON ARE APPROXIMATE AND ARE BASED ON ABOVE GROUND VISIBLE APPURTENANCES.
5. TOPOGRAPHIC INFORMATION AND CONTOURS ARE BASED ON THE MECKLENBURG COUNTY GEOGRAPHIC INFORMATION SYSTEM AND ARE APPROXIMATE.

WASHAM POTTS ROAD
(DEED BOOK 6088 PAGE 11)
EDGE OF PAVEMENT
OVERHEAD ELECTRIC
COMPUTED POINT
EXISTING #4 REBAR
N 37°25'11" E 318.0' (TOTAL)
218.08'
UP
99.92'
S 52°32'31" E 774.27'
(NEW LINE)
N 52°32'11" W 200.04'
RACHEL ANNE POTTS
DB 1444 PG 387
TAX PARCEL 005-091-06
RACHEL ANNE POTTS
DB 1444 PG 387
PORTION OF TAX PARCEL
005-091-06
JEREMY D. THOMPSON
DB 22565 PG 670
TAX PARCEL 005-091-12
N 37°28'18" E 99.99'
S 52°32'52" E 825.13'
WOODED
IAN W. McDONALD &
NICHELE A. McDONALD
DB 30189 PG 517
TAX PARCEL 005-091-10
RACHEL ANNE POTTS
DB 6088 PG 11
TAX PARCEL 005-091-16
N 37°27'14" E 149.82'
TREELINE
EXISTING SANITARY SEWER LINE
JOSEPH R. DEROSA
DB 30804 PG 521
TAX PARCEL 005-091-07
N 77°56'15" W 170.03'
L1
PERMANENT SANITARY SEWER EASEMENT
CITY OF CHARLOTTE
DB 9852 PG 700
N 83°37'41" W 270.59'
W. DOUGLAS WILHELM
DB 3908 PG 68
TAX PARCEL 005-091-17
TOWN OF CORNELIUS
GREENWAY OPEN SPACE
DB 11002 PG 906
MB 32 PG 495
TAX PARCEL 005-091-35
N 81°30'42" W 270.07'
DAVID D. DEMAREST &
SARAH R. DEMAREST
DB 30468 PG 896
TAX PARCEL 005-091-42
4.21'
CHRIS KOLKHORST &
JENNIFER KOLKHORST
DB 19705 PG 64
TAX PARCEL 005-091-41
107.49'
S 24°17'18" W 251.59'
(TOTAL)
112.19'
6.55'
21.15'
JEFFERY S. HOLLEY &
JENNIFER A. HOLLEY
DB 23448 PG 262
TAX PARCEL 005-091-40
EXISTING PIPE
802
800
796
794
792
790
788
786
784
782
780
778
776
774
772
770
768

12/29/16
NORTH CAROLINA PROFESSIONAL SEAL L-3470 LAND SURVEYOR EDWIN S. GODSEY

50 0 25 50 100 200

TOWN OF CORNELIUS
MECKLENBURG COUNTY, NORTH CAROLINA

BOUNDARY SURVEY FOR:

CLASSICA HOMES

SURVEYED BY:	SURVEY DATE(S):	PROJECT NUMBER:
EG	12-16	16028
DRAWN BY:	PLAT DATE:	DRAWING NAME:
EG	12-16	16028
CHECKED BY:	DRAWING SCALE:	FIELD BOOK:
EG	1"=50'	16-01

LANDTEC SURVEYING ■ MAPPING
137 CROSS CENTER RD #253
DENVER, NC 28037
OFFICE 704-483-3201
FAX 704-483-3202

DocuSign Envelope ID: 91CC21CB-3021-4937-B221-49054FA79FDD

11/22/2016

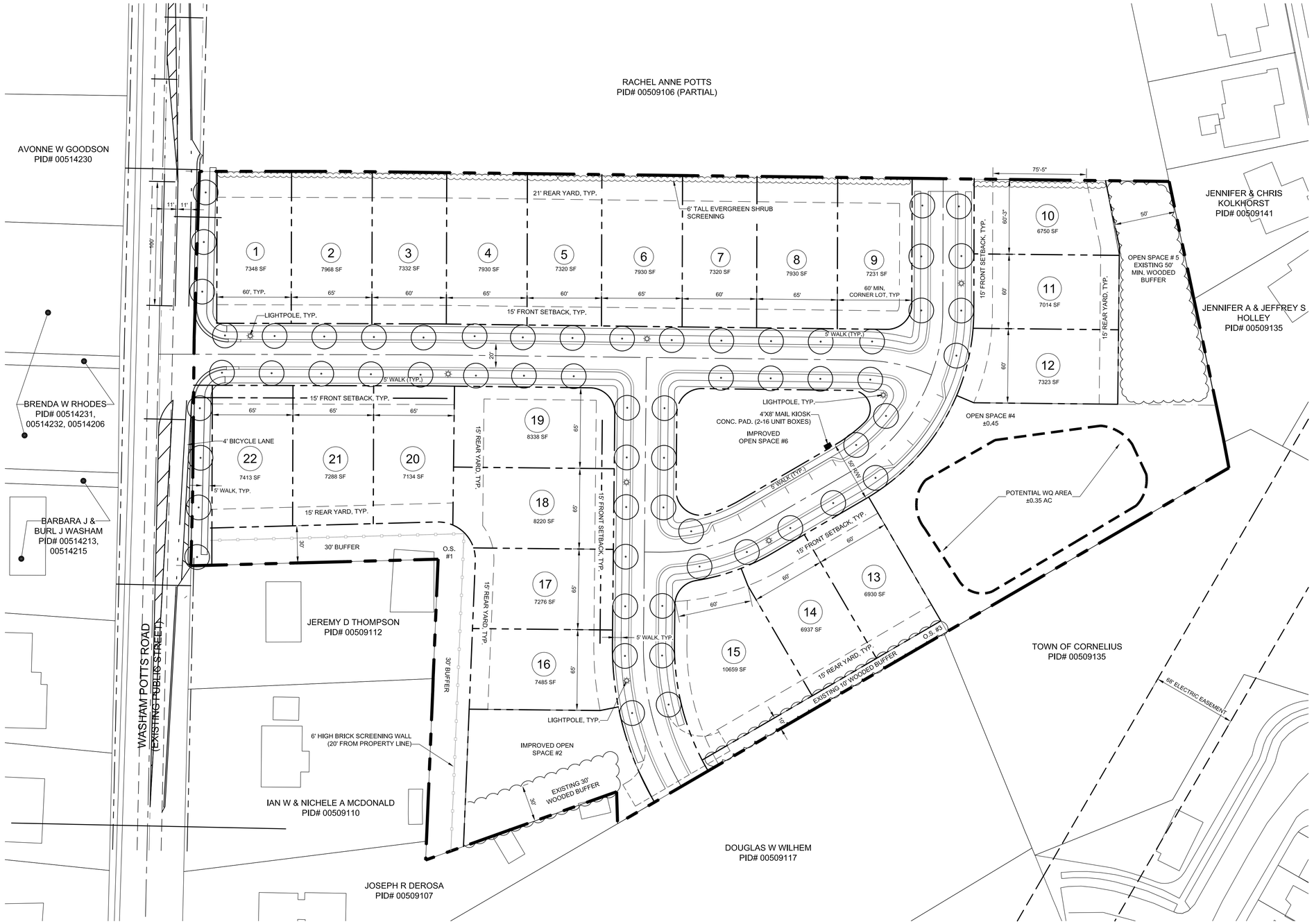
As the property owner of Parcel 00509106 we are allowing and approving the rear yards and buffers to be as shown in the attached sketch plan and will not require the additional buffering requirements that are stated in your new proposed Environmental Protection buffering ordinance in Section 9.4.2 of the Town of Cornelius Land Development Code.

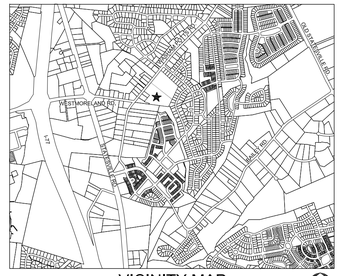
DocuSigned by:
Anne Potts Shoemaker
67C227896BD14E5...

12/20/2016

Rachel Anne Potts

Date



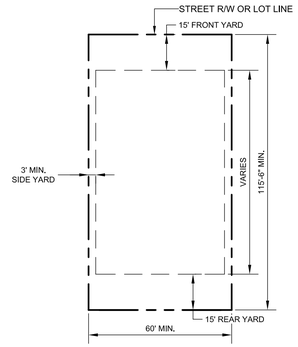


DEVELOPMENT DATA:

TAX PARCEL ID:	00509116, 00509106 (PARTIAL)
REZONING SITE ACREAGE:	± 7.34 AC
EXISTING ZONING:	NR (Neighborhood Residential)
PROPOSED ZONING:	NR (CZ - Conditional Zoning)
PROPOSED USE:	Single-Family
RESIDENTIAL UNITS PROPOSED:	22
RESIDENTIAL DENSITY PROPOSED:	3.00 Units / AC
FRONT YARD:	15'
MIN. SIDE YARD:	3'
MIN. CORNER LOT SIDE YARD:	10'
REAR YARD:	15' MIN.
MAX. FAR:	1.0
PROPOSED BUILDING HEIGHT:	45 FT

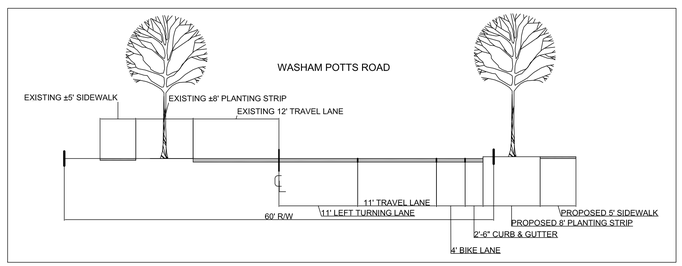
PROPOSED BUILDING FOOTPRINT IS SHOWN FOR ILLUSTRATIVE PURPOSES ONLY. (ACTUAL FOOTPRINT DETERMINED AT TIME OF SALE FOR EACH INDIVIDUAL LOT.)

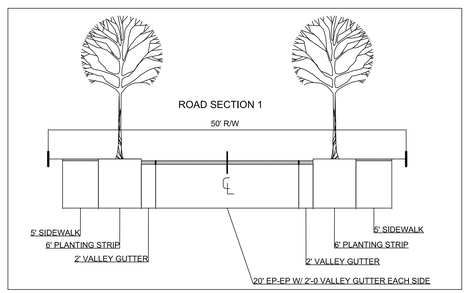
OPEN SPACE REQUIREMENTS:	
20% OF TOTAL SITE:	1.47 AC REQUIRED
	±1.47 AC (64,112 SF) PROVIDED
IMPROVED OPEN SPACE:	
25% OF REQUIRED OPEN SPACE =	0.25 X 1.47 AC = 0.38 AC REQUIRED
	±0.51 AC (22,063 SF) PROVIDED
OPEN SPACE PROVIDED:	
O.S. #1 (GREEN):	±13,332 S.F.
I.O.S. #2 (GREEN):	±11,943 S.F.
O.S. #3 (GREEN):	±2,229 S.F.
O.S. #4 (GREEN):	±15,516 S.F.
O.S. #5 (GREEN):	±11,015 S.F.
I.O.S. #6 (GREEN):	±10,921 S.F.
TOTAL ON-SITE:	±64,956 S.F.
IMPROVED OS:	±22,063 SF (± 34.4% OF TOTAL) (GREEN AREAS TO INCLUDE ORNAMENTAL LANDSCAPING AND PATHWAYS AND/OR SITTING AREAS. FINAL DESIGN TO BE ESTABLISHED DURING PERMITTING PHASE.)

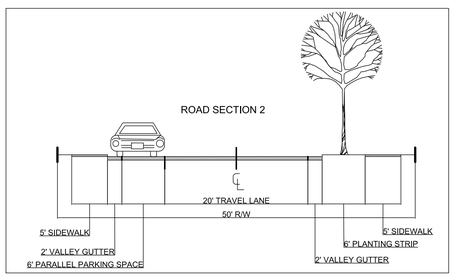


TYPICAL LOT DETAIL
SCALE: NTS

BOUNDARY AND TOPO INFO FROM MECKLENBURG COUNTY GIS









0 40' 80' 160'

SCALE: 1"=40'

REVISIONS:

No.	Date	By	Description

Landworks
Design Group, P.A.
7621 Little Avenue, Suite 111
Charlotte, NC 28226
704-841-1604 fax: 704-841-1604

CLASSICA
HOMES DESIGNED FOR LIVING

WASHAM POTTS ROAD SITE
CORNELIUS , NC
CLASSICA HOMES, LLC
CHARLOTTE, NC

SKETCH PLAN

NORTH CAROLINA
LANDSCAPE ARCHITECTURAL
C-253
LANDWORKS DESIGN GROUP, P.A.

NORTH CAROLINA
REGISTERED LANDSCAPE ARCHITECT
957
MATTHEW E. LANGSTON

Matthew E. Langston 2-20-17

CORPORATE CERTIFICATIONS
NC PE : C-2930 NC LA : C-253
SC ENG : NO. 3599 SC LA : NO. 211

Project Manager: MDL
Drawn By: DRW
Checked By: MEA
Date: 2/20/17
Project Number: 16048

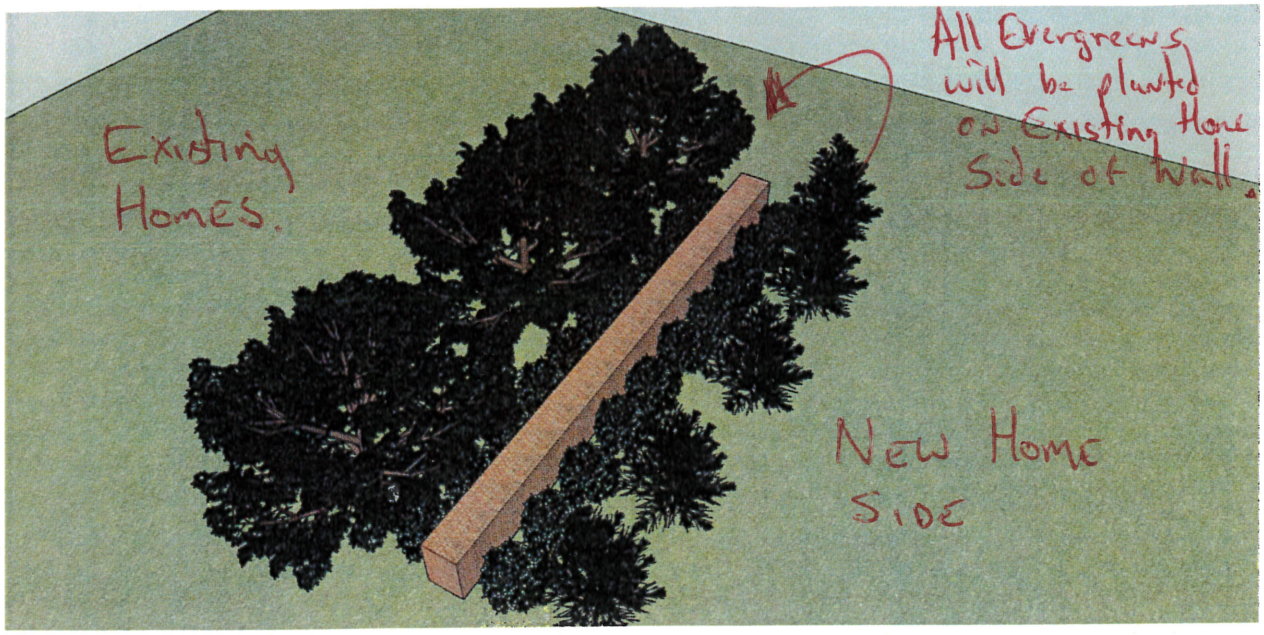
Sheet Number:

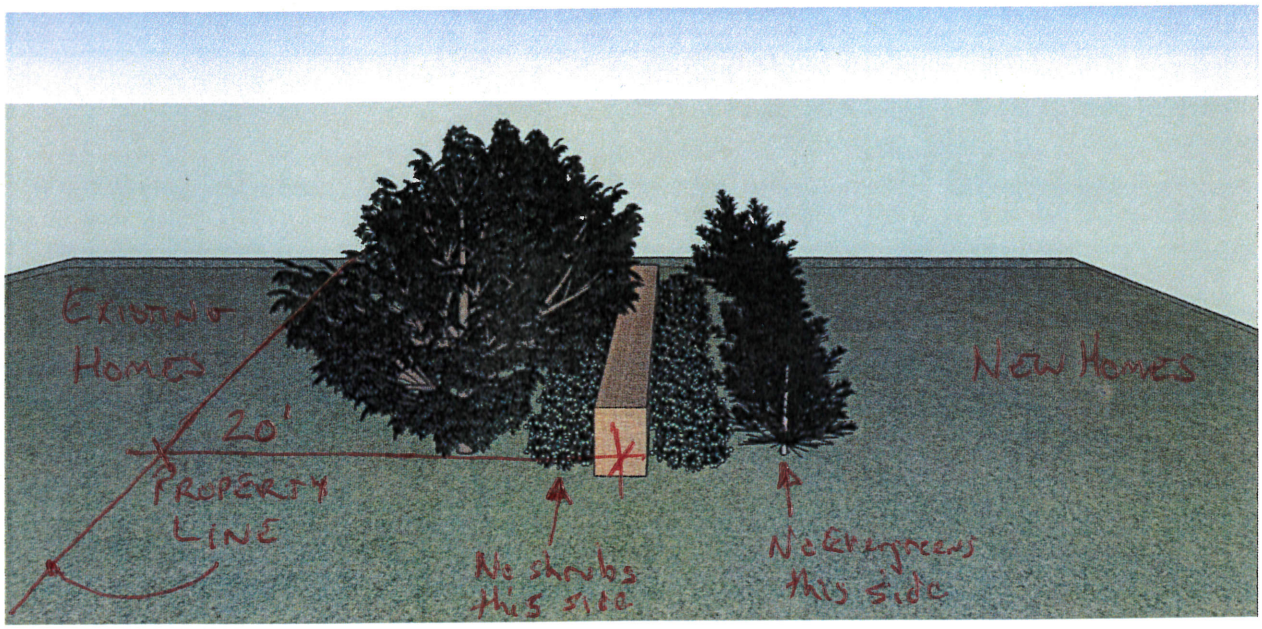
SK-100

SHEET # 1 OF 1

P:\2016 Jobs\16048 - Washam Potts - Classica Homes\CAD\Sketch Planning\16048 SD_2-27-17 REV.dwg

WASHAM POTTS RESERVE PRIVACY WALL





Type A-2

- Minimum width: 30'
- Masonry wall of brick and/or stone with minimum height of 6'
- Masonry wall shall be a minimum of 20' off of any property line
- Deciduous trees at 2.5/100 linear feet – All on Existing Home Side of Wall
- Evergreen trees at 5/100 linear feet – All on Existing Home Side of Wall
- Shrubbery at 20/100 linear feet – All on new home side of wall

REQUEST FOR BOARD ACTION

Print

Date of Meeting: March 13, 2017

To: Planning Board Members

From: Wayne Herron, Director of Planning

Action Requested:

At the September 12th Planning Board Meeting, a discussion was started regarding a potential amendment to the Land Use Plan regarding properties near the intersection of Bailey Road and NC 115. In order to further discuss the idea, the Planning Board requested that staff talk with Charlotte Water to get a better understanding of the existing and proposed sewer service for the area.

1. Currently, the proposed area is not served with sewer.
2. There are two areas that sewer is provided nearby, where service could be obtained for the proposed area in question.
3. The South Prong West Branch of the Rocky River has a gravity trunk line that serves Antiquity and areas to the north in Davidson. A sewer outfall with a pump station could be provided from this gravity trunk line that would be located along a small tributary to serve the area. This is the desired location by Charlotte Water to serve the entire area.
4. Bailey's Glen is served by a gravity local sewer line. Individual properties along Bailey Road could connect to this line, but would require individual pump stations on a per property basis to pump up to Bailey Road. This option could be allowed, but is not the desired method of providing service.
5. Based on a request from the Town Manager, sewer service to this area has been included in the Charlotte Water Five Year Capital Improvement Plan. This does not mean that full funding will be available within five years or at any time in the future. Charlotte Water's policy requires an extension of this nature to have third party participation on costs (ie, developer or other entity). At this time, there is no developer identified for any property within the proposed area. Inclusion in the CIP does help if there were to be a developer or funding to become available in the future.

Staff will discuss the pros and cons of moving forward with a Land Use Plan amendment.

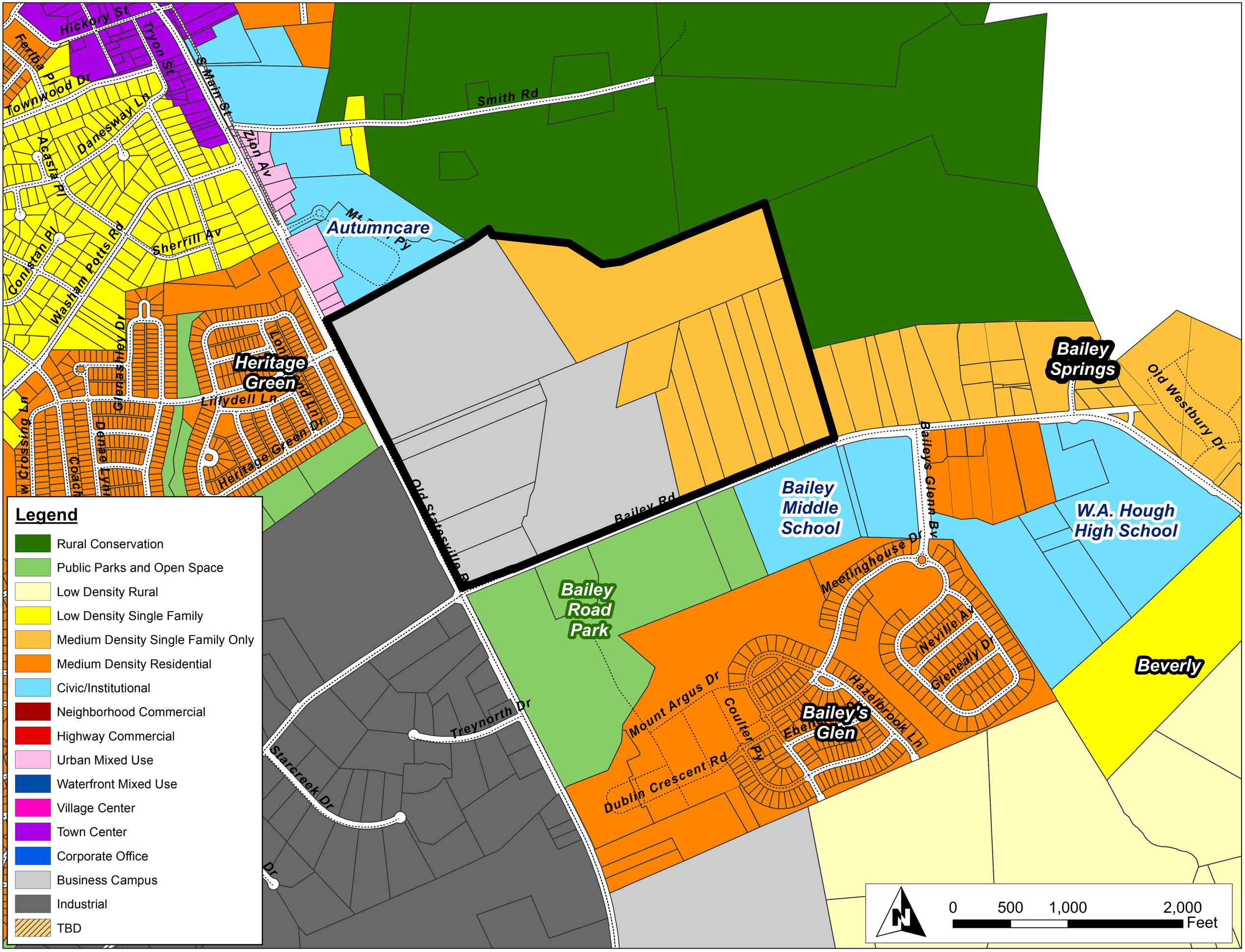
If the Planning Board decides that the Town should consider moving forward, it is recommended that property owners be notified and staff conduct one on one meetings to discuss pros and cons and receive property owner feedback. After receiving property owner feedback, Planning Board may wish to make a final recommendation to the Town Board regarding the issue.

Manager's Recommendation:

Receive Update and Have Discussion Regarding Potential Land Use Plan Amendment.

ATTACHMENTS:

Name:	Description:	Type:
Bailey-115_Land_Use_Change.pdf	Map of Potential Land Use Plan Amendment	Backup Material
Charlotte_Water_Map.pdf	Charlotte Water Letter	Backup Material
Charlotte_Water_Letter.pdf	Charlotte Water Map	Backup Material



Legend
Rural Conservation
Public Parks and Open Space
Low Density Rural
Low Density Single Family
Medium Density Single Family Only
Medium Density Residential
Civic/Institutional
Neighborhood Commercial
Highway Commercial
Urban Mixed Use
Waterfront Mixed Use
Village Center
Town Center
Corporate Office
Business Campus
Industrial
TBD
Hickory St
Tryon St
S Main St
Smith Rd
Zion Av
Townwood Dr
Daneswayl Ln
Acasia Pl
Sherrill Av
Conistan Pl
Washam Potts Rd
Glenashley Dr
Lillydell Ln
Heritage Green Dr
Heritage Green
Autumncare
Old Statesville Rd
Bailey Rd
Bailey Springs
Old Westbury Dr
Baileys Glenn Bv
Bailey Middle School
W.A. Hough High School
Meetinghouse Dr
Bailey Road Park
Neville Av
Glenealy Dr
Beverly
Hazelbrook Ln
Bailey's Glen
Mount Argus Dr
Coulter Py
Dublin Crescent Rd
Treynorth Dr
Starcreek Dr
0
500
1,000
2,000
Feet

MAYOR

CHUCK TRAVIS

MAYOR PRO-TEM

WOODY WASHAM

COMMISSIONERS

JIM DUKE
DAVID GILROY
MICHAEL F. MILTICH
THURMAN ROSS, JR.

TOWN MANAGER

ANTHONY ROBERTS

Mr. Carl Wilson
Chief Engineer
Charlotte Water
5100 Brookshire Boulevard
Charlotte, NC 28216

RE: Capital Budget Request

Dear Carl:

The Town of Cornelius would like to formally request that a project to provide sewer service to the properties located in the Bailey Road/NC 115 area be added to the Charlotte Water Five Year Capital Budget Plan.

The properties are further outlined on the attached map, prepared by Charlotte Water.

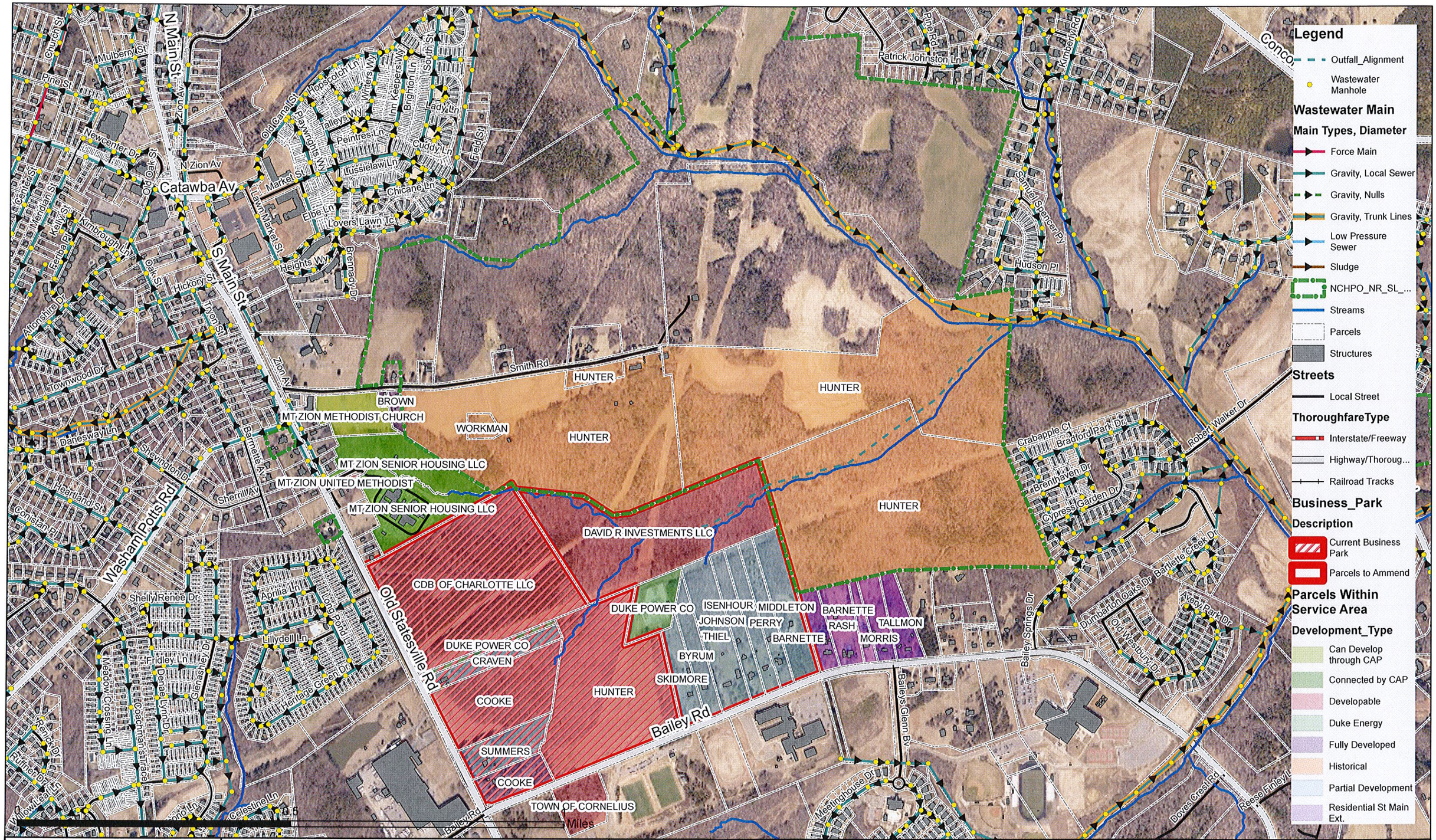
If you should have any questions, please let me know.

Sincerely,

Anthony Roberts
Town Manager

Cc: Wayne Herron, Planning Director

Attachment: Charlotte Water map



CHARLOTTE WATER	Date: 1/10/2017 Scale: 1 inch = 833 ft Created By: Alan H. Gaines Eningeering- Planning Group	N W E S	**Project:** Potts Plantation Development Charlotte Water geographic data and other records are provided for general information purposes only. While Charlotte Water makes every effort to confirm the accuracy of information, it does not warrant nor guarantee information provided is accurate, current or complete. Charlotte Water assumes no responsibility for the consequences of inappropriate uses or misinterpretations of released data.	CHARLOTTE WATER ENGINEERING DIVISION 5100 BROOKSHIRE BLVD CHARLOTTE, NC 28216	Map Number: 1 **A-1** Page 1 of 1