NORTH CAROLINA Turnpike Authority

HNTB

HNTB, North Carolina, PC
343 East Six Forks Rd Suite 200
Raleigh, North Carolina 27609

Final Memorandum

To: Jennifer Harris, PE

From: Bradley Reynolds, PE, PTOE

Subject: US 74 Corridor Analysis Scenarios

Date: October 24, 2013

NORTH CAROLINA PROFESSIONAL SEAL 34318 ENGINEER BRADLEY REYNOLDS

10-24-13

This memo supersedes the sealed memo dated Sept. 19, 2013. No substantive changes have occurred from the draft memo prepared and dated Dec. 7, 2010.

HNTB has been contracted by North Carolina Turnpike Authority (NCTA) to prepare a 2035 comparative planning level analysis of four US 74 corridor scenarios to determine if upgrading US 74 provides acceptable corridor level of service (LOS) D traffic operations. The following scenarios were analyzed and are described below: 1) *No-Build*, 2) *Superstreet Existing*, 3) *Widen to 6-Lane (No Superstreet)*, and 4) *Superstreet 6-Lane*.

The *No-Build* scenario assumes existing roadway characteristics along the US 74 corridor which include 4 and 6-lane sections, high-speed, suburban and intermediate principal arterials and 35, 45, and 55 mph posted speeds. The *Superstreet Existing* scenario assumes maintaining existing 4 and 6-lane sections and upgrading to high-speed principal arterials at 45 and 55 mph. The *Widen to 6-Lane (No Superstreet)* assumes widening the entire US 74 corridor to a 6-lane section while maintaining other existing roadway characteristics. The *Superstreet 6-Lane* scenario assumes widening the entire US 74 corridor to a 6-lane section and upgrading to high-speed principal arterials at 45 and 55 mph.

HNTB utilized the North Carolina Department of Transportation Level of Service (NCLOS) software version 2.0 developed by ITRE at NCSU and Highway Capacity Software (HCS) as comparative tools to evaluate these scenarios. The NCLOS software allows comparisons between the traffic scenarios on a planning level. Based on existing roadway capacity characteristics, the 19.7 mile US 74 project corridor was divided into six NCLOS segments. Each segment was divided into smaller segments based on 2035 No-Build forecast volumes between major intersections. Utilizing NCLOS software, each roadway segment was analyzed based on existing roadway characteristics, proposed design criteria, and based on engineering judgment to determine volume to LOS D threshold (V/LOS D) ratios for each segment of US 74. Since maintaining LOS D is critical to fulfilling the purpose of the project, V/LOS D ratios are reported.

The Highway Capacity Manual 2000 for urban arterial streets provides descriptions of LOS D, E and F in the following manner. LOS D borders on a range in which small increases in flow may cause substantial increases in delay and decreases in travel speed. LOS E is characterized by significant delays and average travel speeds of 33 percent or less of the free-flow speed. LOS F is characterized by urban street flow at extremely low speeds, typically one-third to one-fourth of the free-flow speed and intersection congestion is likely at critical signalized locations, with high delays, high volumes, and extensive queuing.

The 2035 No-Build volumes were used from the *Revised Monroe Connector Bypass No-Build Traffic Forecast Memorandum (HNTB, March 2010)* and were utilized for each upgrade scenario analysis comparison. **Table 1** shows a breakdown of the segments, 2035 No-Build forecast volumes, LOS D daily volume thresholds, and V/LOS D ratios for each scenario.

Table 1 - US 74 Highway/Arterial Segment Levels of Service and Performance Measures

Segment Number [1]	US 74 SEGMENT DESCRIPTION	2035 No-Build			2035 Upgrade US 74 - Superstreet Existing			2035 Upgrade US 74 - Widen to 6-Lane (No Superstreet)			2035 Upgrade US 74 - Superstreet 6-Lane		
		2035 No-Build Volume [2]	LOS D Threshold	V/LOS D Ratio	2035 No-Build Volume [2]	LOS D Threshold	V/LOS D Ratio	2035 No-Build Volume [2]	LOS D Threshold	V/LOS D Ratio	2035 No-Build Volume [2]	LOS D Threshold	V/LOS D Ratio
1	Stallings Rd. to Indian Trail Rd. North	86,300	40,200	***2.15***	86,300	40,200	***2.15***	86,300	60,300	***1.43***	86,300	60,300	***1.43***
	Indian Trail Rd. North to Unionville Indian Trail Rd. West	69,400	40,200	***1.73***	69,400	40,200	***1.73***	69,400	60,300	***1.15***	69,400	60,300	***1.15***
	Unionville Indian Trail Rd. West to Faith Church Rd.	72,300	40,200	***1.80***	72,300	40,200	***1.80***	72,300	60,300	***1.20***	72,300	60,300	***1.20***
	Faith Church Rd. to Sardis Church Rd.	67,900	40,200	***1.69***	67,900	40,200	***1.69***	67,900	60,300	***1.13***	67,900	60,300	***1.13***
	Sardis Church Rd. to Chambers Dr.	71,500	40,200	***1.78***	71,500	40,200	***1.78***	71,500	60,300	***1.19***	71,500	60,300	***1.19***
	Chambers Dr. to N. Rocky River Rd.	67,100	40,200	***1.67***	67,100	40,200	***1.67***	67,100	60,300	***1.11***	67,100	60,300	***1.11***
2	N. Rocky River Rd. to Fowler Secrest Rd.	58,200	32,400	***1.80***	58,200	39,000	***1.49***	58,200	48,700	***1.20***	58,200	58,600	0.99
	Fowler Secrest Rd. to Rolling Hills Dr.	63,700	32,400	***1.97***	63,700	39,000	***1.63***	63,700	48,700	***1.31***	63,700	58,600	***1.09***
	Rolling Hills Dr. to Round Table Rd.	62,900	32,400	***1.94***	62,900	39,000	***1.61***	62,900	48,700	***1.29***	62,900	58,600	***1.07***
	Round Table Rd. to Williams Rd.	62,600	32,400	***1.93***	62,600	39,000	***1.61***	62,600	48,700	***1.29***	62,600	58,600	***1.07***
	Williams Rd. to Hanover Dr.	66,500	32,400	***2.05***	66,500	39,000	***1.71***	66,500	48,700	***1.37***	66,500	58,600	***1.13***
	Hanover Dr. to Dickerson Blvd.	72,100	32,400	***2.23***	72,100	39,000	***1.85***	72,100	48,700	***1.48***	72,100	58,600	***1.23***
3	Dickerson Blvd. to Secrest Shortcut Rd.	59,800	48,700	***1.23***	59,800	58,600	***1.02***	59,800	48,700	***1.23***	59,800	58,600	***1.02***
	Secrest Shortcut Rd. to Secrest Shortcut Rd.	65,000	48,700	***1.33***	65,000	58,600	***1.11***	65,000	48,700	***1.33***	65,000	58,600	***1.11***
	Secrest Shortcut Rd. to Concord Ave.	65,000	48,700	***1.33***	65,000	58,600	***1.11***	65,000	48,700	***1.33***	65,000	58,600	***1.11***
	Concord Ave. to US 601	67,200	48,700	***1.38***	67,200	58,600	***1.15***	67,200	48,700	***1.38***	67,200	58,600	***1.15***
	US 601 to Stafford St.	74,800	48,700	***1.54***	74,800	58,600	***1.28***	74,800	48,700	***1.54***	74,800	58,600	***1.28***
	Stafford St. to Boyte St.	73,300	48,700	***1.51***	73,300	58,600	***1.25***	73,300	48,700	***1.51***	73,300	58,600	***1.25***
	Boyte St. to NC 200	69,800	48,700	***1.43***	69,800	58,600	***1.19***	69,800	48,700	***1.43***	69,800	58,600	***1.19***
	NC 200 to Walkup Ave.	66,900	48,700	***1.37***	66,900	58,600	***1.14***	66,900	48,700	***1.37***	66,900	58,600	***1.14***
	Walkup Ave. to S. Sutherland Ave.	57,500	48,700	***1.18***	57,500	58,600	0.98	57,500	48,700	***1.18***	57,500	58,600	0.98
	S. Sutherland Ave. to Venus St.	54,500	48,700	***1.12***	54,500	58,600	0.93	54,500	48,700	***1.12***	54,500	58,600	0.93
	Venus St. to E. Franklin St.	49,300	48,700	***1.01***	49,300	58,600	0.84	49,300	48,700	***1.01***	49,300	58,600	0.84
	E. Franklin St. to US 601 / N. Medical Center Campus	60,600	48,700	***1.24***	60,600	58,600	***1.03***	60,600	48,700	***1.24***	60,600	58,600	***1.03***
4	US 601/Metro Medical Center Campus to S. Secrest Ave.	39,700	40,200	0.99	39,700	40,200	0.99	39,700	60,300	0.66	39,700	60,300	0.66
	S. Secrest Ave. to S. Bivens Rd.	41,000	40,200	***1.02***	41,000	40,200	***1.02***	41,000	60,300	0.68	41,000	60,300	0.68
5	S. Bivens Rd. to Bivens St.	39,400	33,600	***1.17***	39,400	39,000	***1.01***	39,400	50,600	0.78	39,400	58,600	0.67
	Bivens St. to Austin Chaney Rd.	42,700	33,600	***1.27***	42,700	39,000	***1.09***	42,700	50,600	0.84	42,700	58,600	0.73
6	Austin Chaney Rd. to Forest Hills School Rd. North	35,900	40,200	0.89	35,900	40,200	0.89	35,900	60,300	0.60	35,900	60,300	0.60
	Forest Hills School Rd. North to Monroe Connector/Bypass	31,600	40,200	0.79	31,600	40,200	0.79	31,600	60,300	0.52	31,600	60,300	0.52

1 - US 74 segments are grouped based on similar roadway characteristics.

Segment 1 - No-Build/Superstreet - Piedmont, High Speed (55mph), Principal Arterial, 4 and 6-Lane Sections

Segment 2 - No-Build - Piedmont, Suburban (45mph), Principal Arterial, 4 and 6-Lane Sections; Superstreet - Piedmont, High Speed (45mph), Principal Arterial, 4 and 6-Lane Sections

Segment 3 - No-Build - Piedmont, Suburban (45mph), Principal Arterial, 6-Lane Section; Superstreet - Piedmont, High Speed (45mph), Principal Arterial, 6-Lane Section

Segment 4 - No-Build/Superstreet - Piedmont, High Speed (55mph), Principal Arterial, 4 and 6-Lane Sections

Segment 5 - No-Build - Piedmont, Intermediate (35mph), Principal Arterial, 4 and 6-Lane Sections; Superstreet - Piedmont, High Speed (45mph), Principal Arterial, 4 and 6-Lane Sections

Segment 6 - No-Build/Superstreet - Piedmont, High Speed (55mph), Principal Arterial, 4 and 6-Lane Sections

2 - 2035 No-Build volumes are utilized for each upgrade scenario comparison but are anticipated to be higher with US 74 upgrade scenarios. US 74 upgrade forecast volumes were not available at the time of this analysis.

As shown in **Table 1**, the analysis indicates expected *2035 No-Build* volumes on existing US 74 exceed the max volume LOS D threshold on 27 of the 30 corridor segments. Exceeding the max volume LOS D threshold indicates that the segment is expected to operate at ***LOS E*** or ***F*** and experience heavy congestion, queuing and unstable traffic flow. In the *Superstreet Existing* scenario, volumes indicate that 24 of the 30 corridor segments are expected to exceed LOS D threshold. In the *Widen to 6-Lane (No Superstreet)* scenario, volumes are expected to exceed LOS D threshold on 24 of 30 corridor segments. In this scenario, Segment 3 is an existing 6-lane section and, therefore, no capacity improvements were assumed. In the *Superstreet 6-Lane* scenario, 20 of the 30 corridor segments are expected to exceed LOS D threshold. In all scenarios, Segment 1 and Segment 2 corridors exceed LOS D threshold except for Segment 2 from North Rocky River Road to Fowler Secrest Road. This section has a 0.99 LOS D threshold ratio and could operate at LOS E or F with very minor fluctuations in projected volumes. Along the eastern end of the US 74 project corridor, *2035 No-Build* volumes are expected to operate below the LOS D max threshold. Segments 5 and 6 are expected to operate at acceptable LOS under both *Widen to 6-Lane (No Superstreet*) and *Superstreet 6-Lane* scenarios. Refer to ***Appendix A*** for detailed NCLOS reports.

It is important to note that *2035 No-Build* forecast volumes were utilized for each scenario. However, with capacity improvements along US 74 for each scenario, individual scenario forecasts would be expected to attract additional daily traffic volumes as the corridor is improved. Therefore, the NCLOS capacity results likely present optimistic segment level of service results.

Figures 1 – 4 visually show expected levels of service along the US 74 corridor project area for each scenario. NCLOS and Highway Capacity Software (HCS) examine segments individually and does not account for interaction between segments that occur in the field. Therefore, segments operating at poor LOS E or F are expected to create queues and delays that spillback into and negatively impact other segments along US 74 that are shown to operate at LOS D or better. This type of operation and interaction occurs today along US 74 during times of congestion. Therefore, **Figures 1 – 4** likely show a best-case level of service analysis.

HCS planning level capacity analysis was completed for the *Superstreet 6-Lane* scenario to analyze the best-case upgrade scenario, to compare results to NCLOS, and to provide segment travel speeds through each corridor segment. The *Superstreet 6-Lane* scenario provides the highest corridor capacity compared to the other three scenarios and, correspondingly, the best projected levels of service and travel speeds. However, **Table 2** demonstrates that 3 of the 6 corridor segments, which accounts for 65% of the corridor, are expected to operate at ***LOS F*** and operate with travel speeds less than 10 mph. All other upgrade scenarios would be expected to operate with levels of service and travel speeds equal to or worse than **Table 2**. HCS does not account for interaction between segments which will likely create queues, delays and reduced speeds along Segments 4, 5, and 6. Refer to ***Appendix B*** for detailed HCS reports.

Table 2 - HCS Planning Analysis 2035 Upgrade US 74 - Superstreet 6-Lane					
Segment Number	**Segment Distance (miles)**	**Max 2035 Daily Segment Volume**	**Segment LOS**	**Segment Travel Speed (mph)**	**% of Project Corridor (19.7 Miles)**
1	6.0	86300	***F***	***8.6***	65
2	3.2	72100	***F***	***7.6***	
3	3.6	74800	***F***	***6.1***	
4	1.7	41000	B	37.6	35
5	2.2	42700	B	33.6	
6	3.0	35900	A	46.8	

The result of the comparative analysis shows in the design year 2035, US 74 under all No-Build and Upgrade scenarios is expected to exceed LOS D threshold in a majority of the corridor segments. Even with the *Superstreet 6-Lane* scenario, *2035 No-Build* volumes exceed the LOS D threshold in 20 of the 30 corridor segments and greatly reduce travel speeds through the US 74 corridor.

Please contact Spencer Franklin or me at 919-546-8997 with any additional questions or comments. Thank you for your assistance with this project.

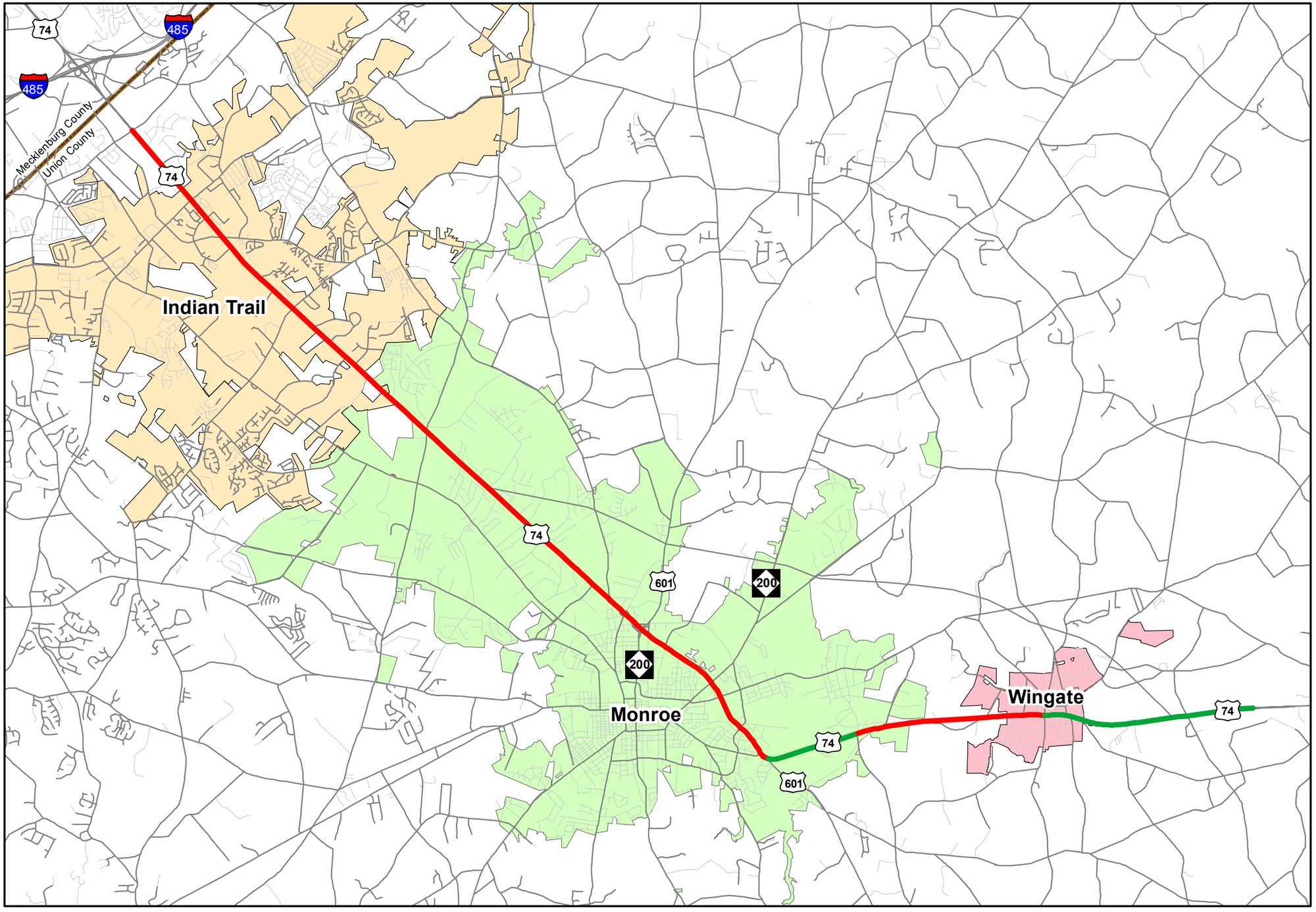
cc: Spencer Franklin, PE

US 74 Level of Service Analysis

Figure 1 - 2035 No-Build

HNTB Project # 46816

Date: December 2010



N
W E
S

LOS A-D
LOS E-F

Legend

Major Roads

Streets

Counties

0 0.4 0.8 1.2 1.6 2 Miles

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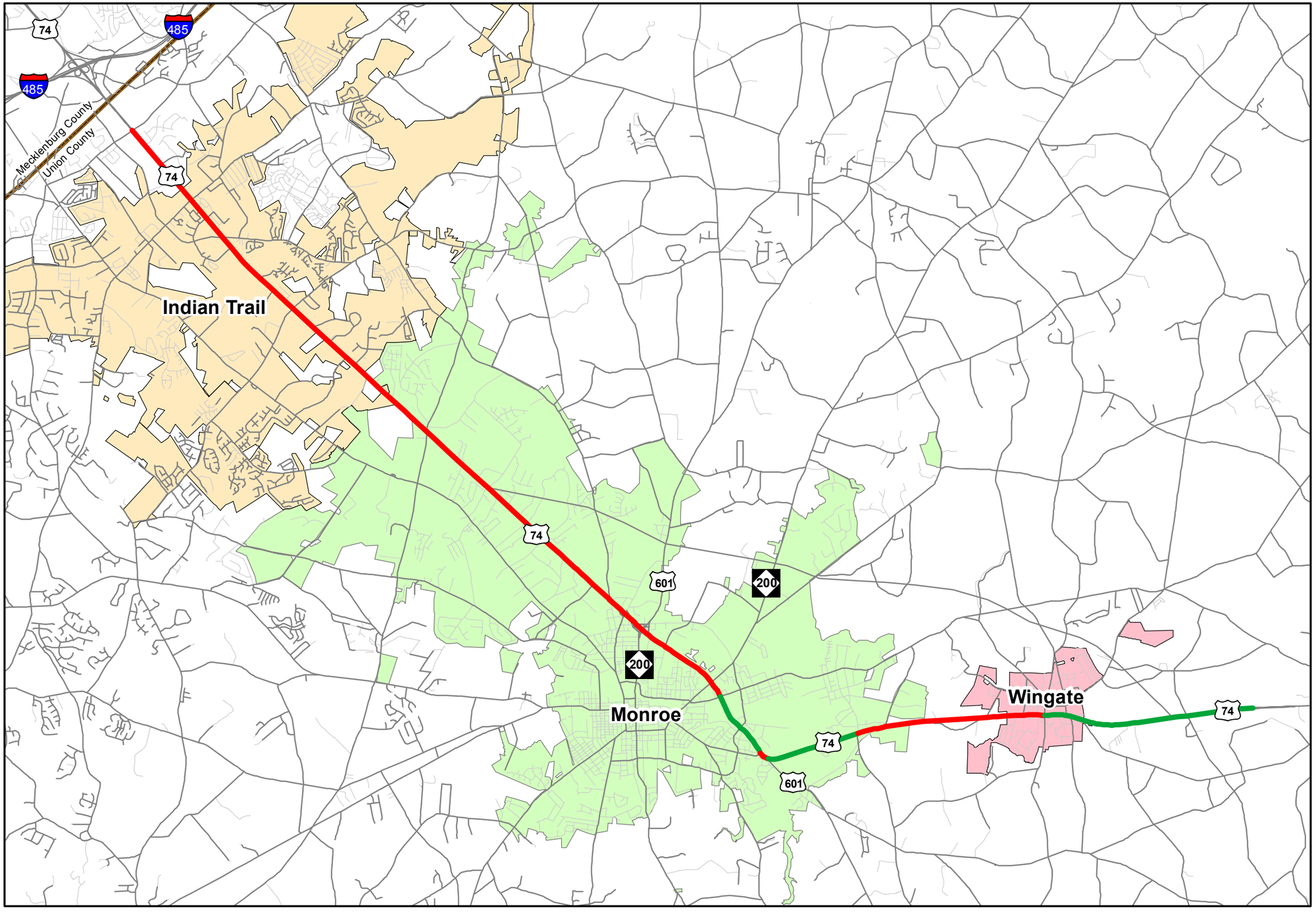
US 74 Level of Service Analysis

Figure 2 - 2035 Superstreet Existing Laneage

HNTB Project # 46816

Date: December 2010



N
W E
S

LOS A-D
LOS E-F

Legend

Major Roads

Streets

Counties

0 0.4 0.8 1.2 1.6 2 Miles

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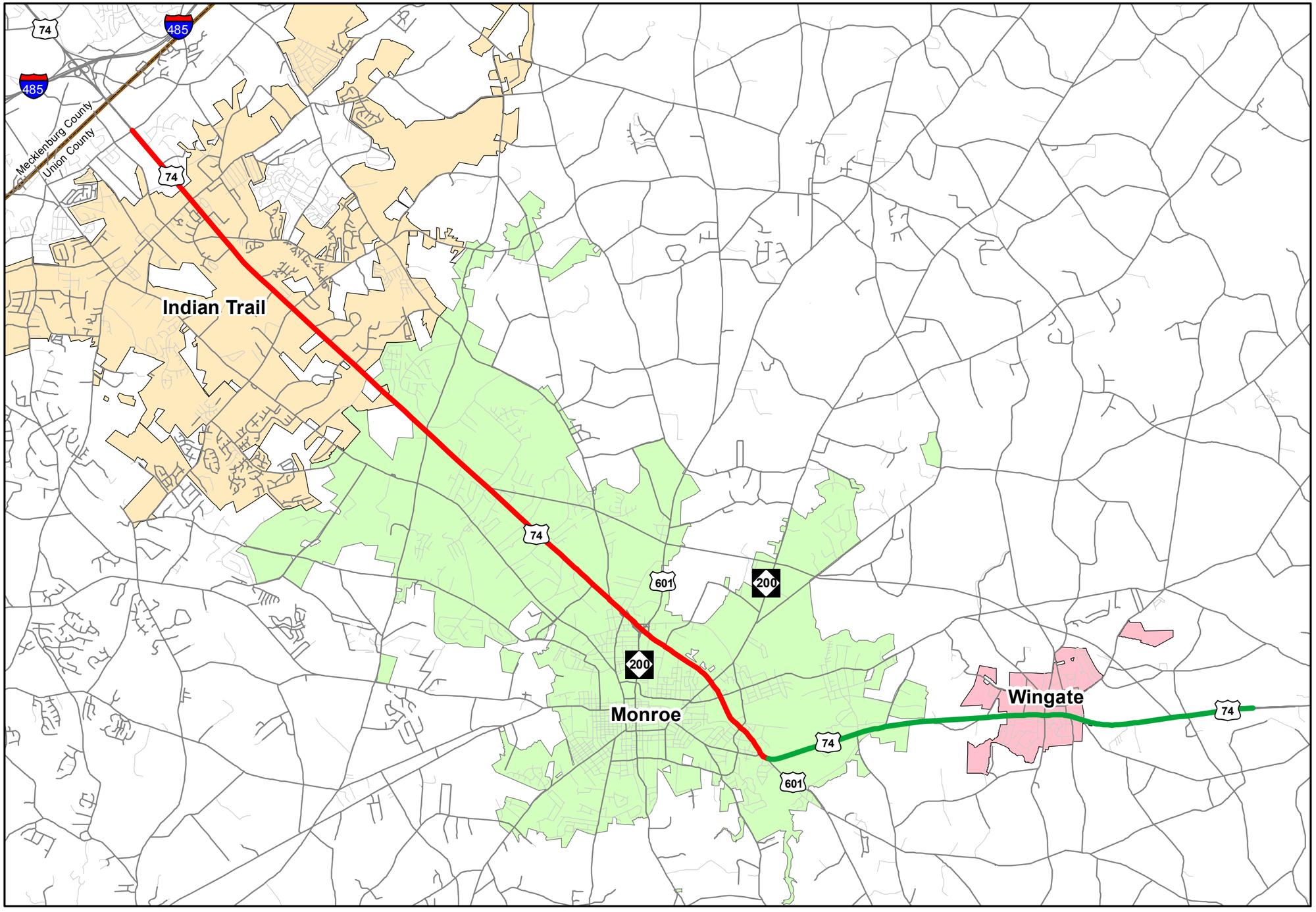
US 74 Level of Service Analysis

Figure 3 - 2035 Six-Lane

HNTB Project # 46816

Date: December 2010



N
W E
S

LOS A-D
LOS E-F

Legend

Major Roads

Streets

Counties

0 0.4 0.8 1.2 1.6 2 Miles

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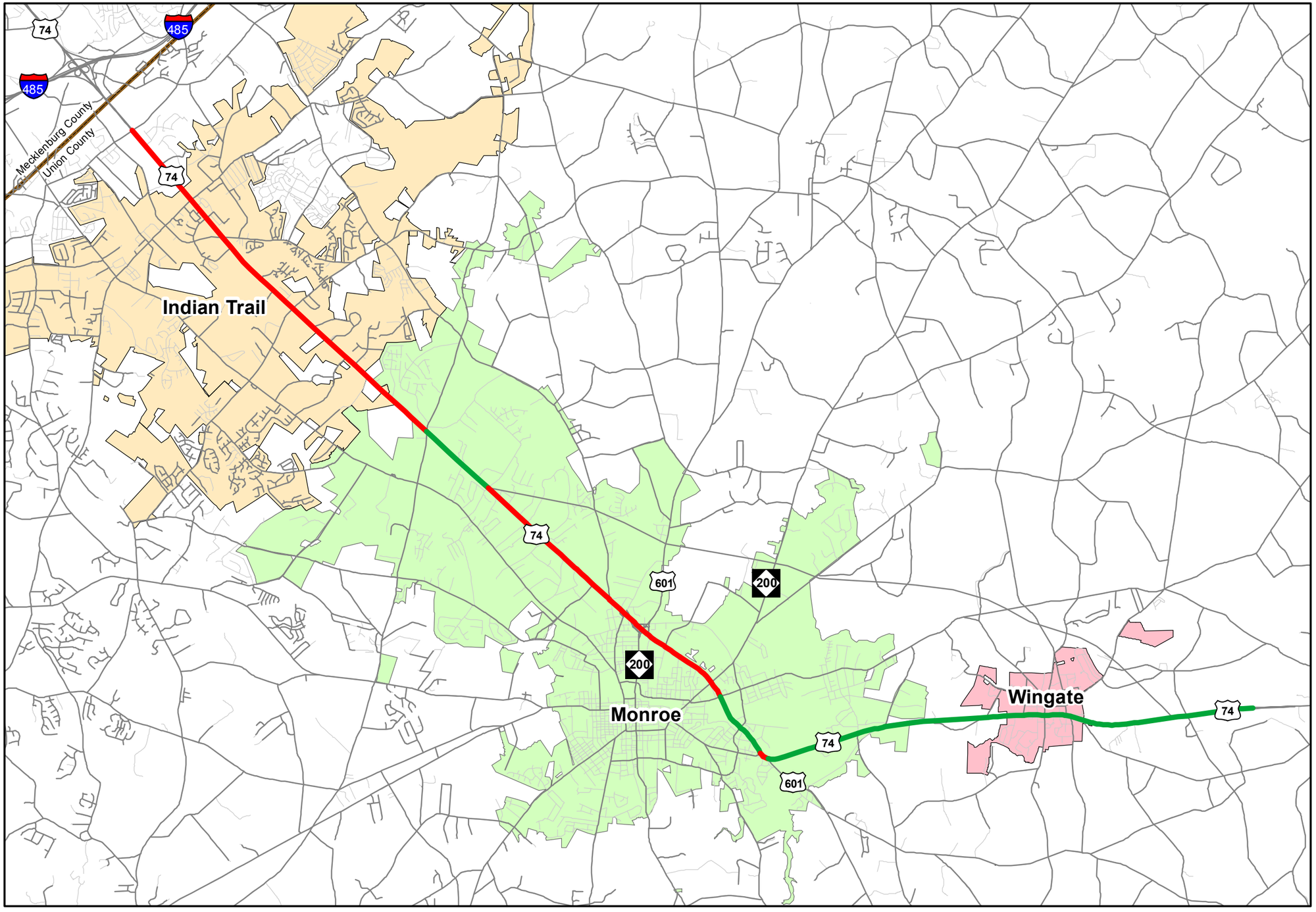
US 74 Level of Service Analysis

Figure 4 - 2035 Supersteet Six Lanes

HNTB Project # 46816

Date: December 2010



N
W E
S

LOS A-D
LOS E-F

Legend

Major Roads

Streets

Counties

0 0.4 0.8 1.2 1.6 2 Miles

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Appendix A – NCLOS Analysis

2035 No Build

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

Facility Name:	US74 Seg1		
Project Name:	Monroe	Organization:	

Region Type:	Piedmont
Facility Type:	Arterial
Design Category:	High-Speed
Functional Category:	Principal Arterial
Street Class:	Class I

Number of Lanes:	2
Segment Len.(mi):	3.00
Signals/Mile:	1.00
Cycle Length(s):	200
g/C Ratio:	0.60

PHF:	0.90	Prop. Lt:	5.00 %
K Factor:	0.10	FFS(mph):	55
D Factor:	0.60	Arival Type:	3

LOS	Max AADT
A	13,200
B	34,400
C	37,200
D	40,200
E	44,400

Printed At: 1:44:24PM On: 12/6/2010

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

Facility Name:	US74 Seg2		
Project Name:	Monroe	Organization:	

Region Type:	Piedmont
Facility Type:	Arterial
Design Category:	Suburban
Functional Category:	Principal Arterial
Street Class:	Class II

Number of Lanes:	2
Segment Len.(mi):	2.00
Signals/Mile:	3.00
Cycle Length(s):	150
g/C Ratio:	0.55

PHF:	0.90	Prop. Lt:	8.00 %
K Factor:	0.10	FFS(mph):	45
D Factor:	0.60	Arival Type:	3

LOS	Max AADT
A	0
B	0
C	18,300
D	32,400
E	34,100

Printed At: 1:46:01PM On: 12/6/2010

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

Facility Name:	US74 Seg3		
Project Name:	Monroe	Organization:	

Region Type:	Piedmont
Facility Type:	Arterial
Design Category:	Suburban
Functional Category:	Principal Arterial
Street Class:	Class II

Number of Lanes:	3
Segment Len.(mi):	2.00
Signals/Mile:	3.00
Cycle Length(s):	150
g/C Ratio:	0.55

PHF:	0.90	Prop. Lt:	8.00 %
K Factor:	0.10	FFS(mph):	45
D Factor:	0.60	Arival Type:	3

LOS	Max AADT
A	0
B	0
C	27,400
D	48,700
E	51,200

Printed At: 2:49:13PM On: 12/6/2010

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

Facility Name:	US74 Seg4		
Project Name:	Monroe	Organization:	

Region Type:	Piedmont
Facility Type:	Arterial
Design Category:	High-Speed
Functional Category:	Principal Arterial
Street Class:	Class I

Number of Lanes:	2
Segment Len.(mi):	3.00
Signals/Mile:	1.00
Cycle Length(s):	200
g/C Ratio:	0.60

PHF:	0.90	Prop. Lt:	5.00 %
K Factor:	0.10	FFS(mph):	55
D Factor:	0.60	Arival Type:	3

LOS	Max AADT
A	13,200
B	34,400
C	37,200
D	40,200
E	44,400

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STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

Facility Name:	US74 Seg5		
Project Name:	Monroe	Organization:	

Region Type:	Piedmont
Facility Type:	Arterial
Design Category:	Intermediate
Functional Category:	Principal Arterial
Street Class:	Class II

Number of Lanes:	2		
Segment Len.(mi):	2.00		
Signals/Mile:	4.00		
Cycle Length(s):	150		
g/C Ratio:	0.55		
PHF:	0.90	Prop. Lt:	12.00 %
K Factor:	0.10	FFS(mph):	40
D Factor:	0.60	Arival Type:	4

LOS	Max AADT
A	0
B	0
C	14,600
D	33,600
E	35,100

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STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

Facility Name:	US74 Seg6		
Project Name:	Monroe	Organization:	

Region Type:	Piedmont
Facility Type:	Arterial
Design Category:	High-Speed
Functional Category:	Principal Arterial
Street Class:	Class I

Number of Lanes:	2
Segment Len.(mi):	3.00
Signals/Mile:	1.00
Cycle Length(s):	200
g/C Ratio:	0.60

PHF:	0.90	Prop. Lt:	5.00 %
K Factor:	0.10	FFS(mph):	55
D Factor:	0.60	Arival Type:	3

LOS	Max AADT
A	13,200
B	34,400
C	37,200
D	40,200
E	44,400

Printed At: 2:53:31PM On: 12/6/2010

2035 Upgrade US 74 – Superstreet Existing

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

Facility Name:	US74 Seg1 SS 4ln		
Project Name:	Monroe	Organization:	

Region Type:	Piedmont
Facility Type:	Arterial
Design Category:	High-Speed
Functional Category:	Principal Arterial
Street Class:	Class I

Number of Lanes:	2
Segment Len.(mi):	3.00
Signals/Mile:	1.00
Cycle Length(s):	200
g/C Ratio:	0.60

PHF:	0.90	Prop. Lt:	5.00 %
K Factor:	0.10	FFS(mph):	55
D Factor:	0.60	Arival Type:	3

LOS	Max AADT
A	13,200
B	34,400
C	37,200
D	40,200
E	44,400

Printed At: 2:59:58PM On: 12/6/2010

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

Facility Name:	US74 Seg2 SS 4ln		
Project Name:	Monroe	Organization:	

Region Type:	Piedmont
Facility Type:	Arterial
Design Category:	High-Speed
Functional Category:	Principal Arterial
Street Class:	Class I

Number of Lanes:	2
Segment Len.(mi):	3.00
Signals/Mile:	1.00
Cycle Length(s):	200
g/C Ratio:	0.60

PHF:	0.90	Prop. Lt:	5.00 %
K Factor:	0.10	FFS(mph):	45
D Factor:	0.60	Arival Type:	3

LOS	Max AADT
A	0
B	22,200
C	36,000
D	39,000
E	43,200

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STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

Facility Name:	US74 Seg3 SS 4ln		
Project Name:	Monroe	Organization:	

Region Type:	Piedmont
Facility Type:	Arterial
Design Category:	High-Speed
Functional Category:	Principal Arterial
Street Class:	Class I

Number of Lanes:	2
Segment Len.(mi):	3.00
Signals/Mile:	1.00
Cycle Length(s):	200
g/C Ratio:	0.60

PHF:	0.90	Prop. Lt:	5.00 %
K Factor:	0.10	FFS(mph):	55
D Factor:	0.60	Arival Type:	3

LOS	Max AADT
A	13,200
B	34,400
C	37,200
D	40,200
E	44,400

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STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

Facility Name:	US74 Seg4 SS 4ln		
Project Name:	Monroe	Organization:	

Region Type:	Piedmont
Facility Type:	Arterial
Design Category:	High-Speed
Functional Category:	Principal Arterial
Street Class:	Class I

Number of Lanes:	2
Segment Len.(mi):	3.00
Signals/Mile:	1.00
Cycle Length(s):	200
g/C Ratio:	0.60

PHF:	0.90	Prop. Lt:	5.00 %
K Factor:	0.10	FFS(mph):	55
D Factor:	0.60	Arival Type:	3

LOS	Max AADT
A	13,200
B	34,400
C	37,200
D	40,200
E	44,400

Printed At: 3:21:57PM On: 12/6/2010

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

Facility Name:	US74 Seg5 SS 4ln		
Project Name:	Monroe	Organization:	

Region Type:	Piedmont
Facility Type:	Arterial
Design Category:	High-Speed
Functional Category:	Principal Arterial
Street Class:	Class I

Number of Lanes:	2
Segment Len.(mi):	3.00
Signals/Mile:	1.00
Cycle Length(s):	200
g/C Ratio:	0.60

PHF:	0.90	Prop. Lt:	5.00 %
K Factor:	0.10	FFS(mph):	45
D Factor:	0.60	Arival Type:	3

LOS	Max AADT
A	0
B	22,200
C	36,000
D	39,000
E	43,200

Printed At: 4:15:48PM On: 12/6/2010

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

Facility Name:	US74 Seg6 SS 4ln		
Project Name:	Monroe	Organization:	

Region Type:	Piedmont
Facility Type:	Arterial
Design Category:	High-Speed
Functional Category:	Principal Arterial
Street Class:	Class I

Number of Lanes:	2
Segment Len.(mi):	3.00
Signals/Mile:	1.00
Cycle Length(s):	200
g/C Ratio:	0.60

PHF:	0.90	Prop. Lt:	5.00 %
K Factor:	0.10	FFS(mph):	55
D Factor:	0.60	Arival Type:	3

LOS	Max AADT
A	13,200
B	34,400
C	37,200
D	40,200
E	44,400

Printed At: 3:30:58PM On: 12/6/2010

2035 Upgrade US 74 –
Widen to 6-Lane (No Superstreet)

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

Facility Name:	US74 Seg1 Upgrade		
Project Name:	Monroe	Organization:	

Region Type:	Piedmont
Facility Type:	Arterial
Design Category:	High-Speed
Functional Category:	Principal Arterial
Street Class:	Class I

Number of Lanes:	3
Segment Len.(mi):	3.00
Signals/Mile:	1.00
Cycle Length(s):	200
g/C Ratio:	0.60

PHF:	0.90	Prop. Lt:	5.00 %
K Factor:	0.10	FFS(mph):	55
D Factor:	0.60	Arival Type:	3

LOS	Max AADT
A	19,900
B	51,800
C	55,800
D	60,300
E	66,600

Printed At: 1:45:01PM On: 12/6/2010

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

Facility Name:	US74 Seg2 Upgrade		
Project Name:	Monroe	Organization:	

Region Type:	Piedmont
Facility Type:	Arterial
Design Category:	Suburban
Functional Category:	Principal Arterial
Street Class:	Class II

Number of Lanes:	3
Segment Len.(mi):	2.00
Signals/Mile:	3.00
Cycle Length(s):	150
g/C Ratio:	0.55

PHF:	0.90	Prop. Lt:	8.00 %
K Factor:	0.10	FFS(mph):	45
D Factor:	0.60	Arival Type:	3

LOS	Max AADT
A	0
B	0
C	27,400
D	48,700
E	51,200

Printed At: 2:48:26PM On: 12/6/2010

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

Facility Name:	US74 Seg3 Upgrade		
Project Name:	Monroe	Organization:	

Region Type:	Piedmont
Facility Type:	Arterial
Design Category:	Suburban
Functional Category:	Principal Arterial
Street Class:	Class II

Number of Lanes:	3
Segment Len.(mi):	2.00
Signals/Mile:	3.00
Cycle Length(s):	150
g/C Ratio:	0.55

PHF:	0.90	Prop. Lt:	8.00 %
K Factor:	0.10	FFS(mph):	45
D Factor:	0.60	Arival Type:	3

LOS	Max AADT
A	0
B	0
C	27,400
D	48,700
E	51,200

Printed At: 3:53:35PM On: 12/6/2010

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

Facility Name:	US74 Seg4 Upgrade		
Project Name:	Monroe	Organization:	

Region Type:	Piedmont
Facility Type:	Arterial
Design Category:	High-Speed
Functional Category:	Principal Arterial
Street Class:	Class I

Number of Lanes:	3
Segment Len.(mi):	3.00
Signals/Mile:	1.00
Cycle Length(s):	200
g/C Ratio:	0.60

PHF:	0.90	Prop. Lt:	5.00 %
K Factor:	0.10	FFS(mph):	55
D Factor:	0.60	Arival Type:	3

LOS	Max AADT
A	19,900
B	51,800
C	55,800
D	60,300
E	66,600

Printed At: 2:50:30PM On: 12/6/2010

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

Facility Name:	US74 Seg5 Upgrade		
Project Name:	Monroe	Organization:	

Region Type:	Piedmont
Facility Type:	Arterial
Design Category:	Intermediate
Functional Category:	Principal Arterial
Street Class:	Class II

Number of Lanes:	3
Segment Len.(mi):	2.00
Signals/Mile:	4.00
Cycle Length(s):	150
g/C Ratio:	0.55

PHF:	0.90	Prop. Lt:	12.00 %
K Factor:	0.10	FFS(mph):	40
D Factor:	0.60	Arival Type:	4

LOS	Max AADT
A	0
B	0
C	22,000
D	50,600
E	52,800

Printed At: 2:52:54PM On: 12/6/2010

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

Facility Name:	US74 Seg6 Upgrade		
Project Name:	Monroe	Organization:	

Region Type:	Piedmont
Facility Type:	Arterial
Design Category:	High-Speed
Functional Category:	Principal Arterial
Street Class:	Class I

Number of Lanes:	3
Segment Len.(mi):	3.00
Signals/Mile:	1.00
Cycle Length(s):	200
g/C Ratio:	0.60

PHF:	0.90	Prop. Lt:	5.00 %
K Factor:	0.10	FFS(mph):	55
D Factor:	0.60	Arival Type:	3

LOS	Max AADT
A	19,900
B	51,800
C	55,800
D	60,300
E	66,600

Printed At: 2:54:05PM On: 12/6/2010

2035 Upgrade US 74 –
Superstreet 6-Lane

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

Facility Name:	US74 Seg1 SS 6ln		
Project Name:	Monroe	Organization:	

Region Type:	Piedmont
Facility Type:	Arterial
Design Category:	High-Speed
Functional Category:	Principal Arterial
Street Class:	Class I

Number of Lanes:	3
Segment Len.(mi):	3.00
Signals/Mile:	1.00
Cycle Length(s):	200
g/C Ratio:	0.60

PHF:	0.90	Prop. Lt:	5.00 %
K Factor:	0.10	FFS(mph):	55
D Factor:	0.60	Arival Type:	3

LOS	Max AADT
A	19,900
B	51,800
C	55,800
D	60,300
E	66,600

Printed At: 3:34:30PM On: 12/6/2010

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

Facility Name:	US74 Seg2 SS 6ln		
Project Name:	Monroe	Organization:	

Region Type:	Piedmont
Facility Type:	Arterial
Design Category:	High-Speed
Functional Category:	Principal Arterial
Street Class:	Class I

Number of Lanes:	3
Segment Len.(mi):	3.00
Signals/Mile:	1.00
Cycle Length(s):	200
g/C Ratio:	0.60

PHF:	0.90	Prop. Lt:	5.00 %
K Factor:	0.10	FFS(mph):	45
D Factor:	0.60	Arival Type:	3

LOS	Max AADT
A	0
B	33,300
C	54,000
D	58,600
E	64,800

Printed At: 3:16:58PM On: 12/6/2010

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

Facility Name:	US74 Seg3 SS 6ln		
Project Name:	Monroe	Organization:	

Region Type:	Piedmont
Facility Type:	Arterial
Design Category:	High-Speed
Functional Category:	Principal Arterial
Street Class:	Class I

Number of Lanes:	3
Segment Len.(mi):	3.00
Signals/Mile:	1.00
Cycle Length(s):	200
g/C Ratio:	0.60

PHF:	0.90	Prop. Lt:	5.00 %
K Factor:	0.10	FFS(mph):	45
D Factor:	0.60	Arival Type:	3

LOS	Max AADT
A	0
B	33,300
C	54,000
D	58,600
E	64,800

Printed At: 3:19:02PM On: 12/6/2010

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

Facility Name:	US74 Seg4 SS 6ln		
Project Name:	Monroe	Organization:	

Region Type:	Piedmont
Facility Type:	Arterial
Design Category:	High-Speed
Functional Category:	Principal Arterial
Street Class:	Class I

Number of Lanes:	3
Segment Len.(mi):	3.00
Signals/Mile:	1.00
Cycle Length(s):	200
g/C Ratio:	0.60

PHF:	0.90	Prop. Lt:	5.00 %
K Factor:	0.10	FFS(mph):	55
D Factor:	0.60	Arival Type:	3

LOS	Max AADT
A	19,900
B	51,800
C	55,800
D	60,300
E	66,600

Printed At: 3:21:05PM On: 12/6/2010

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

Facility Name:	US74 Seg5 SS 6ln		
Project Name:	Monroe	Organization:	

Region Type:	Piedmont
Facility Type:	Arterial
Design Category:	High-Speed
Functional Category:	Principal Arterial
Street Class:	Class I

Number of Lanes:	3
Segment Len.(mi):	3.00
Signals/Mile:	1.00
Cycle Length(s):	200
g/C Ratio:	0.60

PHF:	0.90	Prop. Lt:	5.00 %
K Factor:	0.10	FFS(mph):	45
D Factor:	0.60	Arival Type:	3

LOS	Max AADT
A	0
B	33,300
C	54,000
D	58,600
E	64,800

Printed At: 3:29:15PM On: 12/6/2010

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

Facility Name:	US74 Seg6 SS 6ln		
Project Name:	Monroe	Organization:	

Region Type:	Piedmont
Facility Type:	Arterial
Design Category:	High-Speed
Functional Category:	Principal Arterial
Street Class:	Class I

Number of Lanes:	3
Segment Len.(mi):	3.00
Signals/Mile:	1.00
Cycle Length(s):	200
g/C Ratio:	0.60

PHF:	0.90	Prop. Lt:	5.00 %
K Factor:	0.10	FFS(mph):	55
D Factor:	0.60	Arival Type:	3

LOS	Max AADT
A	19,900
B	51,800
C	55,800
D	60,300
E	66,600

Printed At: 3:31:39PM On: 12/6/2010

Appendix B – HCS Planning Analysis

Phone: Fax:
E-Mail:

PLANNING ANALYSIS

Analyst:	HNTB
Agency/Co.:	HNTB
Date Performed:	11/30/2010
Analysis Time Period:	Peak Hour
Urban Street:	US 74
Direction of Travel:	EB/WB
Jurisdiction:	
Analysis Year:	2035
Project ID:	

Traffic Characteristics

Annual average daily traffic, AADT	86300	vpd
Planning analysis hour factor, K	0.100	
Directional distribution factor, D	0.600	
Peak-hour factor, PHF	0.900	
Adjusted saturation flow rate	1900	pcphgpl
Percent turns from exclusive lanes	5	%

Roadway Characteristics

Number of through lanes one direction, N	3	
Free flow speed, FFS	55	mph
Urban class	1	
Section length	5.88	miles
Median	Yes	
Left-turn bays	Yes	

Signal Characteristics

Signalized intersections	7	
Arrival type, AT	3	
Signal type (k = 0.5 for planning)	Actuated	
Cycle length, C	120.0	sec
Effective green ratio, g/C	0.600	

Results

Annual average daily traffic, AADT	86300	vpd
Two-way hourly volume	8630	vph
Hourly directional volume	5178	vph
Through-volume 15-min. flow rate	5465	v
Running time	397.3	sec
v/c ratio	1.60	
Through capacity	3420	vph
Progression factor, PF	1.000	
Uniform delay	24.0	sec
Filtering/metering factor, I	0.090	
Incremental delay	269.2	sec
Control delay	293.2	sec/v
Total travel speed, Sa	8.6	mph
Total urban street LOS	F	

Phone: Fax:
E-Mail:

PLANNING ANALYSIS

Analyst:	HNTB
Agency/Co.:	HNTB
Date Performed:	11/30/2010
Analysis Time Period:	Peak Hour
Urban Street:	US 74
Direction of Travel:	EB/WB
Jurisdiction:	
Analysis Year:	2035
Project ID:	

Traffic Characteristics

Annual average daily traffic, AADT	72100	vpd
Planning analysis hour factor, K	0.100	
Directional distribution factor, D	0.600	
Peak-hour factor, PHF	0.900	
Adjusted saturation flow rate	1900	pcphgpl
Percent turns from exclusive lanes	5	%

Roadway Characteristics

Number of through lanes one direction, N	3	
Free flow speed, FFS	50	mph
Urban class	1	
Section length	3.14	miles
Median	Yes	
Left-turn bays	Yes	

Signal Characteristics

Signalized intersections	7	
Arrival type, AT	3	
Signal type (k = 0.5 for planning)	Actuated	
Cycle length, C	120.0	sec
Effective green ratio, g/C	0.600	

Results

Annual average daily traffic, AADT	72100	vpd
Two-way hourly volume	7210	vph
Hourly directional volume	4326	vph
Through-volume 15-min. flow rate	4566	v
Running time	257.8	sec
v/c ratio	1.34	
Through capacity	3420	vph
Progression factor, PF	1.000	
Uniform delay	24.0	sec
Filtering/metering factor, I	0.090	
Incremental delay	151.0	sec
Control delay	175.0	sec/v
Total travel speed, Sa	7.6	mph
Total urban street LOS	F	

Phone: Fax:
E-Mail:

PLANNING ANALYSIS

Analyst:	HNTB
Agency/Co.:	HNTB
Date Performed:	11/30/2010
Analysis Time Period:	Peak Hour
Urban Street:	US 74
Direction of Travel:	EB/WB
Jurisdiction:	
Analysis Year:	2035
Project ID:	

Traffic Characteristics

Annual average daily traffic, AADT	74800	vpd
Planning analysis hour factor, K	0.100	
Directional distribution factor, D	0.600	
Peak-hour factor, PHF	0.900	
Adjusted saturation flow rate	1900	pcphgpl
Percent turns from exclusive lanes	5	%

Roadway Characteristics

Number of through lanes one direction, N	3	
Free flow speed, FFS	50	mph
Urban class	1	
Section length	3.51	miles
Median	Yes	
Left-turn bays	Yes	

Signal Characteristics

Signalized intersections	9	
Arrival type, AT	3	
Signal type (k = 0.5 for planning)	Actuated	
Cycle length, C	120.0	sec
Effective green ratio, g/C	0.600	

Results

Annual average daily traffic, AADT	74800	vpd
Two-way hourly volume	7480	vph
Hourly directional volume	4488	vph
Through-volume 15-min. flow rate	4737	v
Running time	305.0	sec
v/c ratio	1.39	
Through capacity	3420	vph
Progression factor, PF	1.000	
Uniform delay	24.0	sec
Filtering/metering factor, I	0.090	
Incremental delay	173.5	sec
Control delay	197.5	sec/v
Total travel speed, Sa	6.1	mph
Total urban street LOS	F	

Phone: Fax:
E-Mail:

PLANNING ANALYSIS

Analyst:	HNTB
Agency/Co.:	HNTB
Date Performed:	11/30/2010
Analysis Time Period:	Peak Hour
Urban Street:	US 74
Direction of Travel:	EB/WB
Jurisdiction:	
Analysis Year:	2035
Project ID:	

Traffic Characteristics

Annual average daily traffic, AADT	41000	vpd
Planning analysis hour factor, K	0.100	
Directional distribution factor, D	0.600	
Peak-hour factor, PHF	0.900	
Adjusted saturation flow rate	1900	pcphgpl
Percent turns from exclusive lanes	5	%

Roadway Characteristics

Number of through lanes one direction, N	3	
Free flow speed, FFS	50	mph
Urban class	1	
Section length	1.69	miles
Median	Yes	
Left-turn bays	Yes	

Signal Characteristics

Signalized intersections	2	
Arrival type, AT	3	
Signal type (k = 0.5 for planning)	Actuated	
Cycle length, C	120.0	sec
Effective green ratio, g/C	0.600	

Results

Annual average daily traffic, AADT	41000	vpd
Two-way hourly volume	4100	vph
Hourly directional volume	2460	vph
Through-volume 15-min. flow rate	2596	v
Running time	124.8	sec
v/c ratio	0.76	
Through capacity	3420	vph
Progression factor, PF	1.000	
Uniform delay	17.6	sec
Filtering/metering factor, I	0.565	
Incremental delay	0.9	sec
Control delay	18.6	sec/v
Total travel speed, Sa	37.6	mph
Total urban street LOS	B	

Phone: Fax:
E-Mail:

PLANNING ANALYSIS

Analyst:	HNTB
Agency/Co.:	HNTB
Date Performed:	11/30/2010
Analysis Time Period:	Peak Hour
Urban Street:	US 74
Direction of Travel:	EB/WB
Jurisdiction:	
Analysis Year:	2035
Project ID:	

Traffic Characteristics

Annual average daily traffic, AADT	42700	vpd
Planning analysis hour factor, K	0.100	
Directional distribution factor, D	0.600	
Peak-hour factor, PHF	0.900	
Adjusted saturation flow rate	1900	pcphgpl
Percent turns from exclusive lanes	5	%

Roadway Characteristics

Number of through lanes one direction, N	3	
Free flow speed, FFS	40	mph
Urban class	2	
Section length	2.23	miles
Median	Yes	
Left-turn bays	Yes	

Signal Characteristics

Signalized intersections	2	
Arrival type, AT	3	
Signal type (k = 0.5 for planning)	Actuated	
Cycle length, C	120.0	sec
Effective green ratio, g/C	0.600	

Results

Annual average daily traffic, AADT	42700	vpd
Two-way hourly volume	4270	vph
Hourly directional volume	2562	vph
Through-volume 15-min. flow rate	2704	v
Running time	200.7	sec
v/c ratio	0.79	
Through capacity	3420	vph
Progression factor, PF	1.000	
Uniform delay	18.3	sec
Filtering/metering factor, I	0.515	
Incremental delay	1.0	sec
Control delay	19.3	sec/v
Total travel speed, Sa	33.6	mph
Total urban street LOS	B	

Phone: Fax:
E-Mail:

PLANNING ANALYSIS

Analyst:	HNTB
Agency/Co.:	HNTB
Date Performed:	11/30/2010
Analysis Time Period:	Peak Hour
Urban Street:	US 74
Direction of Travel:	EB/WB
Jurisdiction:	
Analysis Year:	2035
Project ID:	

Traffic Characteristics

Annual average daily traffic, AADT	35900	vpd
Planning analysis hour factor, K	0.100	
Directional distribution factor, D	0.600	
Peak-hour factor, PHF	0.900	
Adjusted saturation flow rate	1900	pcphgpl
Percent turns from exclusive lanes	5	%

Roadway Characteristics

Number of through lanes one direction, N	3	
Free flow speed, FFS	55	mph
Urban class	1	
Section length	2.93	miles
Median	Yes	
Left-turn bays	Yes	

Signal Characteristics

Signalized intersections	2	
Arrival type, AT	3	
Signal type (k = 0.5 for planning)	Actuated	
Cycle length, C	120.0	sec
Effective green ratio, g/C	0.600	

Results

Annual average daily traffic, AADT	35900	vpd
Two-way hourly volume	3590	vph
Hourly directional volume	2154	vph
Through-volume 15-min. flow rate	2273	v
Running time	191.8	sec
v/c ratio	0.66	
Through capacity	3420	vph
Progression factor, PF	1.000	
Uniform delay	16.0	sec
Filtering/metering factor, I	0.696	
Incremental delay	0.7	sec
Control delay	16.7	sec/v
Total travel speed, Sa	46.8	mph
Total urban street LOS	A	